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

DEKRA

ENAC ENSAYOS Nº 51/LE147

Test report No:
NIE: 60268RRF.013

Partial 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	Mercedes-Benz
(*) Model and /or type reference	NTG7 PREMIUM PLUS
Other identification of the product	HW version: D5 SW version: E17.100 FCC ID: T8GNTG7PREPLUS IC: 6434A-NTG7PREPLUS
(*) Features	FM/AM/DAB/DVBT USB, 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 (10-1-19) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-19) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (March 2019). - Emission limitations radiated (Transmitter) 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. Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor 74841983Y JOSE CARLOS LUQUE (C:A29507456) Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2020.05.25 12:37:15 +02'00'
Date of issue	2020-05-25
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

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

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

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

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

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

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

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

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General conditions

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

Uncertainty

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").

2. The sample of NTG7 PREMIUMPLUS is an Automotive head unit to be installed in cars with the following features: FM/AM/DAB/DVBT, USB, Bluetooth, WLAN and 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 Nº	Description	Model	Serial Nº	Date of reception
60268/298	Mercedes-Benz Automotive infotainment System	NTG7 PREMIUMPLUS	HBM620LS000001	2020/02/26

Auxiliary elements used with the sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
60268/308	RF Harness	--	--	2020/02/26
60268/122	RF Cable with 4 Antennas	--	--	2019/09/30

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

Test sample description

Ports…… :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	Car Connector A	>3m(x1)	☒	☐	☐
	Car Connector B	>3m(x1)	☒	☐	☐
	Display Connector CID/PIP / RVC	>3m(x1)	☒	☒	☐
	USB Connector	<3m(x2)	☒	☒	☐
	Eth Connector	>3m(x1)	☒	☐	☐
	BT/WLAN-Antenna	>3m(x1)	☒	☒	☐
	FM/AM, TV/SDARS Ant	>3m(x1)	☒	☒	☐
	GNSS Antenna	>3m(x1)	☒	☒	☐
Supplementary information to the ports…… :					
Rated power supply .....:	Voltage and Frequency				
	☒	DC: 12V Car battery / attenuator (9,5-15,5V normal operation)			
Rated Power .....:	9,5-15,5V normal operation				
Clock frequencies.....:	See schematics				
Other parameters .....:	See Technical Description				
Software version .....:	E17.100				
Hardware version .....:	D5				
Dimensions in cm (W x H x D) ....:	182 x 78 x 160 mm				
Mounting position .....:	☒	Other: automotive headunit			
Modules/parts.....:	Module/parts of test item		Type	Manufacturer	

	N/A	-	
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	Display	-	LG.
	HARMANeco RasPi / headless	-	HBAS
	Cable harness	-	HBAS
	BT/WLAN-Antenna	-	Hirschmann
Documents as provided by the applicant.....:	Description	File name	Issue date
	Technical Description	Technical Description NTG7_A15 200324 SOP2 AllVariant.doc	

(3) Only for Medical Equipment

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)	2020-03-02
Date (finish)	2020-03-25

Document history

Report number	Date	Description
60268RRF.013	2020-05-25	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

Remarks and comments

The tests have been performed by the technical personnel: José Manuel Jiménez.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09
4.	RF Pre-amplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2020/02	2021/02
5.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
6.	Digital Multimeter, FLUKE 175	2019/10	2020/10
7.	Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
8.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
9.	RF Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/11	2020/11
10.	Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
11.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/10	2021/10
12.	DC Power Supply 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N.A.	N.A.

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**
FCC 15.247 (a)(1) / RSS-247 5.1. (b)	20 dB Bandwidth and Carrier frequency separation	N/M	
FCC 15.247 (a)(1)(iii) / RSS-247 5.1 (d)	Number of hopping channels	N/M	
FCC 15.247 (a)(1)(iii) / RSS-247 5.1 (d)	Time of occupancy (Dwell Time)	N/M	
FCC 15.247 (b) / RSS-247 5.4. (b)	Maximum peak output power and antenna gain	N/M	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	(1)
Supplementary information and remarks: (1) Only test requested.			

2. WLAN 2.4 GHz (802.11 b/g/n20 2x2).

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/M	
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	N/M	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	N/M	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	(1)
Supplementary information and remarks: (1) Only test requested.			

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).

ANTENNA:

Maximum Declared Antenna Gain:	+1.8 dBi (Antenna gain plus antenna cable loss).
Type of Antenna:	External antenna.

TEST FREQUENCIES:

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

RADIATED MEASUREMENTS:

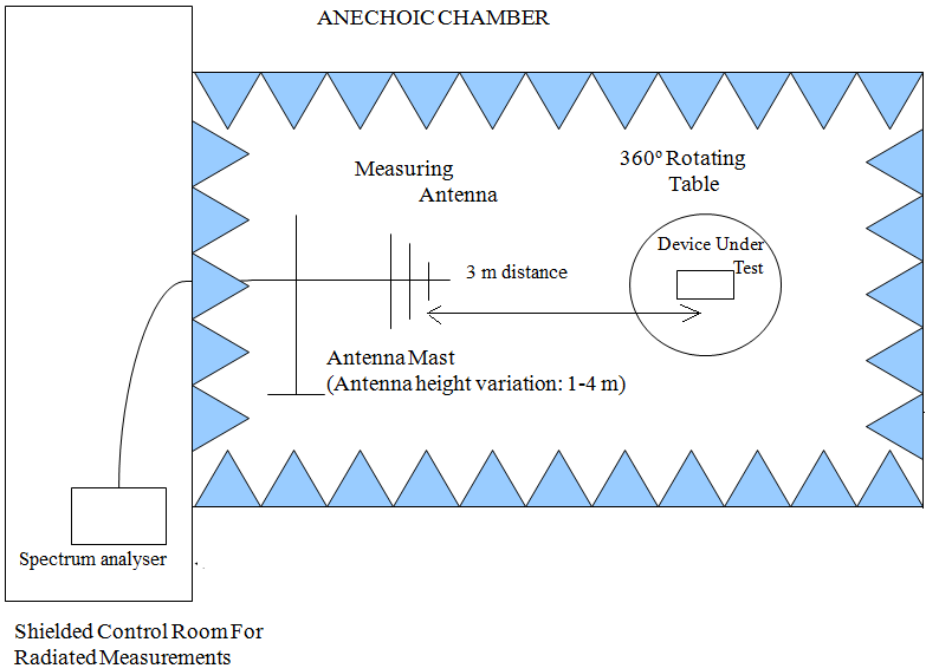
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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.

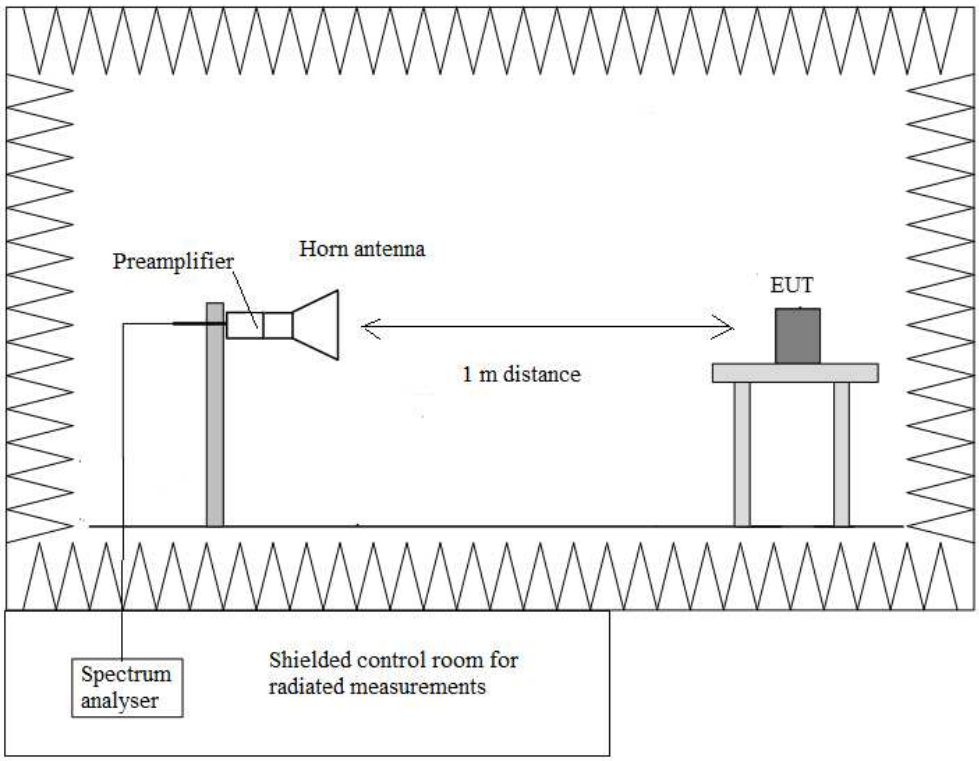
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup f > 1 GHz:



FCC 15.247 (d) / RSS-247 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)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
45.957	39.7	40	V	Quasi peak	<± 5.08
89.219	32.9	43.5	V	Quasi peak	<± 5.08
141.34	27.8	43.5	V	Quasi peak	<± 5.08
375.013	30.4	46	H	Quasi peak	<± 5.08
500.014	27.8	46	H	Quasi peak	<± 5.08

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. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
7.00003	39.49	74	V	Peak	<±5.13

  - MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
5.57157	38.19	74	V	Peak	<±5.13
23.34695	43.95	74	V	Peak	<±5.13

  - HIGH CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
5.57157	38.7	74	V	Peak	<±5.13
7.00003	40.03	74	V	Peak	<±5.13
23.34725	41.92	74	V	Peak	<±4.82

  - RESTRICTED BANDS: No spurious frequencies detected at less than 20 dB below the limit.

Verdict: PASS

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

  - LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
23.34725	43.08	74	V	Peak	<±4.82

  - MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
5.57157	38.12	74	V	Peak	<±5.13
6.99957	40.81	74	V	Peak	<±5.13
23.34695	42.42	74	V	Peak	<±4.82

  - HIGH CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
23.34635	41.87	74	V	Peak	<±4.82

  - RESTRICTED BANDS: No spurious frequencies detected at less than 20 dB below the limit.

Verdict: PASS

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

  - LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
6.99957	39.06	74	V	Peak	<±5.13
5.57157	37.7	74	H	Peak	<±5.13
23.34695	41.29	74	V	Peak	<±4.82

  - MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
5.57157	38.21	74	V	Peak	<±5.13
6.99957	38.83	74	V	Peak	<±5.13
23.34665	42.58	74	V	Peak	<±4.82

  - HIGH CHANNEL. Spurious frequencies closest to the limit:

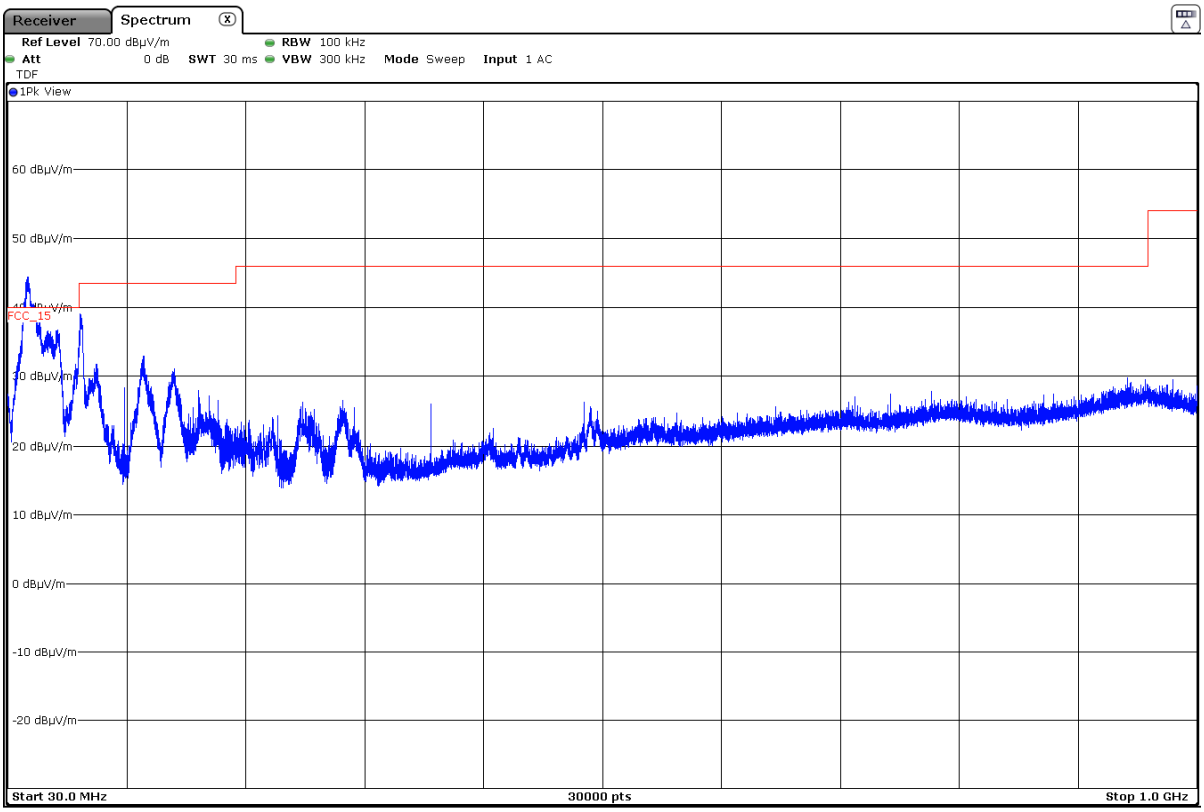
Spurious frequency (GHz)	Emission Level (dBµV/m)	Limit (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
7.00003	40.17	74	V	Peak	<±5.13

  - RESTRICTED BANDS: No spurious frequencies detected at less than 20 dB below the limit.

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

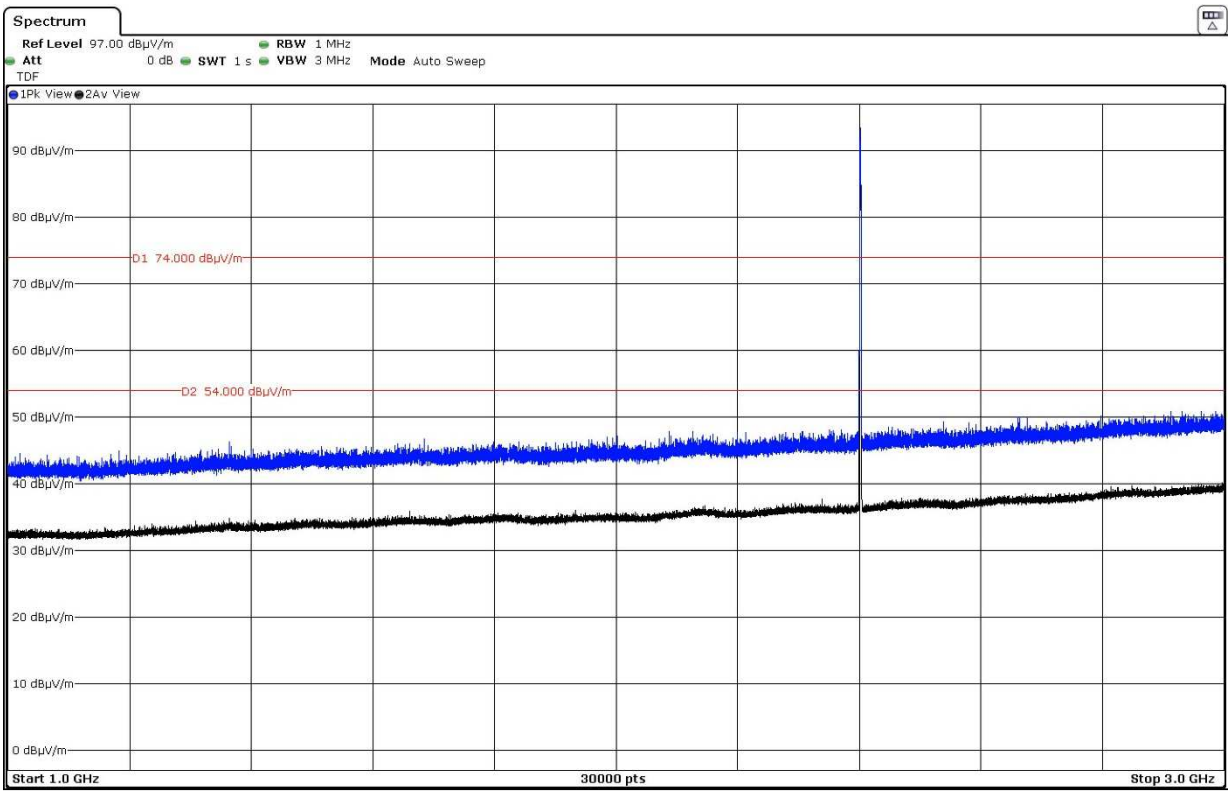
This plot is valid for the Low, Middle and High Channels and all the modulation modes.



