



Test report No:
NIE: 51929RRF.015

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	Headunit with radio and Bluetooth
(*) Trademark	Panasonic
(*) Model and /or type reference	MIB3E_MQB37w_BTWIFI
Other identification of the product	FCC ID: WUQ-MIB3VBTWIFI IC: 216R-MIB3VBTWIFI PN: 5E3.035.869 HW version: X85 SW version: X495
(*) Features	Bluetooth, WLAN, FM, AM, DAB, USB.
Applicant	PANASONIC AUTOMOTIVE SYSTEMS EUROPE GMBH Robert Bosch Str. 27-29 – 63225 Langen - 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. -Emission limitations radiated (Transmitter). USA FCC Part 15.209 10-1-18 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). -Emission limitations radiated (Transmitter). 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.

Approved by (name / position & signature)	A. Llamas RF Lab. Manager
Date of issue	2019-08-13
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 consists of an Automotive head unit to be installed in cars with the following features: Bluetooth, WLAN, FM, AM, DAB, USB.

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 results.

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
51929B/537	Head unit with radio and Bluetooth	MIB3E_MQB37w_BTWIFI	PM6-00108.01.19413F0111	2019/06/05
51292B/538	Harness	---	---	2019/06/05

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⁾		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input checked="" type="checkbox"/> DC: 12 Vdc						
Rated Power							
Clock frequencies							
Other parameters.....:							
Software version	X495						
Hardware version.....:	X85						
Dimensions in cm (W x H x D):							
Mounting position.....:	<input checked="" type="checkbox"/>	Other: Installed in cars					
Modules/parts	Module/parts of test item			Type	Manufacturer		
Accessories (not part of the test item)	Description			Type	Manufacturer		

Documents as provided by the applicant.....:	Description	File name	Issue date

⁽³⁾ Only for Medical Equipment

Identification of the client

PANASONIC AUTOMOTIVE SYSTEMS EUROPE GMBH

Robert Bosch Str. 27-29 – 63225 Langen - Germany

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-07-04
Date (finish)	2019-07-09

Document history

Report number	Date	Description
51929RRF.015	2019-08-06	First release

Environmental conditions

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

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

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

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

Remarks and comments

The tests have been performed by the technical personnel: Ignacio Cabra, José Gabriel Pendón.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	RF Pre-amplifier 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
4.	Biconical/Log Antenna ETS LINDGREN 3142E	2017/09	2020/09
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
6.	RF Pre-amplifier 30 dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	RF Pre-amplifier, 30 dB, 18-40GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
8.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
9.	Broadband Horn antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
10.	DC Power Supply Keysight Technologies U8002A	---	---
11.	Digital multimeter FLUKE 179	2019/06	2020/06

Testing verdicts

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

Summary

1. Bluetooth EDR

FCC PART 15 PARAGRAPH / RSS-247		Verdict	Remark
Requirement – Test case			
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 conducted (Transmitter)	N/A	
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. Wi-Fi 2.4 GHz (802.11b/n20).

FCC PART 15 PARAGRAPH / RSS-247		Verdict	Remark
Requirement – Test case			
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	Emission limitations conducted (Transmitter)	N/A	
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 nonimal: 12 Vdc.

Type of Power Supply: External power supply (Battery).

Type of Antenna: Internal antenna.

Declared Gain for antenna RF (maximum): 1.3 dBi

TEST FREQUENCIES:

Low Channel: 2402 MHz

Middle Channel: 2441 MHz

High Channel: 2480 MHz

RADIATED MEASUREMENTS

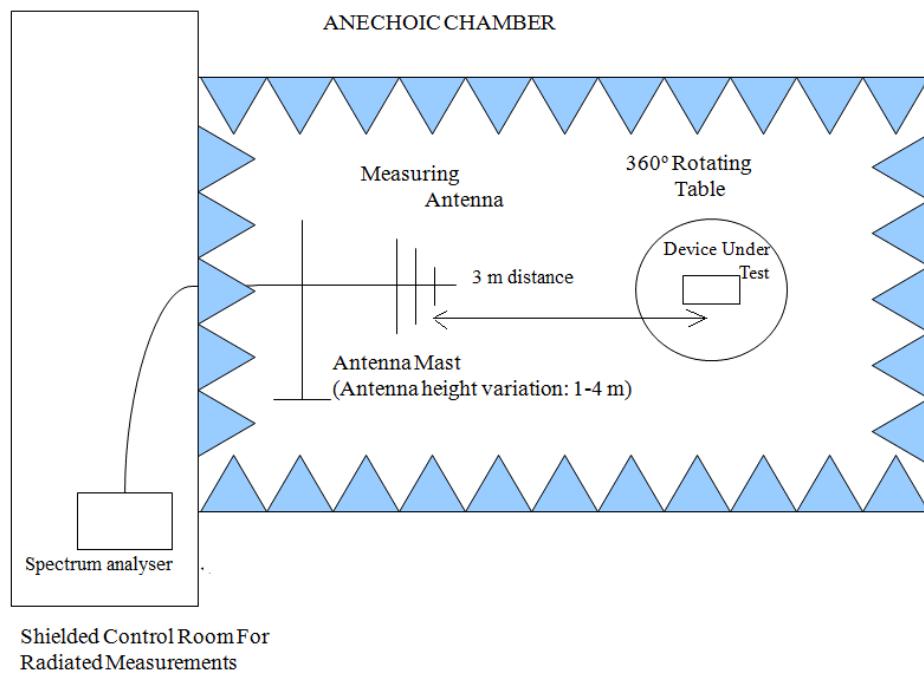
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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.

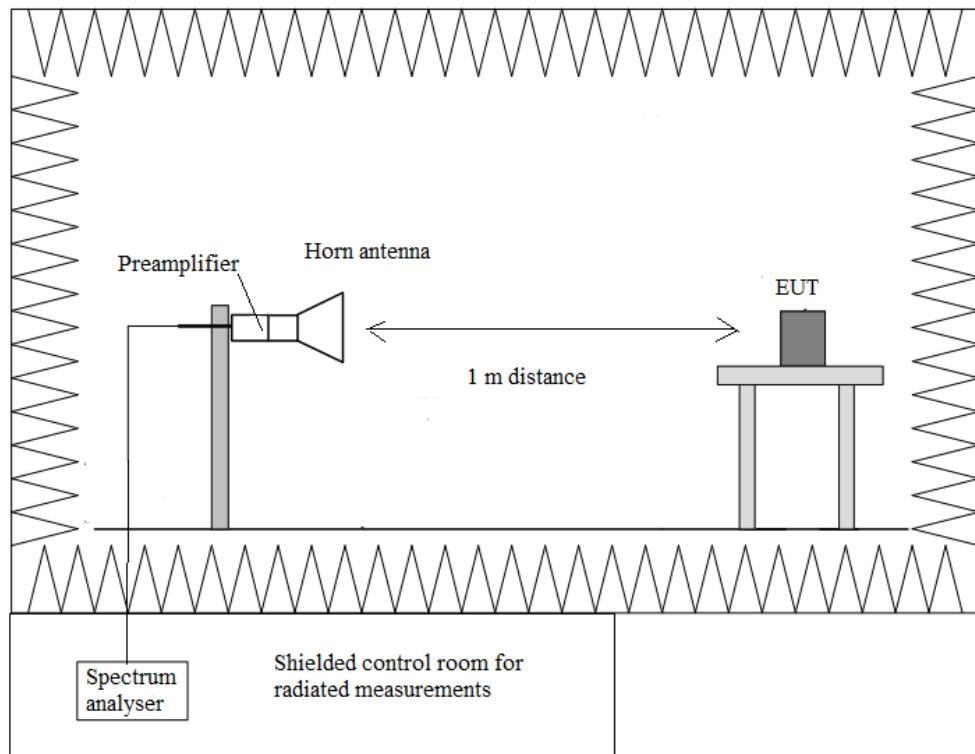
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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



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 Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 10000	500	54	3

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

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

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

RESULTS:

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

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

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

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

Frequency range 30 MHz - 1 GHz:

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

Spurious levels operating (radiated) closest to limit.

Spurious frequency (MHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
188.870	Quasi peak	23.8	H	<± 3.88
322.374	Quasi peak	35.1	H	<± 3.88
574.995	Quasi peak	31.9	V	<± 3.88
621.555	Quasi peak	37.0	V	<± 3.88
725.021	Quasi peak	33.9	V	<± 3.88
950.417	Quasi peak	26.8	H	<± 3.88

Frequency range 1 - 26 GHz:

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

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

Modulation: GFSK (DH5)

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86403	Peak	55.95	V	<± 3.70
	Average	40.03		<± 3.70
2.13910	Peak	54.16	H	<± 3.70
	Average	50.30		<± 3.70
3.09497	Peak	47.22	V	<± 3.70
3.58170	Peak	40.52	H	<± 3.70
3.74363	Peak	40.49	V	<± 3.70
4.12677	Peak	38.14	V	<± 3.70
4.35310	Peak	46.60	H	<± 3.70
4.36897	Peak	47.48	V	<± 3.70
5.57157	Peak	42.80	V	<± 3.70
5.59537	Peak	45.42	H	<± 3.70
6.19037	Peak	43.72	H	<± 3.70
8.81910	Peak	45.55	H	<± 3.70

2. CHANNEL: MIDDLE (2441 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86570	Peak	56.59	V	<± 3.70
	Average	39.50		<± 3.70
2.19770	Peak	54.19	H	<± 3.70
	Average	50.90		<± 3.70
3.08797	Peak	47.18	V	<± 3.70
3.10990	Peak	45.77	H	<± 3.70
3.50423	Peak	41.68	V	<± 3.70
4.33723	Peak	46.04	H	<± 3.70
4.35123	Peak	48.99	V	<± 3.70
5.57763	Peak	45.03	H	<± 3.70
6.37050	Peak	41.56	H	<± 3.70
8.81910	Peak	44.62	H	<± 3.70

3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.76503	Peak	54.97	H	<± 3.70
	Average	37.68		<± 3.70
1.86283	Peak	57.26	V	<± 3.70
	Average	39.84		<± 3.70
2.02743	Peak	56.27	V	<± 3.70
	Average	53.75		<± 3.70
3.11083	Peak	47.60	V	<± 3.70
3.50843	Peak	36.97	V	<± 3.70
3.59803	Peak	39.40	H	<± 3.70
4.33023	Peak	45.17	H	<± 3.70
4.34610	Peak	47.43	V	<± 3.70
5.56457	Peak	44.75	H	<± 3.70
6.58983	Peak	44.96	V	<± 3.70
8.81910	Peak	44.03	H	<± 3.70

Verdict: PASS

Modulation Π/4-DQPSK (2DH5)

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86623	Peak	56.92	V	<± 3.70
	Average	39.96		<± 3.70
3.09730	Peak	47.70	V	<± 3.70
3.52757	Peak	42.06	H	<± 3.70
4.33957	Peak	46.92	V	<± 3.70
4.36570	Peak	46.42	H	<± 3.70
5.56690	Peak	44.24	V	<± 3.70
5.58790	Peak	47.05	H	<± 3.70
6.66217	Peak	44.95	V	<± 3.70
8.81910	Peak	43.63	H	<± 3.70

2. CHANNEL: MIDDLE (2441 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86823	Peak	57.35	V	<± 3.70
	Average	38.97		<± 3.70
2.15790	Peak	54.16	H	<± 3.70
	Average	48.53		<± 3.70
3.08797	Peak	47.33	V	<± 3.70
3.50470	Peak	42.58	H	<± 3.70
4.33910	Peak	48.15	V	<± 3.70
4.59997	Peak	46.53	V	<± 3.70
5.57017	Peak	44.64	V	<± 3.70
5.59957	Peak	42.56	H	<± 3.70
6.89970	Peak	45.61	V	<± 3.70
8.81910	Peak	44.14	H	<± 3.70

3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.85577	Peak	57.34	V	<± 3.70
	Average	40.18		<± 3.70
3.08797	Peak	48.48	V	<± 3.70
3.10570	Peak	44.91	H	<± 3.70
3.52757	Peak	40.73	H	<± 3.70
4.35263	Peak	46.73	V	<± 3.70
4.57570	Peak	45.61	V	<± 3.70
5.57017	Peak	42.35	H	<± 3.70
6.86377	Peak	45.06	V	<± 3.70
8.81910	Peak	44.70	H	<± 3.70

Verdict: PASS

Modulation: 8-DPSK (3DH5)

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.85810	Peak	56.71	V	<± 3.70
	Average	40.07		<± 3.70
3.09963	Peak	46.77	H	<± 3.70
3.11037	Peak	45.89	V	<± 3.70
3.59617	Peak	40.48	H	<± 3.70
3.71423	Peak	40.21	V	<± 3.70
4.19397	Peak	40.60	V	<± 3.70
4.32743	Peak	46.61	H	<± 3.70
4.36150	Peak	46.85	V	<± 3.70
5.55850	Peak	42.50	H	<± 3.70
5.59163	Peak	41.96	V	<± 3.70
6.29070	Peak	42.66	H	<± 3.70
8.81910	Peak	44.34	H	<± 3.70

2. CHANNEL: MIDDLE (2441 MHz).

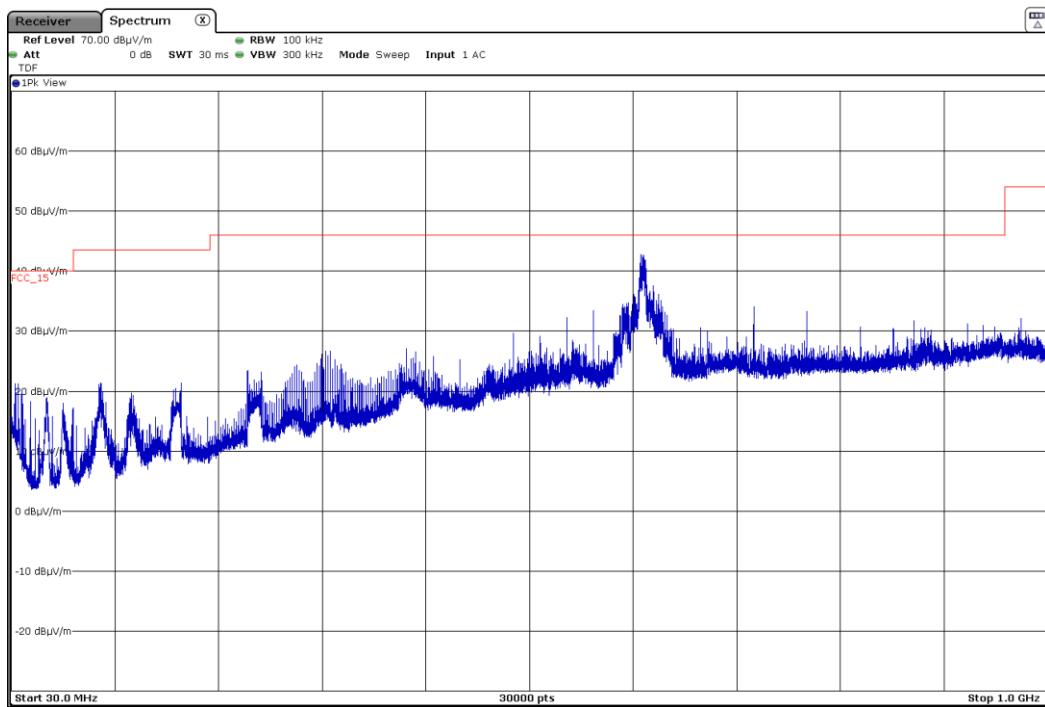
Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86063	Peak	56.75	V	<± 3.70
	Average	39.11		<± 3.70
2.19910	Peak	54.82	H	<± 3.70
	Average	50.96		<± 3.70
3.09123	Peak	46.63	V	<± 3.70
3.57983	Peak	39.19	H	<± 3.70
3.73803	Peak	39.71	V	<± 3.70
4.36850	Peak	46.37	V	<± 3.70
4.76517	Peak	47.20	V	<± 3.70
5.58510	Peak	42.70	V	<± 3.70
7.14750	Peak	41.76	H	<± 3.70
8.81910	Peak	43.61	H	<± 3.70

3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.85330	Peak	57.17	V	<± 3.70
	Average	40.00		<± 3.70
2.14323	Peak	54.03	H	<± 3.70
	Average	50.28		<± 3.70
3.10383	Peak	47.42	V	<± 3.70
3.57190	Peak	39.55	H	<± 3.70
3.59523	Peak	37.41	V	<± 3.70
4.33817	Peak	47.37	H	<± 3.70
5.57857	Peak	42.55	V	<± 3.70
8.81910	Peak	44.61	H	<± 3.70

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

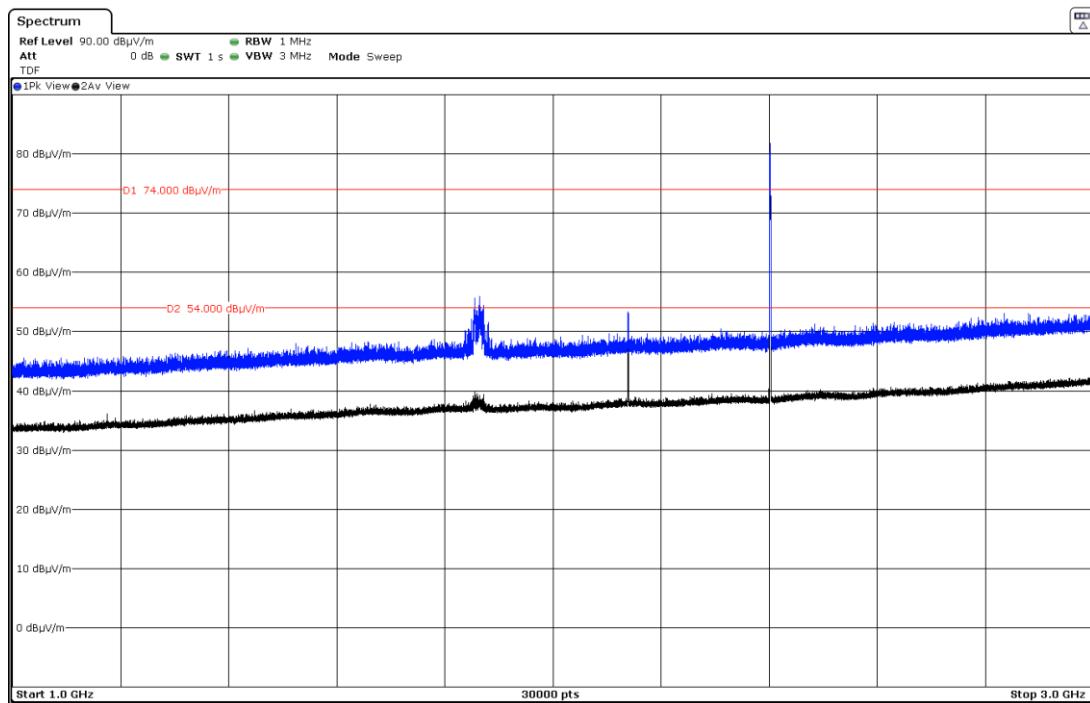


(This plot is valid for all three channels and all modulation modes).

FREQUENCY RANGE 1 - 3 GHz:

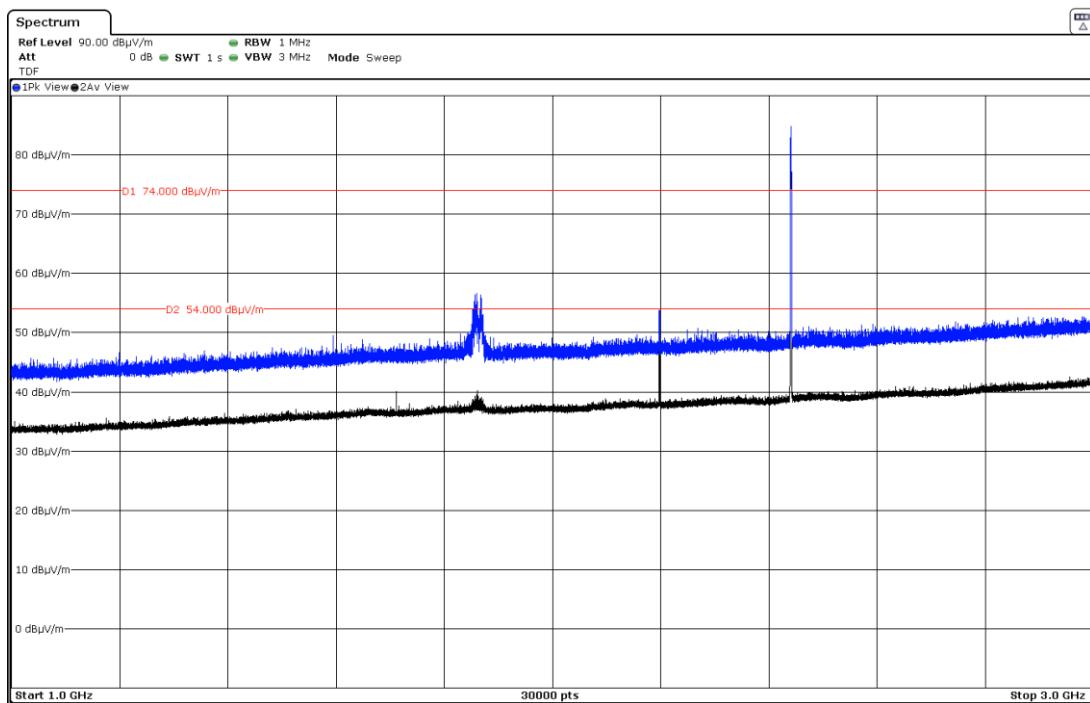
Modulation: GFSK (DH5)

CHANNEL: Lowest (2402 MHz)



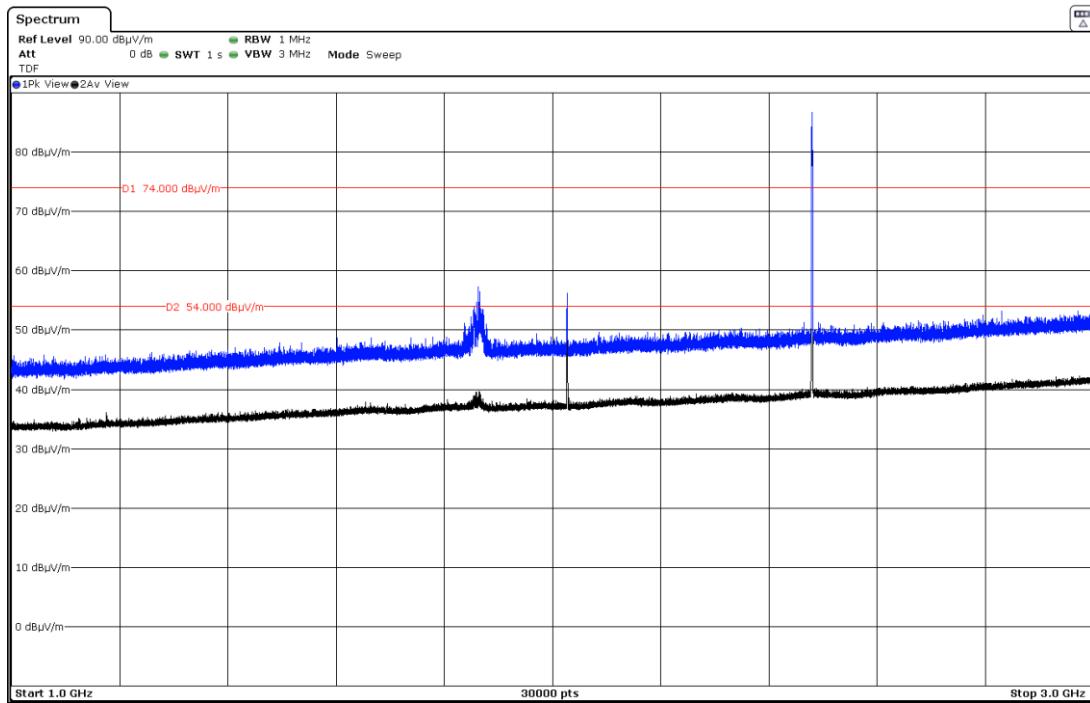
The peak above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz)



The peak above the limit is the carrier frequency.

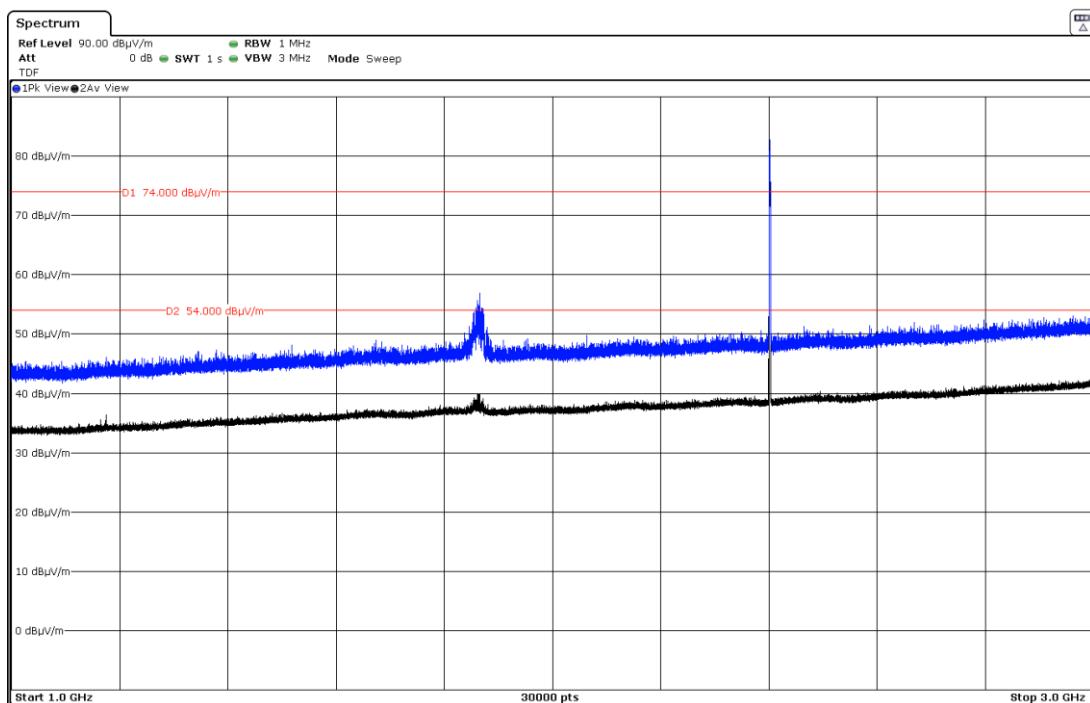
CHANNEL: Highest (2480 MHz)



The peak above the limit is the carrier frequency.

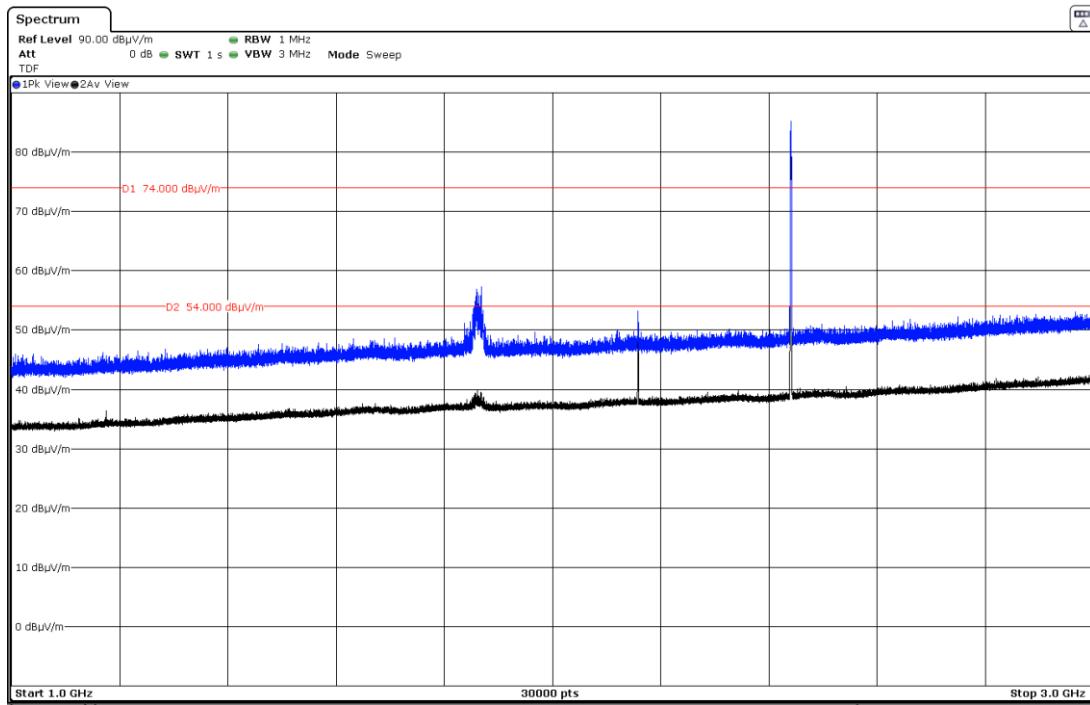
Modulation: Π/4-DQPSK (2DH5)

CHANNEL: Lowest (2402 MHz)



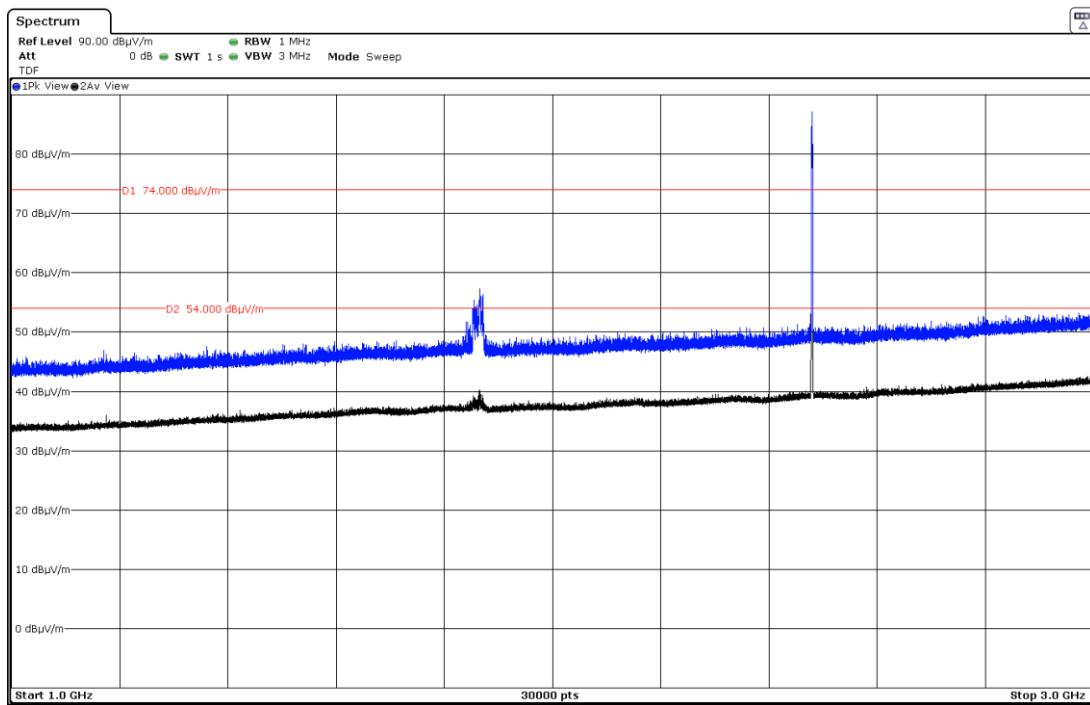
The peak above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz)



The peak above the limit is the carrier frequency.

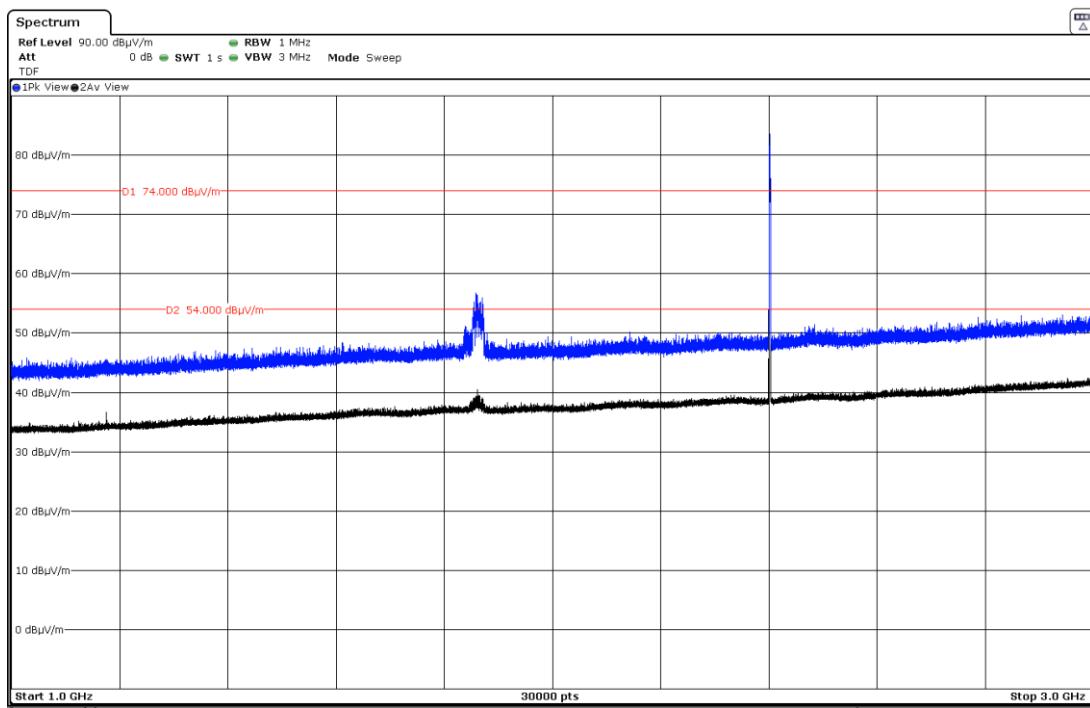
CHANNEL: Highest (2480 MHz)



The peak above the limit is the carrier frequency.

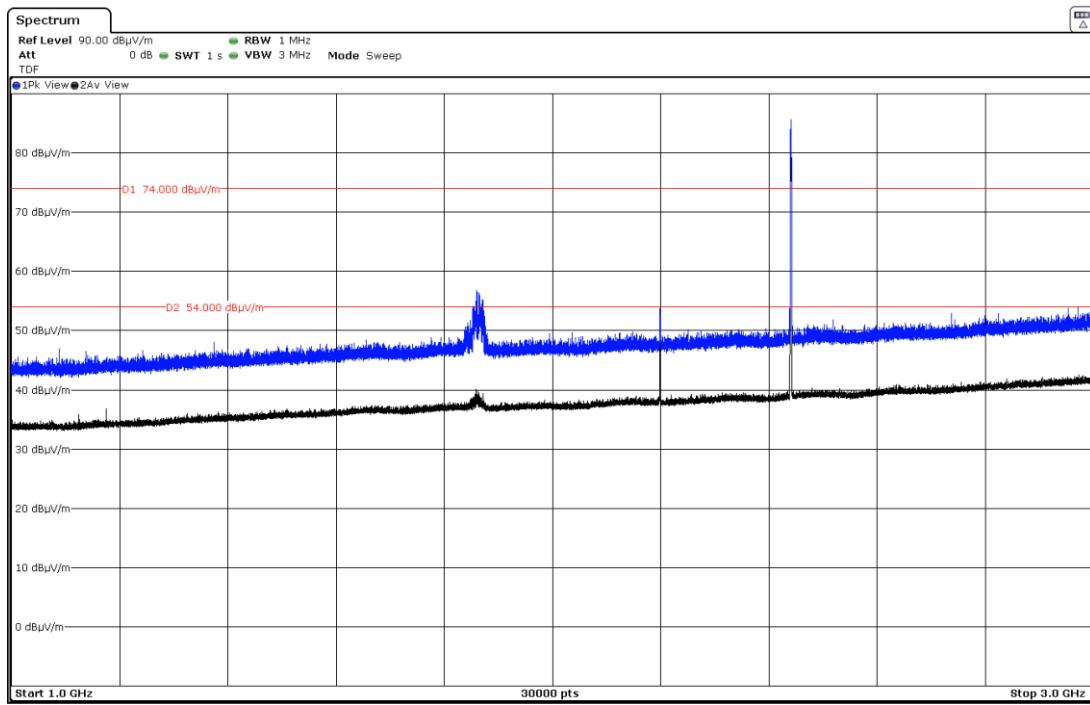
Modulation: 8-DPSK (3DH5)

CHANNEL: Lowest (2402 MHz)



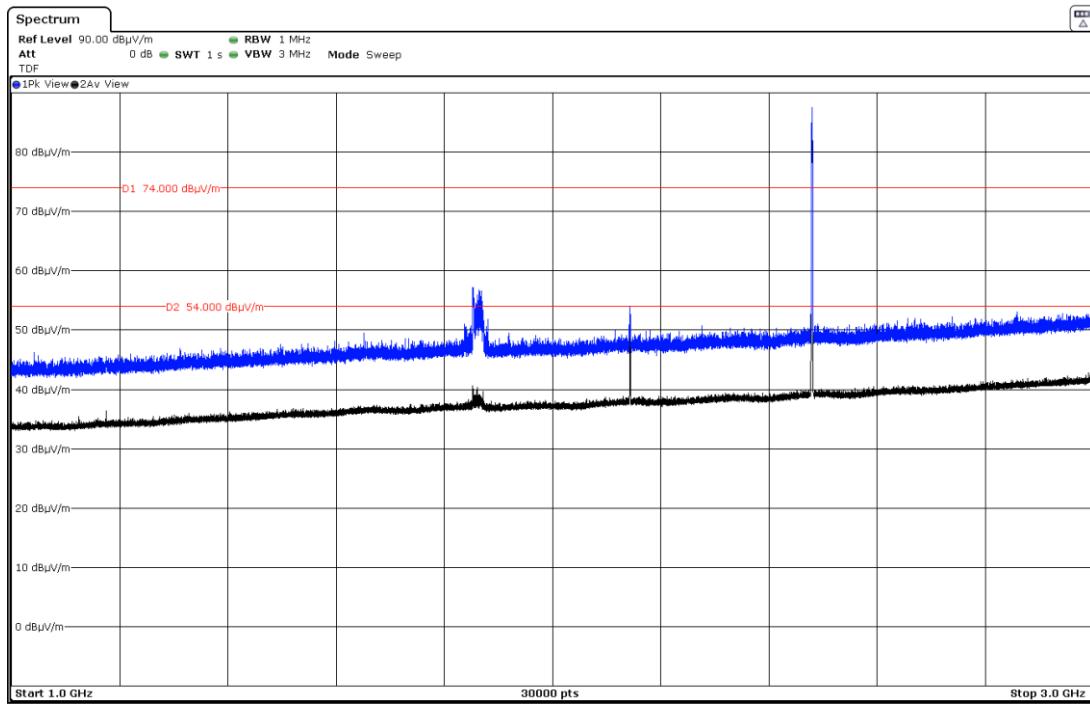
The peak above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz)



The peak above the limit is the carrier frequency.

CHANNEL: Highest (2480 MHz)

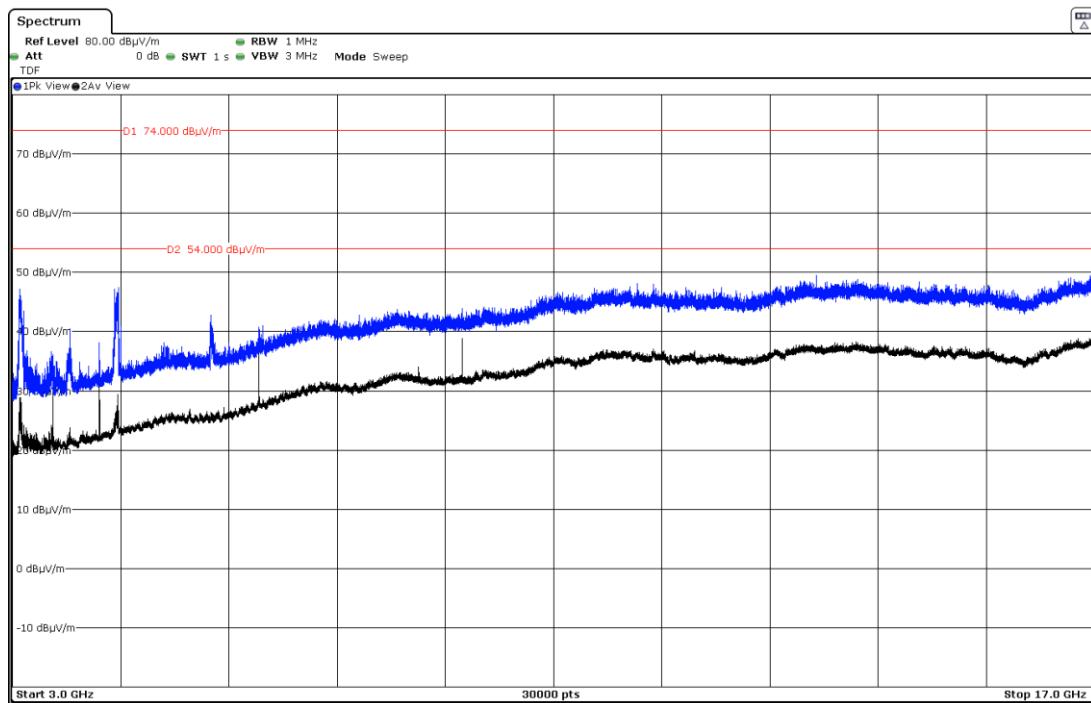


The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

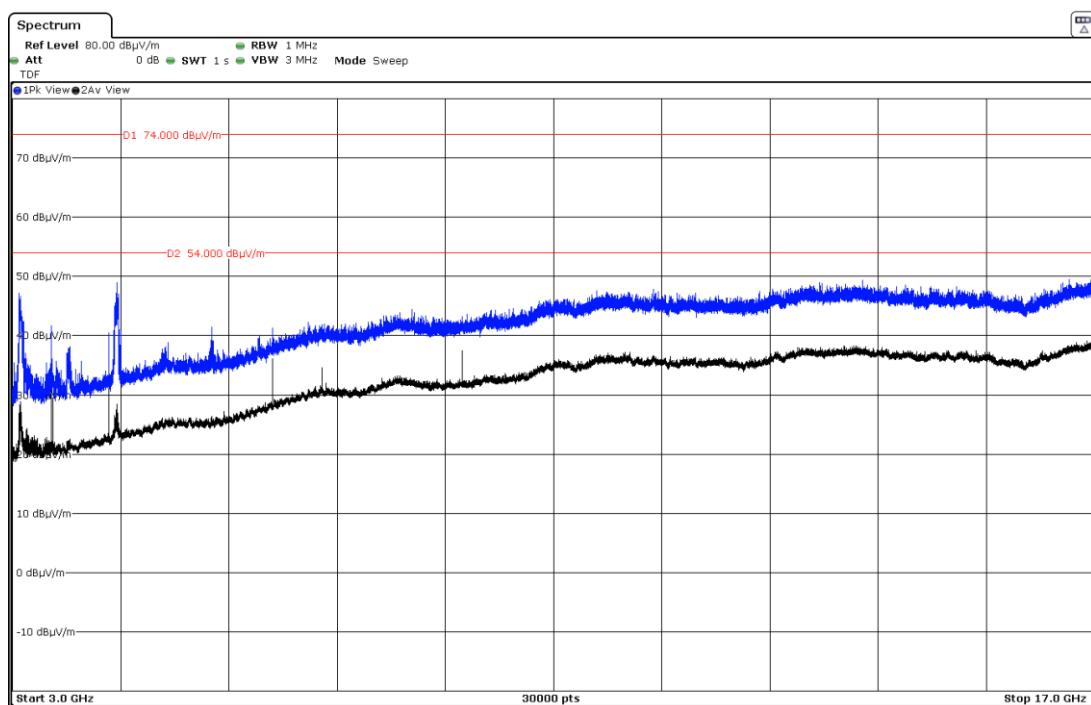
Modulation: GFSK (DH5)

CHANNEL: Lowest (2402 MHz)



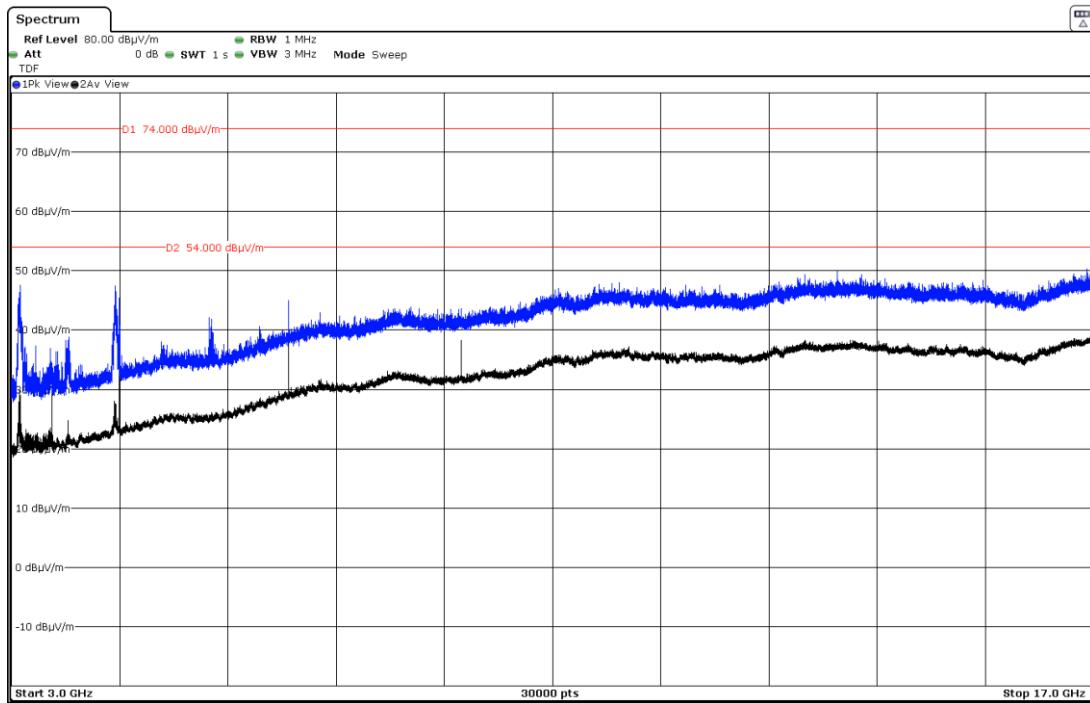
The peak above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz)



The peak above the limit is the carrier frequency.

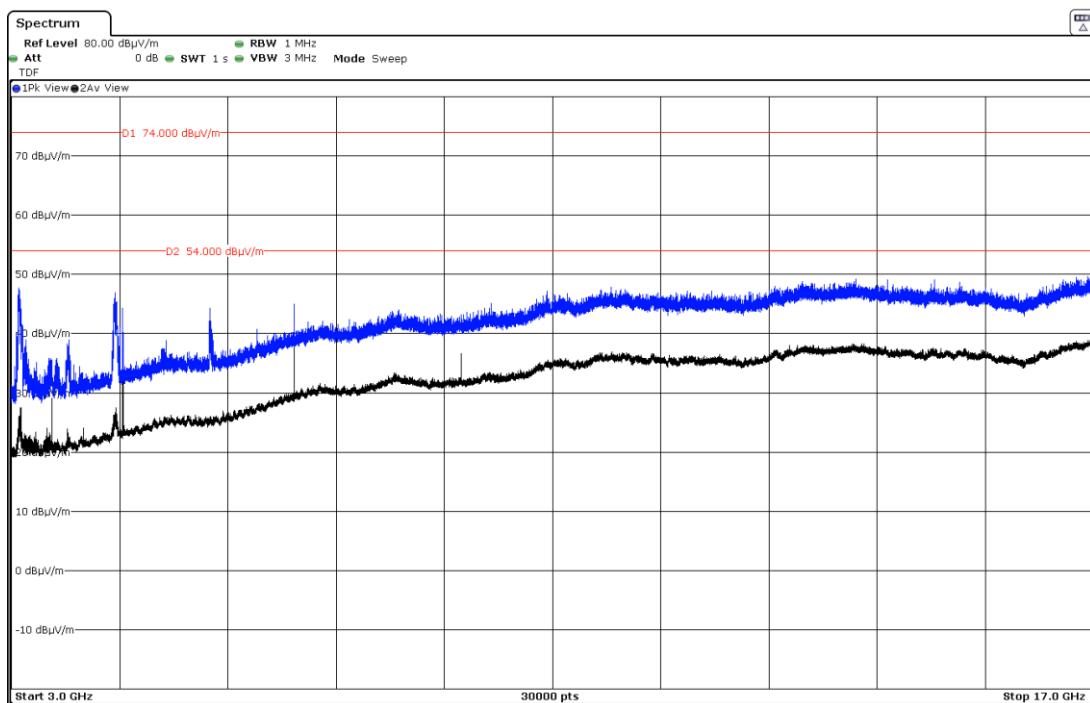
CHANNEL: Highest (2480 MHz)



The peak above the limit is the carrier frequency.

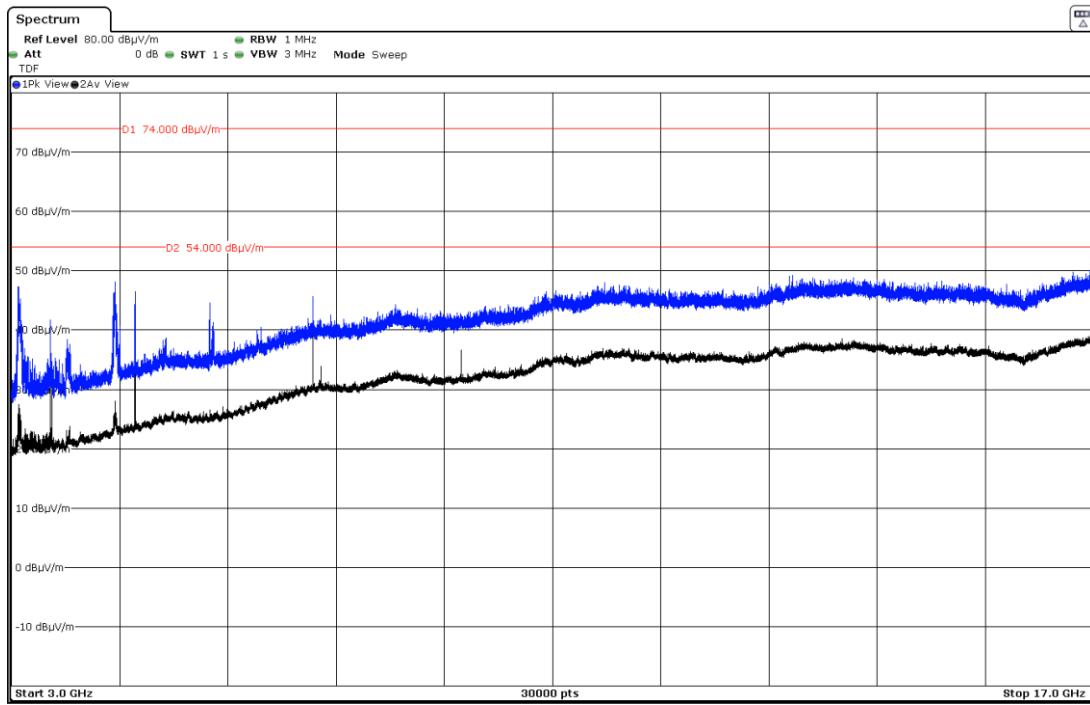
Modulation: Π/4-DQPSK (2DH5)

CHANNEL: Lowest (2402 MHz)



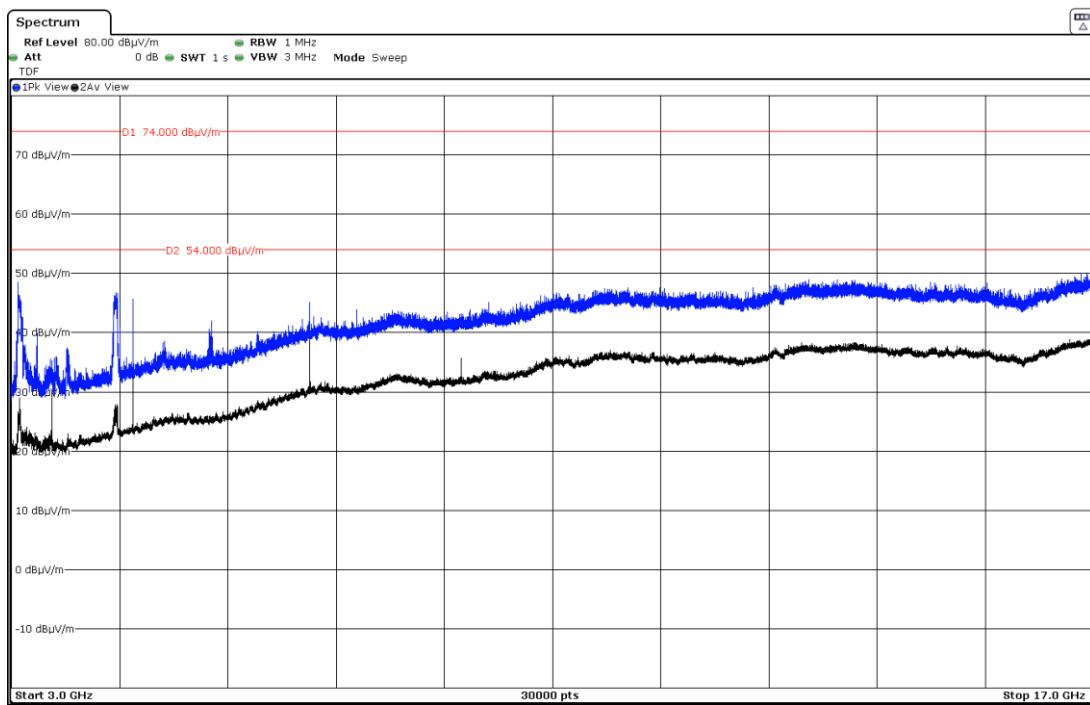
The peak above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz)



The peak above the limit is the carrier frequency.

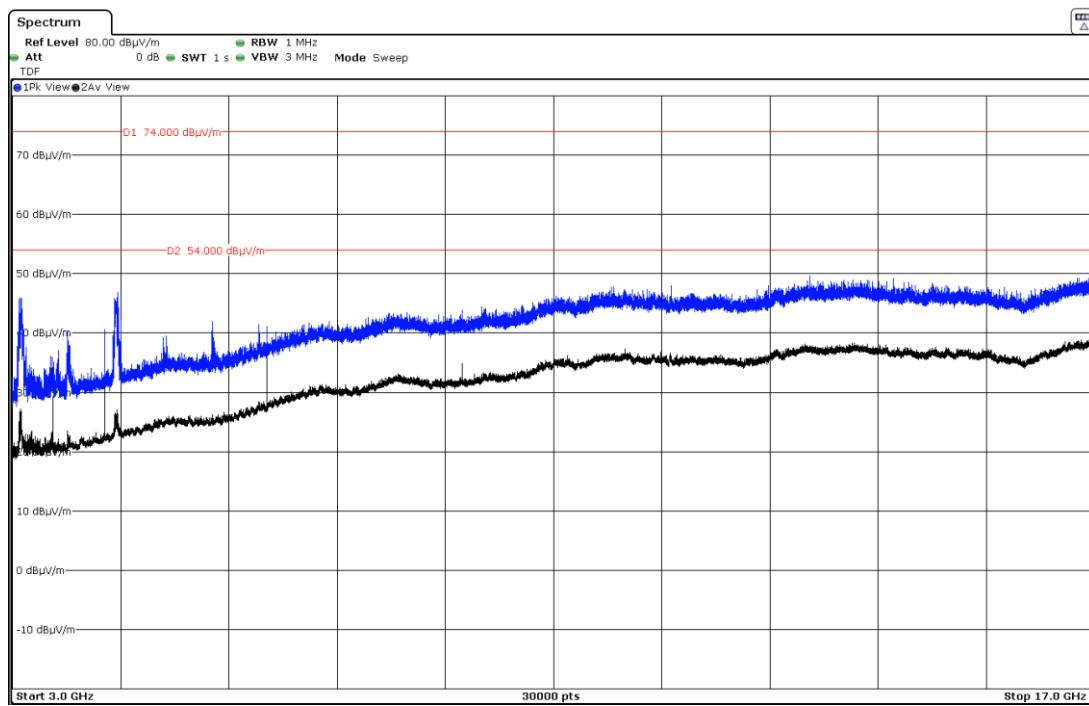
CHANNEL: Highest (2480 MHz)



The peak above the limit is the carrier frequency.

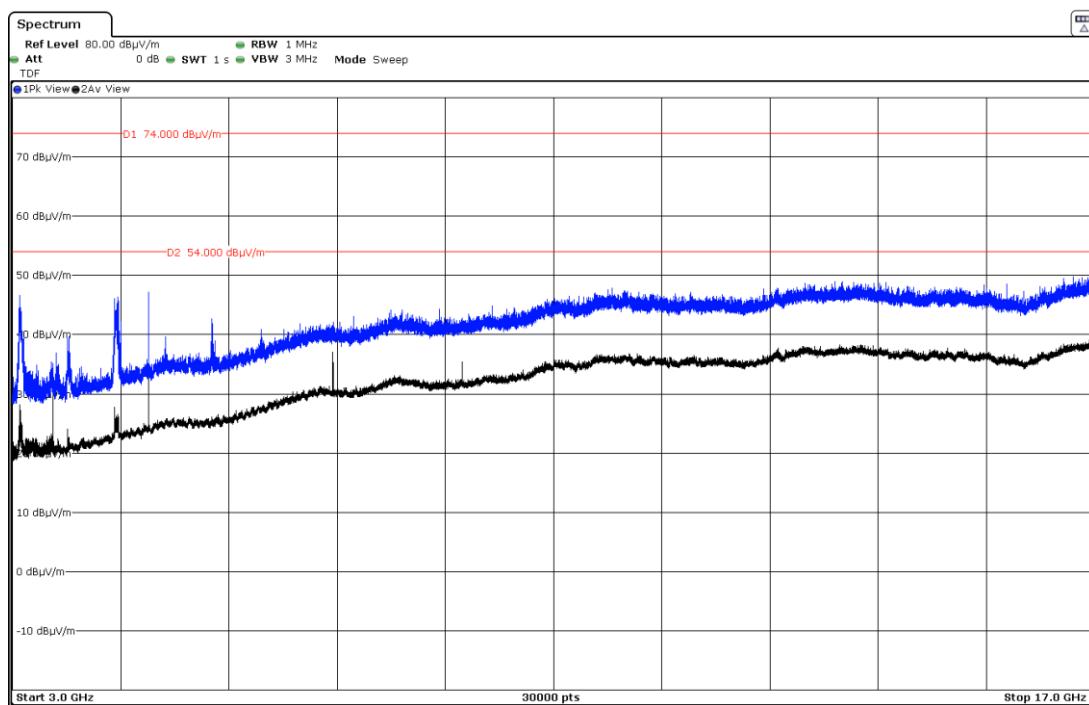
Modulation: 8-DPSK (3DH5)

CHANNEL: Lowest (2402 MHz)



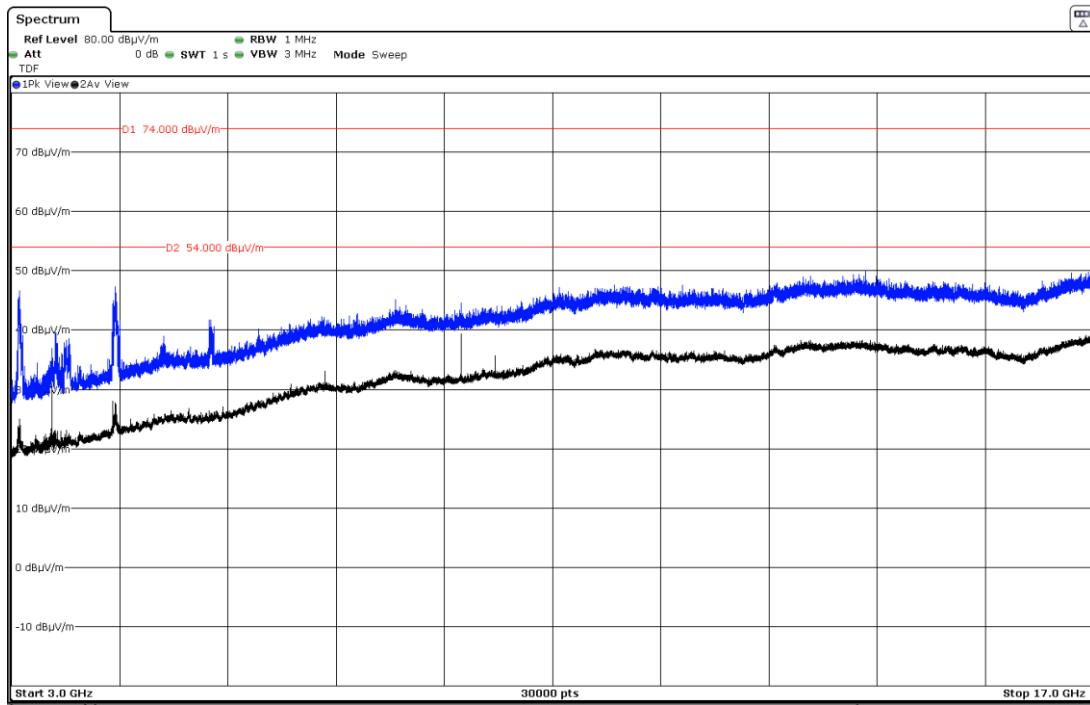
The peak above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz)



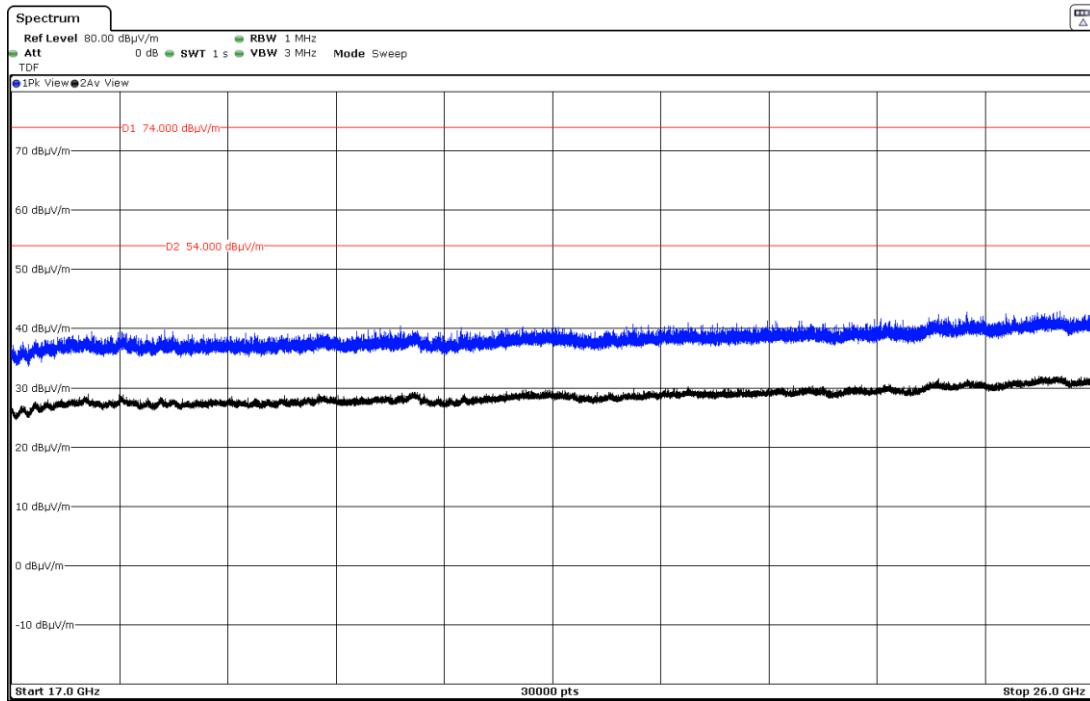
The peak above the limit is the carrier frequency.

CHANNEL: Highest (2480 MHz)



The peak above the limit is the carrier frequency.

FREQUENCY RANGE 17 - 26 GHz:

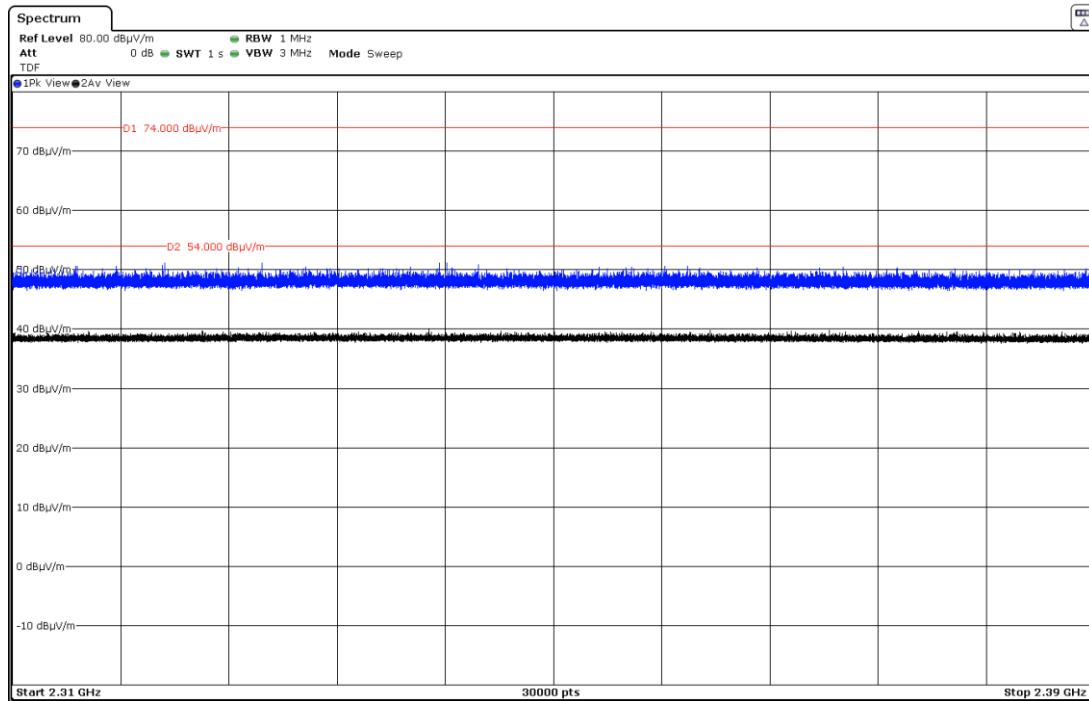


(This plot is valid for all three channels and all modulation modes).

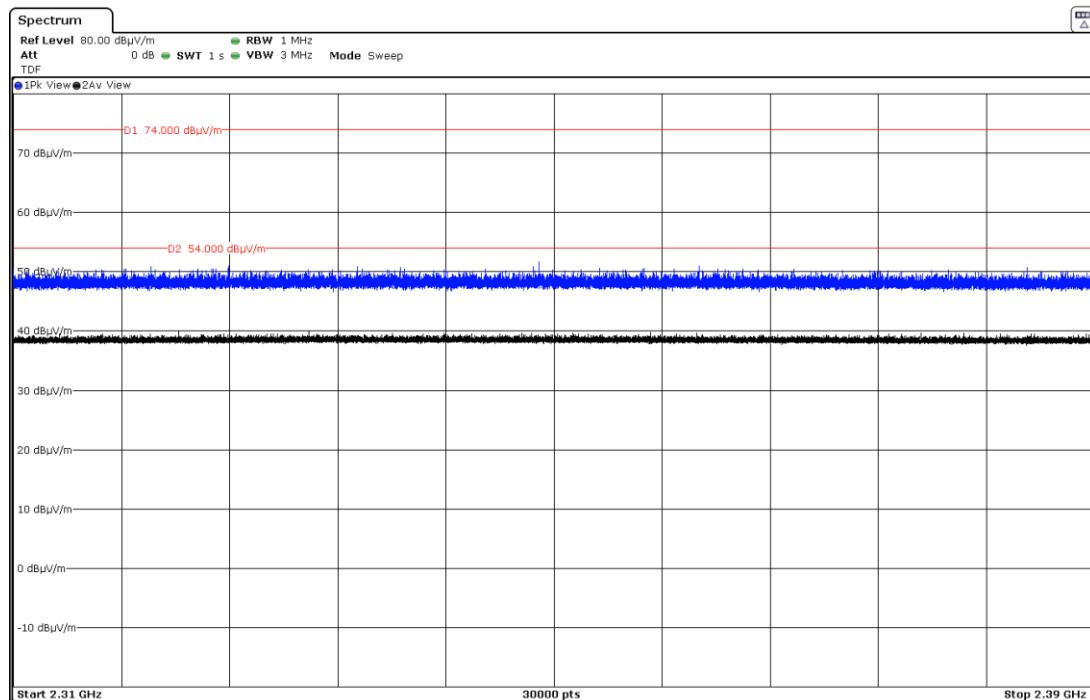
FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band 1):

CHANNEL: Lowest (2402 MHz)

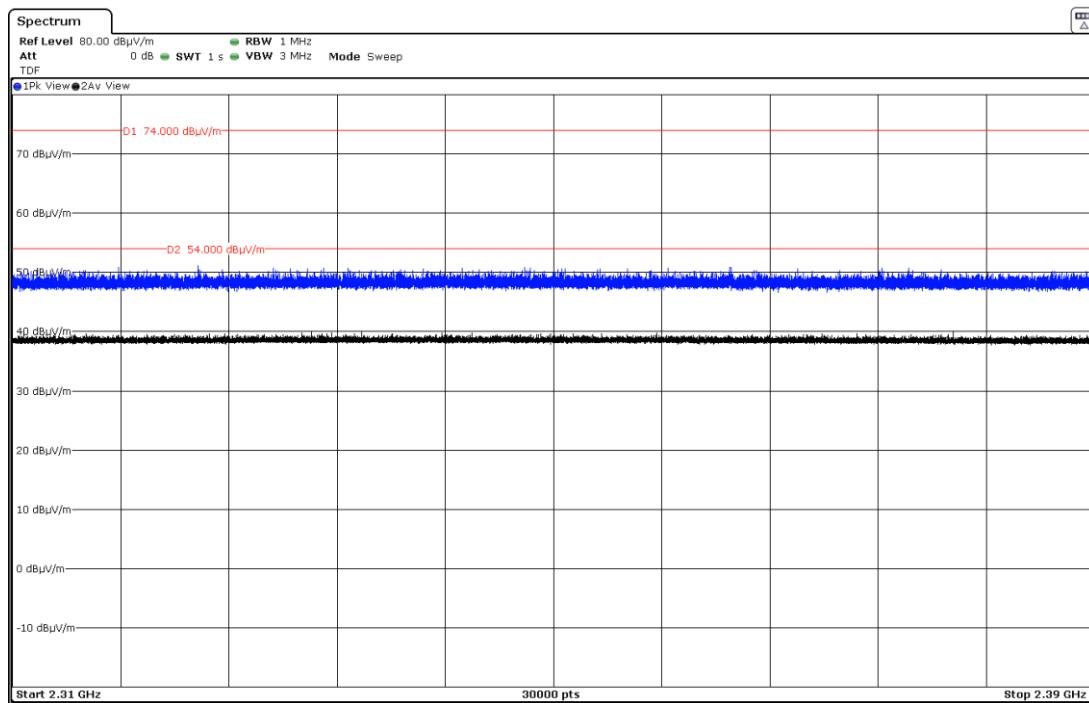
Modulation: GFSK (DH5)



Modulation: $\Pi/4$ -DQPSK (2DH5)



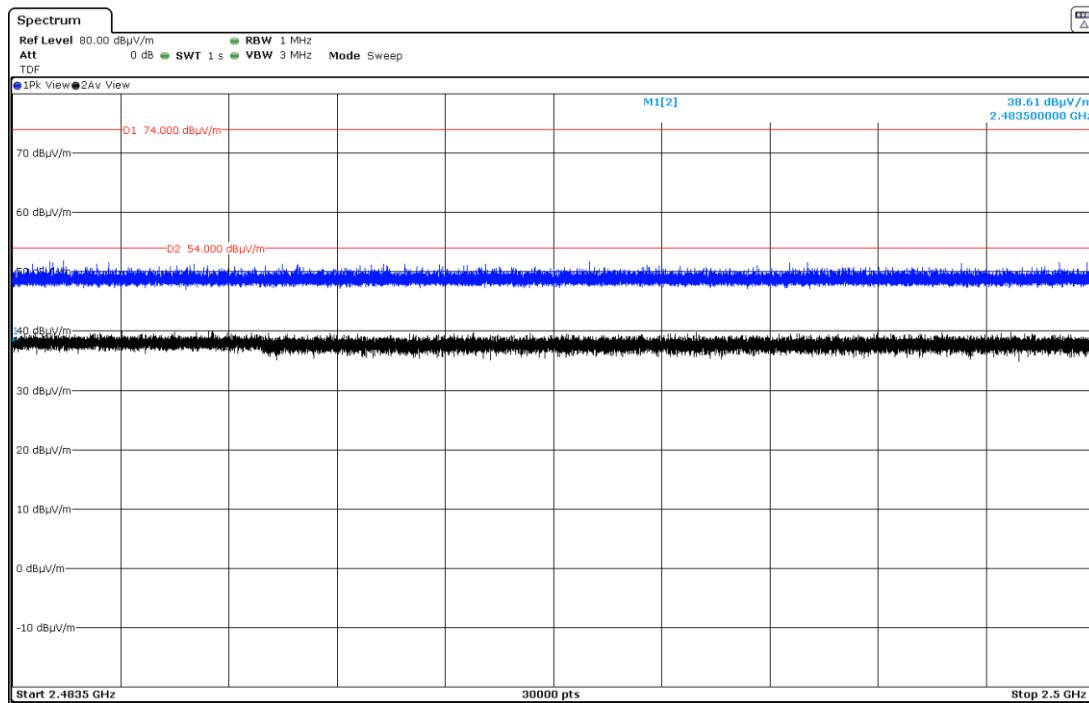
Modulation: 8-DPSK (3DH5)



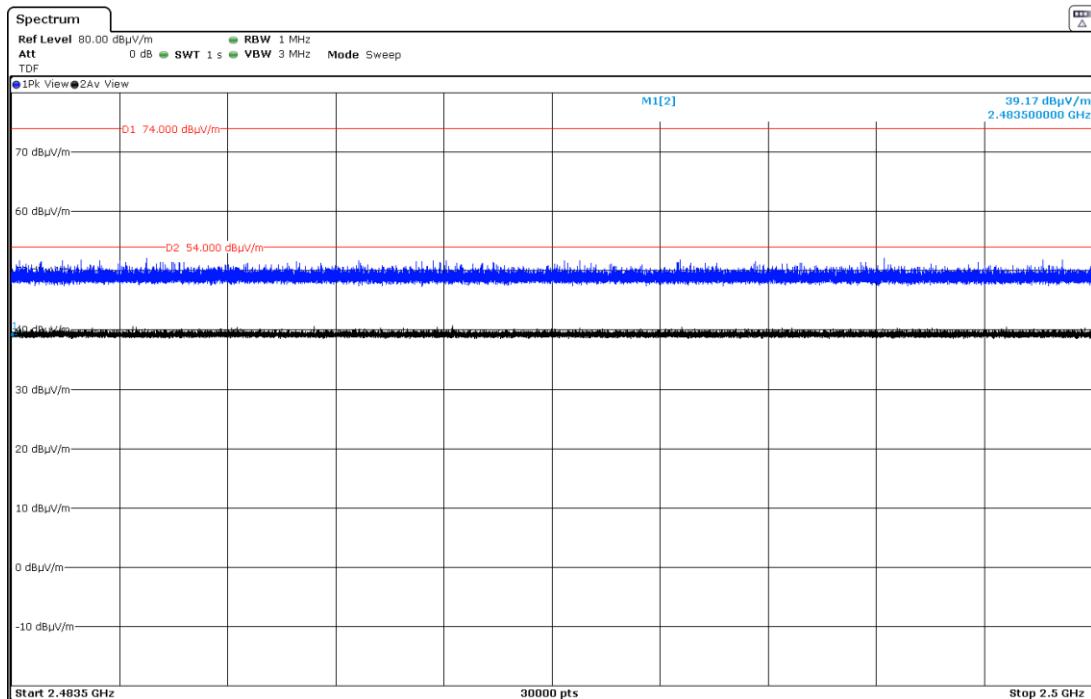
FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band 2):

CHANNEL: Highest (2480 MHz)

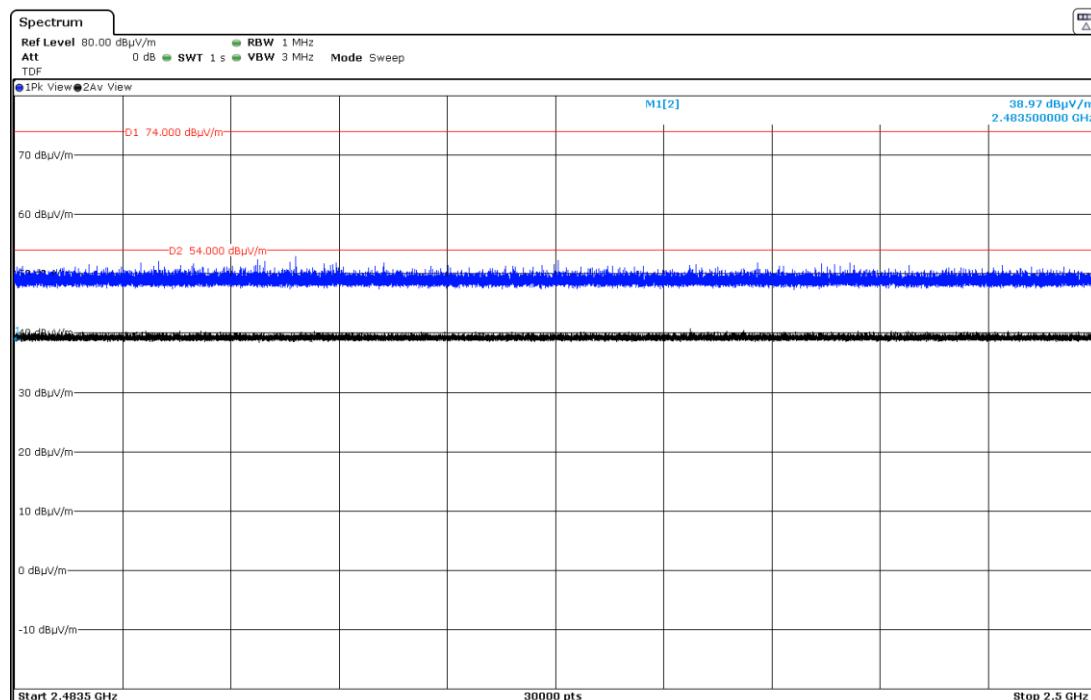
Modulation: GFSK (DH5)



Modulation: $\Pi/4$ -DQPSK (2DH5)



Modulation: 8-DPSK (3DH5)



Appendix B: Test results. . 802.11 b/n20

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TEST CONDITIONS

POWER SUPPLY (V):

V nonimal: 12 Vdc.

Type of Power Supply: External power supply (Battery).

Type of Antenna: Internal antenna.

Declared Gain for antenna RF (maximum): 0.4 dBi

TEST FREQUENCIES:

Low Channel: 2412 MHz

Middle Channel: 2437 MHz

High Channel: 2462 MHz

RADIATED MEASUREMENTS

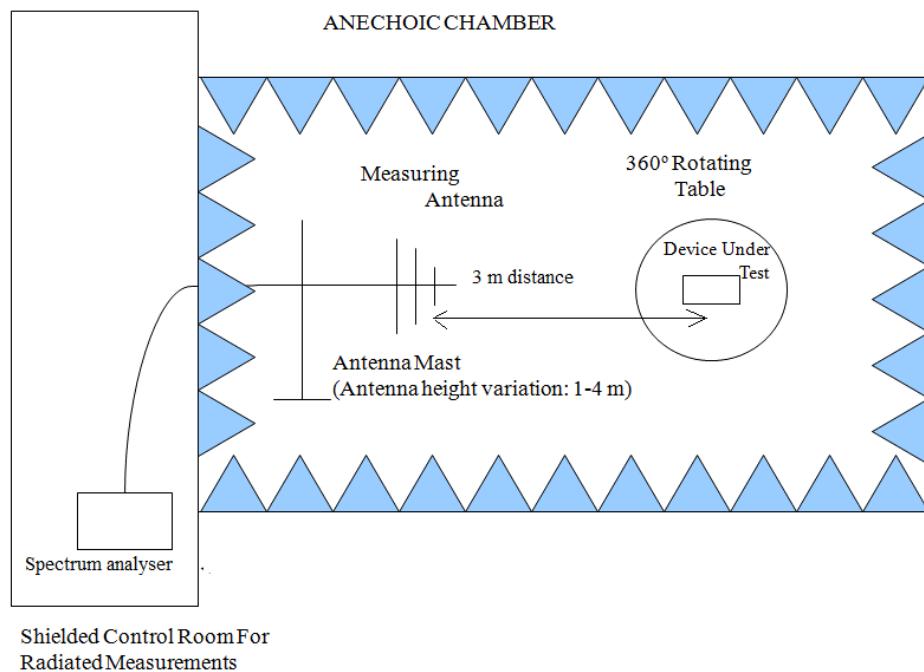
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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.

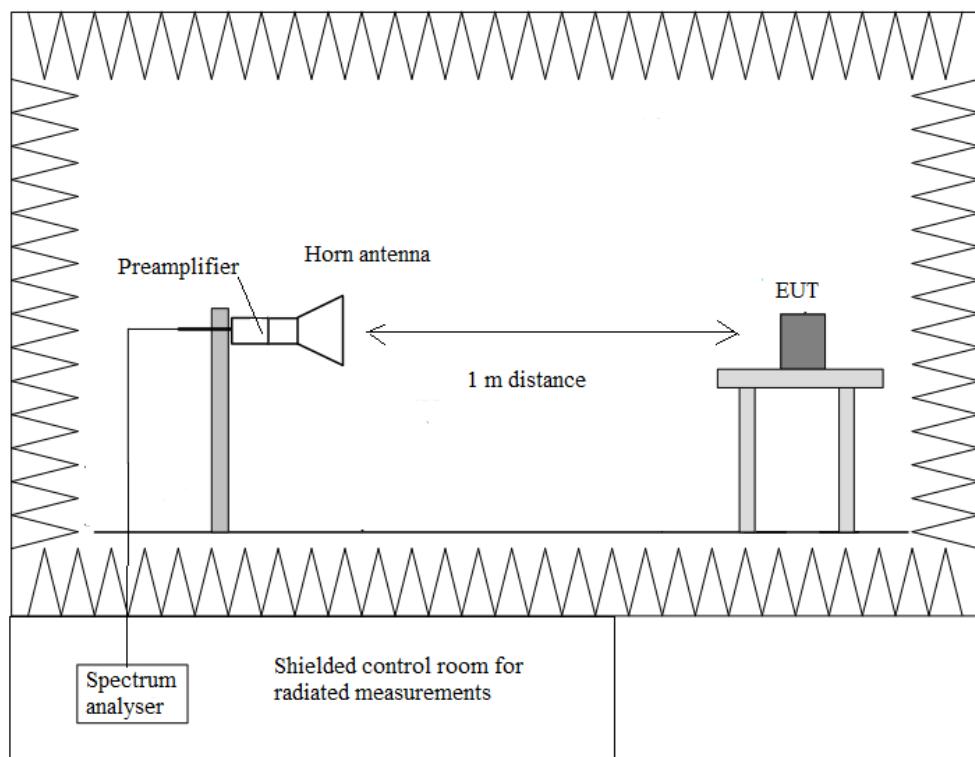
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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



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 Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 10000	500	54	3

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

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

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

RESULTS:

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

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

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

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

Preliminary tests determined the worst case with a bit rate of 1 Mbps (Wi-Fi mode b) and index MSC0 (Wi-Fi mode n20).

- Mode 802.11 b

Frequency range 30 MHz - 1 GHz:

The spurious frequencies do not depend on the operating channel.

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
188.838	Quasi peak	23.7	H	<± 3.88
332.883	Quasi peak	36.7	H	<± 3.88
620.940	Quasi peak	36.5	V	<± 3.88
624.303	Quasi peak	34.6	V	<± 3.88
725.021	Quasi peak	34.2	V	<± 3.88

Frequency range 1 - 26 GHz:

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

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

- LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
2.38483	Peak	53.64	V	<± 3.70
3.10710	Peak	49.25	V	<± 3.70
4.35450	Peak	47.68	V	<± 3.70
6.07650	Peak	41.62	V	<± 3.70
7.23617	Peak	47.23	H	<± 3.70
8.81910	Peak	44.28	H	<± 3.70

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.85350	Peak	54.71	H	<± 3.70
	Average	38.91		<± 3.70
3.11970	Peak	47.11	H	<± 3.70
4.40957	Peak	47.45	H	<± 3.70
6.07650	Peak	41.67	V	<± 3.70
7.31177	Peak	46.90	H	<± 3.70
8.81910	Peak	44.31	H	<± 3.70

- HIGH CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
2.02537	Peak	56.31	V	<± 3.70
	Average	53.66		<± 3.70
3.10103	Peak	48.14	V	<± 3.70
4.36523	Peak	46.20	V	<± 3.70
4.40957	Peak	46.38	H	<± 3.70
7.38783	Peak	46.21	H	<± 3.70
8.81910	Peak	44.86	H	<± 3.70

Verdict: PASS

- Mode 802.11 n20

Frequency range 30 MHz - 1 GHz:

The spurious frequencies do not depend on the operating channel.

Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
622.040	Quasi peak	36.8	V	<± 3.88
725.021	Quasi peak	34.1	V	<± 3.88

Frequency range 1 - 26 GHz:

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

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

- LOW CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86550	Peak	56.95	V	<± 3.70
	Average	39.02		<± 3.70
2.38993	Peak	53.55	H	<± 3.70
3.09777	Peak	46.96	V	<± 3.70
4.35450	Peak	47.18	V	<± 3.70
8.81910	Peak	44.32	H	<± 3.70

- MIDDLE CHANNEL. Spurious frequencies closest to the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86070	Peak	56.13	V	<± 3.70
	Average	39.71		<± 3.70
3.10757	Peak	47.55	V	<± 3.70
4.33723	Peak	46.88	H	<± 3.70
4.35497	Peak	46.69	V	<± 3.70
8.81910	Peak	44.47	H	<± 3.70

- HIGH CHANNEL. Spurious frequencies closest to the limit:

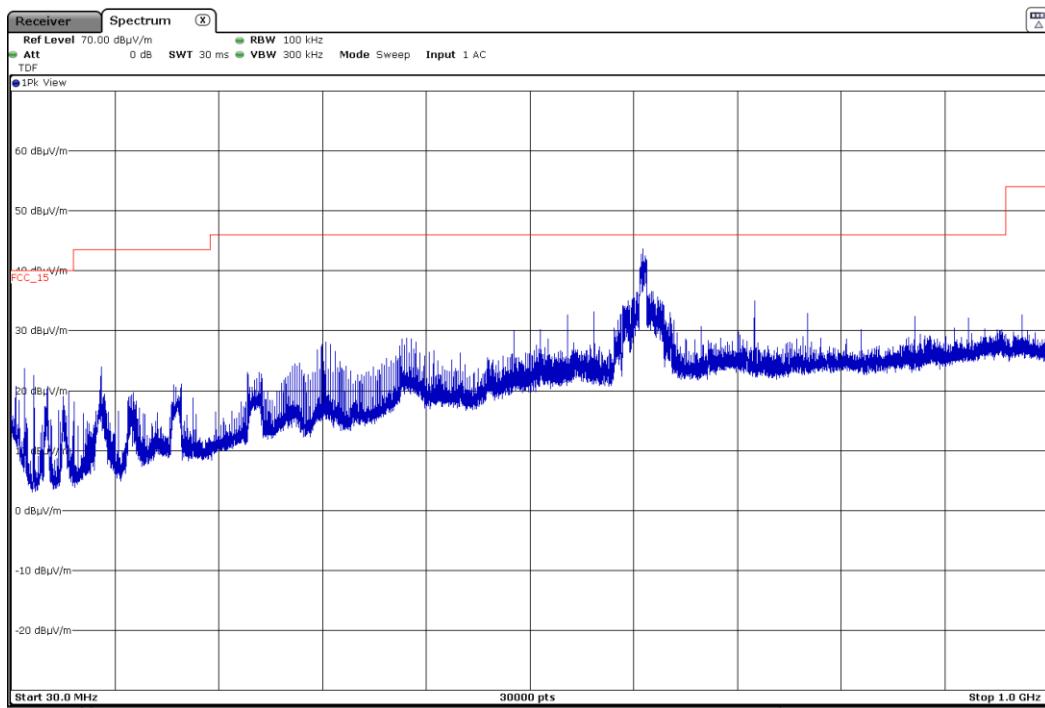
Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
1.86057	Peak	56.48	H	<± 3.70
	Average	39.00		<± 3.70
2.48390	Peak	58.32	V	<± 3.70
	Average	41.90		
3.11363	Peak	47.23	V	<± 3.70
4.33863	Peak	47.06	H	<± 3.70
8.81810	Peak	45.06	H	<± 3.70

Verdict: PASS

- **Mode 802.11 b.**

FREQUENCY RANGE 30 MHz - 1 GHz:

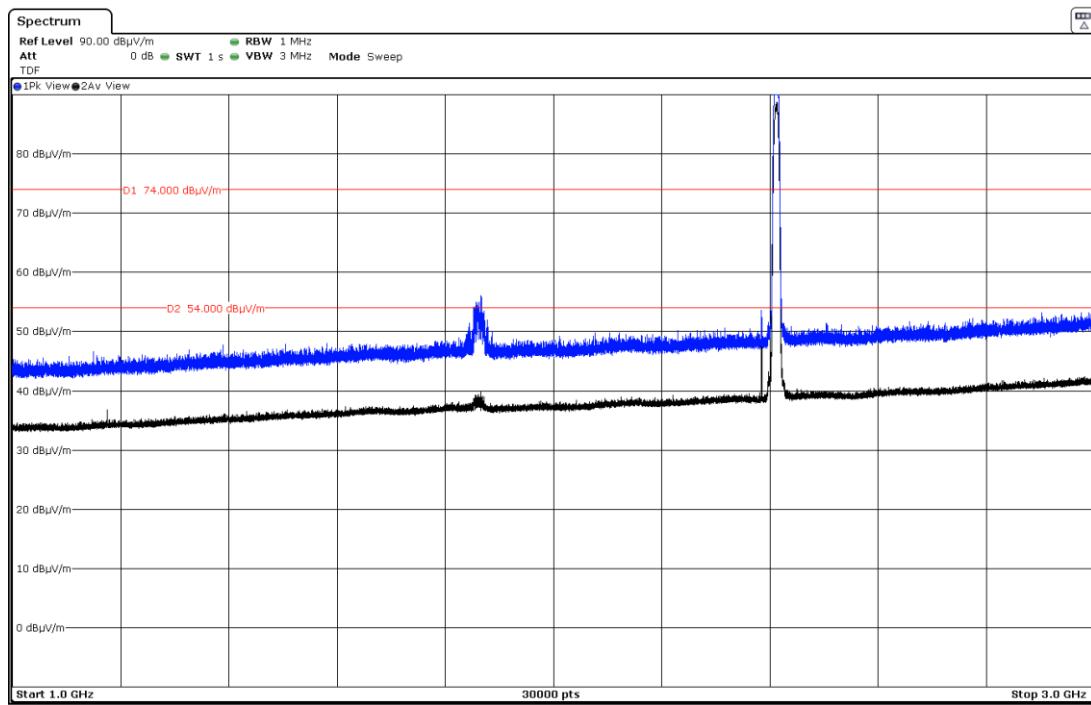
The spurious signals detected do not depend on the operating channel.



Note: This plot is valid for all three channels.

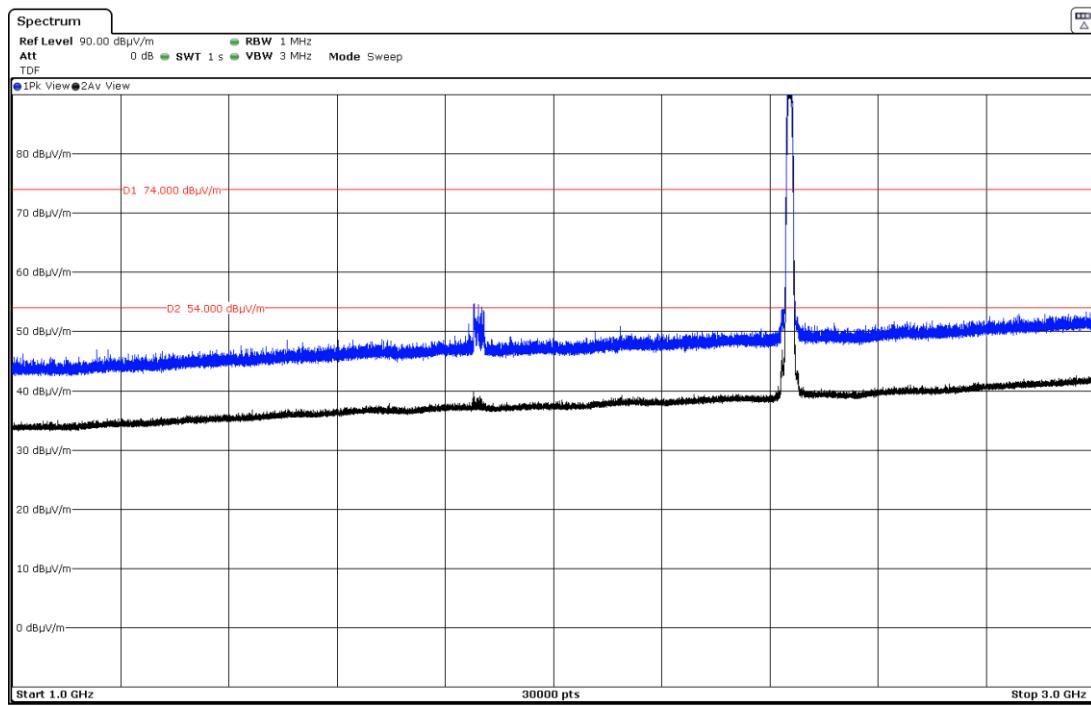
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



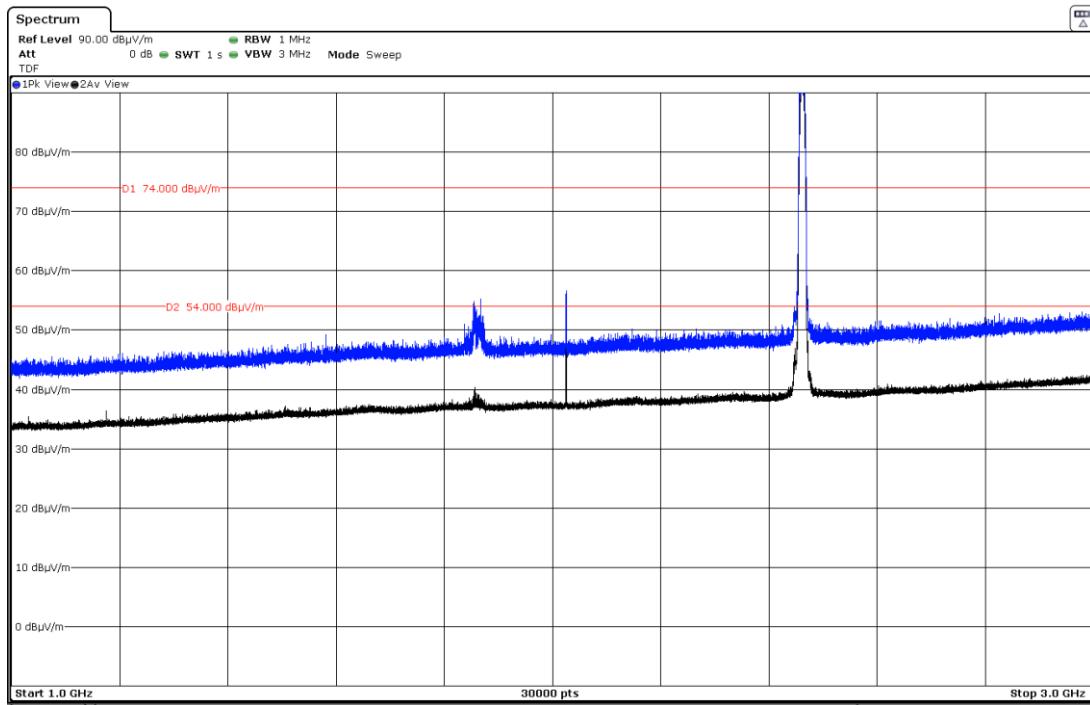
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

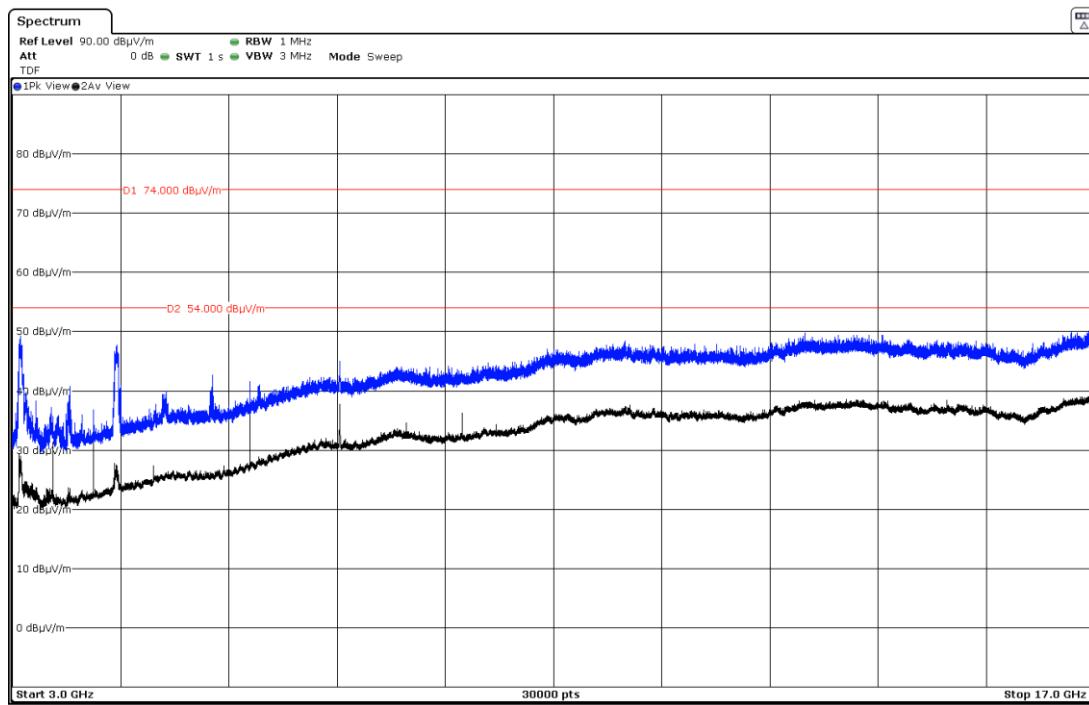
- High Channel:



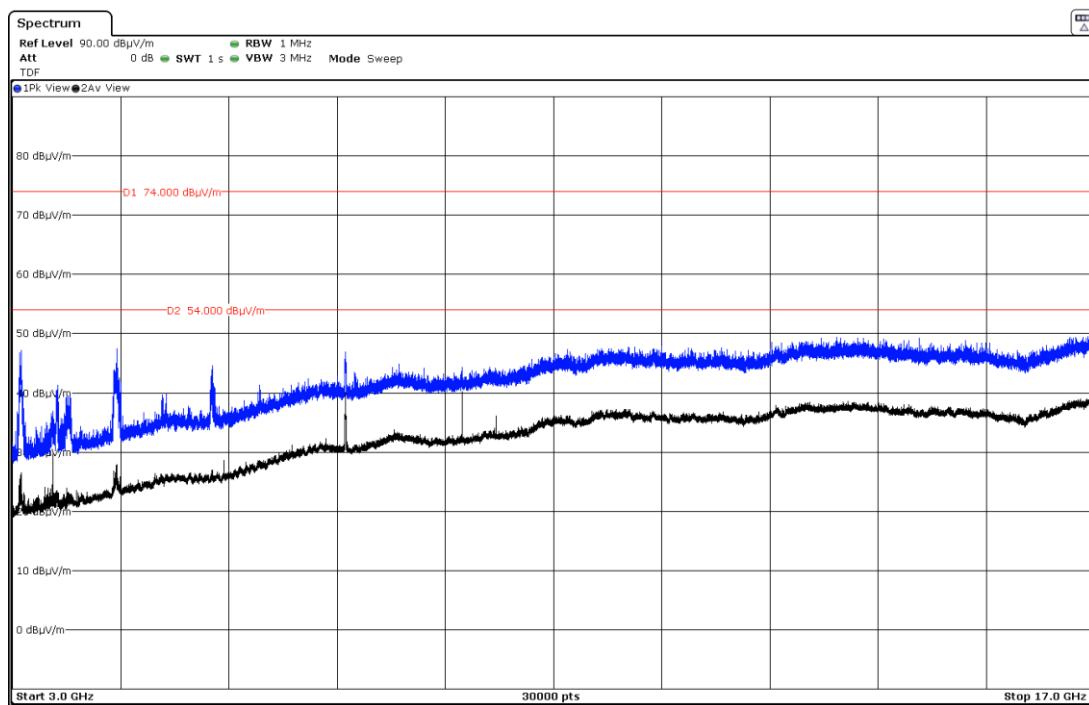
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

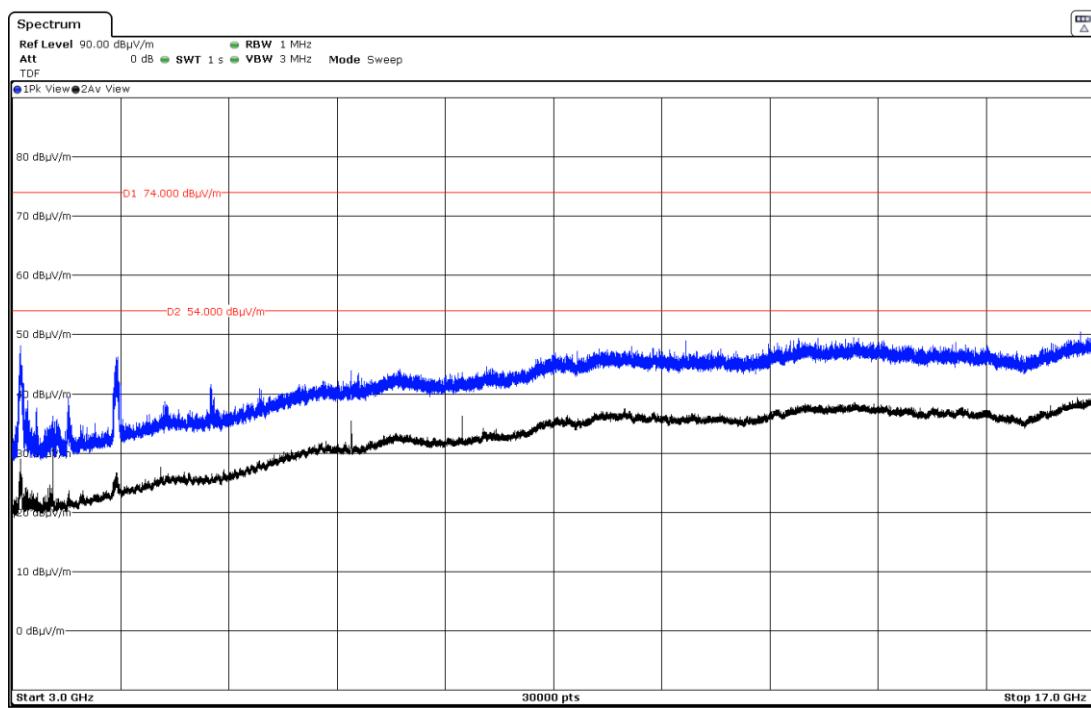
- Low Channel:



- Middle Channel:

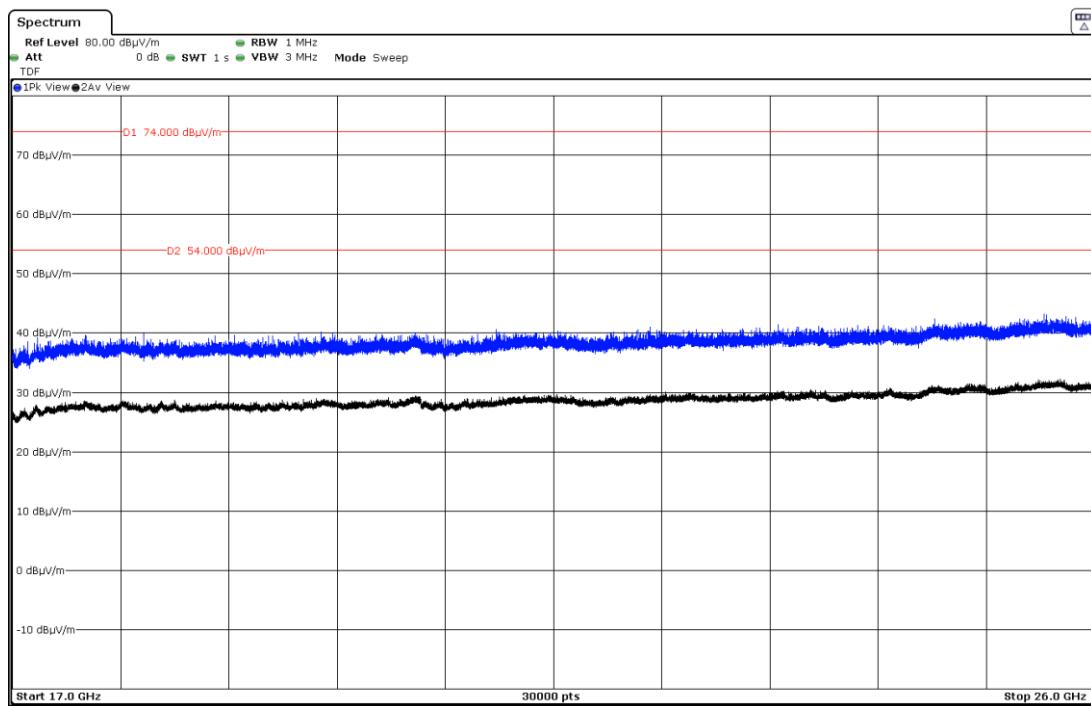


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

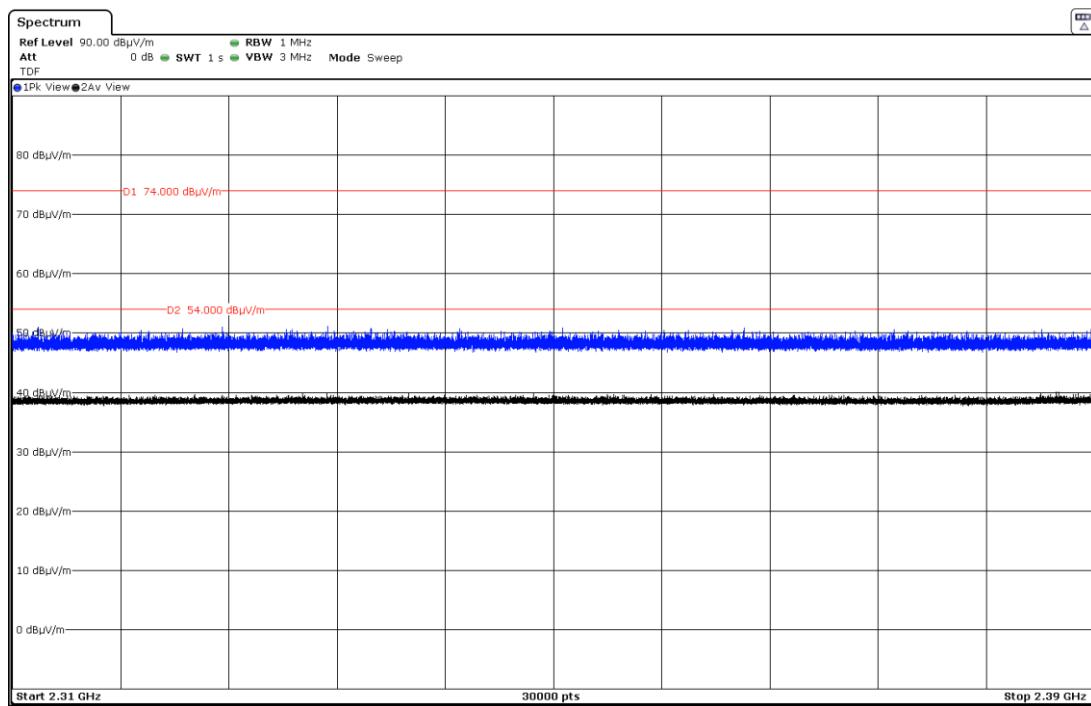
The spurious signals detected do not depend on the operating channel.



Note: This plot is valid for all three channels.

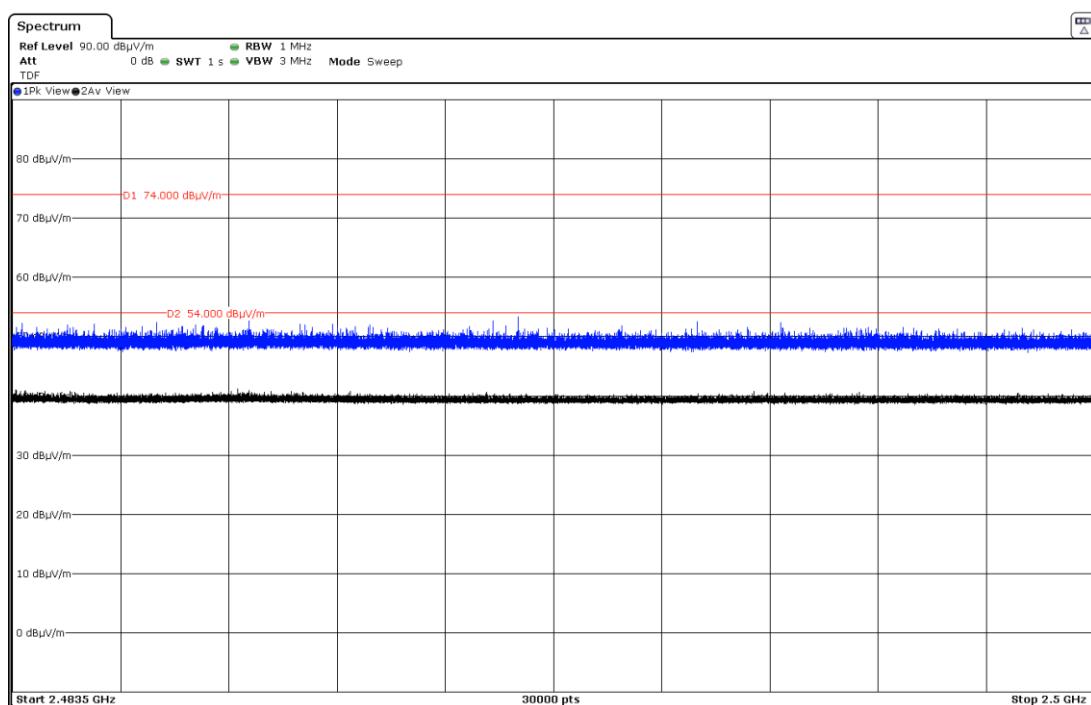
FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band 1):

- Low Channel. CH 1:



FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band 2):

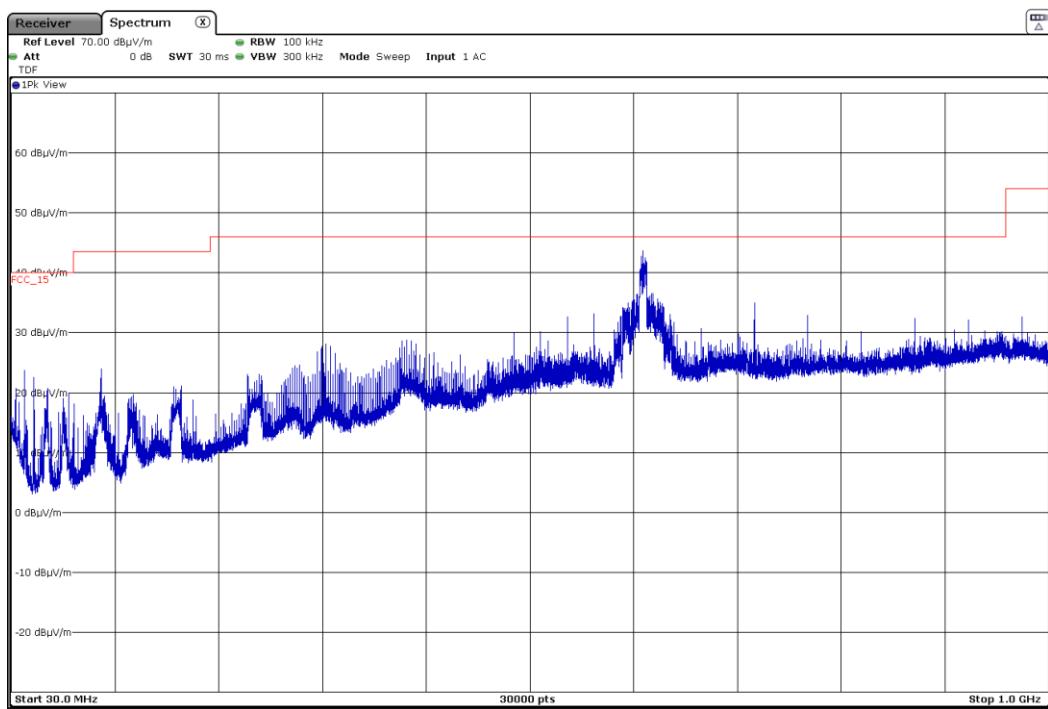
- High Channel. CH 11:



- Mode 802.11 n20

FREQUENCY RANGE 30 MHz - 1 GHz:

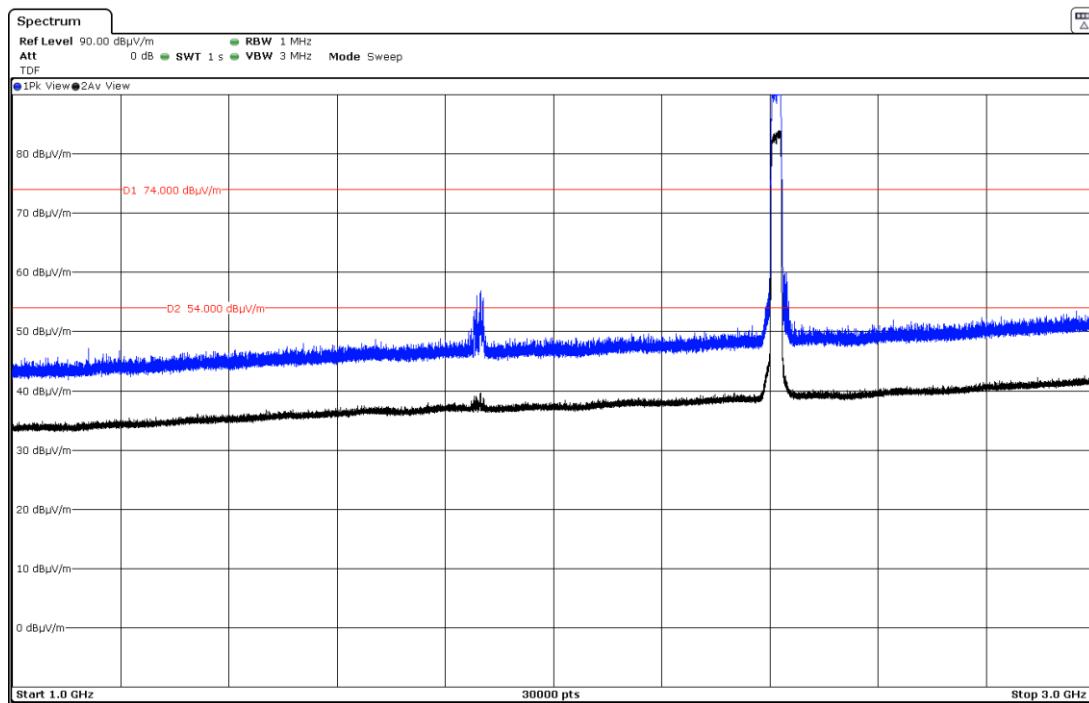
The spurious signals detected do not depend on the operating channel.



Note: This plot is valid for all three channels.

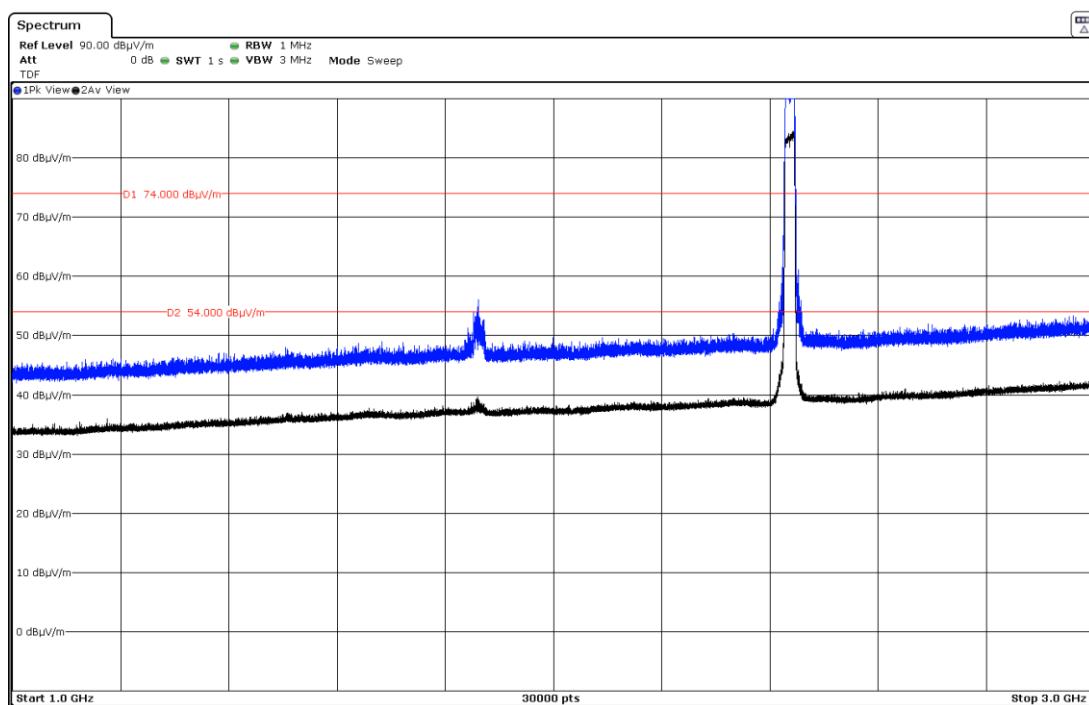
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



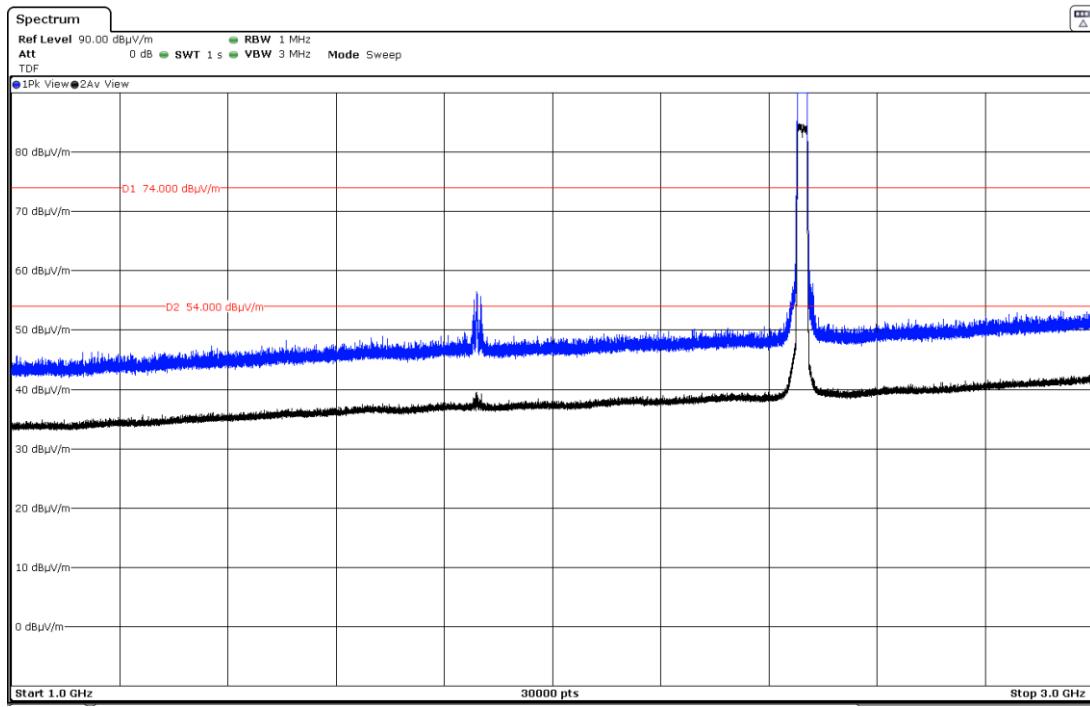
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

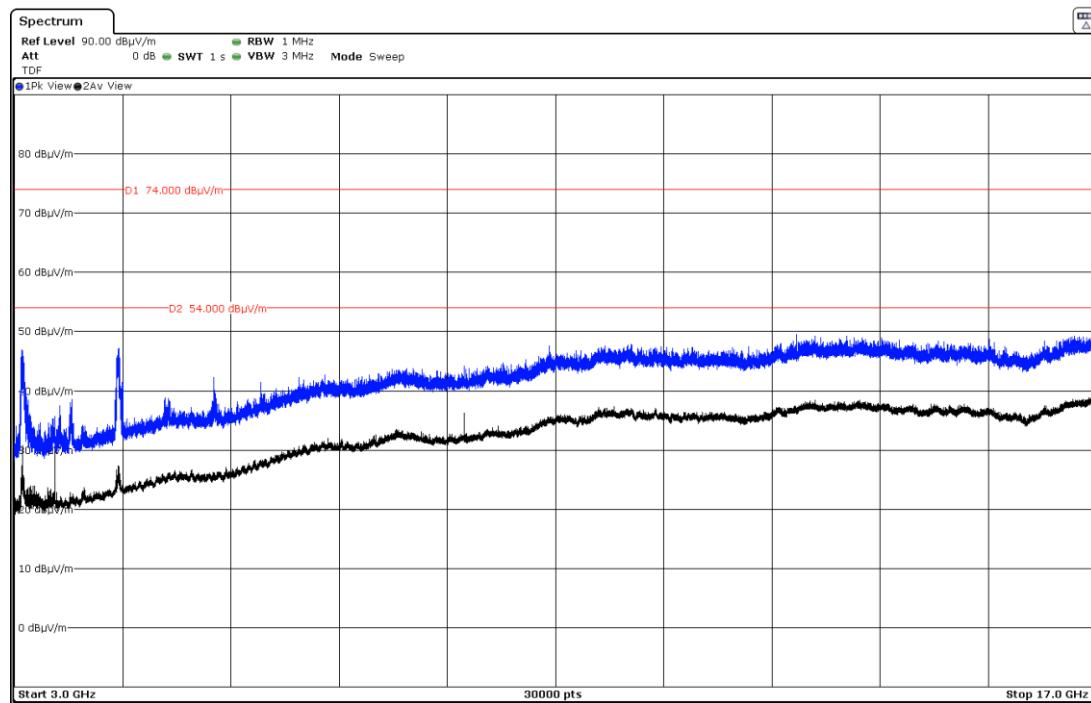
- High Channel:



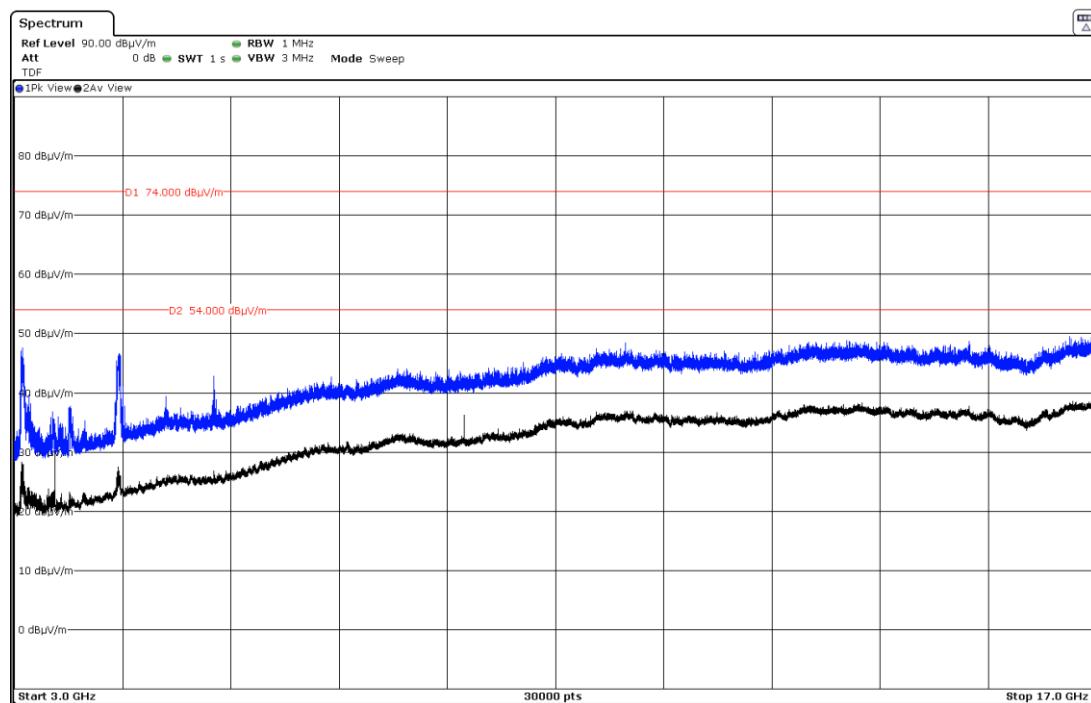
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

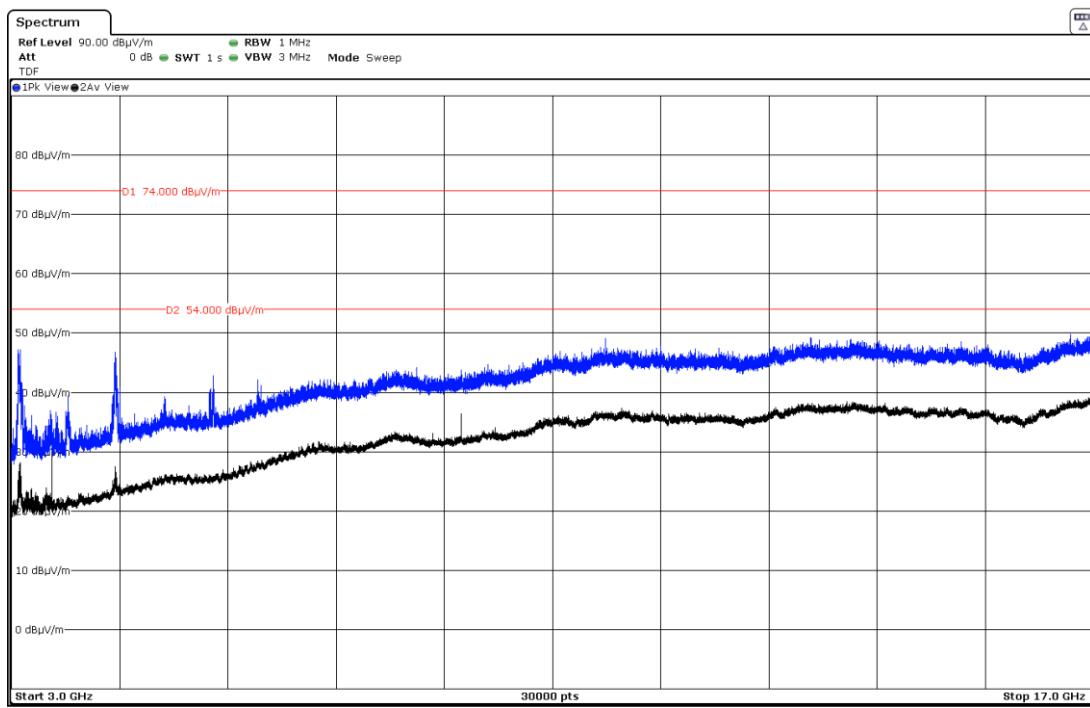
- Low Channel:



- Middle Channel:

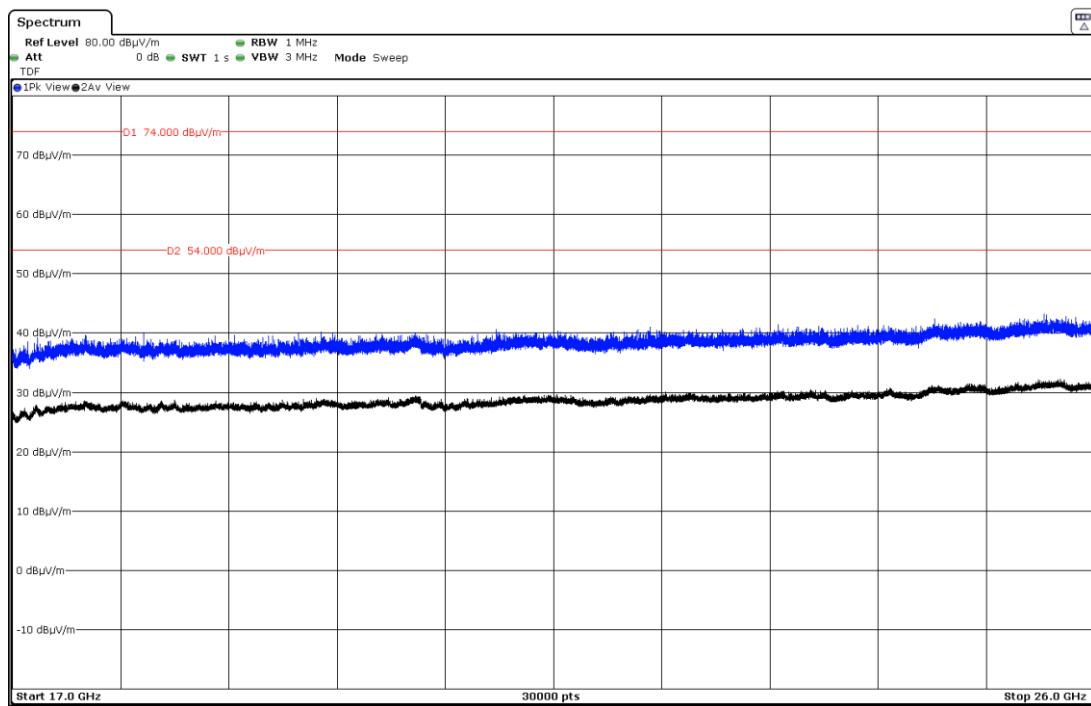


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

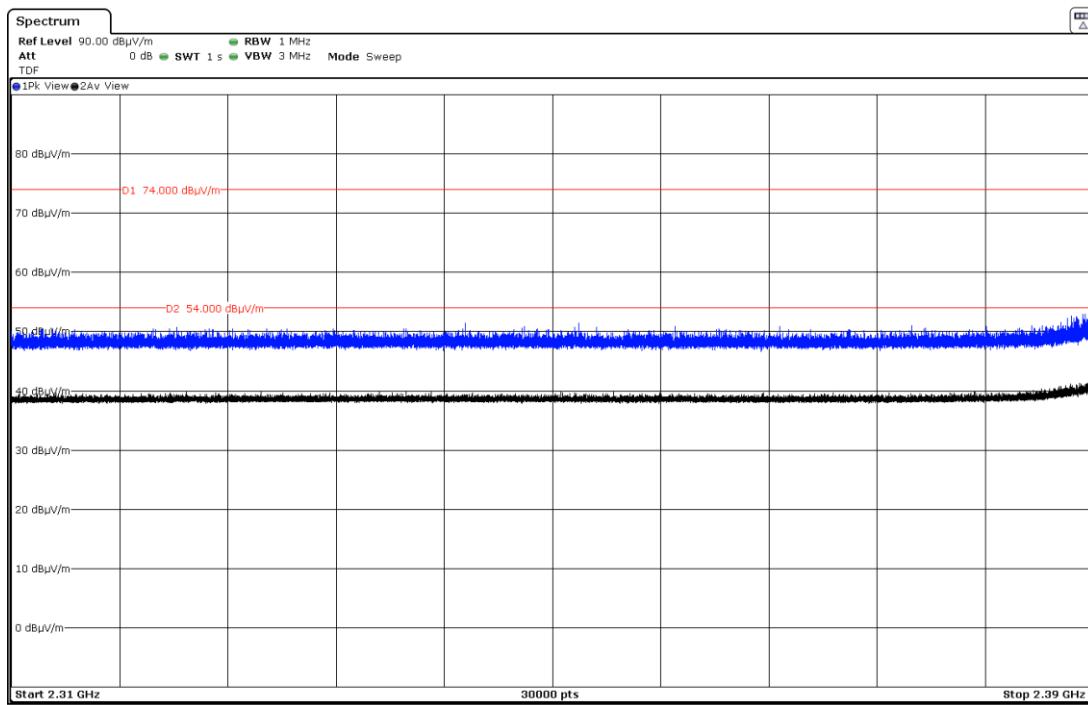
The spurious signals detected do not depend on the operating channel.



Note: This plot is valid for all three channels.

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

- Low Channel. CH 1:



FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band 2):

- High Channel. CH 11:

