



Test report No:
NIE: 61299RRF.001

Test Report

USA FCC Part 15.247, 15.209 CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Automotive Infotainment System		
(*) Trademark	BMW		
(*) Model and /or type reference	MGU_F APN		
Other identification of the product	HW version: HW 3.1 SW version: 19w20.5-1-16 FCC ID: A269ZUA160 IC: 700B-UA160		
(*) Features	BT, WiFi, USB2/3		
Applicant	ALPSALPINE INC. 20-1 YOSHIMA INDUSTRIAL PARK, IWAKI, FUKUSHIMA 970-1192, JAPAN		
Test method requested, standard	USA FCC Part 15.247 (10-1-18) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-18) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.		
Summary	IN COMPLIANCE		
Approved by (name / position & signature)	J. Carlos Luque RF Lab. Supervisor	74841983Y JOSE CARLOS LUQUE (C:A29507456)	Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2019.12.19 13:05:25 +01'00'
Date of issue	2019-12-19		
Report template No	FDT08_22 (*) "Data provided by the client"		

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of MGU_F APN is a device for entertainment and communication inside the car, this includes playing music from several external sources or internal flash-memory, connecting mobile devices (e.g. Apple Car Play) and a navigation system.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
61299/057	Automotive Infotainment System	MGU_F APN	ALB314K0673026	2019/07/24
61299/046	Display	--	--	2019/07/16
61299/059	CAN Box	--	80008147	2019/07/24
61299/061	Ethernet Board	--	--	2019/07/24
61299/064	Ethernet-USB Adapter	EU-4306	EU430693MA00744	2019/07/24
61299/065	Harness	--	--	2019/07/24
61299/111	Antenna			2019/08/30
61299/112	Antenna			2019/08/30

Sample S/01 has undergone the following test(s): All RADIATED tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
61299/057	Automotive Infotainment System	MGU_F APN	ALB314K0673026	2019/07/24
61299/046	Display	--	--	2019/07/16
61299/059	CAN Box	--	80008147	2019/07/24
61299/061	Ethernet Board	--	--	2019/07/24
61299/064	Ethernet-USB Adapter	EU-4306	EU430693MA00744	2019/07/24
61299/065	Harness	--	--	2019/07/24

Sample S/02 has undergone the following test(s): All CONDUCTED tests indicated in Appendix A.

- Sample S/03 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
61299/058	Automotive Infotainment System	MGU_F APN	ALB314K0672284	2019/07/24
61299/046	Display	--	--	2019/07/16
61299/043	CAN Box	--	80008147	2019/07/24
61299/061	Ethernet Board	--	--	2019/07/24
61299/064	Ethernet-USB Adapter	EU-4306	EU430693MA00744	2019/07/24
61299/065	Harness	--	--	2019/07/24
61299/111	Antenna			2019/08/30
61299/112	Antenna			2019/08/30

Sample S/03 has undergone the following test(s): All RADIATED tests for n40 mode indicated in Appendix A.

Test sample description

Ports..... :	Port name and description		Cable				
			Specified length [m]	Attached during test	Shielded		
	BT			☒	☐		
	WLAN			☒	☐		
	USB2			☒	☐		
	USB3			☒	☐		
	APIX			☒	☐		
	OABR			☒	☐		
Supplementary information to the ports..... :	N/A						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☒	DC: 12Vdc.					
Rated Power	12V						
Clock frequencies	Not provided data						
Other parameters..... :	FCC ID: A269ZUA160 IC: 700B-UA160						
Software version	19w20.5-1-16						
Hardware version..... :	HW 3.1						
Dimensions in cm (L x W x D)	Not provided data						
Mounting position..... :	☒	Table top equipment					
	☒	Other: Vehicular environment equipment					
Modules/parts	Module/parts of test item			Type		Manufacturer	
	BT					WNC	
	WiFi					WNC	
Accessories (not part of the test item)	Description			Type		Manufacturer	
	Can Box					Harman	
	Display					Visteon	
	OABR-concerter					Harman	
Documents as provided by the	Description			File name		Issue date	

applicant.....:	Testing manual for BT and WLAN	I&k- MGU_Testing Manual (Radio_WLAN- BT)_v11_2018- 01-18	18.1.2018
	-		
	-		

Identification of the client

ALPINE ELECTRONICS GMBH
 Ohmstrasse 4, 85716 Unterschleißheim, Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-09-04
Date (finish)	2019-09-13

Document history

Report number	Date	Description
61299RRF.001	2019-12-19	First release

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 75 %
Air pressure	Min. = 860 mbar
	Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C
	Max. = 35 °C
Relative humidity	Min. = 20 %
	Max. = 35 %
Air pressure	Min. = 860 mbar
	Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: José Manuel Jiménez, Cristina Calle, Jaime Barranquero, Jesús García, Nicolás Salguero, José Gabriel Pendón, Ignacio Cabra.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	DC power supply R&S NGPE 40/40	2018/02	2021/02
4.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2017/10	2019/10

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	BiconicalLog antenna ETS LINDGREN 3142E	2017/09	2020/09
4.	RF Pre-amplifier 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
6.	RF Pre-amplifier, 30 dB, 1-18 GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	Broadband Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
8.	RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
9.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2018/07	2021/07
10.	DC Power Supply Keysight Technologies U8002A	---	---
12.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2017/04	2020/04

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

1. Bluetooth EDR

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
Section 15.247 Subclause (a) (1) / RSS-247 5.1. (b)	20 dB Bandwidth and Carrier frequency separation	P	
Section 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (d)	Number of hopping channels	P	
Section 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (d)	Time of occupancy (Dwell Time)	P	
Section 15.247 Subclause (b) / RSS-247 5.4. (b)	Maximum peak output power and antenna gain	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u> None.			

2. WLAN 2.4 GHz (802.11 b/g/n20/n40 1x1).

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u> None.			

Appendix A: Test results. Bluetooth EDR (GFSK, Pi/4 DQPSK, 8DPSK)

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TEST CONDITIONS

POWER SUPPLY (V):

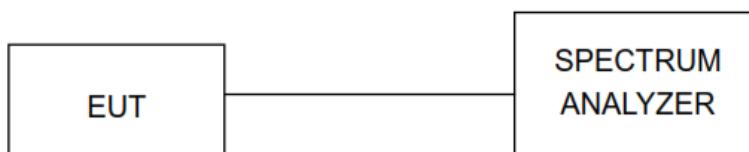
V nominal:	12 Vdc.
Type of Power Supply:	External power supply (Car Battery).
Type of Antenna:	External antenna.
Maximum Declared Antenna Gain:	-6.2 dBi (Antenna gain plus antenna cable loss).

TEST FREQUENCIES:

Low Channel:	2402 MHz
Middle Channel:	2441 MHz
High Channel:	2480 MHz

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The DC supply voltage is applied using an external calibrated power supply with a multimeter.

RADIATED MEASUREMENTS:

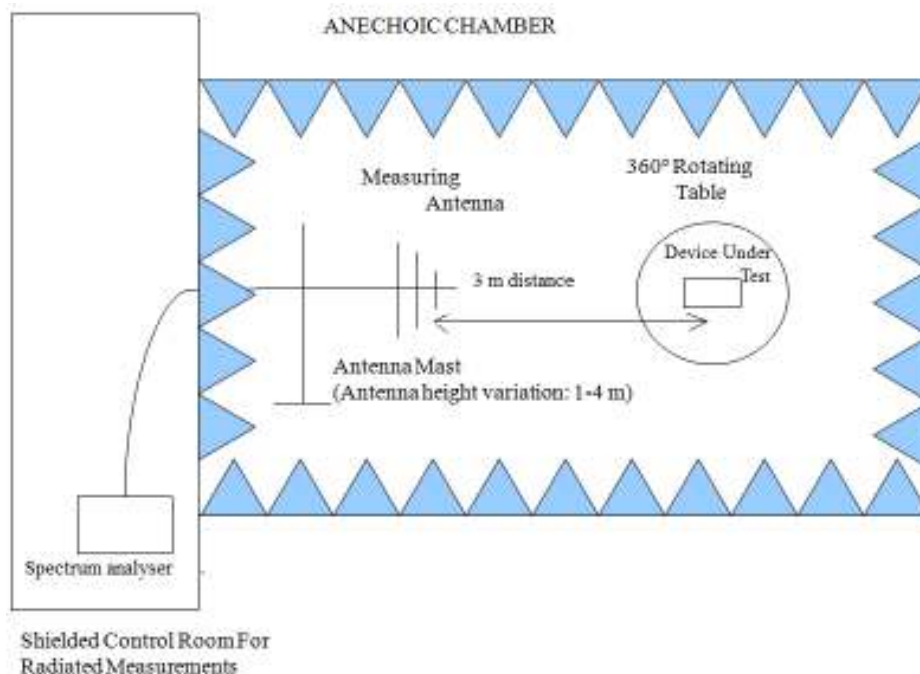
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

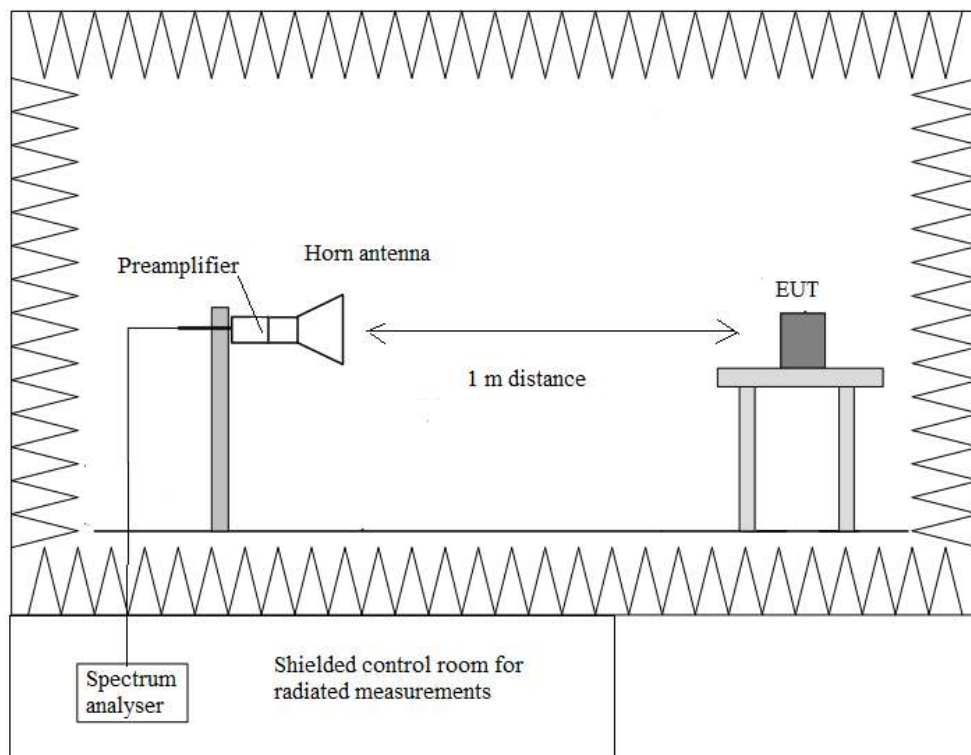
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup $f > 1$ GHz:



FCC Section 15.247 Subclause (a) (1) / RSS-247 Clause 5.1. (b) 20 dB Bandwidth and Carrier frequency separation.

SPECIFICATION:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

RESULTS:

- GFSK**

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
20 dB Spectrum Bandwidth (kHz)	941.846	945.303	941.838
99% Bandwidth (kHz)	878.564	878.724	878.670
Measurement uncertainty (kHz)	<±5.0		

- Pi/4 DQPSK**

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
20 dB Spectrum Bandwidth (kHz)	1359	1361	1361
99% Bandwidth (kHz)	1206.8	1208.4	1208.4
Measurement uncertainty (kHz)	<±5.0		

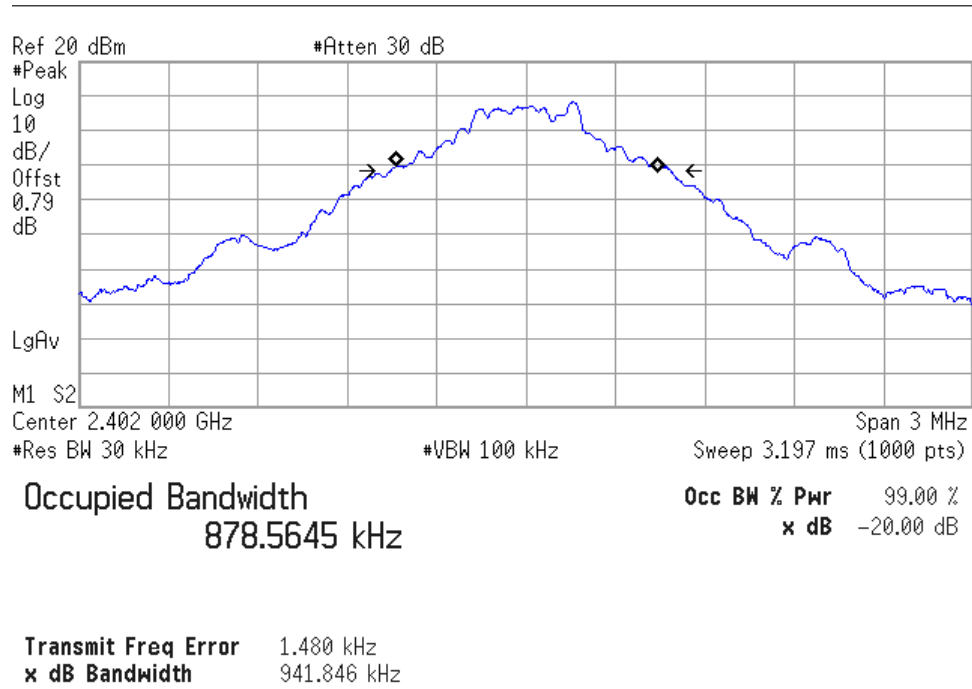
- 8DPSK**

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
20 dB Spectrum Bandwidth (kHz)	1317	1339	1317
99% Bandwidth (kHz)	1208.4	1212.3	1209.2
Measurement uncertainty (kHz)	<±5.0		

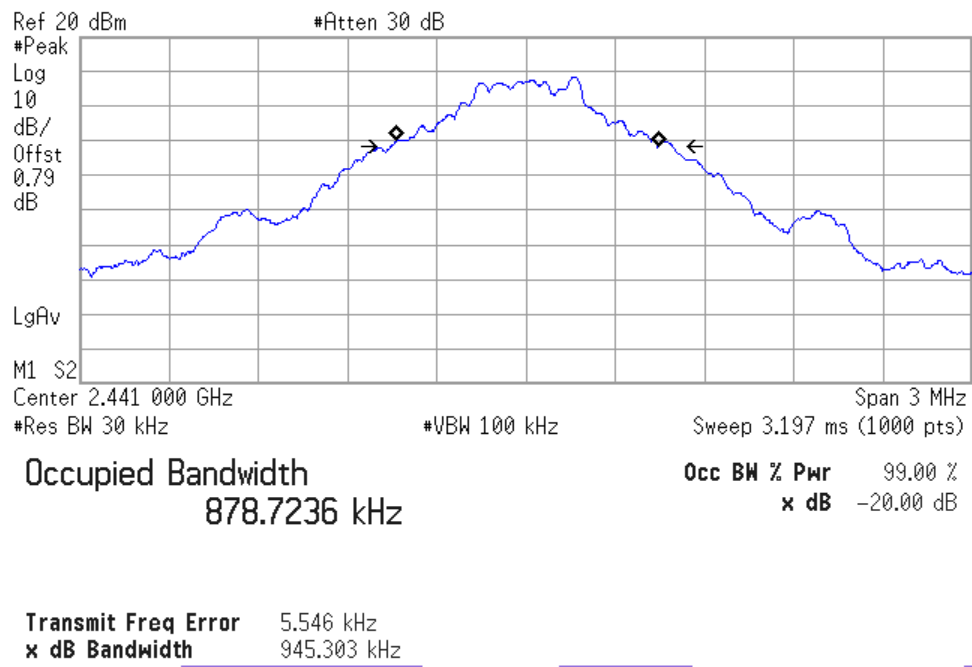
Verdict: PASS

GFSK – Bandwidths

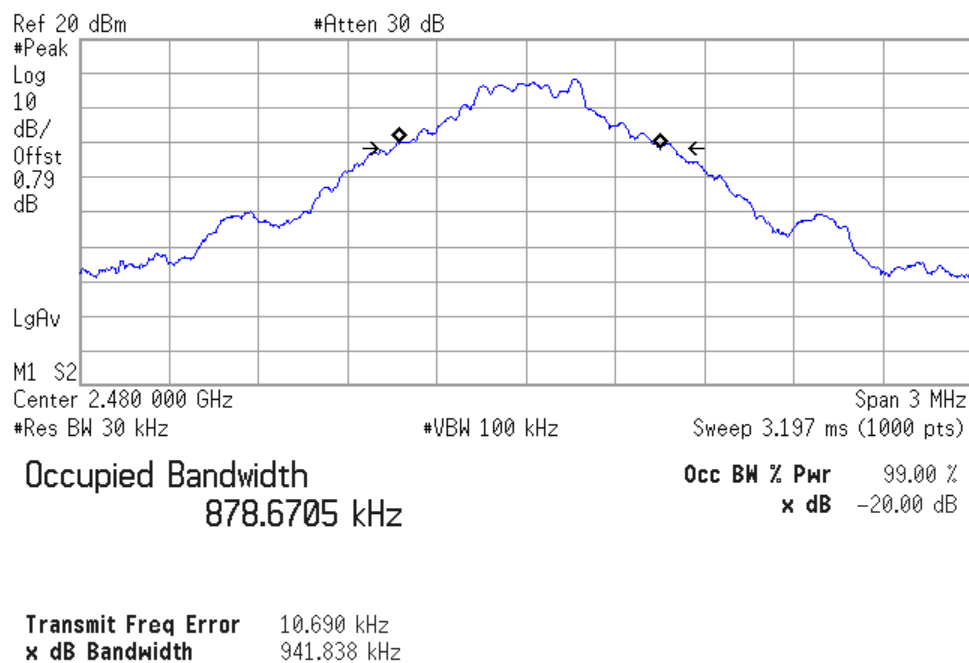
- Low Channel:



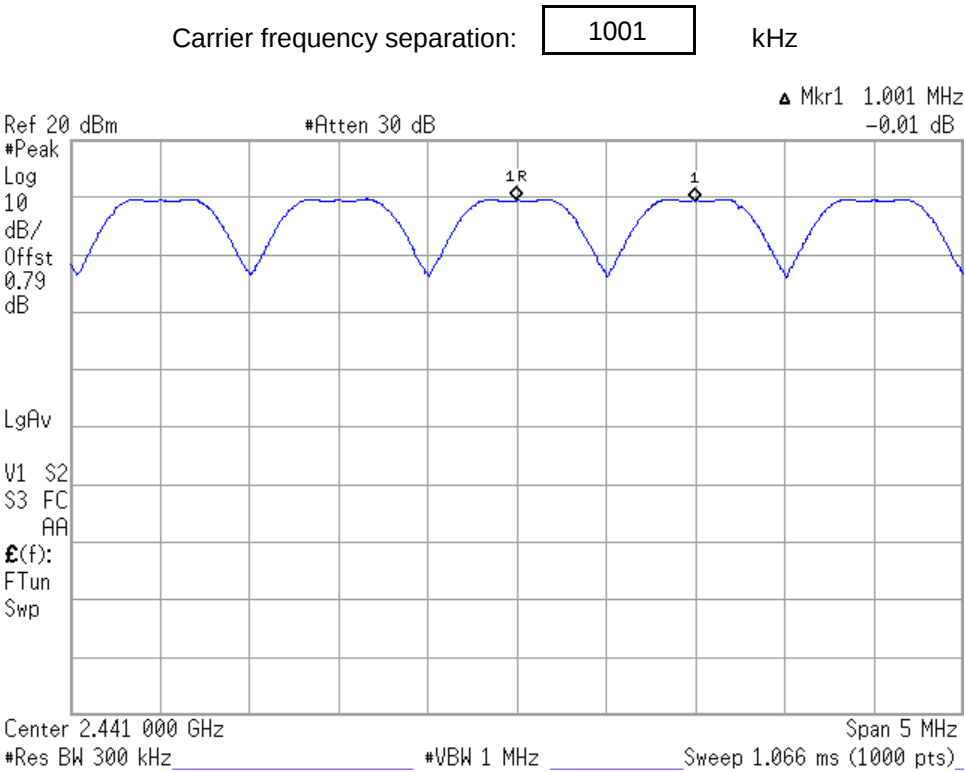
- Middle Channel:



- High Channel:



Carrier frequency separation - GFSK

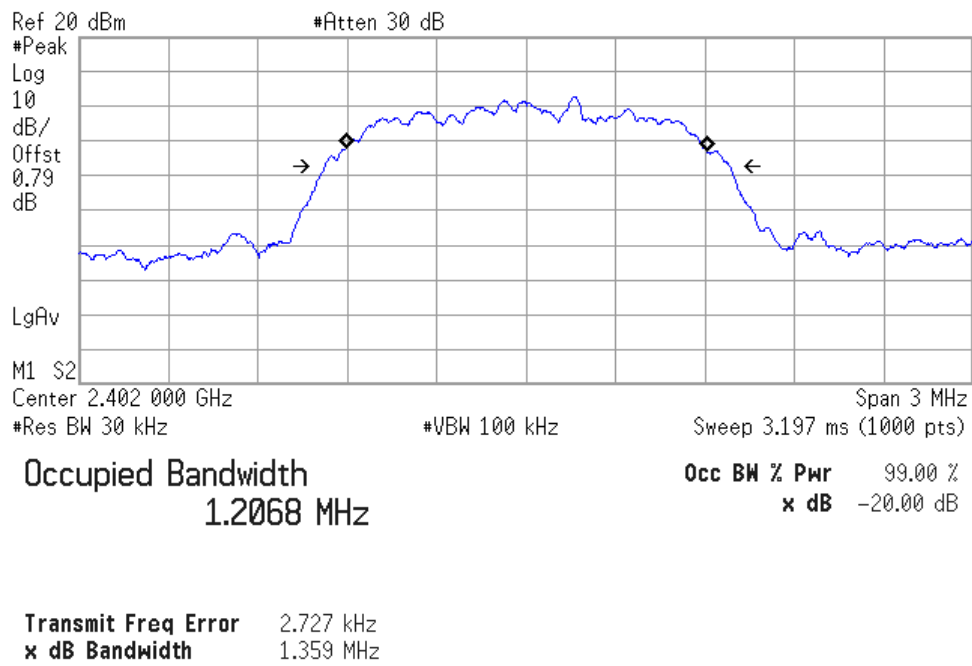


The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

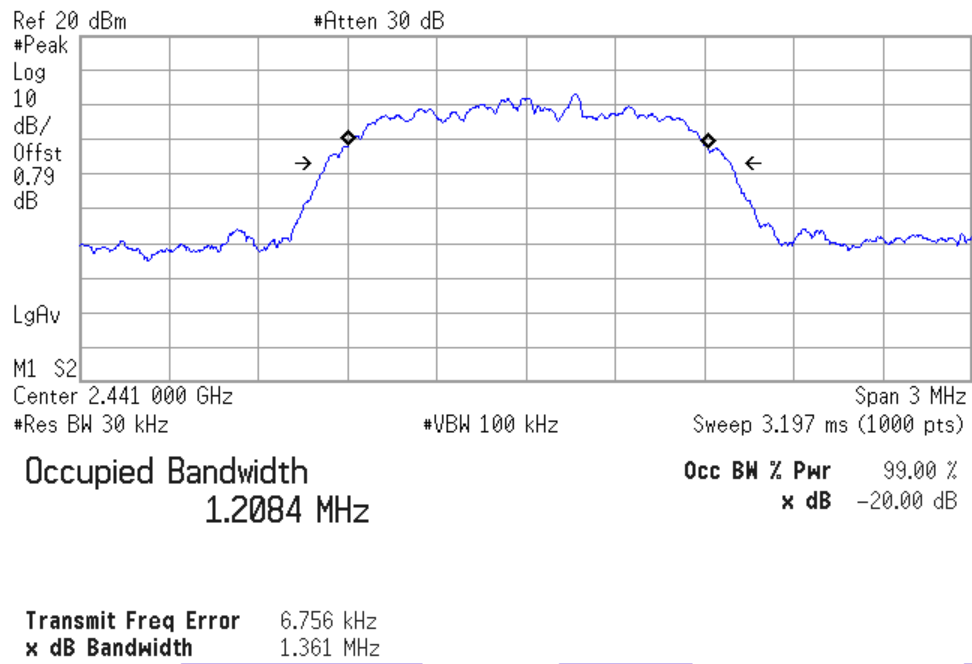
Verdict: PASS

• **PI/4 DQPSK – Bandwidths**

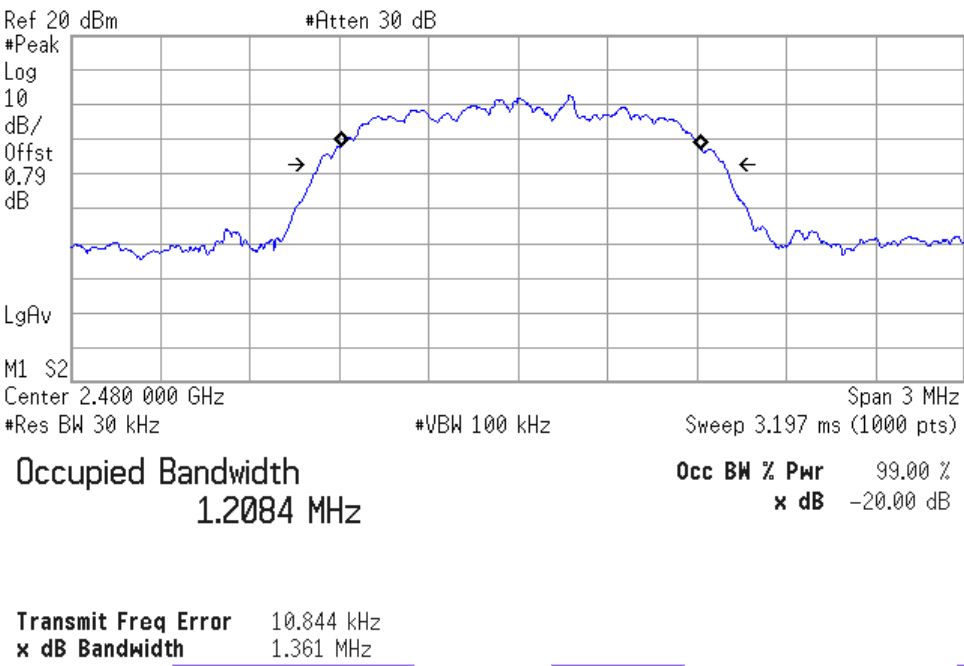
- Low Channel:



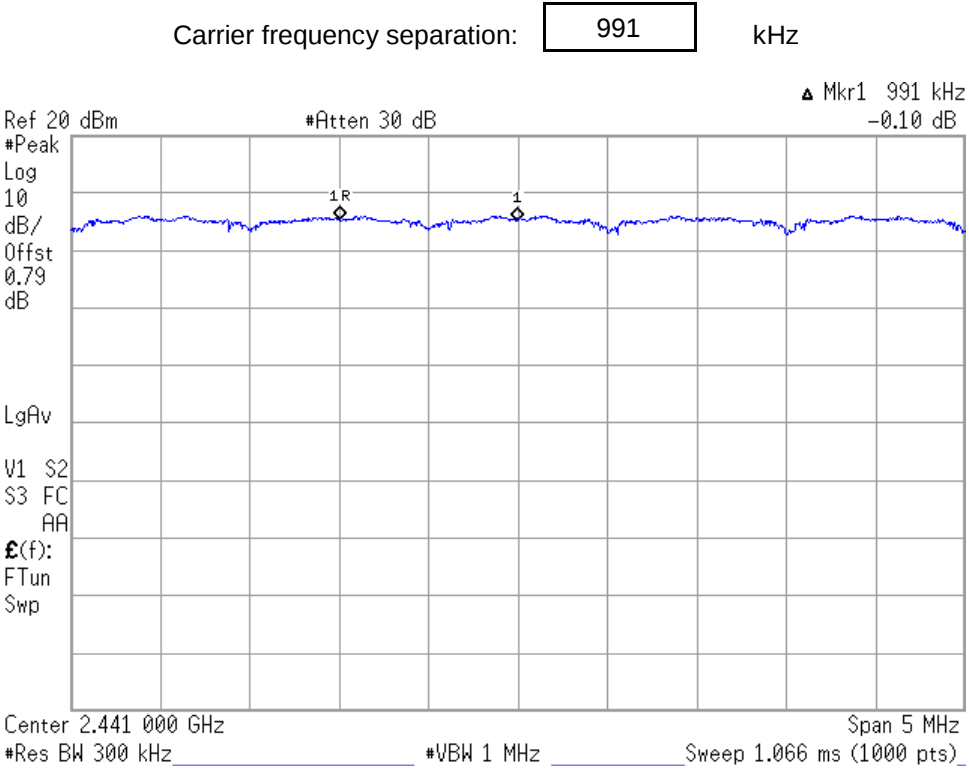
- Middle Channel:



- High Channel:



Carrier frequency separation - Pi/4 DQPSK

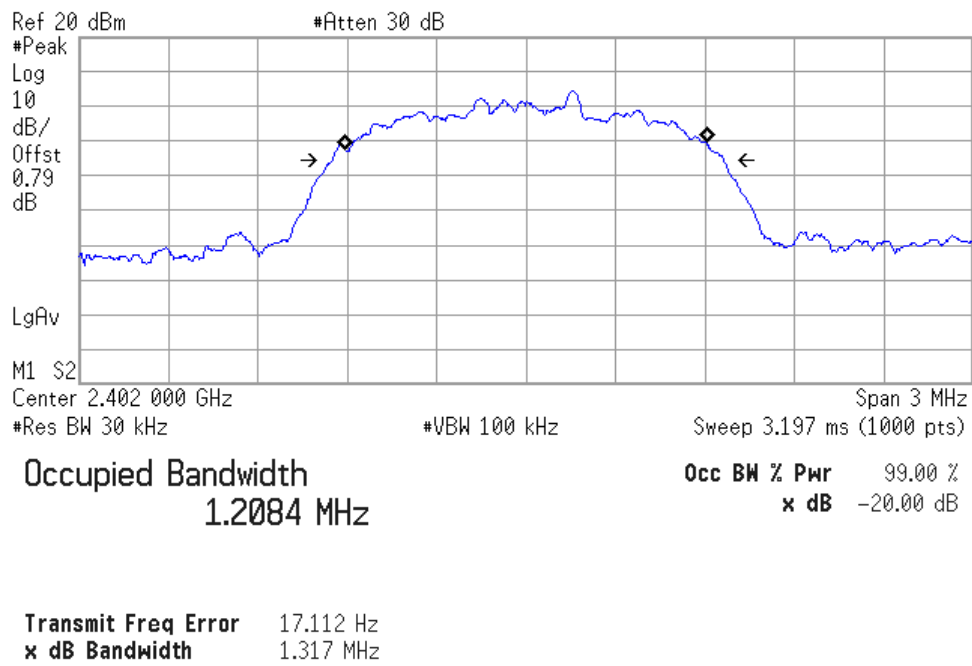


The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

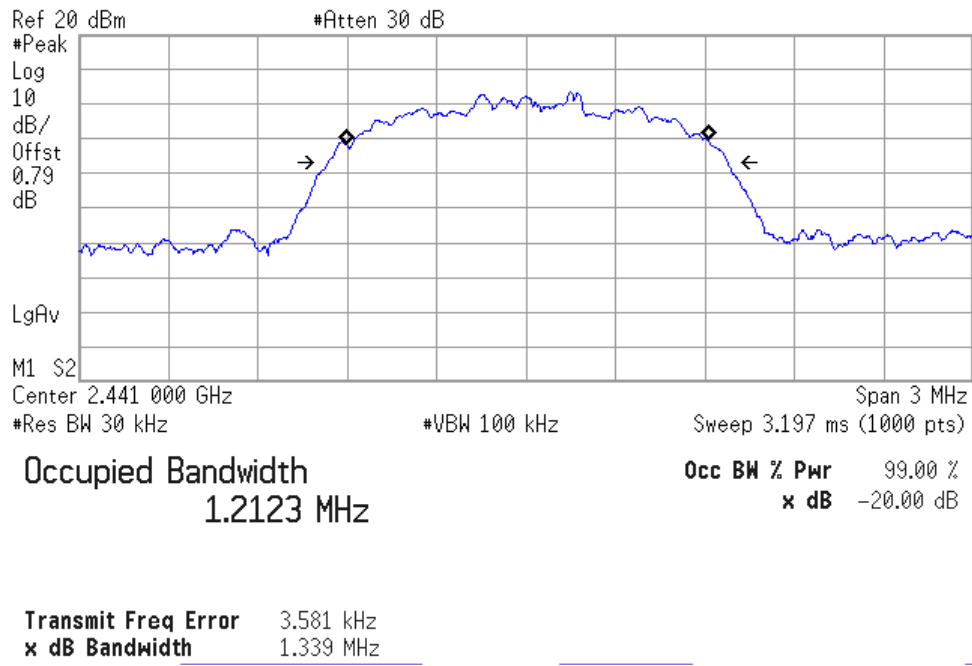
Verdict: PASS

• 8DPSK – Bandwidths

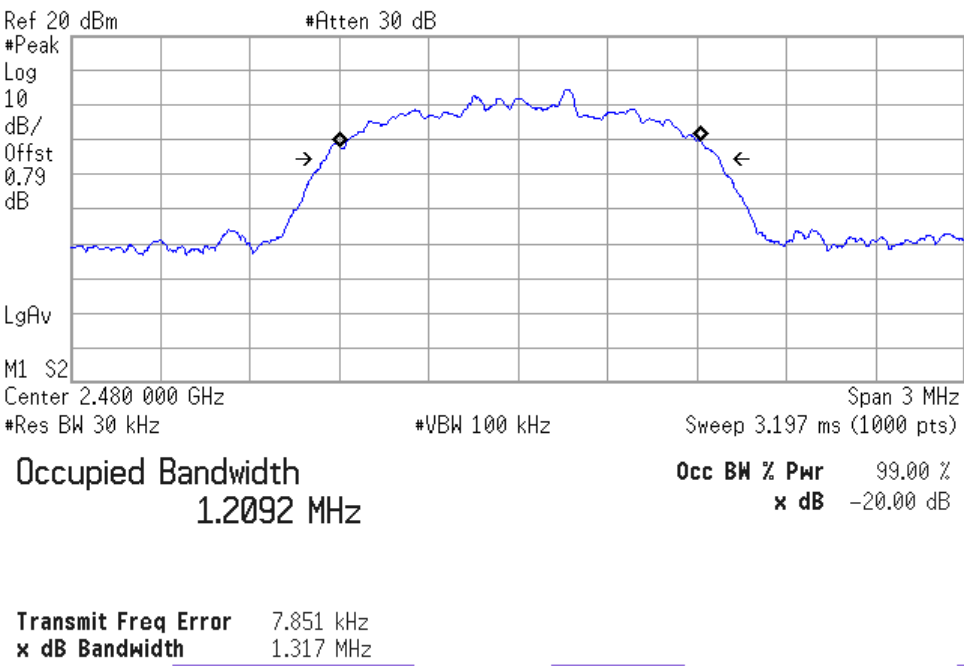
- Low Channel:



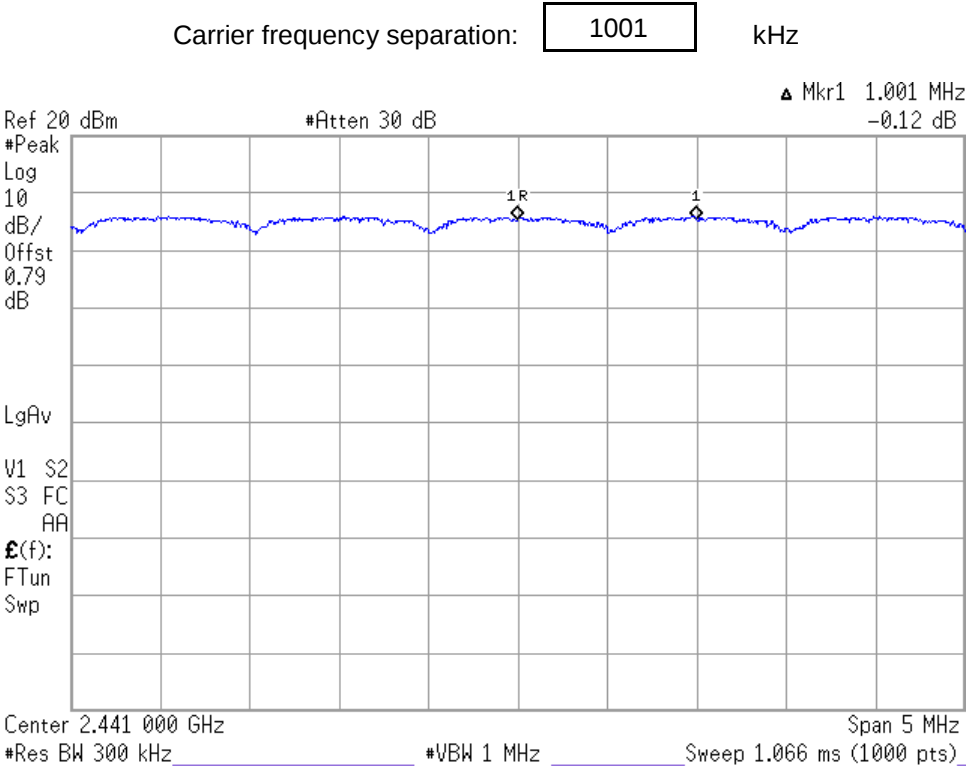
- Middle Channel:



- High Channel:



Carrier frequency separation - 8DPSK



The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

FCC Section 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (d) Number of hopping channels.

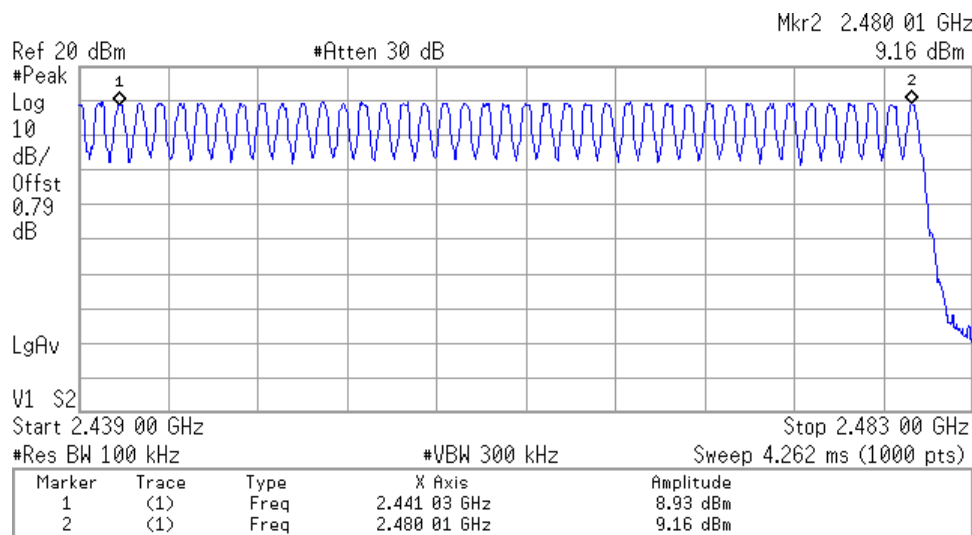
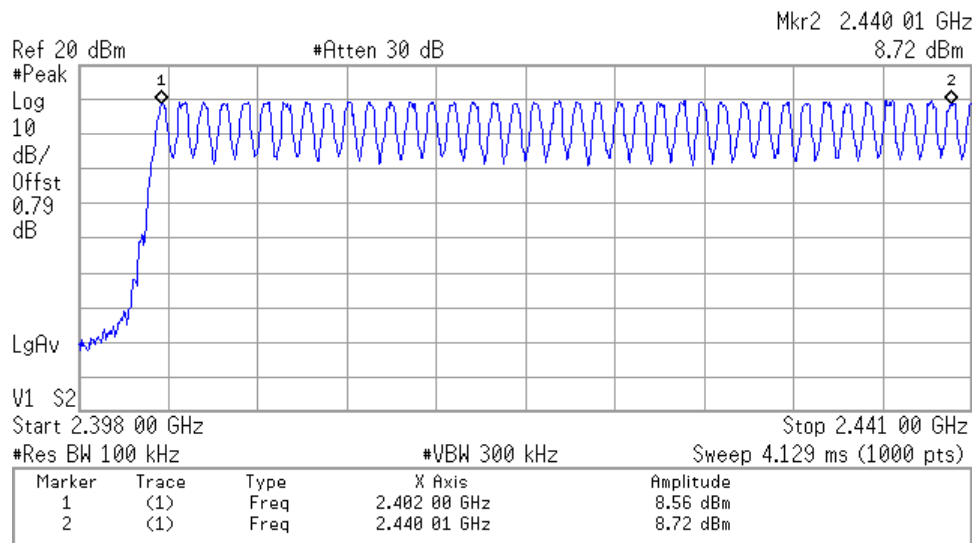
SPECIFICATION:

Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 channels.

RESULTS:

The number of hopping channels is 79 for all three modes.

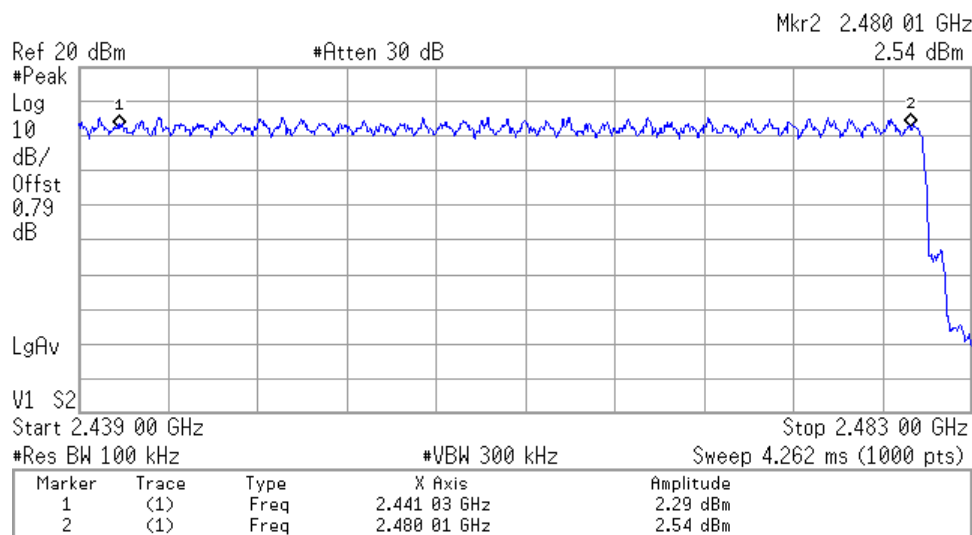
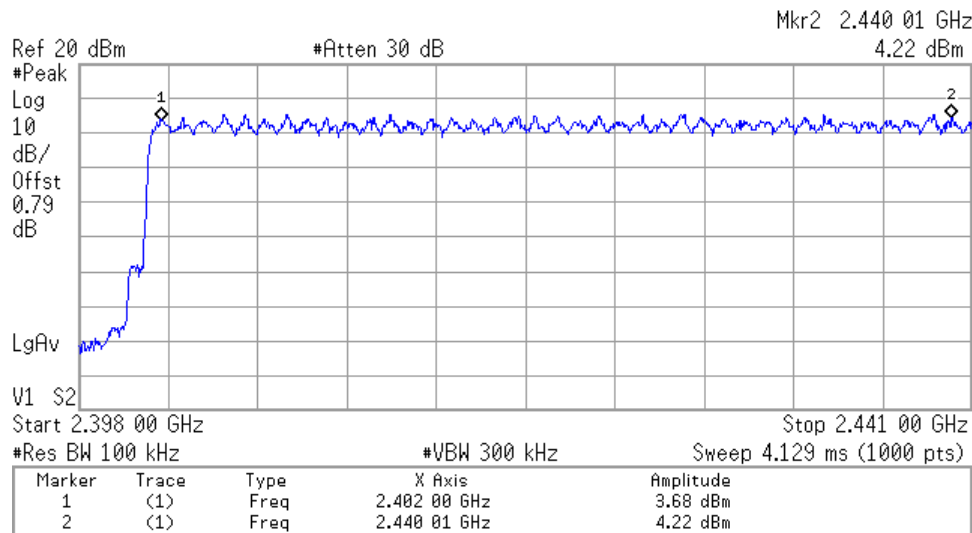
- GFSK – Number of hopping channels



Total number of hopping channels 79

Verdict: PASS

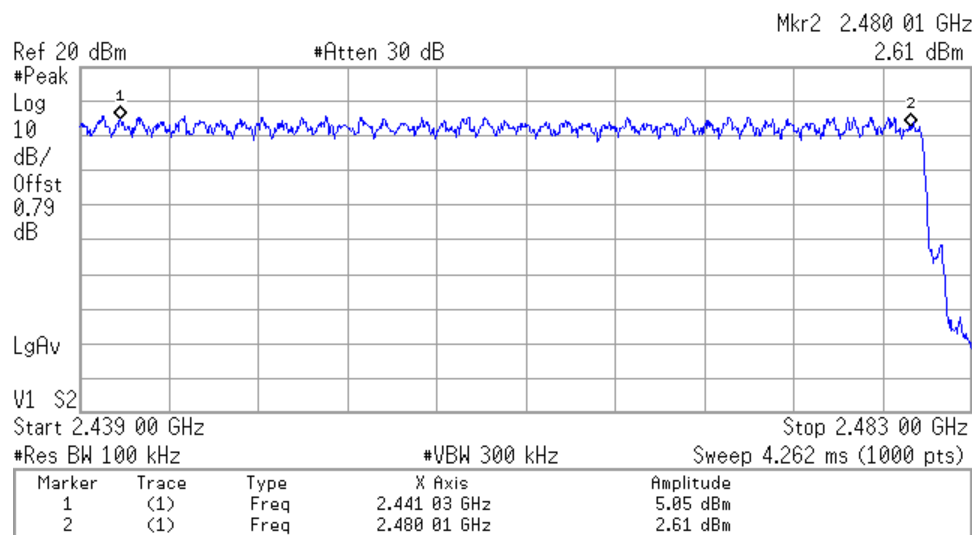
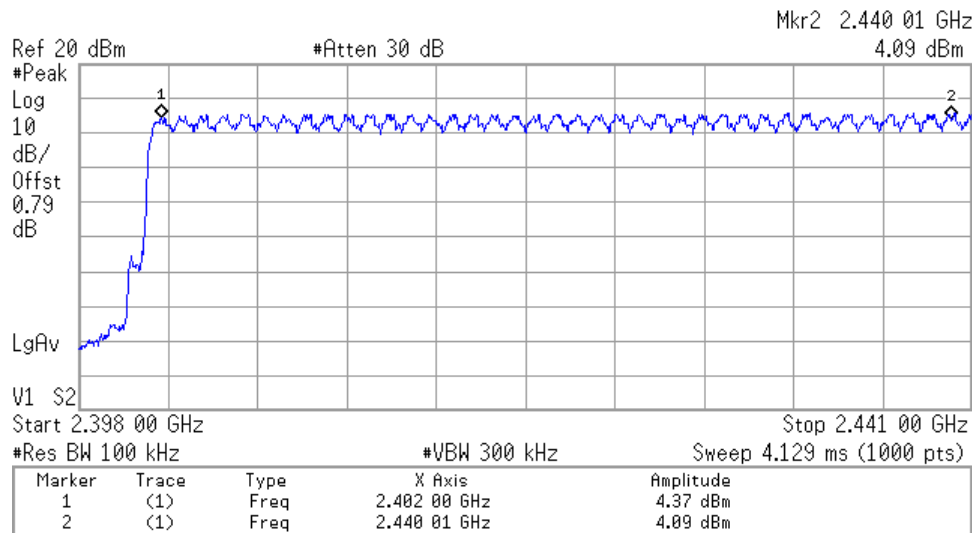
• Pi/4 DQPSK – Number of hopping channels



Total number of hopping channels 79

Verdict: PASS

• 8DPSK – Number of hopping channels



Total number of hopping channels 79

Verdict: PASS

FCC Section 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (d) Time of occupancy (Dwell Time).

SPECIFICATION:

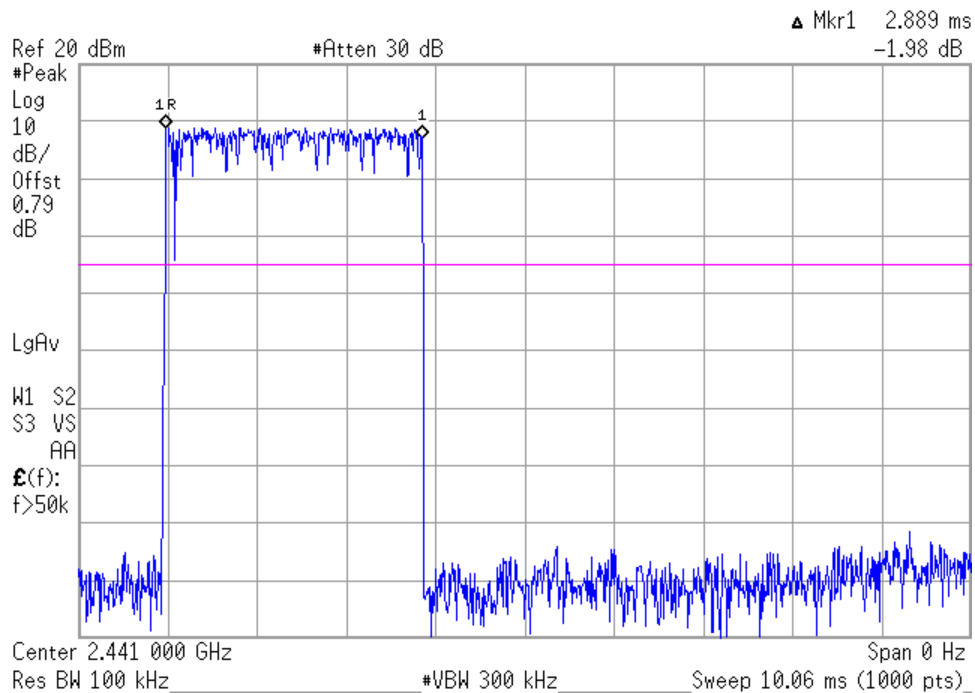
The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = $0.4 \times 79 = 31.6$ seconds.

RESULTS:

• GFSK (packet type DH5) – Time of Occupancy (Dwell Time)

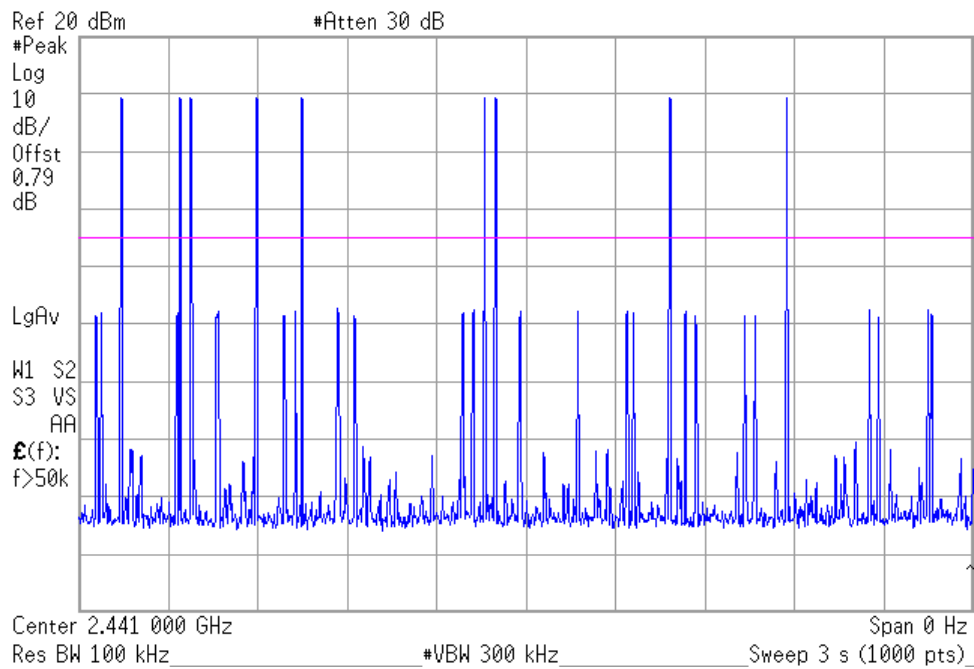
- Transmit Time per Hop:

2.889 ms



Time of Occupancy:

Nº of hops on spectrum analyzer	9
Nº of hops over the period	94.8
Average Time of Occupancy	273.8772 ms



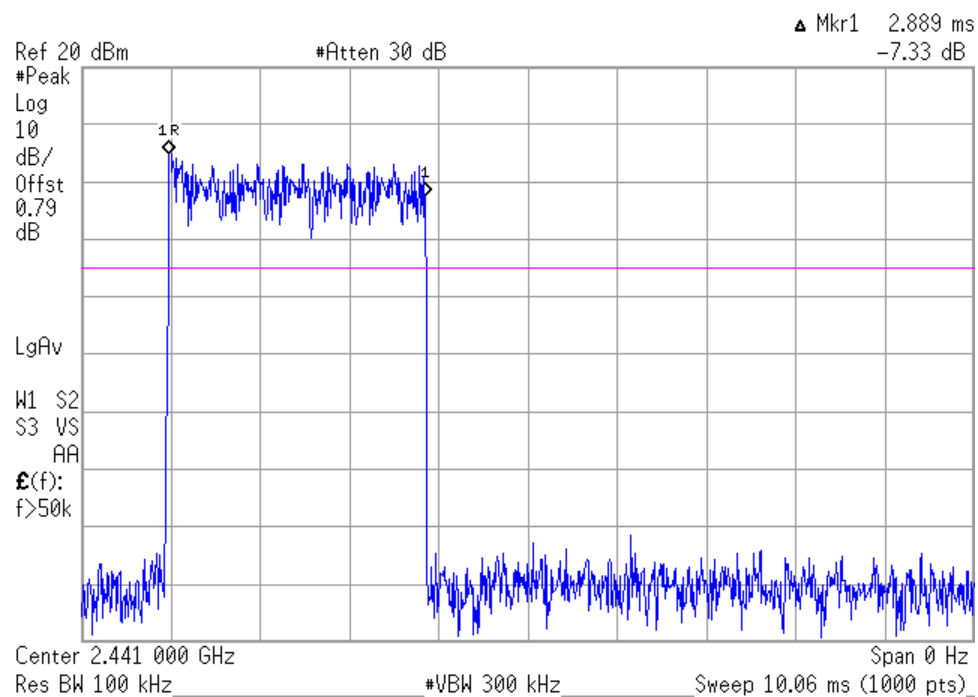
Measurement uncertainty (%)	<±0.01
-----------------------------	--------

Verdict: PASS

• **Pi/4 DQPSK (packet type 2DH5) – Time of Occupancy (Dwell Time)**

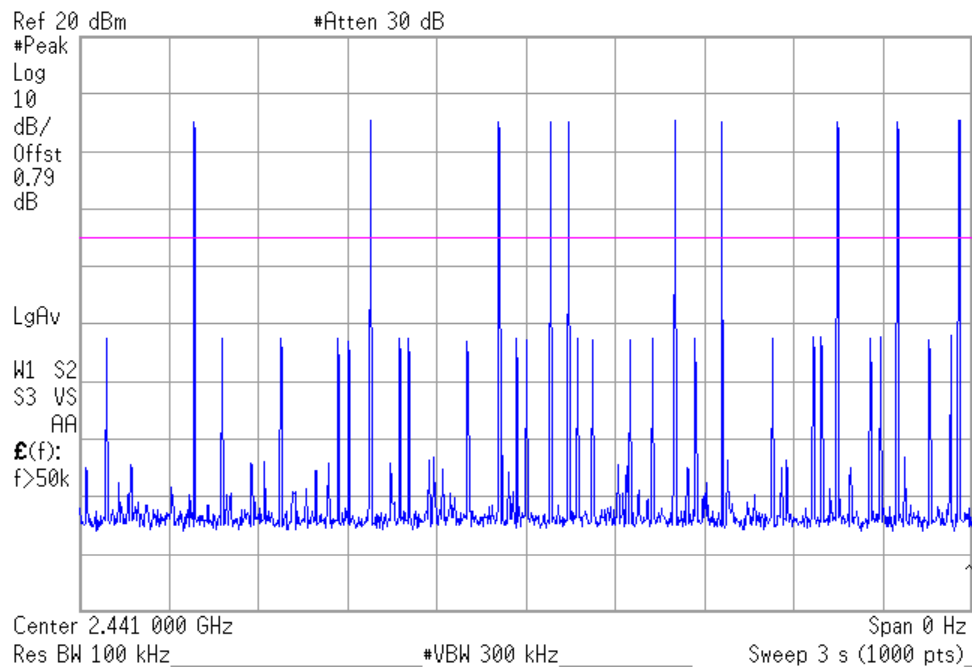
- Transmit Time per Hop:

2.889 ms



Time of Occupancy:

Nº of hops on spectrum analyzer	10
Nº of hops over the period	105.3333333
Average Time of Occupancy	304.308 ms



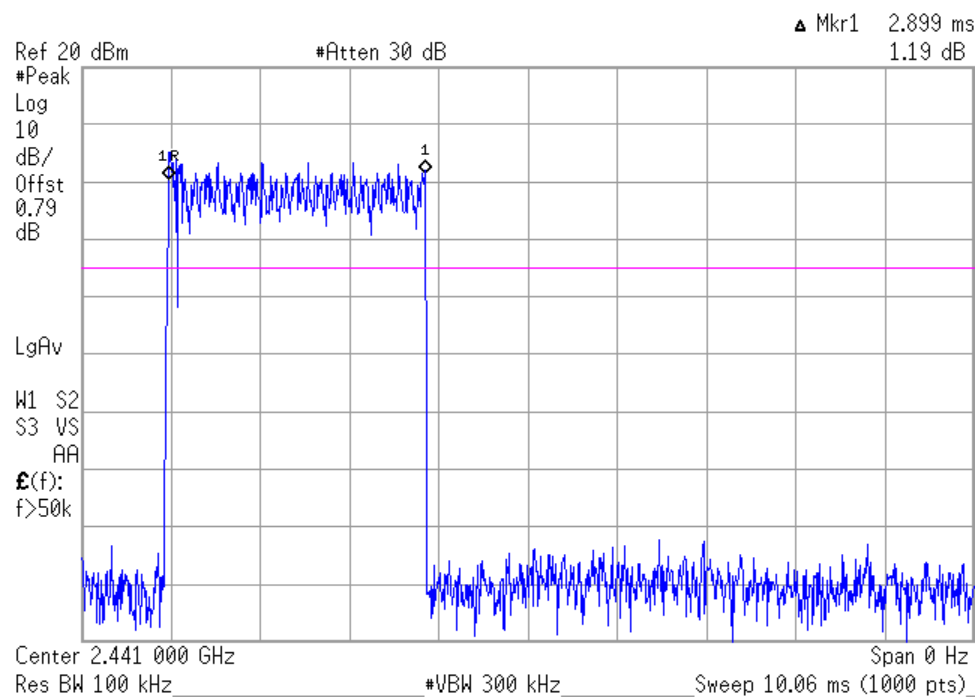
Measurement uncertainty (%)	<±0.01
-----------------------------	--------

Verdict: PASS

• **8DPSK (packet type 3DH5) – Time of Occupancy (Dwell Time)**

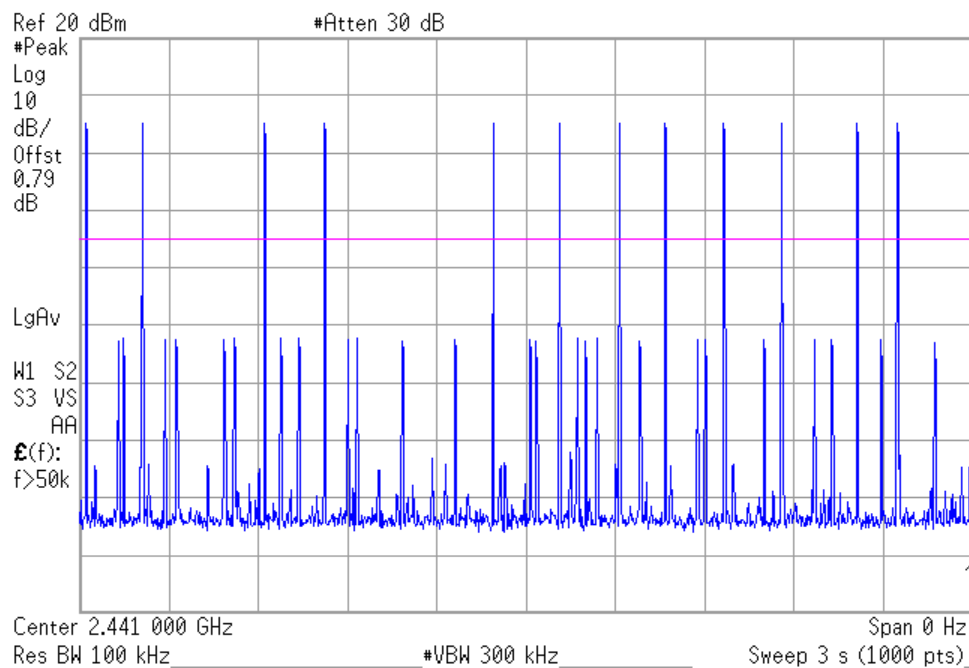
- Transmit Time per Hop:

2.899 ms



▪ Time of Occupancy:

Nº of hops on spectrum analyzer	12
Nº of hops over the period	126.4
Average Time of Occupancy	366.4336 ms



Measurement uncertainty (%)	<±0.01
-----------------------------	--------

Verdict: PASS

FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (b) Maximum peak output power and antenna gain

SPECIFICATION:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels: 1 watt (30 dBm). The e.i.r.p. shall not exceed 4 W (RSS-247).

RESULTS:

The EIRP power (dBm) is calculated by adding the maximum declared antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: -6.2 dBi

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values

- GFSK (1 Mbps)**

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	9.23	9.79	9.73
Maximum EIRP Power (dBm)	3.03	3.59	3.53
Measurement uncertainty (dB)	<±0.78		

- Pi/4 DQPSK (2 Mbps)**

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	7.62	7.97	7.81
Maximum EIRP Power (dBm)	1.42	1.77	1.61
Measurement uncertainty (dB)	<±0.78		

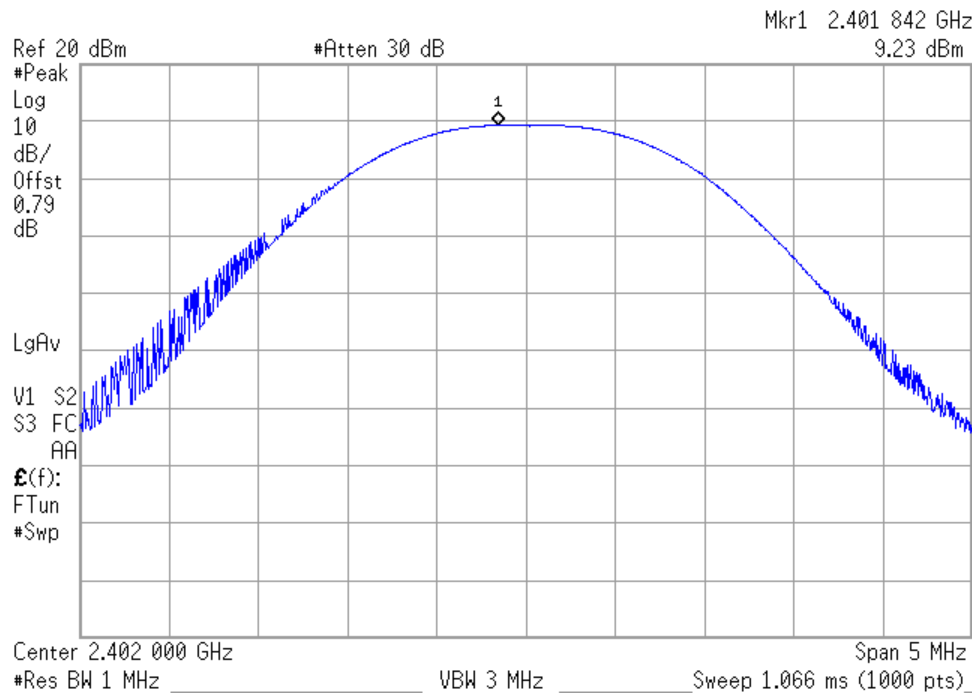
- 8DPSK (3 Mbps)**

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	7.85	8.24	8.05
Maximum EIRP Power (dBm)	1.65	2.04	1.85
Measurement uncertainty (dB)	<±0.78		

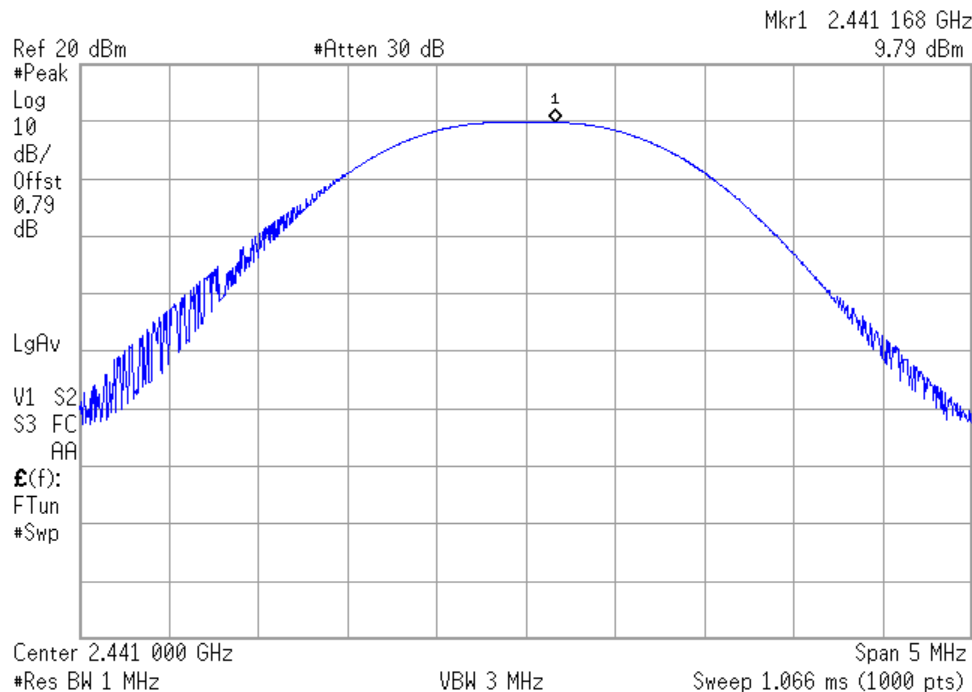
Verdict: PASS

GFSK – Peak Output Power

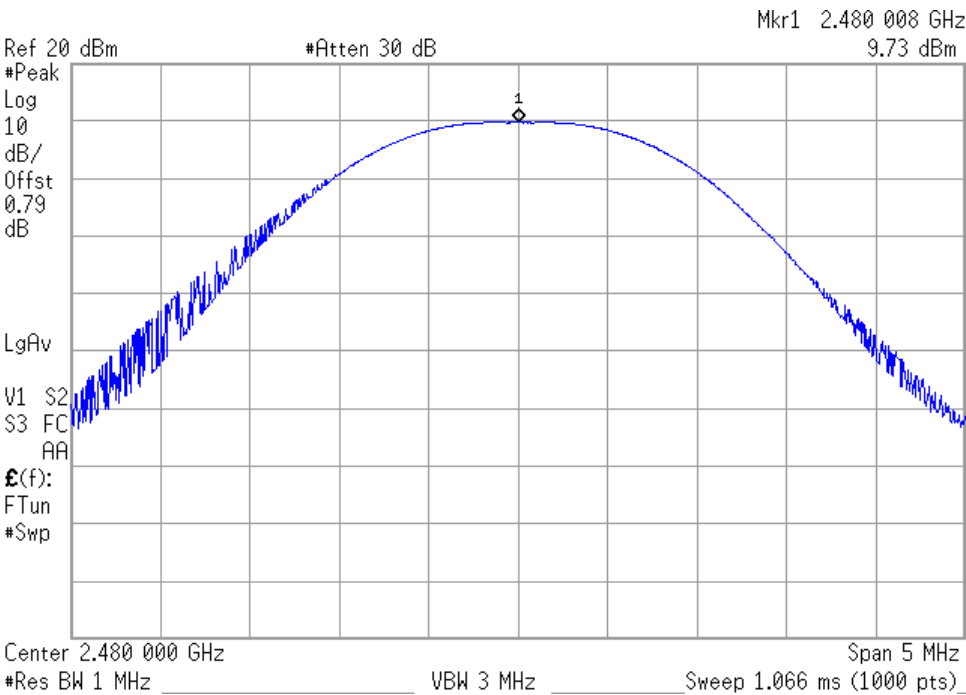
- Low Channel:



- Middle Channel:

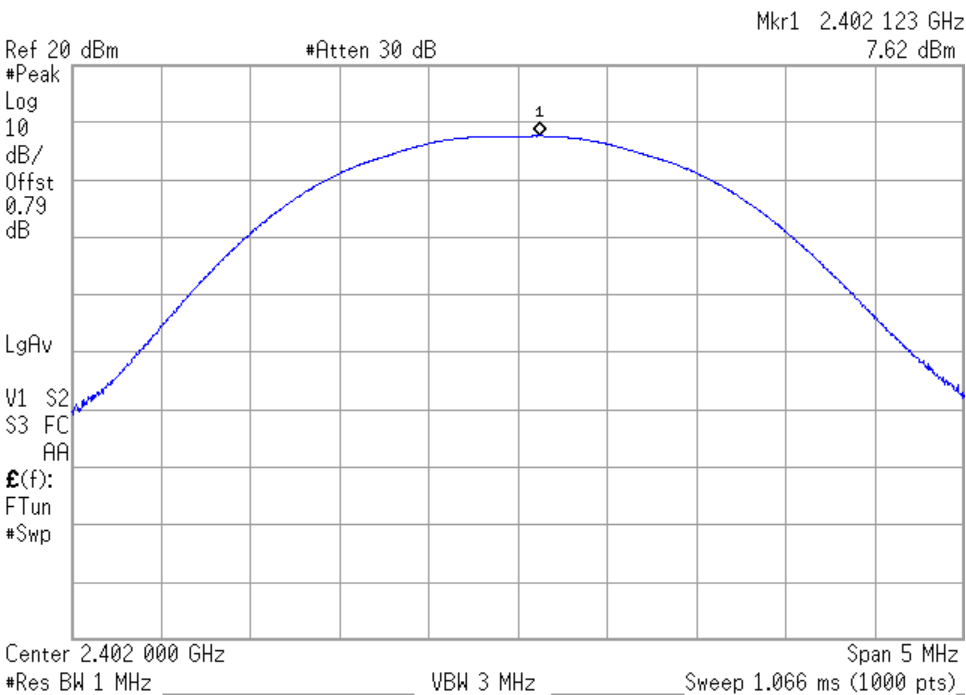


- High Channel:

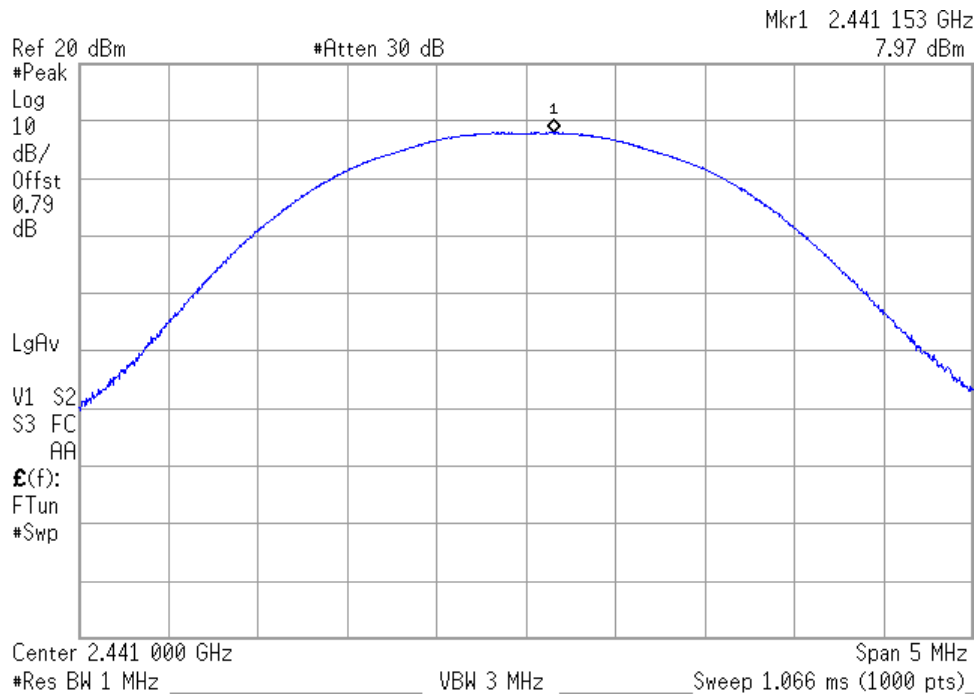


• Pi/4 DQPSK – Peak Output Power

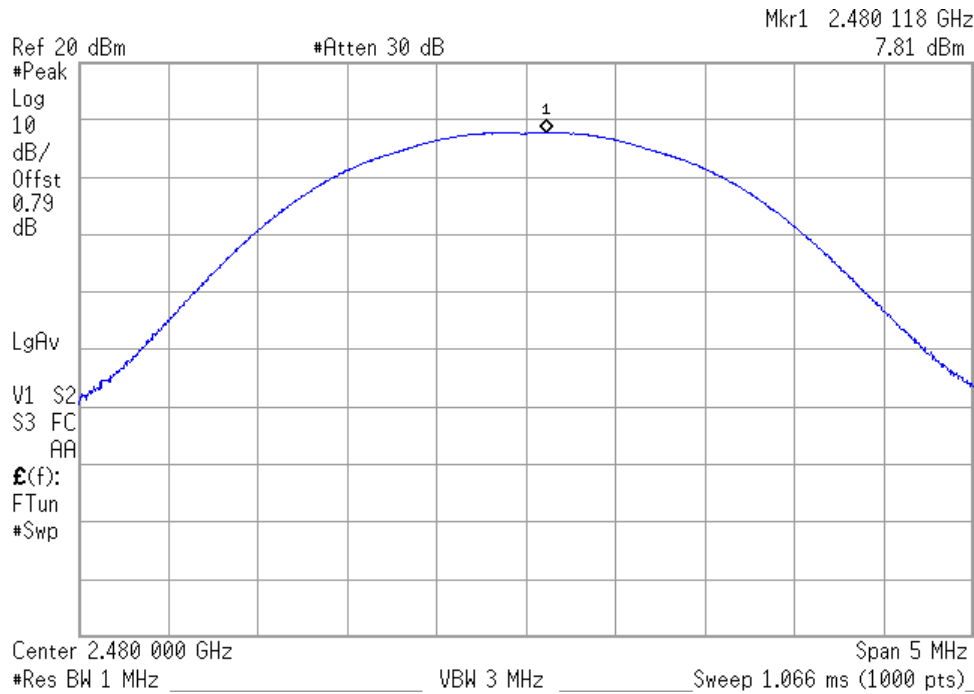
- Low Channel:



- Middle Channel:

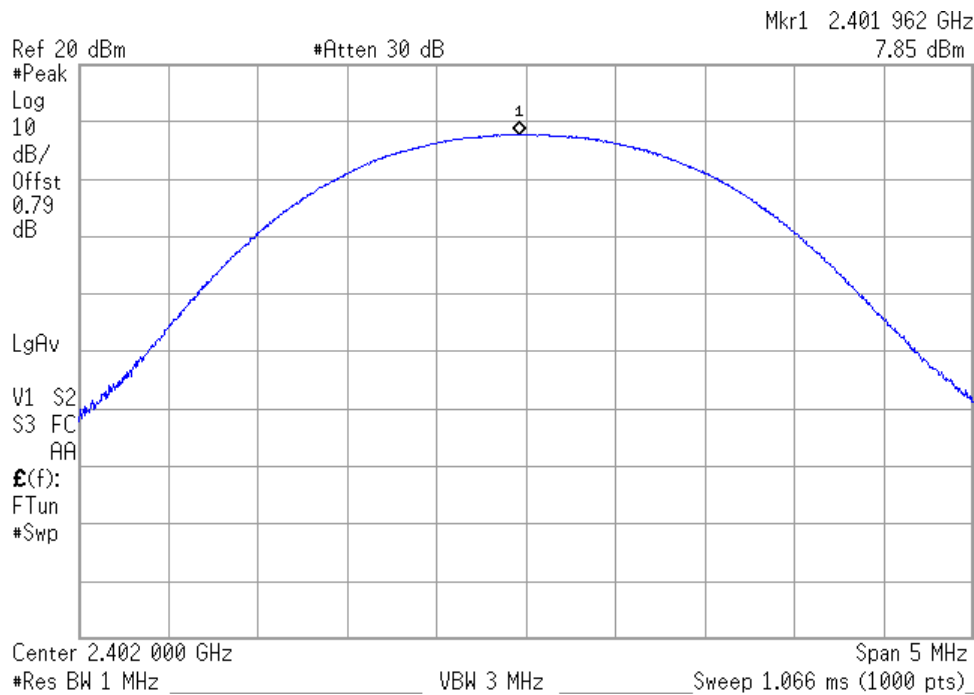


- High Channel:

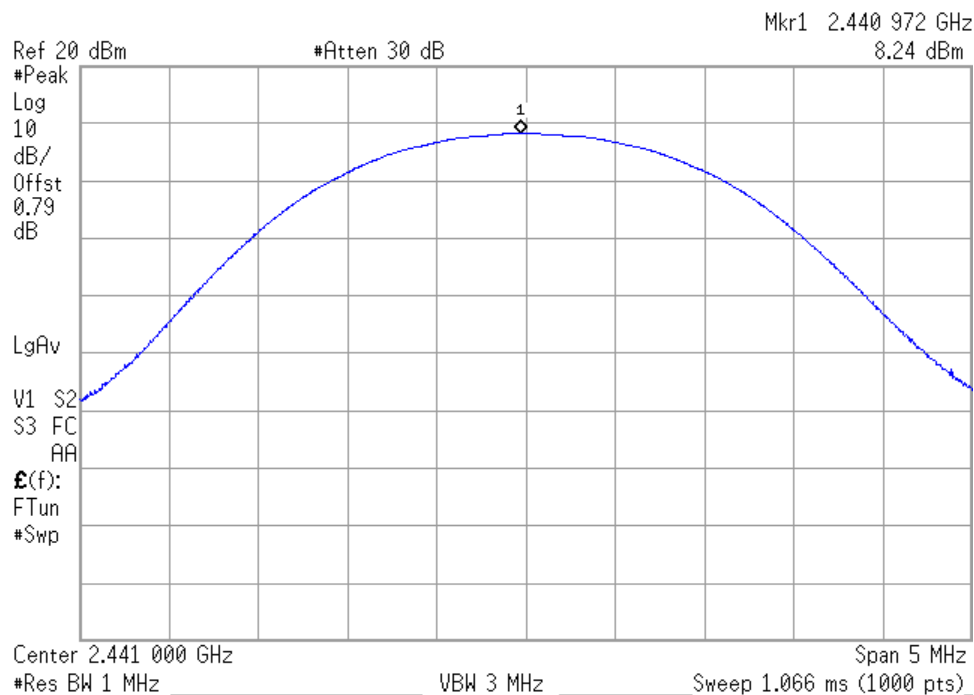


• 8DPSK – Peak Output Power

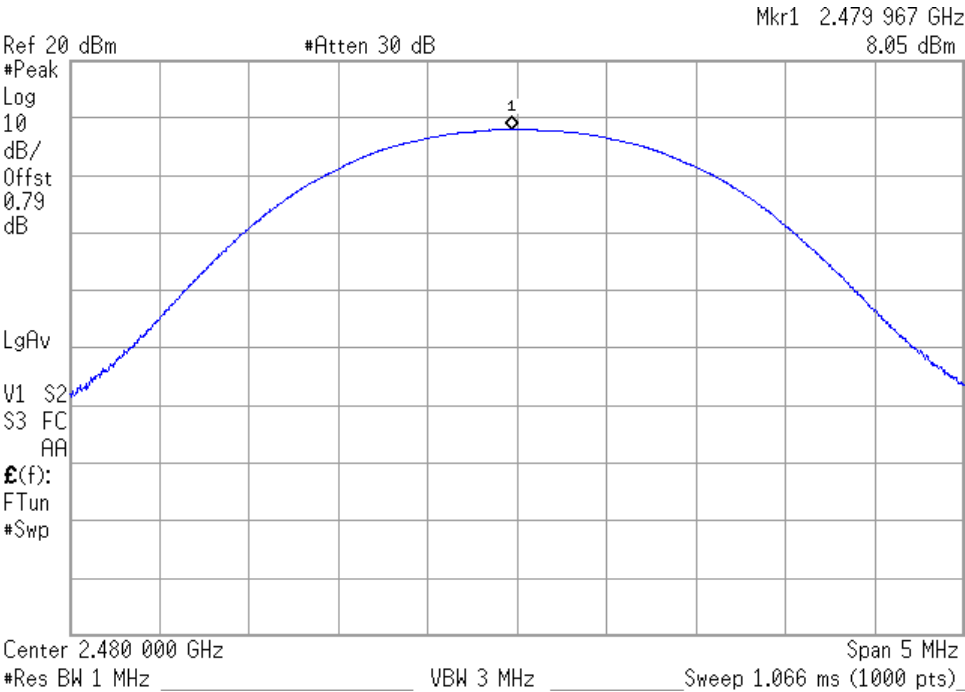
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter) (conducted)

SPECIFICATION:

Emissions outside the frequency band in which the intentional radiator is operating shall be at least 20 dB below the highest level of the desired power.

RESULTS:

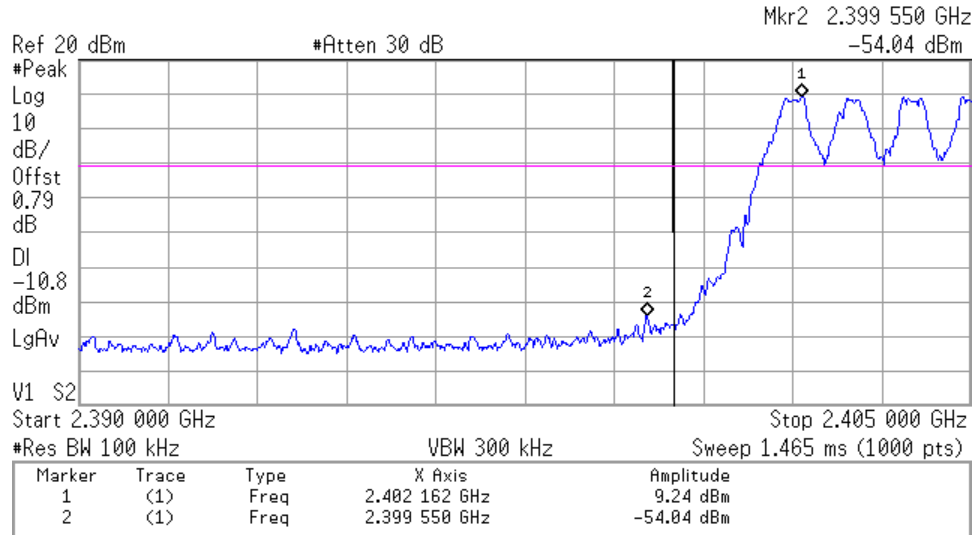
Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Measurement uncertainty (dB)	<±2.03
------------------------------	--------

- **GFSK – Band-edge emissions compliance**

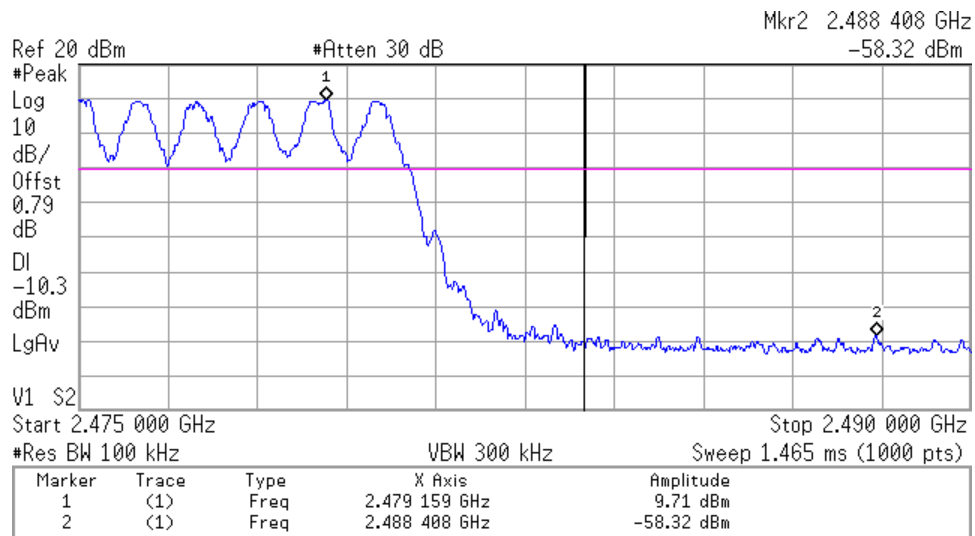
- ❖ **HOPPING ON:**

- **Low Frequency Section 2402 MHz:**



Verdict: PASS

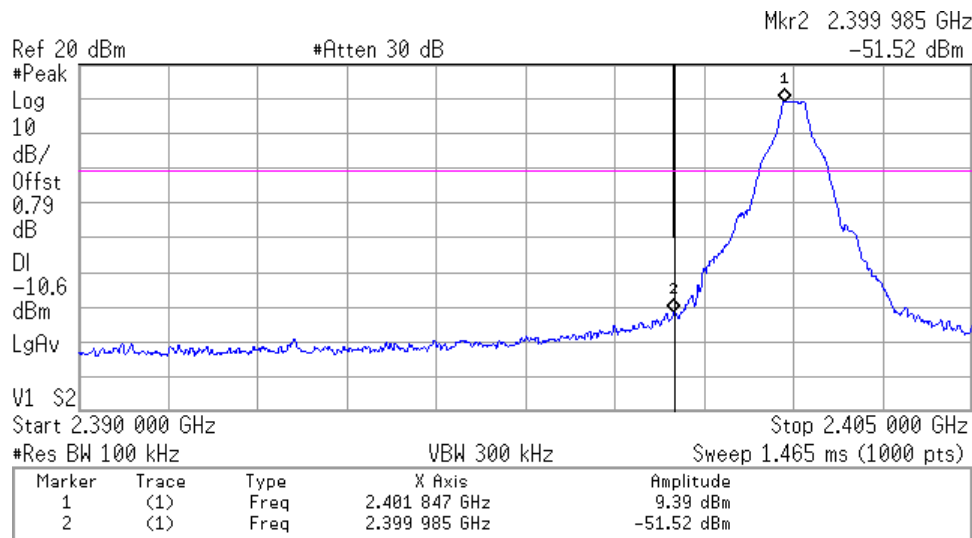
- **High Frequency Section 2480 MHz:**



Verdict: PASS

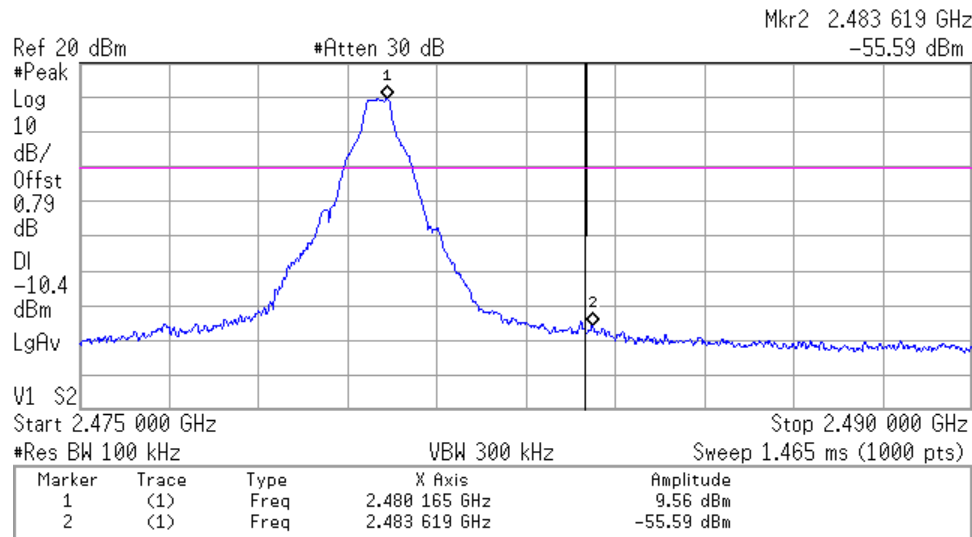
❖ HOPPING OFF:

- Low Frequency Section 2402 MHz:



Verdict: PASS

- High Frequency Section 2480 MHz:

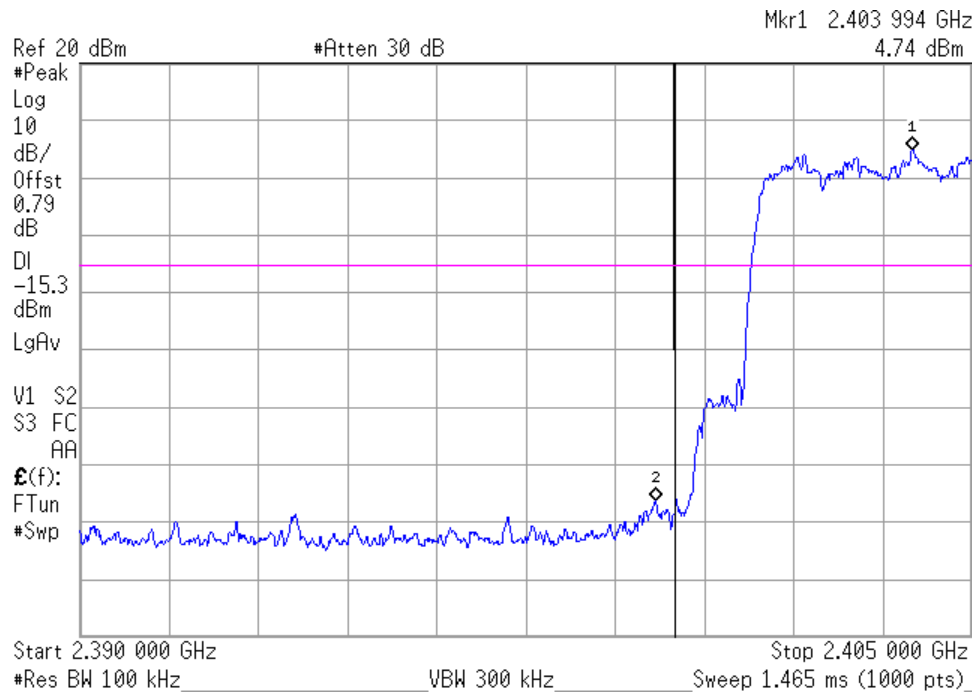


Verdict: PASS

• **PI/4 DQPSK – Band-edge emissions compliance**

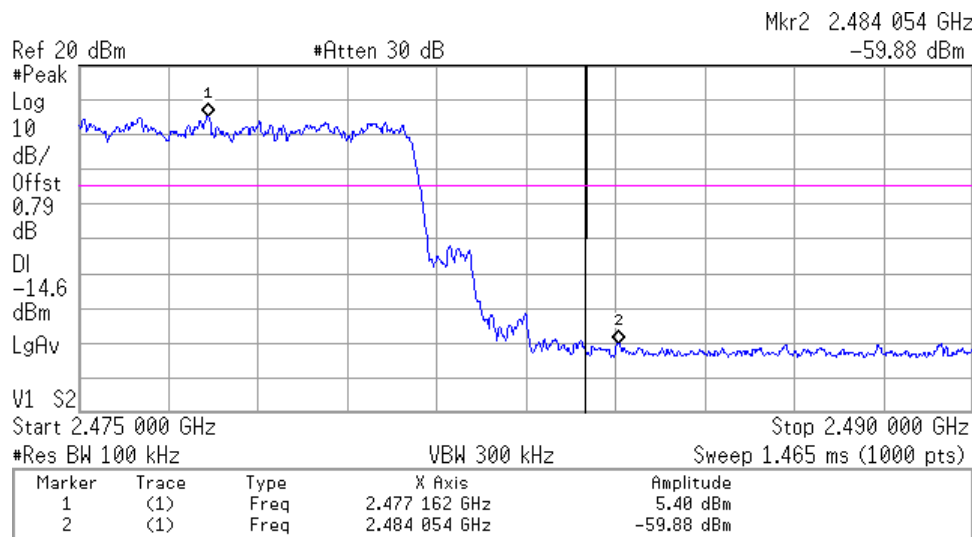
❖ **HOPPING ON:**

- **Low Frequency Section 2402 MHz:**



Verdict: PASS

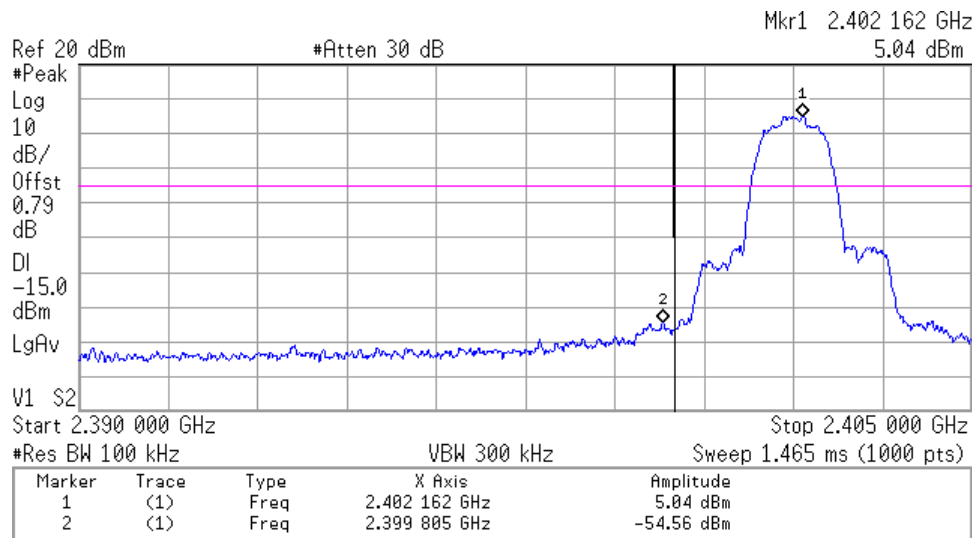
- **High Frequency Section 2480 MHz:**



Verdict: PASS

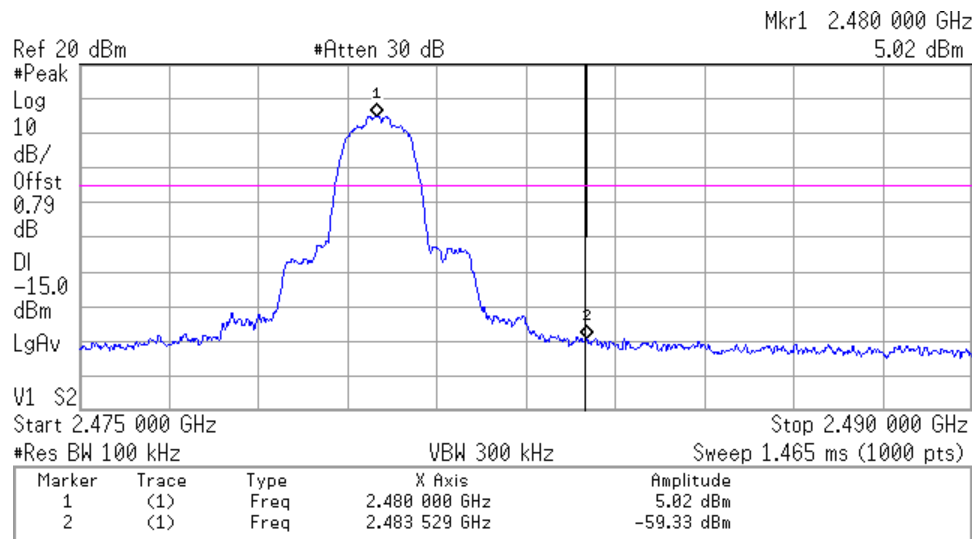
❖ HOPPING OFF:

- Low Frequency Section 2402 MHz:



Verdict: PASS

- High Frequency Section 2480 MHz:

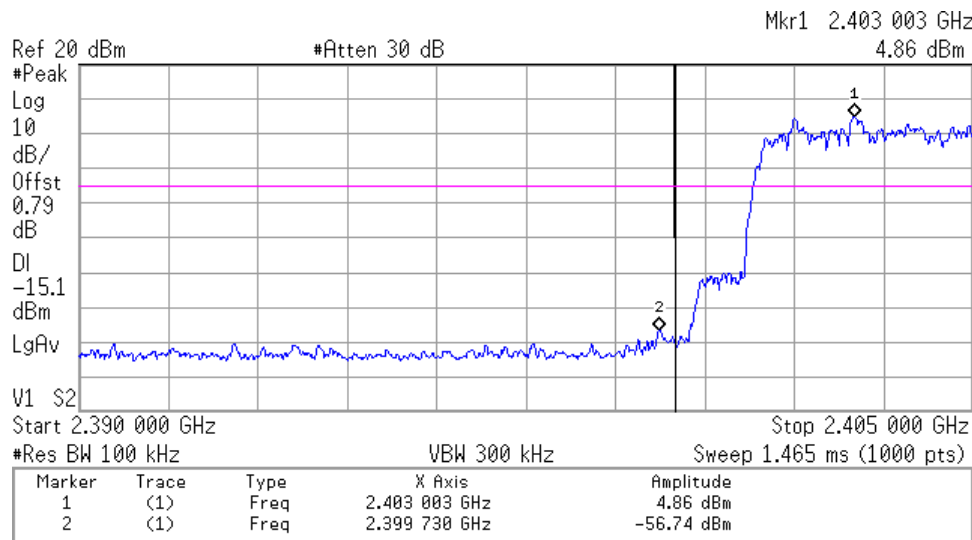


Verdict: PASS

• 8DPSK – Band-edge emissions compliance

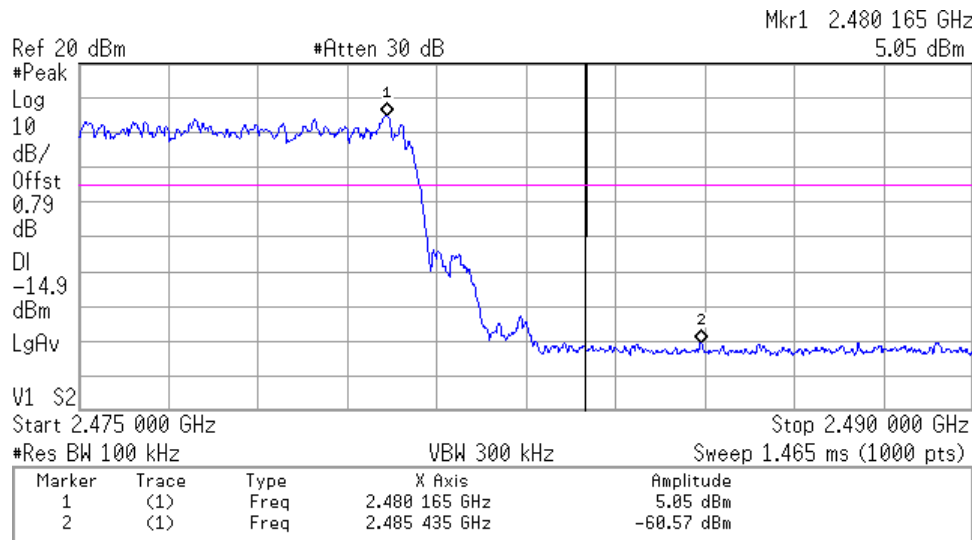
❖ HOPPING ON:

- Low Frequency Section 2402 MHz:



Verdict: PASS

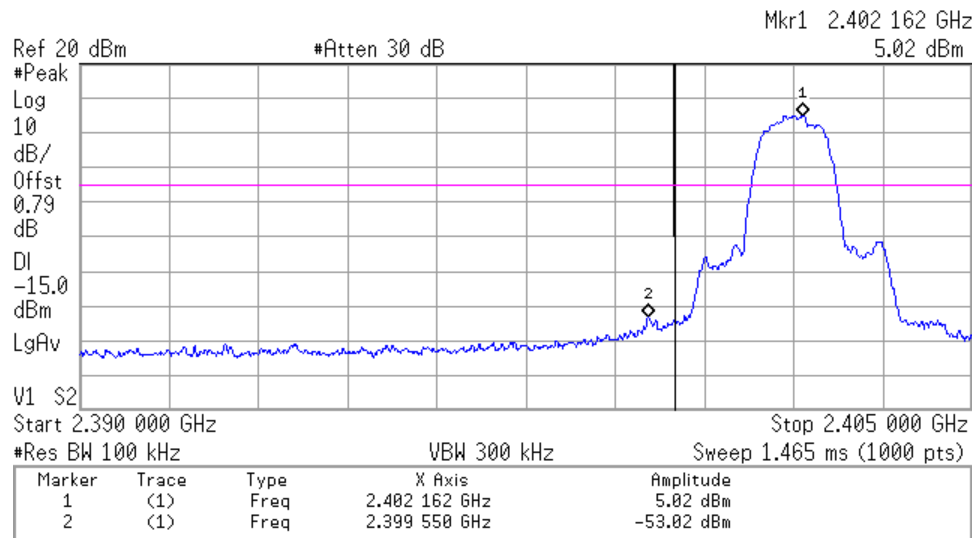
- High Frequency Section 2480 MHz:



Verdict: PASS

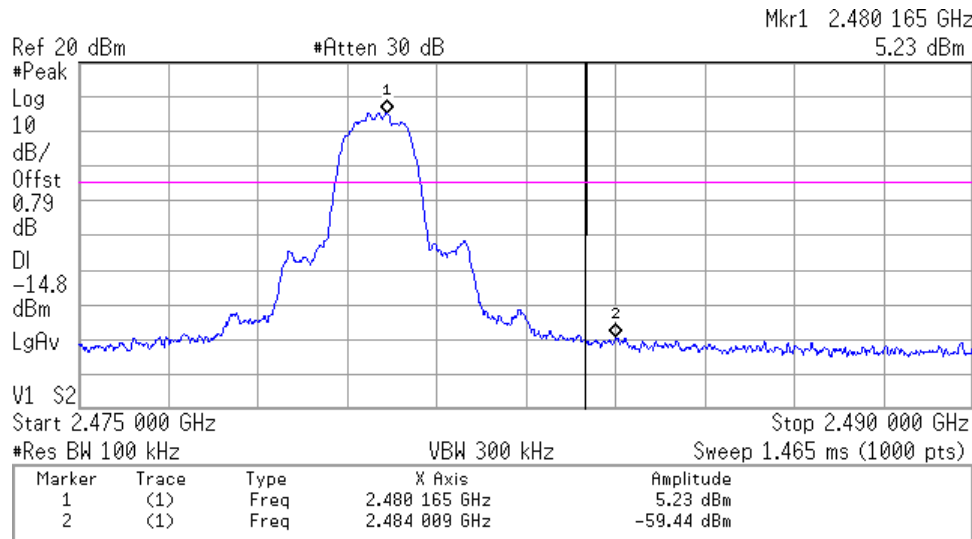
❖ HOPPING OFF:

- Low Frequency Section 2402 MHz:



Verdict: PASS

- High Frequency Section 2480 MHz:



Verdict: PASS

FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated. (Transmitter)

SPECIFICATION:

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)/RSS-Gen):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
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	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz. 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz. there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor. cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious frequencies detected below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious frequencies operating detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
31.374	Quasi peak	28.6	V	<± 2.07
375.013	Quasi peak	32.9	H	<± 2.07
542.888	Quasi peak	26.9	V	<± 2.07
562.514	Quasi peak	33.8	H	<± 2.07
750.015	Quasi peak	32.1	H	<± 2.07
937.516	Quasi peak	31.7	H	<± 2.07

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequencies with peak levels above the average limit (54 dBμV/m at 3 m) are measured with average detector for checking compliance with the average limit.

• GFSK modulation (DH5)

- Low Channel (2402 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
1.39657	Peak	48.86	H	<± 3.04
2.37621	Peak	51.91	V	<± 3.04

- Middle Channel (2441 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
1.39880	Peak	48.94	H	<± 3.04

- High Channel (2480 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
1.39807	Peak	49.34	H	<± 3.04
2.48442	Peak	53.01	V	<± 3.04

Verdict: PASS

- **Pi/4-DQPSK modulation (2-DH5)**

- Low Channel (2402 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
1.39687	Peak	48.75	H	<± 3.04
2.31211	Peak	52.08	V	<± 3.04
2.35615	Peak	51.83	H	<± 3.04
6.00000	Peak	40.15	V	<± 4.88

- Middle Channel (2441 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
1.40007	Peak	49.36	H	<± 3.04

- High Channel (2480 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
1.39713	Peak	48.48	H	<± 3.04
2.49423	Peak	52.45	V	<± 3.04

Verdict: PASS

• **8-DPSK modulation (3DH5)**

- Low Channel (2402 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.39960	Peak	49.22	H	< $\pm$ 3.04
2.34564	Peak	52.07	H	< $\pm$ 3.04

- Middle Channel (2441 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.39533	Peak	48.65	H	< $\pm$ 3.04

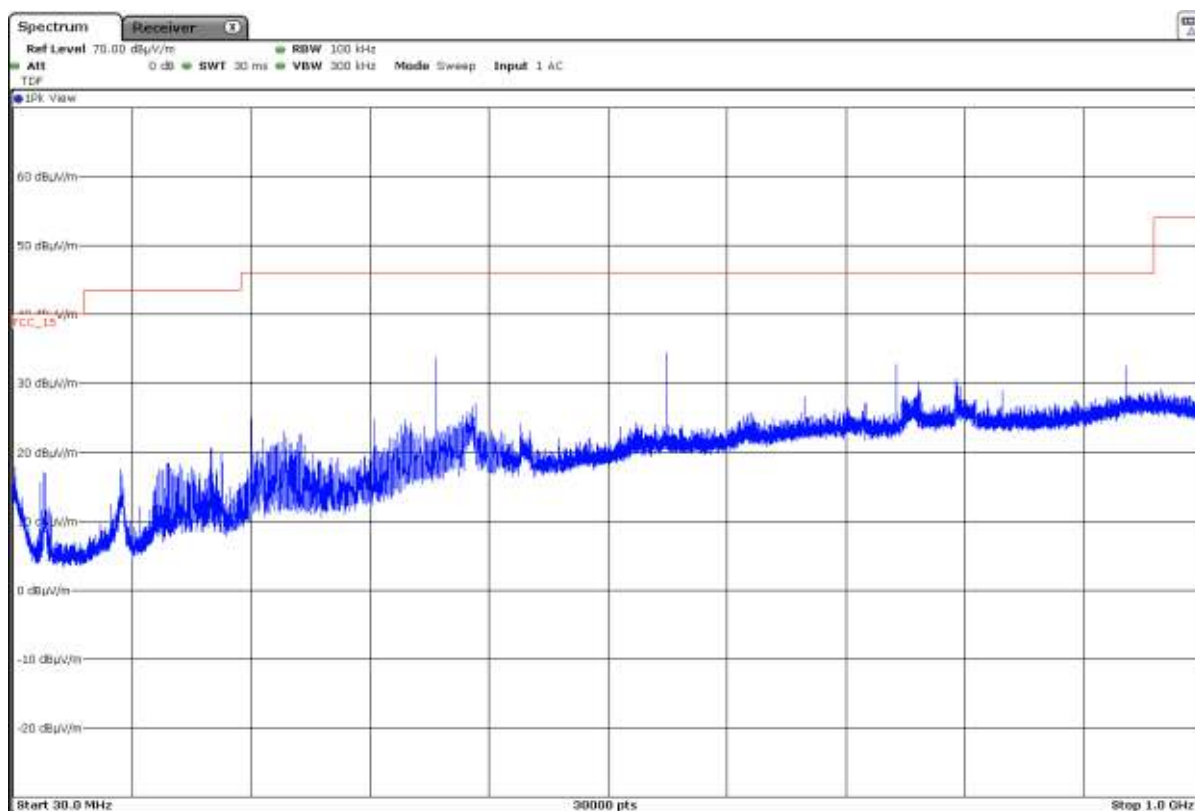
- High Channel (2480 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.39834	Peak	48.88	H	< $\pm$ 3.04
2.49796	Peak	52.63	H	< $\pm$ 3.04

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

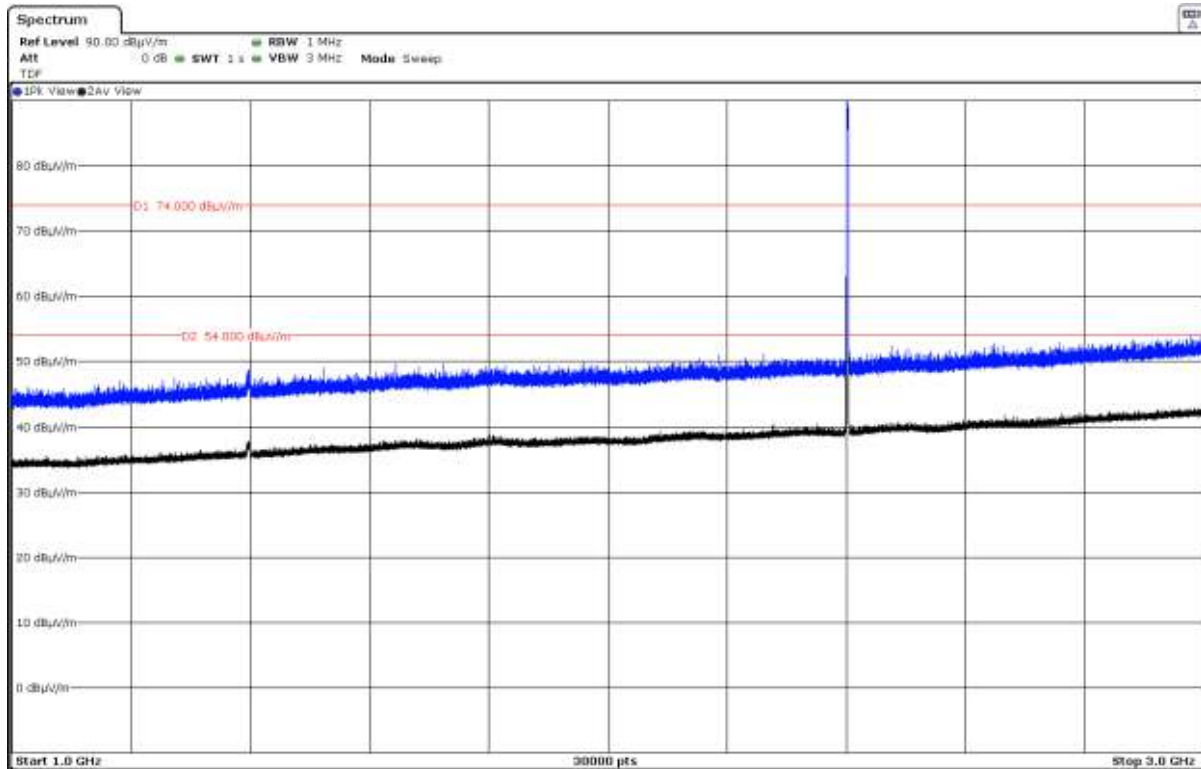
The spurious signals detected do not depend on either the operating channel or the modulation mode.



FREQUENCY RANGE 1 - 3 GHz:

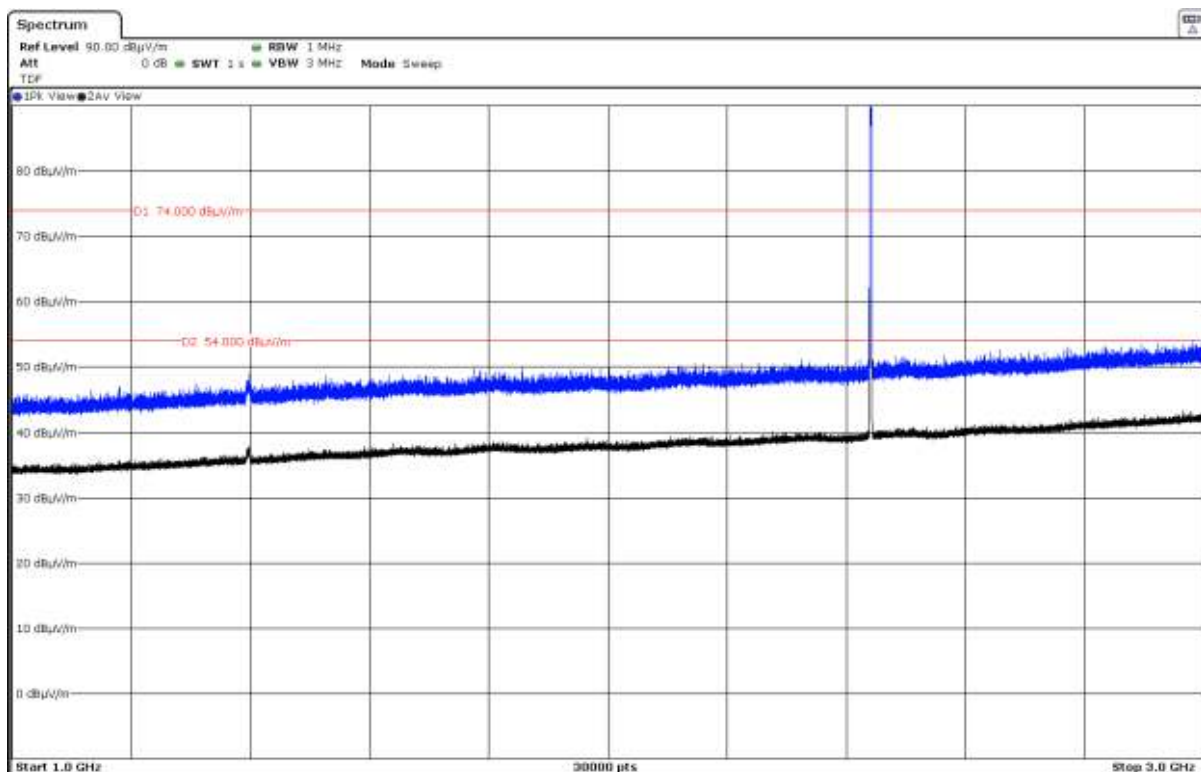
- **GFSK modulation (DH5)**

- Low Channel (2402 MHz):



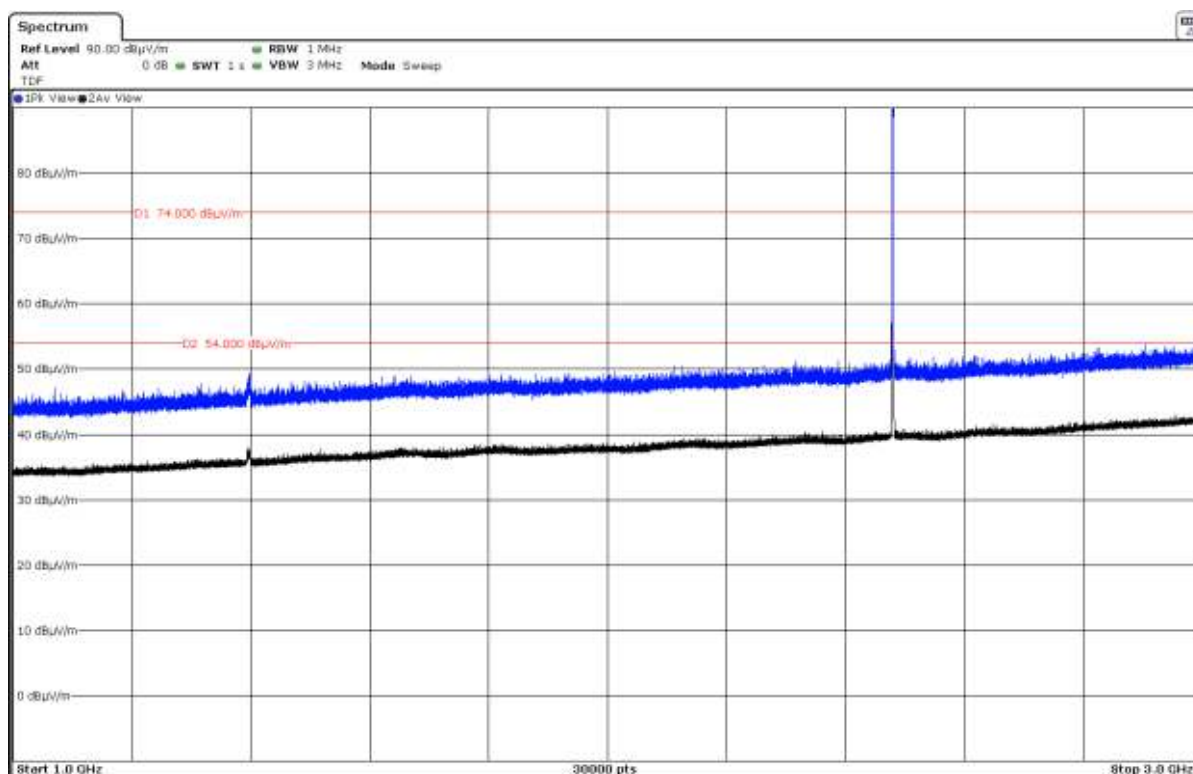
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

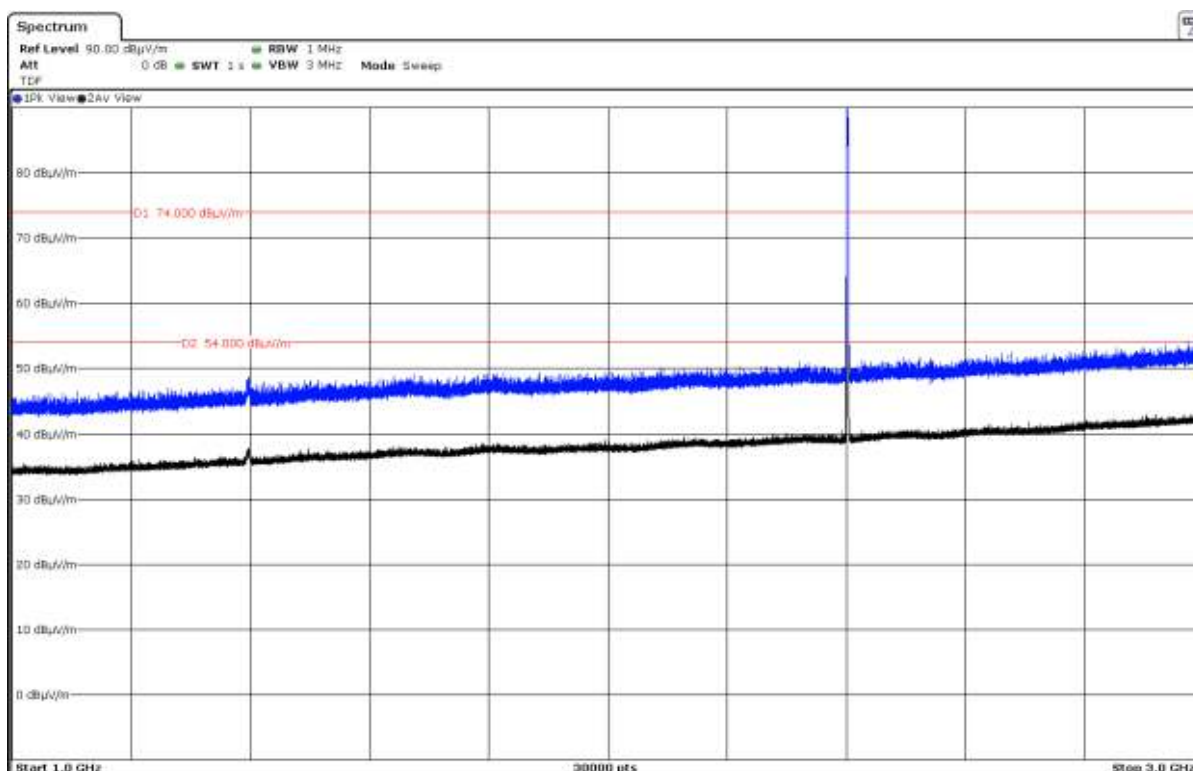
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

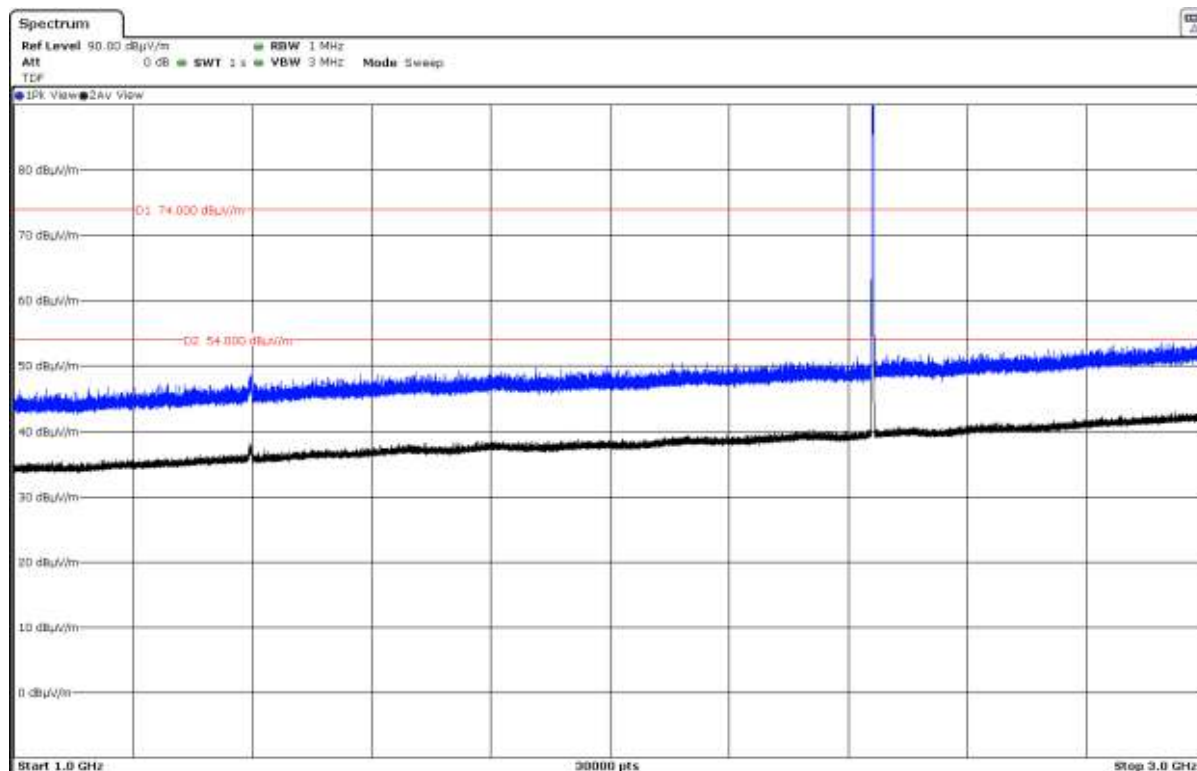
- **Pi/4-DQPSK modulation (2DH5)**

- Low Channel (2402 MHz):



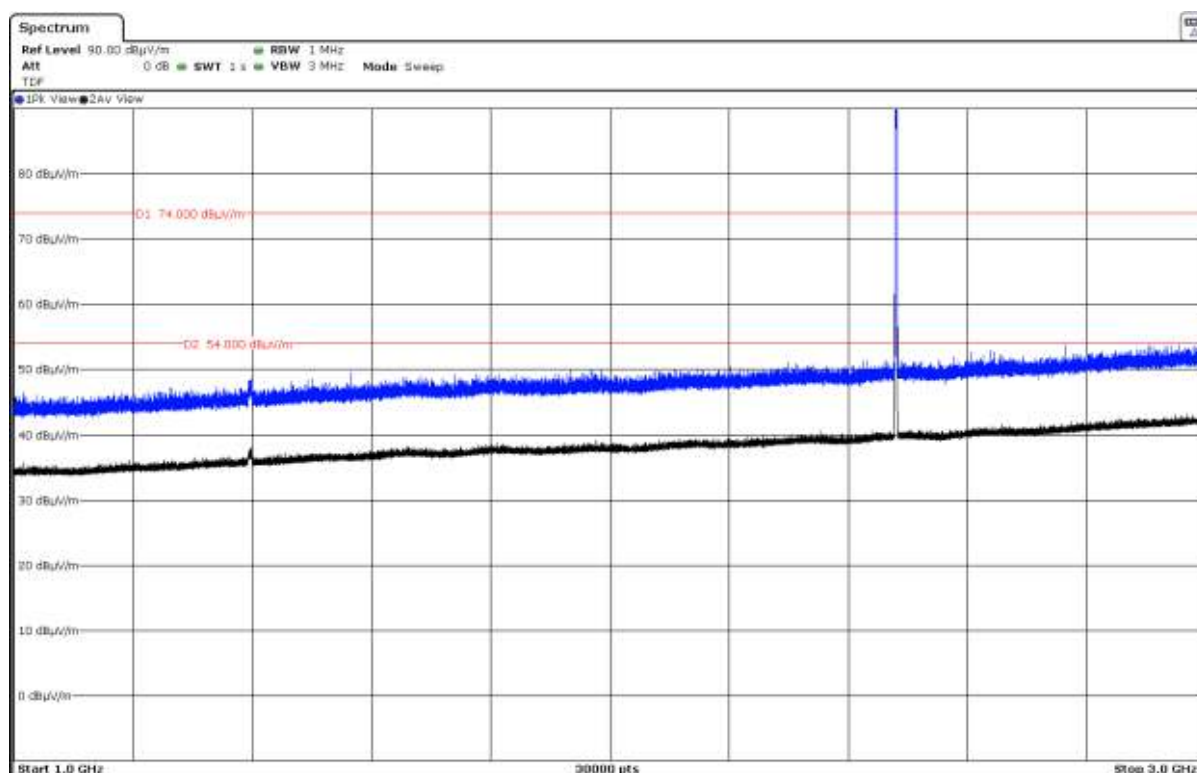
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

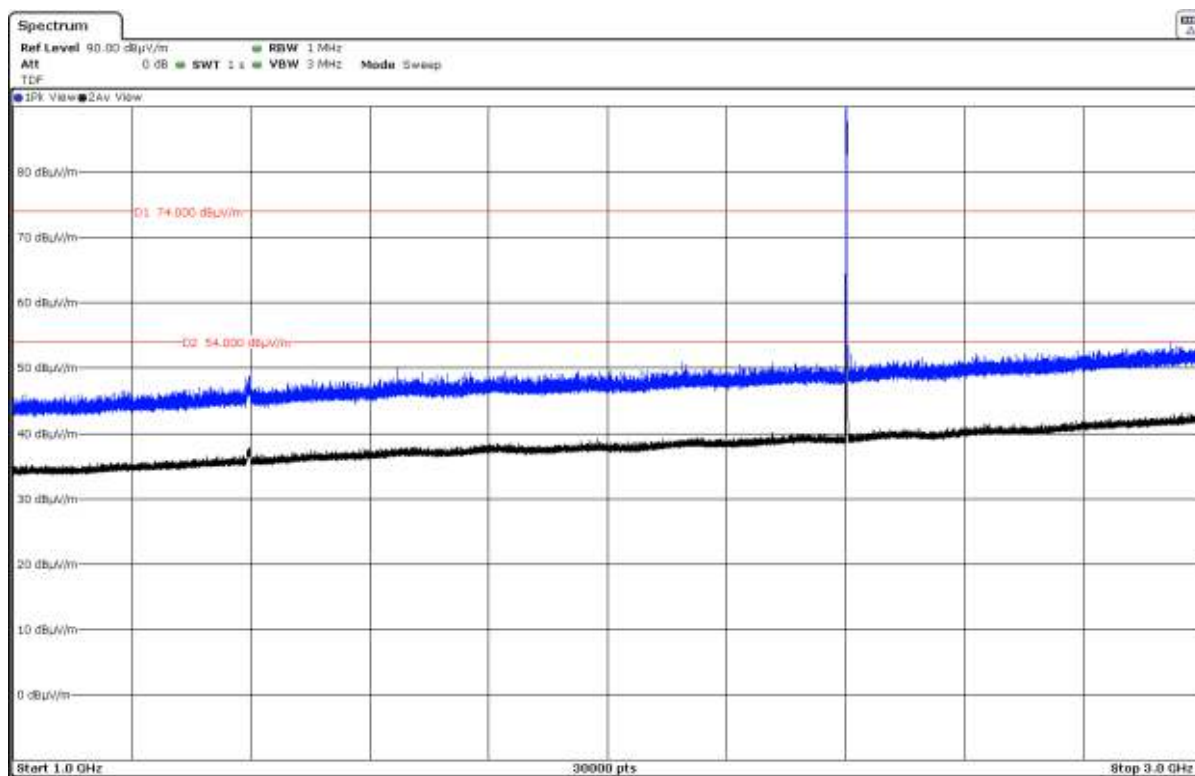
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

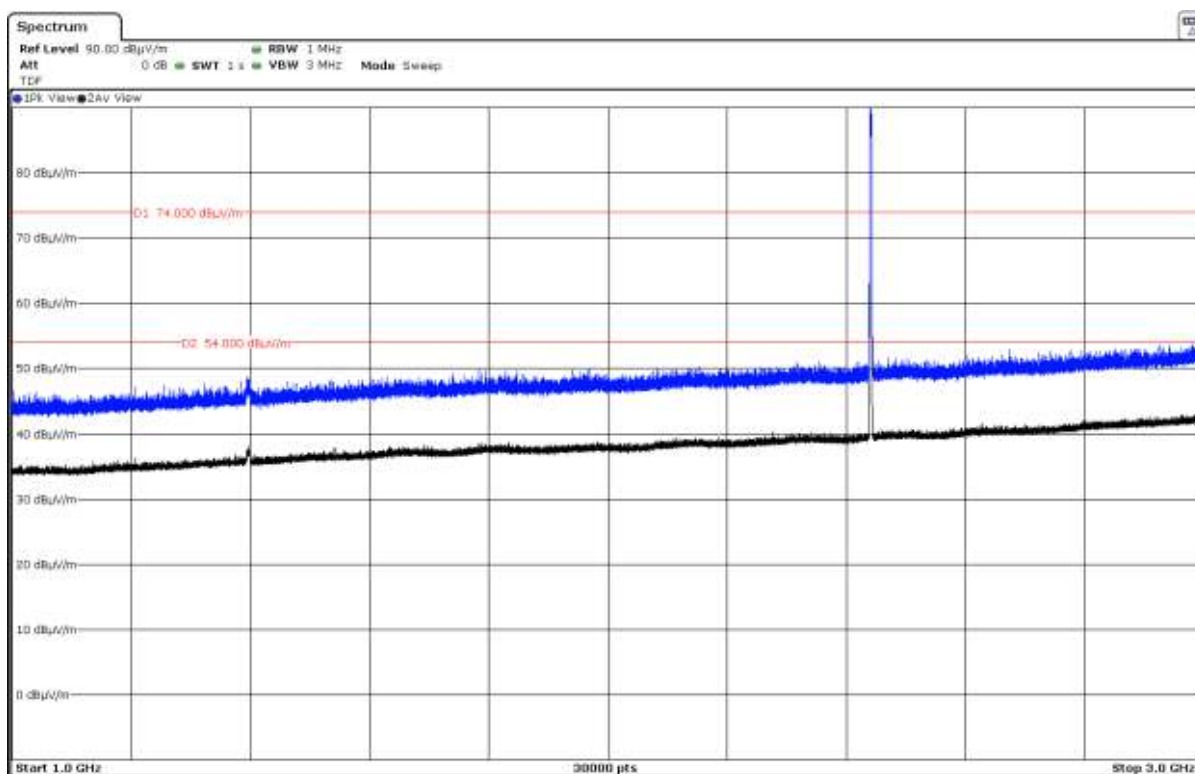
- 8-DPSK modulation (3DH5)

- Low Channel (2402 MHz):



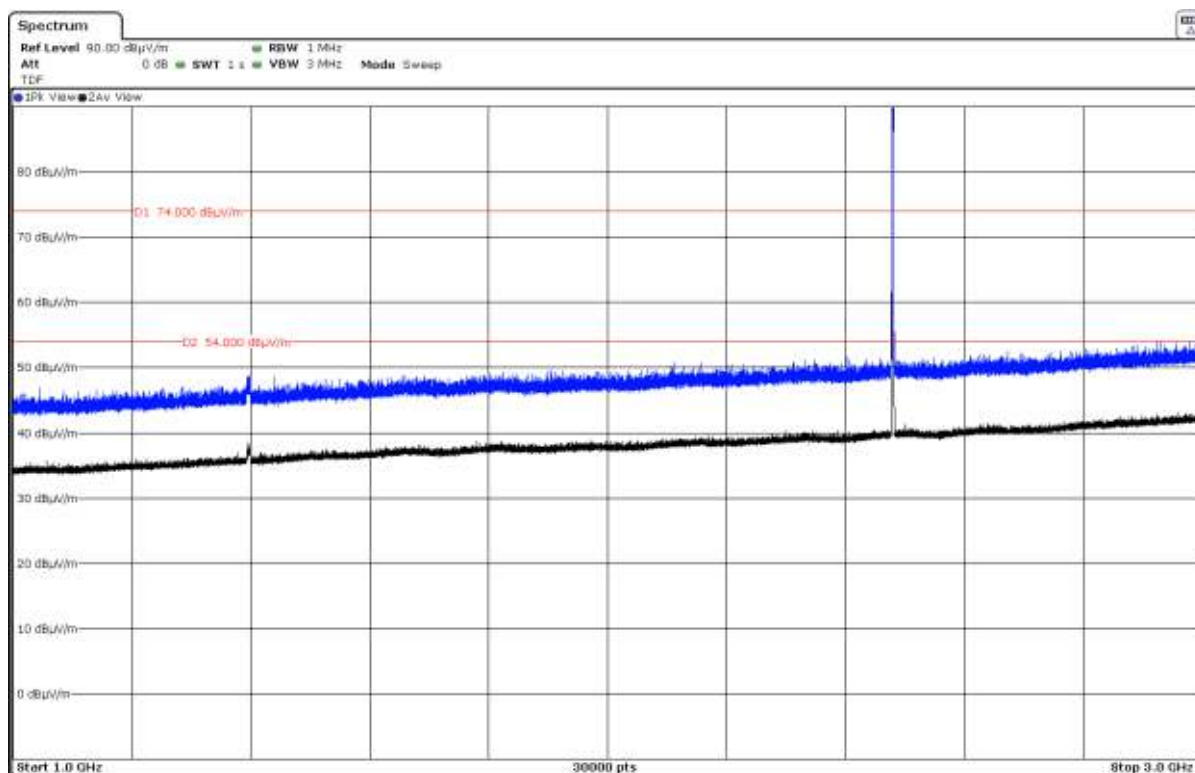
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

- High Channel (2480 MHz):

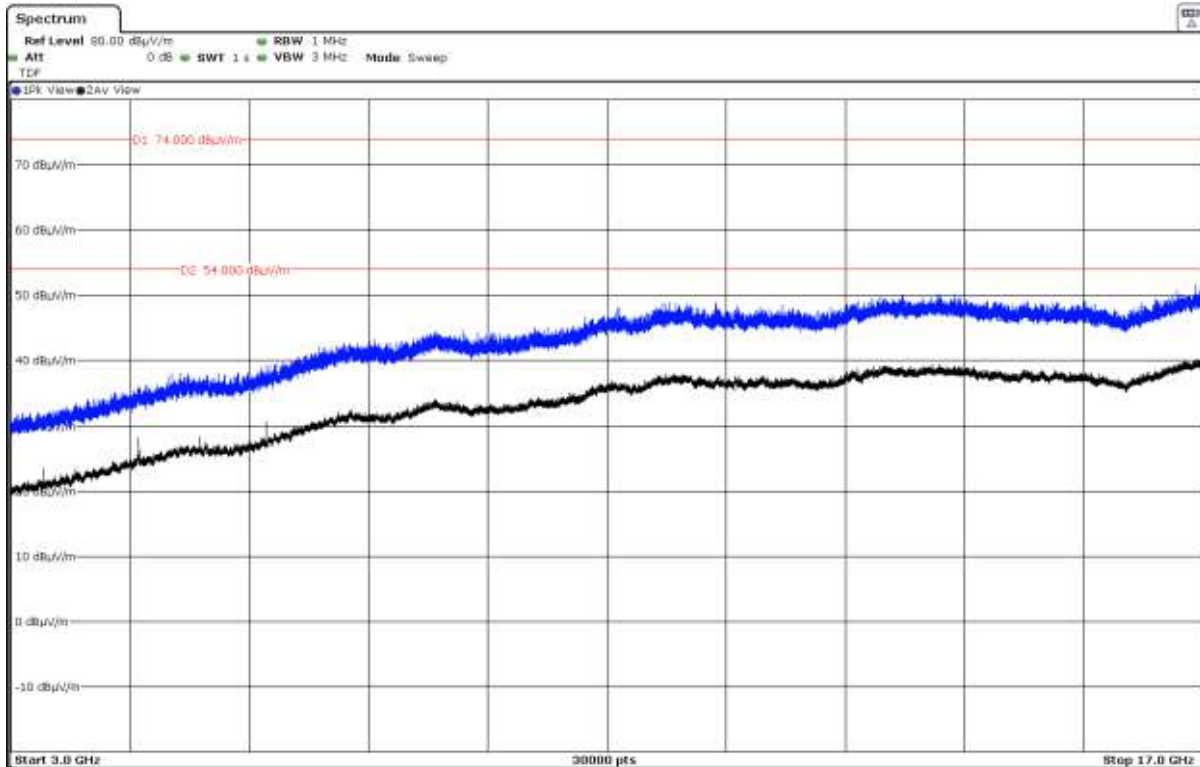


The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

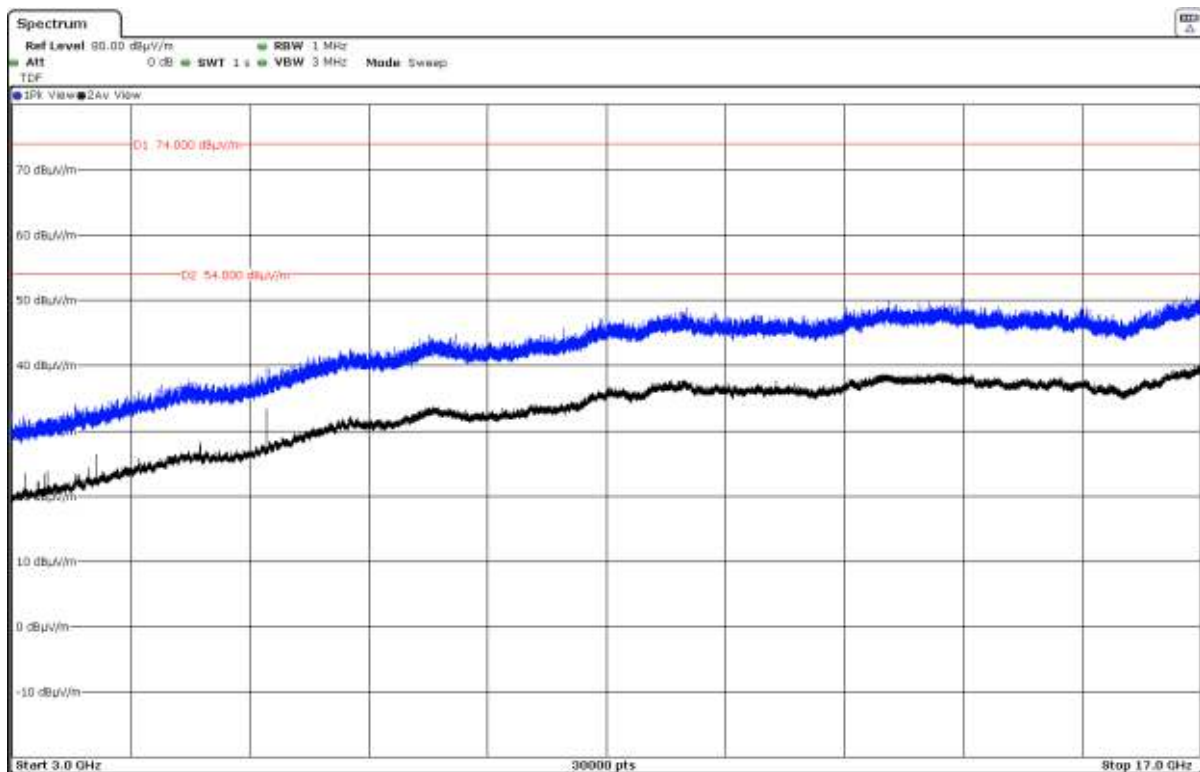
- **GFSK modulation (DH5)**

- Low Channel (2402 MHz):



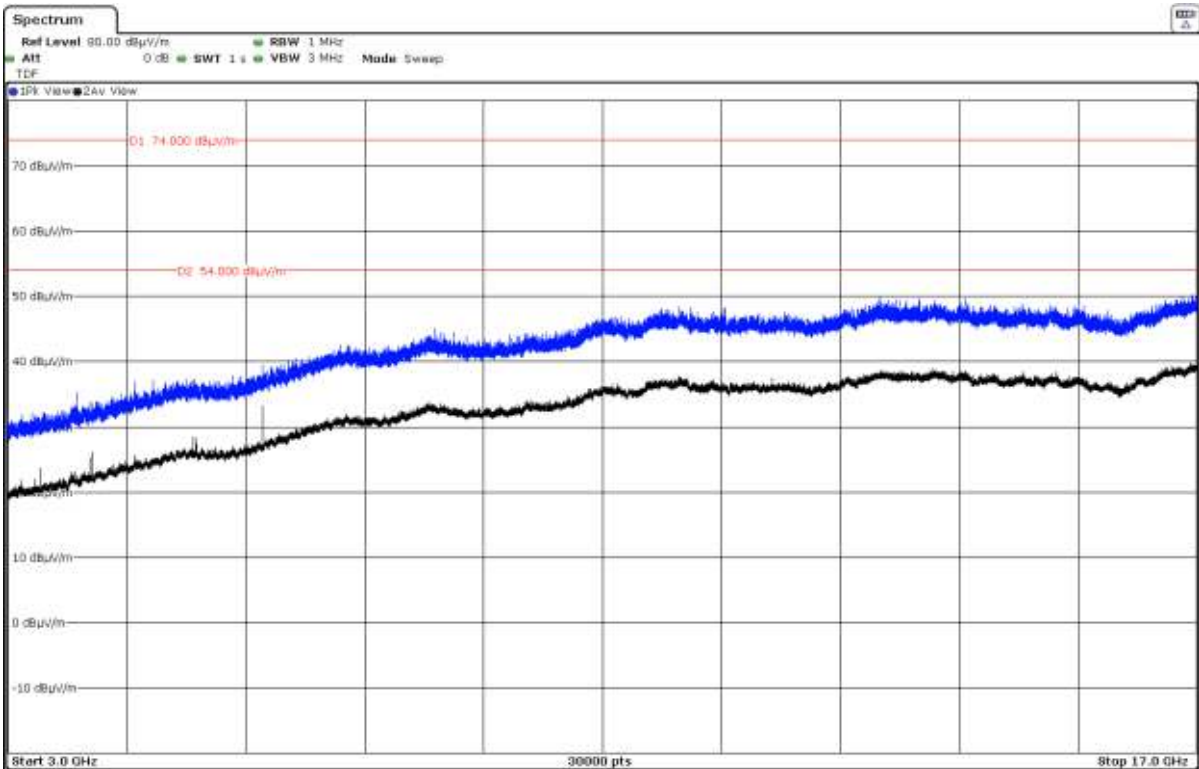
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

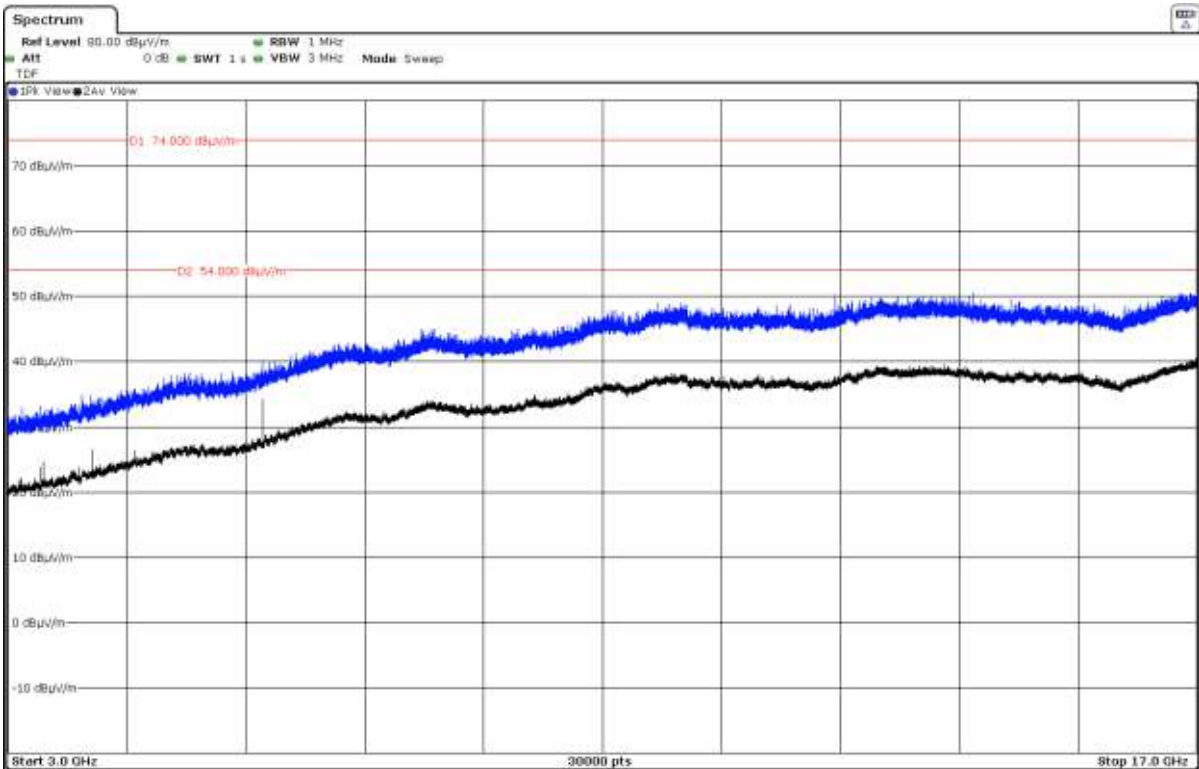
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

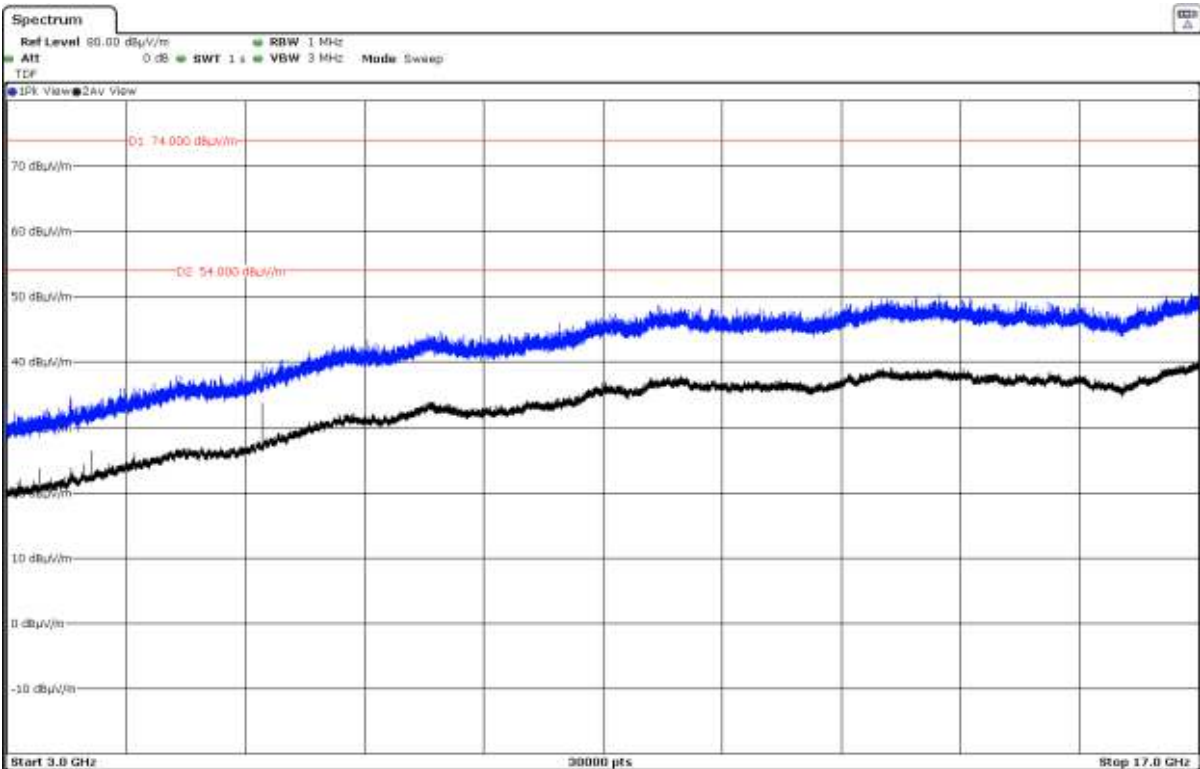
• Pi/4-DQPSK modulation (2DH5)

- Low Channel (2402 MHz):



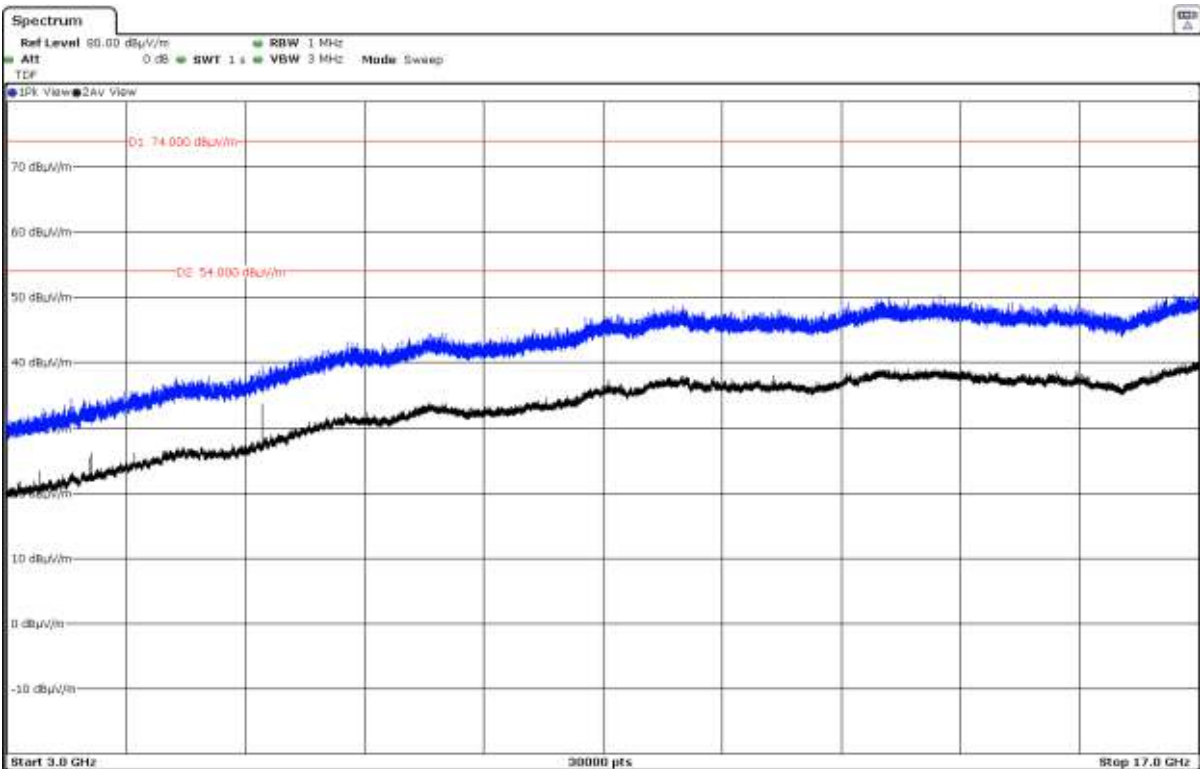
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

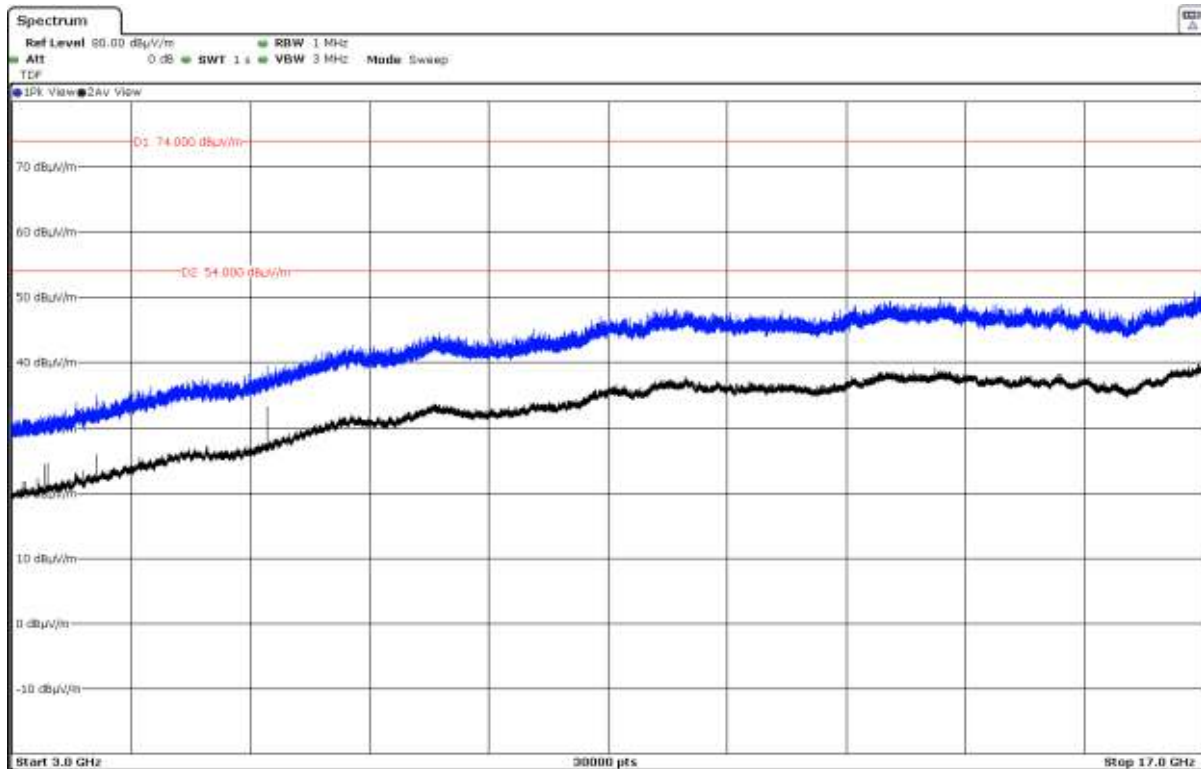
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

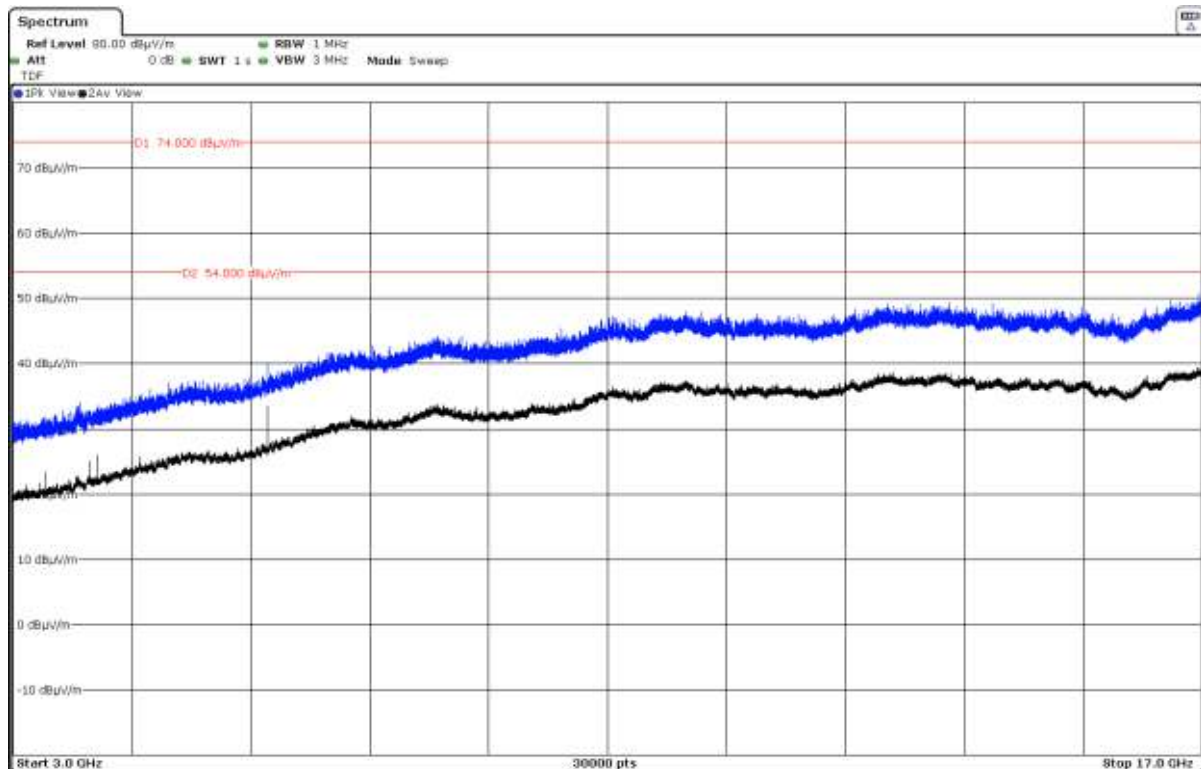
- **8-DPSK modulation (3DH5)**

- Low Channel (2402 MHz):



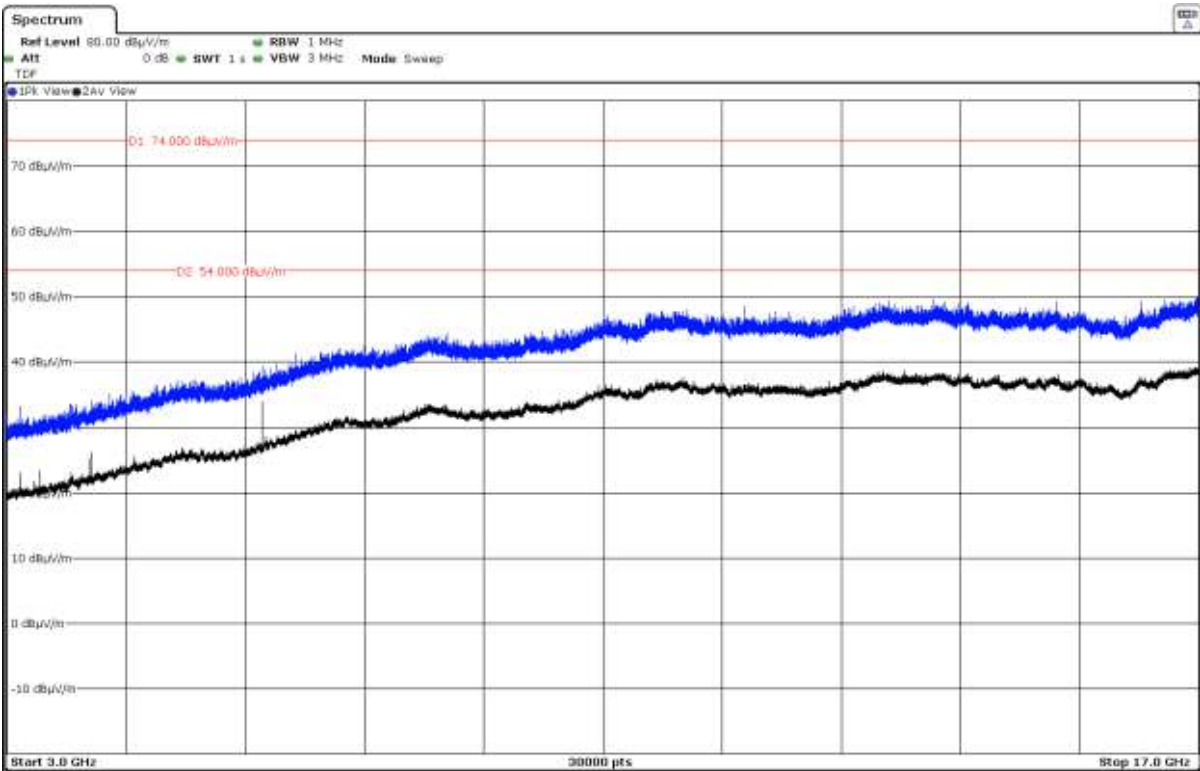
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

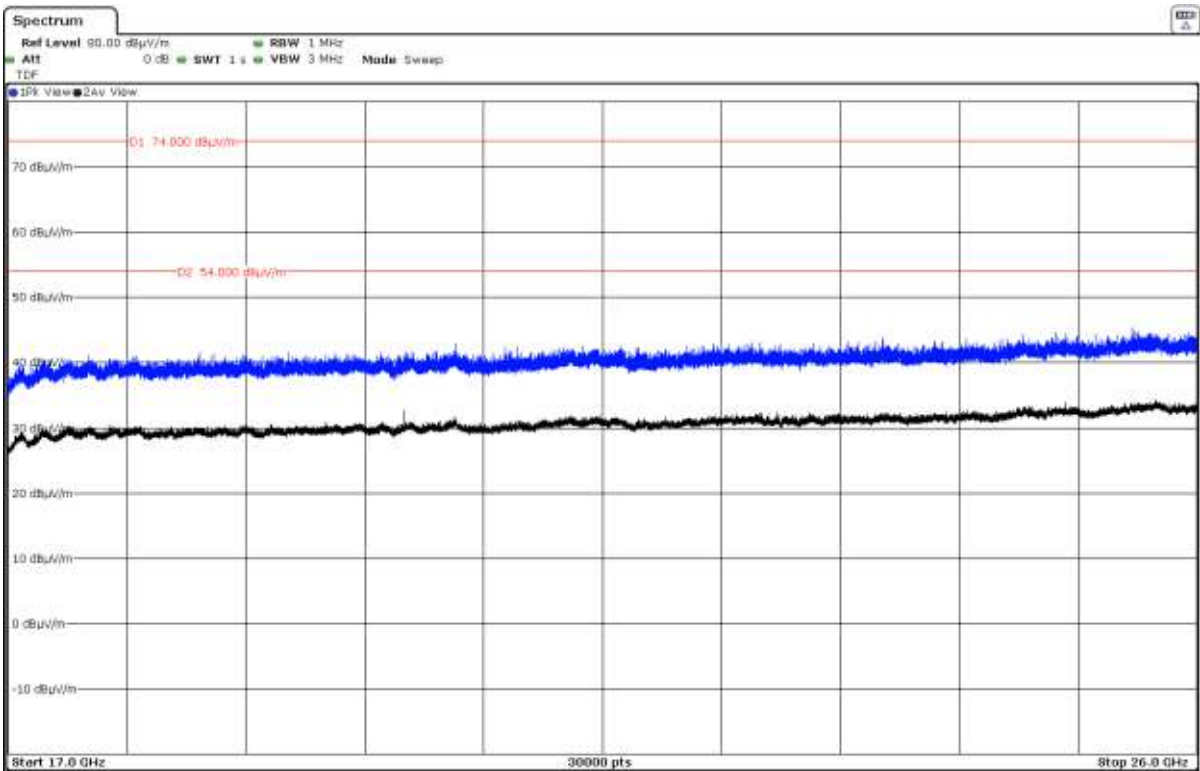
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

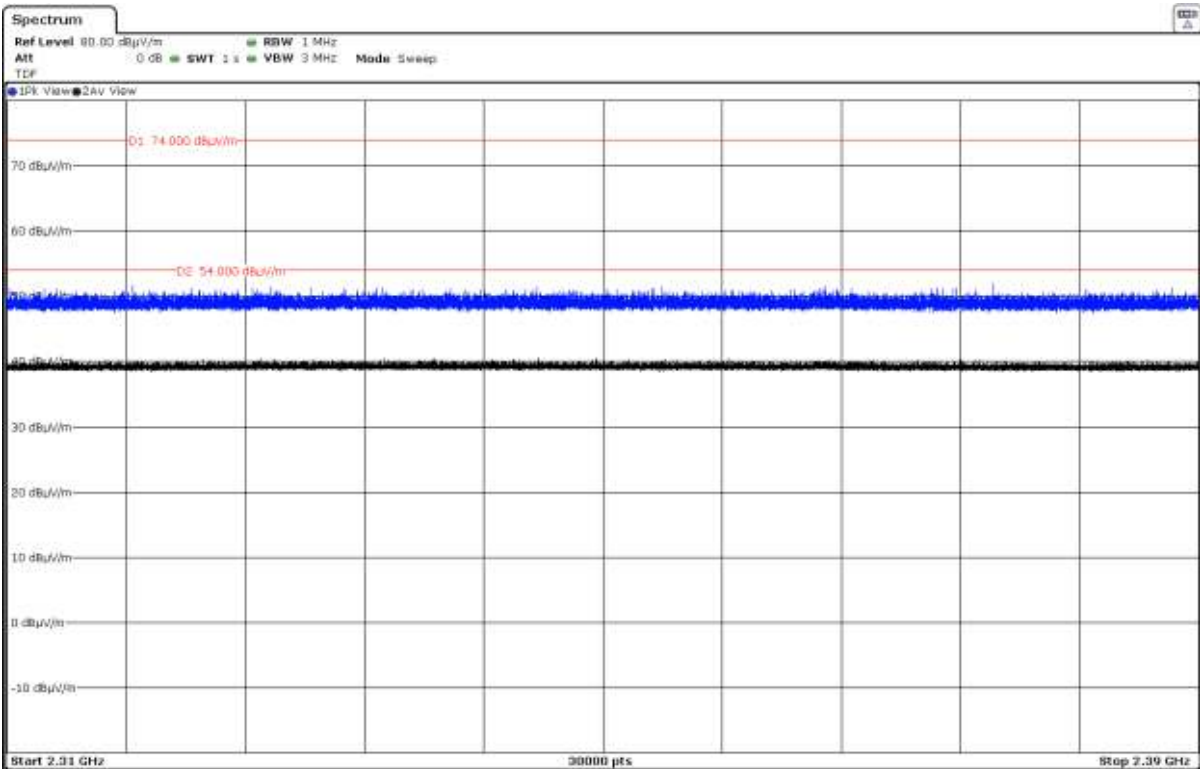
FREQUENCY RANGE 17 - 26 GHz:

This plot is valid for the Low. Middle and High Channels and all the modulation modes.

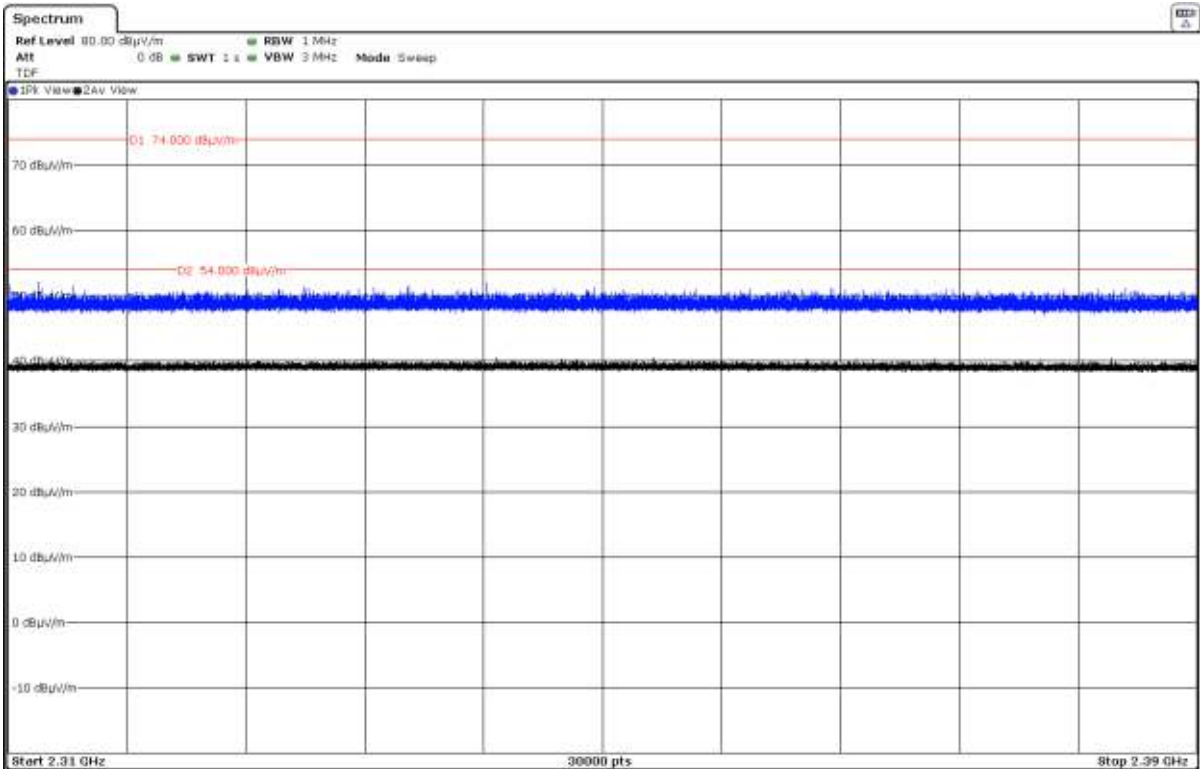


FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band):

- **GFSK modulation (DH5)**
 - Low Channel (2402 MHz):

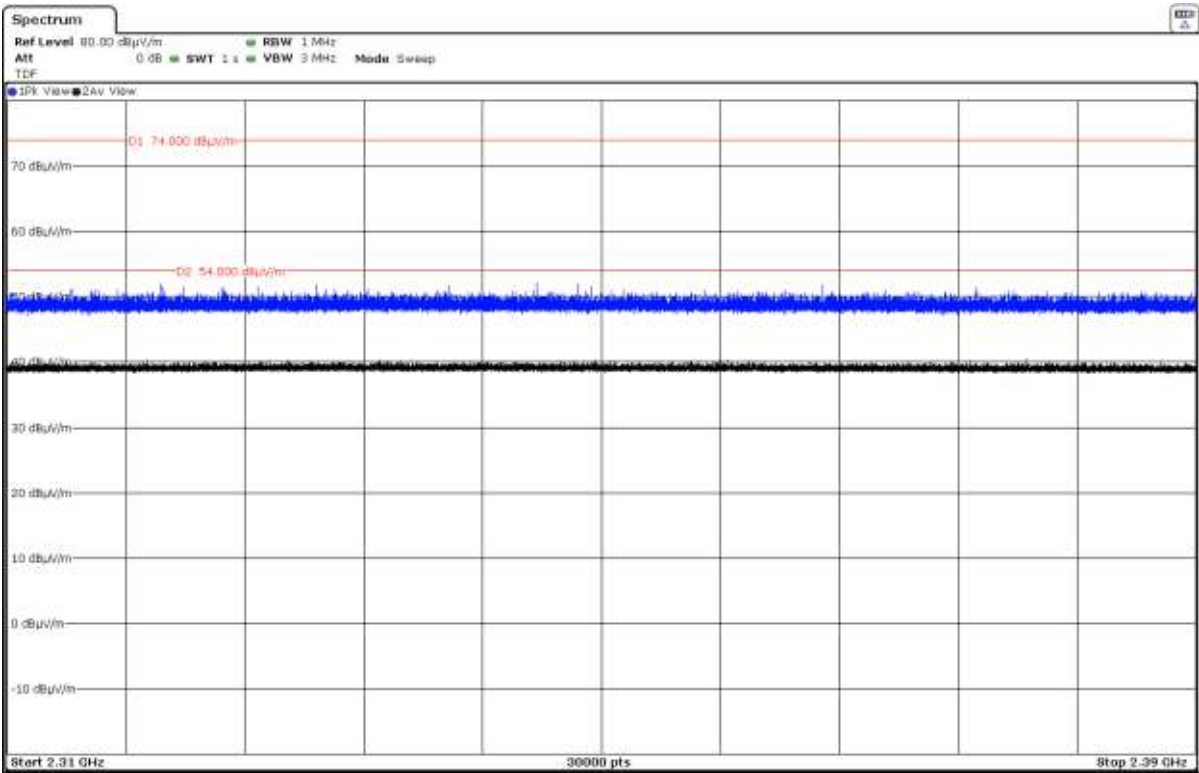


- **Pi/4-DQPSK modulation (2DH5)**
 - Low Channel (2402 MHz):



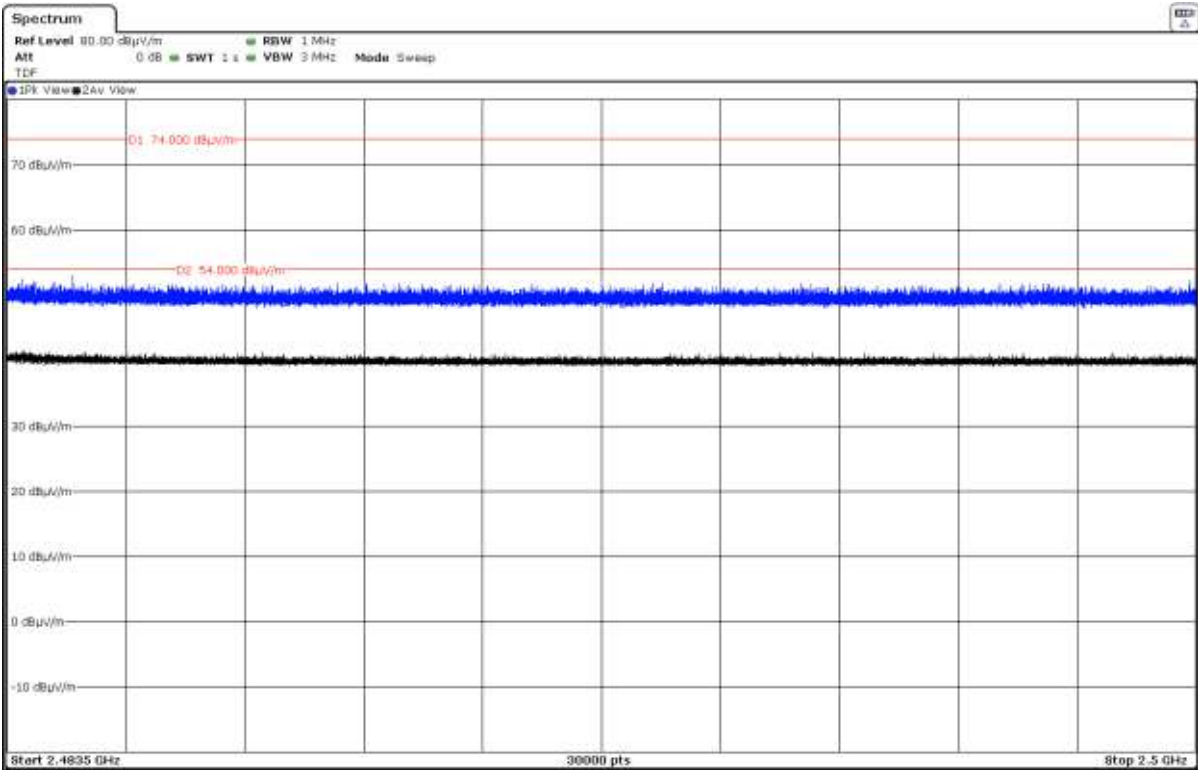
• 8-DPSK modulation (3DH5)

- Low Channel (2402 MHz):

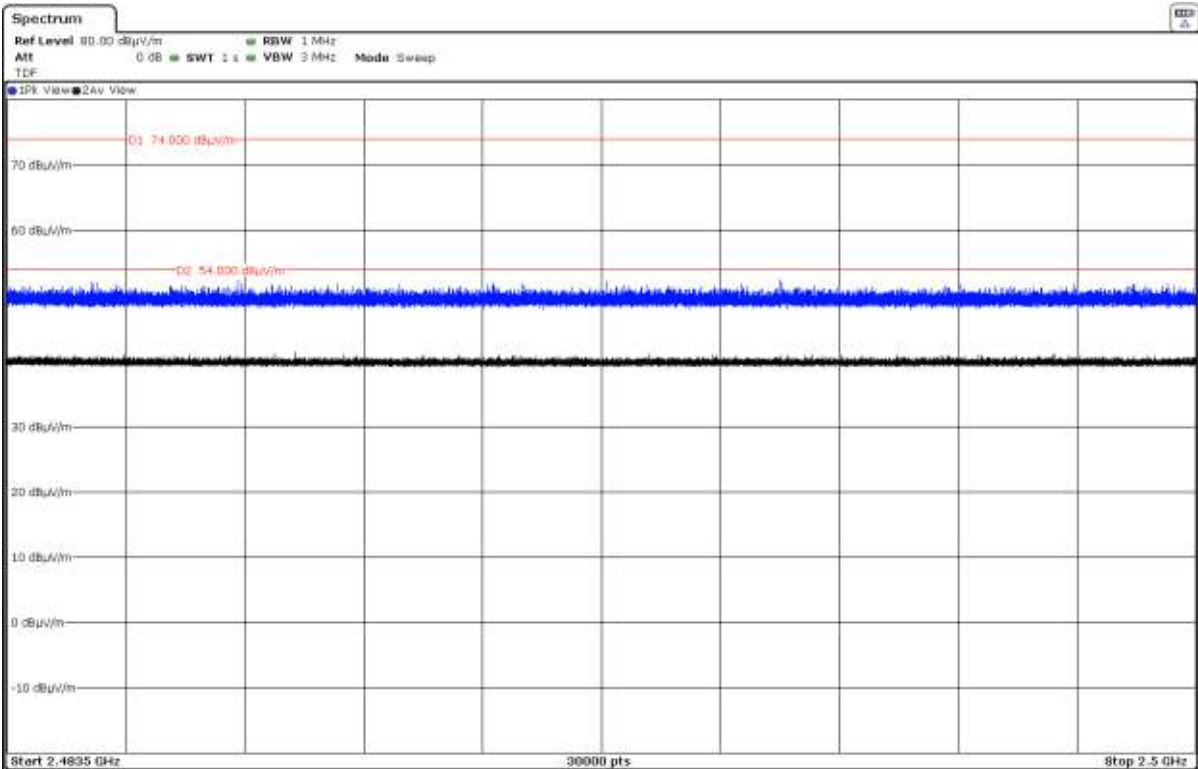


FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band):

- GFSK modulation (DH5)
 - High Channel (2480 MHz):

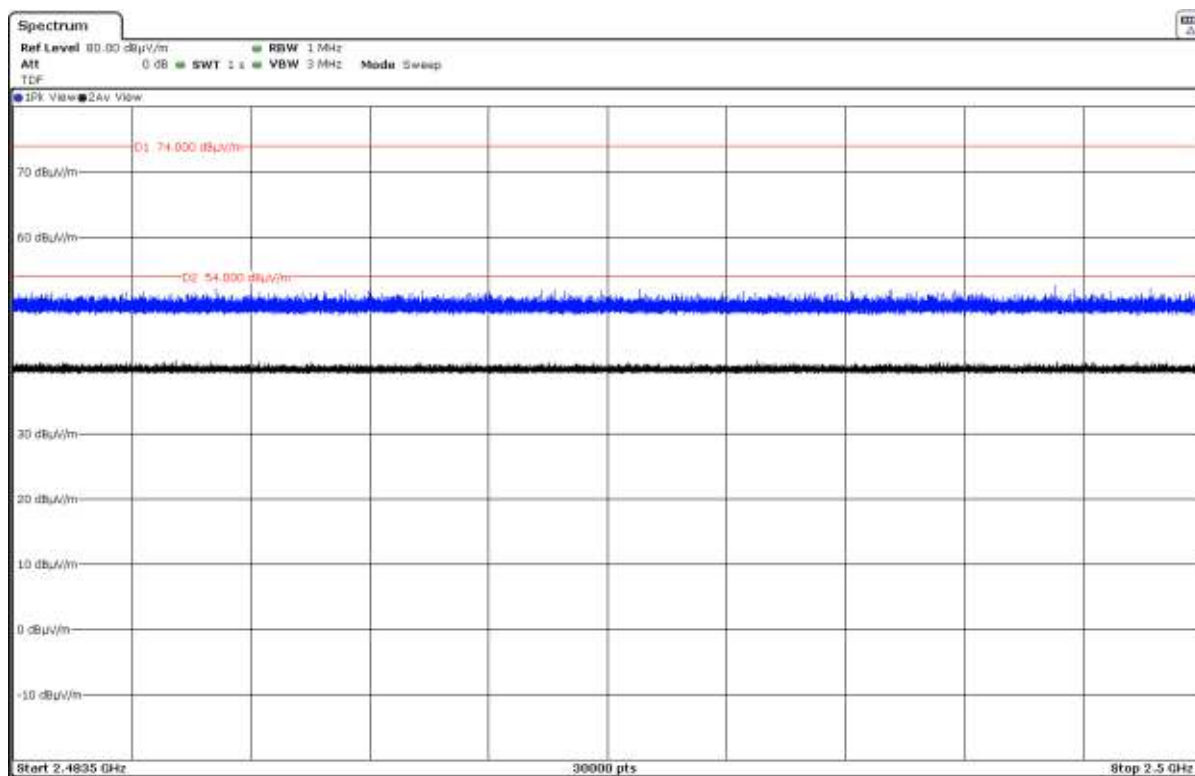


- Pi/4-DQPSK modulation (2DH5)
 - High Channel (2480 MHz):



- **8-DPSK modulation (3DH5)**

- High Channel (2480 MHz):



Appendix B: Test results. 802.11 bgn2040 1x1

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	12 Vdc.
Type of Power Supply:	External power supply (Car Battery).
Type of Antenna:	External antenna.
Maximum Declared Antenna Gain:	-6.2 dBi (Antenna gain plus antenna cable loss).

TEST FREQUENCIES:

802.11 bgn20:

Low Channel:	2412 MHz
Middle Channel:	2437 MHz
High Channel:	2462 MHz

802.11 n40:

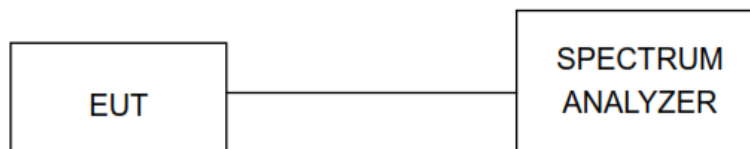
Low Channel:	2422 MHz
Middle Channel:	2437 MHz
High Channel:	2452 MHz

The lowest data rate for all modes supported were used.

Mode	Data rate
b	1Mbps
g	6Mbps
n20	MCS0
n40	MCS0

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

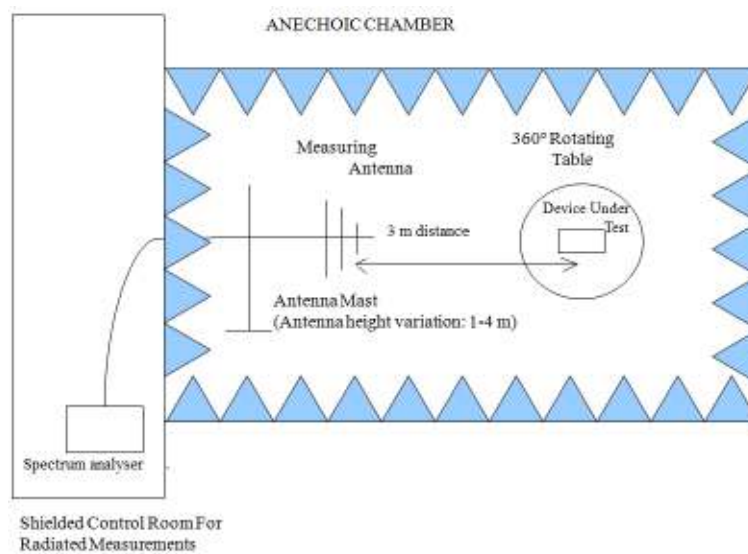
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-26 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

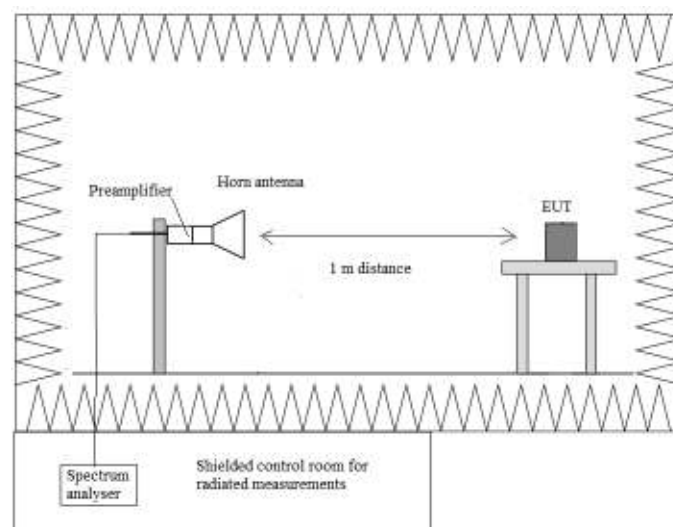
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup $f > 1$ GHz:



Occupied Bandwidth

RESULTS:

- Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	11.448	11.717	11.424
-26 dBc bandwidth (MHz)	14.512	15.095	14.407
Measurement uncertainty (kHz)	<± 50		

- Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	17.077	17.027	16.971
-26 dBc bandwidth (MHz)	22.670	24.489	21.734
Measurement uncertainty (kHz)	<± 83.33		

- Mode 802.11 n20**

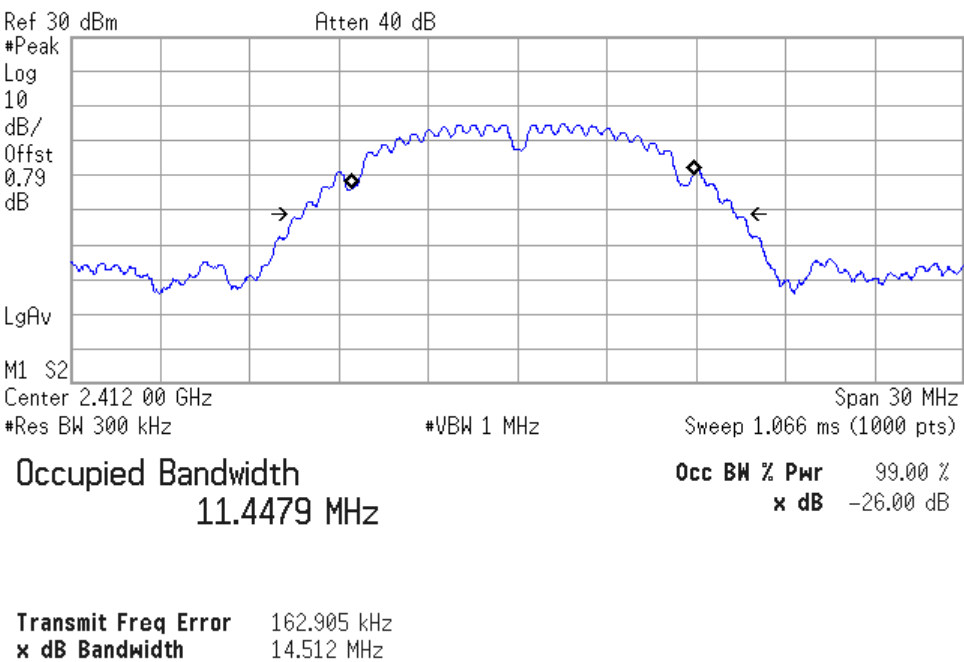
	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
99% bandwidth (MHz)	18.076	18.039	18.000
-26 dBc bandwidth (MHz)	23.258	22.234	21.556
Measurement uncertainty (kHz)	<± 83.33		

- Mode 802.11 n40**

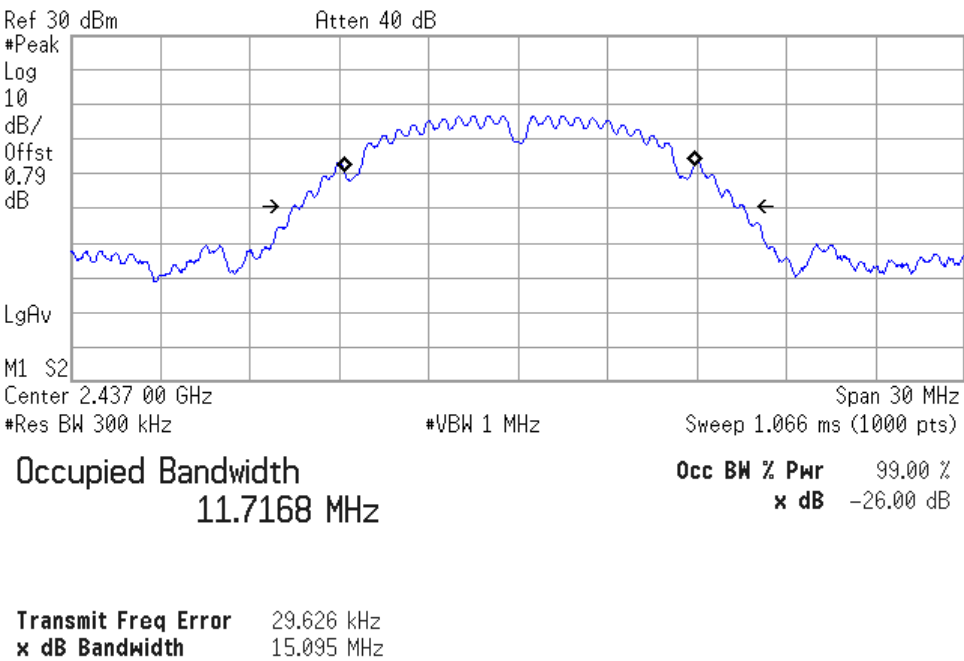
	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2452 MHz
99% bandwidth (MHz)	36.400	36.480	36.480
-26 dBc bandwidth (MHz)	40.773	40.953	40.810
Measurement uncertainty (kHz)	<± 14.01		

• Mode 802.11 b – Occupied Bandwidth

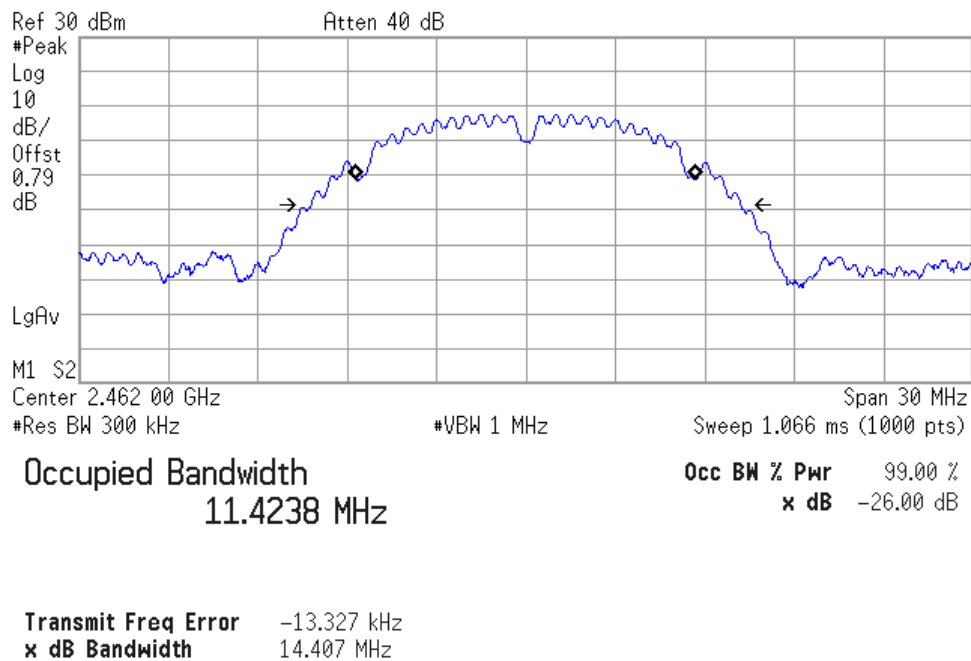
- Low Channel:



- Middle Channel:

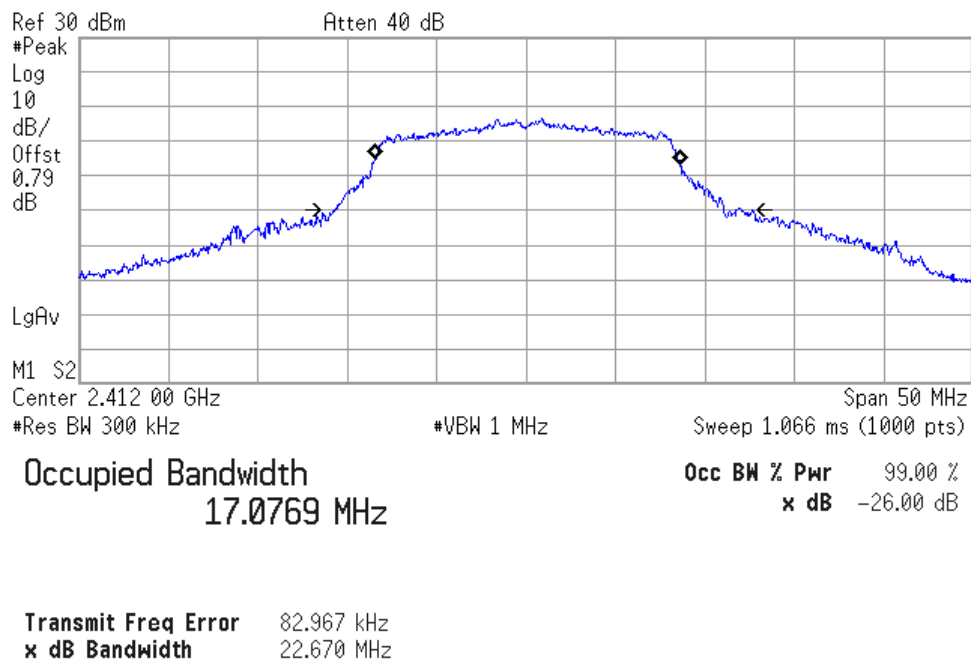


- High Channel:

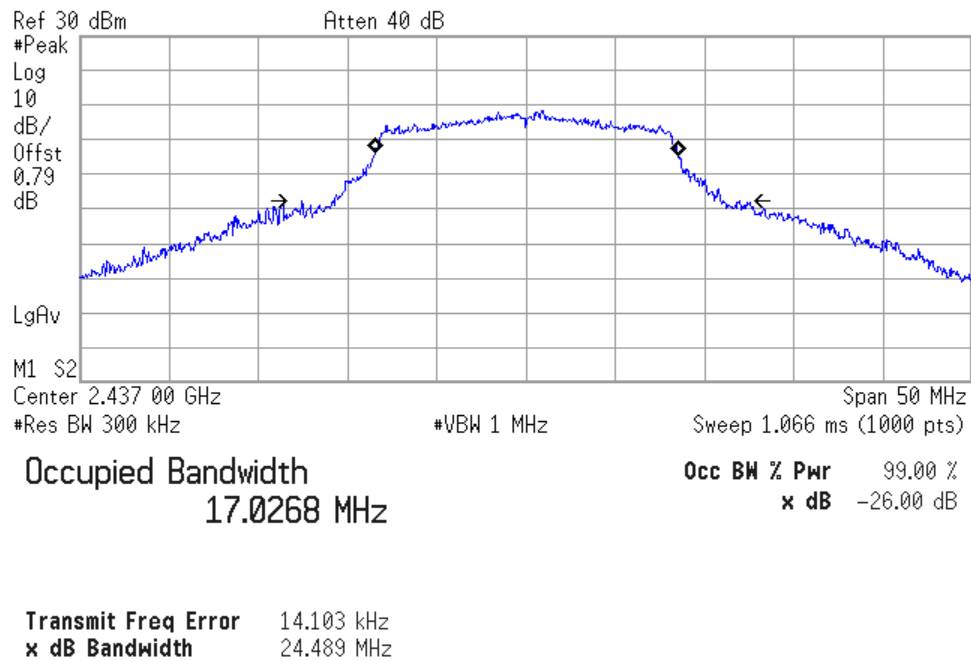


• Mode 802.11 g – Occupied Bandwidth

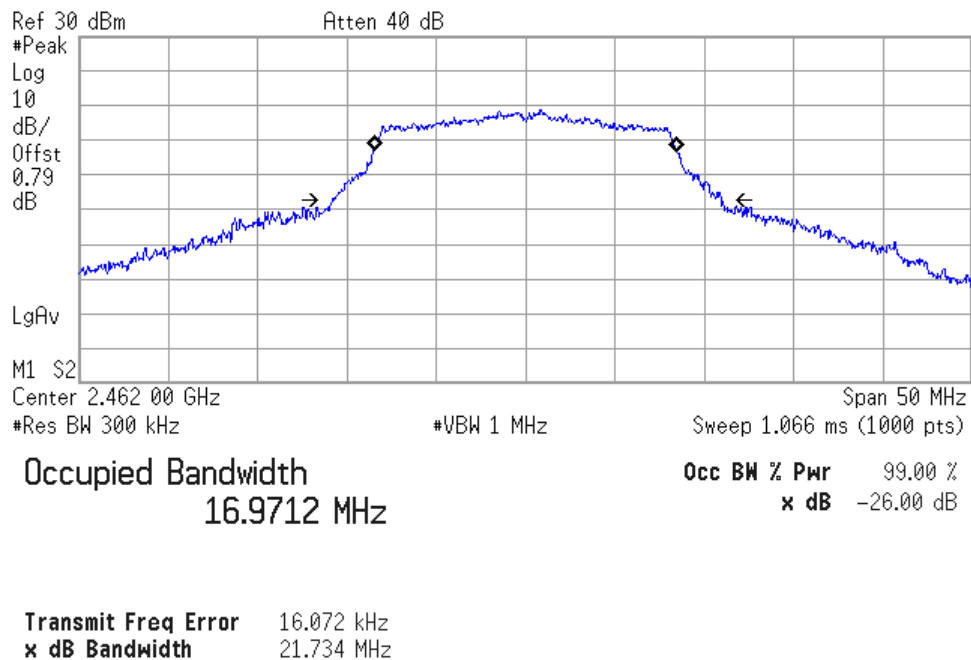
- Low Channel:



- Middle Channel:

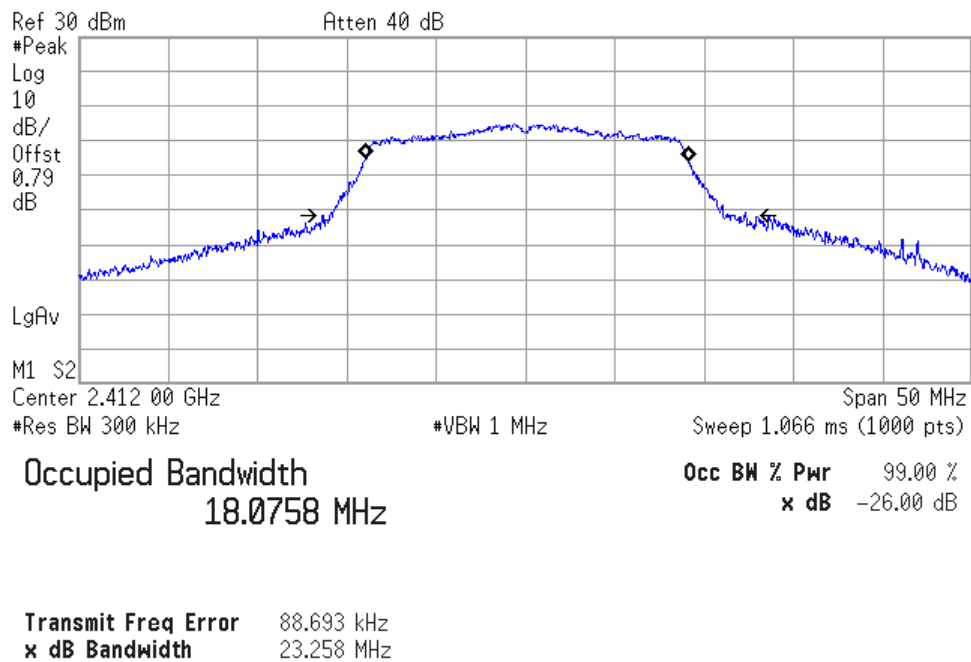


- High Channel:

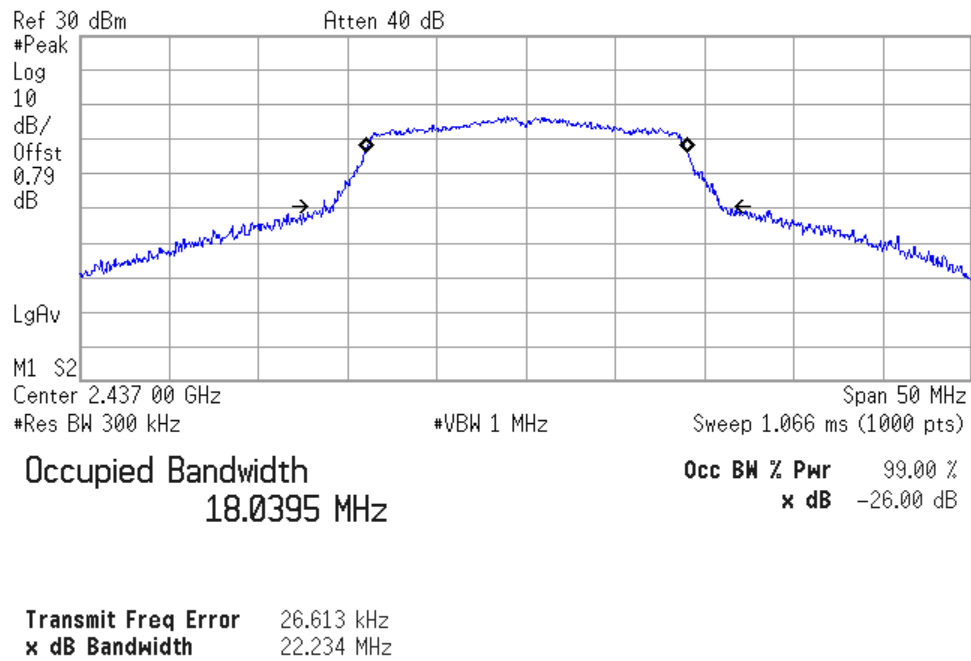


• Mode 802.11 n20 – Occupied Bandwidth

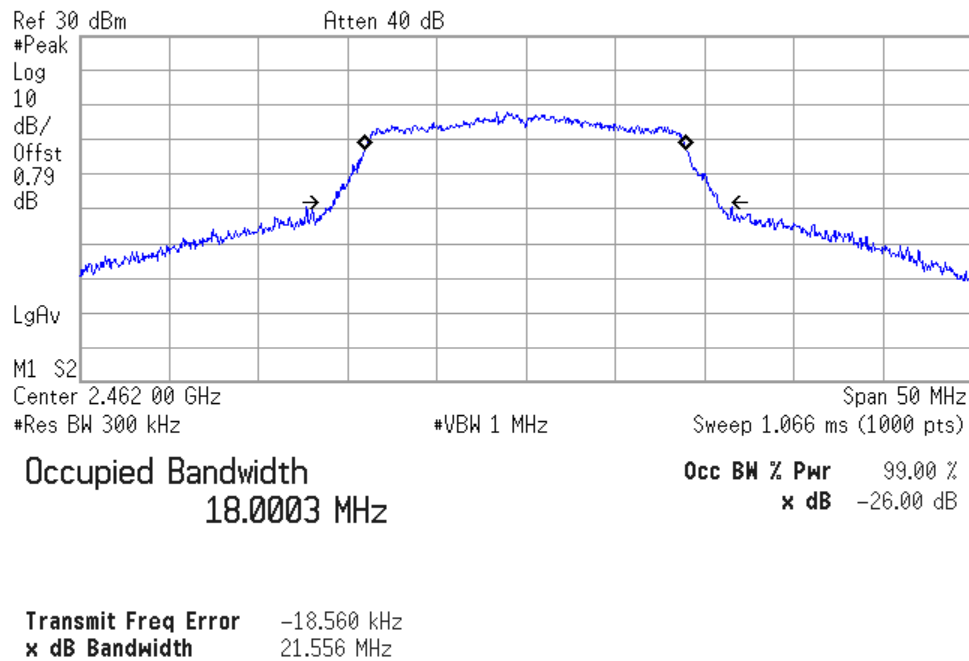
- Low Channel:



- Middle Channel:

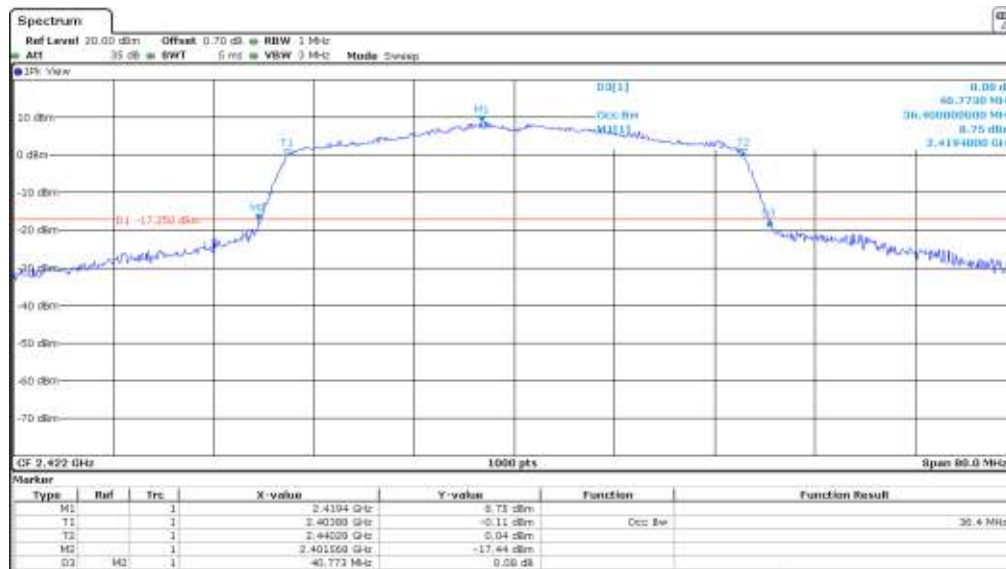


- High Channel:

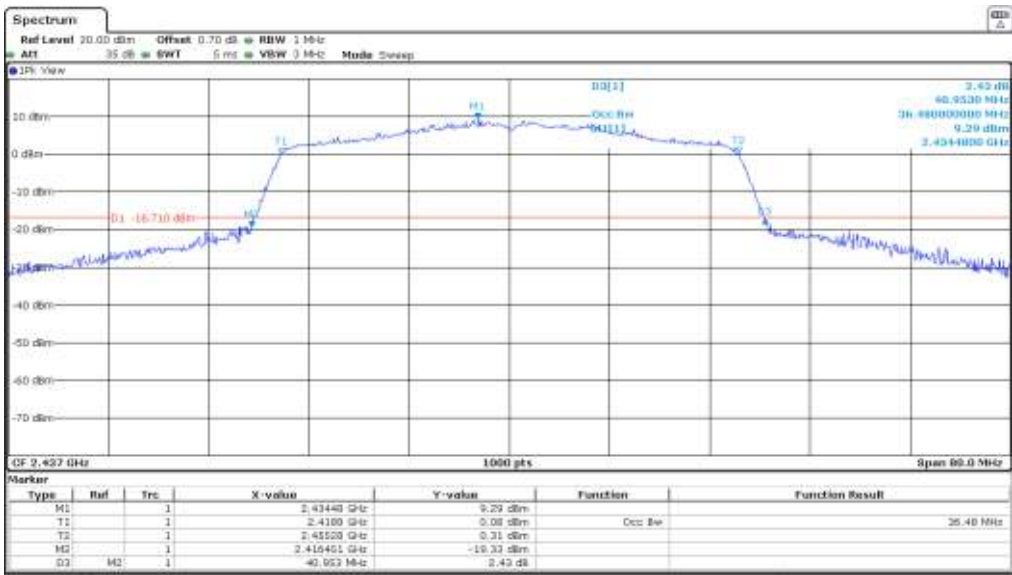


- Mode 802.11 n40 – Occupied Bandwidth

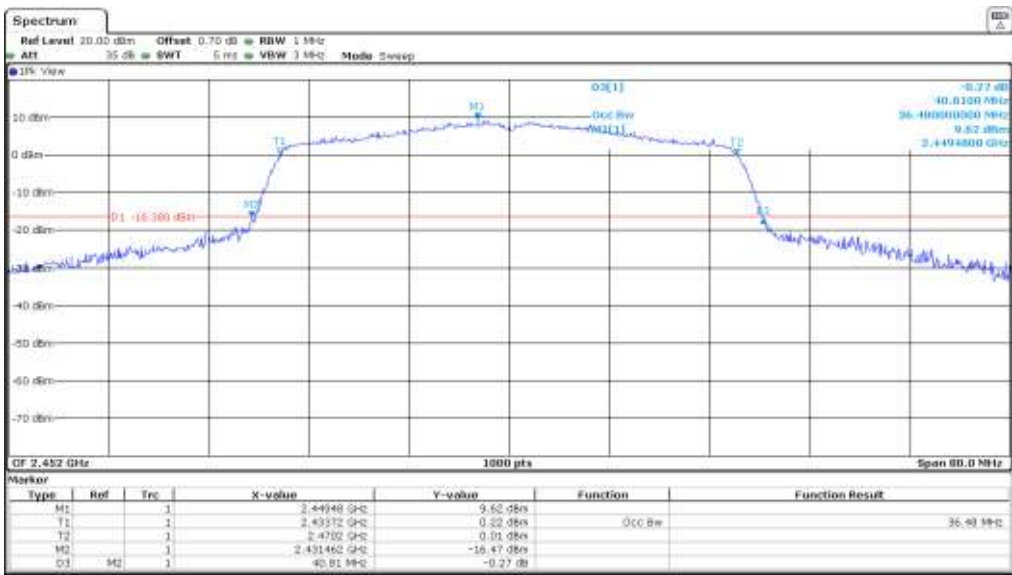
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

- Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum Bandwidth (MHz)	8.5514	8.5704	9.0426
Measurement uncertainty (kHz)	<±3.50		

- Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum Bandwidth (MHz)	16.0418	16.2496	16.0545
Measurement uncertainty (kHz)	<±3.50		

- Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
6 dB Spectrum Bandwidth (MHz)	17.2919	17.527	17.2658
Measurement uncertainty (kHz)	<±3.50		

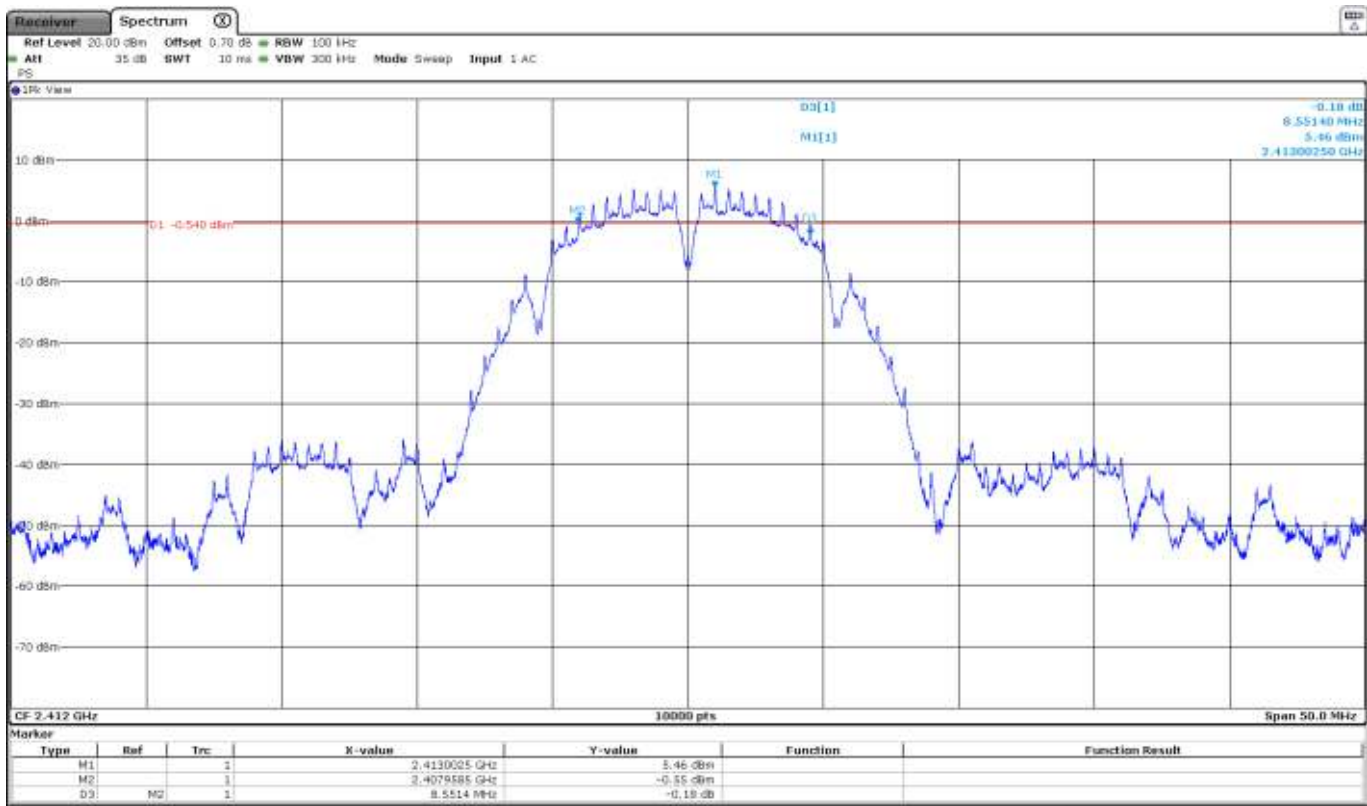
- Mode 802.11 n40**

	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2452 MHz
6 dB Spectrum Bandwidth (MHz)	35.300	35.279	35.482
Measurement uncertainty (kHz)	<±41.04		

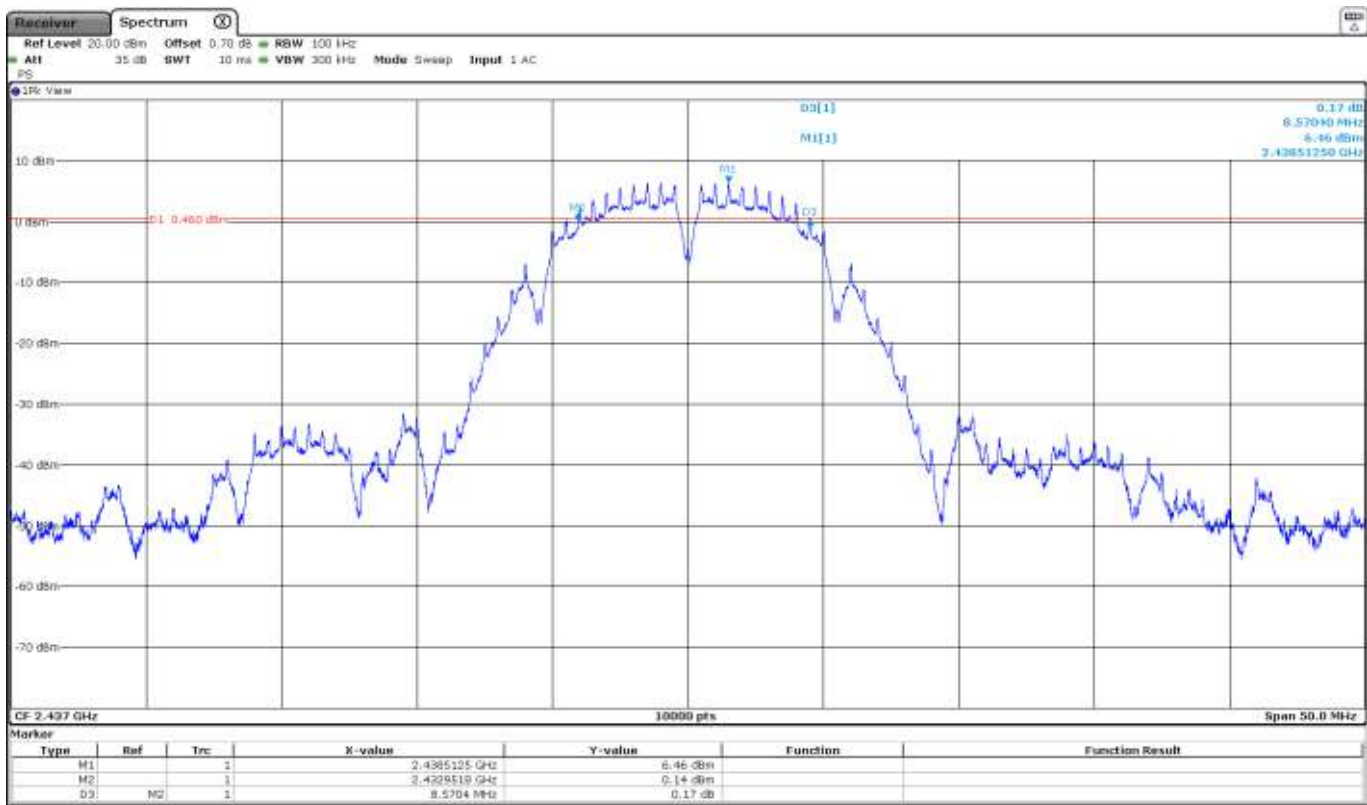
Verdict: PASS

- Mode 802.11 b – 6 dB Bandwidth

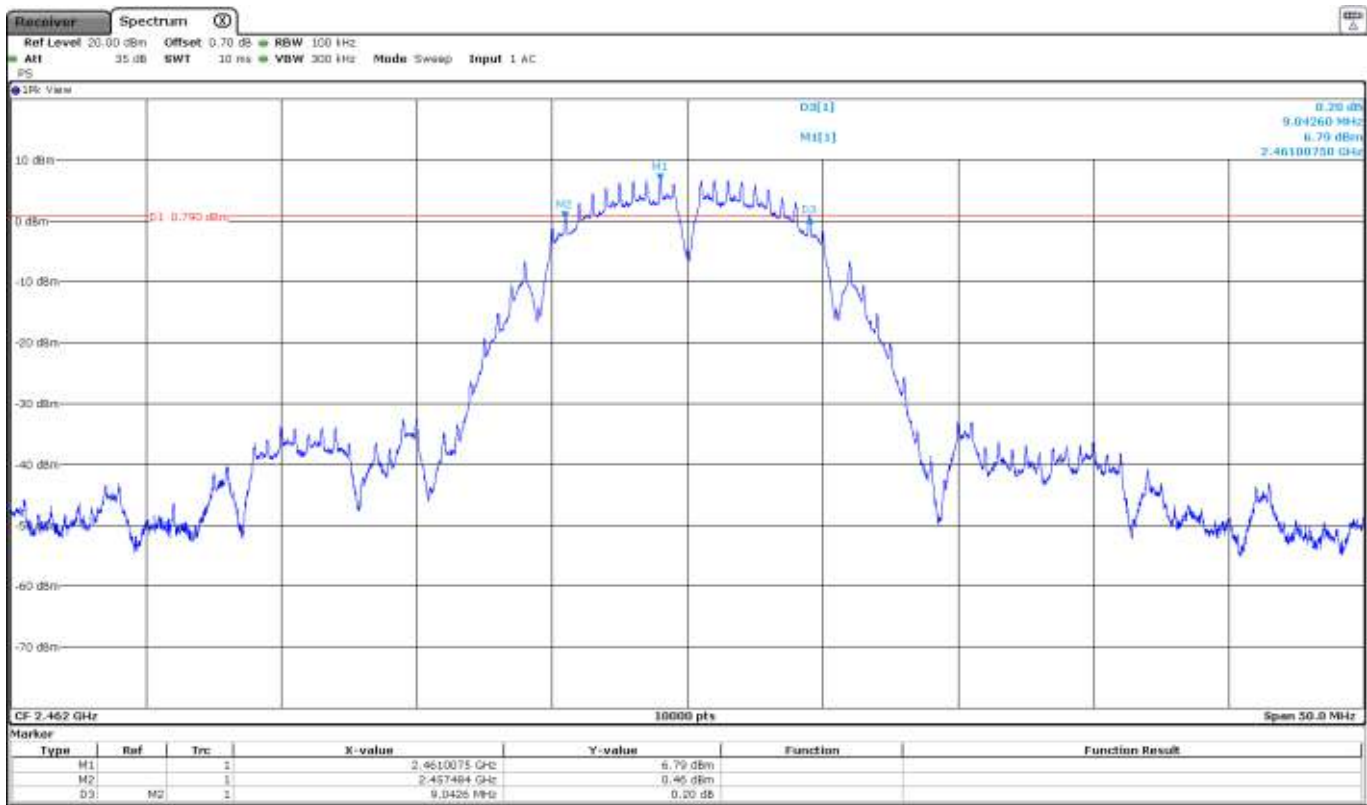
- Low Channel:



- Middle Channel:

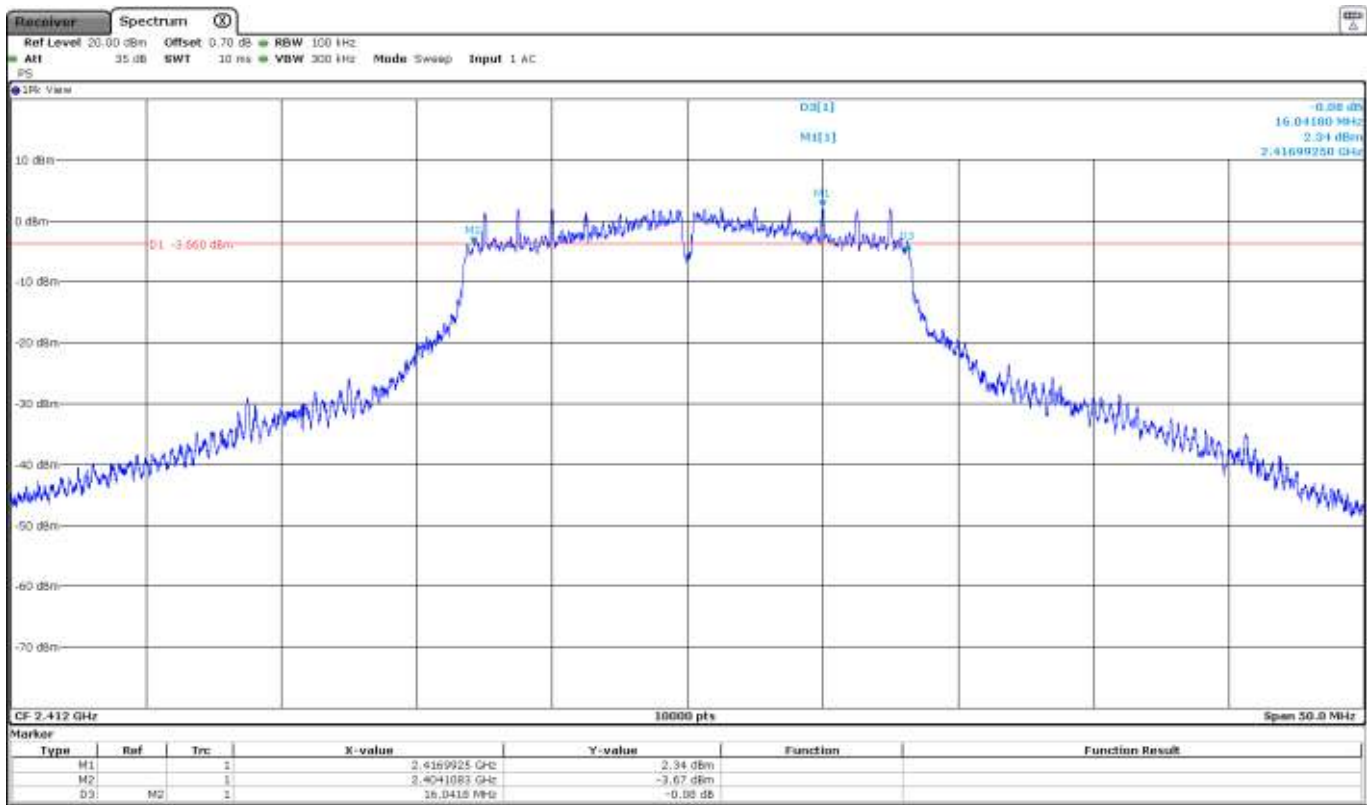


- High Channel:

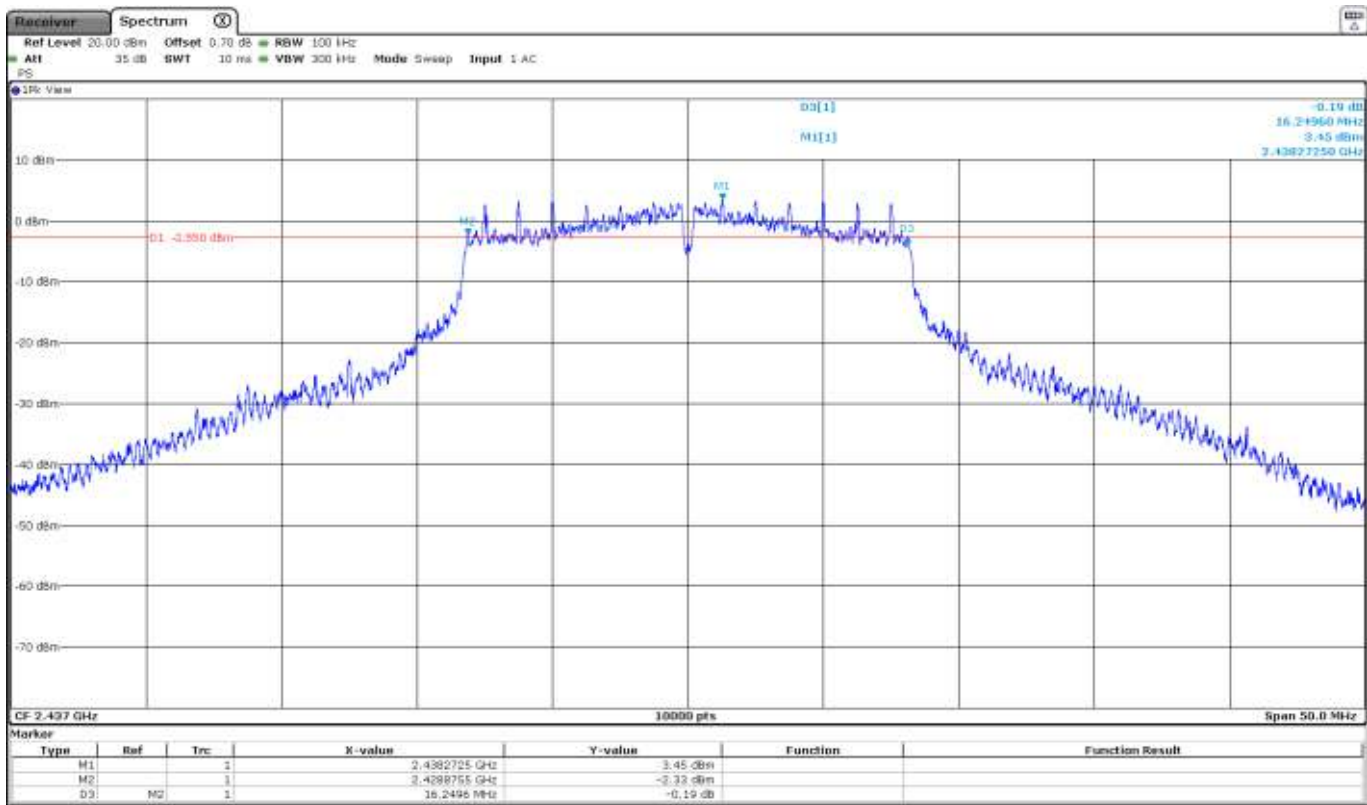


- Mode 802.11 g – 6 dB Bandwidth

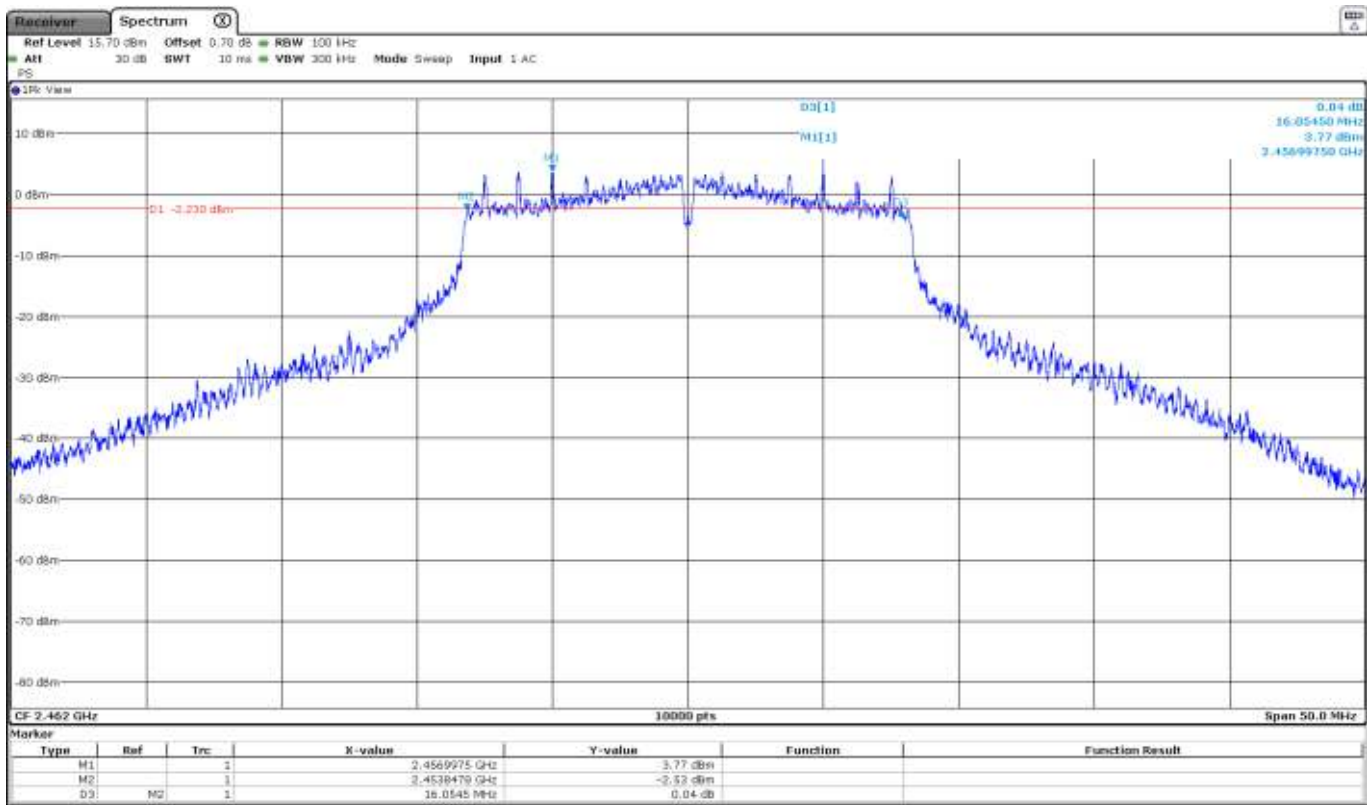
- Low Channel:



- Middle Channel:

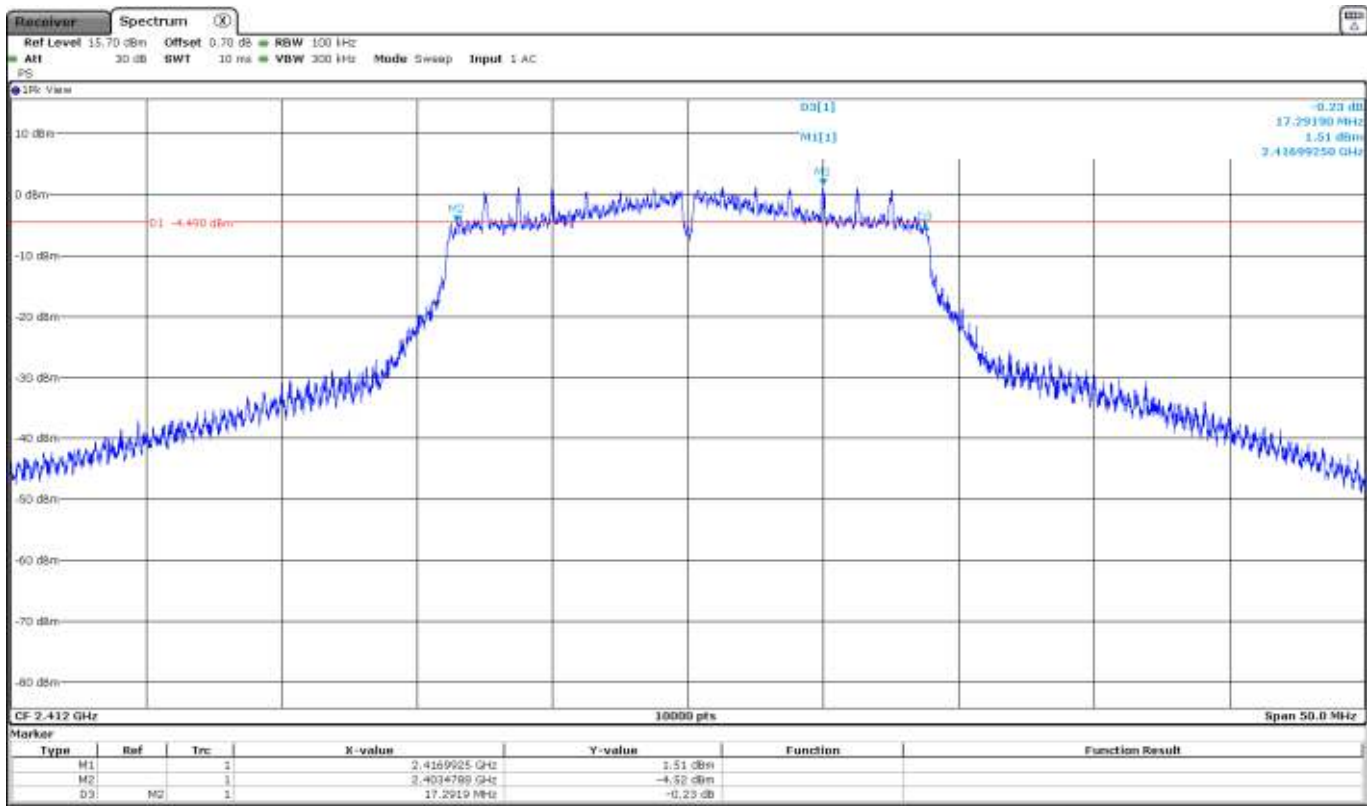


- High Channel:

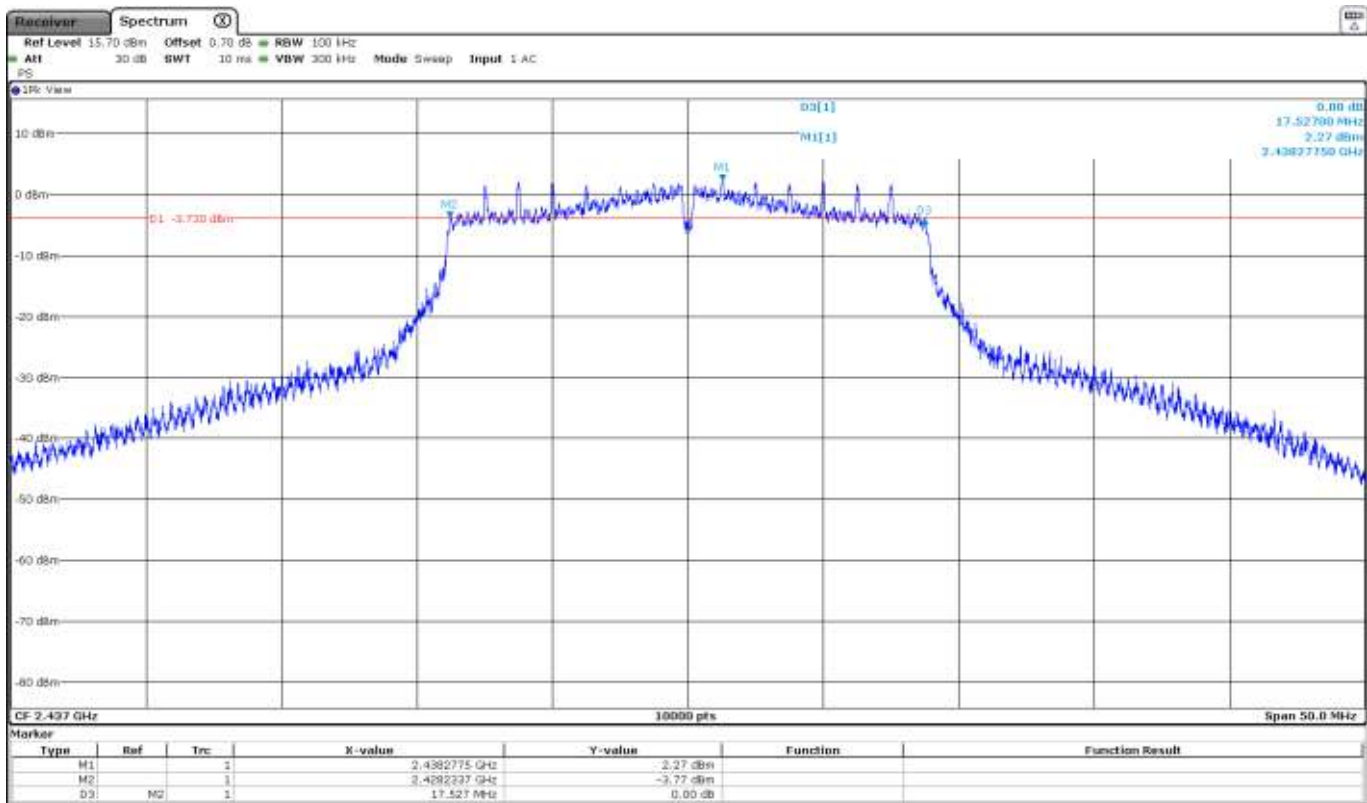


• Mode 802.11 n20 – 6 dB Bandwidth

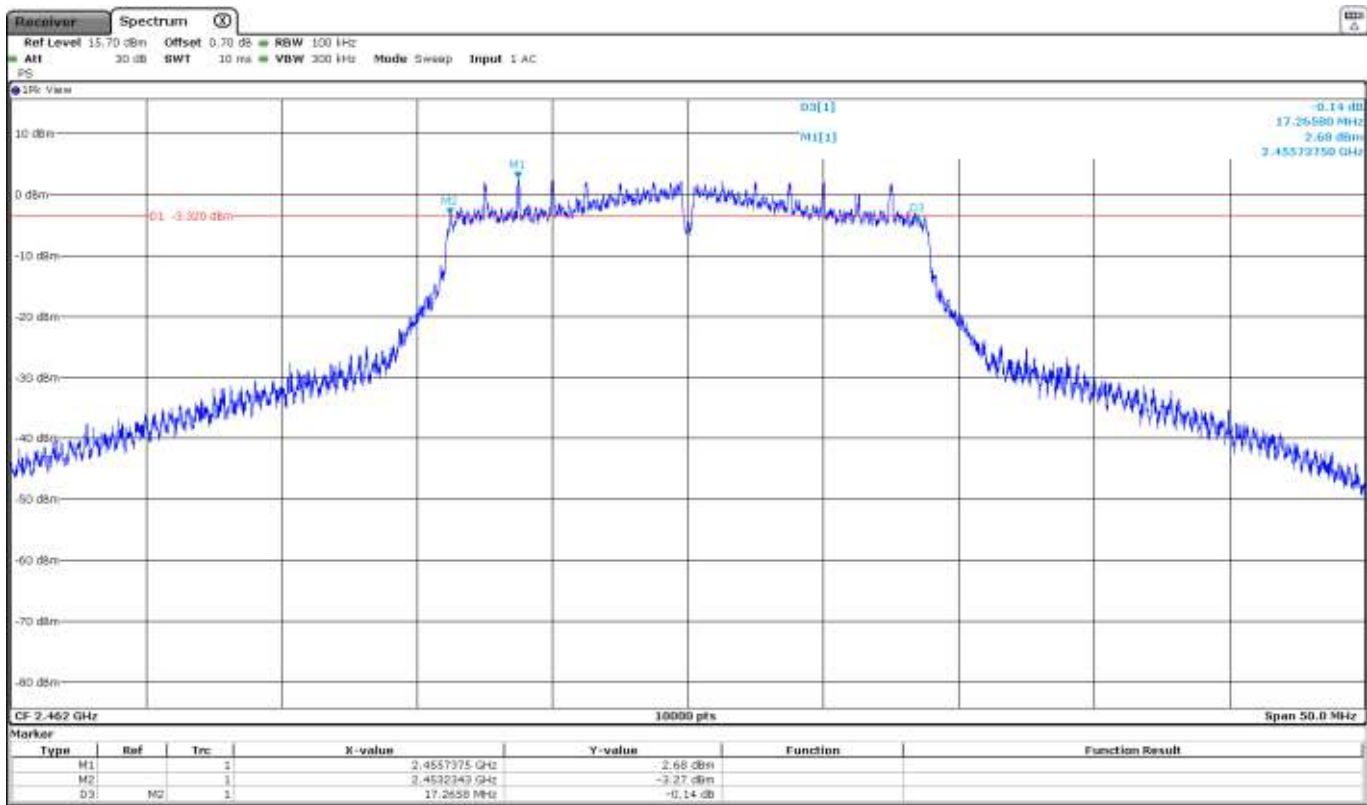
- Low Channel:



- Middle Channel:

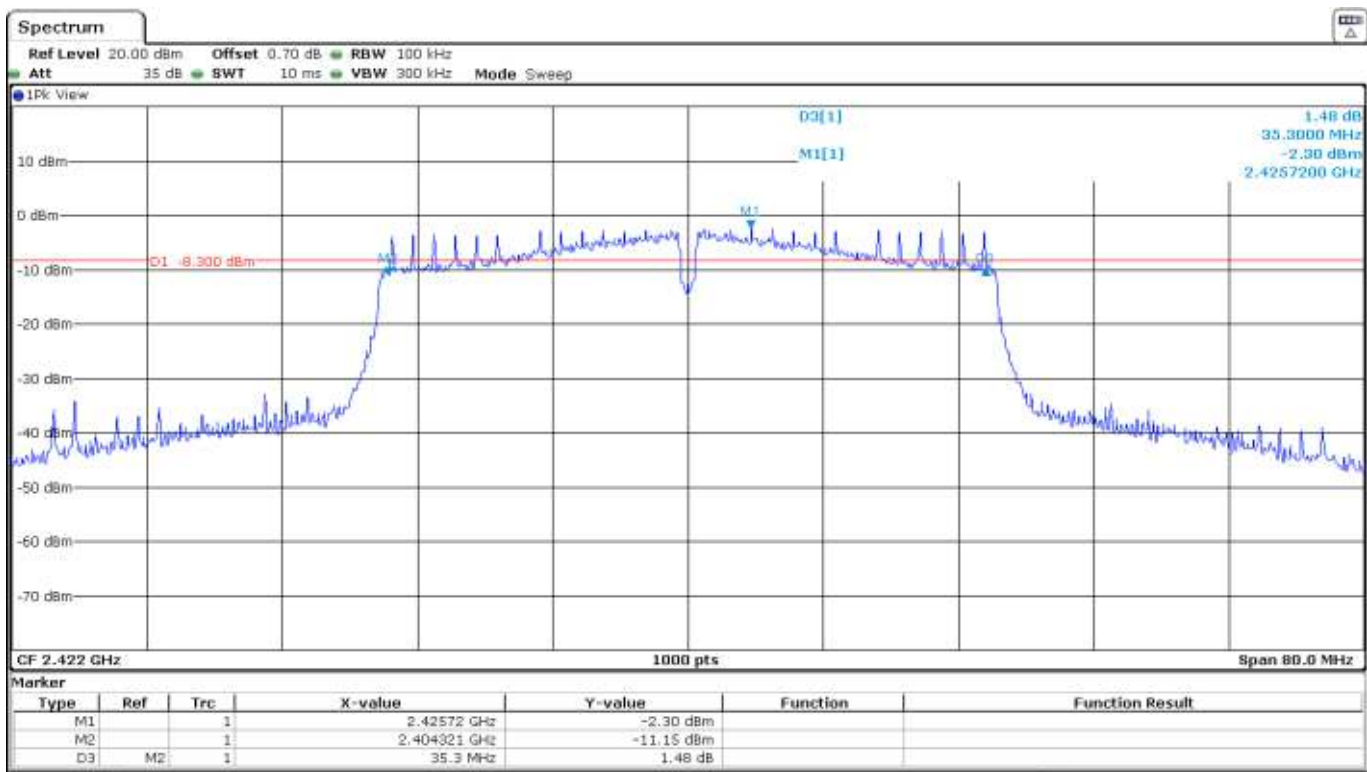


- High Channel:

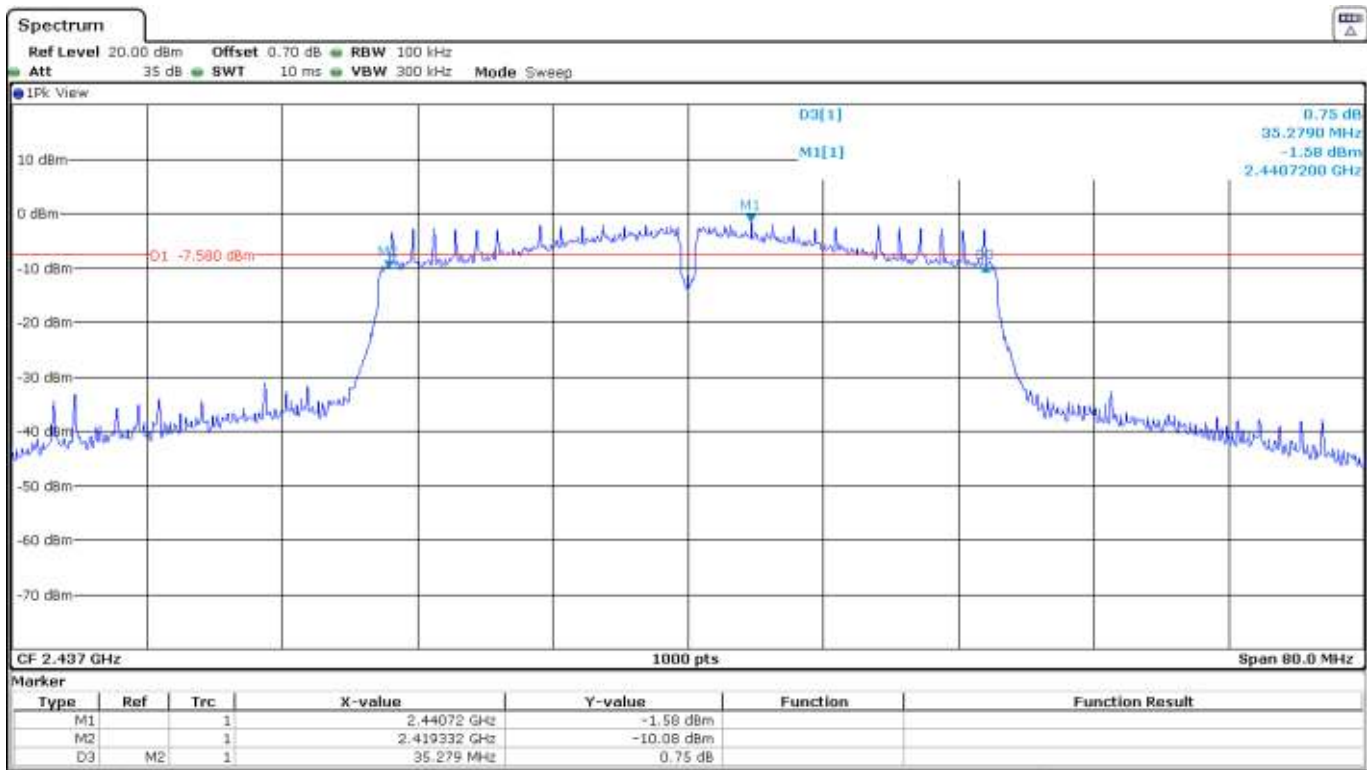


• Mode 802.11 n40 – 6 dB Bandwidth

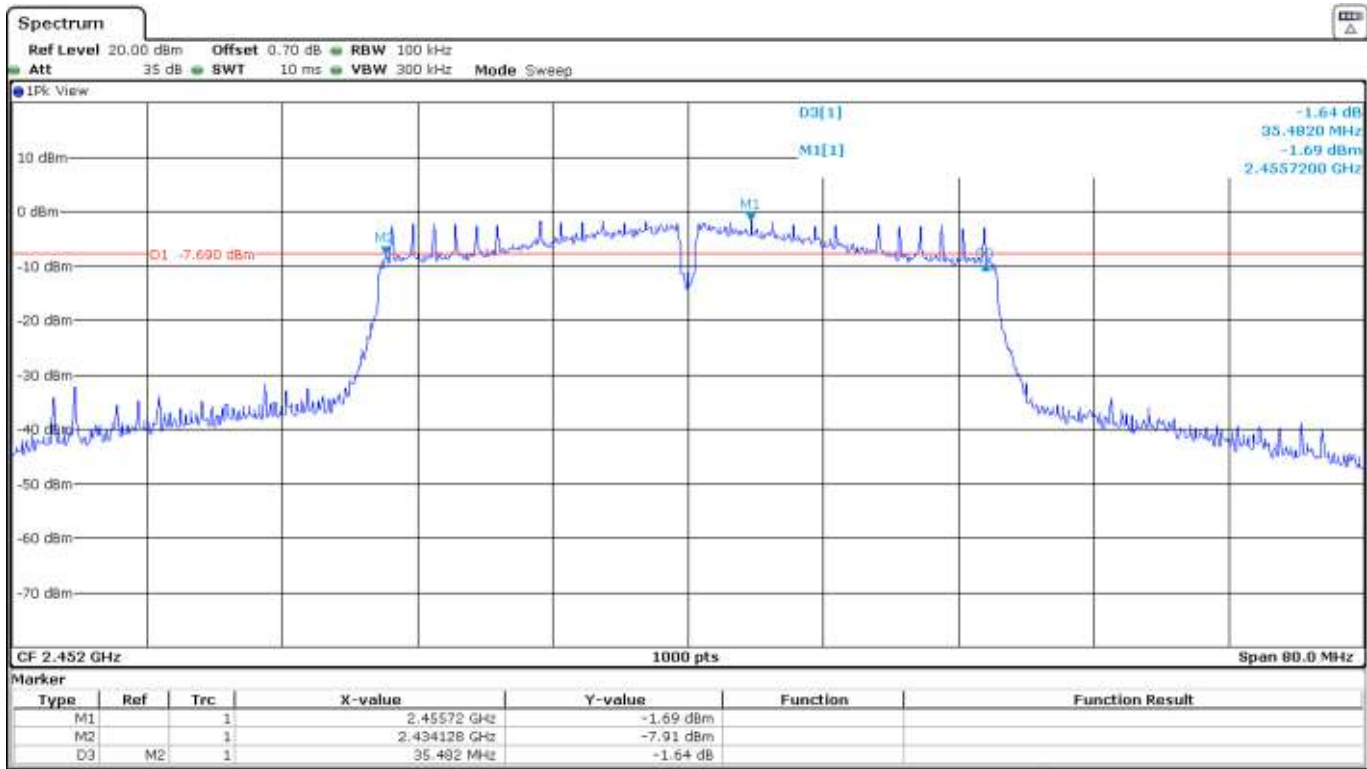
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).
The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum conducted output power was measured using the method according to point 11.9.1.3 "Method PKPM1" of ANSI C.63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: -6.2 dBi

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Mode 802.11 b

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Max. Conducted Power (dBm)	17.77	19.1	19.34
Maximum EIRP Power (dBm)	11.57	12.9	13.14
Measurement uncertainty (dB)	<±0.33		

Mode 802.11 g

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Max. Conducted Power (dBm)	22.52	23.64	24.02
Maximum EIRP Power (dBm)	16.32	17.44	17.82
Measurement uncertainty (dB)	<±0.33		

Mode 802.11 n20

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Max. Conducted Power (dBm)	21.73	22.34	23.77
Maximum EIRP Power (dBm)	15.53	16.14	17.57
Measurement uncertainty (dB)	<±0.33		

Mode 802.11 n40

	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2452 MHz
Max. Conducted Power (dBm)	21.79	21.97	22.30
Maximum EIRP Power (dBm)	15.59	15.77	16.10
Measurement uncertainty (dB)	<±0.33		

Verdict: PASS

FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter)

SPECIFICATION:

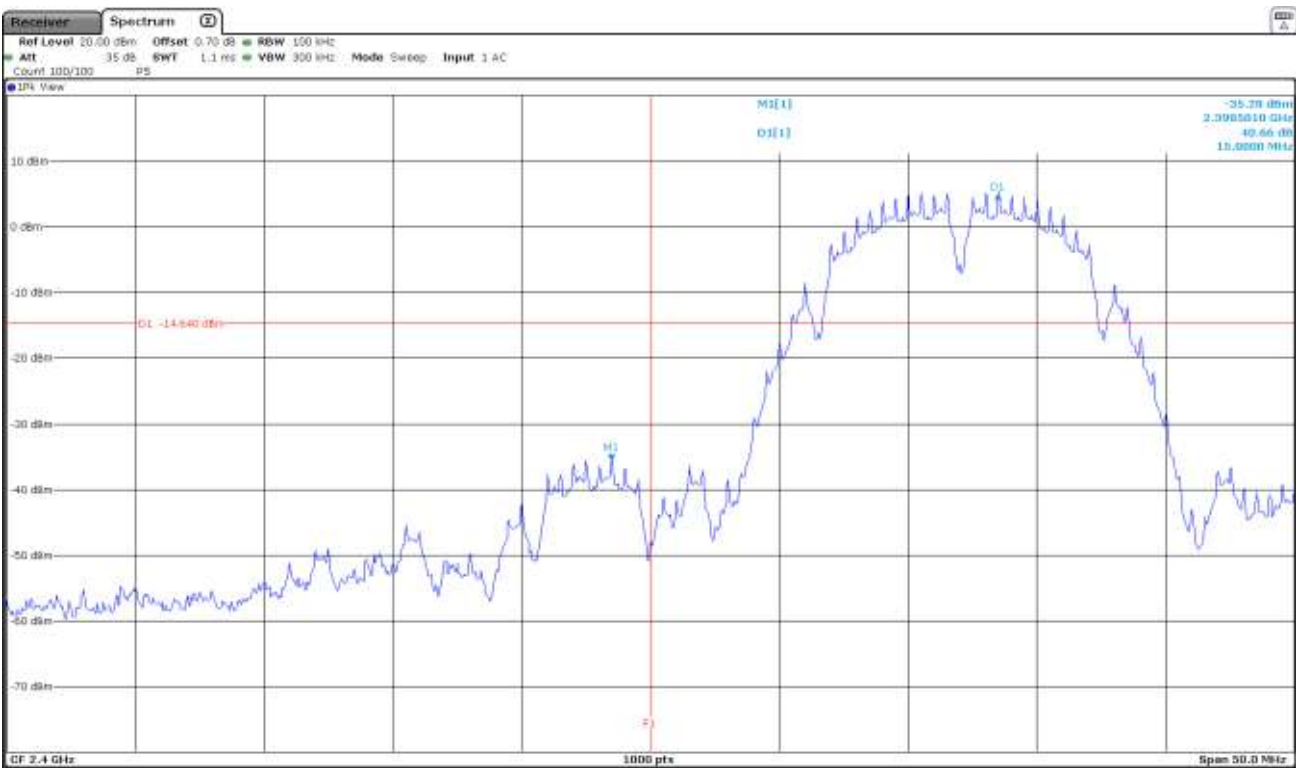
In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, 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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Measurement uncertainty (dB)	<±1.56
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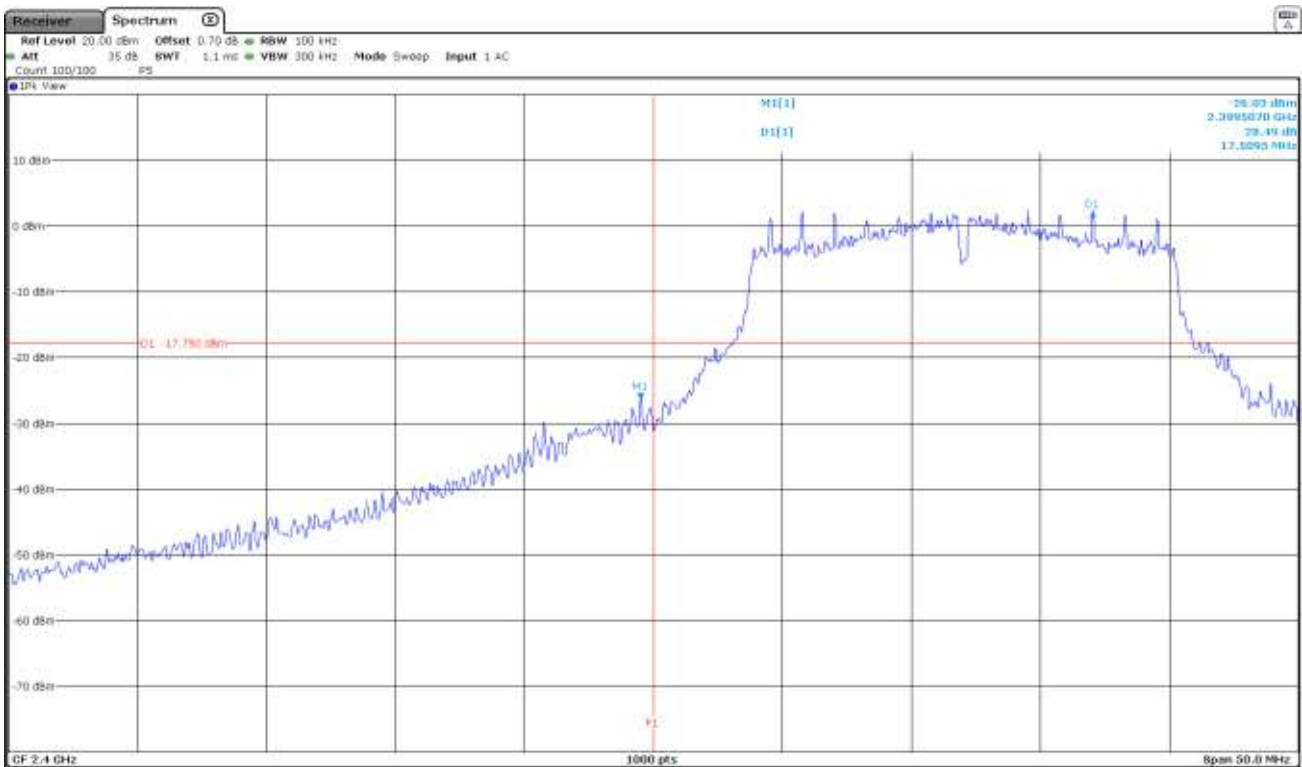
- Mode 802.11 b – Band-edge emissions compliance
 - Low Channel:



Verdict: PASS

- **Mode 802.11 g – Band-edge emissions compliance**

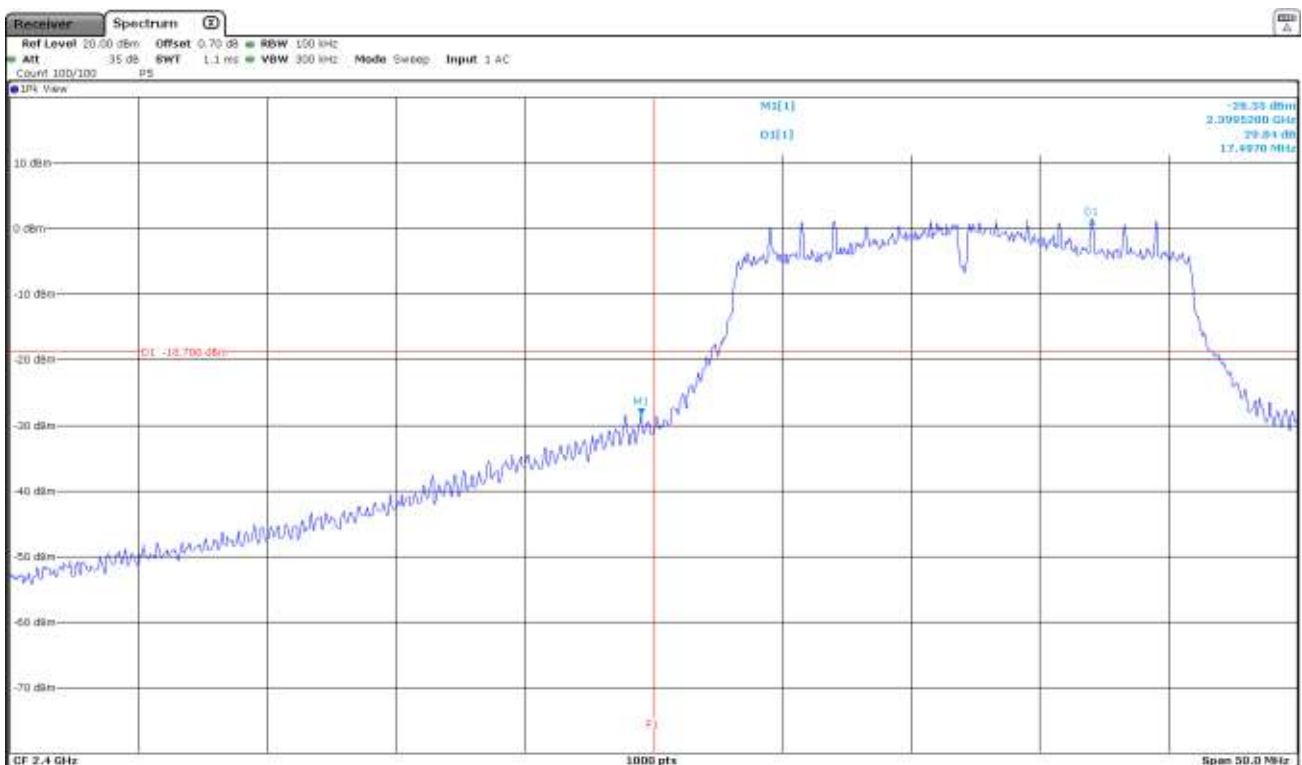
- Low Channel:



Verdict: PASS

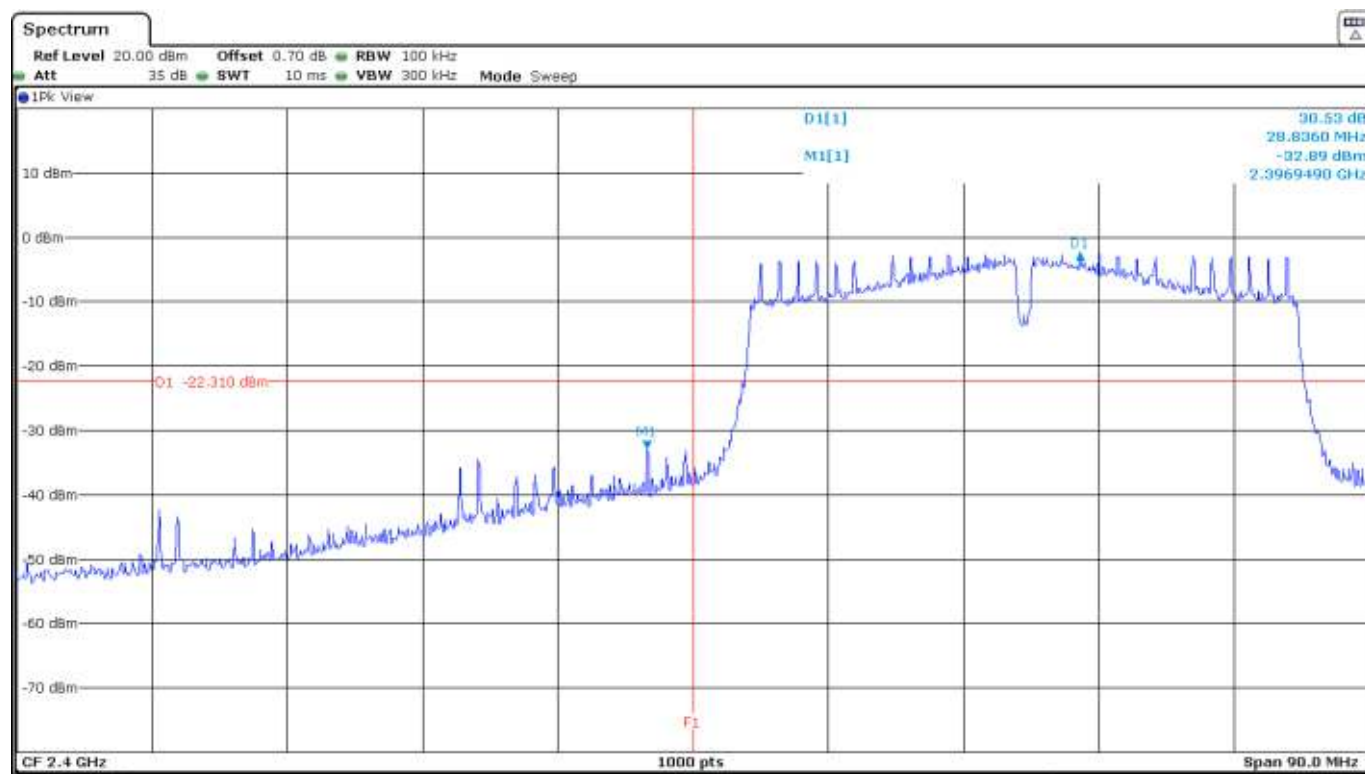
- **Mode 802.11 n20 – Band-edge emissions compliance**

- Low Channel:



- **Mode 802.11 n40 – Band-edge emissions compliance**

- Low Channel:



Verdict: PASS

FCC Section 15.247 Subclause (e) / RSS-247 Clause 5.2. (b) Power spectral density

SPECIFICATION:

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.

RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method according to point 11.10.2." Method PKPSD (peak PSD)" of ANSI C.63.10-2013.

- **Mode 802.11 b**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Power Spectral Density (dBm)	5.38	6.49	7.05
Measurement uncertainty (dB)	<±0.78		

- **Mode 802.11 g**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Power Spectral Density (dBm)	2.55	3.63	4.07
Measurement uncertainty (dB)	<±0.78		

- **Mode 802.11 n20**

	Low Channel 2412 MHz	Middle Channel 2437 MHz	High Channel 2462 MHz
Power Spectral Density (dBm)	1.54	2.32	2.91
Measurement uncertainty (dB)	<±0.78		

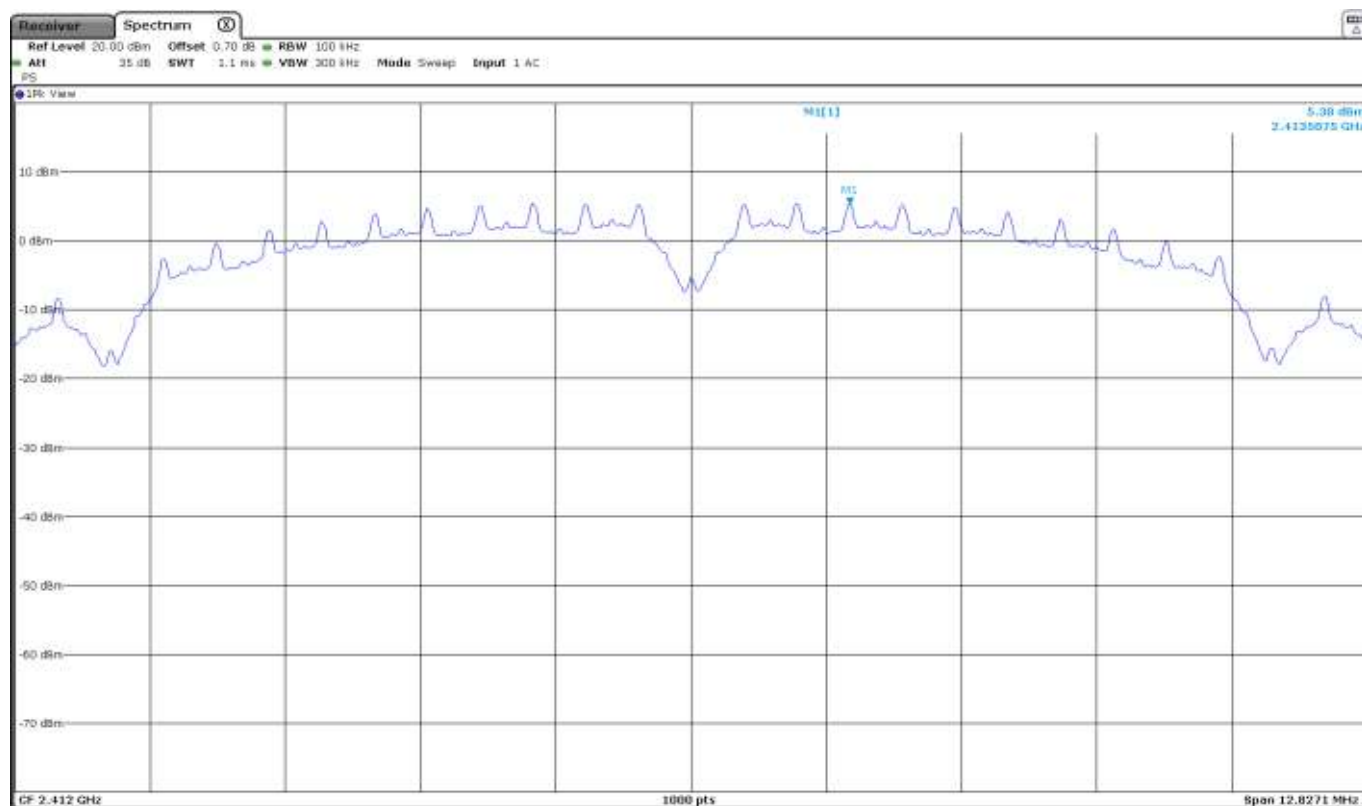
- **Mode 802.11 n40**

	Low Channel 2422 MHz	Middle Channel 2437 MHz	High Channel 2452 MHz
Power Spectral Density (dBm)	-2.28	-1.85	-1.67
Measurement uncertainty (dB)	<±0.78		

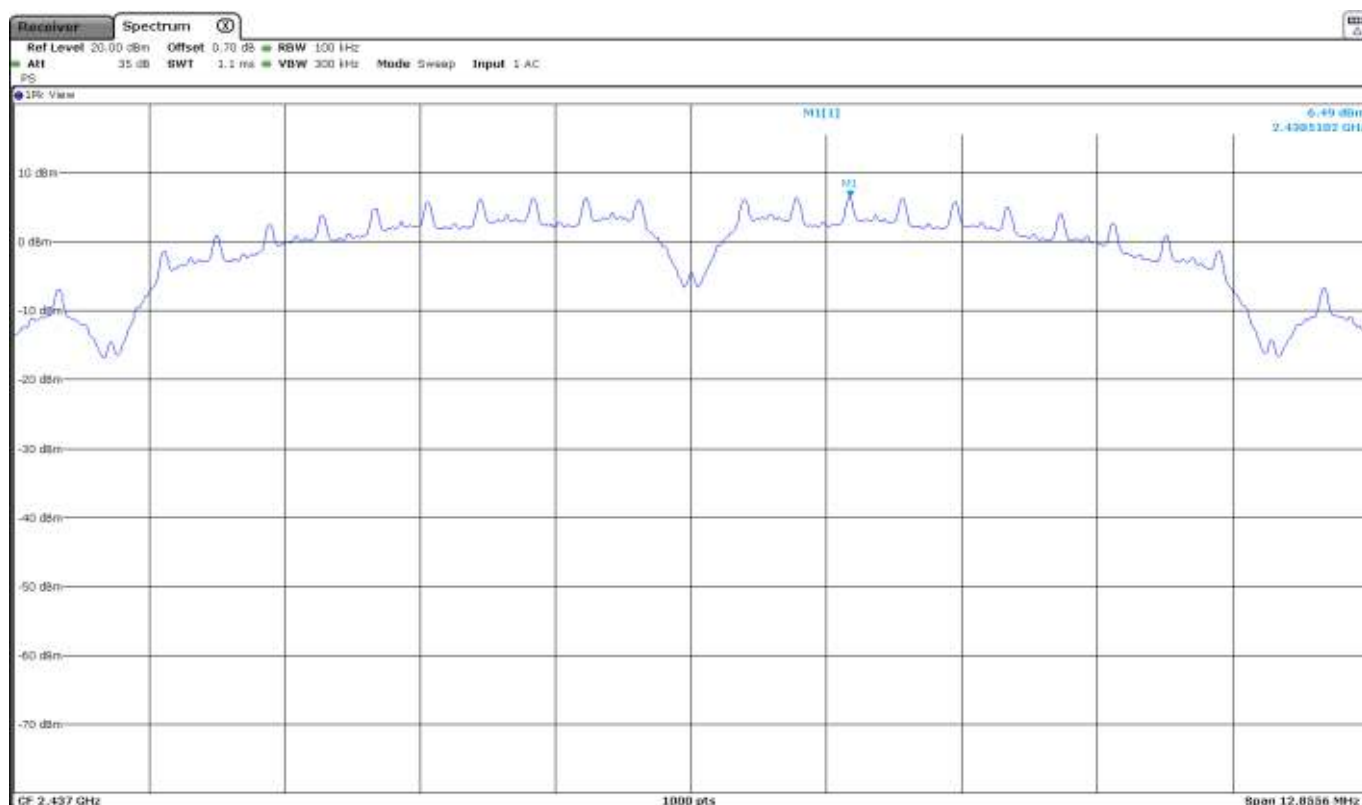
Verdict: PASS

- **Mode 802.11 b – Power Spectral Density**

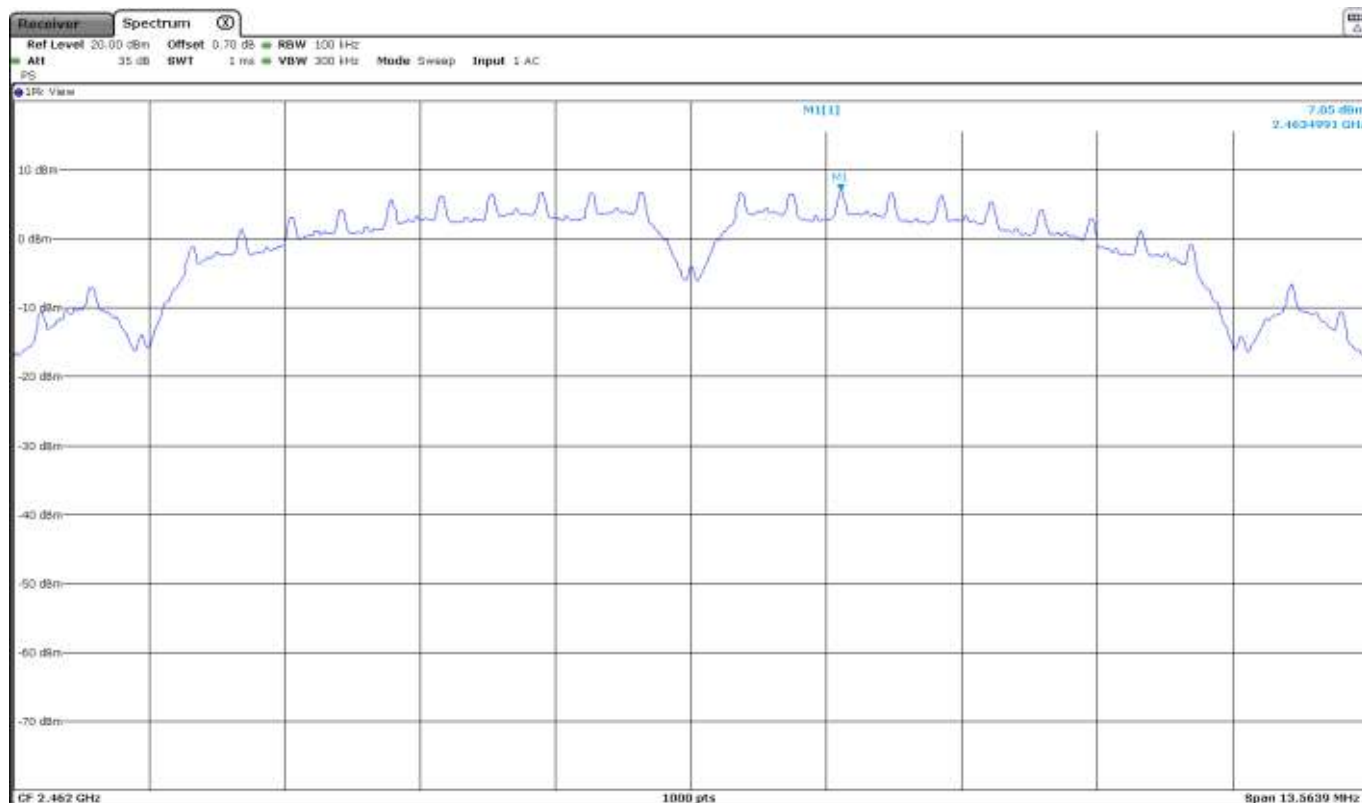
- Low Channel:



- Middle Channel:

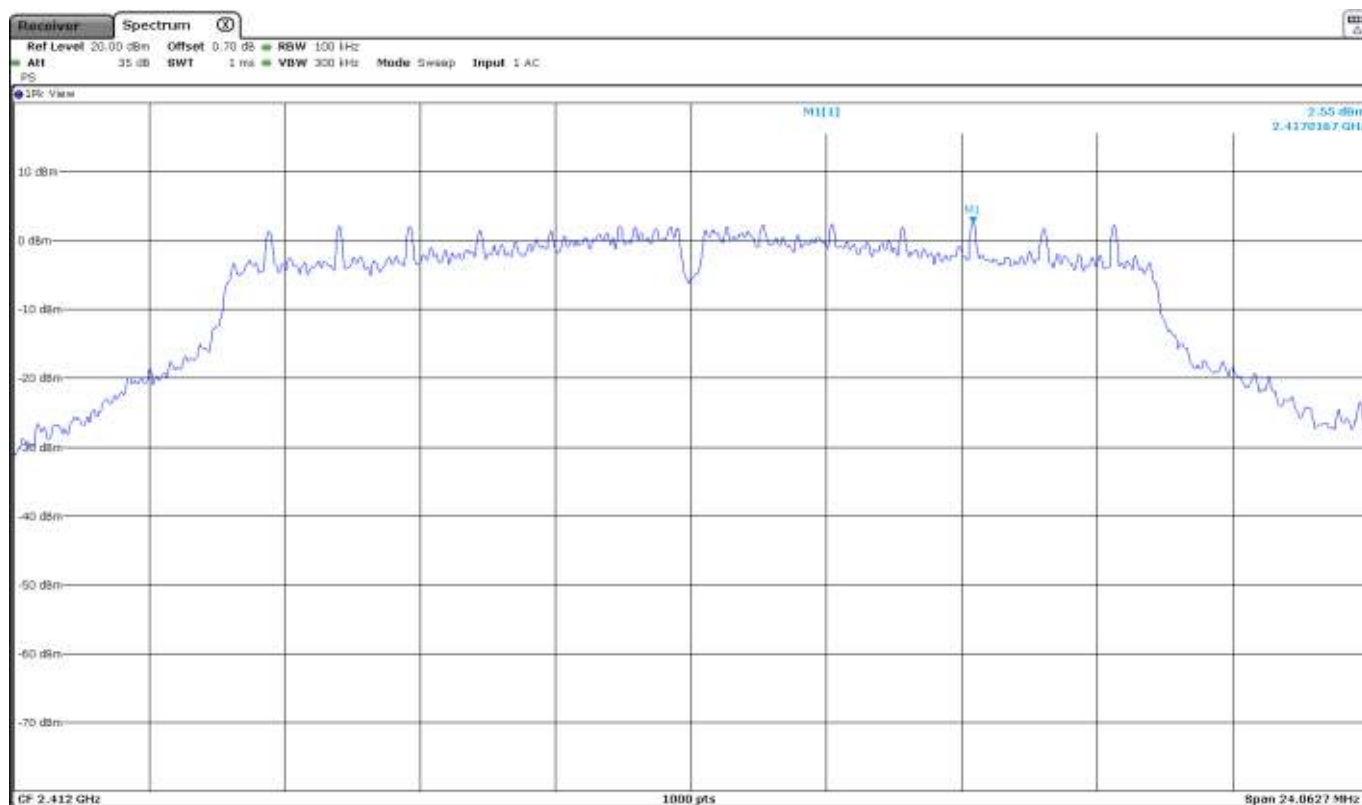


- High Channel:

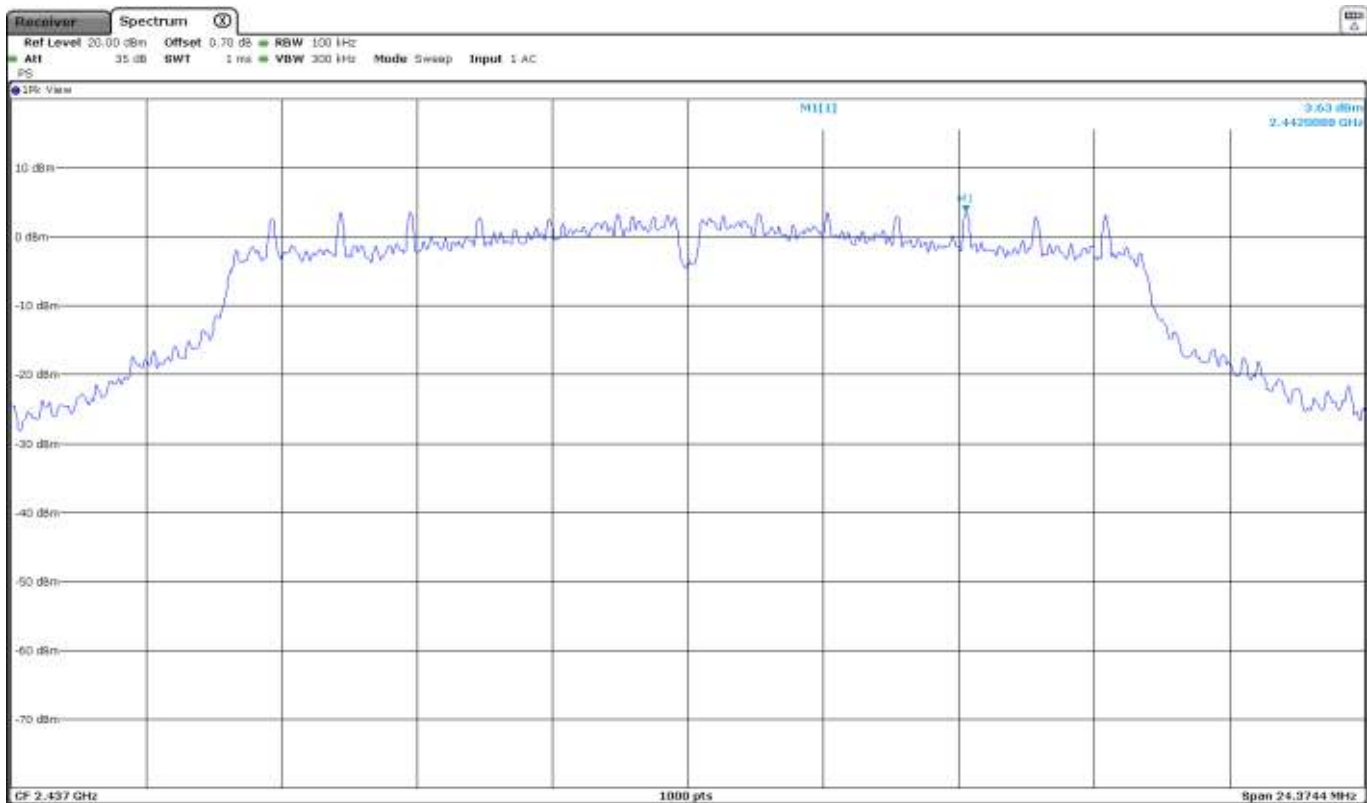


- Mode 802.11 g – Power Spectral Density

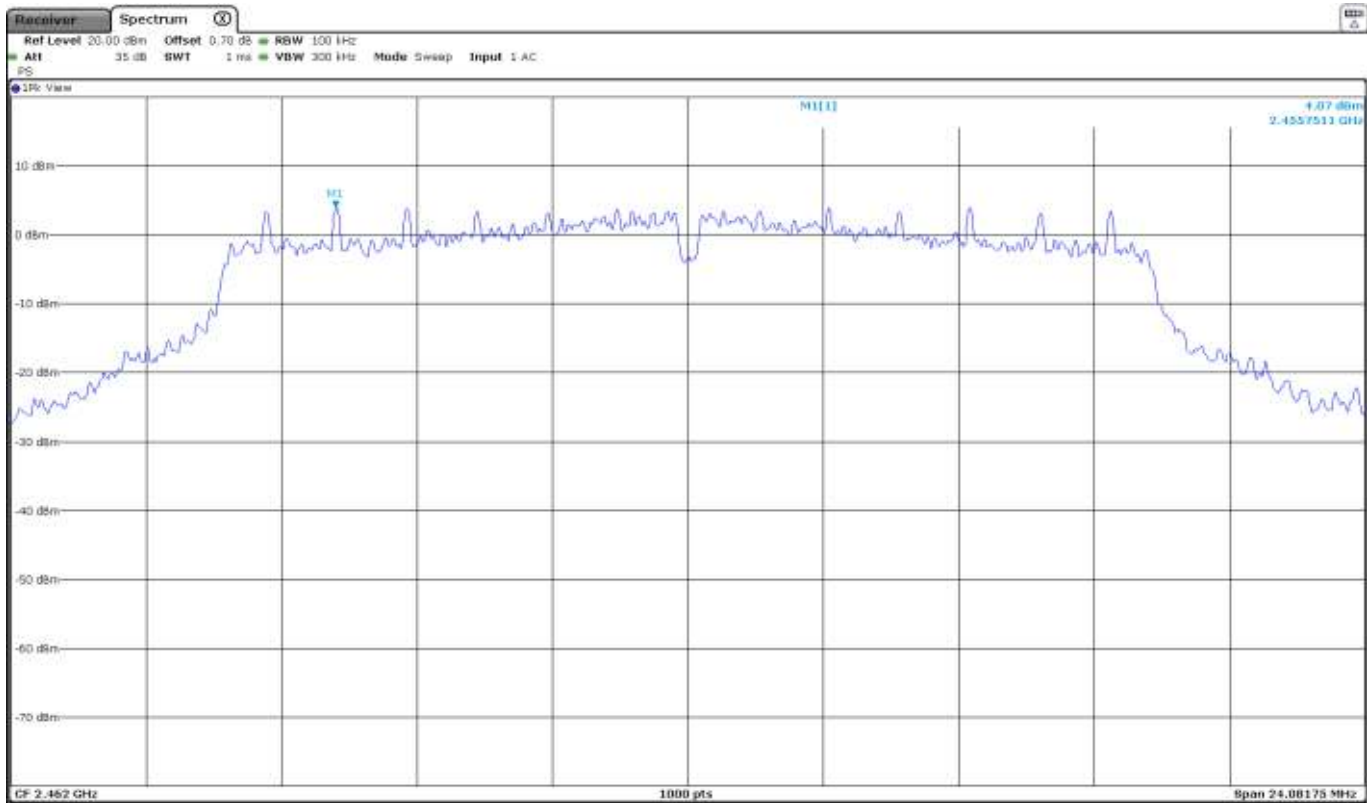
- Low Channel:



- Middle Channel:

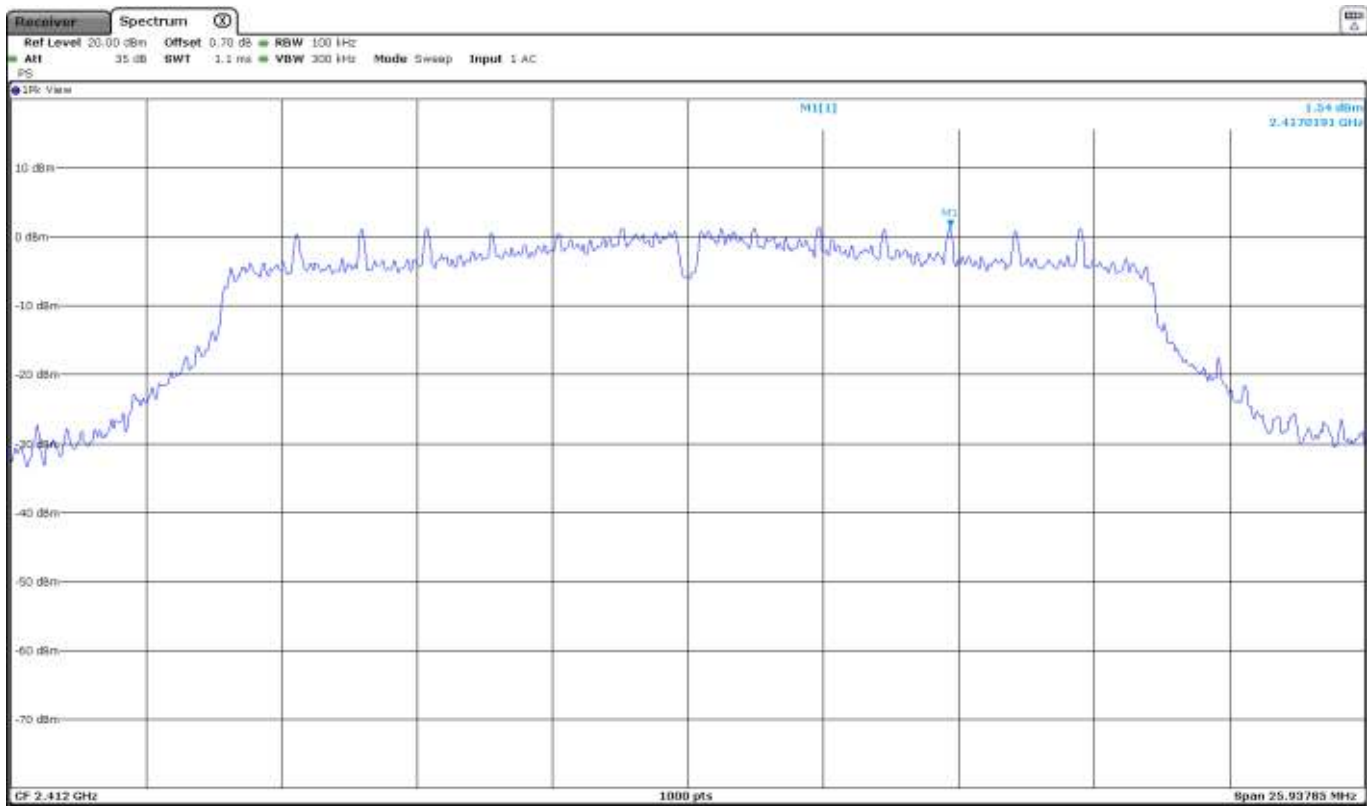


- High Channel:

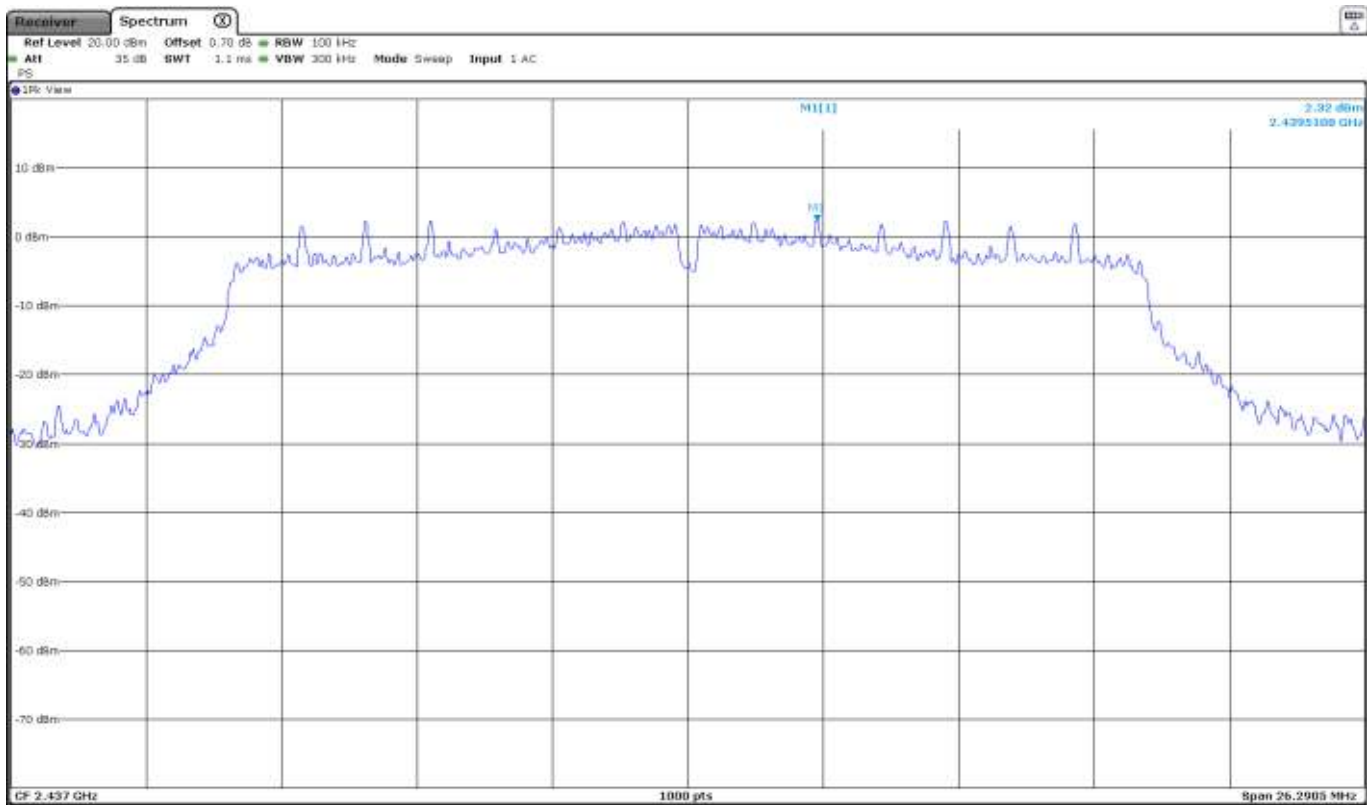


• Mode 802.11 n20 – Power Spectral Density

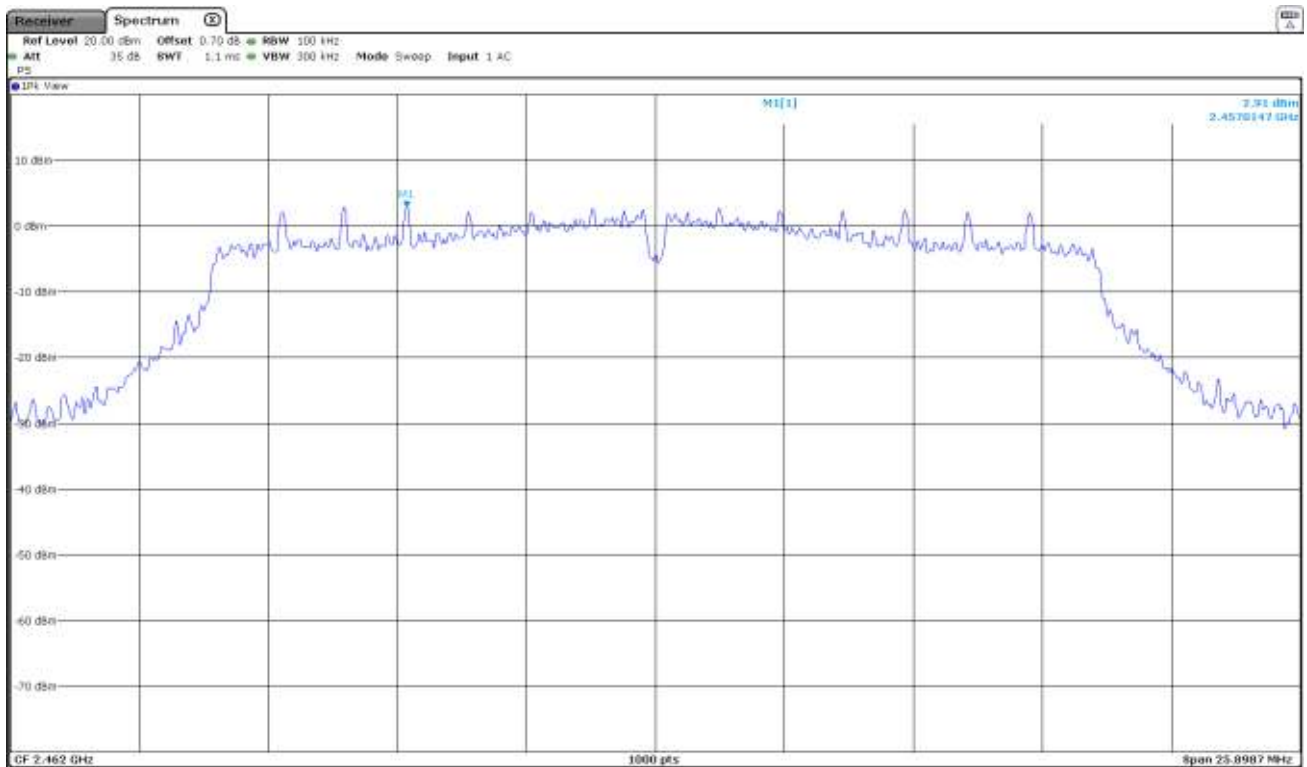
- Low Channel:



- Middle Channel:

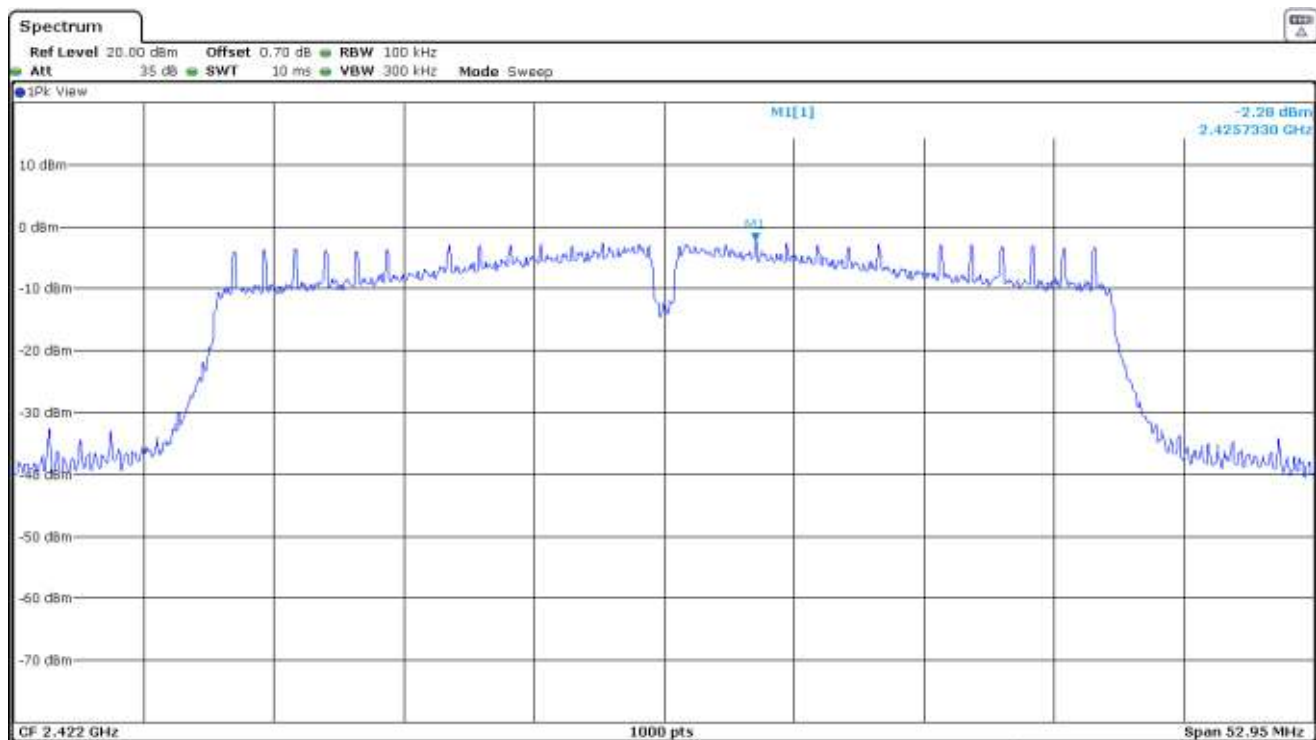


- High Channel:

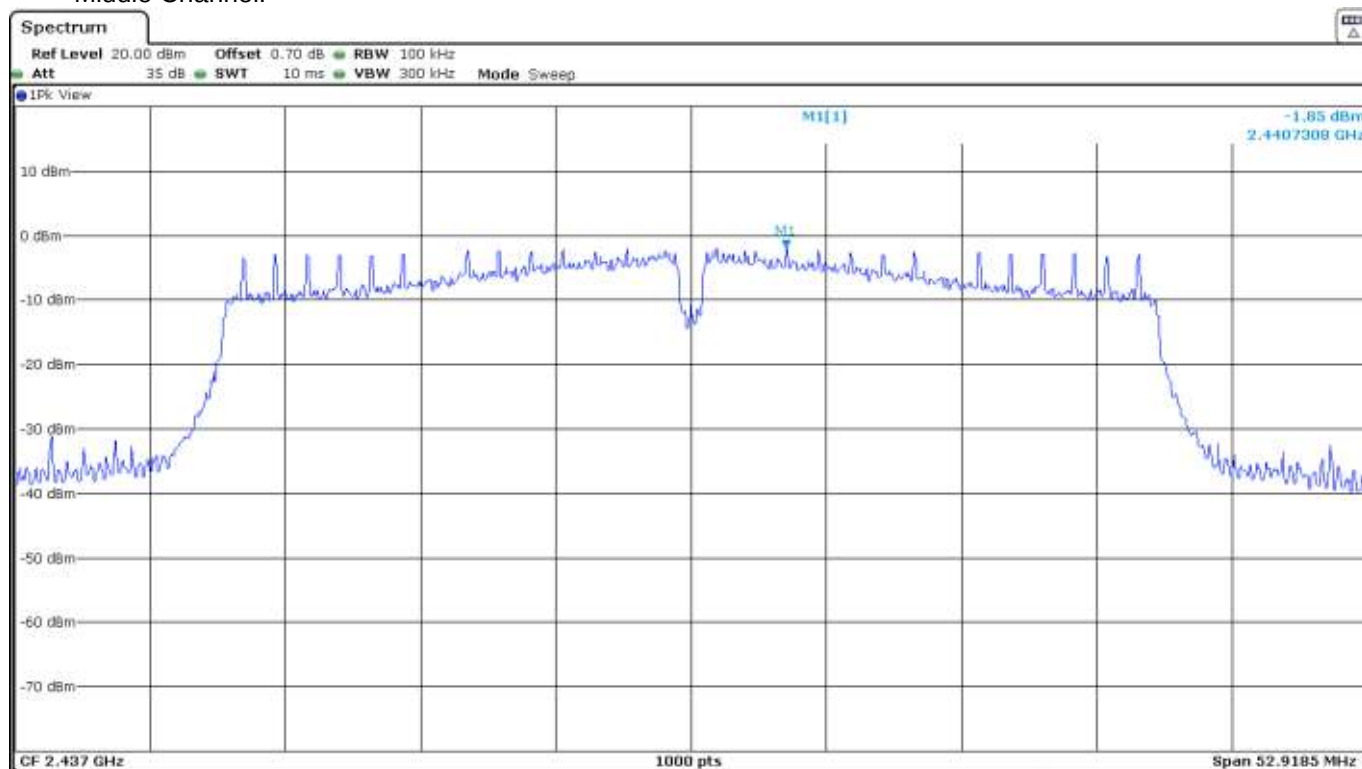


- Mode 802.11 n40 – Power Spectral Density

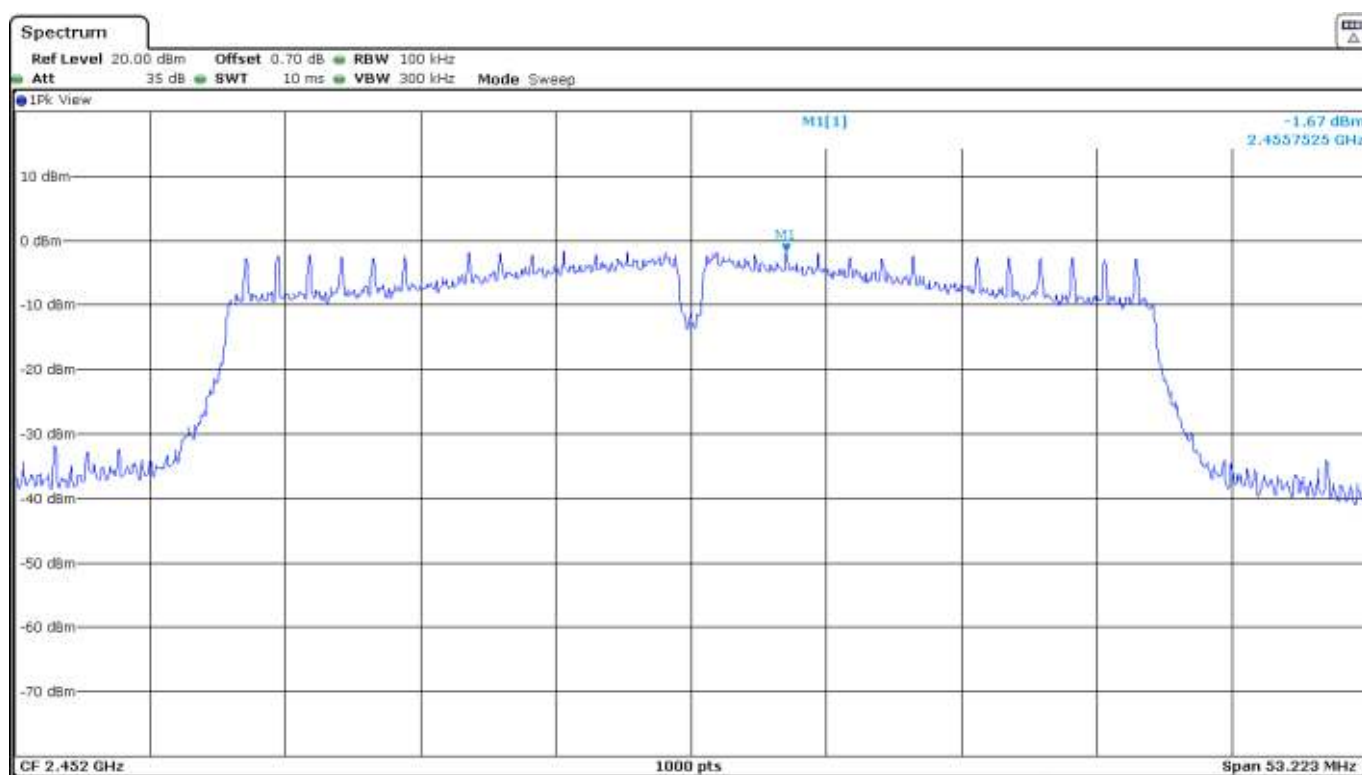
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION:

Radiated emissions which fall in the restricted bands. as defined in Section 15.205(a). must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
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	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 10000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz. 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz. there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247: Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor. cable loss and pre-amplifiers gain.

Frequency range 30 MHz - 1 GHz:

The spurious frequencies detected below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT

Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
250.012	Quasi peak	30.2	V	<± 3.04
375.013	Quasi peak	34.0	H	<± 3.04
525.007	Quasi peak	34.3	V	<± 3.04
562.514	Quasi peak	33.6	H	<± 3.04
750.015	Quasi peak	31.6	H	<± 3.04
937.516	Quasi peak	31.7	H	<± 3.04
956.722	Quasi peak	29.8	H	<± 3.04

• Mode 802.11 b

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious signals with peak levels above the average limit (54 dBμV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
3.23614	Peak	40.60	V	<± 3.04
7.23617	Peak	48.98	V	<± 4.88

- MIDDLE CHANNEL. Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
5.99997	Peak	40.42	V	<± 4.88
7.3127	Peak	47.54	V	<± 4.88

- HIGH CHANNEL. Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
2.48354	Peak	53.54	V	<±3.04
5.99997	Peak	40.05	V	<± 4.88

Verdict: PASS

OFDM modes:

For spurious emissions in the range 30 MHz - 26 GHz (except field strength at the band edges that was performed for all modes) a preliminary scan was performed to determine the worst case mode. Herein the results for the worst case mode: 802.11 g.

Spurious emissions in including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz are measured for all modes.

• **Mode 802.11 g (OFDM worst case for spurious emissions)**

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
2.38995	Peak	64.2	V	< $\pm$ 3.04
	Average	49.57		< $\pm$ 3.04
7.23057	Peak	52.55	V	< $\pm$ 4.88

- MIDDLE CHANNEL. Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
7.3127	Peak	49.89	V	< $\pm$ 4.88

- HIGH CHANNEL. Spurious frequencies operating at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
2.48408878	Peak	63.46	H	< $\pm$ 3.04
	Average	49.45		< $\pm$ 3.04

Verdict: PASS

- **Mode 802.11 n20**

The results in the next tables show the maximum measured levels in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious signals with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- RESTRICTED BAND 2.31 - 2.39 GHz. Spurious frequencies operating at less than 20 dB below the limit:

LOW CHANNEL:

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.3888547	Peak	63.73	V	<±3.04
	Average	48.68		<±3.04

- RESTRICTED BAND 2.4835 - 2.5 GHz. Spurious frequencies operating at less than 20 dB below the limit:

HIGH CHANNEL:

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48371533	Peak	70.85	V	<±3.04
	Average	52.91		<±3.04

Verdict: PASS

- **Mode 802.11 n40**

The results in the next tables show the maximum measured levels in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious signals with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- RESTRICTED BAND 2.31 - 2.39 GHz. Spurious frequencies operating at less than 20 dB below the limit:

LOW CHANNEL:

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.3798173	Peak	59.24	V	<±3.04
	Average	49.73		<±3.04

- RESTRICTED BAND 2.4835 - 2.5 GHz. Spurious frequencies operating at less than 20 dB below the limit:

HIGH CHANNEL:

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48540878	Peak	67.25	V	<±3.04
	Average	53.91		<±3.04

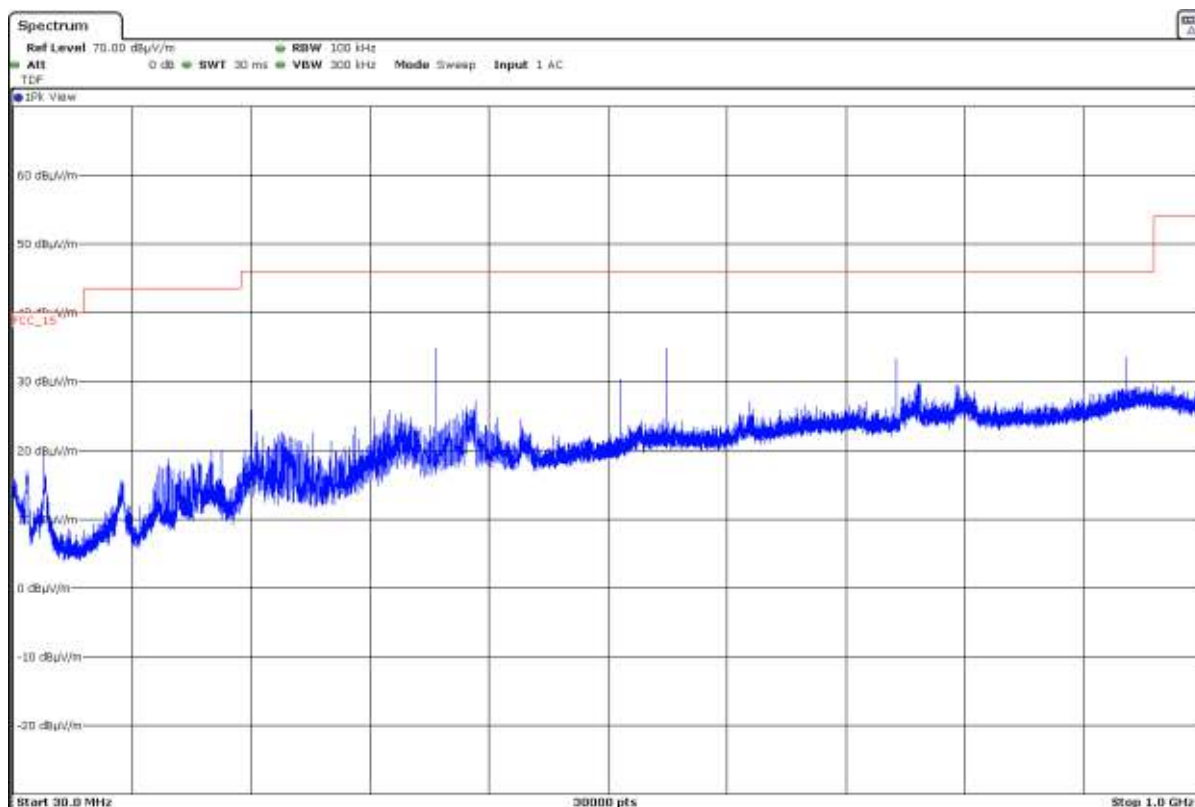
Verdict: PASS

- **Mode 802.11 b**

FREQUENCY RANGE 30 MHz - 1 GHz:

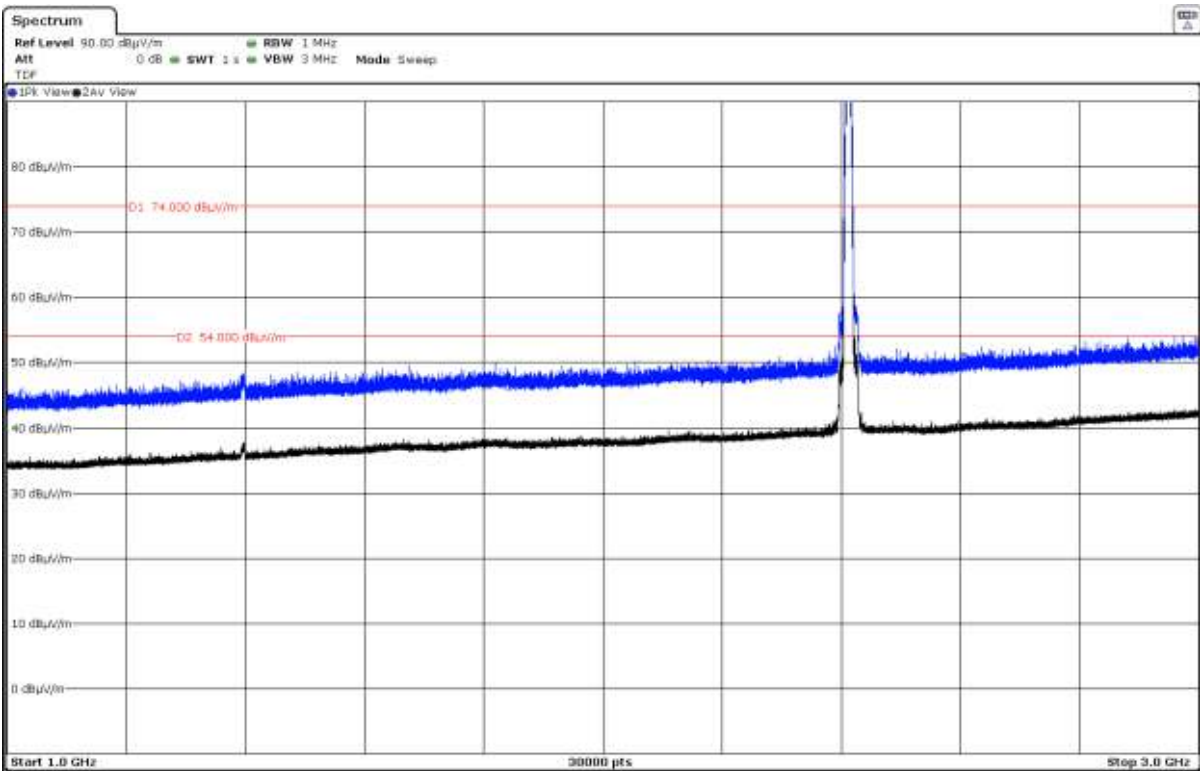
The spurious frequencies detected do not depend on the operating channel.

This plot is valid for the Low. Middle and High Channels.



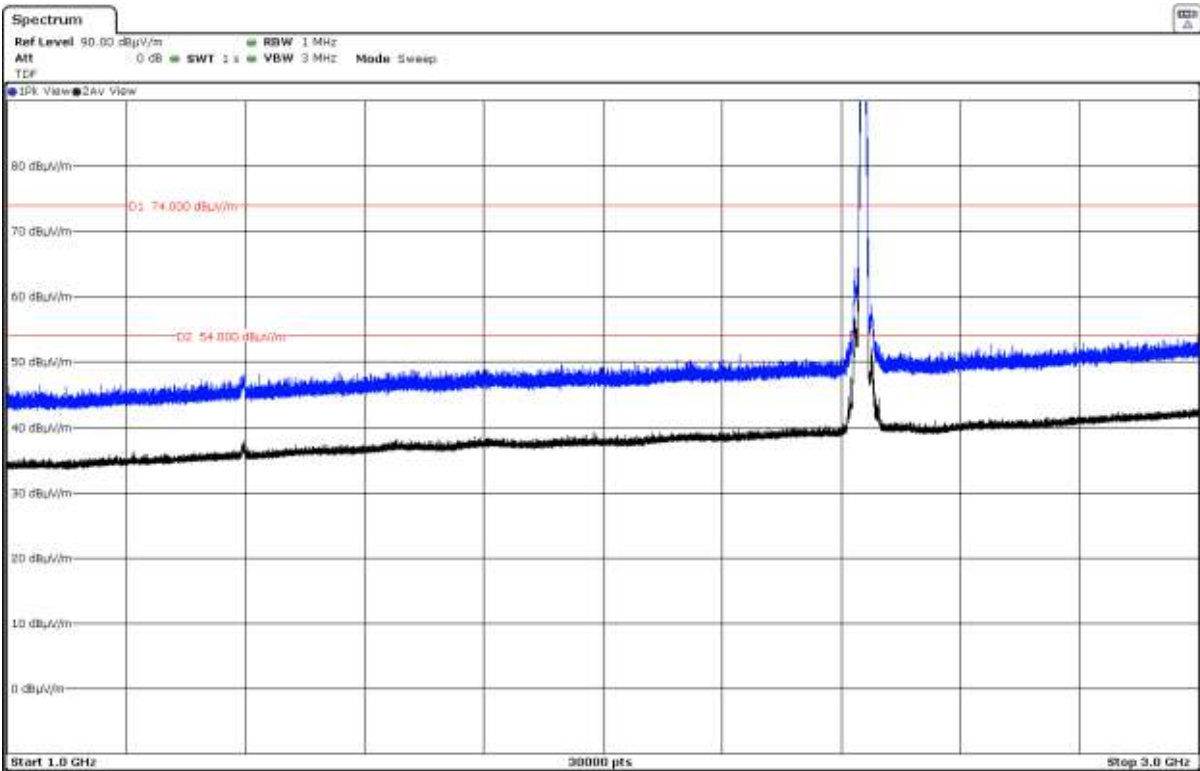
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



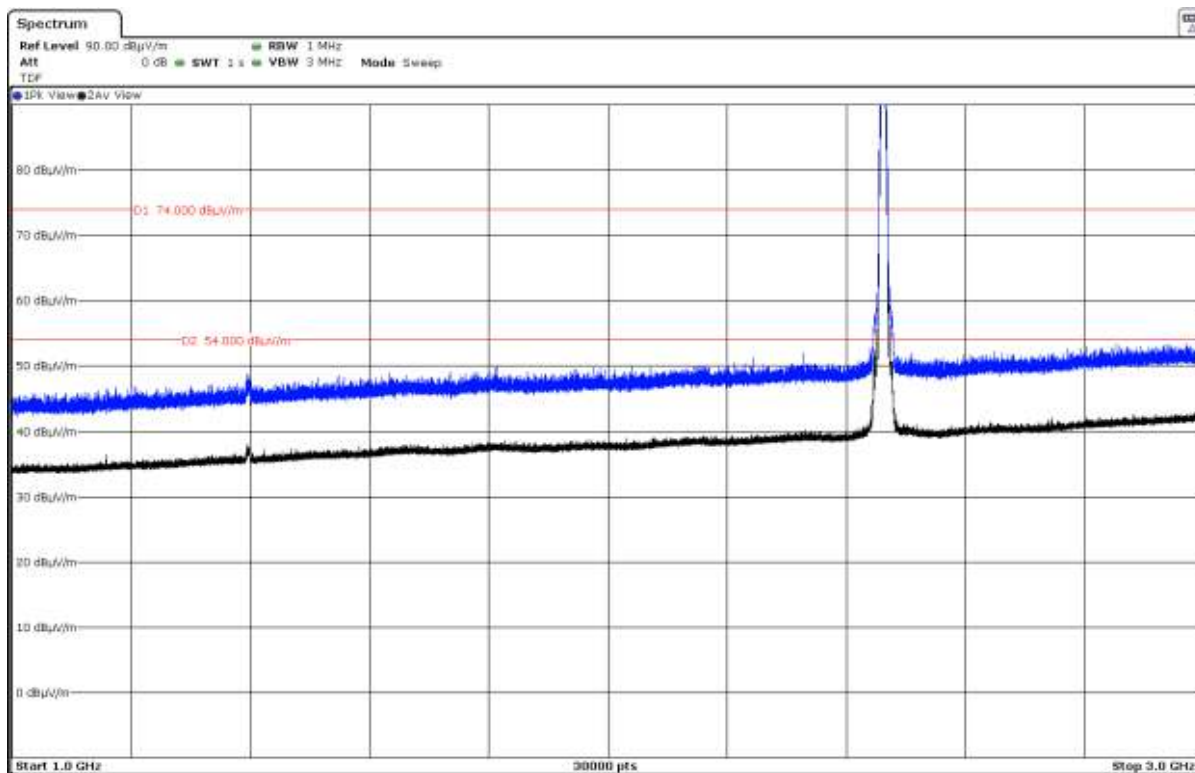
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

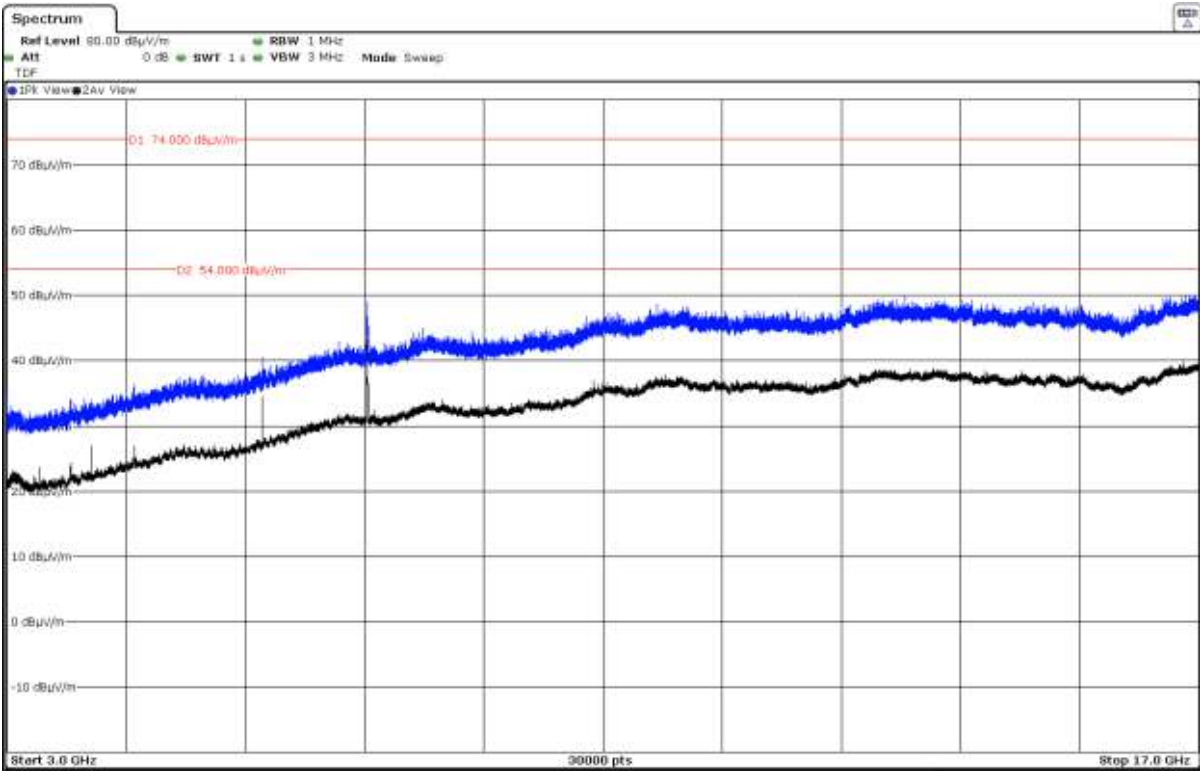
- High Channel:



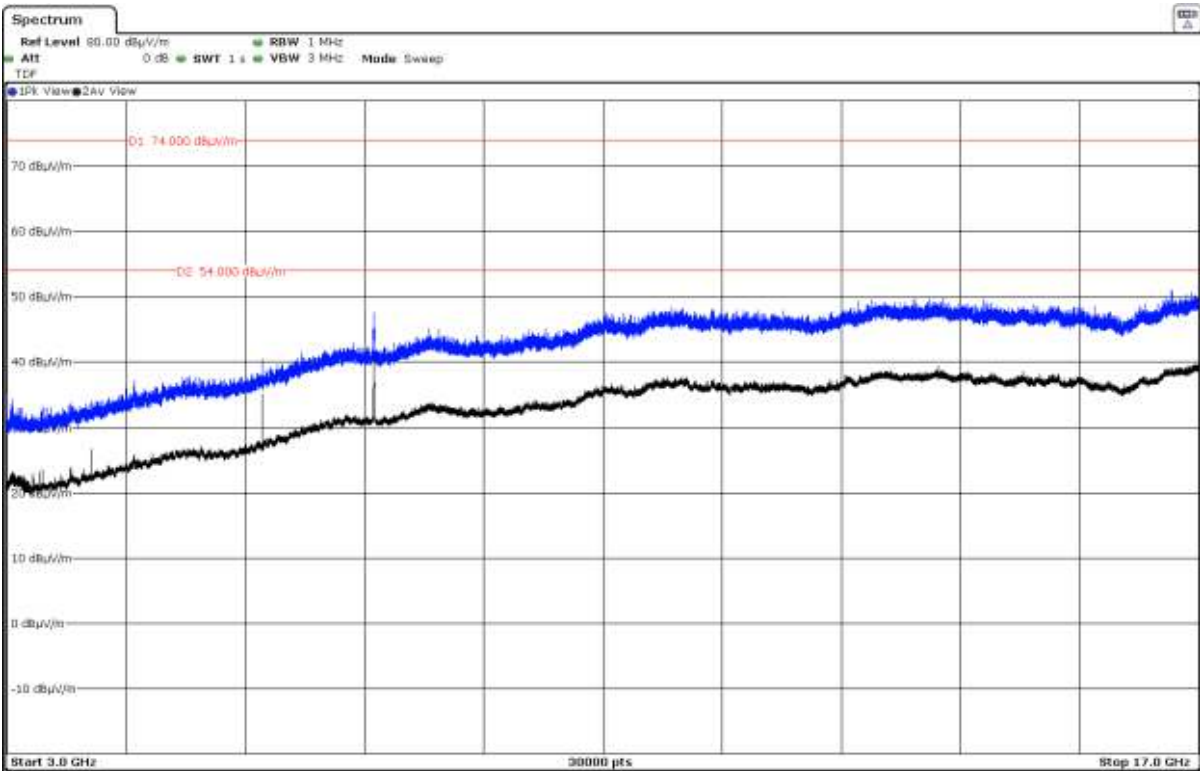
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

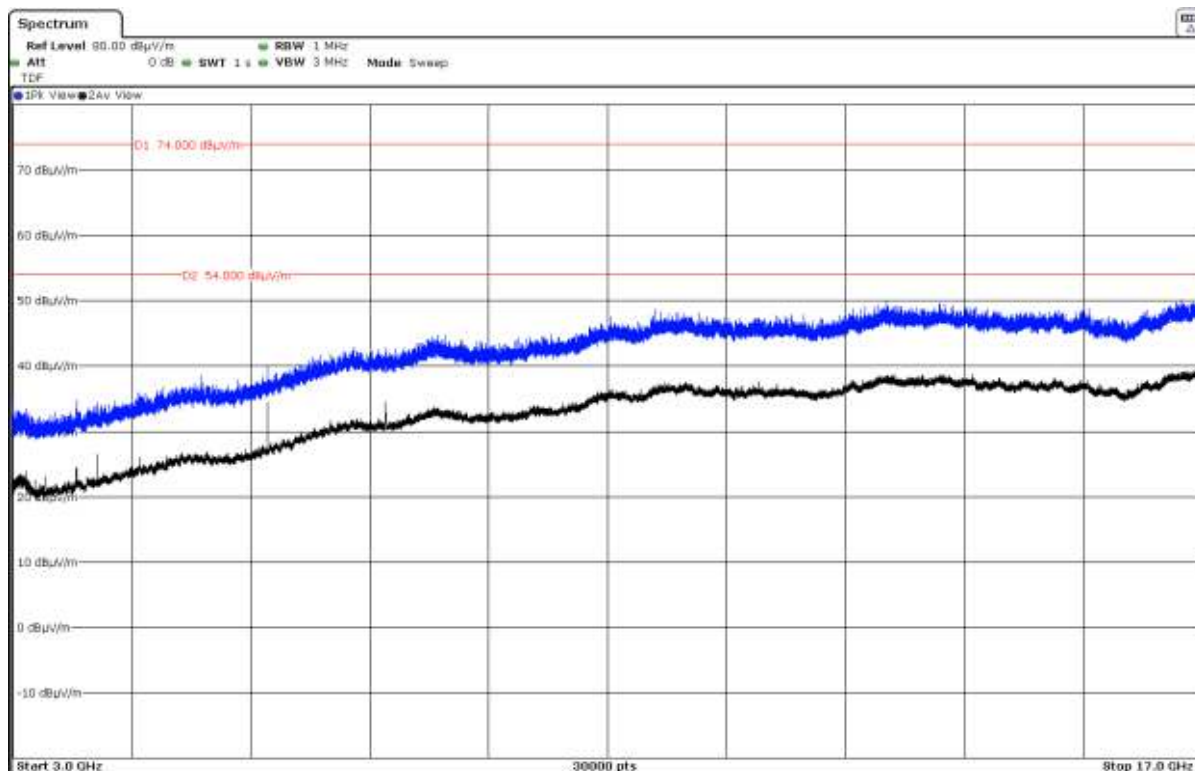
- Low Channel:



- Middle Channel:



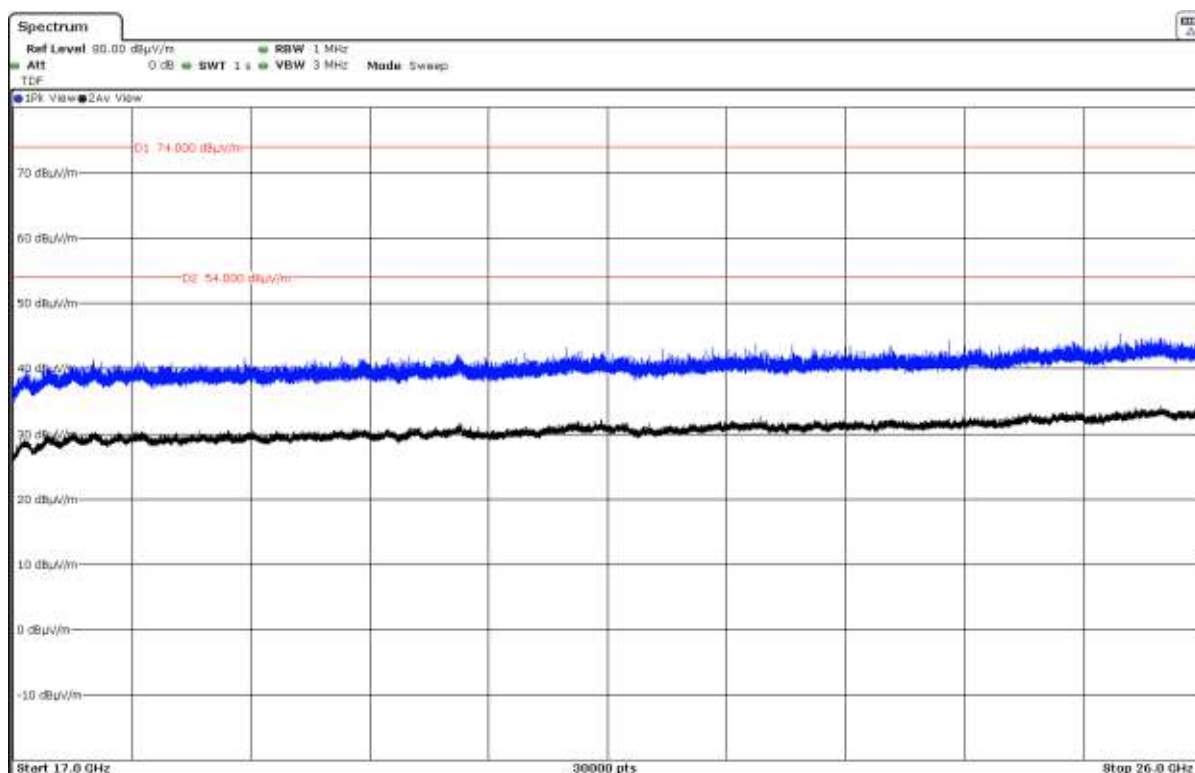
- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

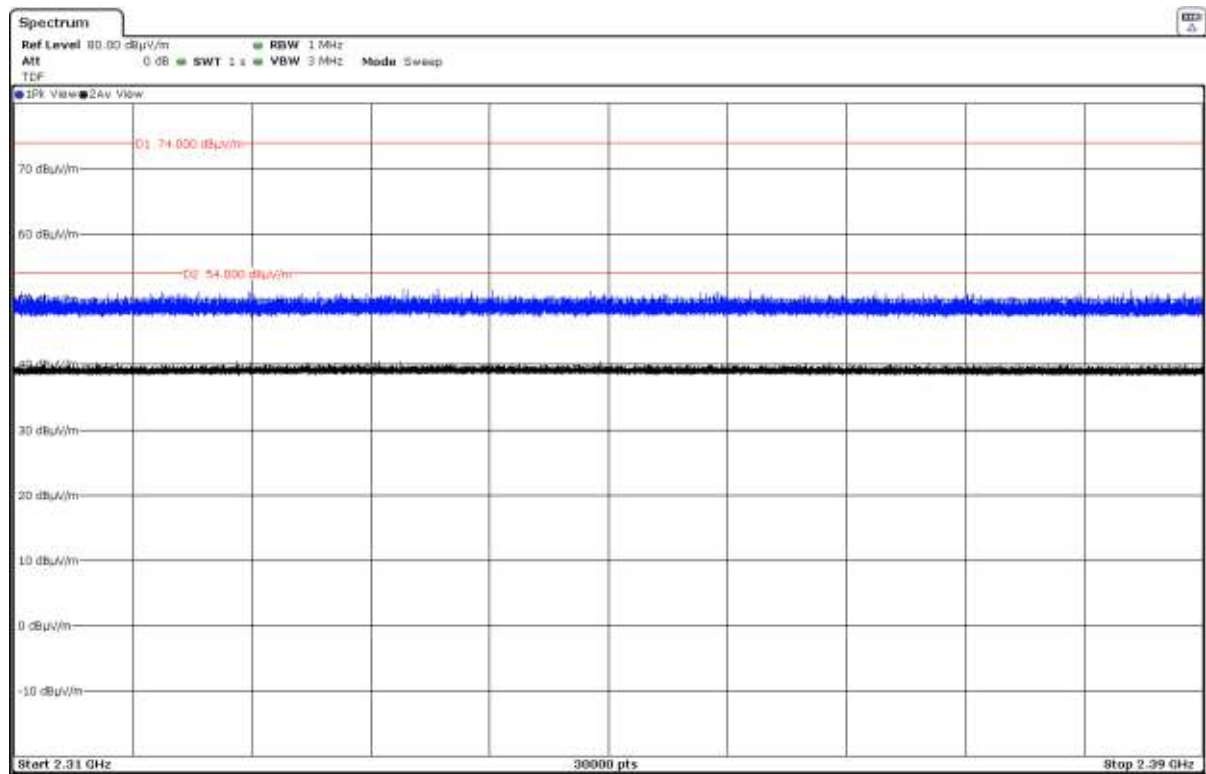
The spurious frequencies detected do not depend on the operating channel.

This plot is valid for the Low. Middle and High Channels.



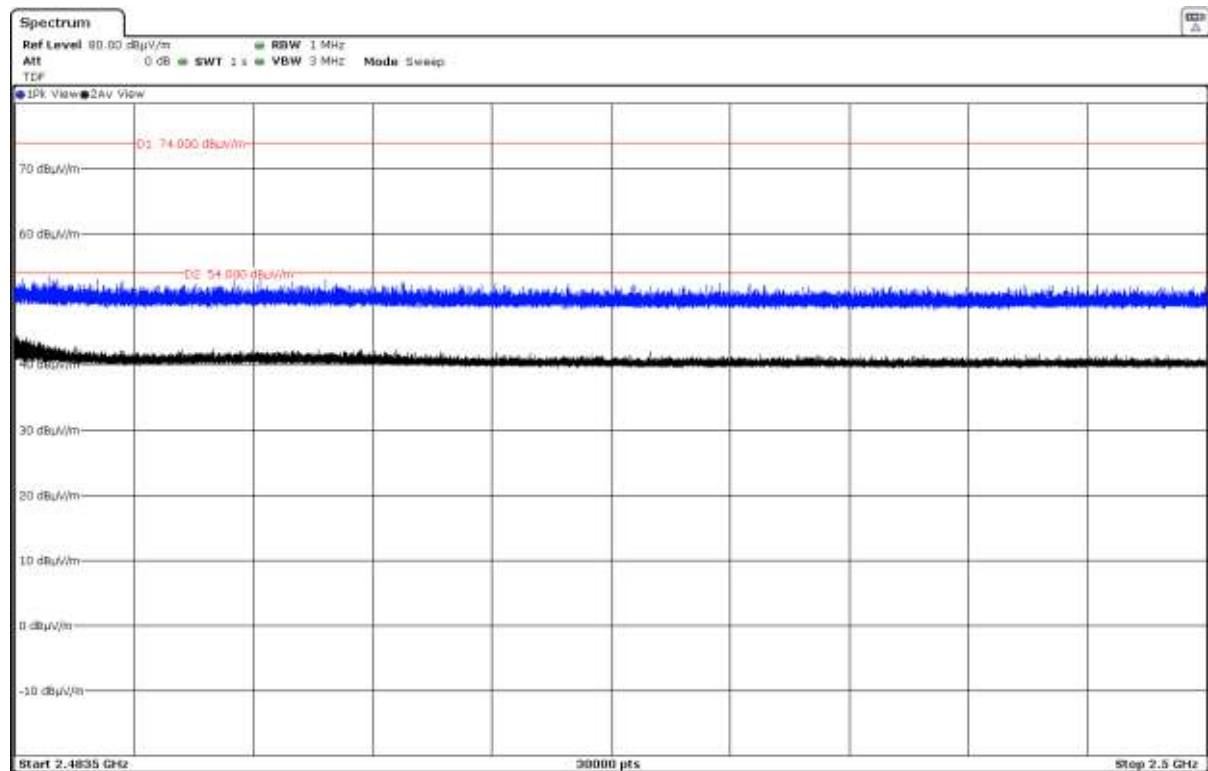
FREQUENCY RANGE 2.31-2.39 GHz:

- Low Channel. CH 1:



FREQUENCY RANGE 2.4835-2.5 GHz:

- High Channel. CH 11:

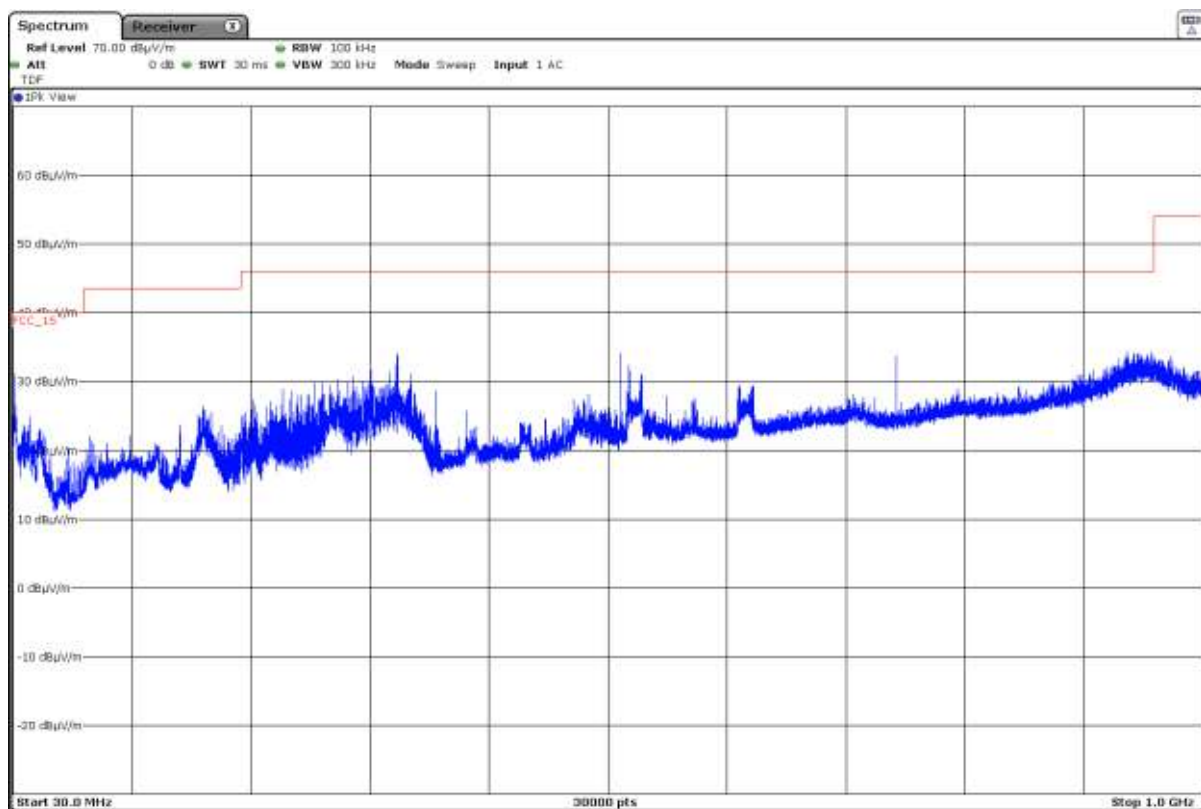


- **Mode 802.11 g (OFDM worst case for spurious emissions)**

FREQUENCY RANGE 30 MHz - 1 GHz:

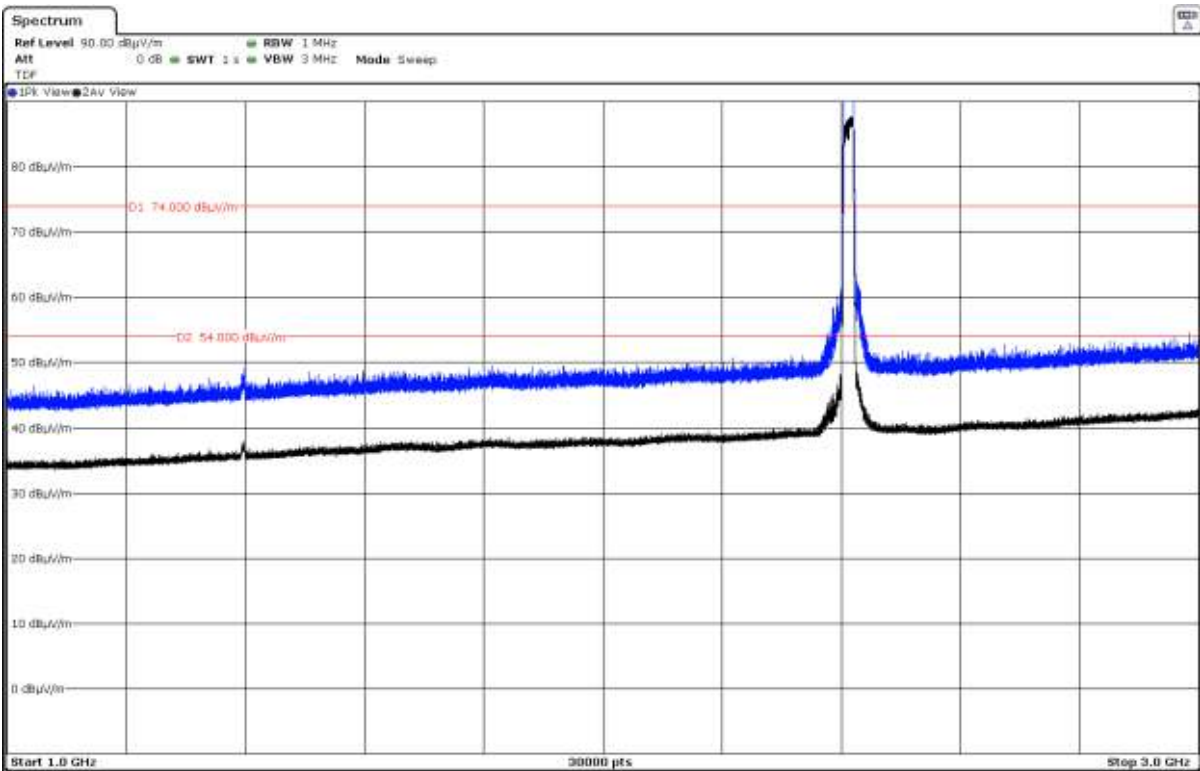
The spurious frequencies detected do not depend on the operating channel.

This plot is valid for the Low. Middle and High Channels.



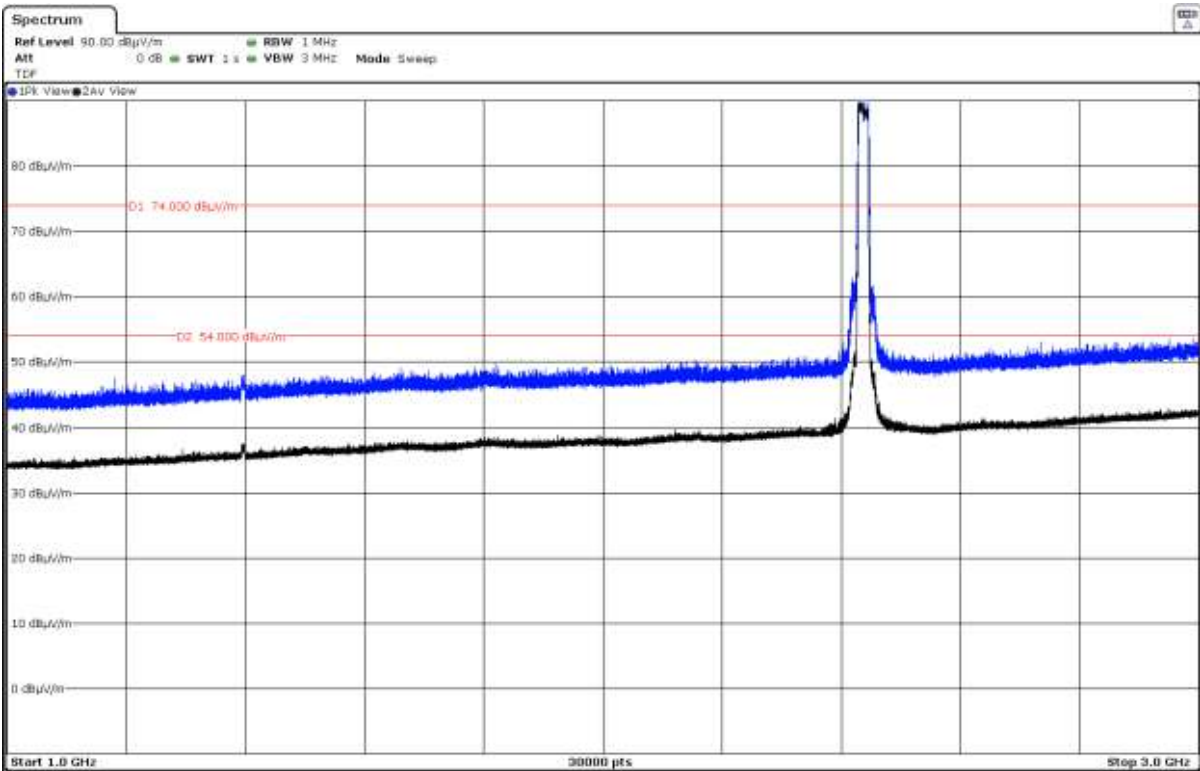
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



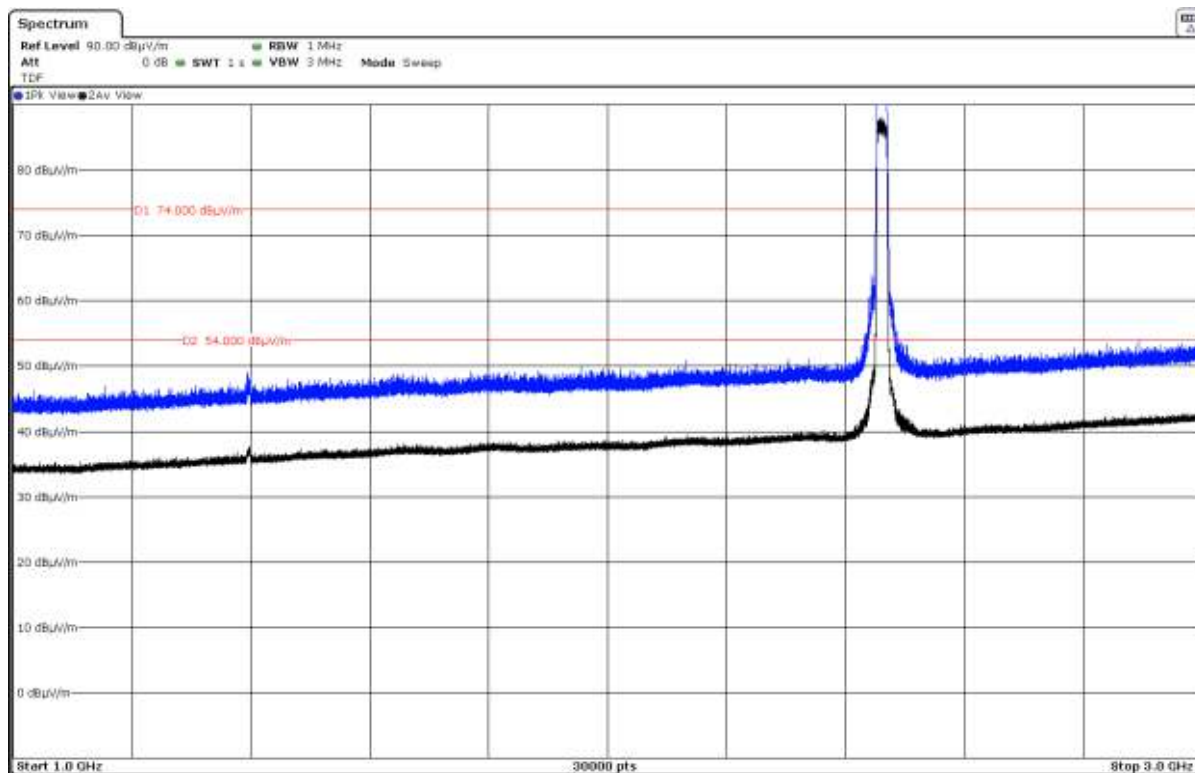
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

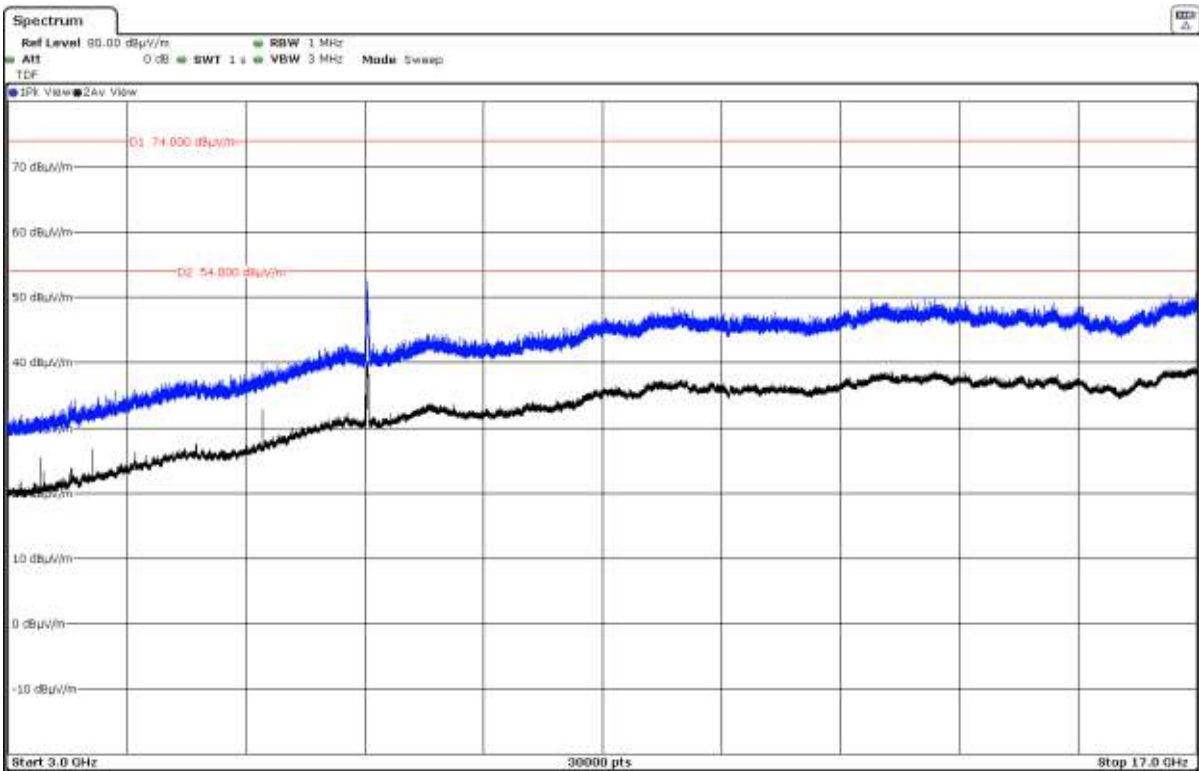
- High Channel:



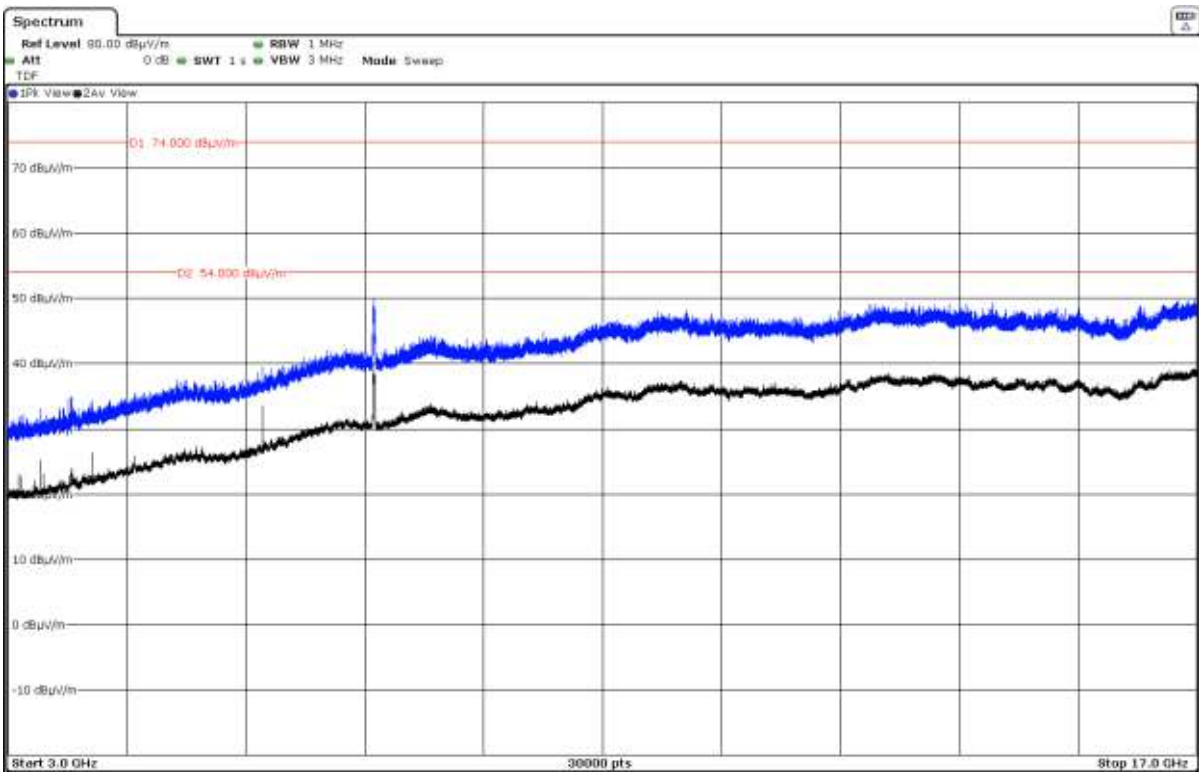
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

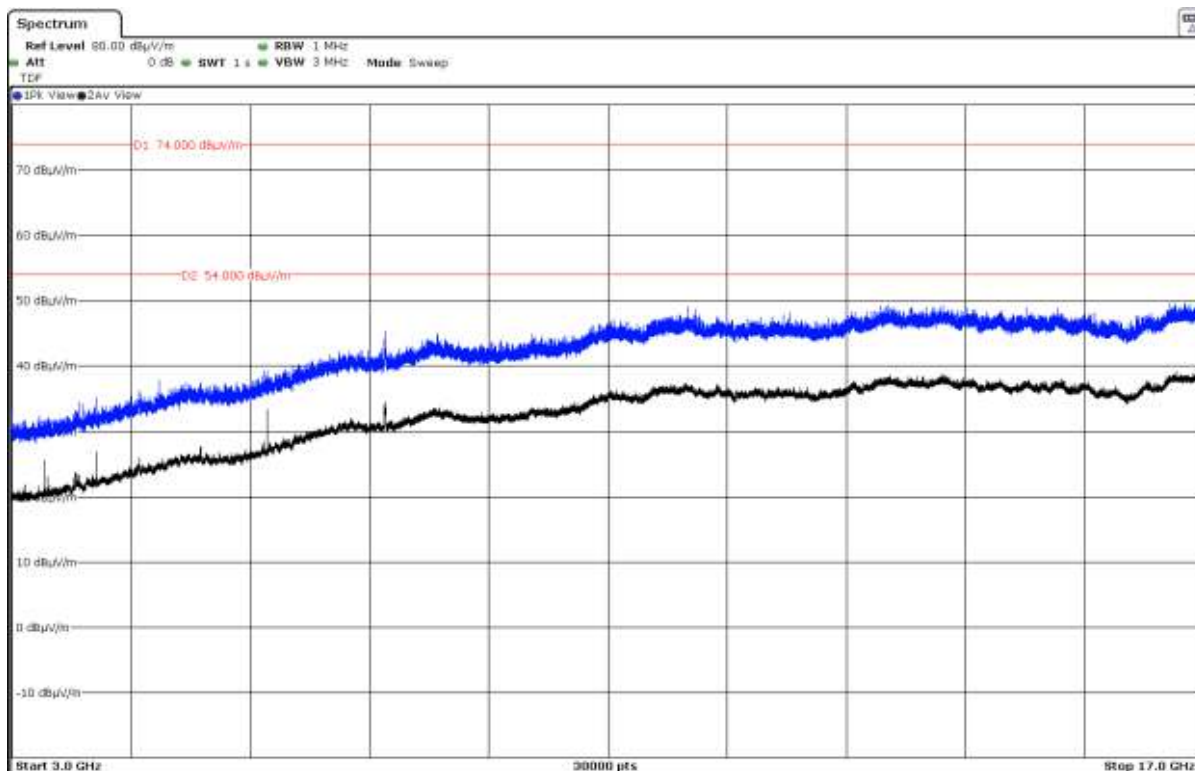
- Low Channel:



- Middle Channel:



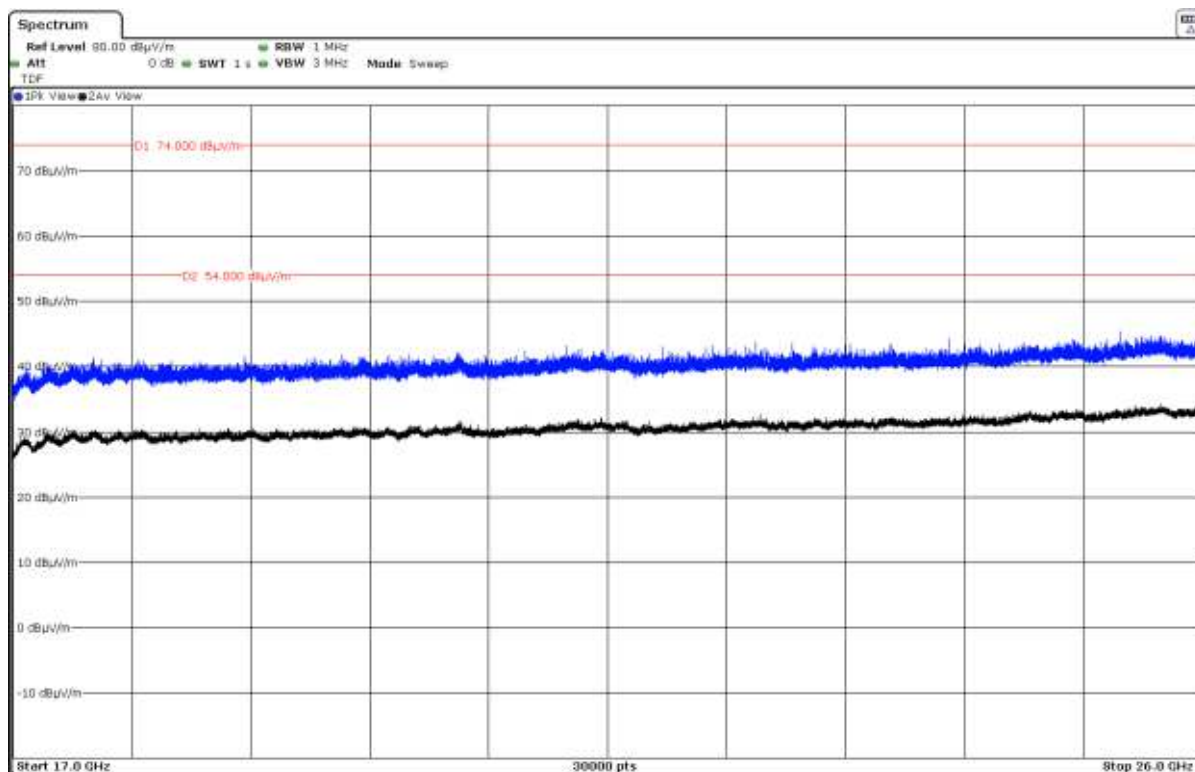
- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

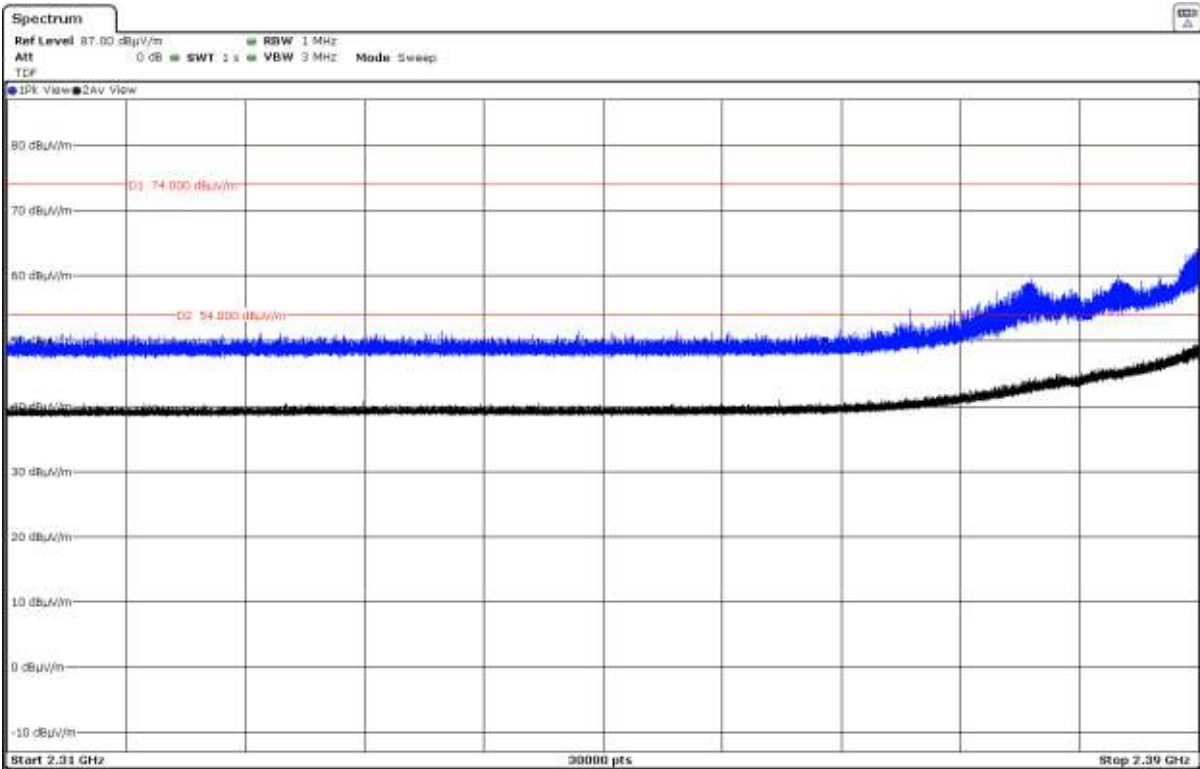
The spurious frequencies detected do not depend on the operating channel.

This plot is valid for the Low, Middle and High Channels.



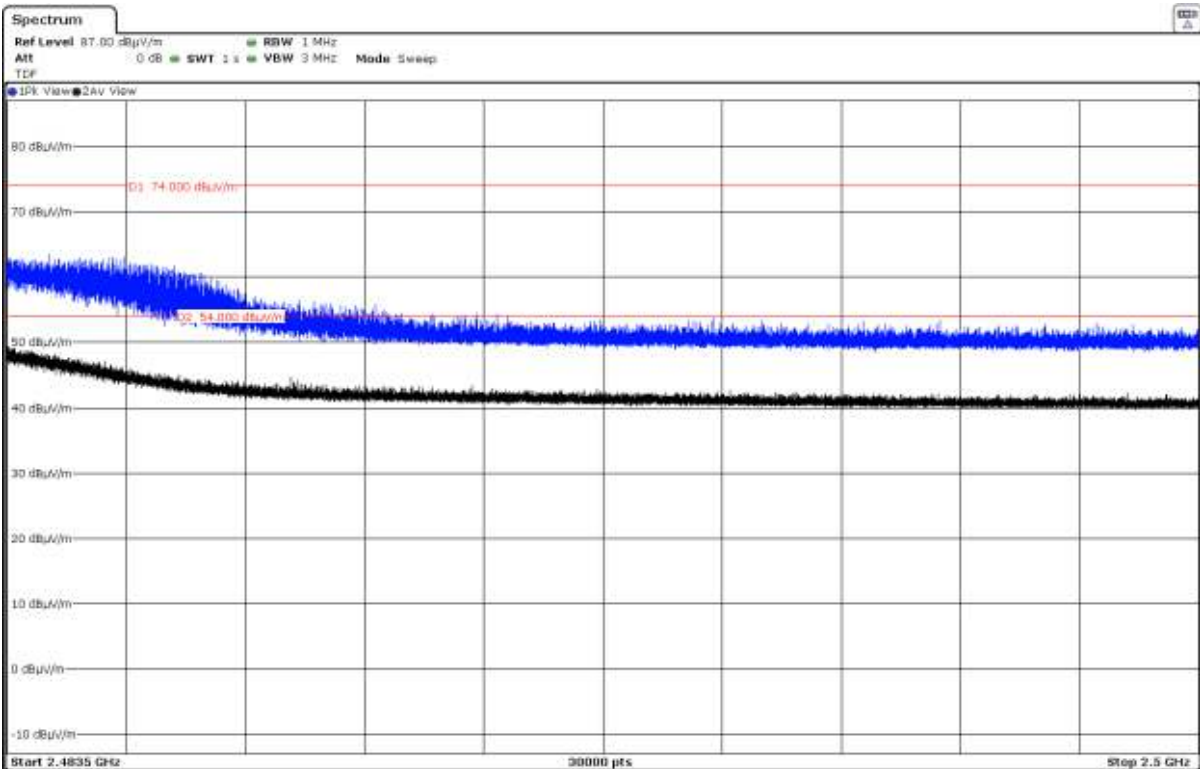
FREQUENCY RANGE 2.31-2.39 GHz

- Low Channel:



FREQUENCY RANGE 2.4835-2.5 GHz:

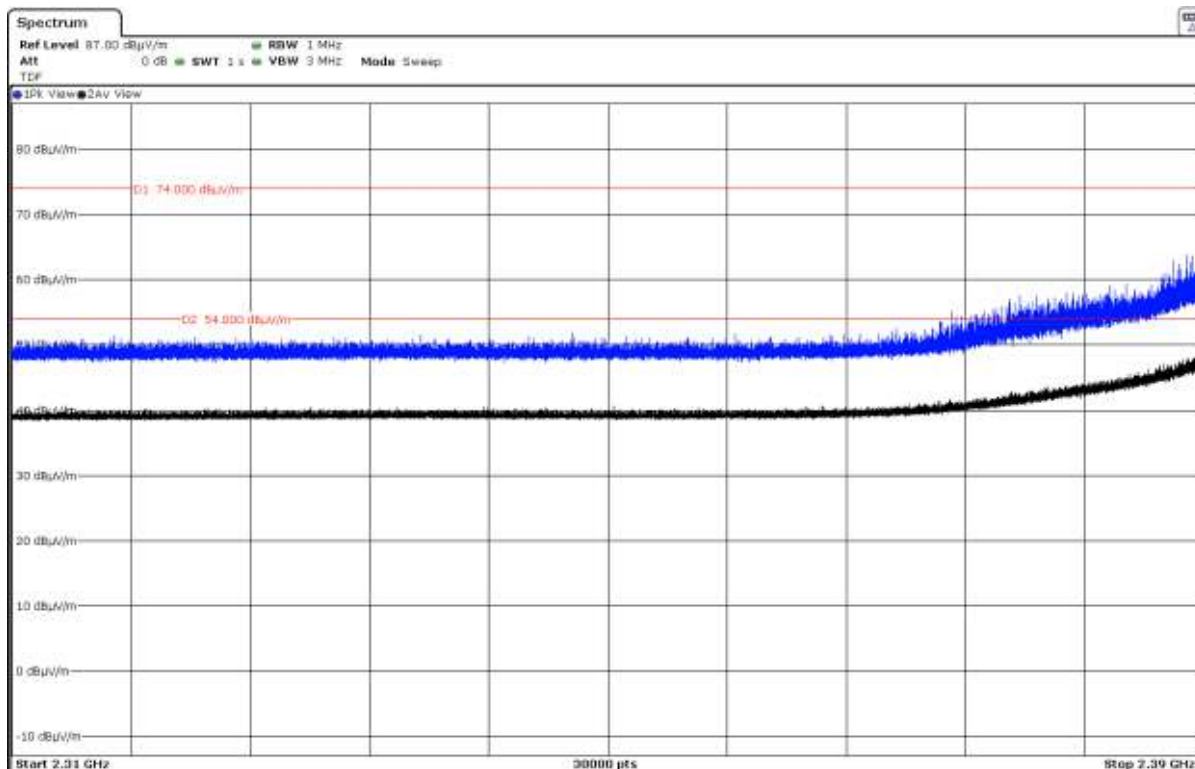
- High Channel:



- **Mode 802.11 n20**

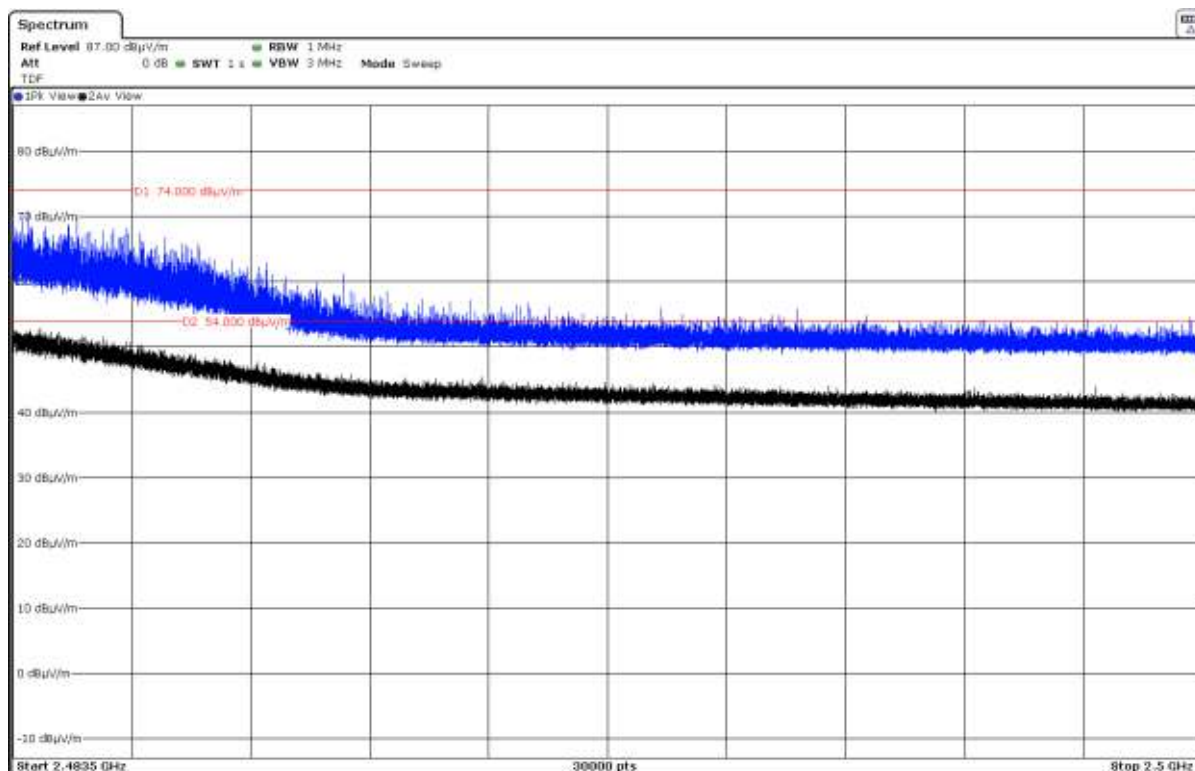
FREQUENCY RANGE 2.31-2.39 GHz:

- Low Channel:



FREQUENCY RANGE 2.4835-2.5 GHz:

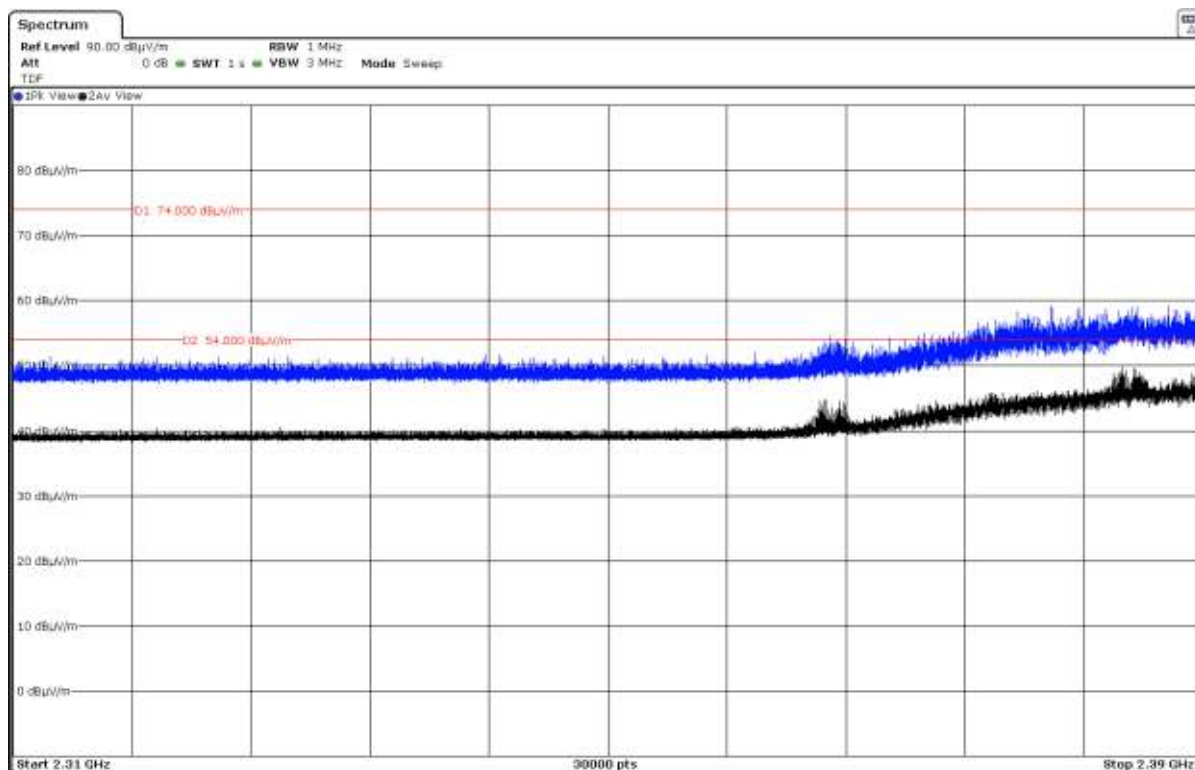
- High Channel:



- **Mode 802.11 n40**

FREQUENCY RANGE 2.31-2.39 GHz:

- Low Channel:



FREQUENCY RANGE 2.4835-2.5 GHz:

- High Channel:

