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

Nº 51/LE147

Test report No:
NIE: 59212RRF.005

Partial Test report

USA FCC Part 15.249, 15.209
CANADA RSS-210, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.

(*) Identification of item tested	Hearing Aid
(*) Trademark	Phonak
(*) Model and /or type reference tested	Naida M90-SP
Other identification of the product	HW version: 050-0579 SW version: 067-1322 FCC ID: KWC-BSP IC: 2262A-BSP
(*) Features	BT Classic, BLE, DM and Flora.
Applicant	SONOVA USA INC. 4520 Weaver Parkway, 60555 Warrenville, IL, USA
Test method requested, standard	USA FCC Part 15.249 10-1-17 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, 5725 - 5875 MHz, and 24.0 – 24.25 GHz. USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. CANADA RSS-210 Issue 9 (August 2016). CANADA RSS-Gen Issue 5 (April 2018). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices. - Section 15.249 Subclause (a) / RSS-210 B.10 (a). Field strength of Fundamental and harmonic emissions. - Section 15.249 Subclause (a) and (d) / RSS-210 B.10 (b). Emissions radiated outside of the specific frequency bands (Transmitter).
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager RAFAEL LÓPEZ MARTÍN 2019.10.11 12:27:04 +02'00'
Date of issue	2019-10-11
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

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

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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.

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

General Conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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.
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Uncertainty

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample consists of a Hearing aid with wireless connectivity and rechargeable battery.
3. According the manufacturer, the Phonak Naída M90-SP was evaluated as representative sample of the 10 variants with this electronic module. This device is also representative of the devices Phonak Naída M70-SP, Phonak Naída M50-SP, Phonak Naída M30-SP, Phonak Naída M-SP Trial, Phonak Sky M90-SP, Phonak Sky M70-SP, Phonak Sky M50-SP, Phonak Sky M30-SP, Phonak Sky M-SP Trial, which are all variants with the identical hardware.

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	Reception
59212D/041	Hearing Aid	Naida M90-SP	WI50H3XH8	2019/08/02

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

Test sample description

<table>
<tr><td rowspan="4">Ports…… :</td><td rowspan="2">Port name and description</td><td colspan="4">Cable</td></tr>
<tr><td>Specified max length [m]</td><td>Attached during test</td><td>Shielded</td><td>Coupled to patient(3)</td></tr>
<tr><td>N/A</td><td></td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td></td><td></td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>Supplementary information to the ports…… :</td><td colspan="5"></td></tr>
<tr><td rowspan="3">Rated power supply ……:</td><td colspan="2" rowspan="2">Voltage and Frequency</td><td colspan="3">Reference poles</td></tr>
<tr><td>L1</td><td>L2</td><td>L3</td><td>N</td><td>PE</td></tr>
<tr><td>☐</td><td>AC:</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>☒</td><td colspan="5">DC:
Naida M90-SP
Vnom : 1.45V Zinc Air Battery</td></tr>
<tr><td>Rated Power ……:</td><td colspan="5"></td></tr>
<tr><td>Clock frequencies ……:</td><td colspan="5"></td></tr>
<tr><td>Other parameters……:</td><td colspan="5"></td></tr>
<tr><td>Software version ……:</td><td colspan="5">067-1322</td></tr>
<tr><td>Hardware version……:</td><td colspan="5">050-0579</td></tr>
<tr><td>Dimensions in cm (W x H x D)….:</td><td colspan="5"></td></tr>
<tr><td rowspan="3">Mounting position……:</td><td>☐</td><td colspan="4">Table top equipment</td></tr>
<tr><td>☐</td><td colspan="4">Wall/Ceiling mounted equipment</td></tr>
<tr><td>☐</td><td colspan="4">Floor standing equipment</td></tr>
</table>

	☐	Hand-held equipment		
	☒	Other: Hearing Aid		
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

SONOVA AG
Laubisruetistrasse 28, 8712 Staefa, Switzerland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-08-22
Date (finish)	2019-08-29

Document history

Report number	Date	Description
59212RRF.005	2019-10-11	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 %

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: Miguel Ángel Torres and Ignacio Cabra.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	BiconicalLog antenna ETS LINDGREN 3142E	2017/09	2020/09
4.	RF Pre-amplifier 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
6.	RF Pre-amplifier, 30 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	Broadband Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
8.	RF Pre-amplifier 30 dB, 18 GHz-40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
9.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2018/07	2021/07

Testing verdicts

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

Summary

1. Bluetooth Low Energy

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		**Verdict**	**Remark**
Section 15.249 Subclause (a) / RSS-210 B.10. (a)	Field strength of fundamental and harmonic emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10. (b)	Emissions radiated outside of the specific frequency bands	P	
Supplementary information and remarks: None.			

2. Bluetooth Basic Rate

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		**Verdict**	**Remark**
Section 15.249 Subclause (a) / RSS-210 B.10. (a)	Field strength of fundamental and harmonic emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10. (b)	Emissions radiated outside of the specific frequency bands	P	
Supplementary information and remarks: None.			

3. Proprietary protocol DM 2.4 GHz

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		**Verdict**	**Remark**
Section 15.249 Subclause (a) / RSS-210 B.10. (a)	Field strength of fundamental and harmonic emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10. (b)	Emissions radiated outside of the specific frequency bands	P	
Supplementary information and remarks: None.			

4. Proprietary protocol Flora 2.4 GHz

FCC PART 15 PARAGRAPH / RSS-210			
Requirement – Test case		**Verdict**	**Remark**
Section 15.249 Subclause (a) / RSS-210 B.10. (a)	Field strength of fundamental and harmonic emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10. (b)	Emissions radiated outside of the specific frequency bands	P	
Supplementary information and remarks: None.			

Appendix A: Test results. Bluetooth Low Energy

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	1.45 Vdc
Type of power supply:	DC voltage from Zinc Air Battery.
Type of antenna:	Small magnetic loop antenna.
Declared antenna gain:	- 12 dBi

TEST FREQUENCIES:

Low Channel:	2402 MHz
Middle Channel:	2440 MHz
High Channel:	2480 MHz

RADIATED MEASUREMENTS

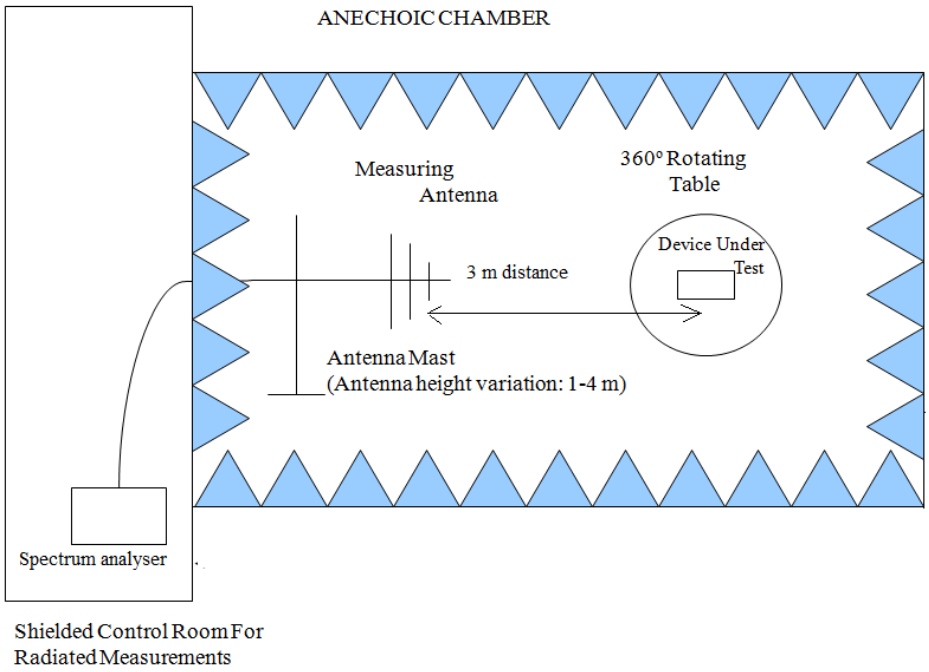
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40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

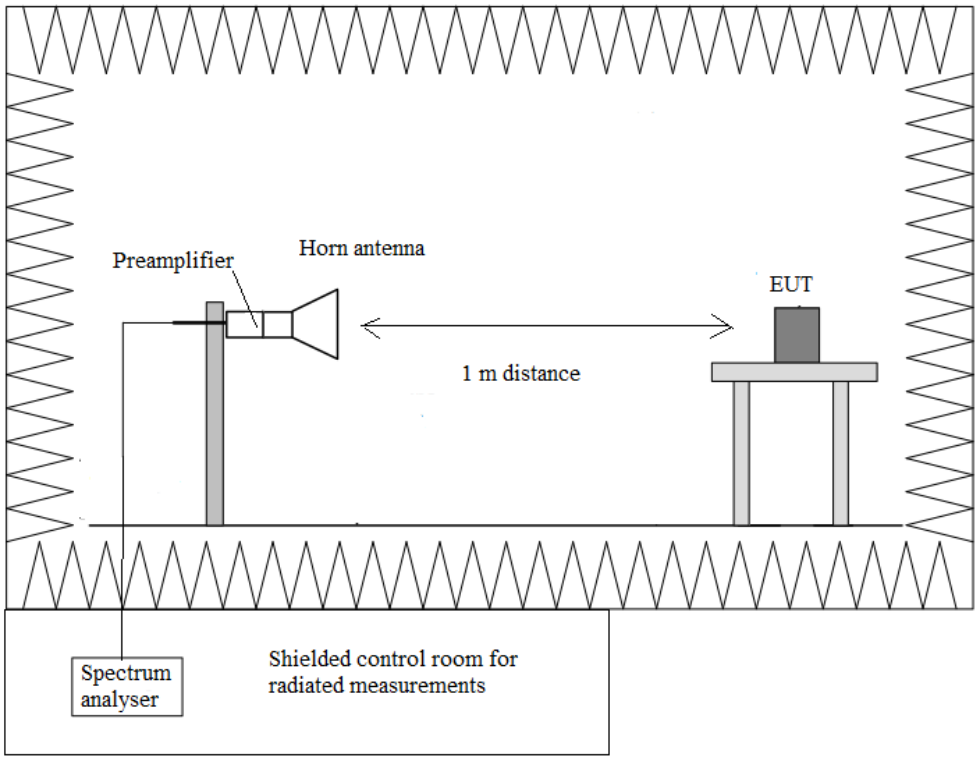
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup f < 1 GHz:



Radiated measurements setup f > 1 GHz:



Section 15.249 Subclause (a) / RSS-210 B.10. (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

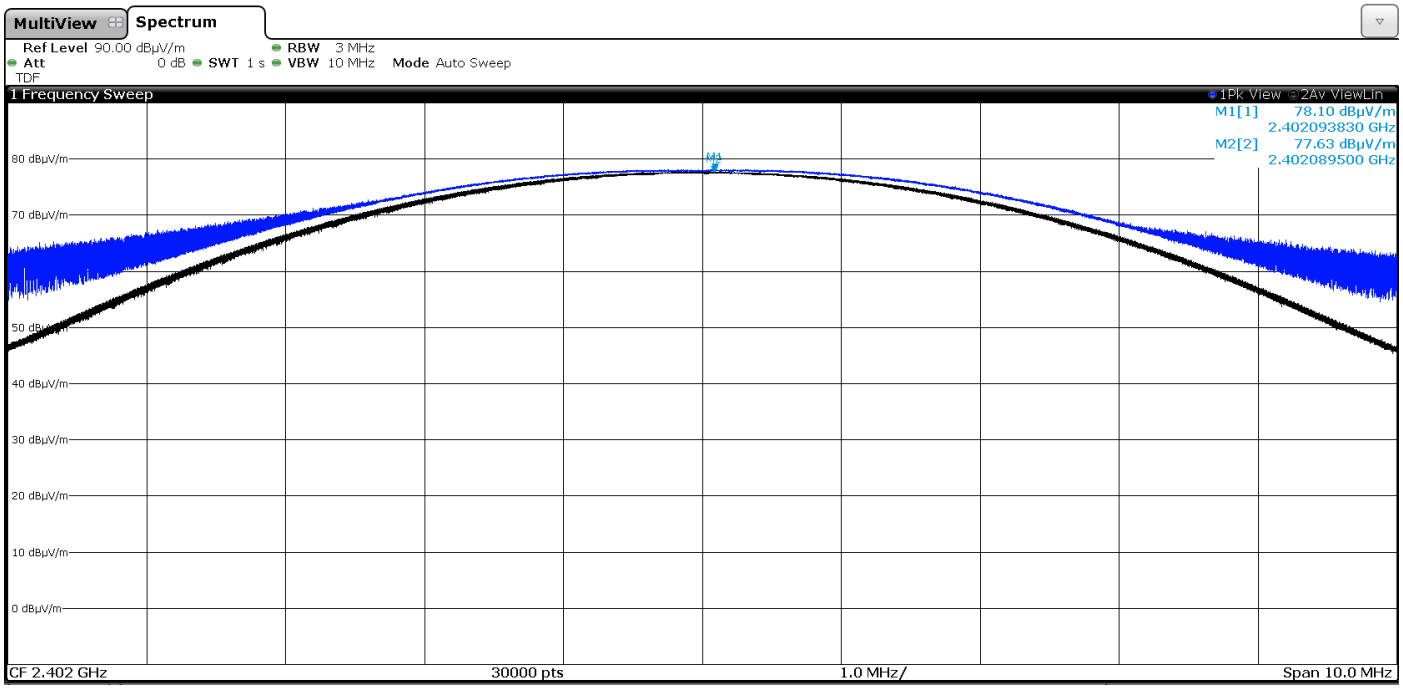
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

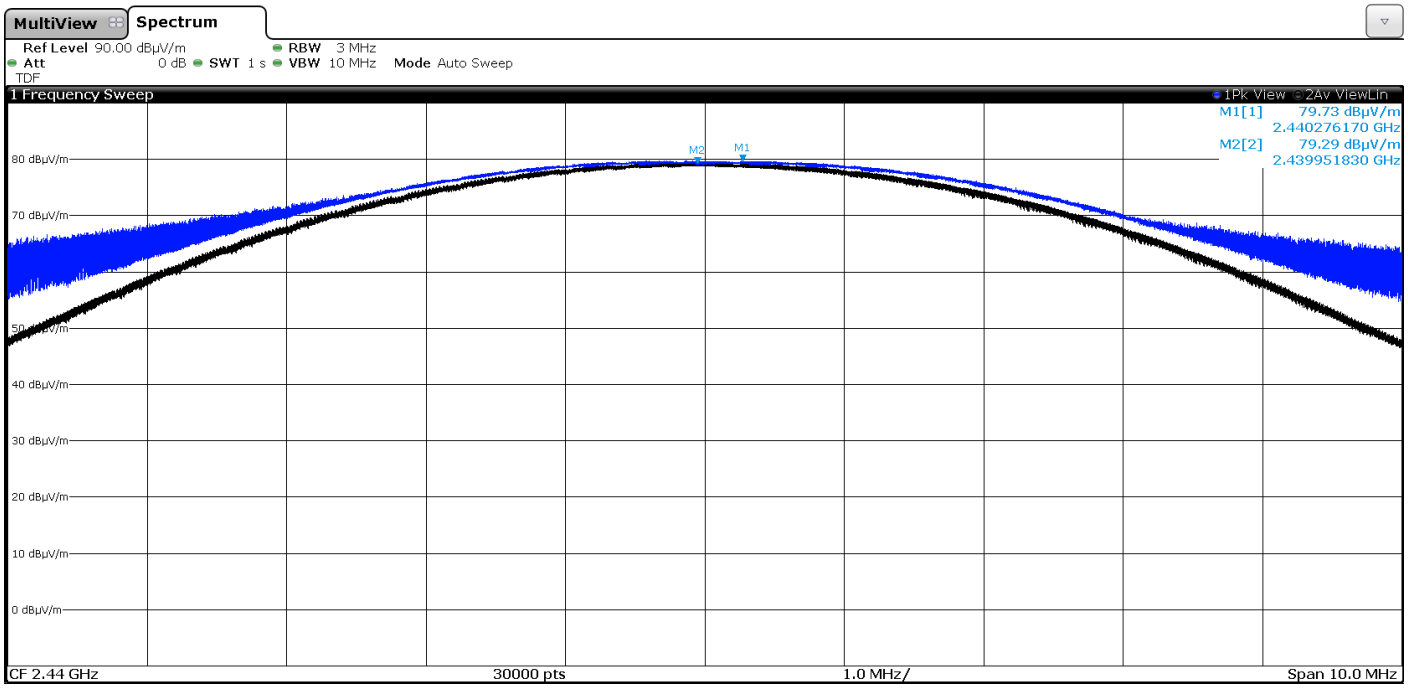
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBµV/m)	77.63	79.29	79.45
Peak Field Strength (dBµV/m)	78.10	79.73	79.90
Measurement Uncertainty (dB)	<±3.04		

Verdict: PASS

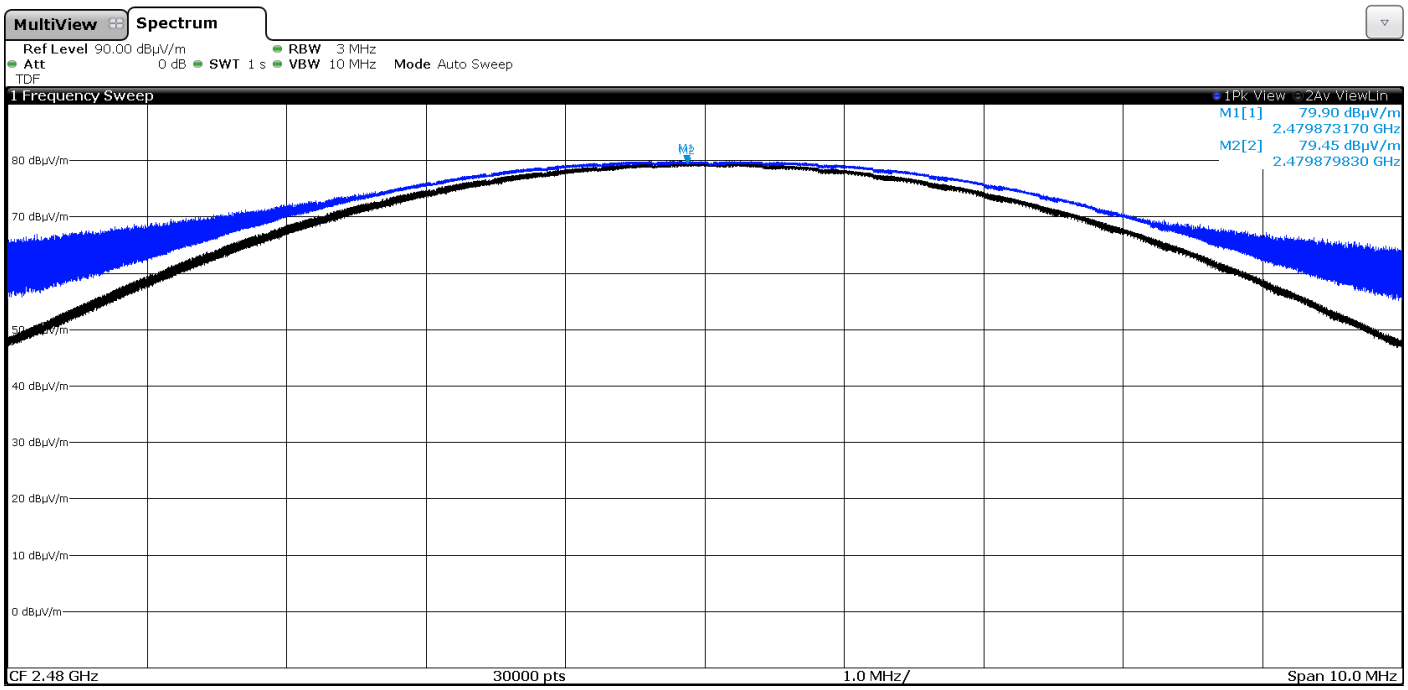
- Low Channel:



- Middle Channel:



- High Channel:



Section 15.249 Subclause (d) / RSS-210 B.10. (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics (µV/m)	Field strength of harmonics (dBµV/m)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

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

Whichever is the lesser attenuation.

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-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.

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

Spurious emissions at less than 20 dB from the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
34.18700	Quasi peak	20.60	V	<± 3.04
124.36500	Quasi peak	22.30	V	<± 3.04

Frequency range 1 - 26 GHz.

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

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

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.80483	Peak	43.20	V	<±4.88
21.62045	Peak	38.77	H	<±4.88

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.87997	Peak	43.30	V	<±4.88
21.96215	Peak	40.22	H	<±4.88

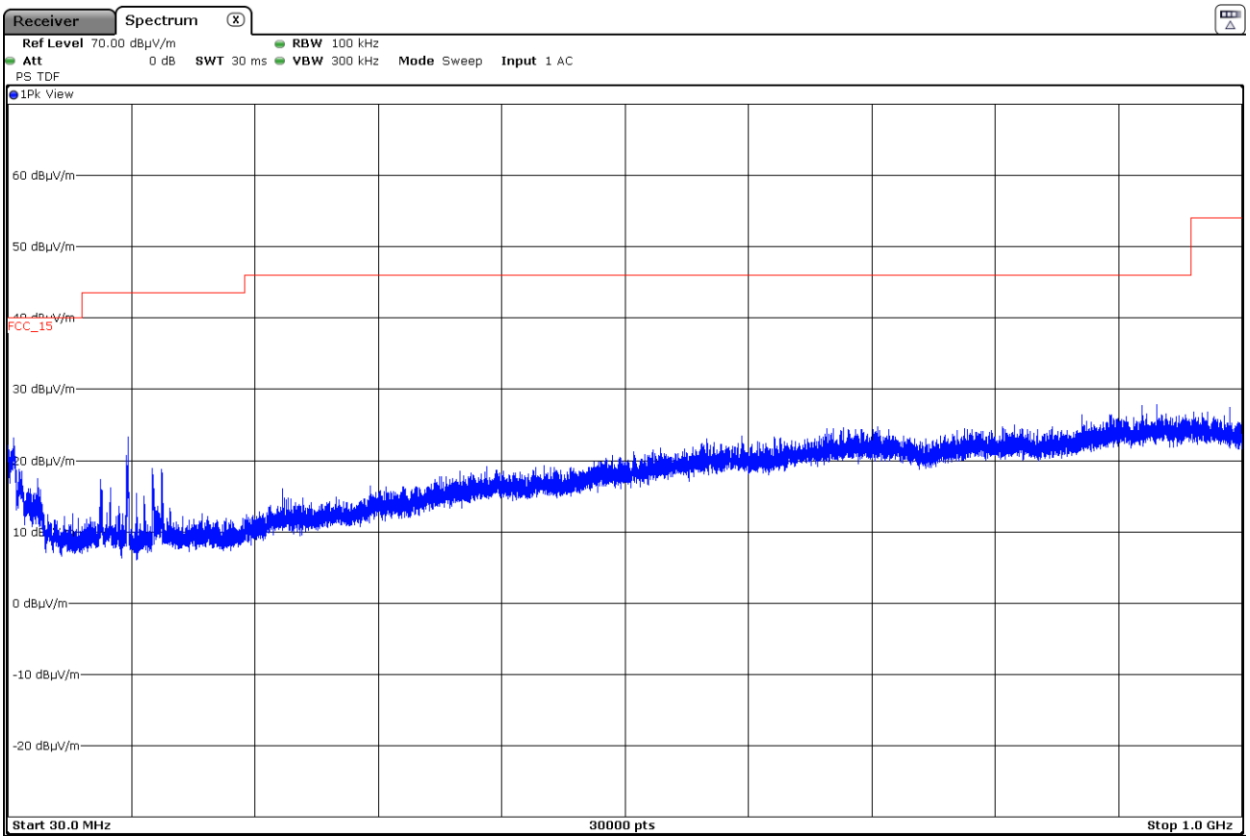
- High Channel (2480 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48356	Peak	57.49	V	<±4.88
	Average	39.50		<±4.88
4.95930	Peak	41.85	V	<±4.88
22.32185	Peak	44.59	H	<±4.88

Verdict: PASS

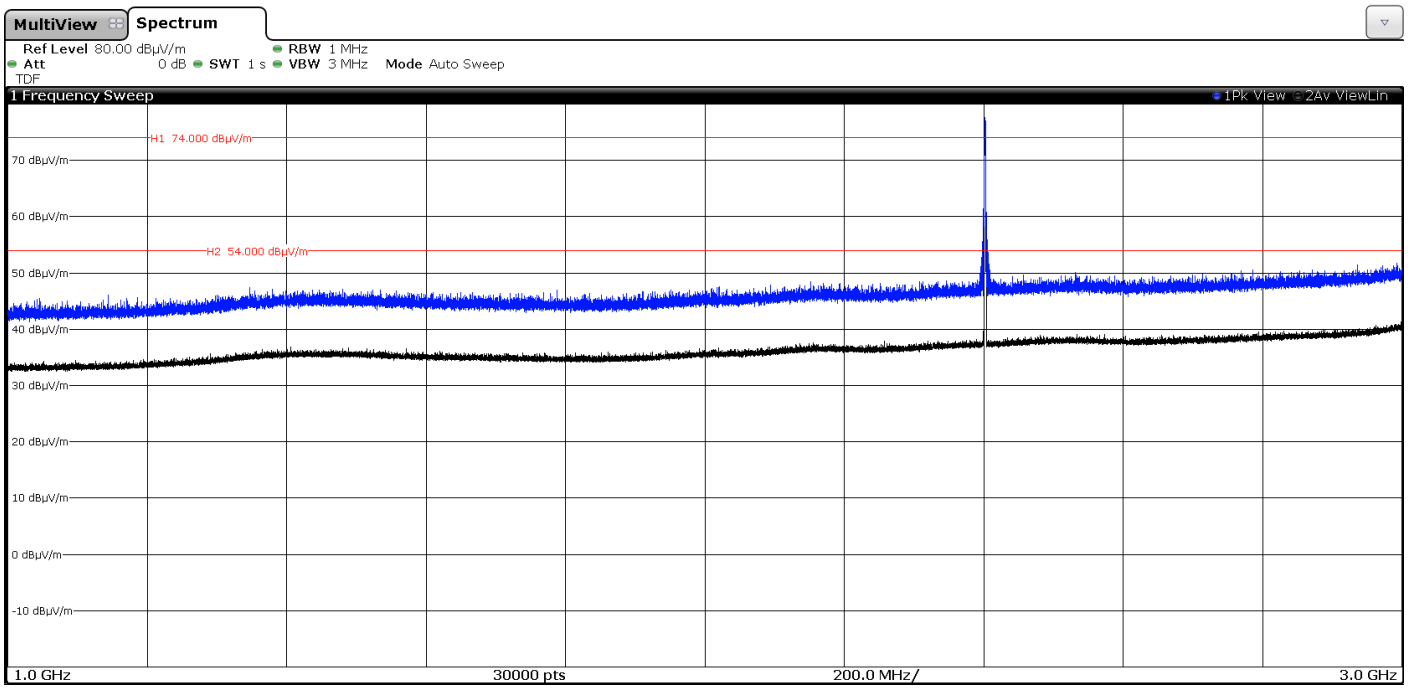
FREQUENCY RANGE 30 MHz - 1 GHz

The spurious signals detected do not depend on the operating channel. This plot is valid for Low, Middle and High Channels.



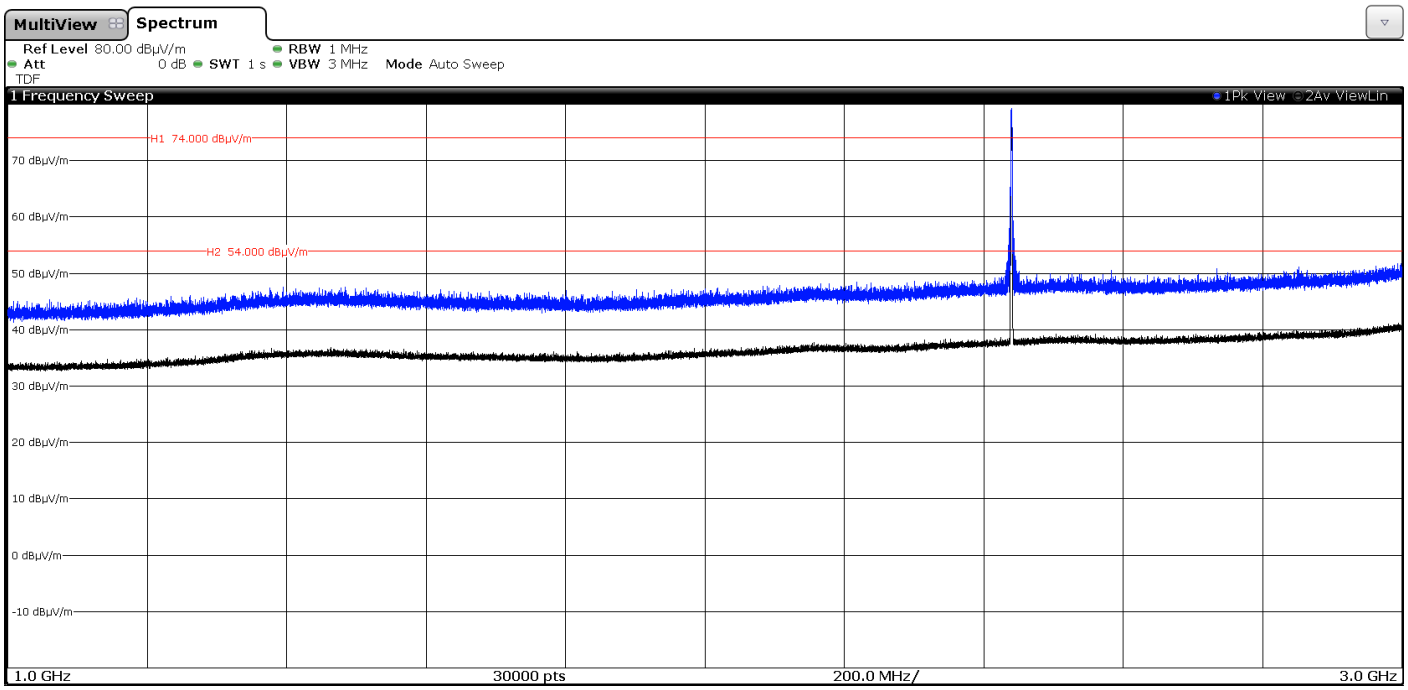
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



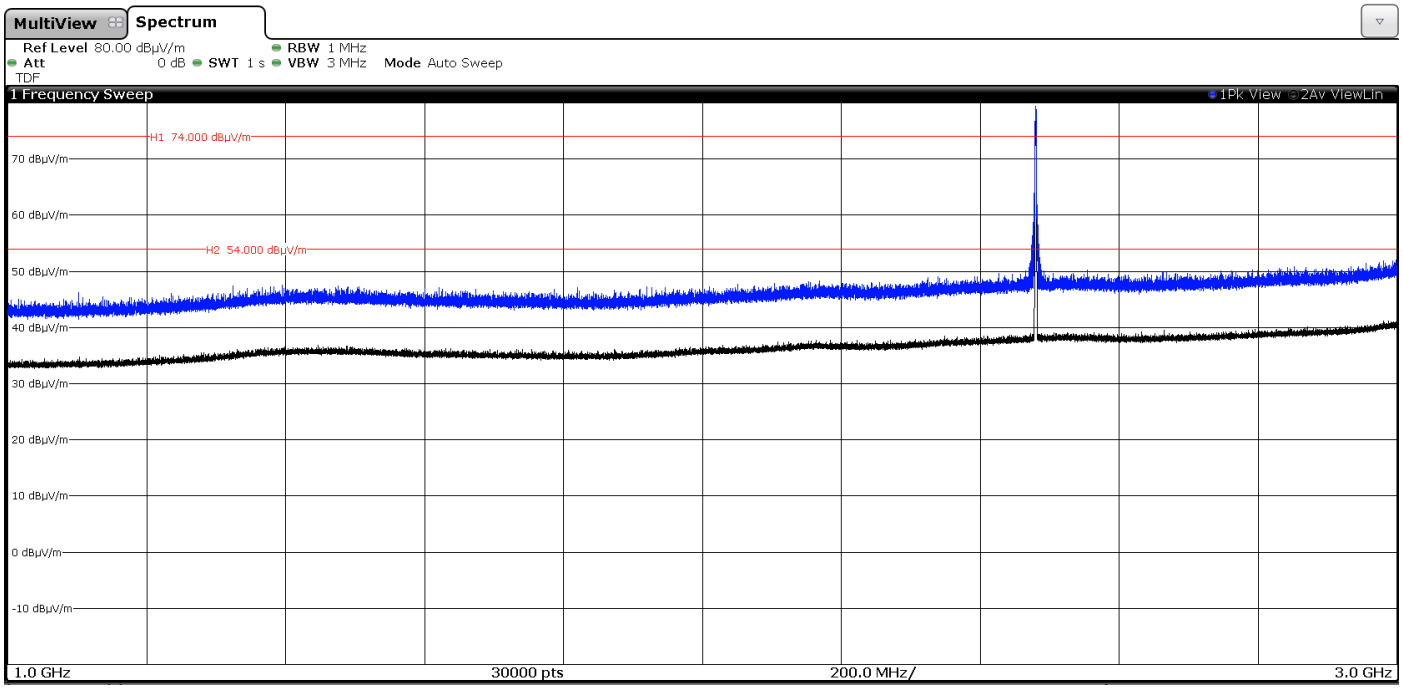
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



