DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29 507 456

Nº 51/LE147

Test report No:
NIE: 61249RRF.004

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	Multimedia System
(*) Trademark	Continental
(*) Model and /or type reference	NAC EUR 19W2
Other identification of the product	HW version: D2 SW version: 21.08.22.32 FCC ID: ZFW-HW19W2
(*) Features	See on page 3
Applicant	CONTINENTAL AUTOMOTIVE RAMBOUILLET FRANCE S.A.S. 1, rue de Clairefontaine, Rambouillet, 78120, France
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)	Rafael López EMC Consumer & RF Lab. Manager RAFAEL LÓPEZ MARTÍN 2019.10.23 15:04:10 +02'00'
Date of issue	2019-10-23
Report template No	FDT08_22 (*) "Data provided by the client"

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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 NAC EUR 19W2 is Multimedia Systems and OEM products for PSA.

   This product is connected to the BSI (Boitier de Servitude Intelligent) via a CAN Low Speed BUS. Two displays can be connected.
3. Features:
   - BT 3.0
   - WiFi b,g,n, 2.4 GHz only
   - Radio (AM, FM, DAB band III & L)

- Navigation (GPS, GLONASS, GALILEO, SBAS)
- External GMSL colour display, CAN interface to car, Internal Audio Amplifier, USB plug

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 Nº	Description	Model	Serial Nº	Date of reception
61249D/003	Multimedia System	NAC EUR 19W2	W2_BS1922000007 3_TOP_RF_RE	2019/07/23
61249D/034	CAN Traffic Simulator (C6)	--	00010	2019/07/23
61249D/039	CSR Interface SDIO card	--	00015	2019/07/23
61249D/043	Ultra Light Harness – FAKRA Block Connector	--	00019	2019/07/23

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

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

Control Nº	Description	Model	Serial Nº	Date of reception
61249D/002	Multimedia System	NAC EUR 19W2	W2_BS1922000007 3_TOP_RF_RE	2019/07/23
61249D/034	CAN Traffic Simulator (C6)	--	00010	2019/07/23
61249D/039	CSR Interface SDIO card	--	00015	2019/07/23
61249D/043	Ultra Light Harness – FAKRA Block Connector	--	00019	2019/07/23

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

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	Power Supply (EMC; Safety & RF cables)	2	☐	☐	☐
	CAN LS (EMC; Safety & RF cables)	2	☐	☐	☐
	Loudspeakers (EMC & Safety cables)	2	☐	☐	☐
	Video Input (EMC & Safety cables)	2	☐	☐	☐
	CD Power (EMC & Safety cables)	2	☐	☐	☐
	CD Audio In (EMC & Safety cables)	2	☐	☐	☐
	Line Out Subwoofer (EMC & Safety cables)	2	☐	☐	☐
	Line Out Central (EMC & Safety cables)	2	☐	☐	☐
	AUX In Stereo (EMC & Safety cables)	2	☐	☐	☐
	Microphone 1 (EMC & Safety cables)	2	☐	☐	☐

	Microphone 2 (EMC & Safety cables)	2	☐	☐	☐

Supplementary information to the ports……..:	2 Harness configurations 1st configuration is complete and used for the EMC & Safety tests 2nd configuration is lighter and used for the RF tests (Power + CAN LS)

Rated power supply .....:

Voltage and Frequency		Reference poles				
		L1	L2	L3	N	PE
☐	AC:	☐	☐	☐	☐	☐
☐	AC:	☐	☐	☐	☐	☐
☒	DC: 12 V					
☐	DC:					

Rated Power .....:	12 V – 15 A => 180 W
Clock frequencies .....:	Max. Frequency = Bluetooth F_{max} 2.4835 GHz
Other parameters.....:	FCC ID: ZFW-HW19W2
Software version .....:	21.08.22.32
Hardware version.....:	D2
Dimensions in cm (W x H x D)....:	22 x 5.2 x 16

Mounting position.....:

☐	Table top equipment
☐	Wall/Ceiling mounted equipment
☐	Floor standing equipment
☐	Hand-held equipment
☒	Other: Car Dashboard Equipment

Modules/parts .....:

Module/parts of test item	Type	Manufacturer

Accessories (not part of the test	Description	Type	Manufacturer

item) .....:	GPS Antenna	Antenna GPS7 M-Fakra Femelle	HIRSCHMANN
	AM/FM/DAB antenna	RDA 015-1450 RD/S	HIRSCHMANN
	CAN SIM Box	C6	RIEDERER ELEKTRONIK
Documents as provided by the applicant.....:	Description	File name	Issue date
	Technical Specifications	HW2019_BT.pdf	
	Technical Specifications	HW2019_WiFi.pdf	

Identification of the client

CONTINENTAL AUTOMOTIVE RAMBOUILLET FRANCE S.A.S.
1, rue de Clairefontaine 78120 Rambouillet France

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-07-29
Date (finish)	2019-09-06

Document history

Report number	Date	Description
61249RRF.004	2019-10-23	First release

Environmental conditions

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

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

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

Temperature	Min. = 15 ºC Max. = 35 ºC
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 ºC Max. = 35 ºC
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: Miguel Ángel Torres, Ignacio Cabra, José Gabriel Pendón.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Bluetooth Test Set ANRITSU MT8852B	N.A.	N.A.
3.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
4.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
5.	DC power supply R&S NGPE 40/40	2018/02	2021/02
6.	Wideband Power Sensor ROHDE AND SCHWARZ Z-81	2017/06	2019/06

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	RF Pre-amplifier 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
4.	Biconical/Log Antenna ETS LINDGREN 3142E	2017/09	2020/09
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
6.	RF Pre-amplifier 30 dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK 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

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 conducted (Transmitter)	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: None.			

2. Wi-Fi 2.4 GHz (802.11 b/g/n20 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	Emission limitations conducted (Transmitter)	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	
Supplementary information and remarks: None.			

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

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TEST CONDITIONS

POWER SUPPLY (V):

V nonimal: 12 Vdc

Type of Power Supply: External power supply (car battery).

Type of Antenna: Internal (printed).

Maximum Declared Antenna Gain: -0.99 dBi.

TEST FREQUENCIES:

Low Channel: 2402 MHz

Middle Channel: 2441 MHz

High Channel: 2480 MHz

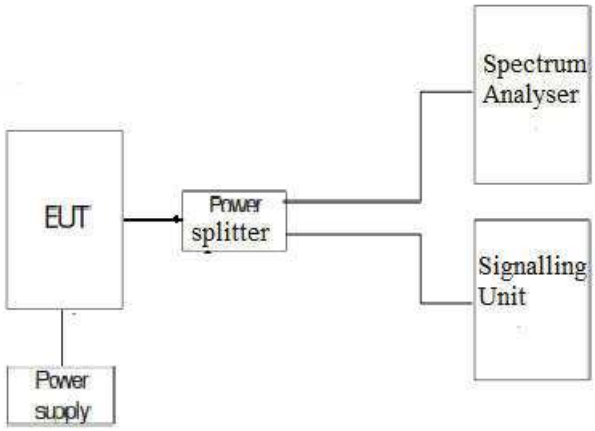
CONDUCTED MEASUREMENTS:

Hopping mode OFF:

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.

Hopping mode ON:

The equipment under test was set up in a shielded room and it is connected to a Bluetooth signalling unit (Bluetooth test set) and to the spectrum analyzer using a 6 dB power splitter. The reading in the spectrum analyzer is corrected taking into account the power splitter loss.



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

RADIATED MEASUREMENTS:

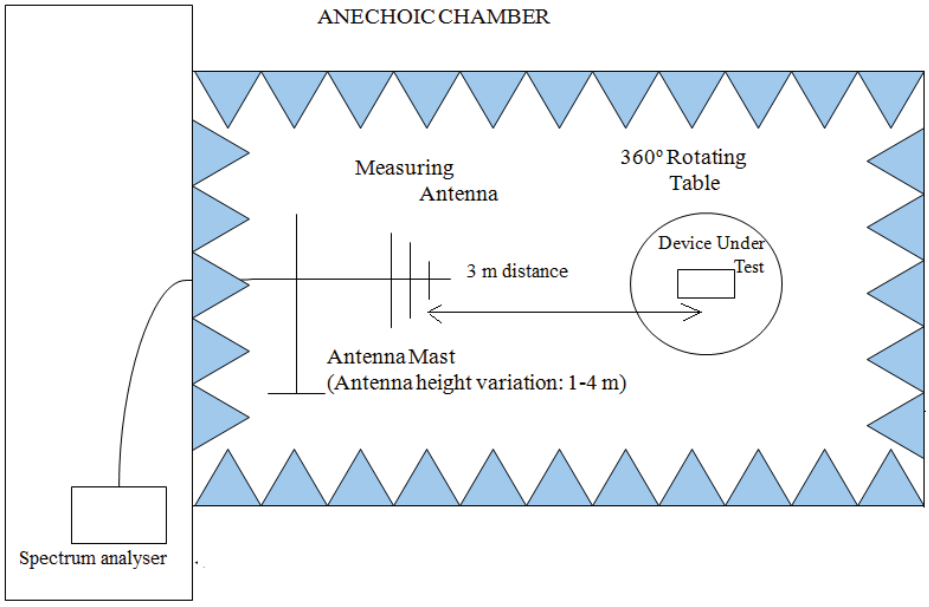
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

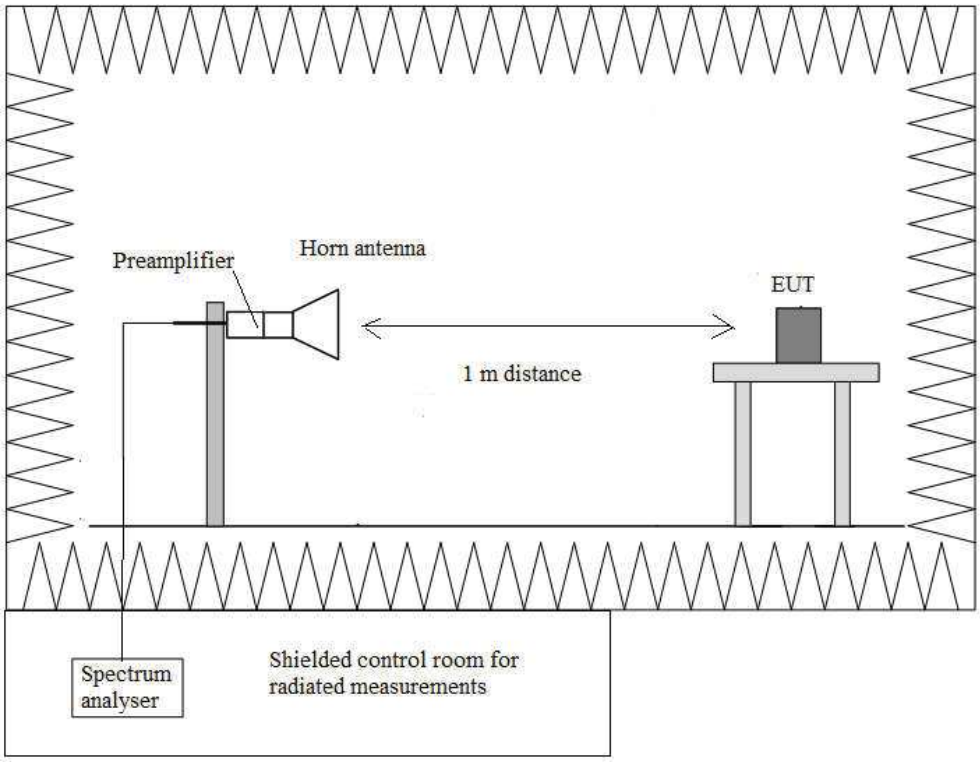
Measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup from 30 MHz to 1 GHz:



Shielded Control Room For Radiated Measurements

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)	959.59	962.35	959.36
99% Bandwidth (kHz)	863.15	867.70	865.12
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)	1291.00	1283.00	1285.00
99% Bandwidth (kHz)	1178.40	1179.20	1175.40
Measurement uncertainty (kHz)	<±5.0		

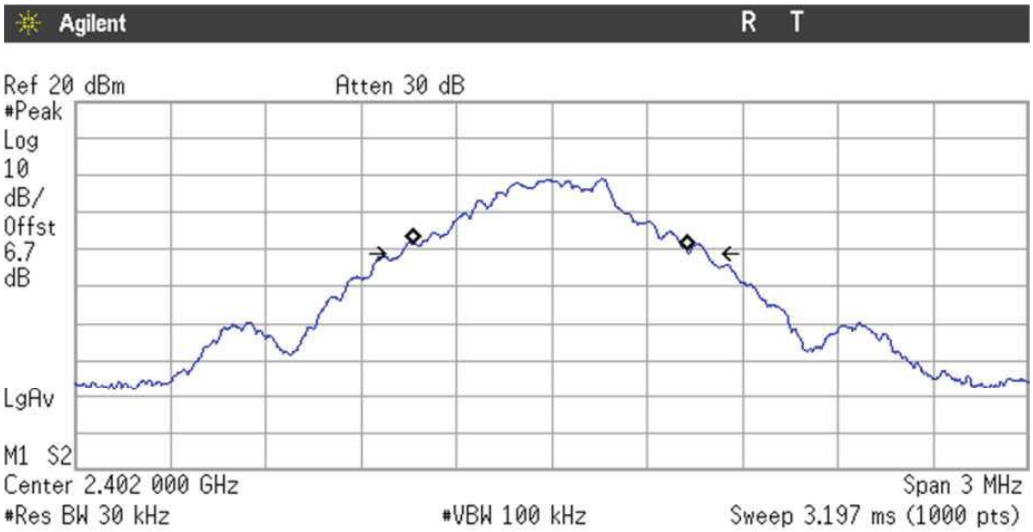
- **8DPSK**

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
20 dB Spectrum Bandwidth (kHz)	1305.00	1299.00	1297.00
99% Bandwidth (kHz)	1187.60	1184.60	1179.70
Measurement uncertainty (kHz)	<±5.0		

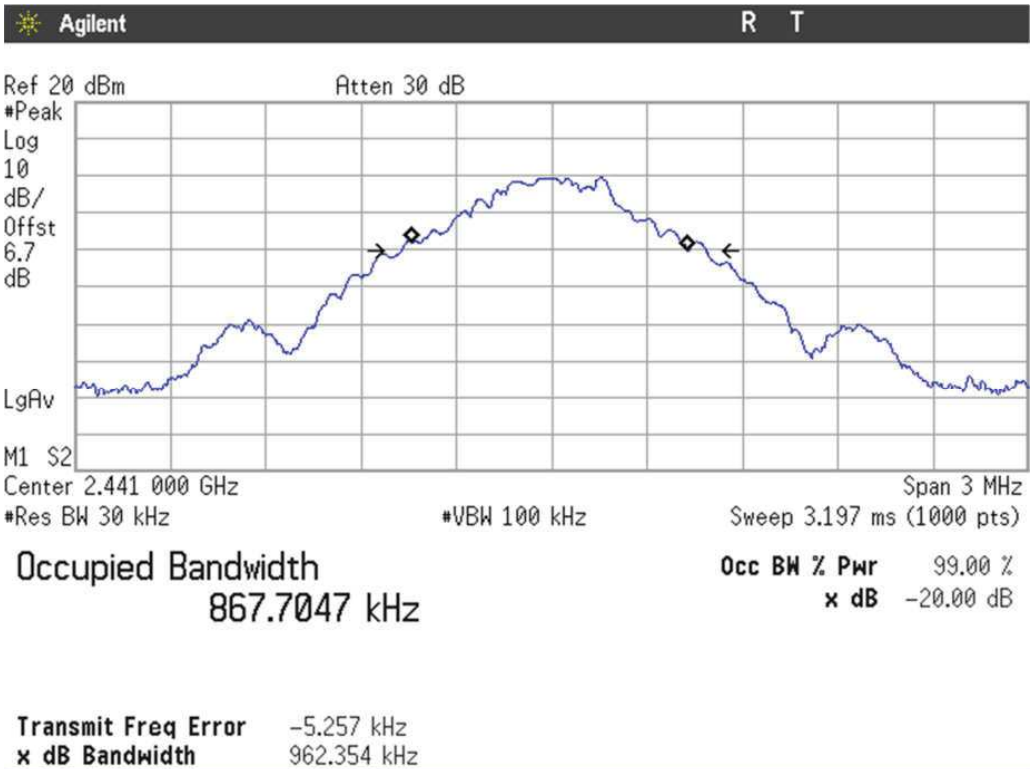
Verdict: PASS

- **GFSK – Bandwidths**

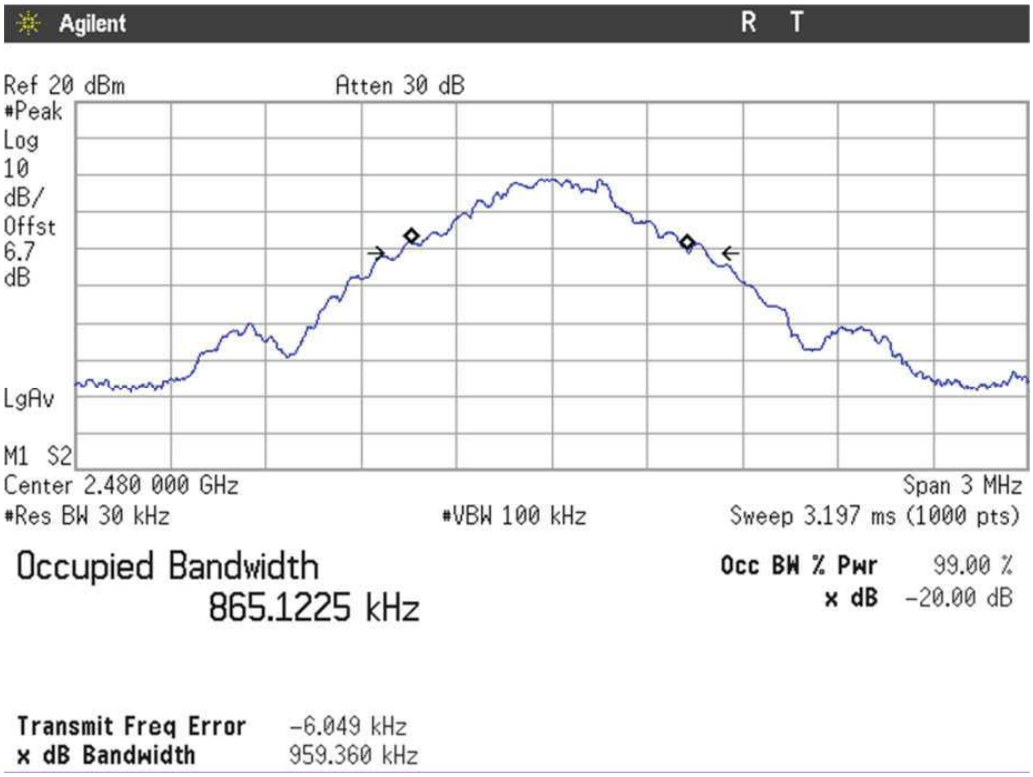
- Low Channel:



- Middle Channel:

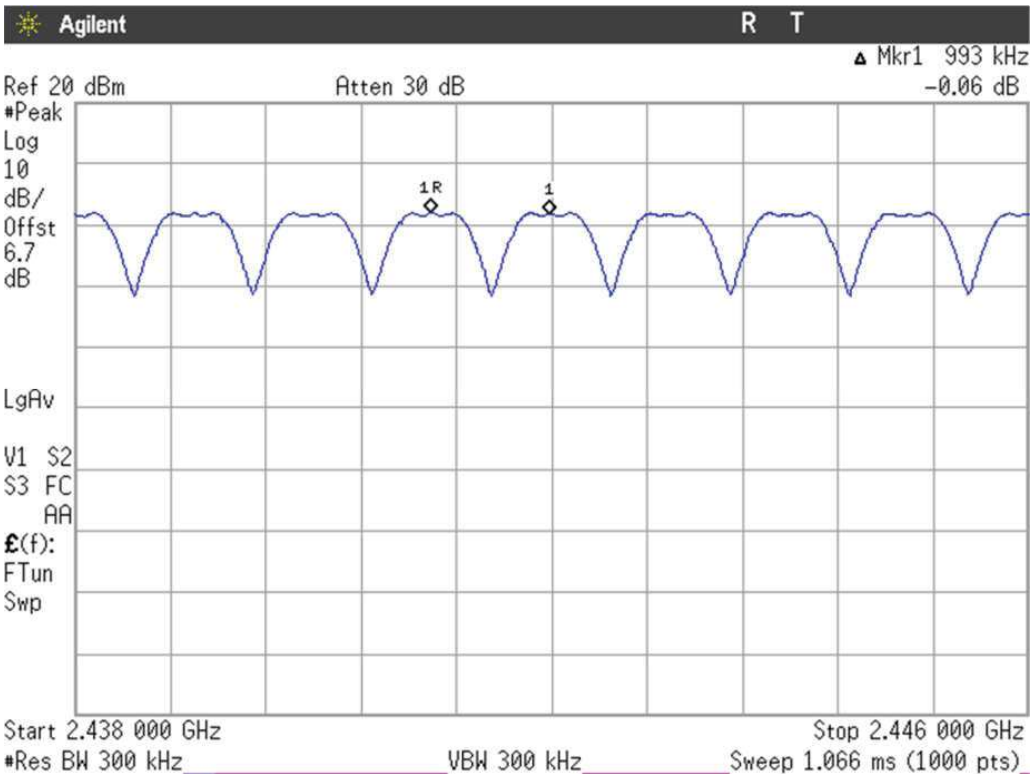


- High Channel:



Carrier frequency separation - GFSK

Carrier frequency separation: 993 kHz

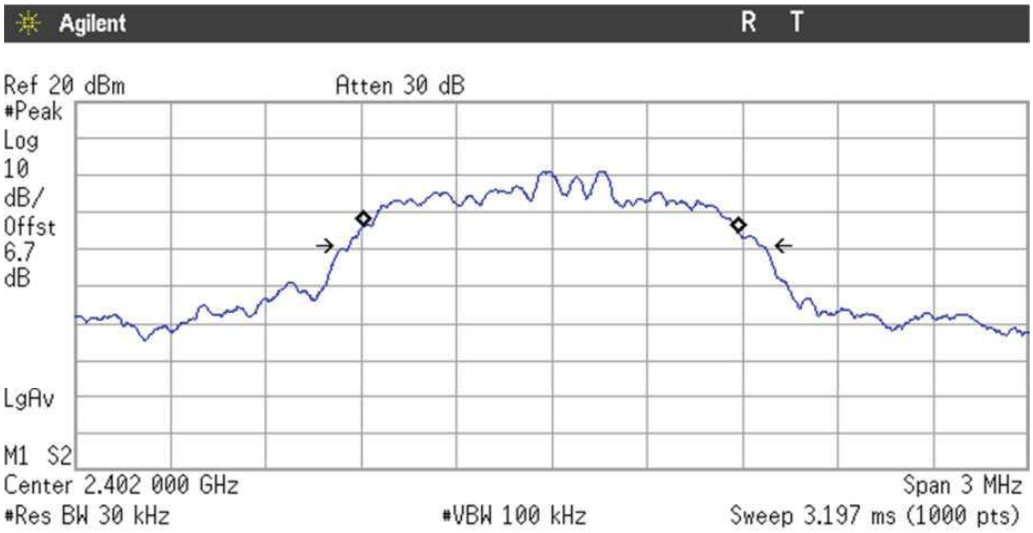


The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

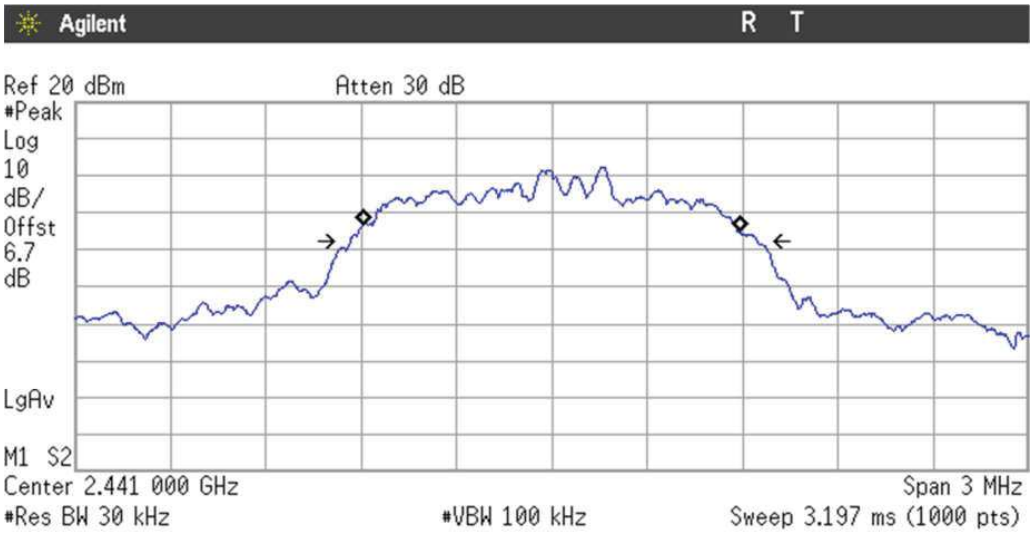
Verdict: PASS

- **Pi/4 DQPSK – Bandwidths**

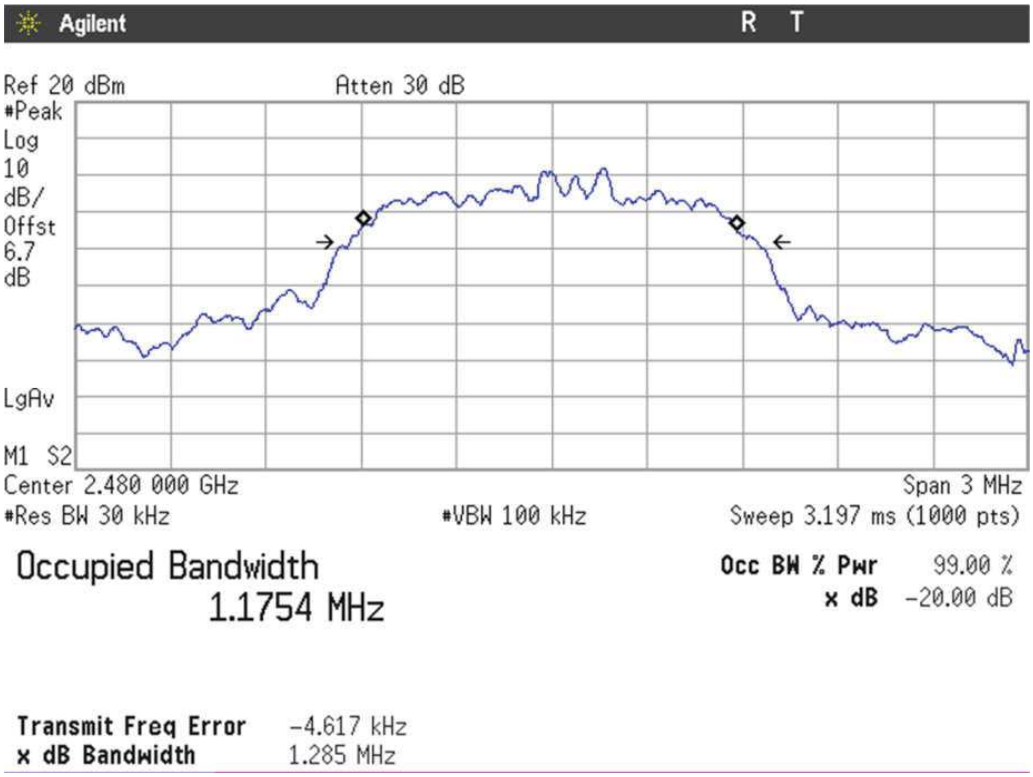
- Low Channel:



- Middle Channel:

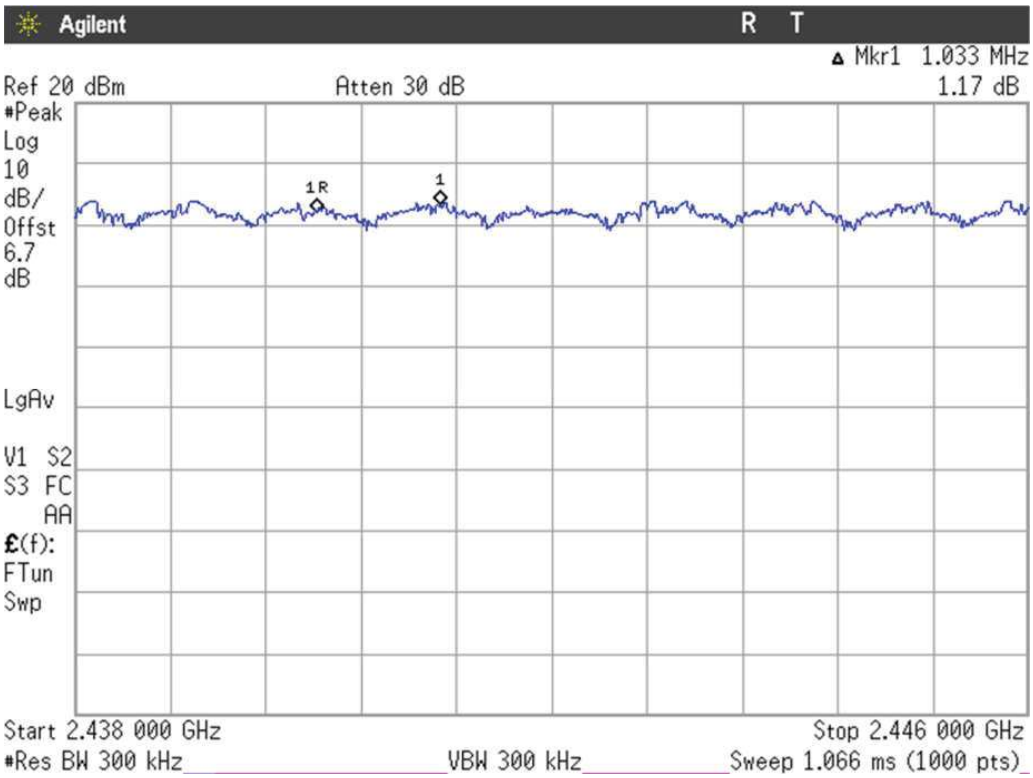


- High Channel:



Carrier frequency separation - Pi/4 DQPSK

Carrier frequency separation: 1033 kHz

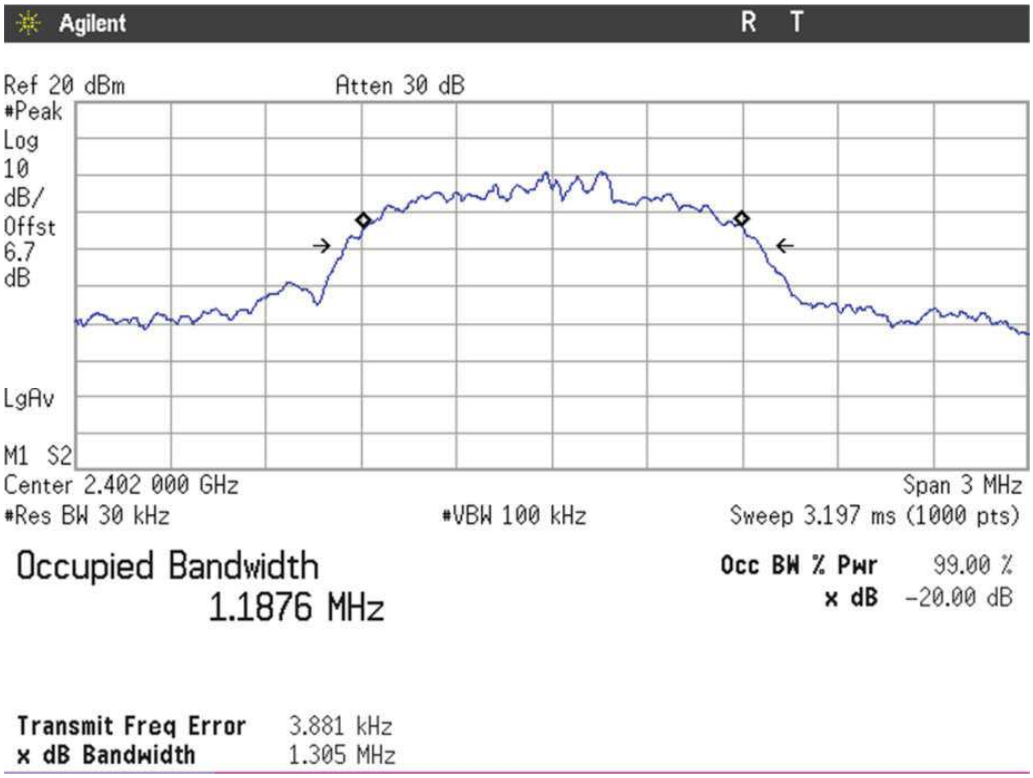


The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

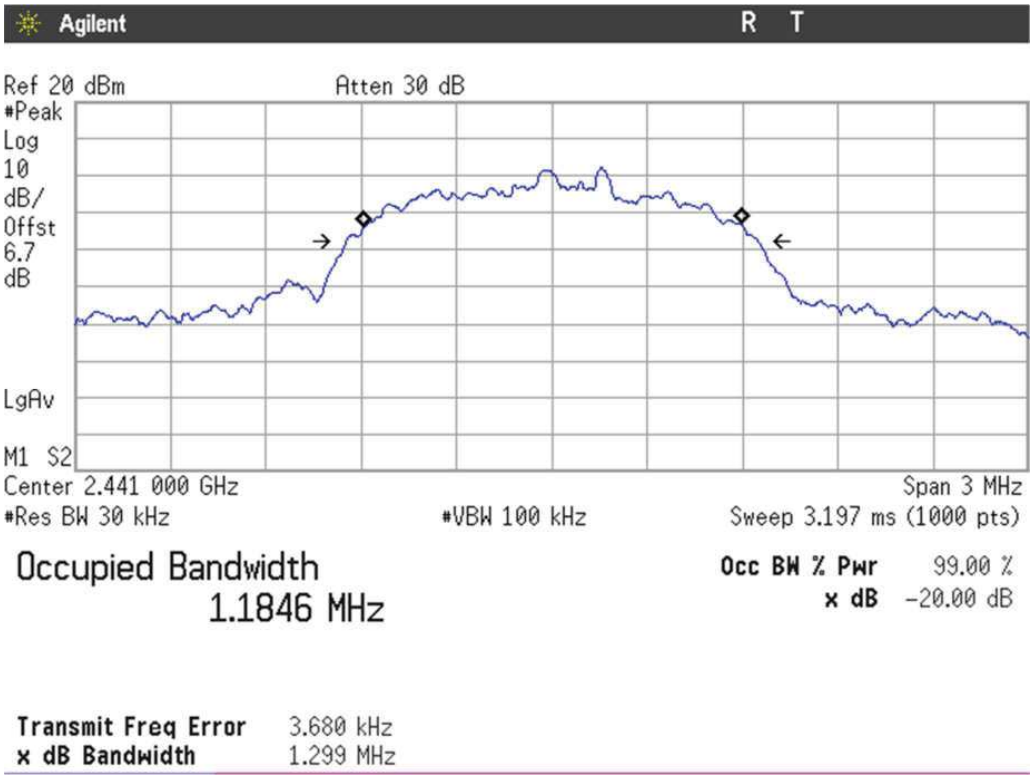
Verdict: PASS

- **8DPSK – Bandwidths**

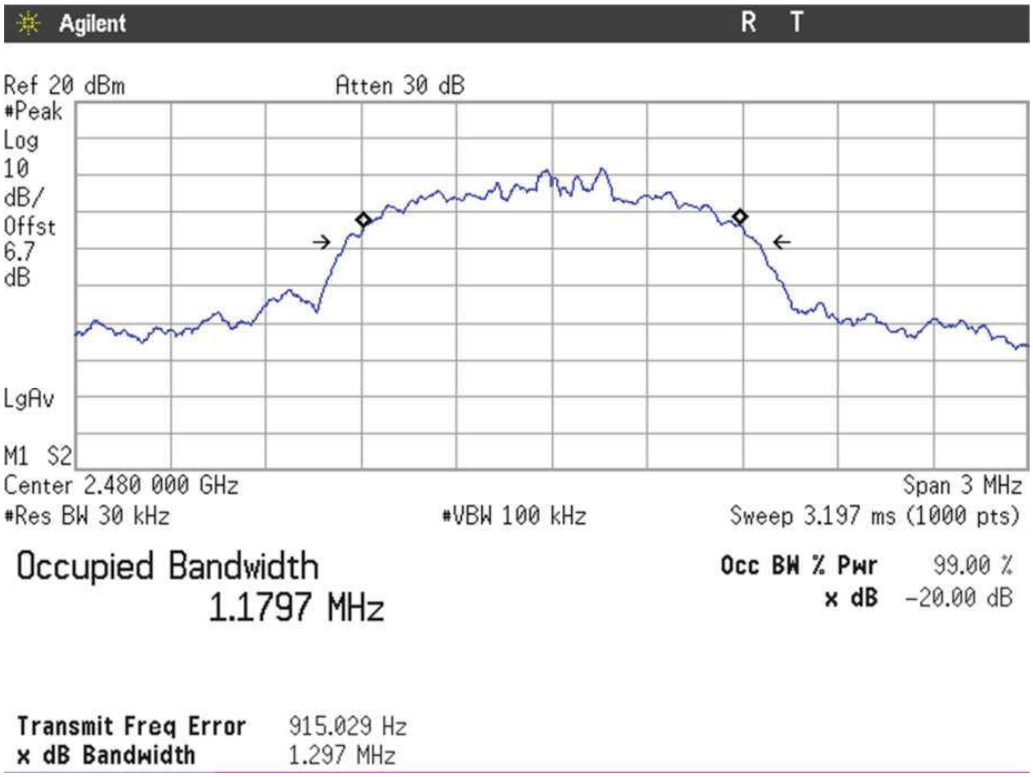
- Low Channel:



- Middle Channel:

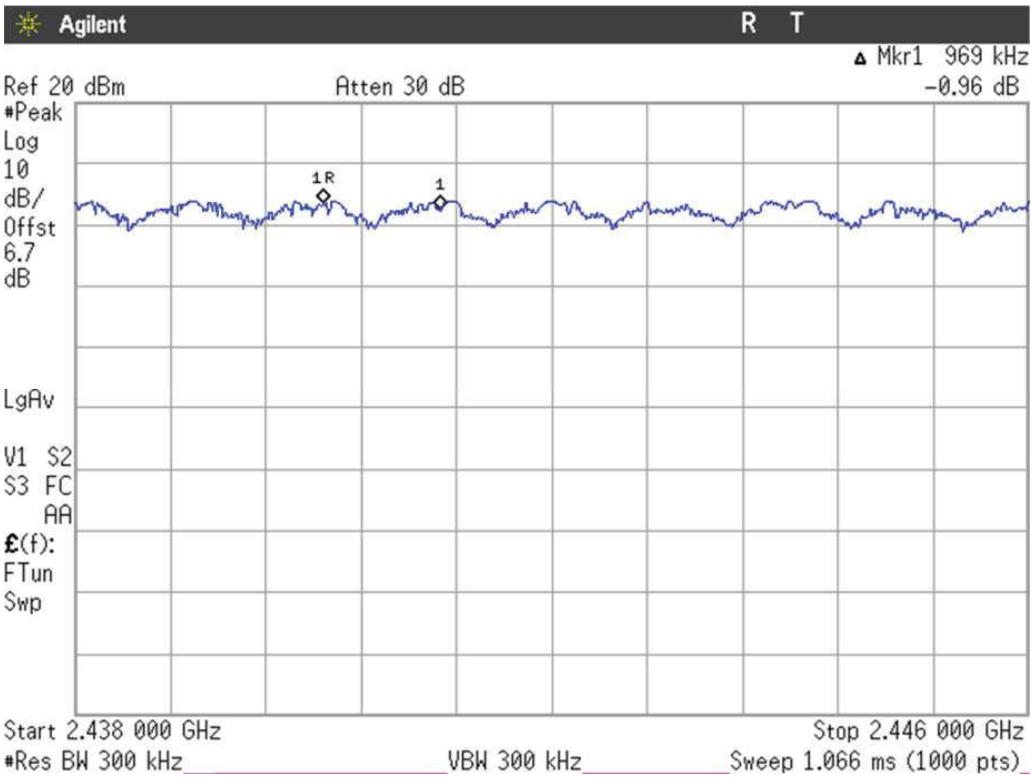


- High Channel:



Carrier frequency separation - 8DPSK

Carrier frequency separation: 969 kHz



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.

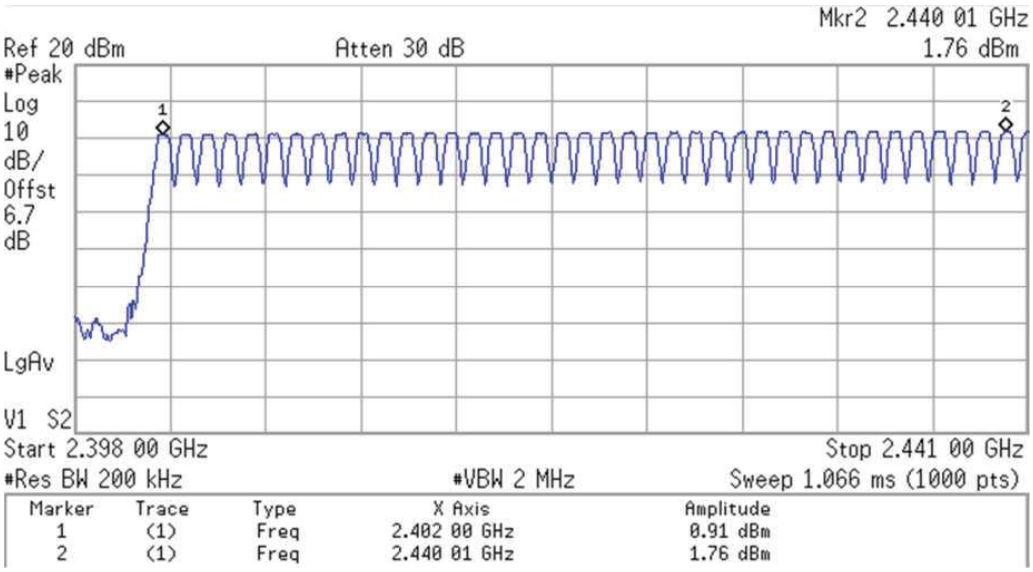
SPECIFICATION:

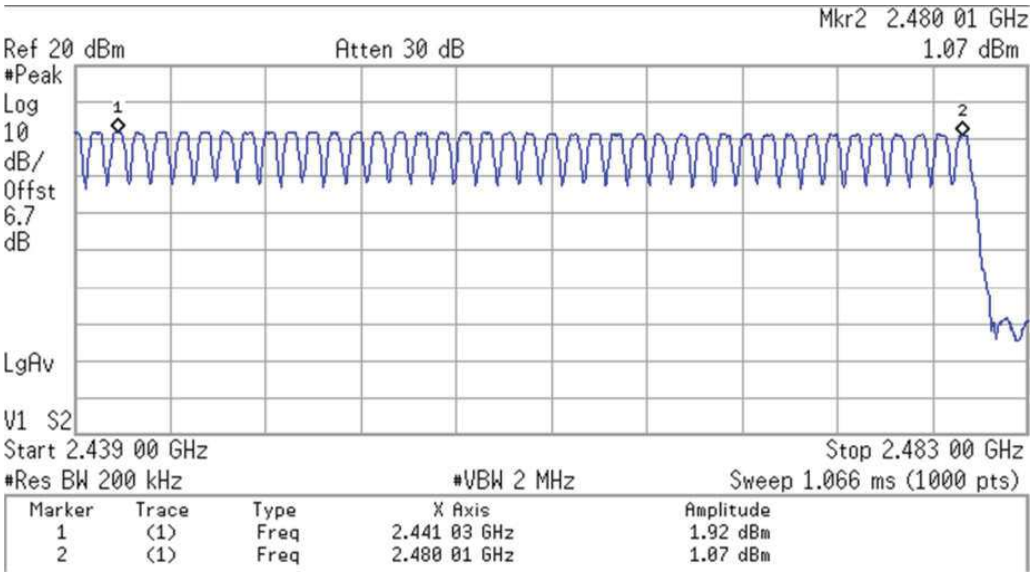
Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 channels.

RESULTS:

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

- **GFSK – Number of hopping channels**

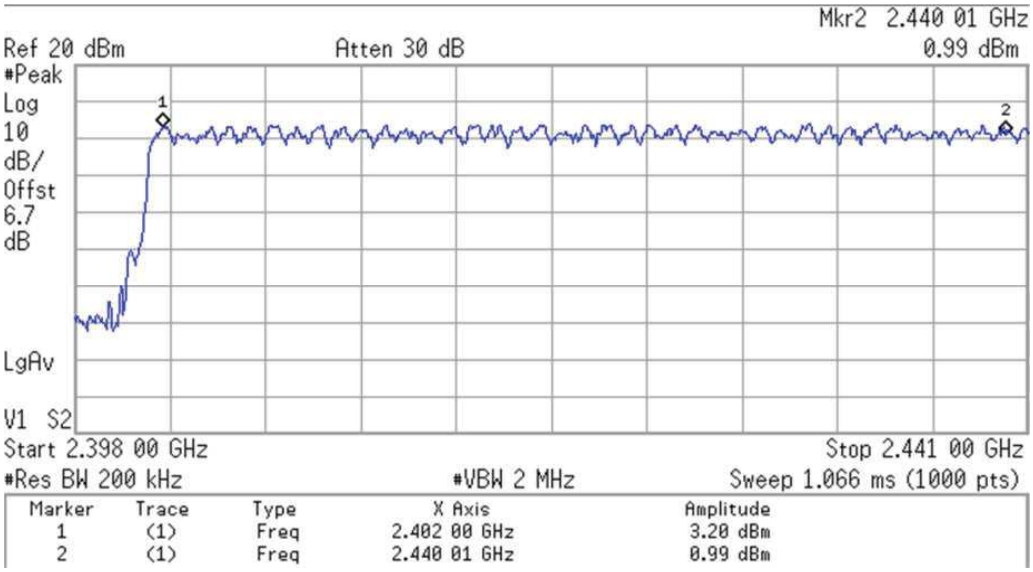


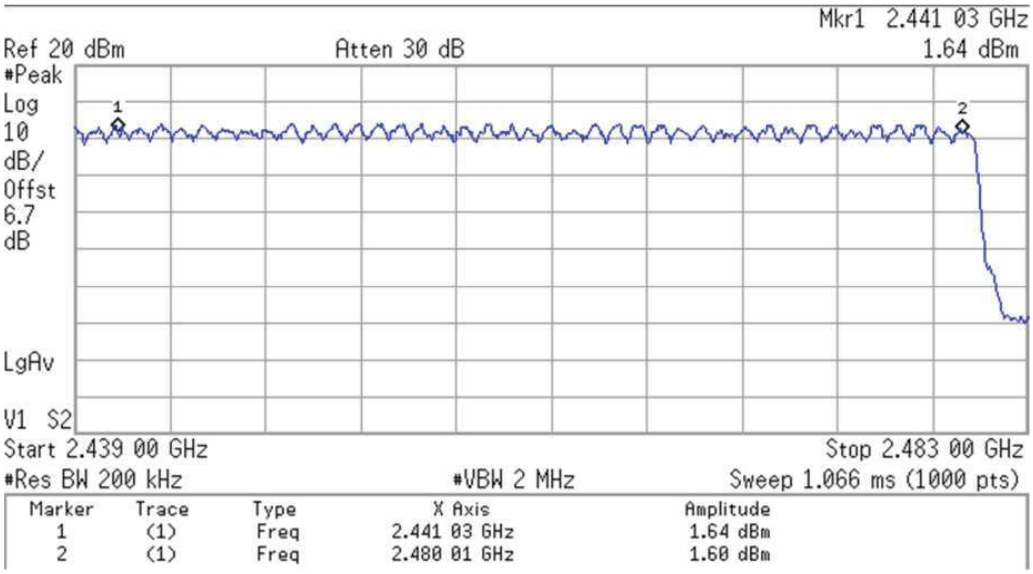


Total number of hopping channels 79

Verdict: PASS

- **Pi/4 DQPSK – Number of hopping channels**

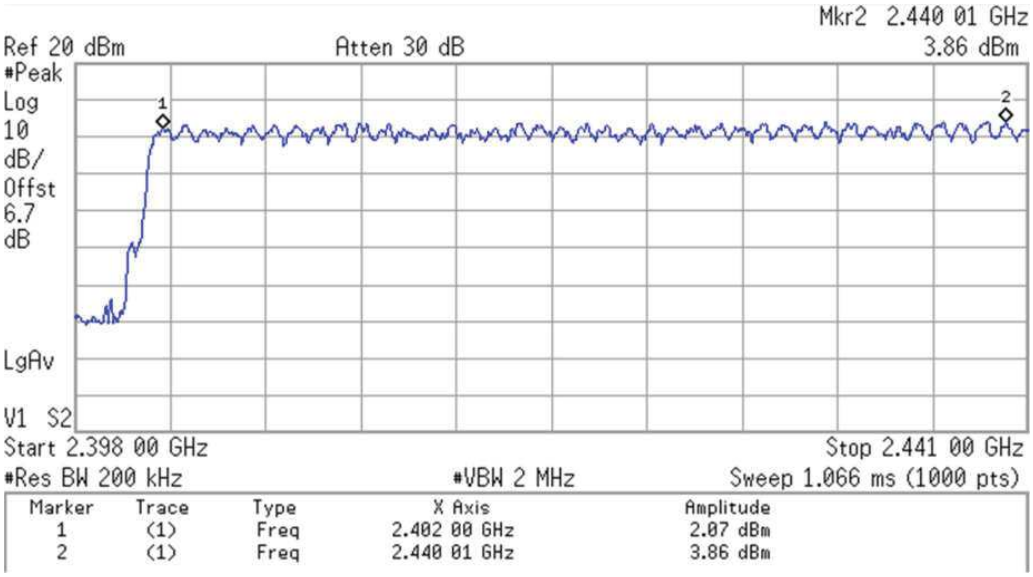


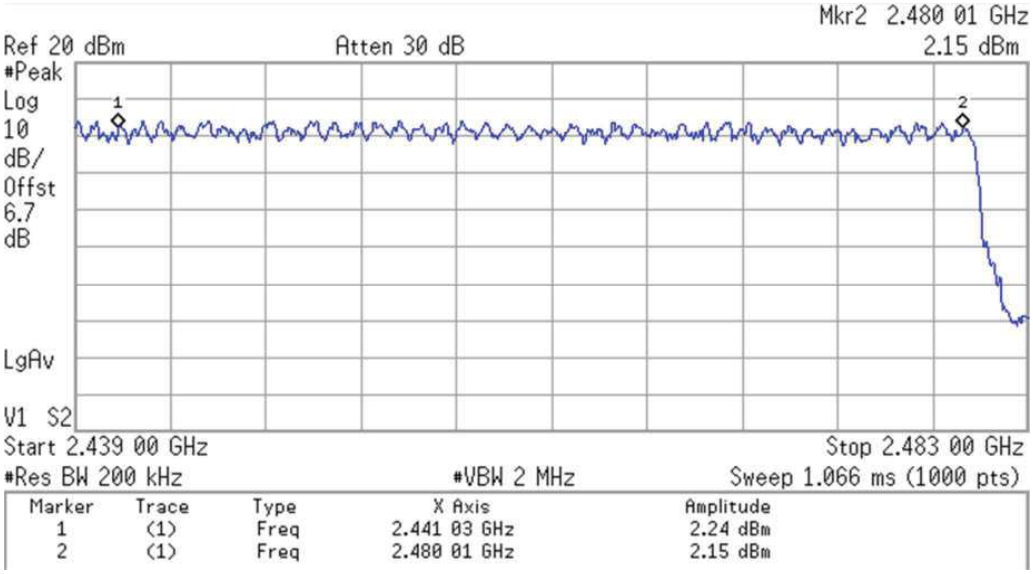


Total number of hopping channels 79

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:

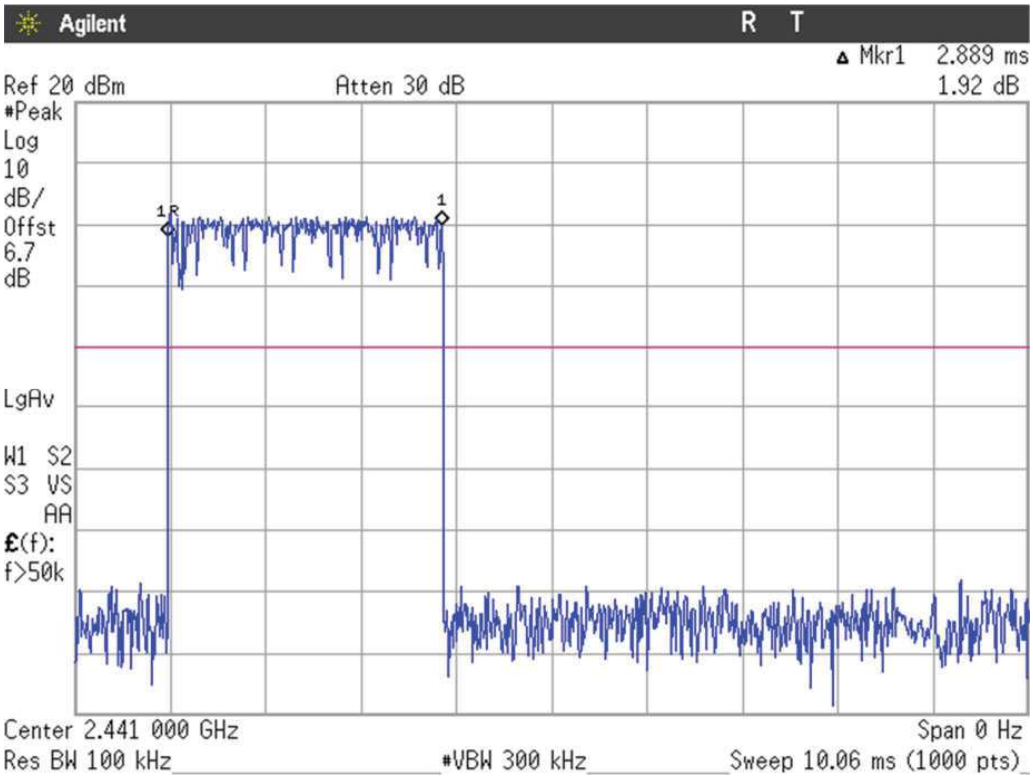
The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = 0.4 x 79= 31.6 seconds.

RESULTS:

- **GFSK (packet type DH5) – Time of Occupancy (Dwell Time)**

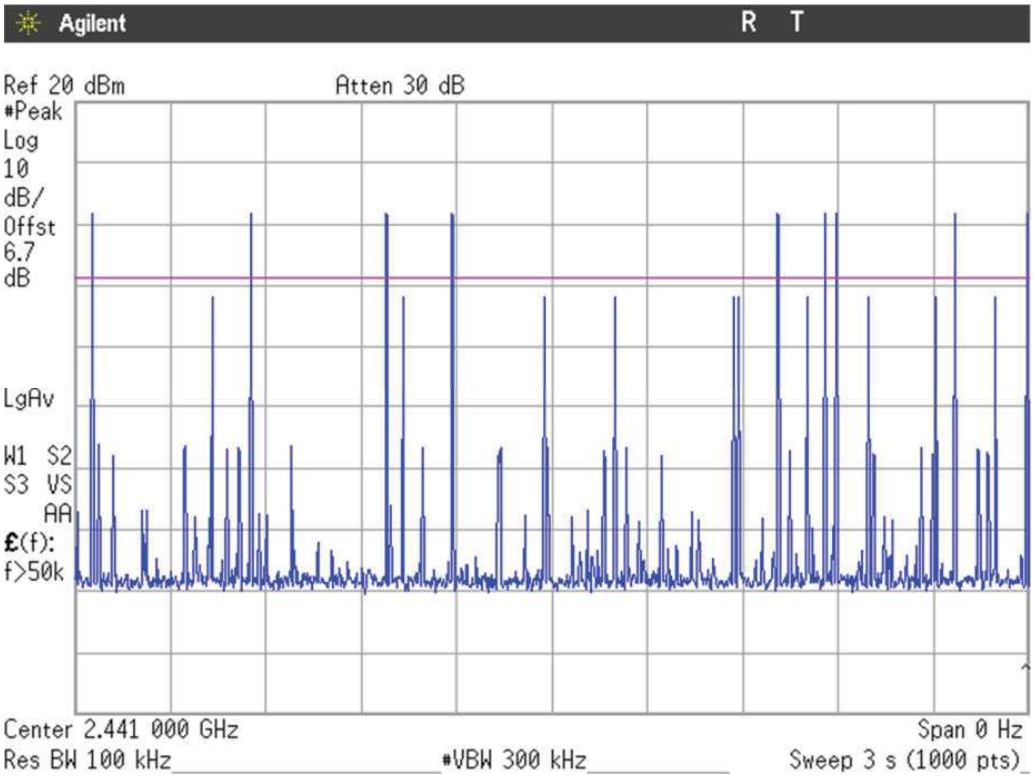
  - Transmit Time per Hop:

2.889	ms



- Time of Occupancy:

Nº of hops on spectrum analyzer	8	
Nº of hops over the period	94.8	
Average Time of Occupancy	273.8772	ms



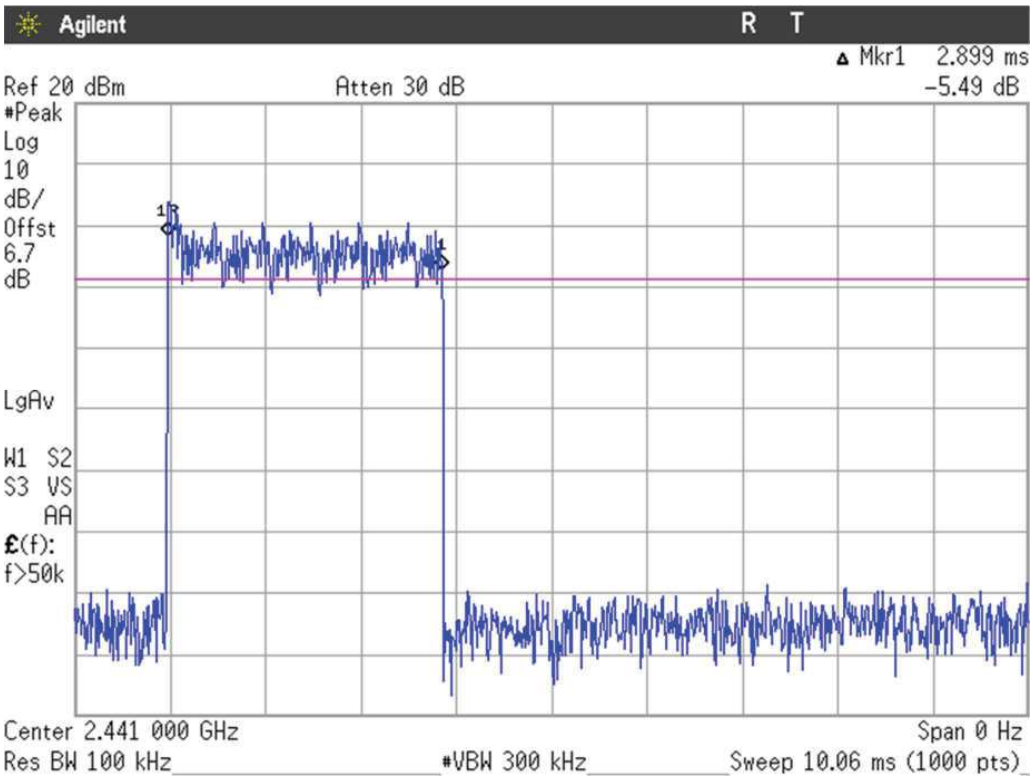
Measurement uncertainty (%)	<±0.01

Verdict: PASS

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

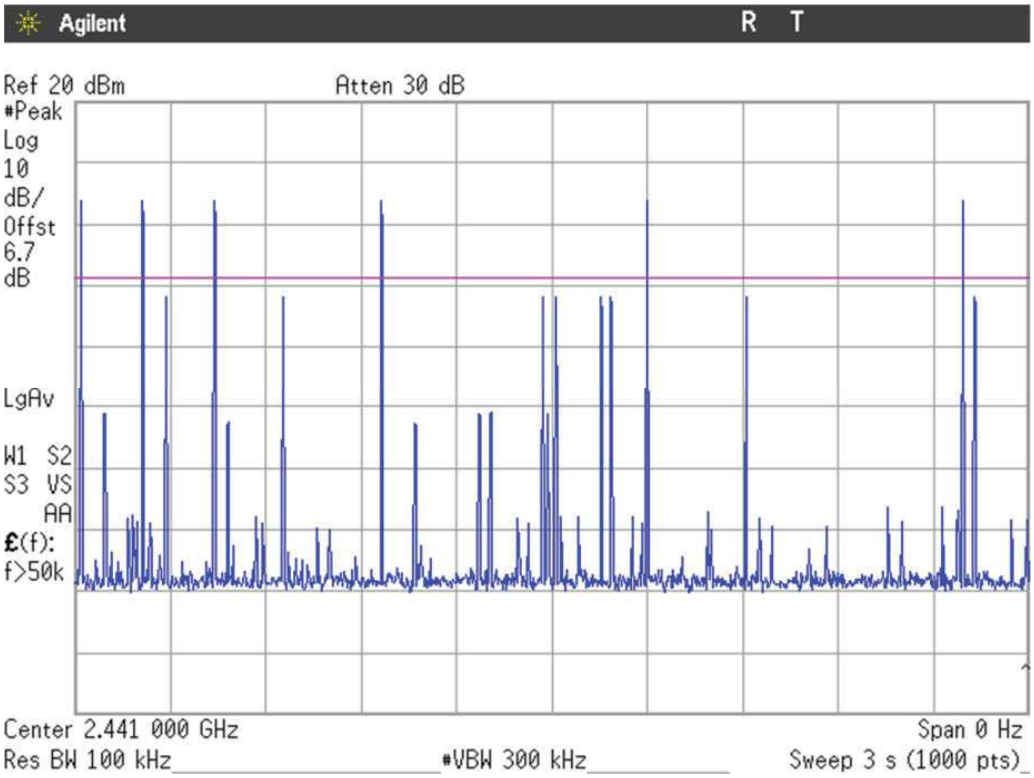
  - Transmit Time per Hop:

2.899	ms



- Time of Occupancy:

Nº of hops on spectrum analyzer	6	
Nº of hops over the period	63.2	
Average Time of Occupancy	183.2168	ms



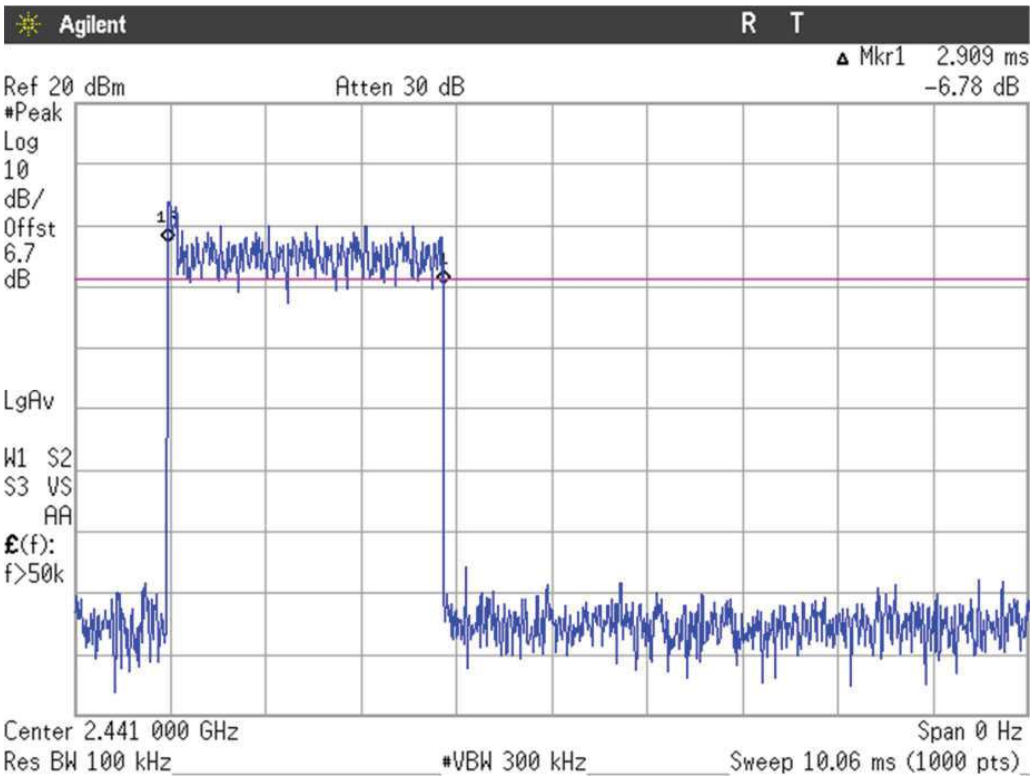
Measurement uncertainty (%)	<±0.01

Verdict: PASS

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

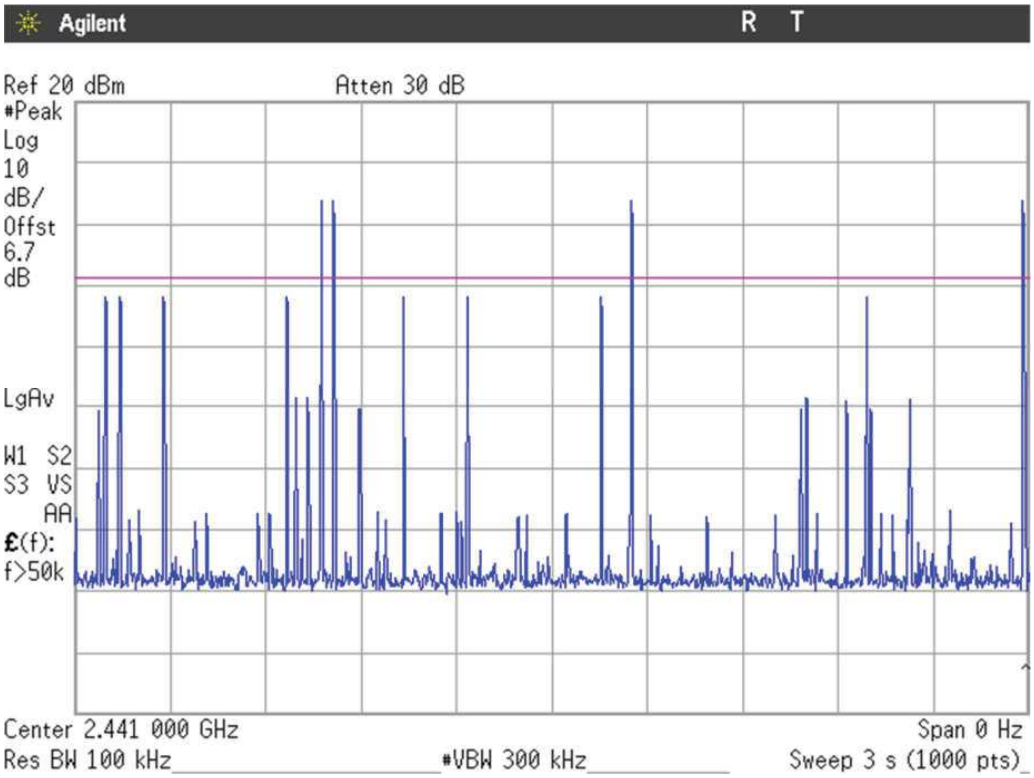
  - Transmit Time per Hop:

2.909	ms



- Time of Occupancy:

Nº of hops on spectrum analyzer	4	
Nº of hops over the period	42.13	
Average Time of Occupancy	122.5658	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: -0.99 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)	1.12	1.94	1.25
Maximum EIRP Power (dBm)	0.13	0.95	0.26
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)	4.59	5.18	4.72
Maximum EIRP Power (dBm)	3.6	4.19	3.73
Measurement uncertainty (dB)	<±0.78		

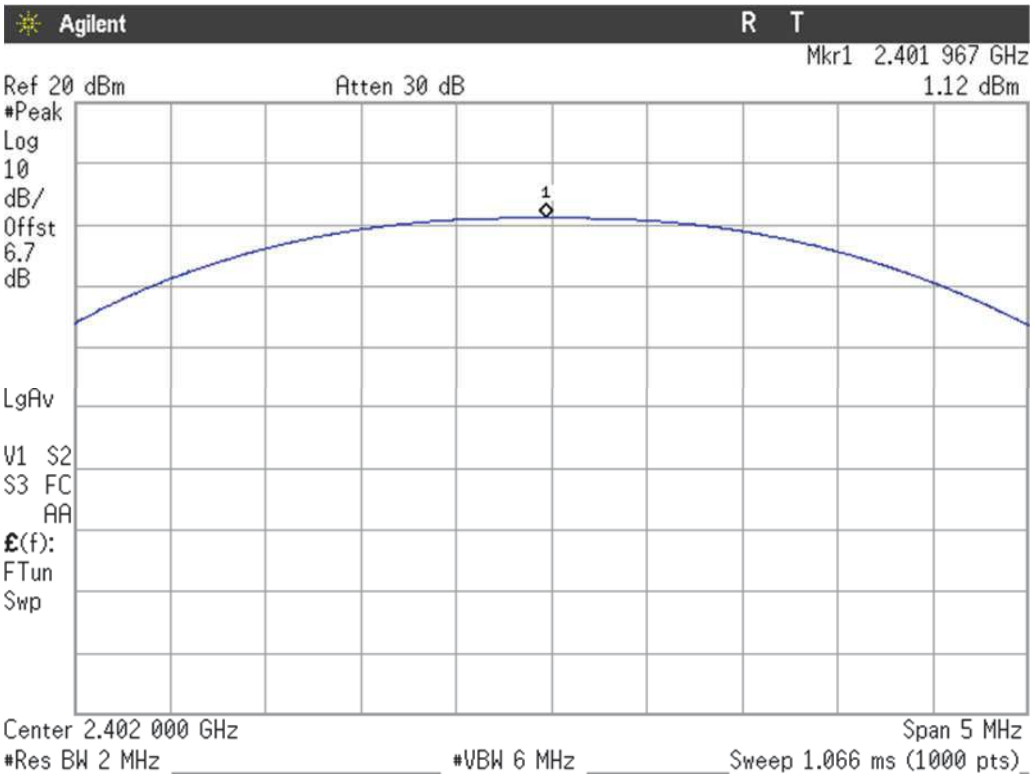
- **8DPSK** (3 Mbps)

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	5.18	5.8	5.34
Maximum EIRP Power (dBm)	4.19	4.81	4.35
Measurement uncertainty (dB)	<±0.78		

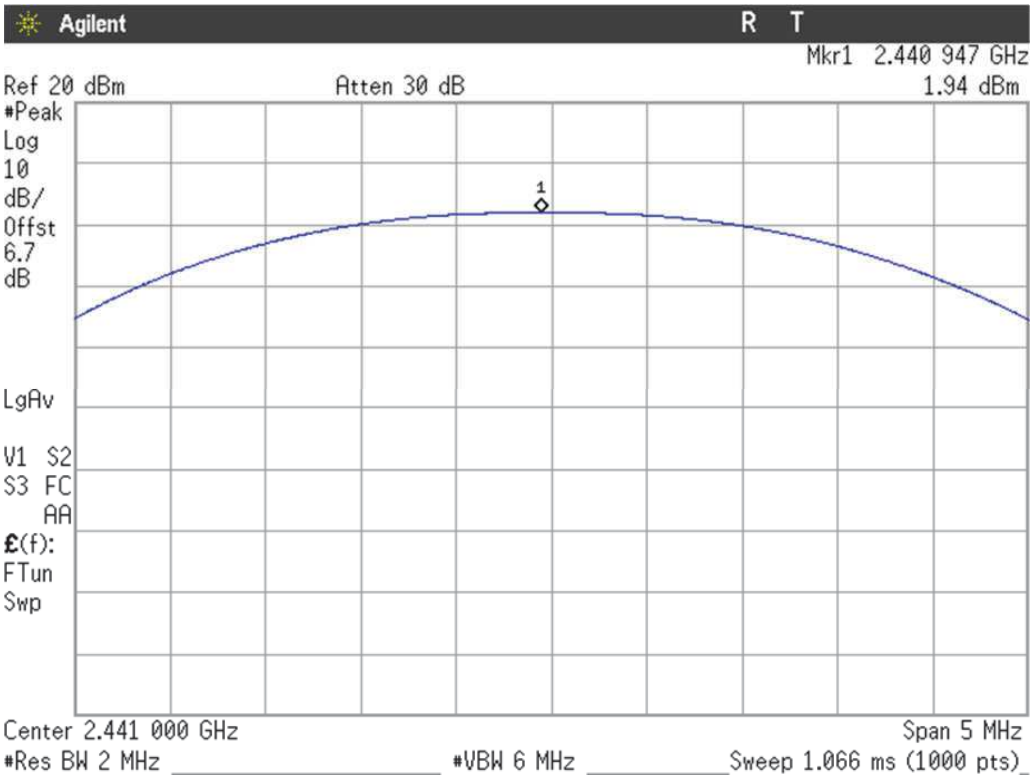
Verdict: PASS

- **GFSK – Peak Output Power**

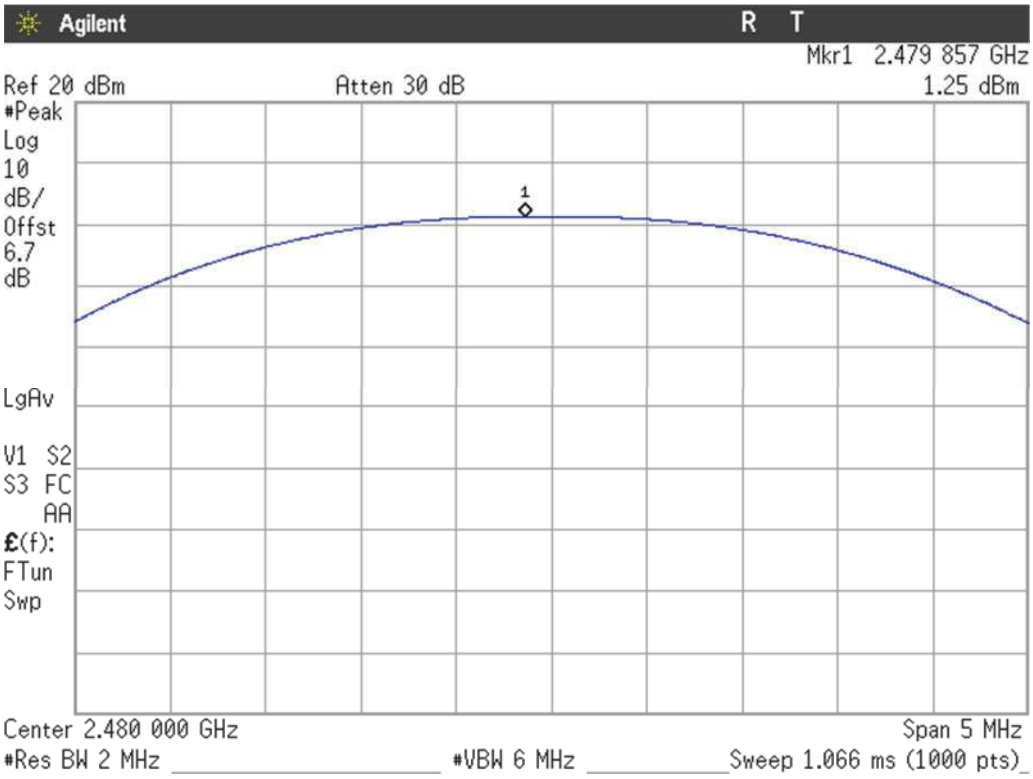
- Low Channel:



- Middle Channel:

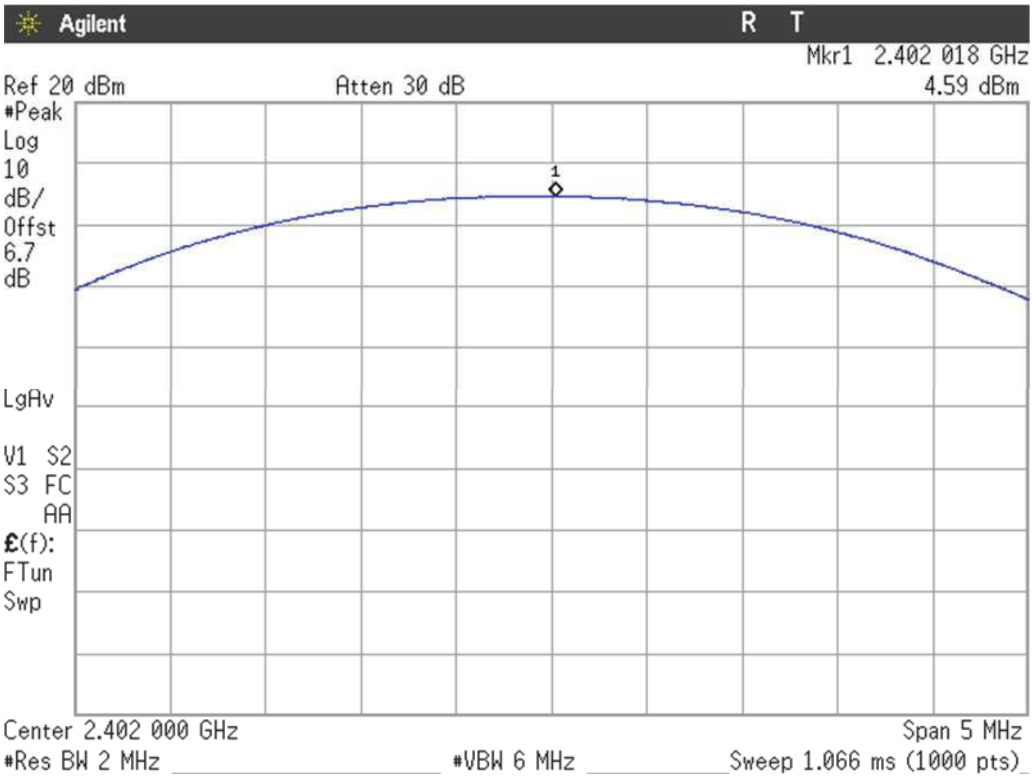


- High Channel:

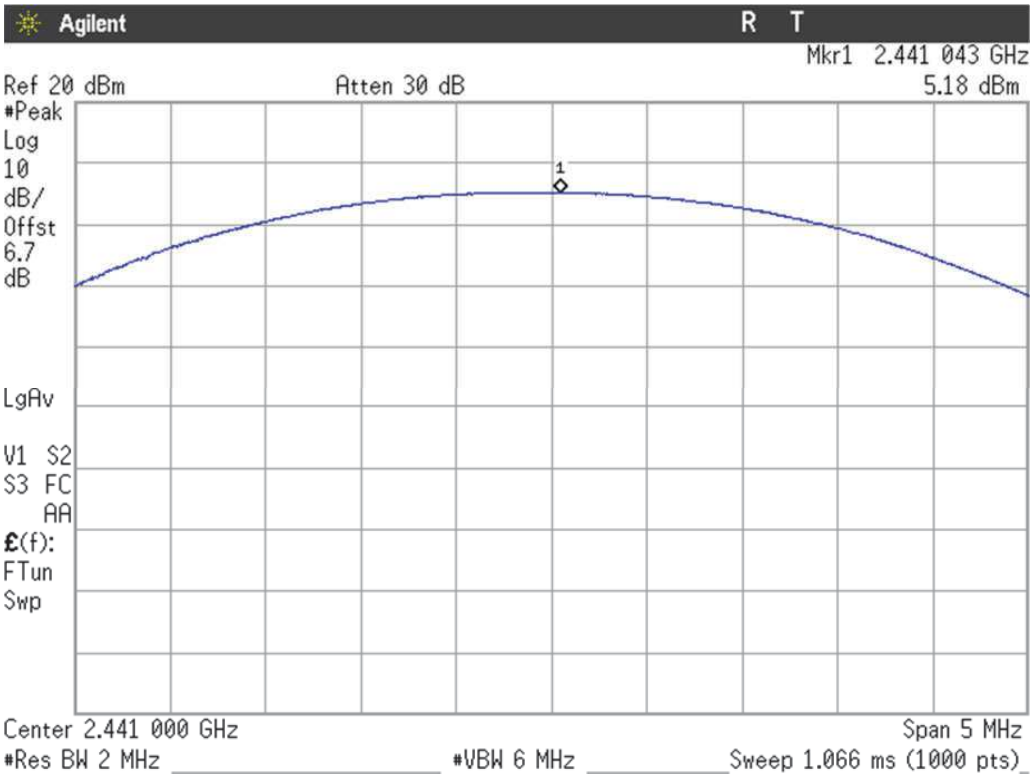


- **Pi/4 DQPSK – Peak Output Power**

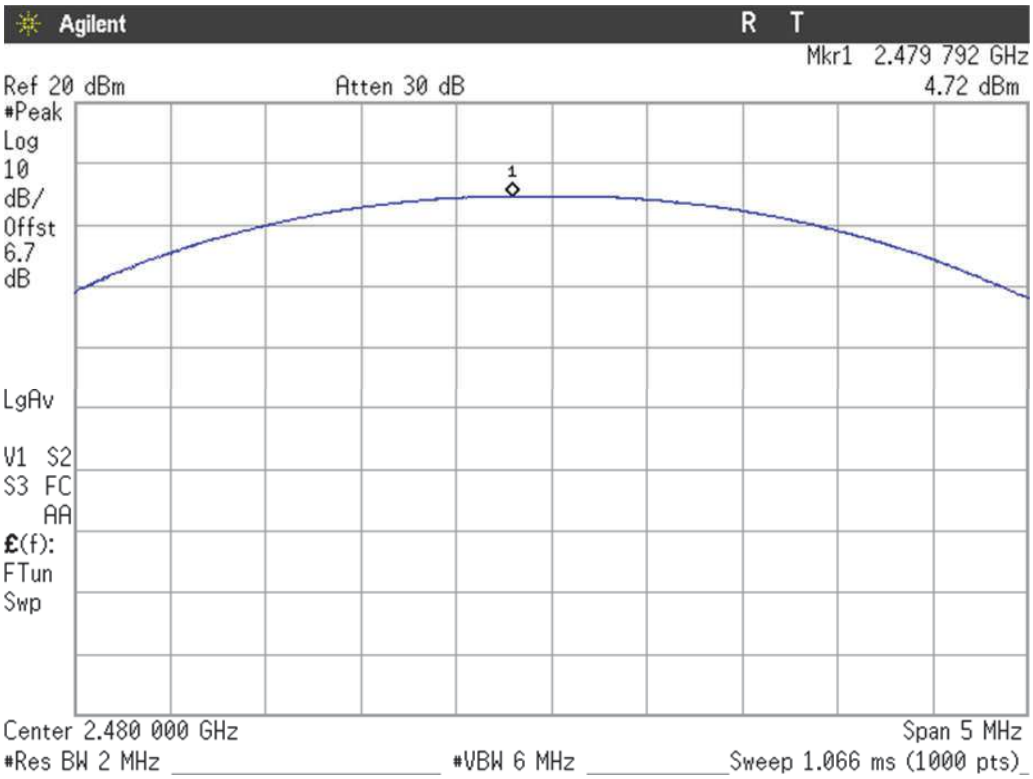
- Low Channel:



- Middle Channel:

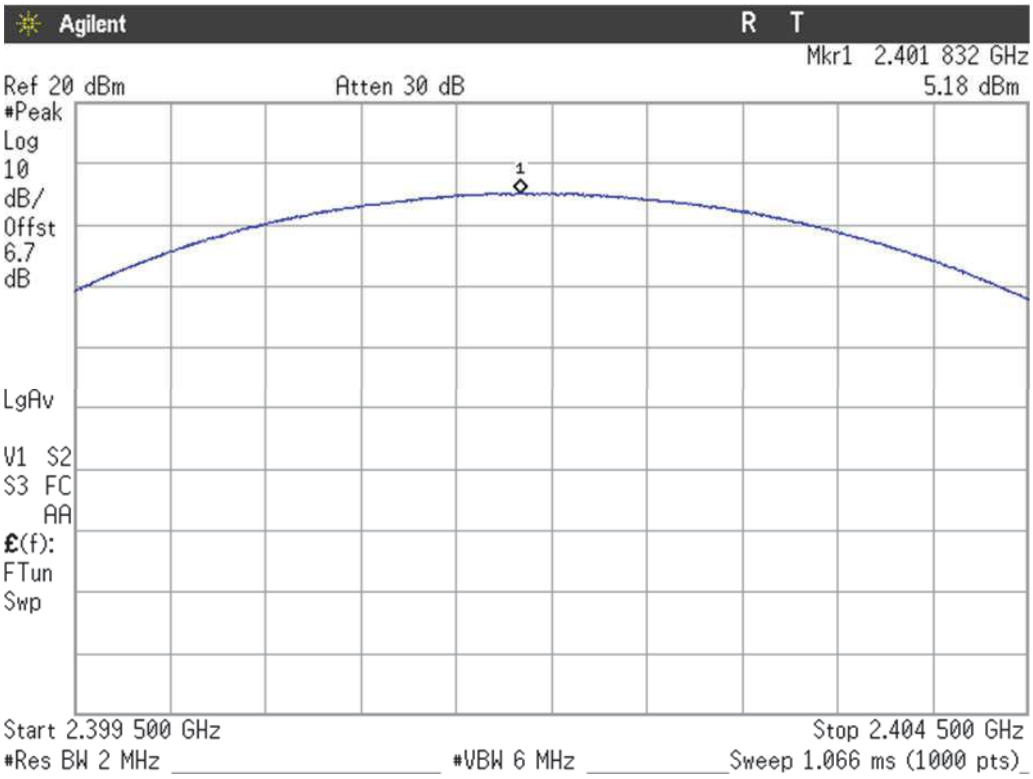


- High Channel:

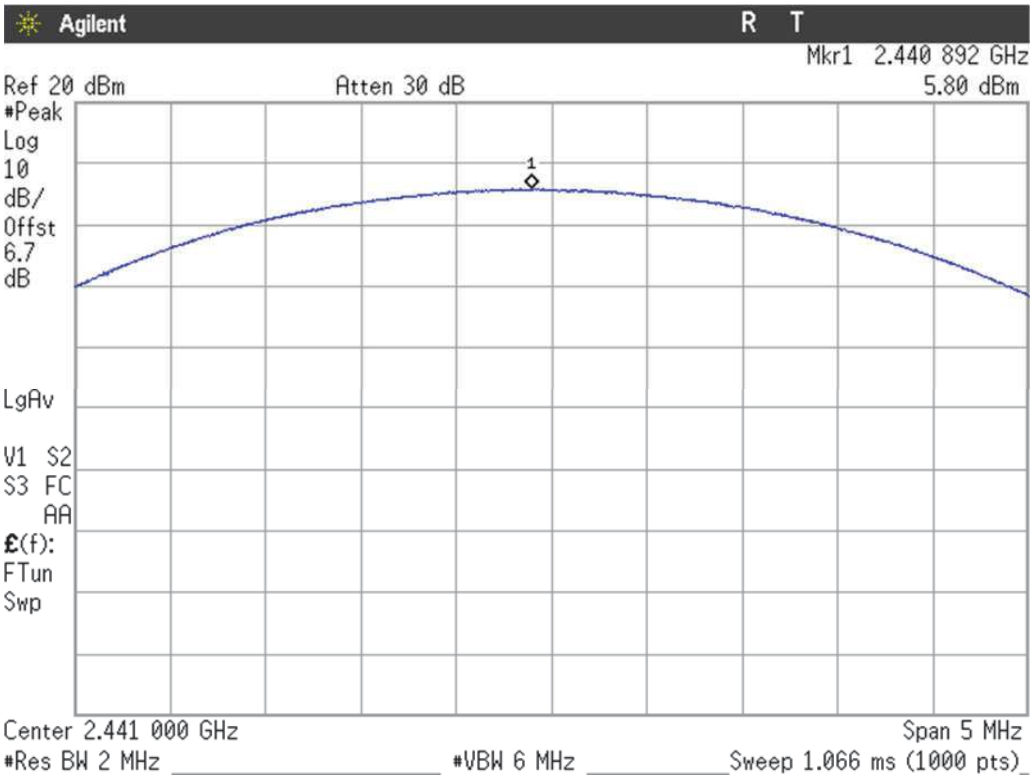


- **8DPSK – Peak Output Power**

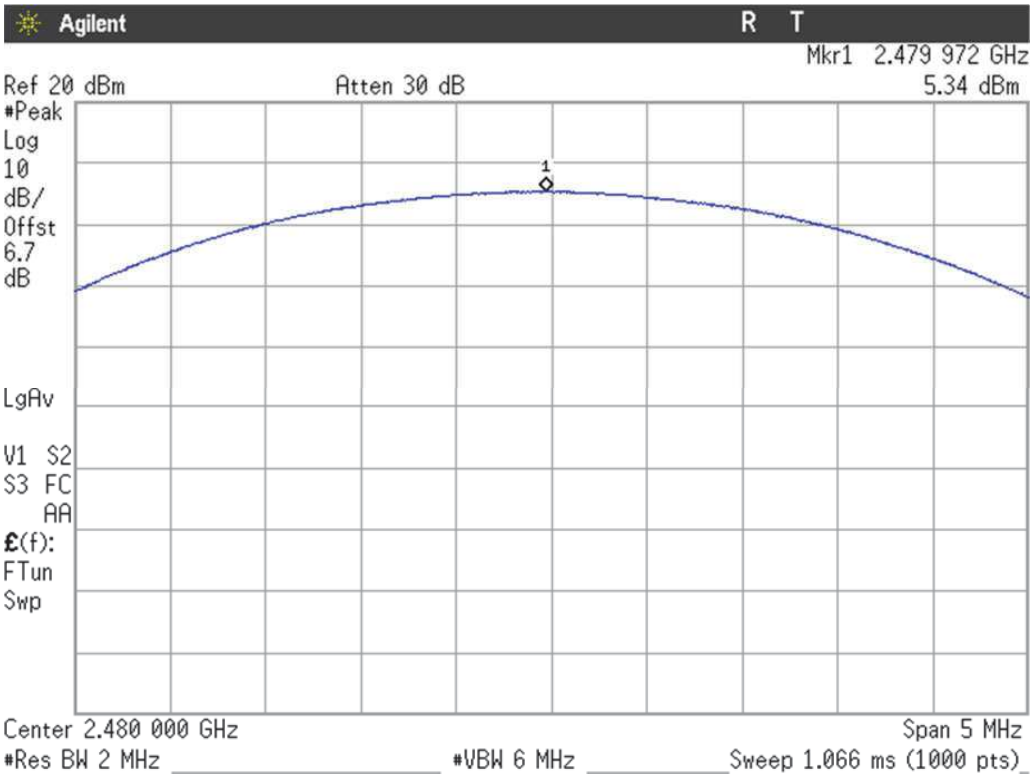
- Low Channel:



- Middle Channel:



- High Channel:



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

- **GFSK:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	0.70	1.65	0.63
Measurement uncertainty (dB)	<±0.78		

- Low Channel:

No spurious peaks found at less than 20 dB below the limit.

- Middle Channel:

No spurious peaks found at less than 20 dB below the limit.

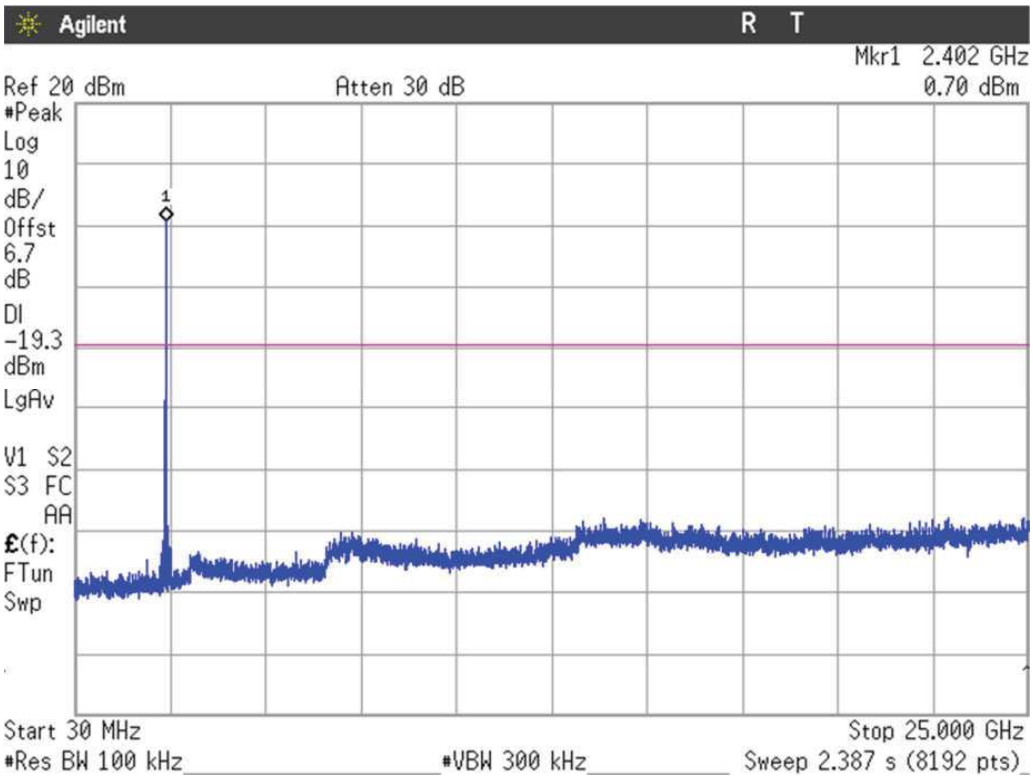
- High Channel:

No spurious peaks found at less than 20 dB below the limit.

Measurement uncertainty (dB)	<±2.03

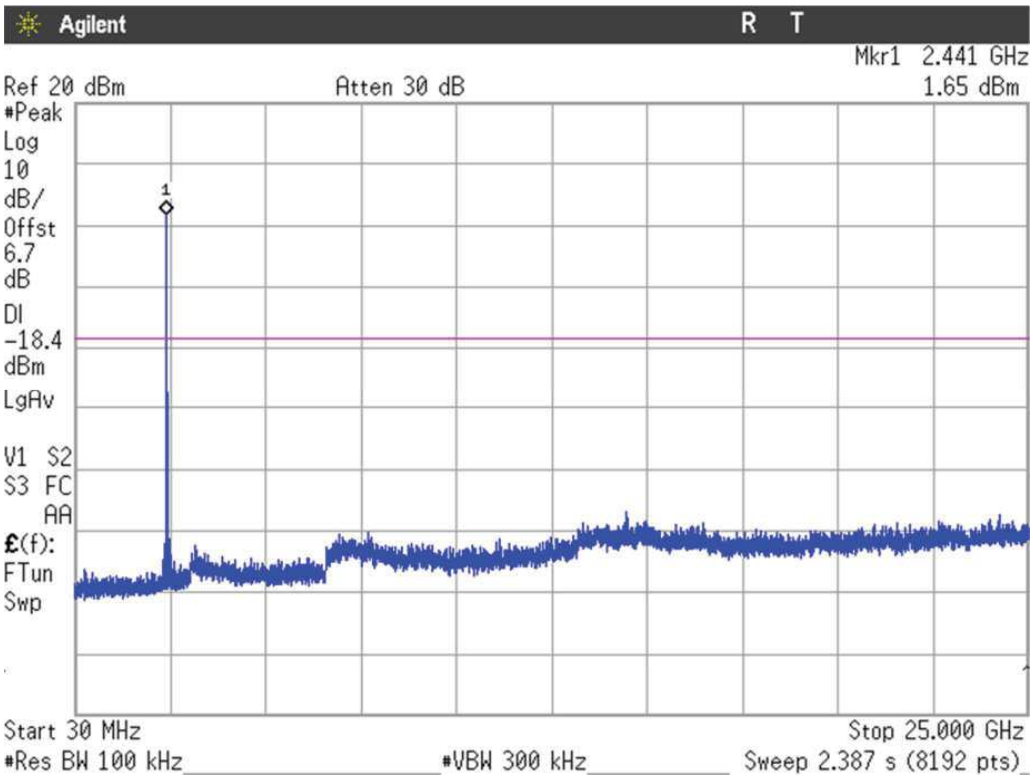
Verdict: PASS

- Low Channel:



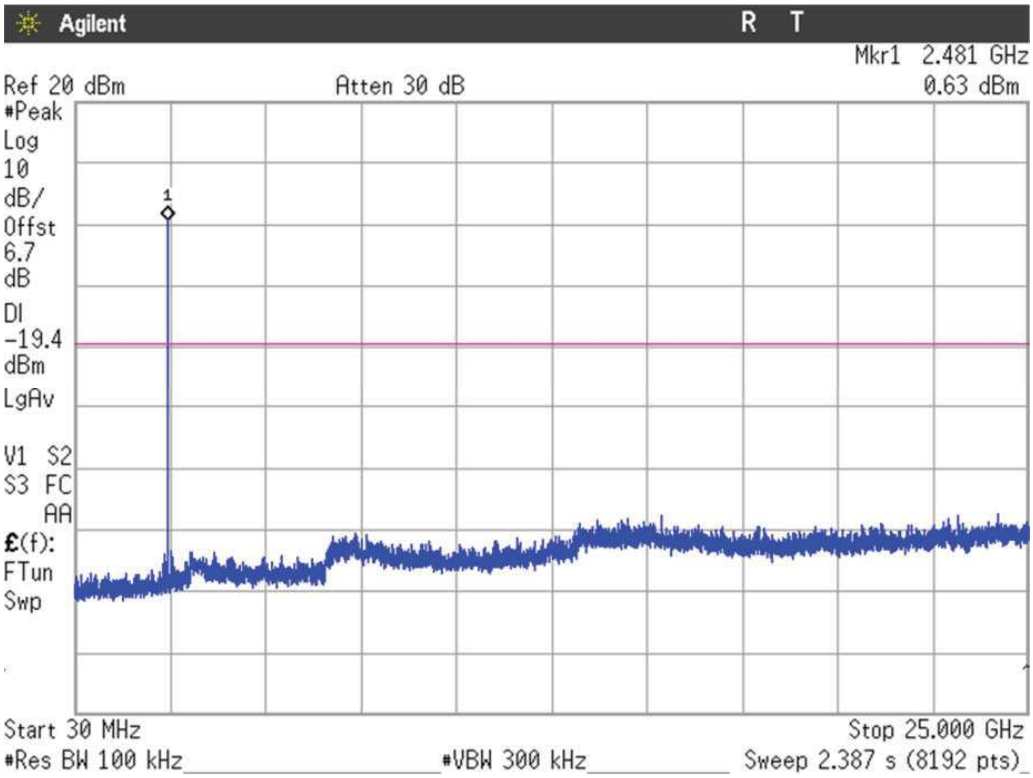
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



The peak shown in the plot above the limit is the carrier frequency.

- High Channel:



The peak shown in the plot above the limit is the carrier frequency.

- **Pi/4 DQPSK:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	0.64	0.7	2.77
Measurement uncertainty (dB)	<±0.78		

- Low Channel:

No spurious peaks found at less than 20 dB below the limit.

- Middle Channel:

No spurious peaks found at less than 20 dB below the limit.

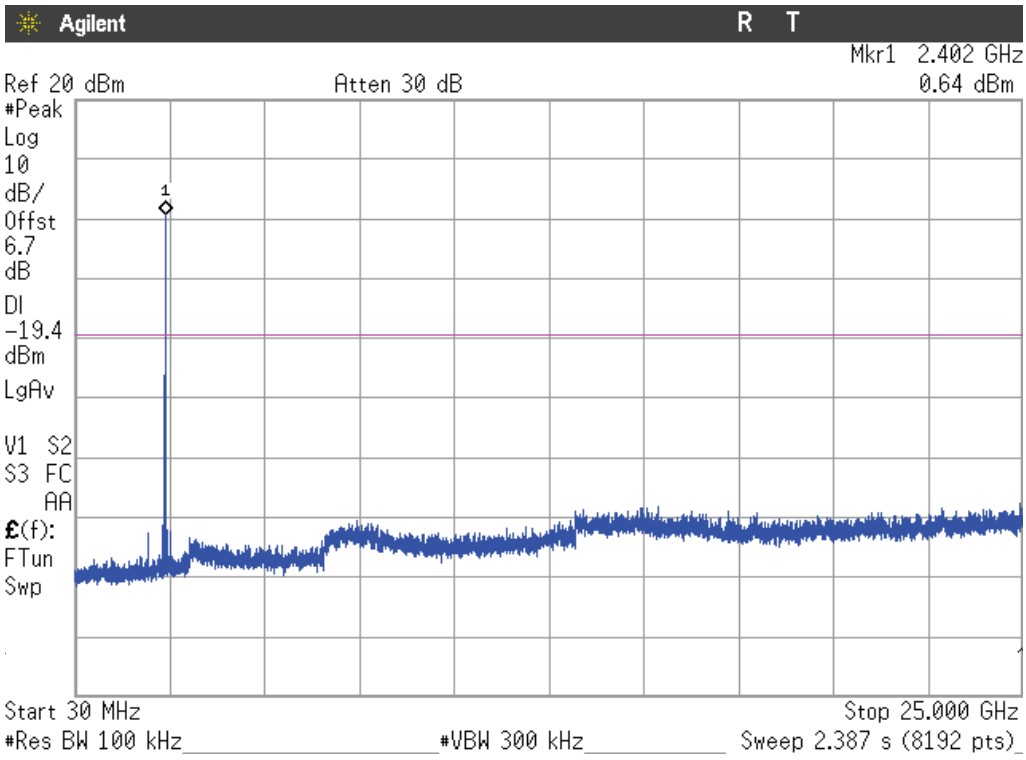
- High Channel:

No spurious peaks found at less than 20 dB below the limit.

Measurement uncertainty (dB)	<±2.03

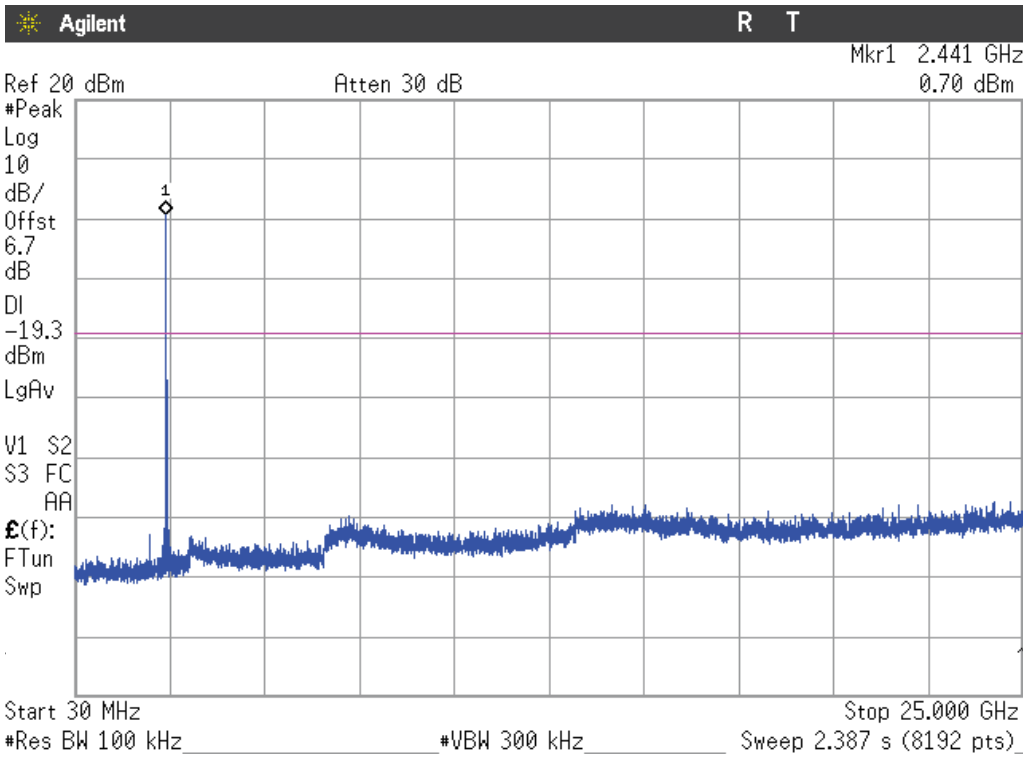
Verdict: PASS

- Low Channel:



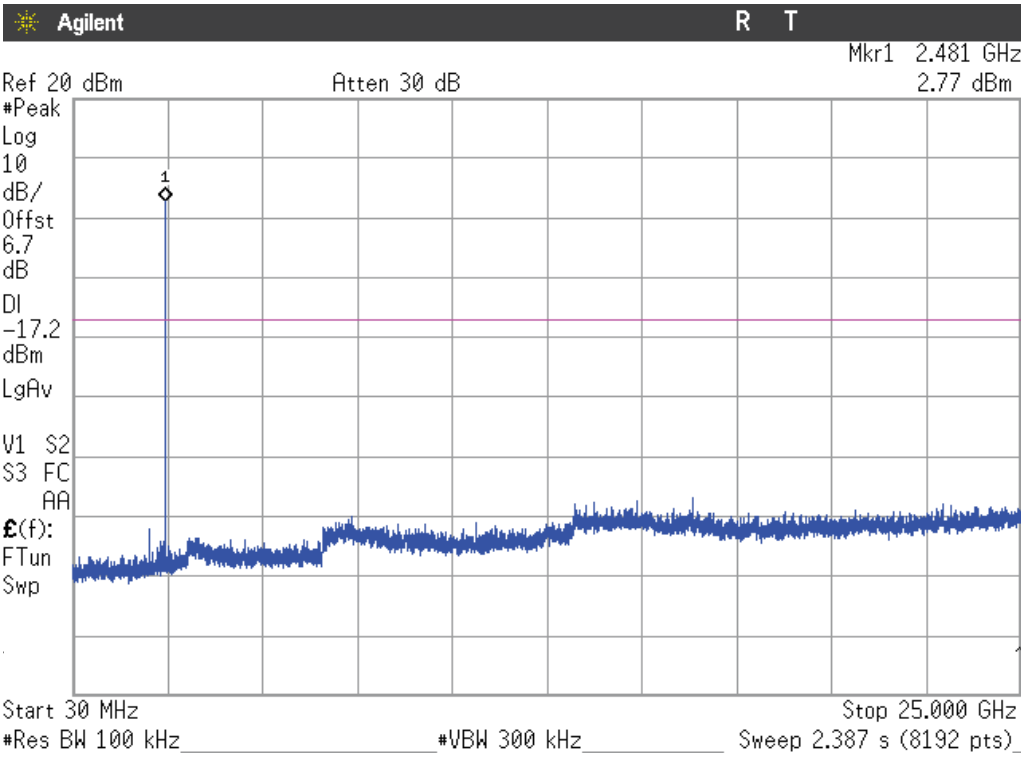
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



The peak shown in the plot above the limit is the carrier frequency.

- High Channel:



The peak shown in the plot above the limit is the carrier frequency.

- **8DPSK:**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	0.89	3.69	1.04
Measurement uncertainty (dB)	<±0.78		

- Low Channel:

No spurious peaks found at less than 20 dB below the limit.

- Middle Channel:

No spurious peaks found at less than 20 dB below the limit.

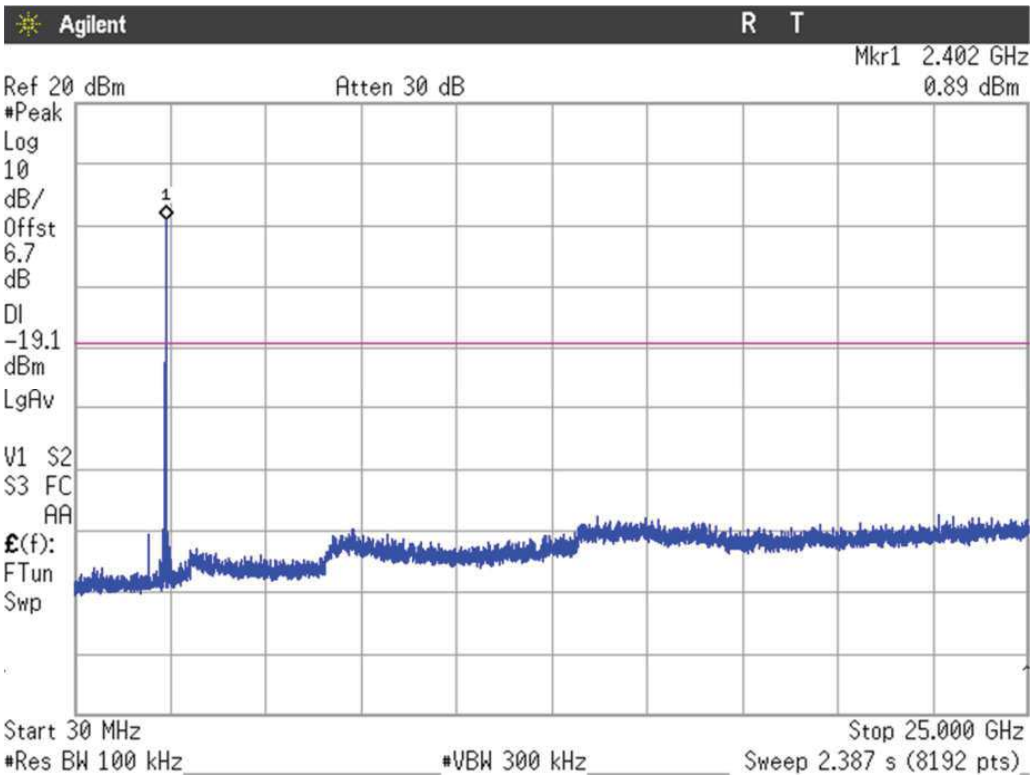
- High Channel:

No spurious peaks found at less than 20 dB below the limit.

Measurement uncertainty (dB)	<±2.03

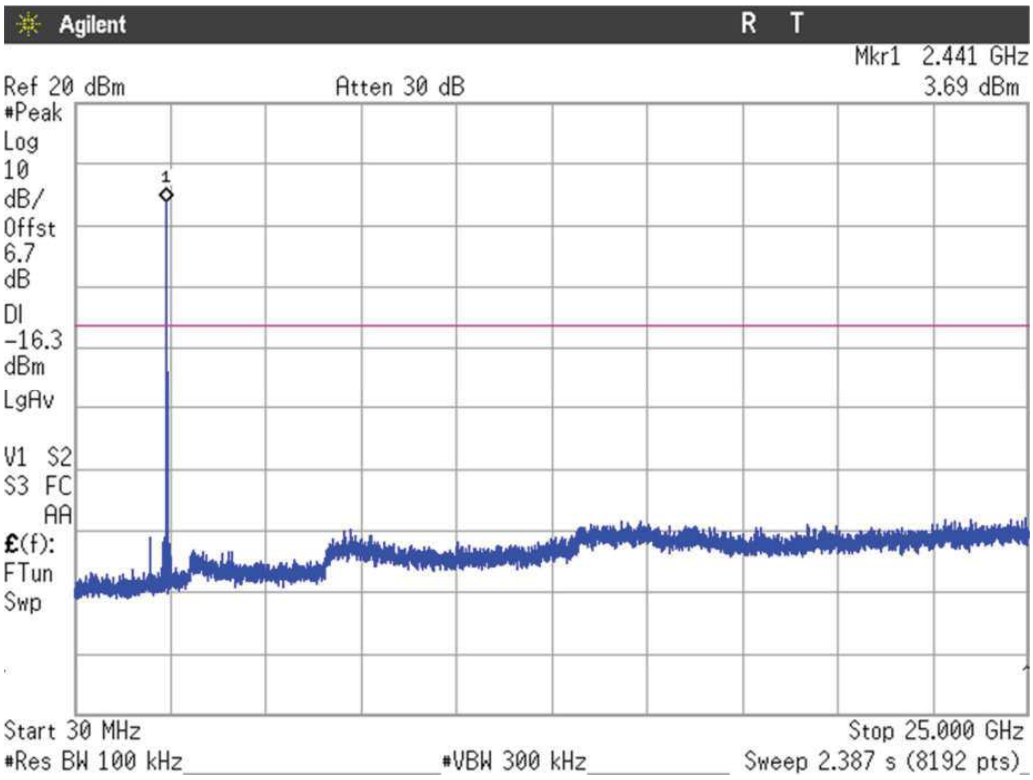
Verdict: PASS

- Low Channel:



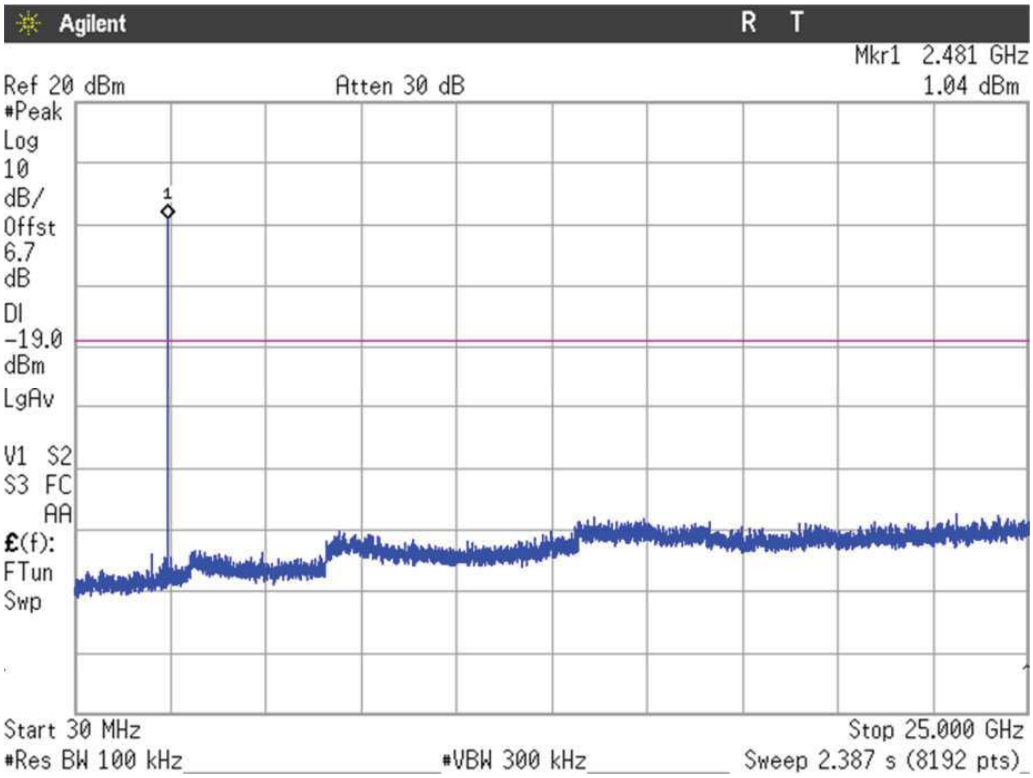
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



The peak shown in the plot above the limit is the carrier frequency.

- High Channel:



The peak shown in the plot above the limit is the carrier frequency.

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:

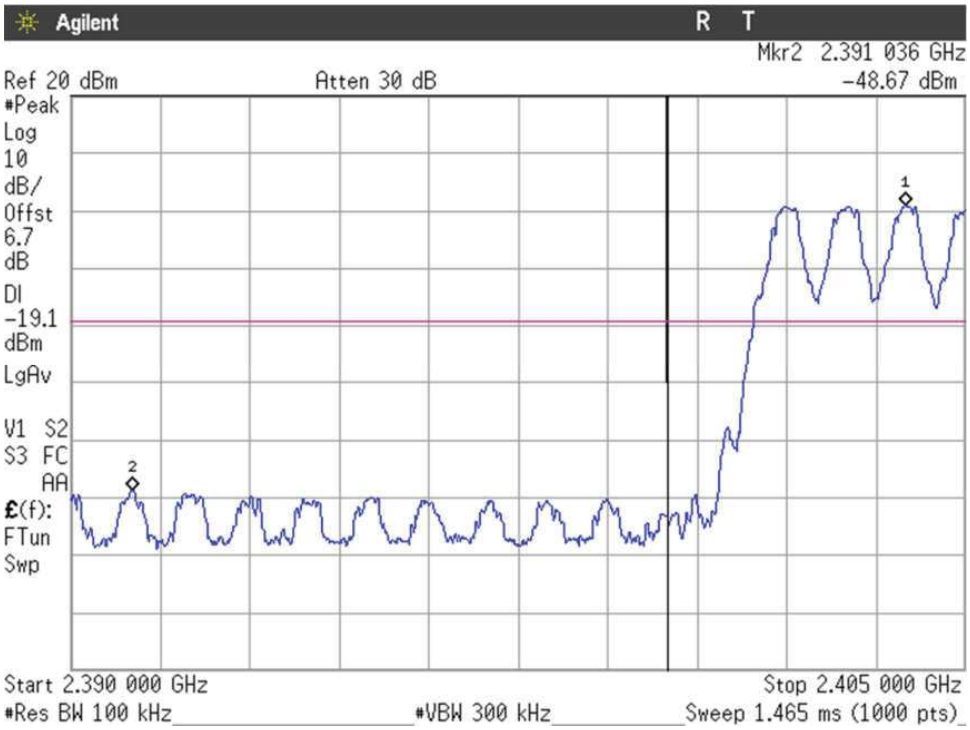
Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Measurement uncertainty (dB)	<±2.03

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

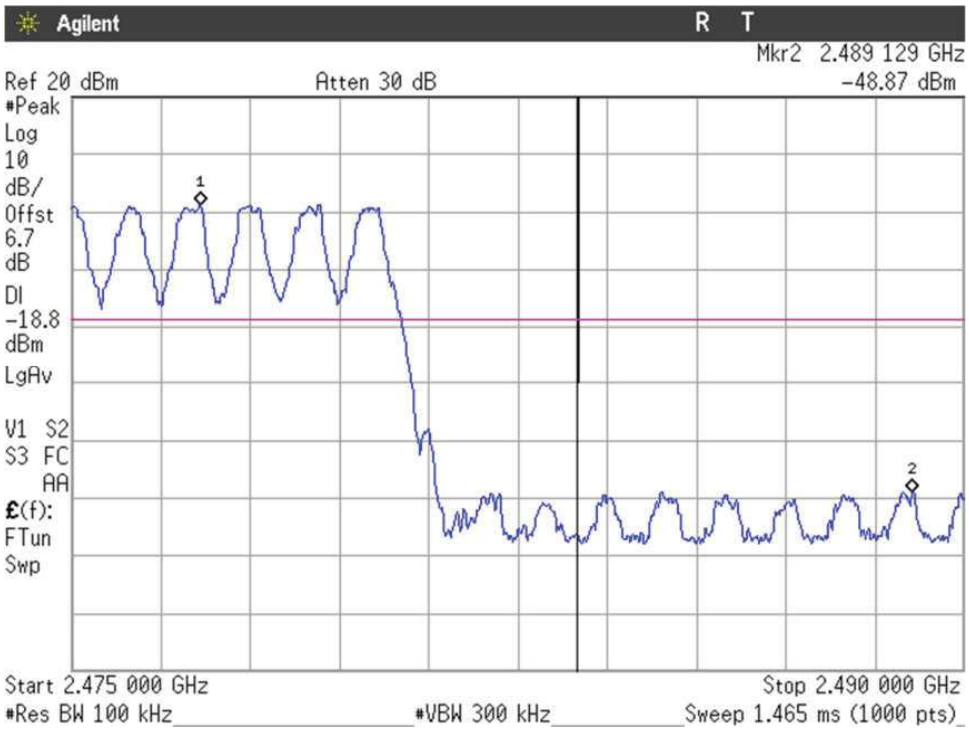
  ❖ HOPPING ON:

  - Low Frequency Section 2402 MHz:



Verdict: PASS

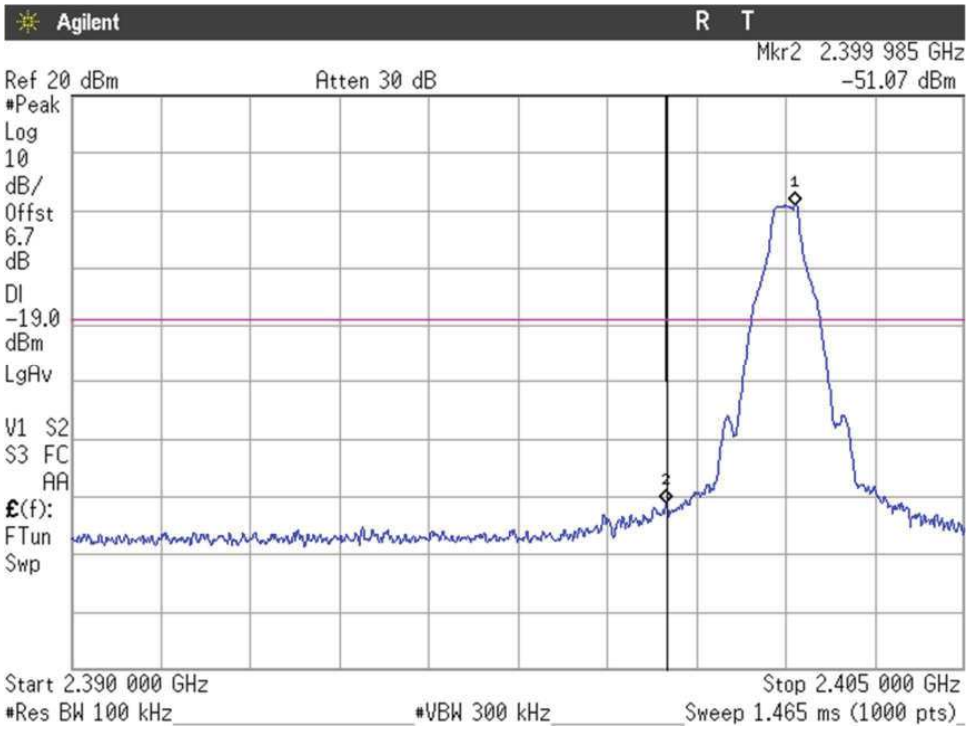
  - High Frequency Section 2480 MHz:



Verdict: PASS

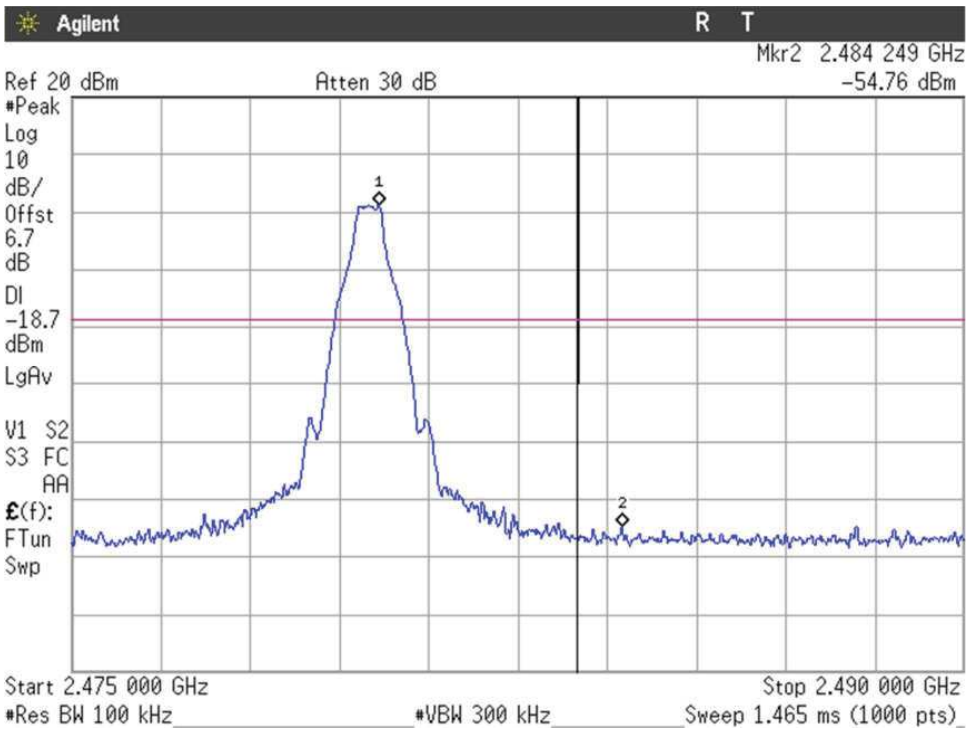
❖ HOPPING OFF:

- Low Frequency Section 2402 MHz:



Verdict: PASS

- High Frequency Section 2480 MHz:

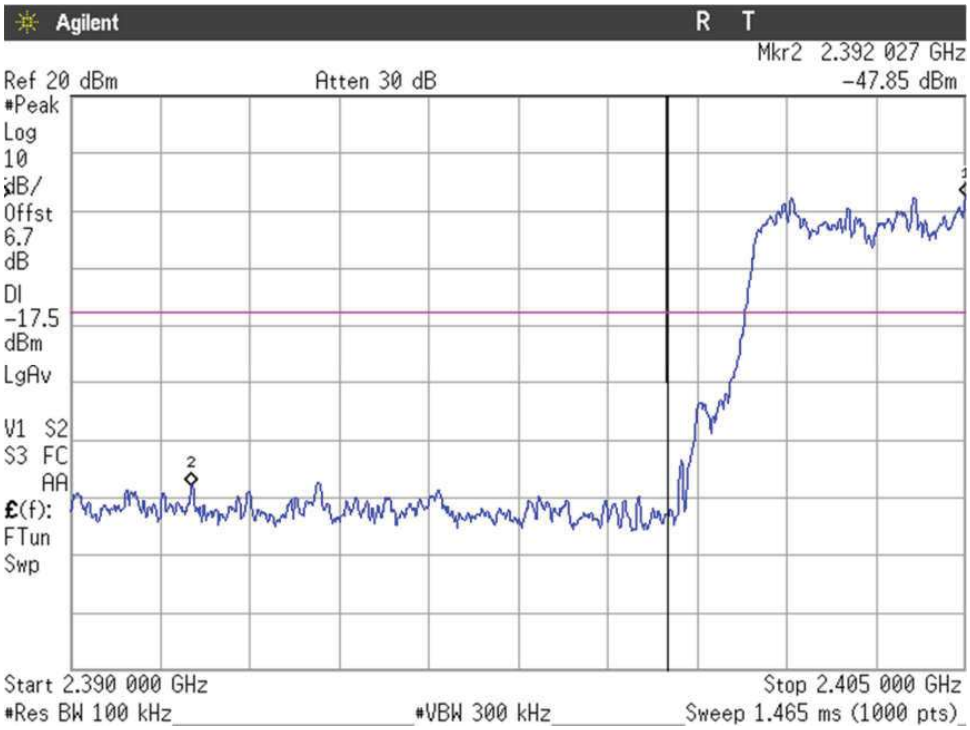


Verdict: PASS

- **Pi/4 DQPSK – Band-edge emissions compliance**

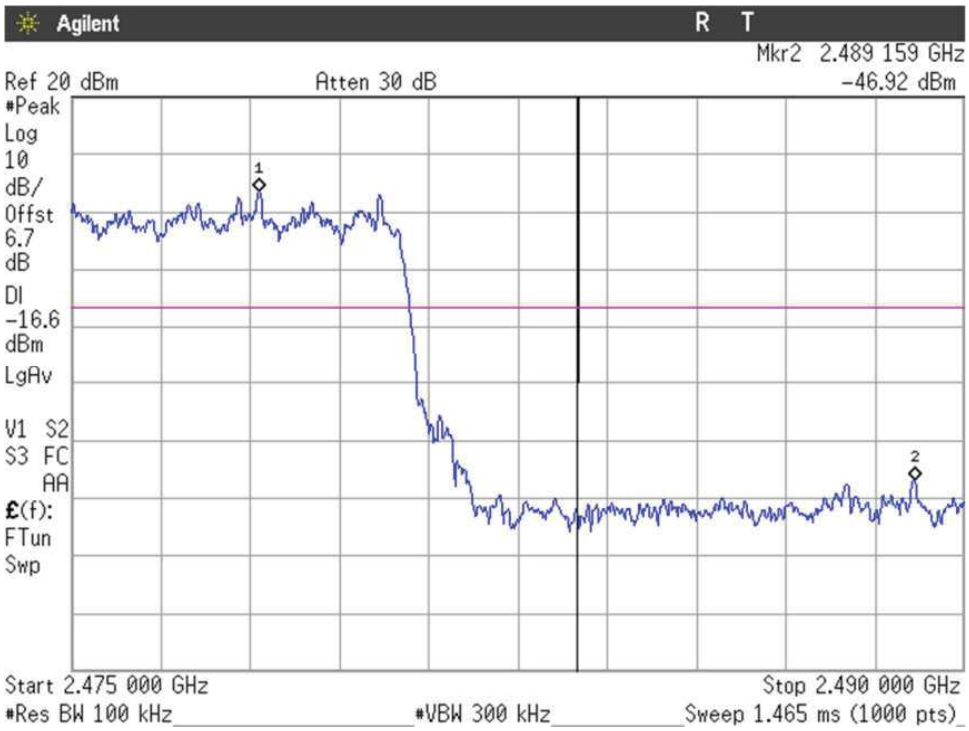
  - ❖ HOPPING ON:

    - Low Frequency Section 2402 MHz:



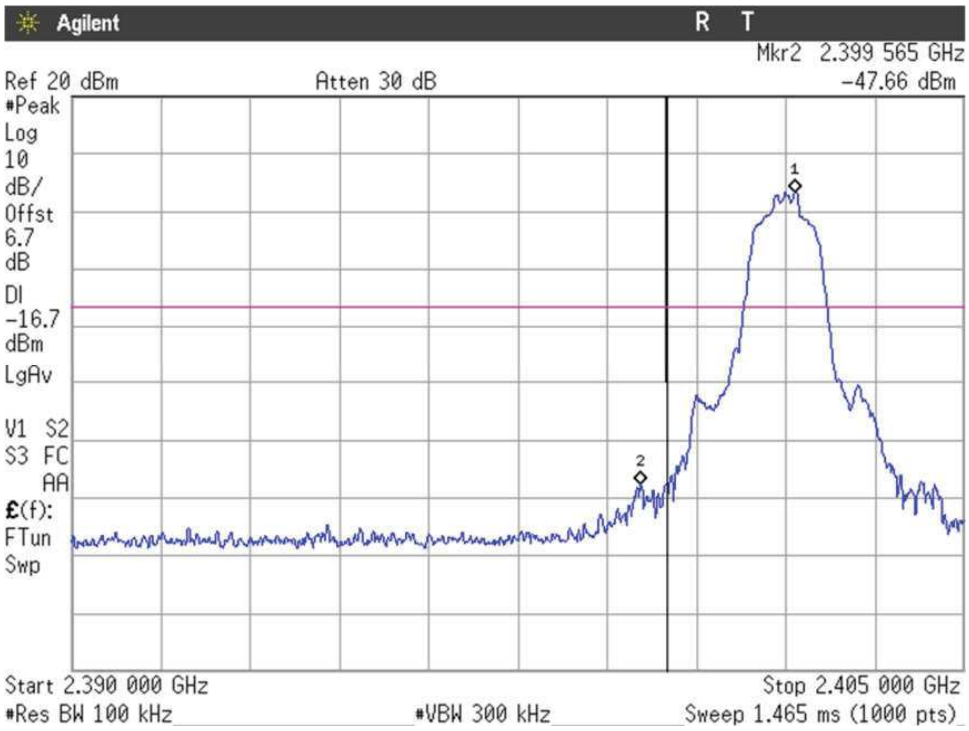
Verdict: PASS

    - High Frequency Section 2480 MHz:



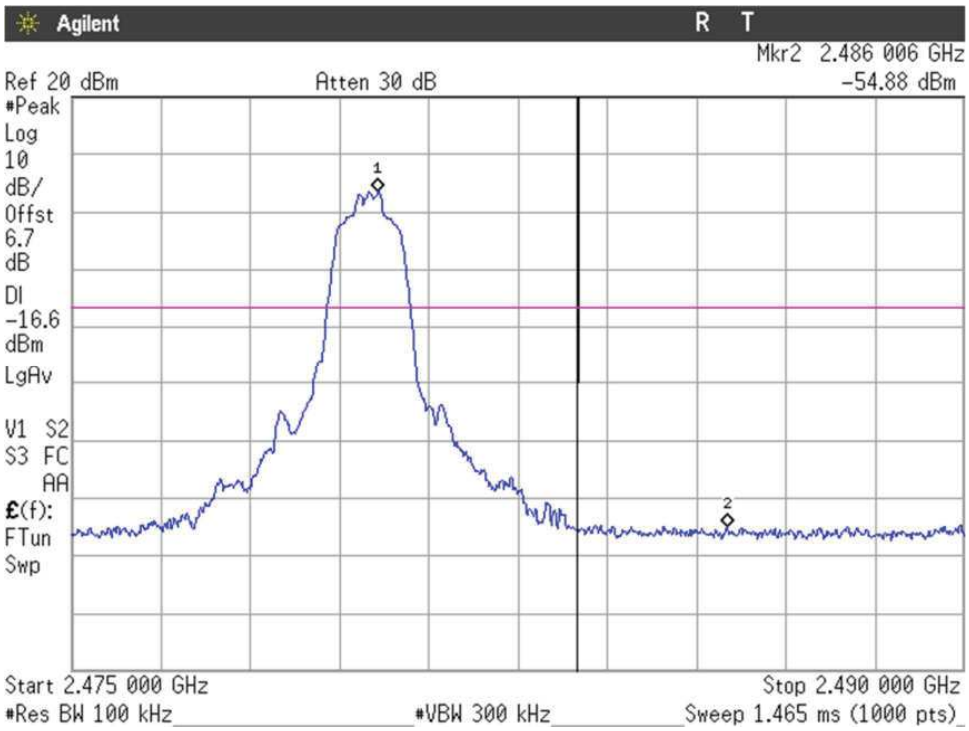
Verdict: PASS

- HOPPING OFF:
  - Low Frequency Section 2402 MHz:



Verdict: PASS

  - High Frequency Section 2480 MHz:

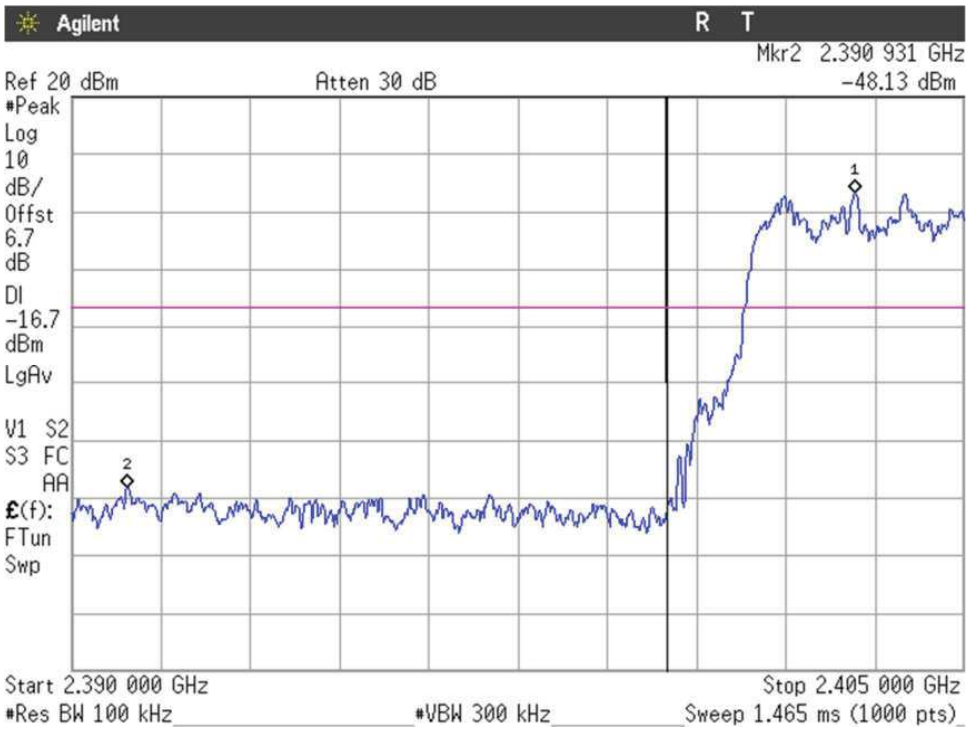


Verdict: PASS

- **8DPSK – Band-edge emissions compliance**

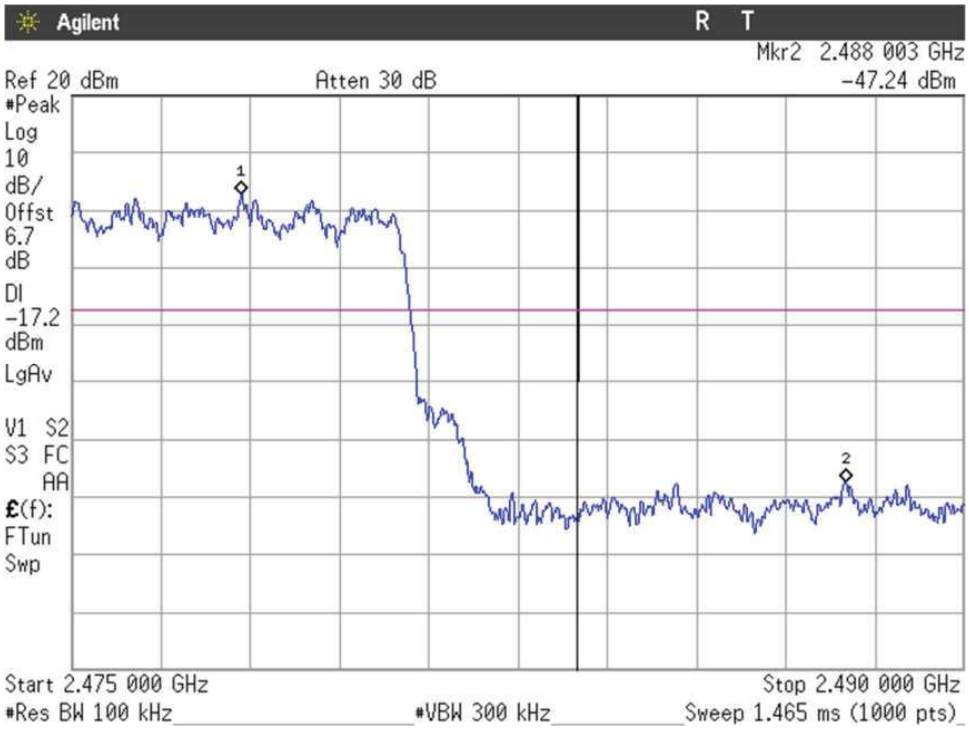
  - ❖ HOPPING ON:

    - Low Frequency Section 2402 MHz:



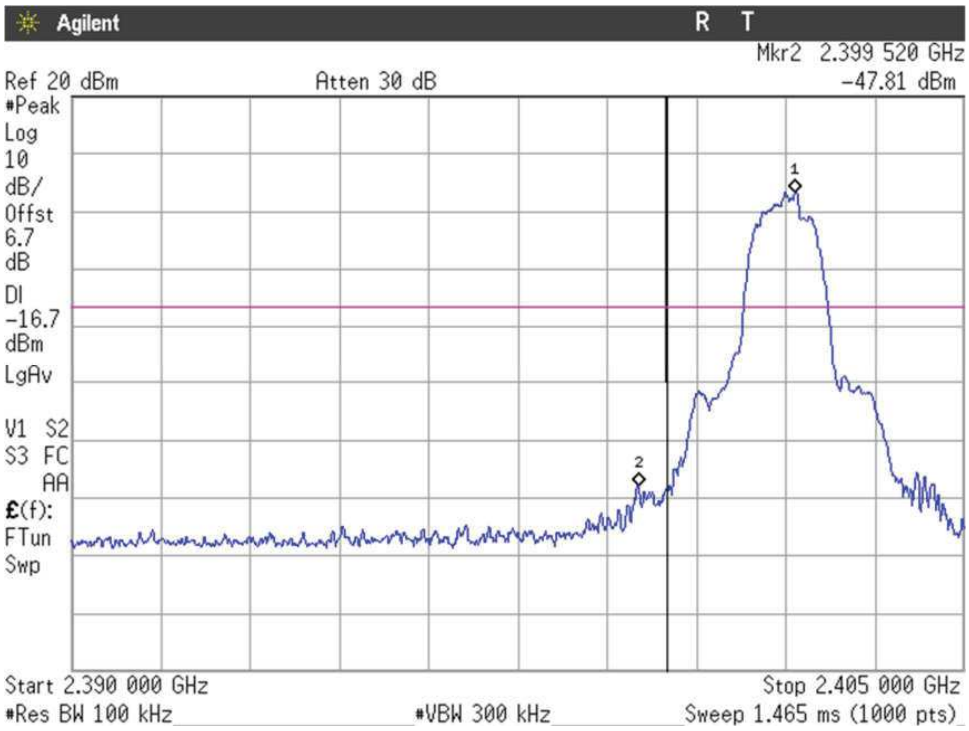
Verdict: PASS

    - High Frequency Section 2480 MHz:



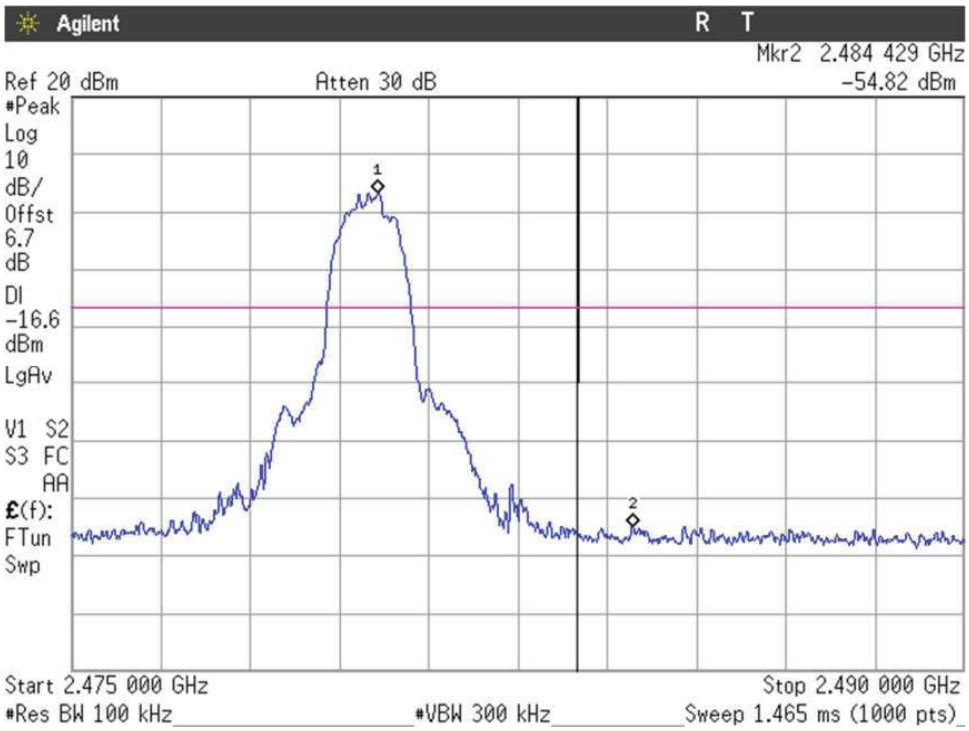
Verdict: PASS

- 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 360º 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 emissions below 1 GHz do not depend neither on the operating channel nor the modulation mode selected in the EUT.

Spurious frequencies operating (radiated) at less than 20 dB below limit:

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
62.188	Quasi peak	34.7	V	<± 2.07
408.025	Quasi peak	28.1	H	<± 2.07
519.996	Quasi peak	31.7	V	<± 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 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.

- **Modulation: GFSK (DH5)**

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.32232	Peak	51.91	V	<± 4.88
2.52203	Peak	51.40	V	<± 4.88
3.27837	Peak	42.37	V	<± 4.88
3.46410	Peak	44.58	H	<± 4.88
4.80390	Peak	45.00	V	<± 4.88
7.20537 (*)	Peak	60.43	V	<± 4.88
	Average	55.23		<± 4.88
9.60730	Peak	50.97	V	<± 4.88
12.00923	Peak	50.05	H	<± 4.88

(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 103.40 dBµV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.36138	Peak	52.17	V	<± 4.88
3.2625	Peak	43.34	V	<± 4.88
3.33297	Peak	44.42	H	<± 4.88
4.88183	Peak	48.41	V	<± 4.88
7.32343	Peak	56.55	H	<± 4.88
	Average	53.76		<± 4.88
9.76457	Peak	48.66	H	<± 4.88

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
1.93670	Peak	53.76	H	<± 4.88
2.35986	Peak	51.28	V	<± 4.88
2.48350	Peak	53.54	V	<± 4.88
3.31337	Peak	45.04	H	<± 4.88
3.71983	Peak	43.02	V	<± 4.88
4.95977	Peak	48.14	V	<± 4.88
7.44010	Peak	55.58	V	<± 4.88
	Average	53.39		<± 4.88

Verdict: PASS

- **Modulation PI/4-DQPSK (2DH5)**

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.32234	Peak	52.02	V	<± 4.88
3.25270	Peak	45.23	H	<± 4.88
3.33903	Peak	43.76	V	<± 4.88
4.80483	Peak	46.34	V	<± 4.88
7.20630 (*)	Peak	59.62	H	<± 4.88
	Average	56.09		<± 4.88
9.60870	Peak	51.07	H	<± 4.88

(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 94.82 dBµV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.36096	Peak	52.79	V	<± 4.88
2.36103	Peak	53.28	V	<± 4.88
3.15377	Peak	42.90	V	<± 4.88
3.32317	Peak	43.61	H	<± 4.88
4.88230	Peak	52.87	V	<± 4.88
7.32343	Peak	58.06	V	<± 4.88
	Average	53.91		<± 4.88
9.76457	Peak	49.15	V	<± 4.88

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48353	Peak	53.54	V	<± 4.88
3.29143	Peak	45.08	H	<± 4.88
3.41277	Peak	43.89	V	<± 4.88
4.96023	Peak	47.04	H	<± 4.88
7.44057	Peak	54.70	V	<± 4.88
	Average	49.54		<± 4.88

Verdict: PASS

- **Modulation: 8-DPSK (3DH5)**

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.32199	Peak	52.77	V	<± 4.88
2.52203	Peak	52.71	V	<± 4.88
3.41277	Peak	45.59	H	<± 4.88
3.60317	Peak	43.04	V	<± 4.88
4.80390	Peak	42.73	V	<± 4.88
7.20537(*)	Peak	59.36	V	<± 4.88
	Average	54.53		<± 4.88
9.60730	Peak	47.57	V	<± 4.88

(*): This spurious frequency is outside the restricted bands as defined in §15.205(a). The measured maximum carrier level at 3 m was 100.62 dBµV/m (Peak) so the spurious level is more than 20 dB below the carrier level.

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

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
3.27510	Peak	42.55	V	<± 4.88
3.31383	Peak	45.26	H	<± 4.88
4.88183	Peak	49.82	V	<± 4.88
7.32297	Peak	56.37	V	<± 4.88
	Average	51.22		<± 4.88
9.76363	Peak	47.95	H	<± 4.88

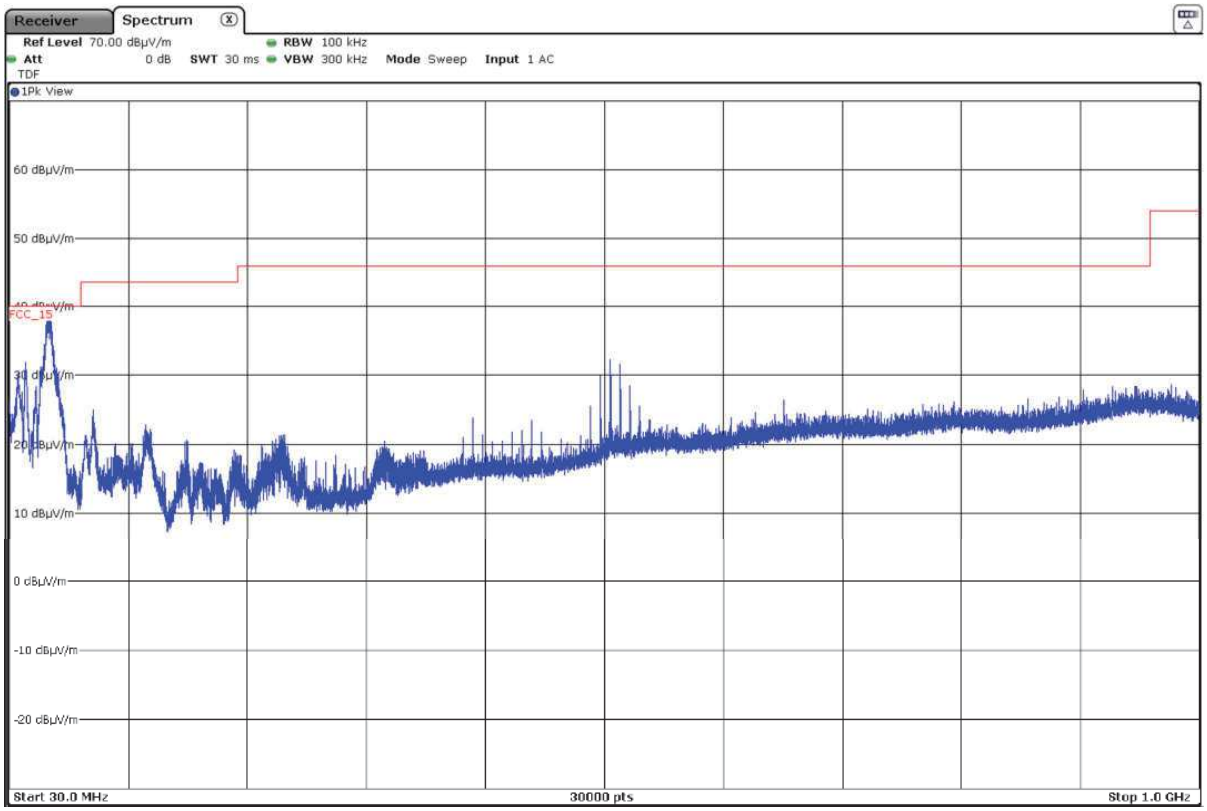
- High Channel (2480 MHz). Spurious frequencies operating (radiated) at less than 20 dB below limit:

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48352	Peak	54.47	V	<± 4.88
	Average	40.94		<± 4.88
3.06417	Peak	44.13	H	<± 4.88
3.31057	Peak	42.71	V	<± 4.88
4.95977	Peak	48.92	V	<± 4.88
7.43963	Peak	56.56	V	<± 4.88
	Average	52.09		<± 4.88

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

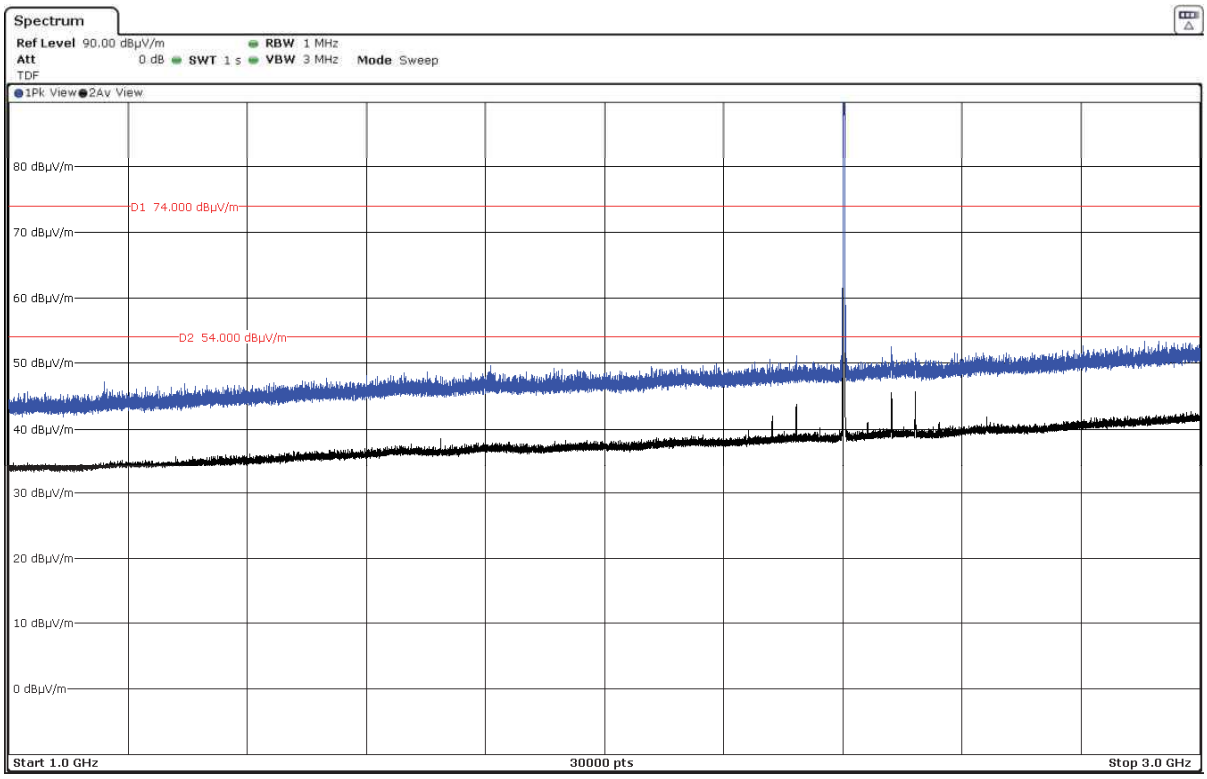
This plot is valid for the Low, Middle and High Channels and all modulation modes.



FREQUENCY RANGE 1 - 3 GHz:

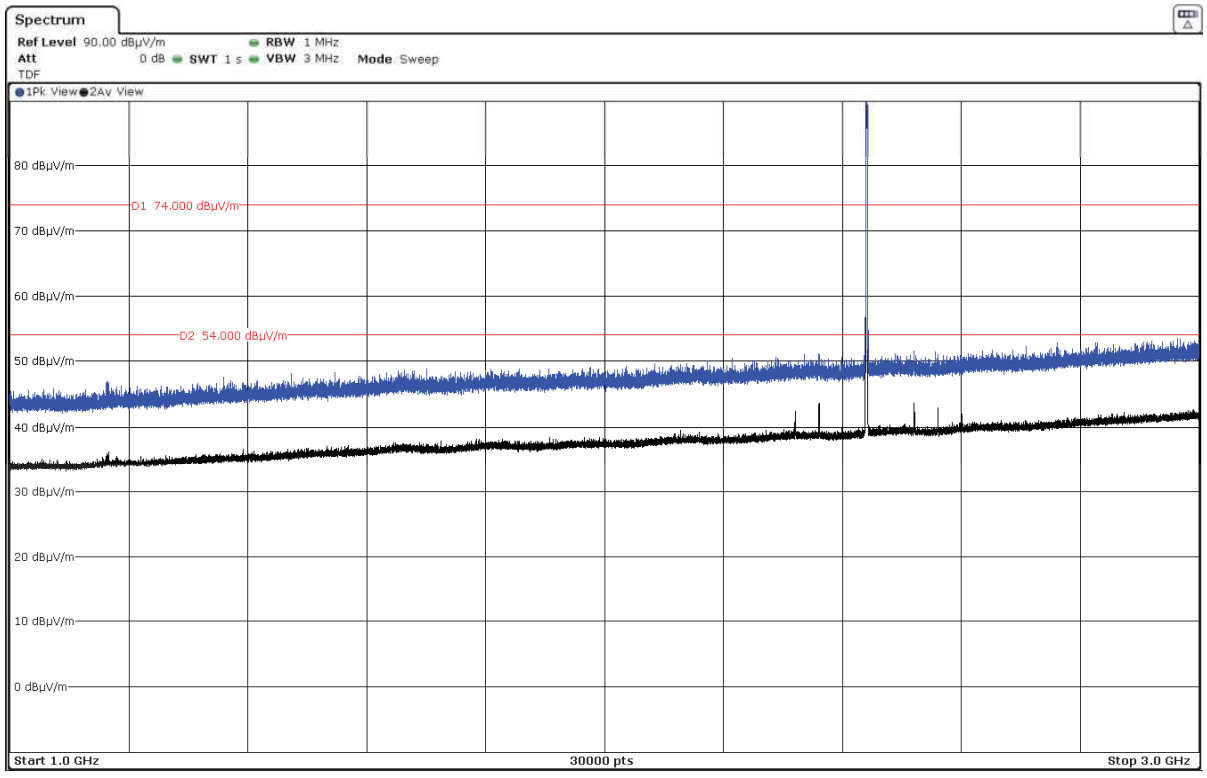
- **Modulation: GFSK (DH5)**

- Low Channel (2402 MHz):



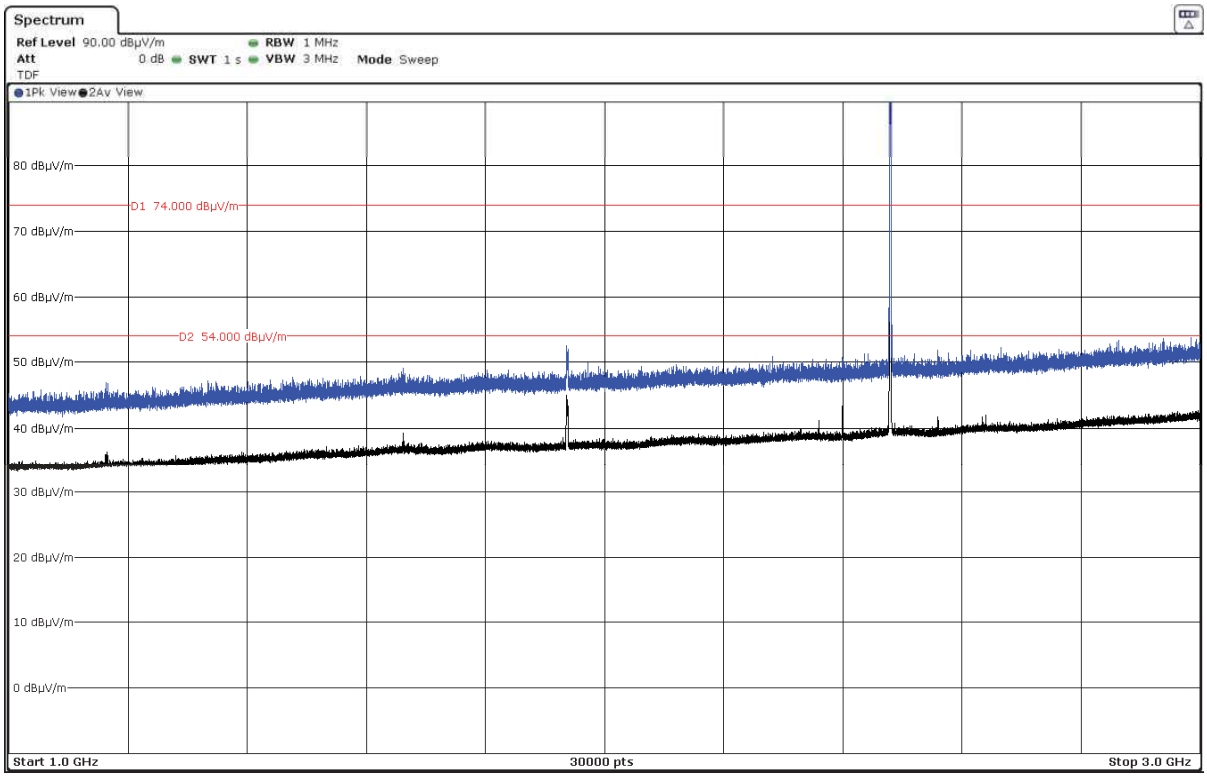
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

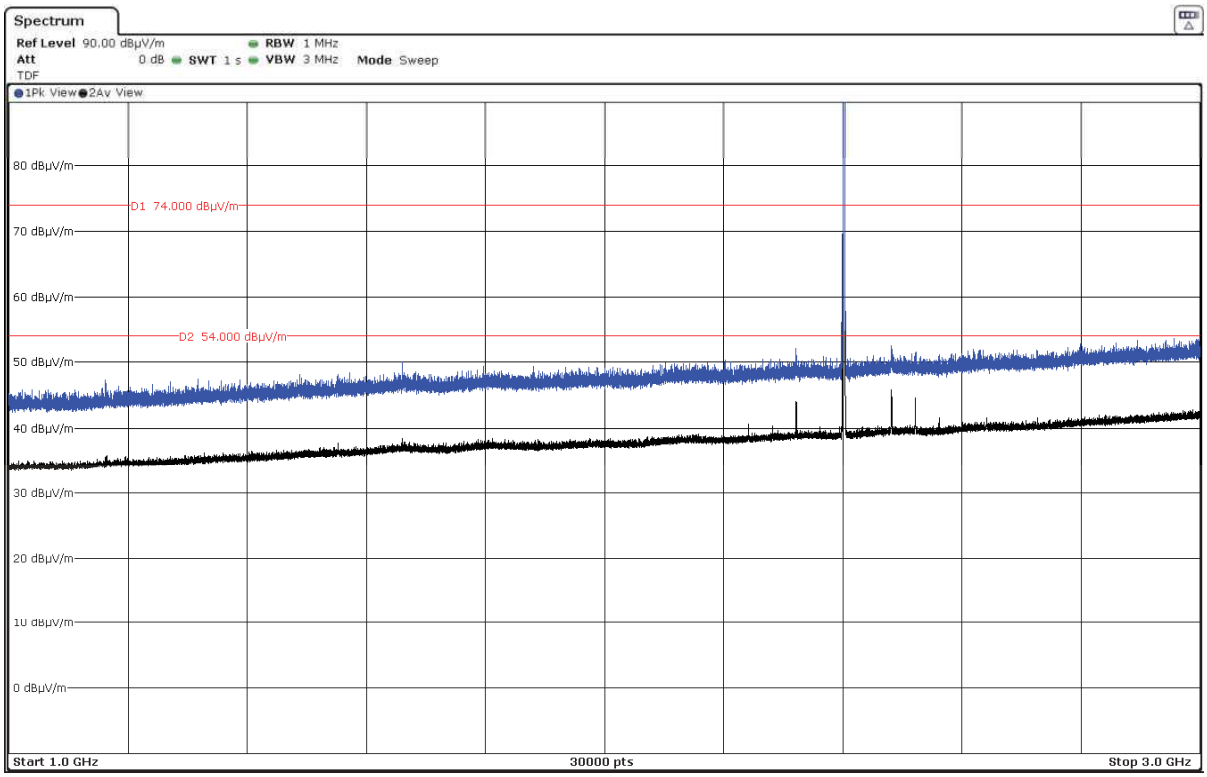
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

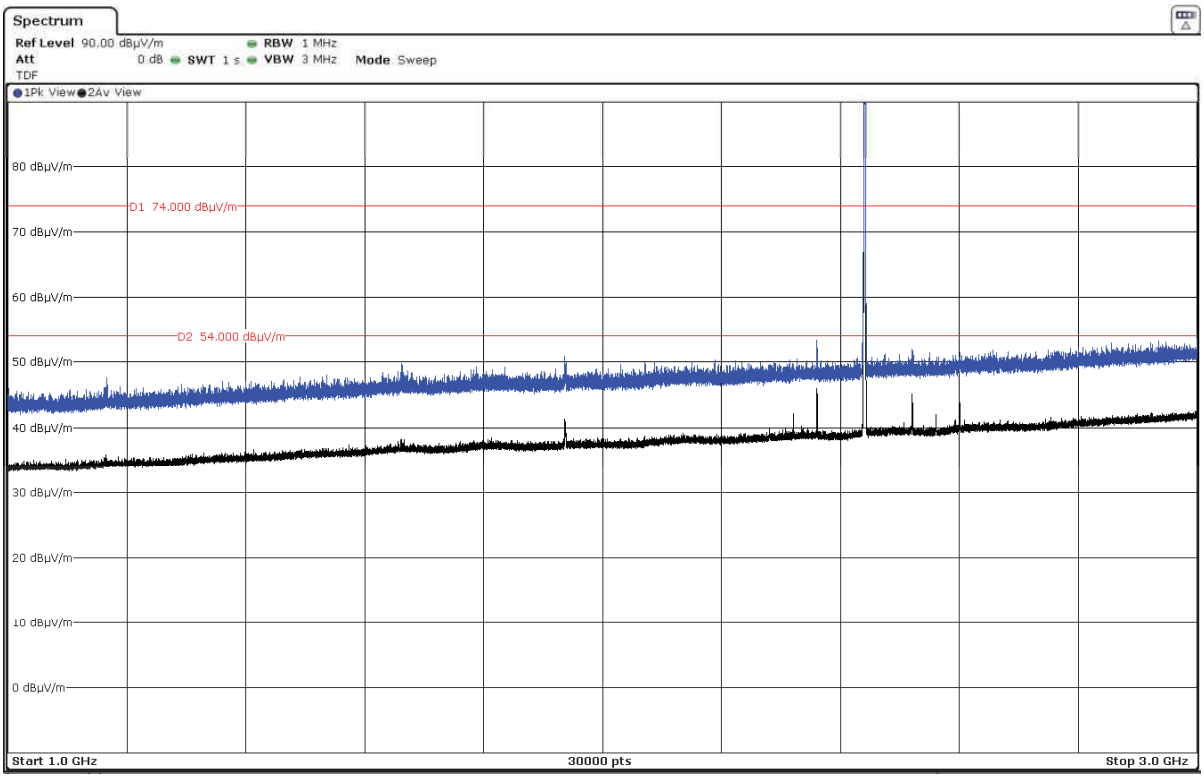
- **Modulation: PI/4-DQPSK (2DH5)**

- Low Channel (2402 MHz):



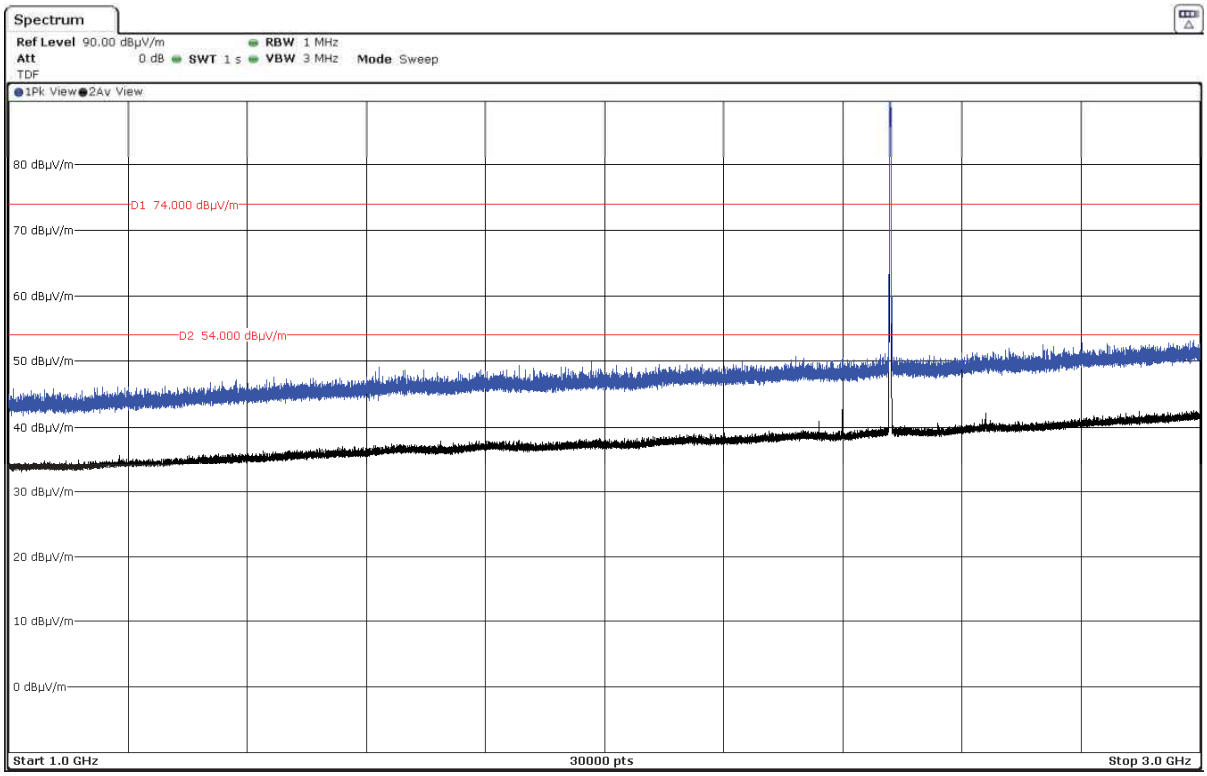
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

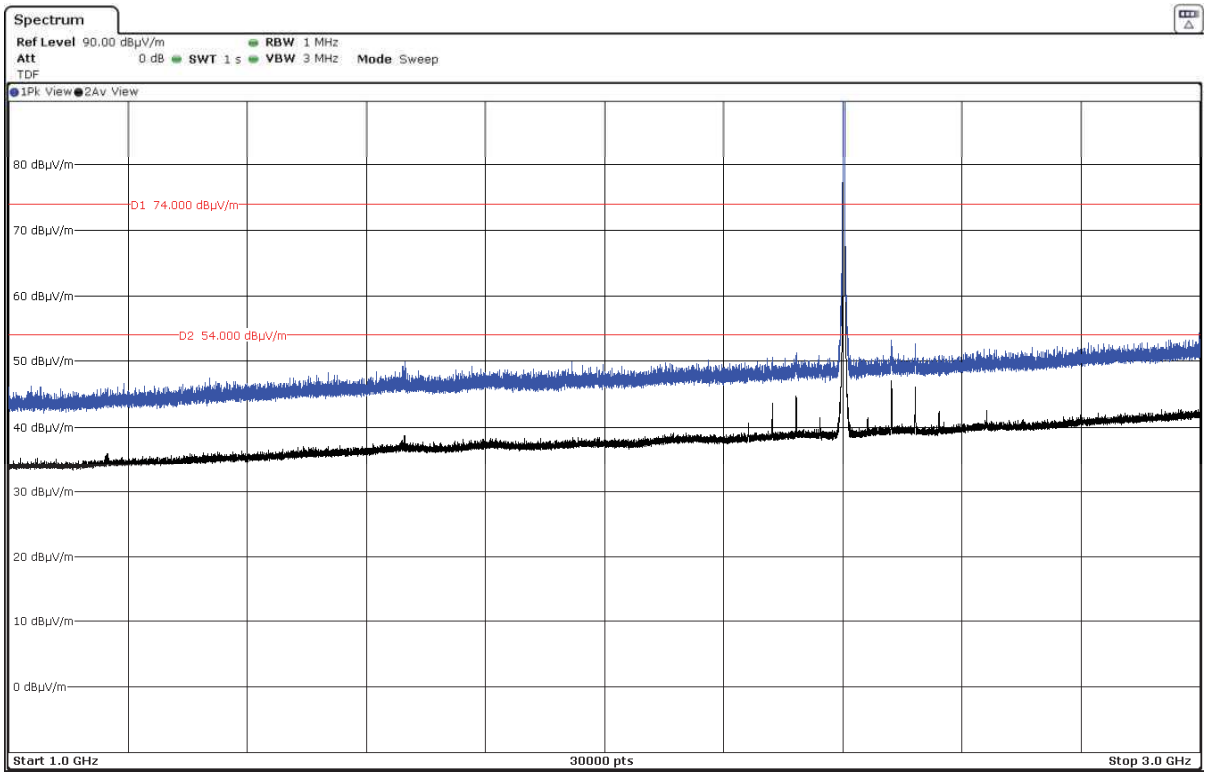
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

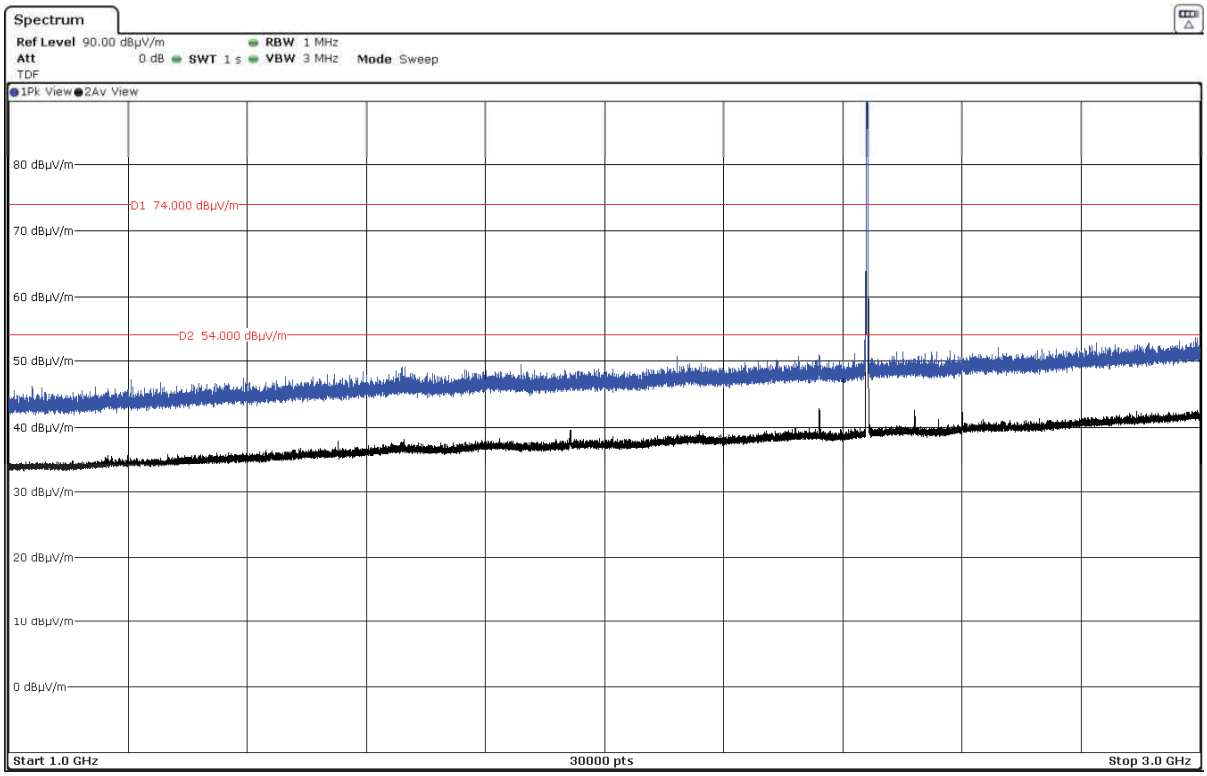
- **Modulation: 8-DPSK (3DH5)**

- Low Channel (2402 MHz):



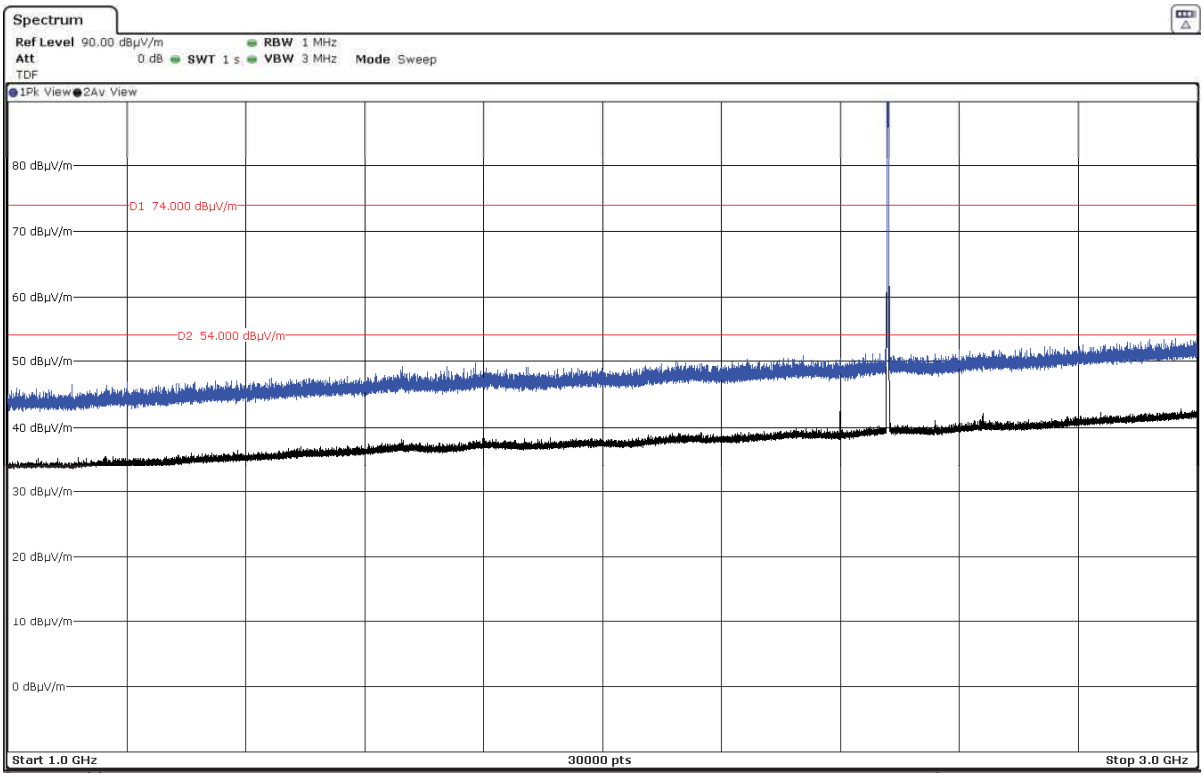
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

- High Channel (2480 MHz):

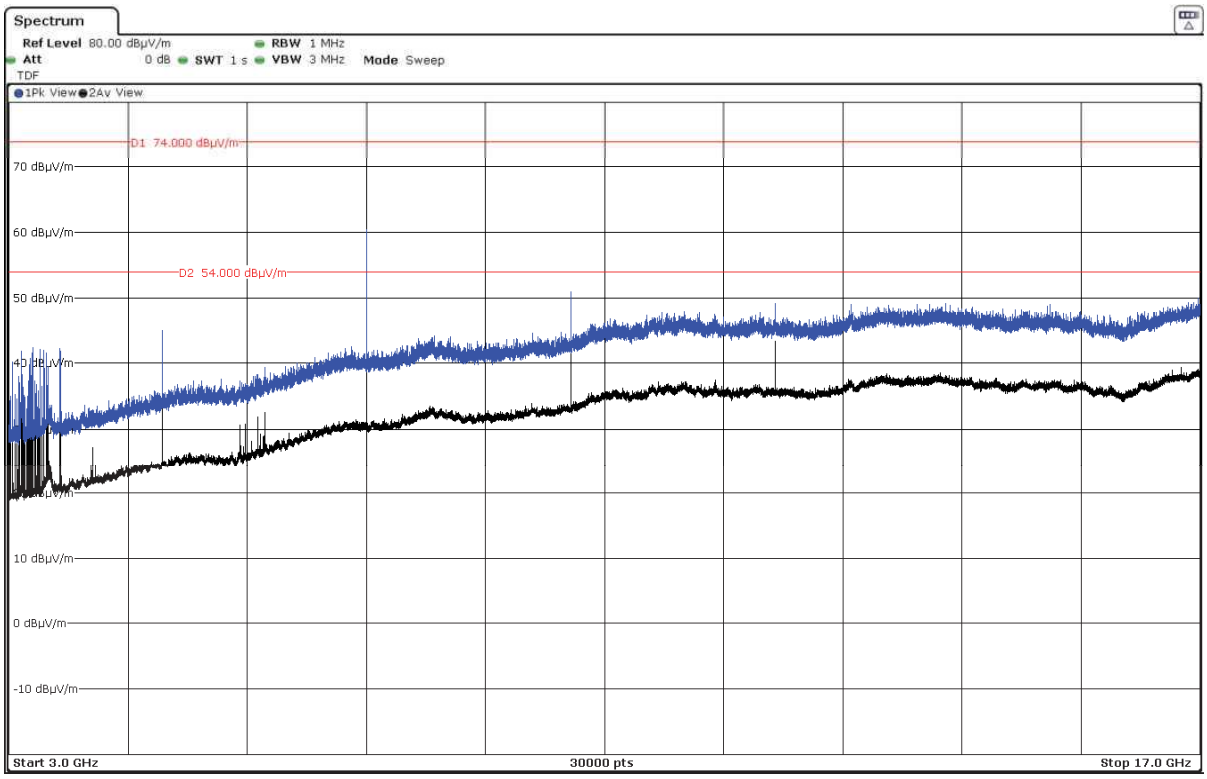


The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

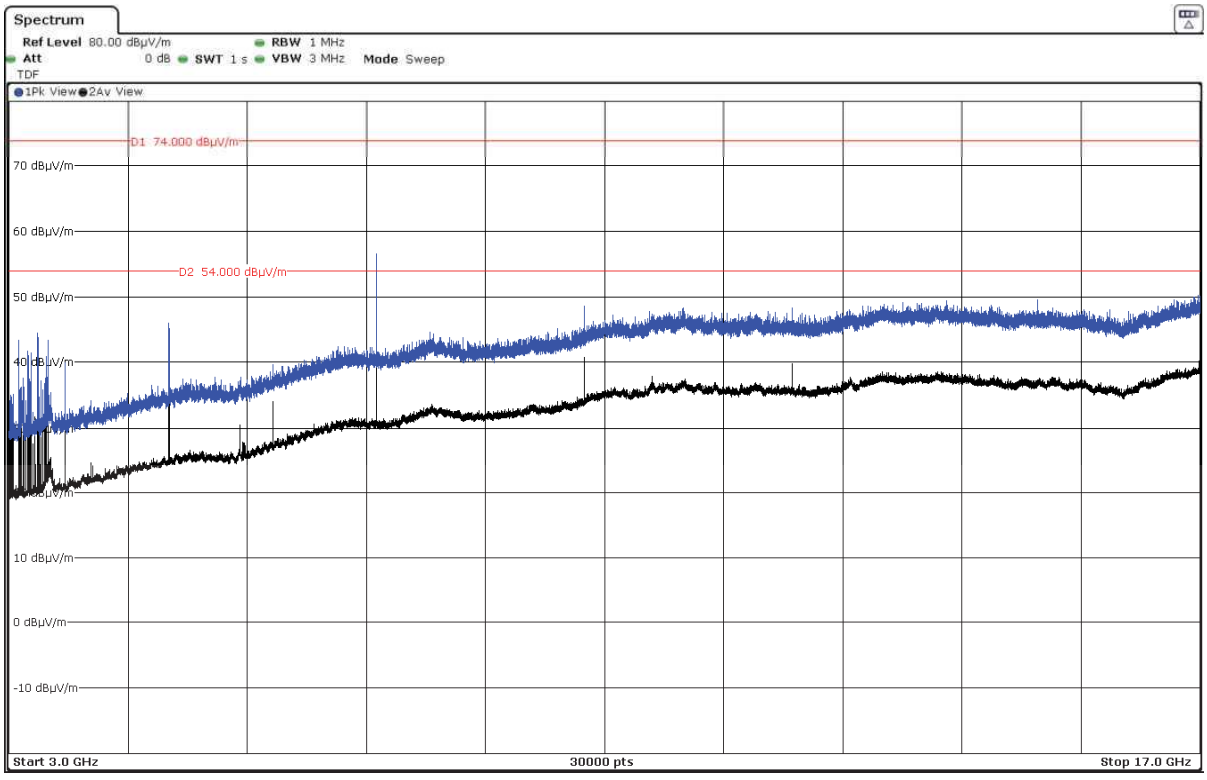
- **Modulation: GFSK (DH5)**

- Low Channel (2402 MHz):



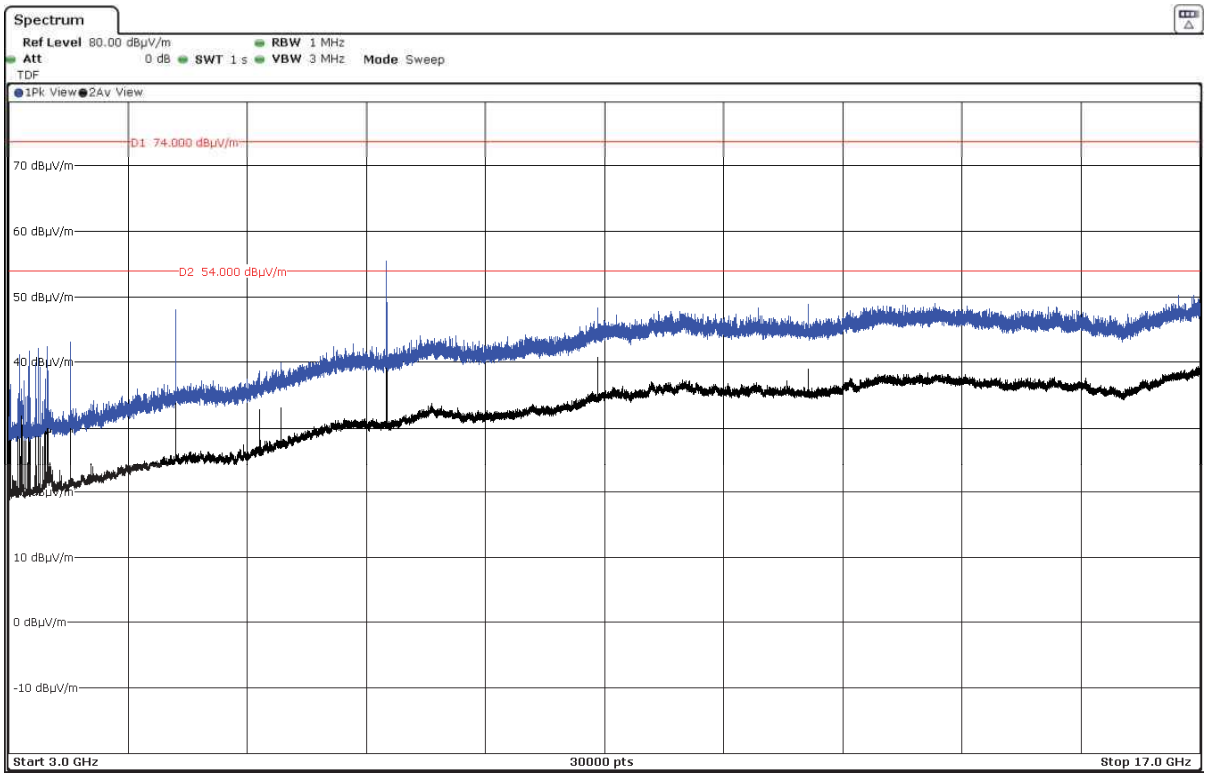
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

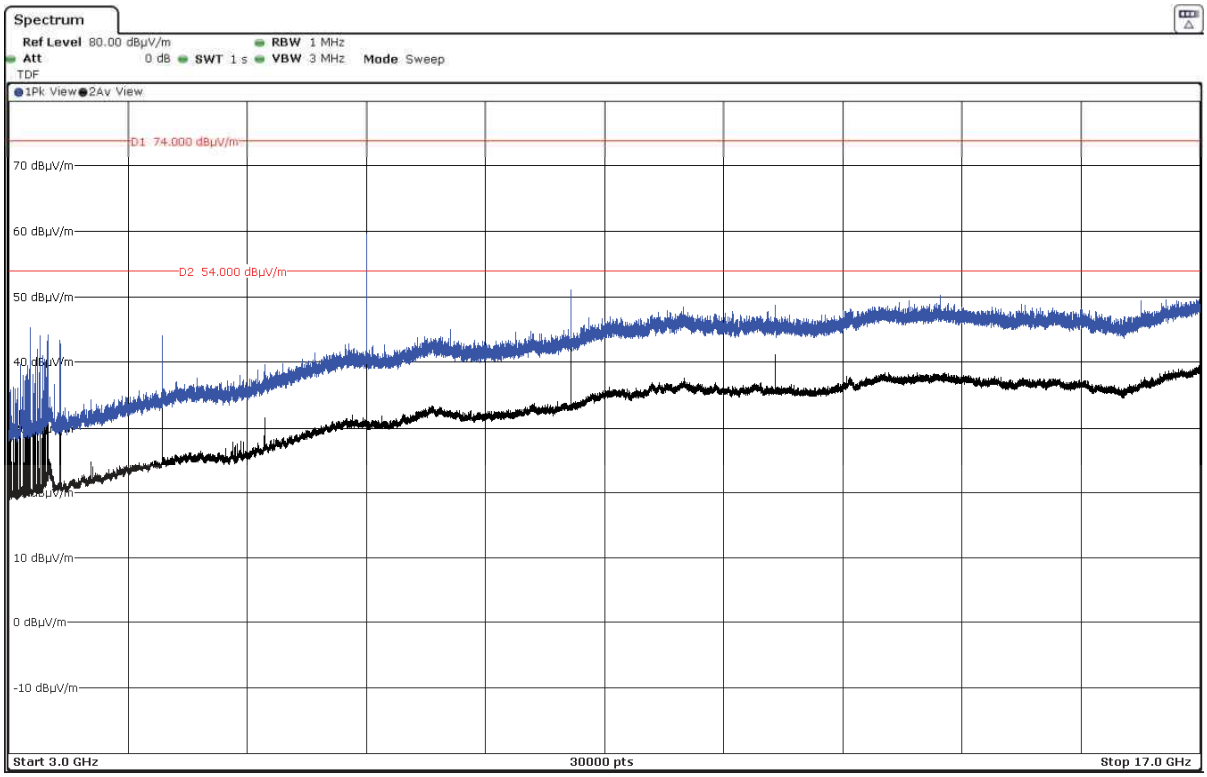
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

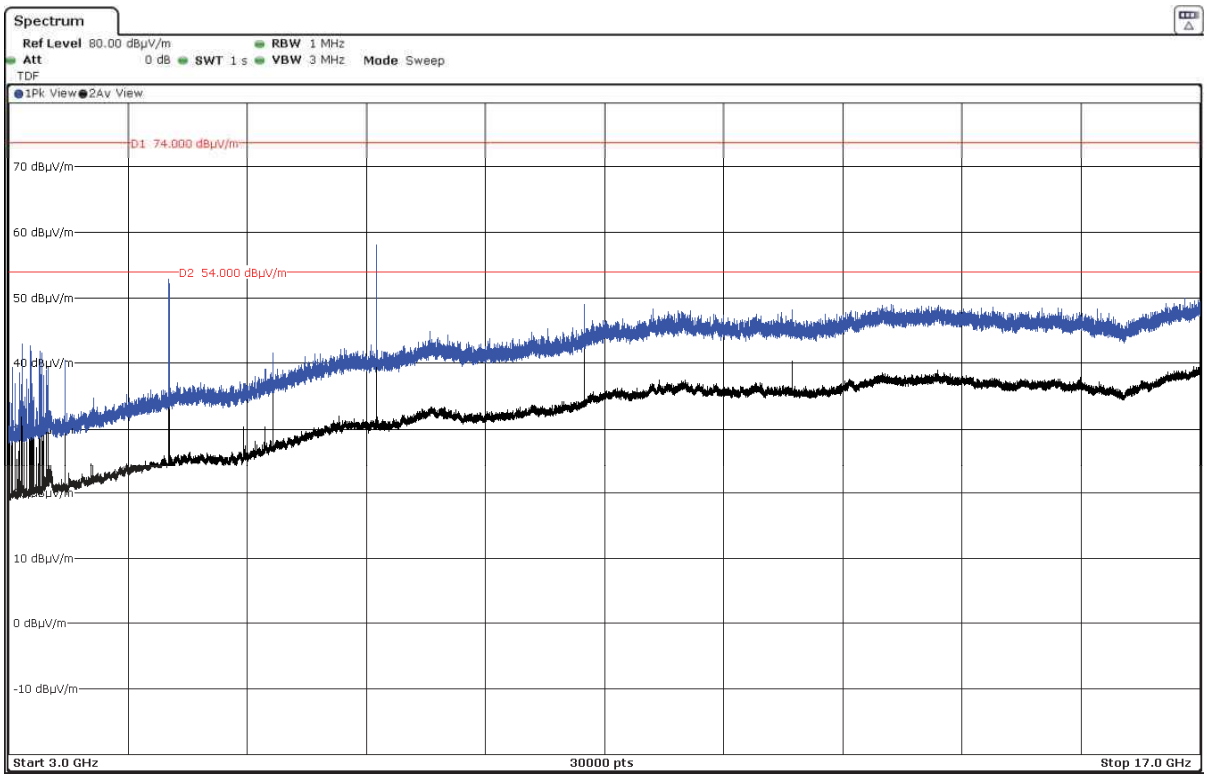
- **Modulation: PI/4-DQPSK (2DH5)**

- Low Channel (2402 MHz):



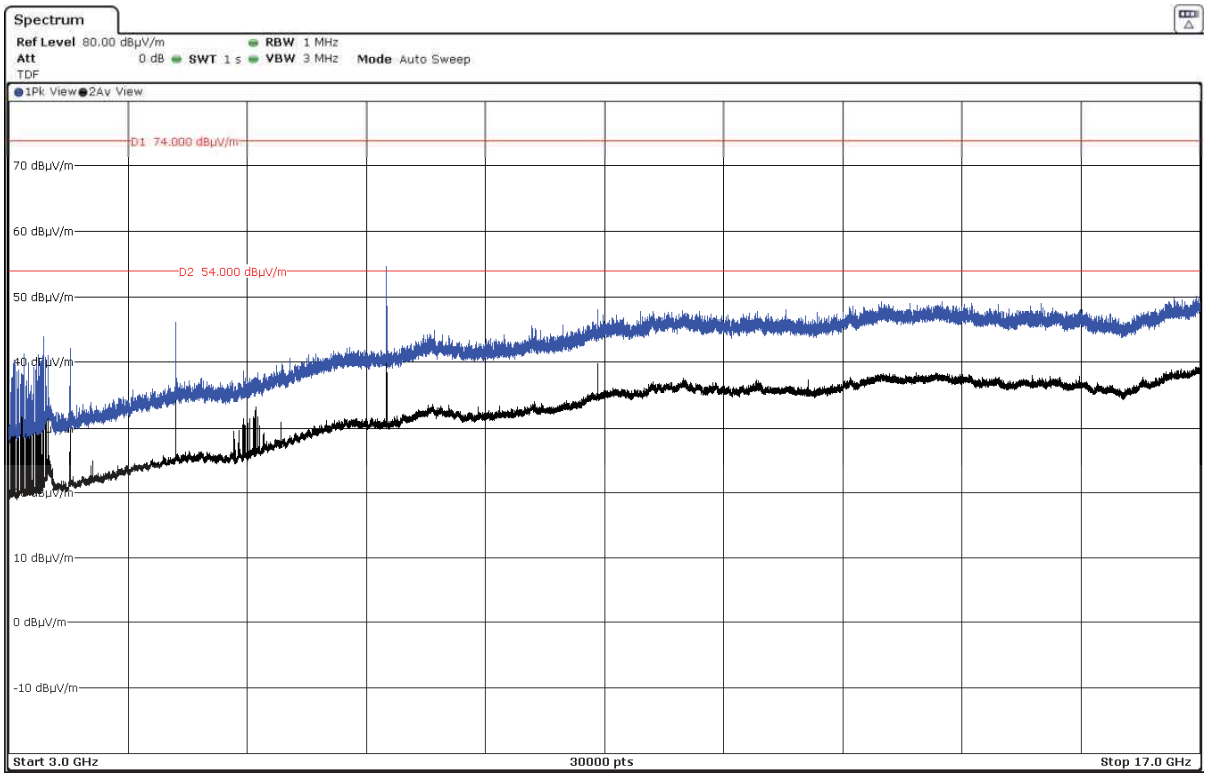
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

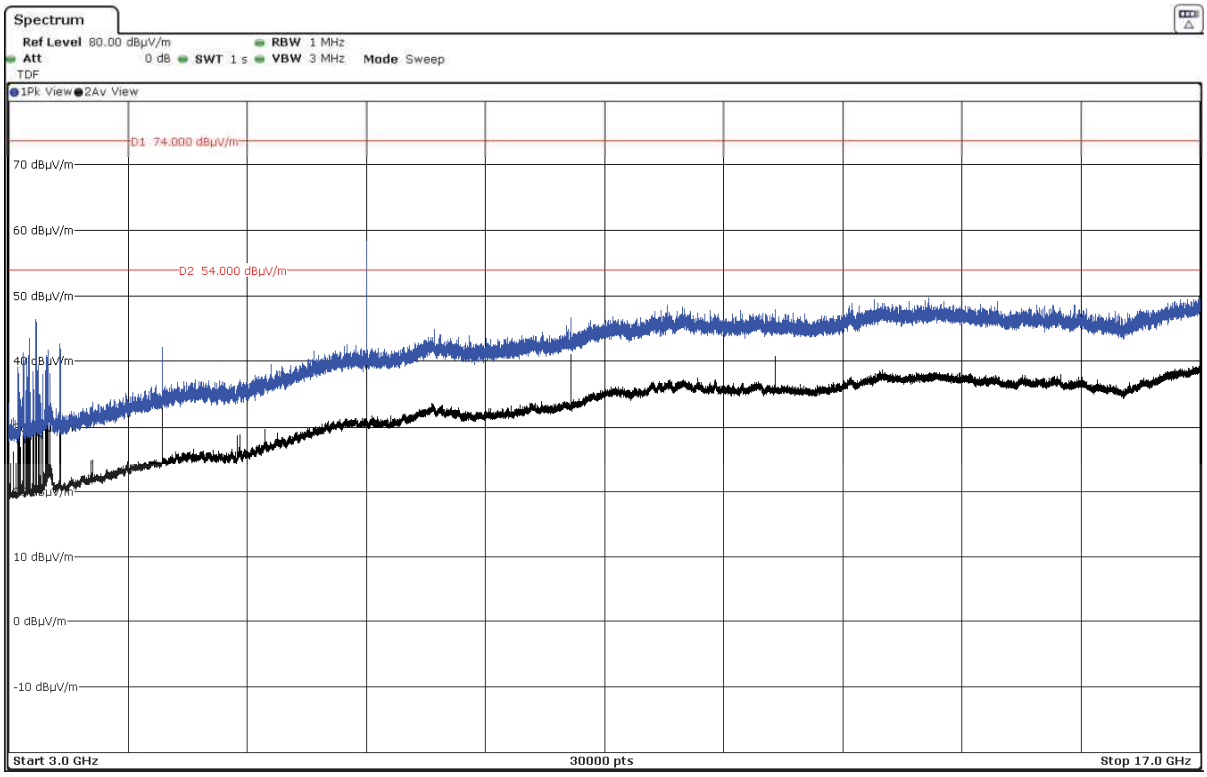
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

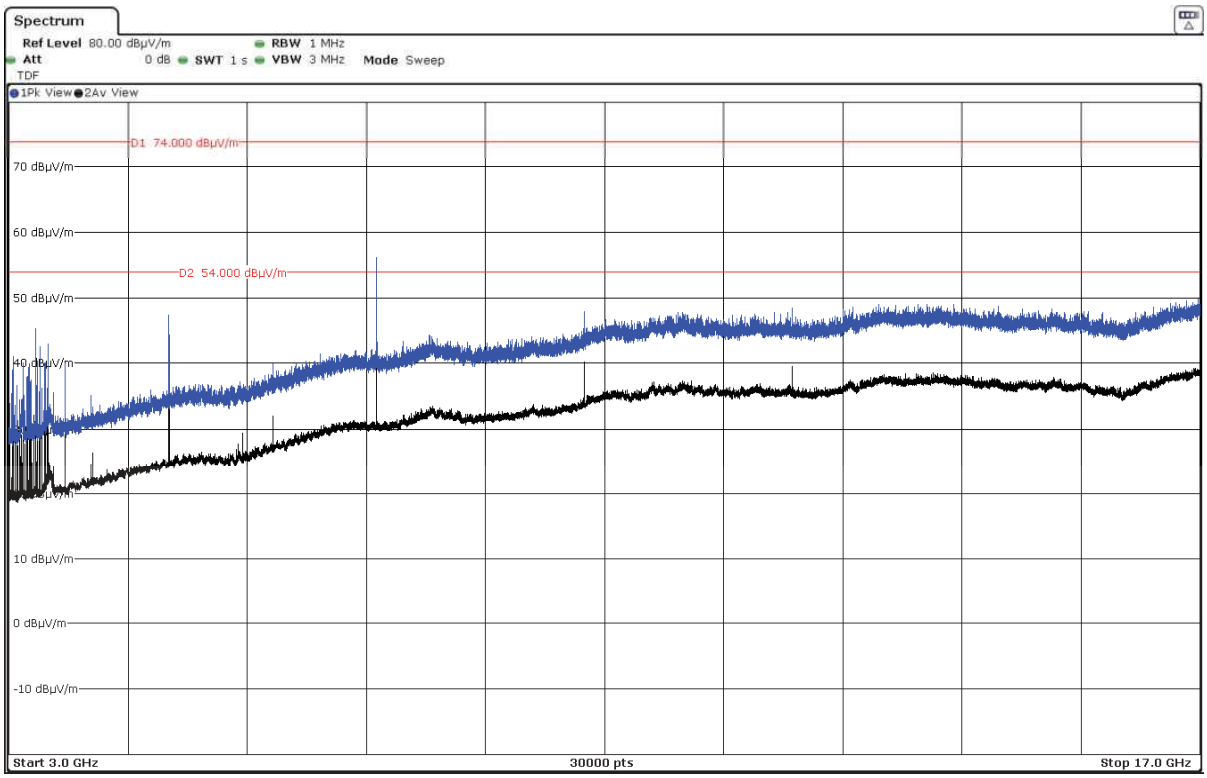
- **Modulation: 8-DPSK (3DH5)**

- Low Channel (2402 MHz):



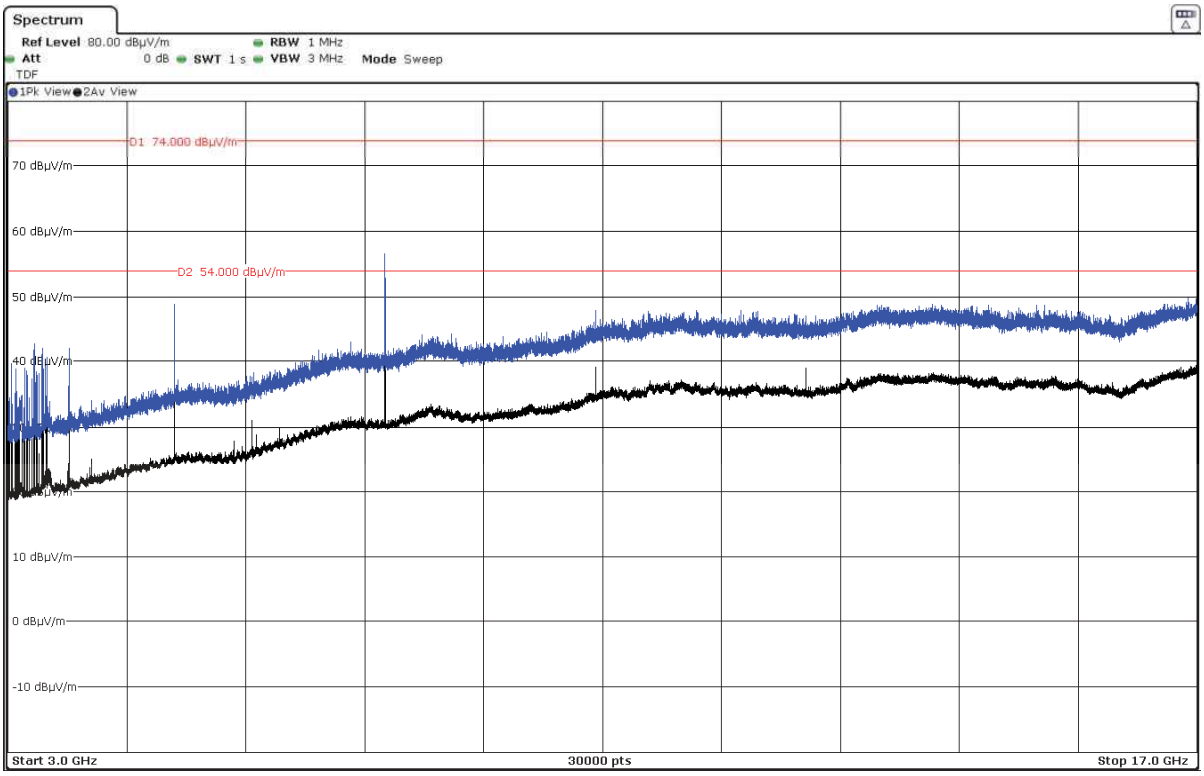
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

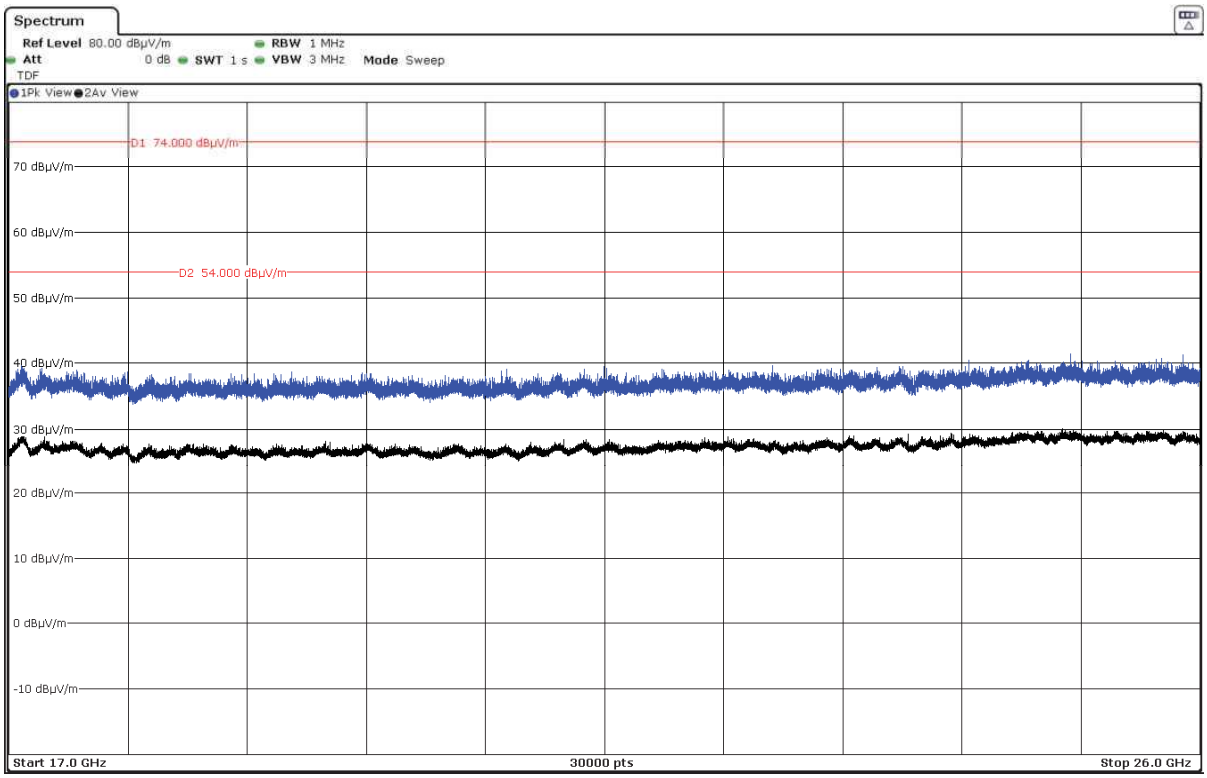
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

FREQUENCY RANGE 17 - 26 GHz:

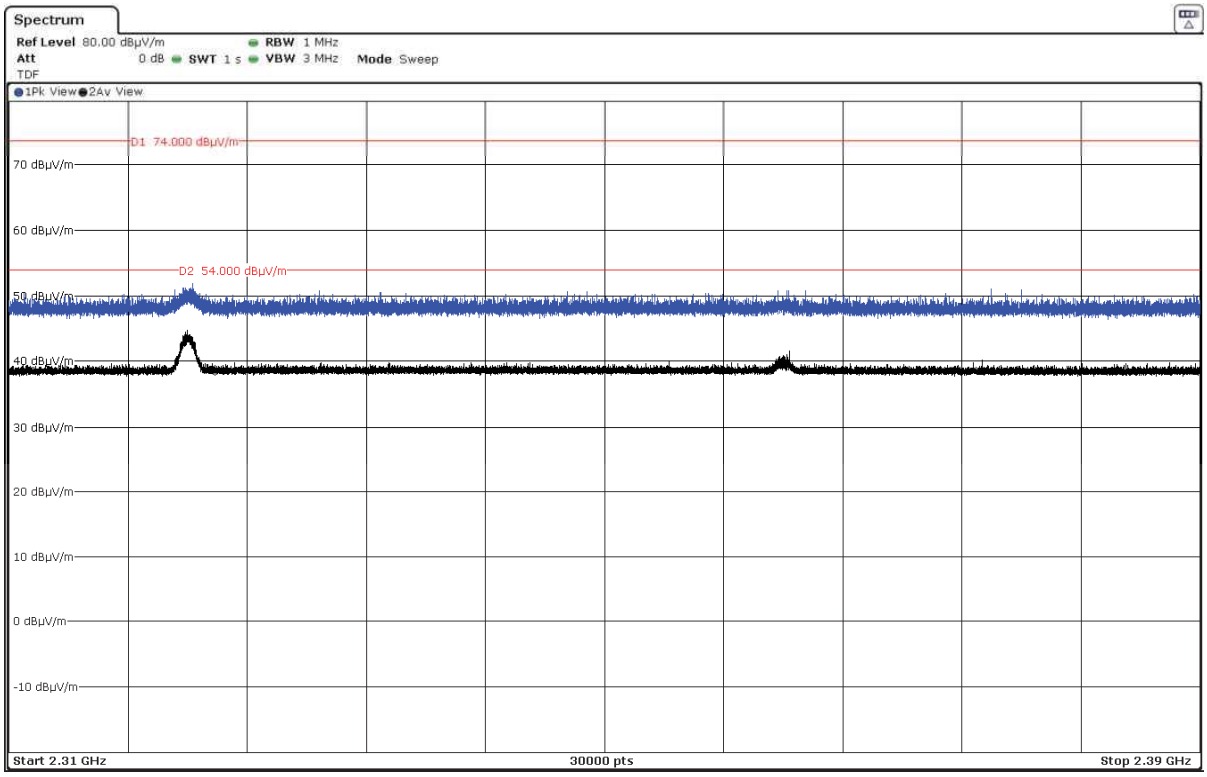
This plot is valid for the Low, Middle and High Channels and all modulation modes.



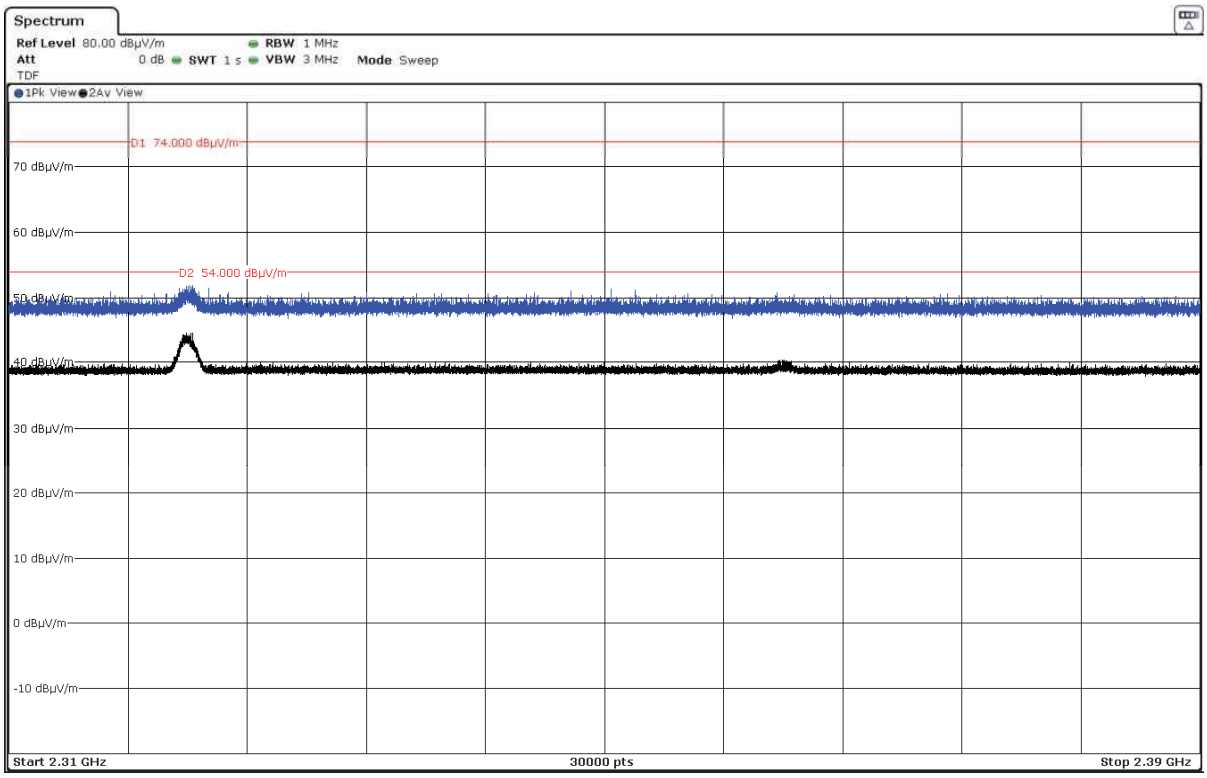
FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band 1):

- Low Channel (2402 MHz):

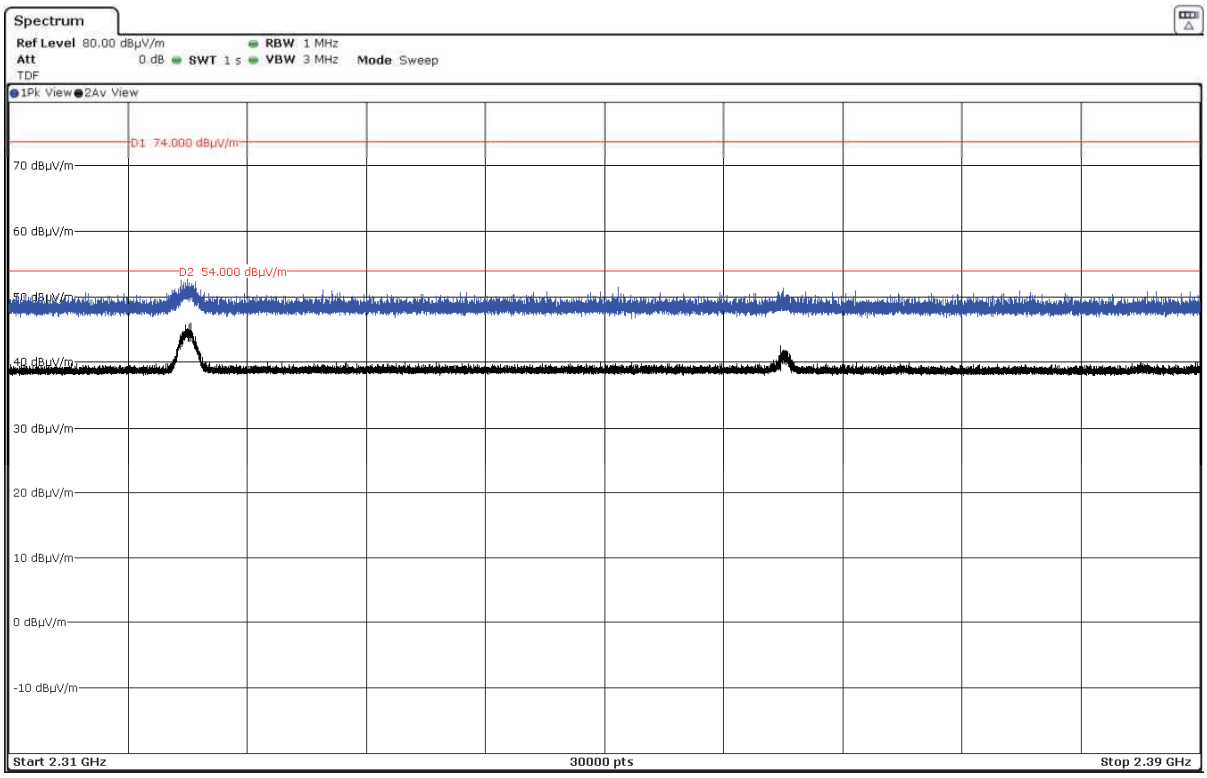
- **Modulation: GFSK (DH5)**



- **Modulation: PI/4-DQPSK (2DH5)**

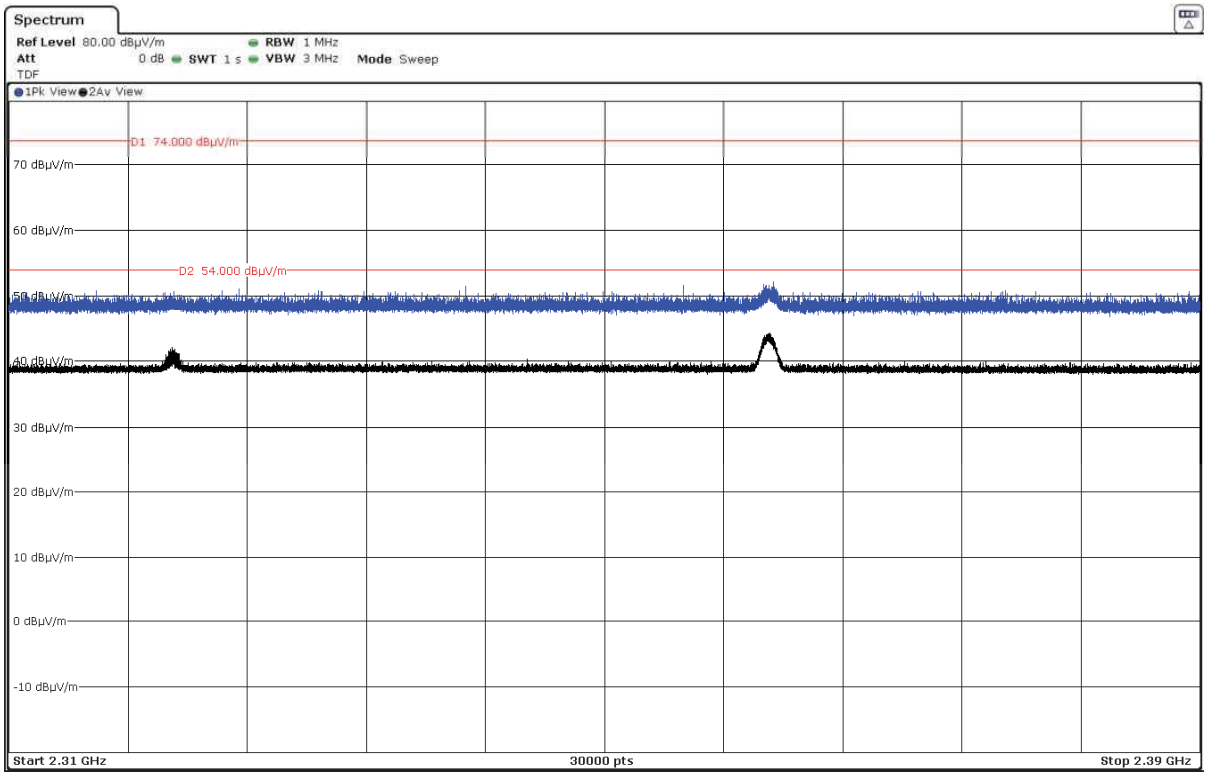


- **Modulation: 8-DPSK (3DH5)**

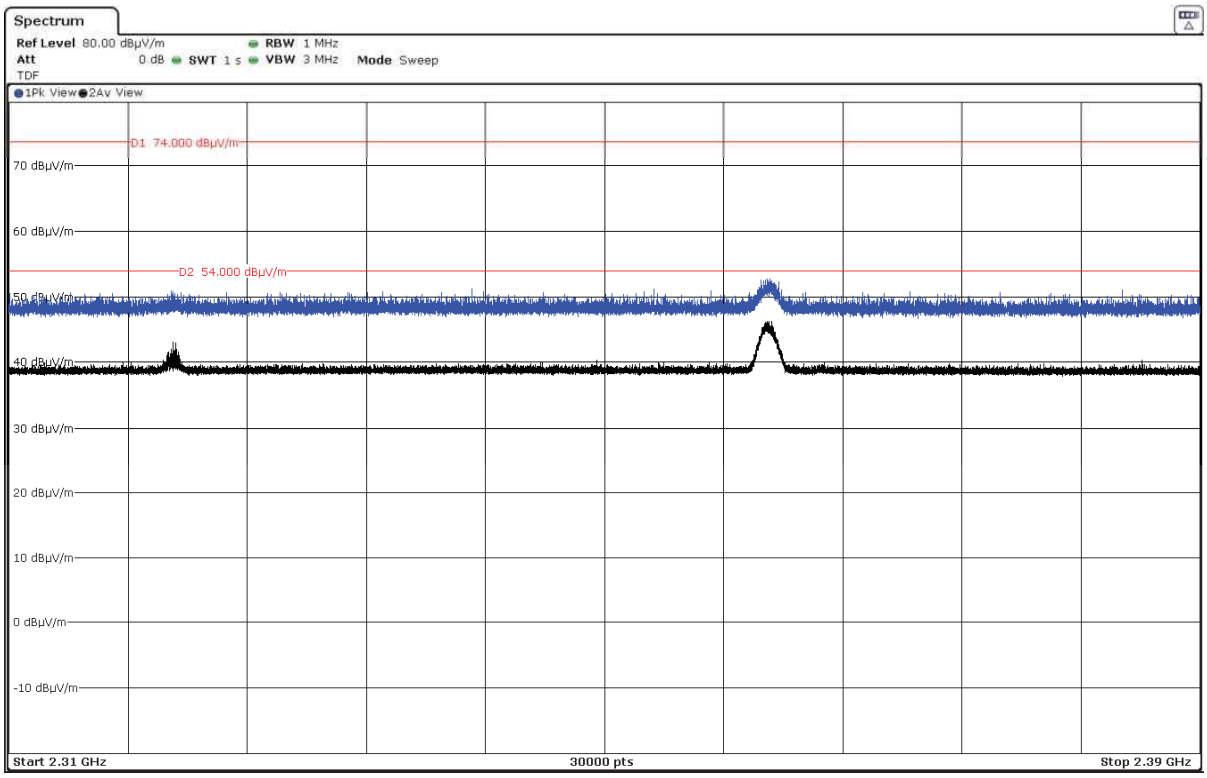


- Middle Channel (2441 MHz):

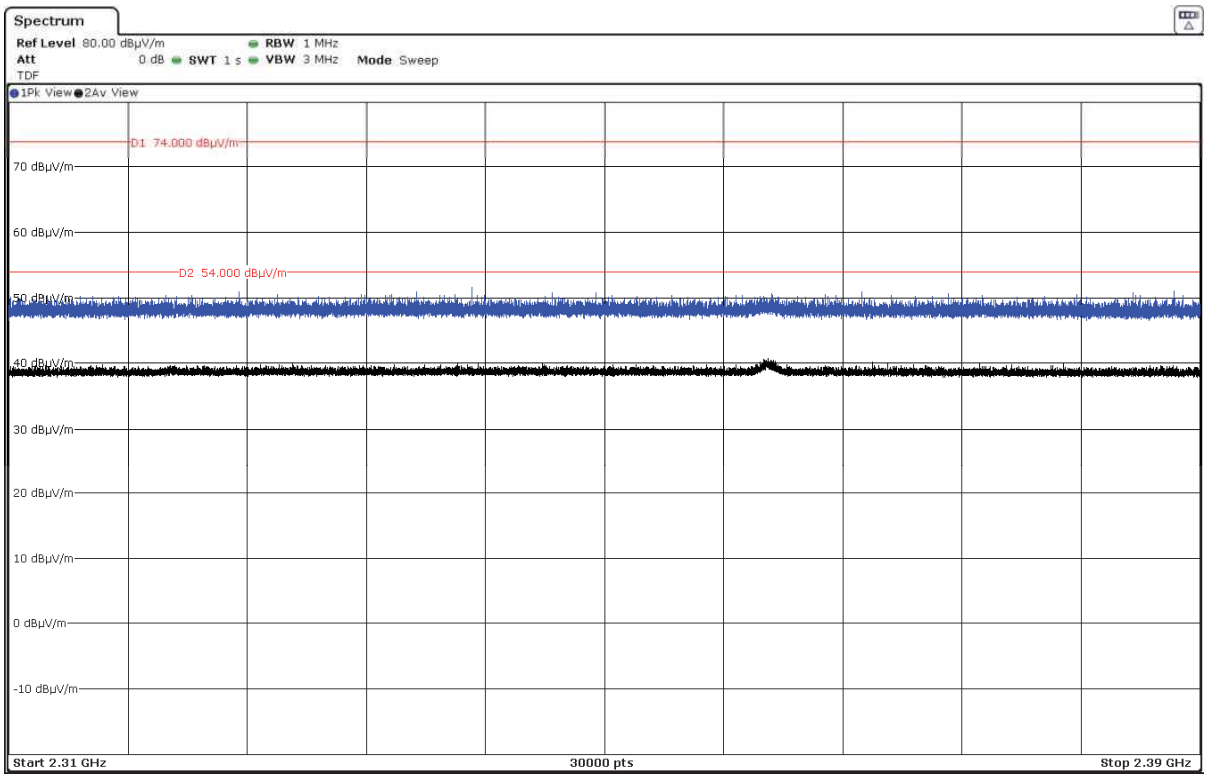
- **Modulation: GFSK (DH5)**



- **Modulation: PI/4-DQPSK (2DH5)**

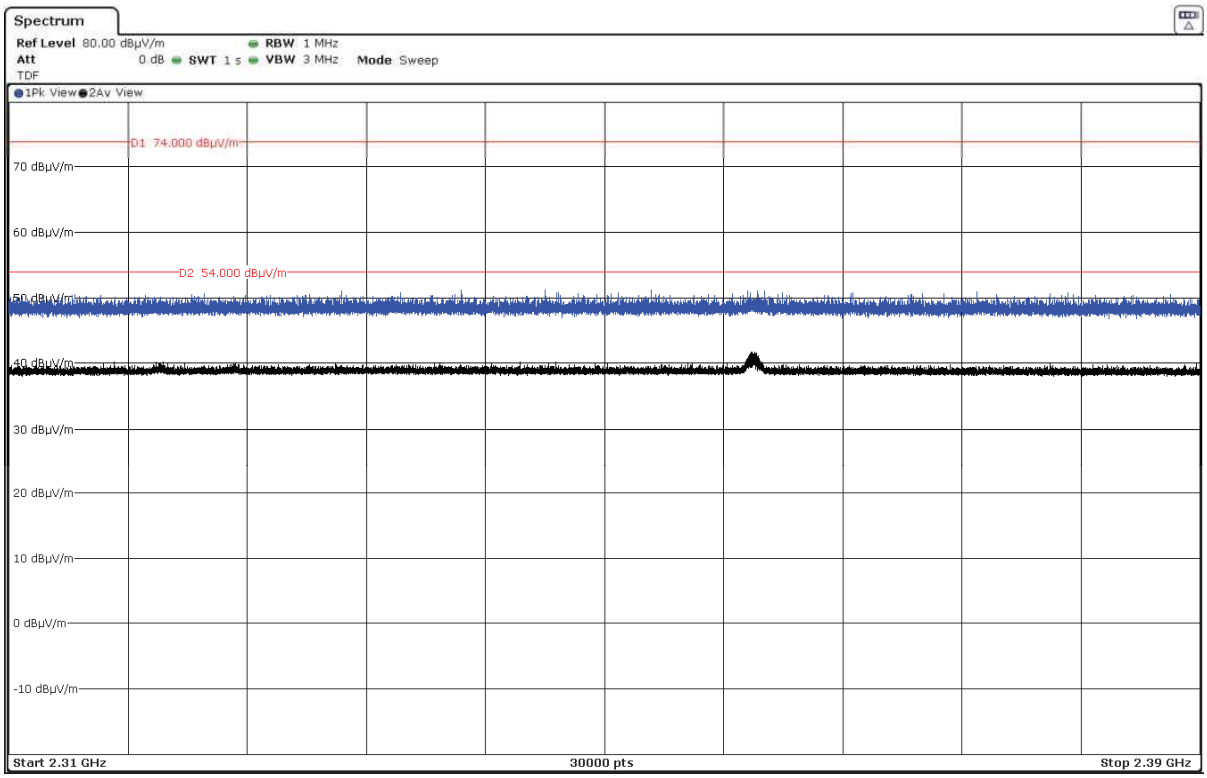


- **Modulation: 8-DPSK (3DH5)**

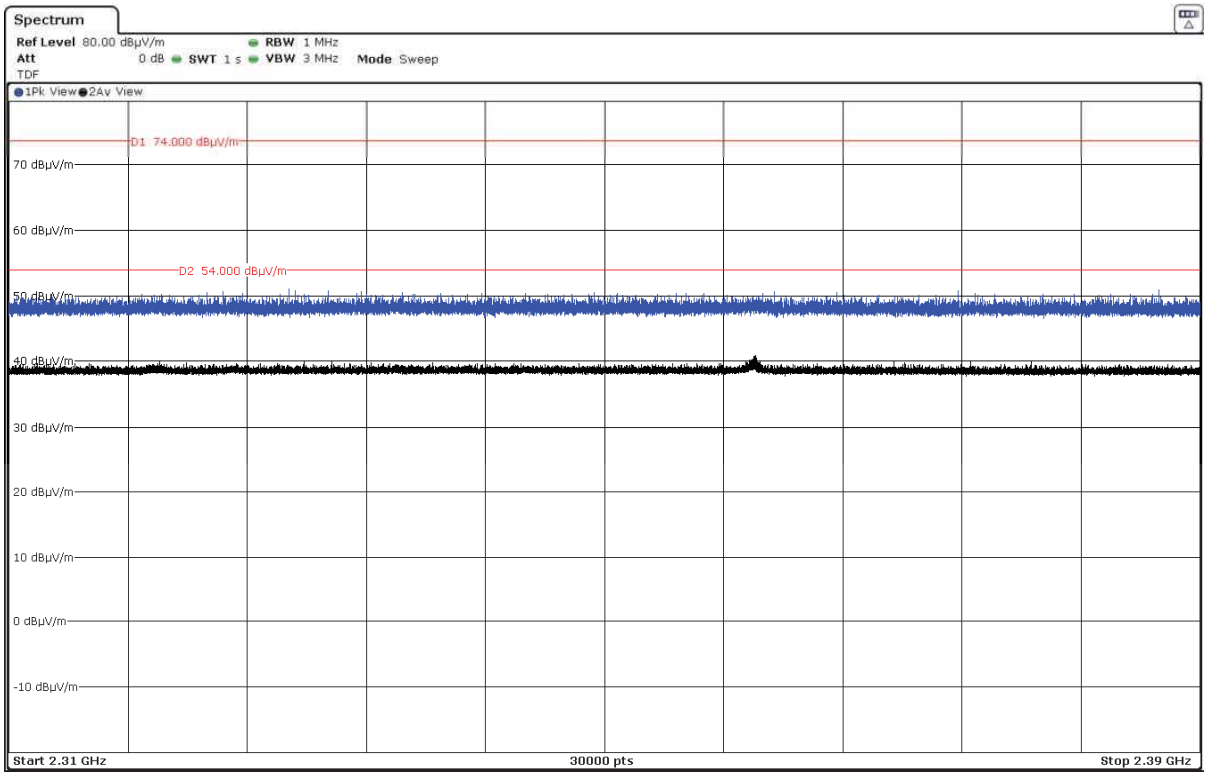


- High Channel (2480 MHz):

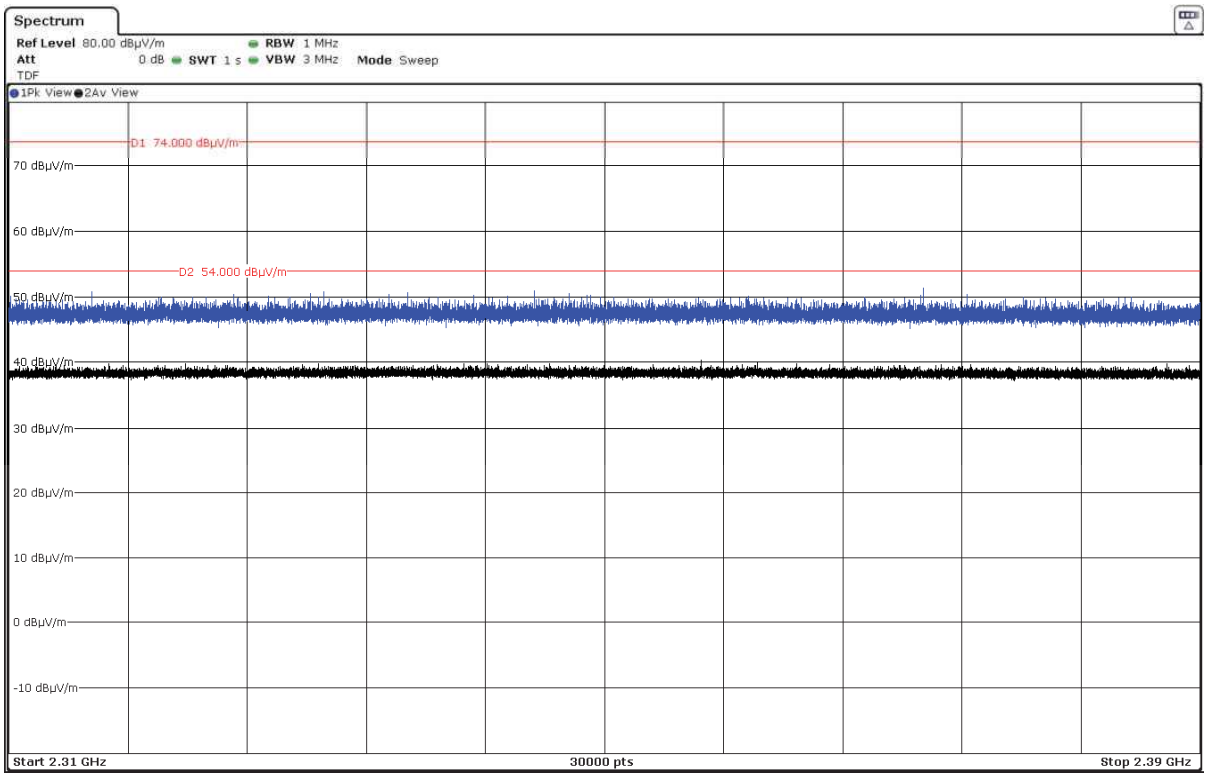
- **Modulation: GFSK (DH5)**



- **Modulation: PI/4-DQPSK (2DH5)**



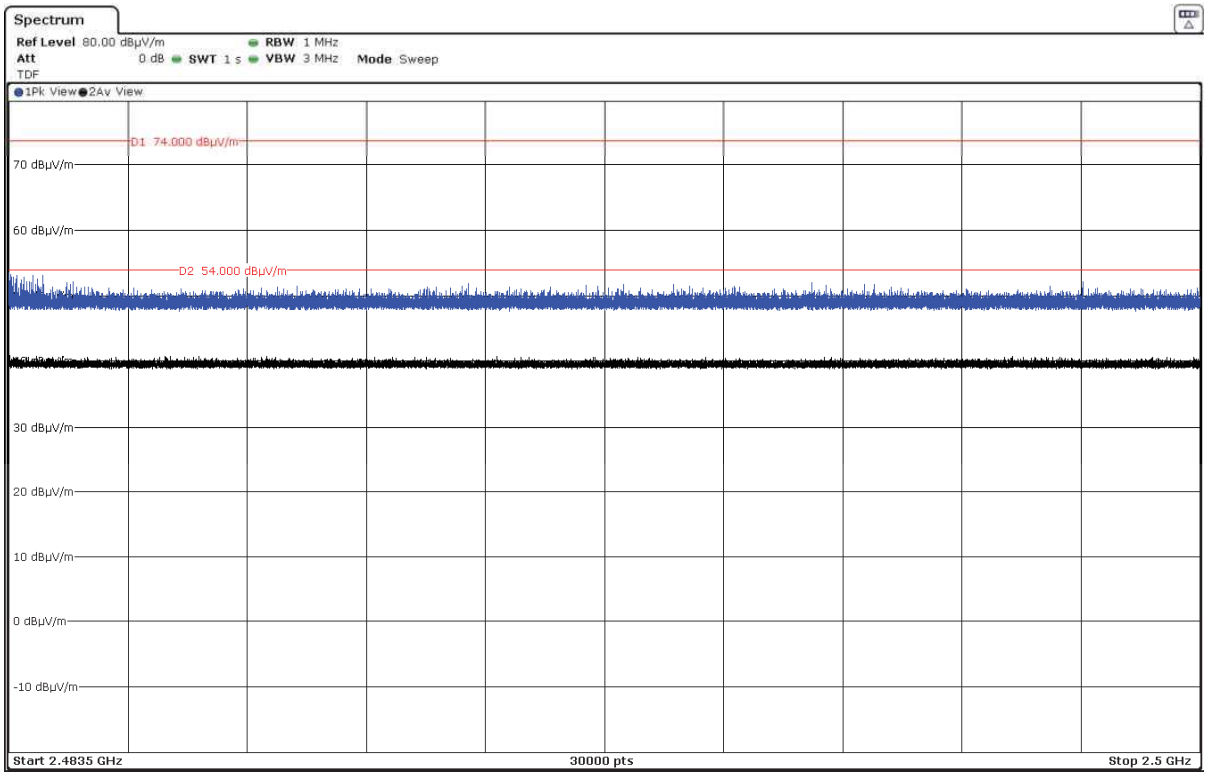
- **Modulation: 8-DPSK (3DH5)**



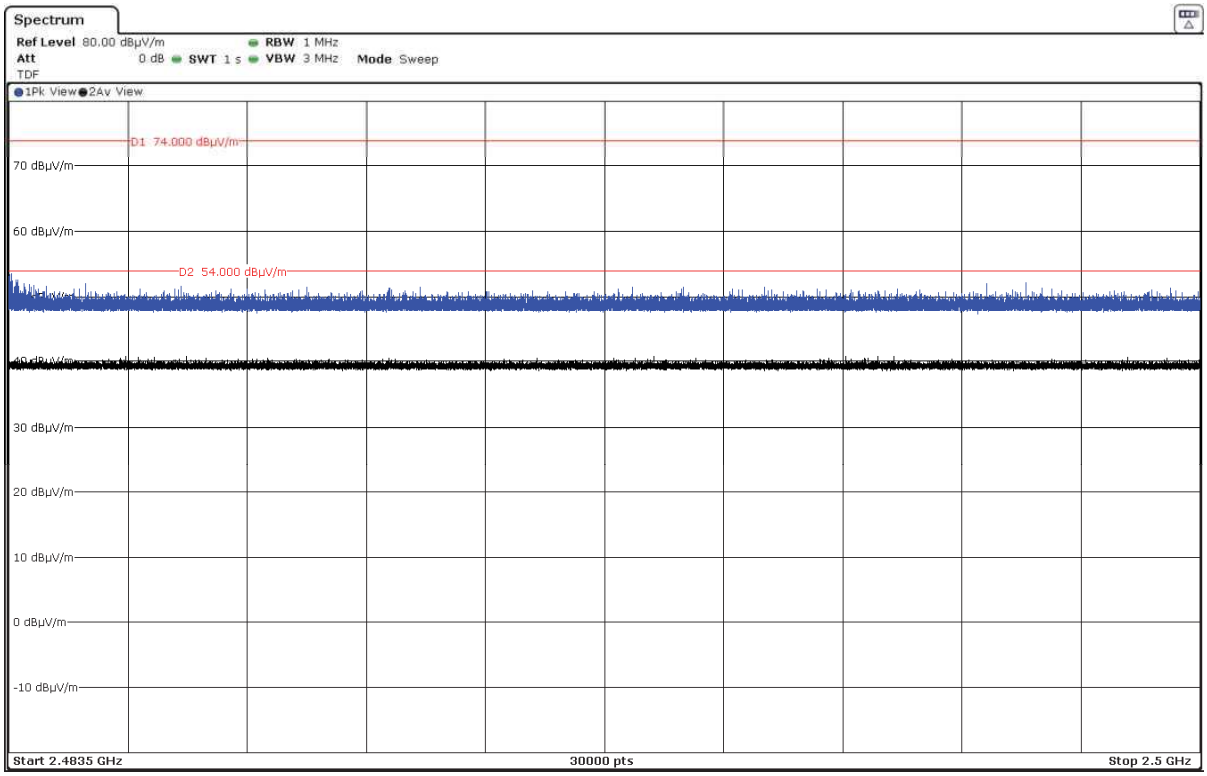
FREQUENCY RANGE 2.4835-2.5 GHz:

- High Channel (2480 MHz):

- **Modulation: GFSK (DH5)**



- **Modulation: PI/4-DQPSK (2DH5)**



- **Modulation: 8-DPSK (3DH5)**