



Test report No:
NIE: 60268RRF.010

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 HIGH
Other identification of the product	HW version: D5 SW version: E17.100 FCC ID: T8GNTG7HIGH IC: 6434A-NTG7HIGH
(*) 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. - Emission limitations radiated (Transmitter). USA FCC Part 15.209 (10-1-19) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). - Emission limitations radiated (Transmitter). CANADA RSS-Gen Issue 5 (March 2019). 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)	J. Carlos Luque RF Lab. Supervisor
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 HIGH 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
60268/302	Automotive Infotainment System	NTG7 HIGH	HBM609LS000001	2020/02/26
60268/308	Cable RF Harness	--	--	2020/02/26
60268/122	Antennas	--	--	2019/09/30

Sample S/01 has undergone the following test(s): All RADIATED 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⁾
	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		Reference poles		
			L1	L2	L3
	☒	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	
	-		

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)	2020-03-10
Date (finish)	2020-03-25

Document history

Report number	Date	Description
60268RRF.010	2020-05-25	First release

Environmental conditions

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

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

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

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. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
4. RF Pre-amplifier, G>40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2020/02	2021/02
5. Hybrid Bilog Antenna 30 MHz – 6 GHz ETS LINDGREN 3142E	2017/09	2020/09
6. Signal and Spectrum Analyzer 10 Hz-40 GHz ROHDE AND SCHWARZ FSV40	2019/10	2021/10
7. RF Pre-amplifier, G>30 dB, 1-18 GHz BONN ELEKTRONIK BLMA 0118-3A	2019/11	2020/11
8. RF Pre-amplifier, G>30dB, 18-40GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
9. Broadband Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
10. Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
11. DC Power Supply Keysight Technologies U8002A	N.A.	N.A.
12. Digital multimeter FLUKE 175	2019/10	2020/10

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	N/M	(1)
Section 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (d)	Number of hopping channels	N/M	(1)
Section 15.247 Subclause (a)(1)(iii) / RSS-247 Clause 5.1 (d)	Time of occupancy (Dwell Time)	N/M	(1)
Section 15.247 Subclause (b) / RSS-247 5.4. (b)	Maximum peak output power and antenna gain	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
(1) Test not requested.			

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

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	N/M	(1)
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	(1)
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
(1) Test not requested.			

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

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	12 Vdc.
Type of Power Supply:	External power supply (Car Battery).
Type of Antenna:	External antenna.
Maximum Declared Antenna Gain:	+1.8 dBi (Antenna gain plus antenna cable loss).

TEST FREQUENCIES:

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

RADIATED MEASUREMENTS:

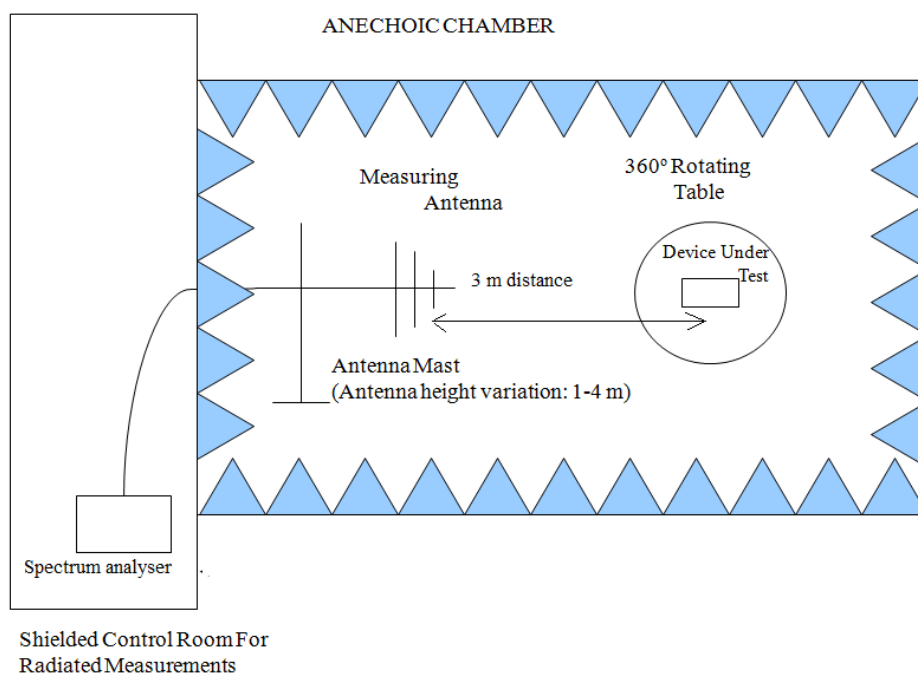
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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.

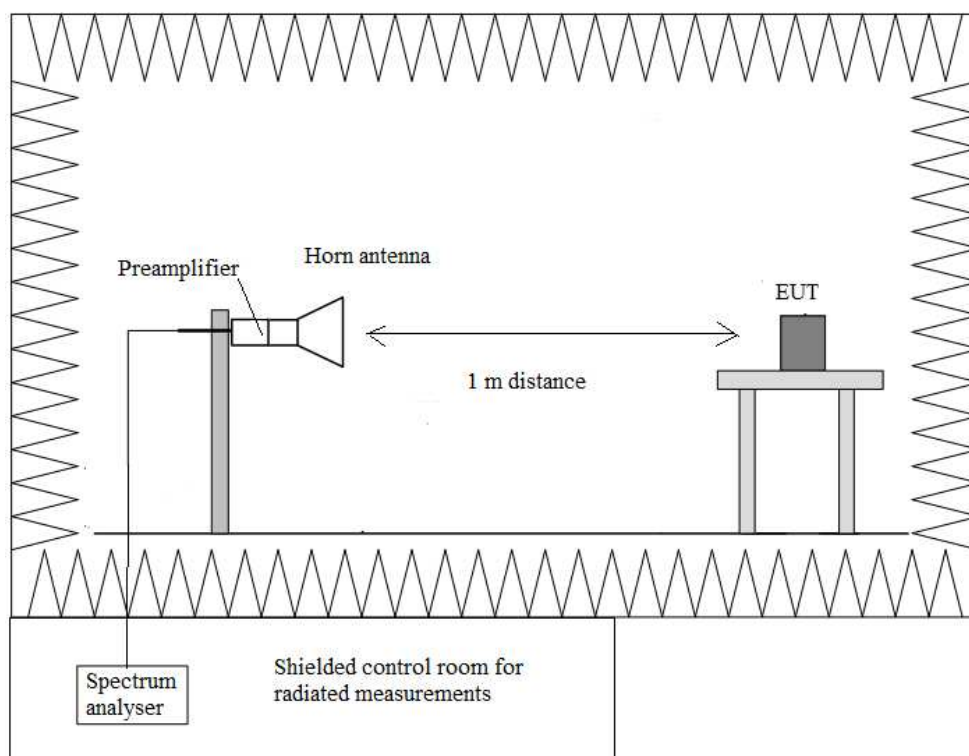
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup $f > 1$ GHz:



FCC Section 15.247 Subclause (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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

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

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

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

RESULTS:

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

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

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

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

Frequency range 30 MHz - 1 GHz:

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

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

Spurious frequency (MHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
46.733	Quasi peak	39.2	V	<± 3.81
125.012	Quasi peak	34.8	V	<± 3.81
238.275	Quasi peak	32.8	V	<± 3.81
250.012	Quasi peak	29.3	H	<± 3.81
375.013	Quasi peak	31.3	H	<± 3.81
716.615	Quasi peak	28.5	H	<± 3.81
958.856	Quasi peak	29.2	H	<± 3.81

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)
6.9995	Peak	39.53	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)
6.9995	Peak	40.19	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)
7.0000	Peak	40.65	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 (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
6.9995	Peak	39.54	V	< $\pm$ 4.72

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

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
7.0000	Peak	40.27	V	< $\pm$ 4.72

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

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
6.9995	Peak	40.01	V	< $\pm$ 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)
6.9995	Peak	40.30	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)
6.9995	Peak	40.21	V	<± 4.72

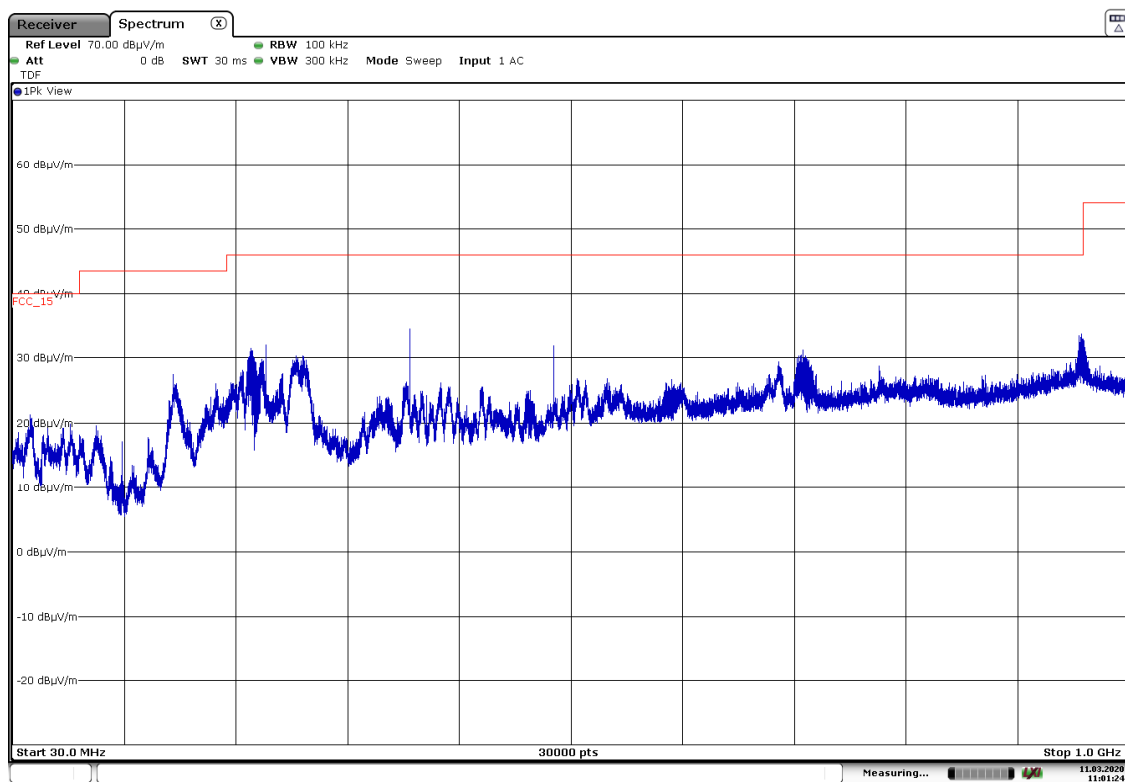
- HIGH CHANNEL (2480 MHz). Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
6.9995	Peak	40.16	V	<± 4.72

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

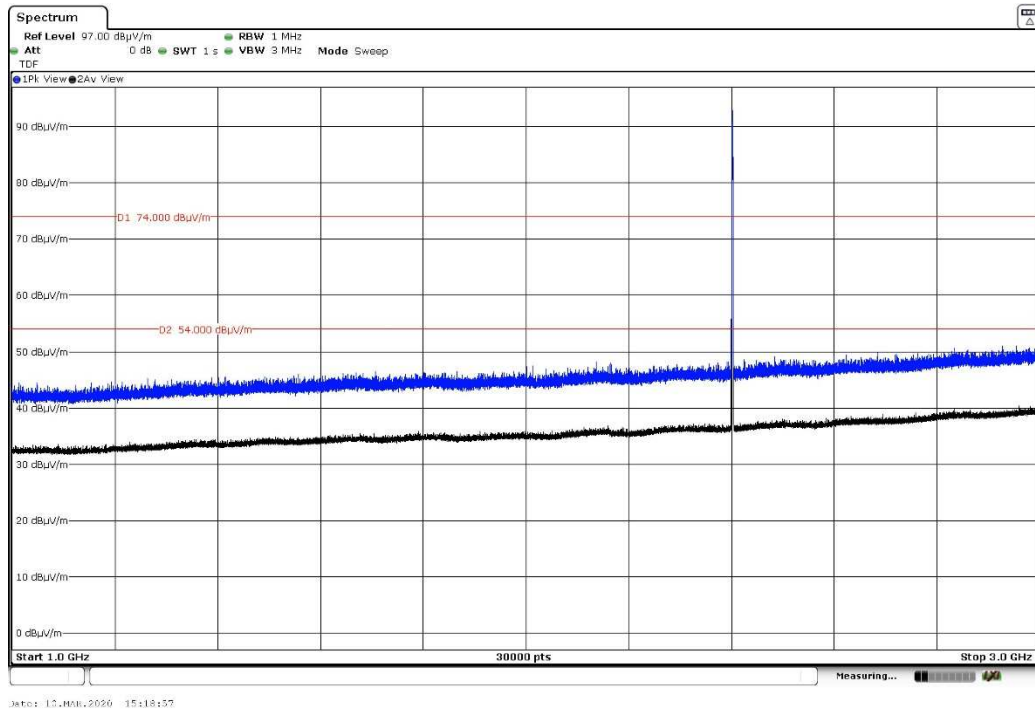
This plot is valid for the Low, Middle and High Channels and all the modulation modes.



FREQUENCY RANGE 1 - 3 GHz:

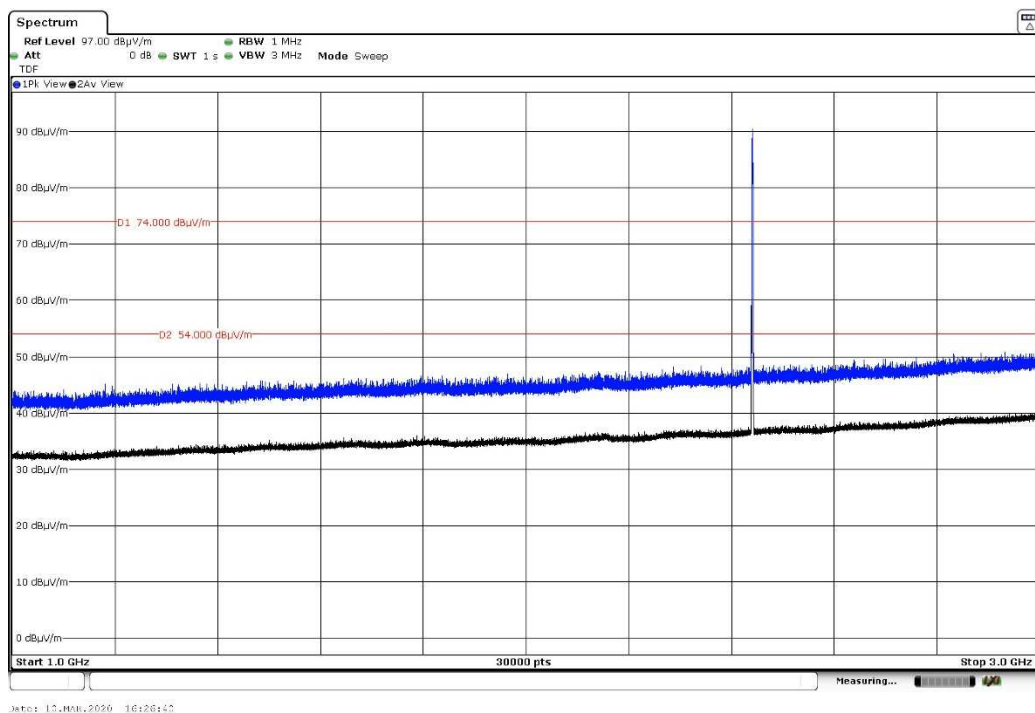
- **GFSK modulation (DH5)**

- Low Channel (2402 MHz):



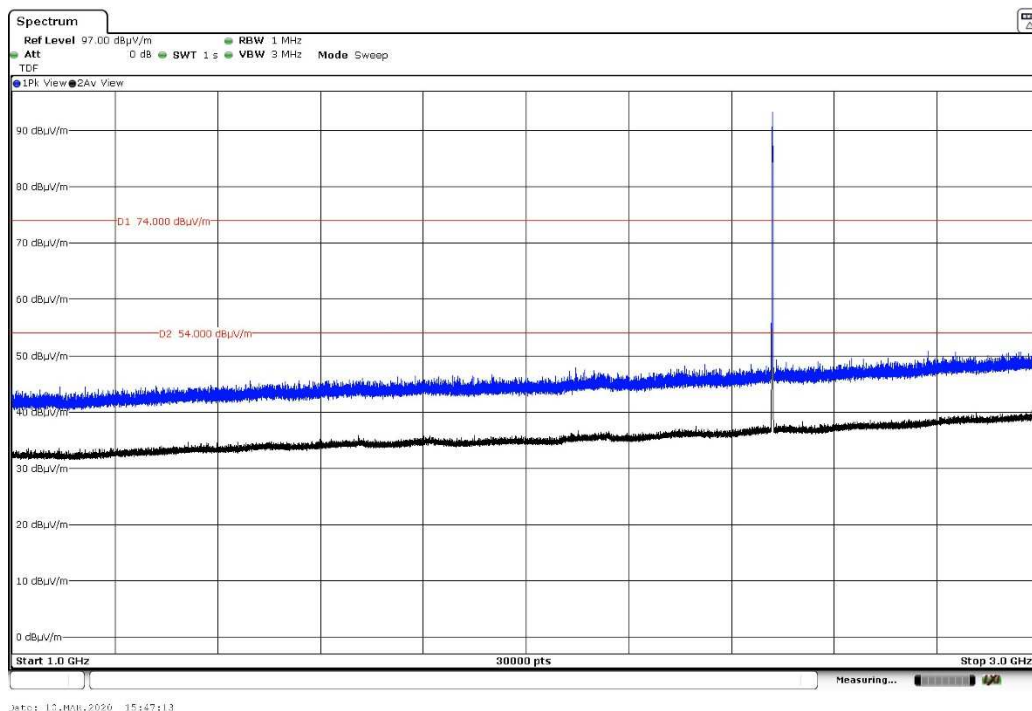
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

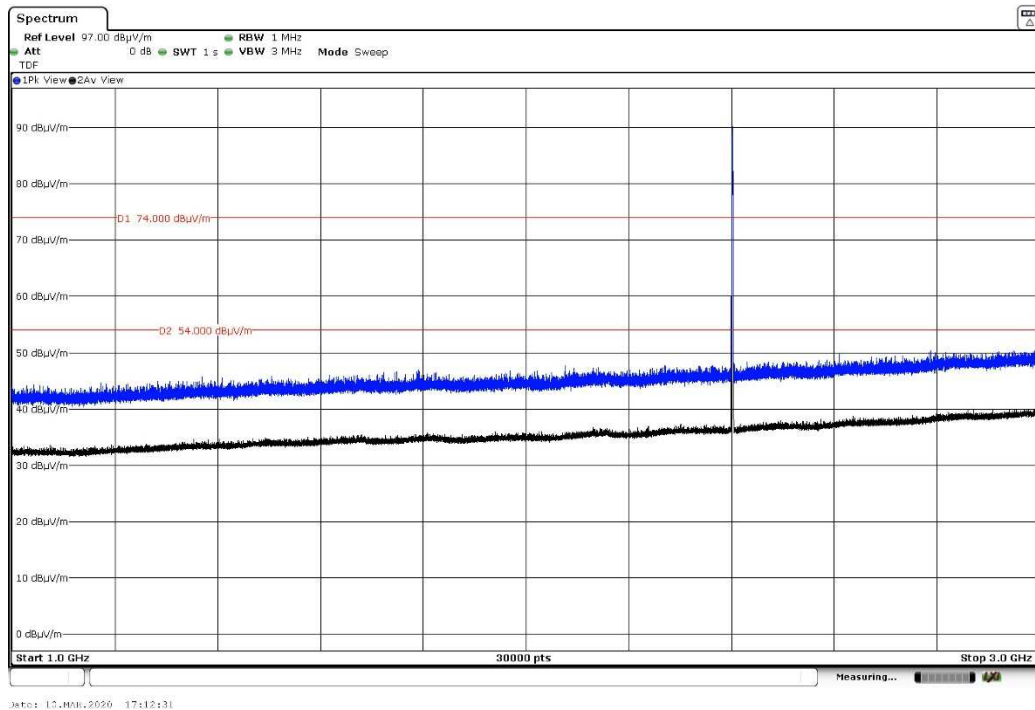
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

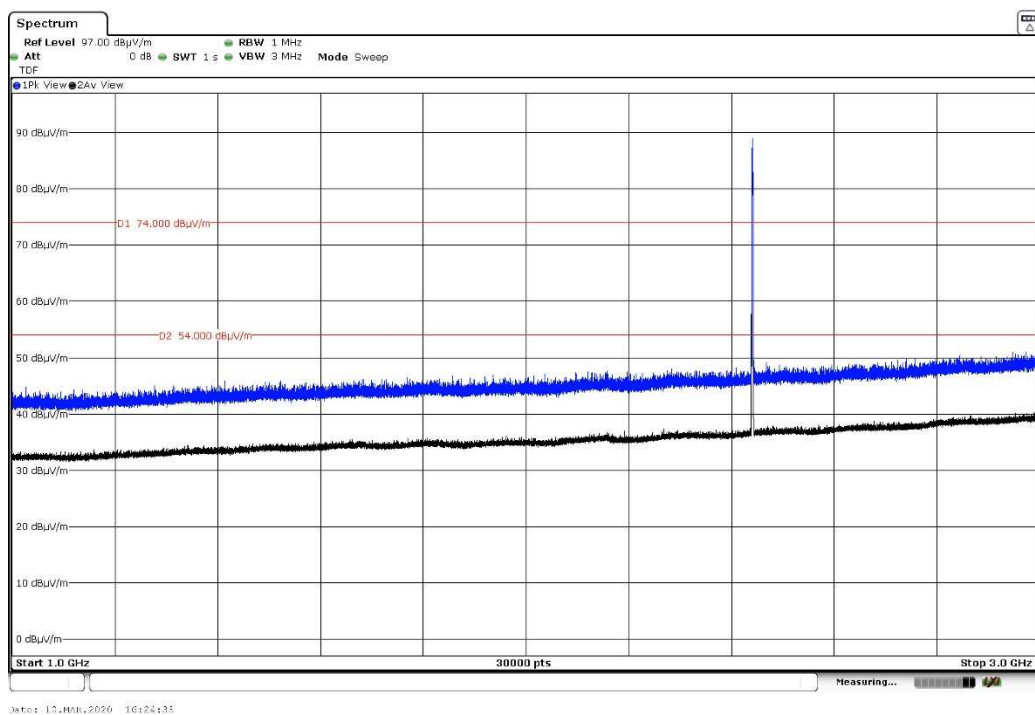
- **Pi/4-DQPSK modulation (2DH5)**

- Low Channel (2402 MHz):



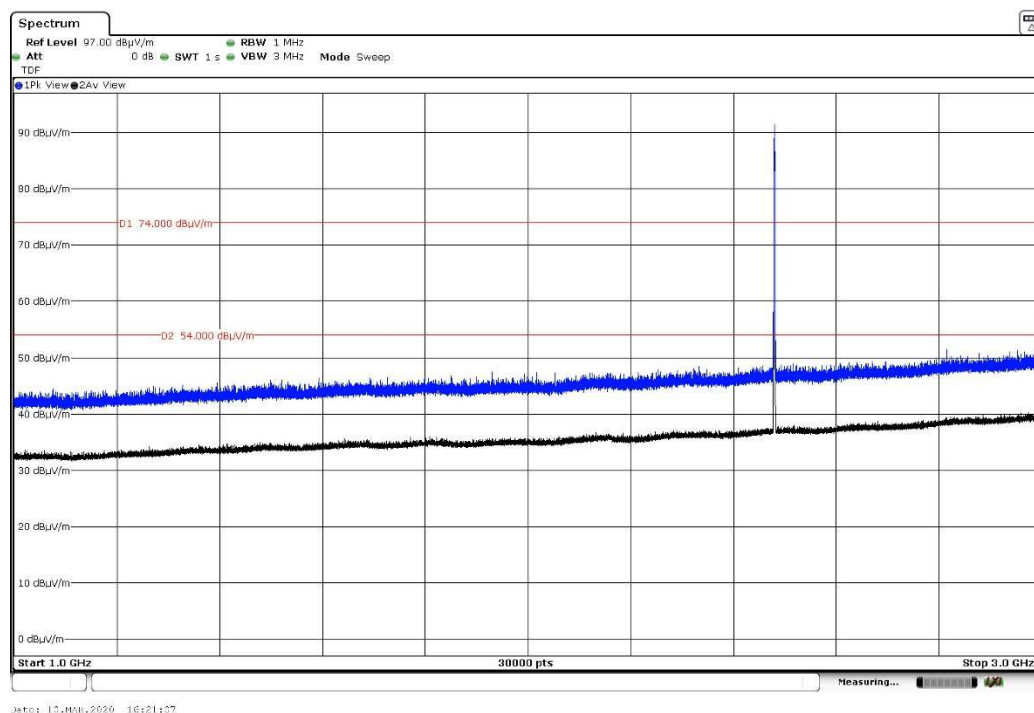
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

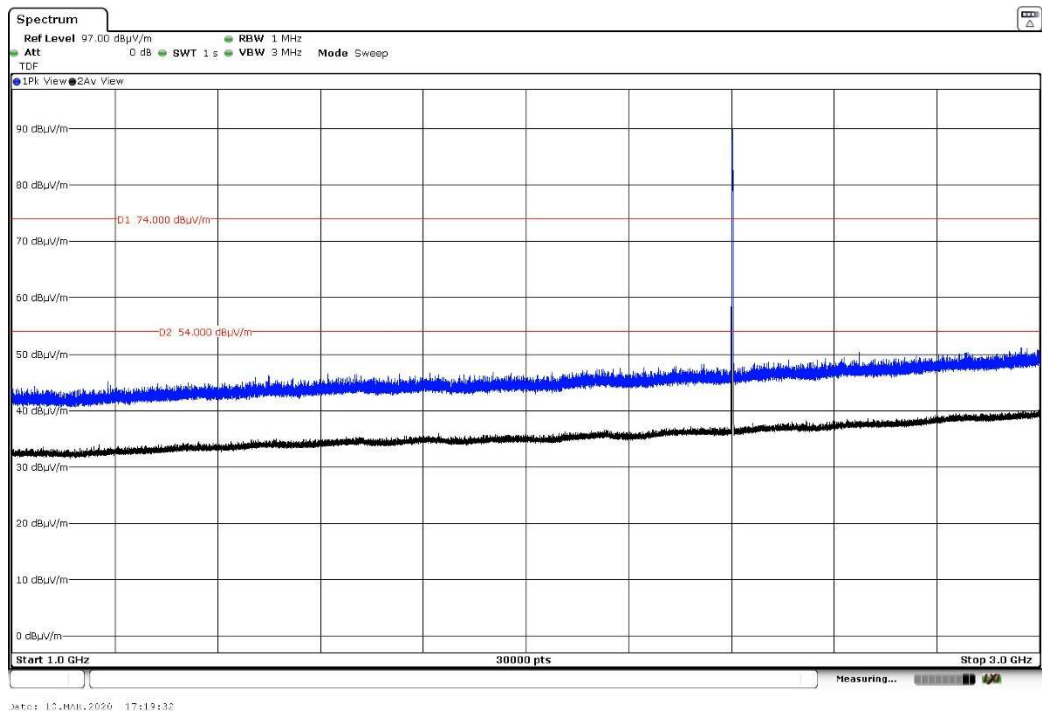
- High Channel (2480 MHz):



The peak above the limit is the carrier frequency.

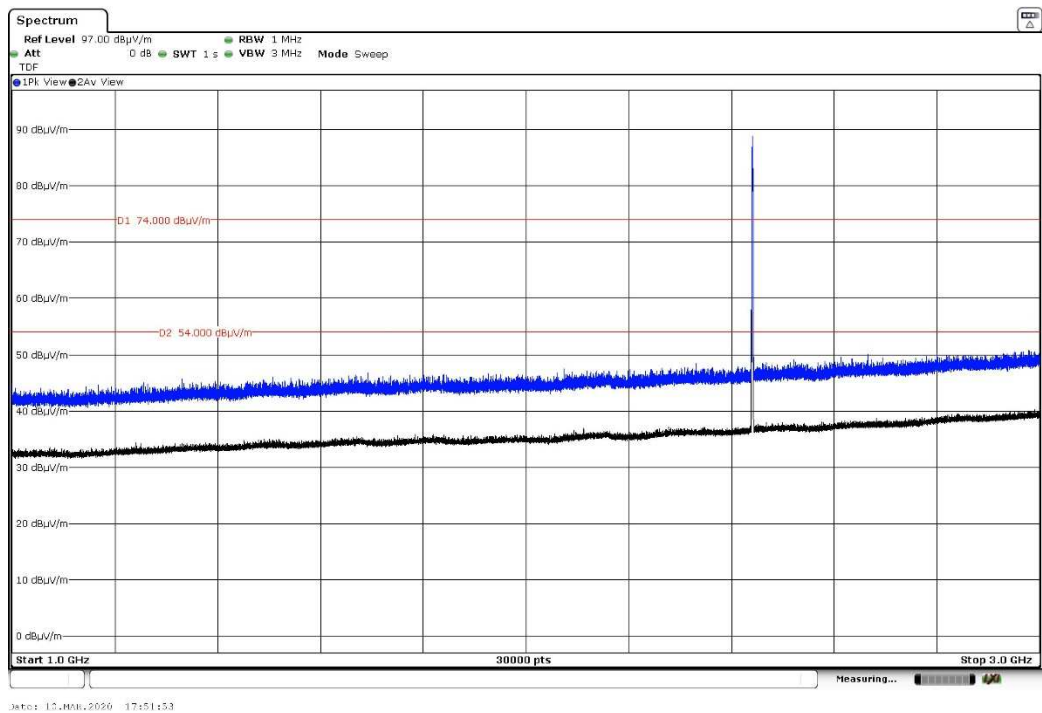
• 8-DPSK modulation (3DH5)

- Low Channel (2402 MHz):



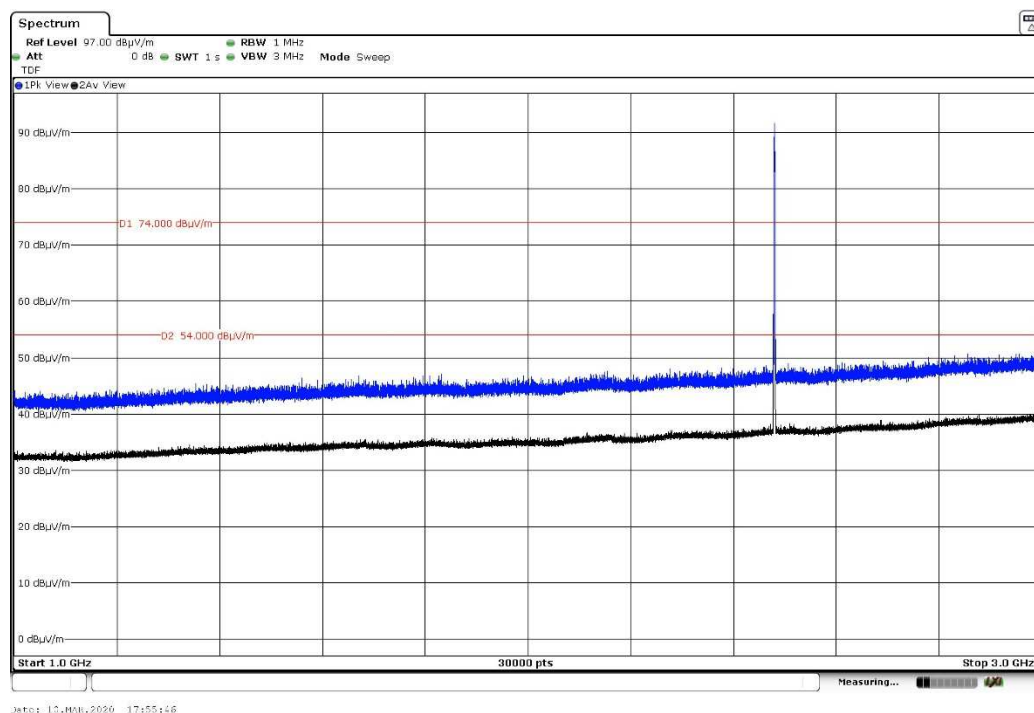
The peak above the limit is the carrier frequency.

- Middle Channel (2441 MHz):



The peak above the limit is the carrier frequency.

- High Channel (2480 MHz):

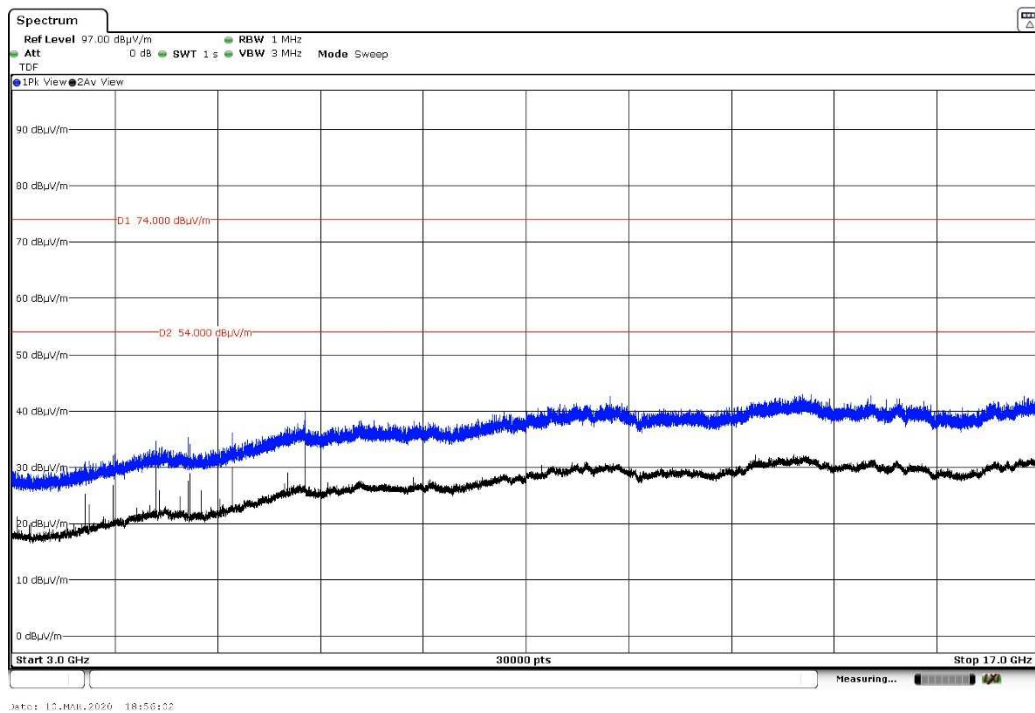


The peak above the limit is the carrier frequency.

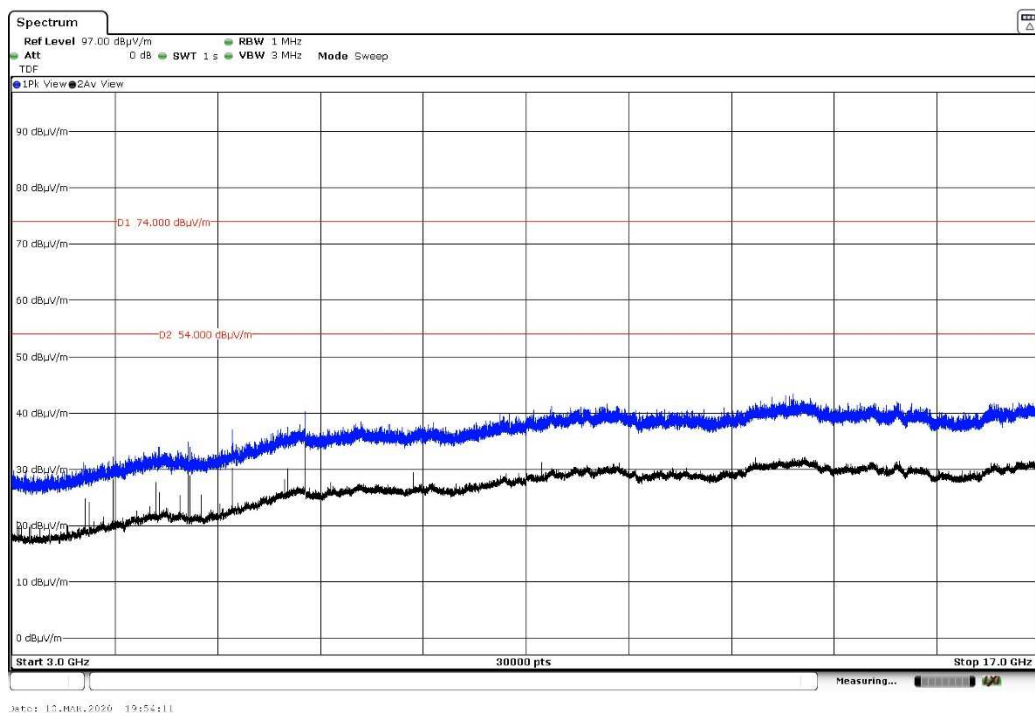
FREQUENCY RANGE 3 - 17 GHz:

- GFSK modulation (DH5)

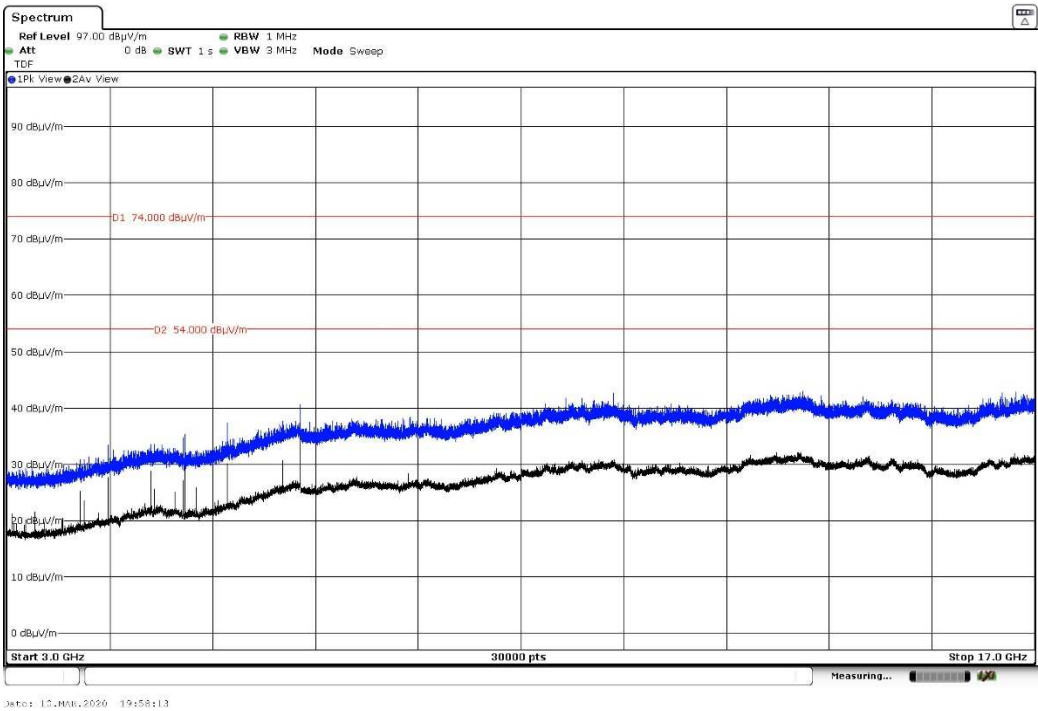
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

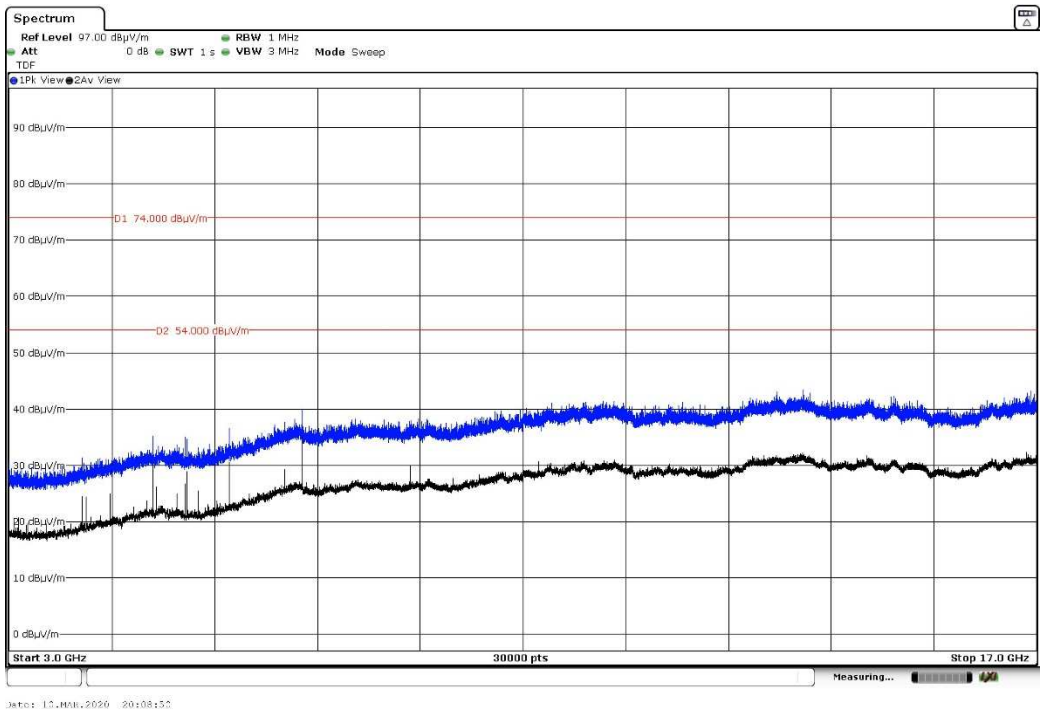


- High Channel (2480 MHz):

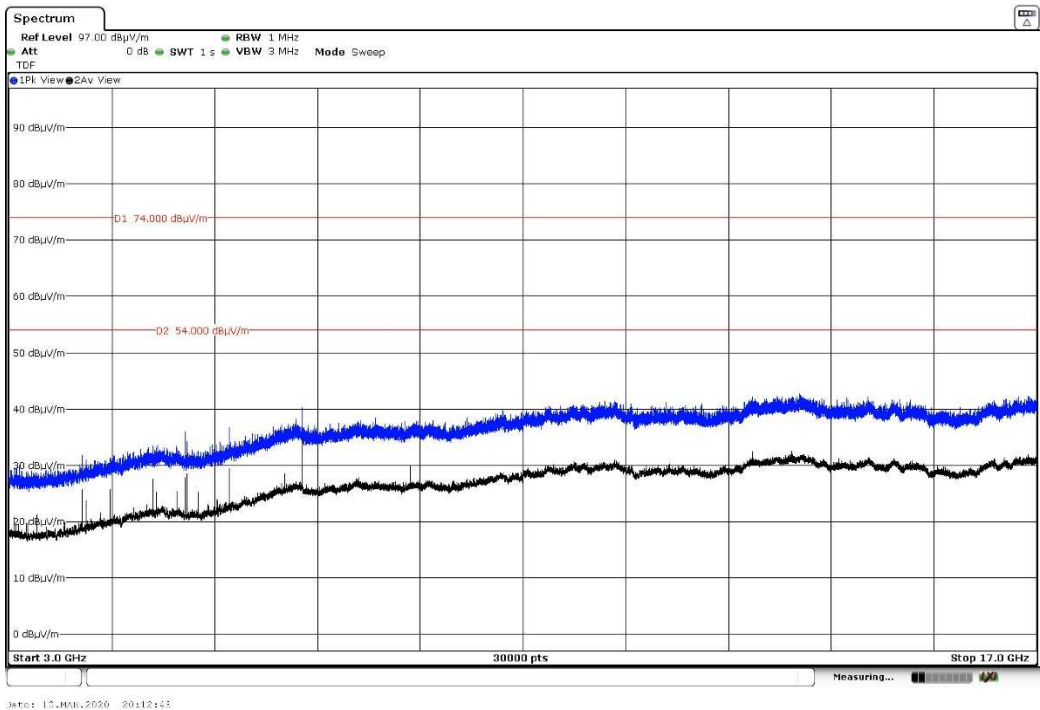


- **Pi/4-DQPSK modulation (2DH5)**

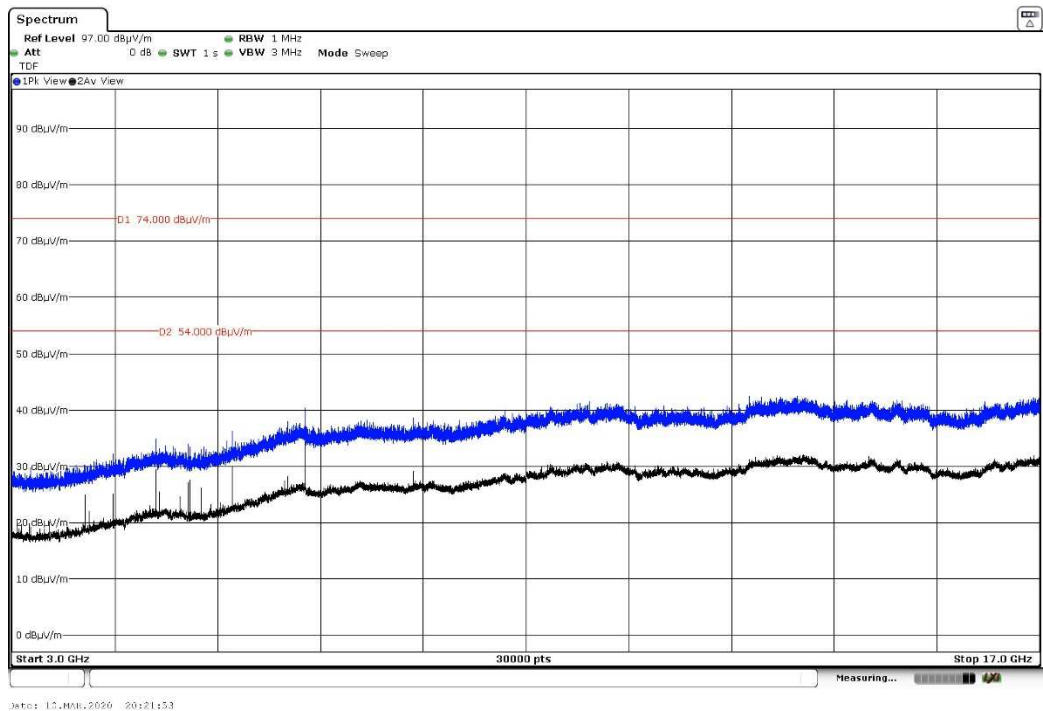
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

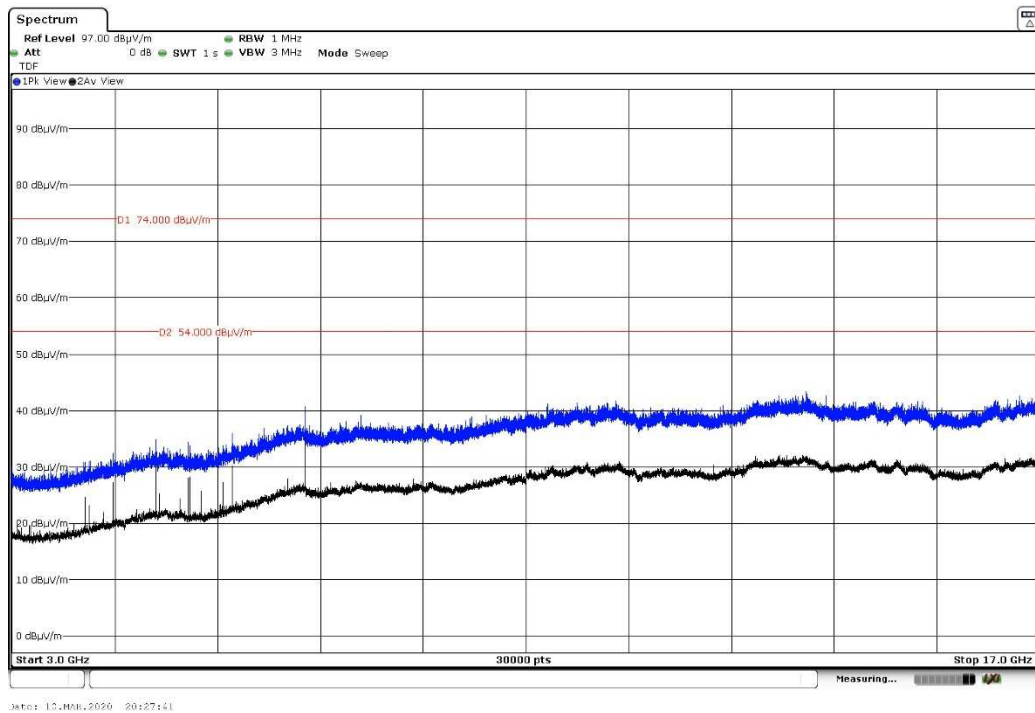


- High Channel (2480 MHz):

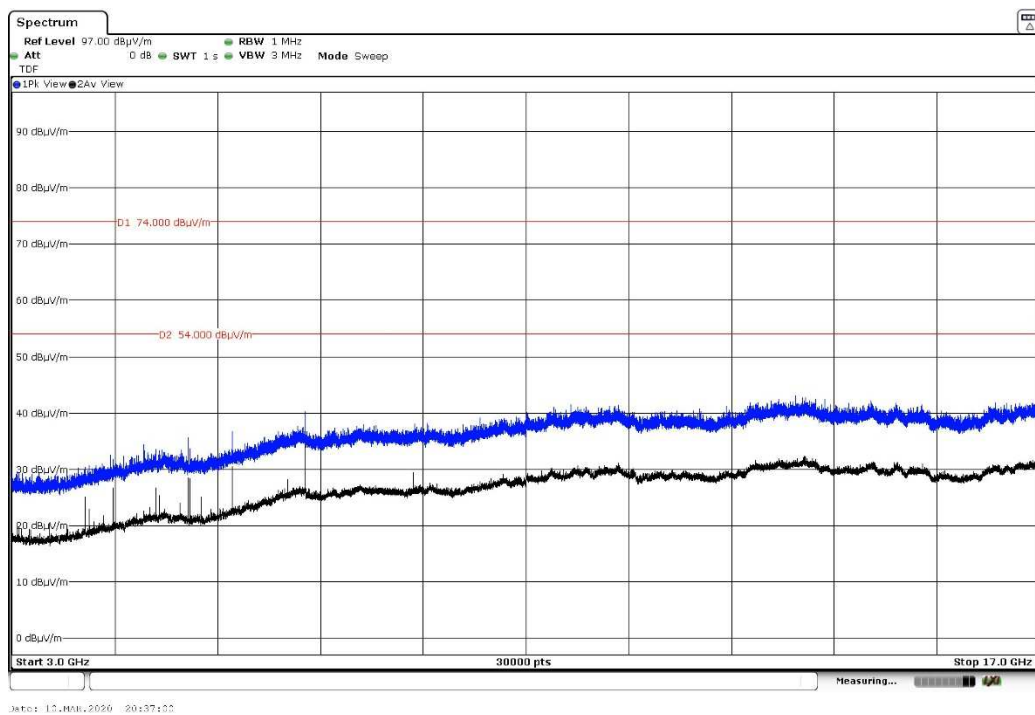


- 8-DPSK modulation (3DH5)

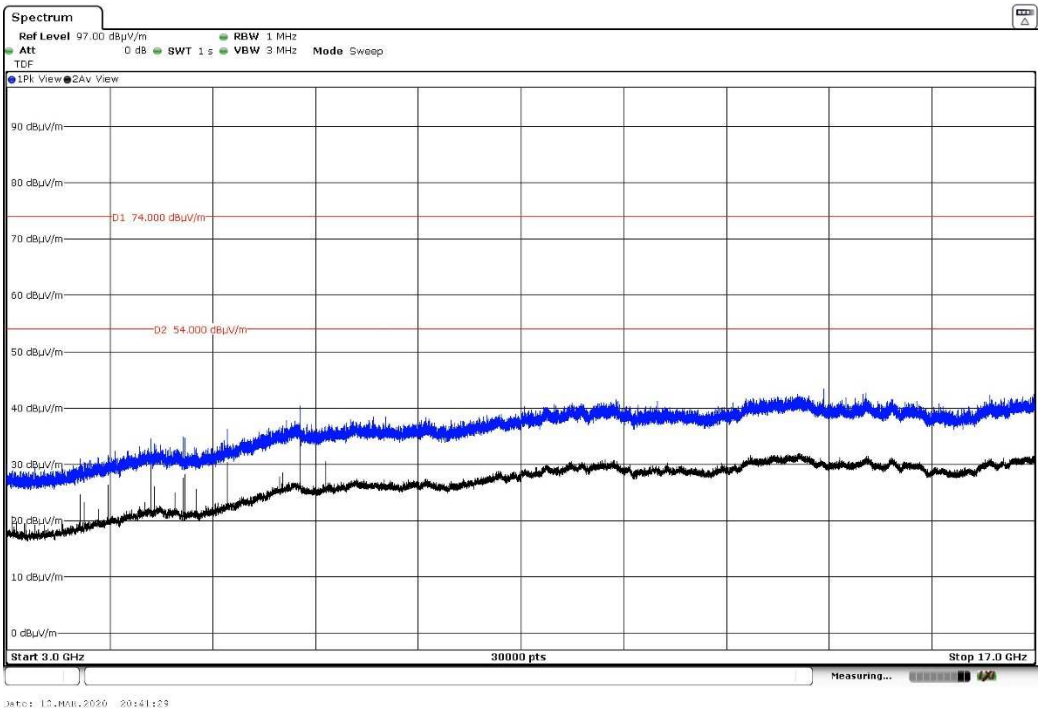
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

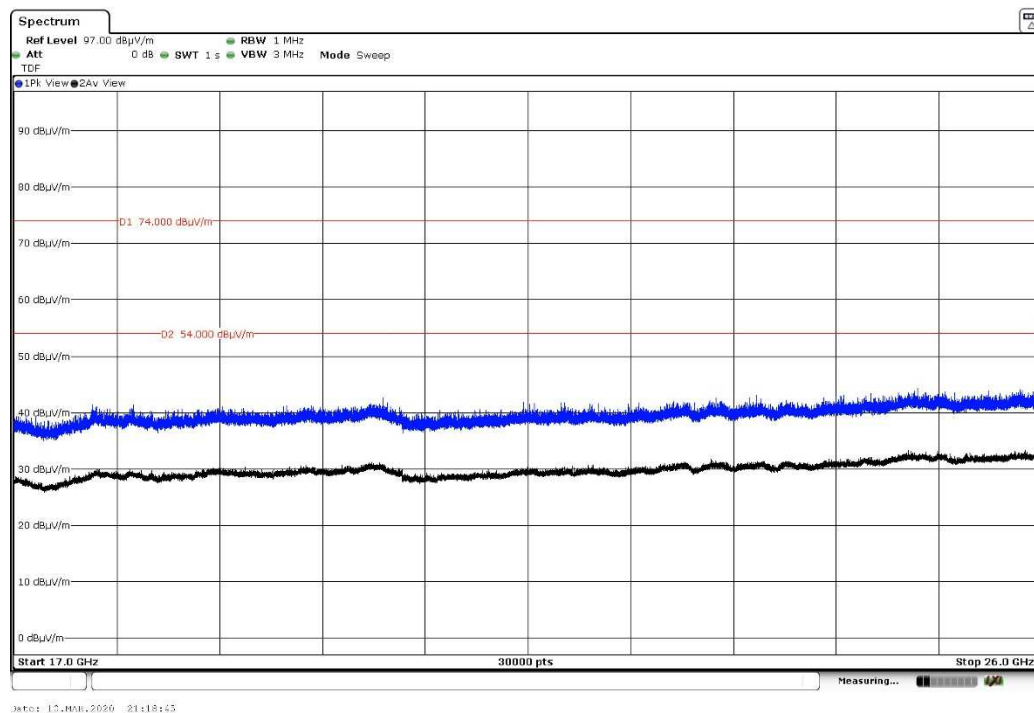


- High Channel (2480 MHz):



FREQUENCY RANGE 17 - 26 GHz:

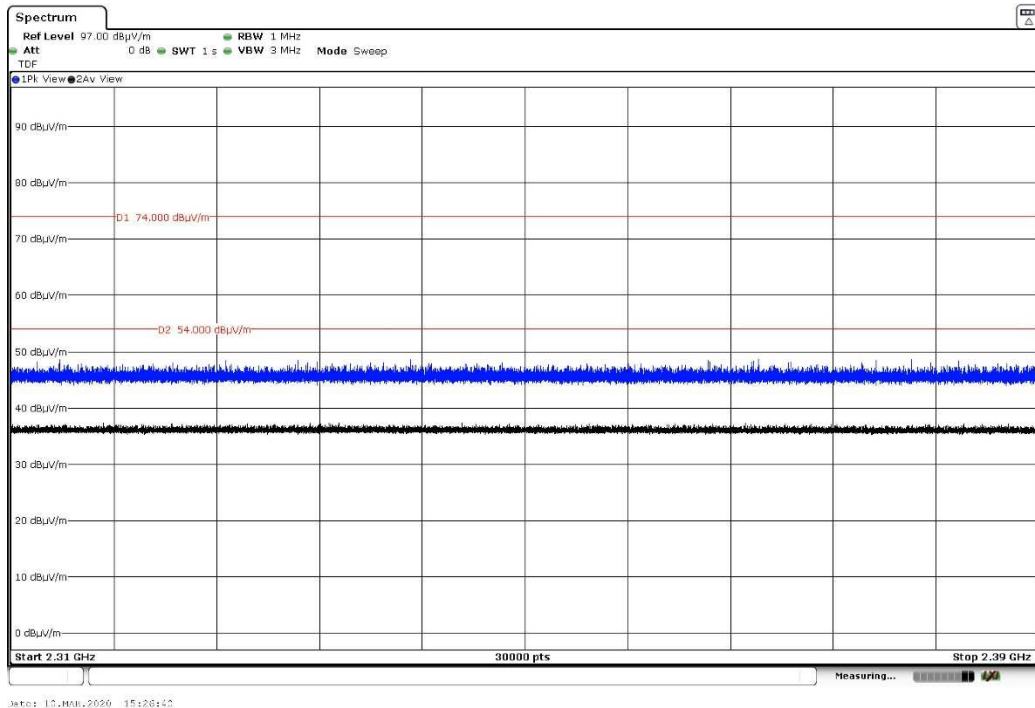
This plot is valid for the Low, Middle and High Channels and all the modulation modes.



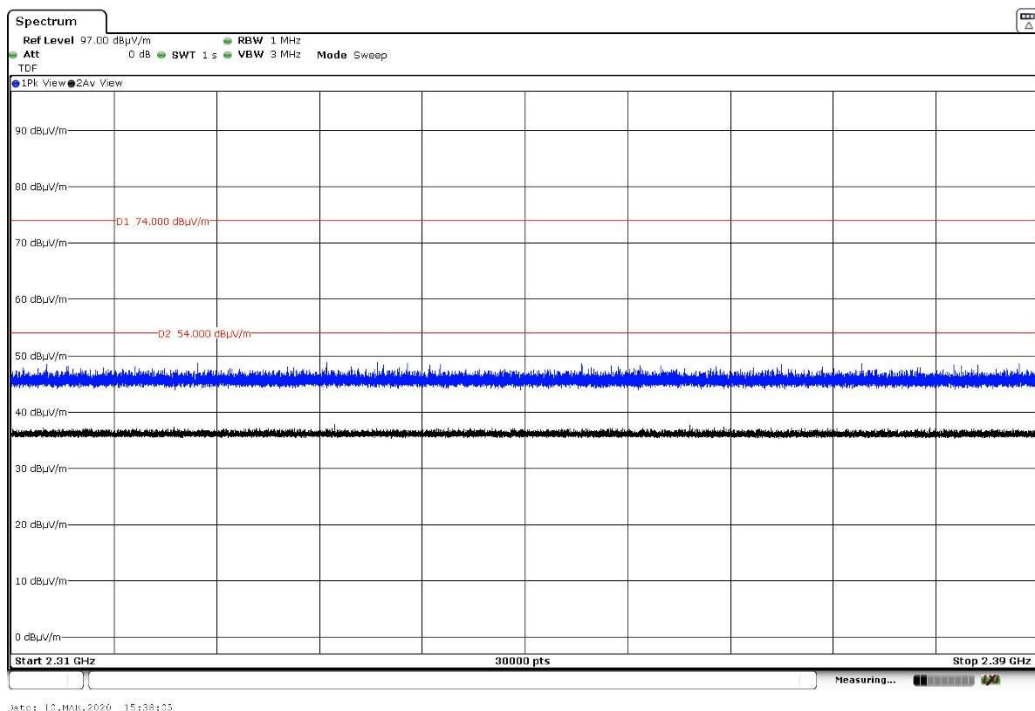
FREQUENCY RANGE 2.31-2.39 GHz:

- GFSK modulation (DH5)**

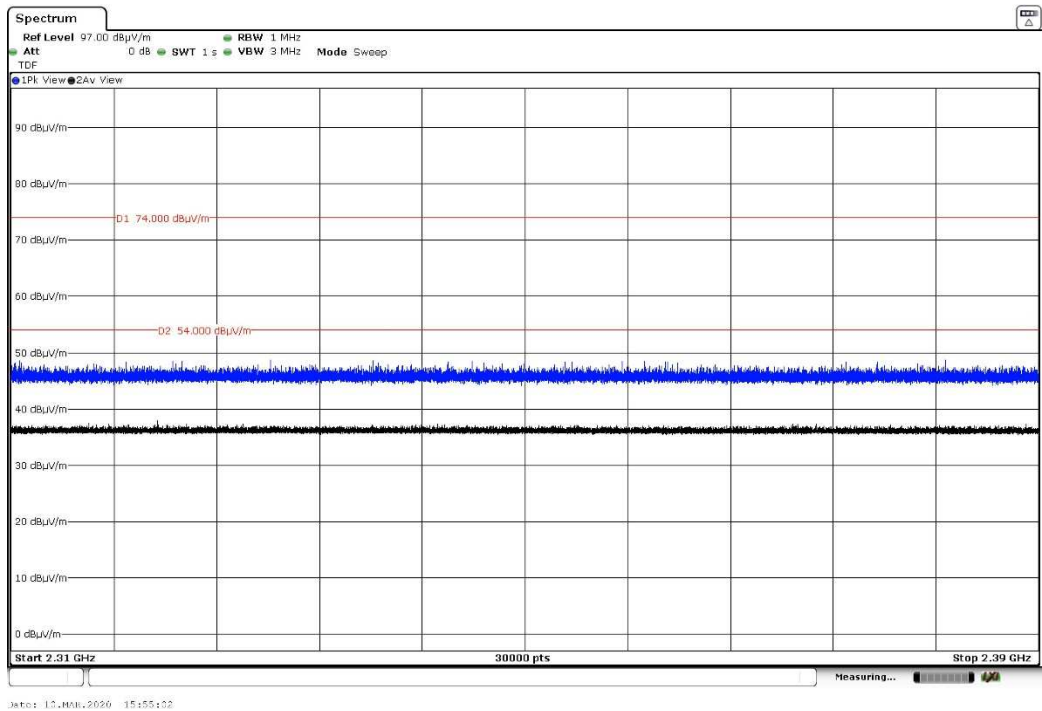
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

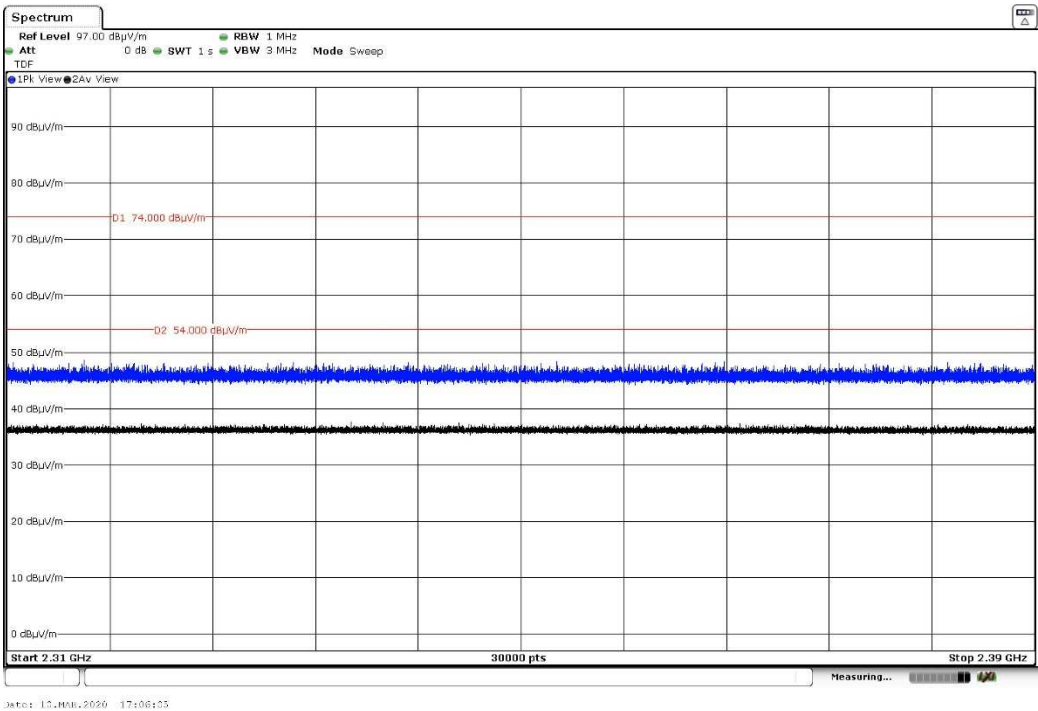


- High Channel (2480 MHz):

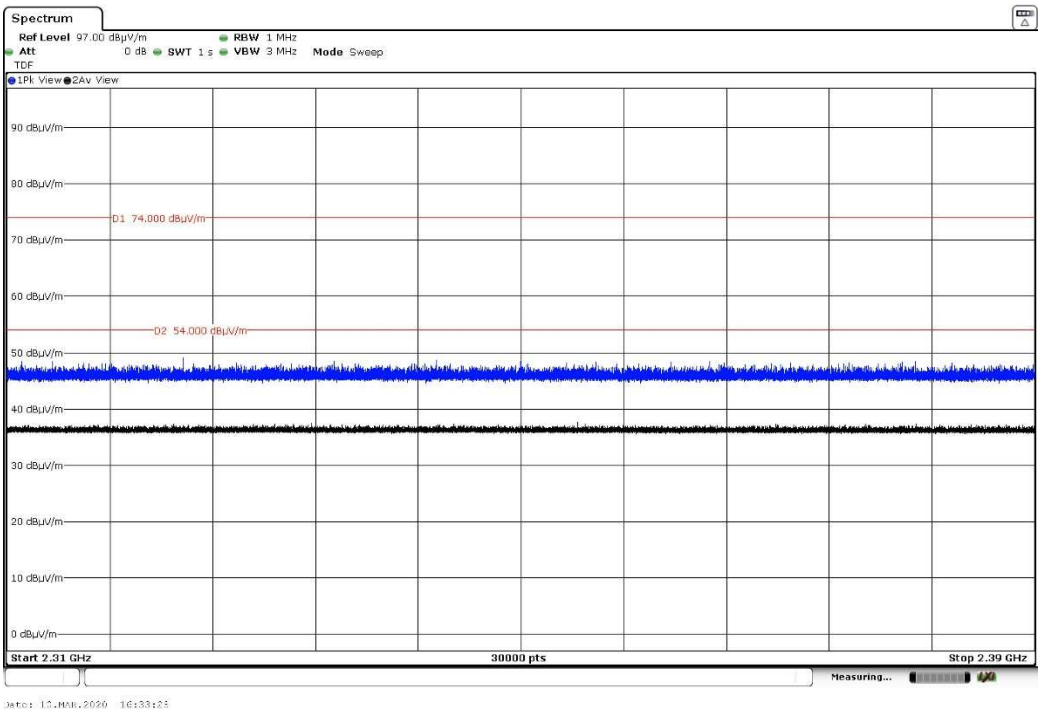


• Pi/4-DQPSK modulation (2DH5)

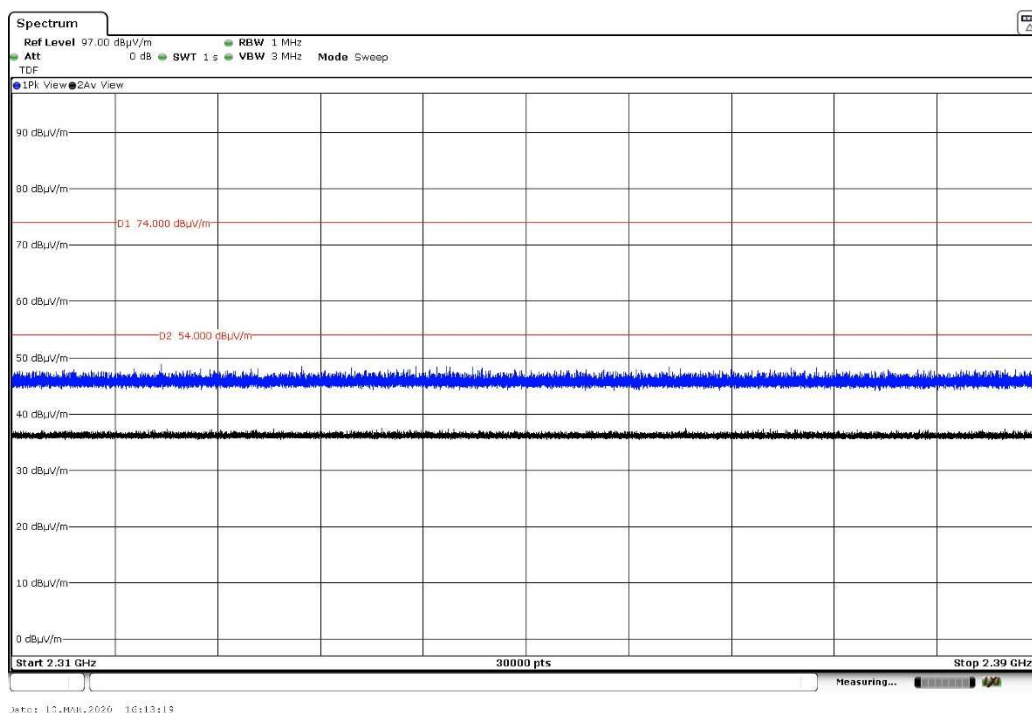
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

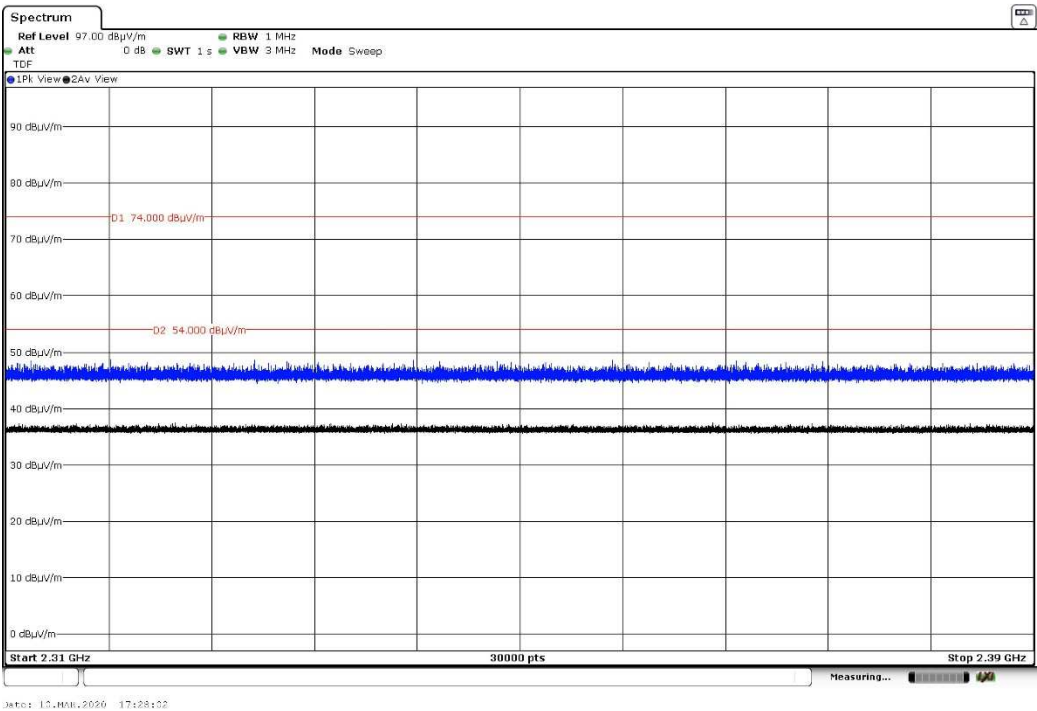


- High Channel (2480 MHz):

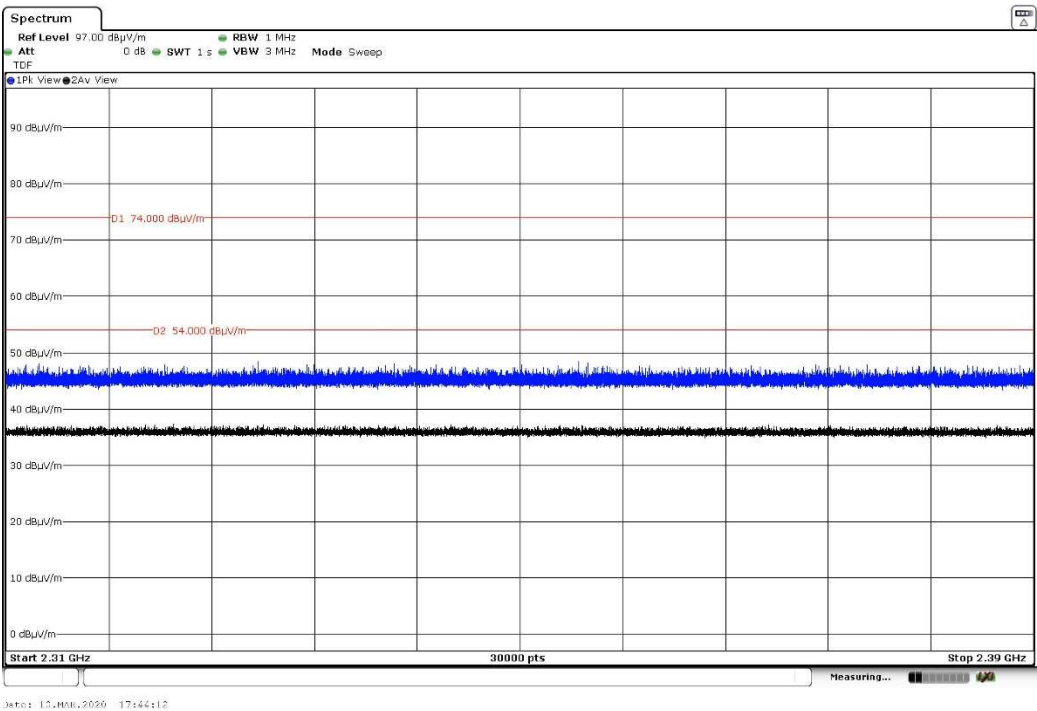


- 8-DPSK modulation (3DH5)

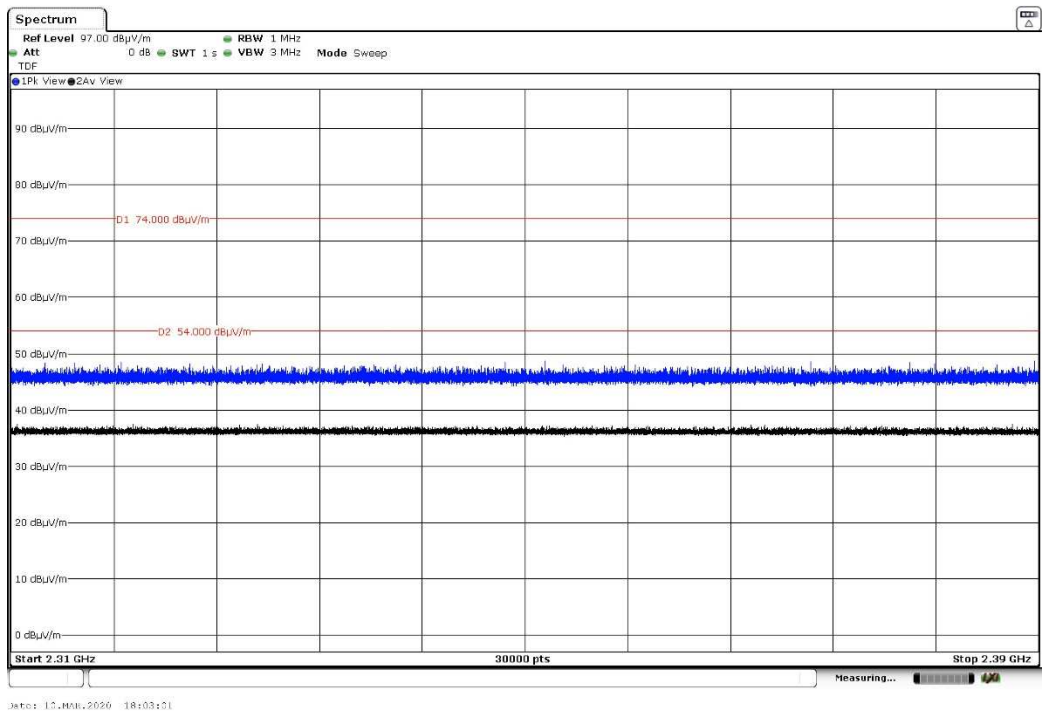
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

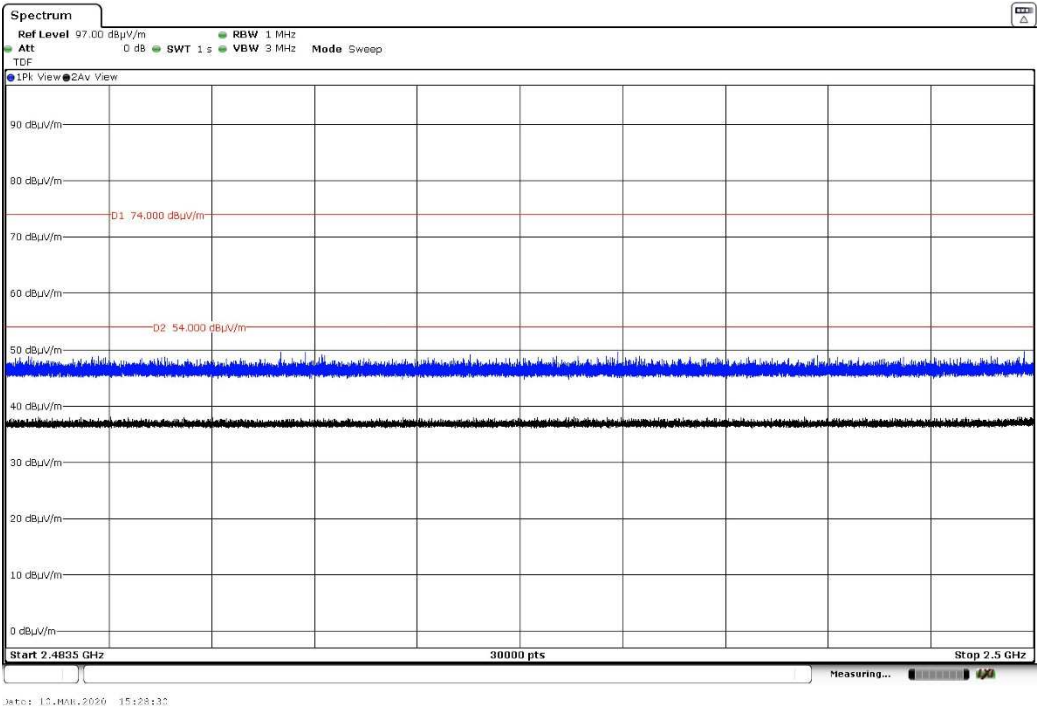


- High Channel (2480 MHz):

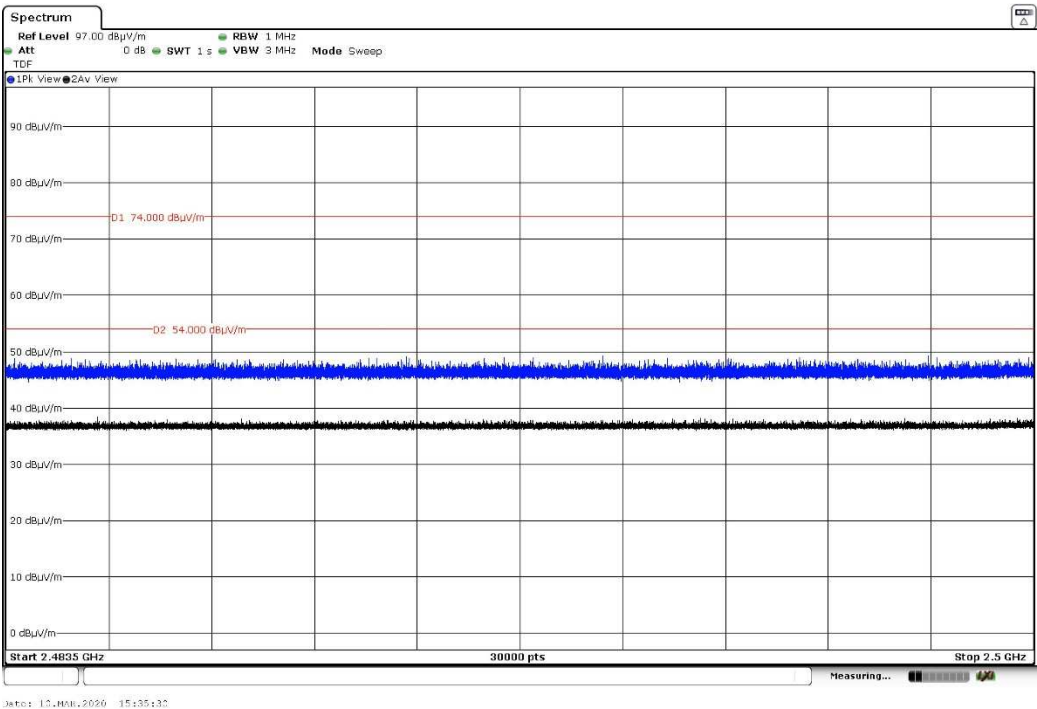


FREQUENCY RANGE 2.4835-2.5 GHz:

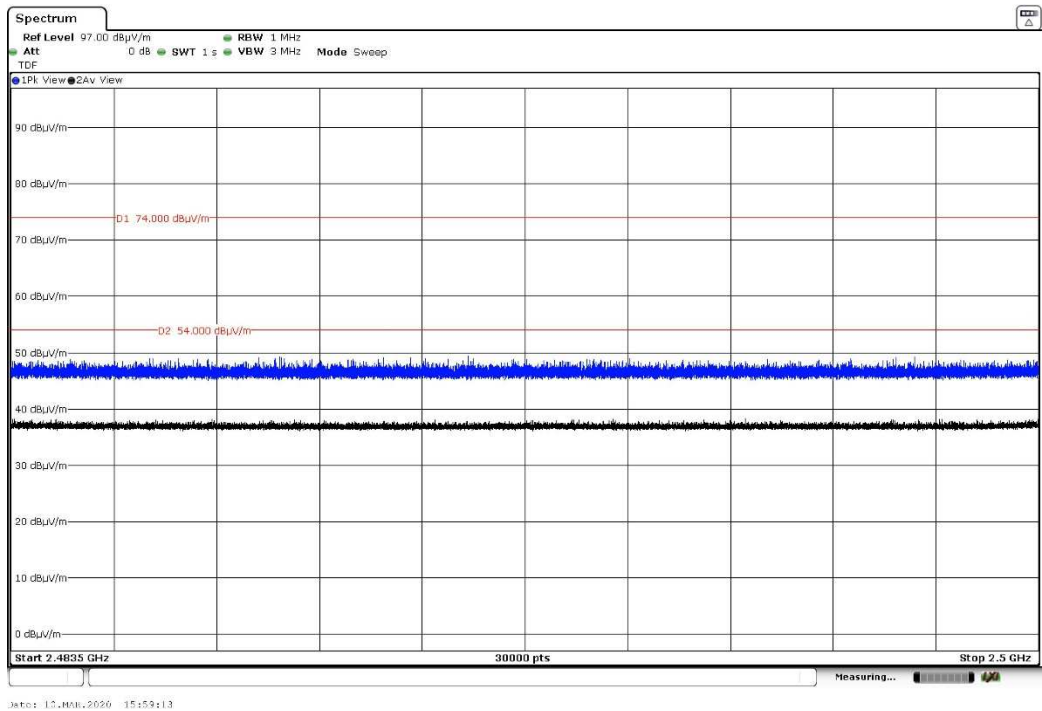
- GFSK modulation (DH5)
 - Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

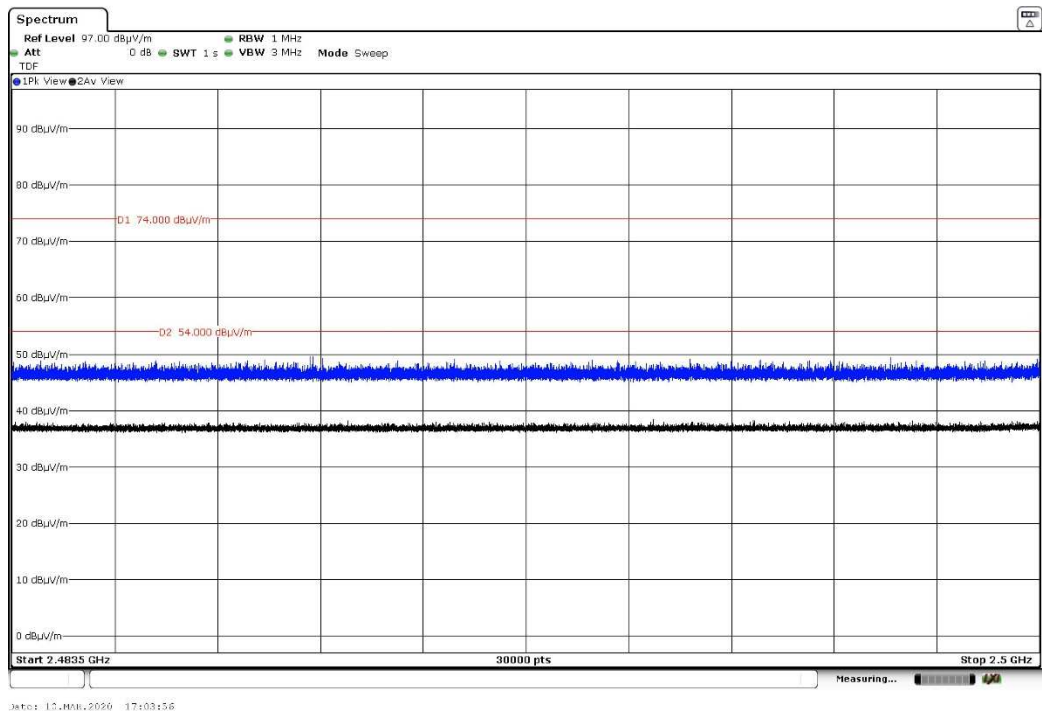


- High Channel (2480 MHz):

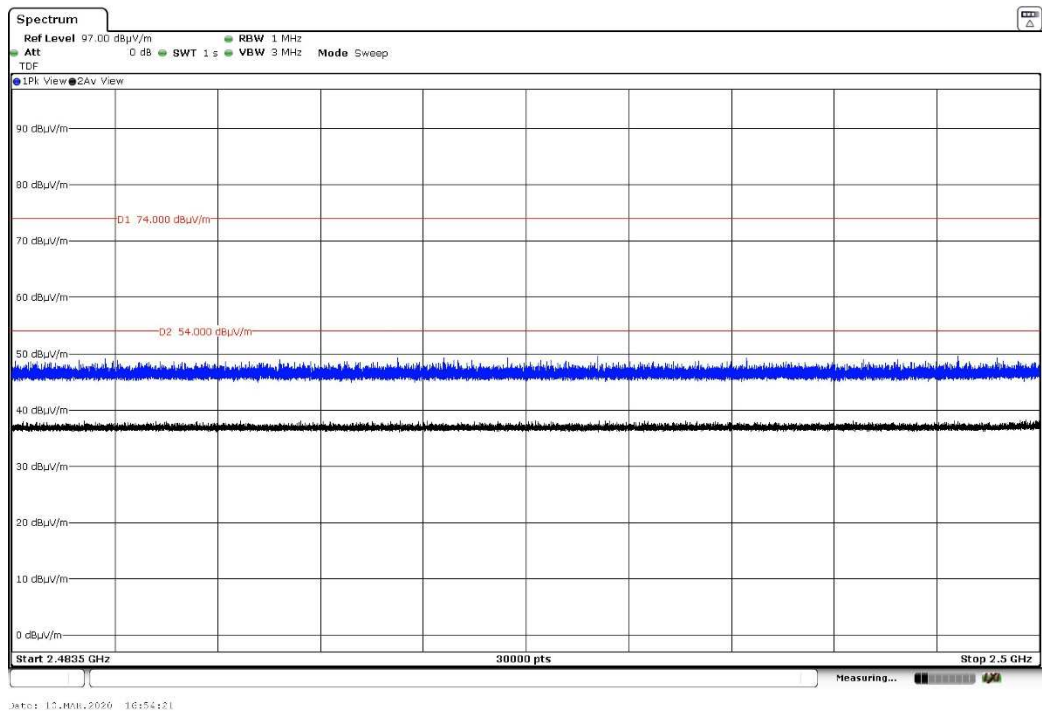


• Pi/4-DQPSK modulation (2DH5)

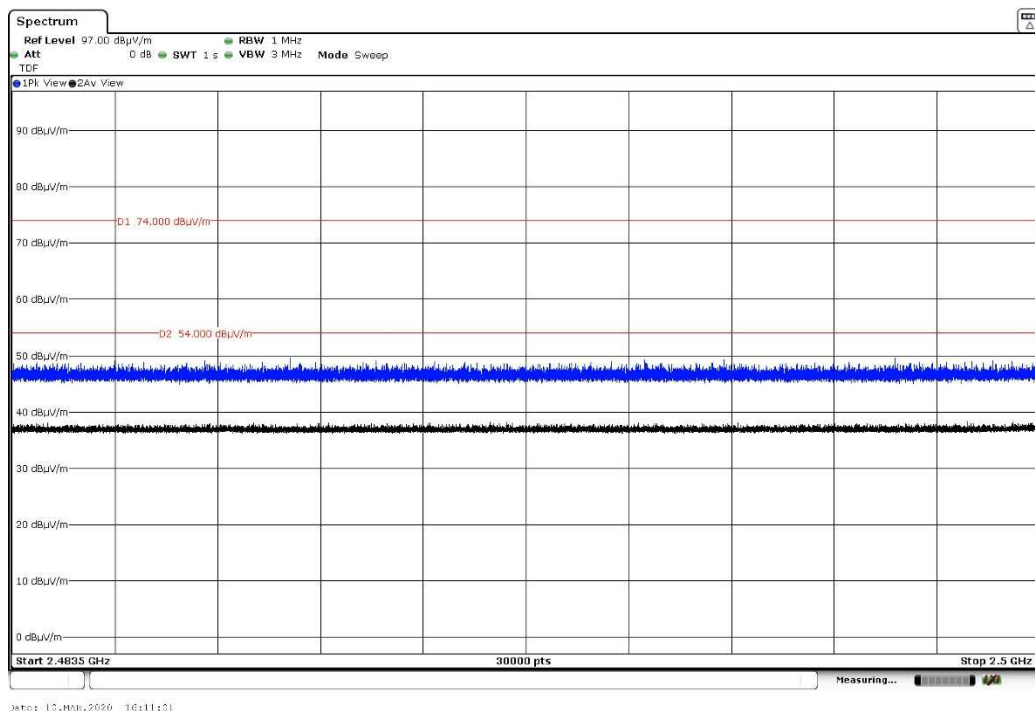
- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):

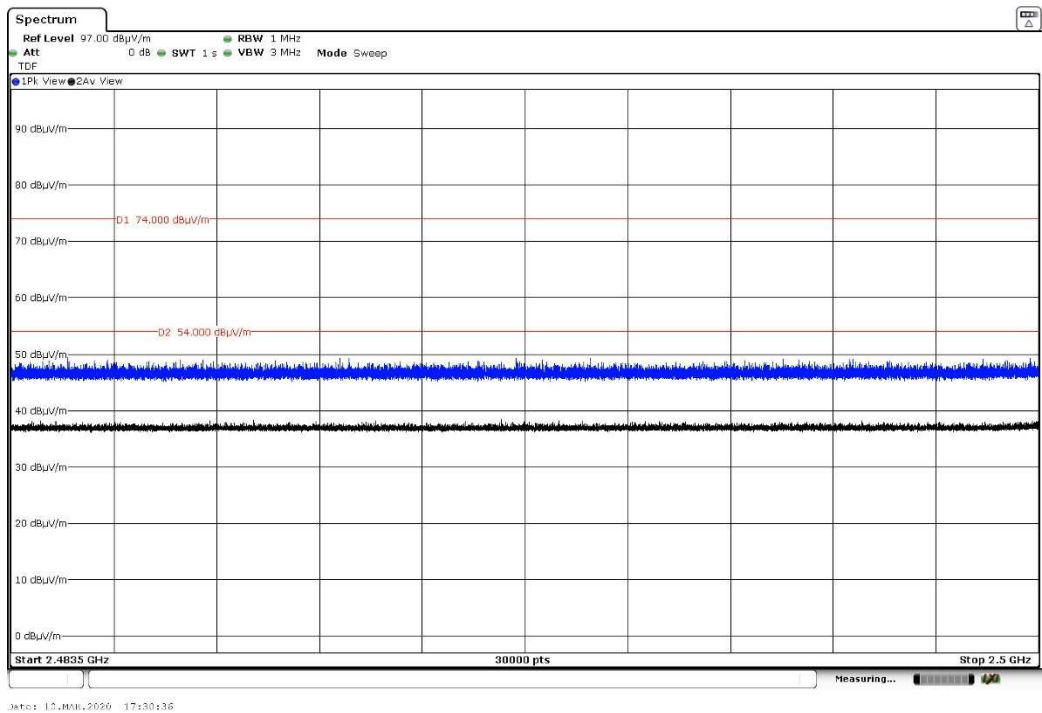


- High Channel (2480 MHz):

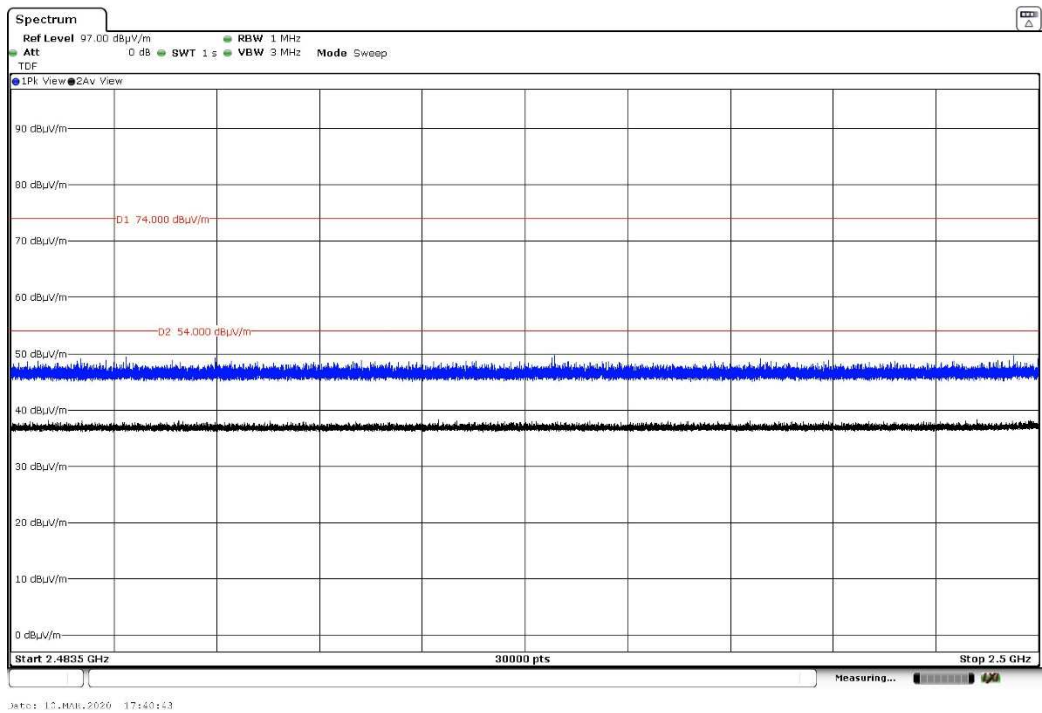


- 8-DPSK modulation (3DH5)

- Low Channel (2402 MHz):



- Middle Channel (2441 MHz):



- High Channel (2480 MHz):