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

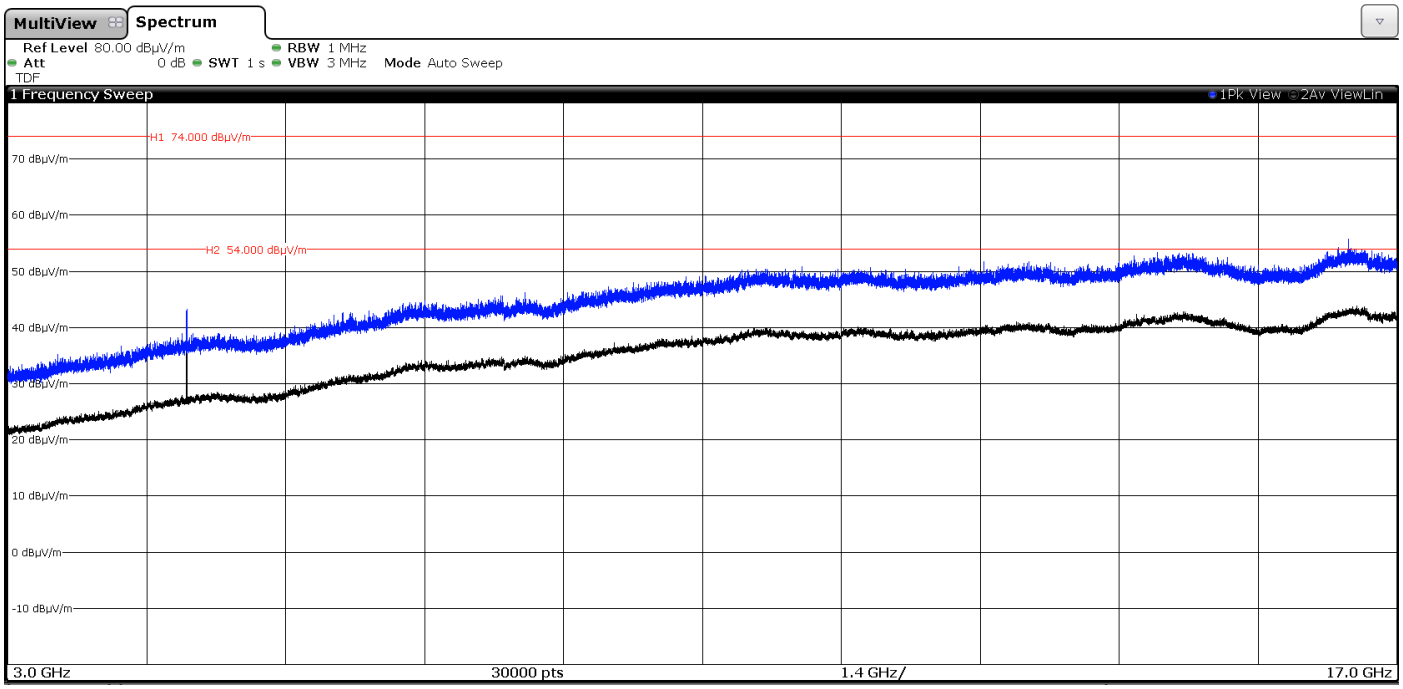
- High Channel:



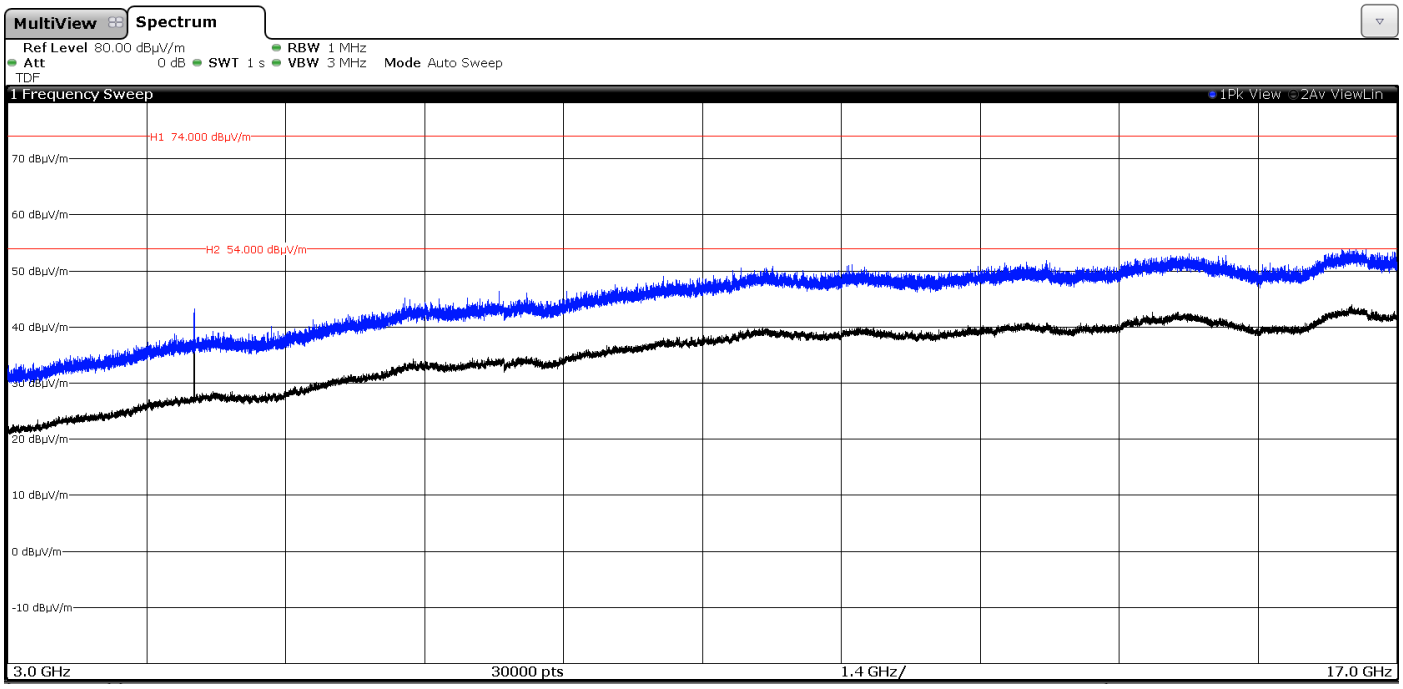
The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

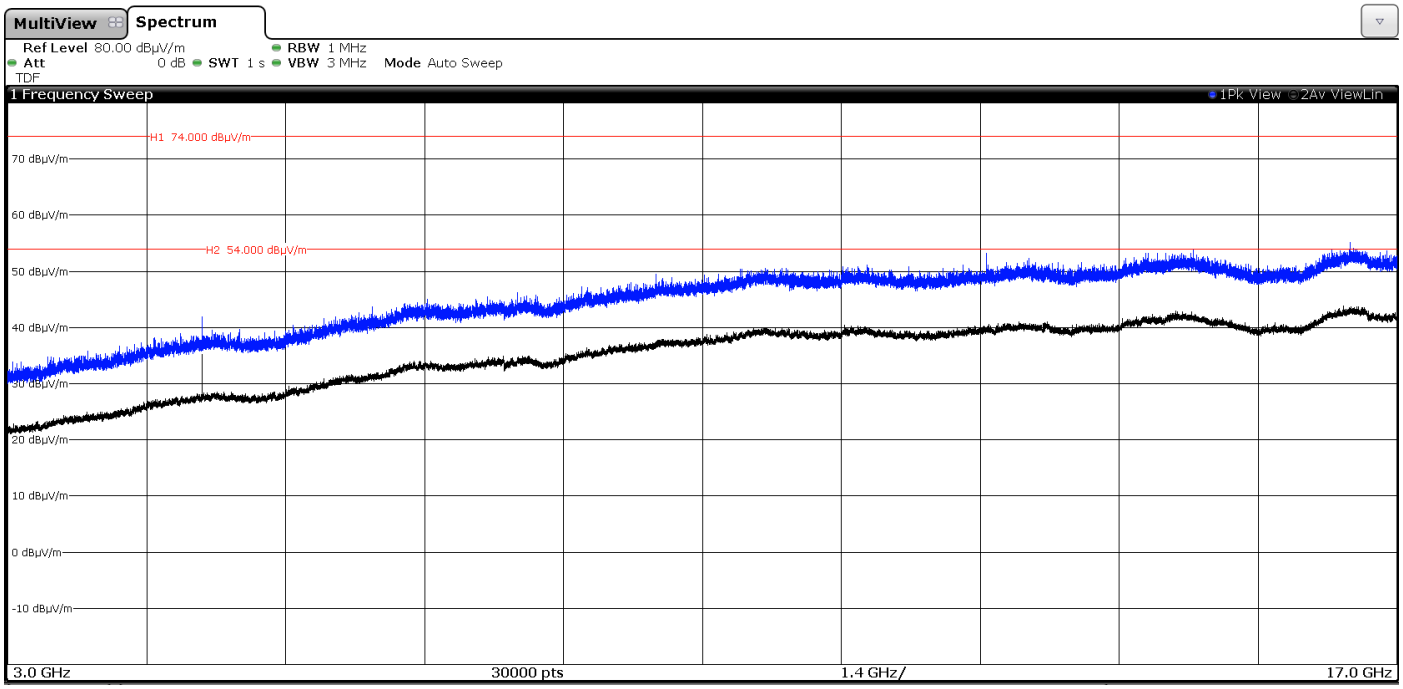
- Low Channel:



- Middle Channel:

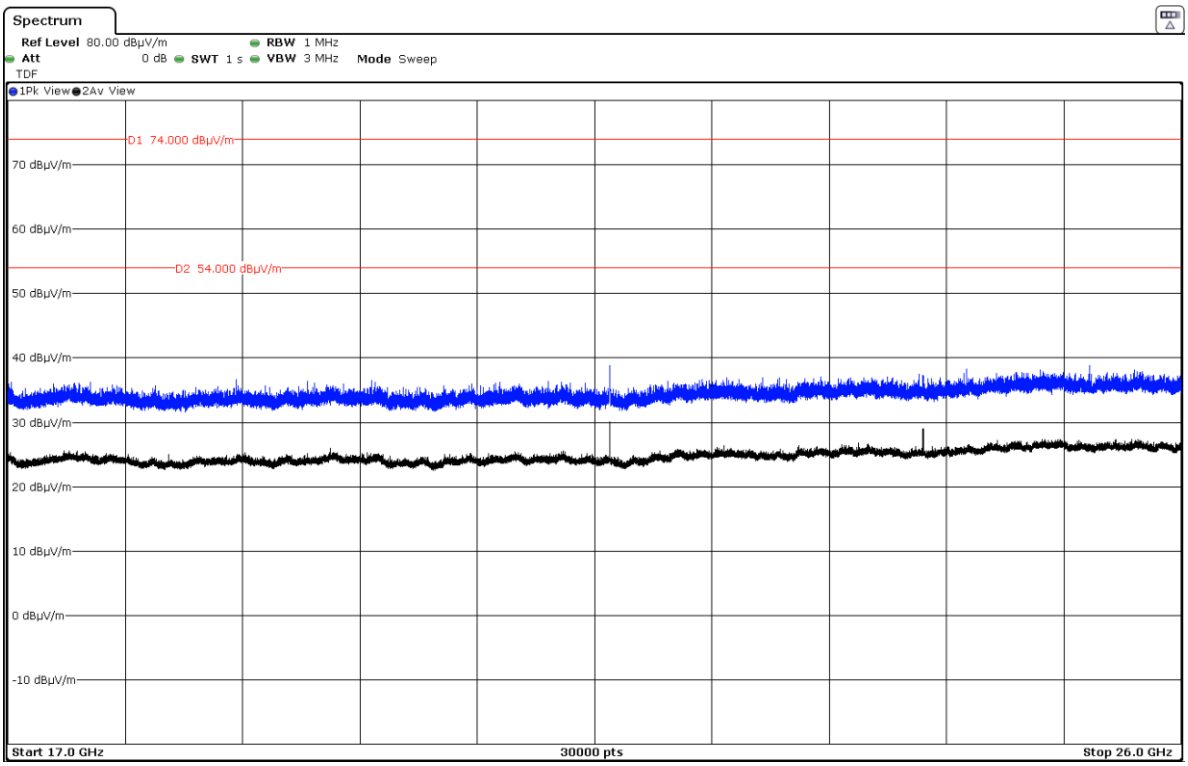


- High Channel:

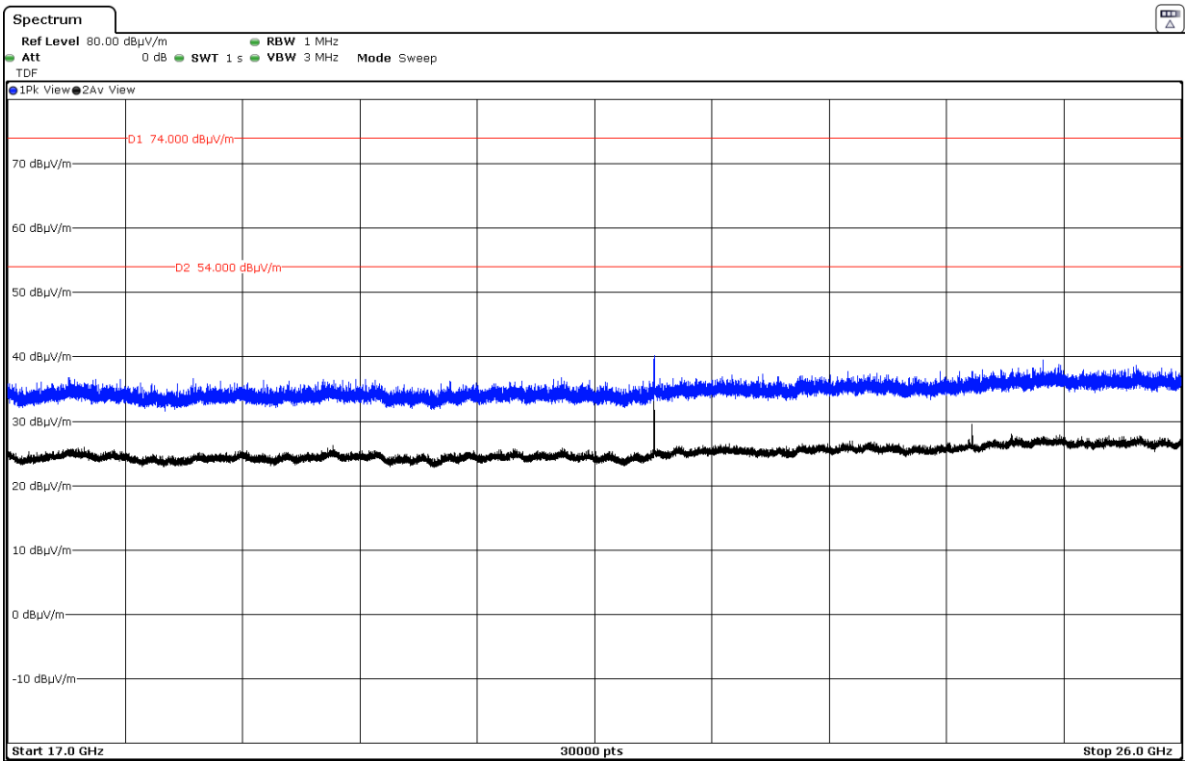


FREQUENCY RANGE 17 - 26 GHz

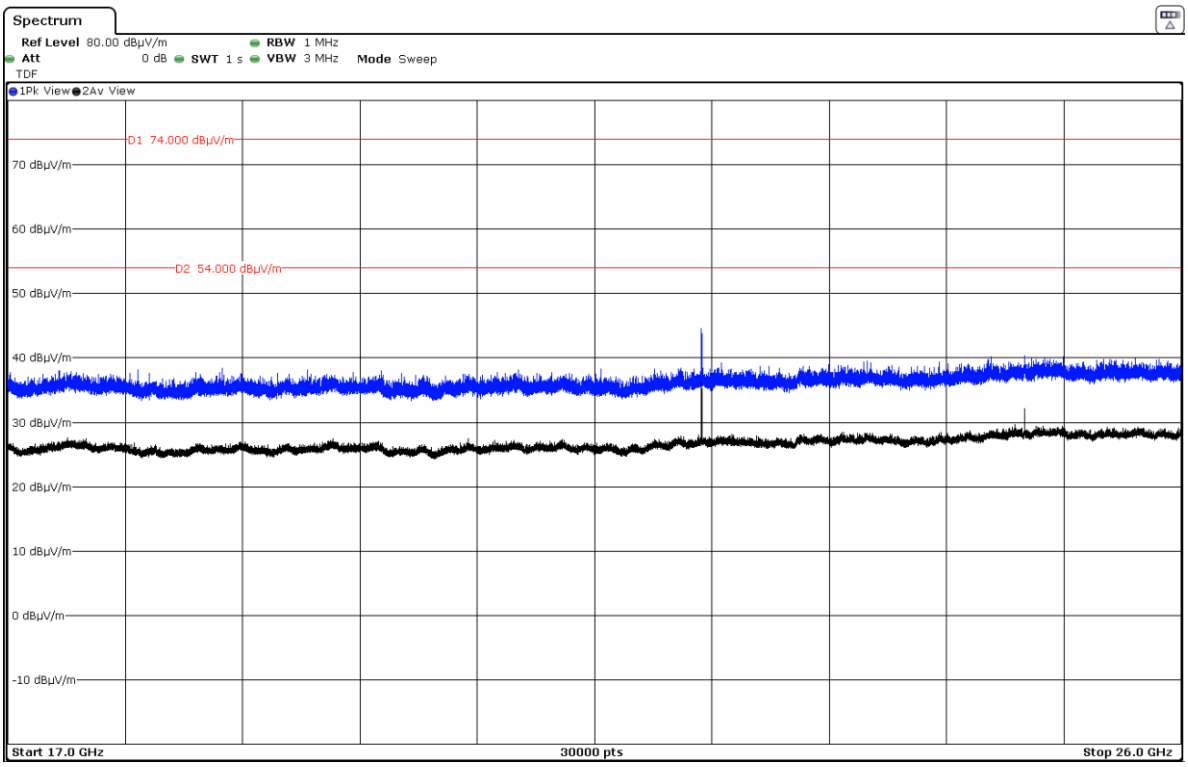
- Low Channel:



- Midle Channel:

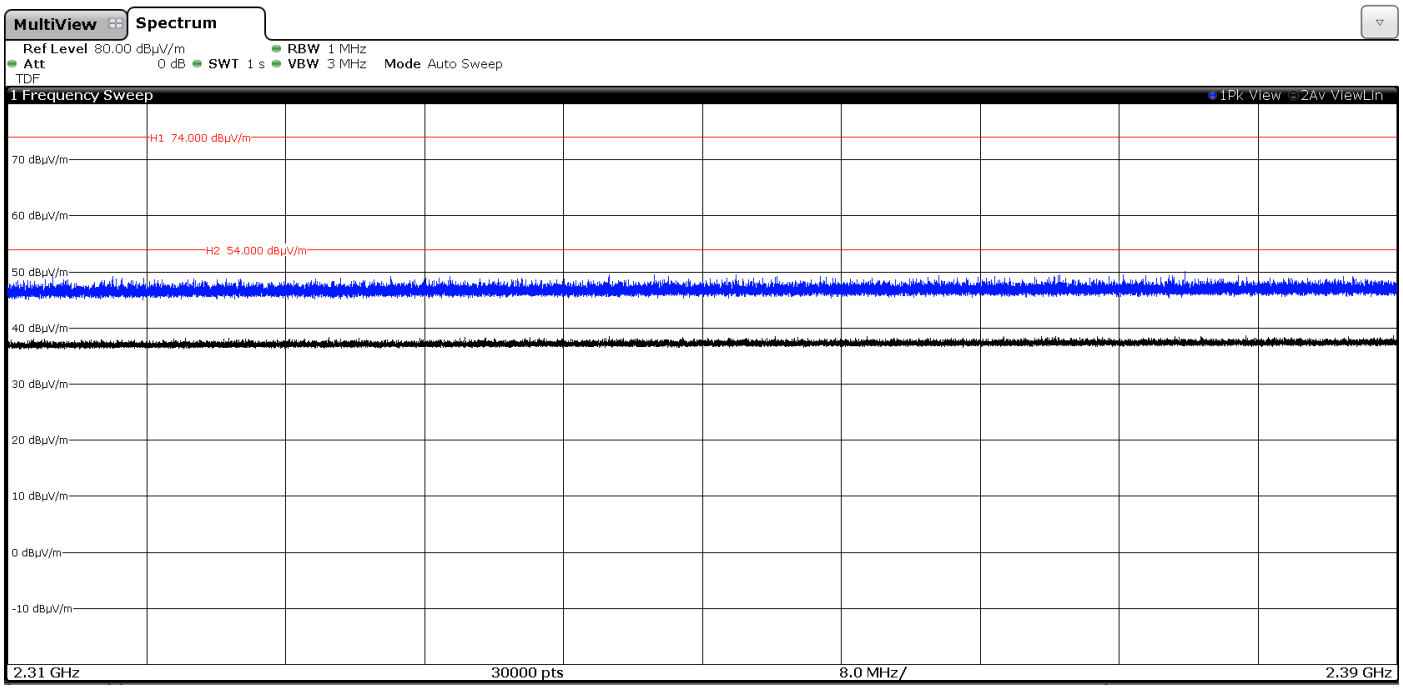


- High Channel::

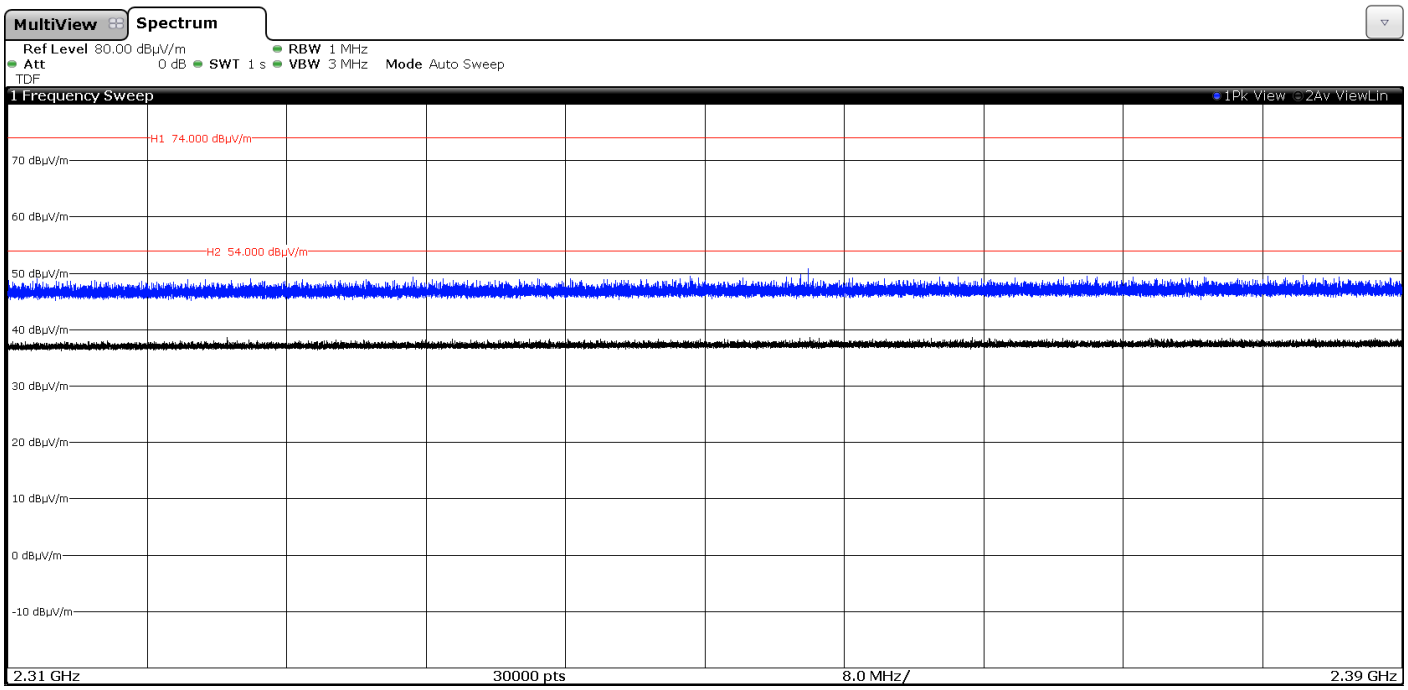


FREQUENCY RANGE 2.31 - 2.39 GHz

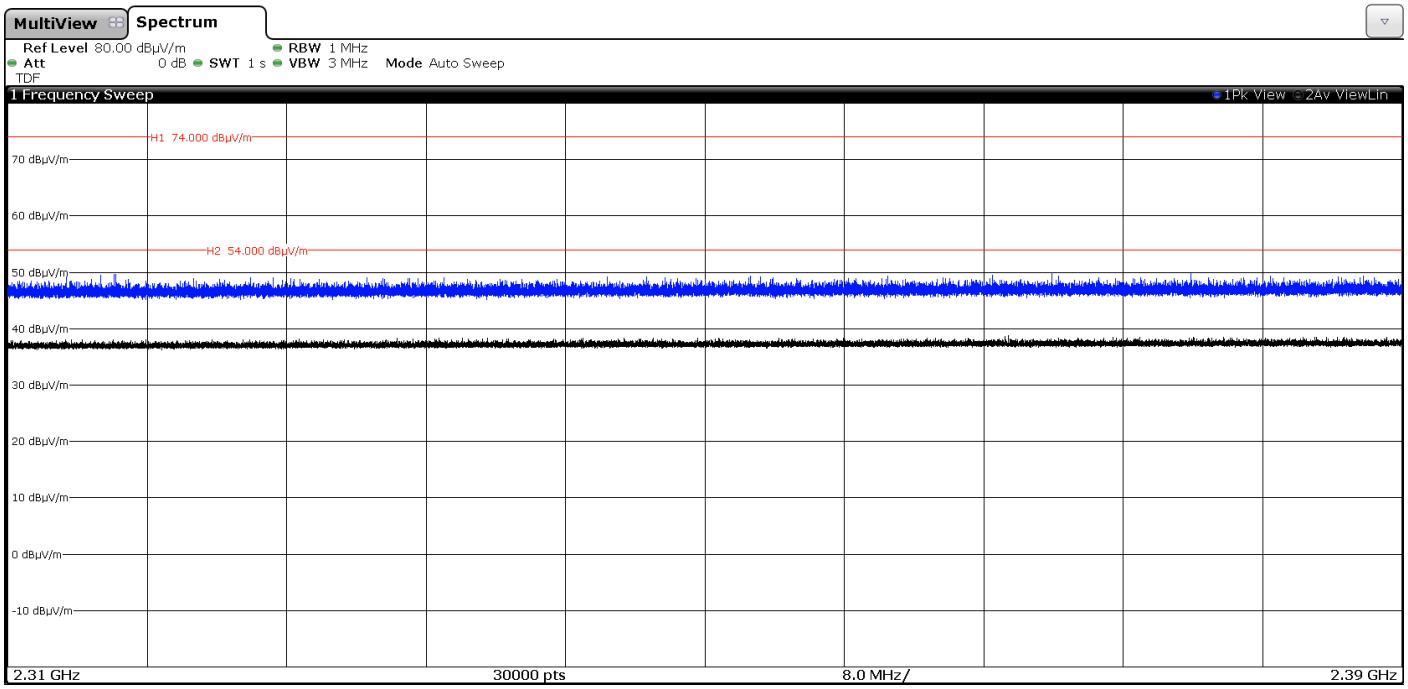
- Low Channel:



- Middle Channel:

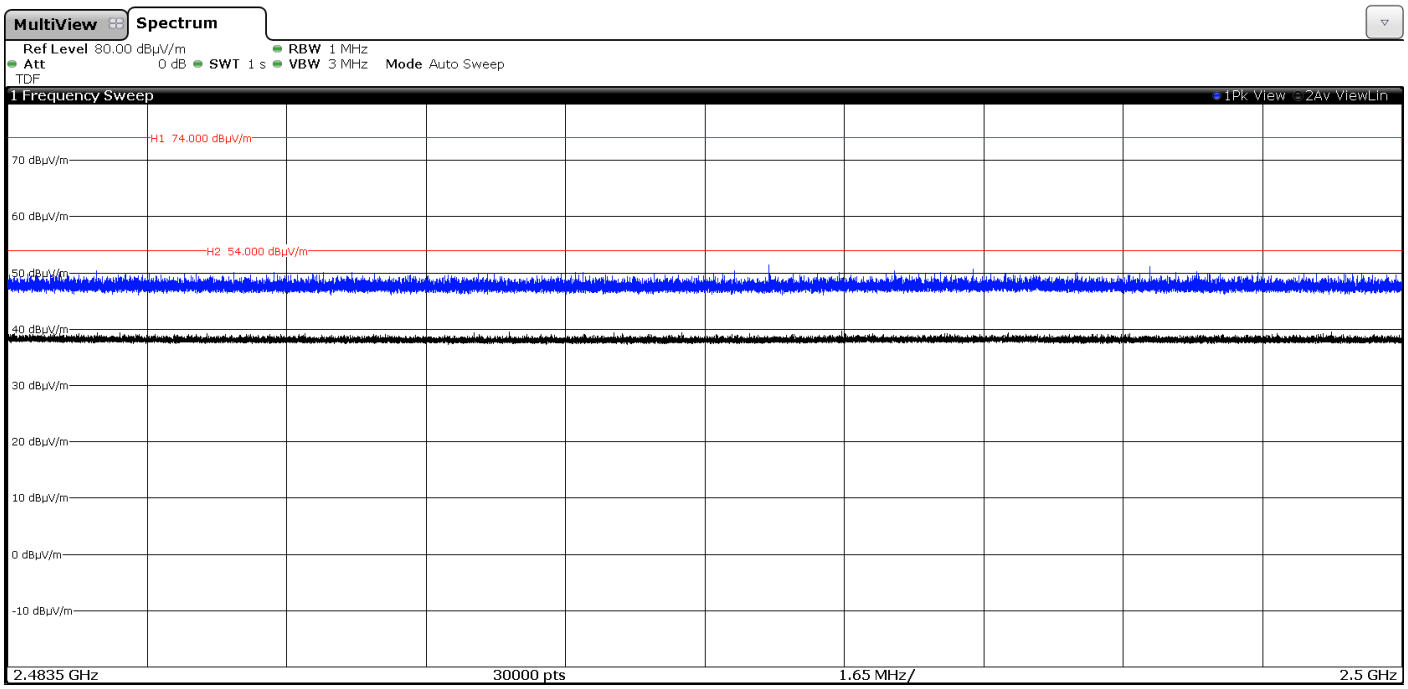


- High Channel:

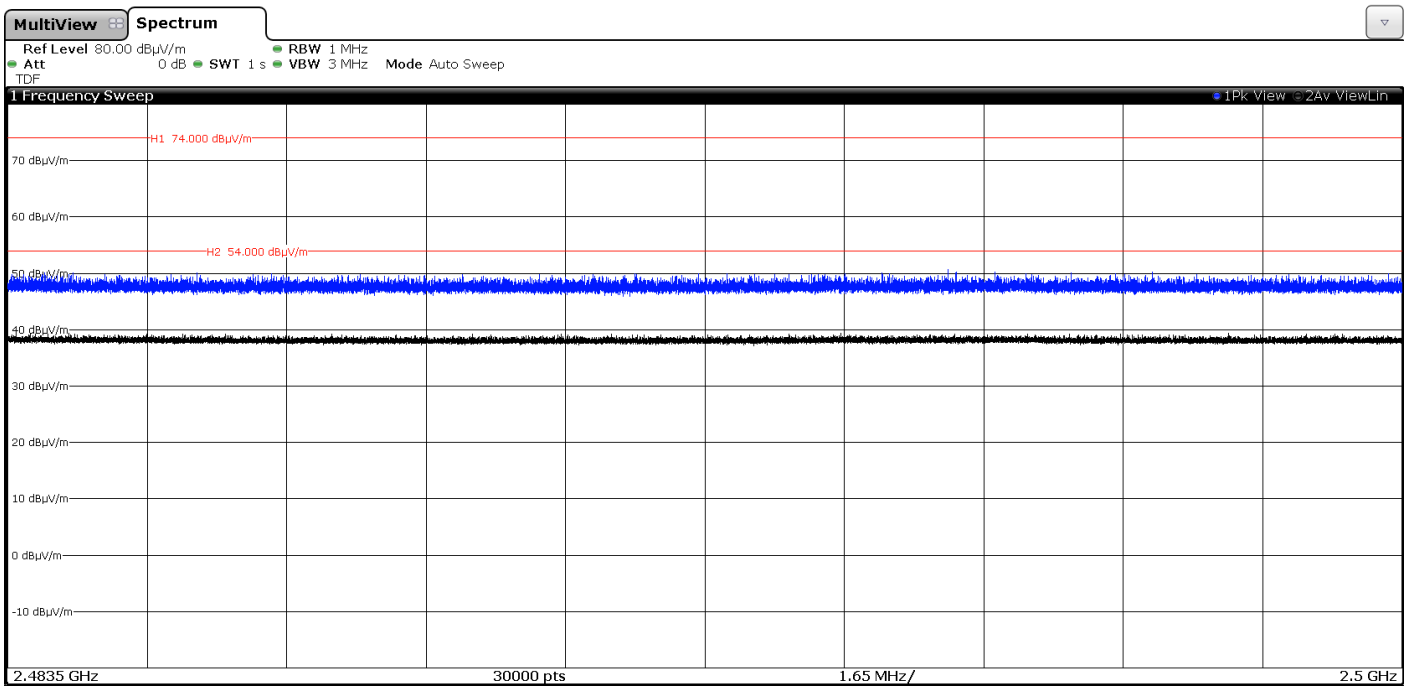


FREQUENCY RANGE 2.4835 - 2.5 GHz

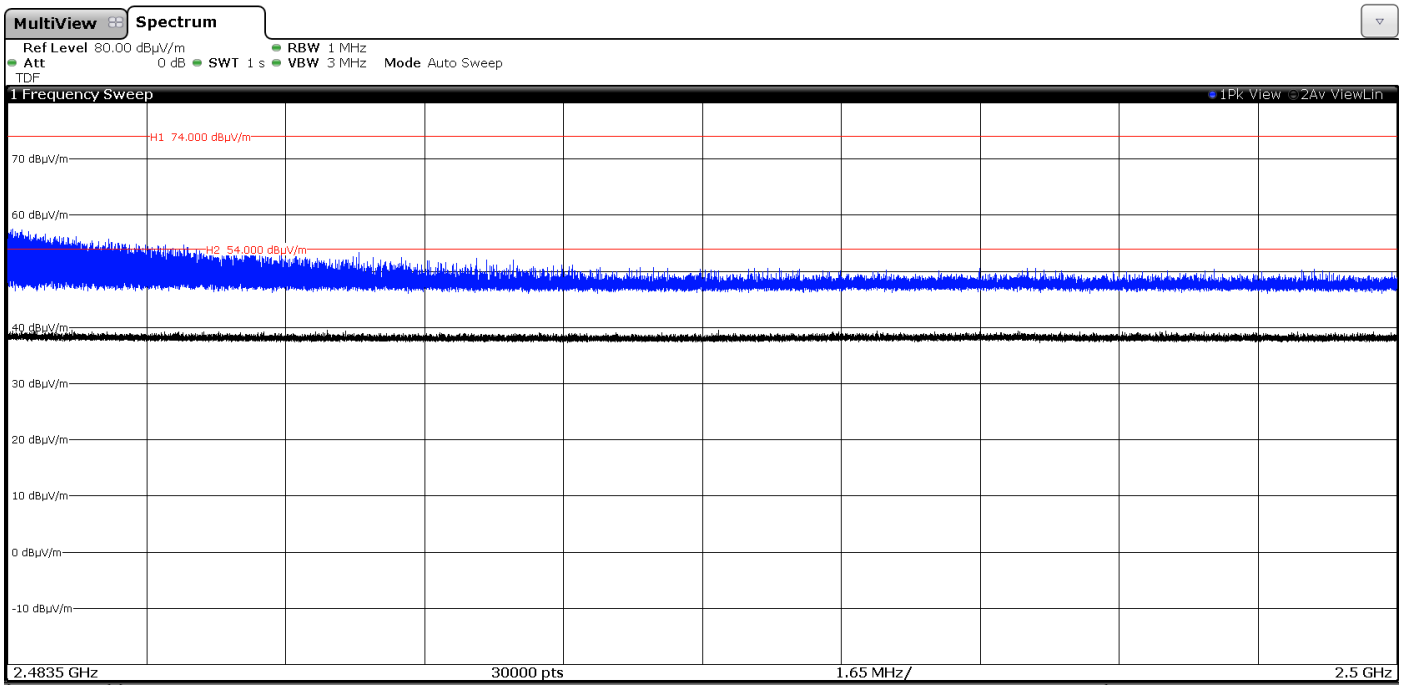
- Low Channel:



- Middle Channel:



- High Channel:



Appendix B: Test results. Bluetooth Basic Rate

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	1.45 Vdc
Type of power supply:	DC voltage from Zinc Air Battery.
Type of antenna:	Small magnetic loop antenna.
Declared antenna gain:	- 12 dBi

TEST FREQUENCIES:

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

RADIATED MEASUREMENTS

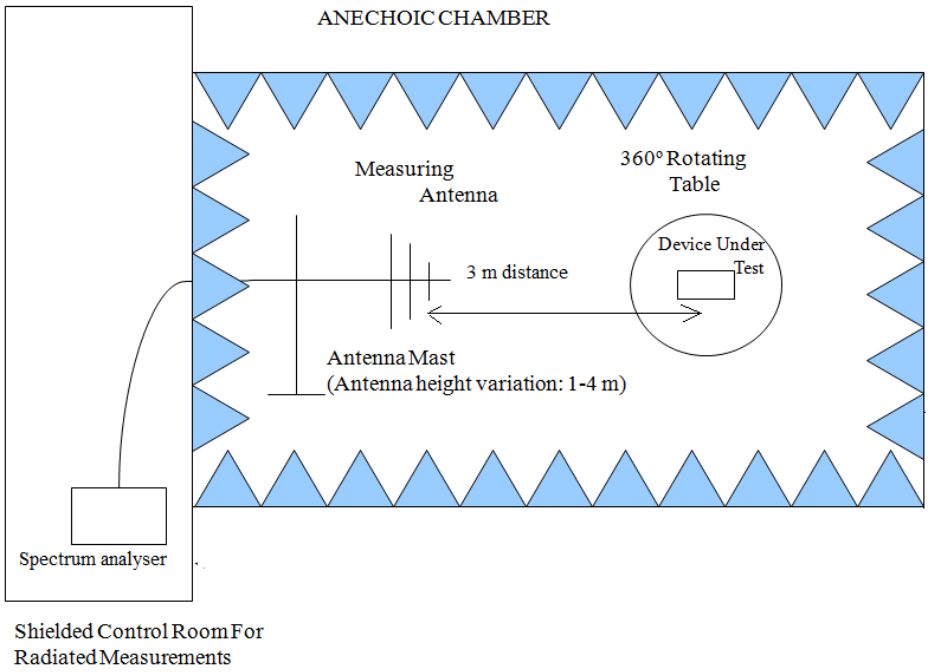
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40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

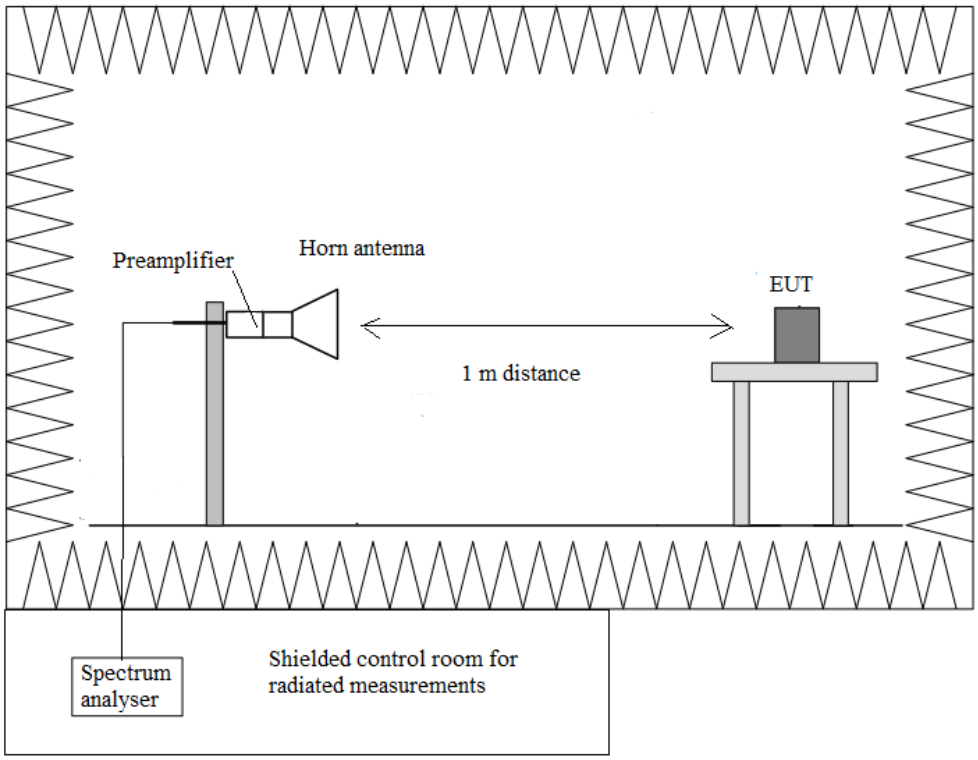
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup f < 1 GHz:



Radiated measurements setup f > 1 GHz:



Section 15.249 Subclause (a) / RSS-210 B.10. (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

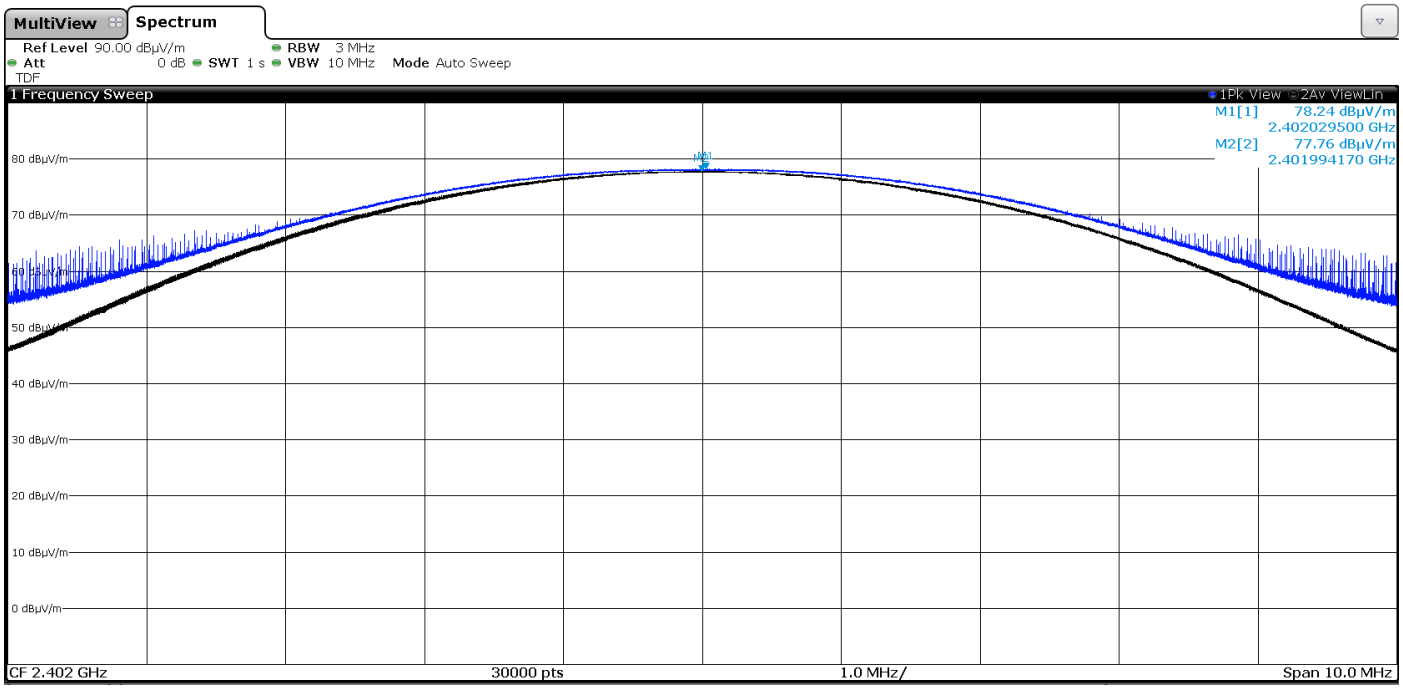
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

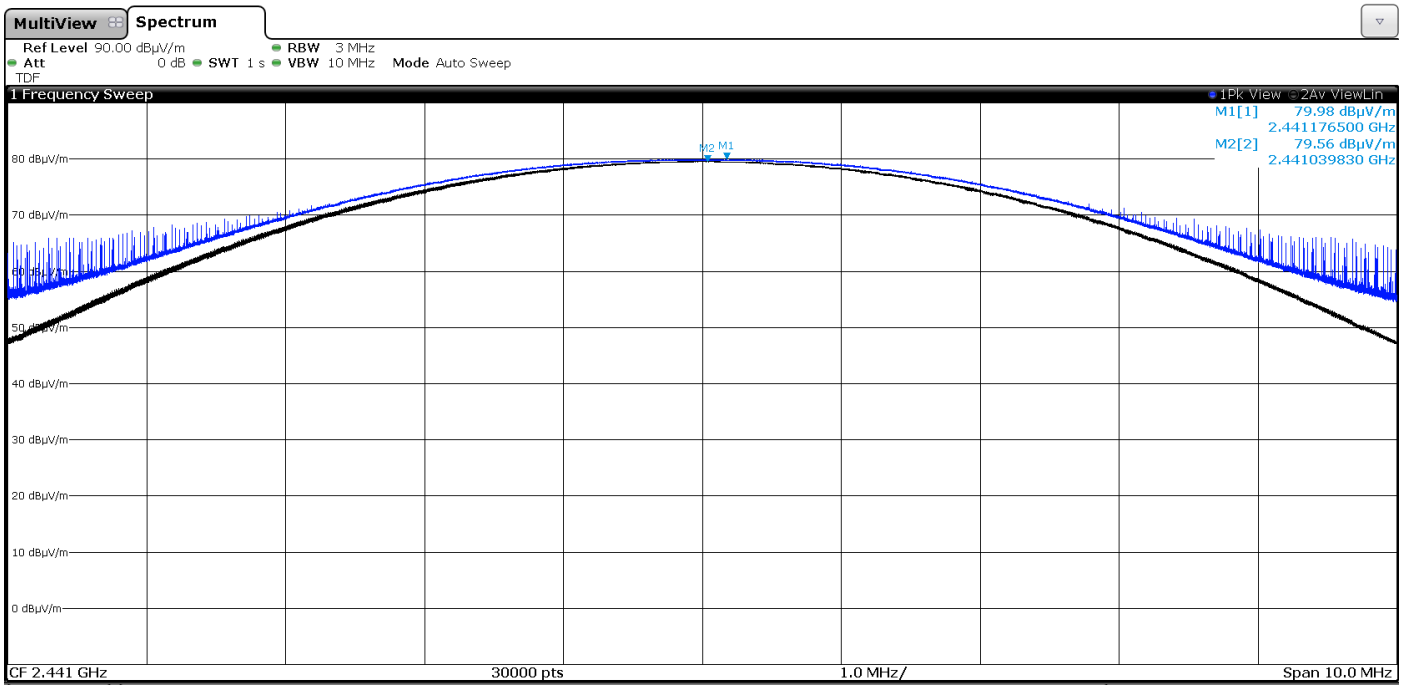
	Low Channel 2402 MHz	Middle Channel 2441 MHz	High Channel 2480 MHz
Average Field Strength (dBµV/m)	77.76	79.56	79.01
Peak Field Strength (dBµV/m)	78.24	79.98	79.39
Measurement Uncertainty (dB)	<±3.04		

Verdict: PASS

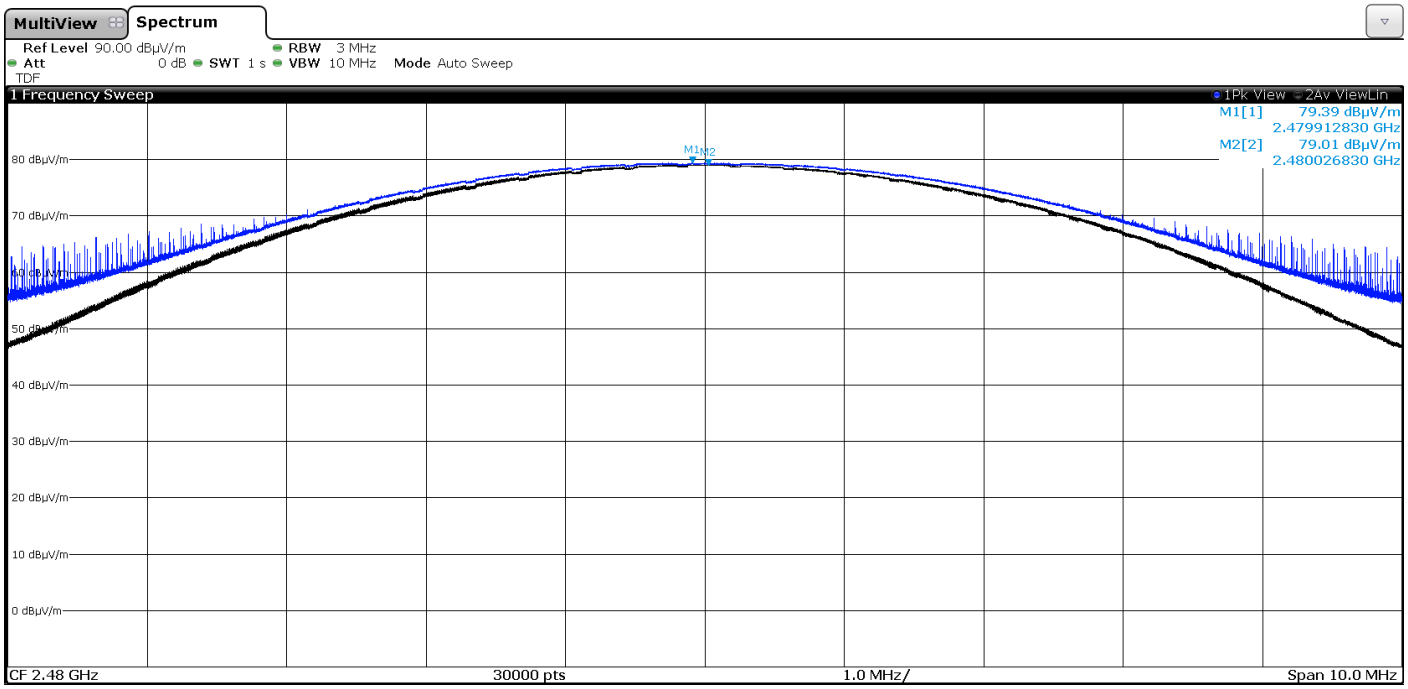
- Low Channel:



- Middle Channel:



- High Channel:



Section 15.249 Subclause (d) / RSS-210 B.10. (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics (µV/m)	Field strength of harmonics (dBµV/m)	Measurement distance (m)
902 – 928	500	54	3
2400 – 2483.5	500	54	3
5725 – 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

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

Whichever is the lesser attenuation.

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-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.

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

No spurious emissions were found at less than 20 dB of the limit.

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 (see next plots).

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

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.80437	Peak	43.39	V	<±4.88
21.61655	Peak	39.75	H	<±4.88

- Middle Channel (2441 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.88183	Peak	43.51	V	<±4.88
21.61685	Peak	39.69	H	<±4.88

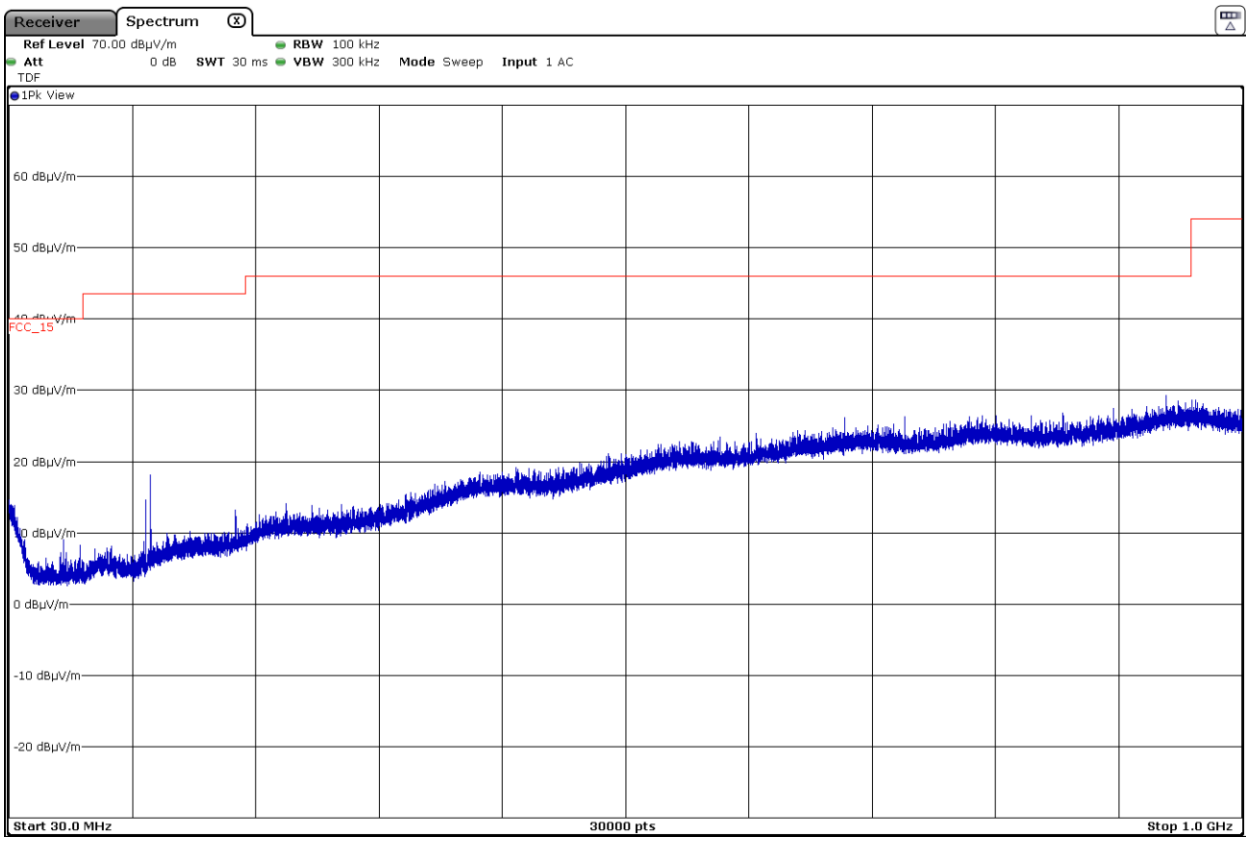
- High Channel (2480 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48366	Peak	55.66	V	<±4.88
	Average	39.38		
4.95977	Peak	41.56	V	<±4.88
21.61655	Peak	39.45	H	<±4.88

Verdict: PASS

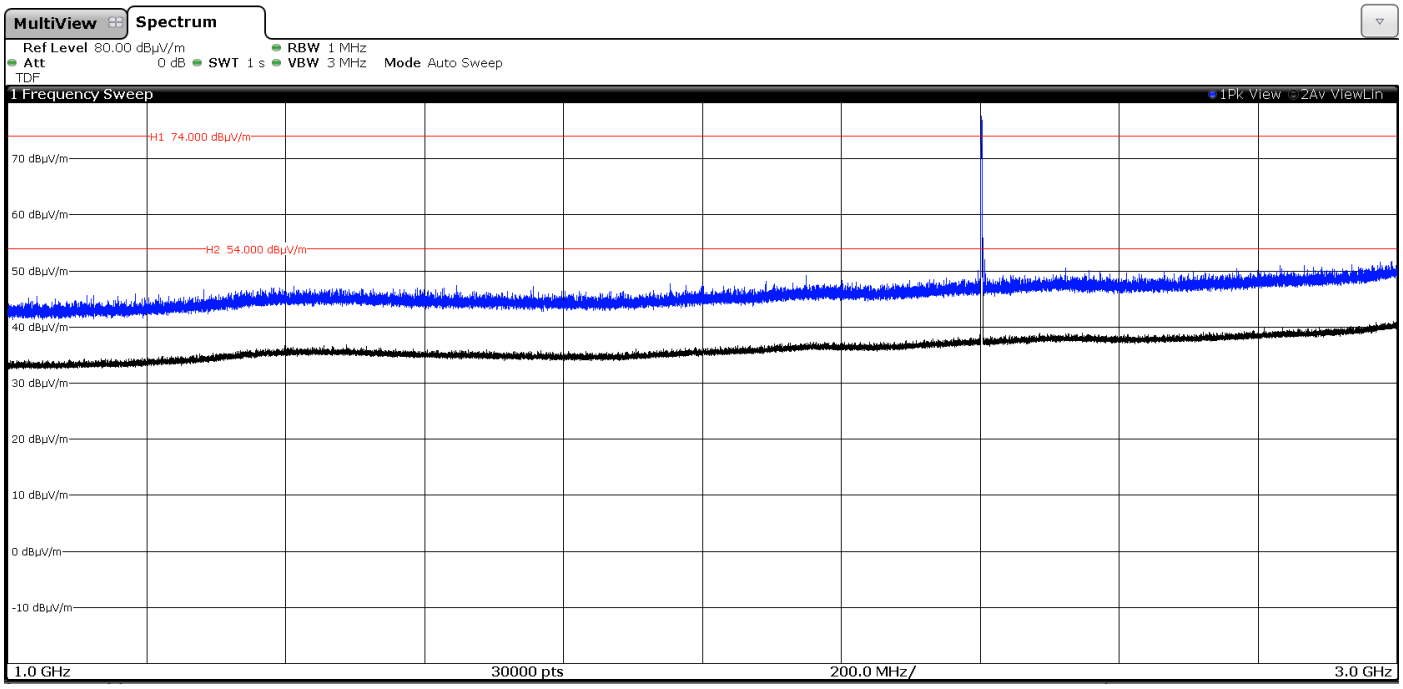
FREQUENCY RANGE 30 MHz - 1 GHz

The spurious signals detected do not depend on the operating channel. This plot is valid for Low, Middle and High Channels.



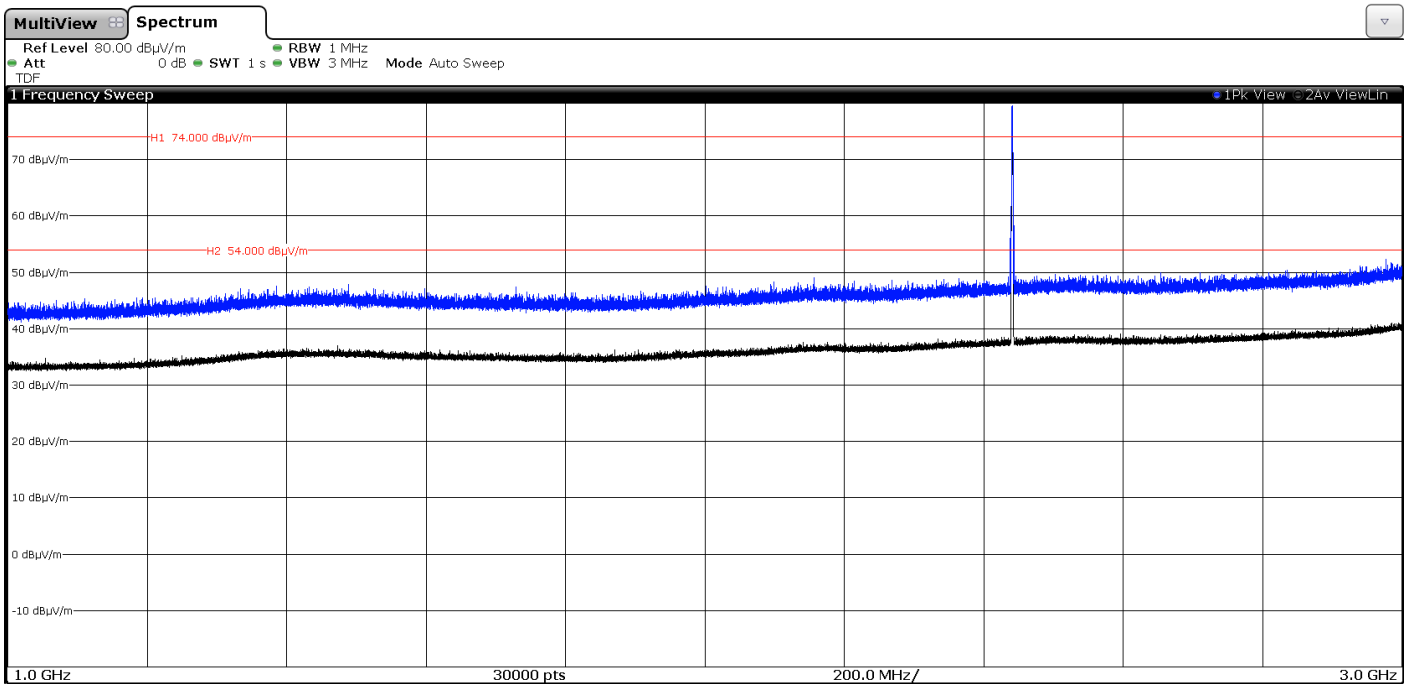
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



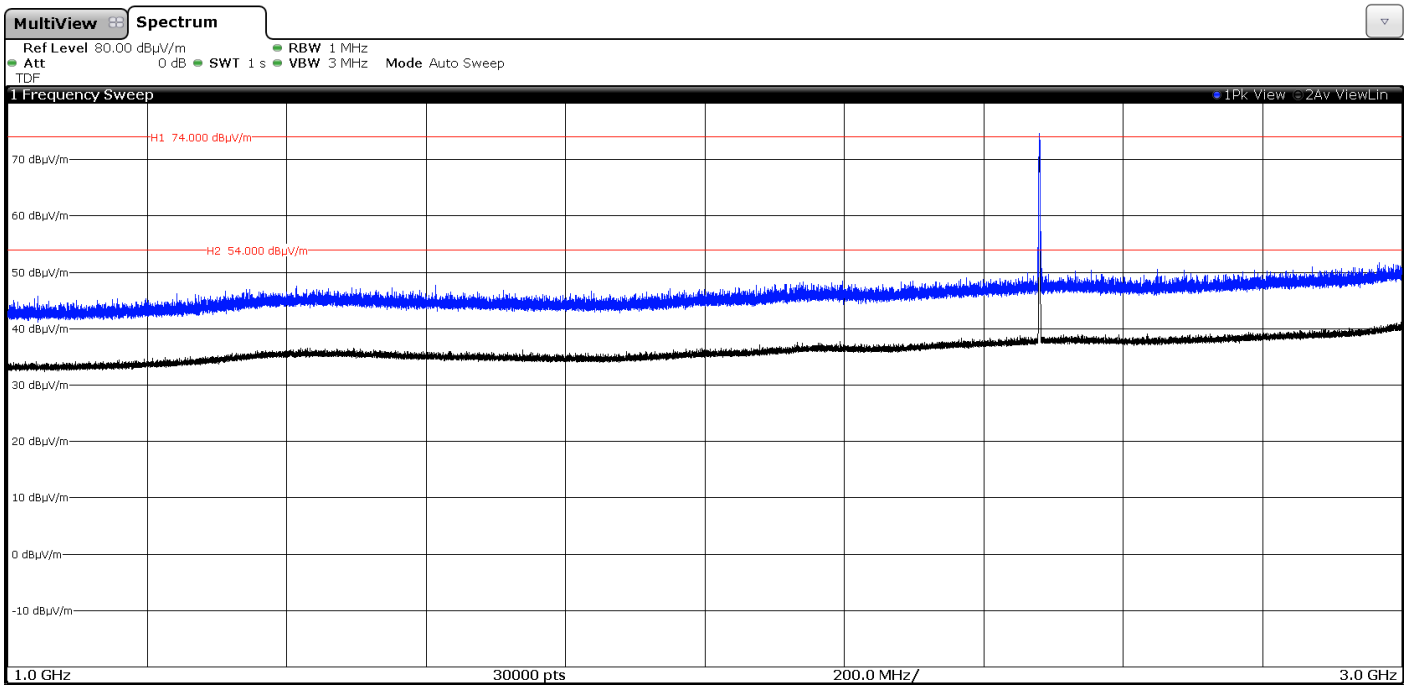
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



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

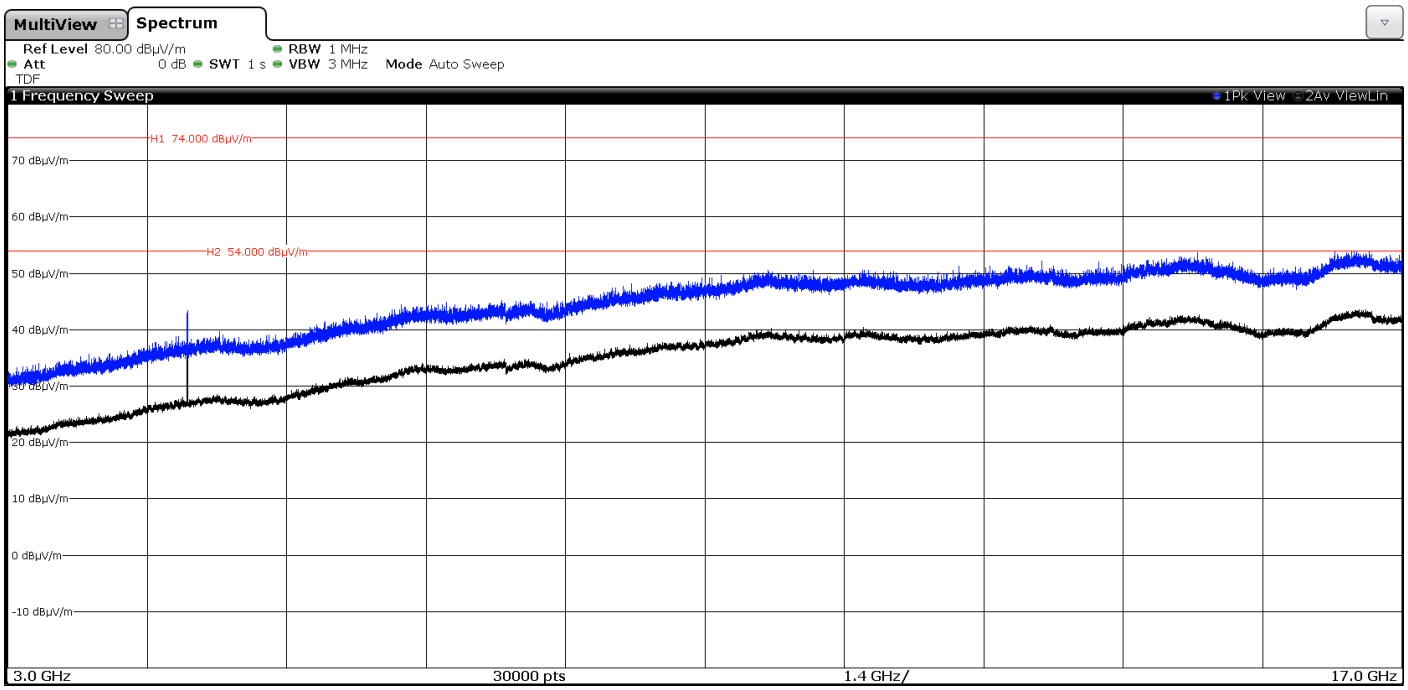
- High Channel:



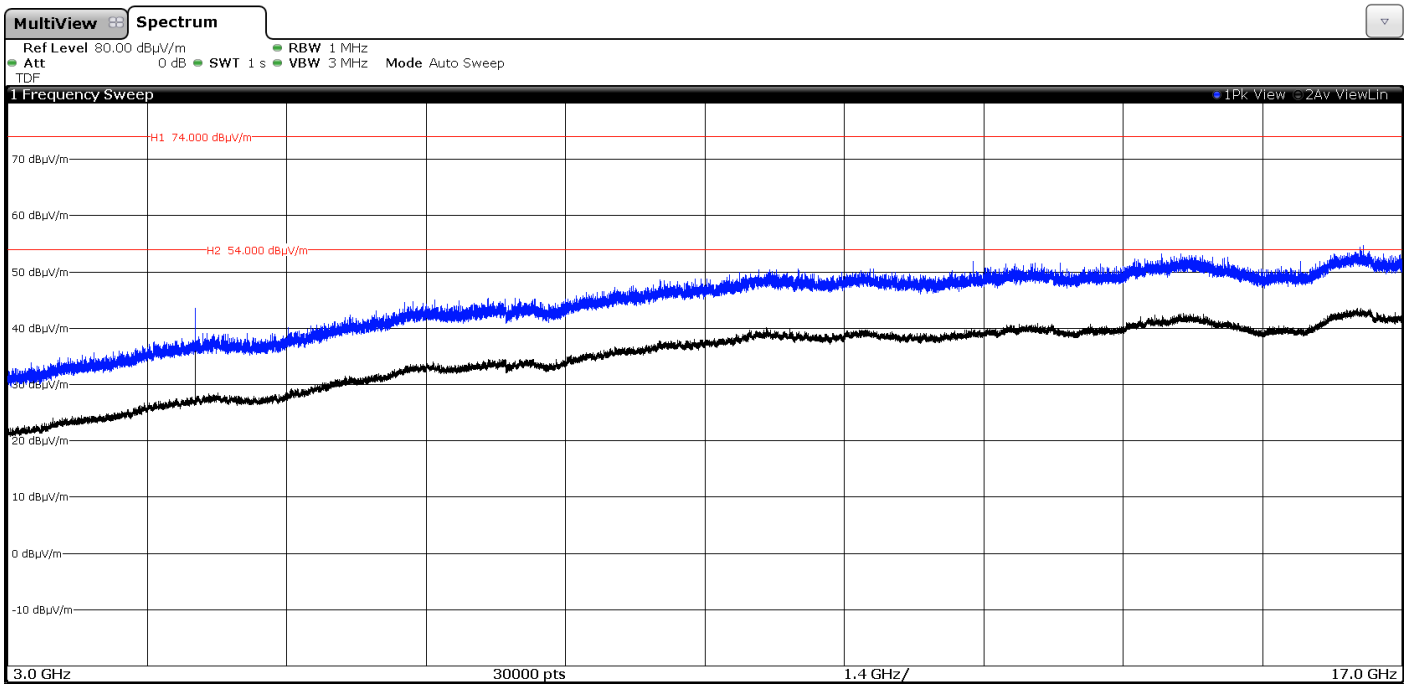
The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

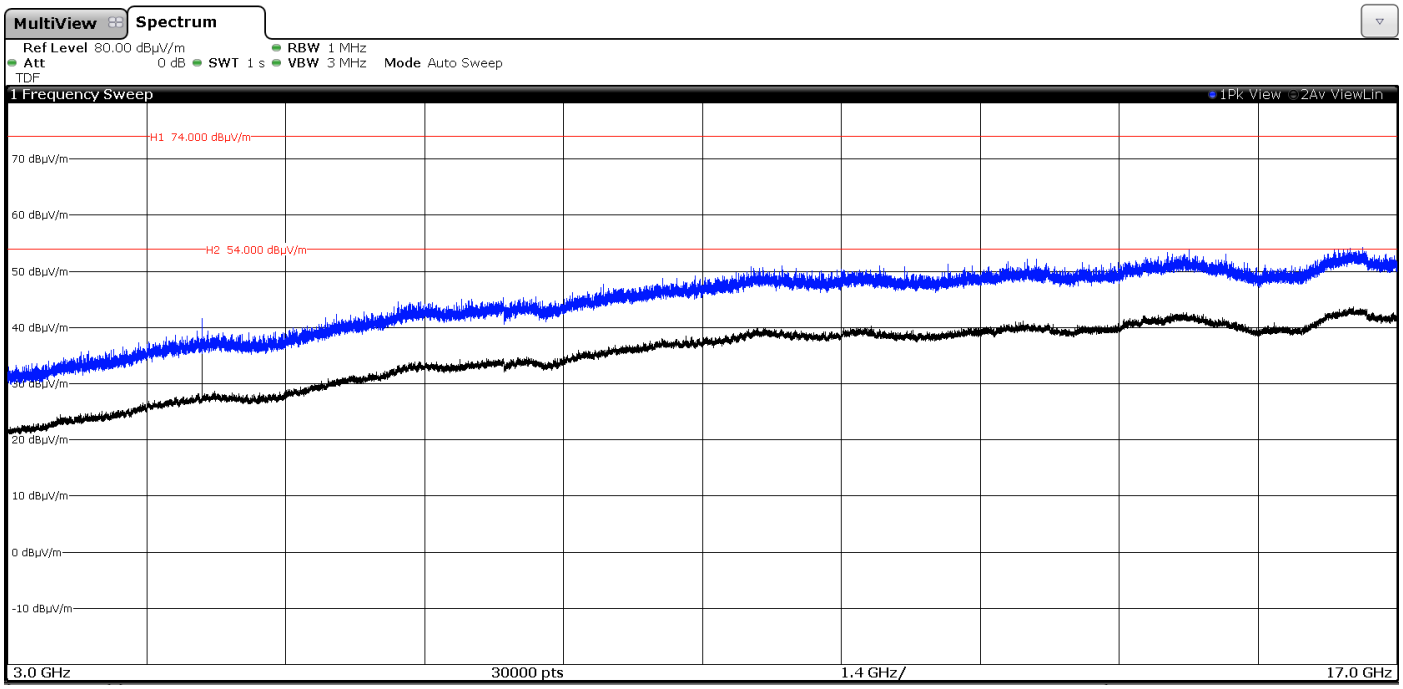
- Low Channel:



- Middle Channel:

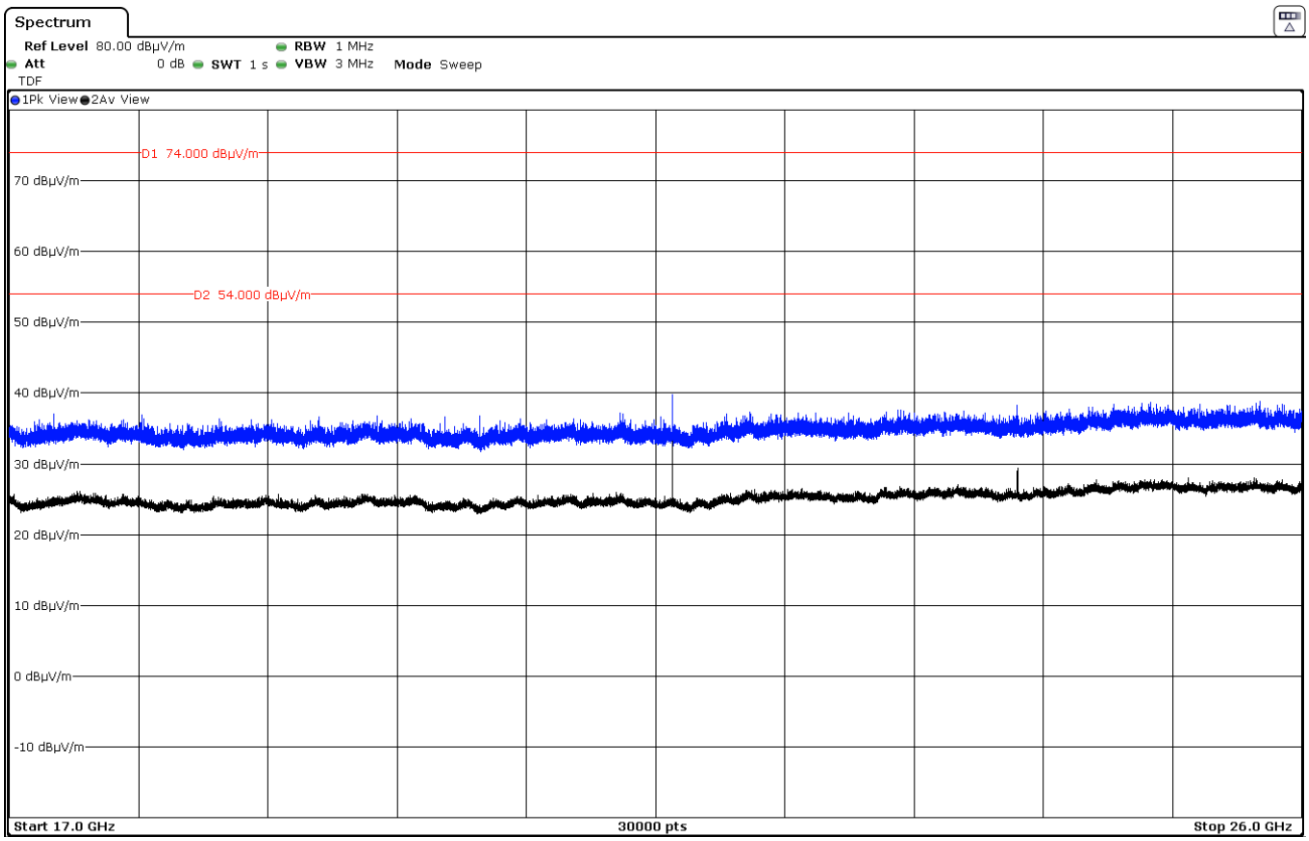


- High Channel:



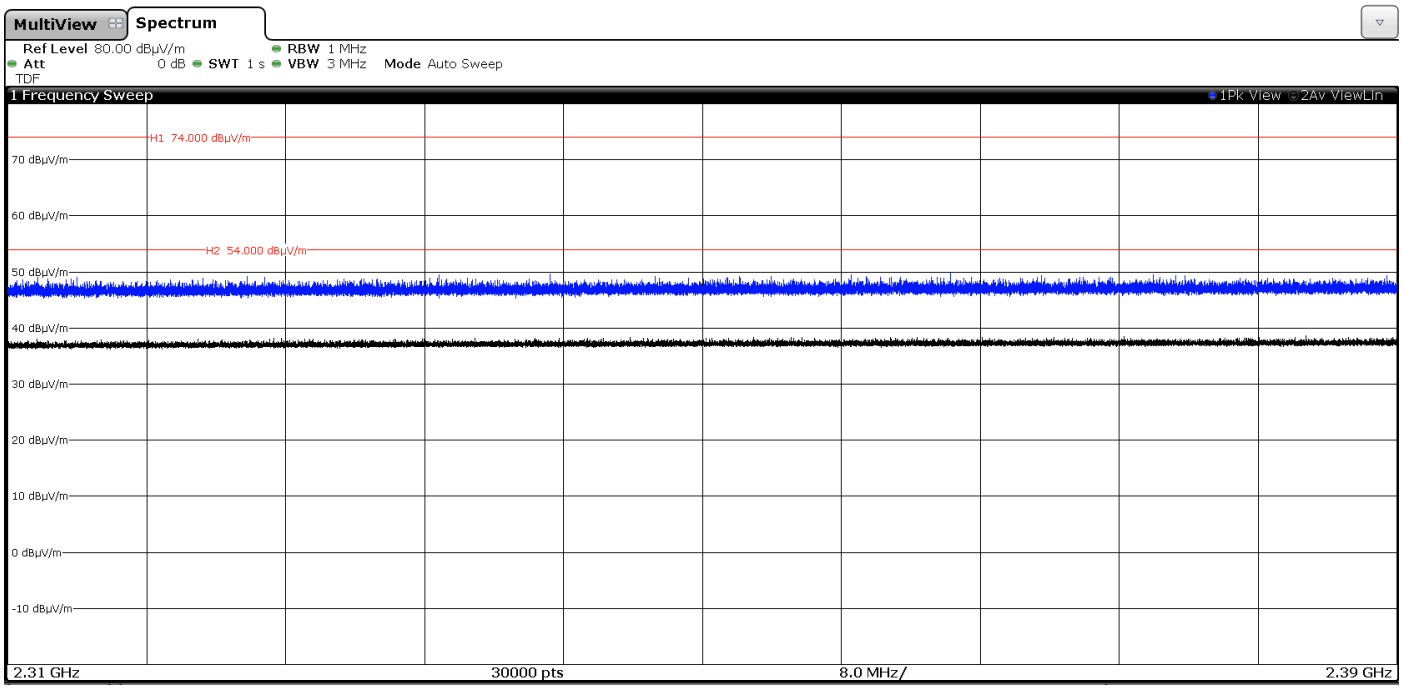
FREQUENCY RANGE 17 - 26 GHz

The spurious signals detected do not depend on the operating channel, so this plot is valid for Low, Middle and High Channels.

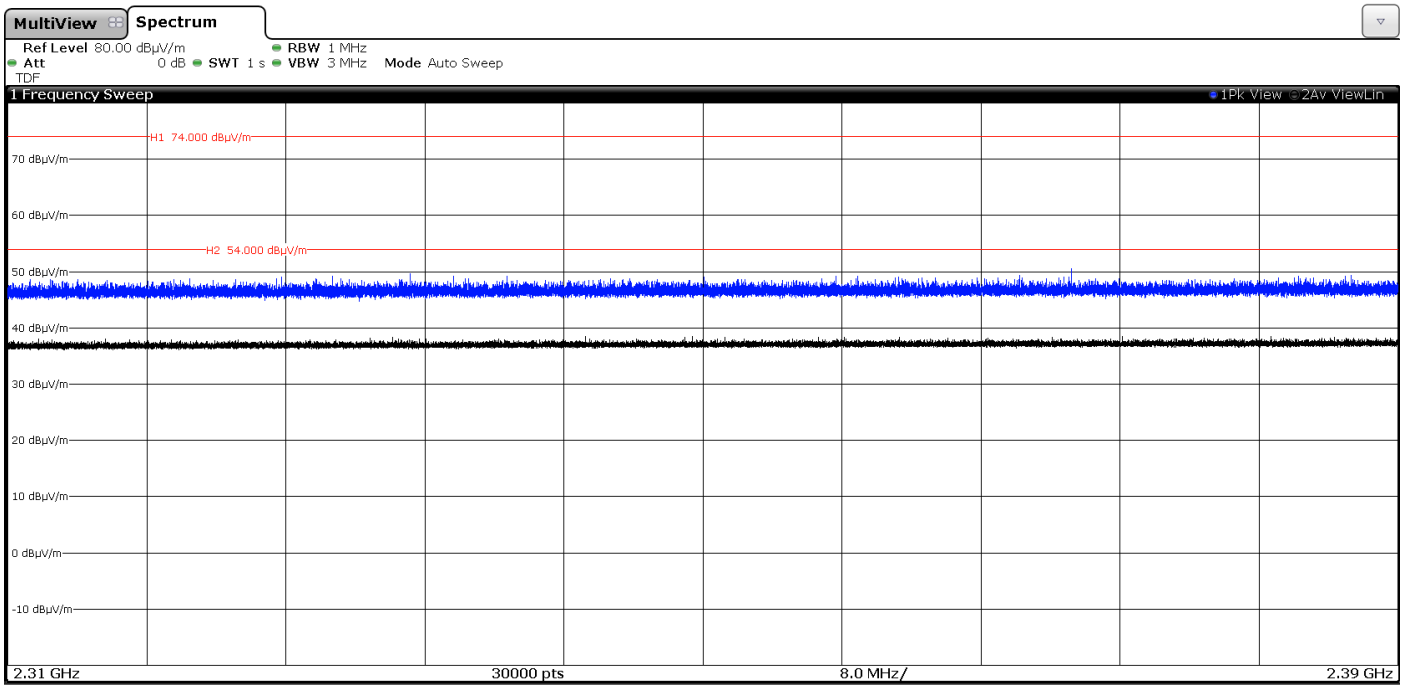


FREQUENCY RANGE 2.31 - 2.39 GHz

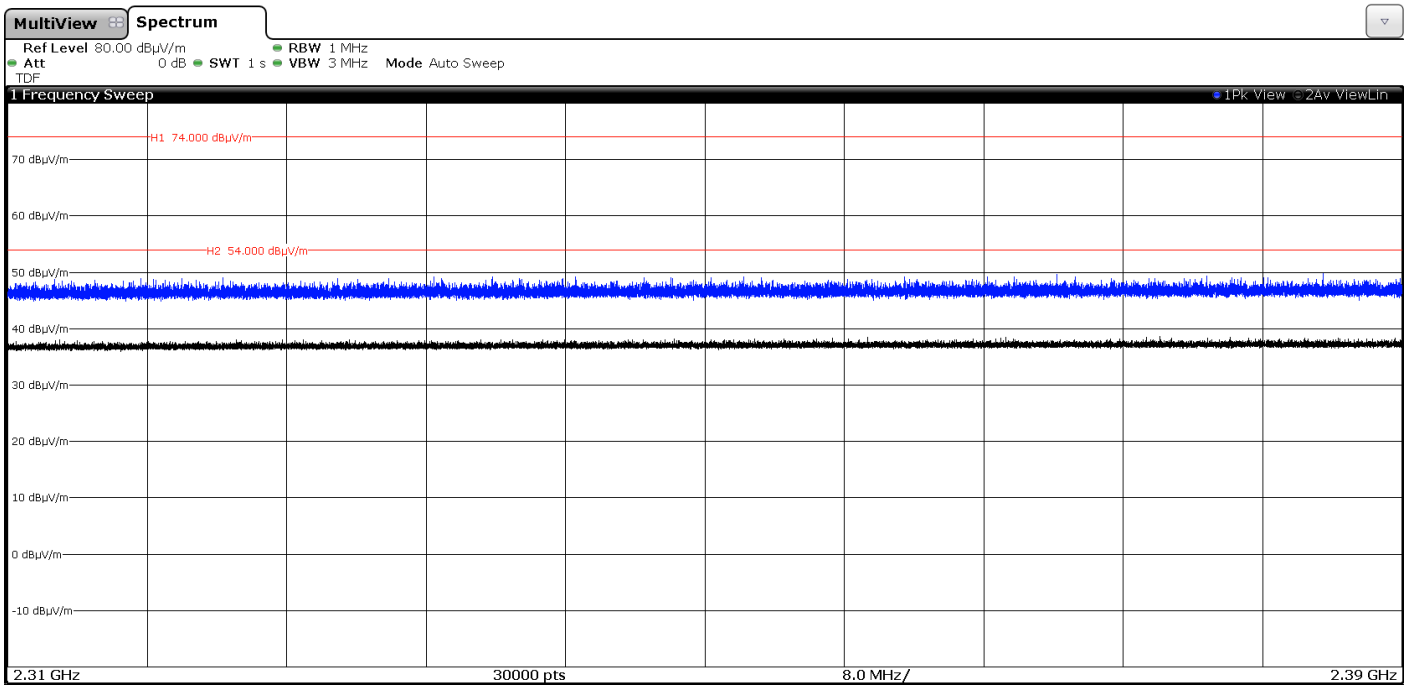
- Low Channel:



- Middle Channel:

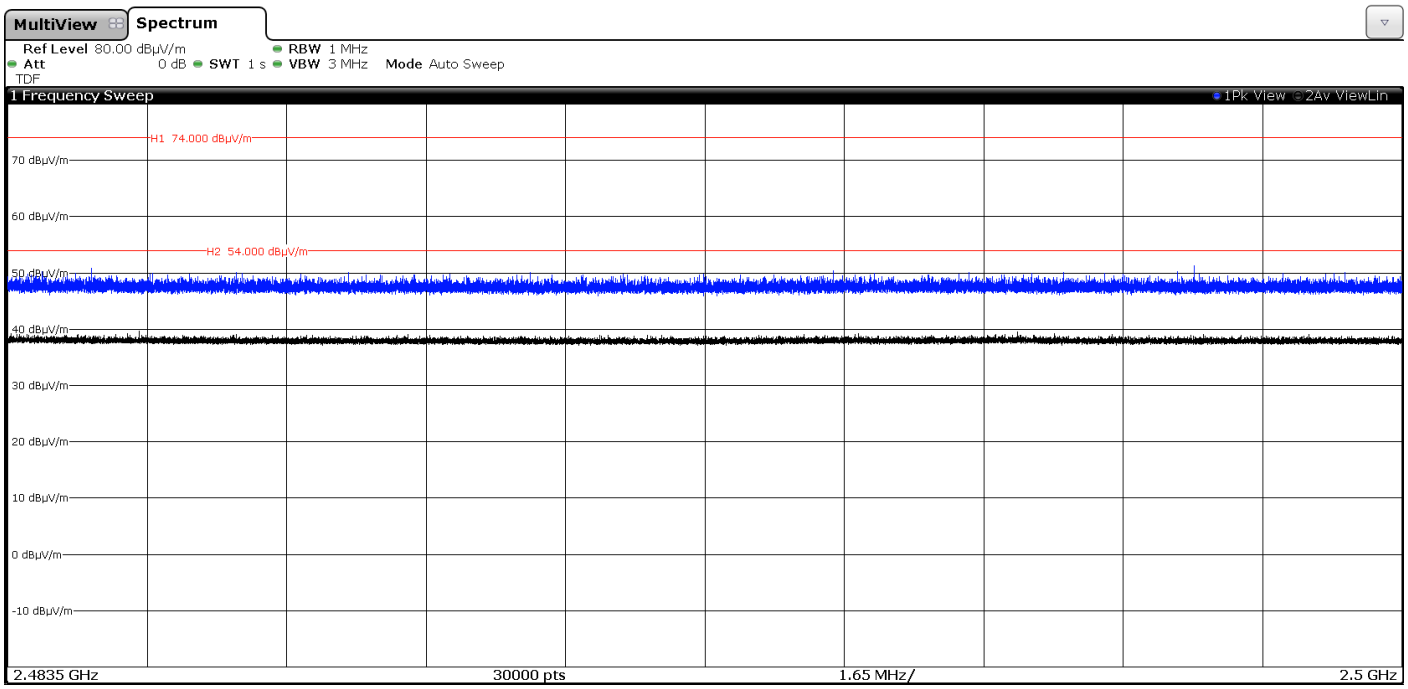


- High Channel:

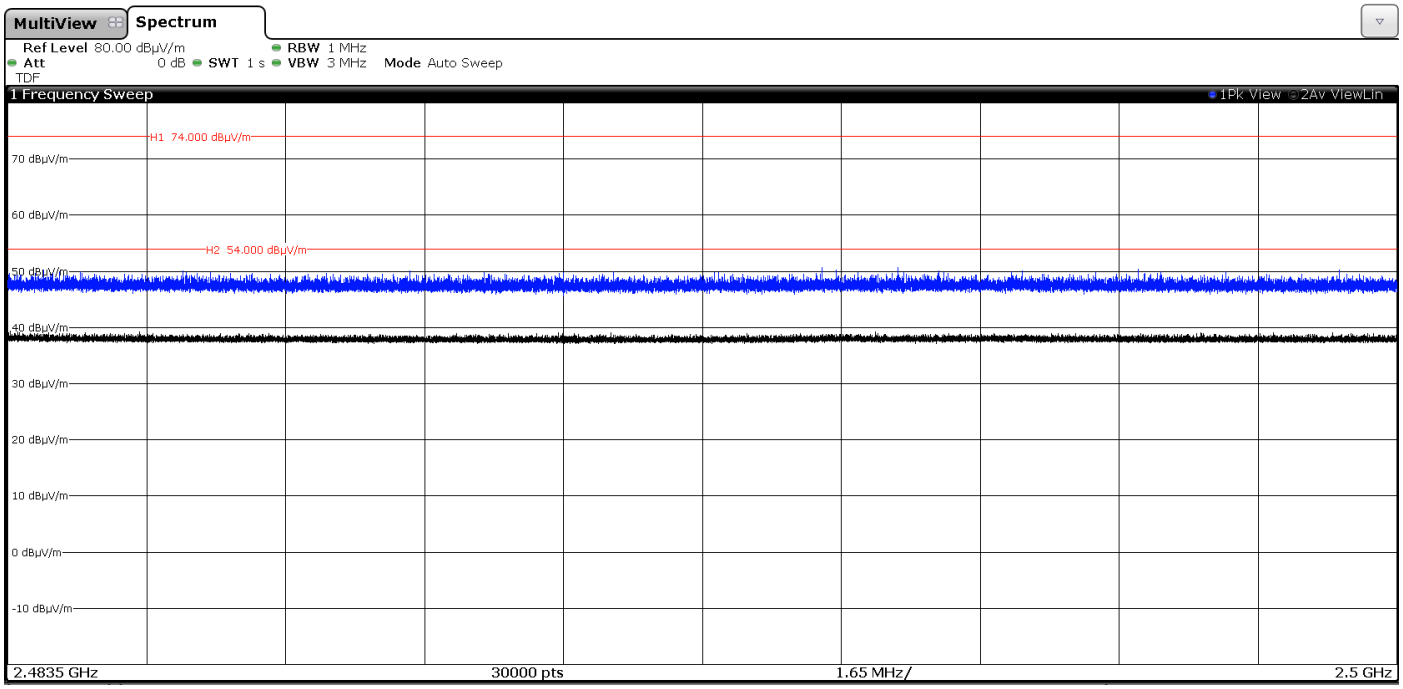


FREQUENCY RANGE 2.4835 - 2.5 GHz

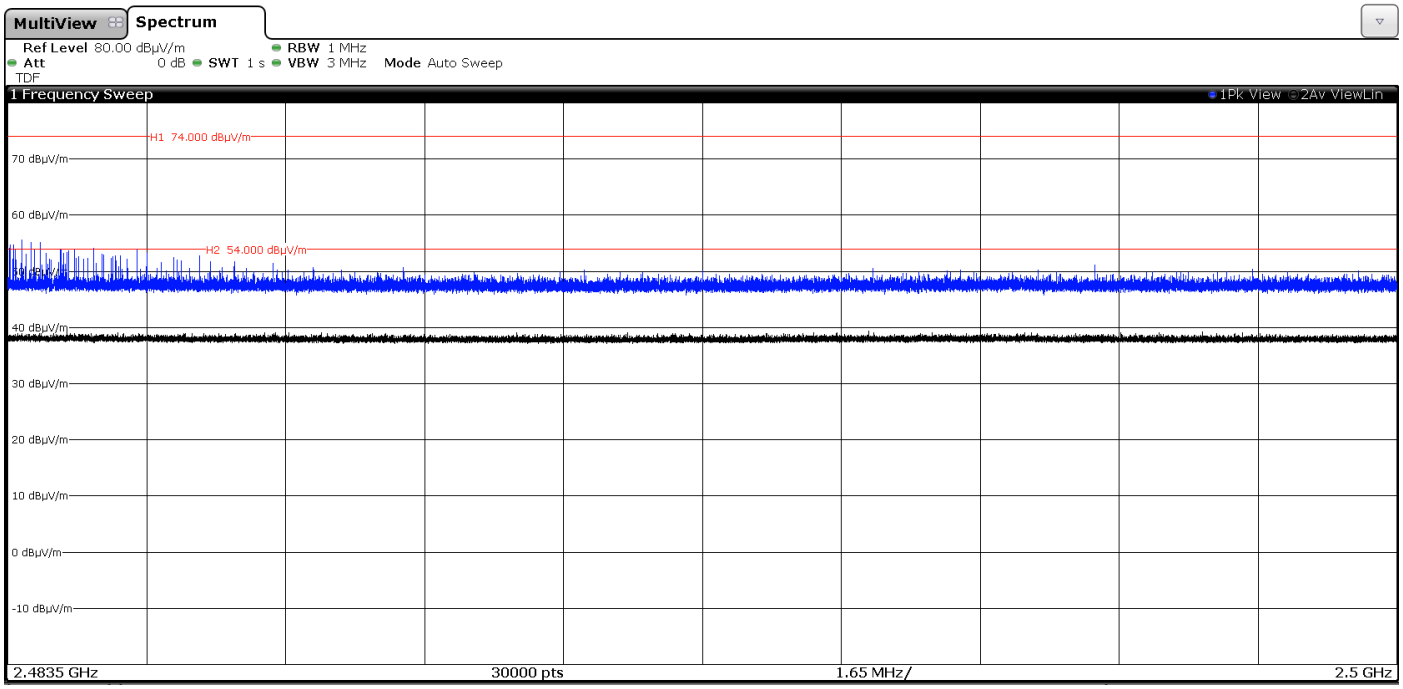
- Low Channel:



- Middle Channel:



- High Channel:



Appendix C: Test results. Proprietary protocol DM

INDEX

TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	1.45 Vdc
Type of power supply:	DC voltage from Zinc Air Battery
Type of antenna:	Small magnetic loop antenna.
Declared antenna gain:	- 12 dBi

TEST FREQUENCIES:

Low Channel:	2402 MHz
Middle Channel:	2440 MHz
High Channel:	2480 MHz

RADIATED MEASUREMENTS

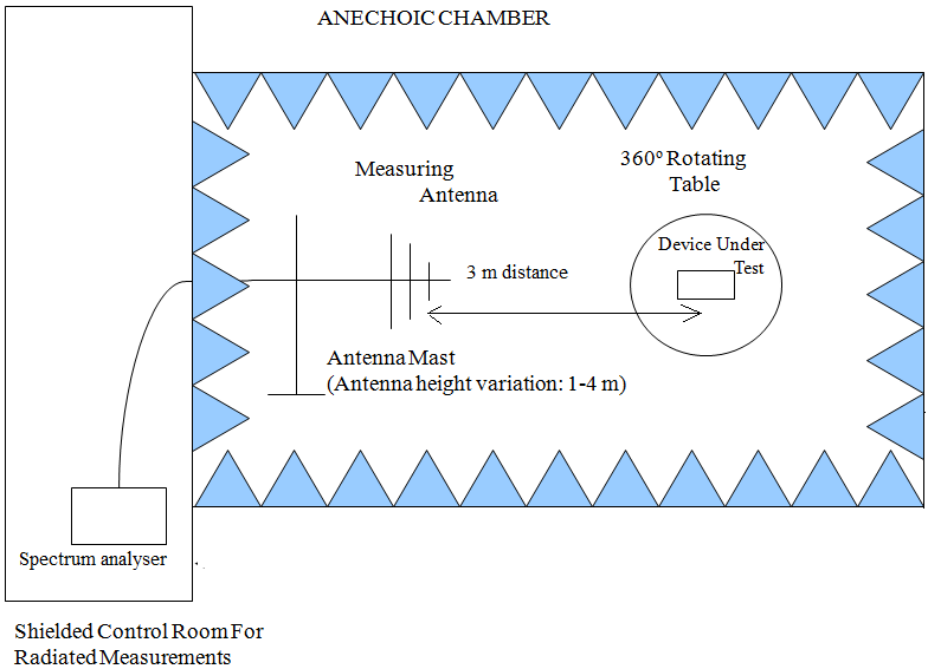
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40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

