시 험 성 적 서

TEST REPORT

성적서 번호 Report No.		ICRT-TR-E241038-0A
신청자 Client	기관명 Name	AISOLUTION CO., LTD
	주 소 Address	28-4, Samyang-ro 29gil, Gangbuk-gu, Seoul, 01194, Republic of Korea
시험대상품목 Sample description		Bluetooth Barcode Scanner Sled
모델명 Type description		KDC1000
정 격 Ratings		DC 3.7 V
시험장소 Place of test		■ 고정시험실(Permanent Testing Lab) □ 현장시험(On Site Testing) 주소지(Address): 112, 113 Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea
시험기간 Date of test		03. Apr. 2024 ~ 04. Apr. 2024
시험방법/항목 Test Method/Item		FCC Part 15 Subpart C
시험결과 Test Results		Refer to 3. Test Summary
확 인 Affirmation	작성자 Tested by 성명 Name: Si-Yeon, Hawng (서명) (Signature)	기술책임자 Technical Manager 성명 Name: Tae-Yang, Yoon (서명) (Signature)

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□ The above test report is certified that the above mentioned products have been tested for the sample.

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□ The above test report is not related to accreditation by KS Q ISO/IEC 17025 and Korea Laboratory Accreditation scheme.

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2024. 04. 05

주식회사 아이씨알 대표이사

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112, Hwanggeum3-ro 7beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea / Tel: 02-6351-9001 ~ 6

Contents

Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E241038-0A	2024. 04. 05	Initial Issue	All

1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	AISOLUTION CO., LTD
Address	28-4, Samyang-ro 29gil, Gangbuk-gu, Seoul, 01194, Republic of Korea

1.2 Manufacturer Information

Applicant	AISOLUTION CO., LTD
Address	28-4, Samyang-ro 29gil, Gangbuk-gu, Seoul, 01194, Republic of Korea

1.3 Test Laboratory Information

Laboratory	ICR Co., Ltd.
Address	112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea
Telephone No.	+82-2-6351-9002
Fax No.	+82-2-6351-9007
KOLAS No.	KT652
KC & FCC	KR0165

1.4 Measurement Uncertainty

Parameter	Uncertainty	Limit
Occupied Channel Bandwidth	2.75%	±5 %
RF output power, conducted	1.39 dB	±1.5 dB
Power Spectral Density, conducted	1.65 dB	±3 dB
Unwanted Emissions, conducted	1.82 dB	±3 dB
Supply voltages	0.06%	±3 %
Time	1.17%	±5 %
All emissions, radiated (Under the 1 GHz)	3.22 dB	±6 dB
All emissions, radiated (Above the 1 GHz)	3.67 dB	±6 dB

2. Equipment under Test(EUT) Information

2.1 General Information

Product Name	Bluetooth Barcode Scanner Sled
Model Name	KDC1000
Additional Model Name	KDC1100
FCC ID	VH9-KDC1000
Power Supply	DC 3.7 V

2.2 Additional Information

Equipment Class	DTS-Digital Transmission System	
Device Type	Stand-alone	
Adaptive/Non-Adaptive	Non-Adaptive Equipment	
Operating Frequency	2 402 ㎒ ~ 2 480 ㎒	
RF Output Power	Bluetooth LE 1 Mbps	0.81 ㏈m
	Bluetooth LE 2 Mbps	0.78 ㏈m
	Bluetooth LE 125 Kbps	0.80 ㏈m
	Bluetooth LE 500 Kbps	0.76 ㏈m
Number of Channel	40	
Modulation Type	GFSK	
Antenna Type	Chip Antenna	
Antenna Gain	3.14 ㏈i	

2.3 Product Type

A Type	C Type Connector
B Type	Lightning Connector

* The internal circuitry of type A and type B is the same.

2.4 Reason of Additional Model Name

NO	Family Model Name	Difference
1	KDC1100	Only the outer case has been modified. Same electrical specifications, structure and circuit as the basic model

3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C			
Clause	Test items	Applied	Results
§15.247 (a) (2)	6 dB Bandwidth	■	PASS
§15.247 (b) (3)	Maximum Conducted Output Power	■	PASS
§15.247 (e)	Power Spectral Density	■	PASS
§15.247 (d)	Conducted Spurious Emission & band Edge	■	PASS
§15.247 (d) & §15.209 & §15.205	Radiated Spurious Emission	■	PASS
§15.207	Power Line Conducted Emission	■	PASS

3.2 Test Methodology

- Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3.3 Configuration of Test System

- Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3.4.1 Radiated emission test

- Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber.
The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

3.5 Antenna requirement

- According to §15.203, 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.
The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.
And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.
Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Result: Pass

The transmitter has a **Chip Antenna**. The directional gain of the antenna is **3.14 dBi**.

4. Test Result - Type A - LE (1 Mbps)

4.1. 6 dB Bandwidth

4.1.1 Test procedure

ANSI C63.10-2013 Clause 11.8

4.1.2 Limit

§15.247 (a) (2)

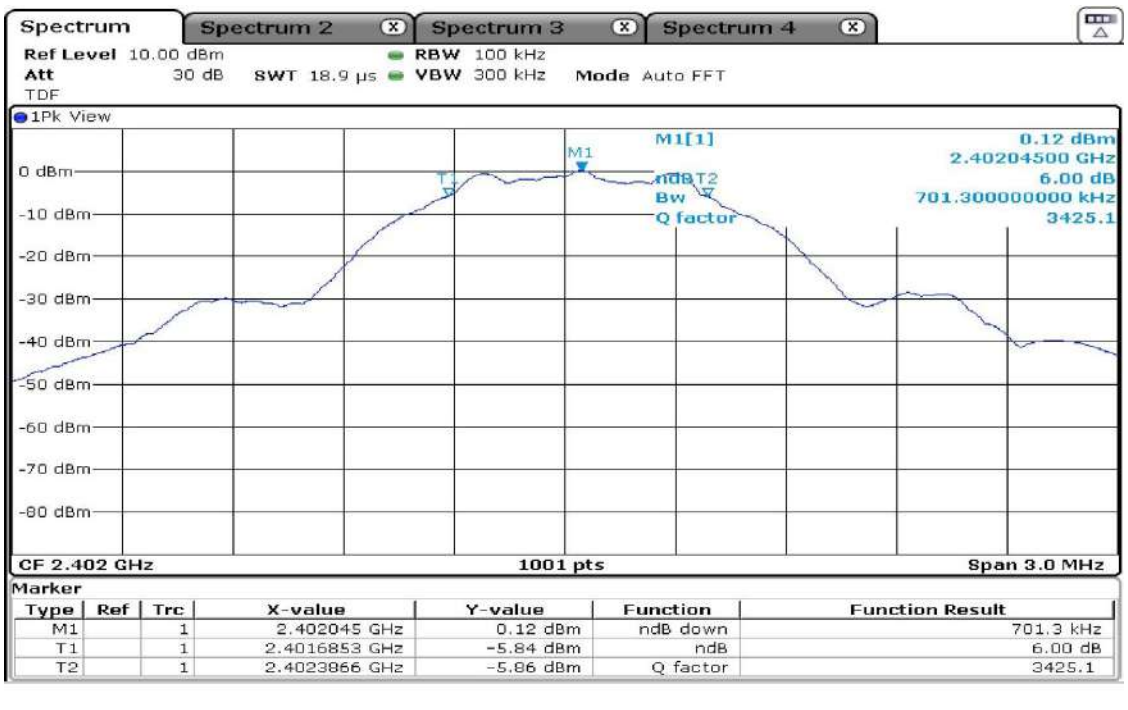
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.1.3 Test data

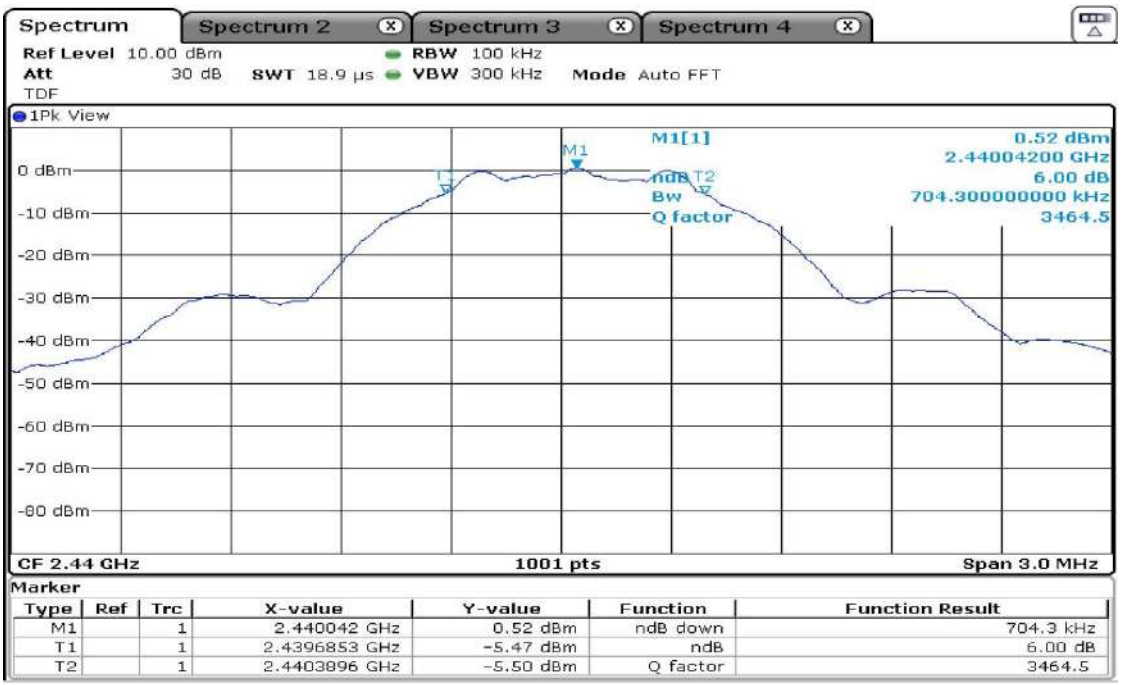
Result : Pass

Mode	Frequency (MHz)	Measured Value (kHz)	Limit (kHz)
Bluetooth LE 1Mbps	2 402	701.3	at least 500
	2 440	704.3	
	2 480	713.3	

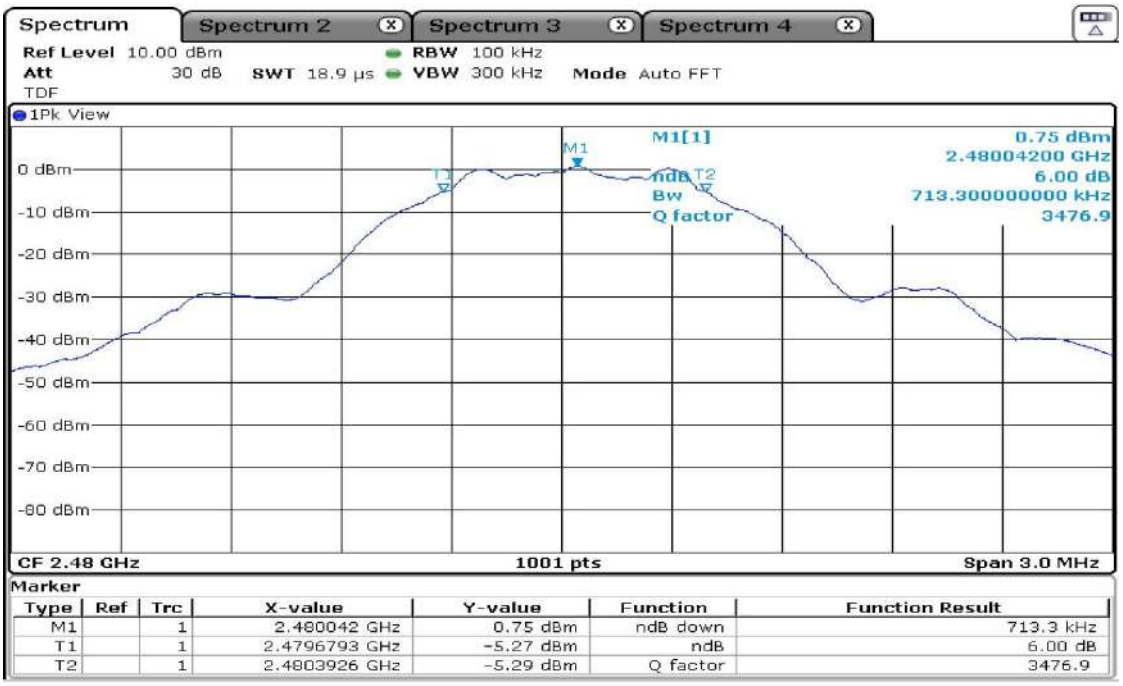
Low ch_6 dB Bandwidth



Mid ch_6 dB Bandwidth



High ch_6 dB Bandwidth



4.2 Maximum Conducted Output Power

4.2.1 Test procedure

ANSI C63.10-2013 Clause 11.9

4.2.2 Limit

§15.247 (b) (3)

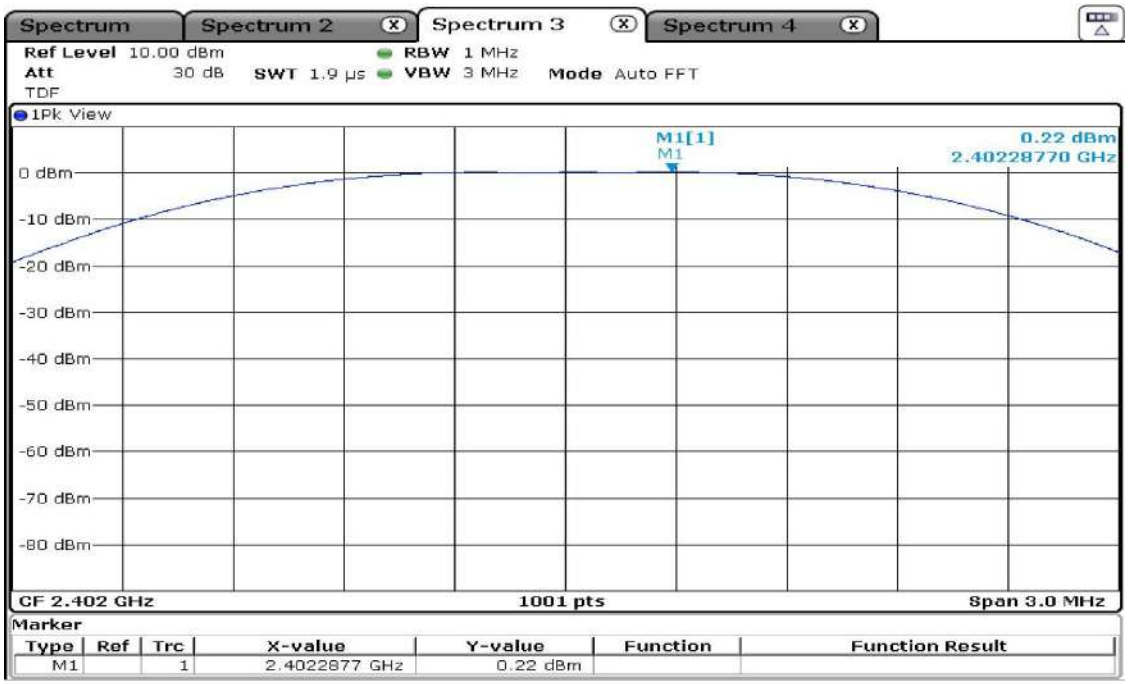
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as 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.

4.2.3 Test data

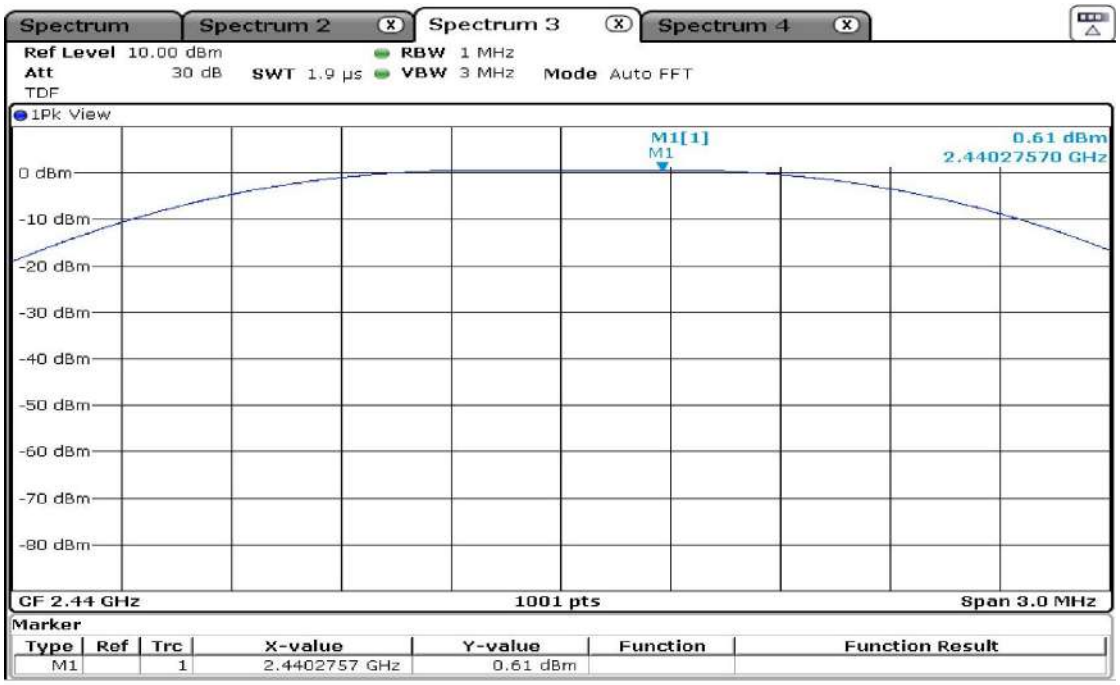
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)
Bluetooth LE 1Mbps	2 402	0.22	30
	2 440	0.61	
	2 480	0.81	

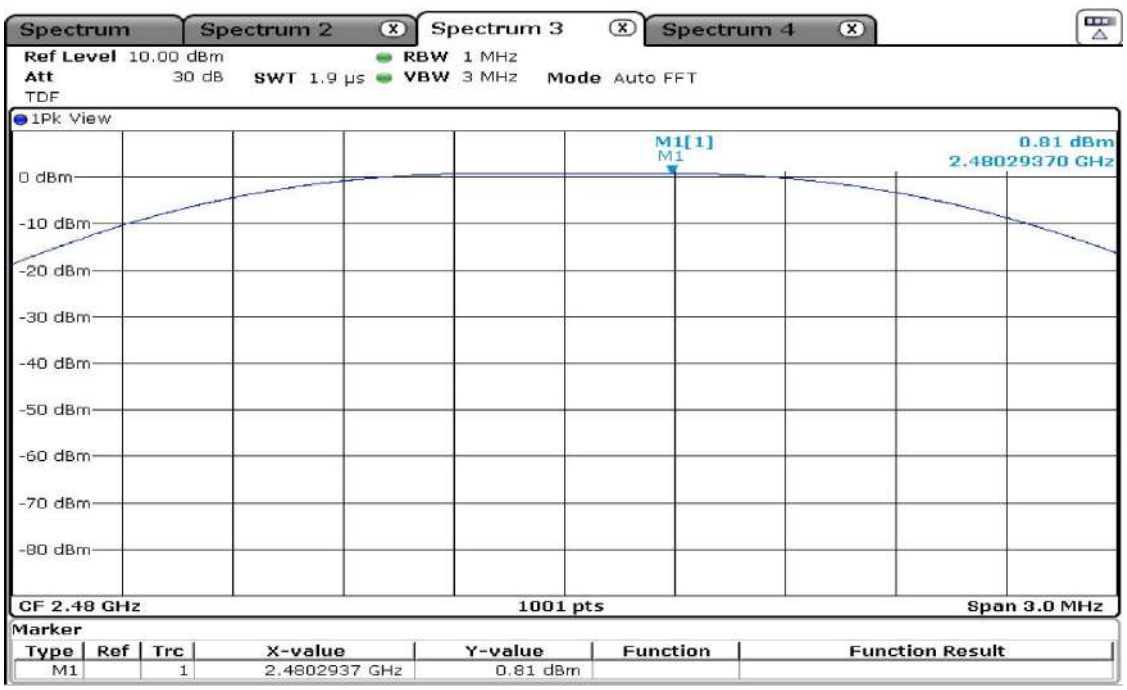
Low ch_Maximum Conducted Output Power



Mid ch_Maximum Conducted Output Power



High ch_Maximum Conducted Output Power



4.3 Power Spectral Density

4.3.1 Test procedure

ANSI C63.10-2013 Clause 11.10

4.3.2 Limit

§15.247 (e)

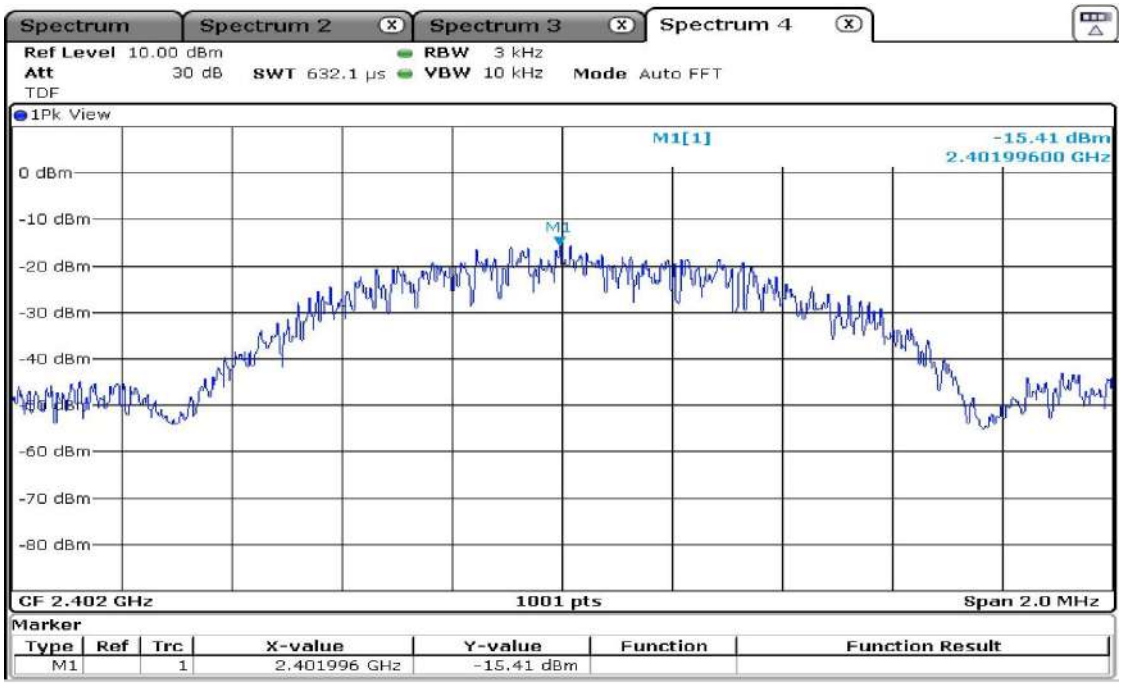
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

4.3.3 Test data

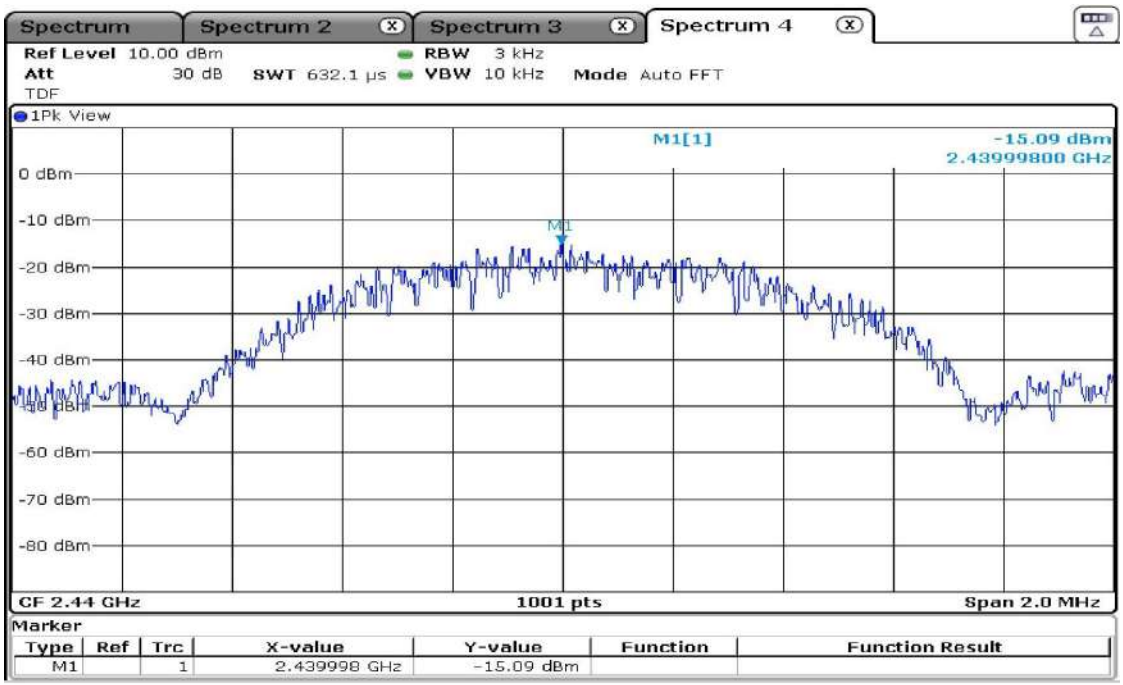
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm/3 kHz)
Bluetooth LE 1Mbps	2 402	-15.41	8
	2 440	-15.09	
	2 480	-14.89	

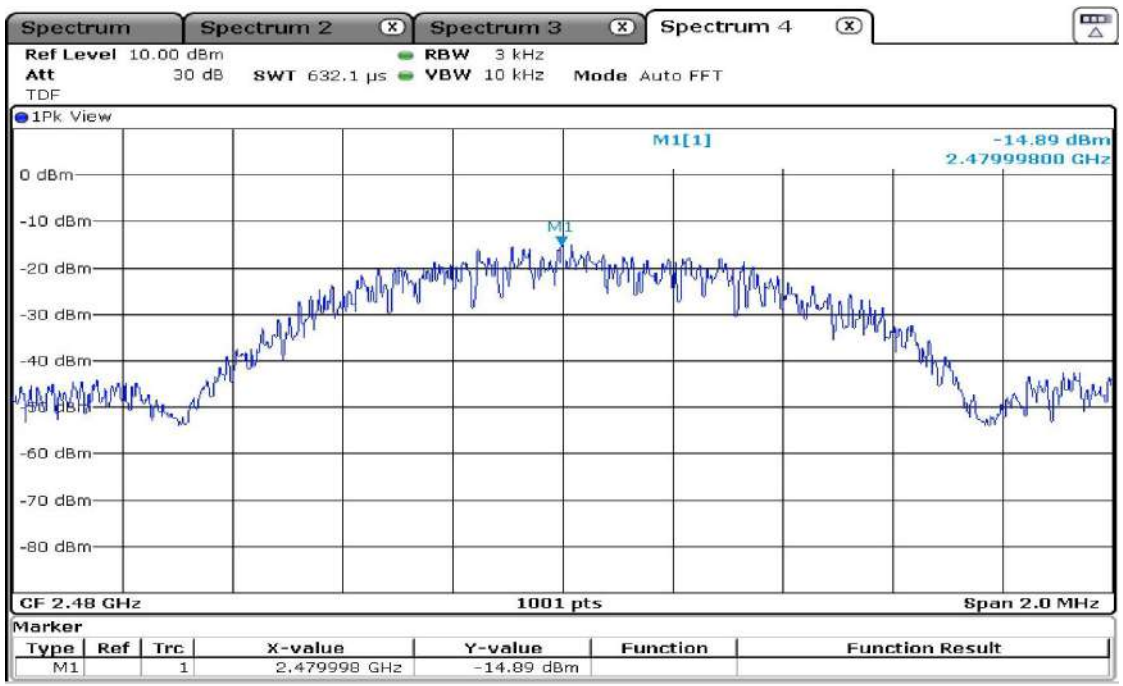
Low ch_Power Spectral Density



Mid ch_Power Spectral Density



High ch_Power Spectral Density



4.4 Conducted Spurious Emission & Band Edge

4.4.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.13

4.4.2 Limit

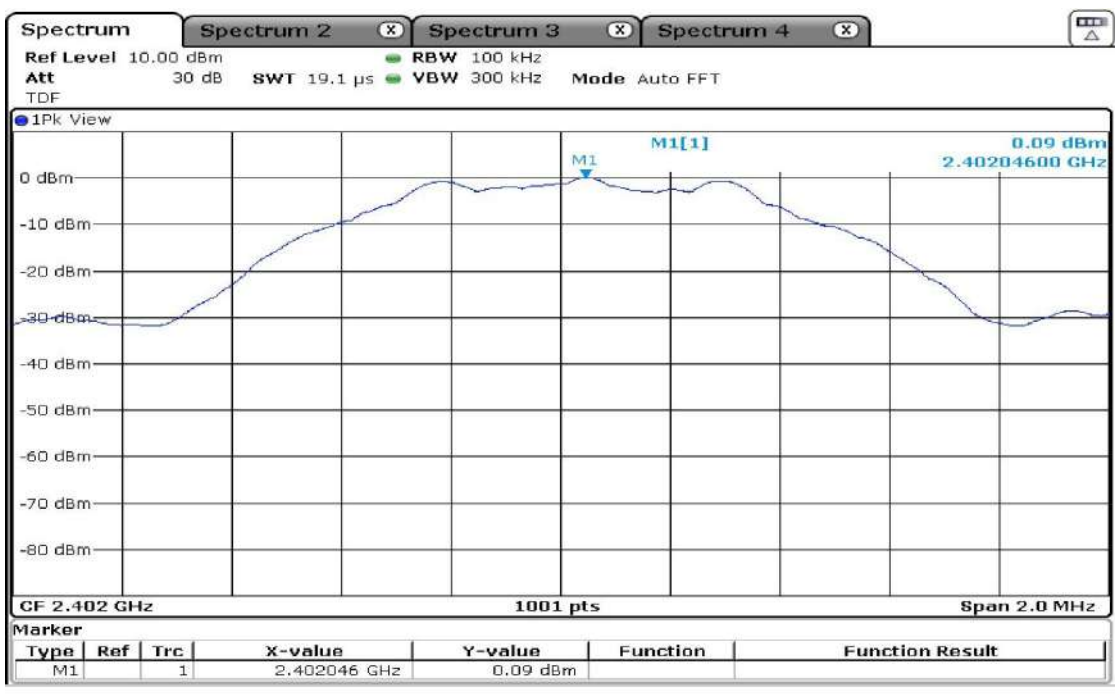
§15.247 (d)

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. 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)).

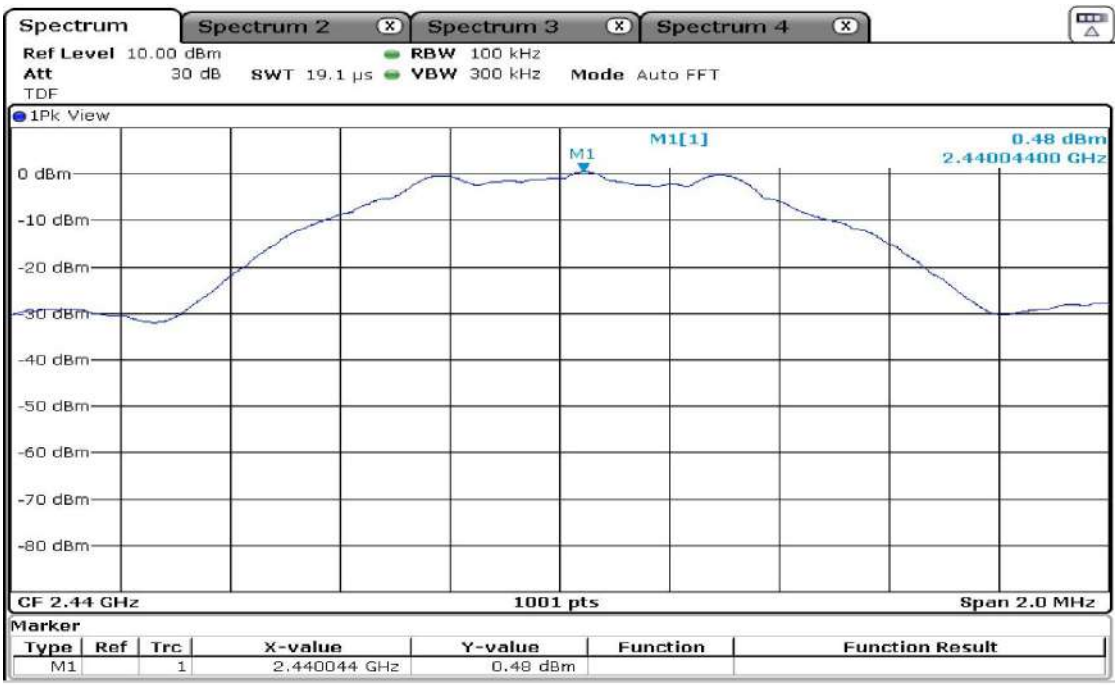
4.4.3 Test data

Result : Pass

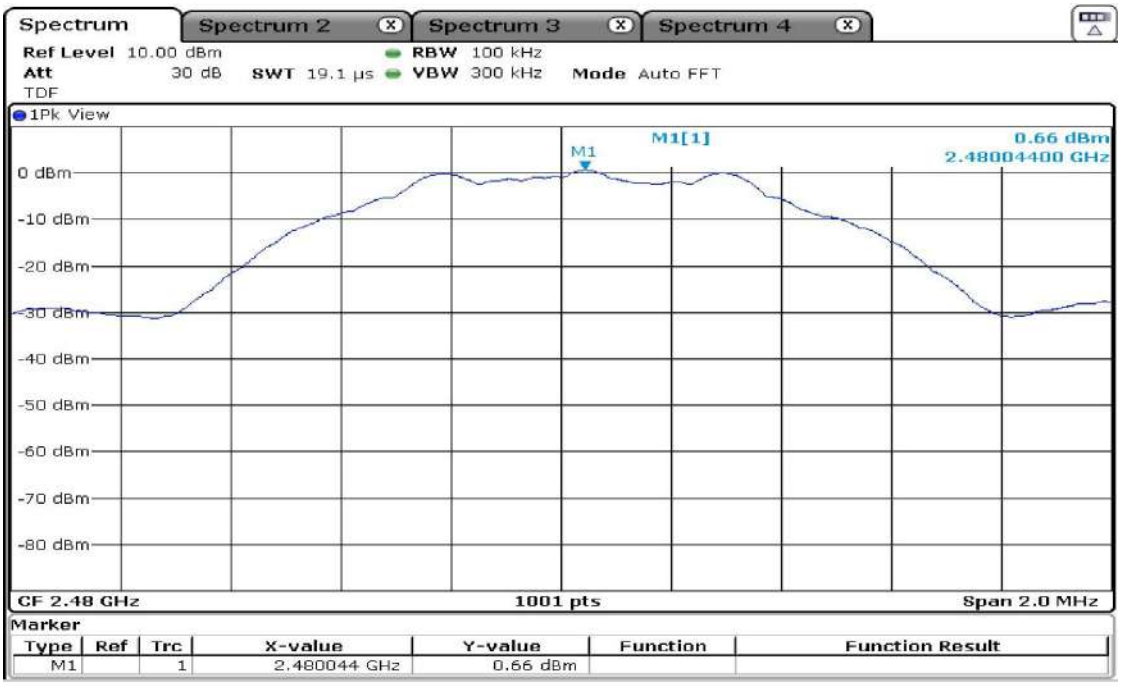
Low ch_Reference Level



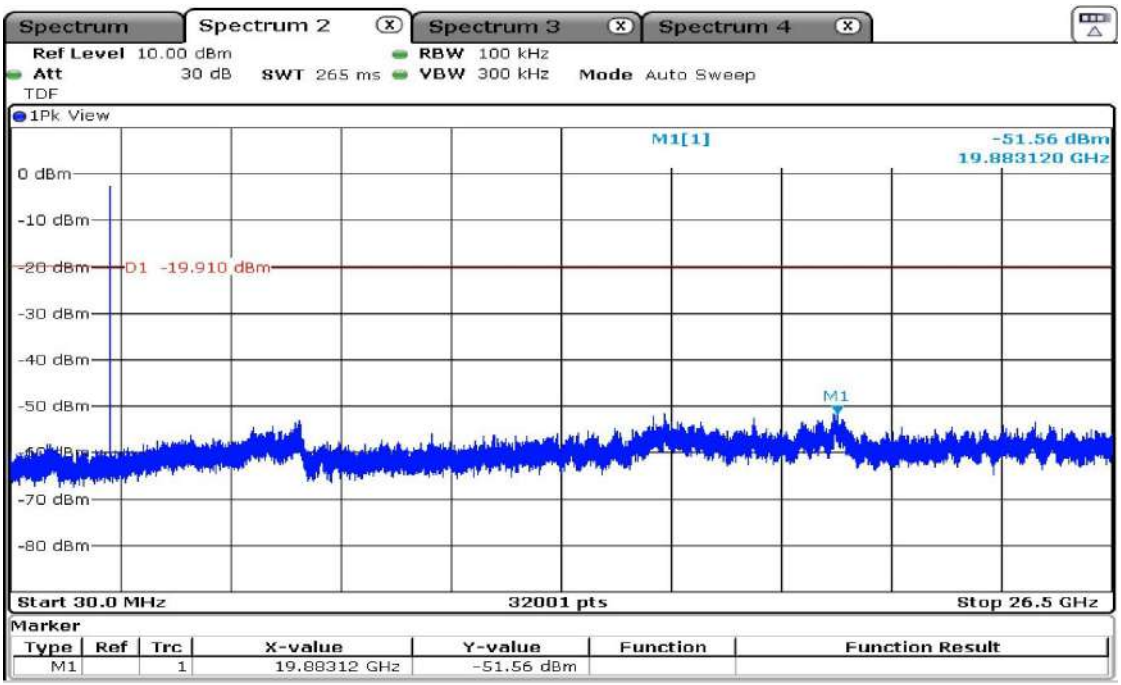
Mid ch_Reference Level



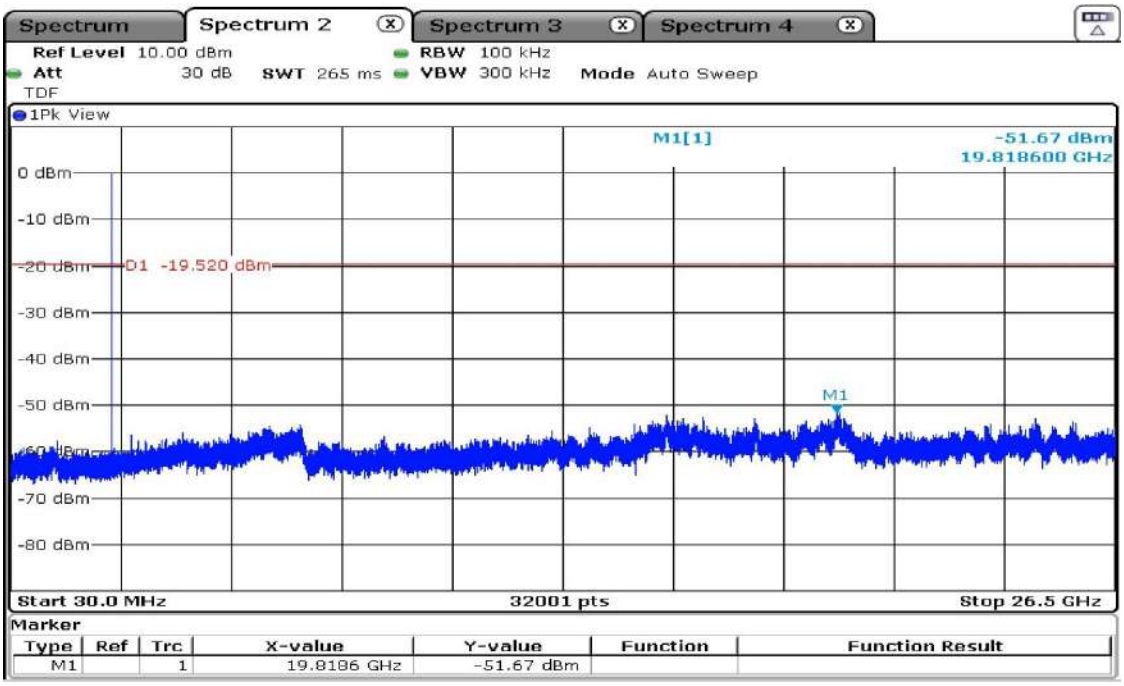
High ch_Power Spectral Density



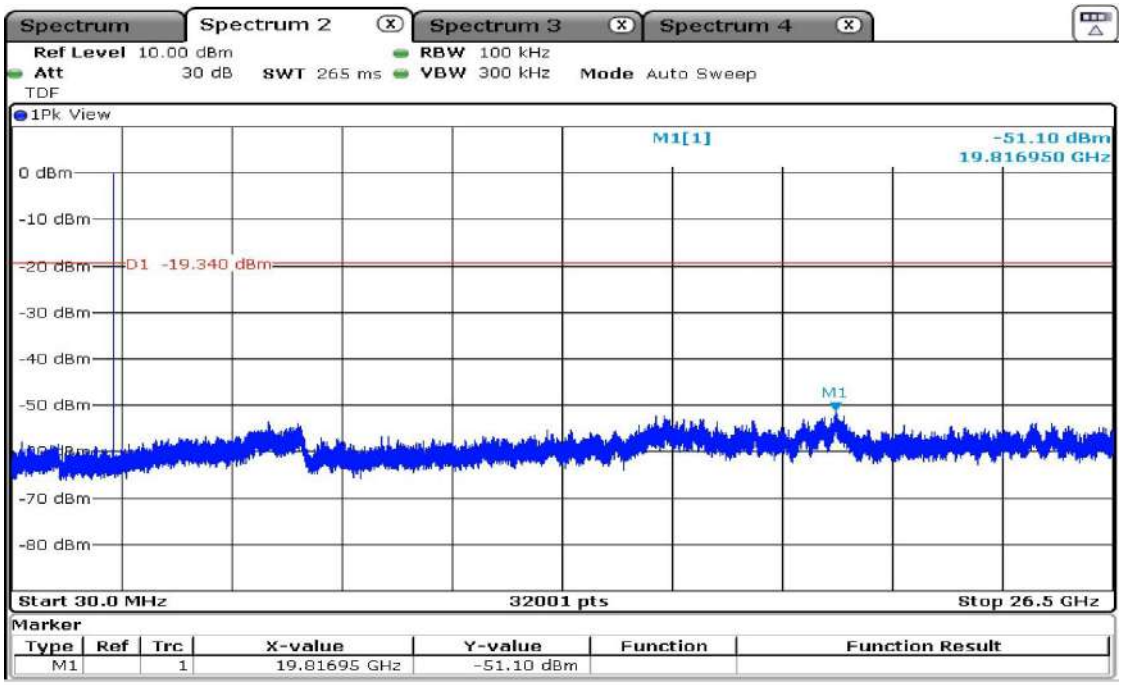
Low ch_Conducted Spurious Emission



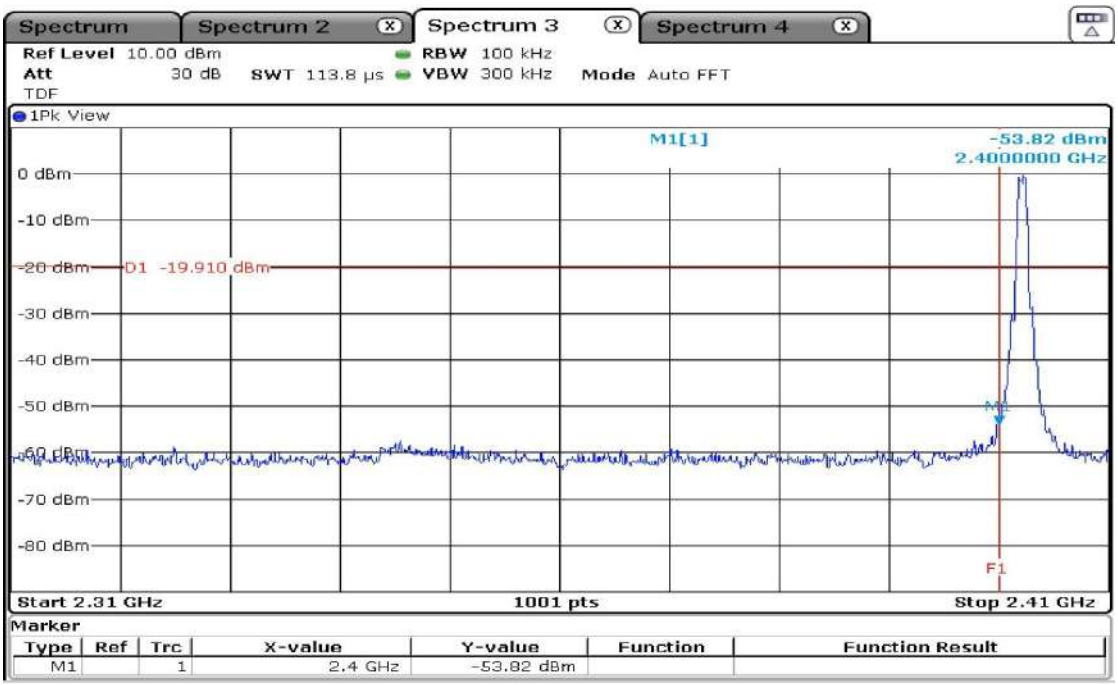
Mid ch_Conducted Spurious Emission



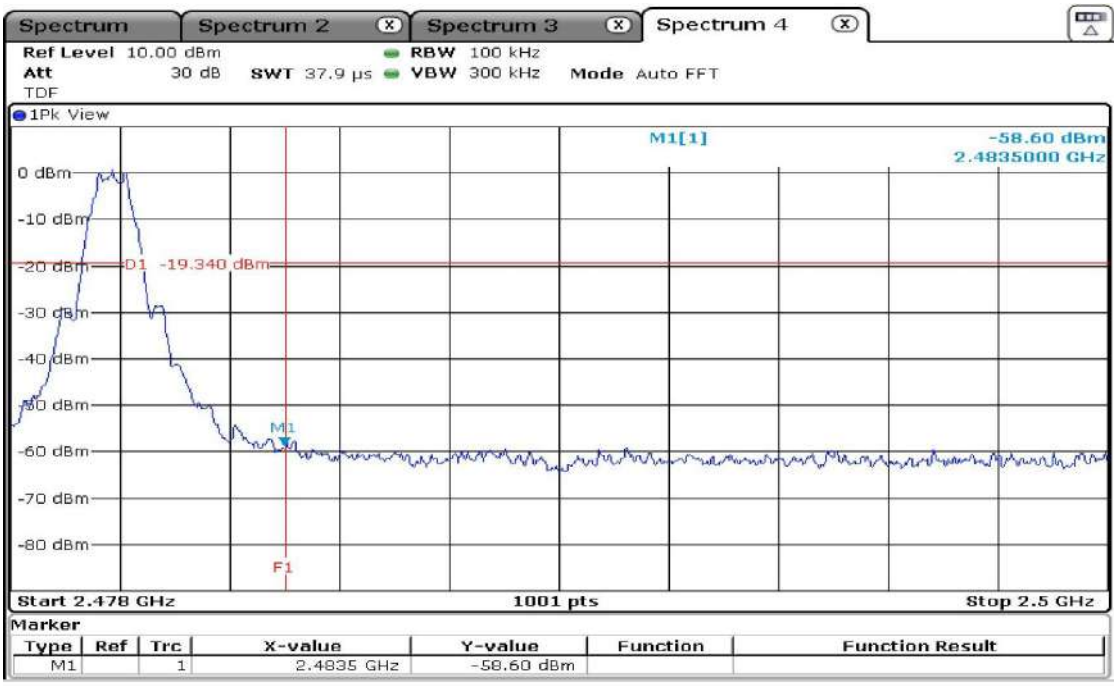
High ch_Conducted Spurious Emission



Low ch_Band Edge



High ch_Band Edge



4.5 Radiated Spurious Emission

4.5.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.12

4.5.2 Limit

§15.247 (d)

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. 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)).

§15.209 Radiated emission limits; general requirements.(a)

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** 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.

§15.205 Restricted bands of operation.(a),(b)

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

[2] Above 38.6

Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

4.5.3 Test data

Result : Pass

- Below 30 MHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- 30 MHz ~ 1 GHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
31.940	51.37	QP	V	-27.1	24.27	40	15.73	
37.275	51.64	QP	V	-25.3	26.34	40	13.66	
359.994	48.29	QP	H	-20.1	28.19	46	17.81	
413.053	43.07	QP	H	-18.2	24.87	46	21.13	

- 30 MHz ~ 1 GHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.984	52.19	QP	V	-25.5	26.69	40	13.31	
40.961	48.87	QP	V	-23.9	24.97	40	15.03	
424.693	42.09	QP	H	-18.0	24.09	46	21.91	
469.313	41.79	QP	H	-17.4	24.39	46	21.61	

- 30 MHz ~ 1 GHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.402	51.46	QP	V	-25.6	25.86	40	14.14	
40.670	48.45	QP	V	-24.0	24.45	40	15.55	
359.994	49.38	QP	H	-20.1	29.28	46	16.72	
421.783	42.34	QP	H	-18.0	24.34	46	21.66	

- 1 GHz Above_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 328.00	47.25	PK	V	-11.0	36.25	74	37.75	Restricted band
	33.62	AVG	V		22.62	54	31.38	
4 804.00	60.11	PK	H	-1.7	58.41	74	15.59	2nd Harmonic
	51.85	AVG	H		50.15	54	3.85	
7 206.00	52.58	PK	H	3.0	55.58	74	18.42	3nd Harmonic
	40.14	AVG	H		43.14	54	10.86	
9 608.40	43.47	PK	V	5.5	48.97	74	25.03	4nd Harmonic
	29.77	AVG	V		35.27	54	18.73	

- 1 GHz Above_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
4 880.50	55.55	PK	H	-1.6	53.95	74	20.05	2nd Harmonic
	44.60	AVG	H		43.00	54	11.00	
7 318.80	47.59	PK	H	2.7	50.29	74	23.71	3nd Harmonic
	34.41	AVG	H		37.11	54	16.89	
9 760.80	42.00	PK	V	6.4	48.40	74	25.60	4nd Harmonic
	29.02	AVG	V		35.42	54	18.58	

- 1 GHz Above_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 484.50	53.66	PK	H	-10.2	43.46	74	30.54	Restricted band
	36.51	AVG	H		26.31	54	27.69	
4 960.00	62.00	PK	H	-1.5	60.50	74	13.50	2nd Harmonic
	53.55	AVG	H		52.05	54	1.95	
7 438.80	50.49	PK	H	2.5	52.99	74	21.01	3nd Harmonic
	37.67	AVG	H		40.17	54	13.83	
9 919.20	43.76	PK	H	5.8	49.56	74	24.44	4nd Harmonic
	31.47	AVG	H		37.27	54	16.73	

5. Test Result - Type A - LE (2 Mbps)

5.1. 6 dB Bandwidth

5.1.1 Test procedure

ANSI C63.10-2013 Clause 11.8

5.1.2 Limit

§15.247 (a) (2)

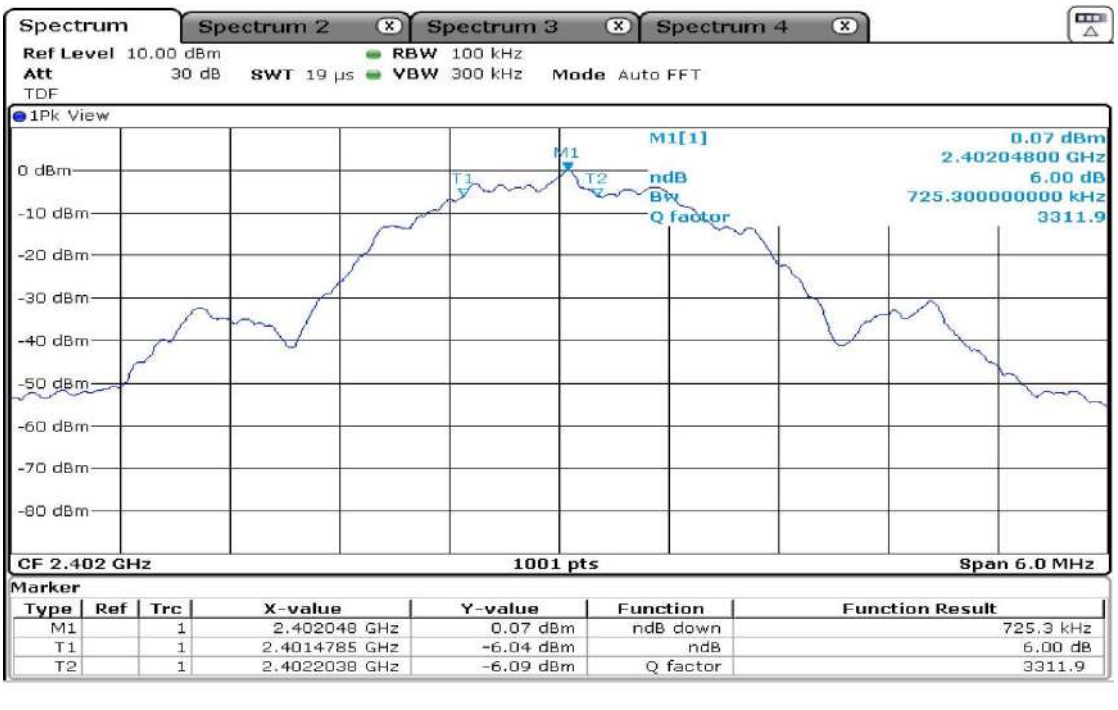
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.3 Test data

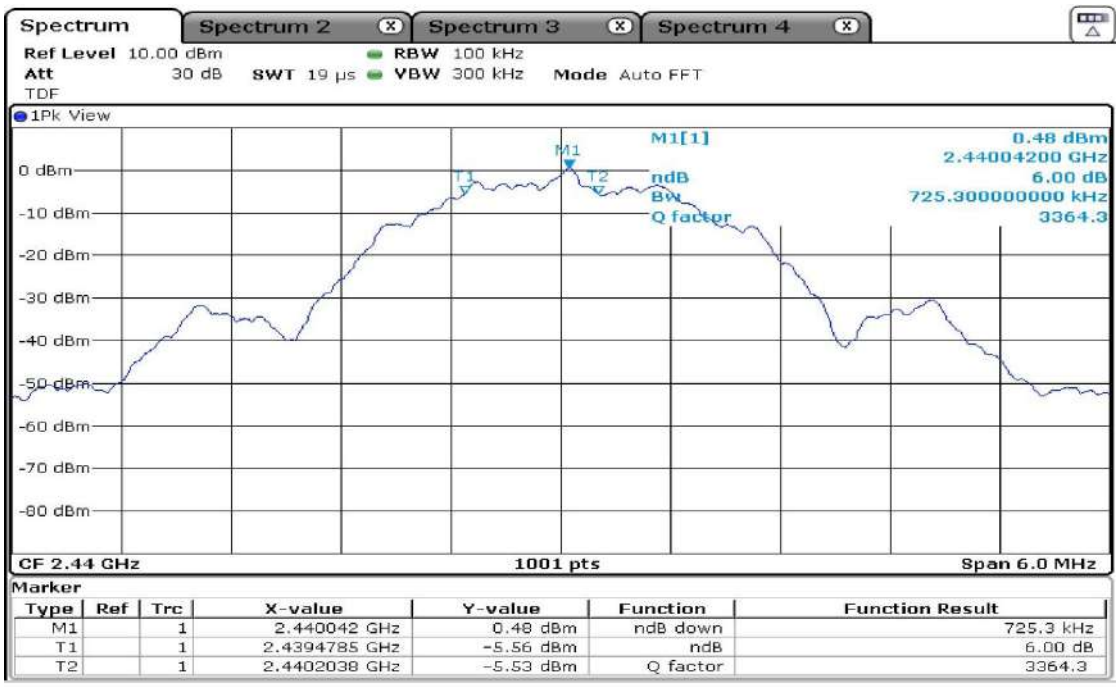
Result : Pass

Mode	Frequency (MHz)	Measured Value (kHz)	Limit (kHz)
Bluetooth LE 2Mbps	2 402	725.3	at least 500
	2 440	725.3	
	2 480	725.3	

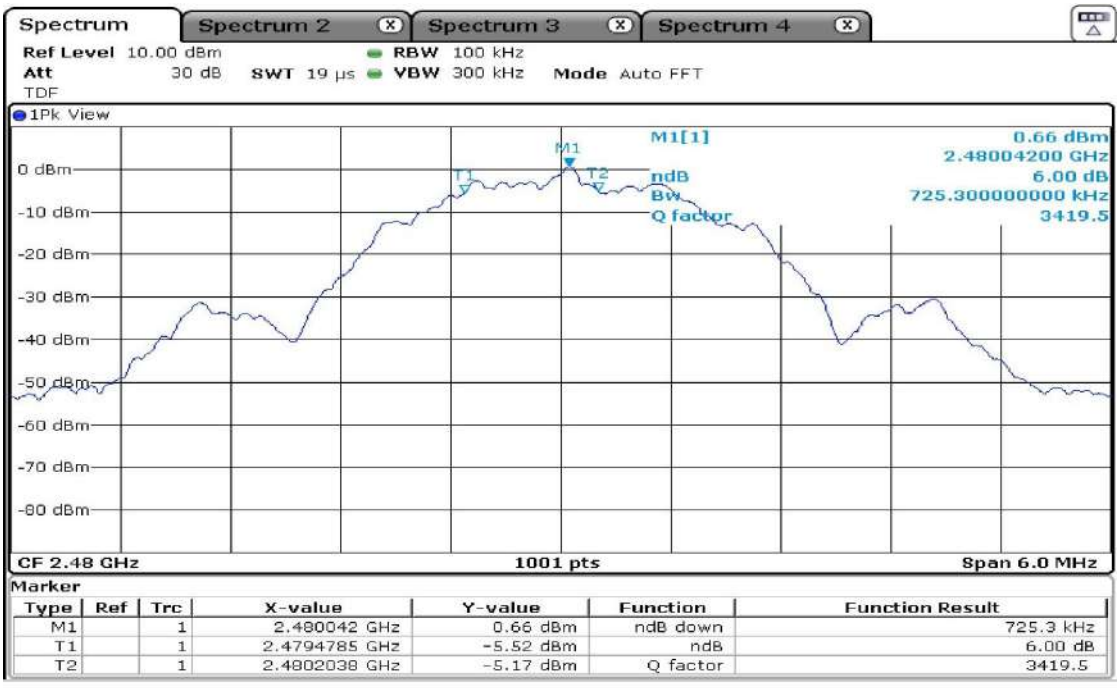
Low ch_6 dB Bandwidth



Mid ch_6 dB Bandwidth



High ch_6 dB Bandwidth



5.2 Maximum Conducted Output Power

5.2.1 Test procedure

ANSI C63.10-2013 Clause 11.9

5.2.2 Limit

§15.247 (b) (3)

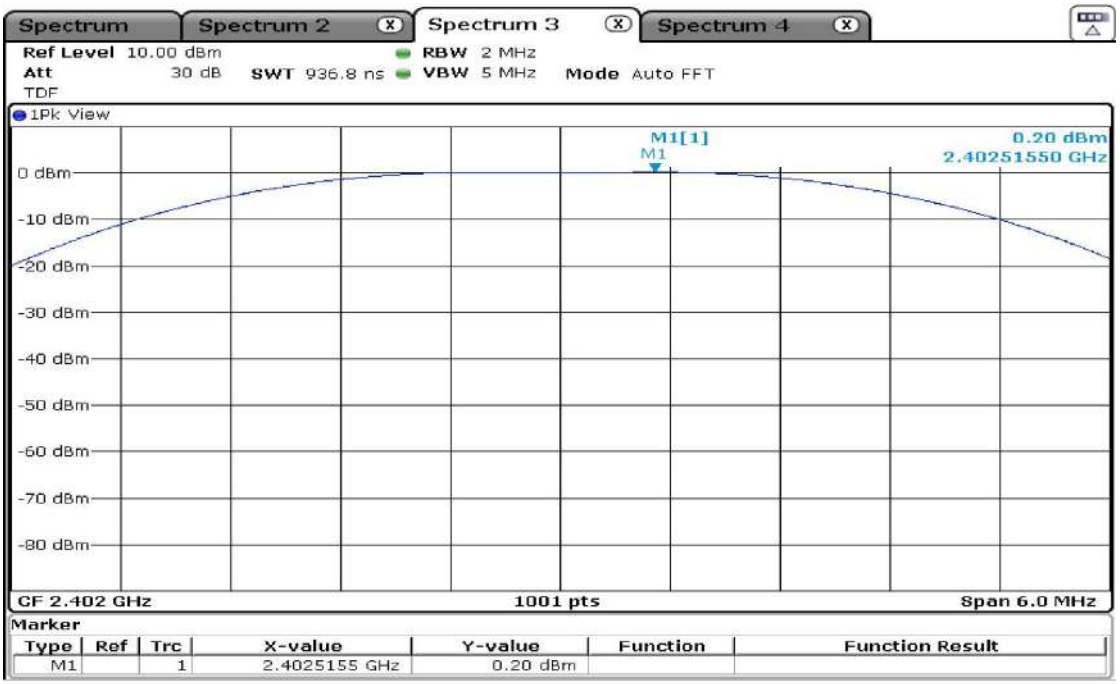
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as 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.

5.2.3 Test data

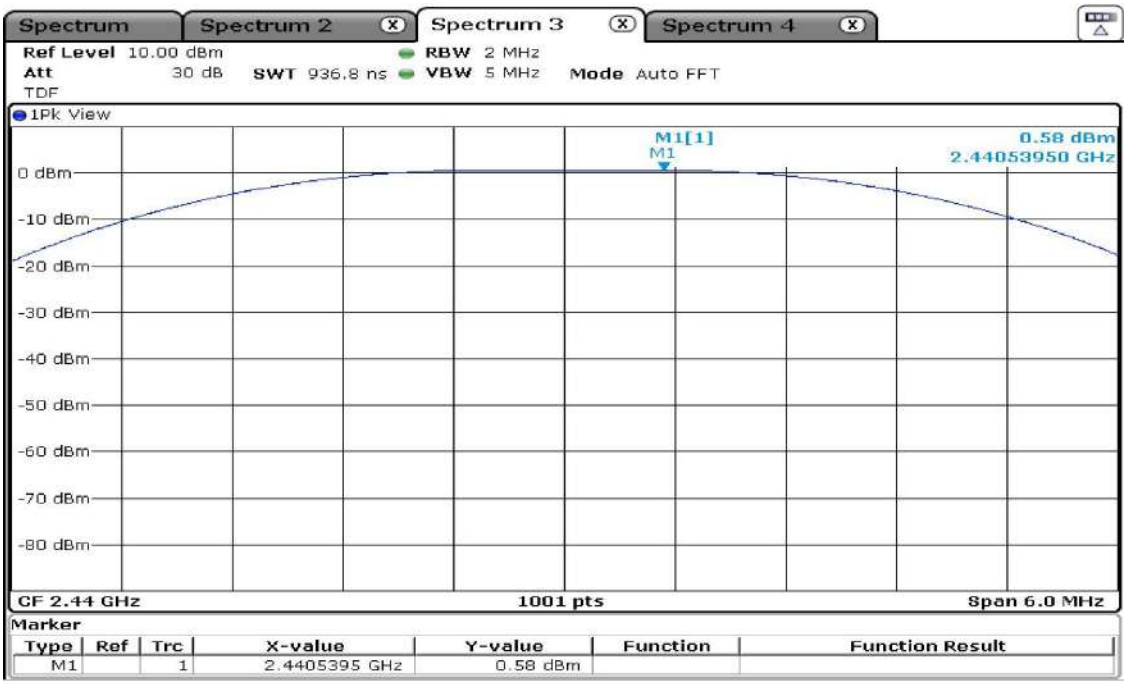
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)
Bluetooth LE 2Mbps	2 402	0.20	30
	2 440	0.58	
	2 480	0.78	

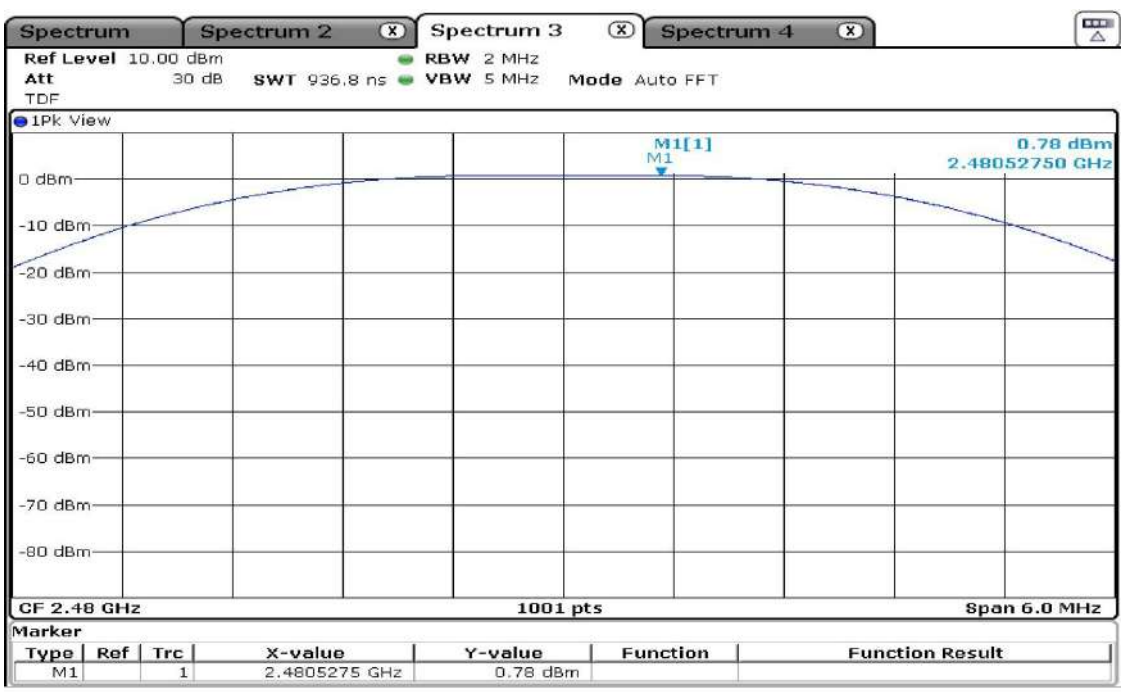
Low ch_Maximum Conducted Output Power



Mid ch_Maximum Conducted Output Power



High ch_Maximum Conducted Output Power



5.3 Power Spectral Density

5.3.1 Test procedure

ANSI C63.10-2013 Clause 11.10

5.3.2 Limit

§15.247 (e)

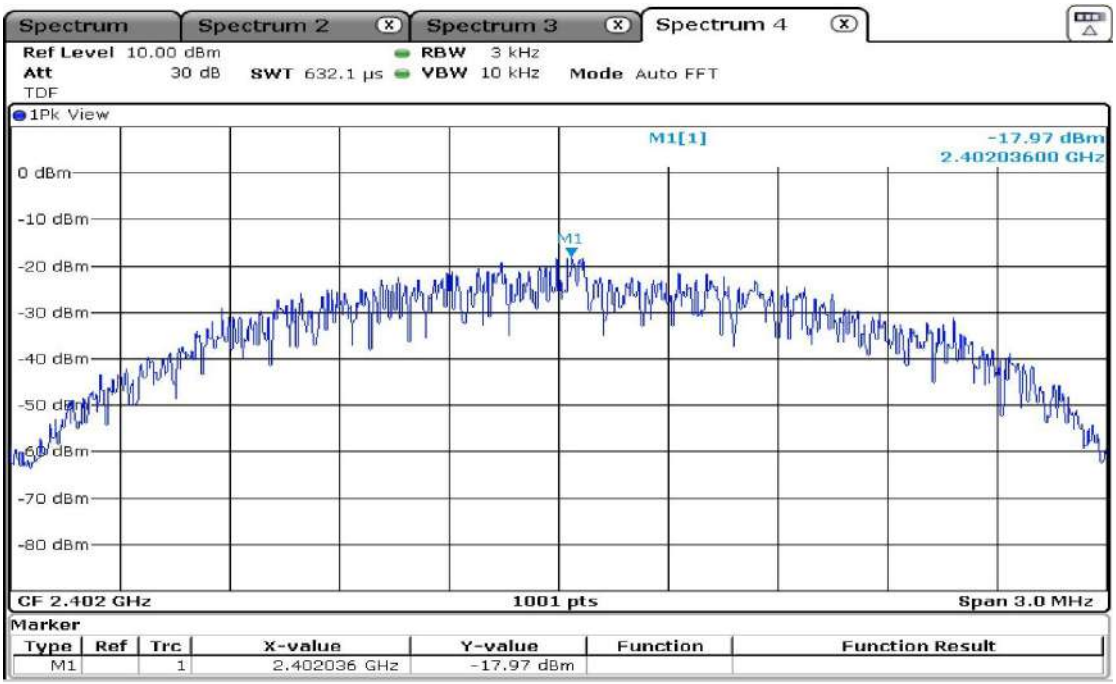
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3.3 Test data

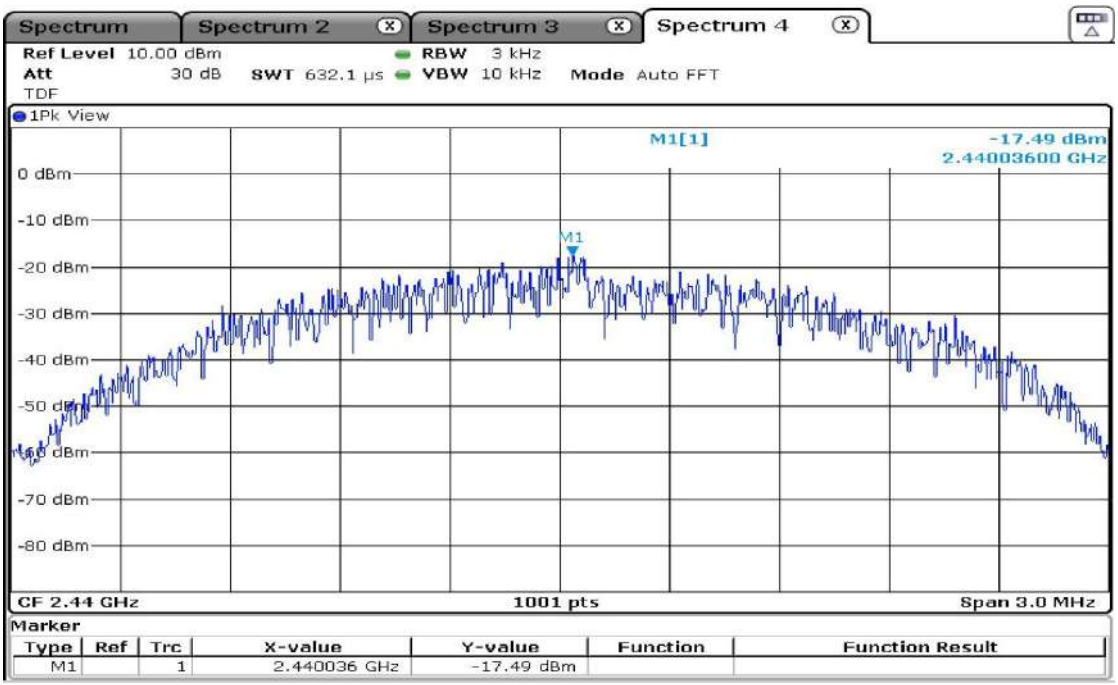
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm/3 kHz)
Bluetooth LE 2Mbps	2 402	-17.97	8
	2 440	-17.49	
	2 480	-17.16	

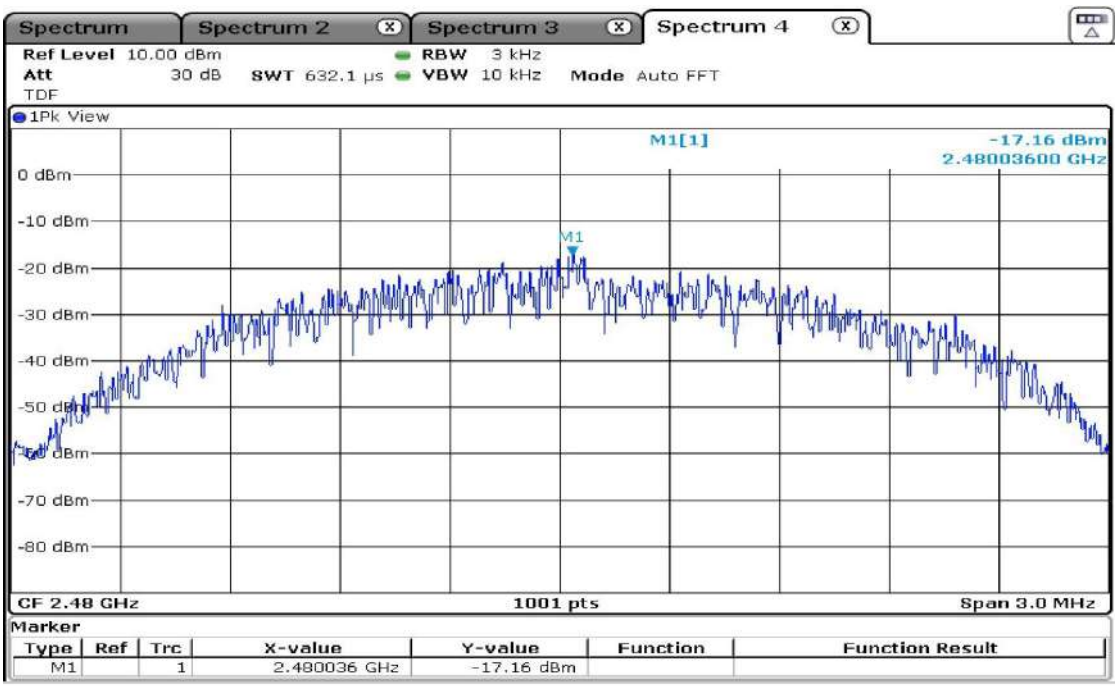
Low ch_Power Spectral Density



Mid ch_Power Spectral Density



High ch_Power Spectral Density



5.4 Conducted Spurious Emission & Band Edge

5.4.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.13

5.4.2 Limit

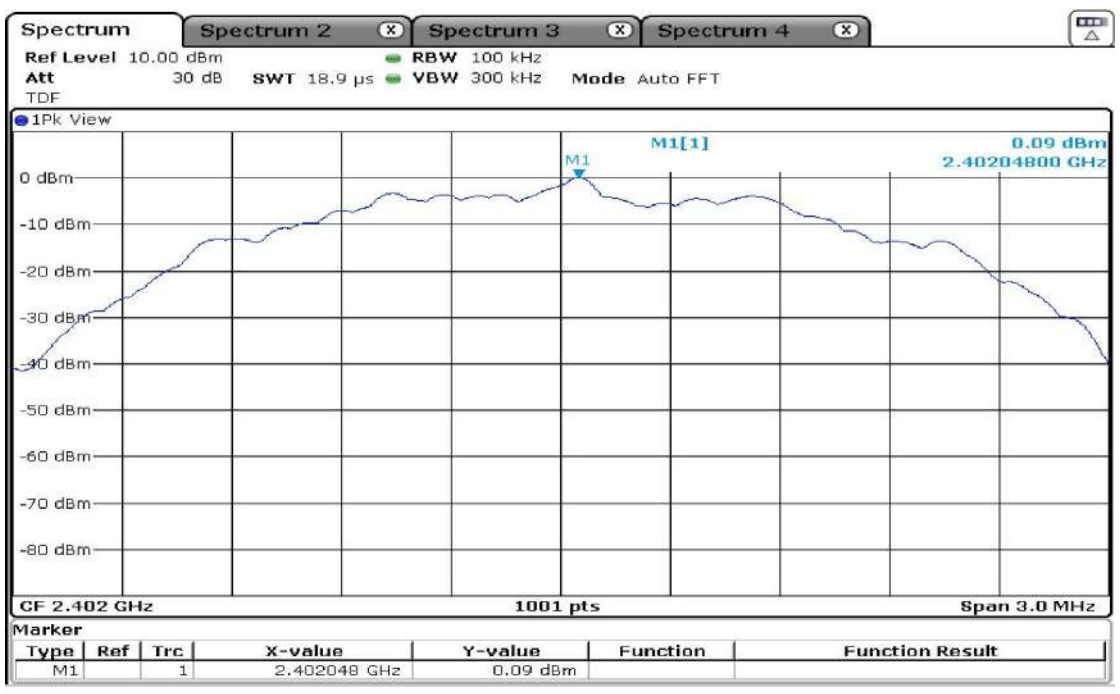
§15.247 (d)

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. 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)).