FREQUENCY RANGE 1 - 3 GHz:

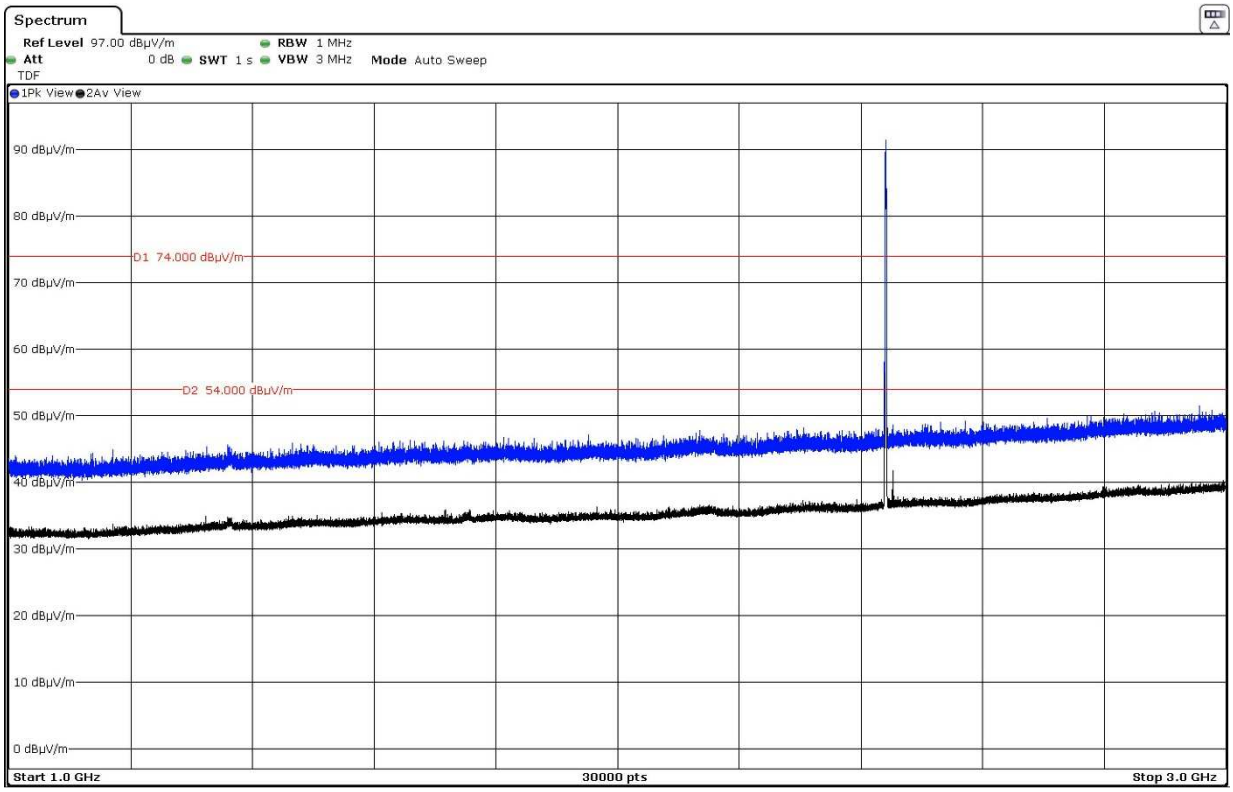
- **GFSK modulation (DH5)**

- Low Channel (2402 MHz):



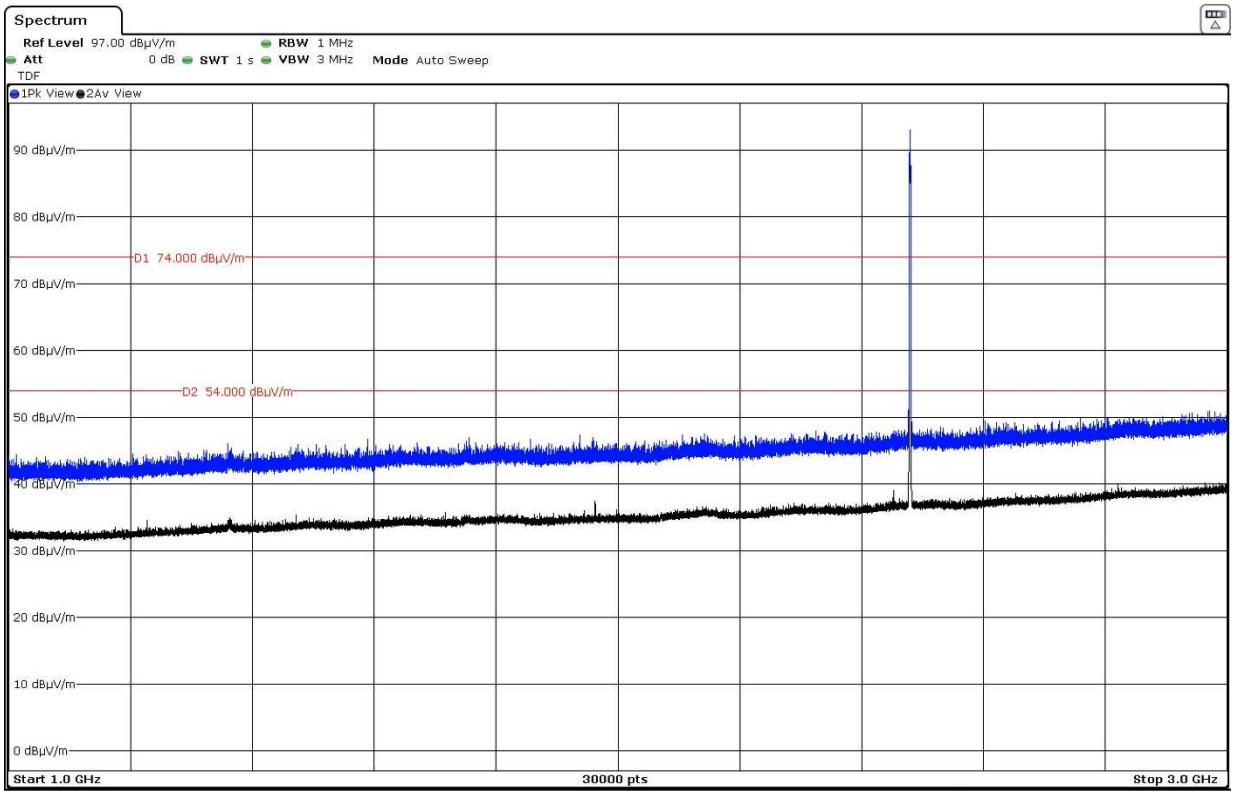
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

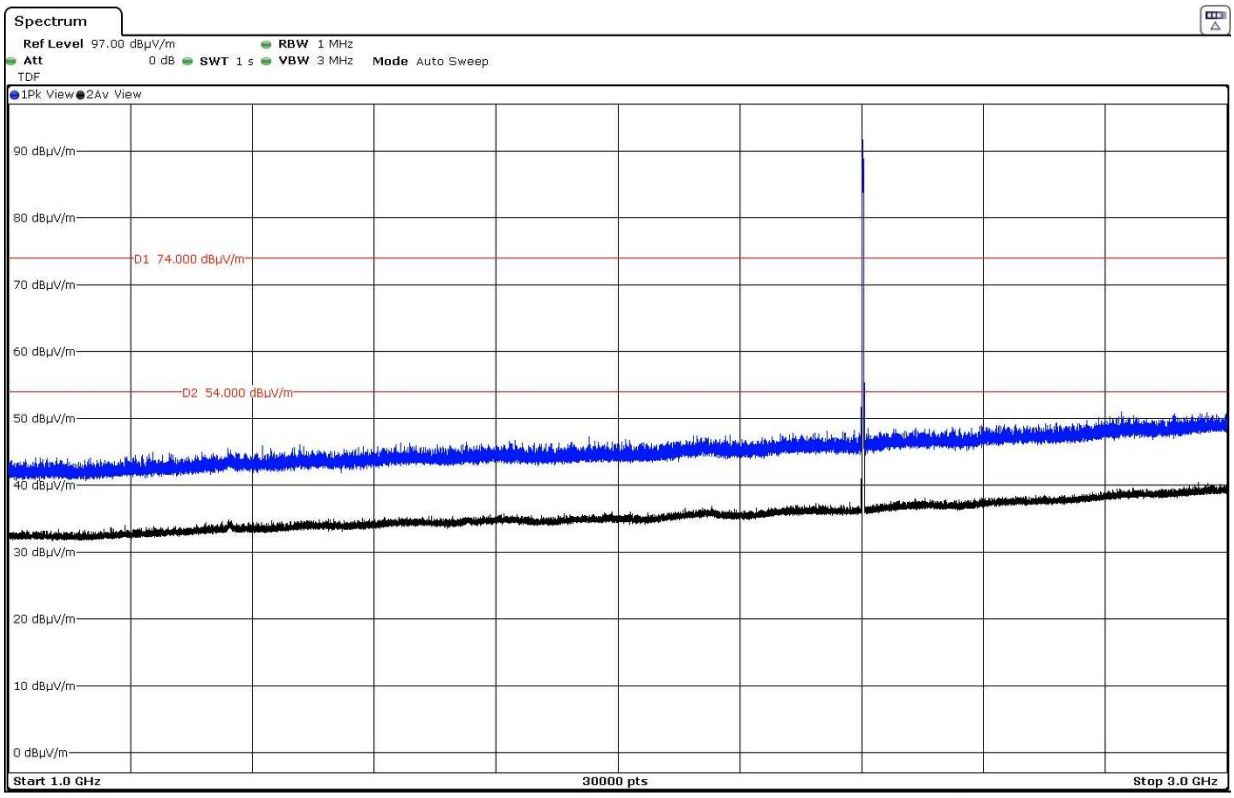
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

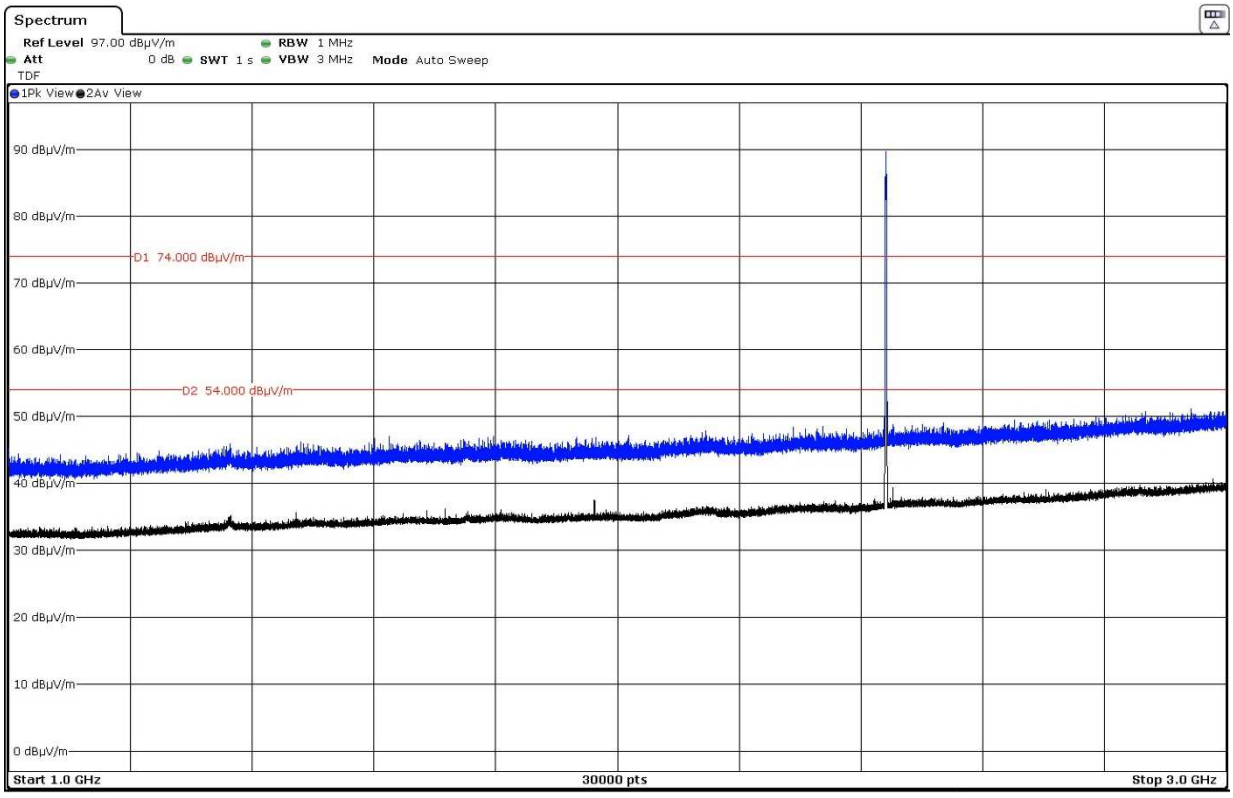
- **Pi/4-DQPSK modulation (2DH5):**

- Low Channel (2402 MHz):



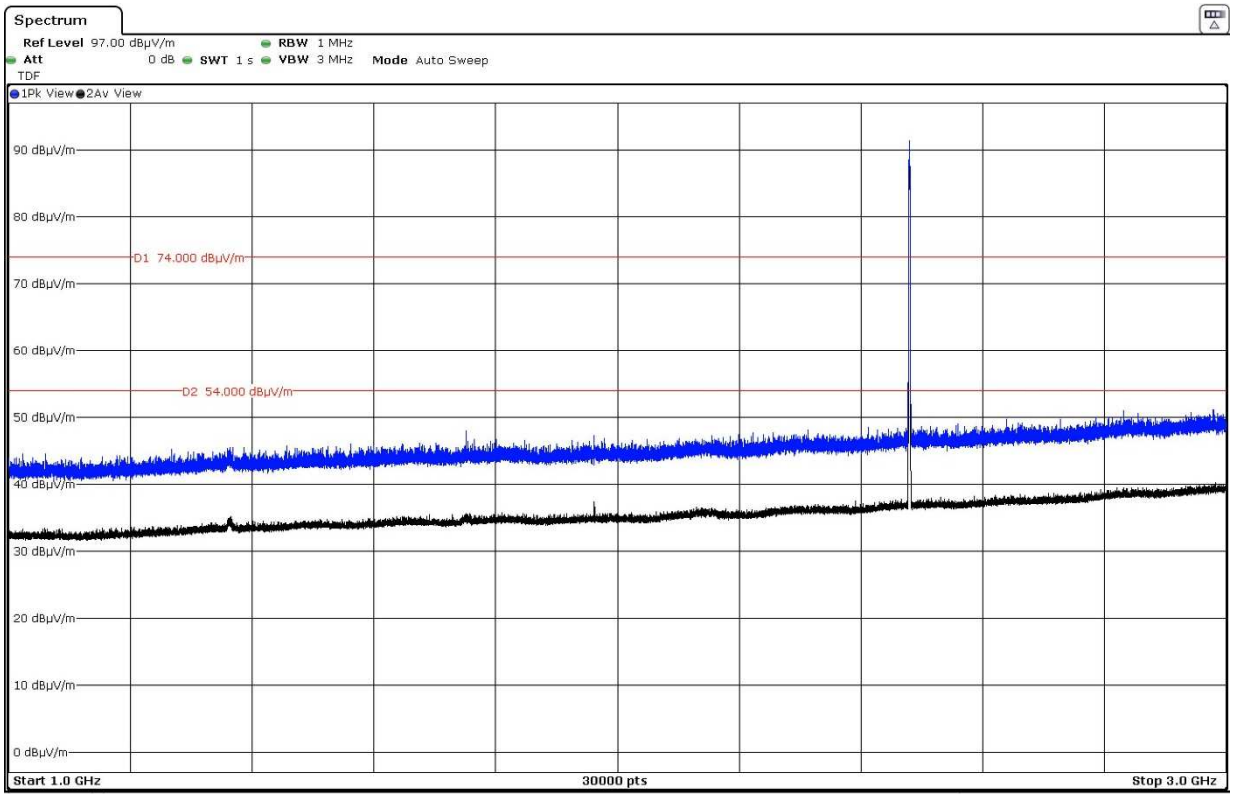
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