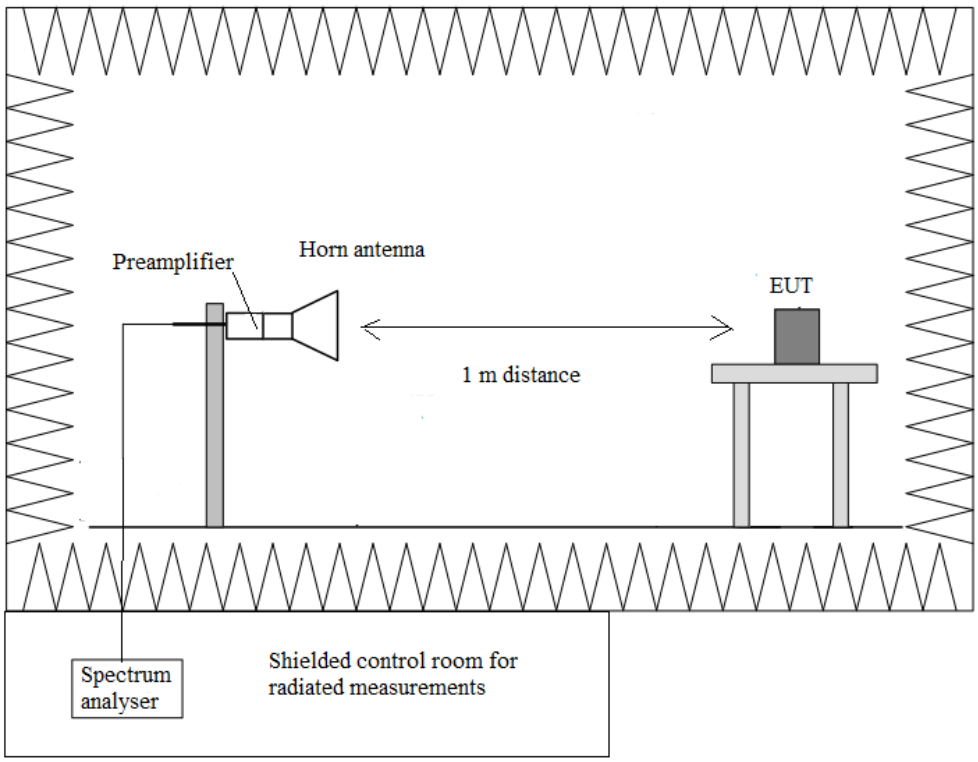
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup f < 1 GHz:



Radiated measurements setup f > 1 GHz:



Section 15.249 Subclause (a) / RSS-210 B.10. (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

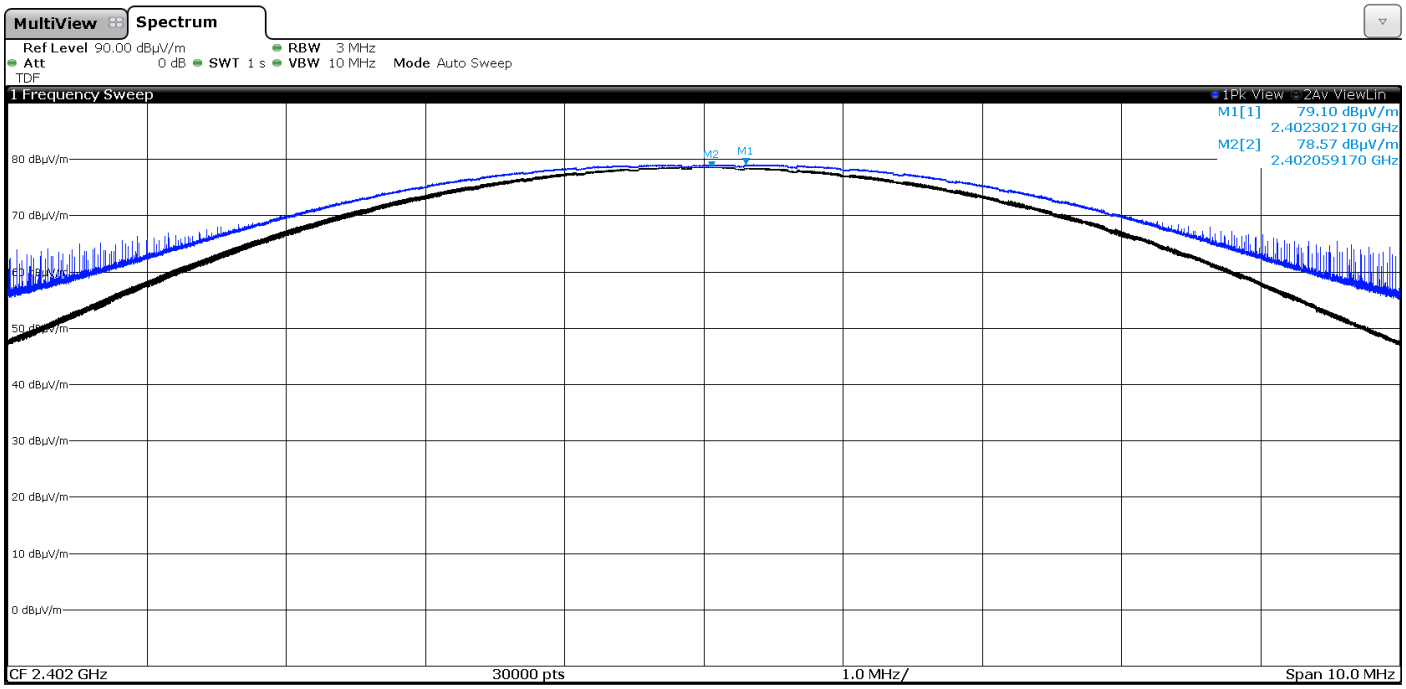
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

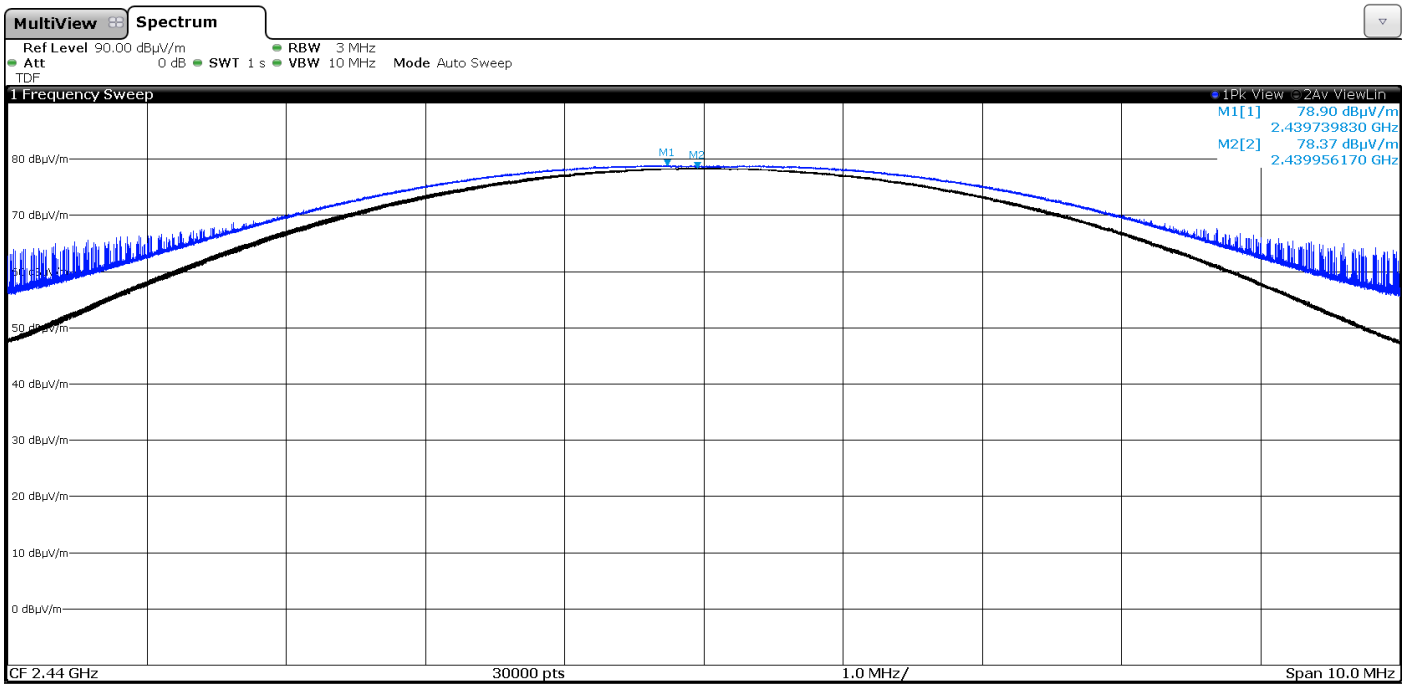
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBµV/m)	78.57	78.37	77.76
Peak Field Strength (dBµV/m)	79.10	78.90	78.35
Measurement Uncertainty (dB)	<±3.04		

Verdict: PASS

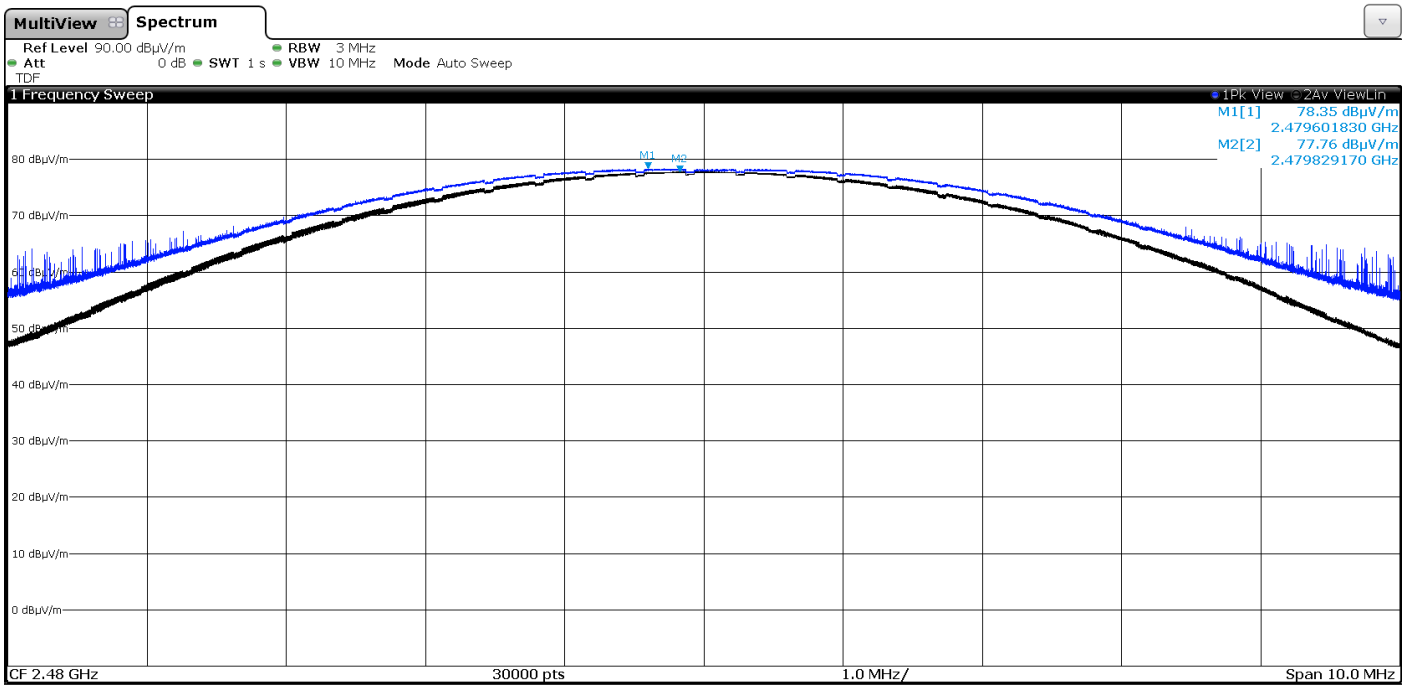
- Low Channel:



- Middle Channel:



- High Channel:



Section 15.249 Subclause (d) / RSS-210 B.10. (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics (µV/m)	Field strength of harmonics (dBµV/m)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

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

Whichever is the lesser attenuation.

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-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.

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

Spurious emissions at less than 20 dB from the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
645.80500	Quasi peak	26.02	H	<± 3.04

Frequency range 1 - 26 GHz.

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

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

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.80343	Peak	43.29	V	<±4.88
21.61852	Peak	40.77	H	<±4.88

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.87950	Peak	43.69	V	<±4.88
21.96245	Peak	40.11	H	<±4.88

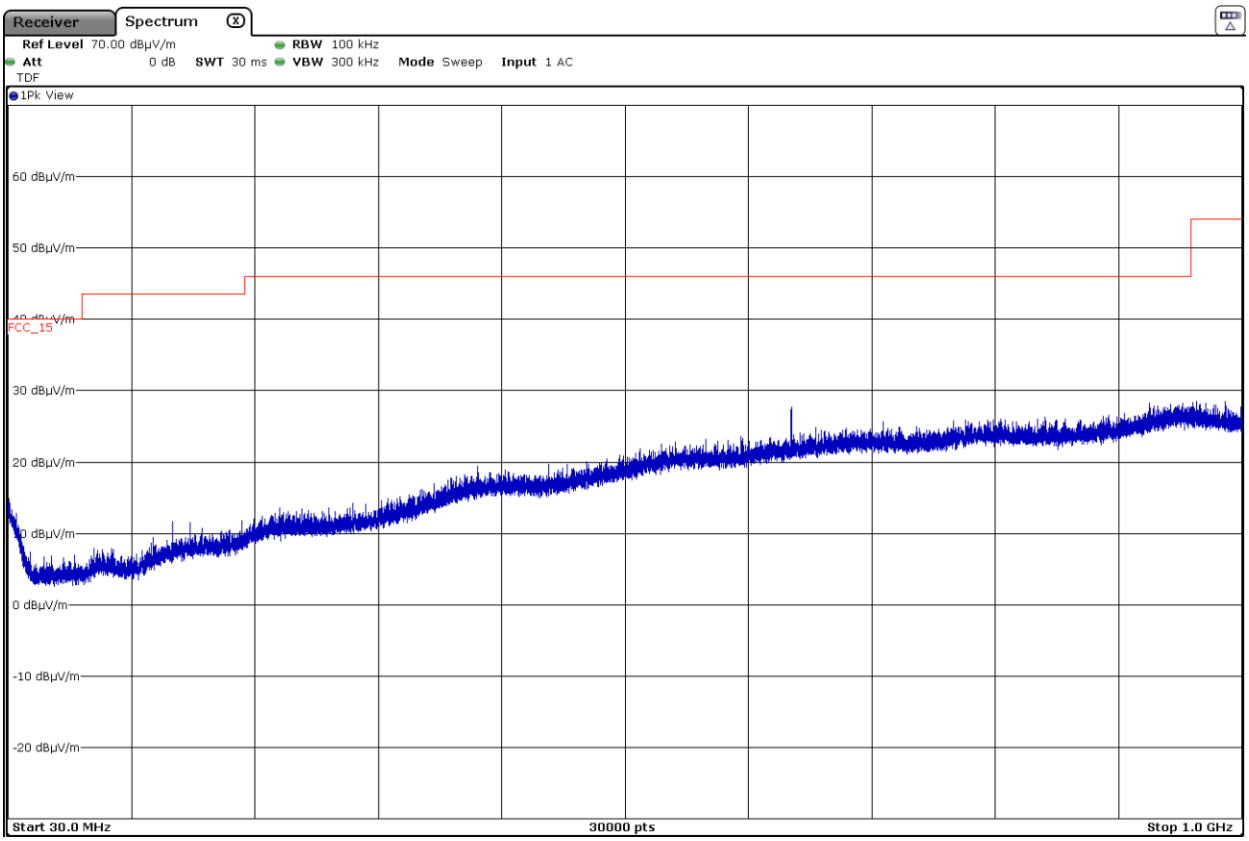
- High Channel (2480 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
2.48382	Peak	56.40	V	<±4.88
	Average	39.78		<±4.88
4.95977	Peak	41.76	V	<±4.88
22.31735	Peak	42.81	H	<±4.88

Verdict: PASS

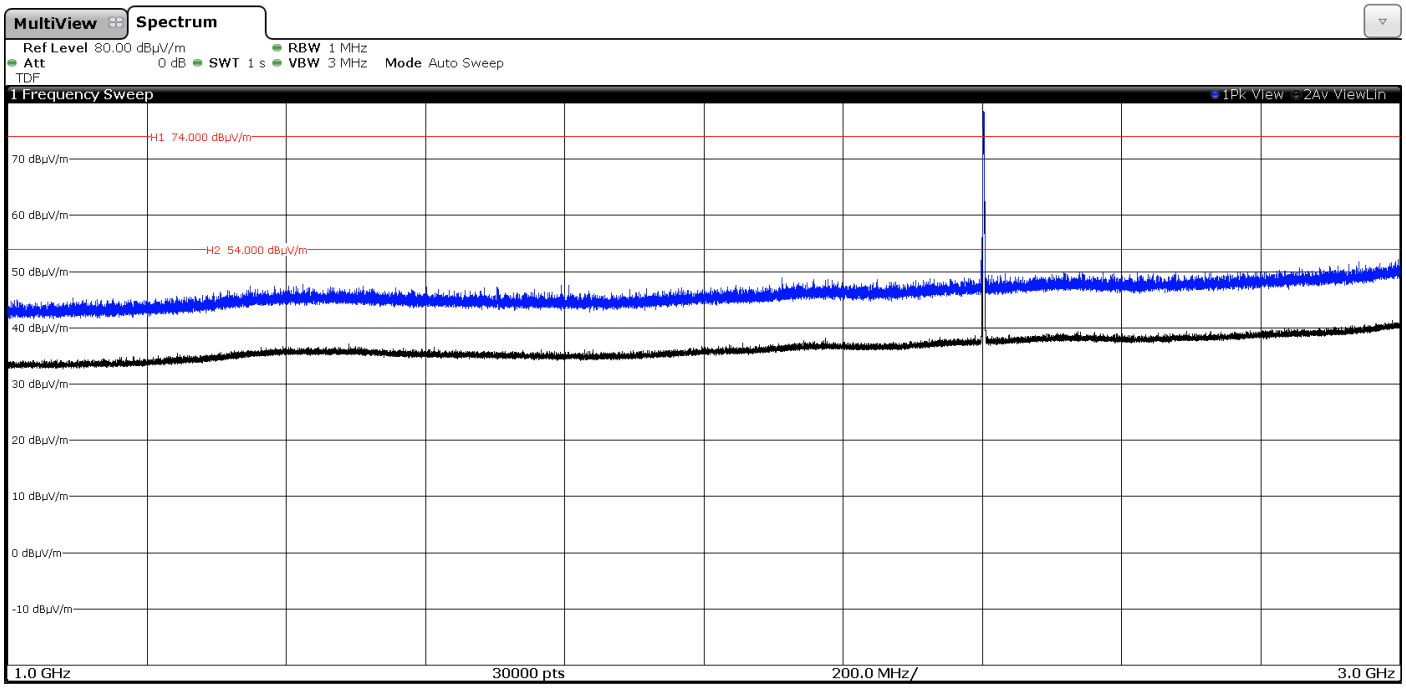
FREQUENCY RANGE 30 MHz - 1 GHz

The spurious signals detected do not depend on the operating channel, so this plot is valid for Low, Middle and High Channels.



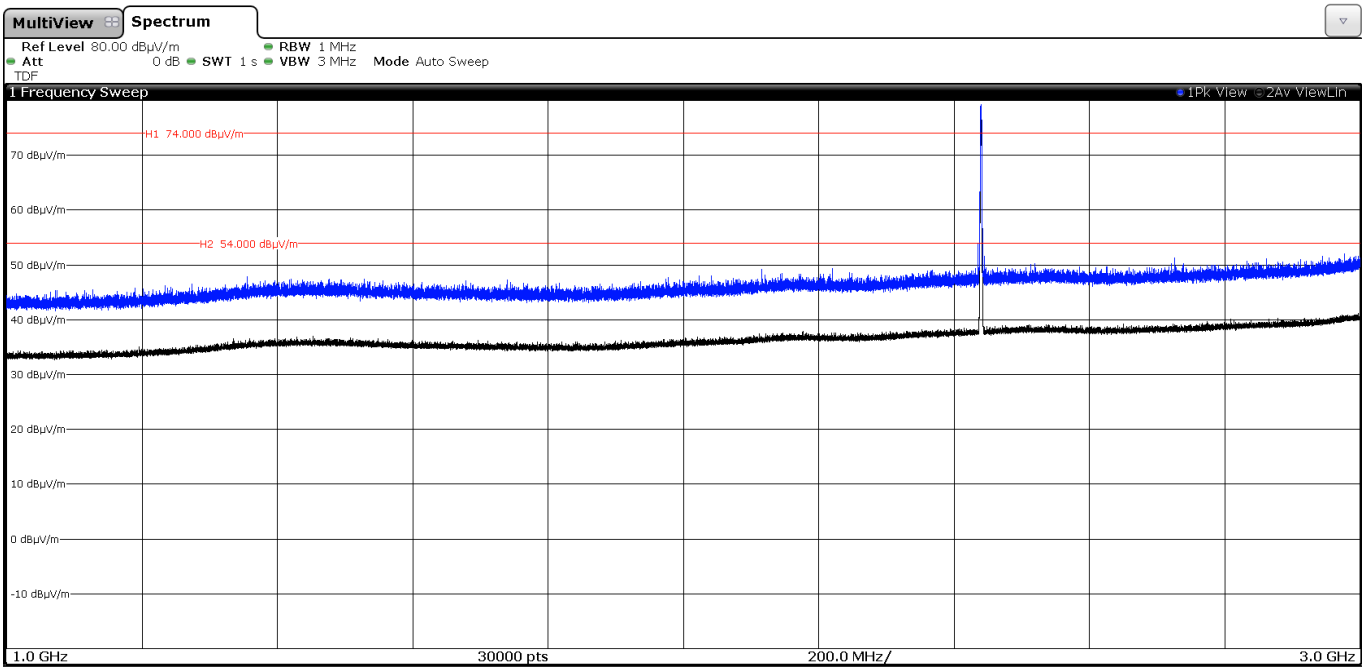
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



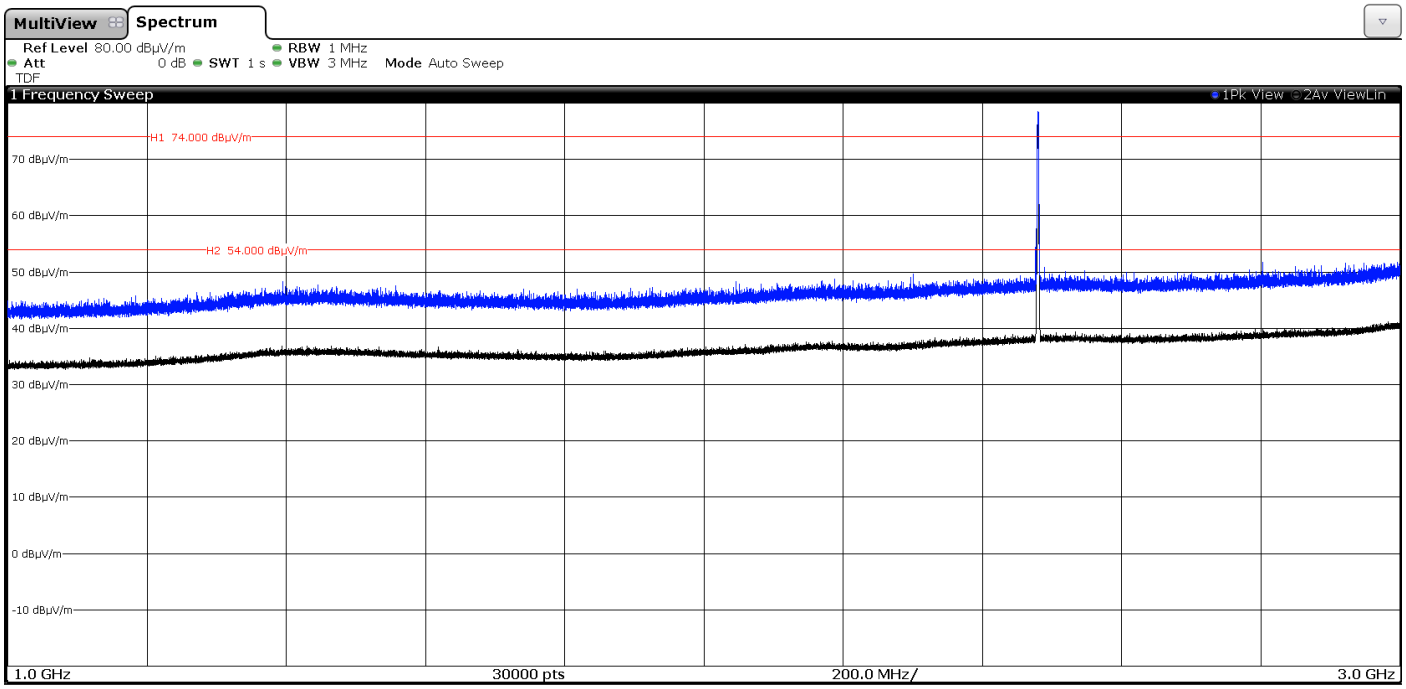
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



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

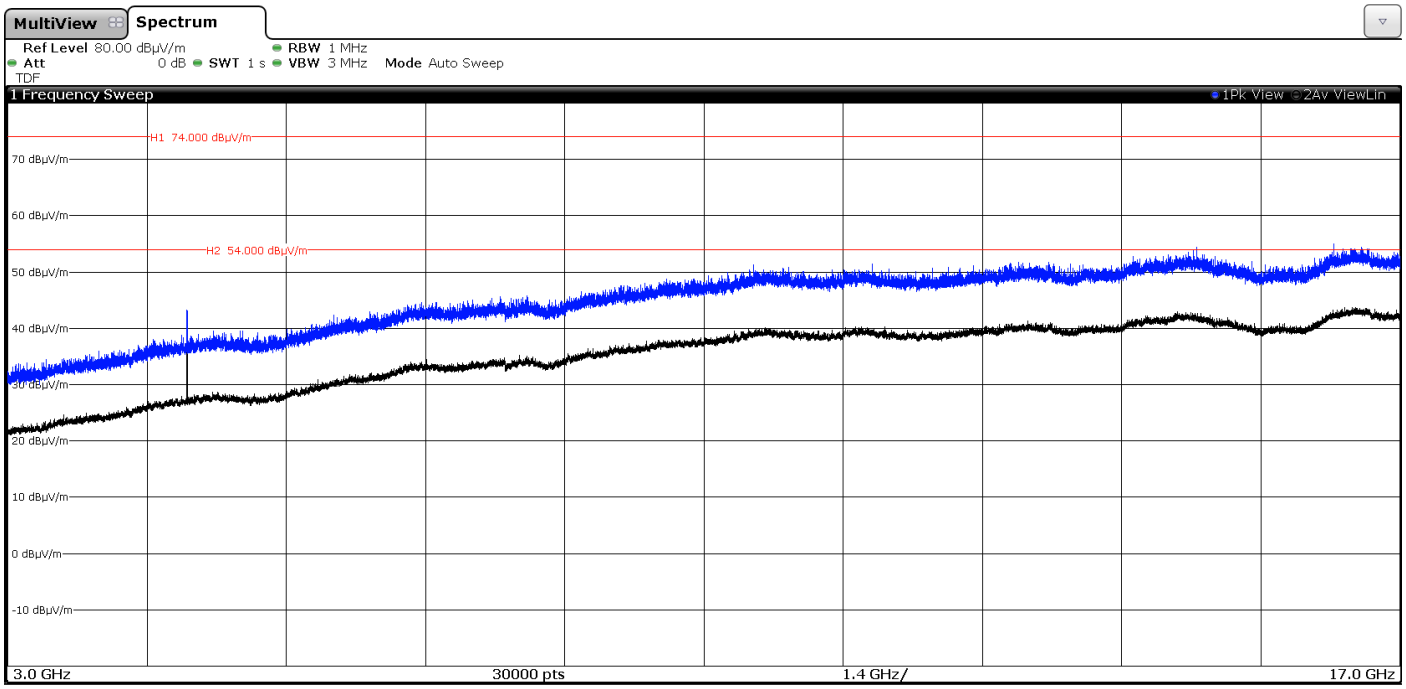
- High Channel:



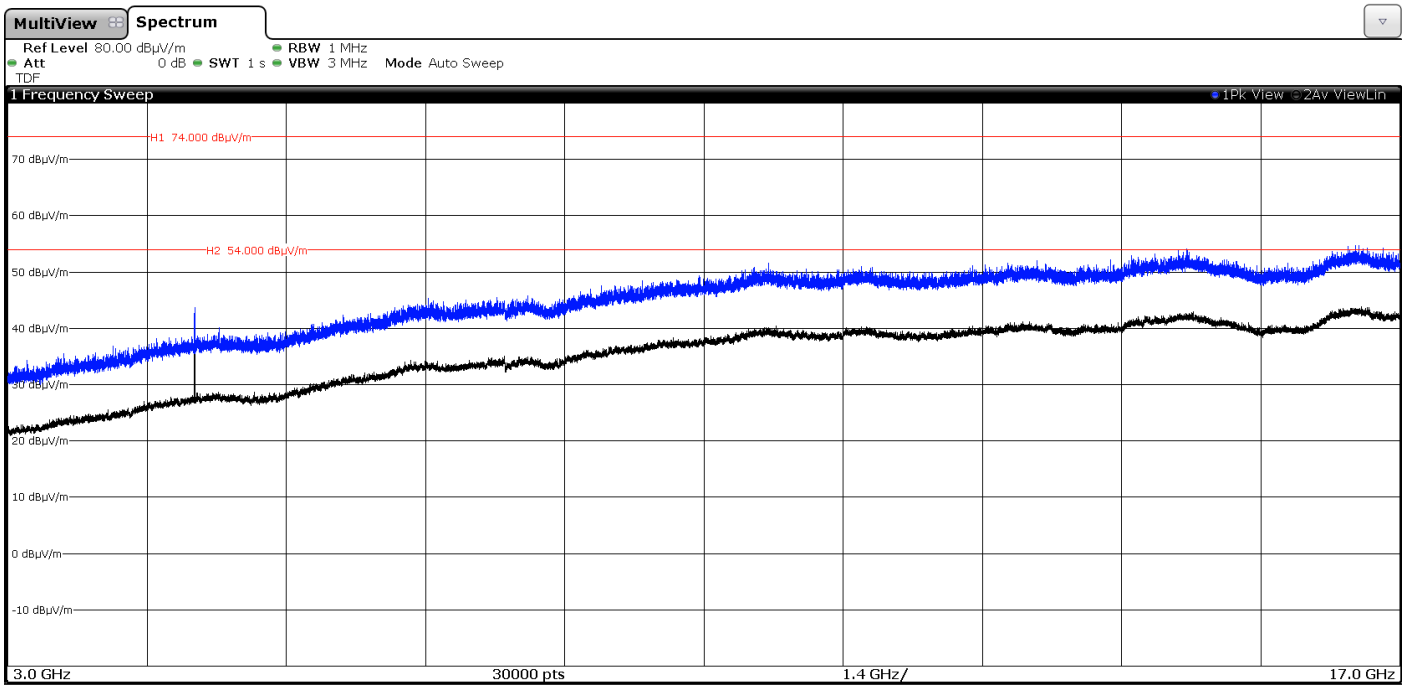
The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

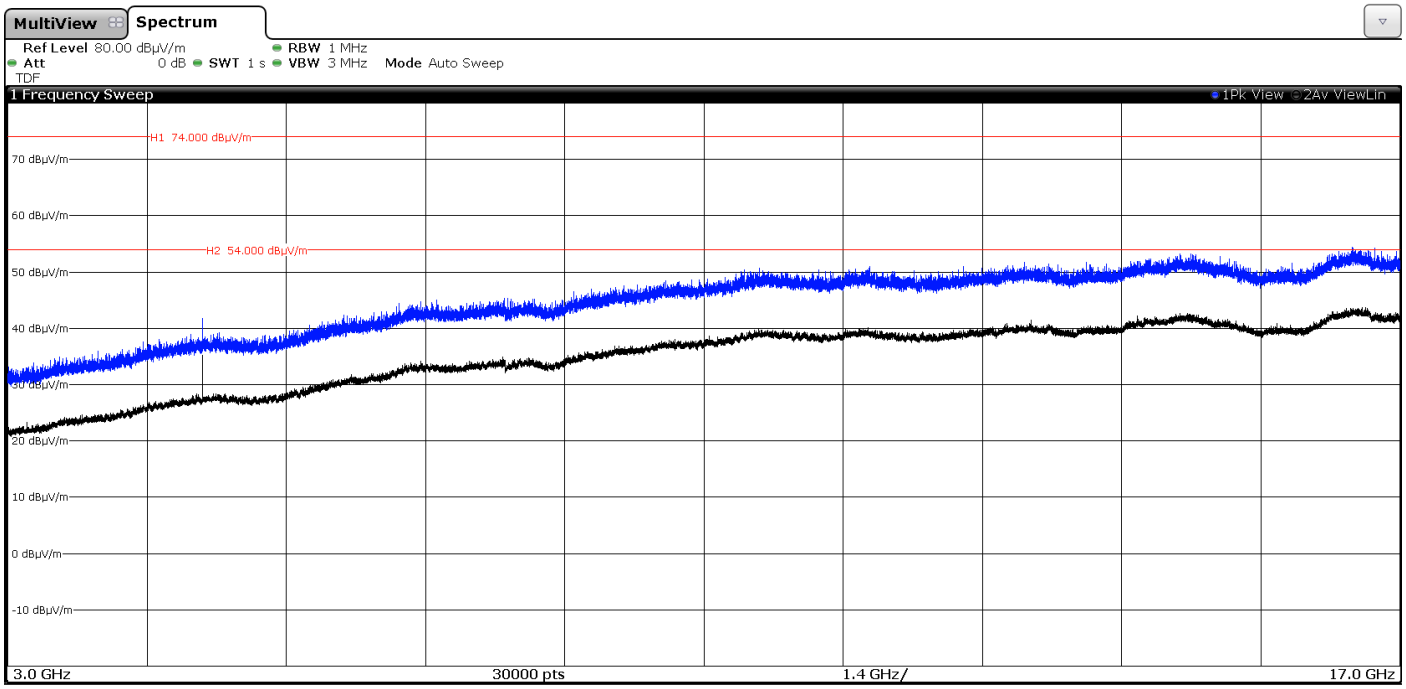
- Low Channel:



- Middle Channel:

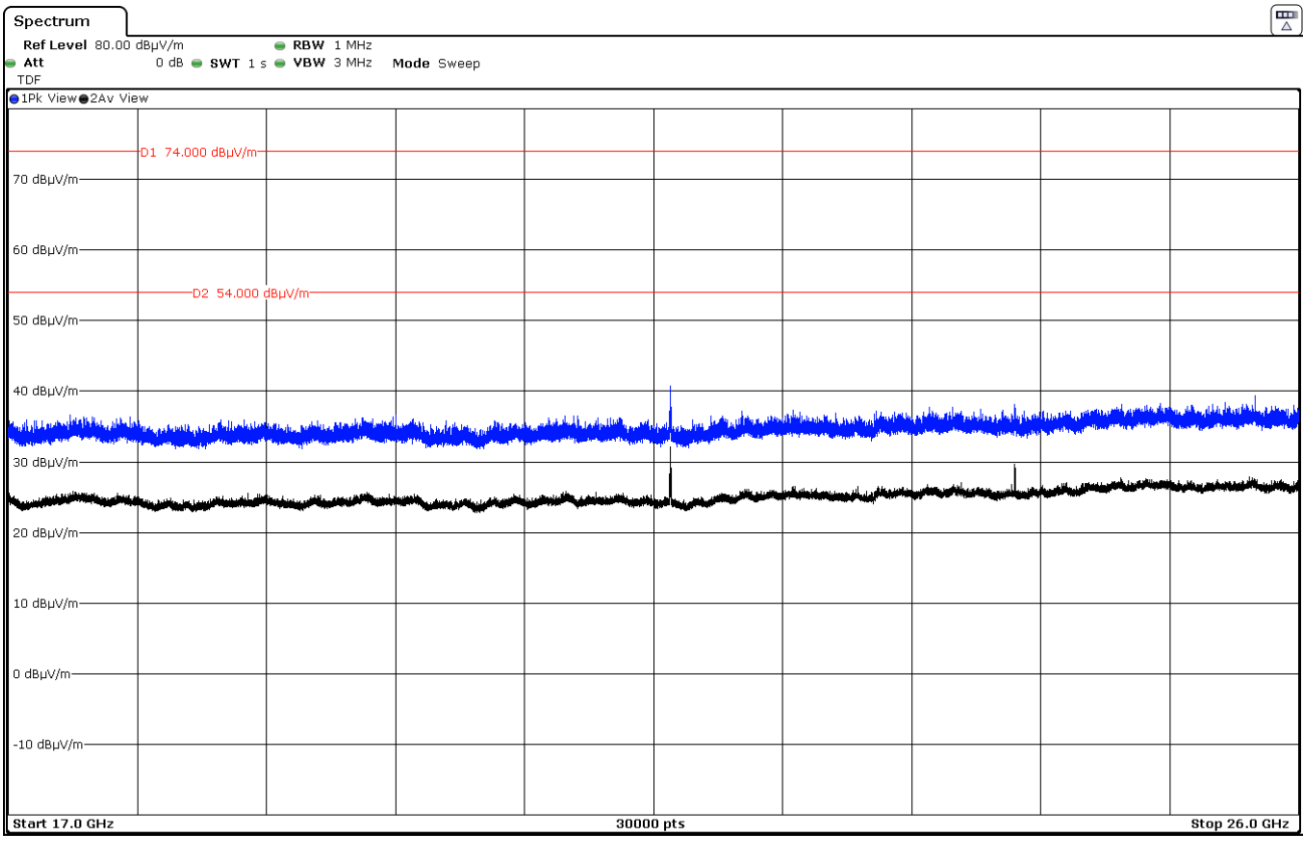


- High Channel:

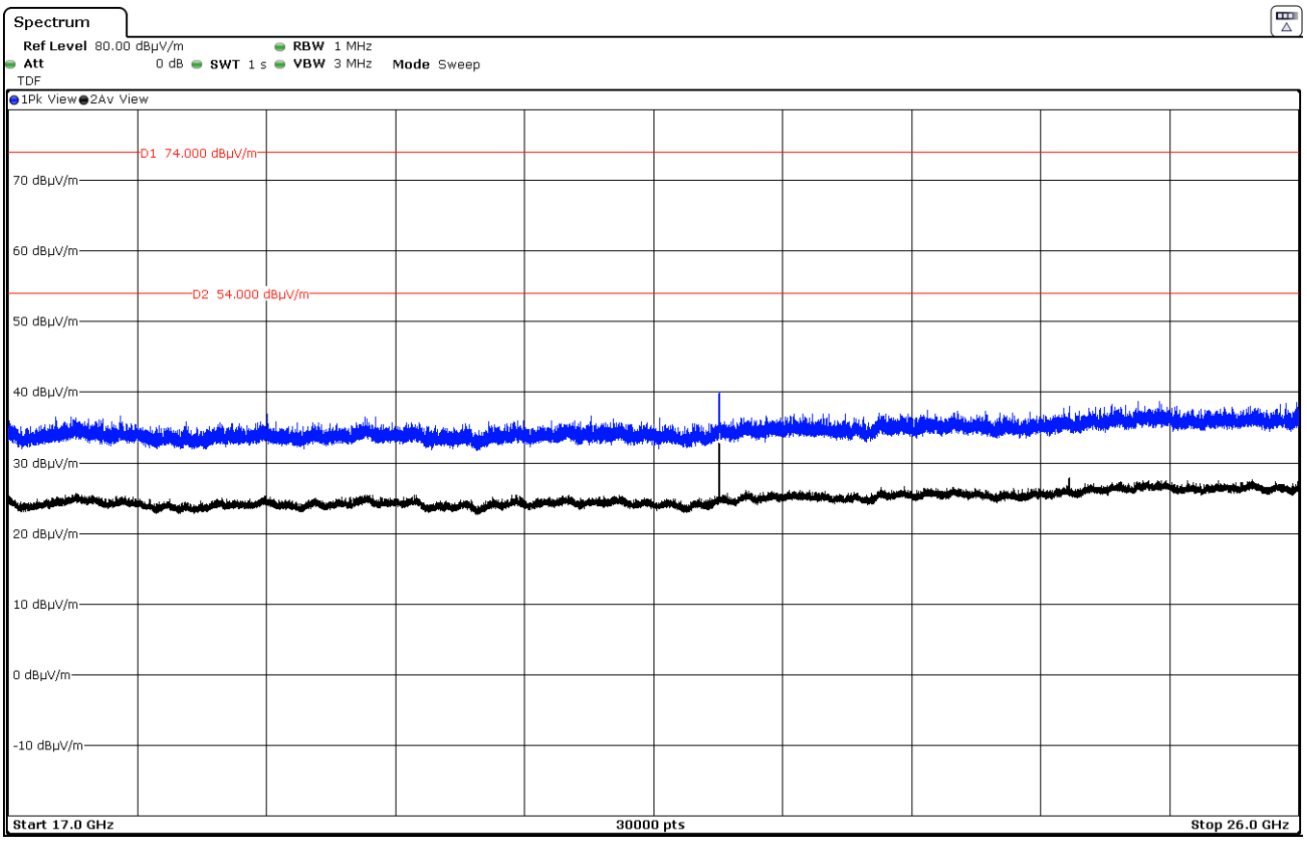


FREQUENCY RANGE 17 - 26 GHz

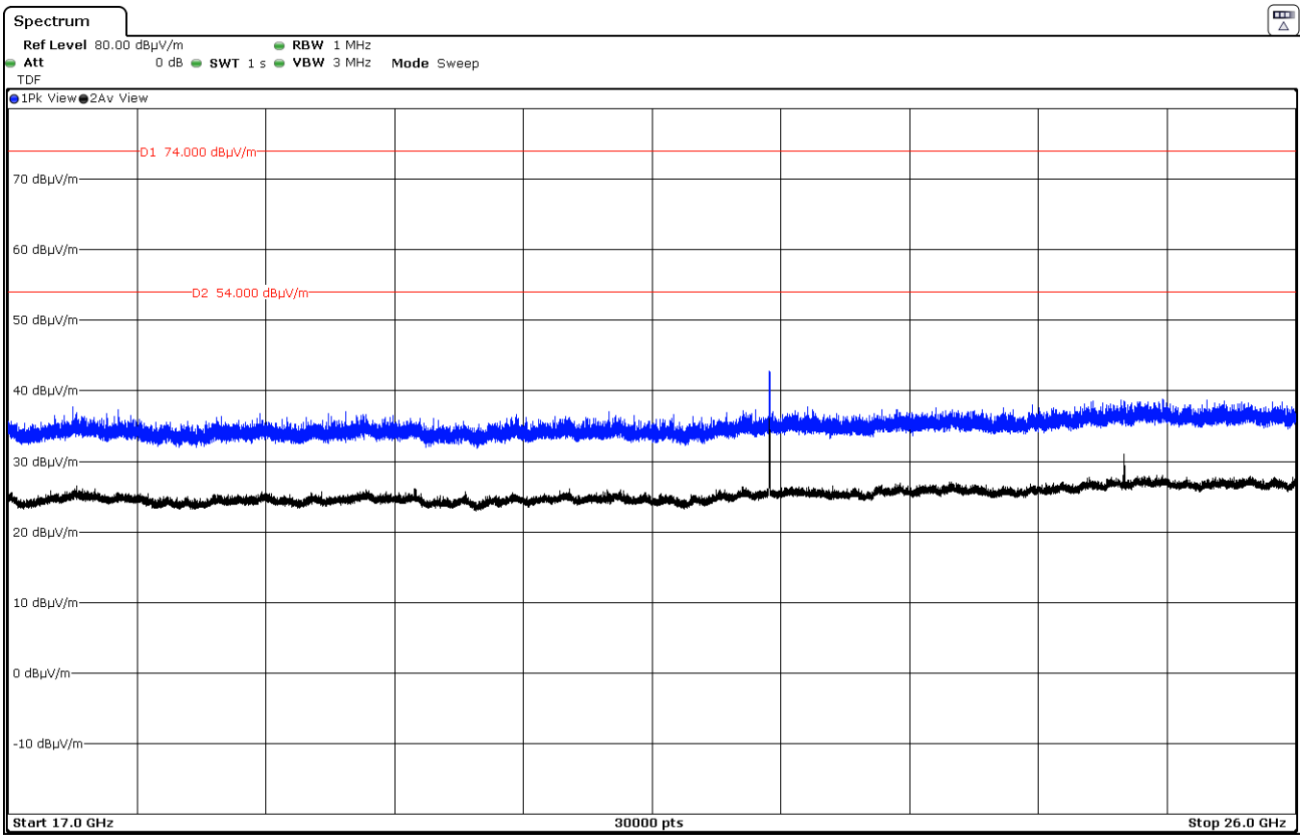
- Low Channel:



- Middle Channel:

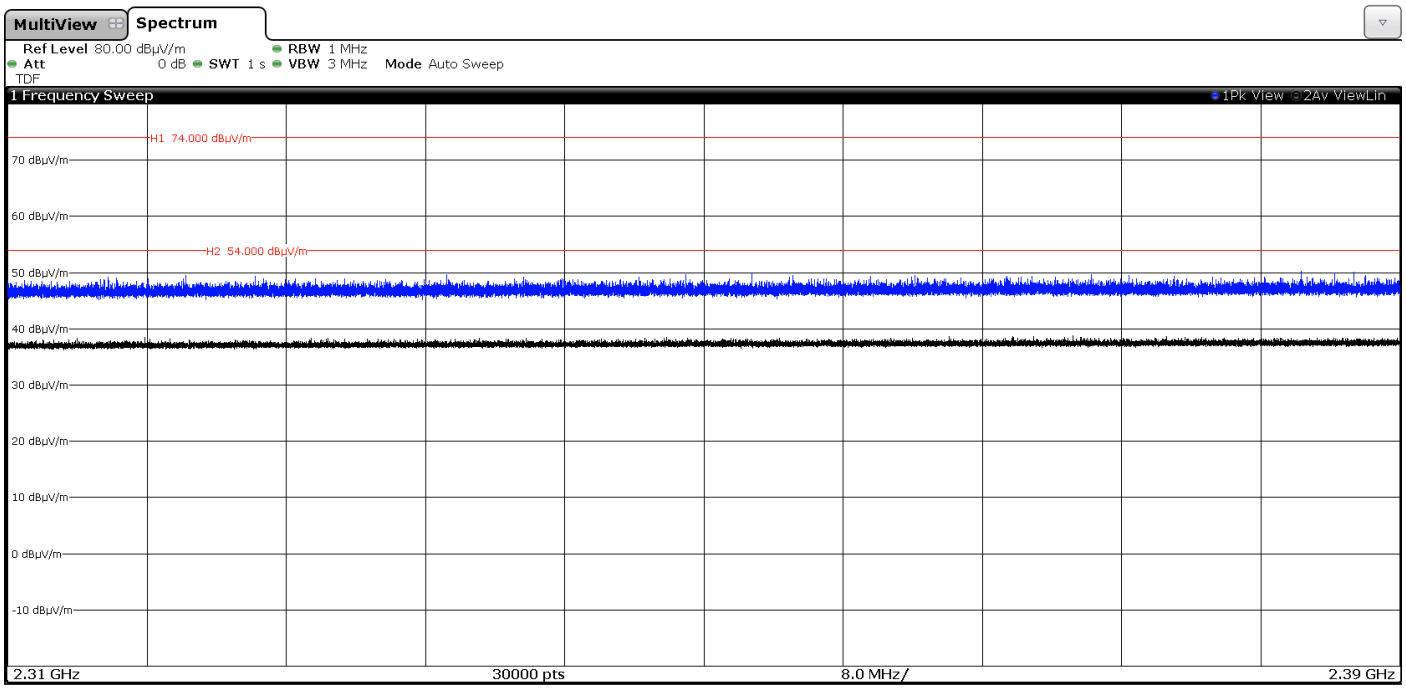


-High channel:

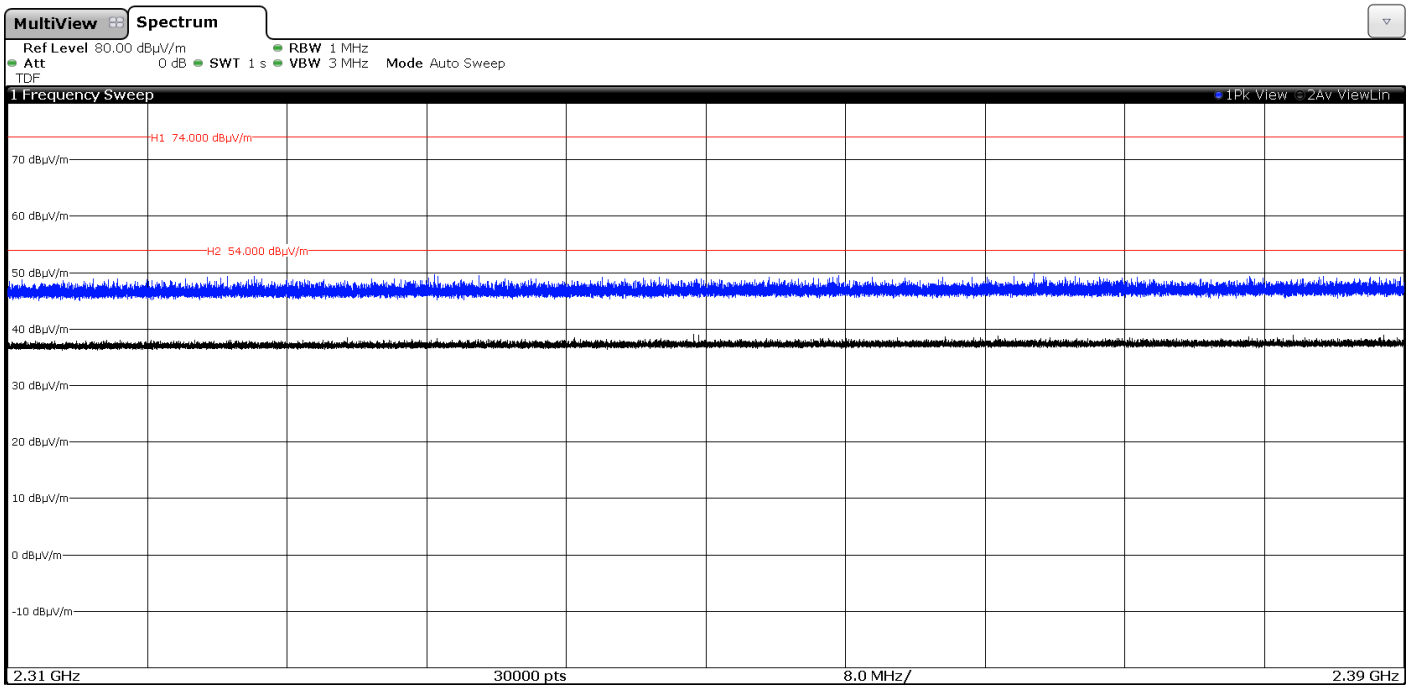


FREQUENCY RANGE 2.31 - 2.39 GHz

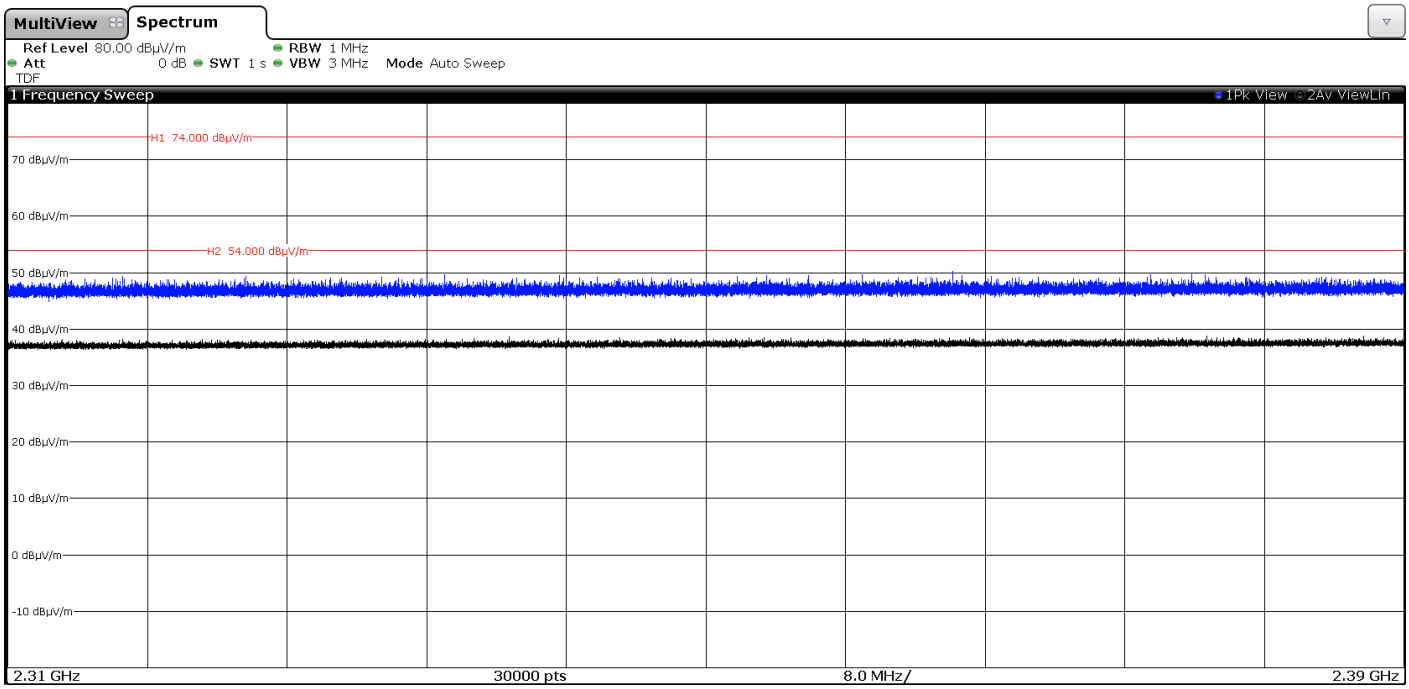
- Low Channel:



- Middle Channel:

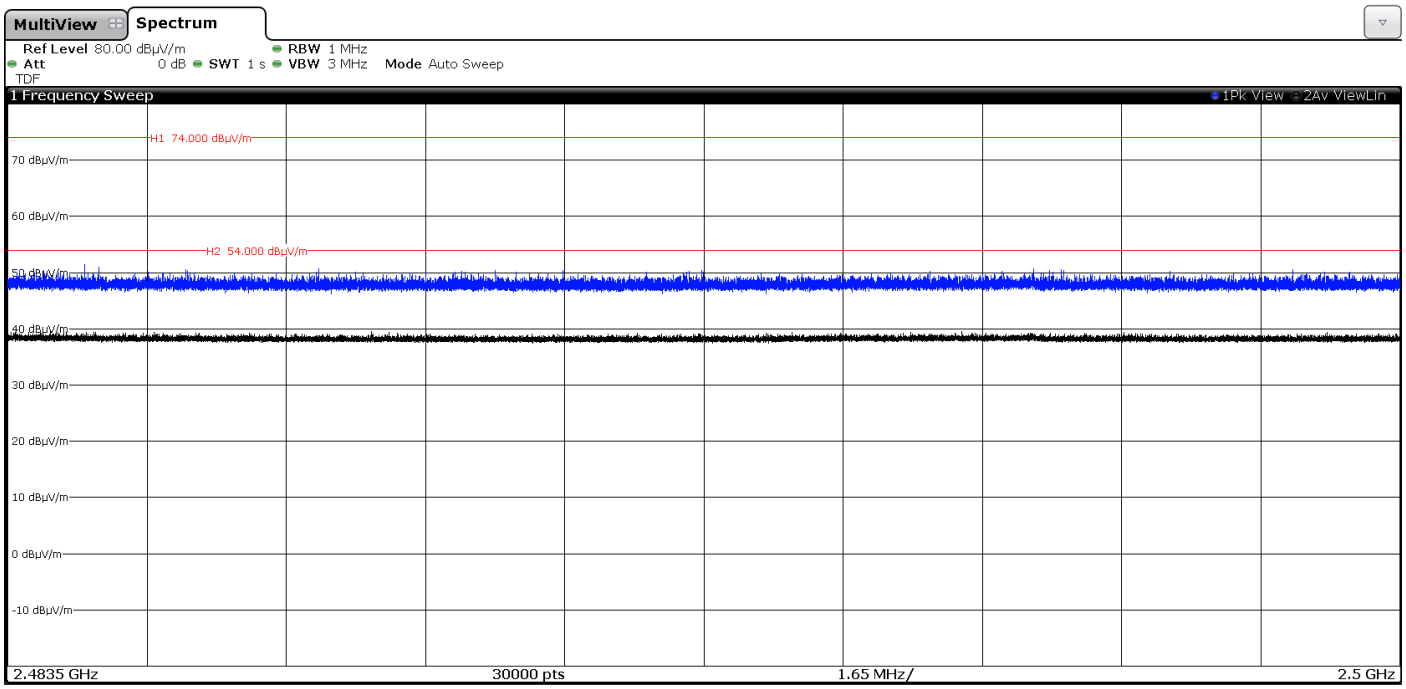


- High Channel:

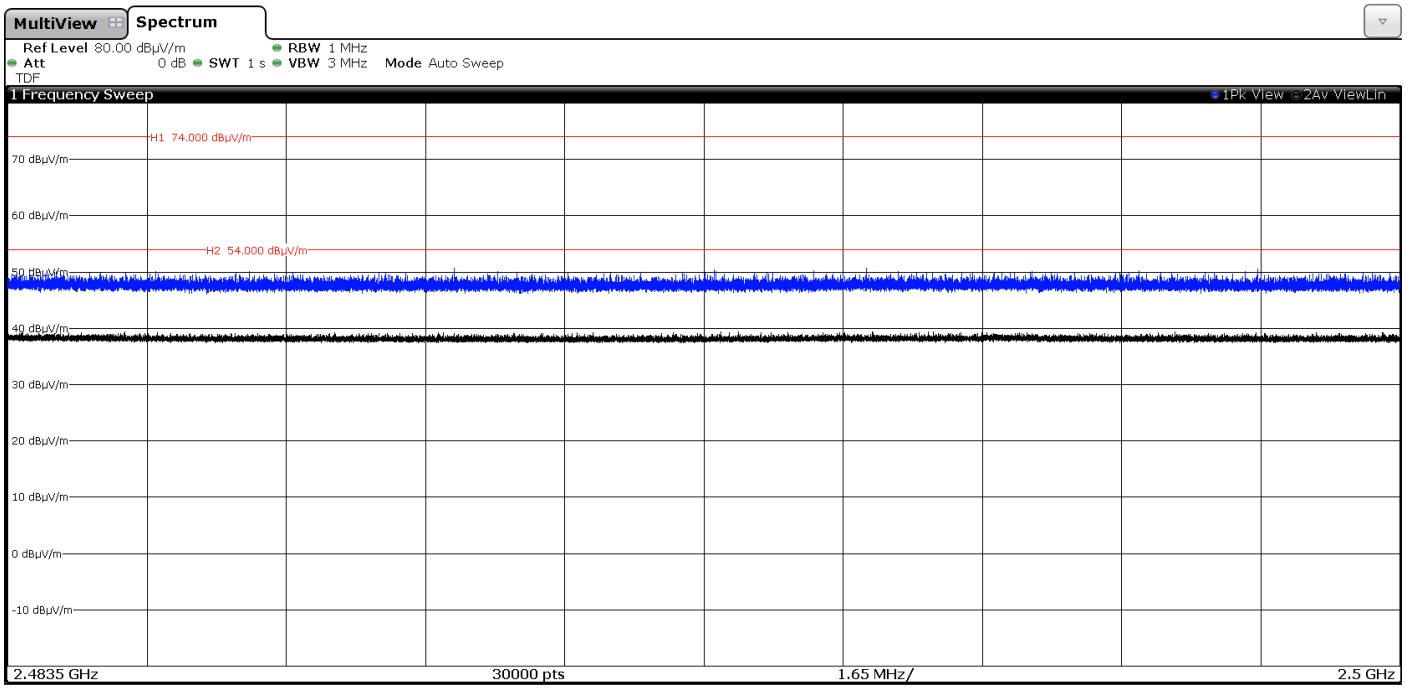


FREQUENCY RANGE 2.4835 - 2.5 GHz

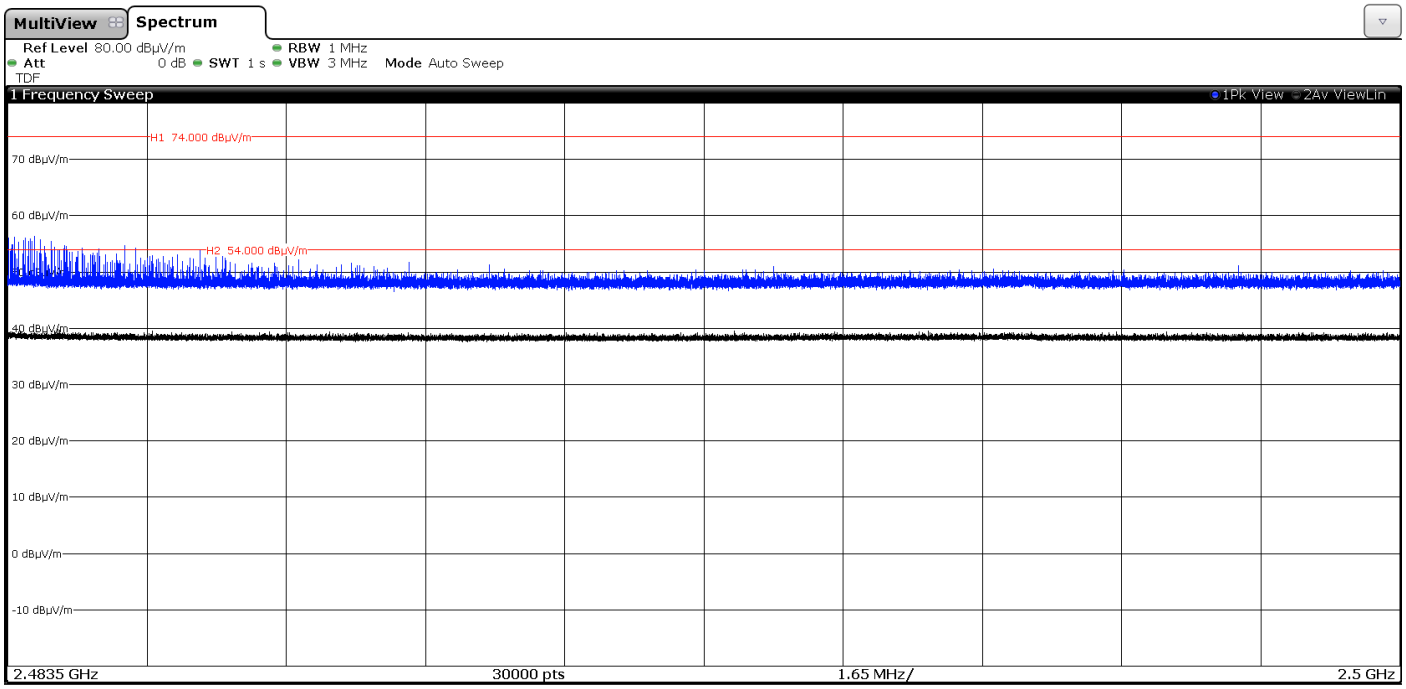
- Low Channel:



- Middle Channel:



- High Channel:



Appendix D: Test results. Proprietary protocol Flora

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TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	1.45 Vdc
Type of power supply:	DC voltage from Zinc Air Battery
Type of antenna:	Small magnetic loop antenna.
Declared antenna gain:	- 12 dBi

TEST FREQUENCIES:

Low Channel:	2402 MHz
Middle Channel:	2440 MHz
High Channel:	2480 MHz

RADIATED MEASUREMENTS

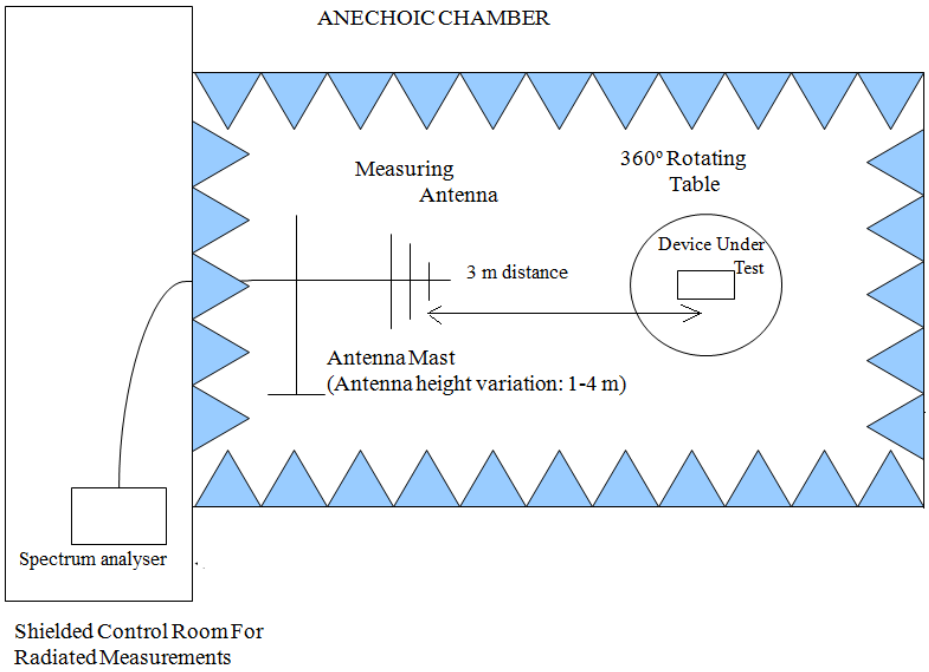
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40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