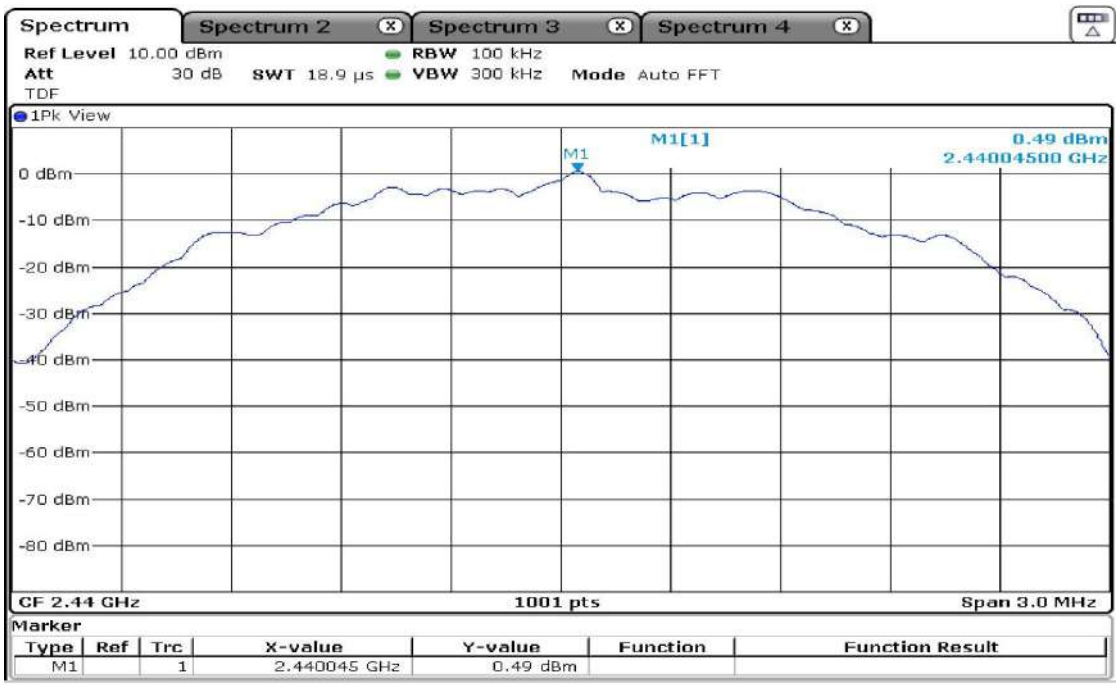
5.4.3 Test data

Result : Pass

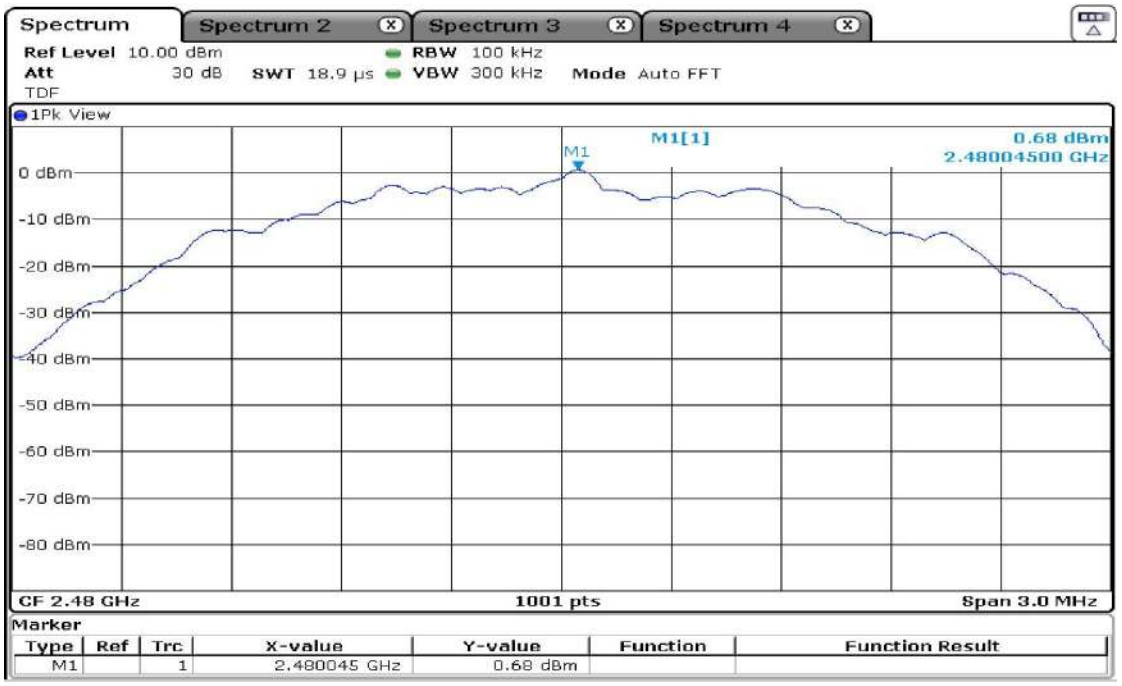
Low ch_Reference Level



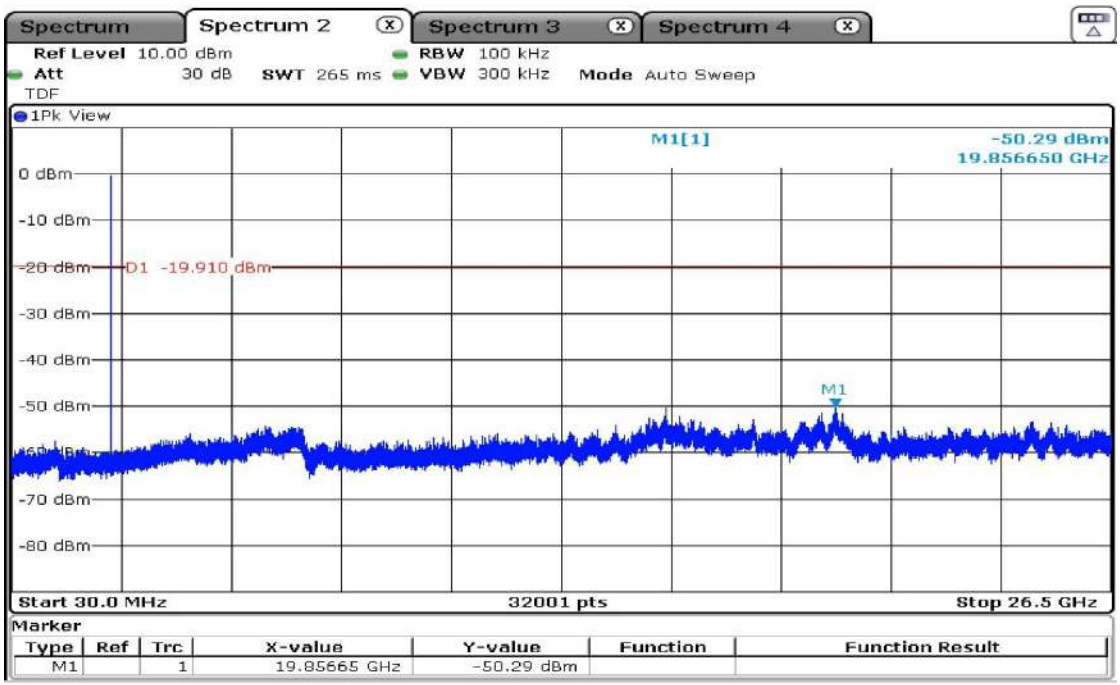
Mid ch_Reference Level



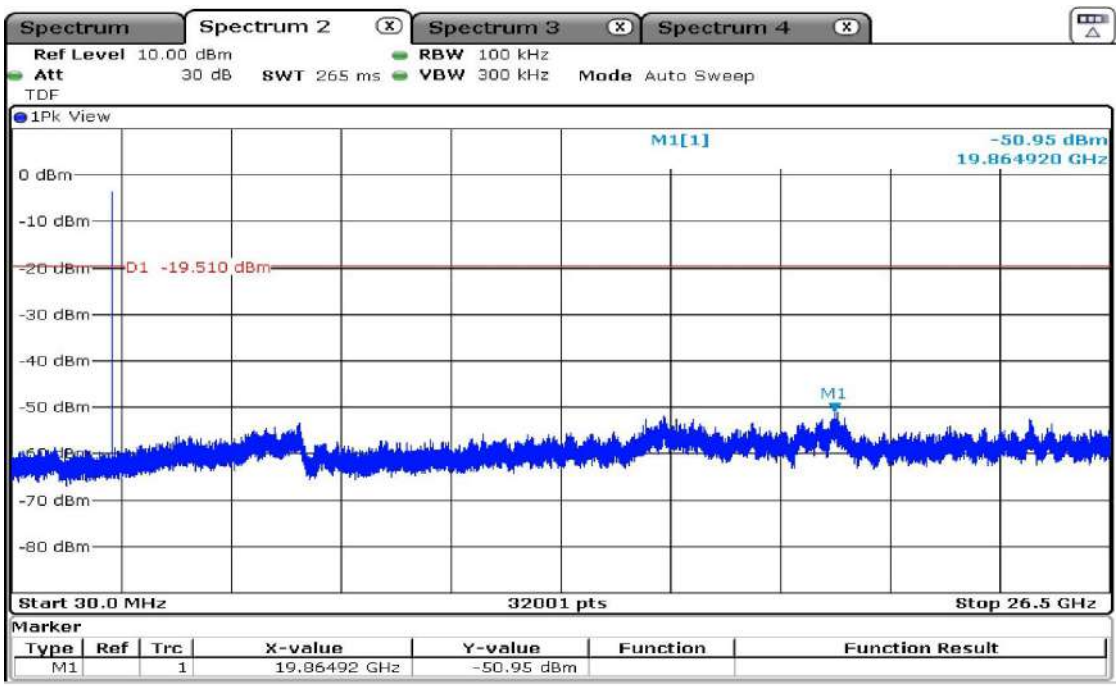
High ch_Power Spectral Density



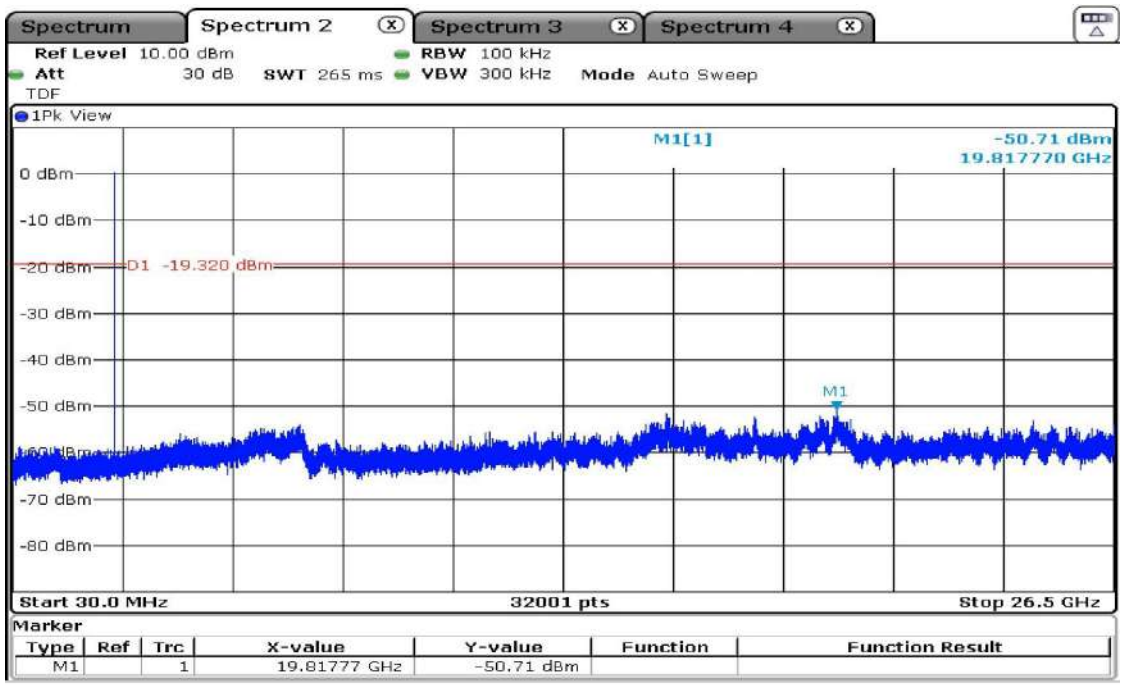
Low ch_Conducted Spurious Emission



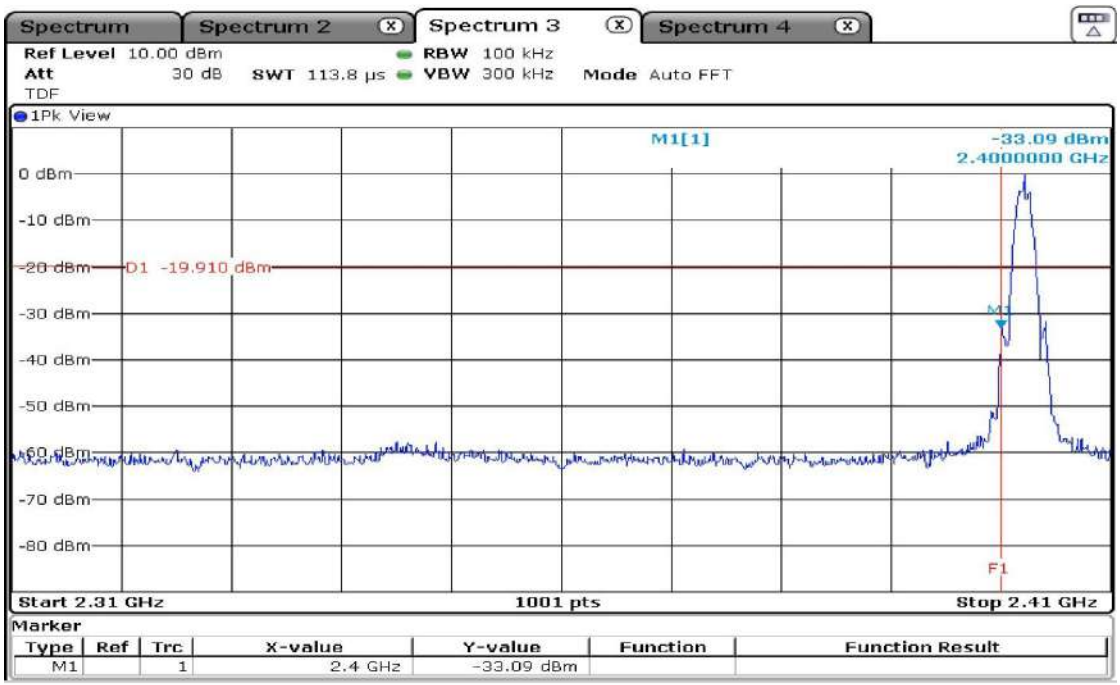
Mid ch_Conducted Spurious Emission



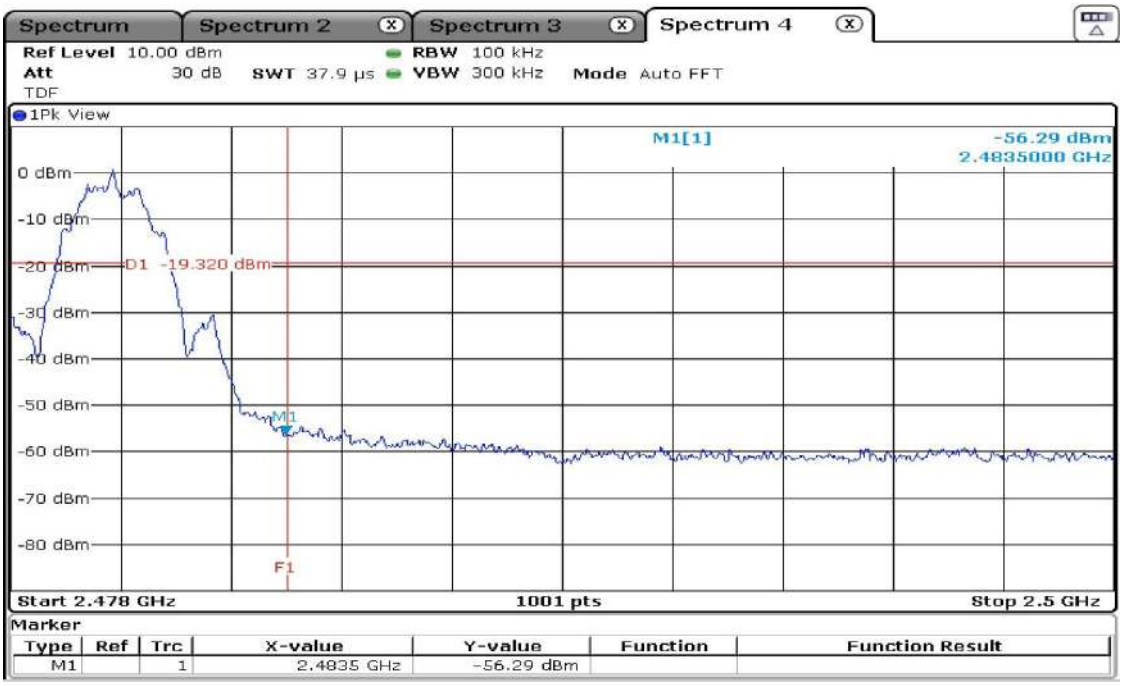
High ch_Conducted Spurious Emission



Low ch_Band Edge



High ch_Band Edge



5.5 Radiated Spurious Emission

5.5.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.12

5.5.2 Limit

§15.247 (d)

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. 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)).

§15.209 Radiated emission limits; general requirements.(a)

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** 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.

§15.205 Restricted bands of operation.(a),(b)

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

[2] Above 38.6

Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

5.5.3 Test data

Result : Pass

- Below 30 MHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- 30 MHz ~ 1 GHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.402	51.89	QP	V	-25.6	26.29	40	13.71	
301.406	43.20	QP	H	-21.7	21.50	46	24.50	
359.994	48.93	QP	H	-20.1	28.83	46	17.17	
429.737	39.93	QP	H	-18.0	21.93	46	24.07	

- 30 MHz ~ 1 GHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
37.469	51.40	QP	V	-25.2	26.20	40	13.80	
40.185	49.97	QP	V	-24.2	25.77	40	14.23	
359.994	49.21	QP	H	-20.1	29.11	46	16.89	
449.622	42.87	QP	H	-17.9	24.97	46	21.03	

- 30 MHz ~ 1 GHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
38.148	49.85	QP	V	-24.8	25.05	40	14.95	
41.155	47.76	QP	V	-23.9	23.86	40	16.14	
359.994	49.44	QP	H	-20.1	29.34	46	16.66	
469.313	41.63	QP	H	-17.4	24.23	46	21.77	

- 1 GHz Above_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 341.00	46.90	PK	H	-10.9	36.00	74	38.00	Restricted band
	33.67	AVG	H		22.77	54	31.23	
4 805.00	60.21	PK	H	-1.7	58.51	74	15.49	2nd Harmonic
	43.31	AVG	H		41.61	54	12.39	
7 207.20	42.81	PK	V	3.0	45.81	74	28.19	3nd Harmonic
	28.69	AVG	V		31.69	54	22.31	
9 607.20	41.18	PK	V	5.4	46.58	74	27.42	4nd Harmonic
	27.22	AVG	V		32.62	54	21.38	

- 1 GHz Above_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 989.50	55.56	PK	V	-7.0	48.56	74	25.44	Spurious Emission
	32.06	AVG	V		25.06	54	28.94	
4 879.50	55.81	PK	H	-1.6	54.21	74	19.79	2nd Harmonic
	41.27	AVG	H		39.67	54	14.33	
7 321.20	49.96	PK	H	2.7	52.66	74	21.34	3nd Harmonic
	34.86	AVG	H		37.56	54	16.44	
9 759.60	40.79	PK	V	6.4	47.19	74	26.81	4nd Harmonic
	26.65	AVG	V		33.05	54	20.95	

- 1 GHz Above_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 484.50	56.55	PK	H	-10.2	46.35	74	27.65	Restricted band
	38.07	AVG	H		27.87	54	26.13	
4 959.50	54.59	PK	H	-1.5	53.09	74	20.91	Restricted band
	40.11	AVG	H		38.61	54	15.39	
7 438.80	52.19	PK	H	2.5	54.69	74	19.31	2nd Harmonic
	37.26	AVG	H		39.76	54	14.24	
9 921.60	40.20	PK	H	5.8	46.00	74	28.00	3nd Harmonic
	26.04	AVG	H		31.84	54	22.16	

6. Test Result - Type A - LE (125 Kbps)

6.1. 6 dB Bandwidth

6.1.1 Test procedure

ANSI C63.10-2013 Clause 11.8

6.1.2 Limit

§15.247 (a) (2)

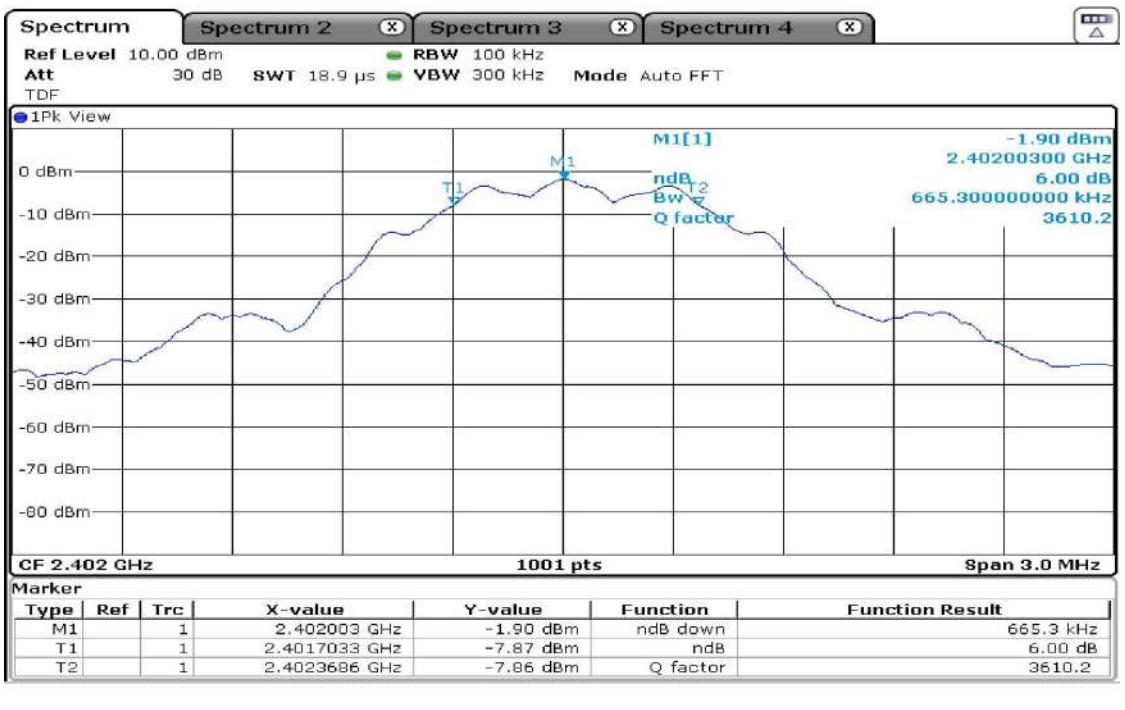
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

6.1.3 Test data

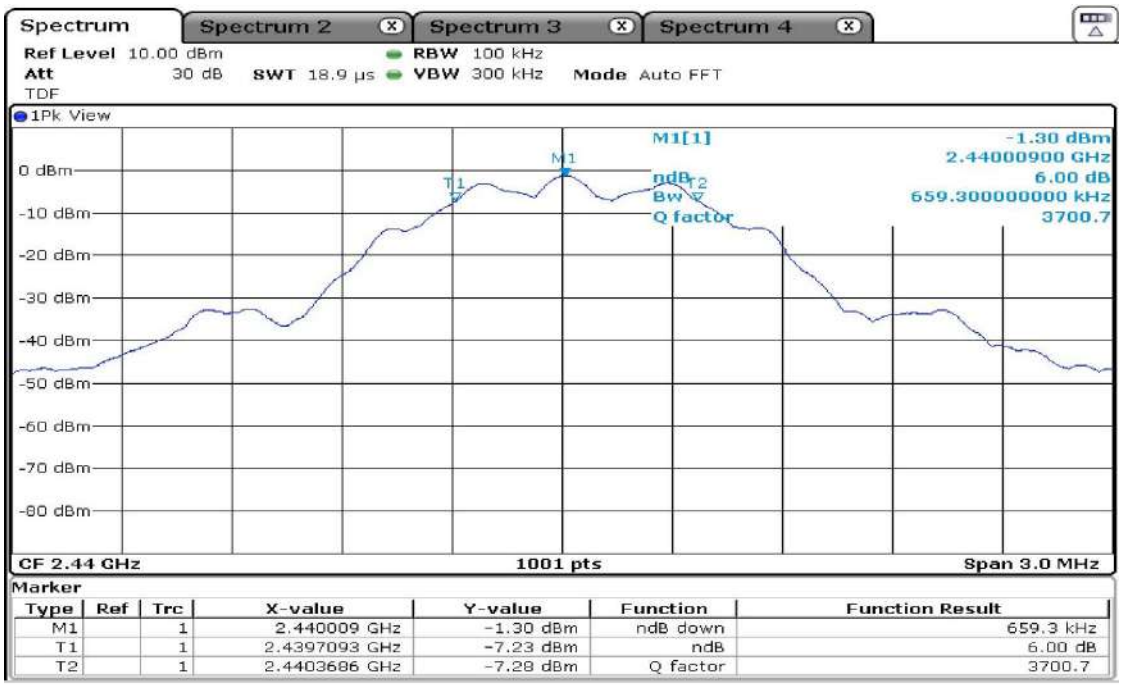
Result : Pass

Mode	Frequency (MHz)	Measured Value (kHz)	Limit (kHz)
Bluetooth LE 125 Kbps	2 402	665.3	at least 500
	2 440	659.3	
	2 480	728.3	

Low ch_6 dB Bandwidth



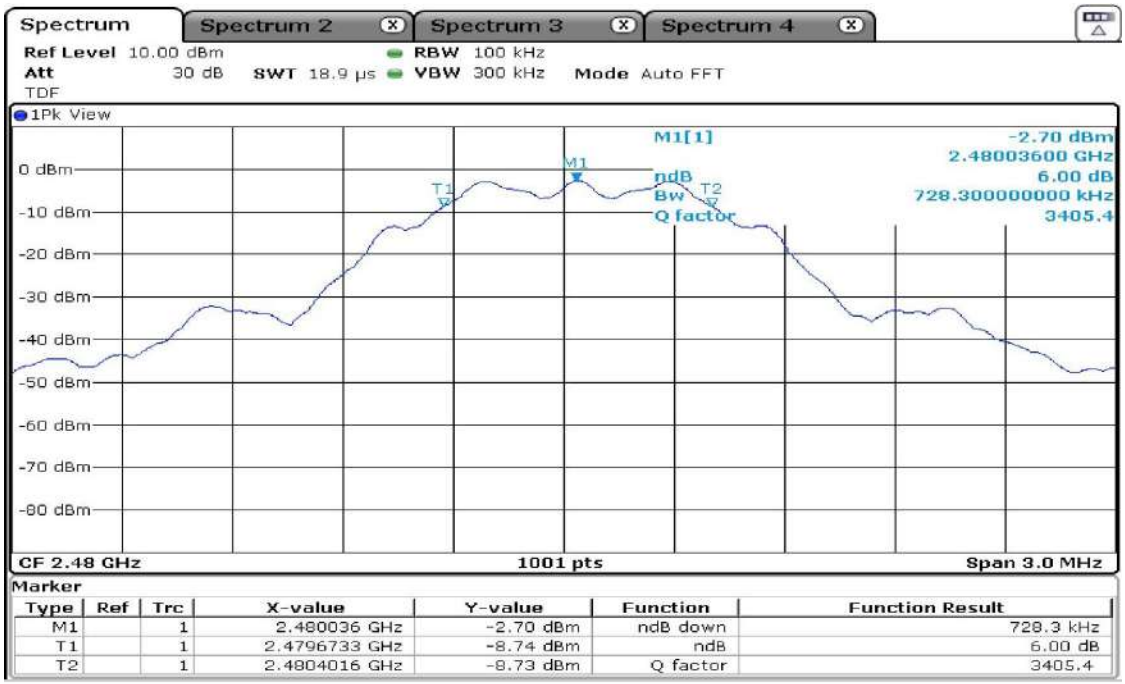
Mid ch_6 dB Bandwidth



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.440009 GHz	-1.30 dBm	ndB down	659.3 kHz
T1		1	2.4397093 GHz	-7.23 dBm	ndB	6.00 dB
T2		1	2.4403686 GHz	-7.28 dBm	Q factor	3700.7

High ch_6 dB Bandwidth



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.480036 GHz	-2.70 dBm	ndB down	728.3 kHz
T1		1	2.4796733 GHz	-8.74 dBm	ndB	6.00 dB
T2		1	2.4804016 GHz	-8.73 dBm	Q factor	3405.4

6.2 Maximum Conducted Output Power

6.2.1 Test procedure

ANSI C63.10-2013 Clause 11.9

6.2.2 Limit

§15.247 (b) (3)

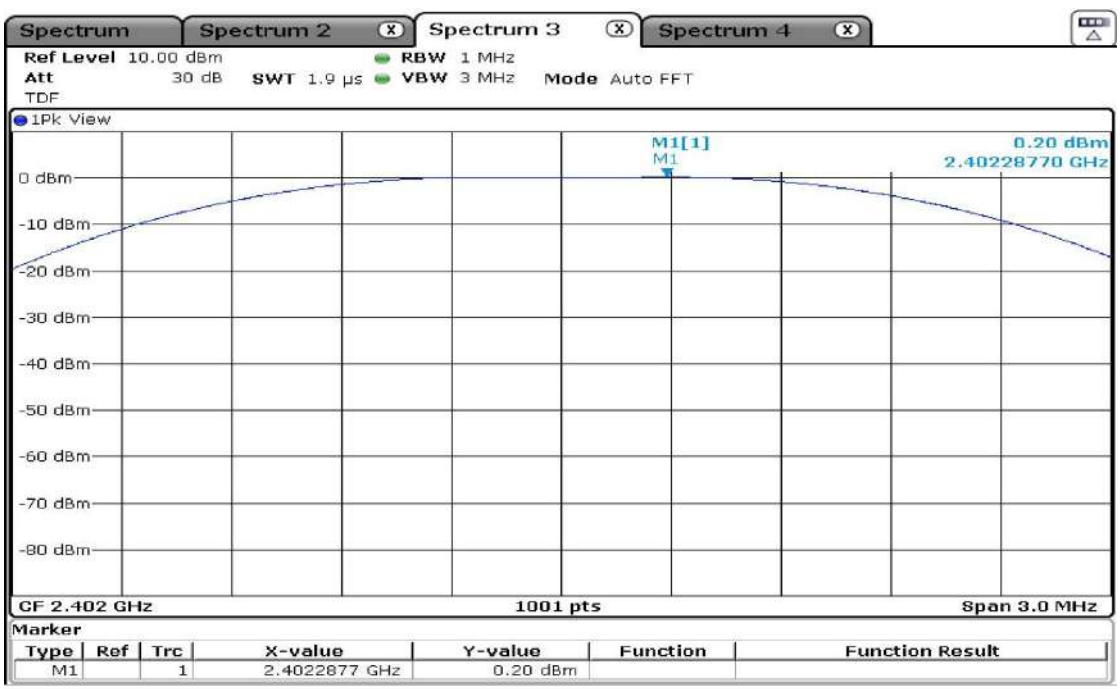
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as 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.

6.2.3 Test data

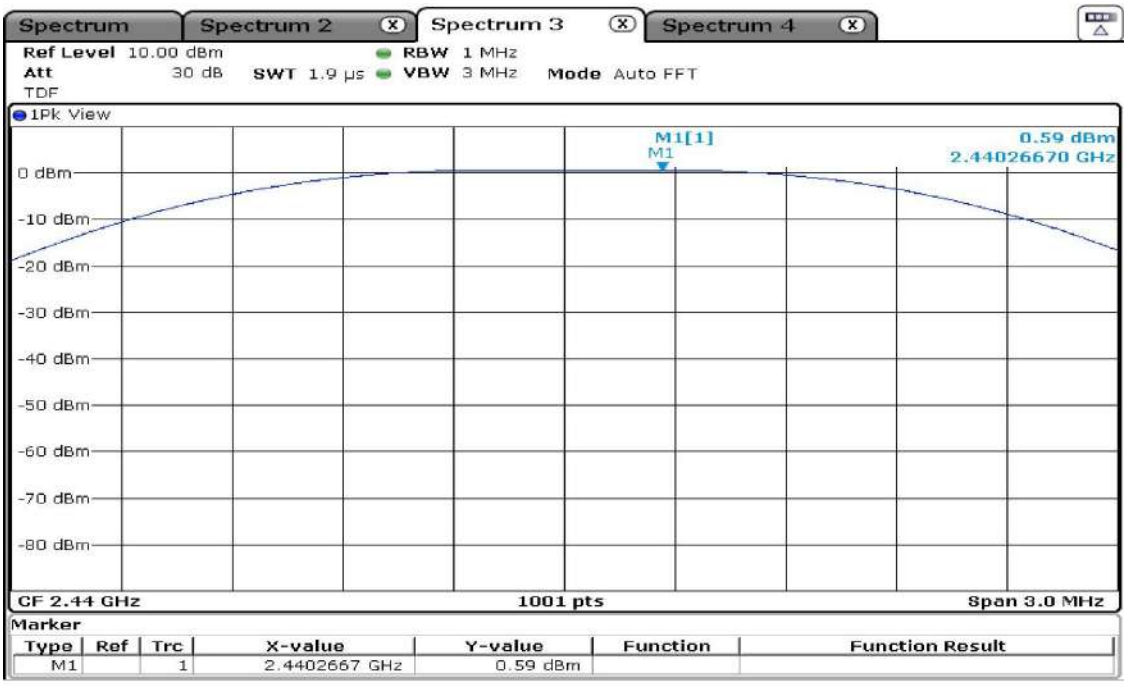
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)
Bluetooth LE 125 Kbps	2 402	0.20	30
	2 440	0.59	
	2 480	0.80	

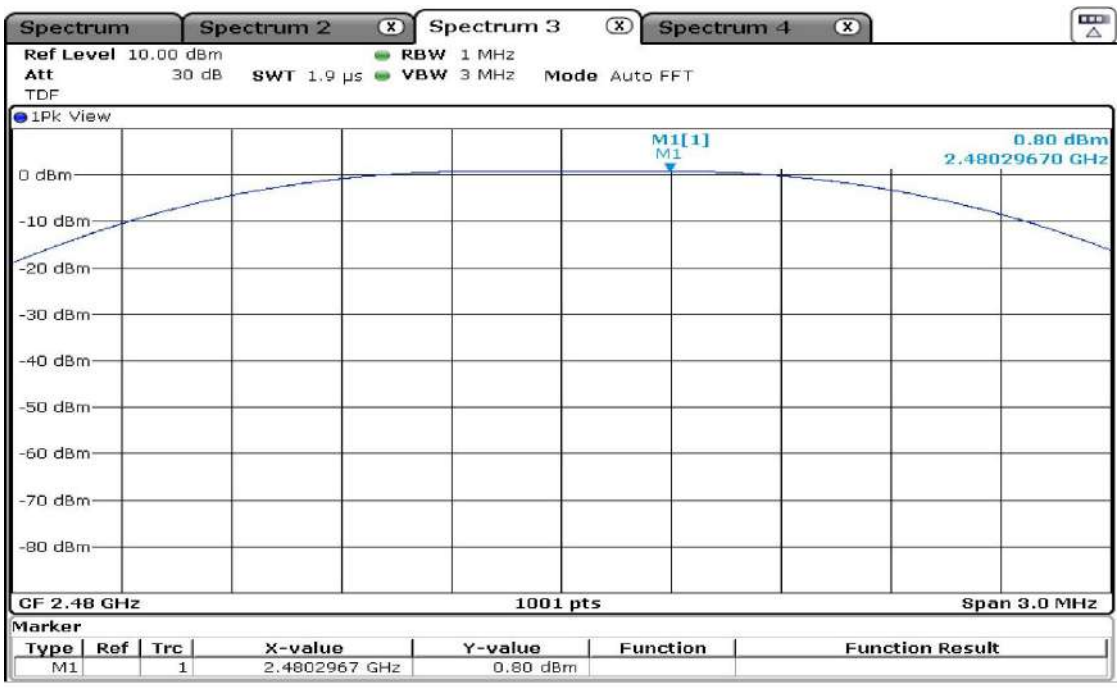
Low ch_Maximum Conducted Output Power



Mid ch_Maximum Conducted Output Power



High ch_Maximum Conducted Output Power



6.3 Power Spectral Density

6.3.1 Test procedure

ANSI C63.10-2013 Clause 11.10

6.3.2 Limit

§15.247 (e)

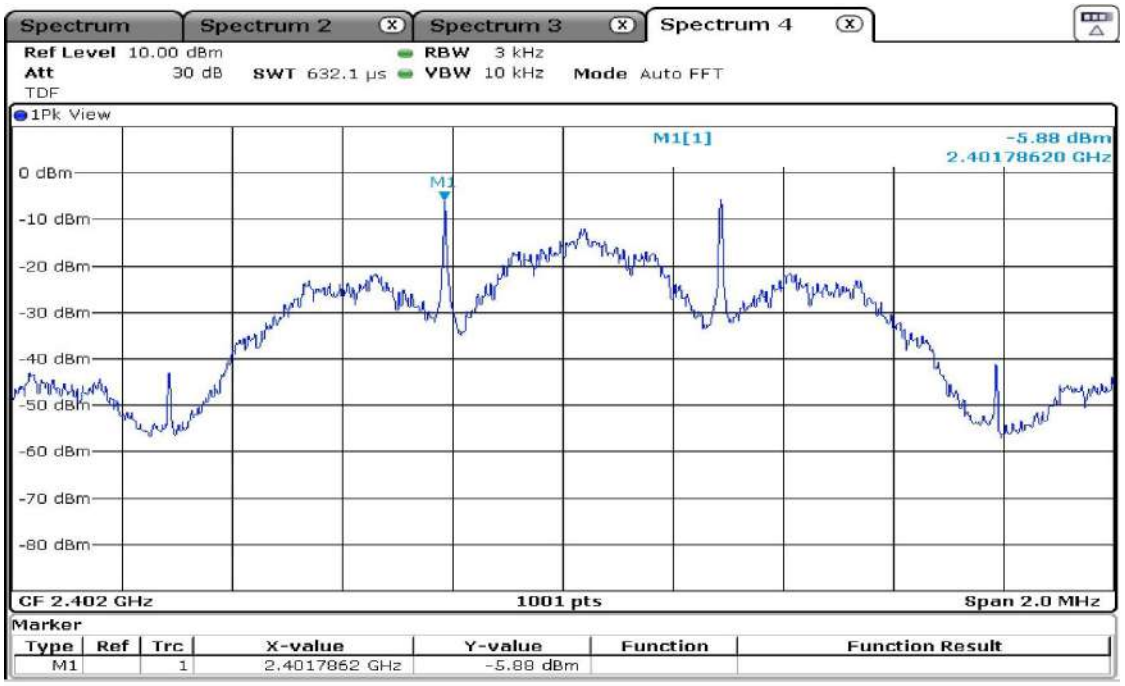
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.3.3 Test data

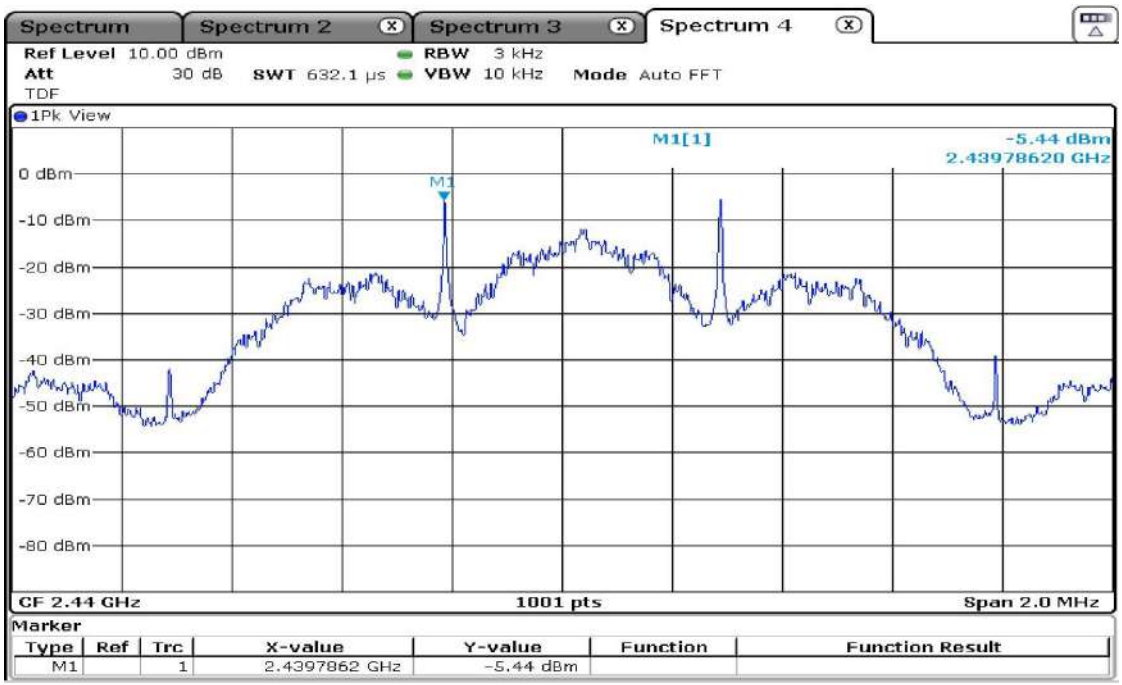
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm/3 kHz)
Bluetooth LE 125 Kbps	2 402	-5.88	8
	2 440	-5.44	
	2 480	-5.21	

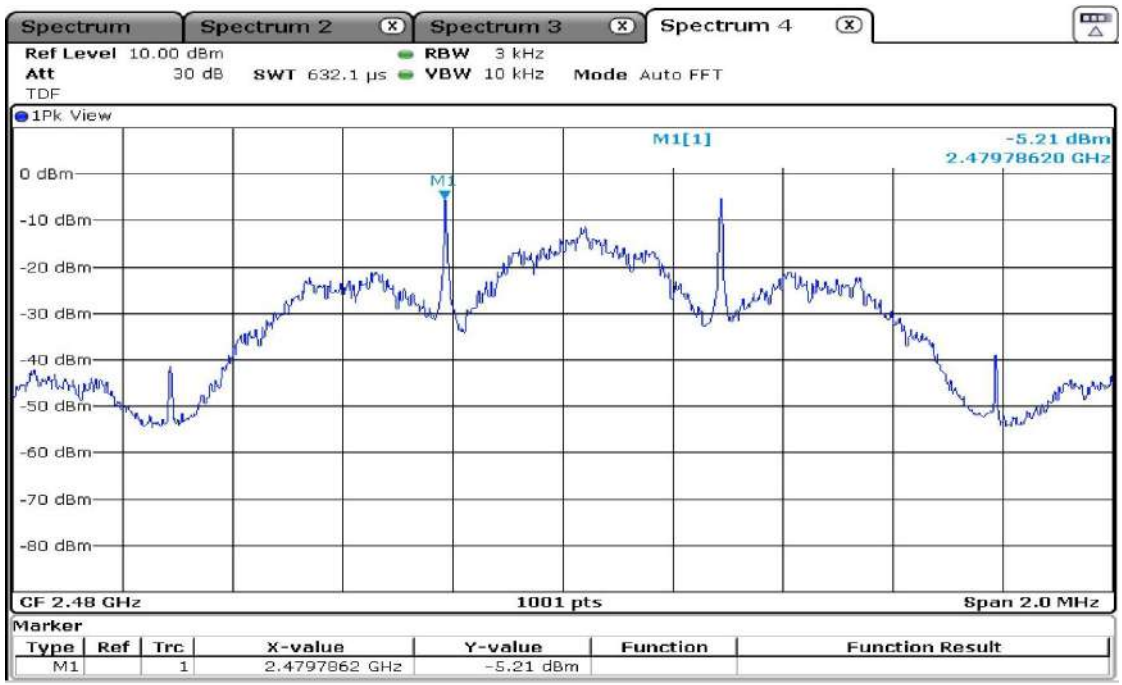
Low ch_Power Spectral Density



Mid ch_Power Spectral Density



High ch_Power Spectral Density



6.4 Conducted Spurious Emission & Band Edge

6.4.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.13

6.4.2 Limit

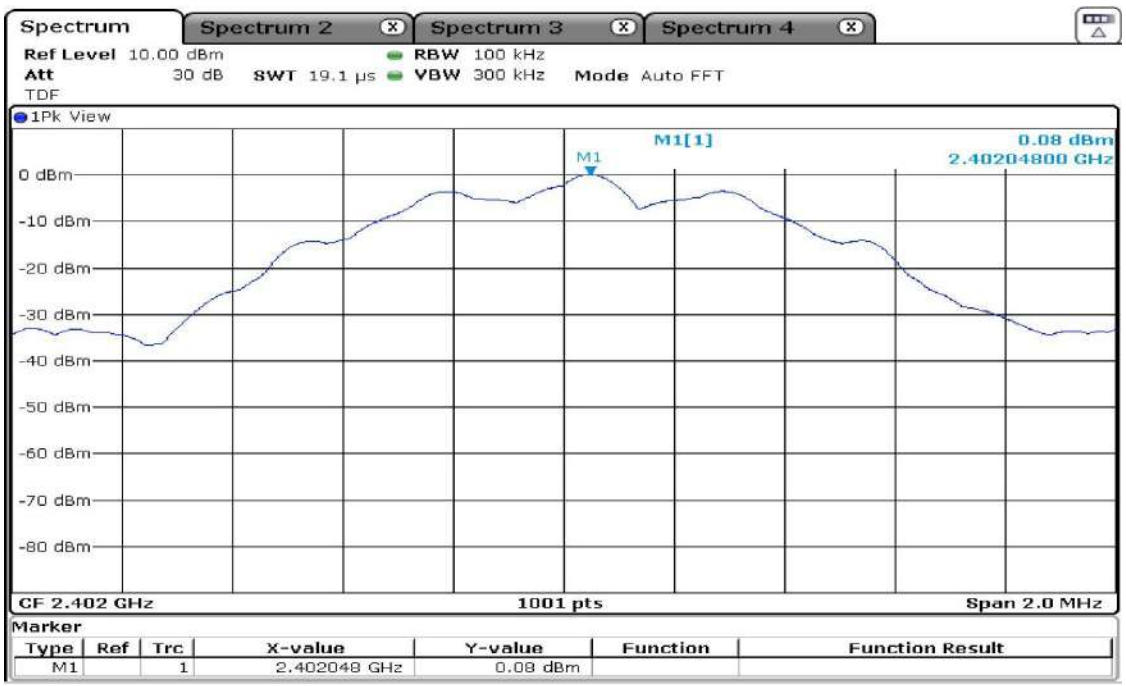
§15.247 (d)

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. 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)).

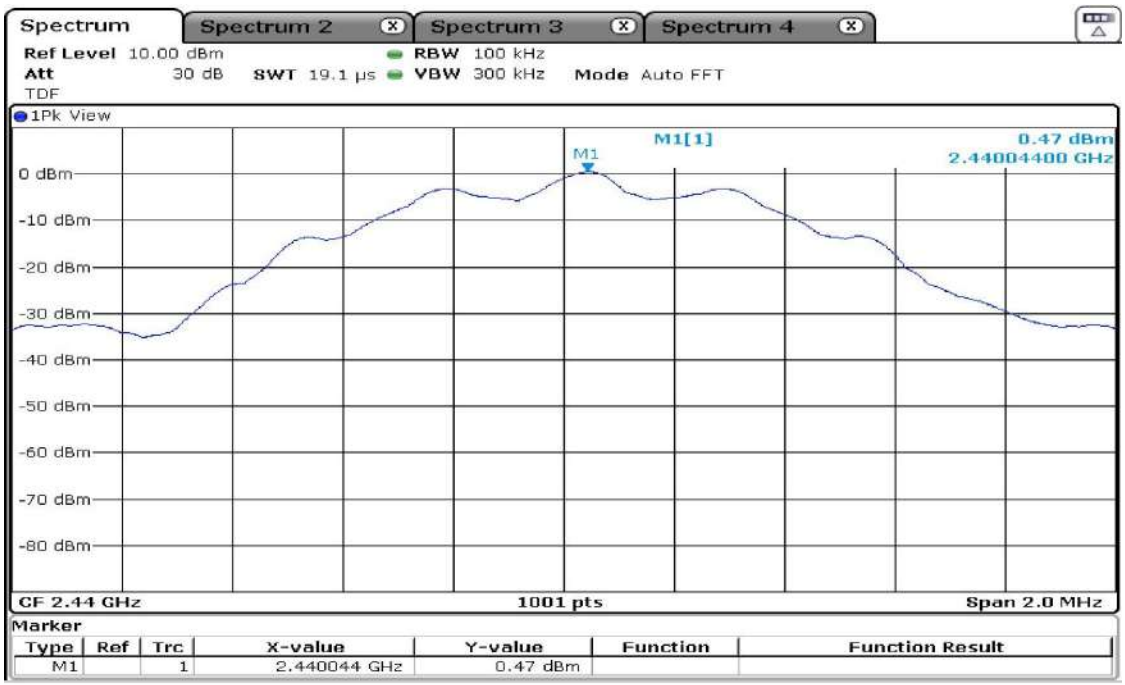
6.4.3 Test data

Result : Pass

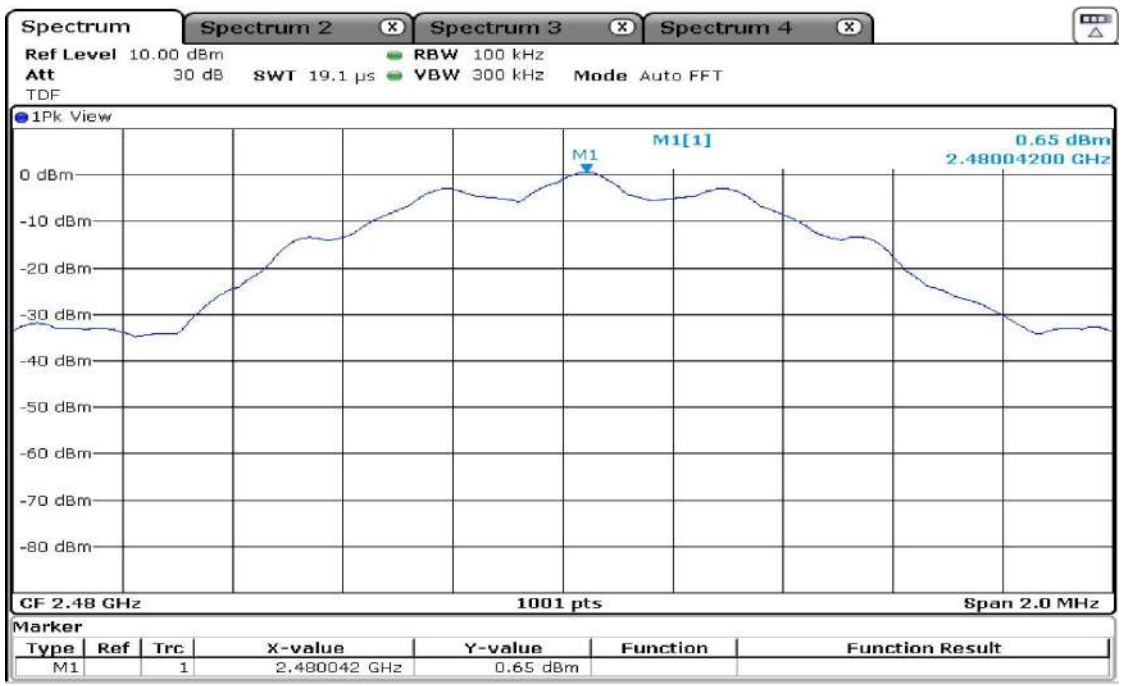
Low ch_Reference Level



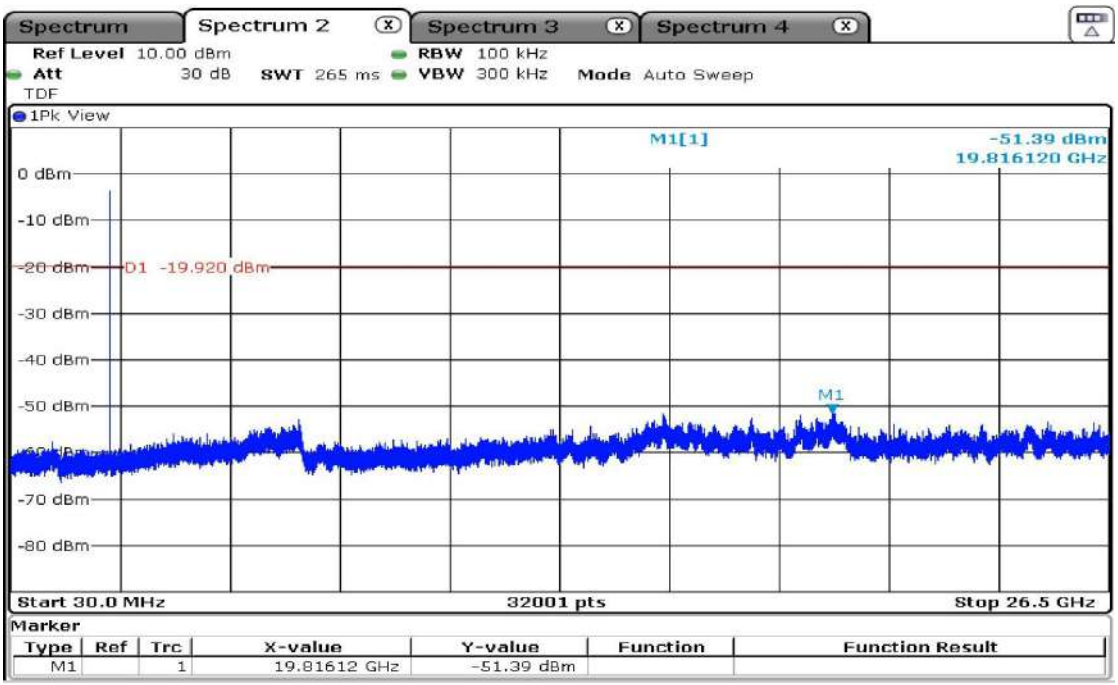
Mid ch_Reference Level



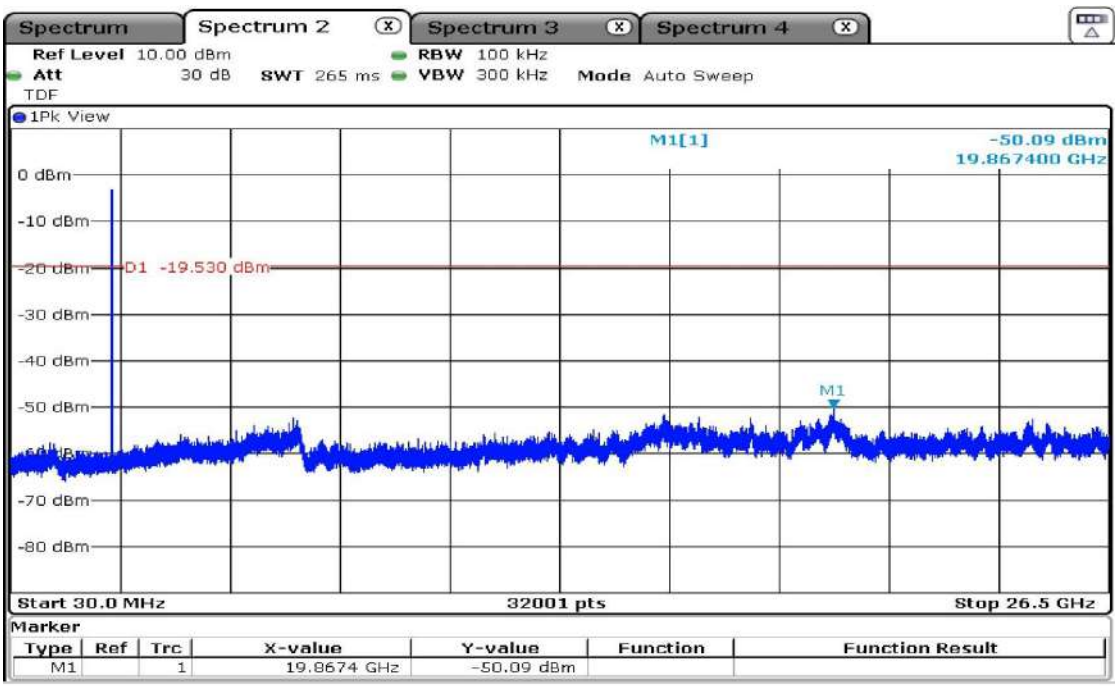
High ch_Power Spectral Density



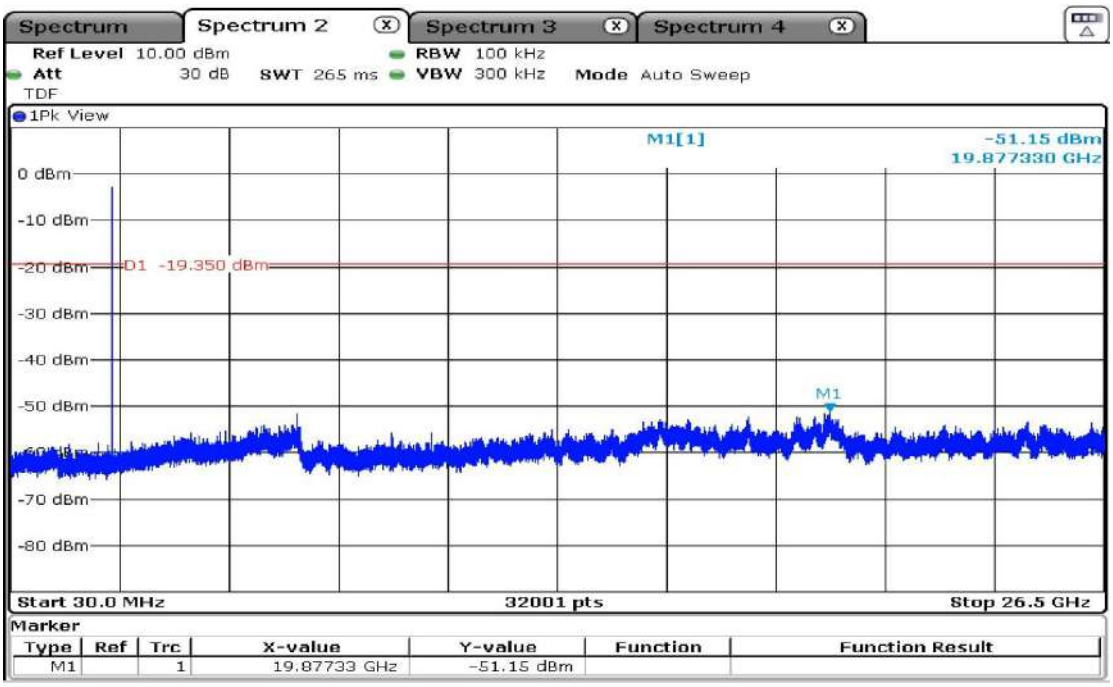
Low ch_Conducted Spurious Emission



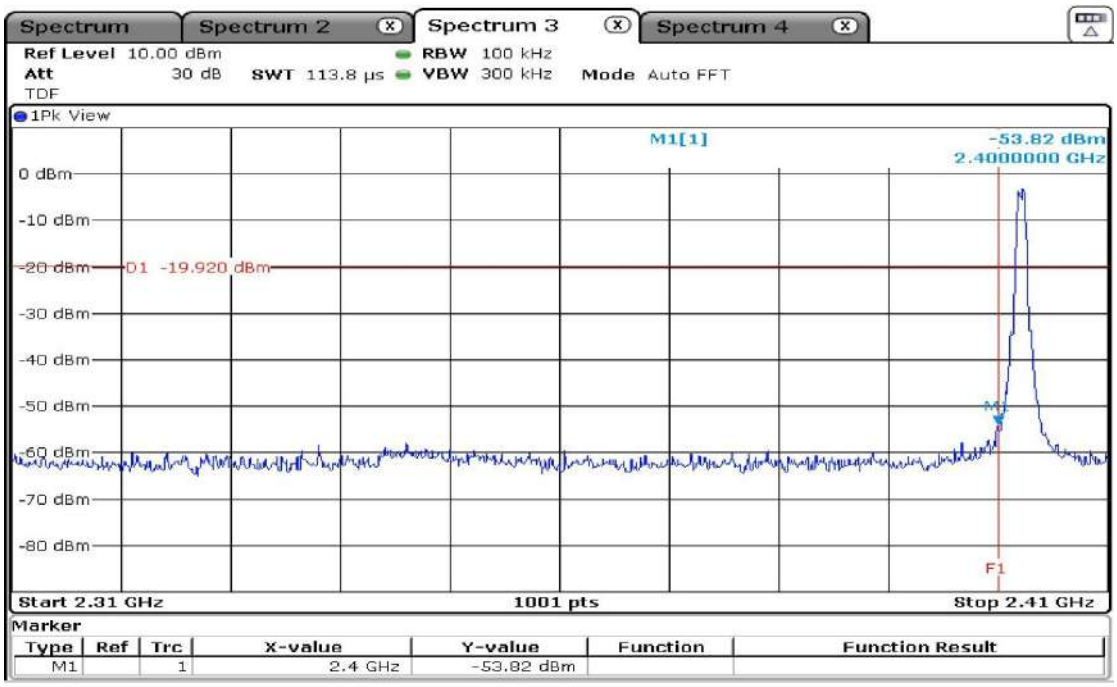
Mid ch_Conducted Spurious Emission



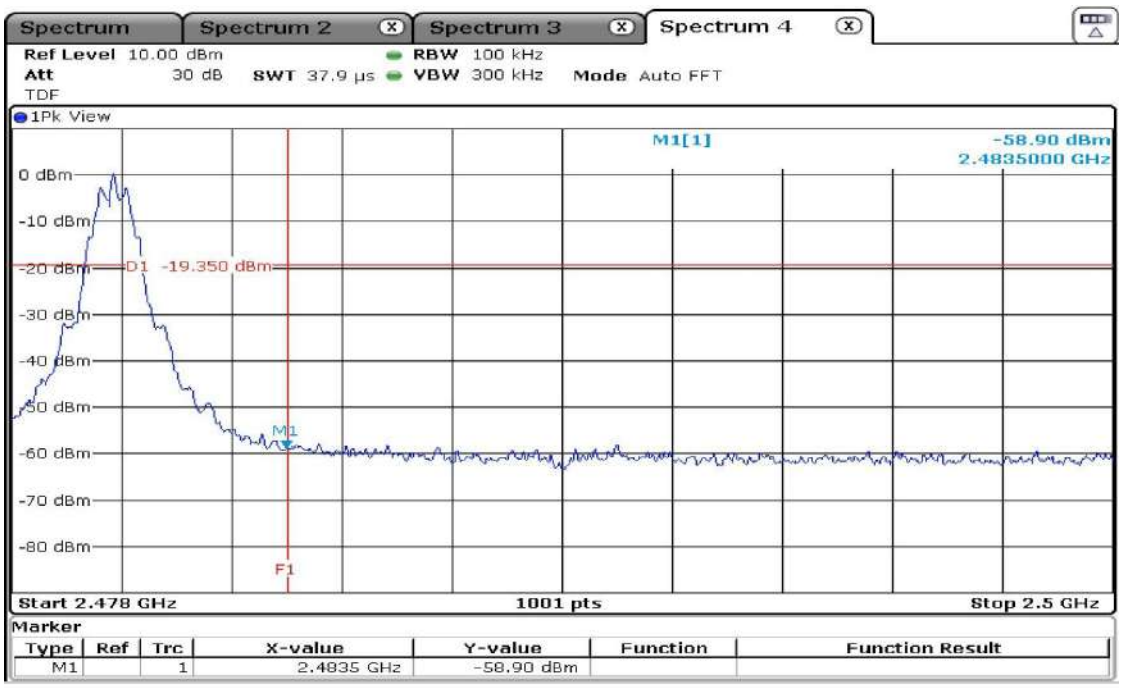
High ch_Conducted Spurious Emission



Low ch_Band Edge



High ch_Band Edge



6.5 Radiated Spurious Emission

6.5.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.12

6.5.2 Limit

§15.247 (d)

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. 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)).

§15.209 Radiated emission limits; general requirements.(a)

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** 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.

§15.205 Restricted bands of operation.(a),(b)

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

[2] Above 38.6

Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

6.5.3 Test data

Result : Pass

- Below 30 MHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- 30 MHz ~ 1 GHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.887	51.50	QP	V	-25.5	26.00	40	14.00	
359.994	49.21	QP	H	-20.1	29.11	46	16.89	
411.889	43.18	QP	H	-18.3	24.88	46	21.12	
442.056	42.62	QP	H	-17.9	24.72	46	21.28	

- 30 MHz ~ 1 GHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.596	52.69	QP	V	-25.6	27.09	40	12.91	
38.439	50.01	QP	V	-24.7	25.31	40	14.69	
359.994	49.40	QP	H	-20.1	29.30	46	16.70	
471.059	41.89	QP	H	-17.3	24.59	46	21.41	

- 30 MHz ~ 1 GHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.402	51.89	QP	V	-25.6	26.29	40	13.71	
359.994	49.48	QP	H	-20.1	29.38	46	16.62	
432.938	42.01	QP	H	-18.0	24.01	46	21.99	
474.939	42.44	QP	H	-17.2	25.24	46	20.76	

- 1 GHz Above_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 381.00	47.44	PK	H	-10.7	36.74	74	37.26	Restricted band
	33.64	AVG	H		22.94	54	31.06	
4 804.00	60.36	PK	H	-1.7	58.66	74	15.34	2nd Harmonic
	53.54	AVG	H		51.84	54	2.16	
7 204.80	48.90	PK	H	3	51.90	74	22.10	3nd Harmonic
	37.18	AVG	H		40.18	54	13.82	
9 609.60	44.50	PK	H	5.5	50.00	74	24.00	4nd Harmonic
	32.03	AVG	H		37.53	54	16.47	

- 1 GHz Above_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
4 879.50	58.99	PK	H	-1.6	57.39	74	16.61	2nd Harmonic
	50.64	AVG	H		49.04	54	4.96	
7 318.80	47.54	PK	H	2.7	50.24	74	23.76	3nd Harmonic
	35.59	AVG	H		38.29	54	15.71	
9 760.80	40.74	PK	H	6.4	47.14	74	26.86	4nd Harmonic
	27.28	AVG	H		33.68	54	20.32	

- 1 GHz Above_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 490.50	49.28	PK	H	-10.2	39.08	74	34.92	Restricted band
	35.56	AVG	H		25.36	54	28.64	
4 959.50	62.78	PK	H	-1.5	61.28	74	12.72	2nd Harmonic
	54.72	AVG	H		53.22	54	0.78	
7 438.80	48.61	PK	H	2.5	51.11	74	22.89	3nd Harmonic
	37.19	AVG	H		39.69	54	14.31	
9 920.40	47.83	PK	H	5.8	53.63	74	20.37	4nd Harmonic
	34.84	AVG	H		40.64	54	13.36	

7. Test Result - Type A - LE (500 Kbps)

7.1. 6 dB Bandwidth

7.1.1 Test procedure

ANSI C63.10-2013 Clause 11.8

7.1.2 Limit

§15.247 (a) (2)

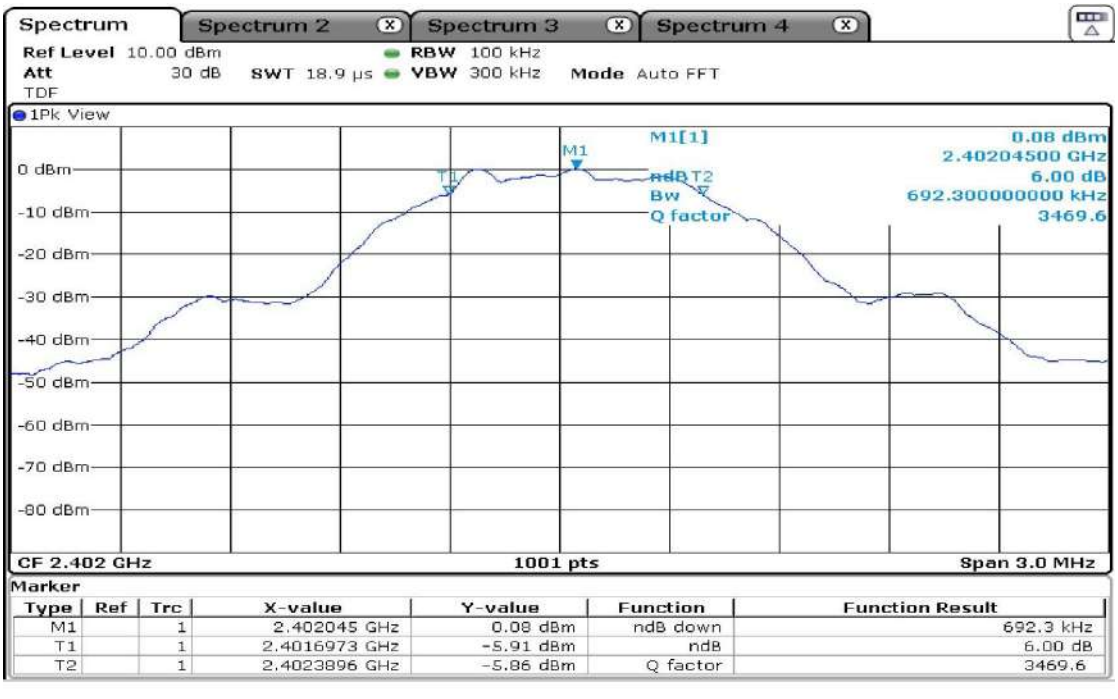
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

7.1.3 Test data

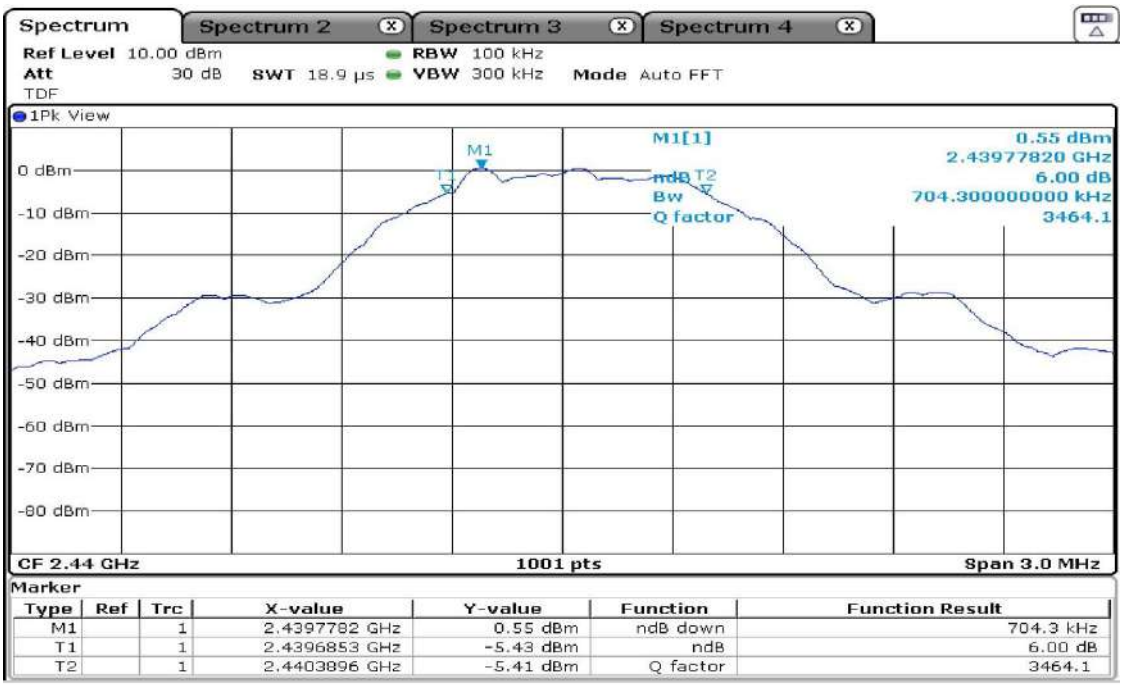
Result : Pass

Mode	Frequency (MHz)	Measured Value (kHz)	Limit (kHz)
Bluetooth LE 500 Kbps	2 402	692.3	at least 500
	2 440	704.3	
	2 480	707.3	

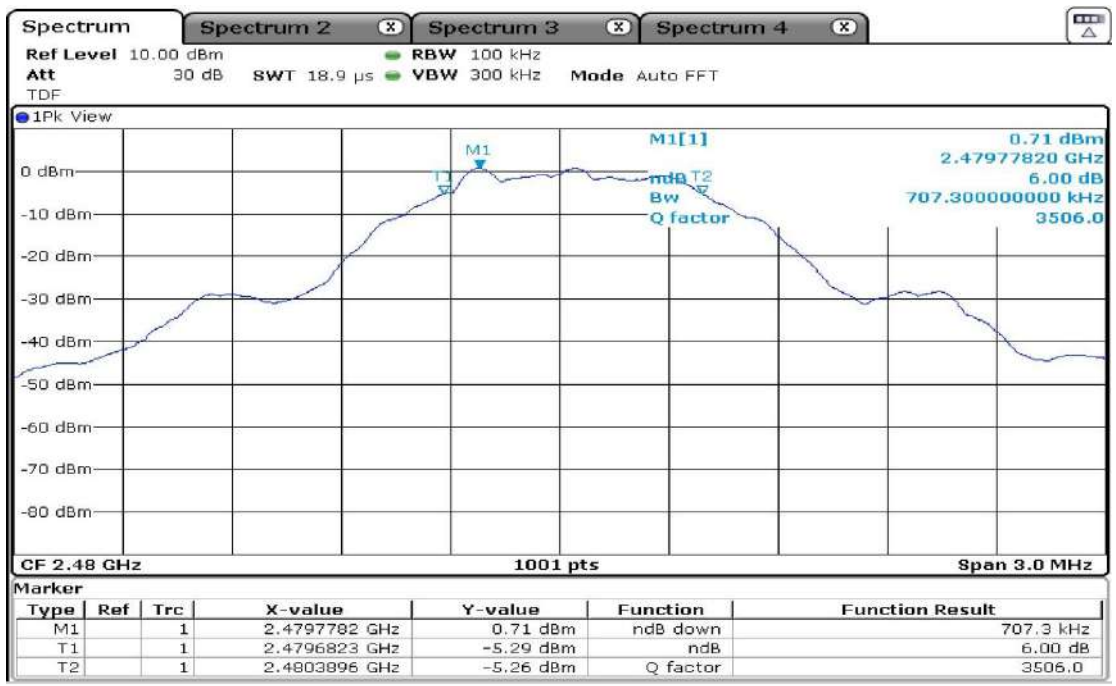
Low ch_6 dB Bandwidth



Mid ch_6 dB Bandwidth



High ch_6 dB Bandwidth



7.2 Maximum Conducted Output Power

7.2.1 Test procedure

ANSI C63.10-2013 Clause 11.9

7.2.2 Limit

§15.247 (b) (3)

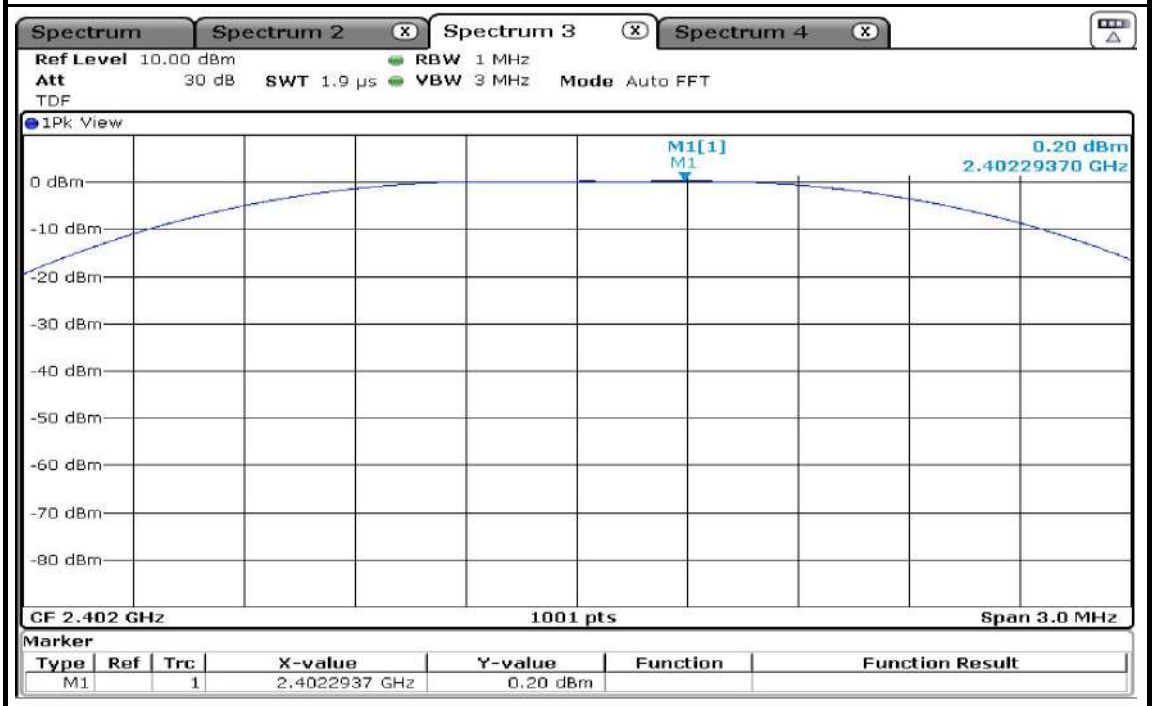
For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as 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.

7.2.3 Test data

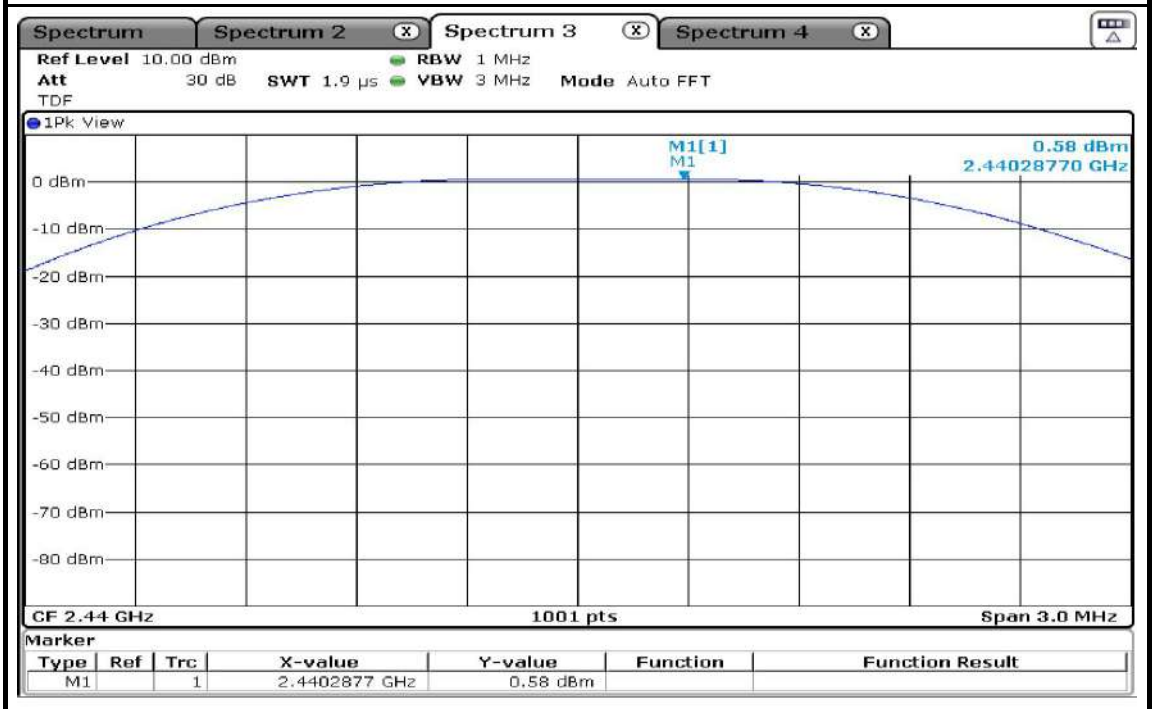
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)
Bluetooth LE 500 Kbps	2 402	0.20	30
	2 440	0.58	
	2 480	0.76	

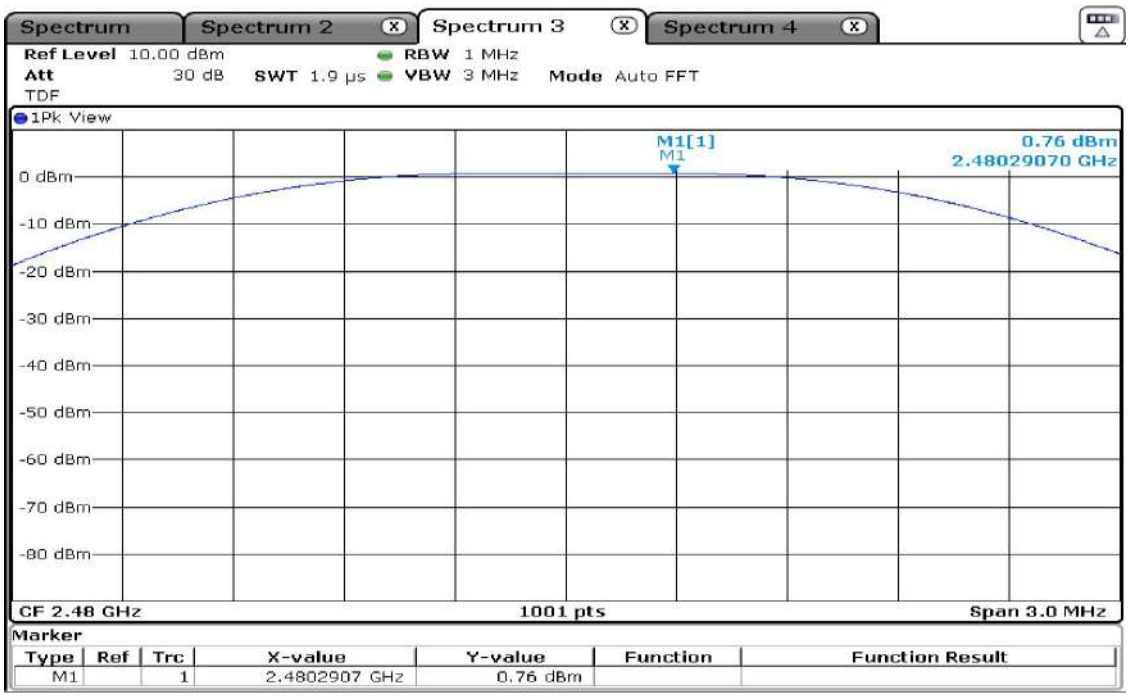
Low ch_Maximum Conducted Output Power



Mid ch_Maximum Conducted Output Power



High ch_Maximum Conducted Output Power



7.3 Power Spectral Density

7.3.1 Test procedure

ANSI C63.10-2013 Clause 11.10

7.3.2 Limit

§15.247 (e)

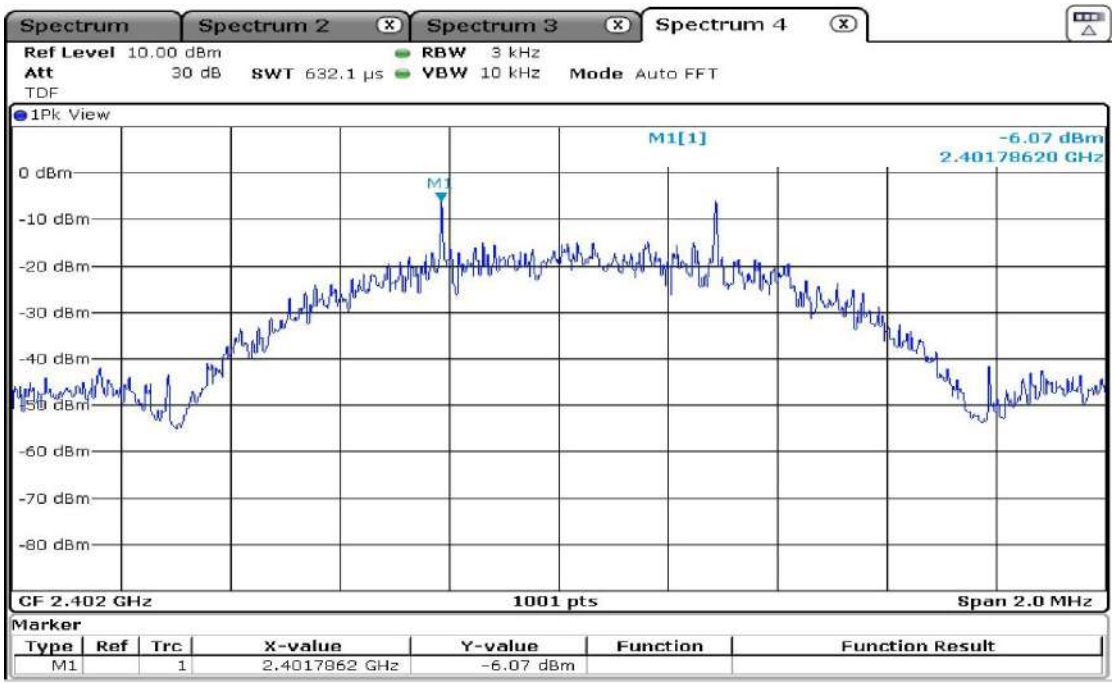
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

7.3.3 Test data

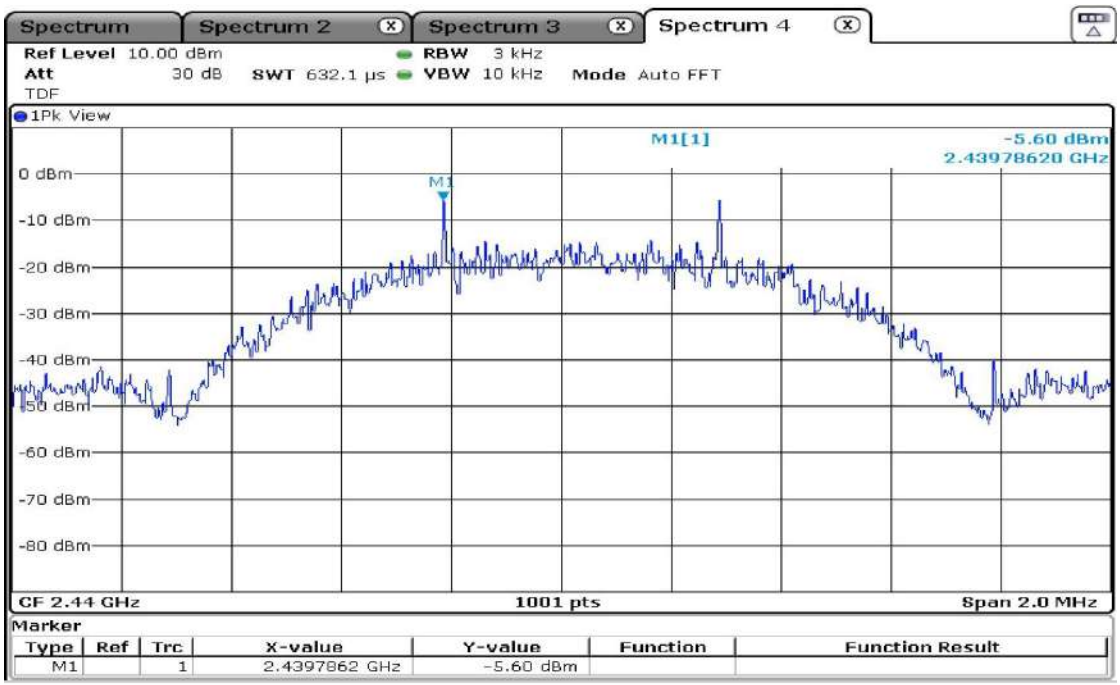
Result : Pass

Mode	Frequency (MHz)	Measured Value (dBm)	Limit (dBm/3 kHz)
Bluetooth LE 500 Kbps	2 402	-6.07	8
	2 440	-5.60	
	2 480	-5.43	

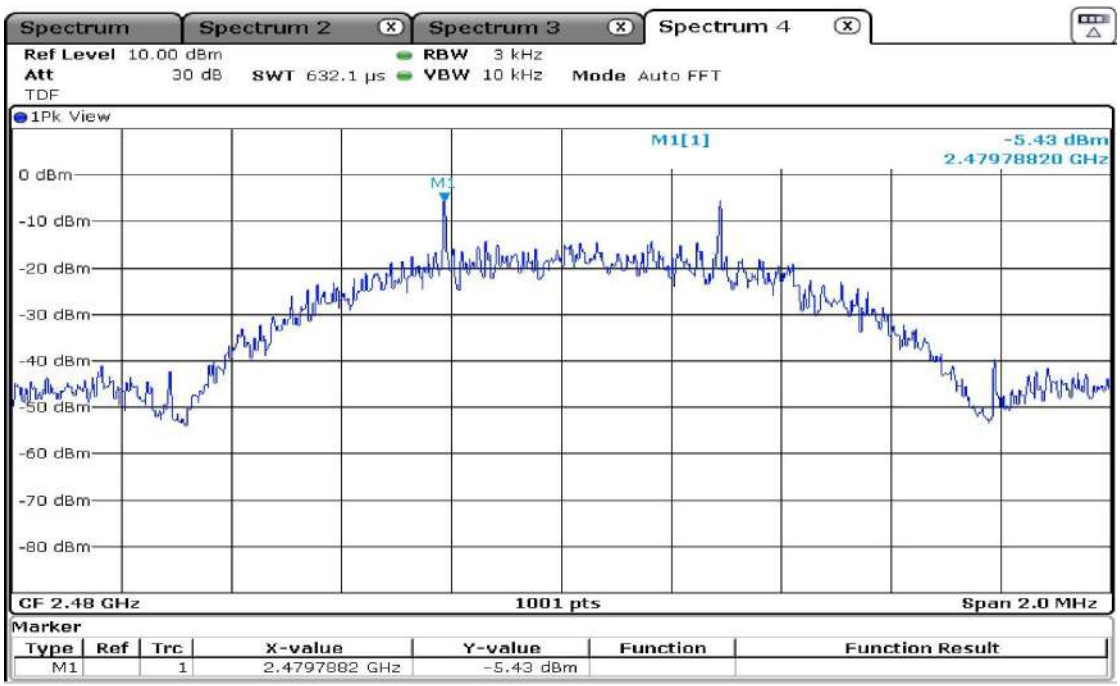
Low ch_Power Spectral Density



Mid ch_Power Spectral Density



High ch_Power Spectral Density



7.4 Conducted Spurious Emission & Band Edge

7.4.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.13

7.4.2 Limit

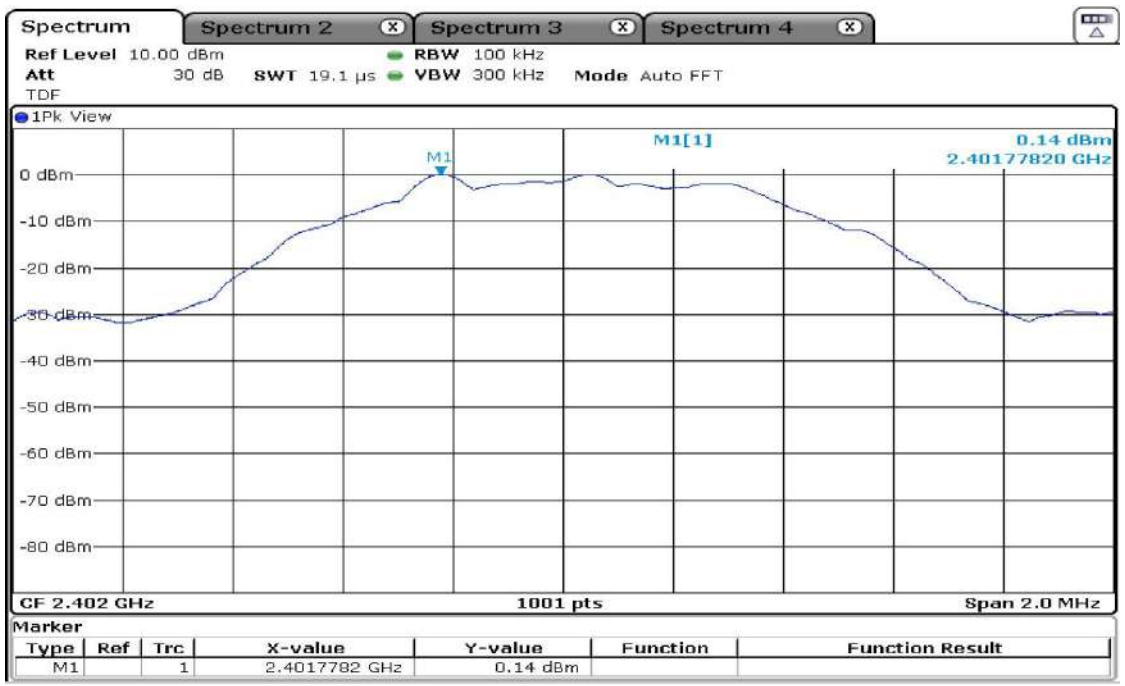
§15.247 (d)

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. 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)).

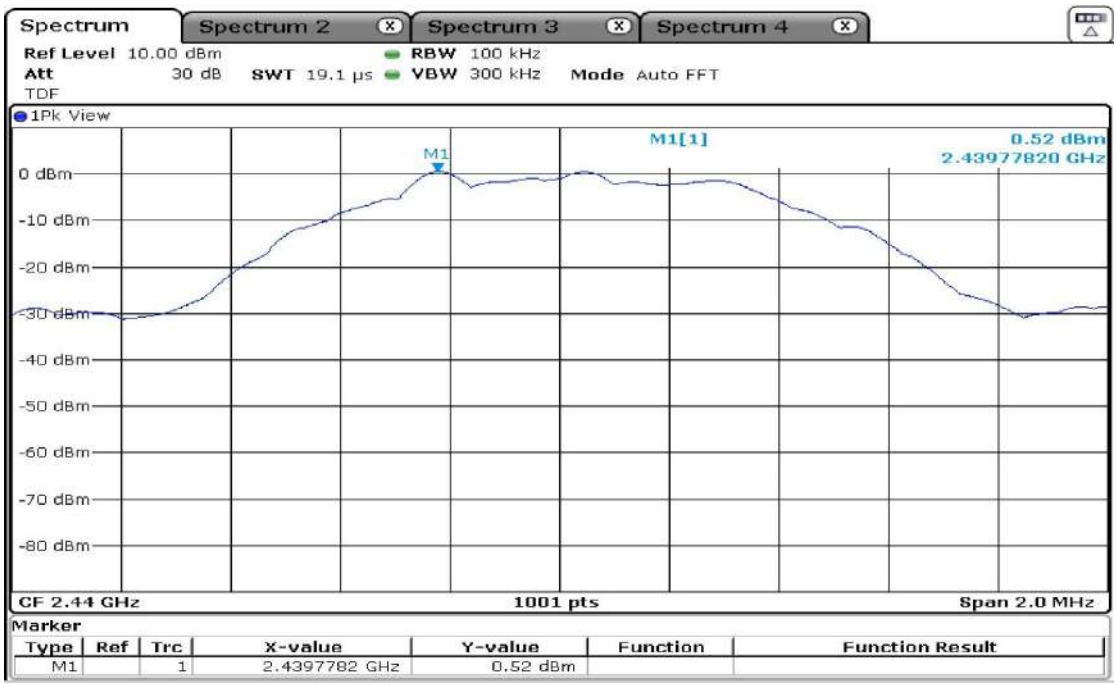
7.4.3 Test data

Result : Pass

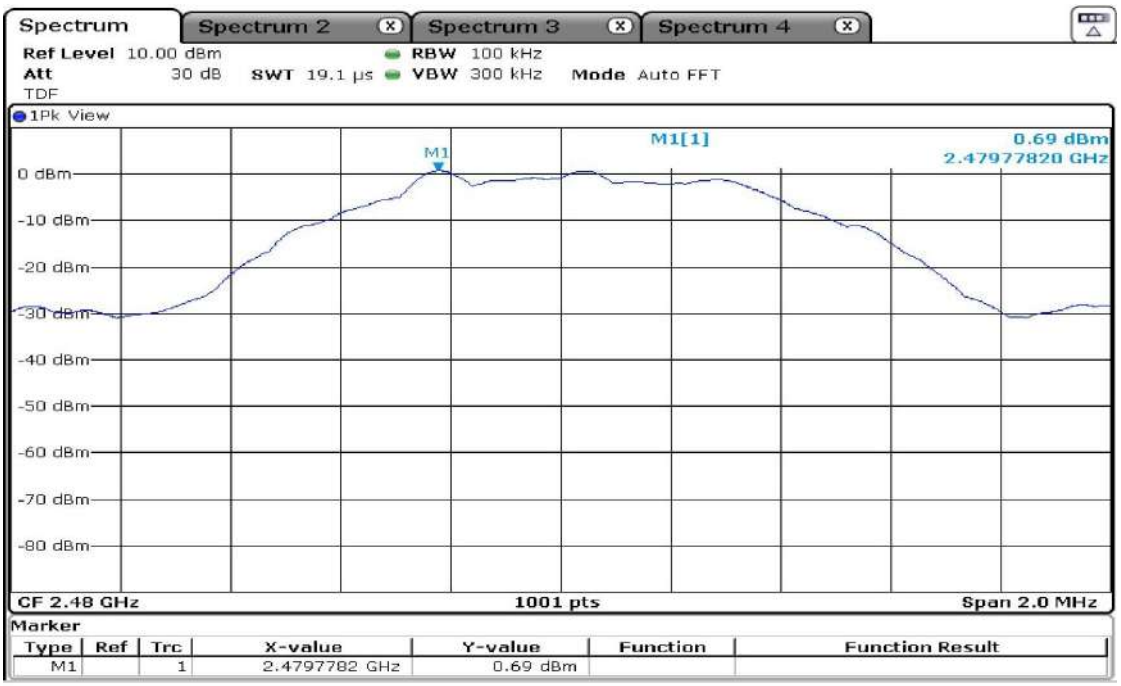
Low ch_Reference Level



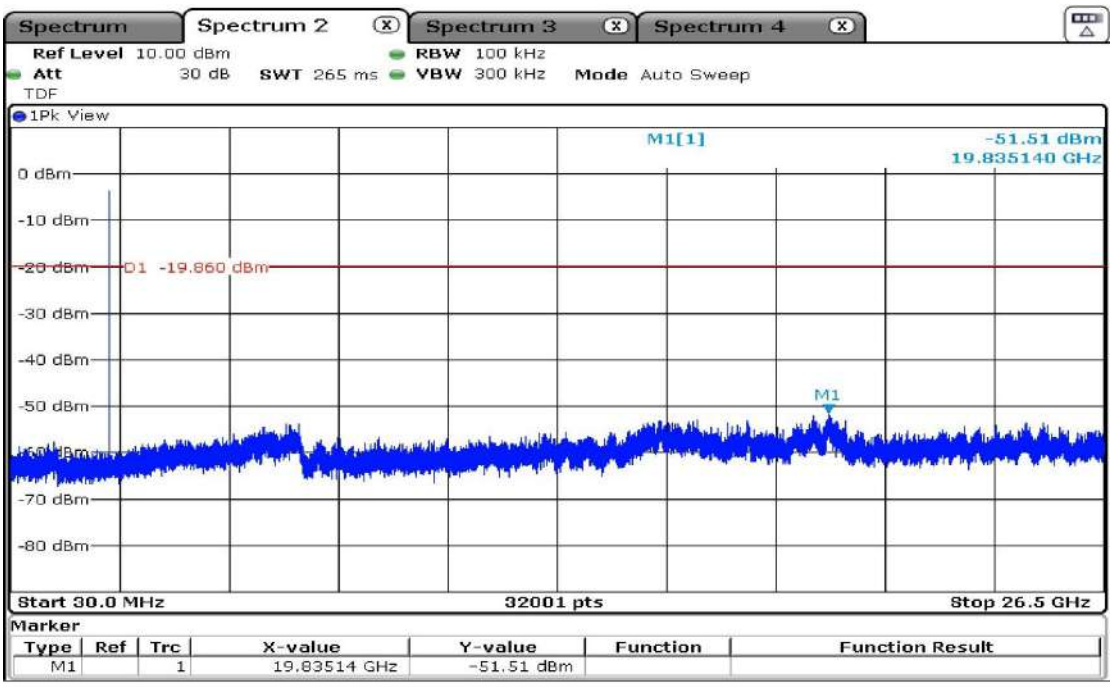
Mid ch_Reference Level



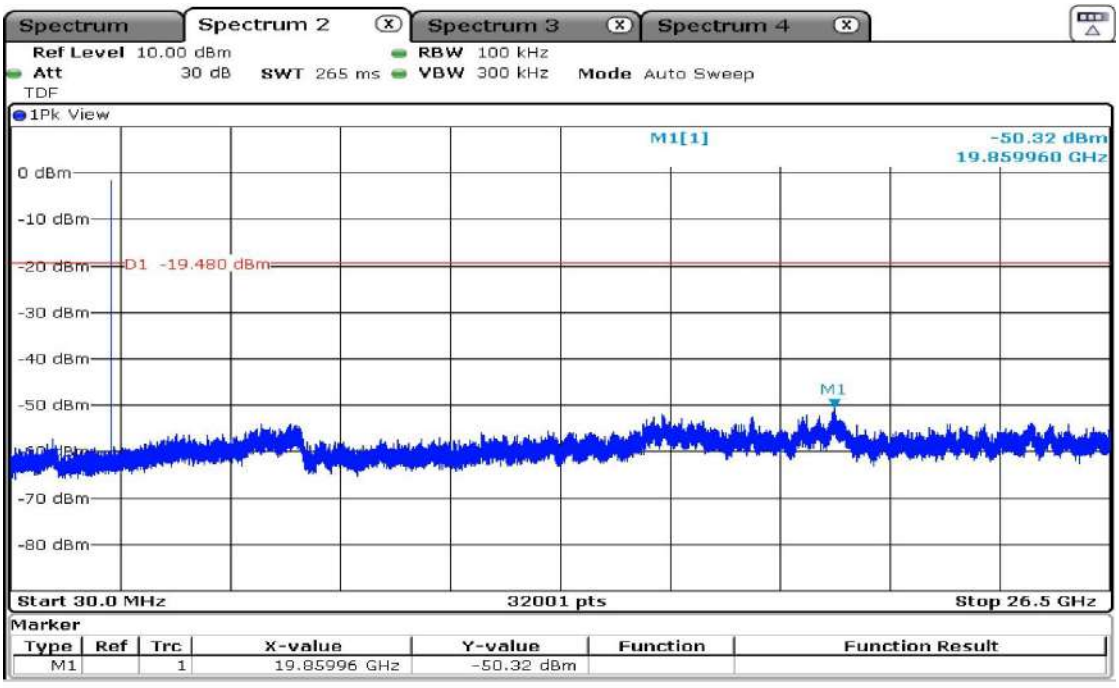
High ch_Power Spectral Density



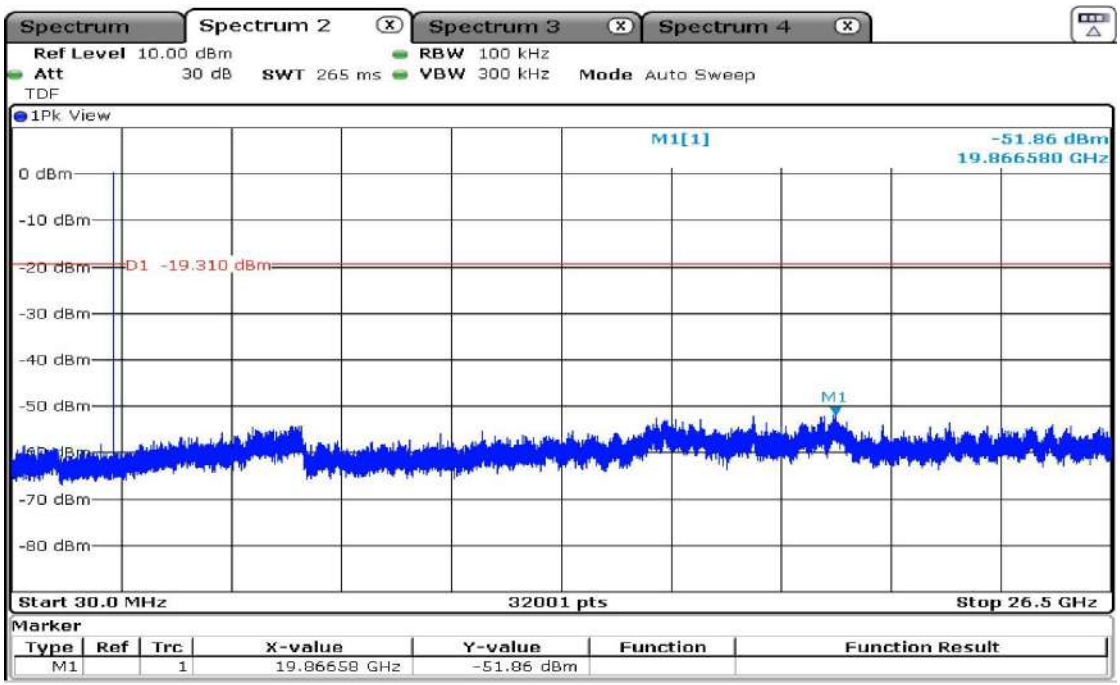
Low ch_Conducted Spurious Emission



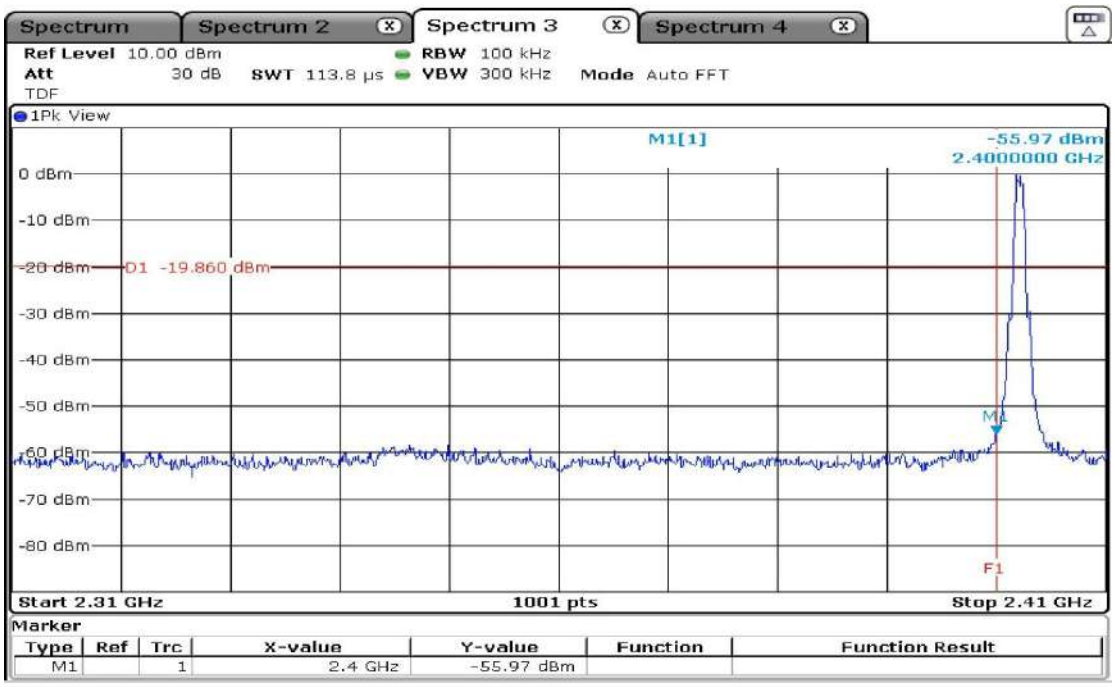
Mid ch_Conducted Spurious Emission



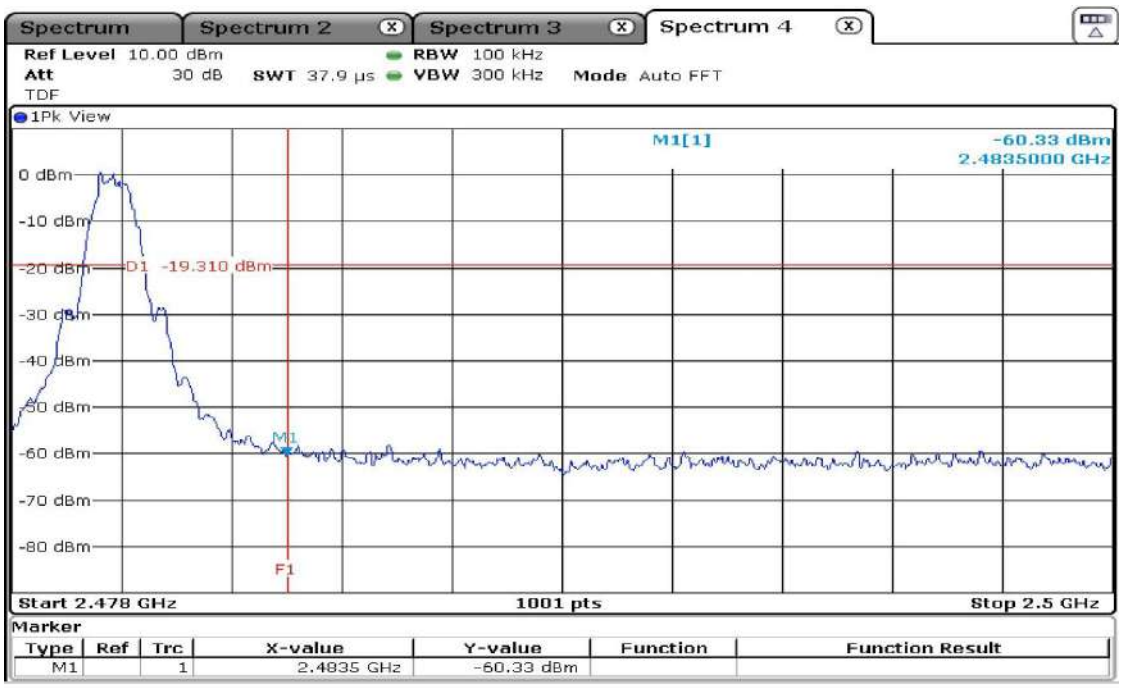
High ch_Conducted Spurious Emission



Low ch_Band Edge



High ch_Band Edge



7.5 Radiated Spurious Emission

7.5.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.12

7.5.2 Limit

§15.247 (d)

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. 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)).

§15.209 Radiated emission limits; general requirements.(a)

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** 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.

§15.205 Restricted bands of operation.(a),(b)

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

[2] Above 38.6

Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

7.5.3 Test data

Result : Pass

- Below 30 MHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- 30 MHz ~ 1 GHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.305	52.26	QP	V	-25.7	26.56	40	13.44	
293.937	43.20	QP	H	-21.8	21.40	46	24.60	
359.994	49.56	QP	H	-20.1	29.46	46	16.54	
456.606	42.05	QP	H	-17.8	24.25	46	21.75	

- 30 MHz ~ 1 GHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.596	52.38	QP	V	-25.6	26.78	40	13.22	
39.894	48.70	QP	V	-24.3	24.40	40	15.60	
359.994	51.19	QP	H	-20.1	31.09	46	14.91	
466.791	42.77	QP	H	-17.5	25.27	46	20.73	

- 30 MHz ~ 1 GHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
36.499	51.30	QP	V	-25.6	25.7	40	14.30	
39.894	48.56	QP	V	-24.3	24.3	40	15.74	
359.994	49.46	QP	H	-20.1	29.4	46	16.64	
453.599	43.00	QP	H	-17.9	25.1	46	20.90	

- 1 GHz Above_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 351.00	48.46	PK	V	-10.9	37.56	74	36.44	Restricted band
	33.67	AVG	V		22.77	54	31.23	
2 986.50	50.47	PK	V	-7.0	43.47	74	30.53	Spurious Emission
	32.12	AVG	V		25.12	54	28.88	
4 804.00	60.18	PK	H	-1.7	58.48	74	15.52	2nd Harmonic
	50.79	AVG	H		49.09	54	4.91	
7 204.80	47.37	PK	H	3.0	50.37	74	23.63	3nd Harmonic
	33.93	AVG	H		36.93	54	17.07	
9 609.60	42.64	PK	V	5.5	48.14	74	25.86	4nd Harmonic
	28.33	AVG	V		33.83	54	20.17	

- 1 GHz Above_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
4 881.00	55.70	PK	H	-1.6	54.10	74	19.90	2nd Harmonic
	43.17	AVG	H		41.57	54	12.43	
7 321.20	50.65	PK	H	2.7	53.35	74	20.65	3nd Harmonic
	36.24	AVG	H		38.94	54	15.06	
9 759.60	40.62	PK	V	6.4	47.02	74	26.98	4nd Harmonic
	26.90	AVG	V		33.30	54	20.70	

- 1 GHz Above_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 491.00	49.27	PK	V	-10.2	39.07	74	34.93	Restricted band
	33.99	AVG	V		23.79	54	30.21	
4 960.50	60.46	PK	H	-1.5	58.96	74	15.04	2nd Harmonic
	49.88	AVG	H		48.38	54	5.62	
7 438.80	52.96	PK	H	2.5	55.46	74	18.54	3nd Harmonic
	39.67	AVG	H		42.17	54	11.83	
9 919.20	42.13	PK	H	5.8	47.93	74	26.07	4nd Harmonic
	28.67	AVG	H		34.47	54	19.53	

8. Test Result - Type B

8.1 Radiated Spurious Emission

8.1.1 Test procedure

ANSI C63.10-2013 Clause 11.11, 11.12

8.1.2 Limit

§15.247 (d)

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. 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)).

§15.209 Radiated emission limits; general requirements.(a)

Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100 **	3
88–216	150 **	3
216–960	200 **	3
Above 960	500	3

** 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.

§15.205 Restricted bands of operation.(a),(b)

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	([2])
13.36–13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.

[2] Above 38.6

Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in § 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in § 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in § 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in § 15.35 apply to these measurements.

8.1.3 Test data

Result : Pass

- Below 30 MHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

- Below 30 MHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
It was not found any emissions peaks found from the EUT.								

* Tested in worst case (Bluetooth LE 1 Mbps)

- 30 MHz ~ 1 GHz_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
45.035	33.18	QP	V	-23.2	9.98	40	30.02	
359.994	43.75	QP	H	-20.1	23.65	46	22.35	
420.425	40.95	QP	H	-18.1	22.85	46	23.15	
463.202	43.61	QP	H	-17.6	26.01	46	19.99	

- 30 MHz ~ 1 GHz_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
216.434	47.82	QP	H	-24.7	23.12	46	22.88	
246.019	42.06	QP	H	-22.9	19.16	46	26.84	
359.994	47.88	QP	H	-20.1	27.78	46	18.22	
435.654	43.04	QP	H	-17.9	25.14	46	20.86	

- 30 MHz ~ 1 GHz_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
243.497	43.09	QP	H	-23.0	20.09	46	25.91	
359.994	48.02	QP	H	-20.1	27.92	46	18.08	
420.716	43.56	QP	H	-18.1	25.46	46	20.54	
448.361	42.70	QP	H	-17.9	24.80	46	21.20	

* Tested in worst case (Bluetooth LE 1 Mbps)

- 1 GHz Above_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 350.50	47.32	PK	V	-12.0	35.32	74	38.68	Restricted band
	33.86	AVG	V		21.86	54	32.14	
4 804.00	58.82	PK	H	-2.3	56.52	74	17.48	2nd Harmonic
	50.38	AVG	H		48.08	54	5.92	
7 207.20	47.05	PK	H	2.1	49.15	74	24.85	3nd Harmonic
	33.09	AVG	H		35.19	54	18.81	
9 608.40	41.17	PK	V	4.6	45.77	74	28.23	4nd Harmonic
	27.54	AVG	V		32.14	54	21.86	

- 1 GHz Above_Mid ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
4 880.00	50.34	PK	H	-2.2	48.14	74	25.86	2nd Harmonic
	40.58	AVG	H		38.38	54	15.62	
7 320.00	41.49	PK	H	2.0	43.49	74	30.51	3nd Harmonic
	27.89	AVG	H		29.89	54	24.11	
9 760.80	40.98	PK	V	5.3	46.28	74	27.72	4nd Harmonic
	27.65	AVG	V		32.95	54	21.05	

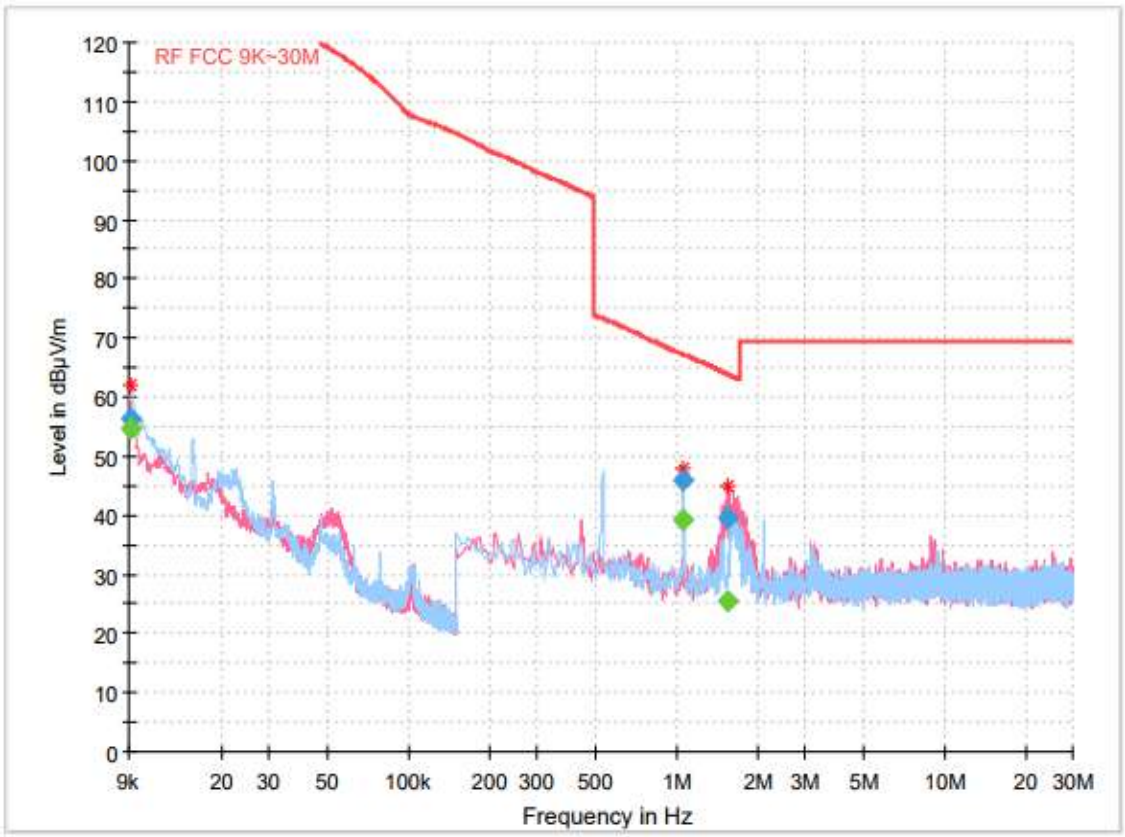
- 1 GHz Above_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 487.50	48.49	PK	H	-11.2	37.29	74	36.71	Restricted band
	34.80	AVG	H		23.60	54	30.40	
4 959.50	58.17	PK	H	-2.2	55.97	74	18.03	2nd Harmonic
	47.83	AVG	H		45.63	54	8.37	
7 441.20	45.11	PK	V	2.2	47.31	74	26.69	3nd Harmonic
	31.03	AVG	V		33.23	54	20.77	
9 919.20	40.96	PK	H	5.3	46.26	74	27.74	4nd Harmonic
	27.79	AVG	H		33.09	54	20.91	

* Tested in worst case (Bluetooth LE 1 Mbps)

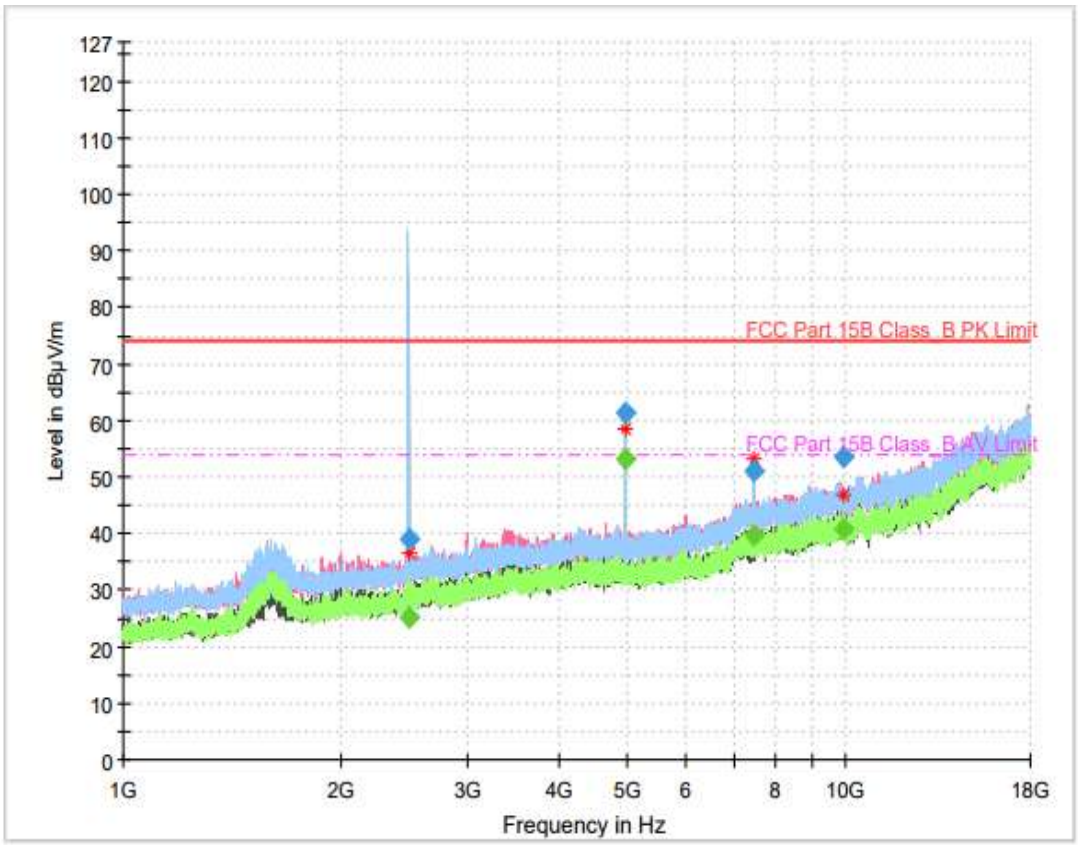
8.1.4 Radiated Spurious Emission - Worst Case Plot

Result : Pass



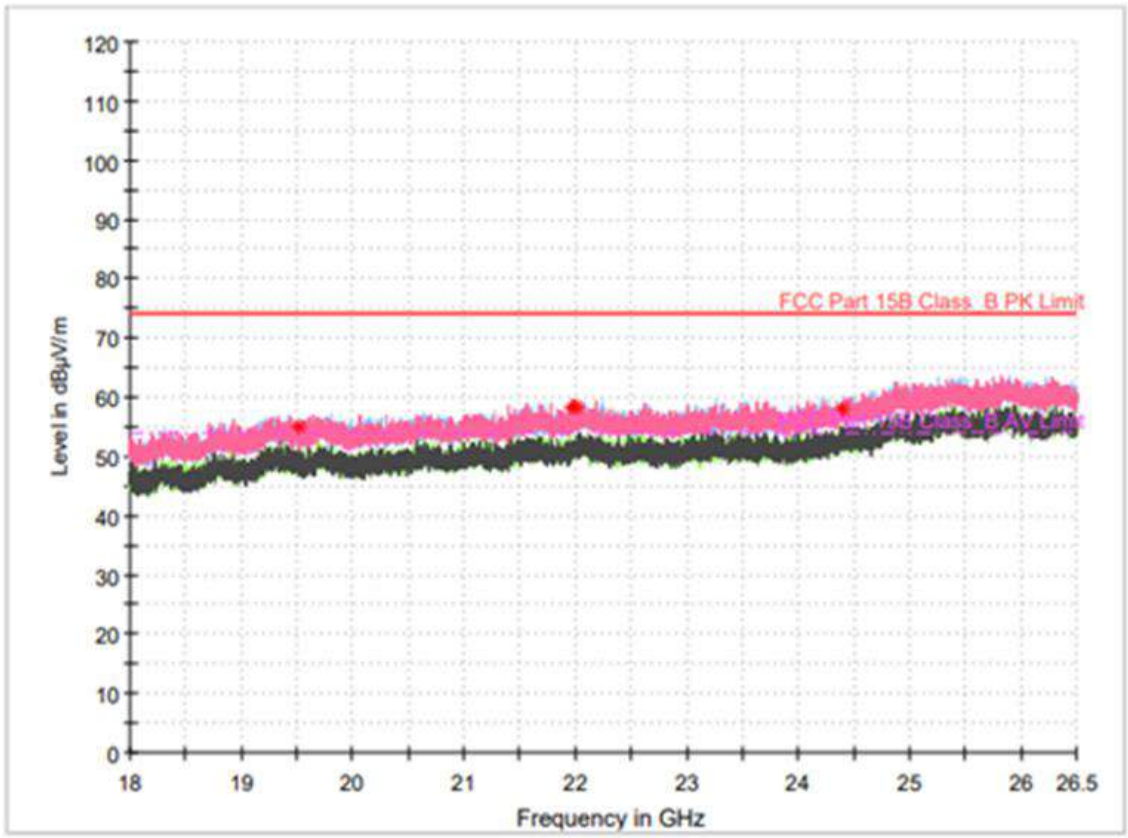
30MHz ~ 1GHz

* Tested in worst case (A Type - Bluetooth LE 125 Kbps - High ch)



1GHz ~ 18GHz

* Tested in worst case (A Type - Bluetooth LE 125 Kbps - High ch)



18GHz ~ 26.5GHz

* Tested in worst case (A Type - Bluetooth LE 125 Kbps - High ch)

8.2 Power Line Conducted Emission

8.2.1 Test procedure

ANSI C63.10-2013 Clause 6.2

8.2.2 Limit

§15.207 (a)

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). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

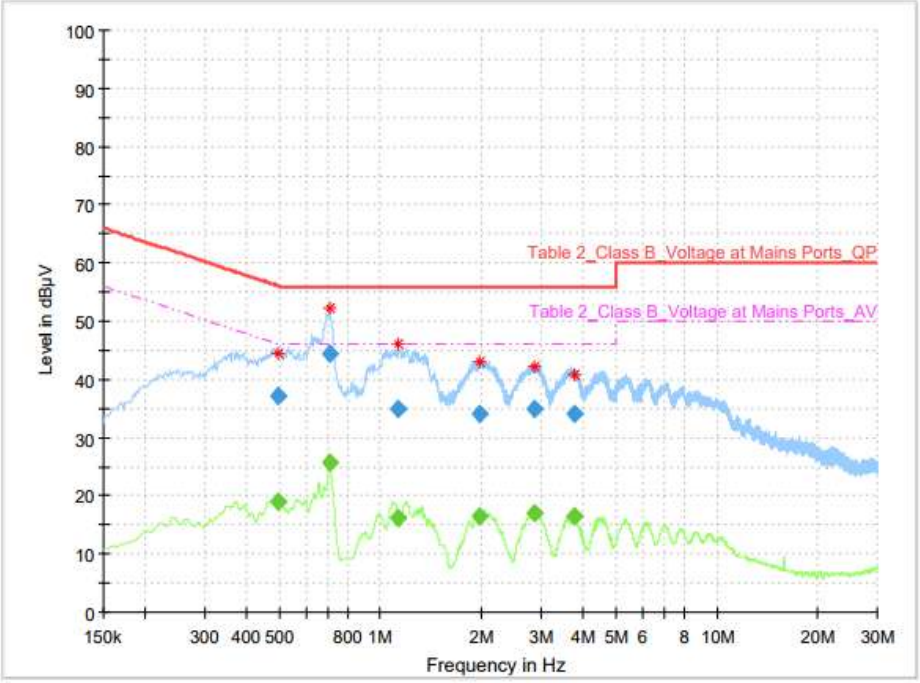
Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

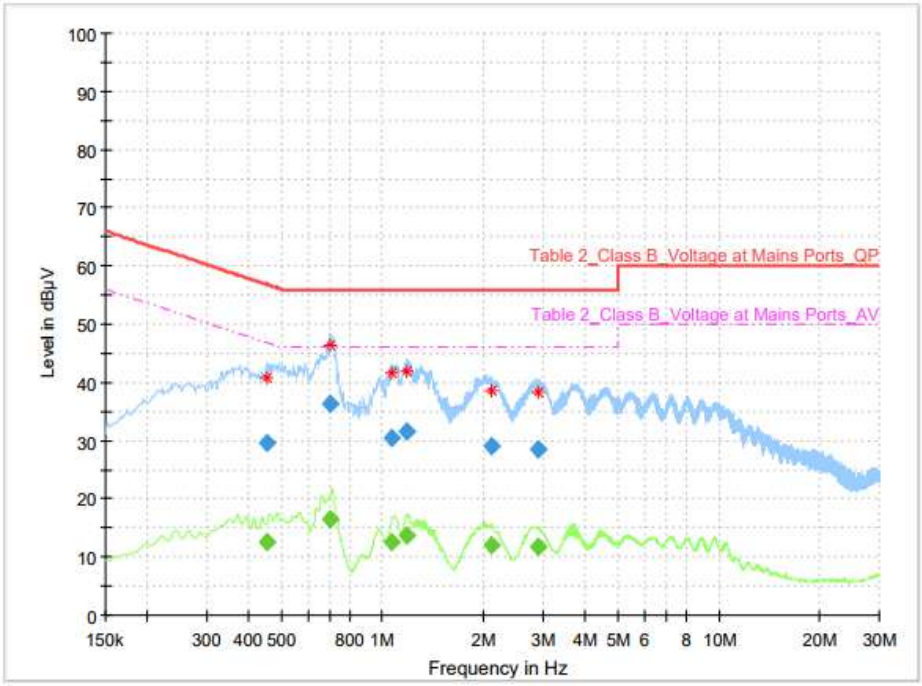
8.2.3 Test data

Result : Pass

L-Line Conducted Emission



N-Line Conducted Emission



9. Used equipment

	Description	Model Name	Manufacturer	Serial Number	Next Cal
■	SIGNAL GENERATOR	SMB100A	R&S	180607	2025-02-27
■	SIGNAL ANALYZER	FSV30	R&S	103030	2025-02-27
■	DC BLOCK	PDCB-00012650-SMSF-3	PSATEK INC.	-	2025-03-06
■	DC POWER SUPPLY	E3632A	AGILANT	MY51300069	2025-02-27
■	LOOP ANTENNA	HFH2-Z2	R&S	100271	2025-03-08
■	BI-Log ANTENNA	VULB 9162	SCHWARZBECK	120	2024-12-26
■	SIGNAL CONDITIONING UNIT	SCU 08	R&S	100746	2025-03-28
■	EMI TEST RECEIVER	ESR26	R&S	101462	2025-03-28
■	DOUBLE RIDGED HORN ANTENNA	HF907	R&S	102556	2024-08-04
■	SIGNAL CONDITIONING UNIT	SCU18	R&S	102342	2025-03-28
■	EMI TEST RECEIVER	ESR26	R&S	101461	2025-03-28
■	HORN ANTENNA	LB-42-10-C-KF	A-INFOMW	J202024625	2025-03-12
■	PREAMPLIFIER	AMF-4F-18265- 35-8P-1	MITEQ	771846	2025-03-06

- END OF REPORT.