DEKRA Testing and Certification, S.A.U.
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C.I.F. A29 507 456

DEKRA

ENAC ENSAYOS Nº 51/LE147

Test report No:
NIE: 56925RRF.001A1

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
Other identification of the product	HW version: HW3.1 SW version: 19w13.2-1-36 FCC ID: T8GMGUF IC: 6434A-MGUF
(*) Features	Bluetooth, WLAN, GNSS
Applicant	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY
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: 2019.11.26 09:15:45 +01'00'
Date of issue	2019-11-26
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.

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.
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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 sample of MGU F is an automotive head unit to be installed in cars with the following features: Bluetooth, WLAN, GNSS.

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
56925B/058	Automotive Infotainment System	MGU F	B264D$0K8951102	2019/08/07
56925B/053	Antenna	--	--	2019/05/30
56925B/054	Antenna	--	--	2019/05/30
56925B/055	Antenna	--	--	2019/05/30
56925B/015	Harness	--	--	2019/05/30
56925B/024	Interface Board	--	--	2019/05/30

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

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

Control N°	Description	Model	Serial N°	Date of reception
56925B/056	Automotive Infotainment System	MGU F	B264D40K8951047	2019/08/07
56925B/015	Harness	--	--	2019/05/30
56925B/024	Interface Board	--	--	2019/05/30

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

Test sample description

Ports..... :	Port name and description		Cable				
			Specified length [m]		Attached during test		Shielded
	Not provided data				☐		☐
Supplymentary information to the ports..... :	Not provided data						
Rated power supply.....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☒	DC: 12Vdc.					
Rated Power .....:	Not provided data						
Clock frequencies.....:	Not provided data						
Other parameters.....:	Not provided data						
Software version .....:	19w13.2-1-36						
Hardware version .....:	HW3.1						
Dimensions in mm (W x H x D) ...:	Not provided data						
Mounting position .....:	☒	Other: Car radio					
Modules/parts.....:	Module/parts of test item		Type			Manufacturer	
	Not provided data						

Identification of the client

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH
BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-06-04
Date (finish)	2019-10-29

Document history

Report number	Date	Description
56925RRF.001	2019-11-06	First reléase
56925RRF.001A1	2019-11-26	First modification. Added the sentence and the table with different configurations of modulations and data rates in the appendix B. This modification test report cancels and replaces the test report 56925RRF.001.

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: Cristina Calle, Jaime Barranquero, Nicolás Salguero, Francisco José Alcaide, José Manuel Jiménez, Miguel Ángel Torres, José Gabriel Pendón.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
2.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
3.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/09	2021/09
4.	DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02

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	2019/10	2021/10
3.	RF pre-amplifier 10 MHz-6 GHz Bonn Elektronik BLNA 0160-01N	2019/02	2020/025
4.	Biconical/Log Antenna ETS LINDGREN 3142E	2017/04	2020/04
5.	Spectrum analyser Rohde & Schwarz FSW50	2018/02	2020/02
6.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2019/04	2020/04
7.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2016/11	2019/11
8.	DC Power Supply Keysight Technologies U8002A	---	---
9.	Digital multimeter FLUKE 179	2019/06	2020/06
10.	RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
11.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2018/07	2021/07
12.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02

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	
Supplementary information and remarks: None.			

2. WLAN 2.4 GHz (802.11 b/g/n2040 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	
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):

Vnonimal:	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:

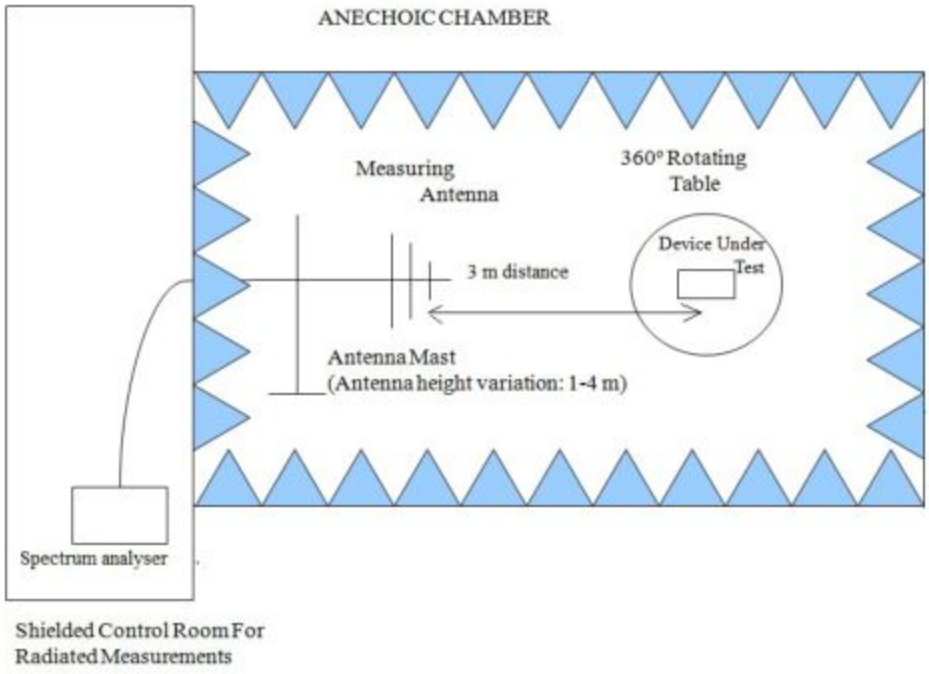
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn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

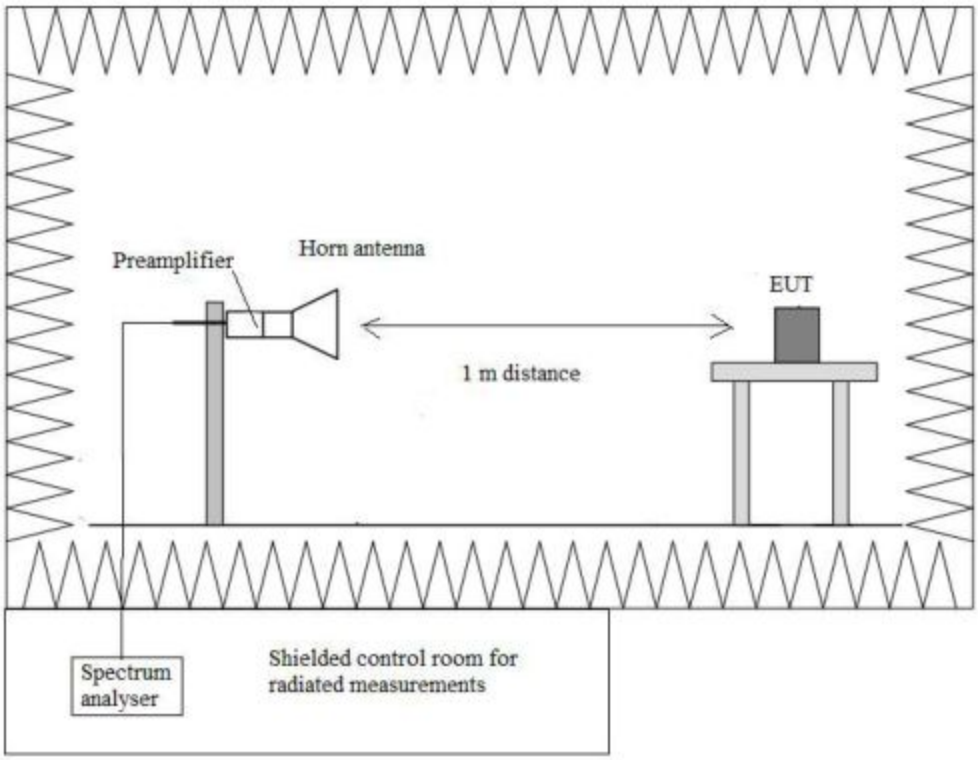
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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


Preamplifier
Horn antenna
EUT
1 m distance
Spectrum analyser
Shielded control room for radiated measurements

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)	944.126	941.262	941.934
99% Bandwidth (kHz)	877.315	874.0936	880.0461
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)	1361	1365	1361
99% Bandwidth (kHz)	1206.6	1211.3	1208.2
Measurement uncertainty (kHz)	<±5.0		

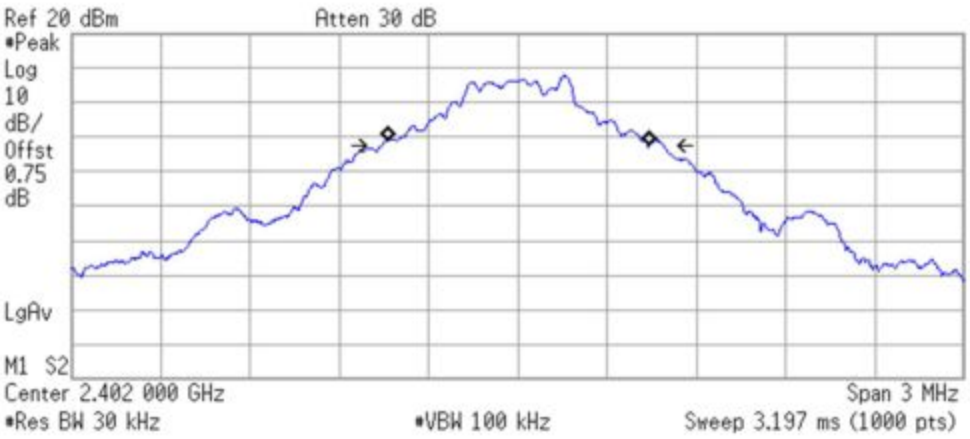
- **8DPSK**

	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
20 dB Spectrum Bandwidth (kHz)	1315	1315	1318
99% Bandwidth (kHz)	1206.4	1207.7	1208
Measurement uncertainty (kHz)	<±5.0		

Verdict: PASS

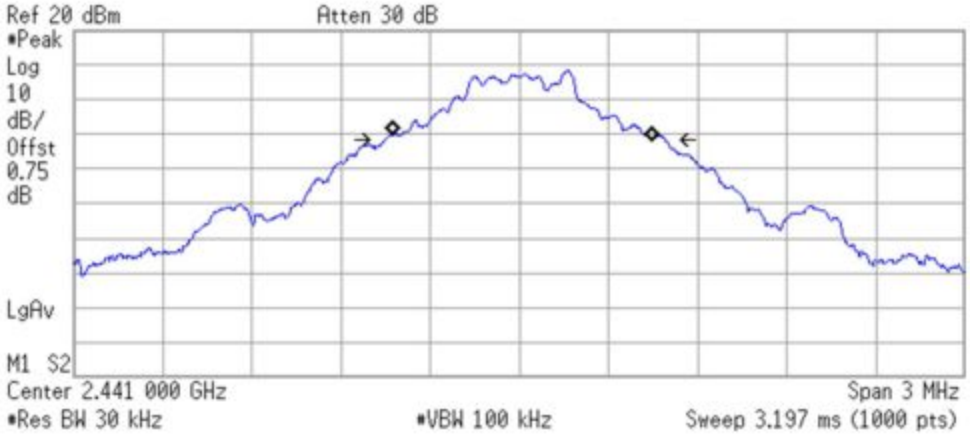
- **GFSK – Bandwidths**

- Low Channel:



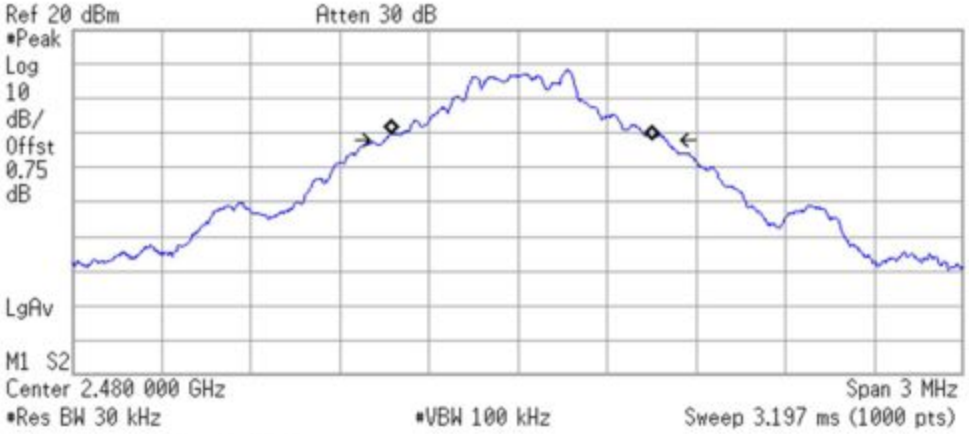
Transmit Freq Error	3.175 kHz
x dB Bandwidth	944.126 kHz

- Middle Channel:



Transmit Freq Error	7.852 kHz
x dB Bandwidth	941.262 kHz

- High Channel:



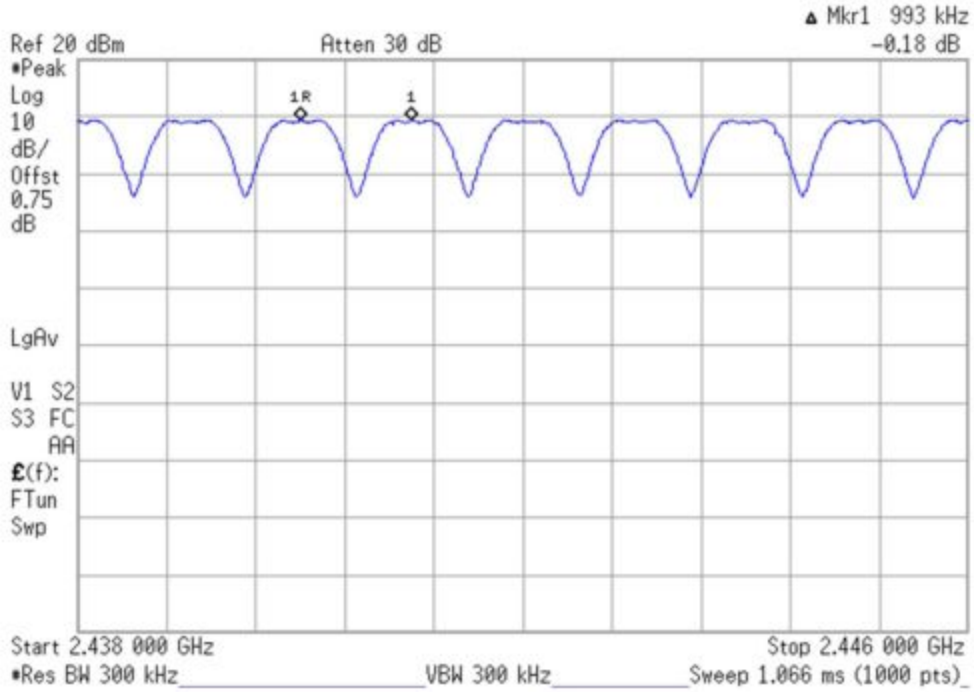
Occupied Bandwidth
880.0461 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error 10.809 kHz
x dB Bandwidth 941.934 kHz

Carrier frequency separation - GFSK

Carrier frequency separation: 993 kHz

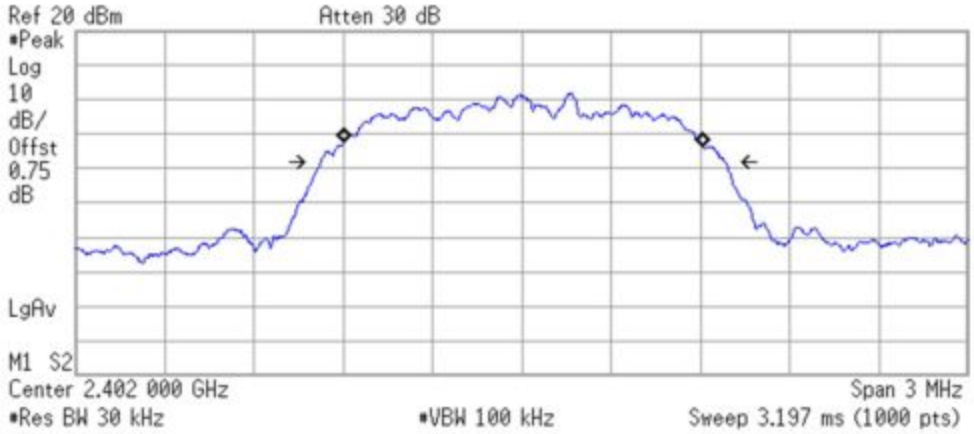


The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

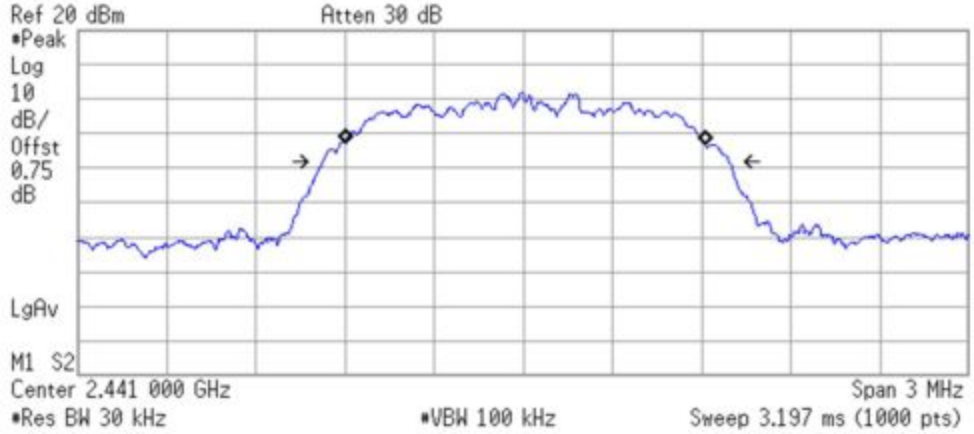
- **Pi/4 DQPSK – Bandwidths**

- Low Channel:



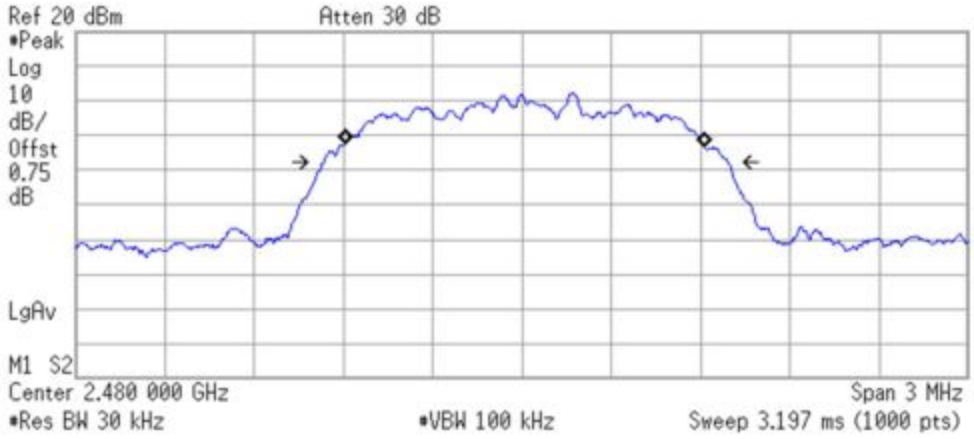
Transmit Freq Error	3.363 kHz
x dB Bandwidth	1.361 MHz

- Middle Channel:



Transmit Freq Error	7.497 kHz
x dB Bandwidth	1.365 MHz

- High Channel:



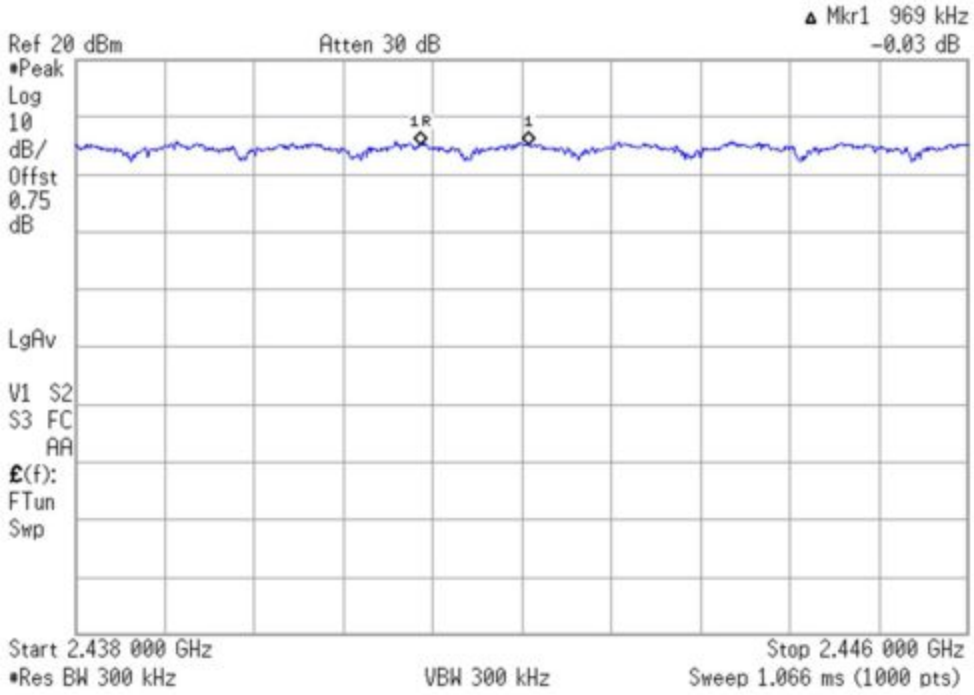
Occupied Bandwidth
1.2082 MHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error 10.556 kHz
x dB Bandwidth 1.361 MHz

Carrier frequency separation - Pi/4 DQPSK

Carrier frequency separation: 969 kHz

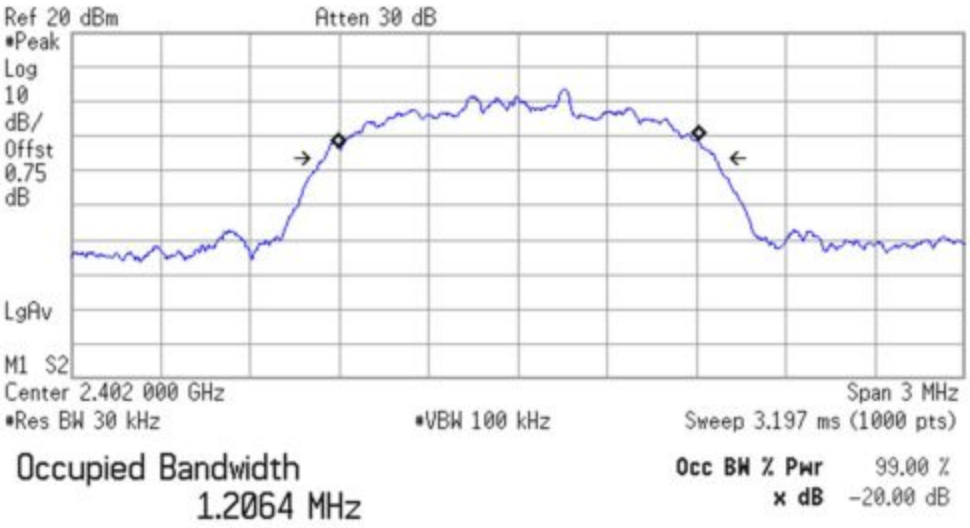


The hopping channel carrier frequencies are separated by a minimum two-thirds of the 20 dB bandwidth of the hopping channel.

Verdict: PASS

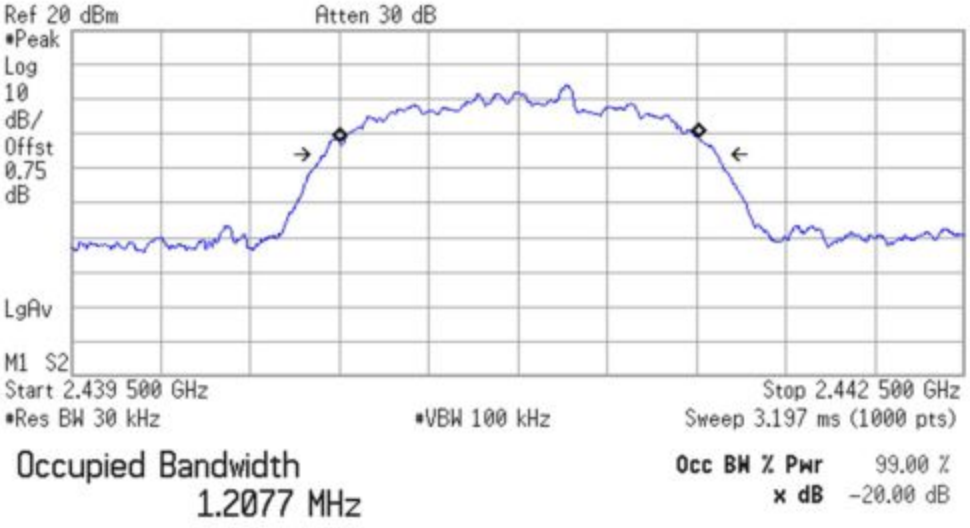
- **8DPSK – Bandwidths**

- Low Channel:



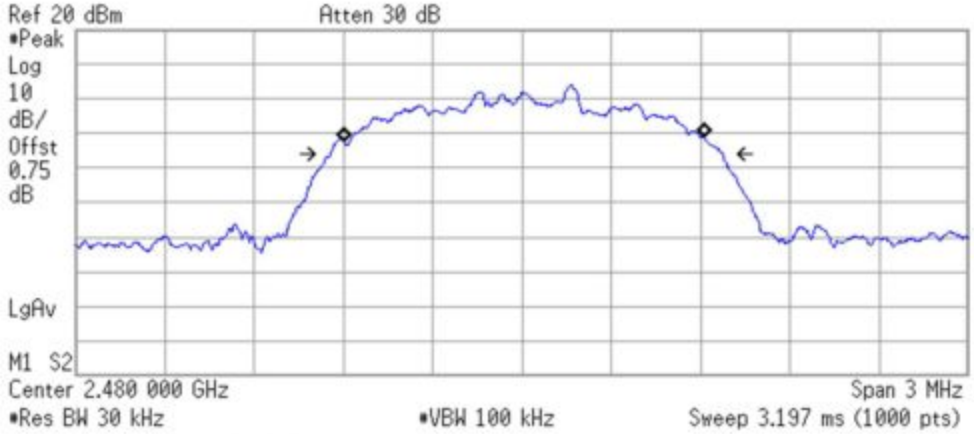
Transmit Freq Error	1.056 kHz
x dB Bandwidth	1.315 MHz

- Middle Channel:



Transmit Freq Error	3.467 kHz
x dB Bandwidth	1.315 MHz

- High Channel:



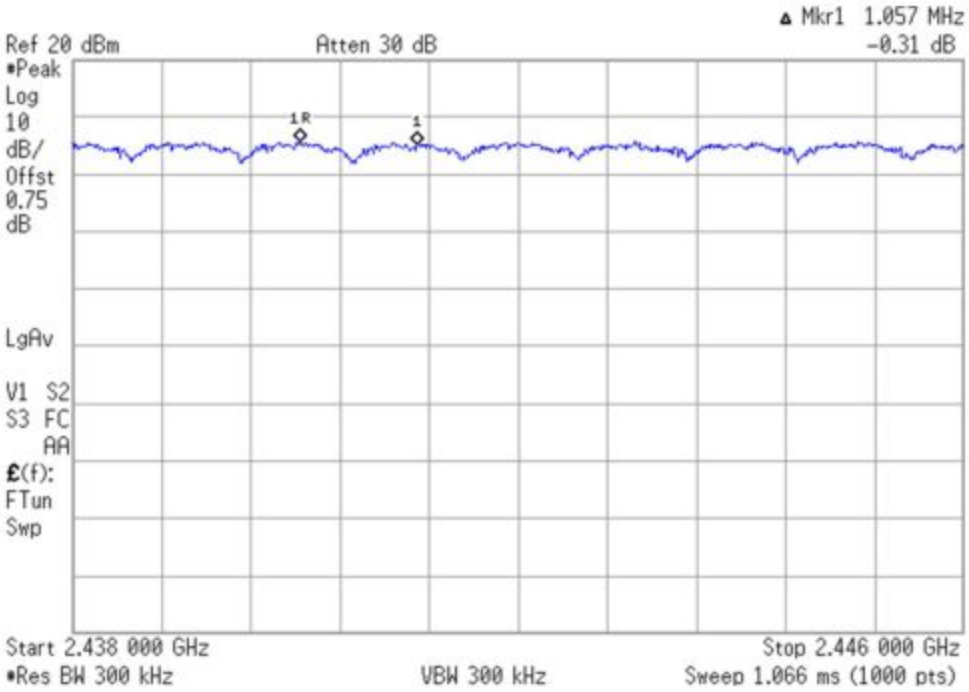
Occupied Bandwidth
1.2080 MHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error 7.805 kHz
x dB Bandwidth 1.318 MHz

Carrier frequency separation - 8DPSK

Carrier frequency separation: 1057 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.

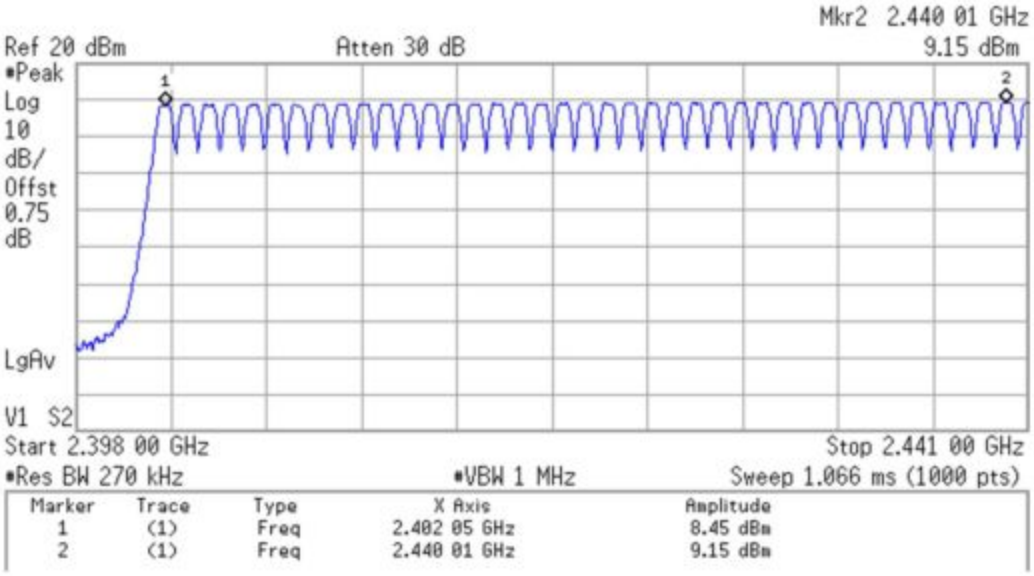
SPECIFICATION:

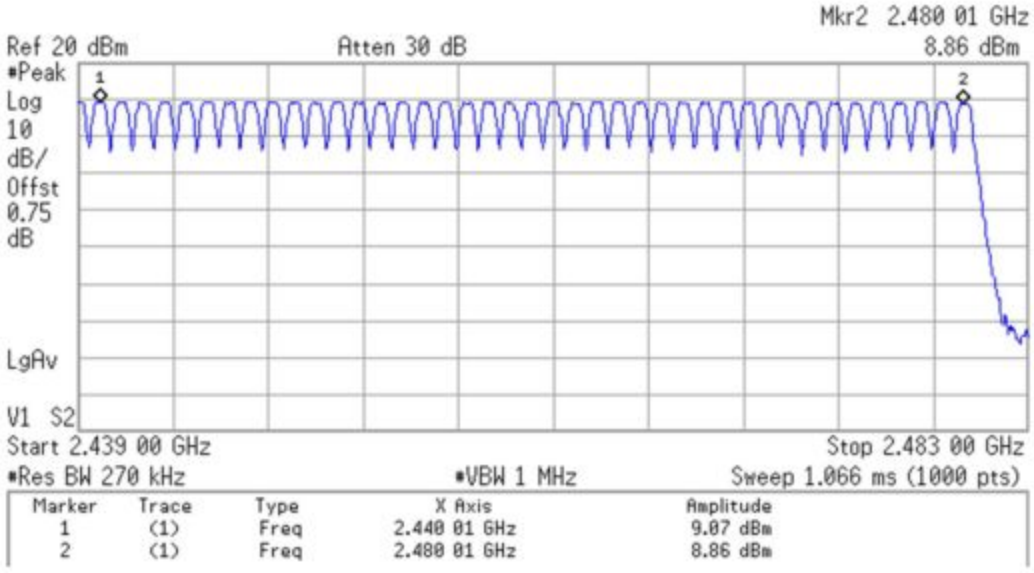
Frequency hopping system in the 2400-2483.5 MHz band shall use at least 15 channels.

RESULTS:

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

- **GFSK – Number of hopping channels**

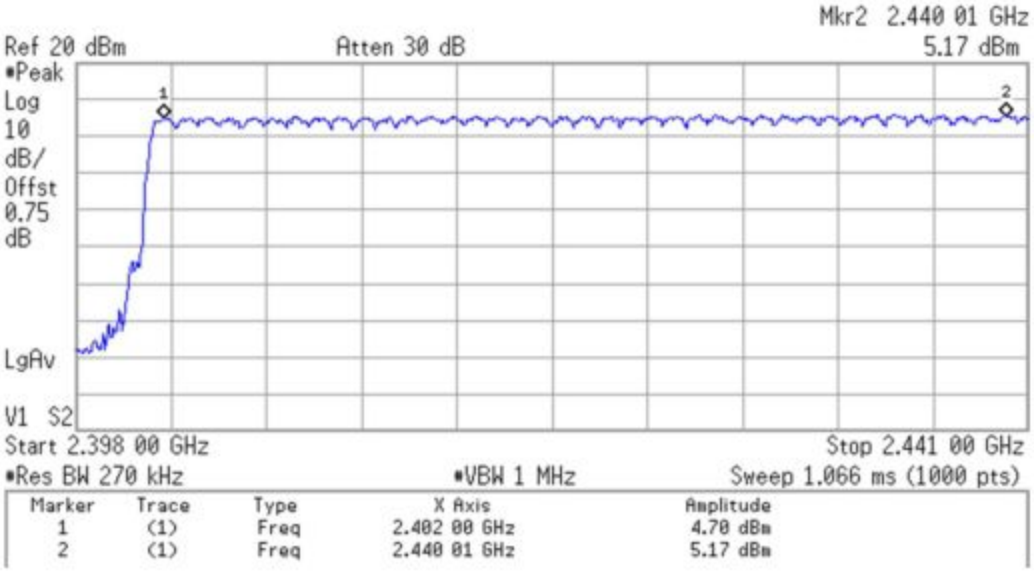


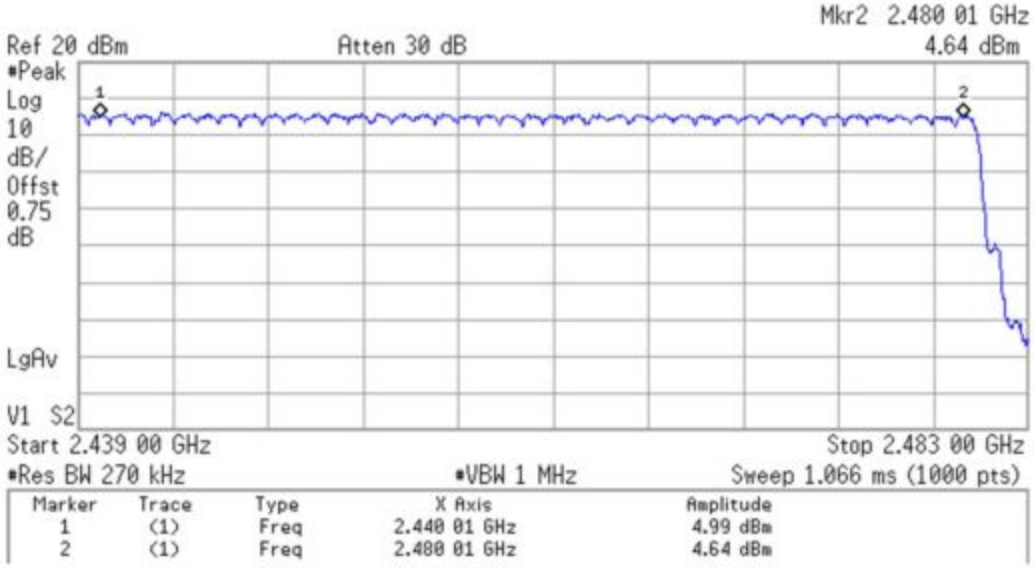


Total number of hopping channels 79

Verdict: PASS

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

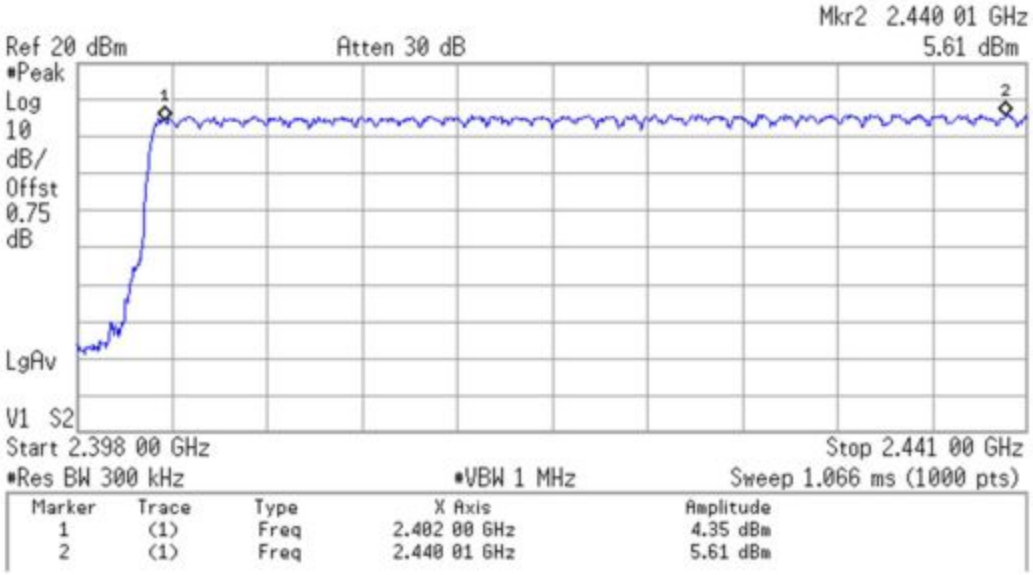


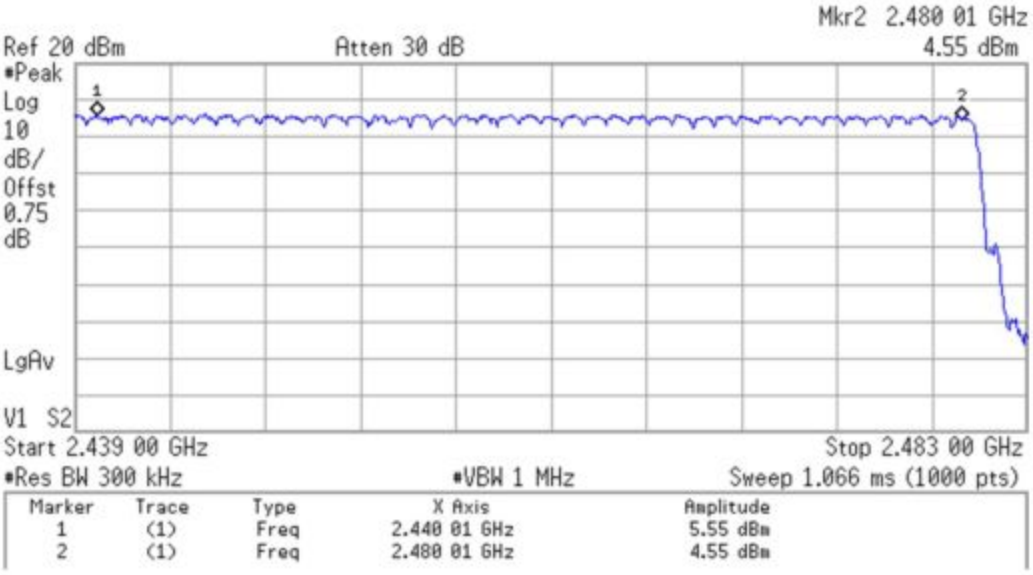


Total number of hopping channels 79

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:

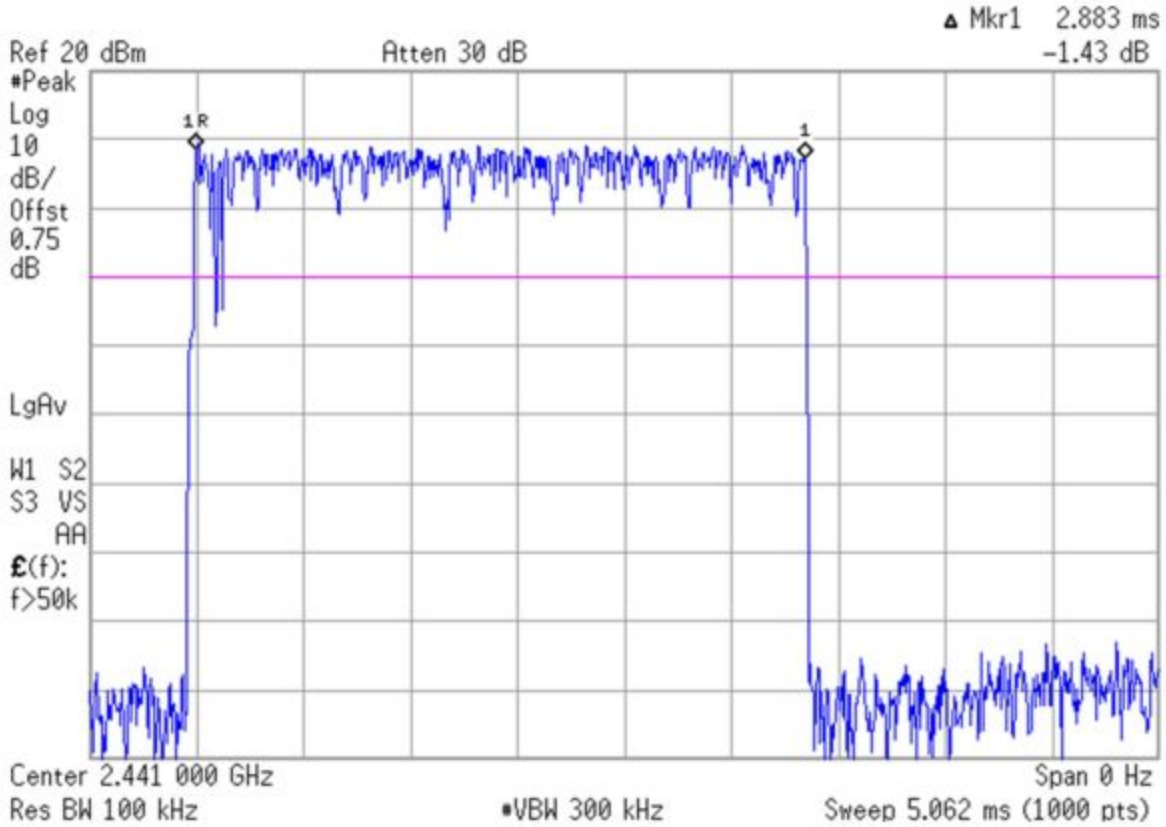
The average time of occupancy on any channel shall not be greater than 0.4 seconds (400 ms) within a period of 0.4 seconds multiplied by the number of hopping channels employed = 0.4 x 79= 31.6 seconds.

RESULTS:

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

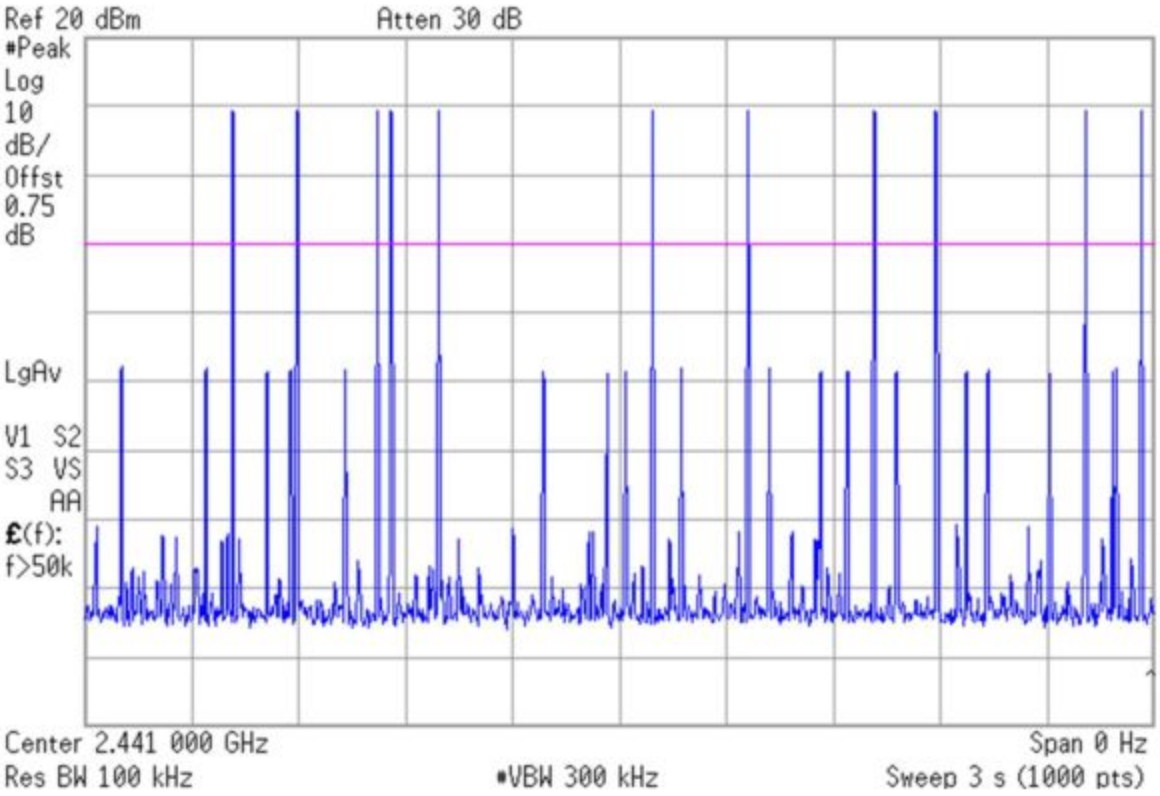
  - Transmit Time per Hop:

2.883	ms



- Time of Occupancy:

Nº of hops on spectrum analyzer	11	
Nº of hops over the period	115.8666667	
Average Time of Occupancy	334.0436	ms



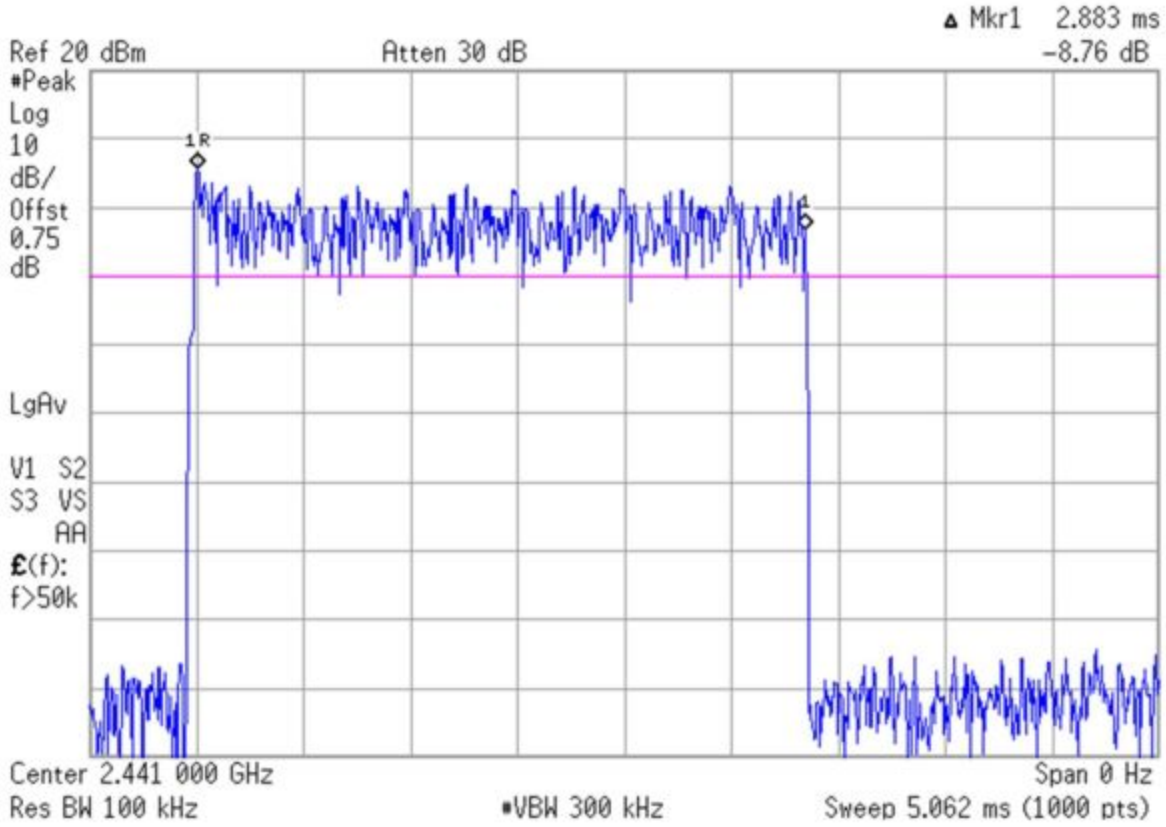
Measurement uncertainty (%)	<±0.01

Verdict: PASS

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

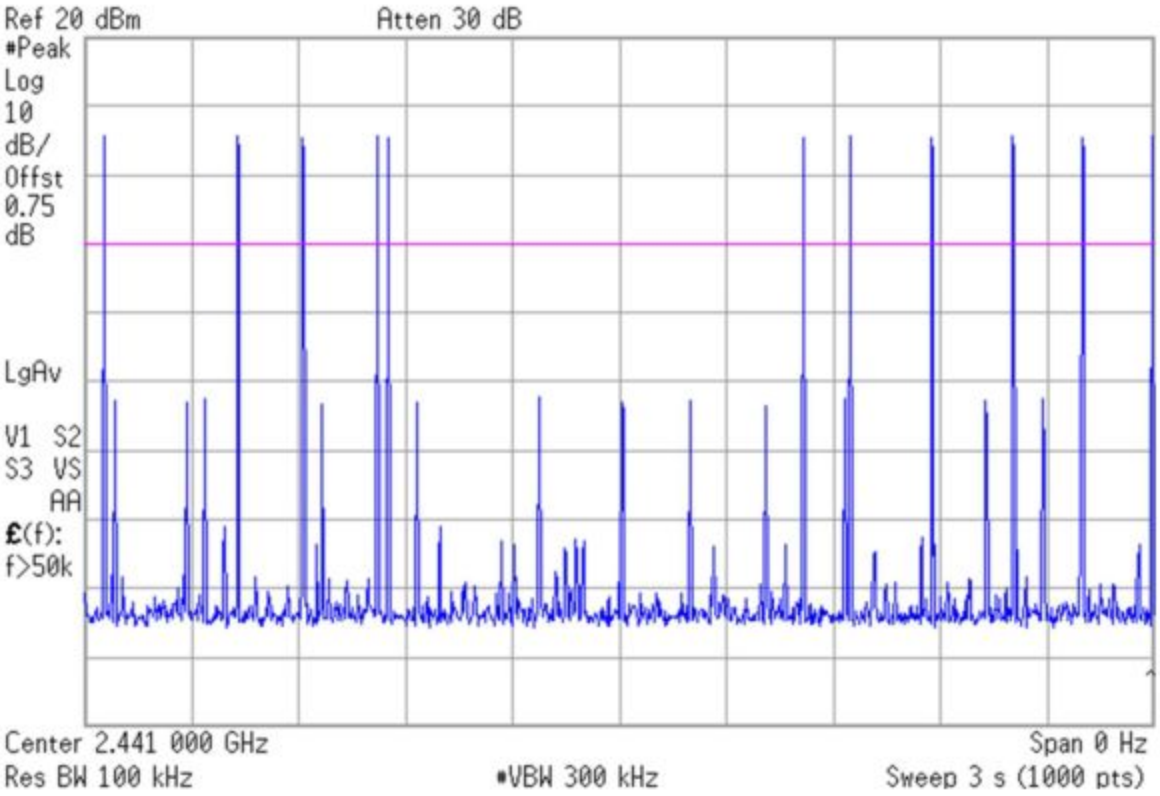
  - Transmit Time per Hop:

2.883	ms



- Time of Occupancy:

Nº of hops on spectrum analyzer	11	
Nº of hops over the period	115.8666667	
Average Time of Occupancy	334.0436	ms



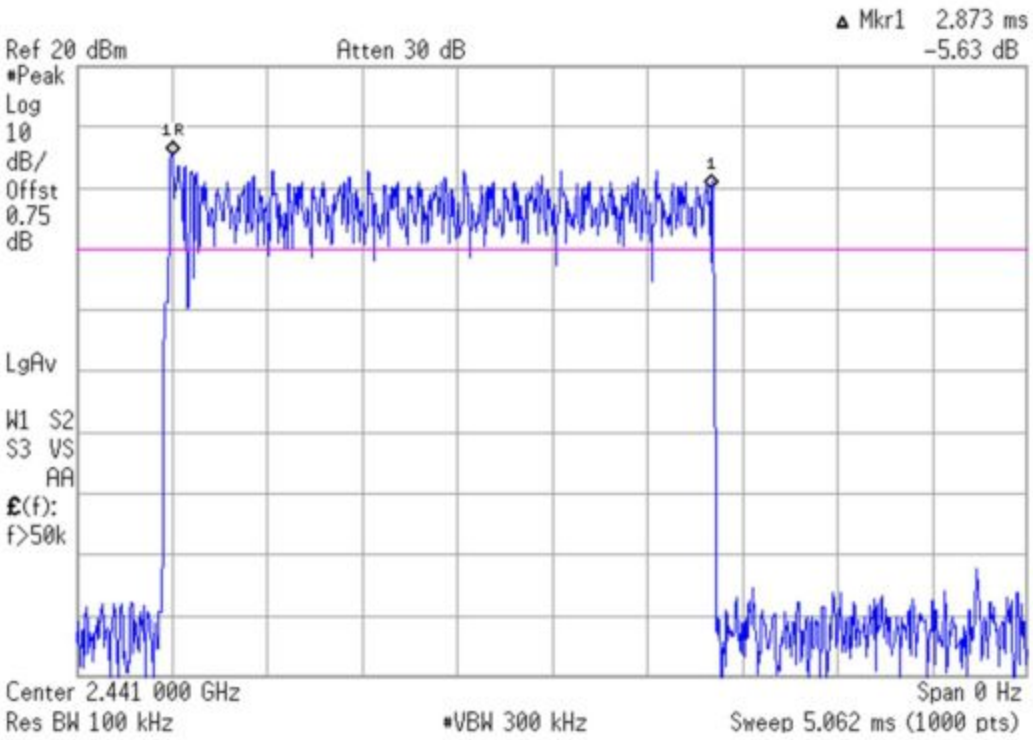
Measurement uncertainty (%)	<±0.01

Verdict: PASS

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

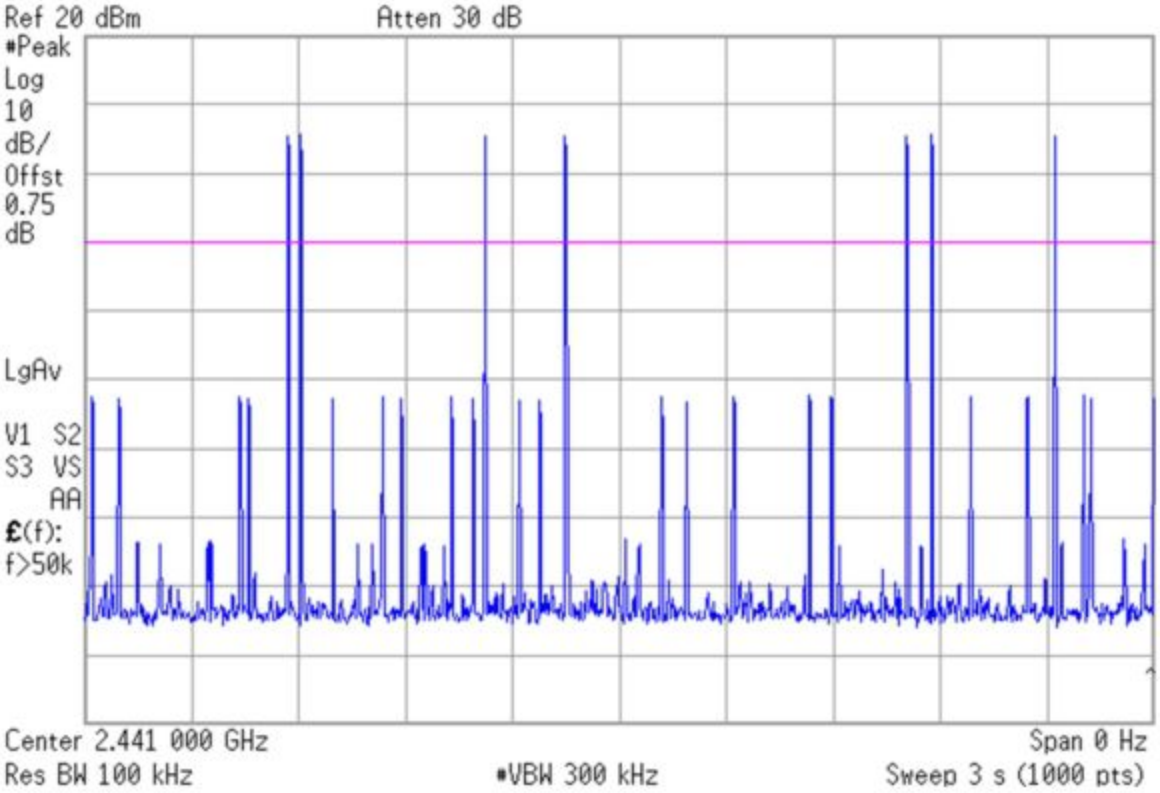
  - Transmit Time per Hop:

2.873	ms



- Time of Occupancy:

Nº of hops on spectrum analyzer	7	
Nº of hops over the period	73.73333333	
Average Time of Occupancy	211.8358667	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 maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW ≥ DTS bandwidth"f of ANSI C.63.10-2013.

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)	8.96	9.63	9.44
Maximum EIRP Power (dBm)	2.76	3.43	3.24
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)	7.22	7.91	7.61
Maximum EIRP Power (dBm)	1.02	1.71	1.41
Measurement uncertainty (dB)	<±0.78		

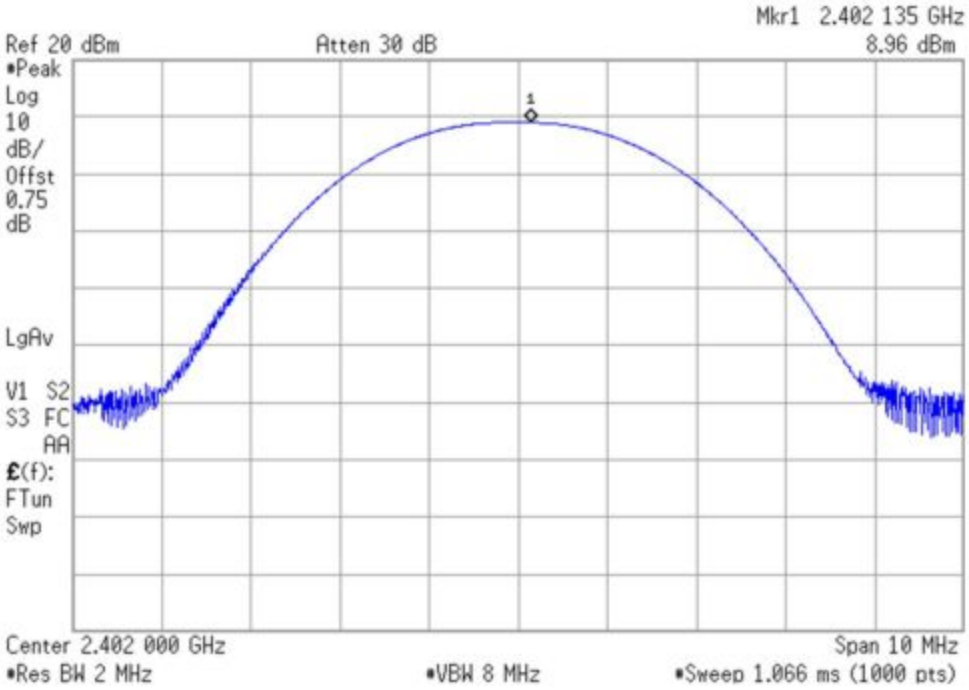
- **8DPSK** (3 Mbps)

Peak Conducted Output Power	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	7.74	8.41	8.11
Maximum EIRP Power (dBm)	1.54	2.21	1.91
Measurement uncertainty (dB)	<±0.78		

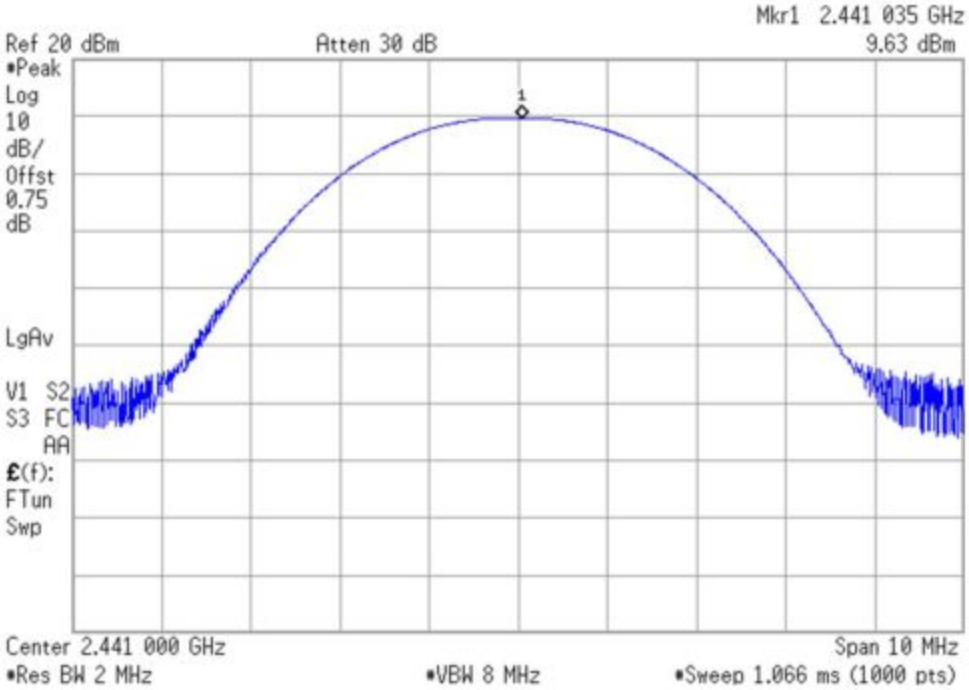
Verdict: PASS

- **GFSK – Peak Output Power**

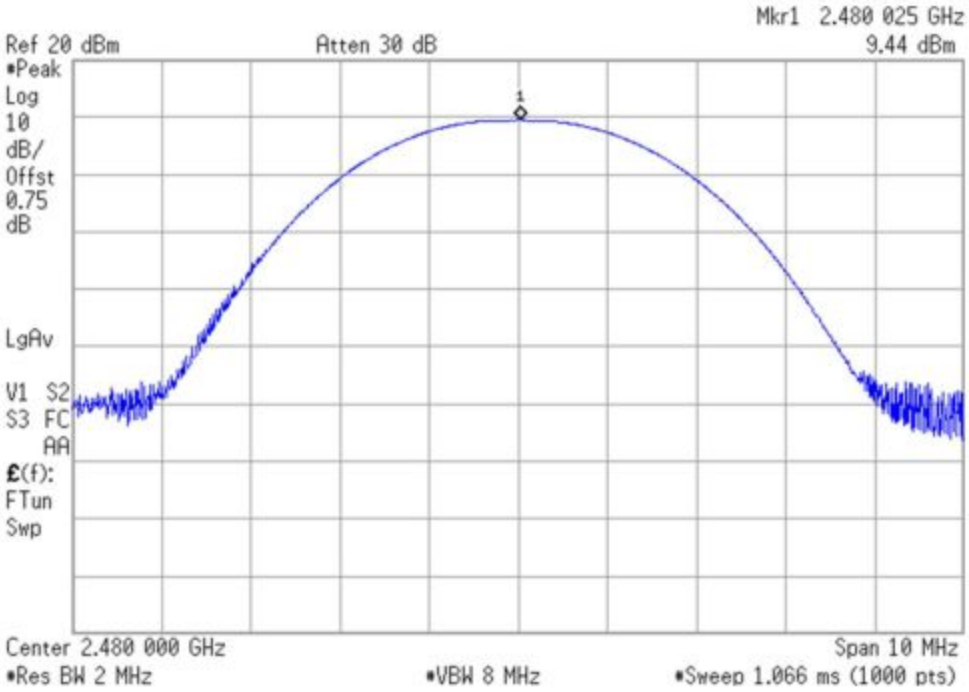
- Low Channel:



- Middle Channel:

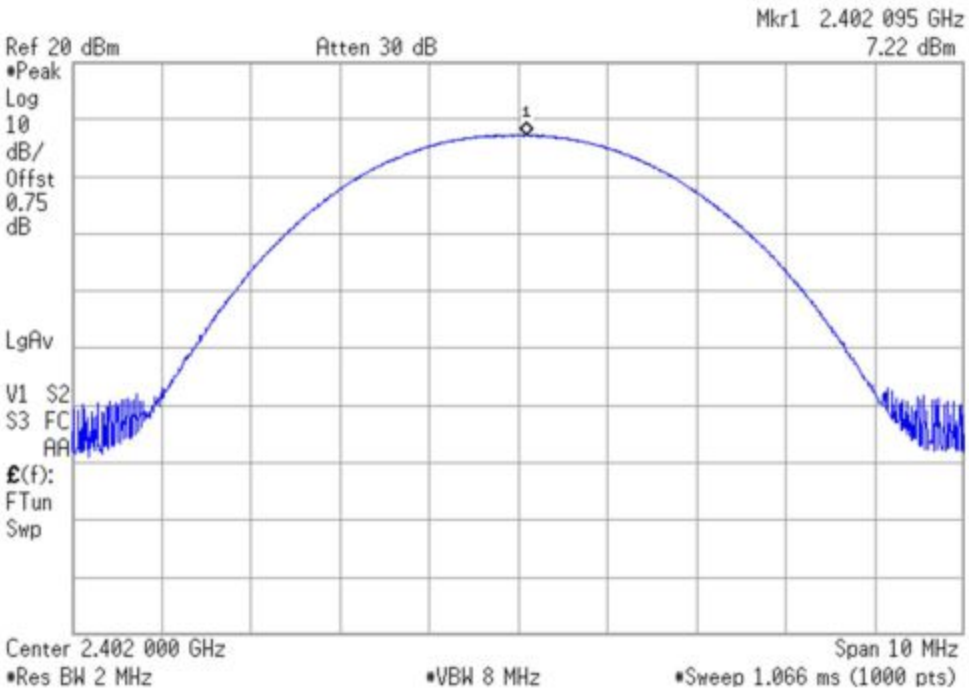


- High Channel:

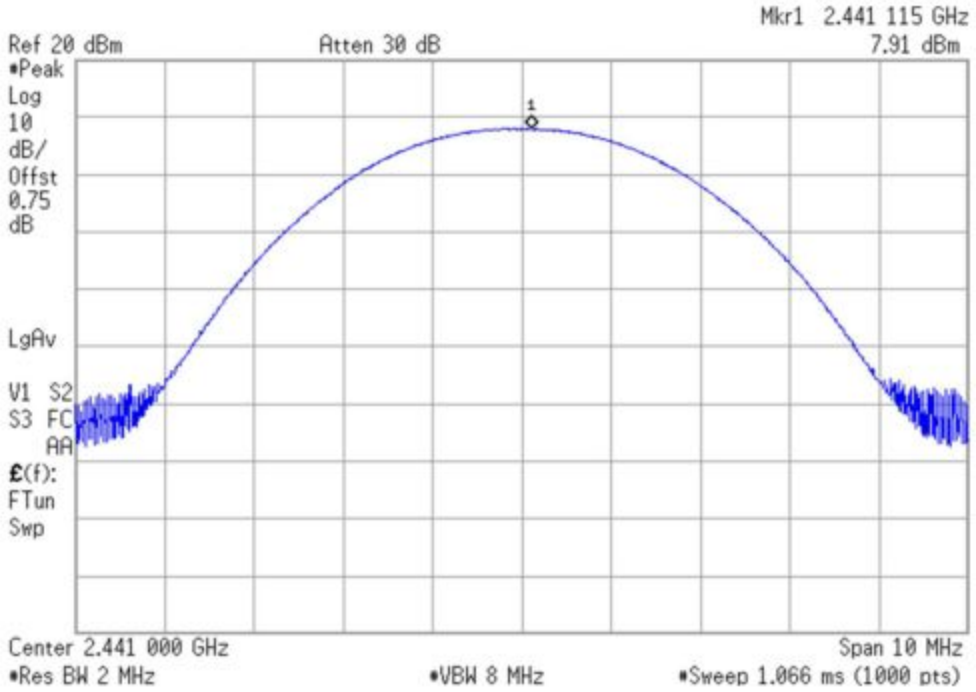


- **Pi/4 DQPSK – Peak Output Power**

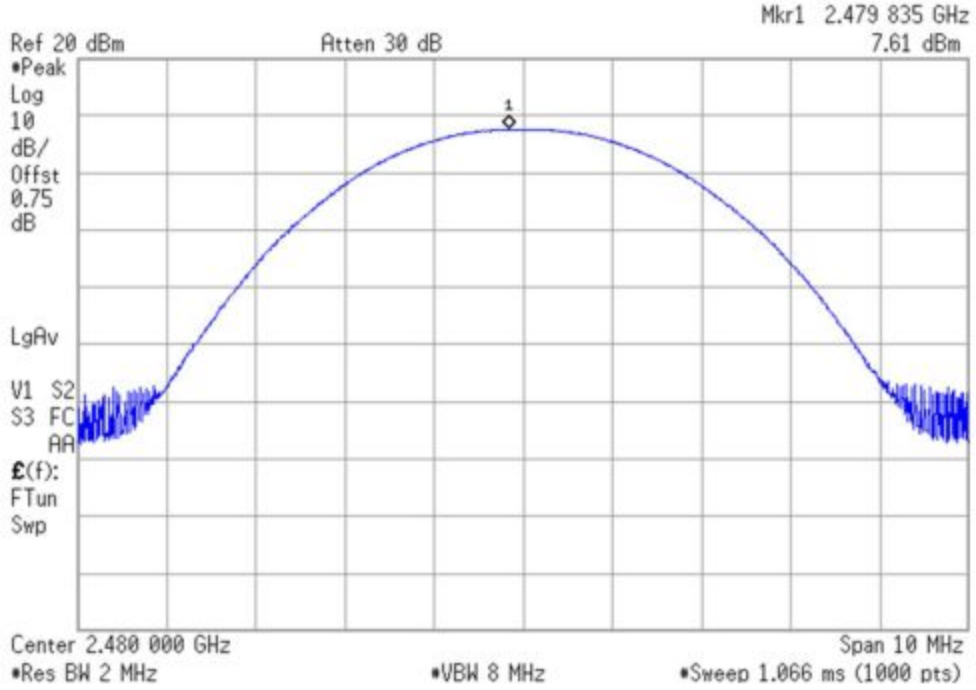
- Low Channel:



- Middle Channel:

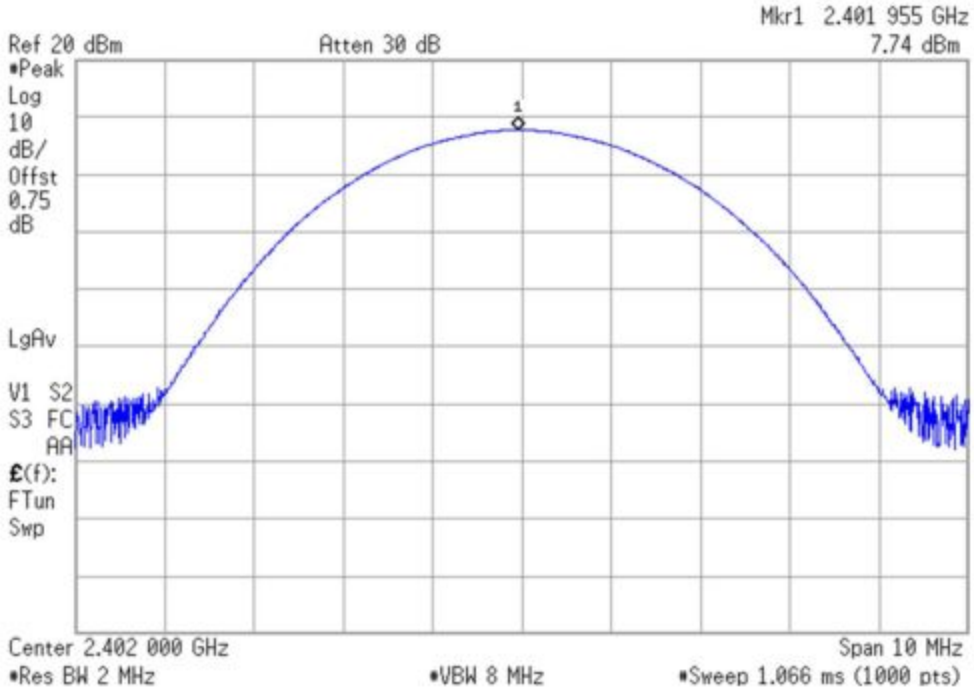


- High Channel:

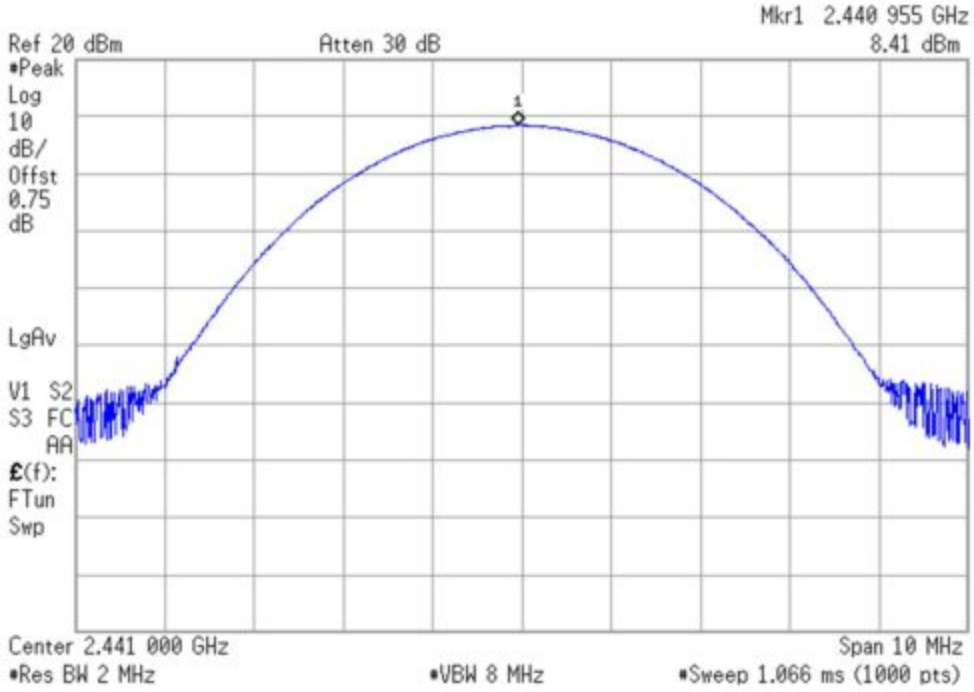


- **8DPSK – Peak Output Power**

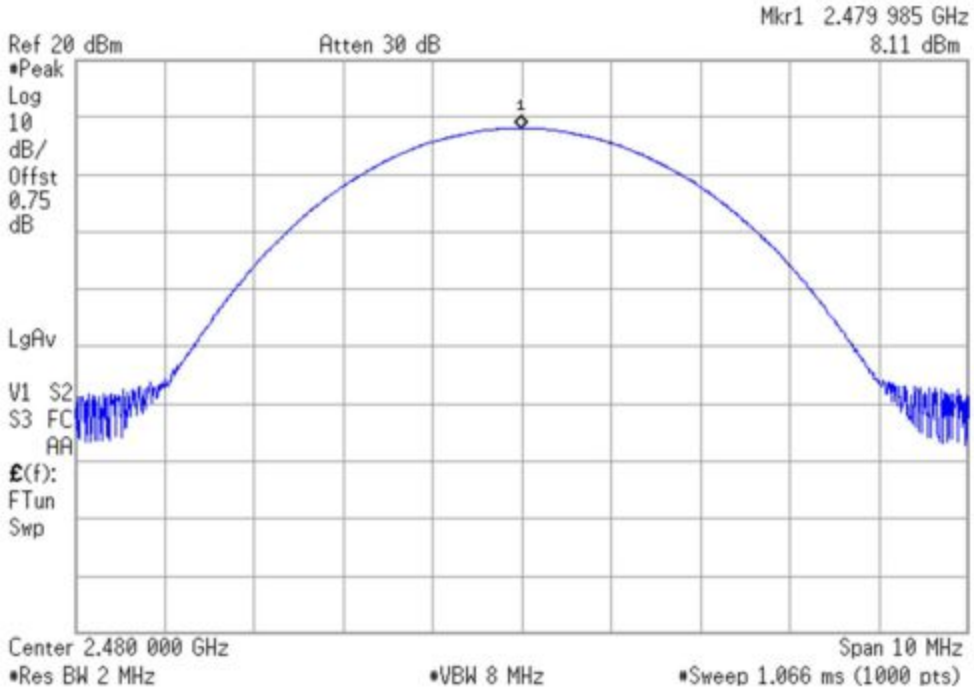
- Low Channel:



- 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:

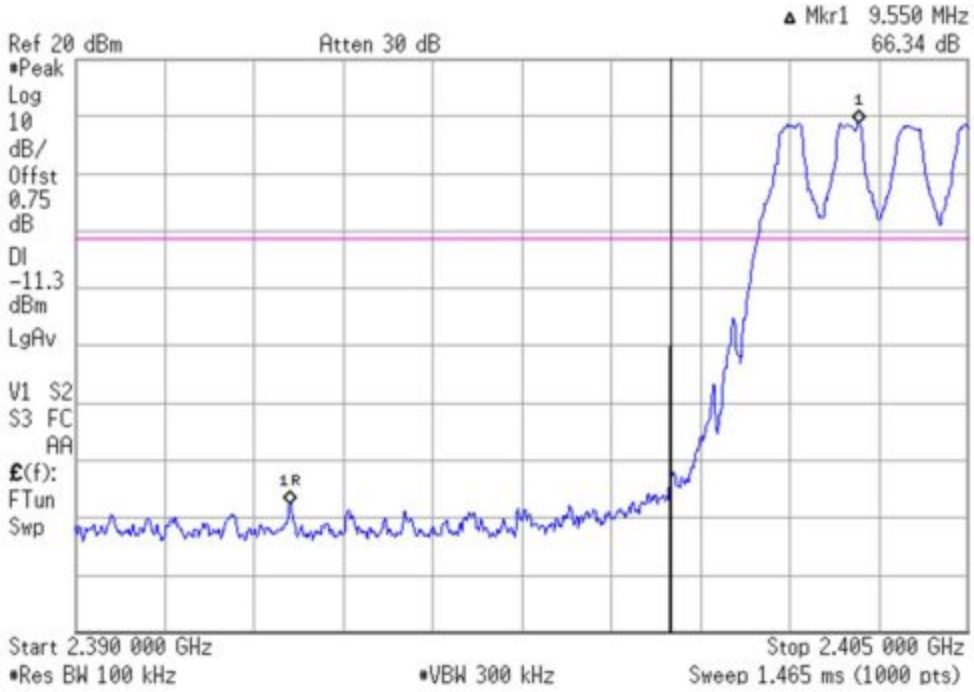
Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Measurement uncertainty (dB)	<±2.03

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

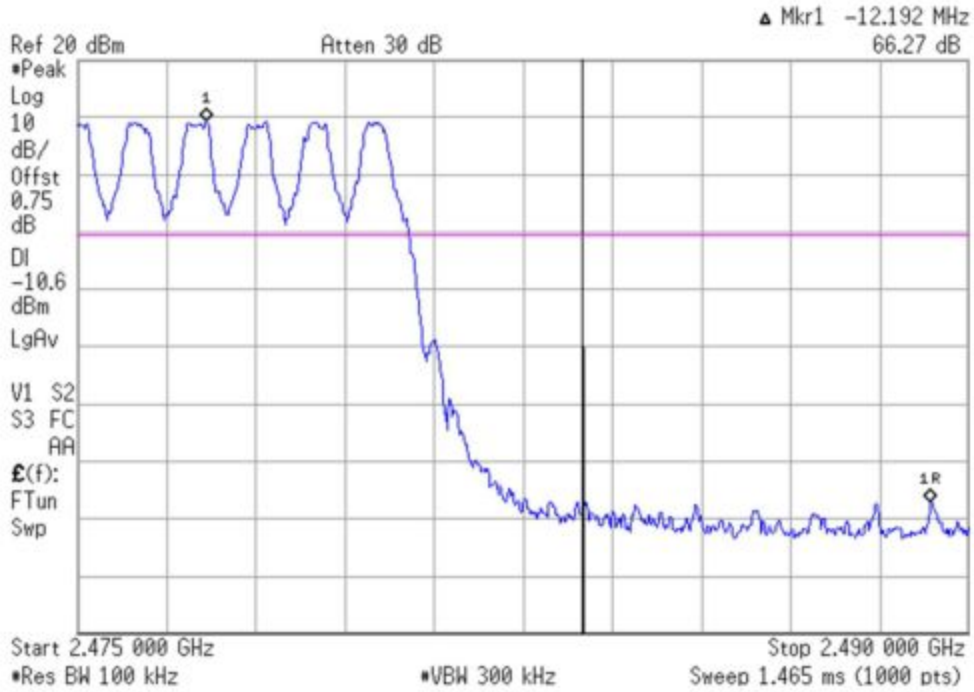
  - HOPPING ON:

    - Low Frequency Section 2402 MHz:



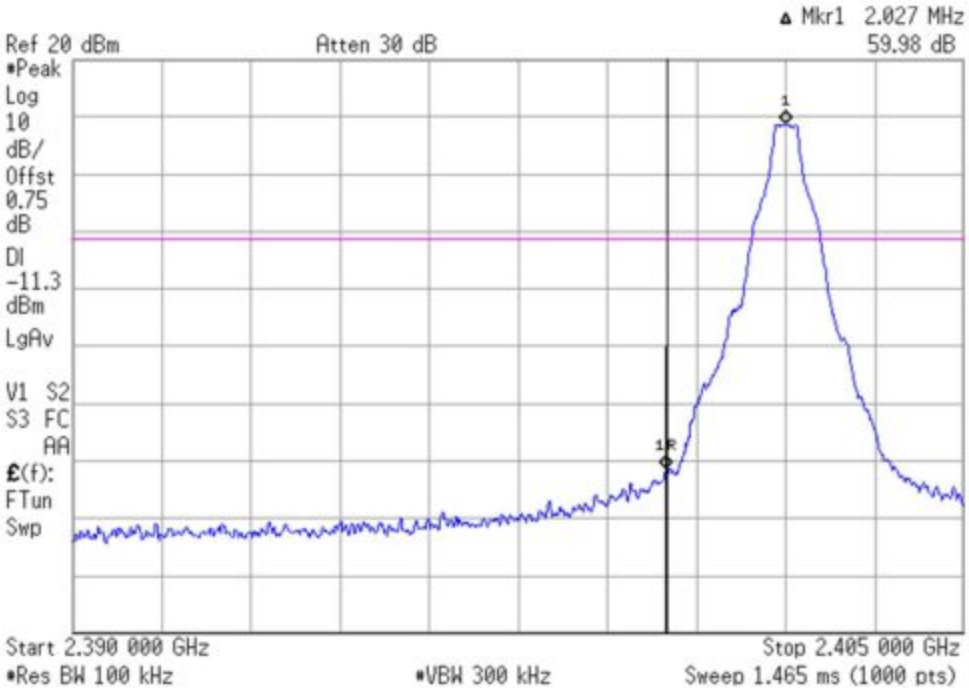
Verdict: PASS

    - High Frequency Section 2480 MHz:



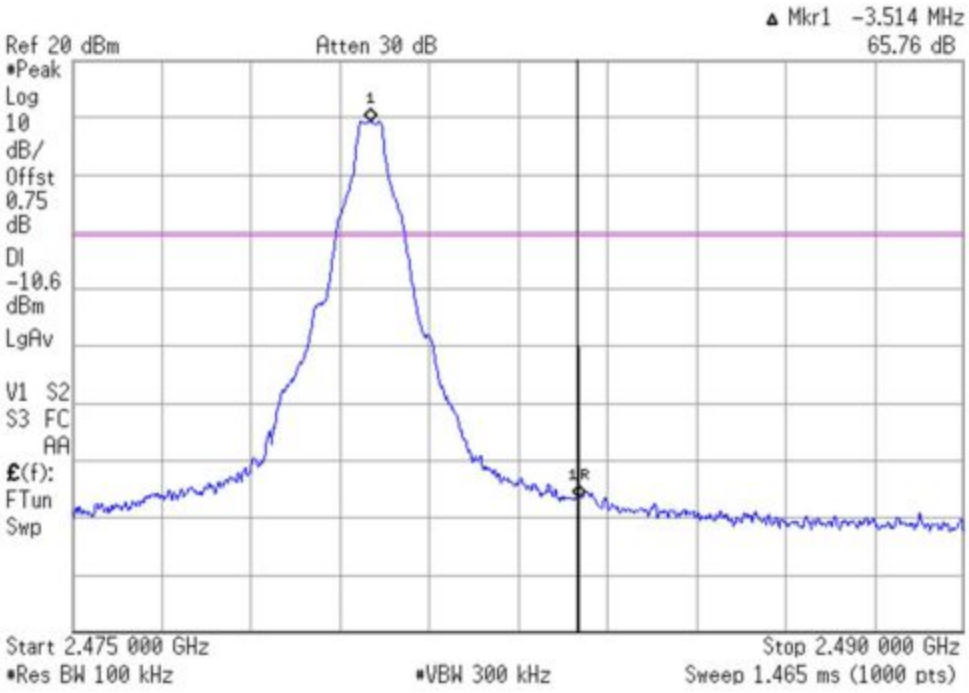
Verdict: PASS

- HOPPING OFF:
  - Low Frequency Section 2402 MHz:



Verdict: PASS

  - High Frequency Section 2480 MHz:

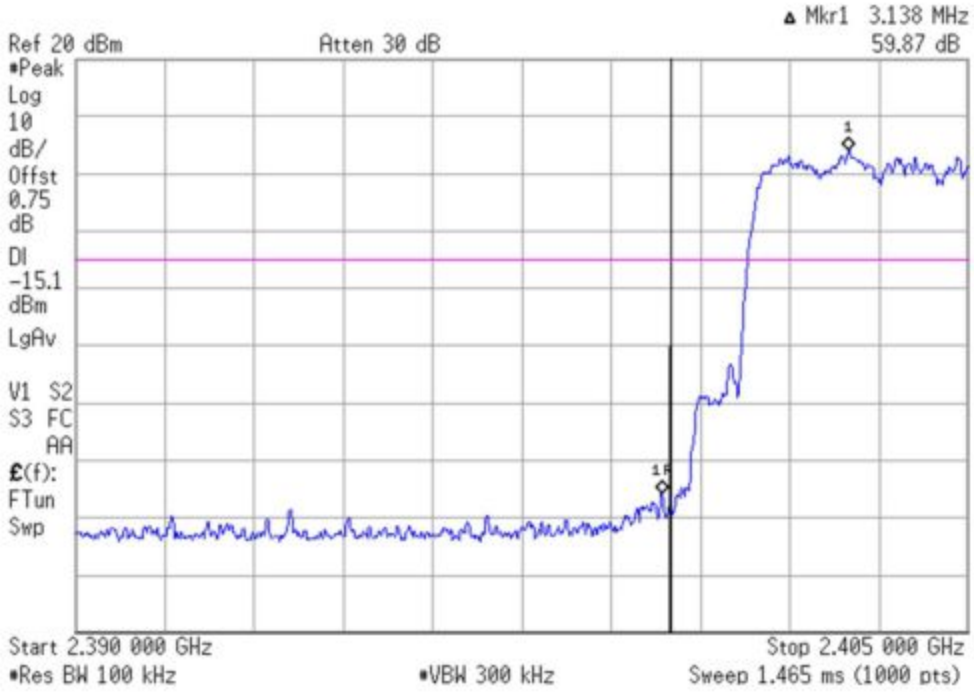


Verdict: PASS

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

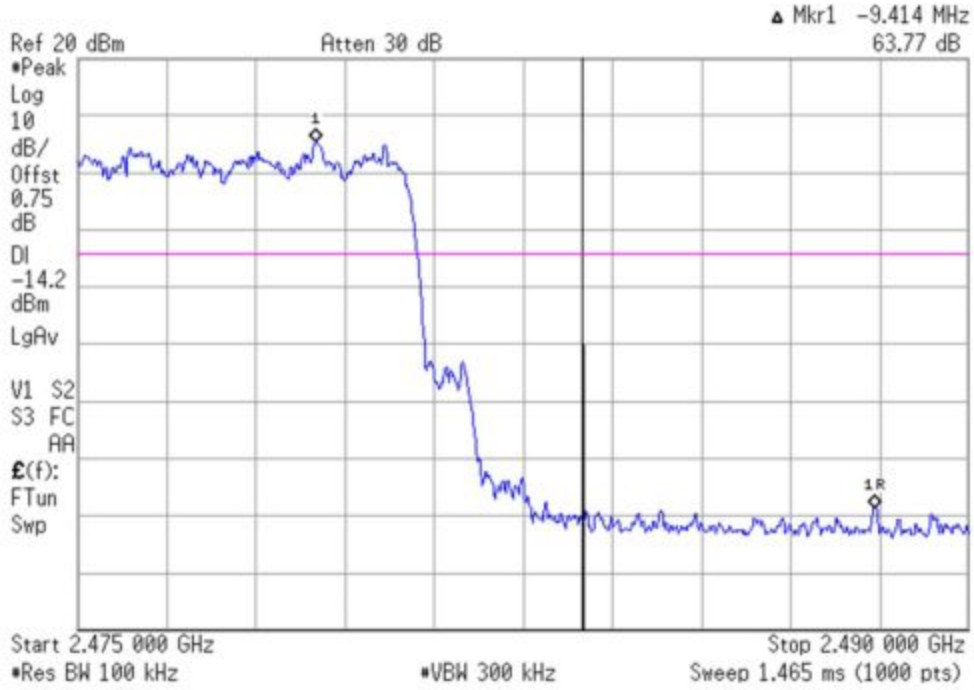
  - HOPPING ON:

    - Low Frequency Section 2402 MHz:



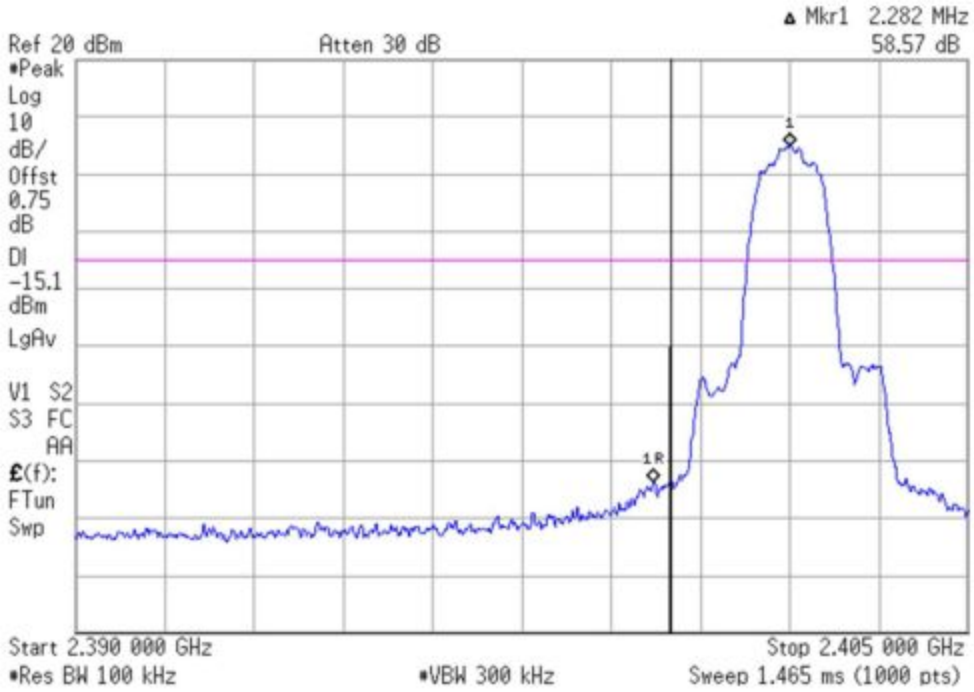
Verdict: PASS

    - High Frequency Section 2480 MHz:



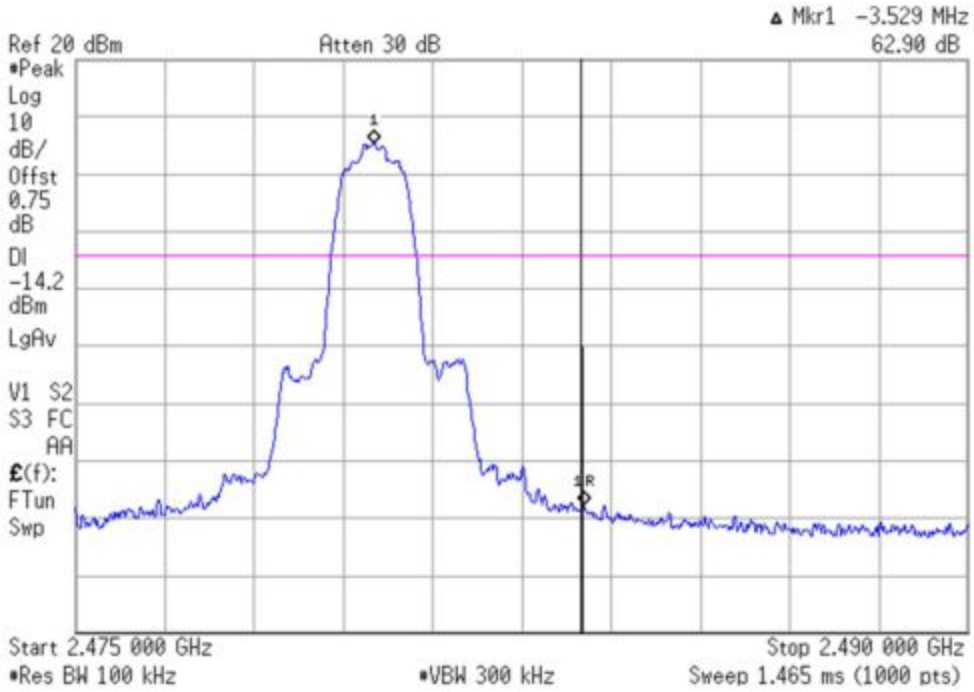
Verdict: PASS

- HOPPING OFF:
  - Low Frequency Section 2402 MHz:



Verdict: PASS

  - High Frequency Section 2480 MHz:

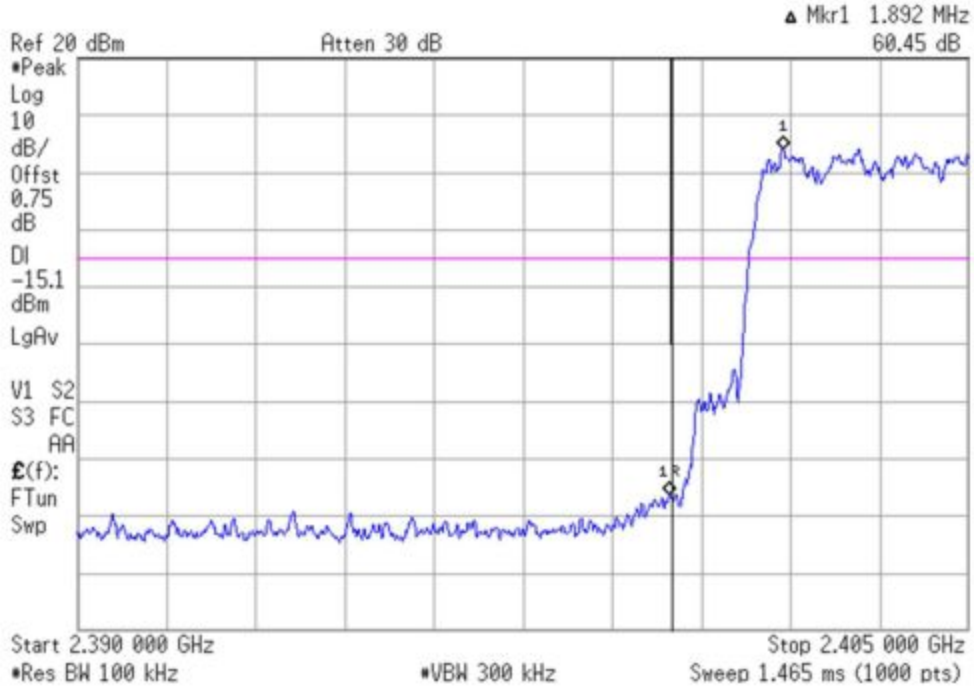


Verdict: PASS

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

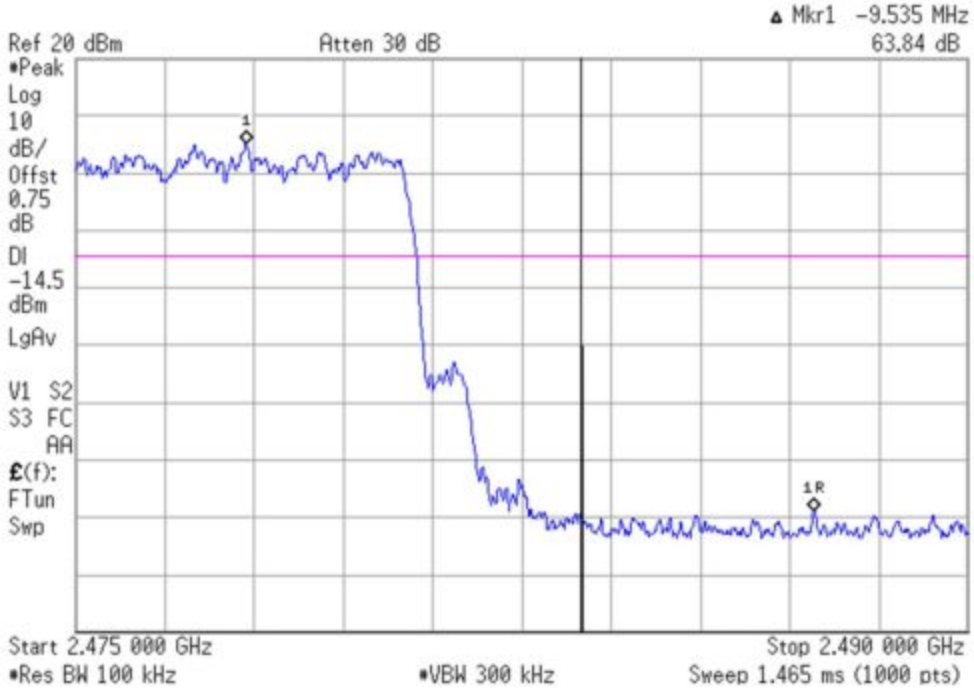
  - HOPPING ON:

    - Low Frequency Section 2402 MHz:



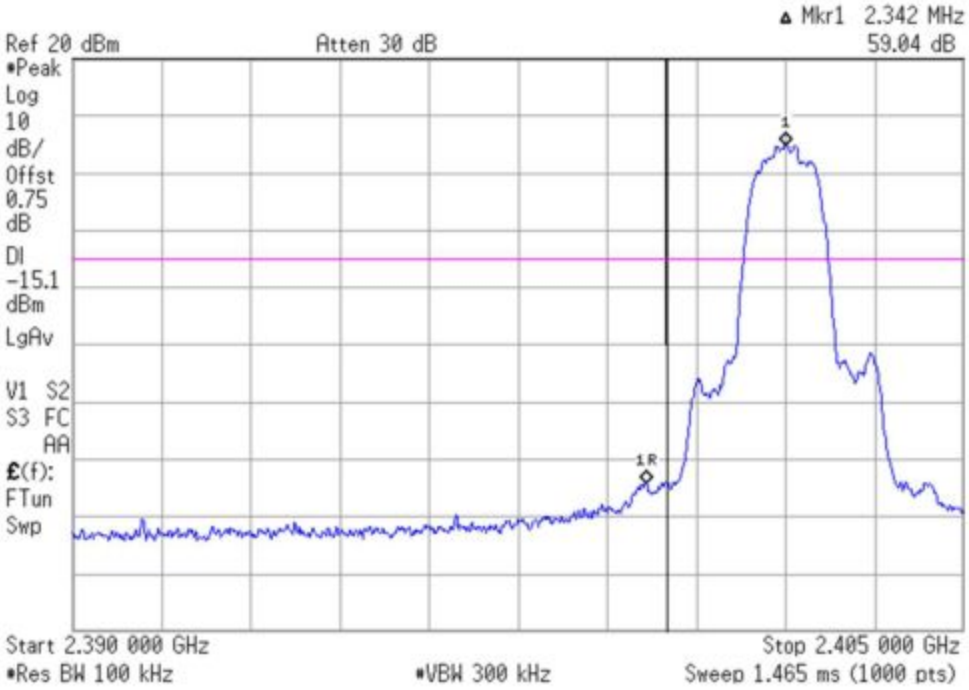
Verdict: PASS

- High Frequency Section 2480 MHz:



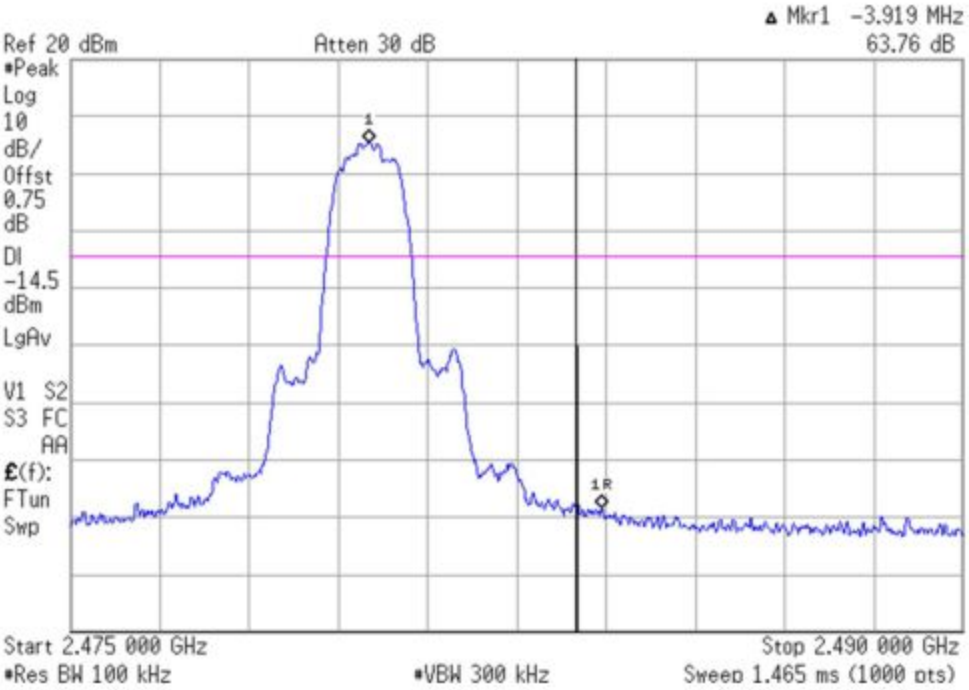
Verdict: PASS

- 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 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 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)
38.391	Quasi peak	26.4	V	<± 3.04
168.726	Quasi peak	24.9	V	<± 3.04
250.012	Quasi peak	36.5	V	<± 3.04

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)
3.0021	Peak	41.21	V	<± 4.72
4.0003	Peak	36.72	V	<± 4.72
4.80011	Peak	38.92	V	<± 4.72
4.98403	Peak	45.5	V	<± 4.72
10.00013	Peak	47.5	V	<± 4.72
10.5318	Peak	51.44	H	<± 4.72

  - 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)
3.0553	Peak	41.71	V	<± 4.72
4.00041	Peak	37.85	H	<± 4.72
4.7997	Peak	37.84	V	<± 4.72
4.98777	Peak	45.85	V	<± 4.72
10.00001	Peak	48.74	V	<± 4.72

- 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)
3.00117	Peak	40.9	V	<± 4.72
4.0003	Peak	37.23	V	<± 4.72
4.80035	Peak	37.7	V	<± 4.72
4.99897	Peak	45.1	V	<± 4.72
10.00037	Peak	48.8	V	<± 4.72

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)
3.05623	Peak	40.16	V	<± 4.72
4.00052	Peak	36.77	V	<± 4.72
4.79947	Peak	37.51	H	<± 4.72
4.99617	Peak	46.55	V	<± 4.72

- 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)
3.0637	Peak	41.29	V	<± 4.72
3.99983	Peak	36.79	V	<± 4.72
4.99383	Peak	46.64	V	<± 4.72

- 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)
3.0623	Peak	39.98	V	<± 4.72
3.99983	Peak	38.02	V	<± 4.72
4.80017	Peak	37.53	V	<± 4.72
4.99803	Peak	45.45	V	<± 4.72

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 (dBµV/m)	Polarization	Measurement Uncertainty (dB)
1.39225	Peak	49.88	H	<± 2.72
3.06743	Peak	40.3	V	<± 4.72
4.0003	Peak	37.58	V	<± 4.72
4.9915	Peak	46.13	V	<± 4.72
10.00032	Peak	46.69	H	<± 4.72

  - 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)
1.3945	Peak	50.81	H	<± 2.72
3.0609	Peak	40.63	V	<± 4.72
4.0003	Peak	36.32	V	<± 4.72
4.99617	Peak	45.54	V	<± 4.72

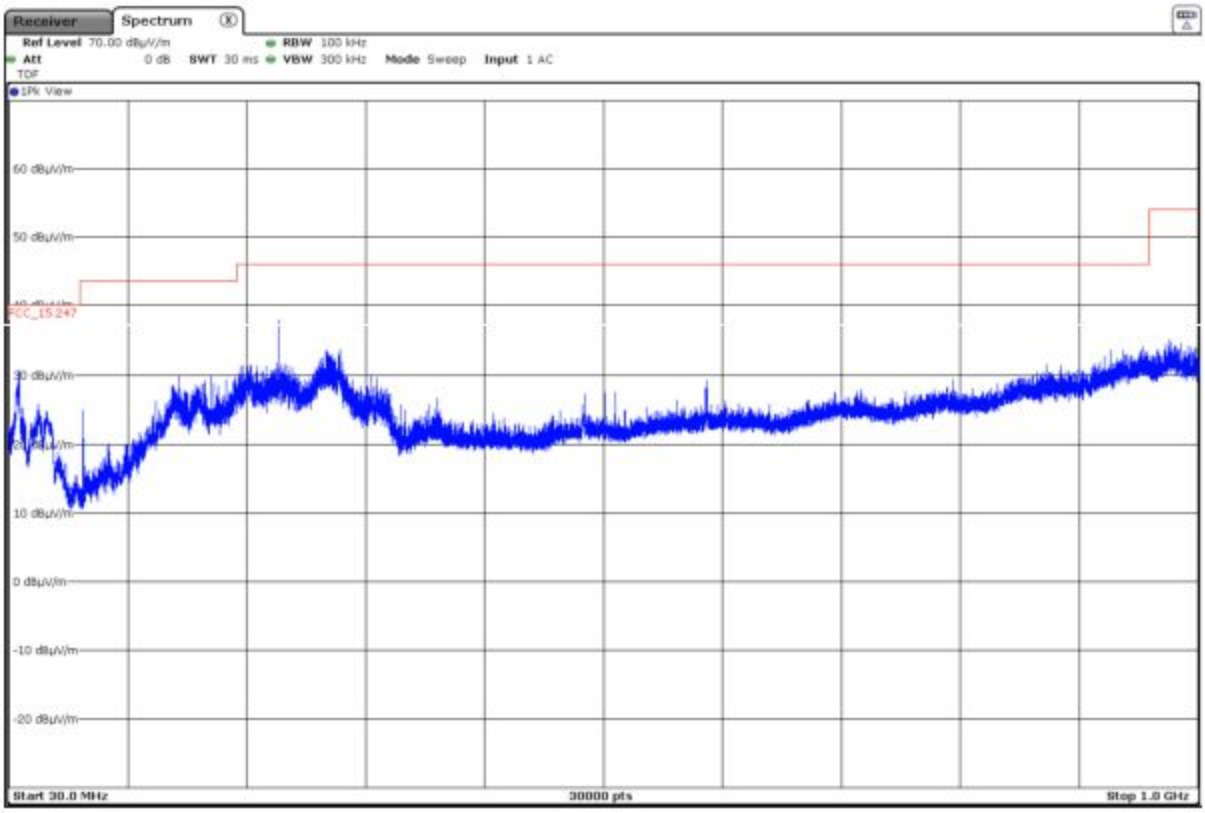
  - High Channel (2480 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
1.3959	Peak	50.6	H	<± 2.72
3.09403	Peak	40.52	V	<± 4.72
4.0003	Peak	36.36	V	<± 4.72
4.99337	Peak	45.64	V	<± 4.72

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

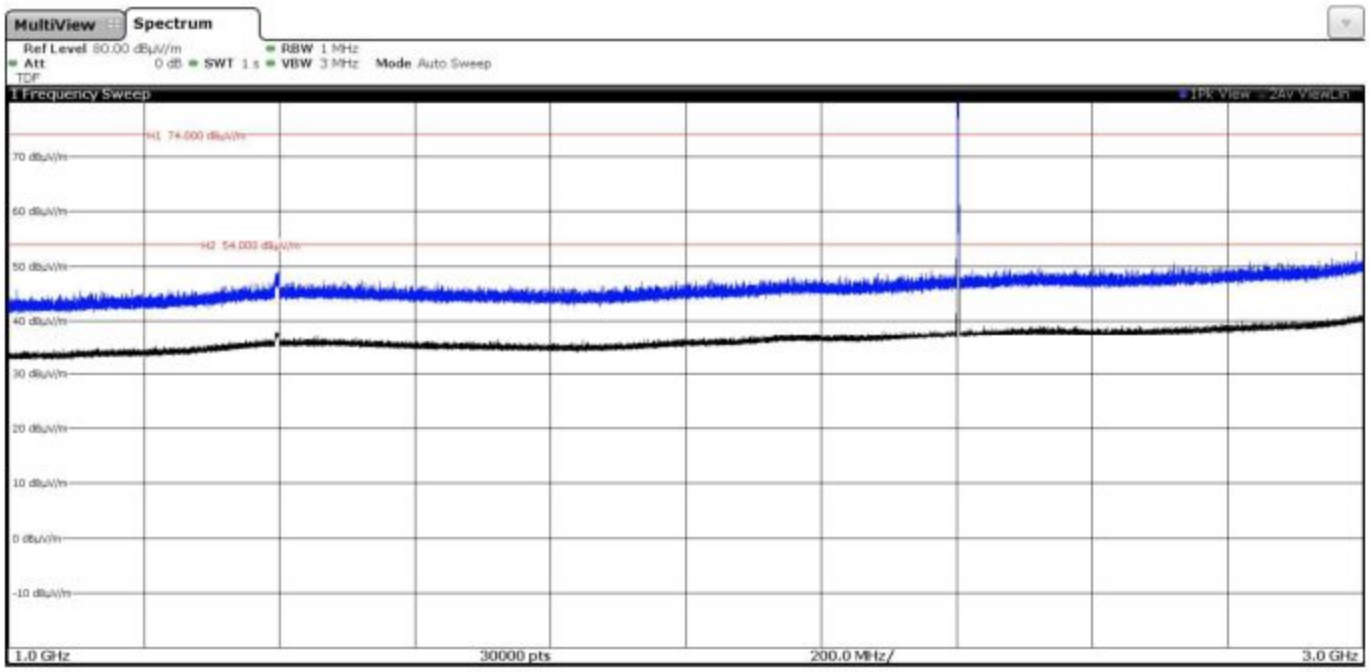
This plot is valid for the Low, Middle and High Channels and all the modulation modes.



FREQUENCY RANGE 1 - 3 GHz:

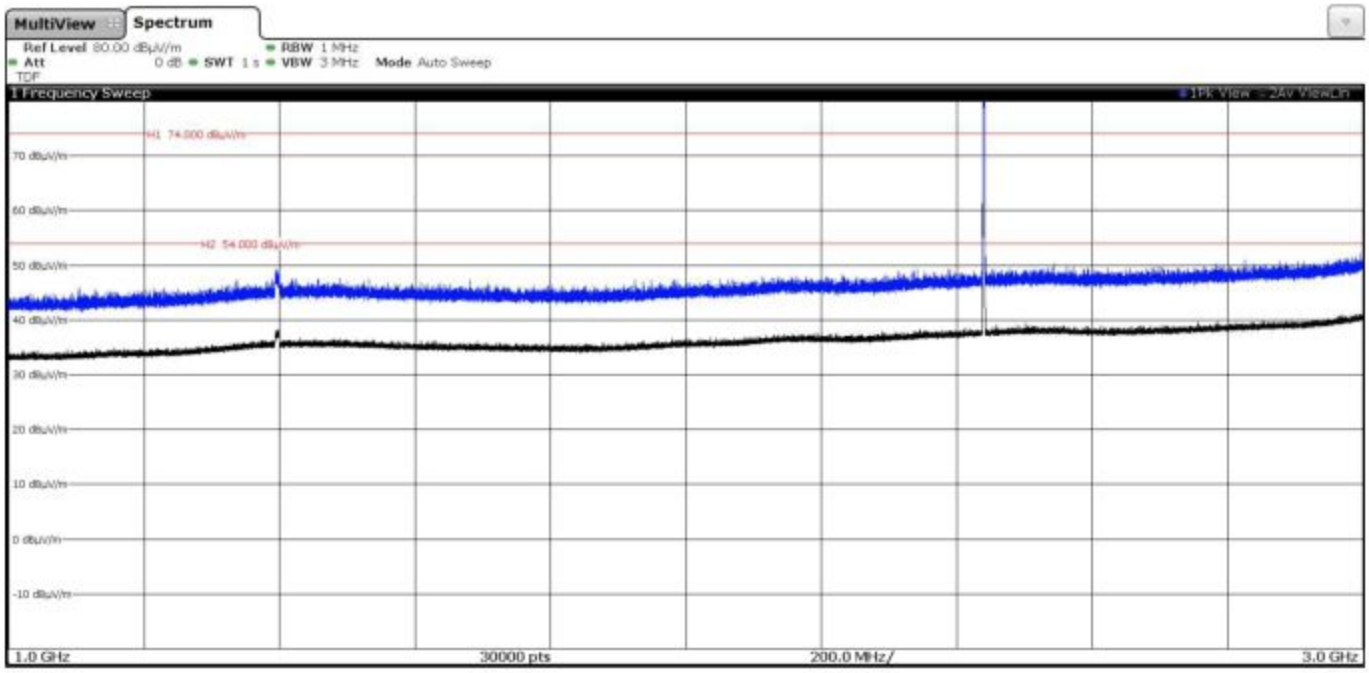
- **GFSK modulation (DH5)**

  - Low Channel (2402 MHz):



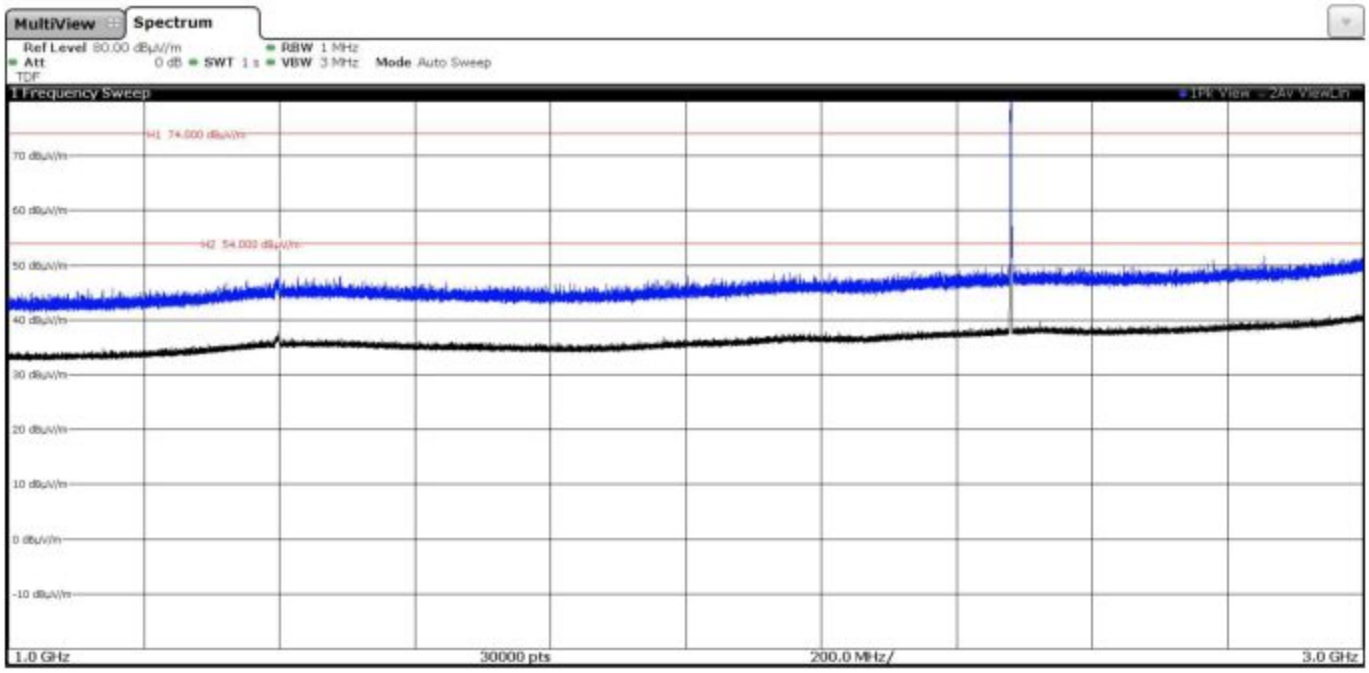
The peak above the limit is the carrier frequency.

  - Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

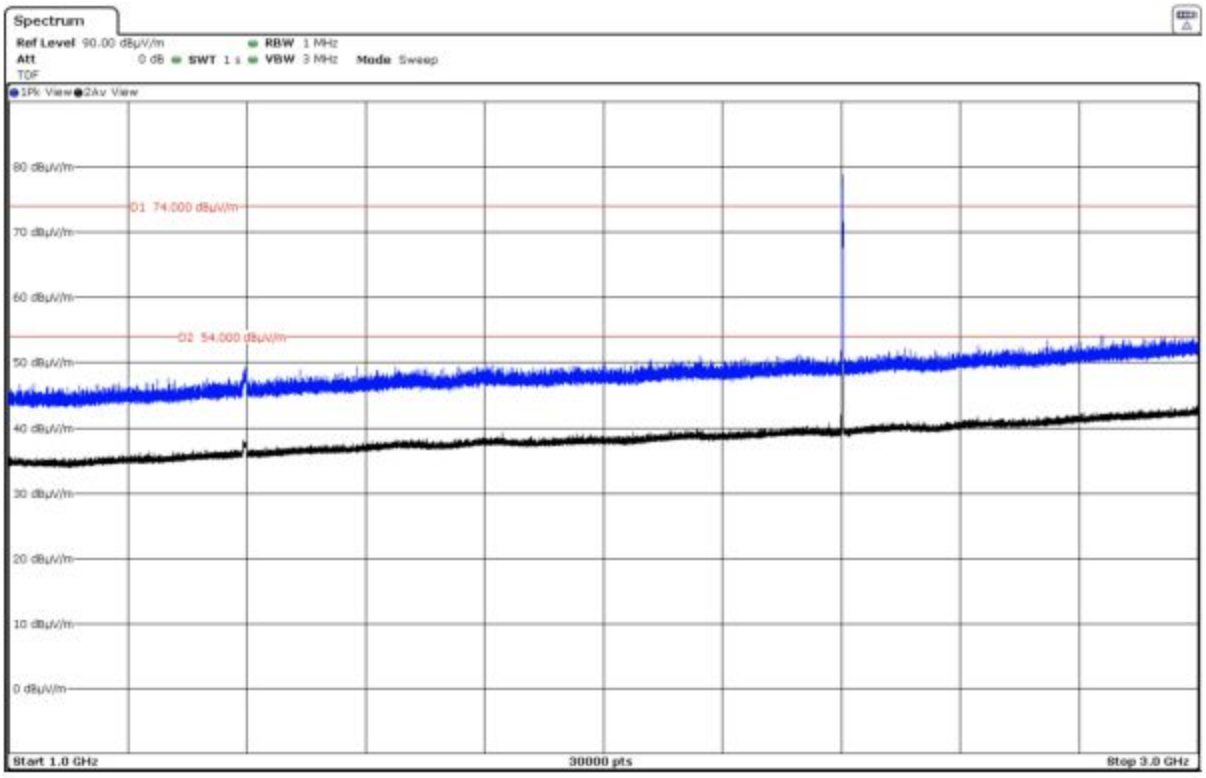
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

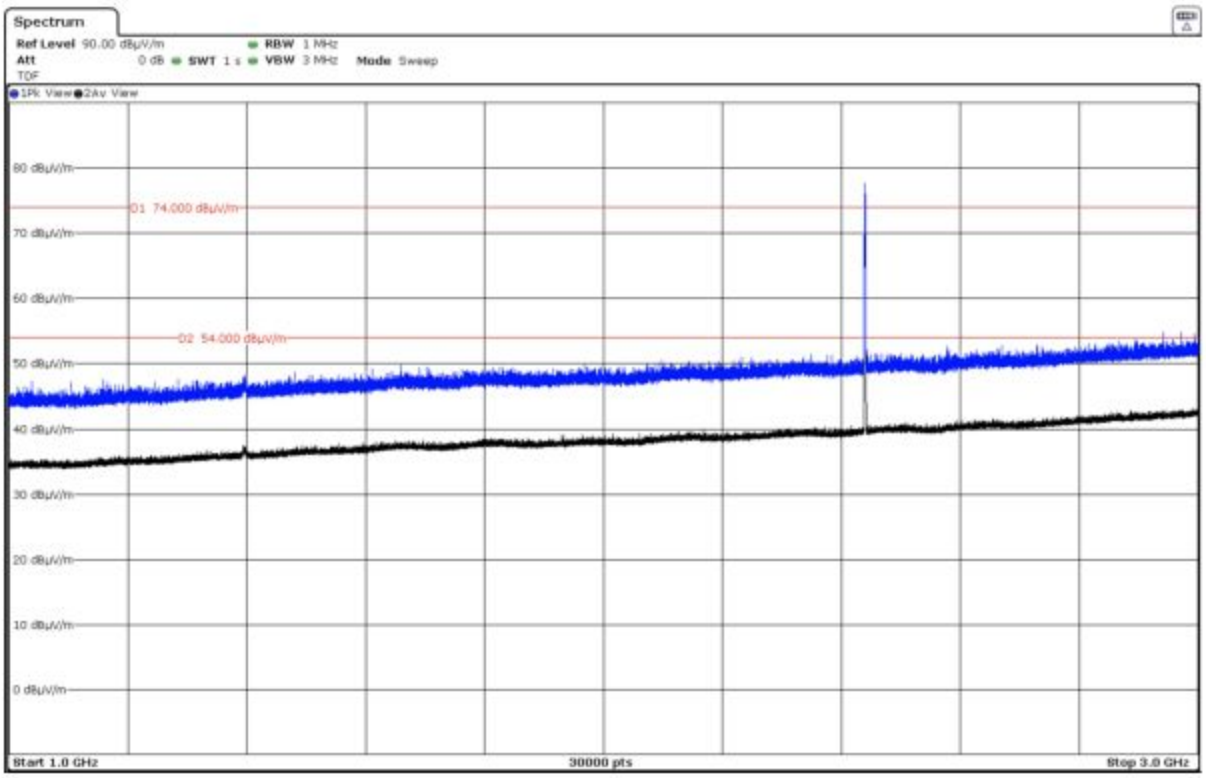
- **Pi/4-DQPSK modulation (2DH5)**

  - Low Channel (2402 MHz):



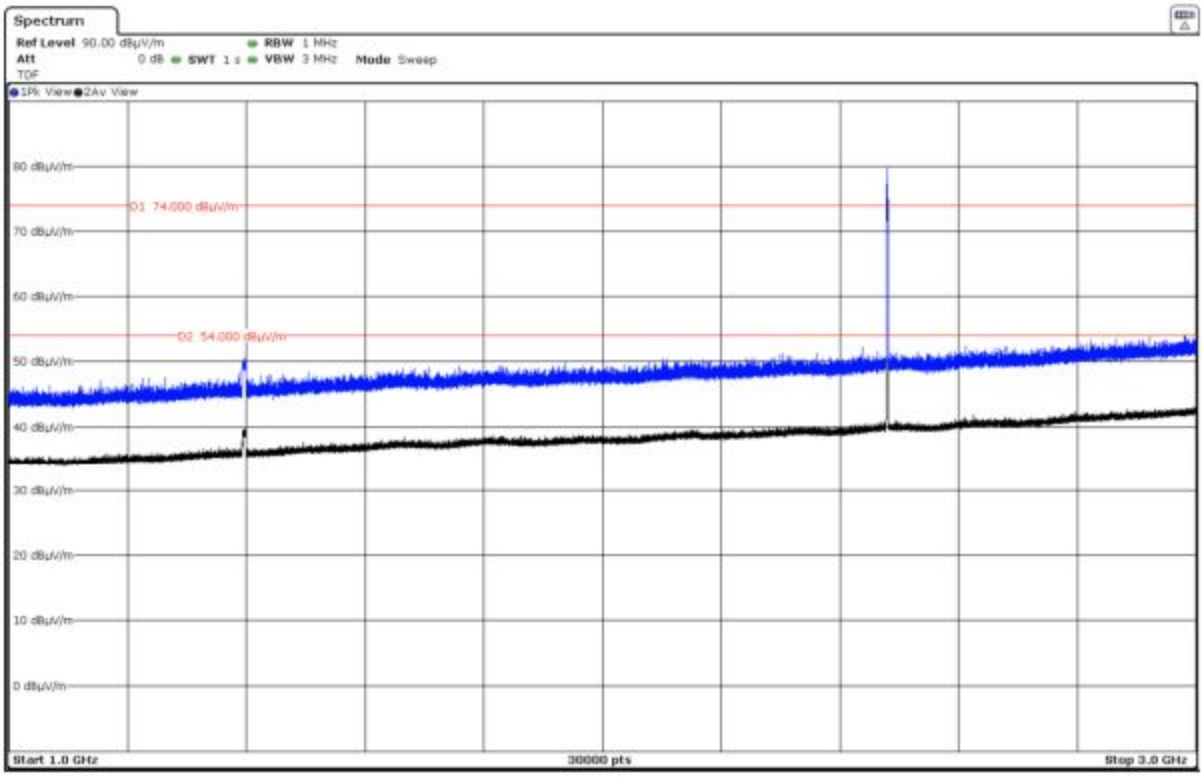
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

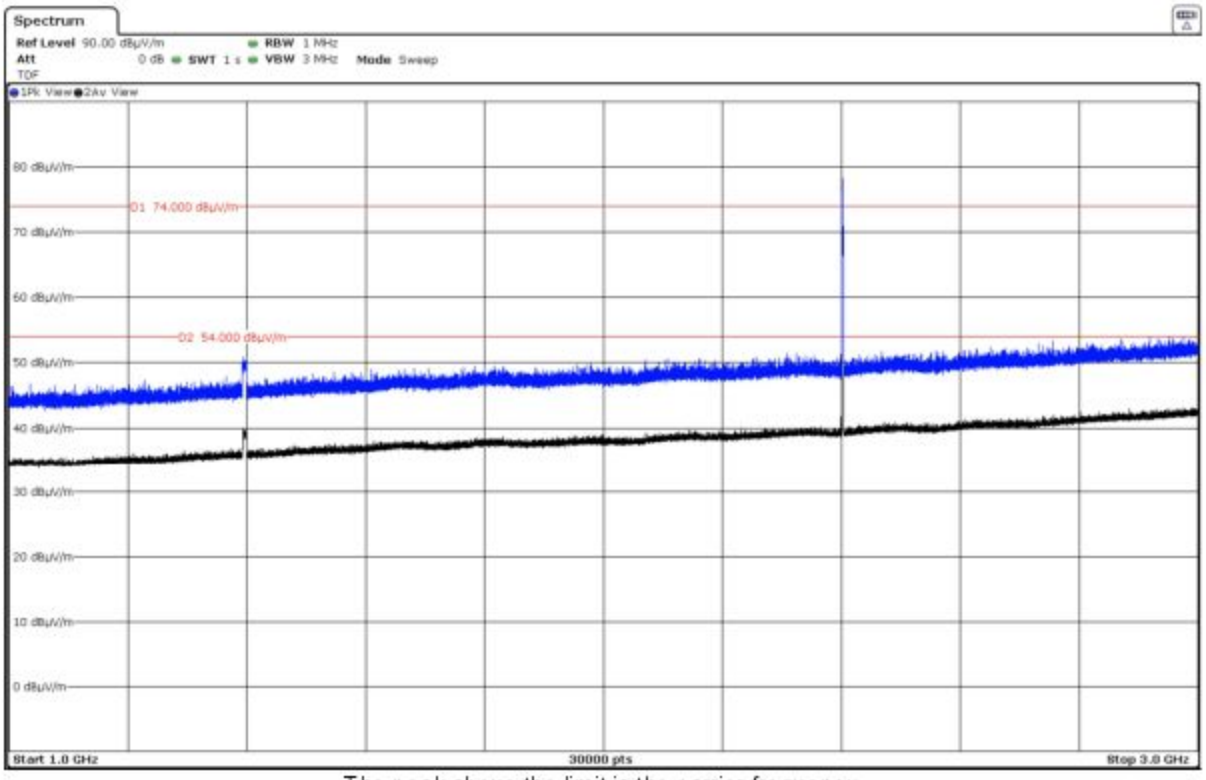
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

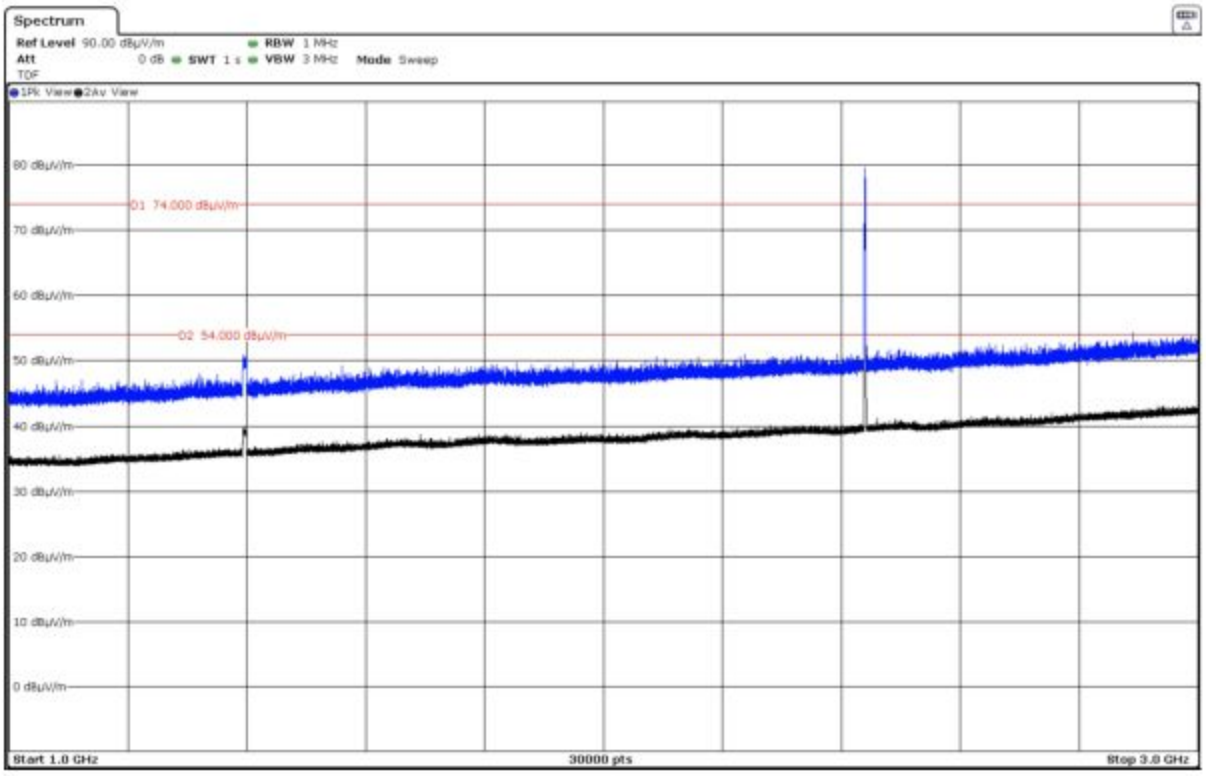
- **8-DPSK modulation (3DH5)**

- Low Channel (2402 MHz):



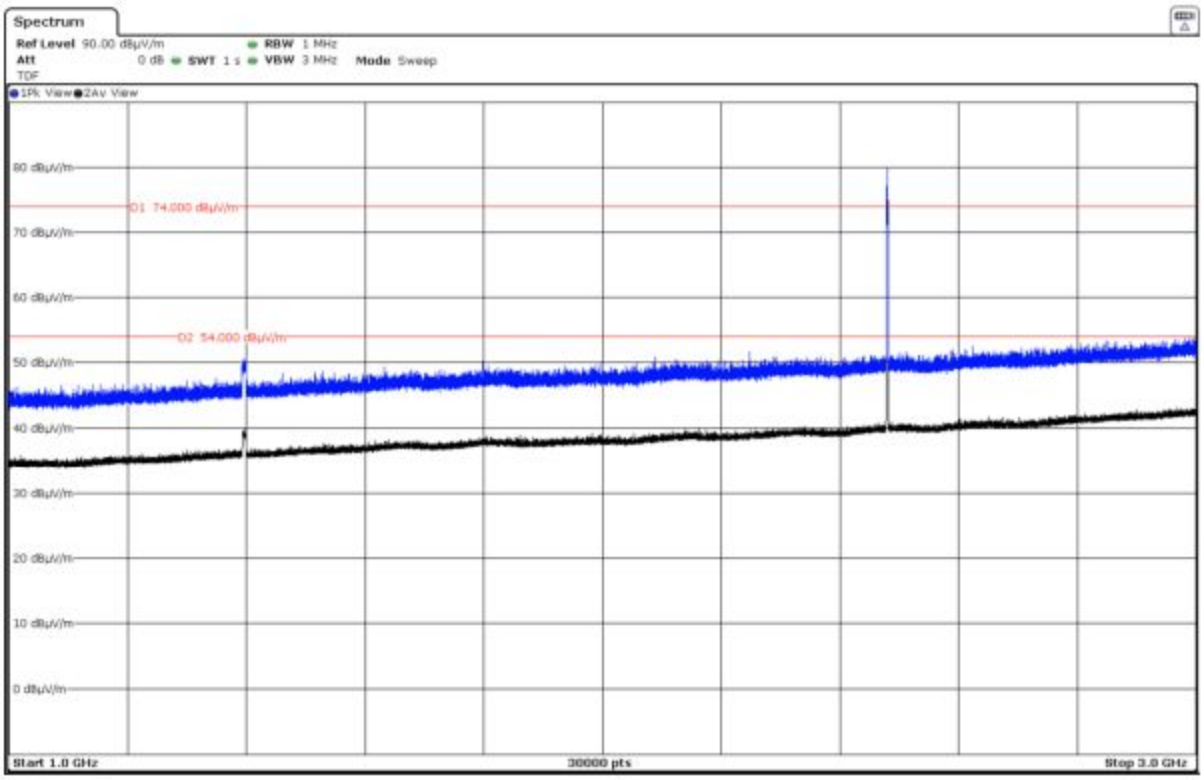
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

- High Channel (2480 MHz):

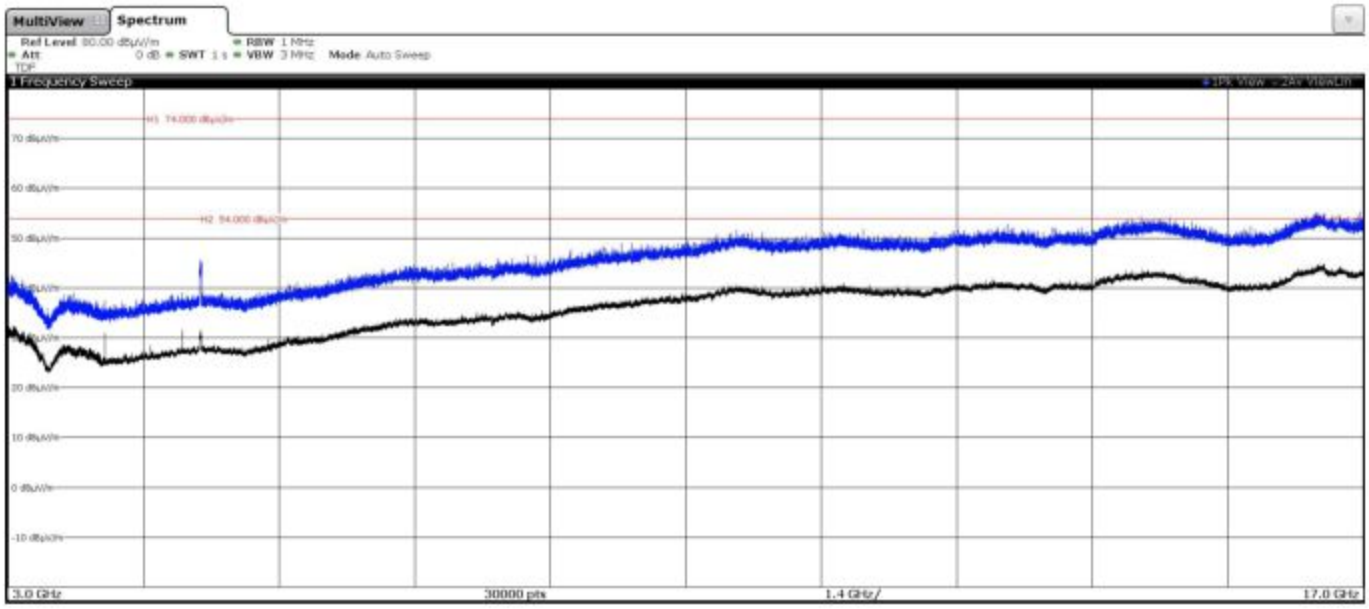


The peak above the limit is the carrier frequency.

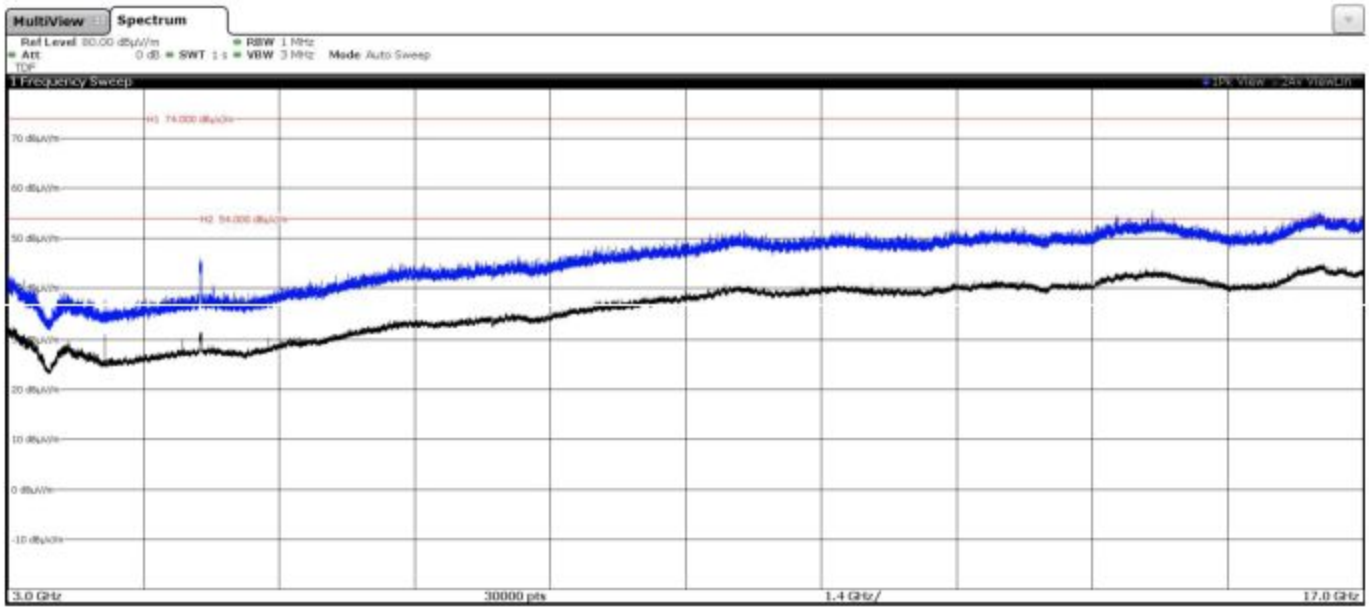
FREQUENCY RANGE 3 - 17 GHz:

- **GFSK modulation (DH5)**

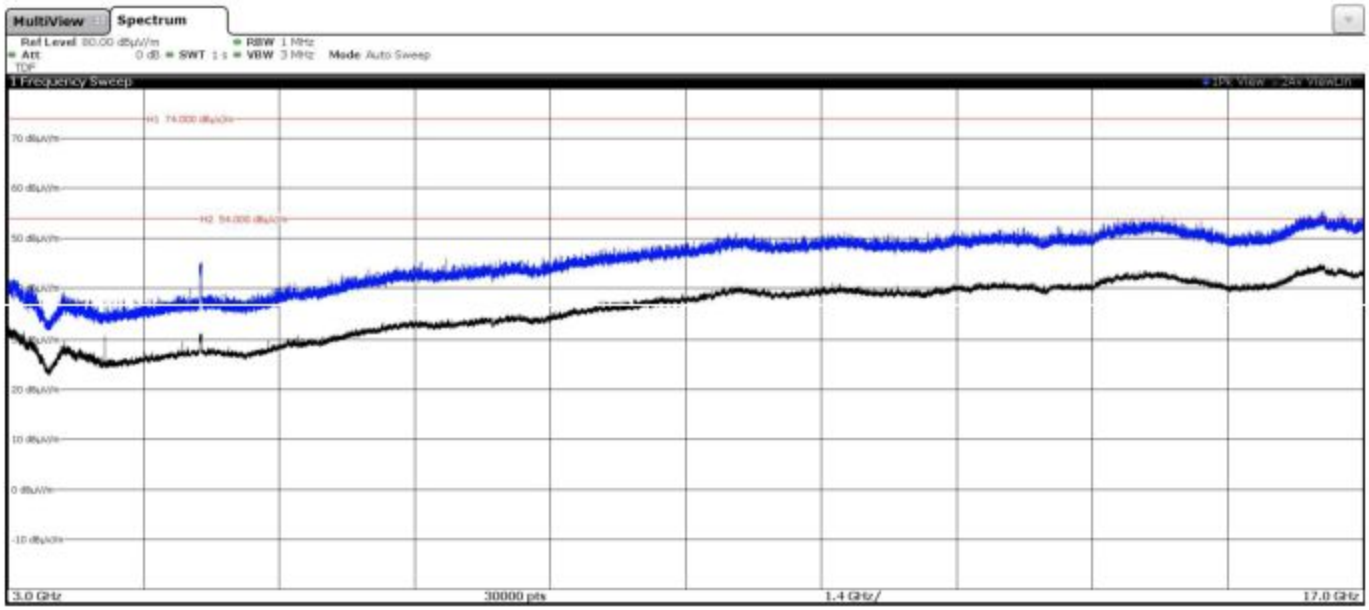
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):

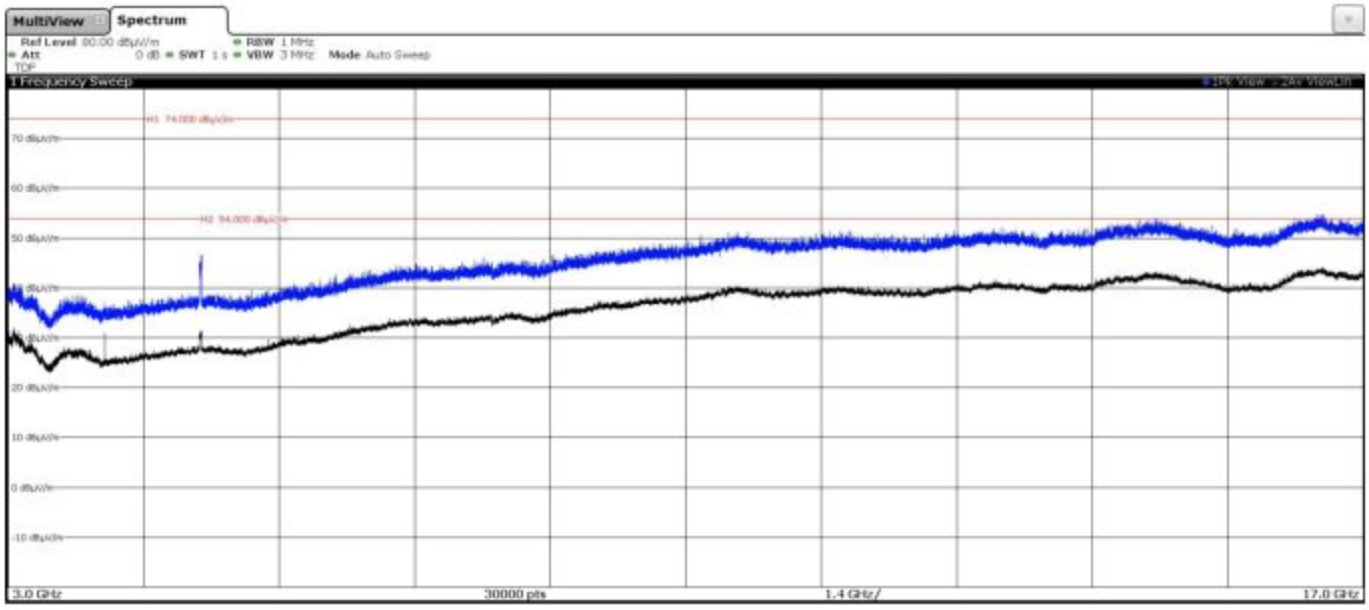


- High Channel (2480 MHz):

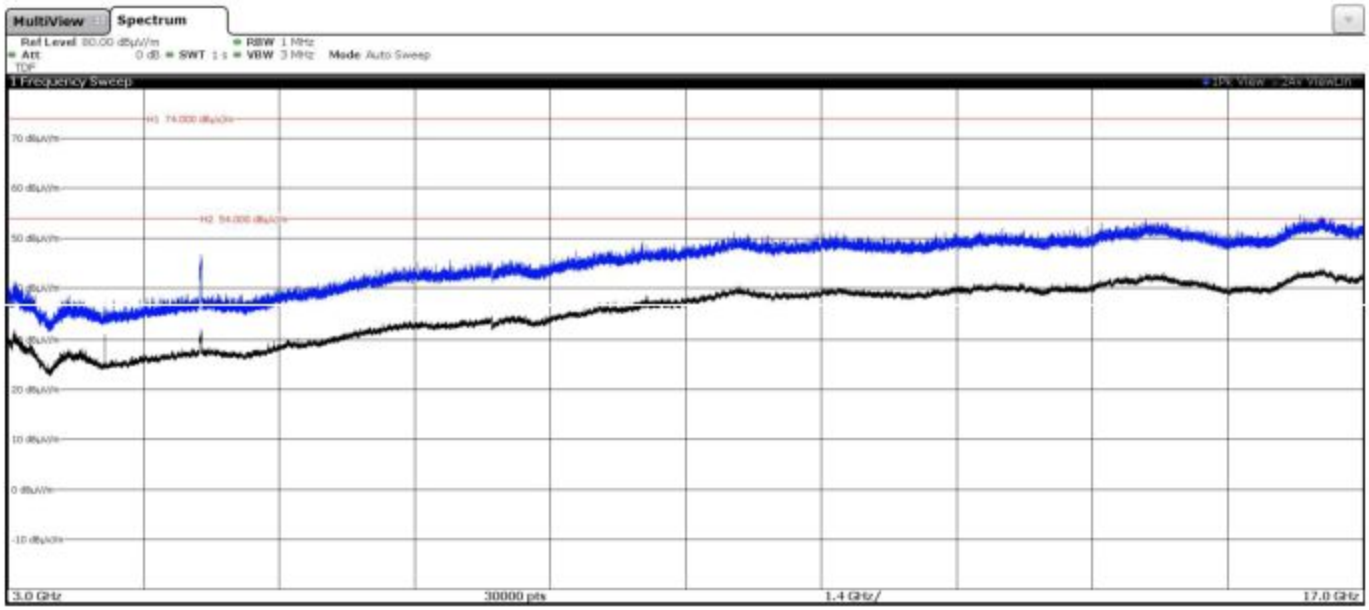


- **Pi/4-DQPSK modulation (2DH5)**

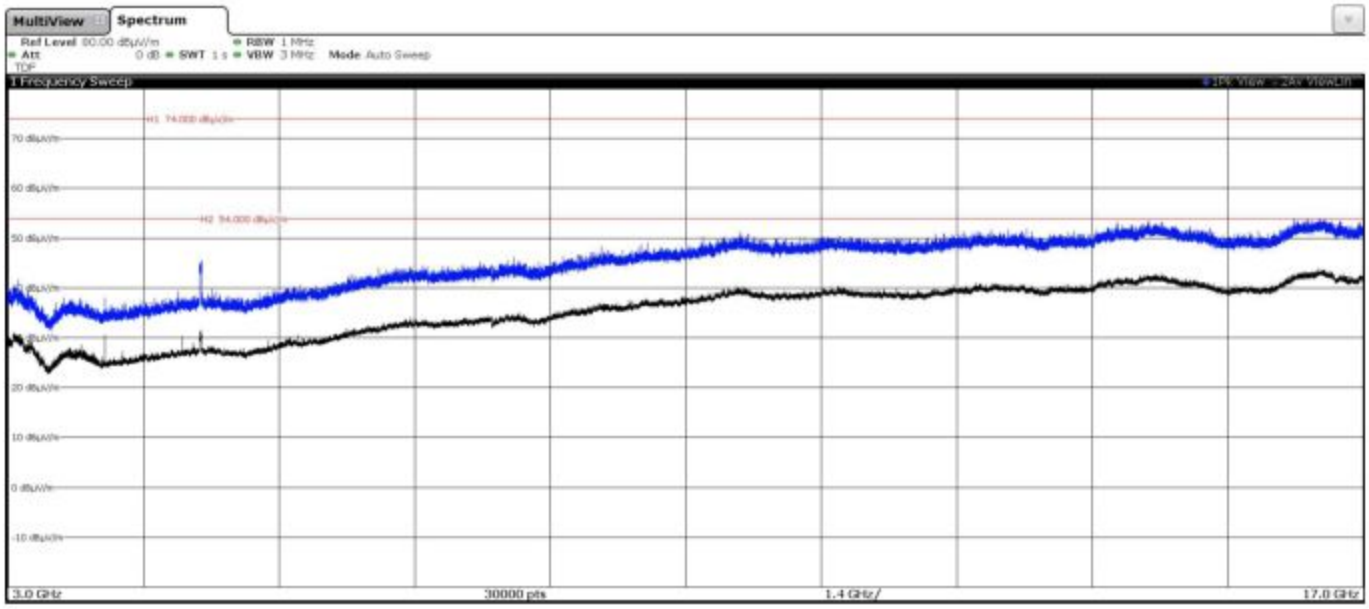
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

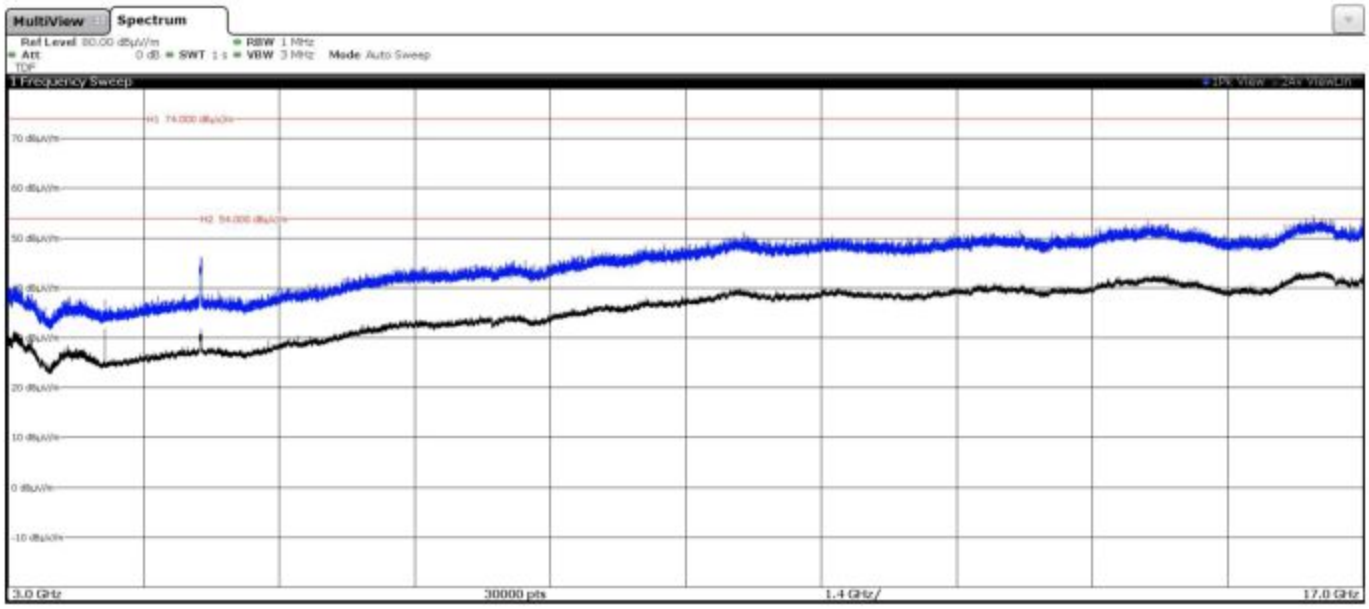


- High Channel (2480 MHz):

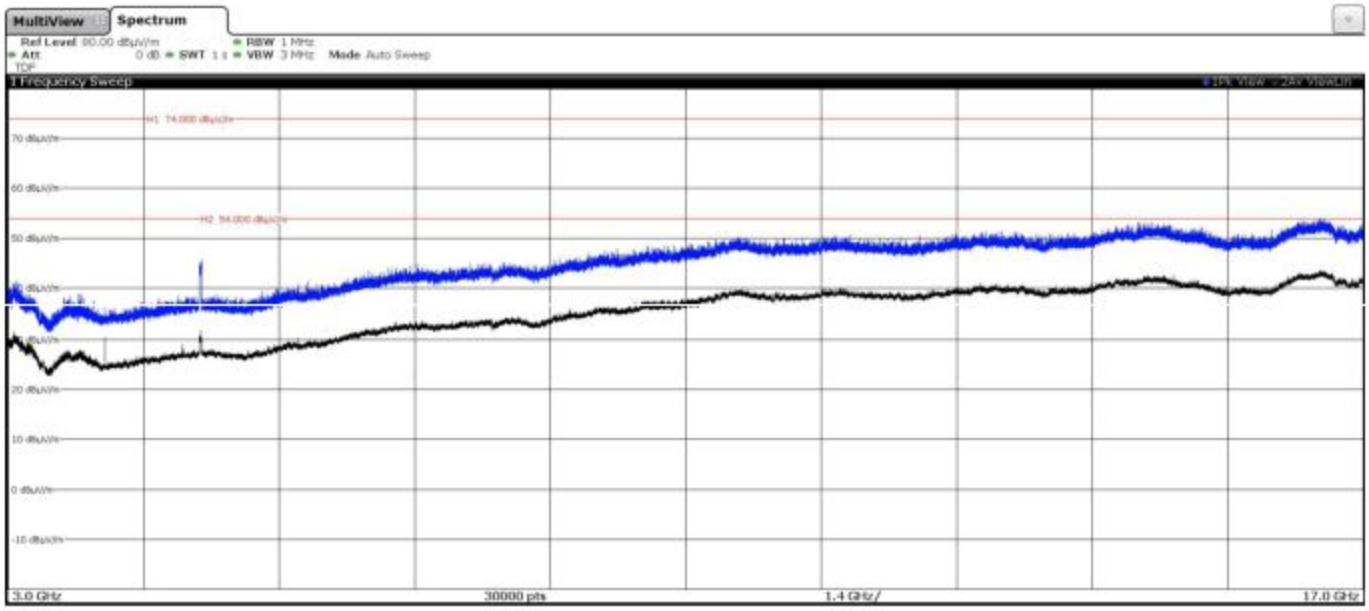


- **8-DPSK modulation (3DH5)**

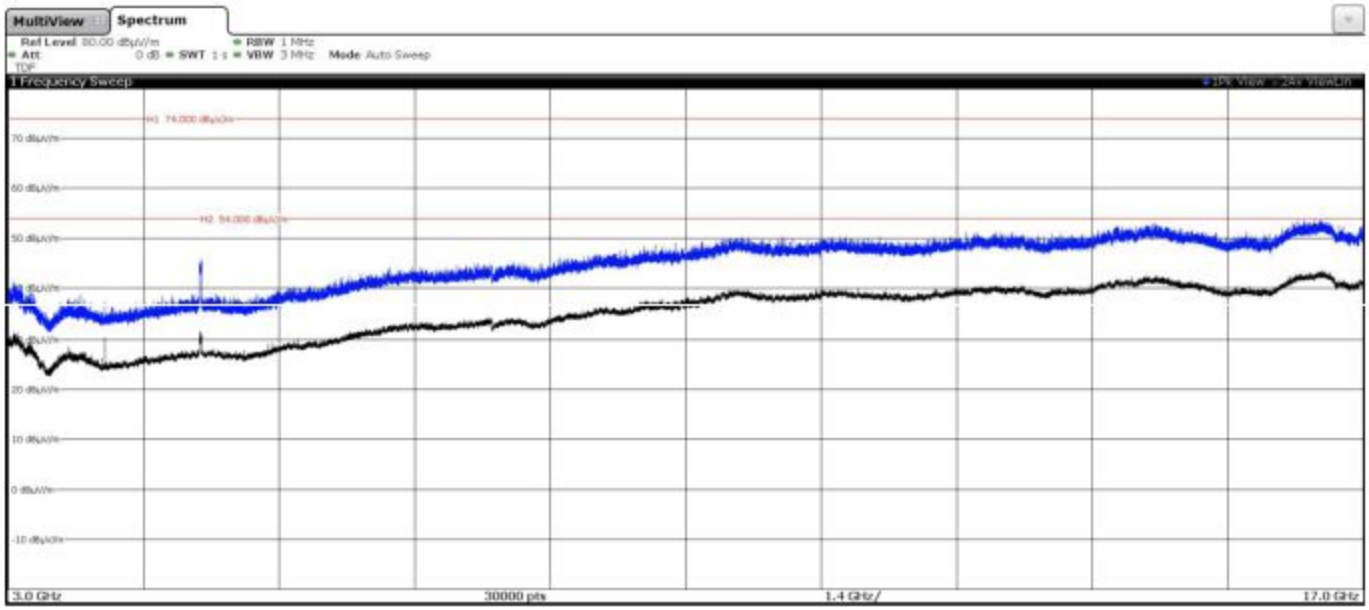
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):



- High Channel (2480 MHz):



FREQUENCY RANGE 17 - 26 GHz:

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