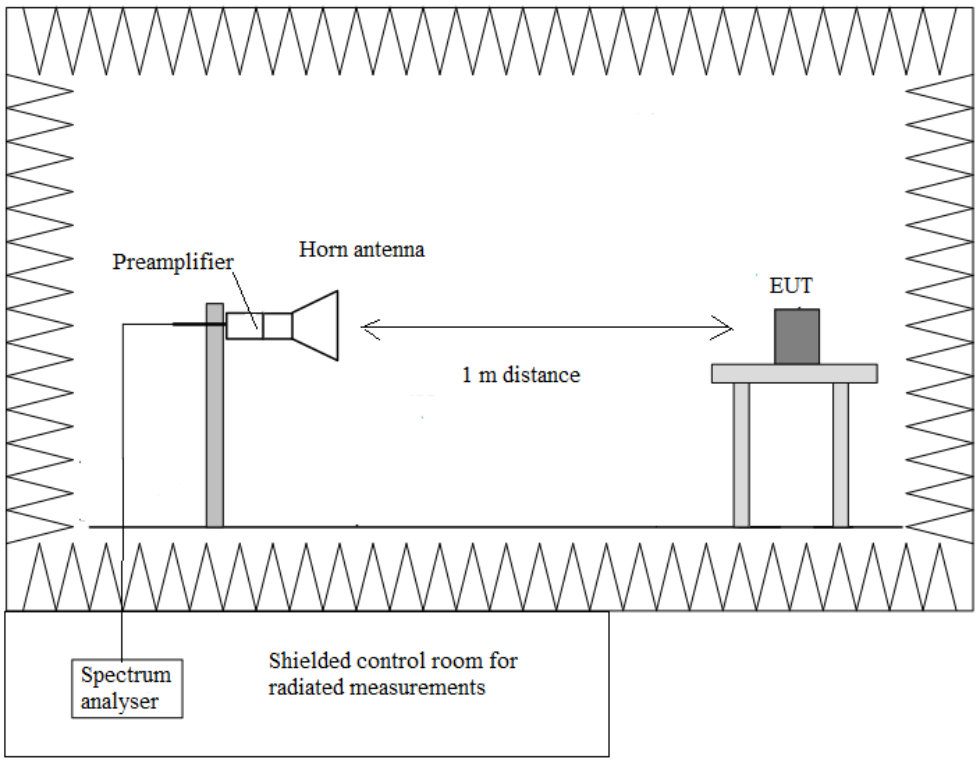
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup f < 1 GHz:



Radiated measurements setup f > 1 GHz:



Section 15.249 Subclause (a) / RSS-210 B.10. (a) Field strength of fundamental and harmonics emissions

SPECIFICATION:

The field strength of emissions from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of fundamental (mV/m)	Field strength (dBµV/m)	Measurement distance (m)
902 - 928	50	93.98	3
2400 – 2483.5	50	93.98	3
5725 - 5875	50	93.98	3
24000-24250	250	107.96	3

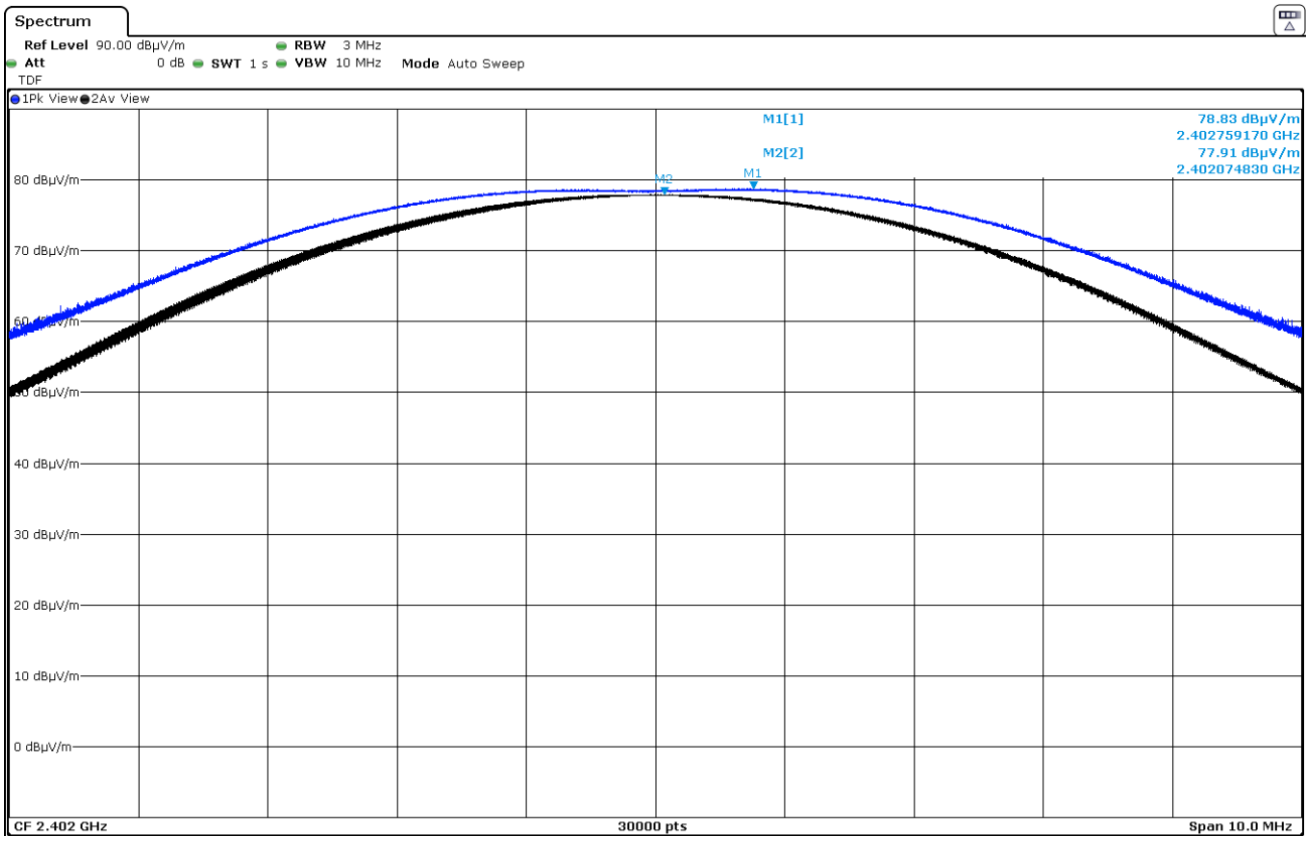
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS:

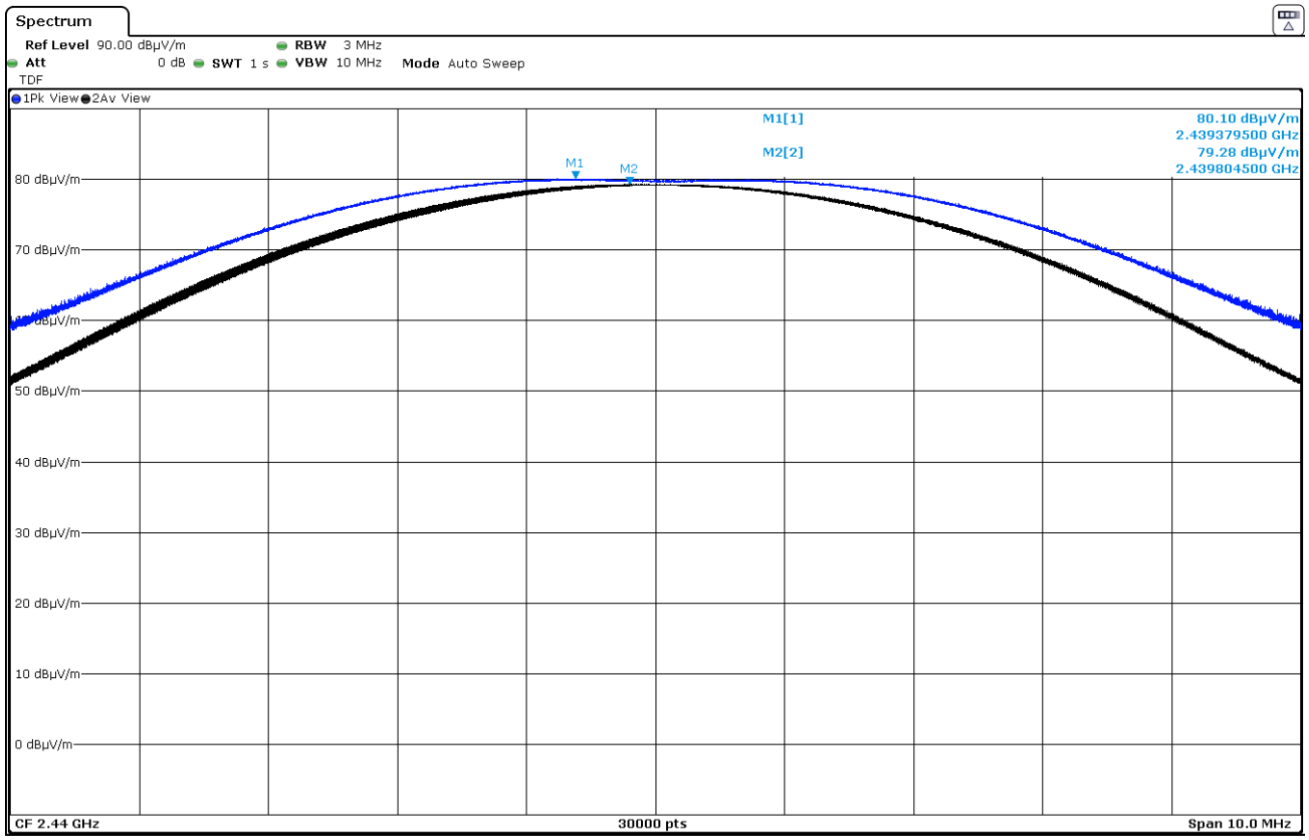
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Average Field Strength (dBµV/m)	77.91	79.28	78.33
Peak Field Strength (dBµV/m)	78.83	80.10	79.29
Measurement Uncertainty (dB)	<±3.04		

Verdict: PASS

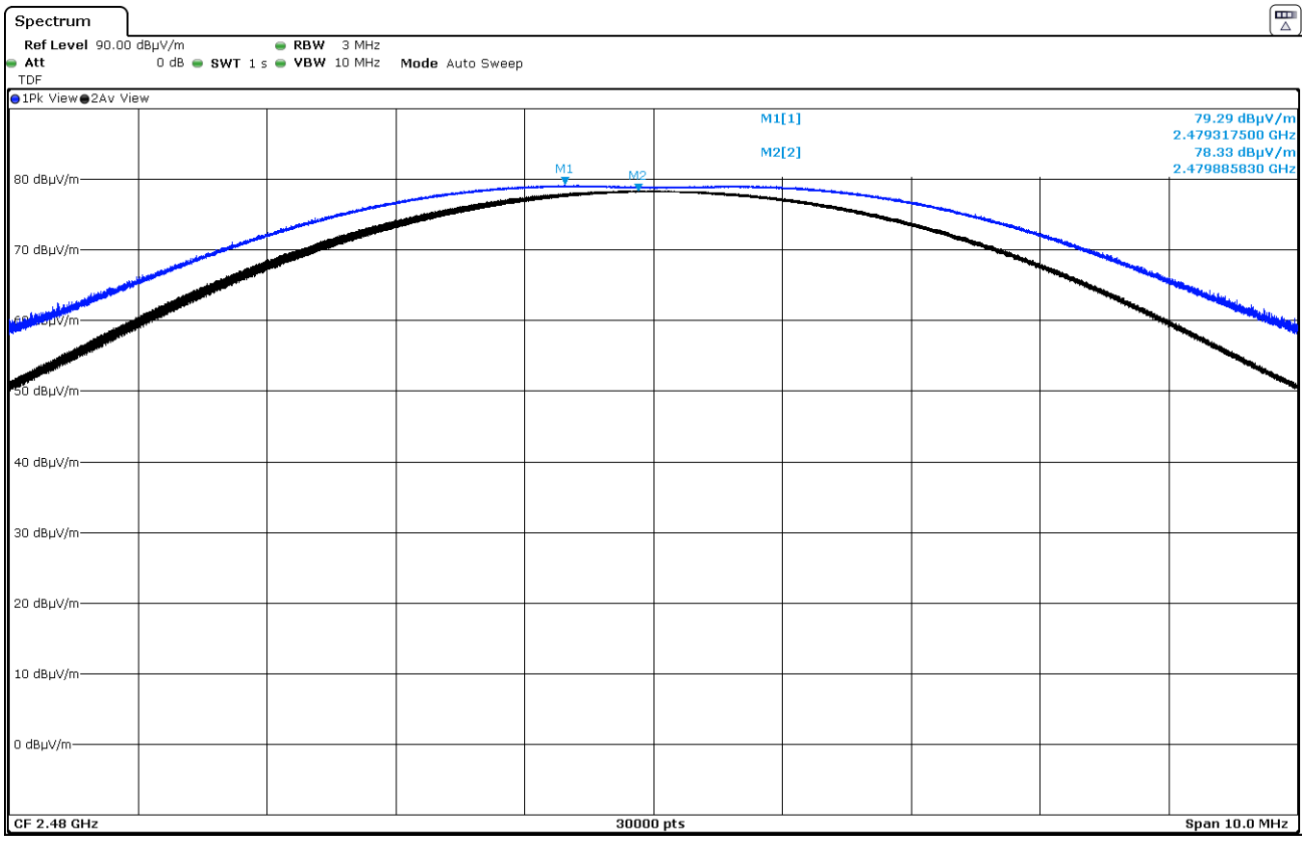
- Low Channel:



- Middle Channel:



- High Channel:



Section 15.249 Subclause (d) / RSS-210 B.10. (b) Emissions radiated outside of the specific frequency bands

SPECIFICATION:

The field strength of harmonics from intentional radiators shall comply with the following

Fundamental frequency (MHz)	Field strength of harmonics (µV/m)	Field strength of harmonics (dBµV/m)	Measurement distance (m)
902 - 928	500	54	3
2400 – 2483.5	500	54	3
5725 - 5875	500	54	3
24000-24250	2500	67.96	3

Emissions radiated outside of the specific frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of fundamental or to the general radiated emission limits specified in section 15.209:

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

Whichever is the lesser attenuation.

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-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.

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

No spurious emissions were found at less than 20 dB of the limit.

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 (see next plots).

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

- Low Channel (2402 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.80483	Peak	41.03	V	<±3.70
21.62405	Peak	39.49	H	<±3.70

- Middle Channel (2440 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
4.87903	Peak	41.74	V	<±3.70
21.96605	Peak	41.47	H	<±3.70

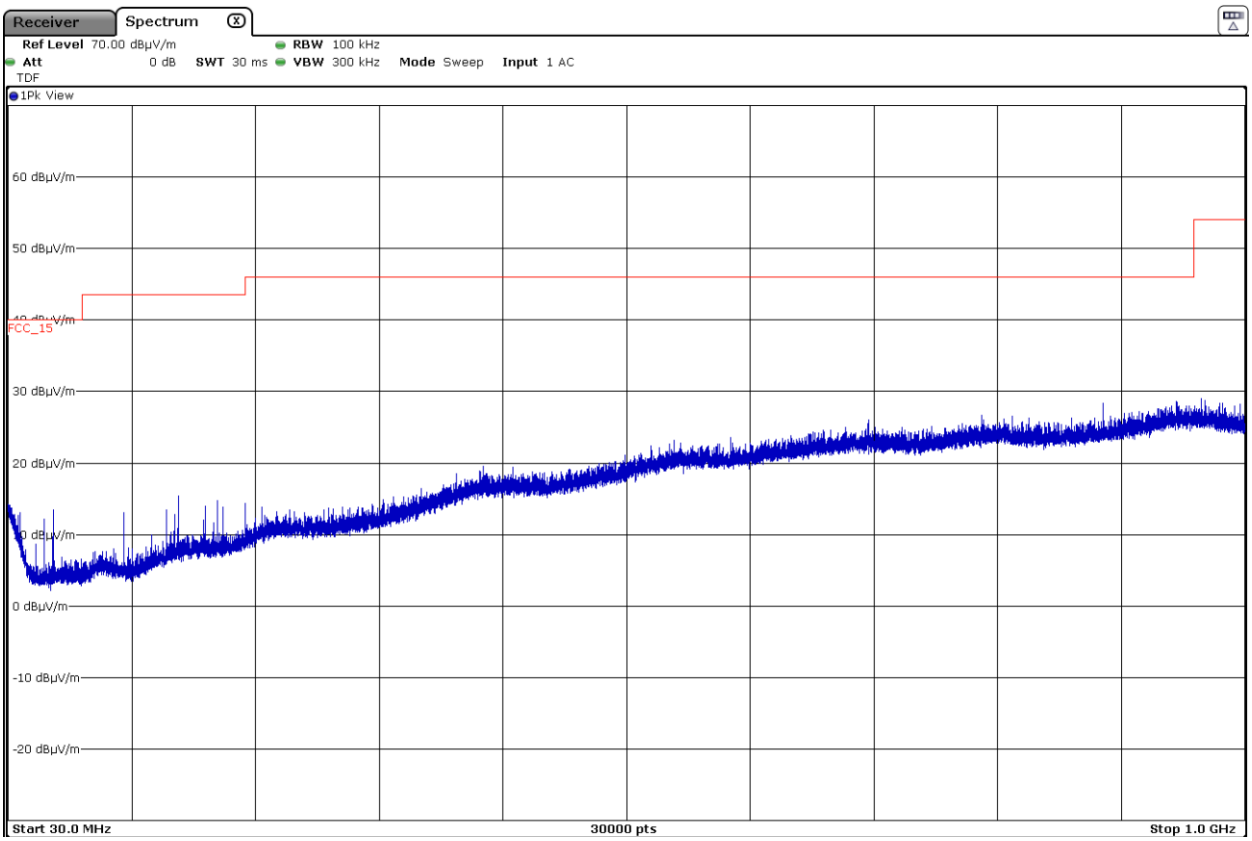
- High Channel (2480 MHz):

Spurious frequency (GHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
22.31405	Peak	39.41	H	<±3.70

Verdict: PASS

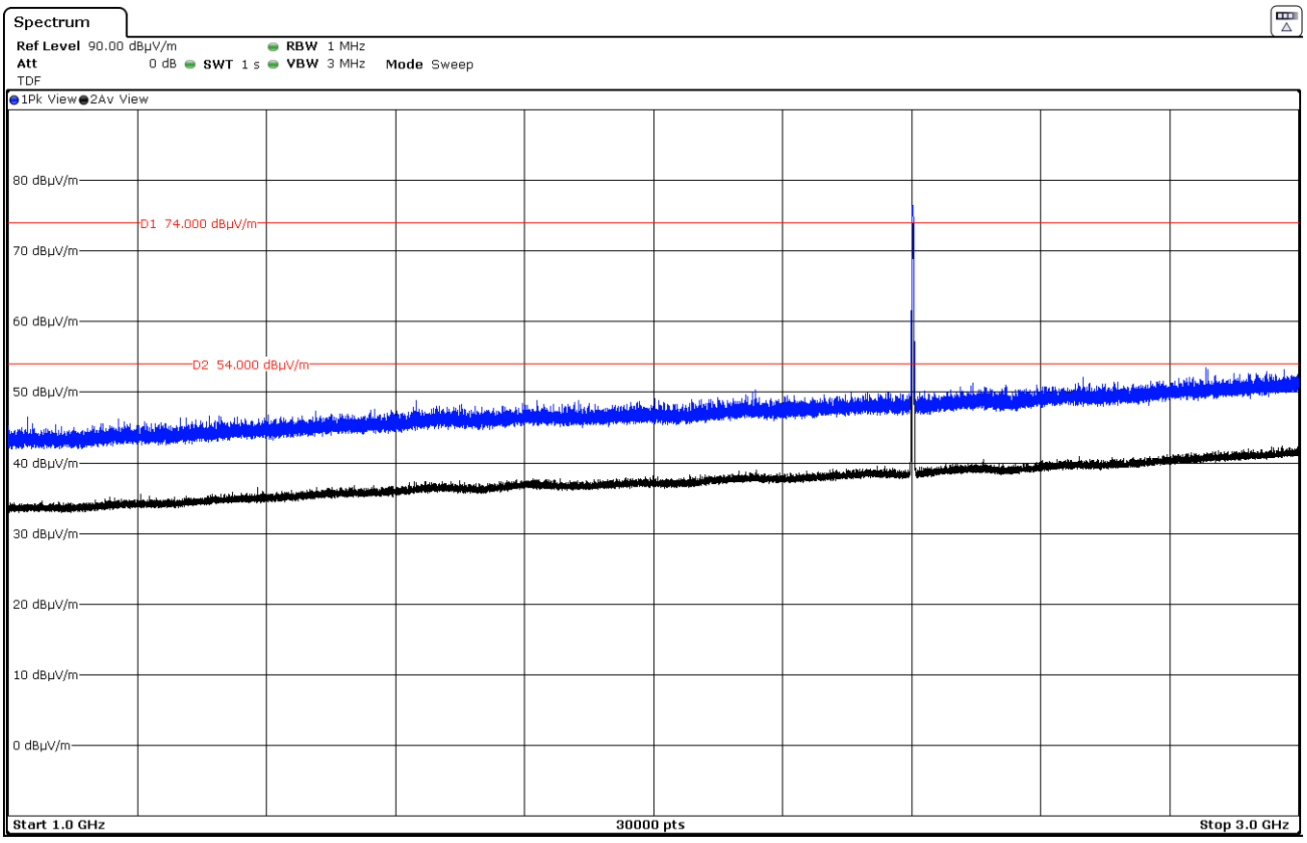
FREQUENCY RANGE 30 MHz - 1 GHz

The spurious signals detected do not depend on the operating channel, so this plot is valid for Low, Middle and High Channels.



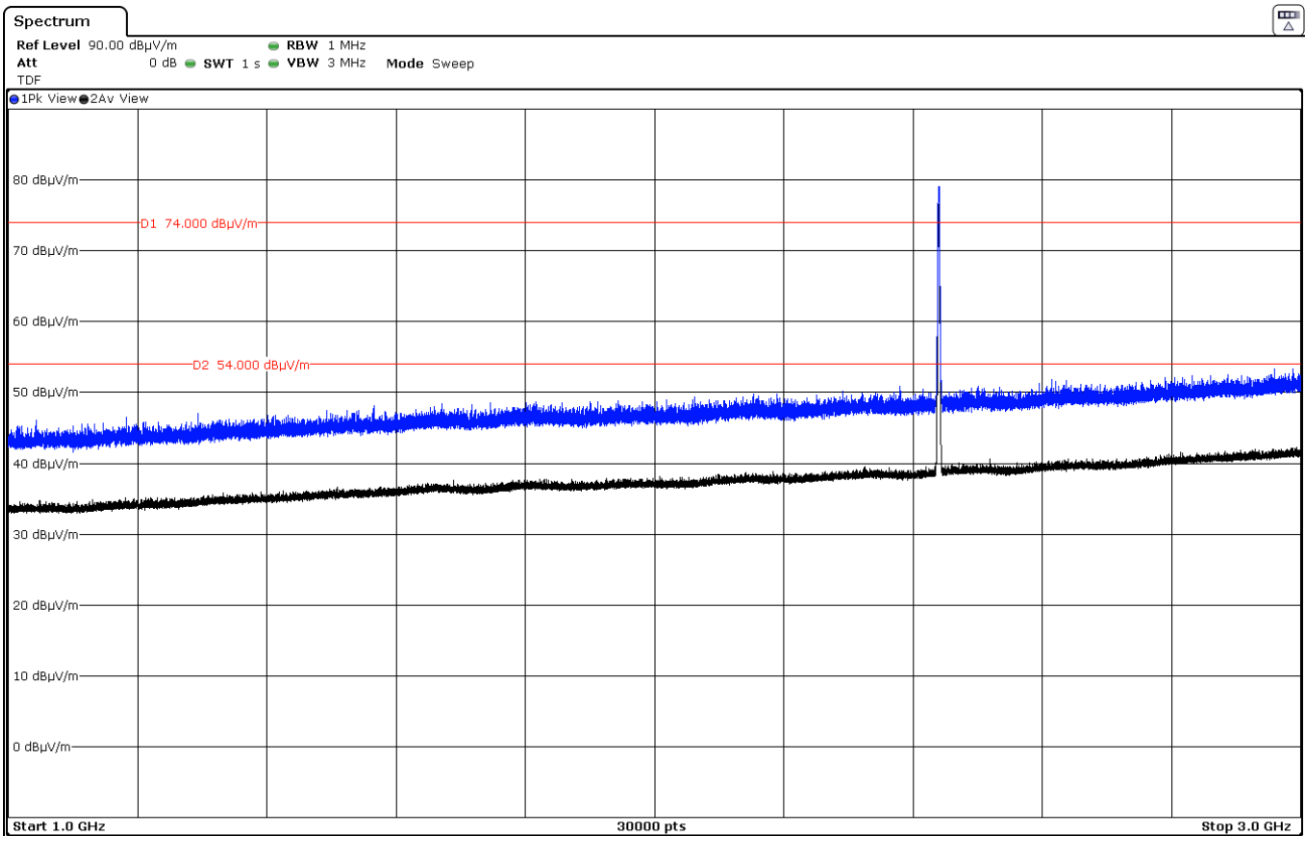
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



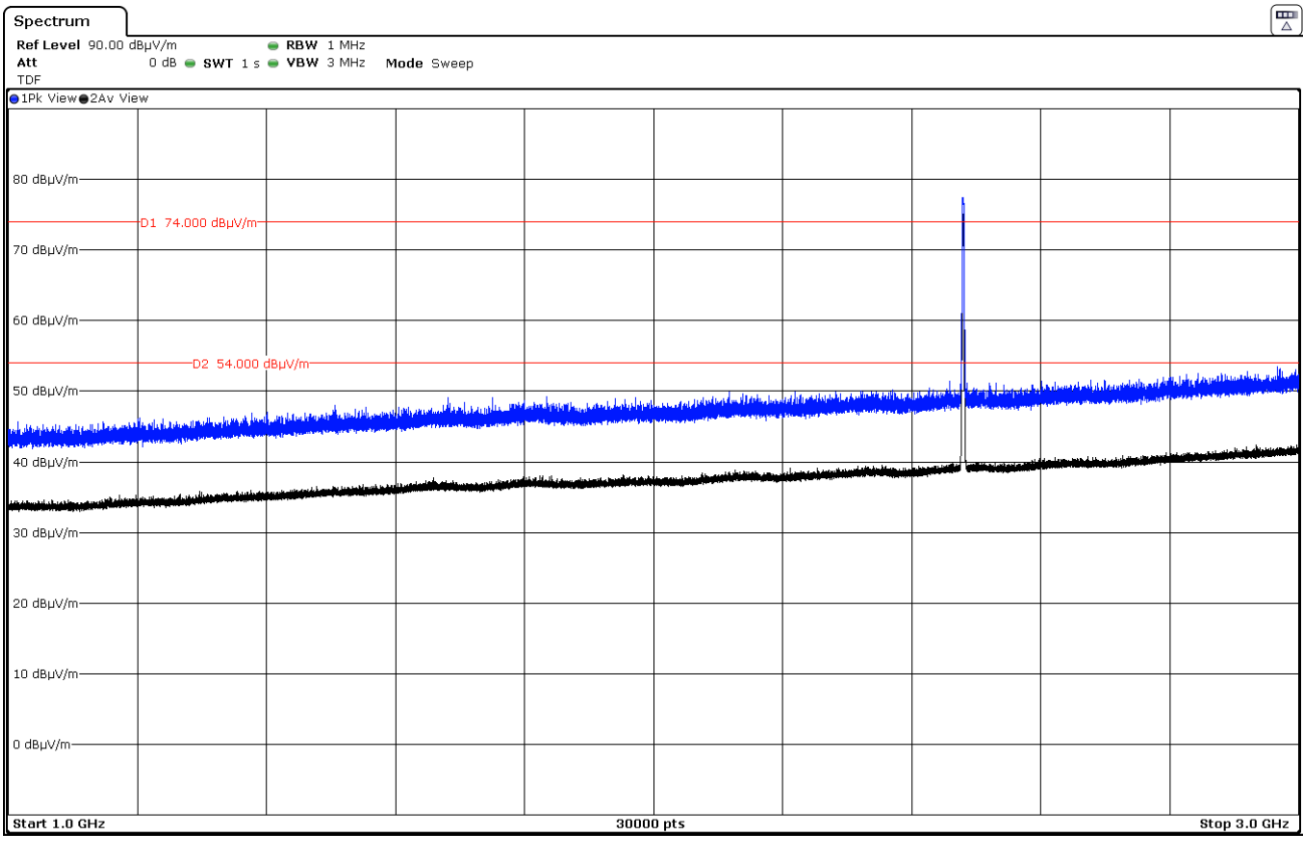
The peak shown in the plot above the limit is the carrier frequency.

- Middle Channel:



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

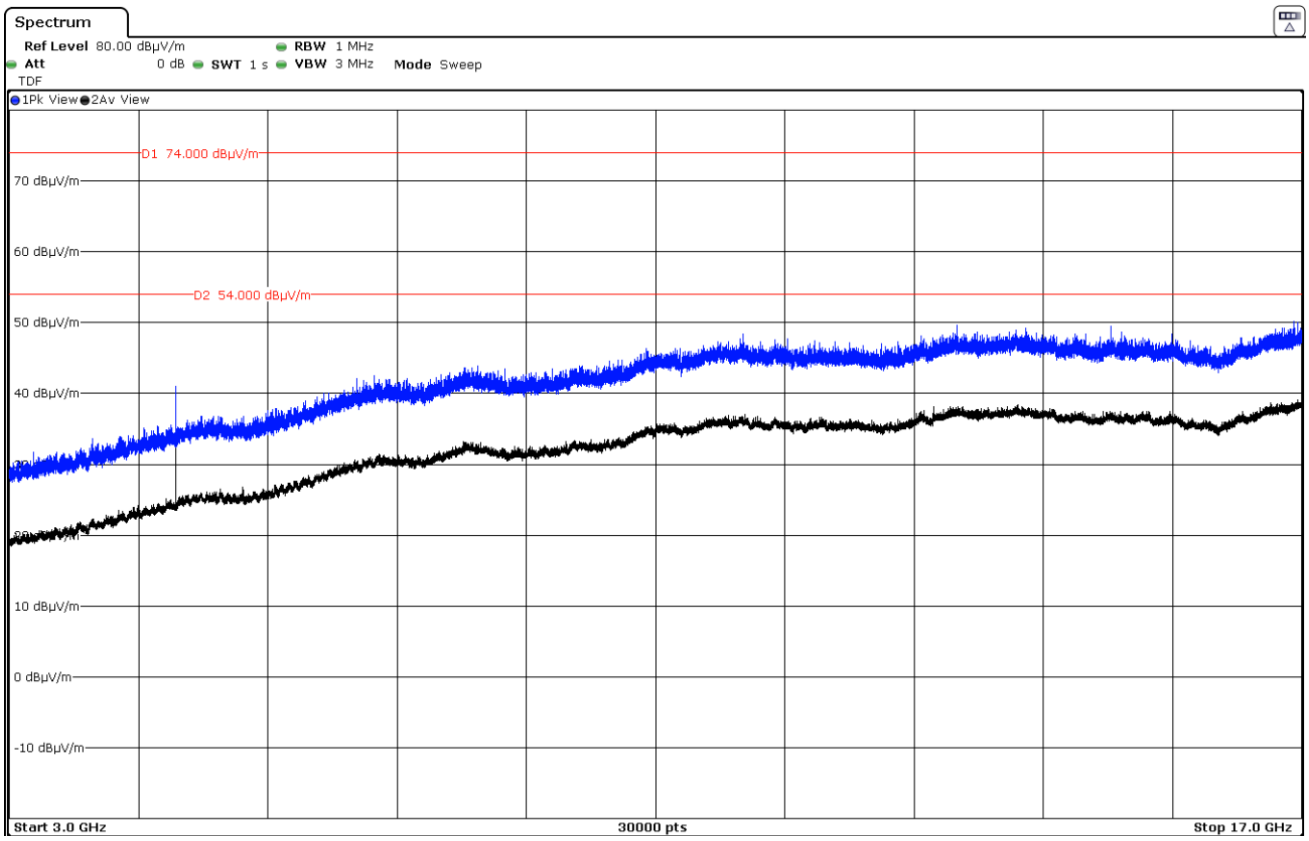
- High Channel:



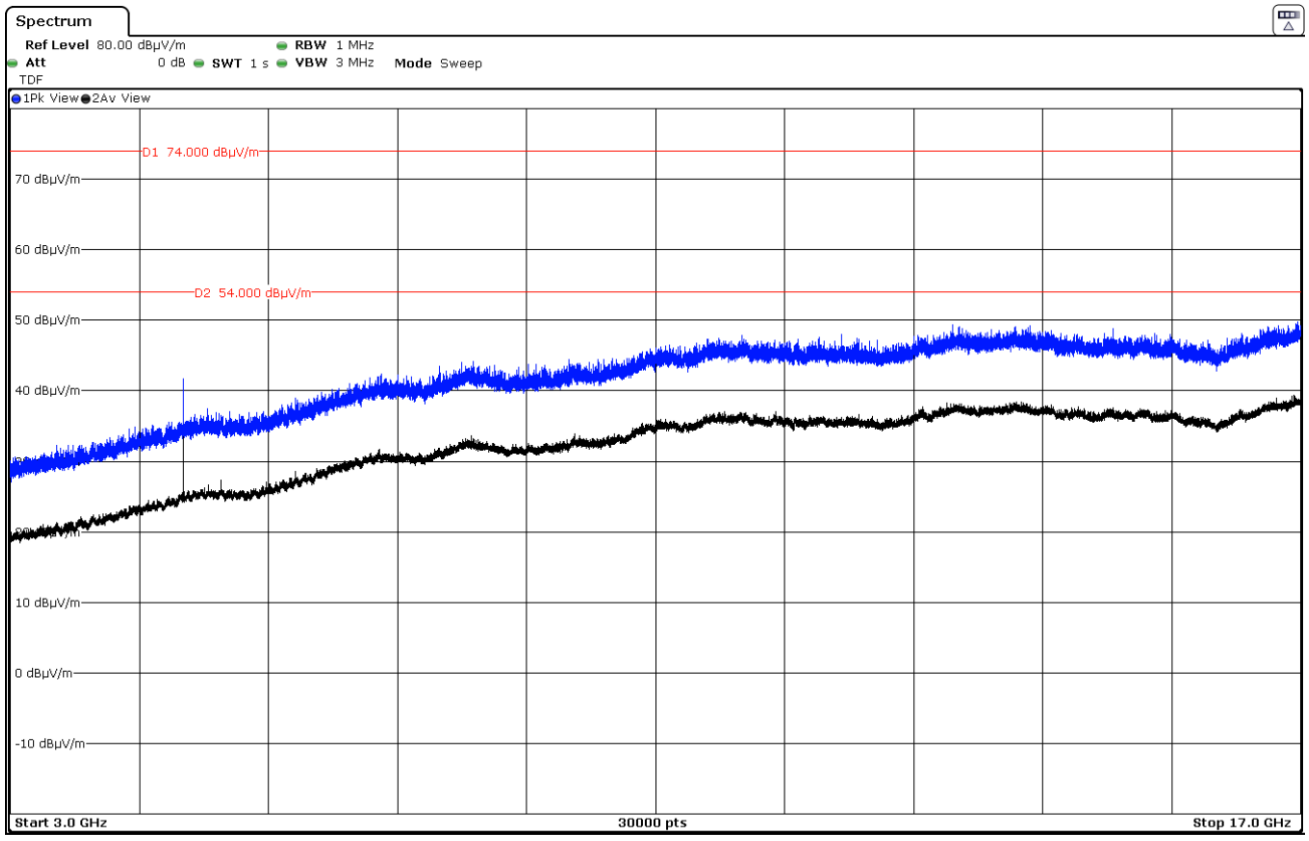
The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

