TEST REPORT

성적서 번호 Report No.		ICRT-TR-E242769-0A
신청자 Client	기관명 Name	Ace Antenna Corp.
	주 소 Address	237, Namdongseo-ro, Namdong-gu, Incheon, 21634, Korea
시험대상품목 Product name		WCWM / WiFi Module
모델명 Model name		AVG-00011
정 격 Ratings		DC 5.0 V
시험장소 Place of test		■ 고정시험(Inside test) ☐ 현장시험(Field test) 주소지(Address): 112, 113 Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea
시험기간 Date of test		20. Sep. 2024 ~ 04. Oct. 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, Hwang (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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2024. 10. 15

주식회사 아이씨알 대표이사

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

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E242769-0A	2024. 10. 15	Initial Issue	All

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1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	Ace Antenna Corp.
Address	237, Namdongseo-ro, Namdong-gu, Incheon, 21634, Korea

1.2 Manufacturer Information

Applicant	Ace Antenna Corp.
Address	237, Namdongseo-ro, Namdong-gu, Incheon, 21634, 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 ㎓)	3.22 dB	±6 dB
All emissions, radiated (Above the 1 ㎓)	3.67 dB	±6 dB

2. Equipment under Test(EUT) Information

2.1 General Information

Product Name	WCWM / WiFi Module
Model Name	AVG-00011
Additional Model Name	-
FCC ID	2A3SR-AVG-00011
Power Supply	DC 5.0 V
Hardware Version	1.0
Software Version	1.0

2.2 Additional Information

Equipment Class	DTS-Digital Transmission System	
Device Type	Stand-alone	
Operating Frequency	802.11n(HT20)	2 412 ㎒ ~ 2 462 ㎒
RF Output Power	802.11n(HT20)	21.58 ㏈m
Number of Channel	802.11n(HT20)	11
Modulation Type	OFDM	
Antenna Type	Planar Invert F Antenna	
Antenna Gain	1.98 ㏈i	

3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C			
Clause	Test items	Applied	Results
§15.247 (a) (2)	6 ㏈ 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	□	N/A

3.2 Purpose of the test

- To determine whether the equipment under test fulfills the requirements of the standards stated in FCC Part 15 Subpart C Section 15.247.

3.3 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.

3.4 Configuration of Test System

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 **Planar Invert F Antenna**. The directional gain of the antenna is **1.98**dBi.

4. Test Result

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)

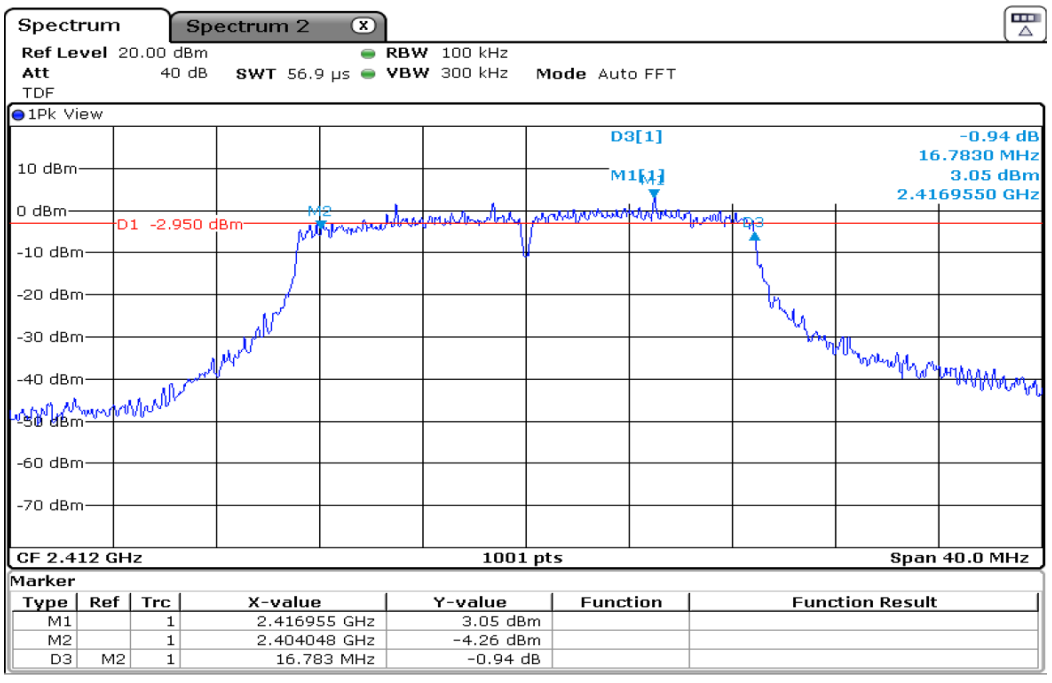
Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.1.3 Test data

Result : Pass

Mode	Frequency (MHz)	Measured Value (kHz)	Limit (kHz)
802.11n(20 MHz BW)	2 412	16 783	at least 500
	2 437	17 278	
	2 462	17 717	

Low ch_6 dB Bandwidth



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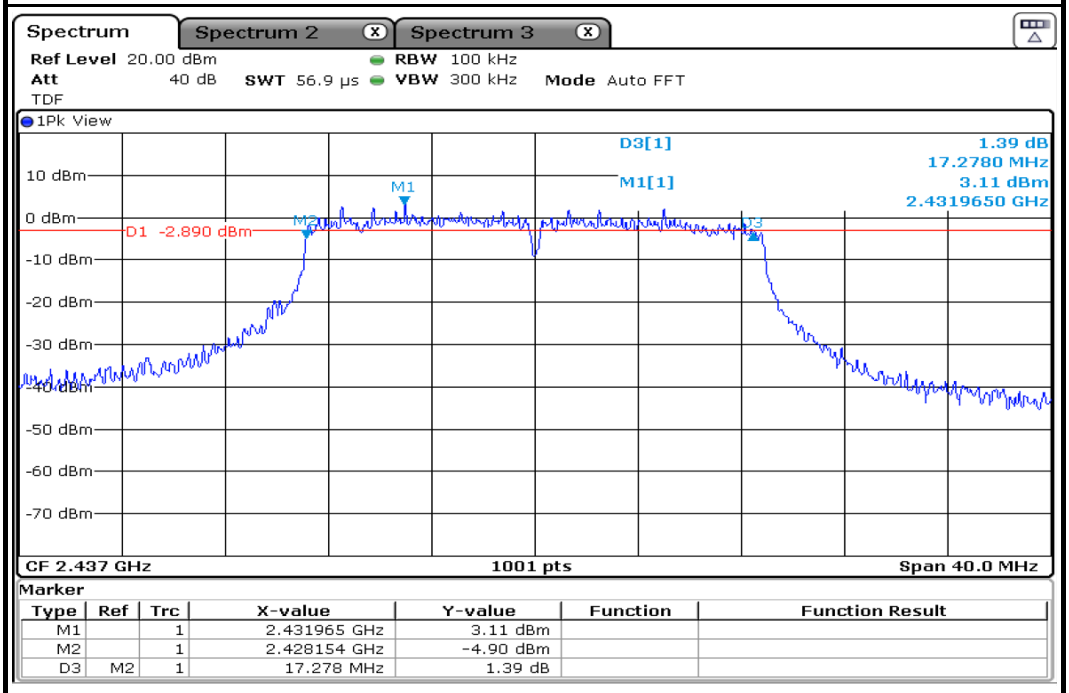
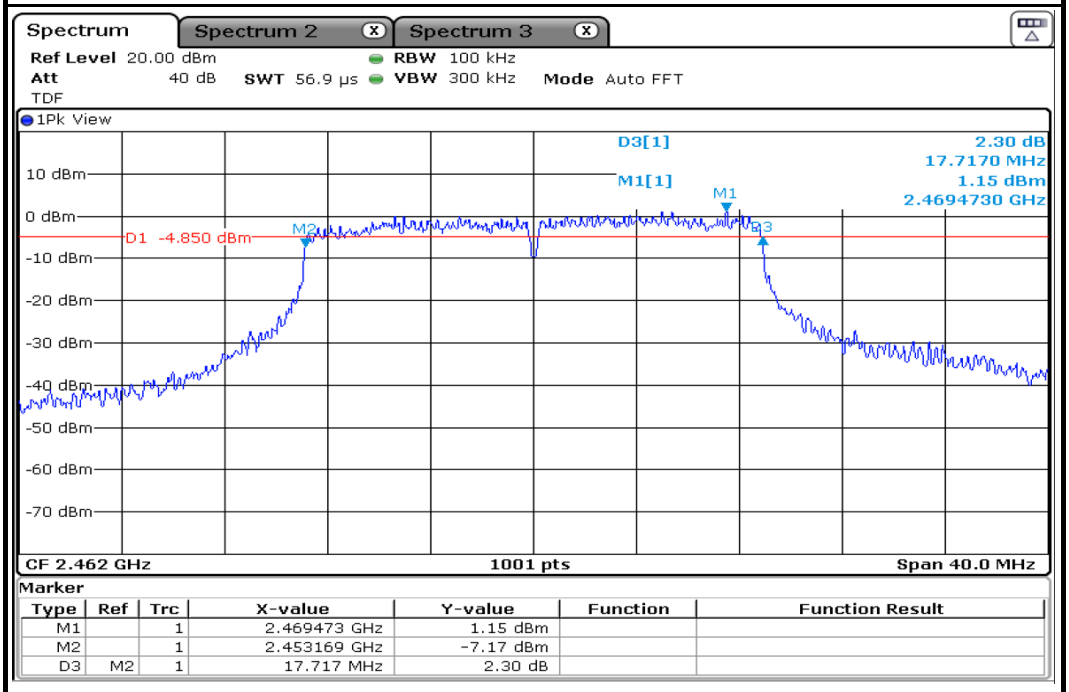
Mid ch_6 dB Bandwidth



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.431965 GHz	3.11 dBm		
M2		1	2.428154 GHz	-4.90 dBm		
D3	M2	1	17.278 MHz	1.39 dB		

High ch_6 dB Bandwidth



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.469473 GHz	1.15 dBm		
M2		1	2.453169 GHz	-7.17 dBm		
D3	M2	1	17.717 MHz	2.30 dB		

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)
802.11n(20 MHz BW)	2 412	21.28	30
	2 437	21.58	
	2 462	21.13	

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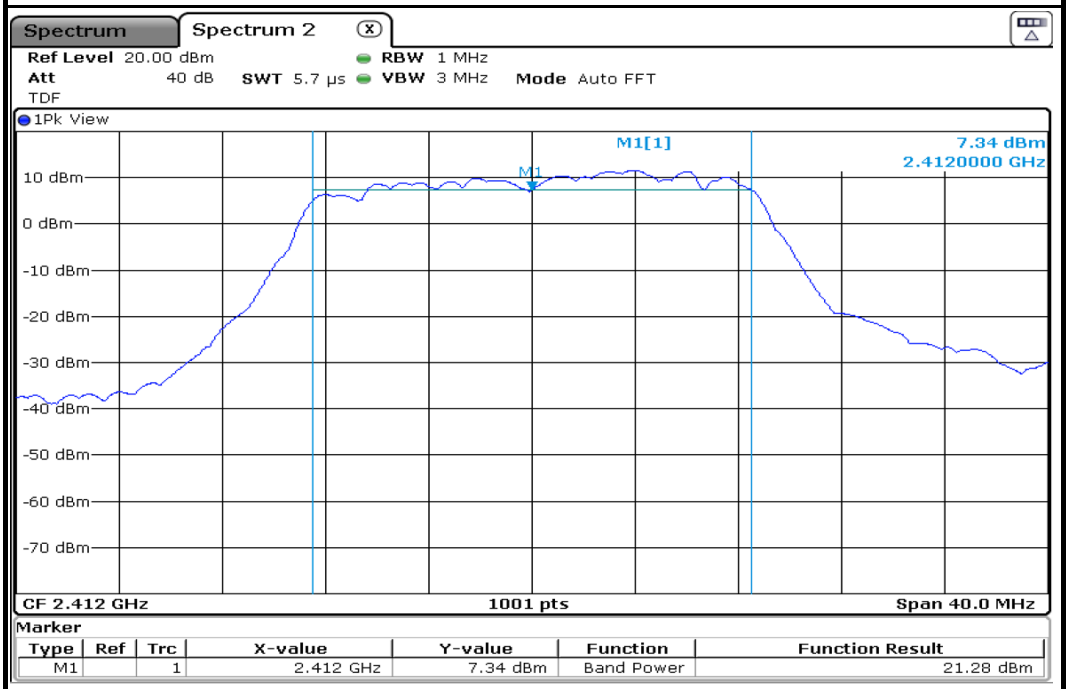
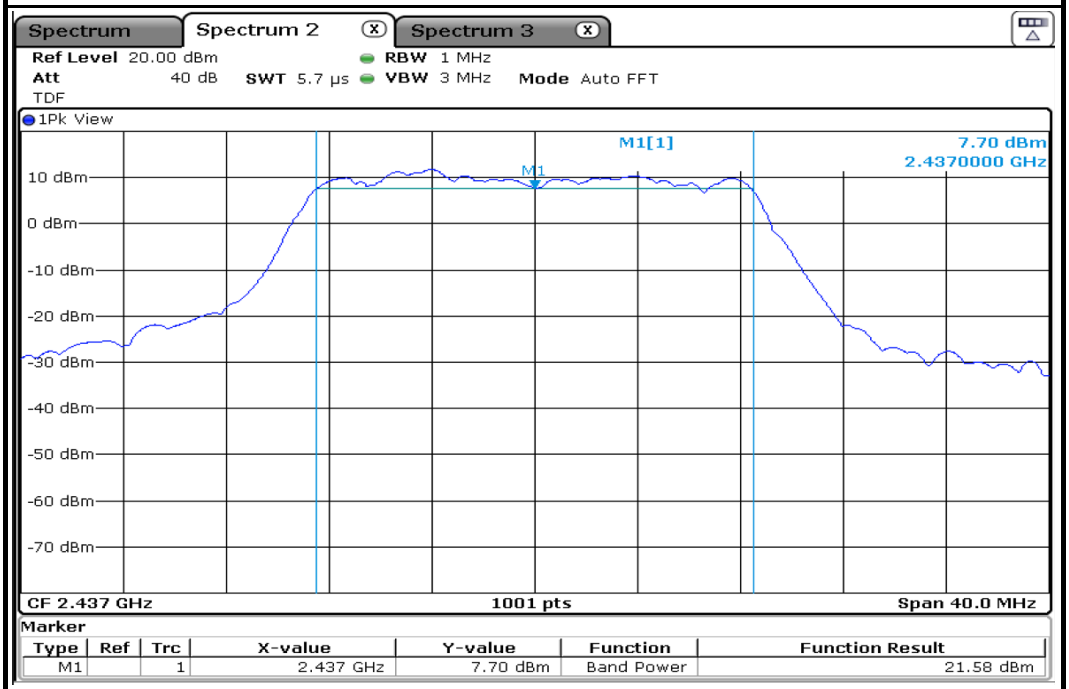
Low ch_Maximum Conducted Output Power



Mid ch_Maximum Conducted Output Power



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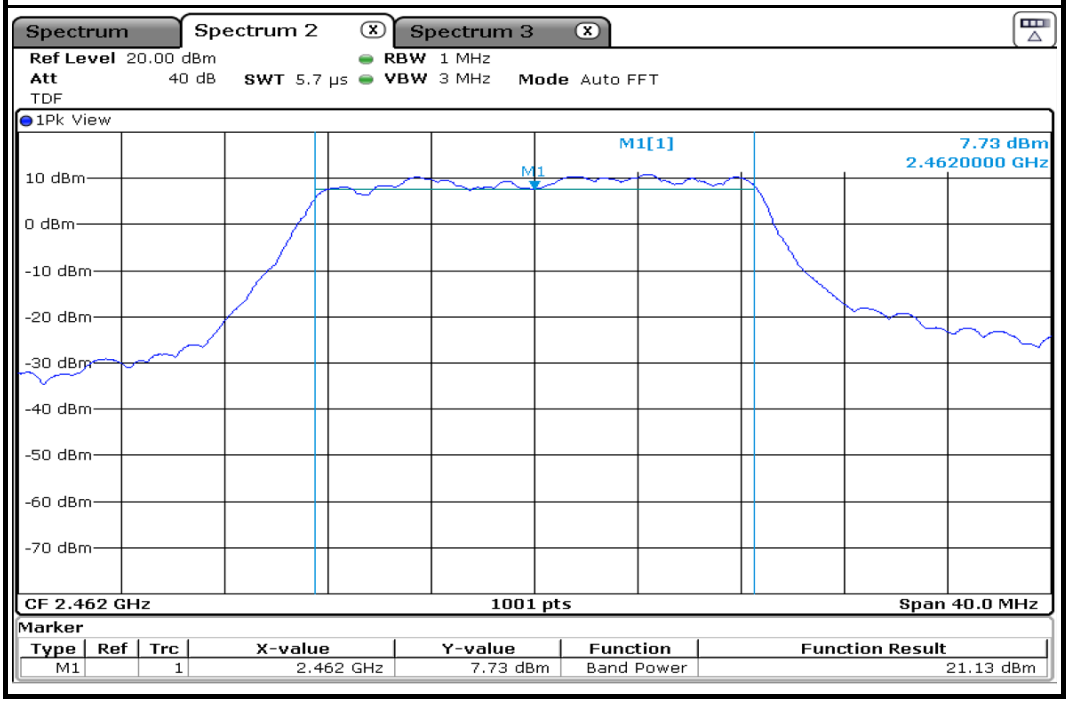
High ch_Maximum Conducted Output Power



4.3 Power Spectral Density

4.3.1 Test procedure

ANSI C63.10-2013 Clause 11.10

4.3.2 Limit

§15.247 (e)

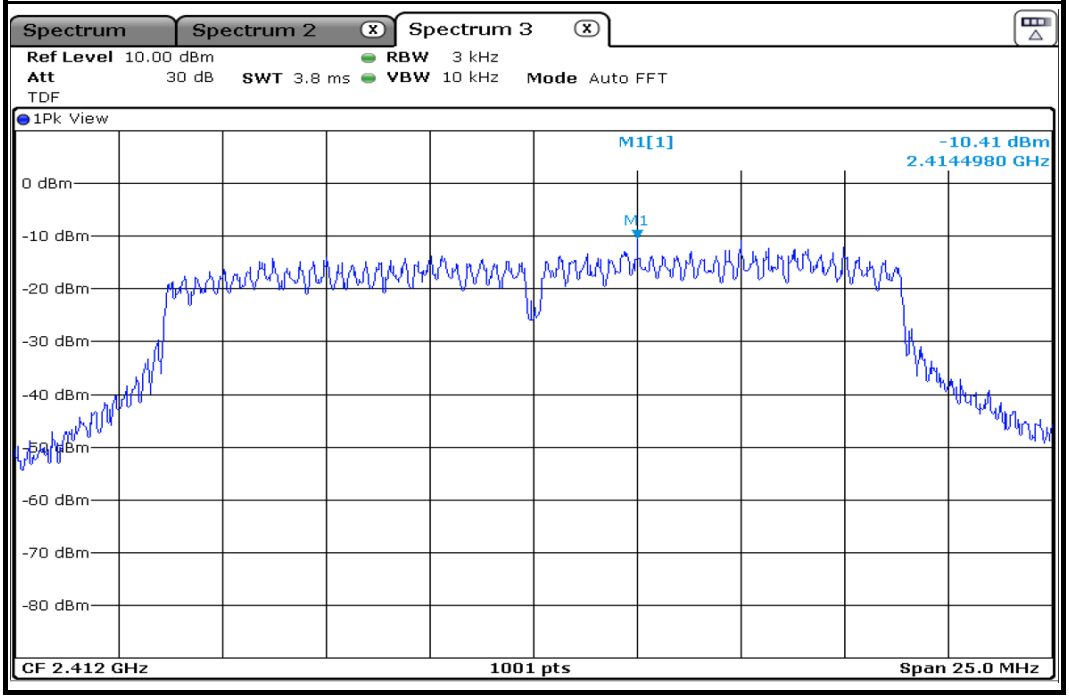
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of 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)
802.11n(20 MHz BW)	2 412	-10.41	8
	2 437	-11.49	
	2 462	-11.55	

Low ch_Power Spectral Density



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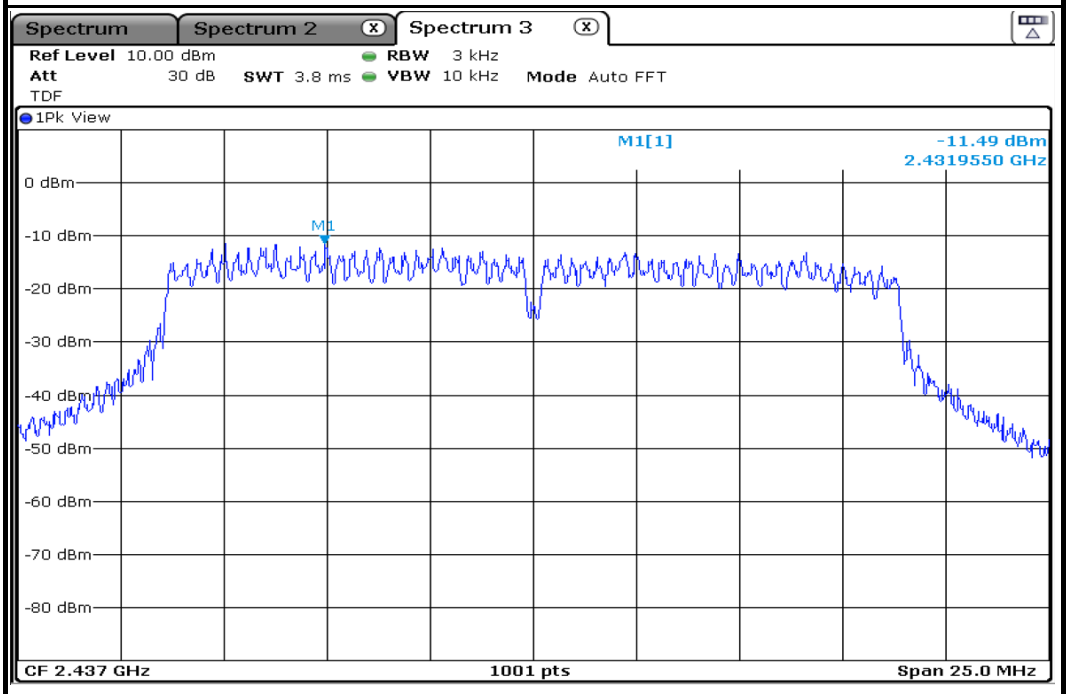
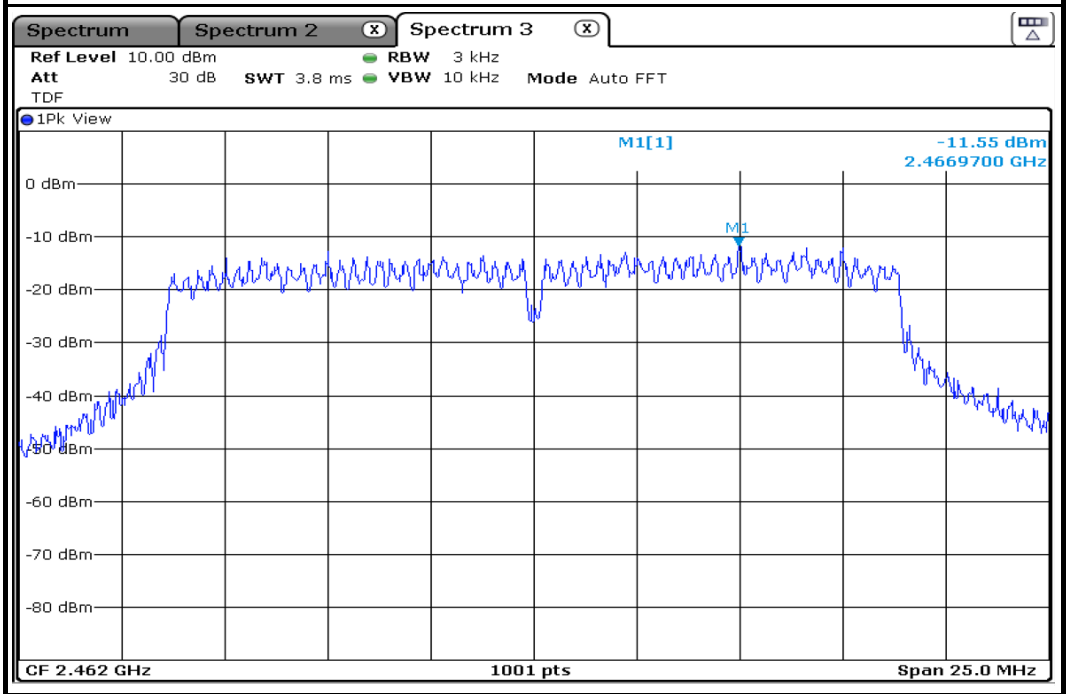
Mid ch_Power Spectral Density



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

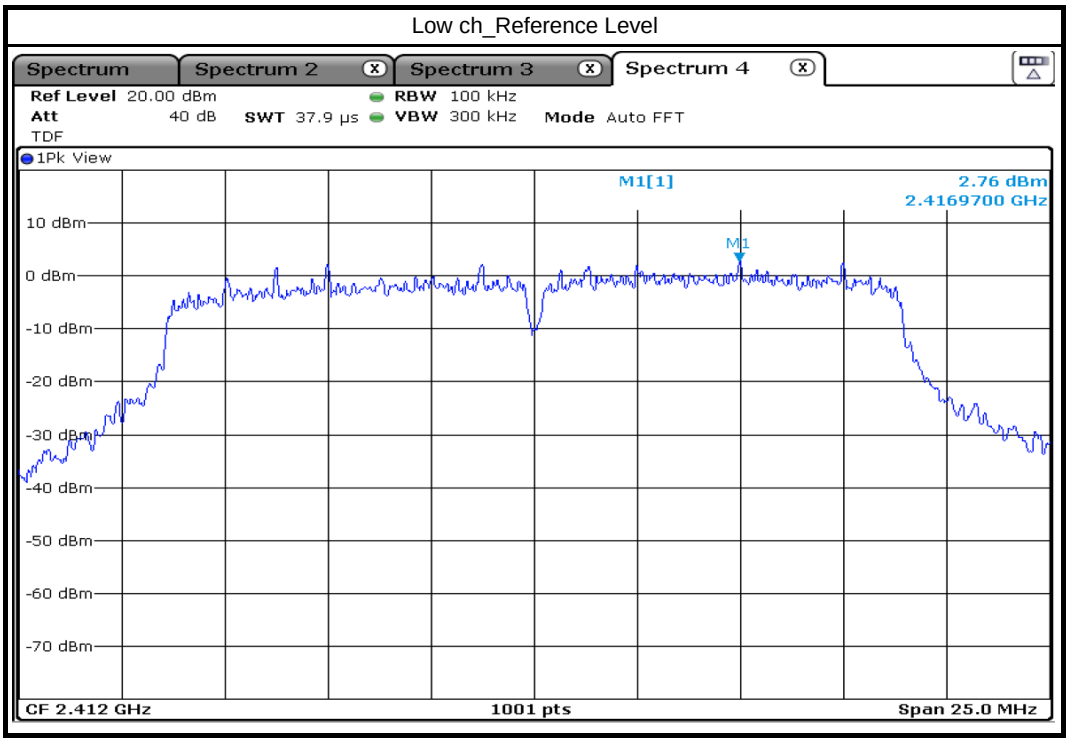
§15.247 (d)

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



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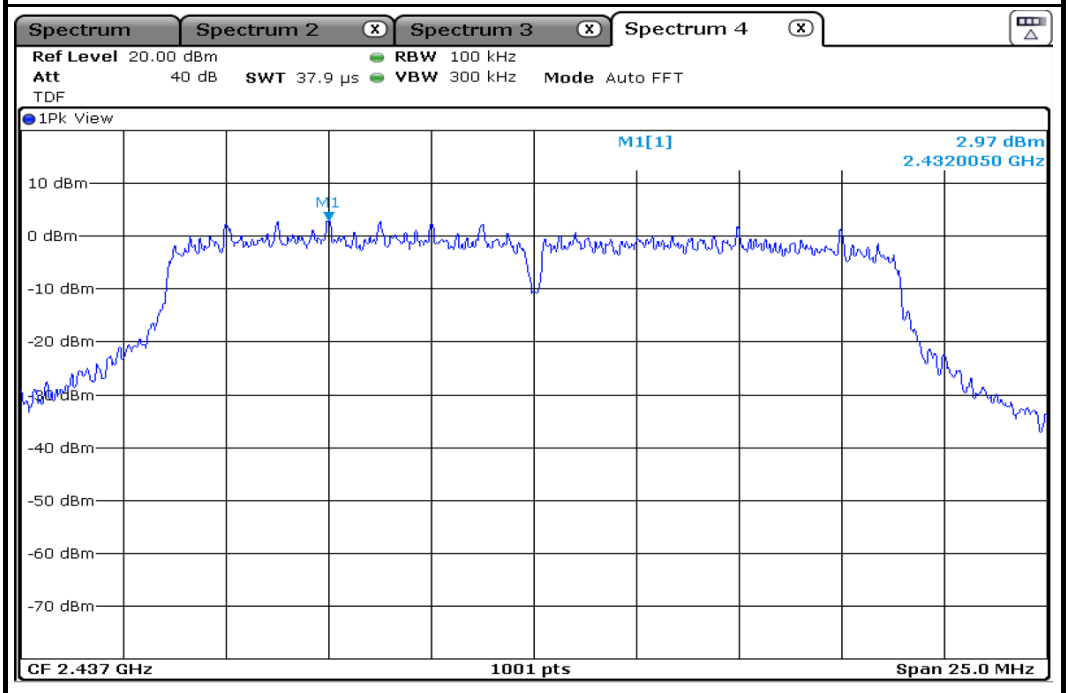
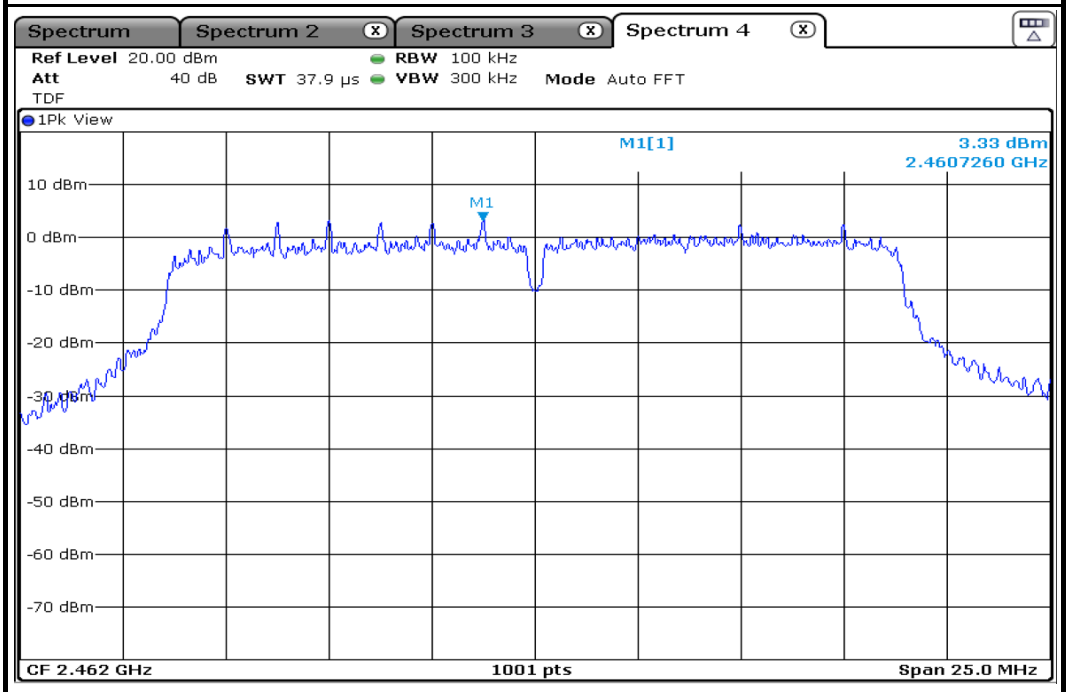
Mid ch_Reference Level



High ch_Reference Level



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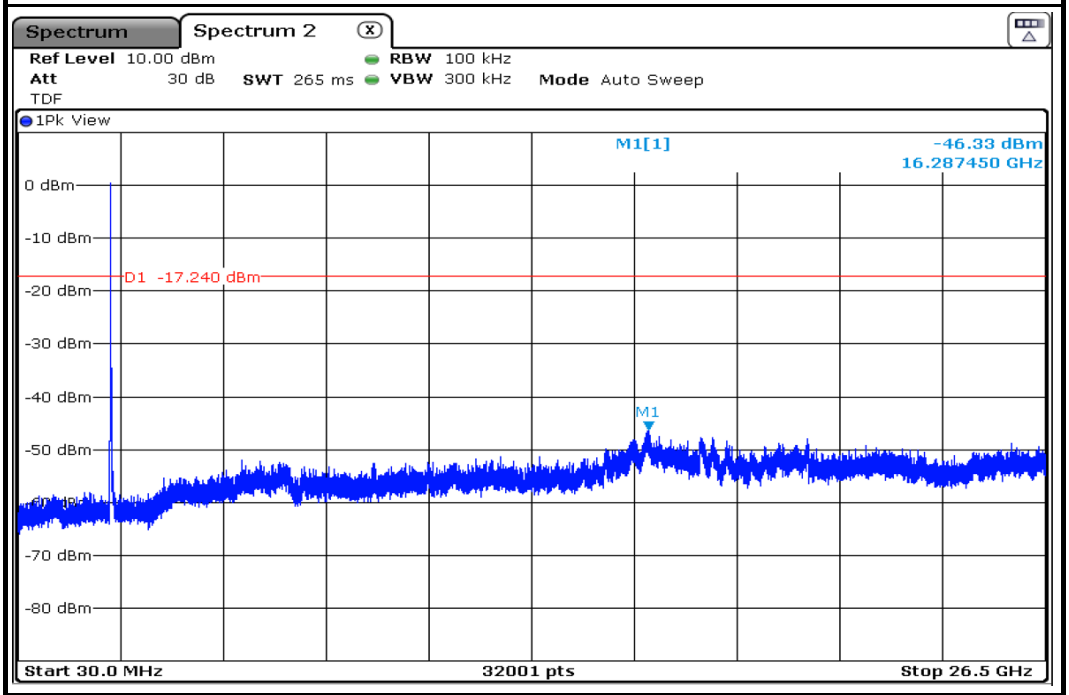
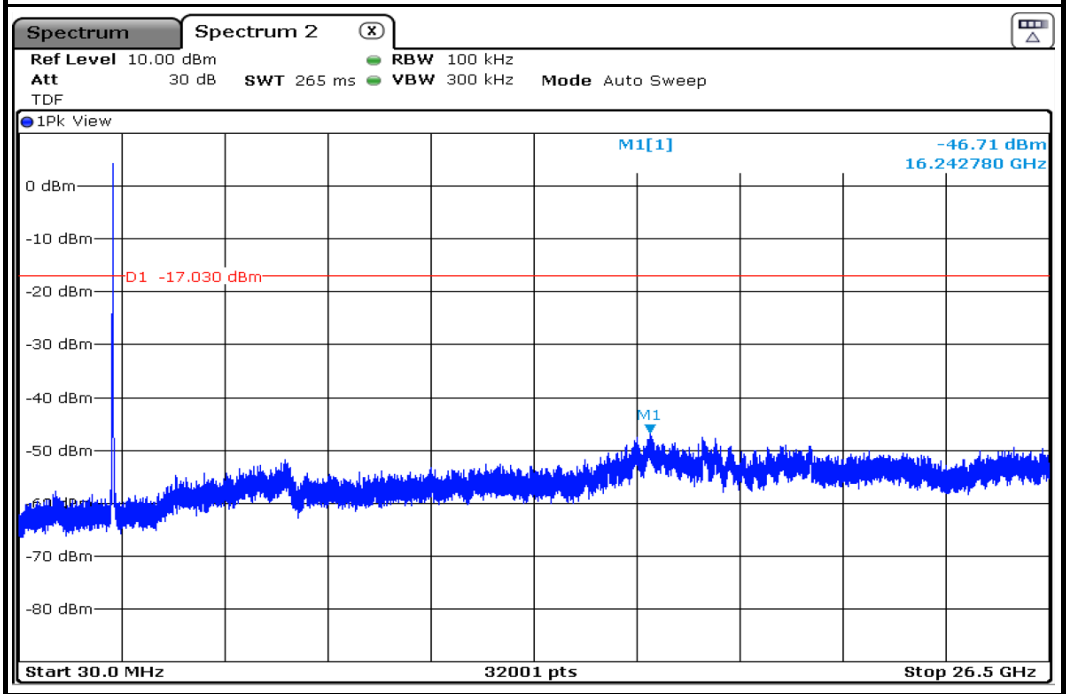
Low ch_Conducted Spurious Emission



Mid ch_Conducted Spurious Emission



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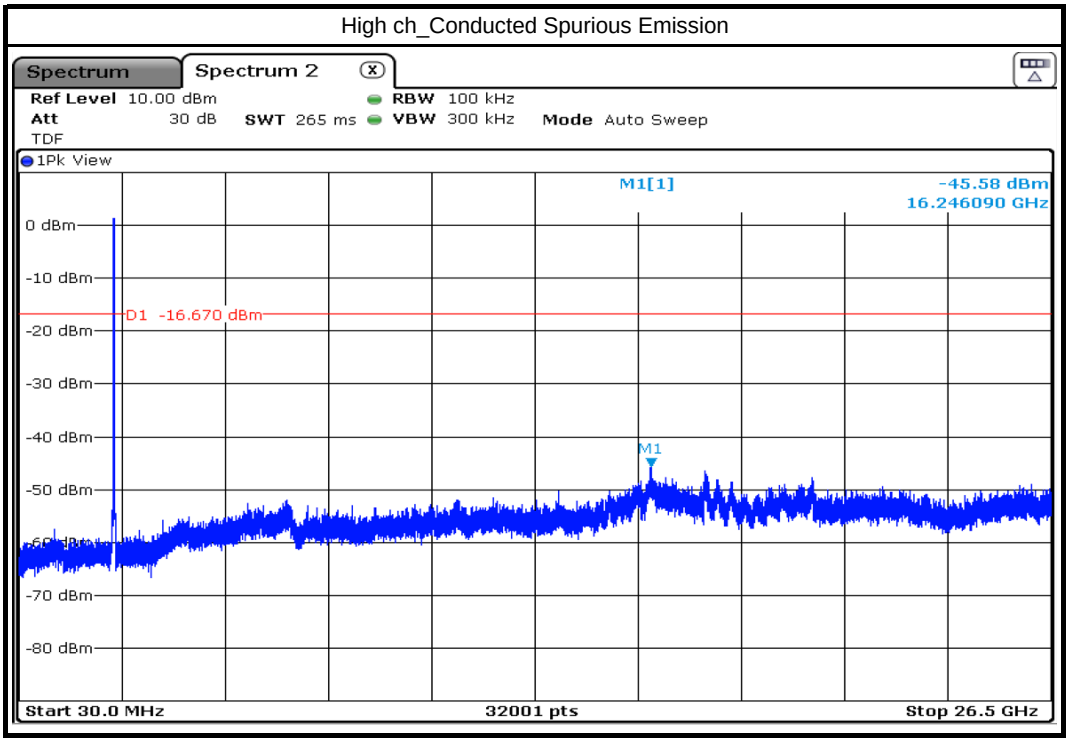
High ch_Conducted Spurious Emission



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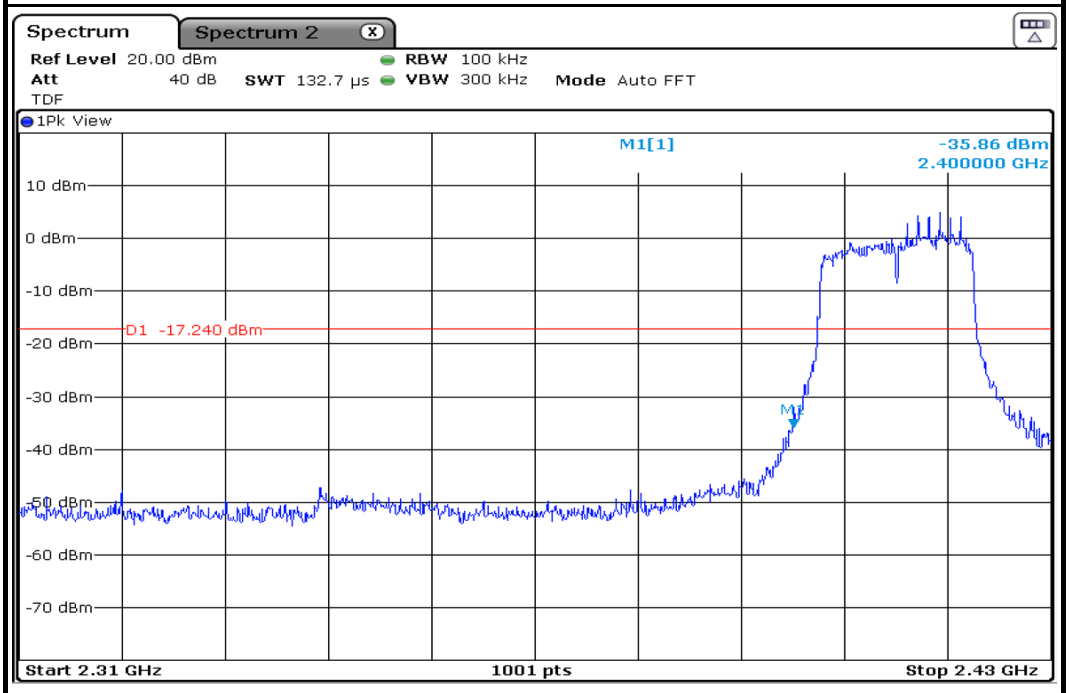
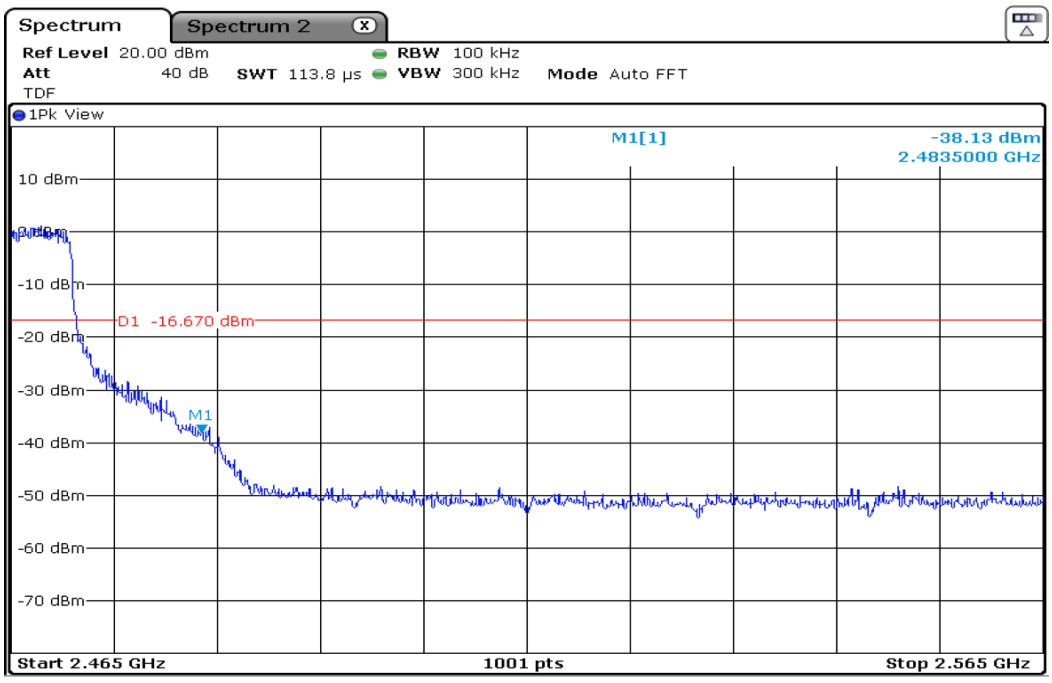
Low ch_Band Edge



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.

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§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 (High ch (WORST CASE))

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
0.009	35.83	QP	V	20.3	56.13	128.50	72.37	-
0.431	30.22	QP	V	19.3	49.52	94.96	45.44	-
1.054	29.80	QP	H	19.4	49.20	67.22	18.02	-
1.481	30.75	QP	V	19.4	50.15	64.21	14.06	-

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- 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
71.710	53.57	QP	V	-20.3	33.27	40.00	6.73	-
132.044	56.31	QP	V	-20.4	35.91	43.50	7.59	-
227.977	57.79	QP	V	-16.7	41.09	46.00	4.91	-
251.936	48.92	QP	V	-15.0	33.92	46.00	12.08	-

- 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
71.710	53.35	QP	V	-20.3	33.05	40.00	6.95	-
132.044	57.00	QP	V	-20.4	36.60	43.50	6.90	-
227.977	57.62	QP	V	-16.7	40.92	46.00	5.08	-
252.033	53.25	QP	V	-14.9	38.35	46.00	7.65	-

- 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
71.710	54.70	QP	V	-20.3	34.40	40.00	5.60	-
132.044	57.41	QP	V	-20.4	37.01	43.50	6.49	-
156.003	56.22	QP	V	-20.1	36.12	43.50	7.38	-
252.033	53.37	QP	V	-14.9	38.47	46.00	7.53	-

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- 1 GHz Above_Low ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 381.000	56.55	PK	H	-11.5	45.05	74.00	28.95	Restricted band
	42.74	AVG	H		31.24	54.00	22.76	
4 823.500	60.93	PK	H	-1.8	59.13	74.00	14.87	2nd Harmonic
	47.13	AVG	H		45.33	54.00	8.67	
7 234.800	36.04	PK	H	2.6	38.64	74.00	35.36	3nd Harmonic
	23.30	AVG	H		25.90	54.00	28.10	
9 646.800	35.62	PK	V	4.7	40.32	74.00	33.68	4nd Harmonic
	21.72	AVG	V		26.42	54.00	27.58	

- 1 GHz Above_Mid ch

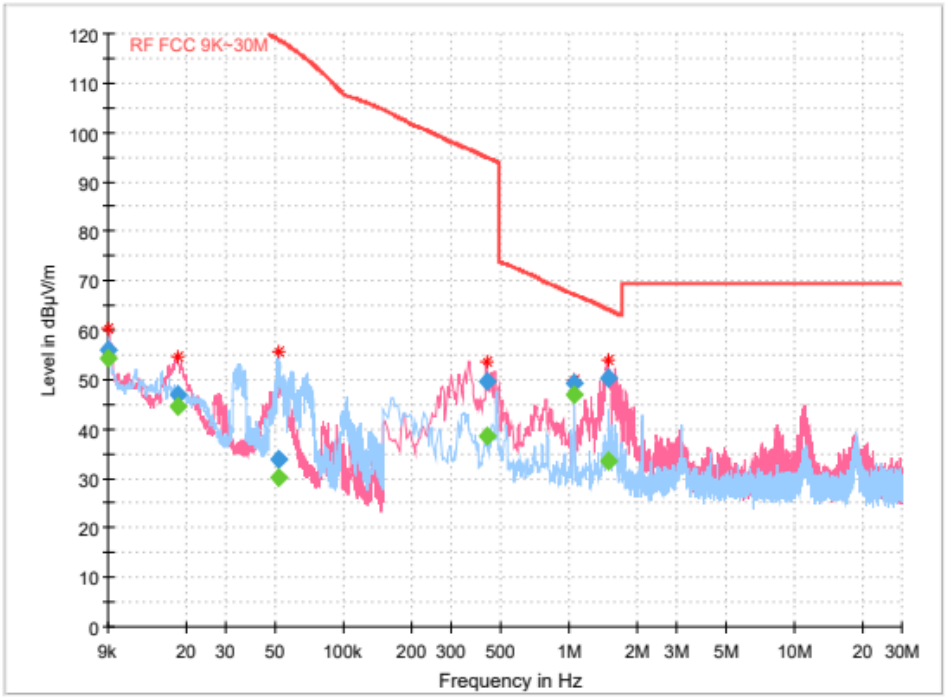
Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
4 880.000	57.51	PK	H	-1.8	55.71	74.00	18.29	2nd Harmonic
	42.01	AVG	H		40.21	54.00	13.79	
7 312.800	39.09	PK	H	2.3	41.39	74.00	32.61	3nd Harmonic
	26.22	AVG	H		28.52	54.00	25.48	
9 746.400	34.88	PK	V	5.4	40.28	74.00	33.72	4nd Harmonic
	21.70	AVG	V		27.10	54.00	26.90	

- 1 GHz Above_High ch

Frequency (MHz)	Reading (dBuV/m)	Detector	Pol.	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	note
2 496.000	62.74	PK	H	-11.0	51.74	74.00	22.26	Restricted band
	47.23	AVG	H		36.23	54.00	17.77	
4 929.000	62.45	PK	H	-1.8	60.65	74.00	13.35	2nd Harmonic
	47.40	AVG	H		45.60	54.00	8.40	
7 382.400	37.34	PK	H	2.6	39.94	74.00	34.06	3nd Harmonic
	24.29	AVG	H		26.89	54.00	27.11	
9 848.400	33.13	PK	H	5.4	38.53	74.00	35.47	4nd Harmonic
	20.19	AVG	H		25.59	54.00	28.41	

4.5.3 Radiated Spurious Emission - Worst Case Plot

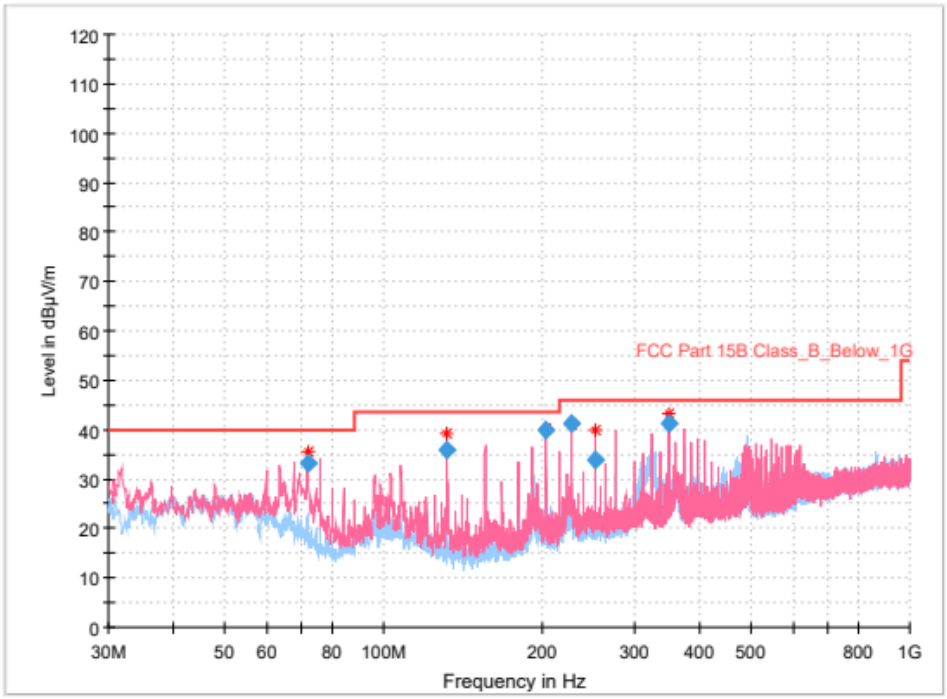
Result : Pass



9kHz ~ 30MHz

* Tested in worst case - High ch

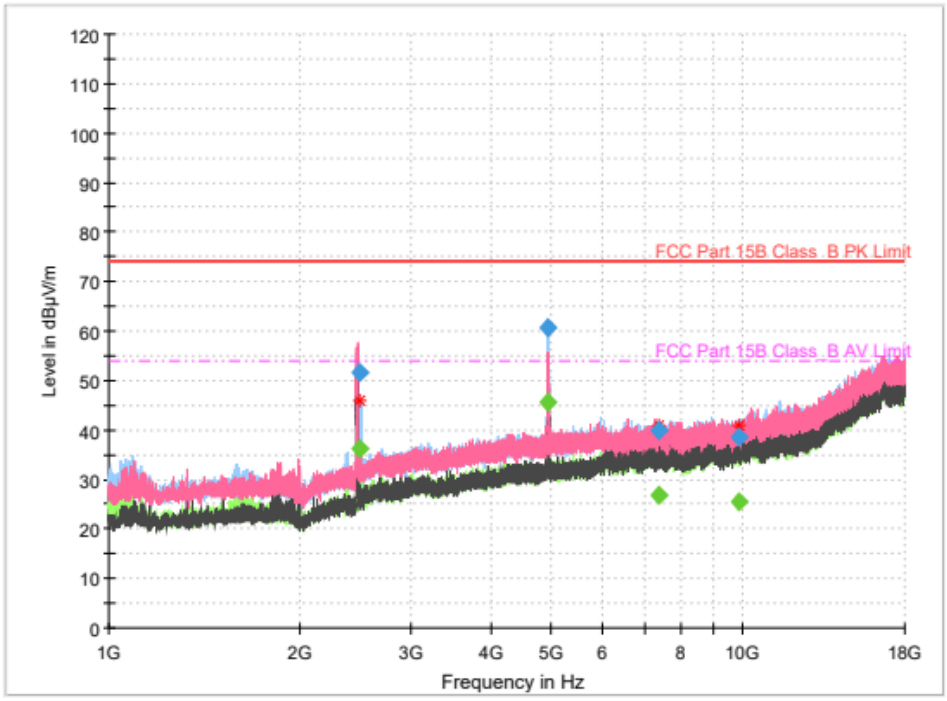
TEST REPORT



30MHz ~ 1GHz

* Tested in worst case - Low ch

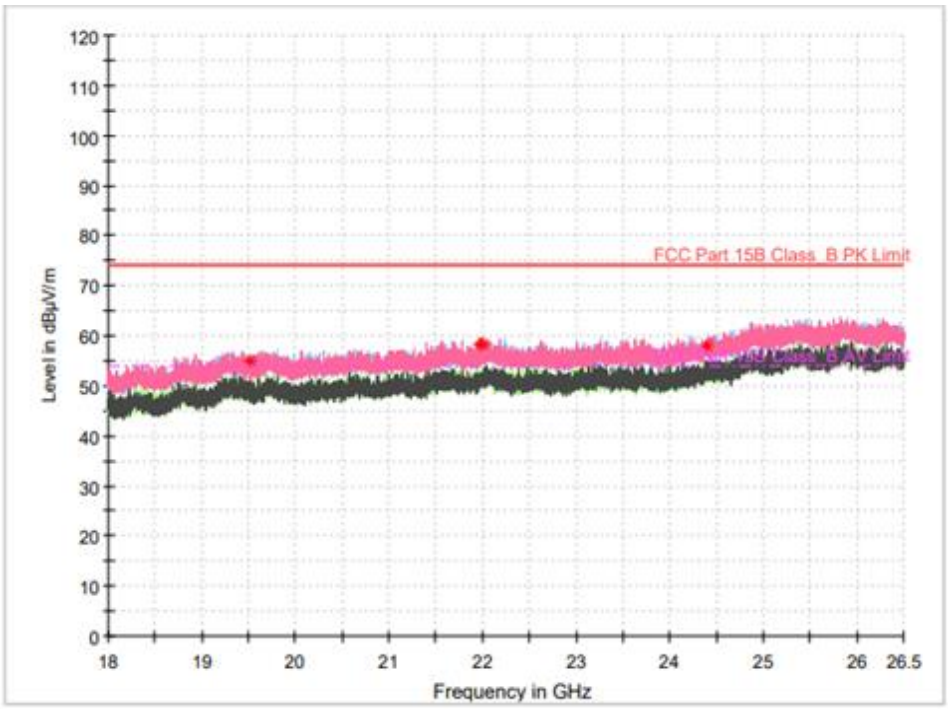
TEST REPORT



1GHz ~ 18GHz

* Tested in worst case - High ch

TEST REPORT



18GHz ~ 26.5GHz

* Tested in worst case - High ch

TEST REPORT

5. Used equipment

	Description	Model Name	Manufacturer	Serial Number	Next Cal
■	SIGNAL GENERATOR	SMB100A	ROHDE & SCHWARZ	180607	2025-02-27
■	SPECTRUM ANALYZER	FSV40-N	ROHDE & SCHWARZ	101936	2025-02-28
■	DC BLOCK	PDCB-00012650-SMSF-3	PSATEK INC.	-	2025-03-06
■	DC POWER SUPPLY	E3632A	AGILANT	MY51300069	2025-02-27
■	LOOP ANTENNA	HFH2-Z2	ROHDE & SCHWARZ	100271	2025-03-08
■	TRILOG BROADBAND ANTENNA	VULB 9162	SCHWARZBECK	120	2024-12-26
■	MXE EMI RECEIVER	N9038A	AGILENT	MY54450077	2025-05-20
■	RF Pre Amplifier	SCU08	ROHDE & SCHWARZ	100746	2025-03-28
■	HORN ANTENNA	HF907	ROHDE & SCHWARZ	102869	2025-04-04
■	EMI Test Receiver	ESR26	ROHDE & SCHWARZ	101461	2025-03-28
■	RF Pre Amplifier	SCU18	ROHDE & SCHWARZ	102342	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

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