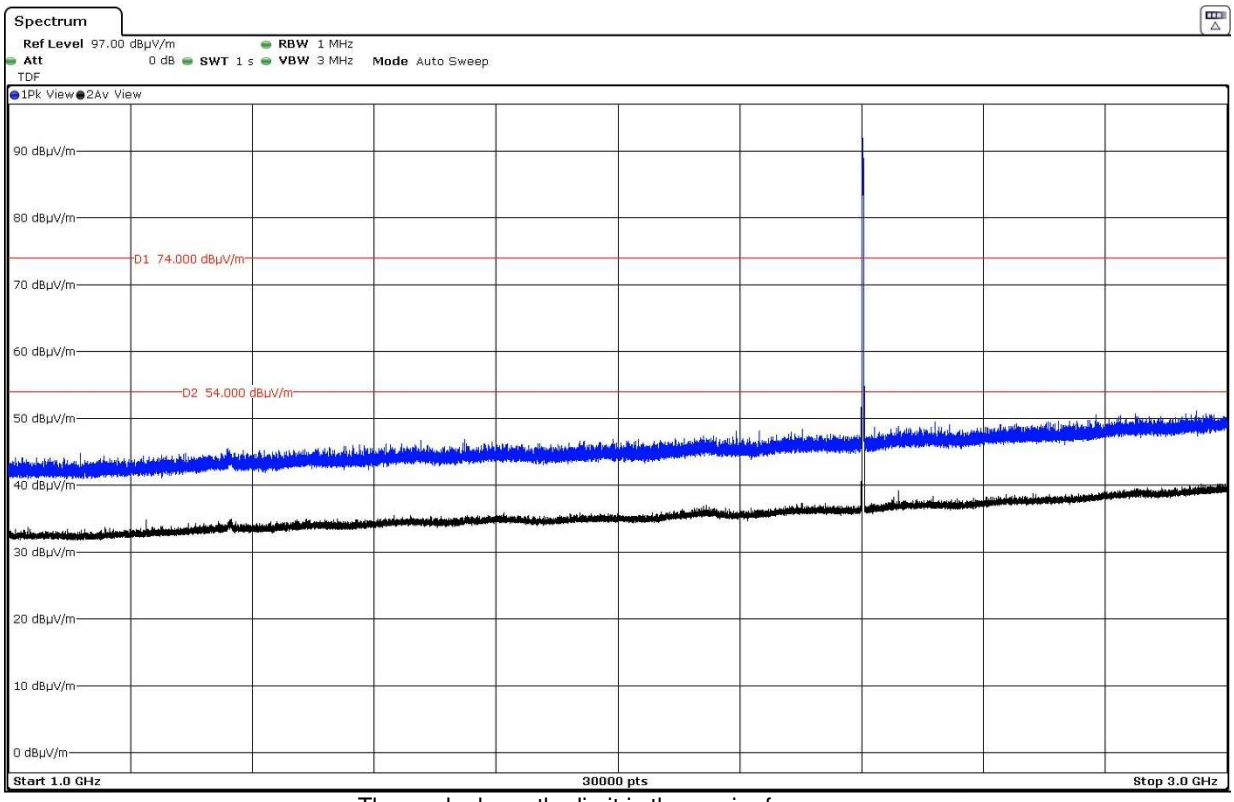
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

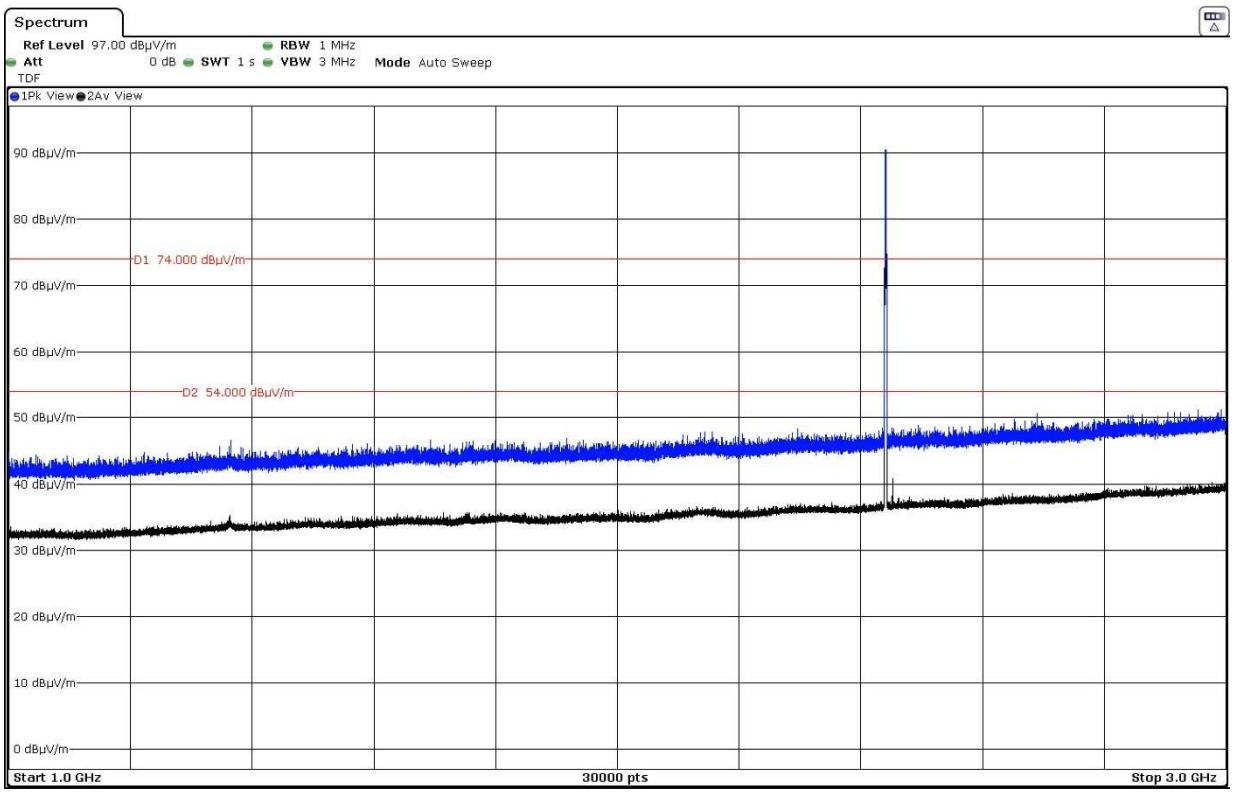
- **8-DPSK modulation (3DH5):**

  - Low Channel (2402 MHz):



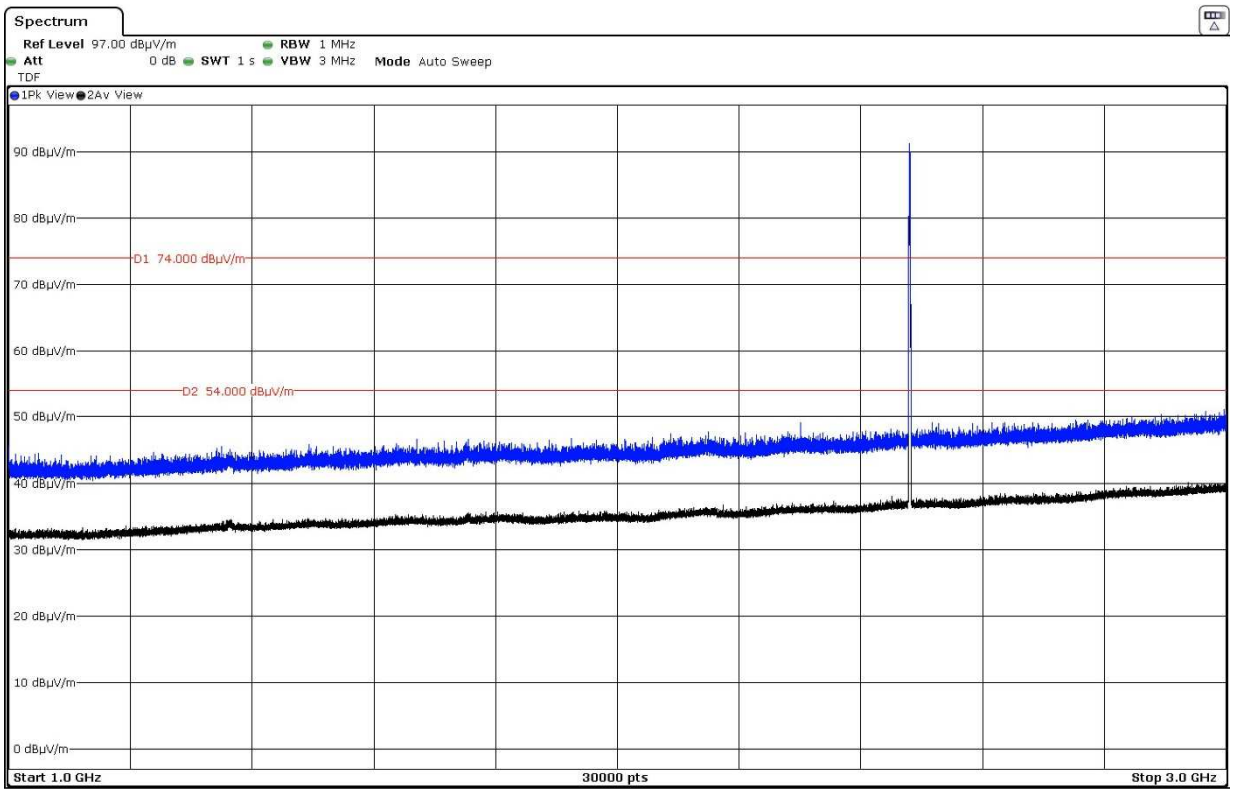
The peak above the limit is the carrier frequency.

  - Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

- High Channel (2480 MHz):

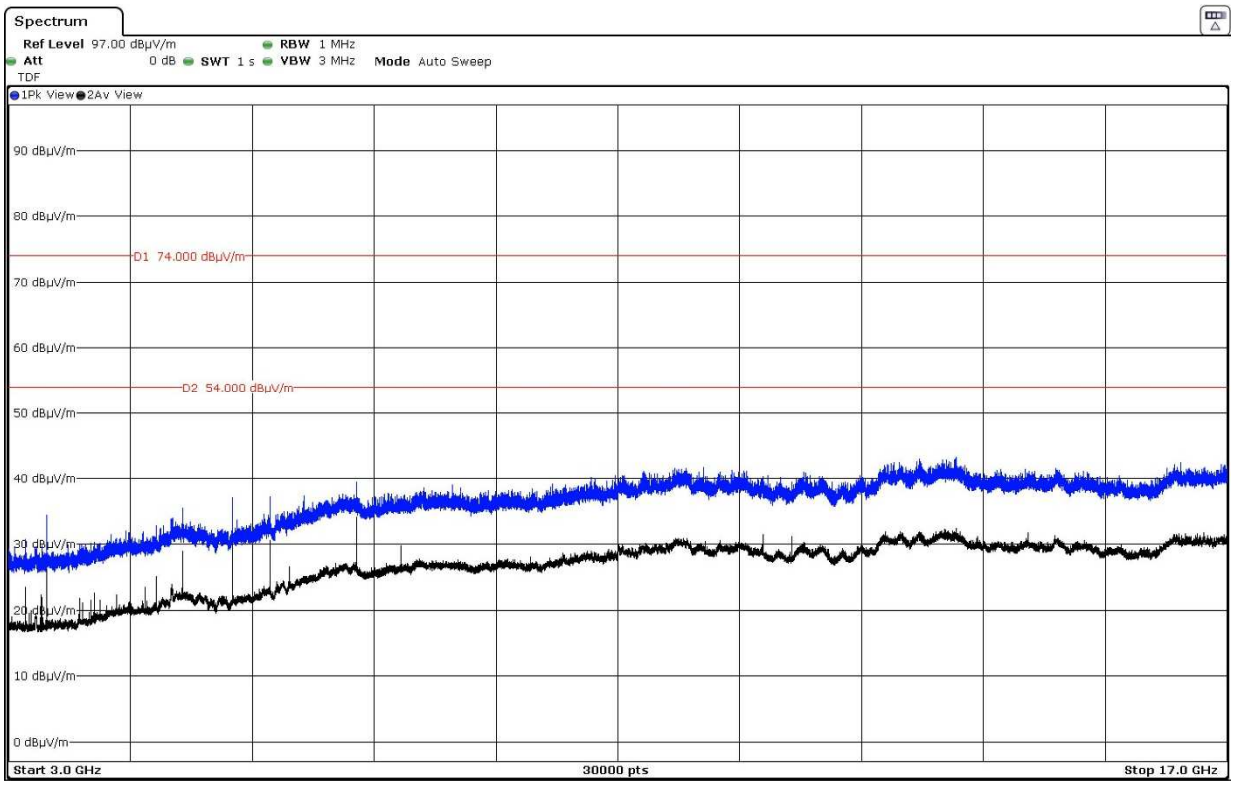


The peak above the limit is the carrier frequency.

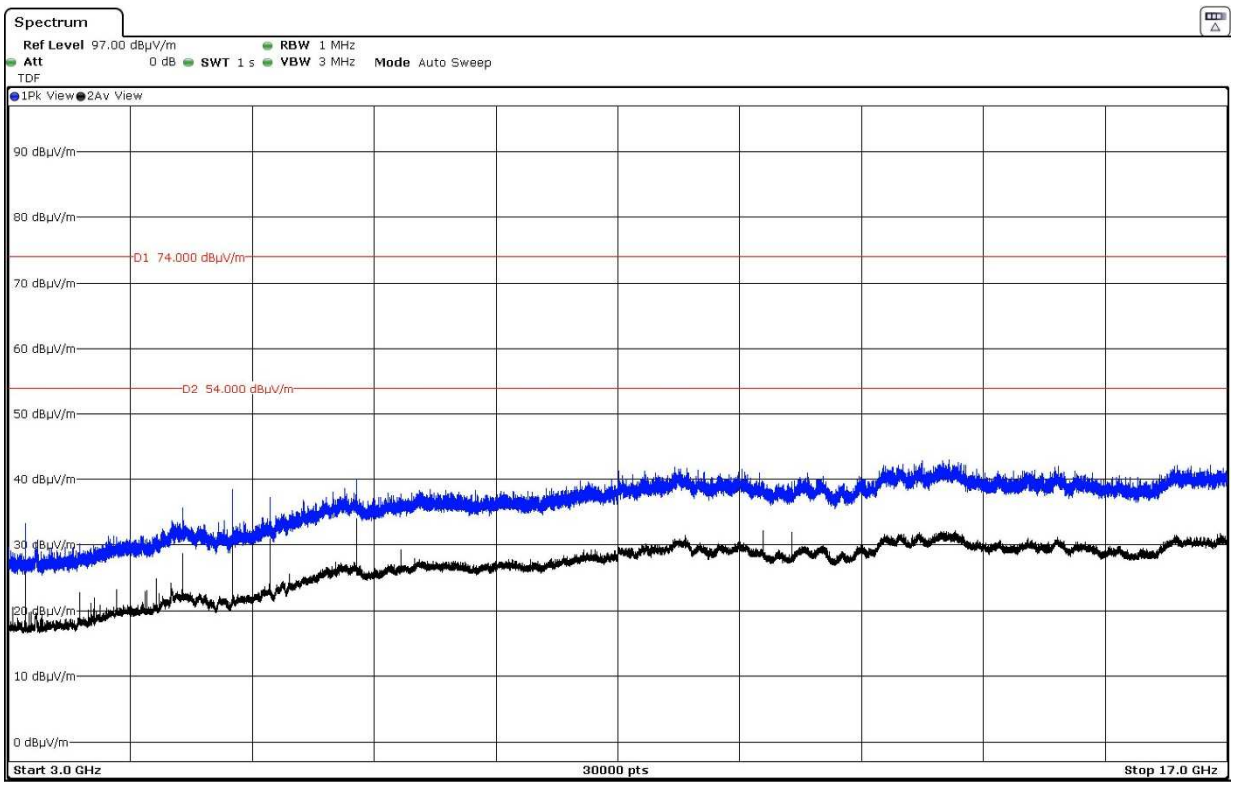
FREQUENCY RANGE 3 - 17 GHz:

- **GFSK modulation (DH5)**

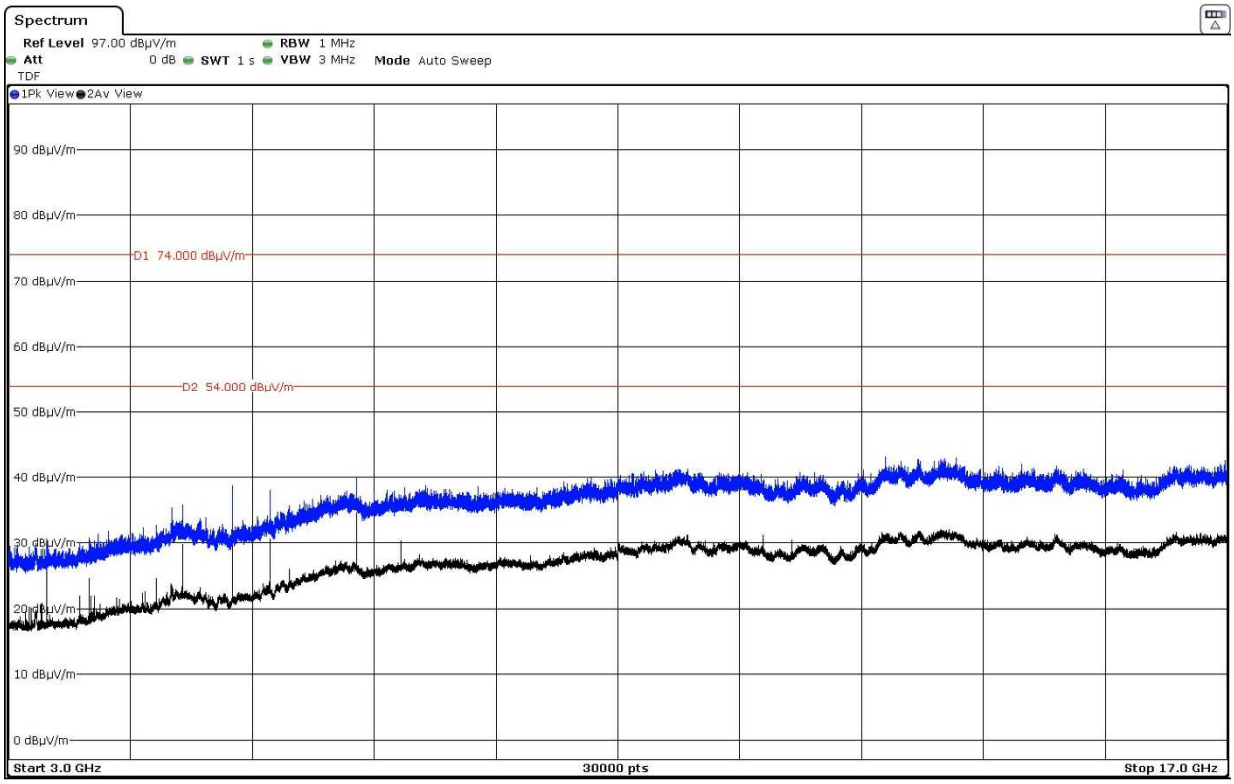
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

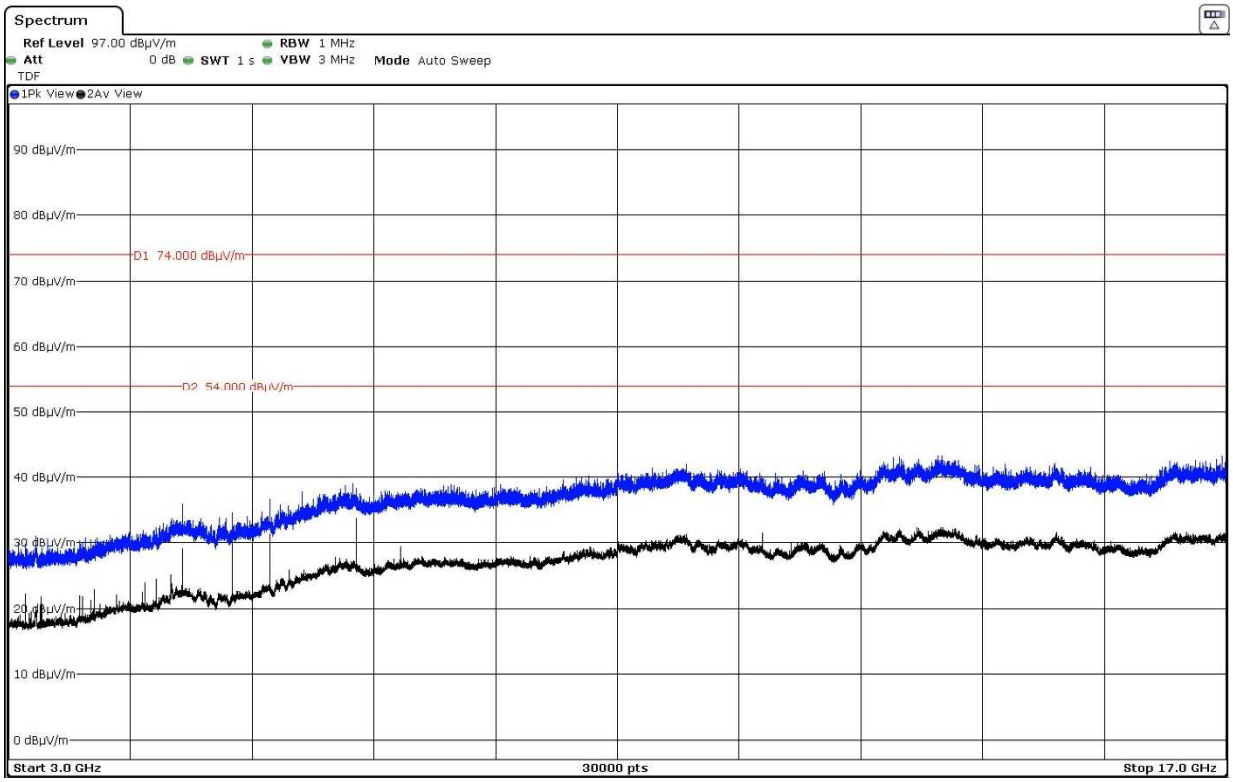


- High Channel (2480 MHz):

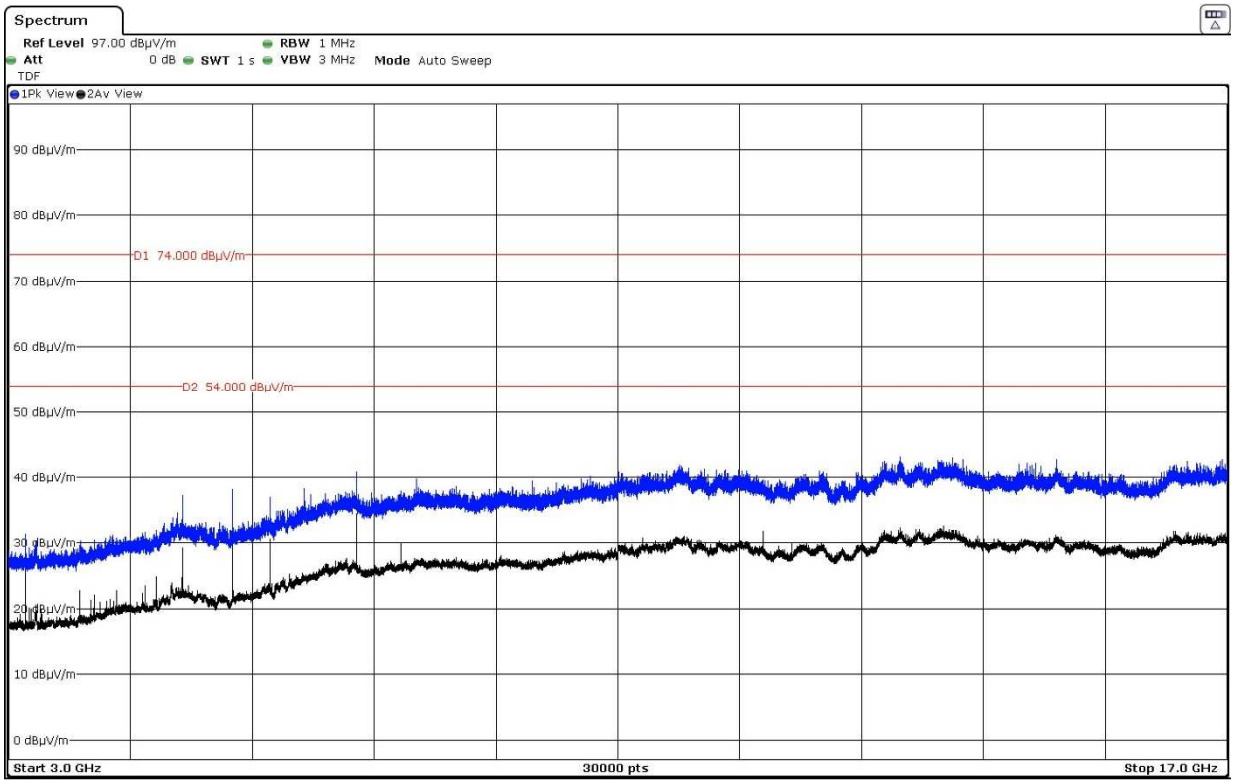


- **Pi/4-DQPSK modulation (2DH5):**

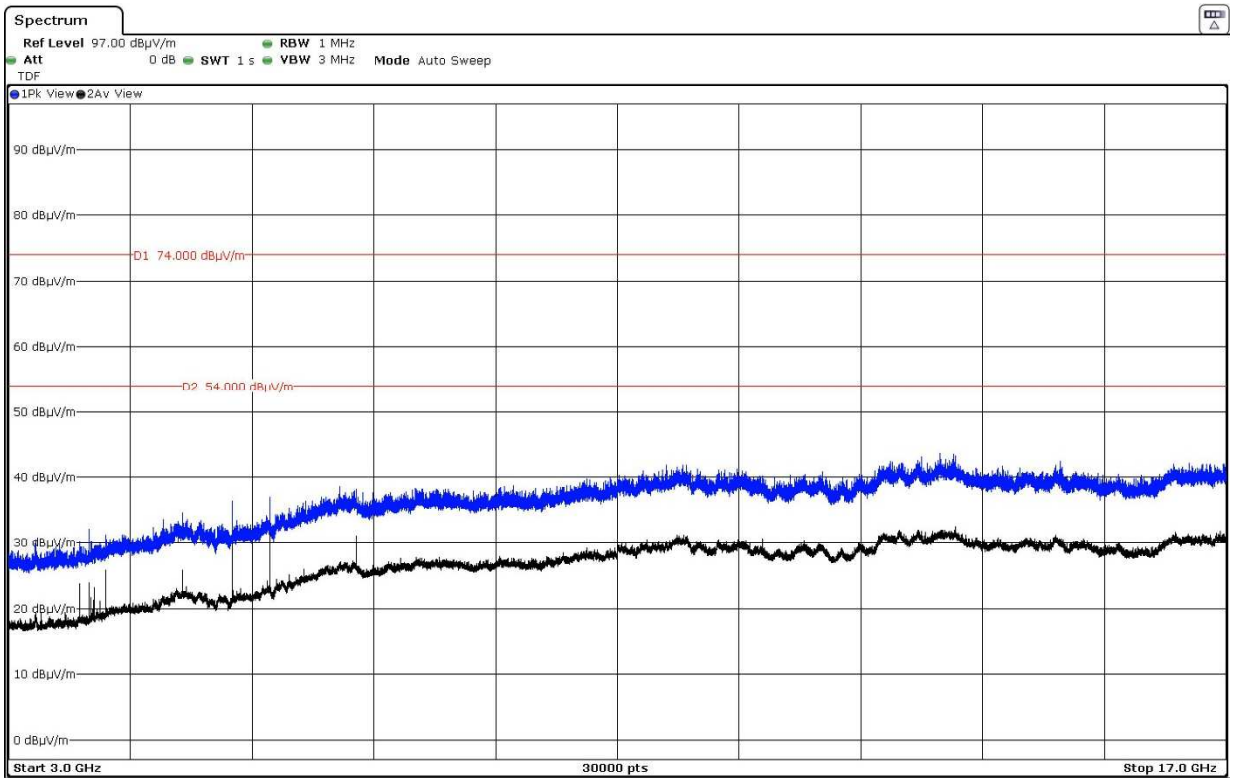
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

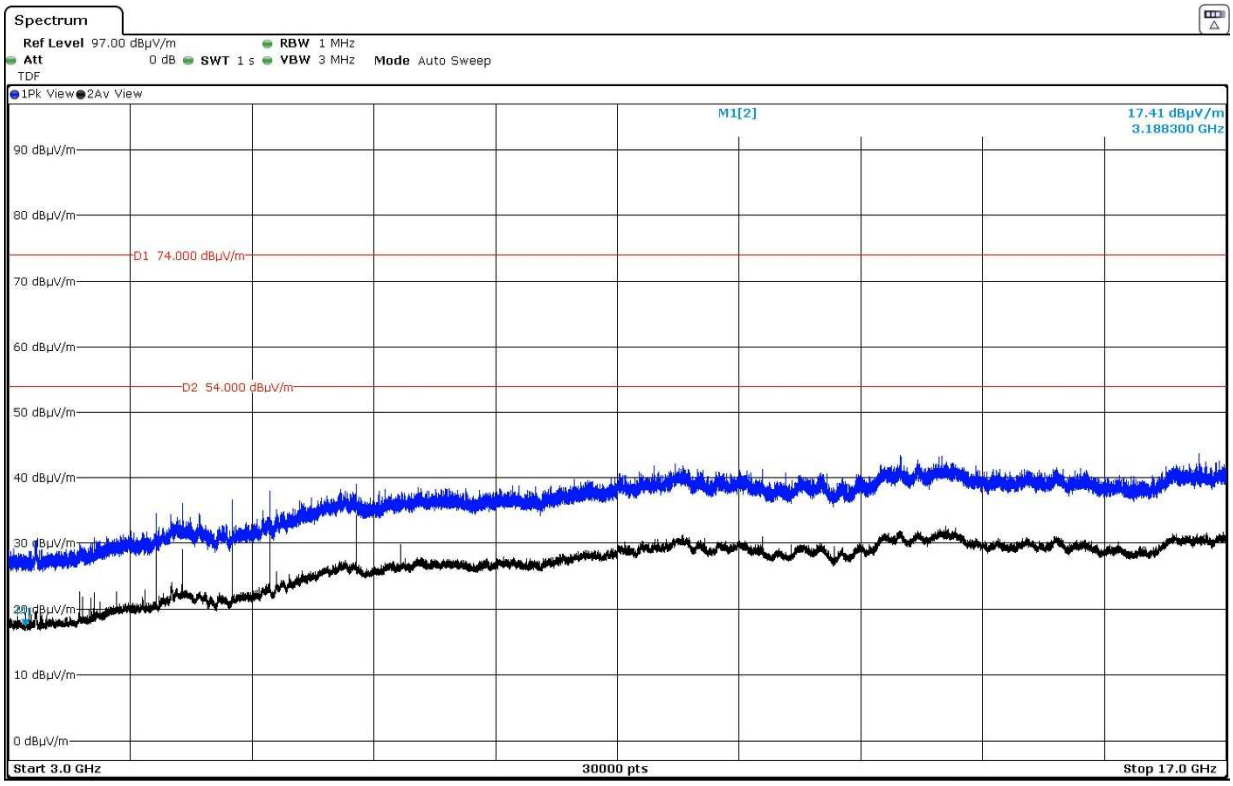


- High Channel (2480 MHz):

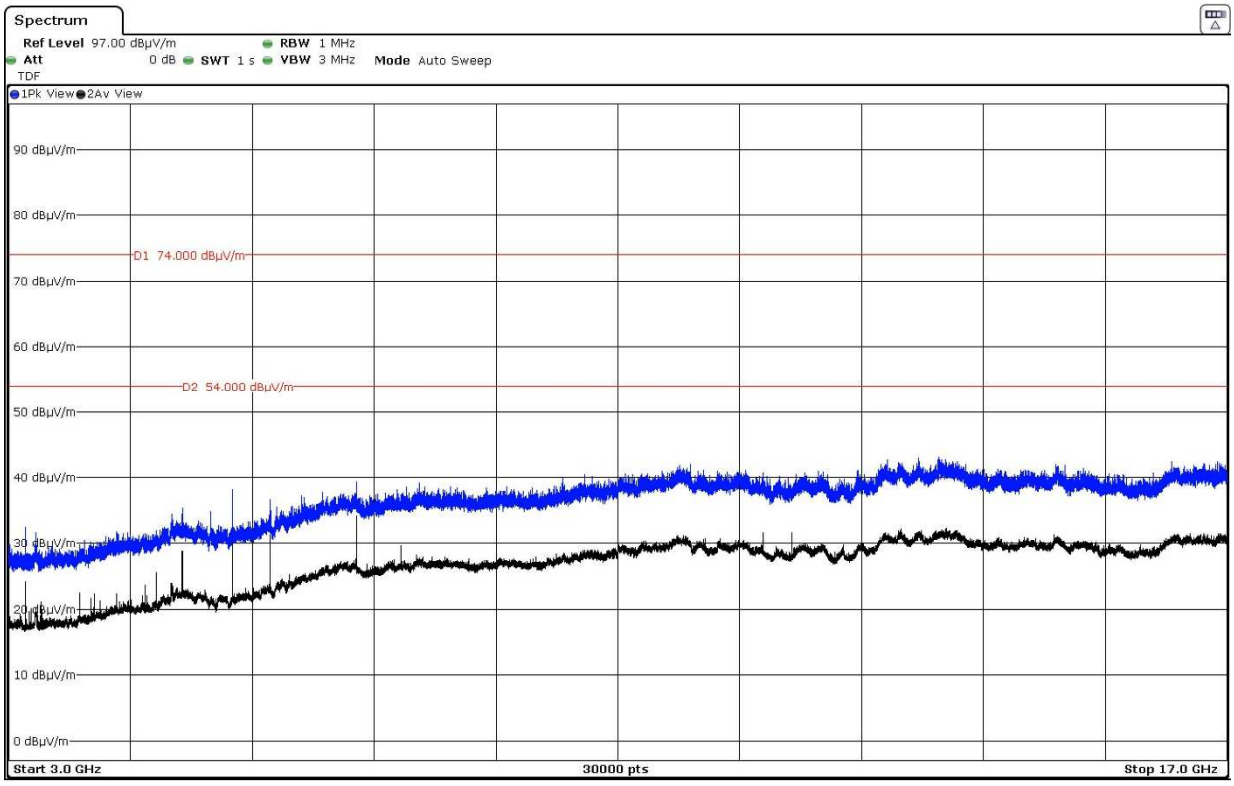


- **8-DPSK modulation (3DH5):**

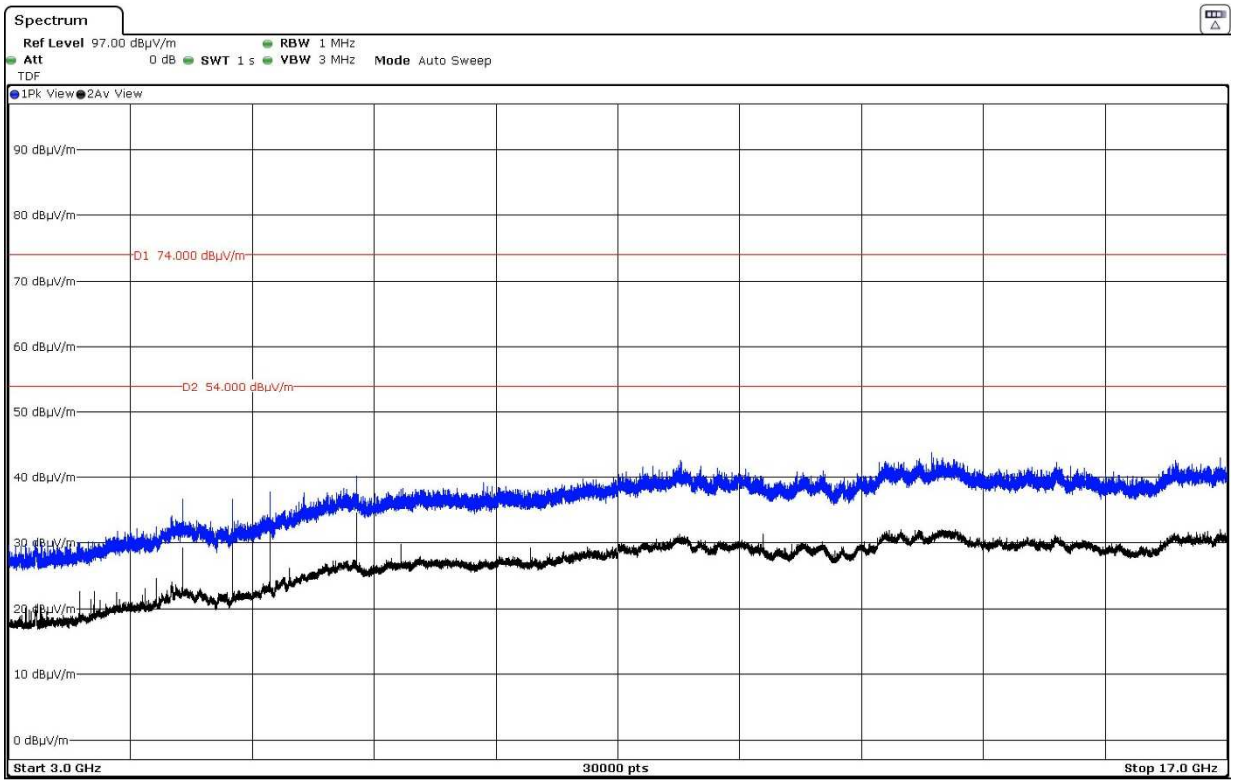
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):

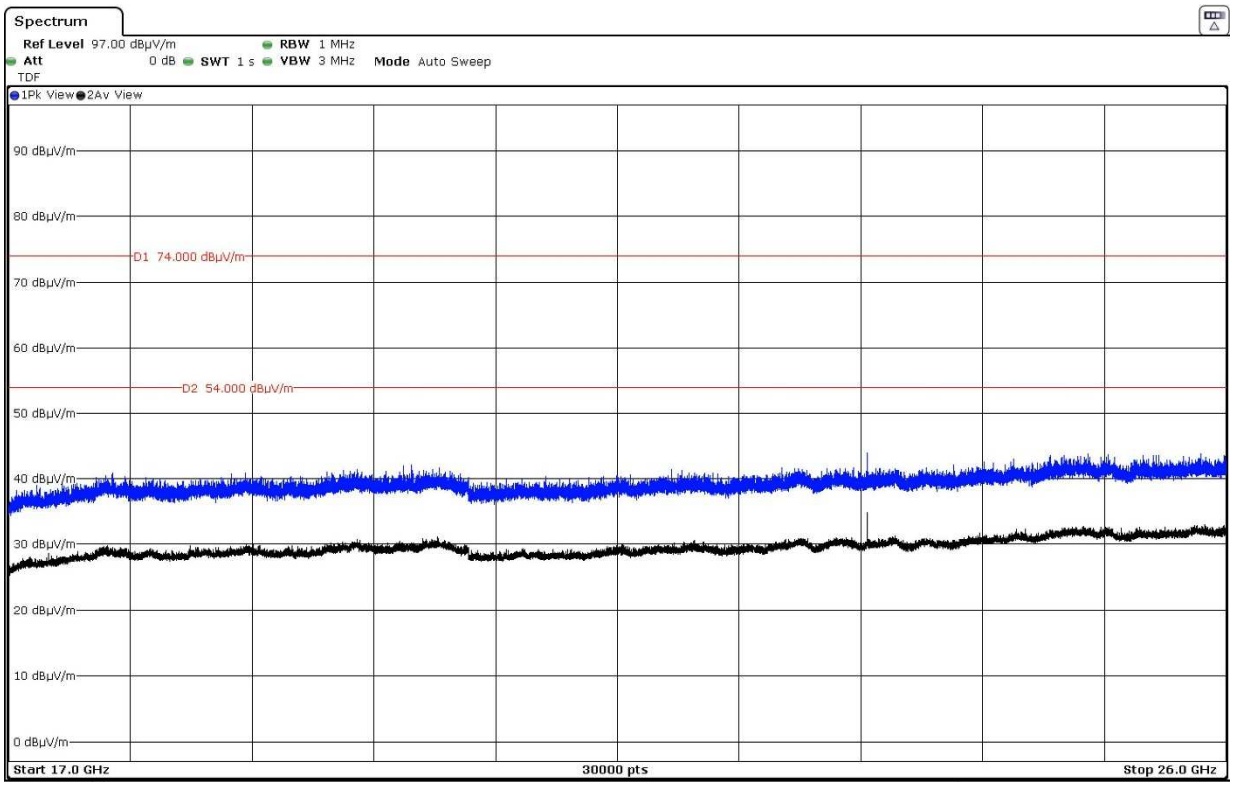


- High Channel (2480 MHz):



FREQUENCY RANGE 17 - 26 GHz:

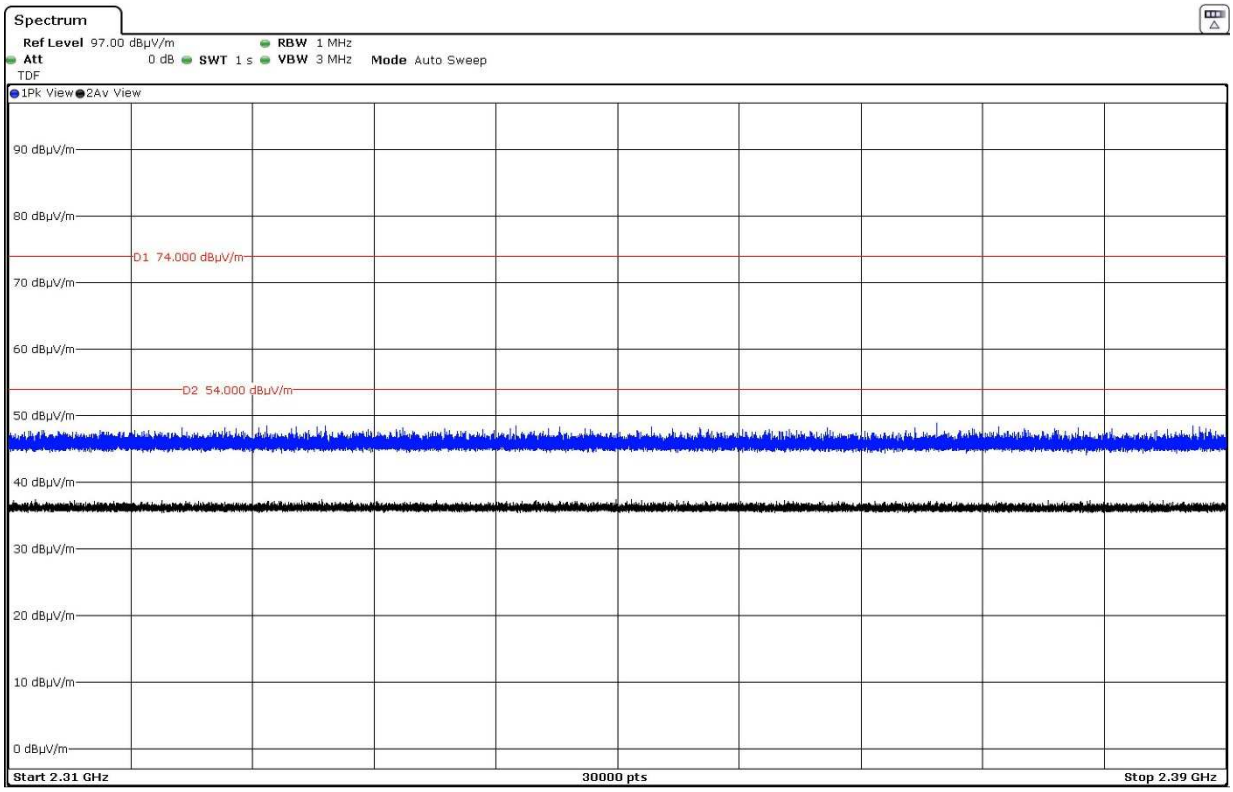
This plot is valid for the Low, Middle and High Channels and all the modulation modes.



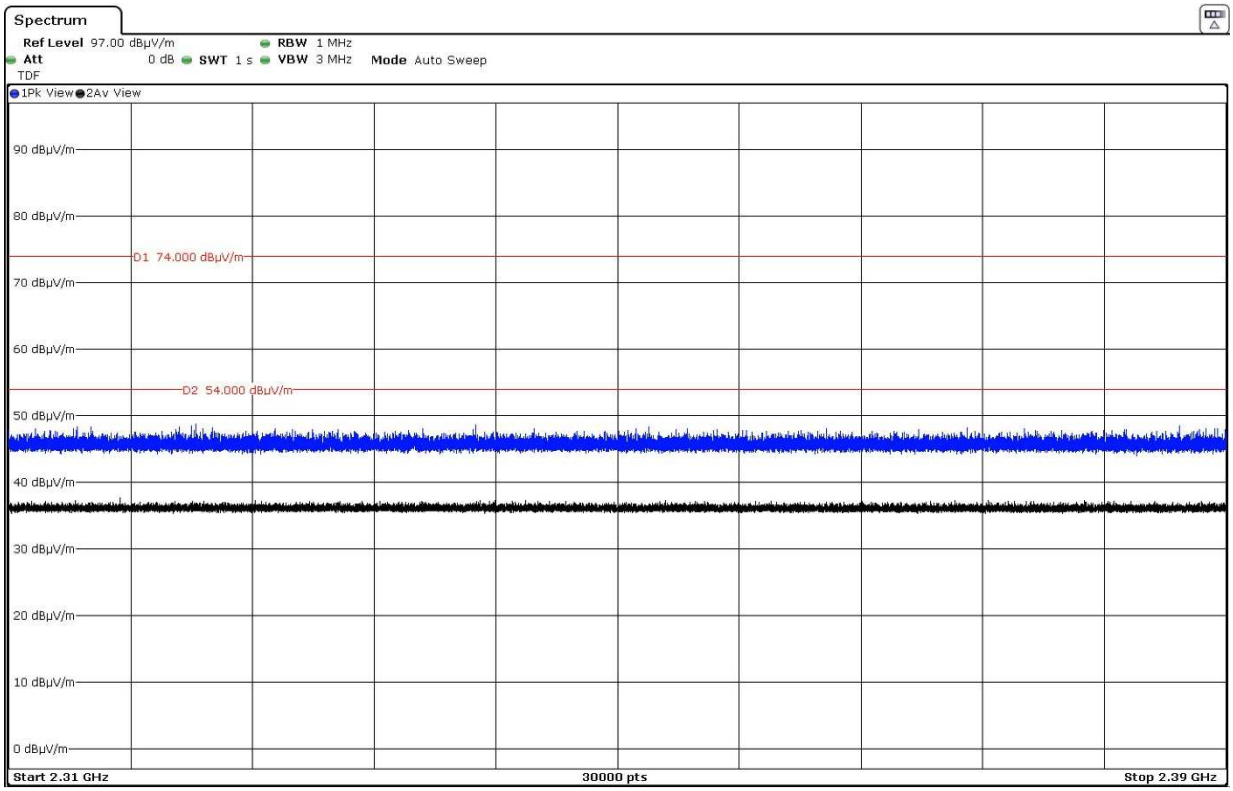
RESTRICTED BAND 2.31-2.39 GHz:

- **GFSK modulation (DH5):**

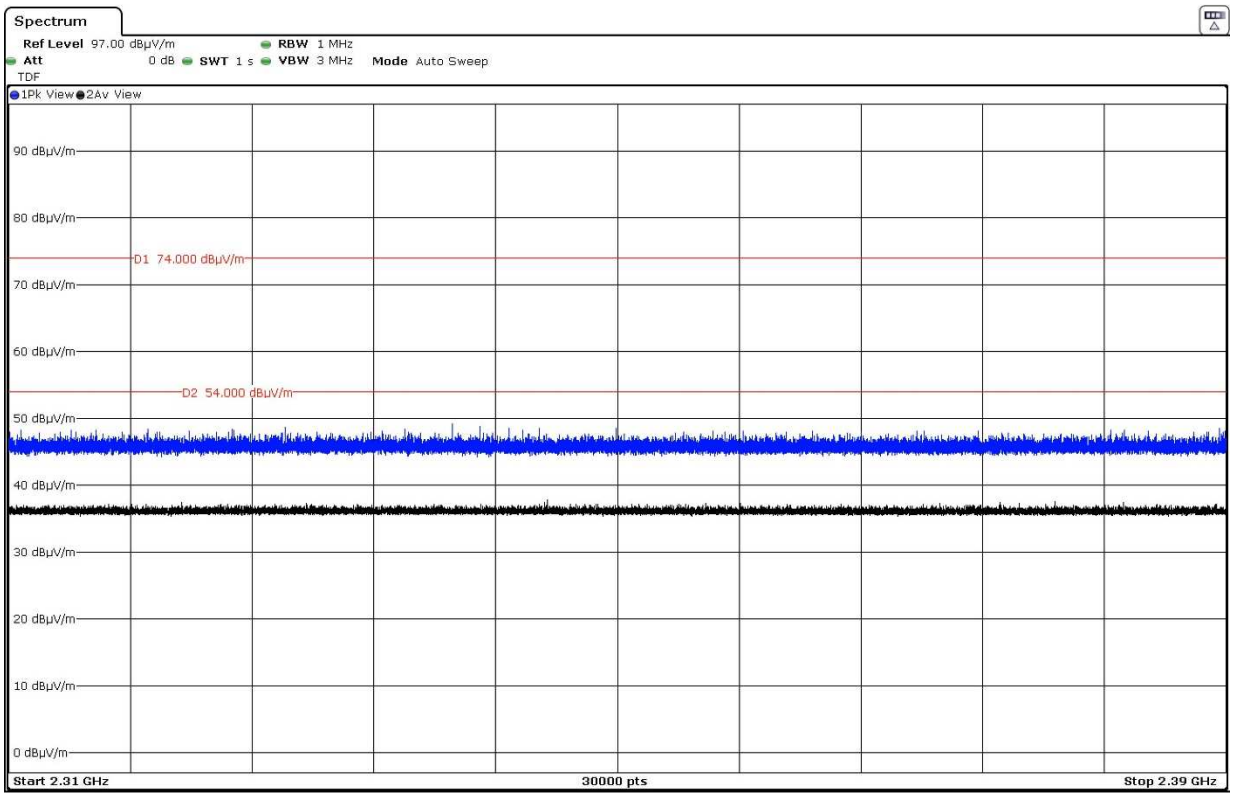
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):

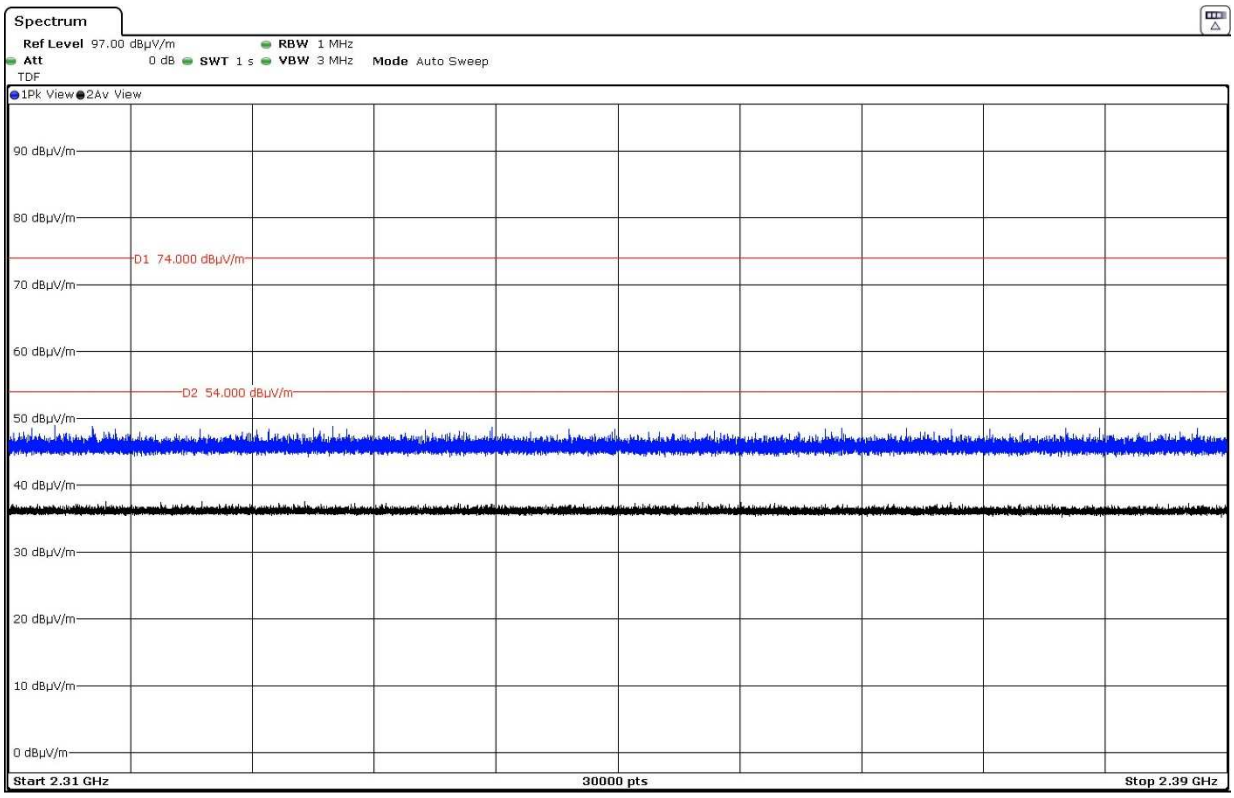


- High Channel (2480 MHz):

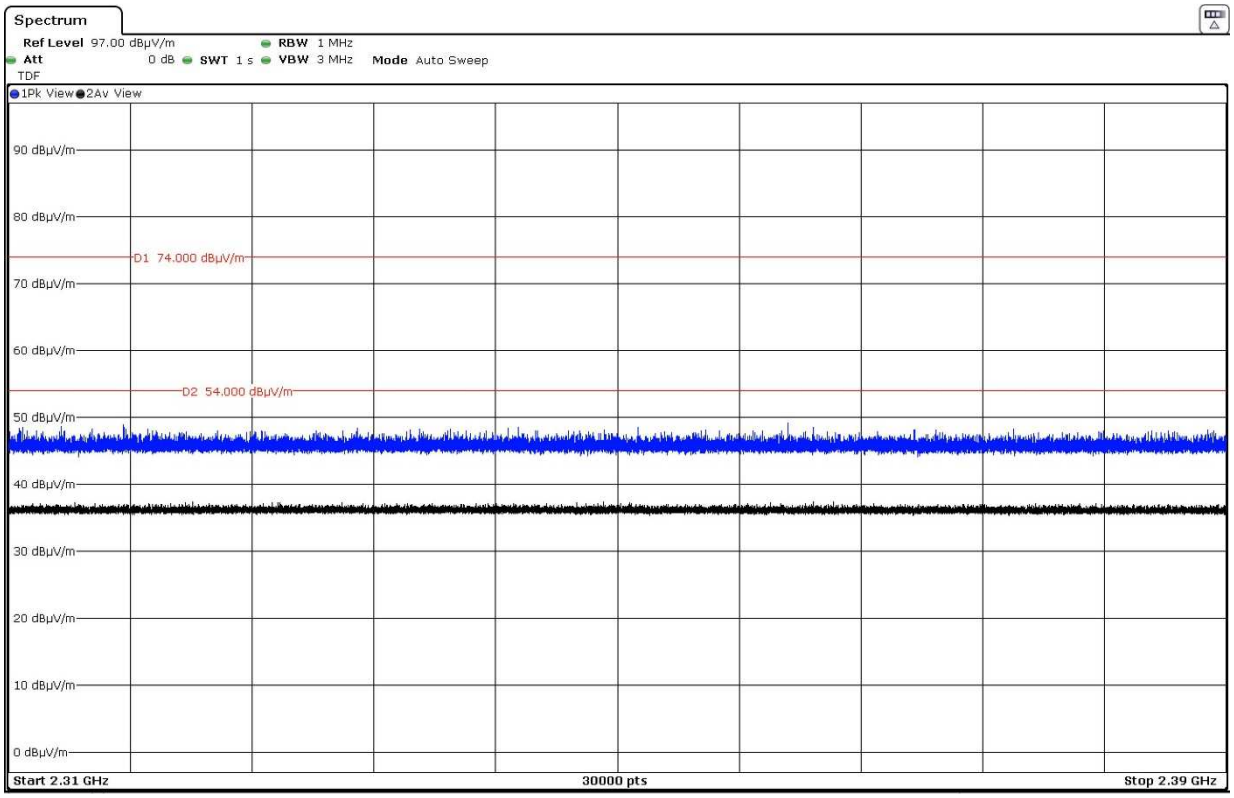


- **Pi/4-DQPSK modulation (2DH5):**

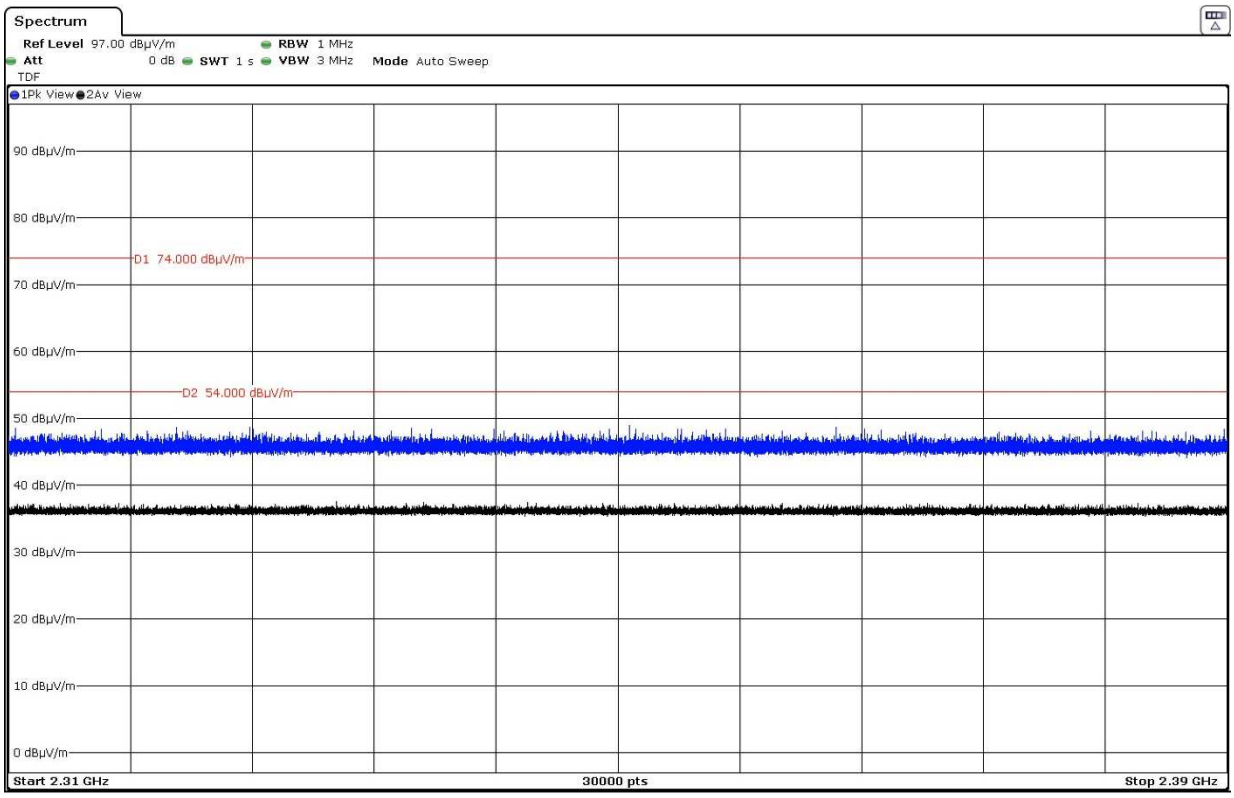
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):

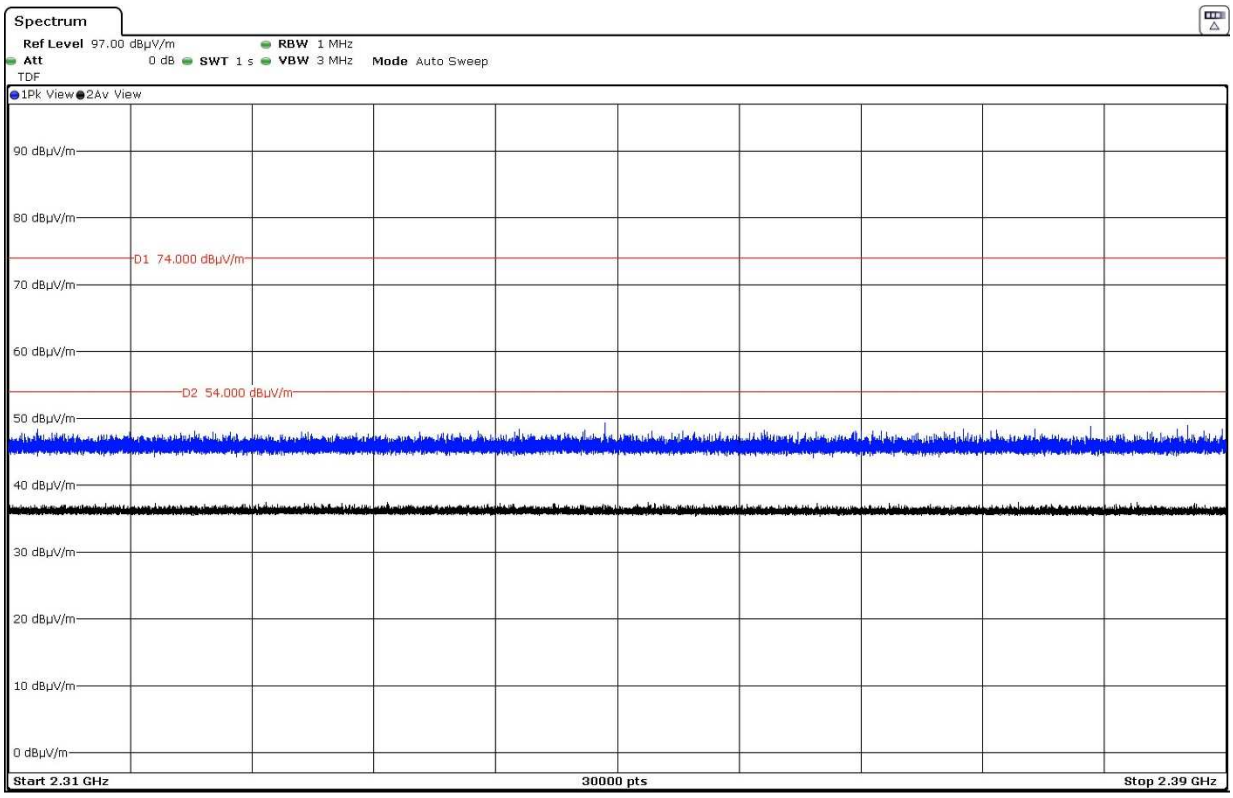


- High Channel (2480 MHz):

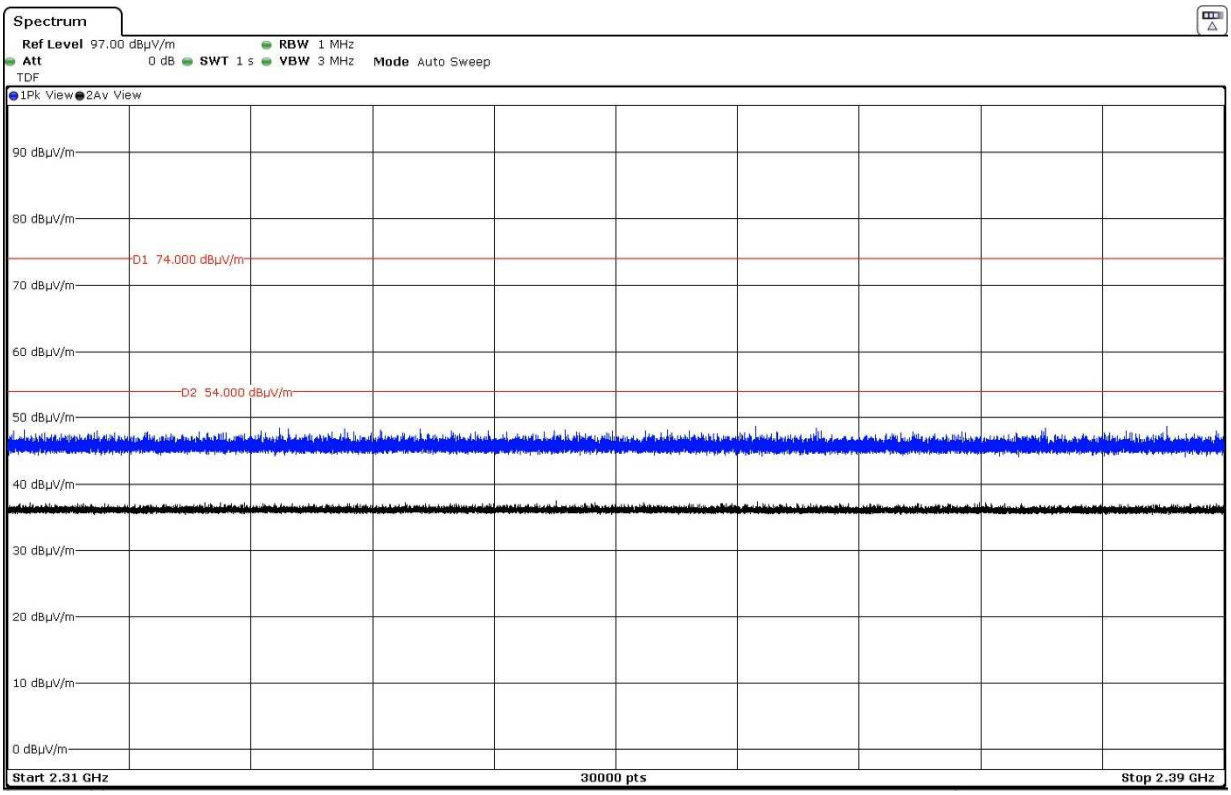


- **8-DPSK modulation (3DH5):**

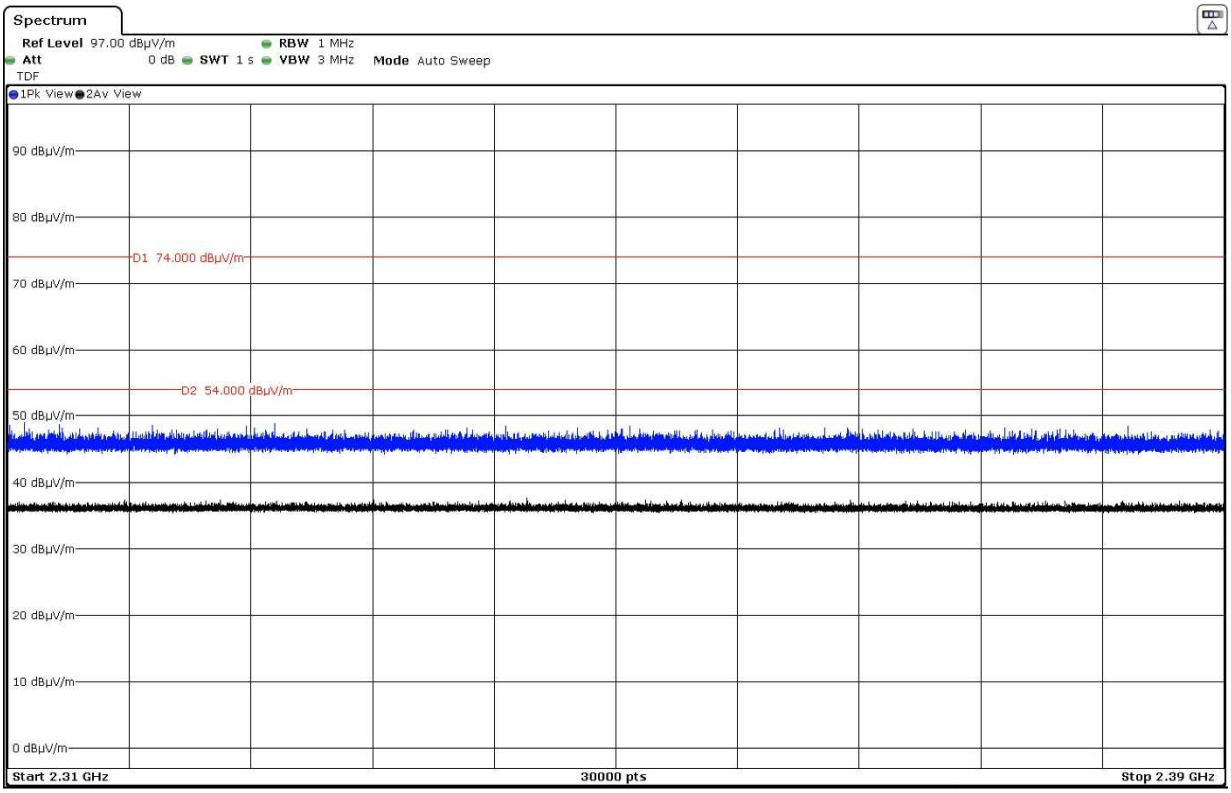
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):



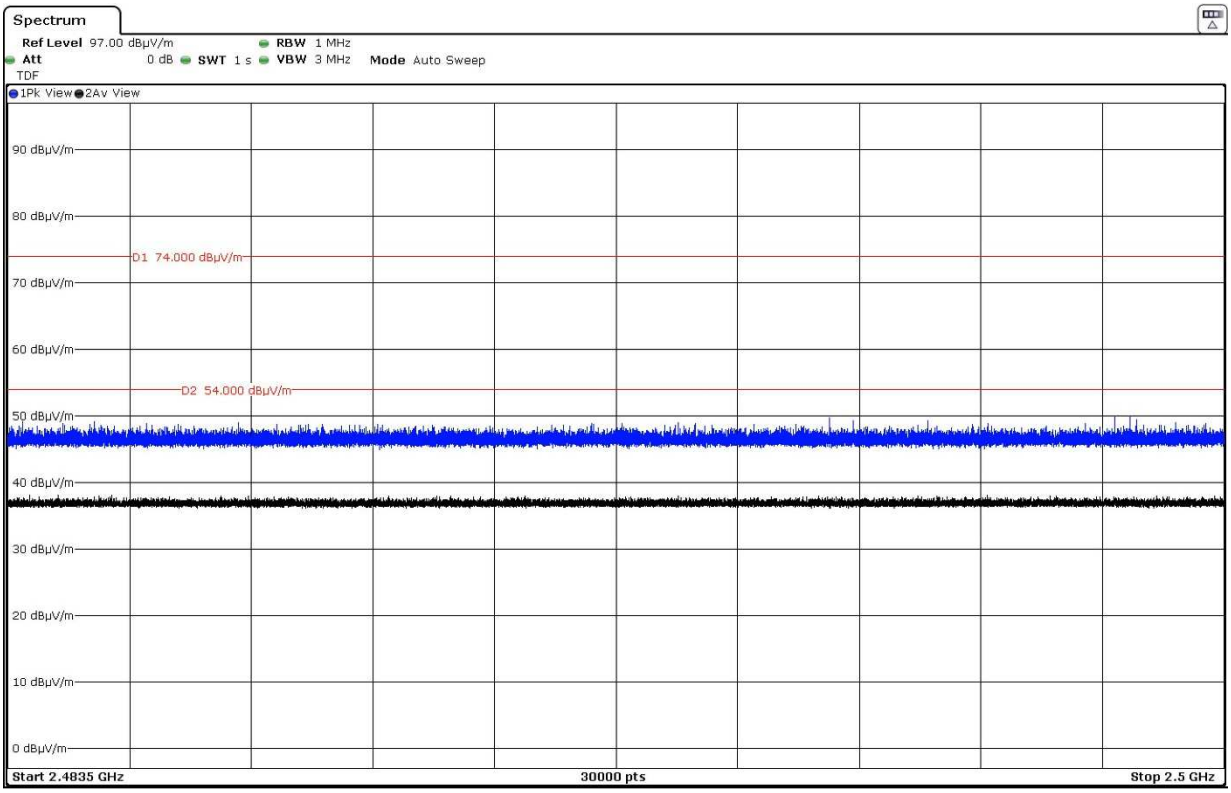
- High Channel (2480 MHz):



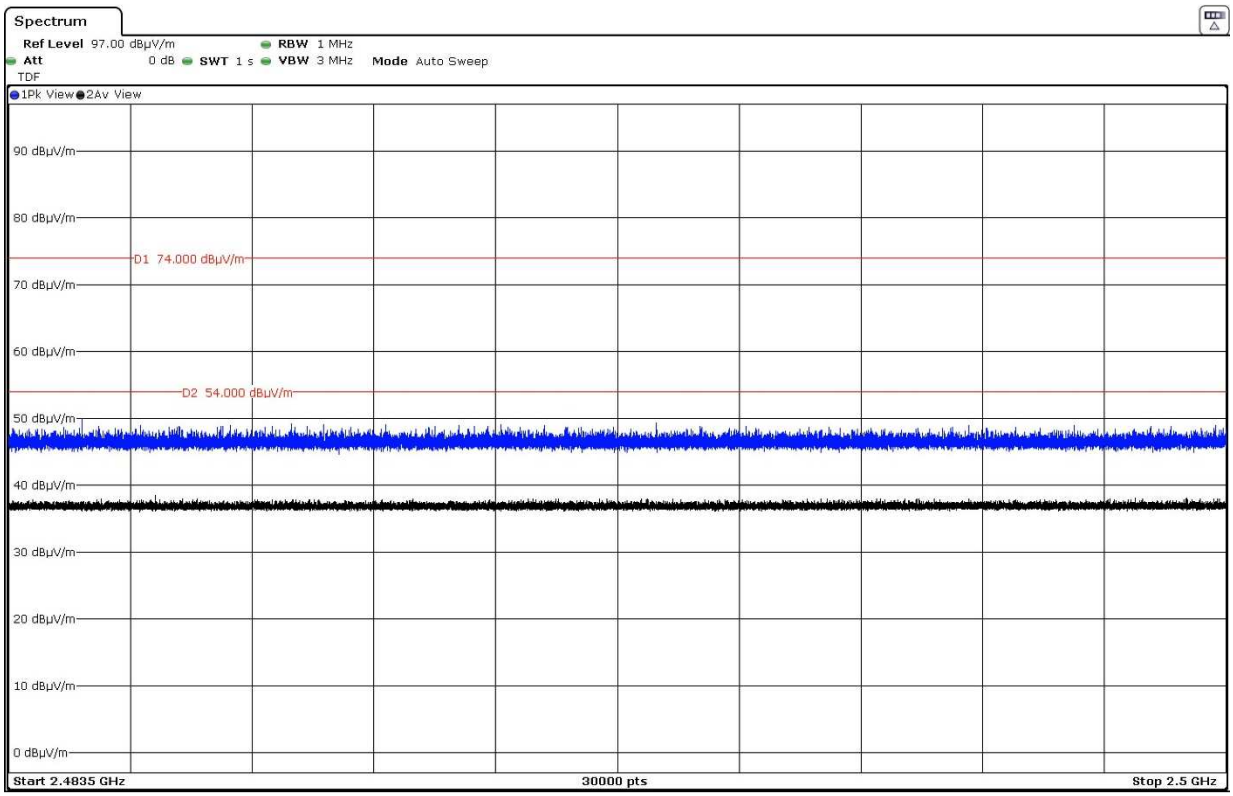
RESTRICTED BAND 2.4835-2.5 GHz:

- **GFSK modulation (DH5):**

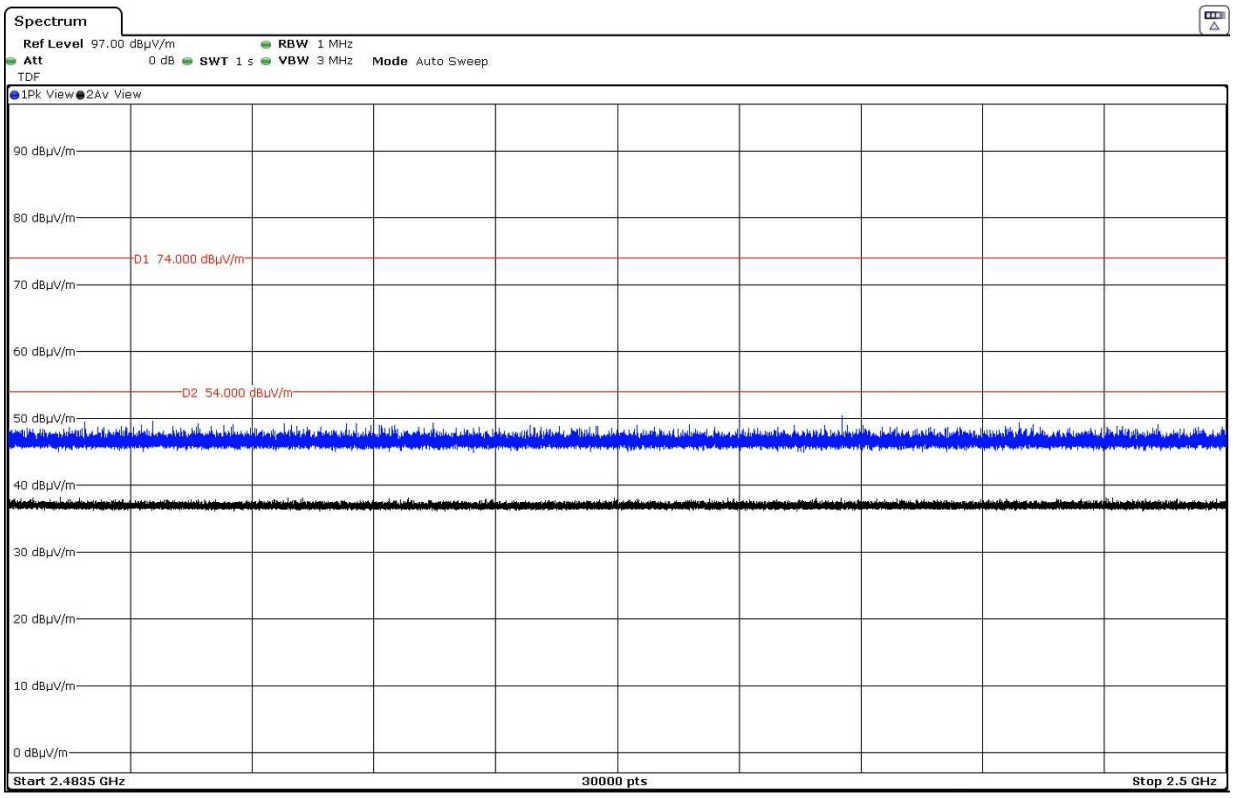
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):

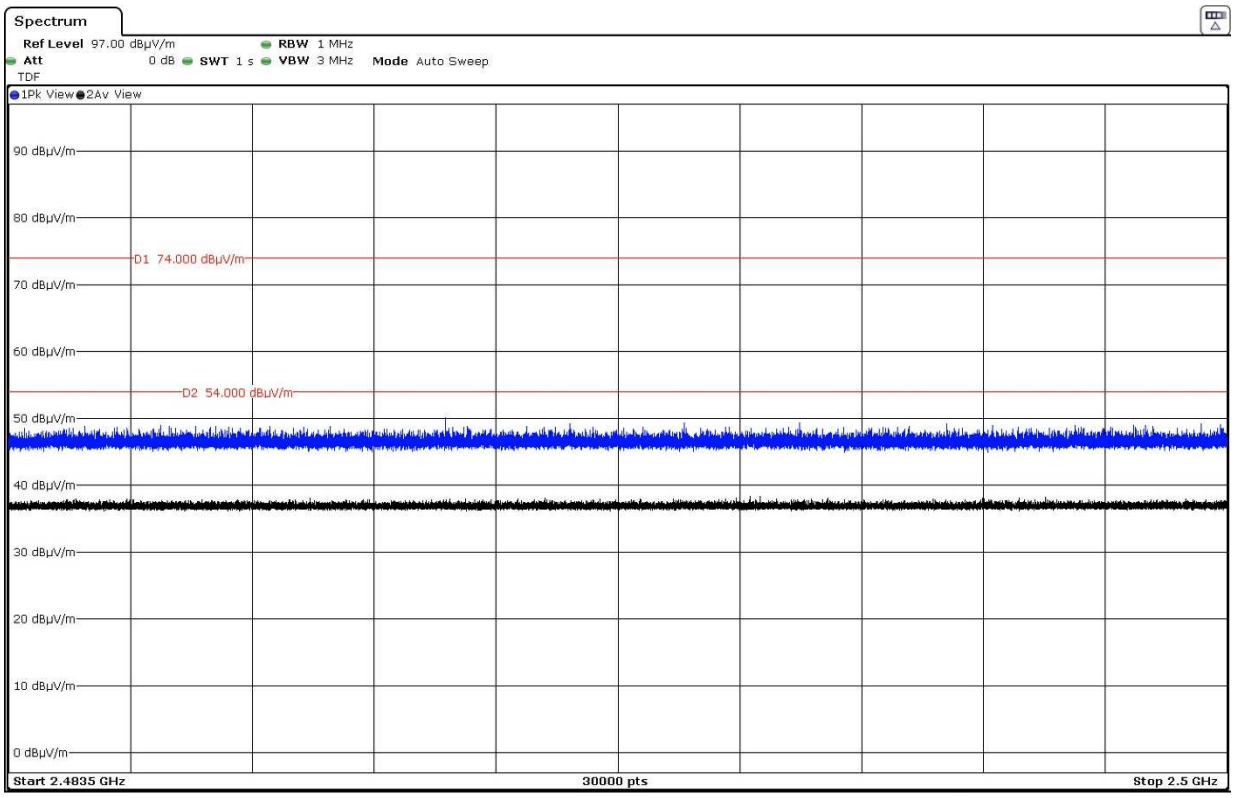


- High Channel (2480 MHz):

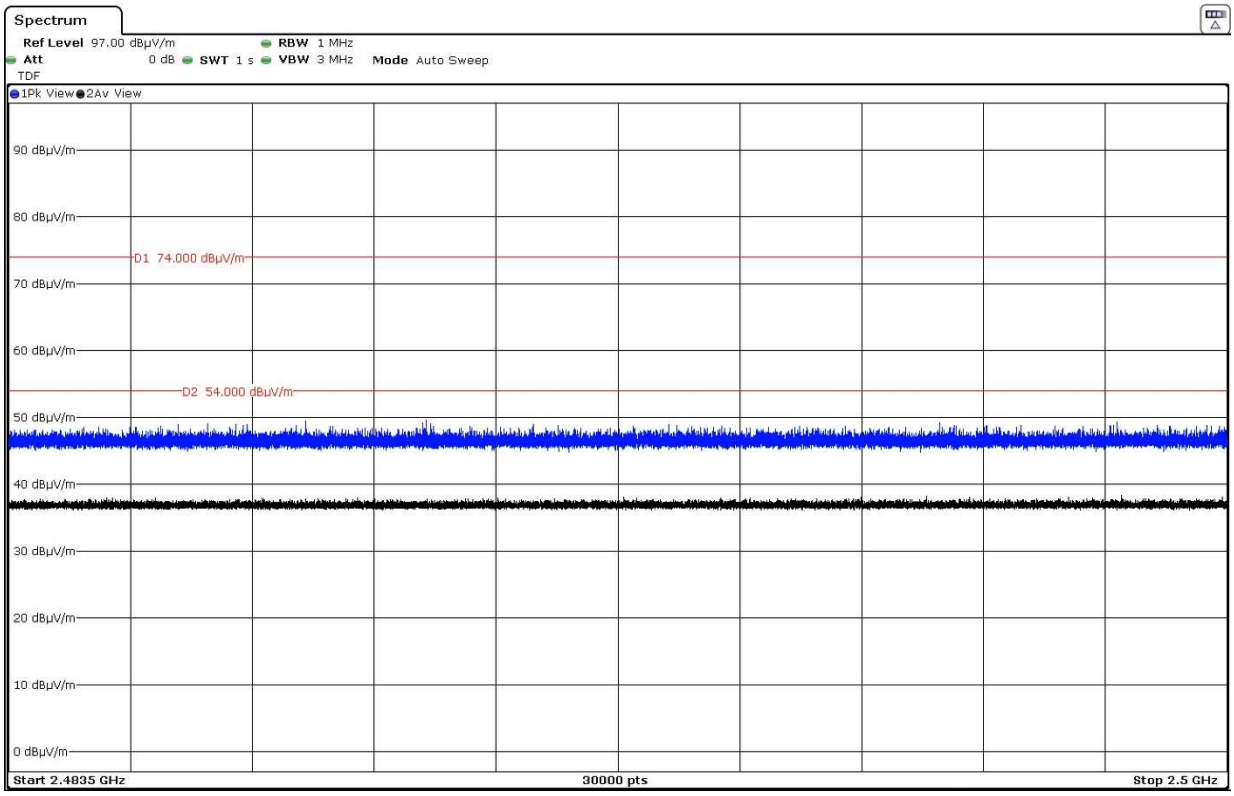


- **Pi/4-DQPSK modulation (2DH5):**

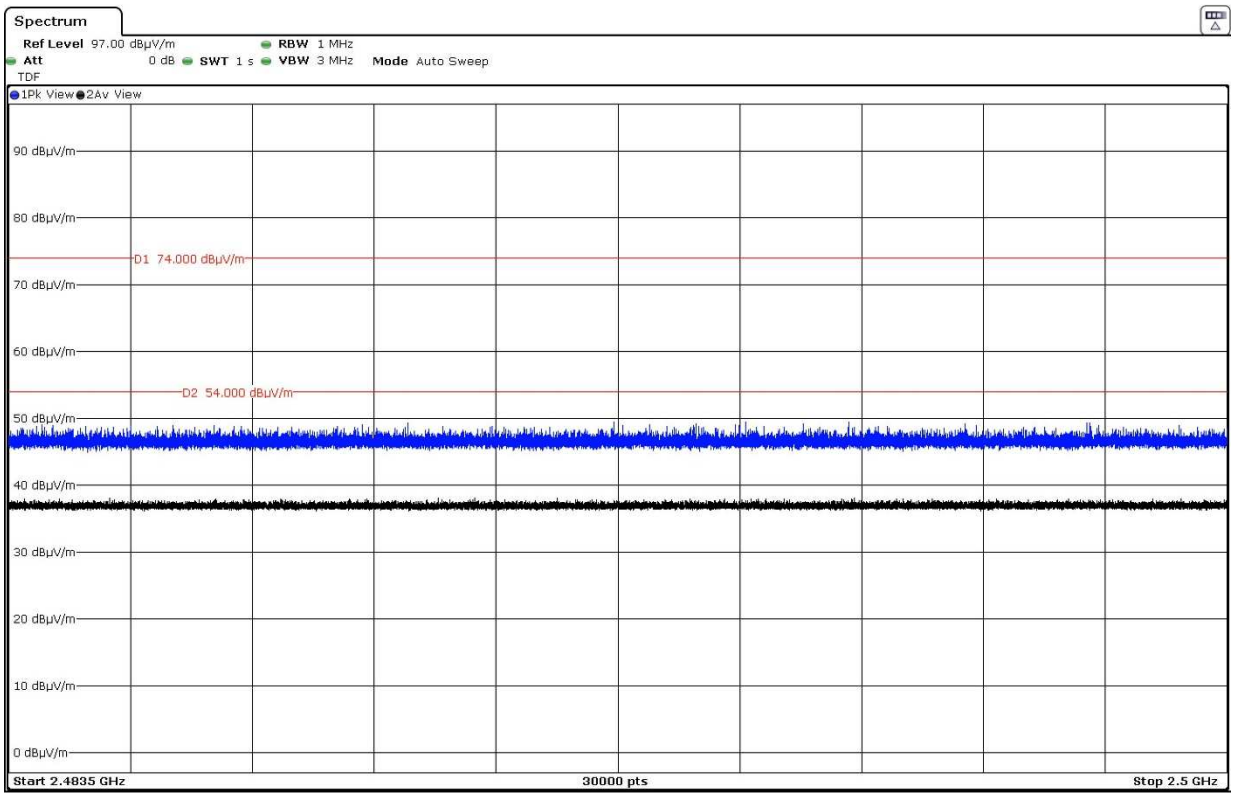
  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):

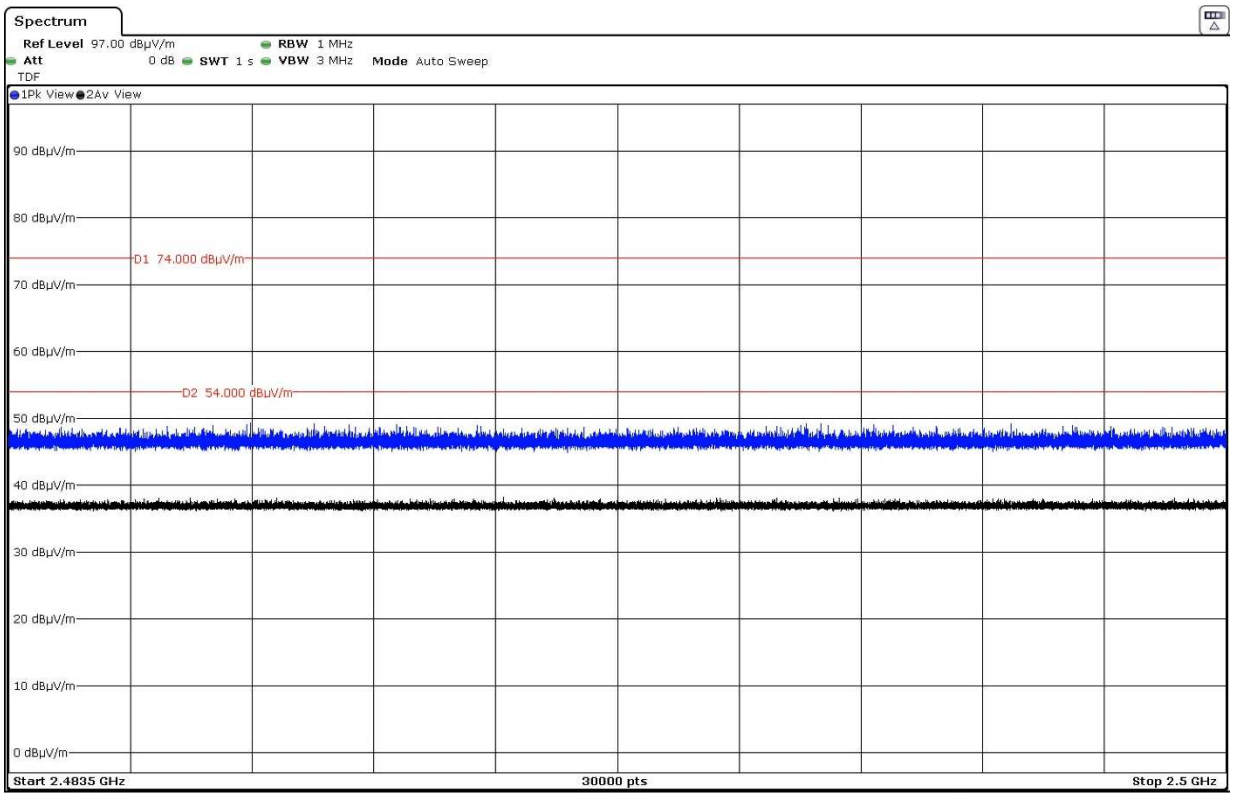


- High Channel (2480 MHz):

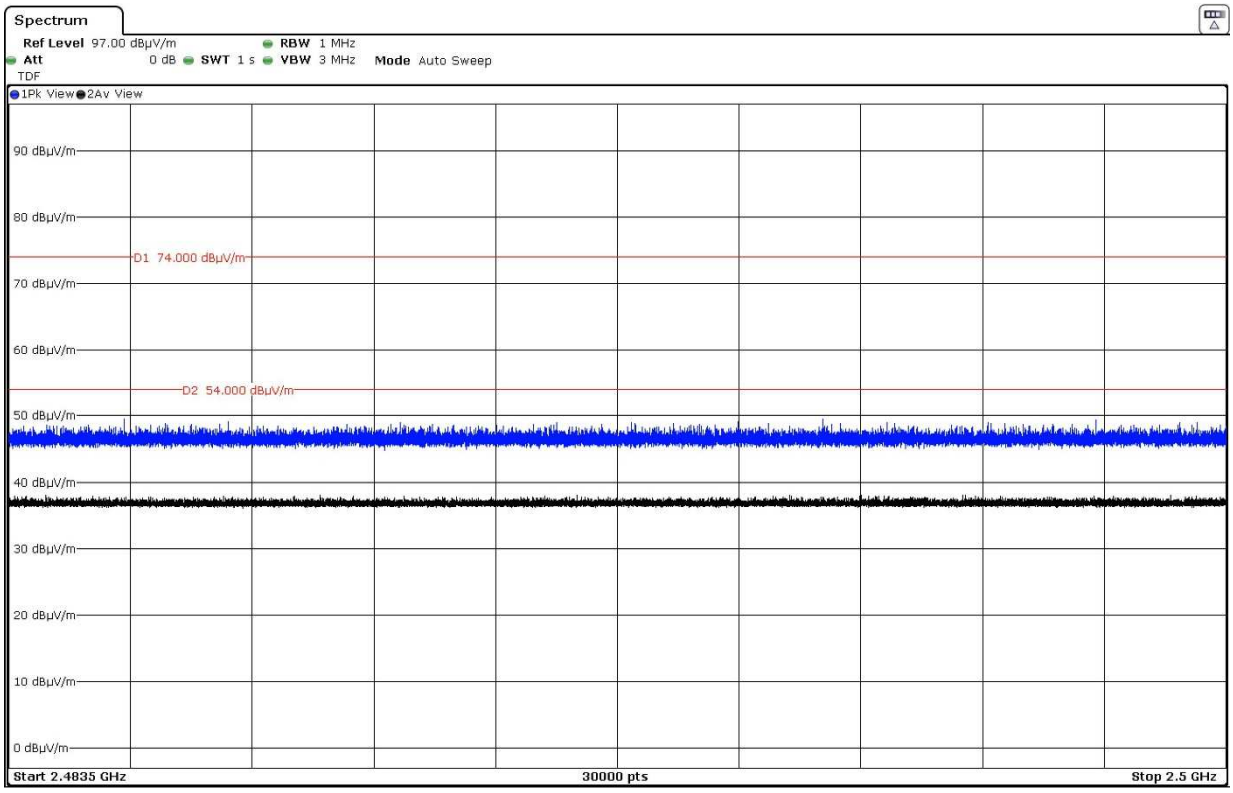
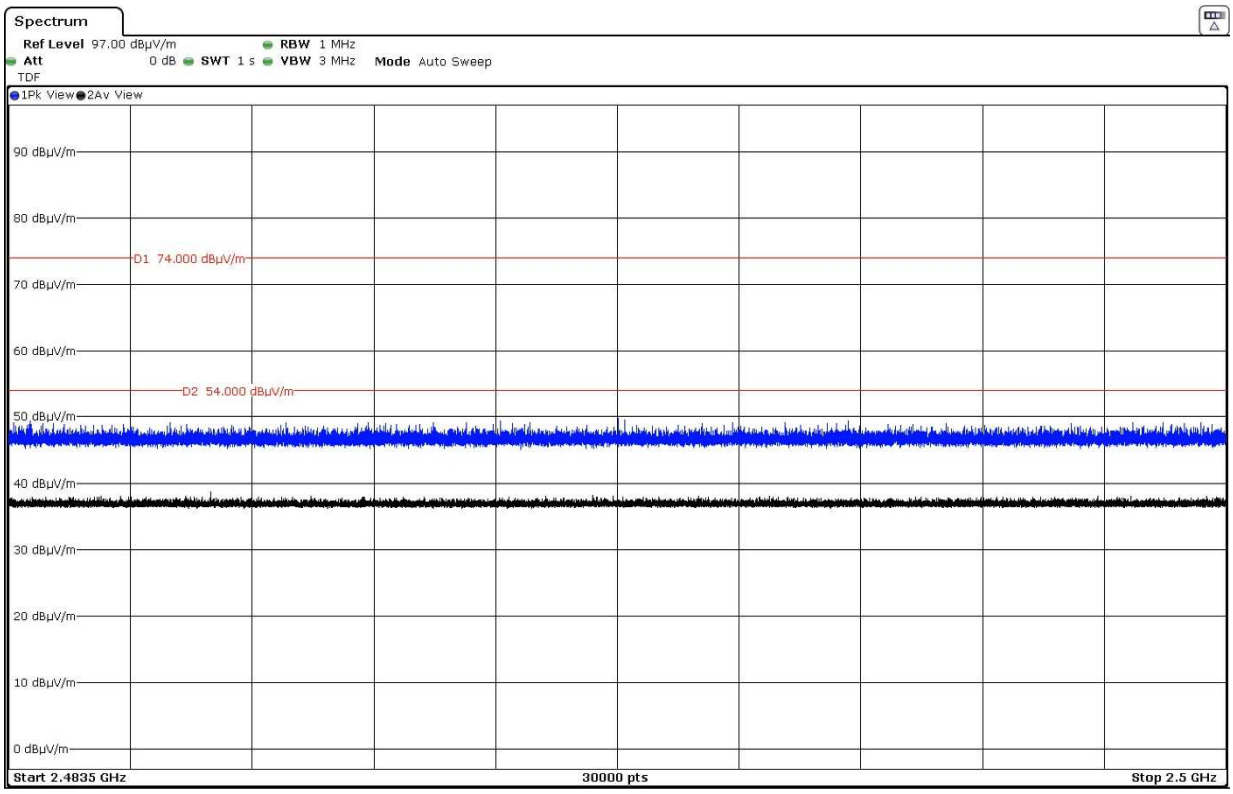


- **8-DPSK modulation (3DH5):**

  - Low Channel (2402 MHz):



  - Middle Channel (2441 MHz):



- High Channel (2480 MHz):