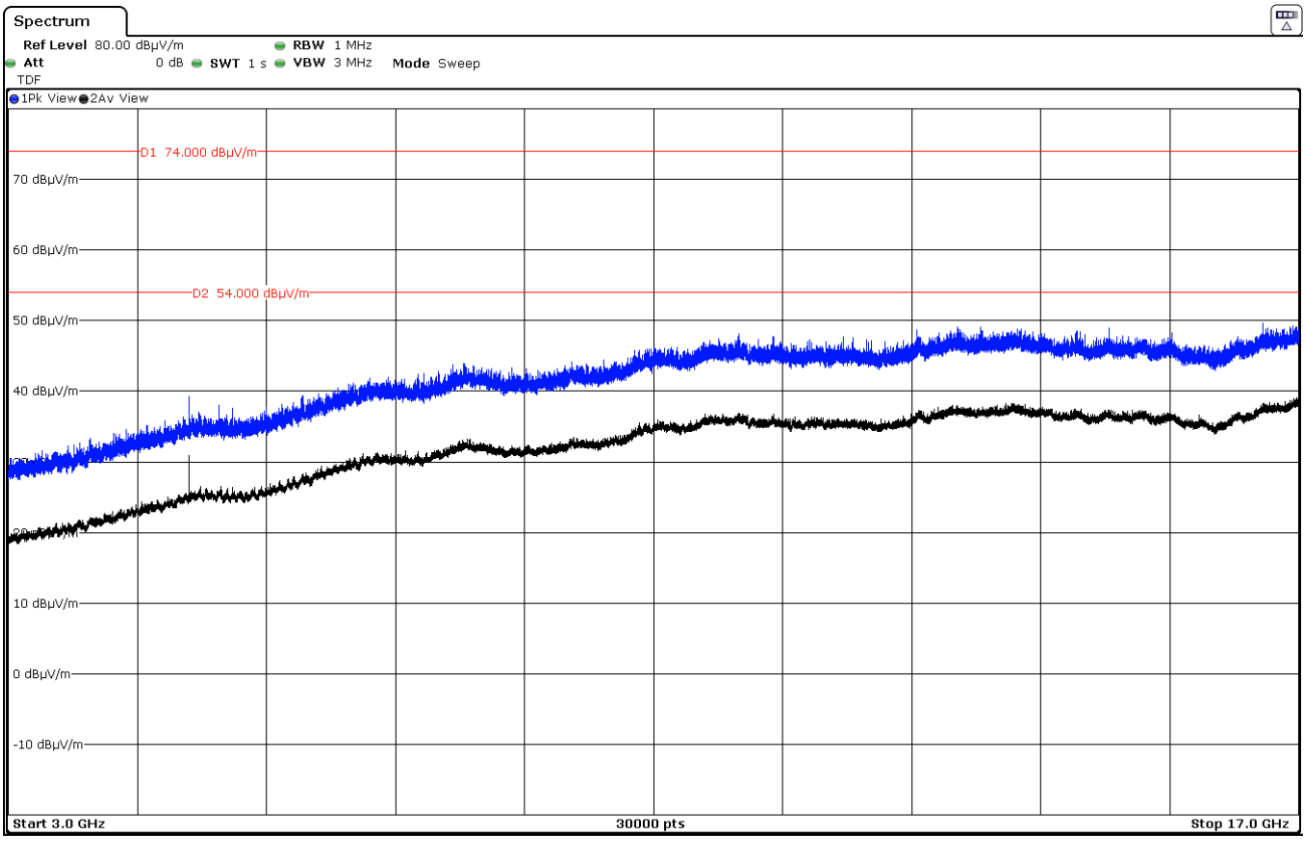
- Low Channel:



- Middle Channel:

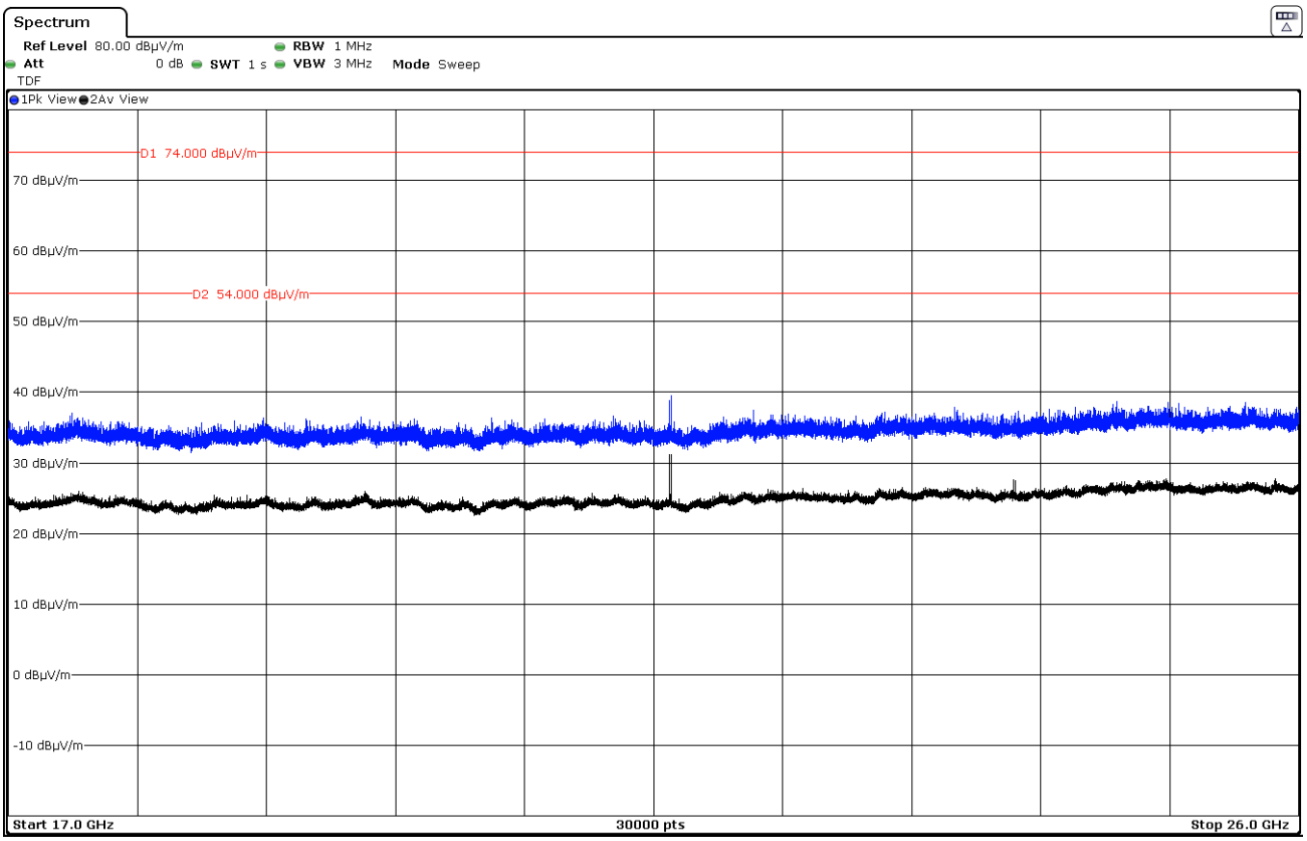


- High Channel:

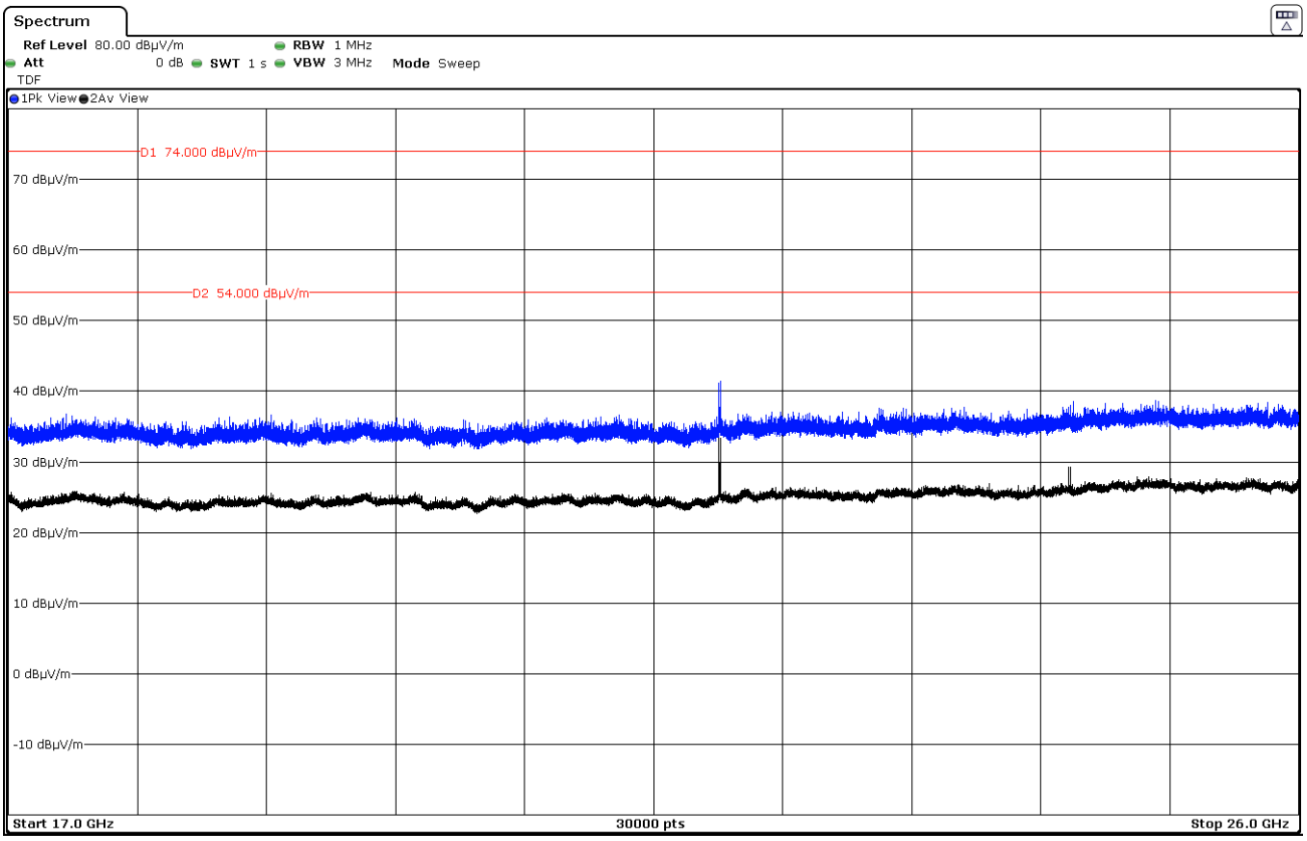


FREQUENCY RANGE 17 - 26 GHz

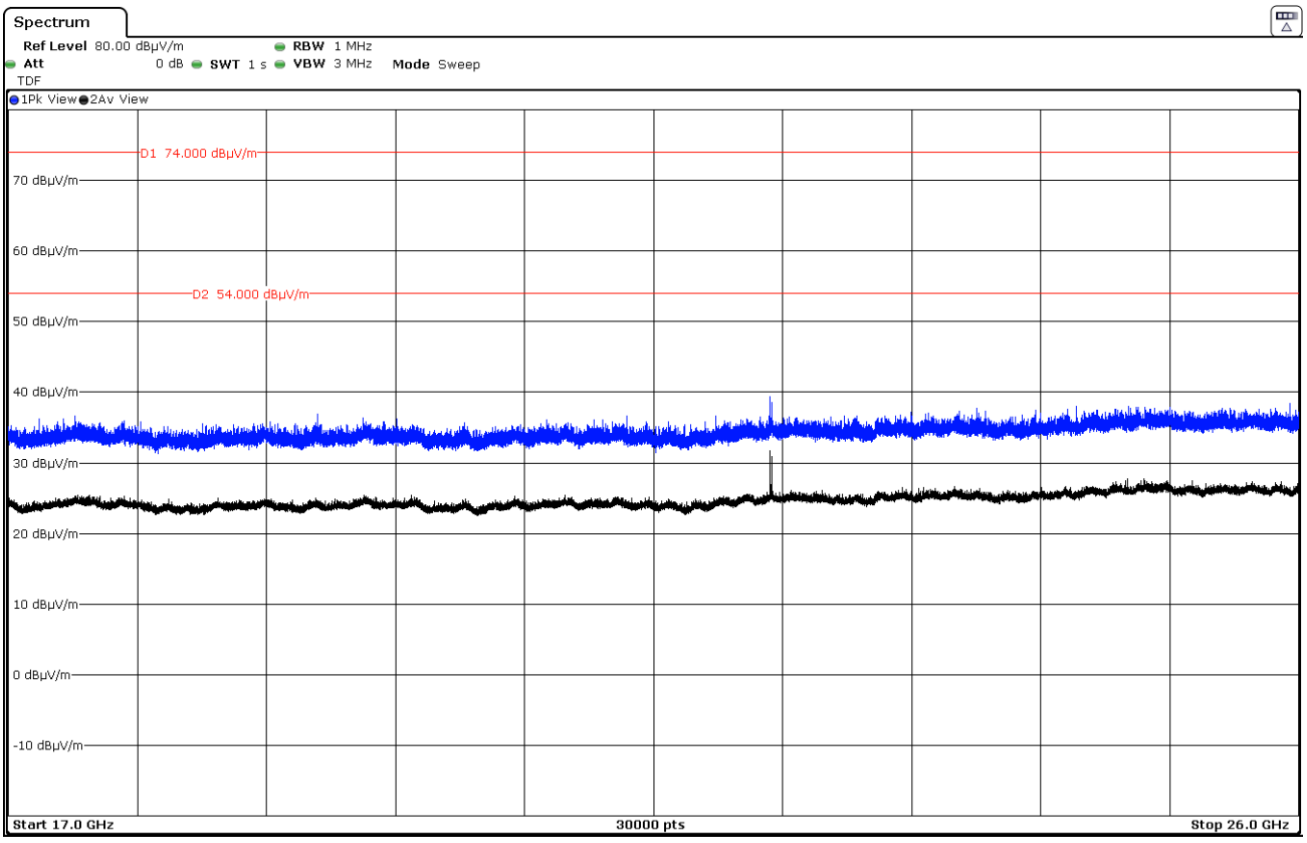
-Low channel:



-Middle channel:

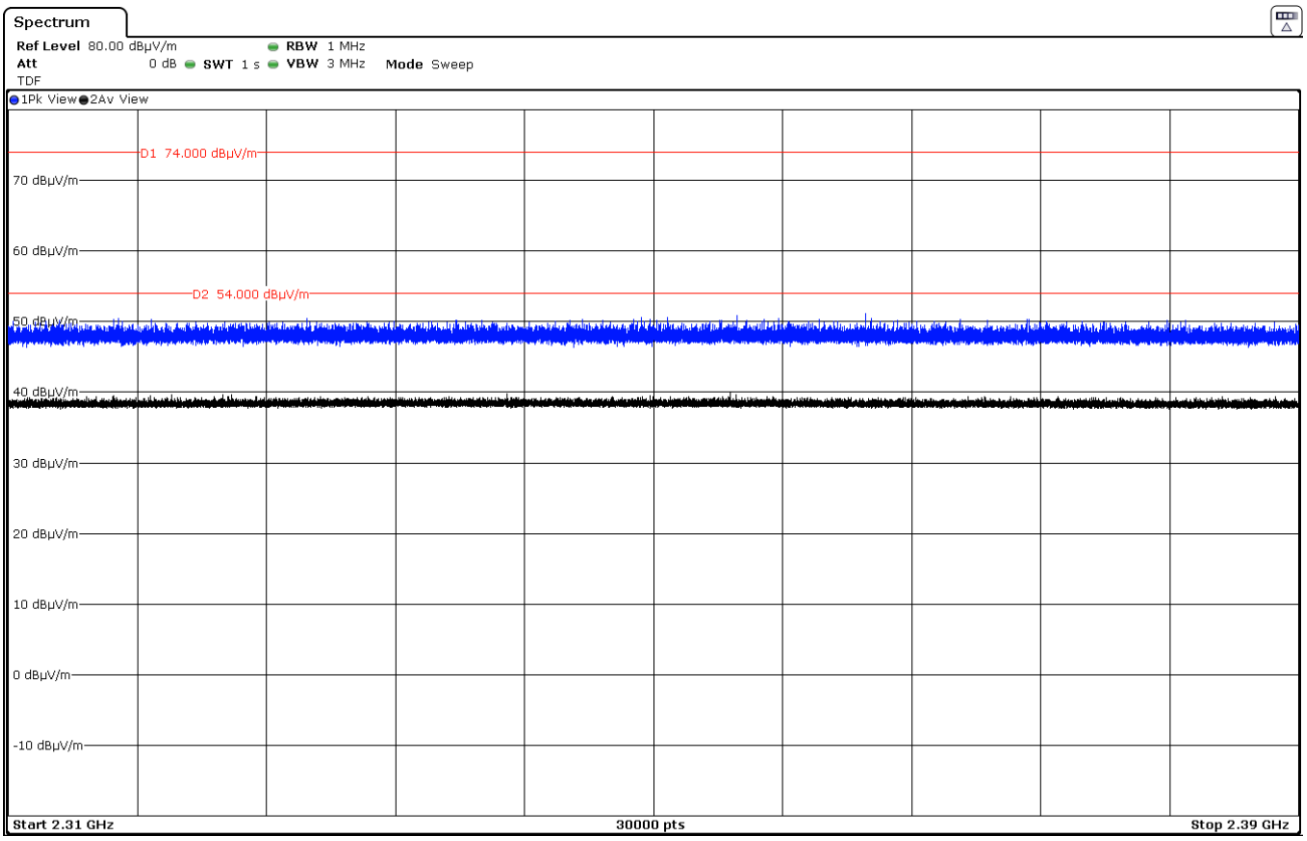


-High channel:

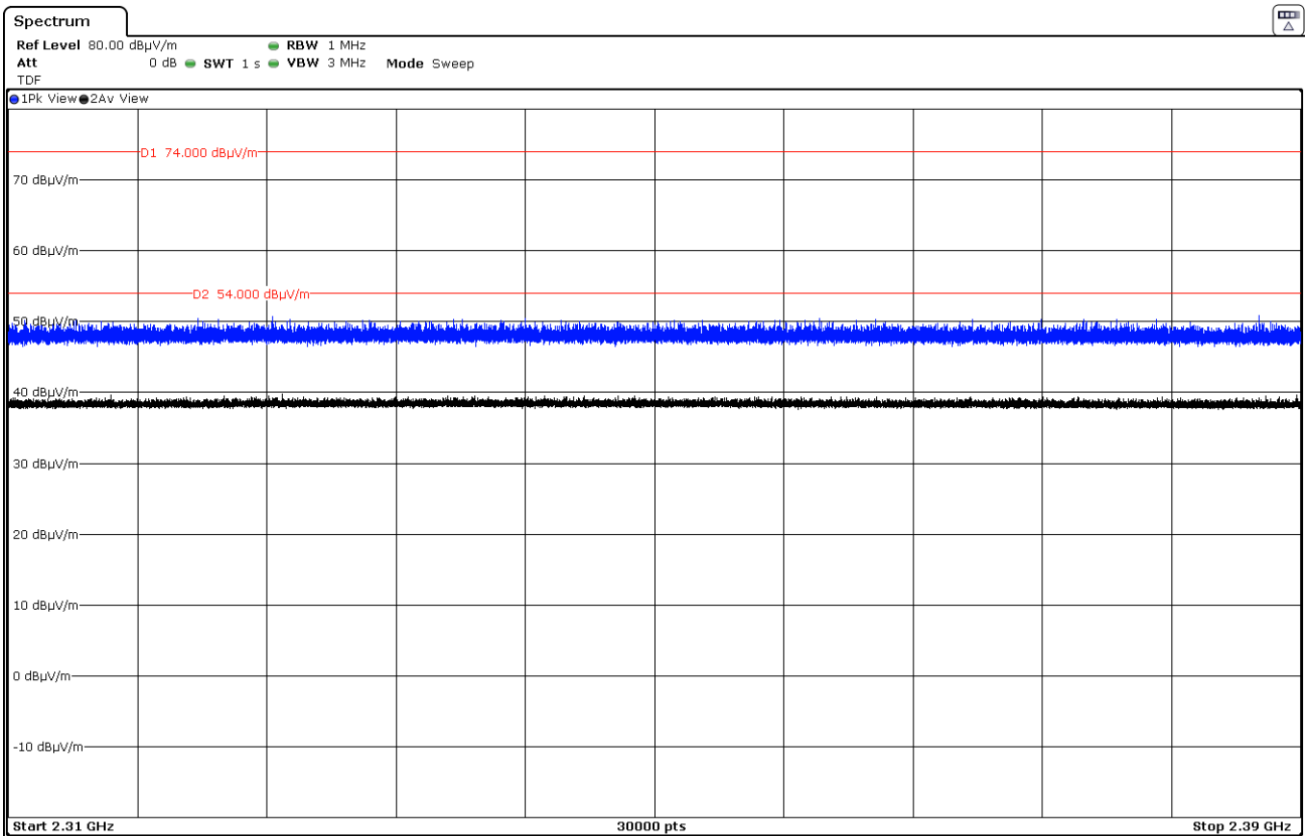


FREQUENCY RANGE 2.31 - 2.39 GHz

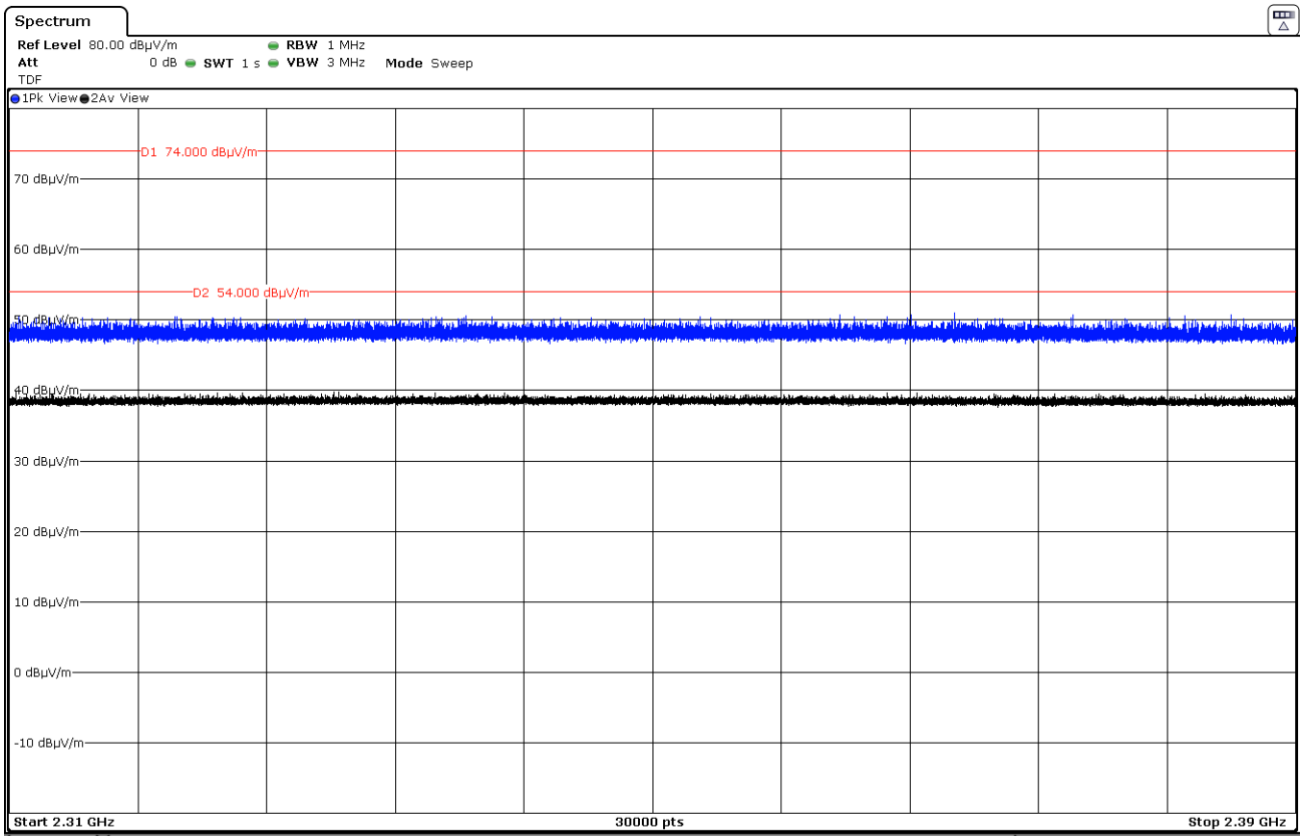
- Low Channel:



- Middle Channel:

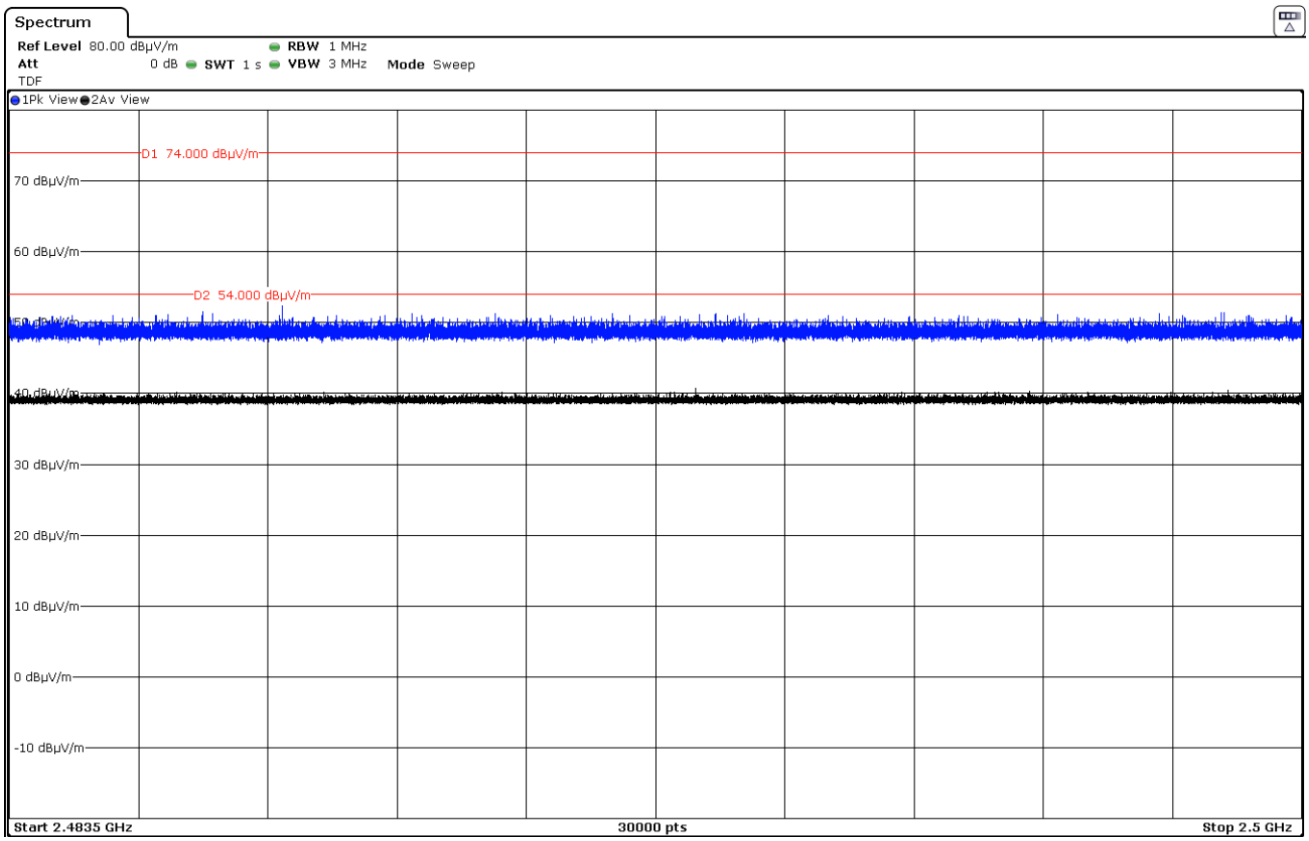


- High Channel:

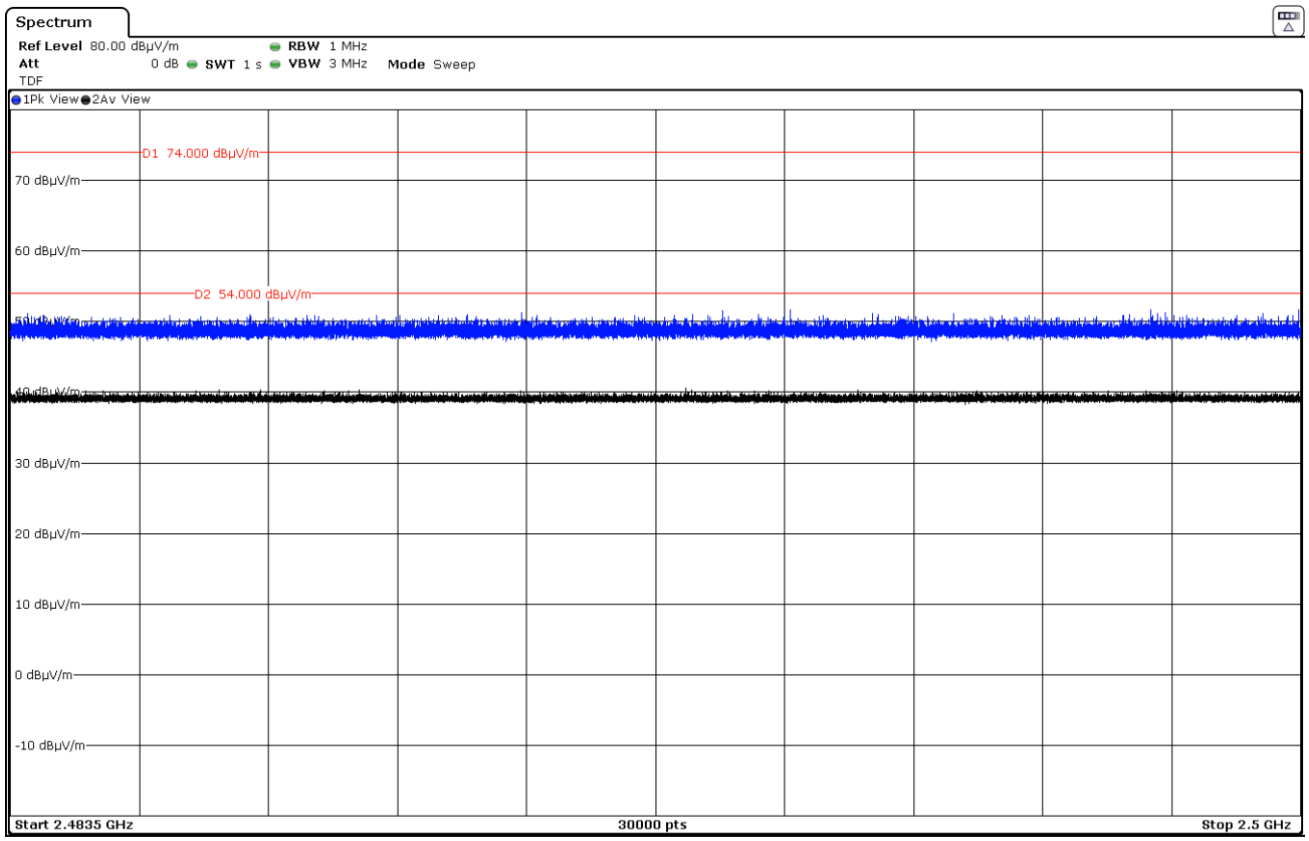


FREQUENCY RANGE 2.4835 - 2.5 GHz

- Low Channel:



- Middle Channel:



- High Channel: