



ISED LISTED
 REGISTRATION NUMBER
 4621A-4

Test report No:
 NIE: 58154RRF.002

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	Wireless audio transceiver attachable to dedicated hearing aid system.
Trademark	Phonak
Model and /or type reference	Naida CI connect
Other identification of the product	FCC ID: KWCNCC IC: 2262A-NCC
Features	BT BR/LE 4.2, DM (proprietary)
Applicant	For USA: SONOVA USA INC. 4520 Weaver Parkway, 60555 Warrenville, IL, USA For Canada: PHONAK CANADA LTD. 80 Courtney park Dr West, Unit 1 Mississauga, ON, L5W 0B3, Canada
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.
Approved by (name / position & signature)	A. Llamas RF Lab. Manager

Date of issue	2019-01-16
Report template No	FDT08_21

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Competences and guarantees

DEKRA Testing and Certification 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 a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-4.

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

DEKRA Testing and Certification 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 at the time of performance of the test.

DEKRA Testing and Certification 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.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification.

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.
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 and the Accreditation Bodies.

Uncertainty

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

Data provided by the client

The sample under test consists of a Bluetooth and Phonak Airstream ear level adapter for AB Naida CI Q90 users. It brings the 2.4GHz connectivity to the users for phone calls, music listening, TV watching and remote microphones.

DEKRA 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 M/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
58154/003	Wireless audio transceiver attachable to dedicated hearing aid system	Naida CI connect	--	2018-10-19

Auxiliary elements used with the sample M/01

Control N°	Description	Model	Serial N°	Date of reception
58154/020	Battery AA adaptor	--	--	2018-10-19

1. Sample M/01 has undergone the following test(s):
All conducted tests indicated in Appendices A, B and C.

Sample M/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
58154/039	Wireless audio transceiver attachable to dedicated hearing aid system with Brooklyn Copper	Naida CI connect	--	2018-10-19

Auxiliary elements used with the sample M/02

Control N°	Description	Model	Serial N°	Date of reception
58154/032	Battery	CI-5517	--	2018-10-19
58154/048	Reader headpiece	CI-6510-001	995794	2018-10-23
58154/047	Cochlear headpiece	--	--	2018-10-23
58154/008	Base Cork accessory	--	--	2018-10-19

2. Sample M/02 has undergone the following test(s):
All radiated tests indicated in Appendices A, B and C.

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"/>		
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input checked="" type="checkbox"/>	DC: 1.4 V						
Rated Power..... :	N/A						
Clock frequencies..... :							
Other parameters							
Software version..... :	068-1300						
Hardware version	075-3001						
Dimensions in cm (W x H x D) ... :							
Mounting position	<input checked="" type="checkbox"/>	Other: hearing aid ear-level					
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			

Identification of the client

Phonak Communications AG
 Länggasse 17, CH-3280 Murten, Switzerland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-10-23
Date (finish)	2018-10-24

Document history

Report number	Date	Description
58154RRF.002	2019-01-16	

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 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

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

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

The tests have been performed by the technical personnel: José Gabriel Pendón, Carlos Alberto Contreras, Miguel Ángel Torres, Jaime Amador, Francisco José Alcaide.

Used instrumentation:

Conducted Measurements

	Last Cal. date	Cal. due date
1. Spectrum Analyzer AGILENT TECHNOLOGIES E4440A	2017/10	2019/10

Radiated Measurements

	Last Cal. date	Cal. due date
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP.	N.A.	N.A.
2. Antena Bilog 30MHz - 6GHz ETS LINDGREN 3142E.	2018/07	2021/07
3. Preamplifier, 38 dB, 30 MHz – 6 GHz BONN ELEKTRONIK BLNA 0360-01N.	2017/08	2019/08
4. Receiver EMI ROHDE AND SCHWARZ ESR7.	2017/08	2019/08
5. Spectrum analyser Rohde & Schwarz FSV40	2018/02	2019/02
6. Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2018/01	2021/01
7. Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2017/03	2020/03
8. RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A	2018/03	2019/03
9. RF pre-amplifier 18-40 GHz NARDA JS44-18004000-33-8P	2018/02	2019/02

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 harmonics emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10.(b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u>			
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 harmonics emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10.(b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u>			
None.			

3. Proprietary protocol DM

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 harmonics emissions	P	
Section 15.249 Subclause (d) / RSS-210 B.10.(b)	Emissions radiated outside of the specific frequency bands	P	
<u>Supplementary information and remarks:</u> None.			

Appendix A: Test results. Bluetooth Low Energy

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TEST CONDITIONS

Power supply (V):

Vnominal = 1.4 Vdc

Type of power supply = DC voltage from battery.

Type of antenna = Integral antenna.

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

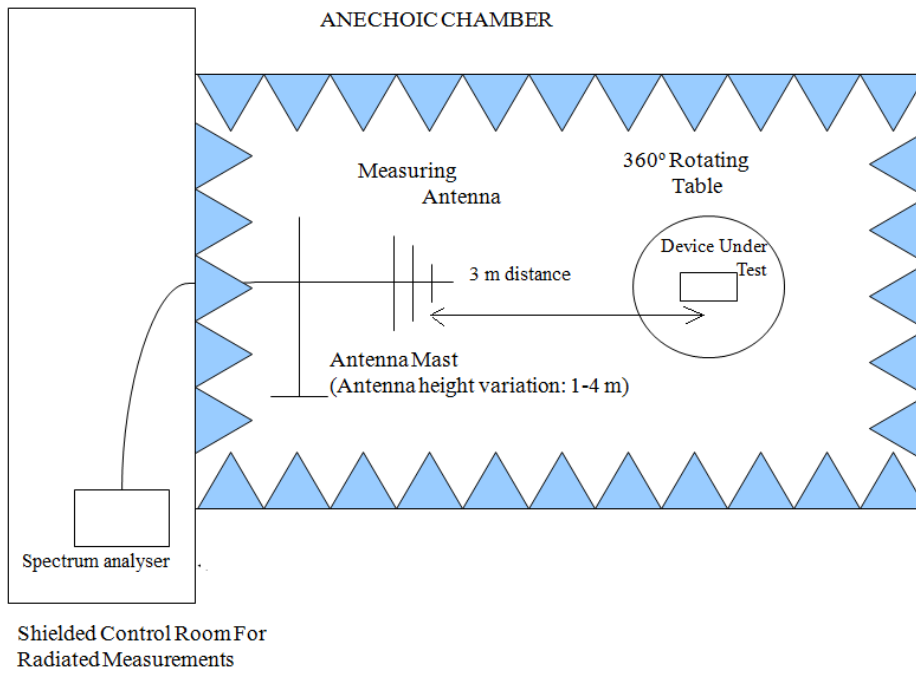
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 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.

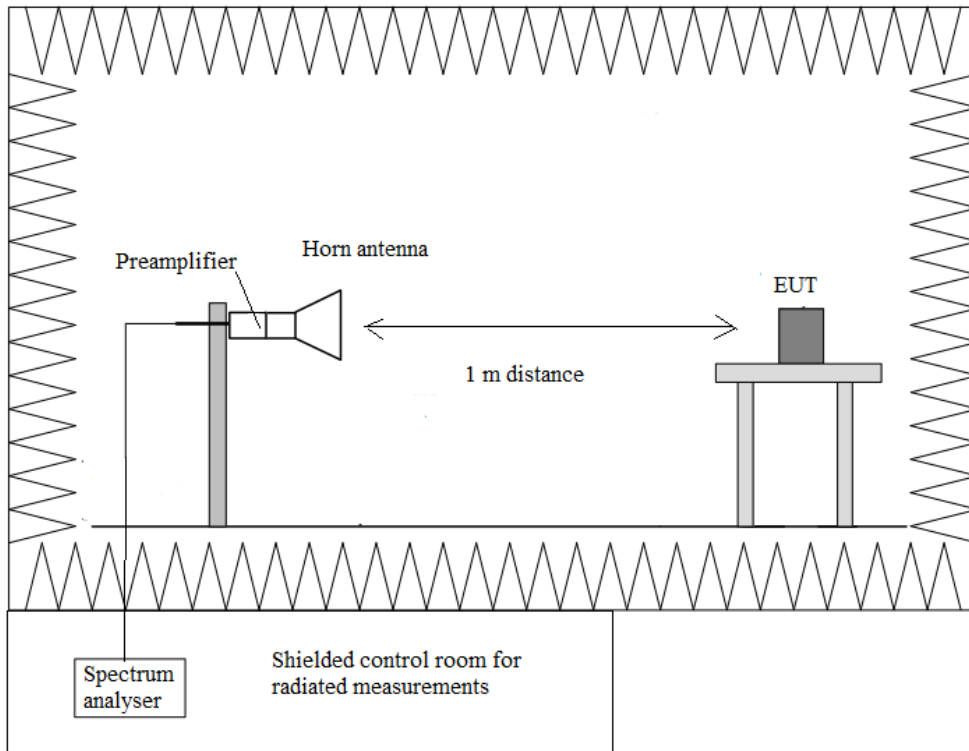
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



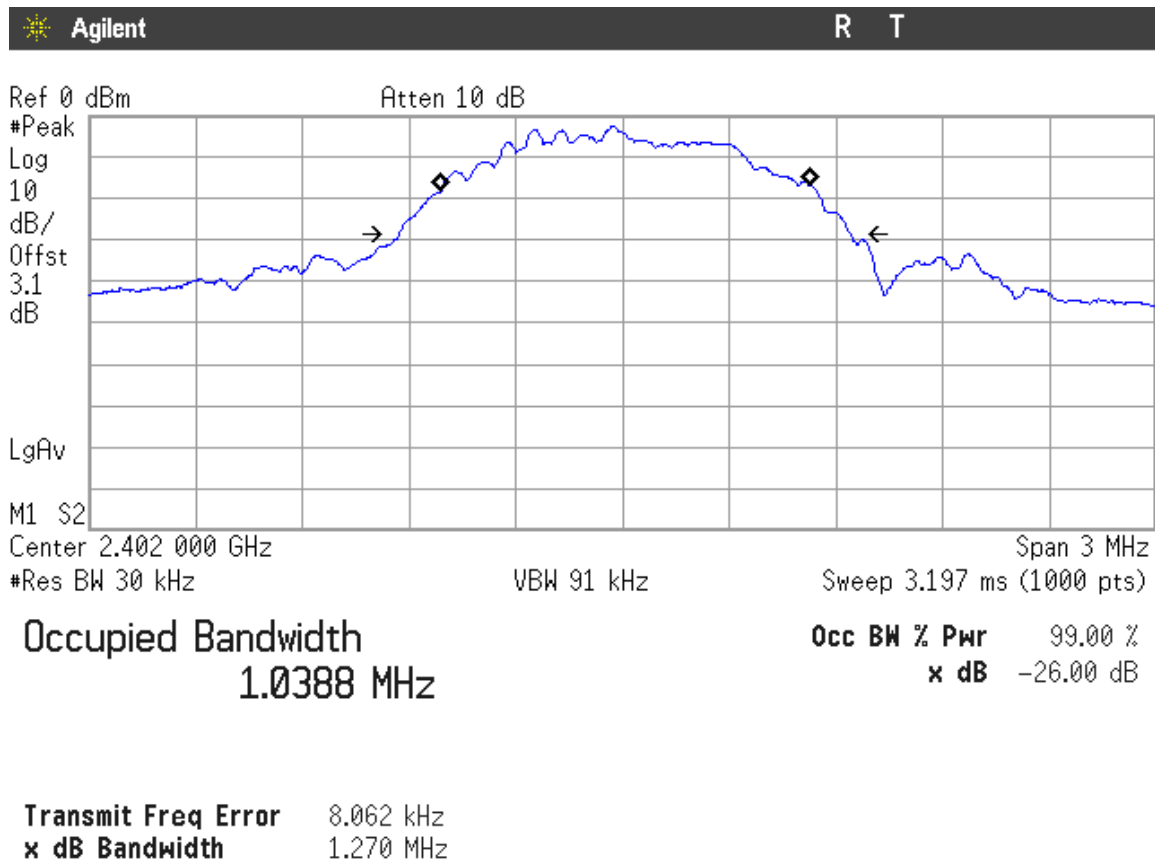
Occupied Bandwidth

RESULTS

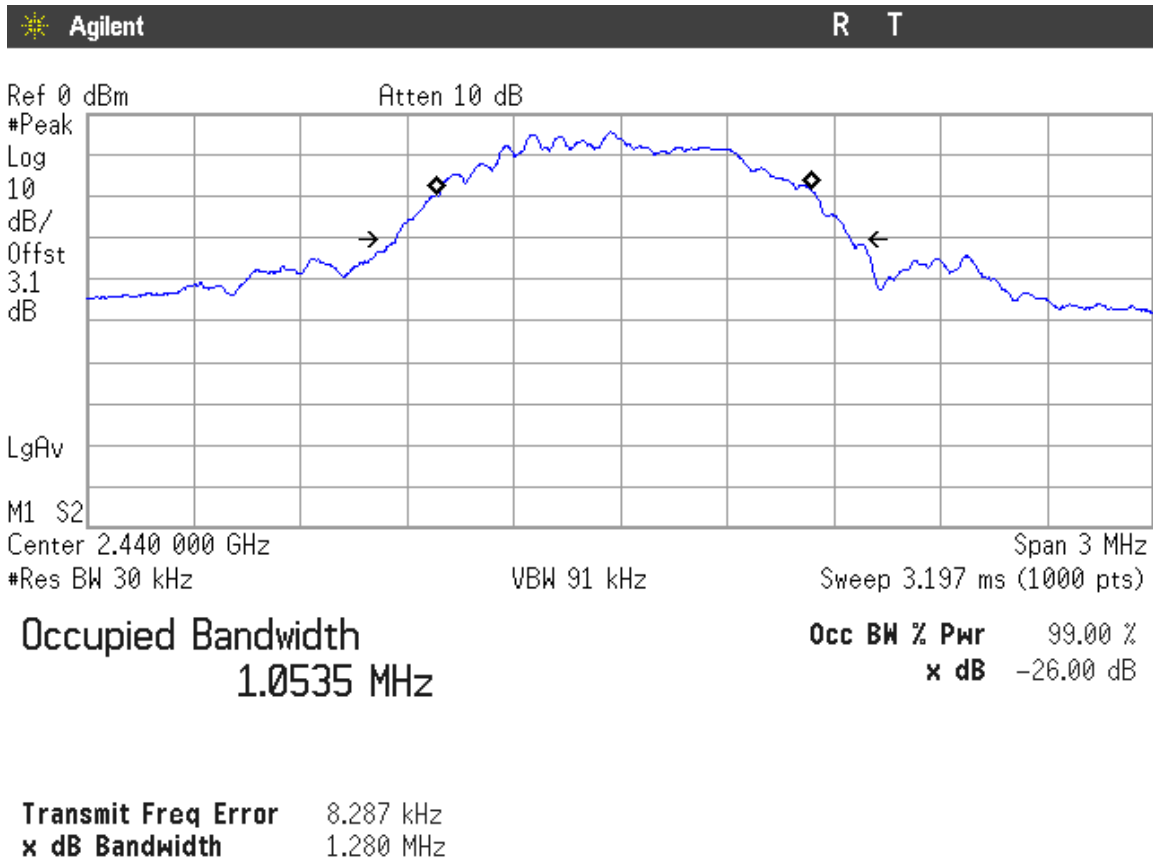
(see next plots).

	Lowest frequency	Middle frequency	Highest frequency
	2402 MHz	2440 MHz	2480 MHz
99% bandwidth (MHz)	1.0388	1.0535	1.0686
-26 dBc bandwidth (MHz)	1.270	1.280	1.296
Measurement uncertainty (kHz)	<±5.00		

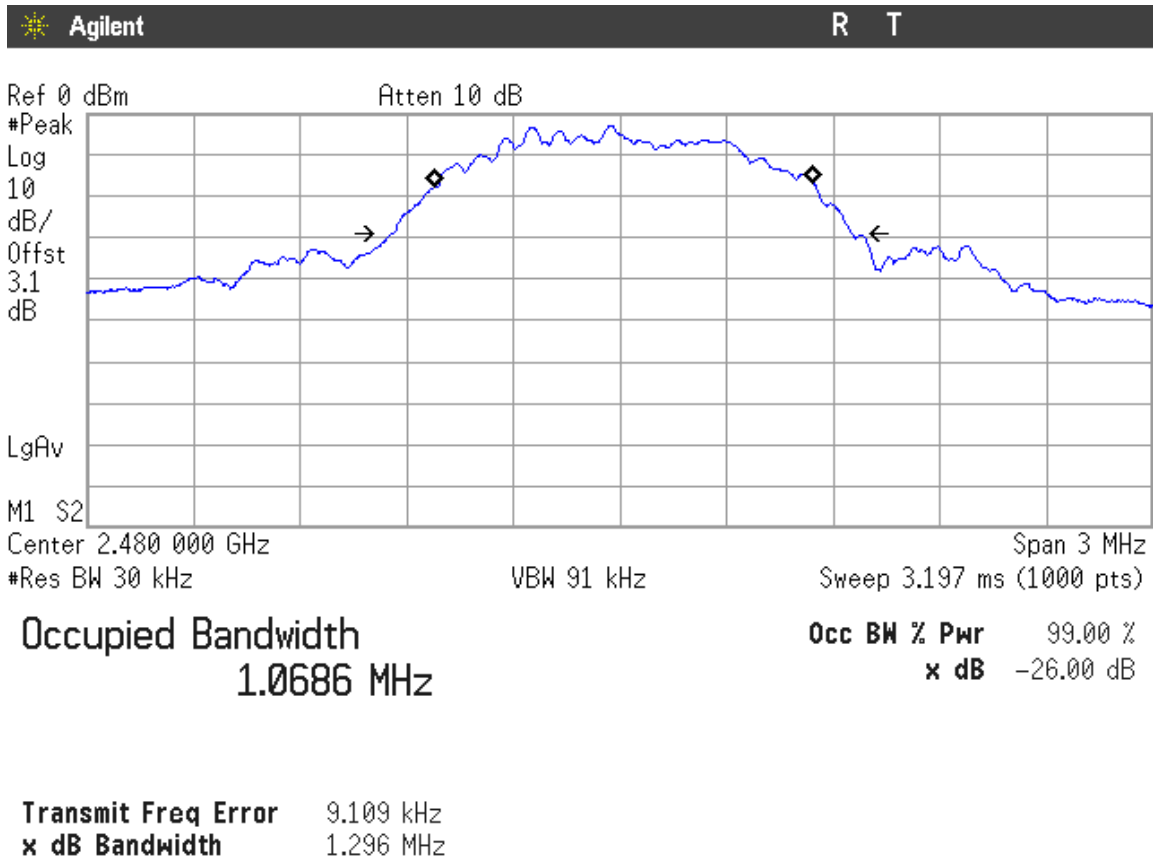
Lowest Channel



Middle Channel



Highest channel



Section 15.249 Subclause (a) / RSS-210 B.10 (a). Field strength of Fundamental

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

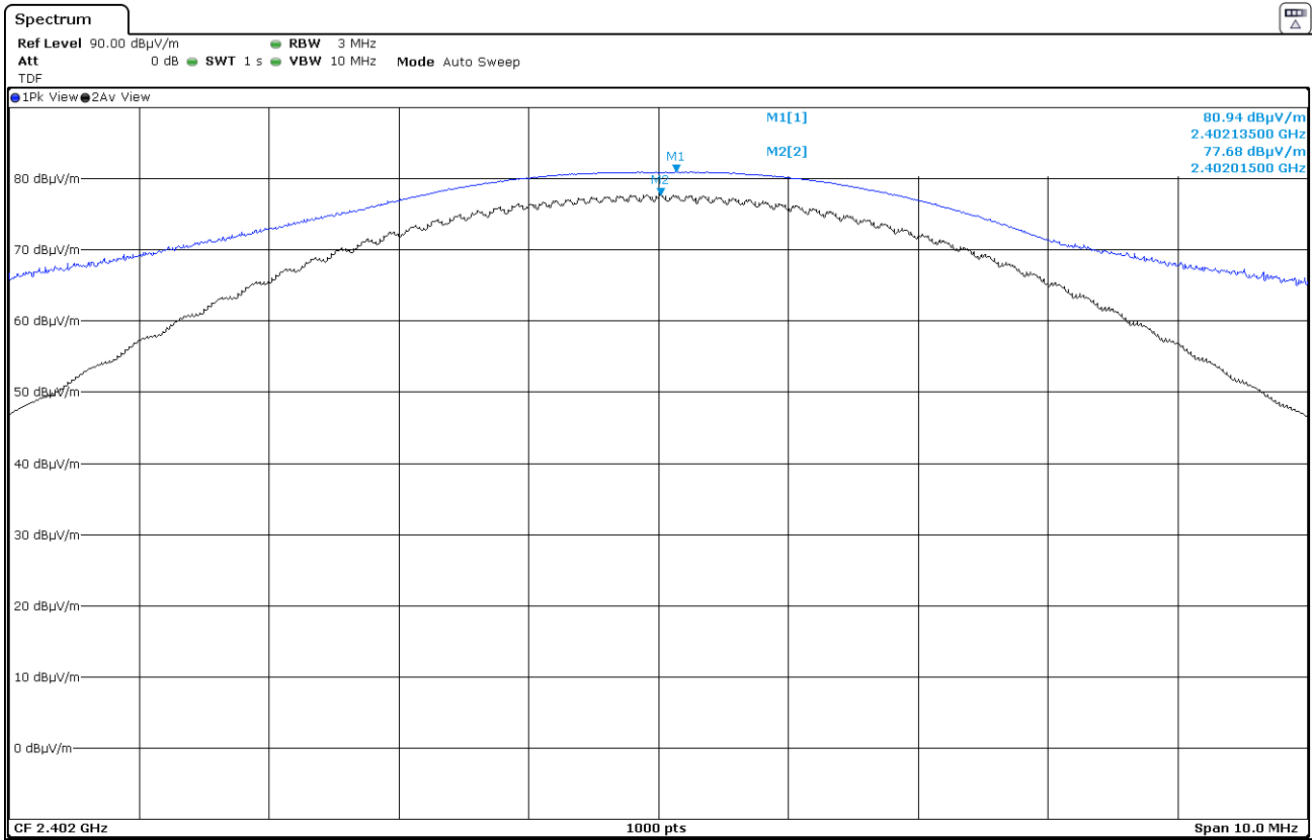
For frequencies above 1000 MHz, the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

RESULTS

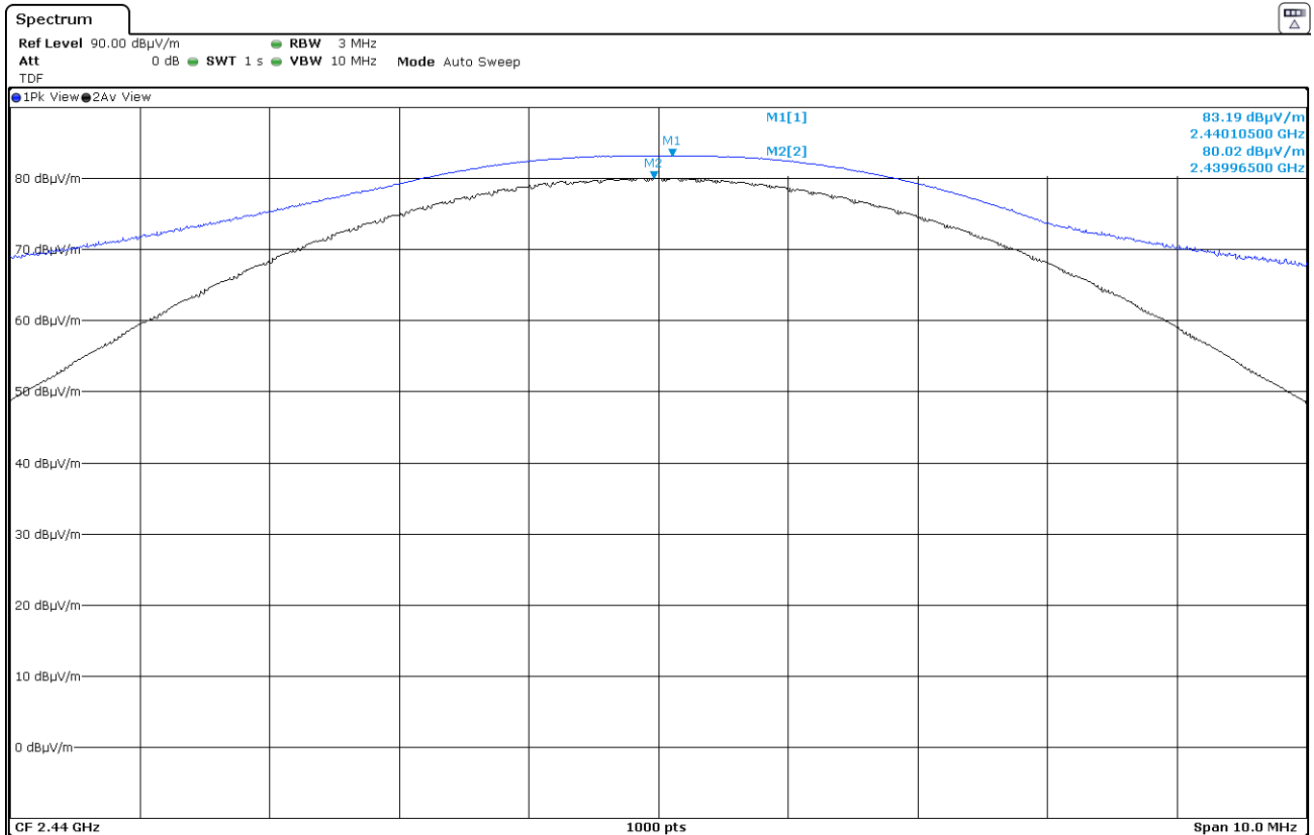
	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Field strength (dBµV/m) average	77.68	80.02	76.11
Field strength (dBµV/m) peak	80.94	83.19	79.35
Measurement uncertainty (dB)	<±4.87		

FIELD STRENGTH

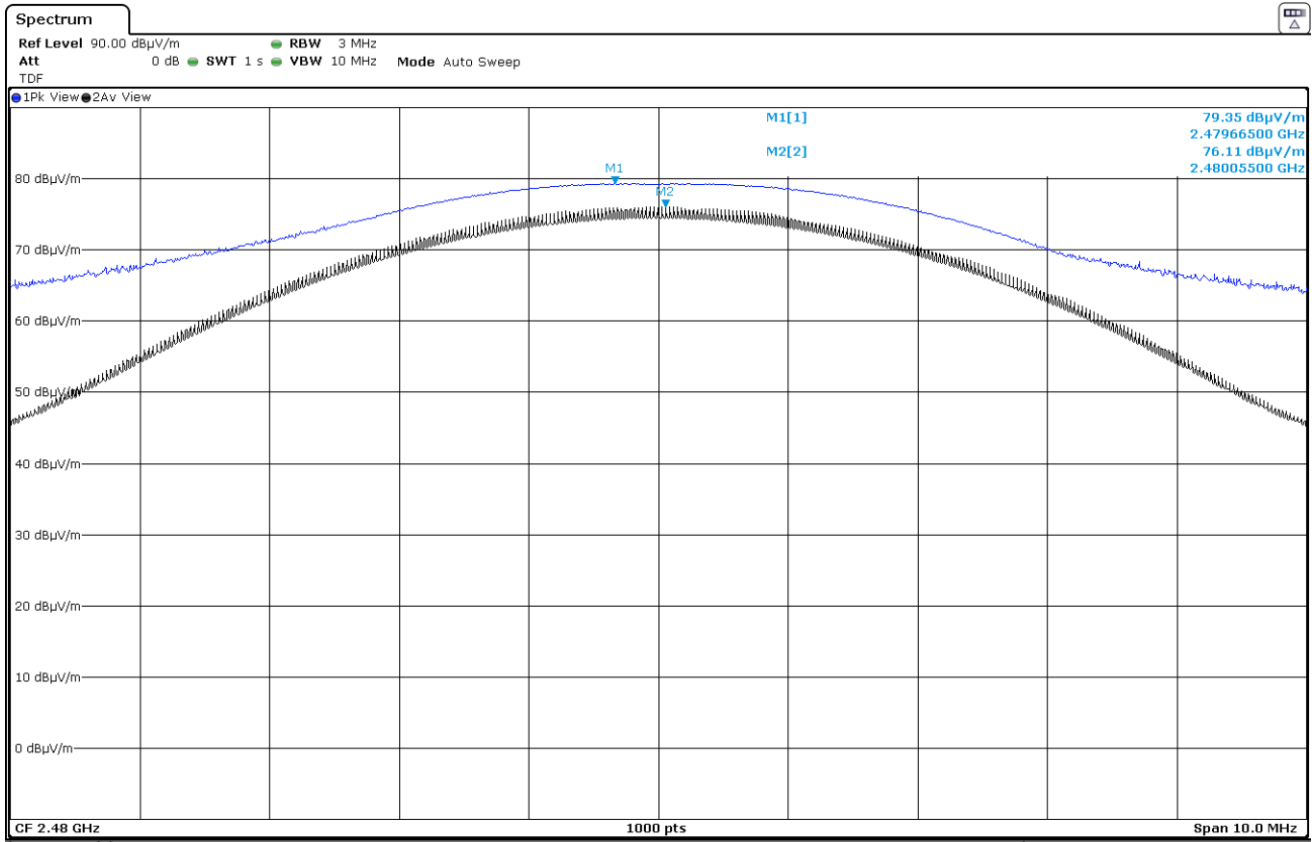
Lowest Channel



Middle Channel



Highest Channel



Verdict: PASS

Section 15.249 Subclause (a) and (d) / RSS-210 B.10 (b). Emissions limitations radiated (Transmitter)

SPECIFICATION

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

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

Whichever is the lesser attenuation.

RESULTS:

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

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

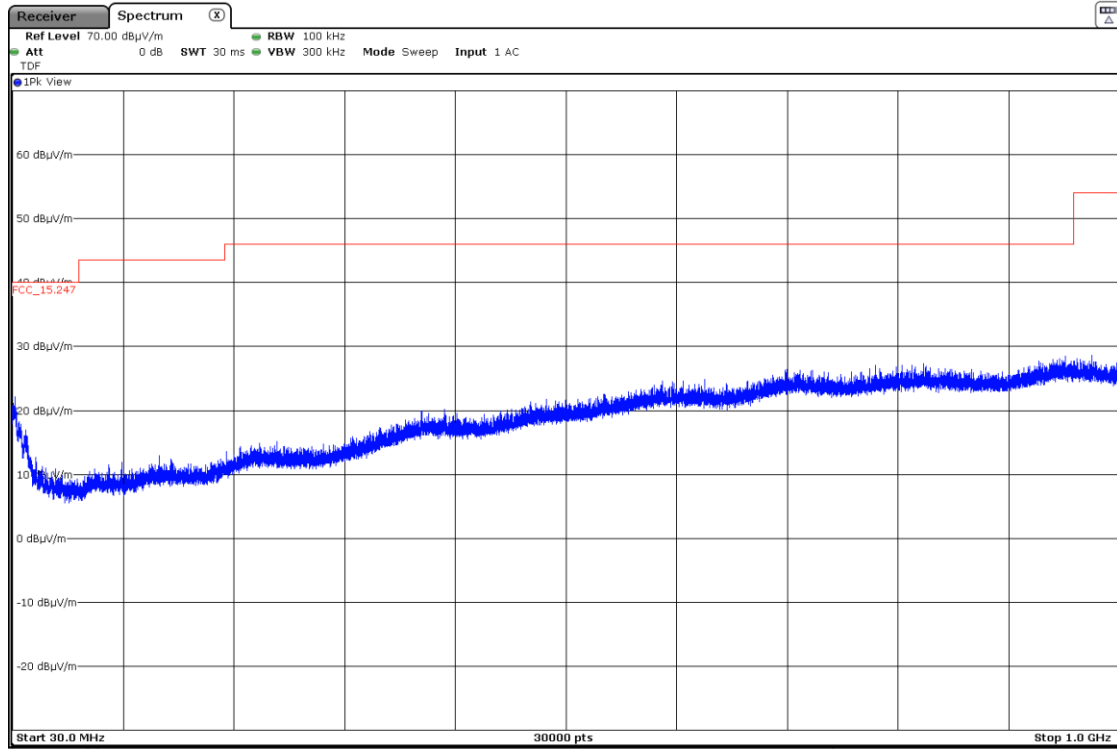
All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

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

Frequency range 30 MHz-1000 MHz.

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

No spurious signal found.



(This plot is valid for all three channels).

Frequency range 1 GHz-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 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.389633	H	Peak	51.76	< \pm 3.70
2.488616	H	Peak	52.20	< \pm 3.70
24.0171	V	Peak	48.37	< \pm 3.70

2. CHANNEL: MIDDLE (2440 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.34882	H	Peak	51.16	< \pm 3.70
2.49183	V	Peak	51.99	< \pm 3.70
21.9576	H	Peak	39.24	< \pm 3.70
24.3976	V	Peak	48.11	< \pm 3.70

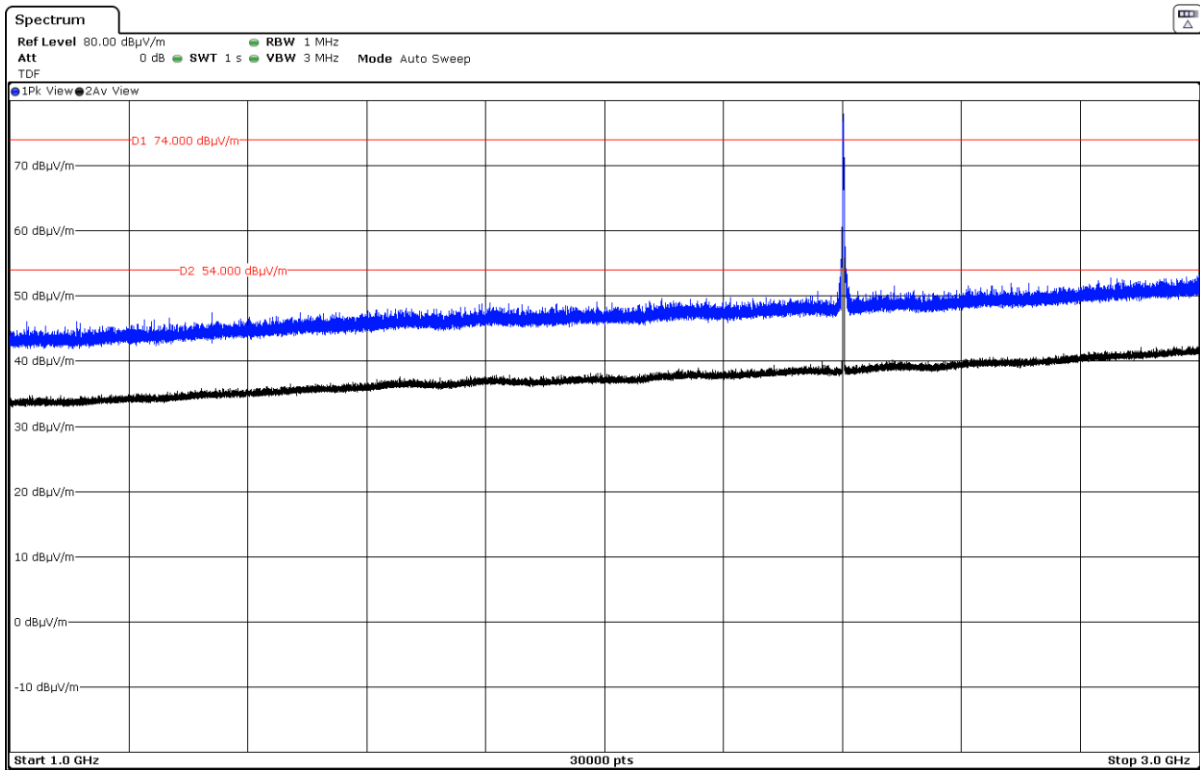
3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.345529	H	Peak	50.96	< \pm 3.70
2.483513	V	Peak	56.31	< \pm 3.70
		Average	40.65	
19.8378	H	Peak	38.61	< \pm 3.70
22.3176	V	Peak	39.83	< \pm 3.70
24.8022	V	Peak	45.7	< \pm 3.70

Verdict: PASS

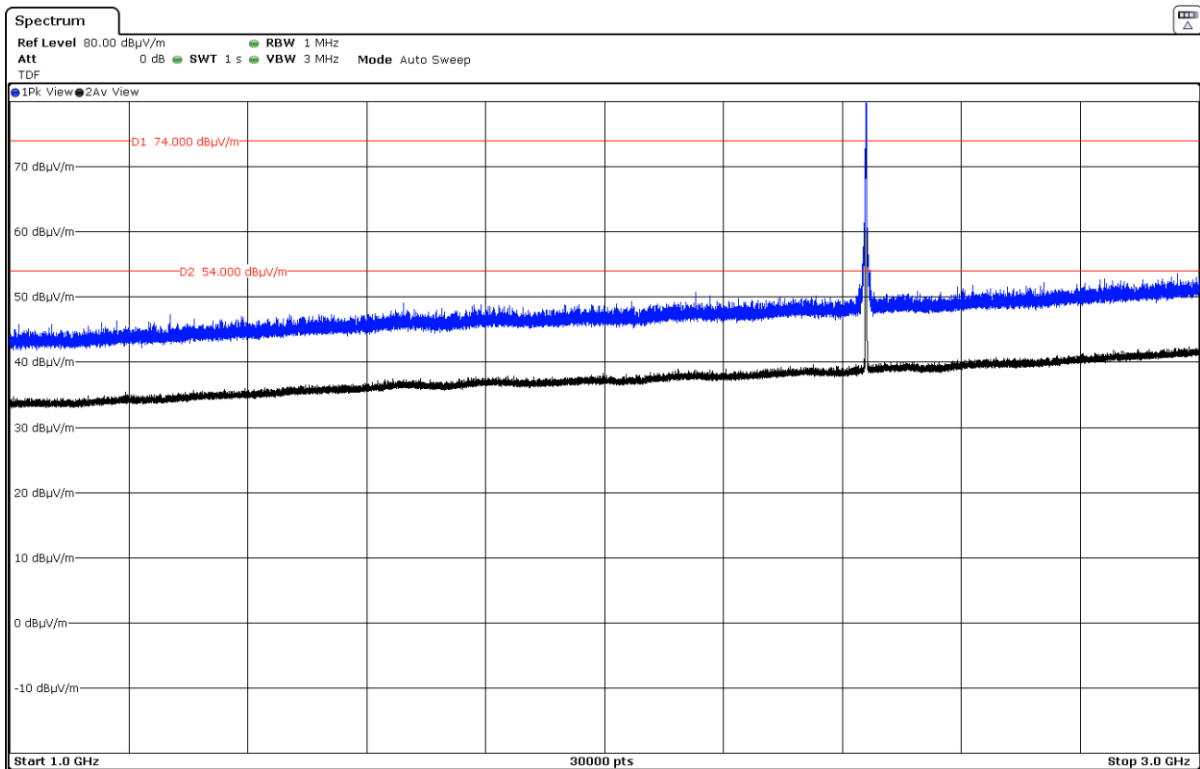
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2402 MHz).



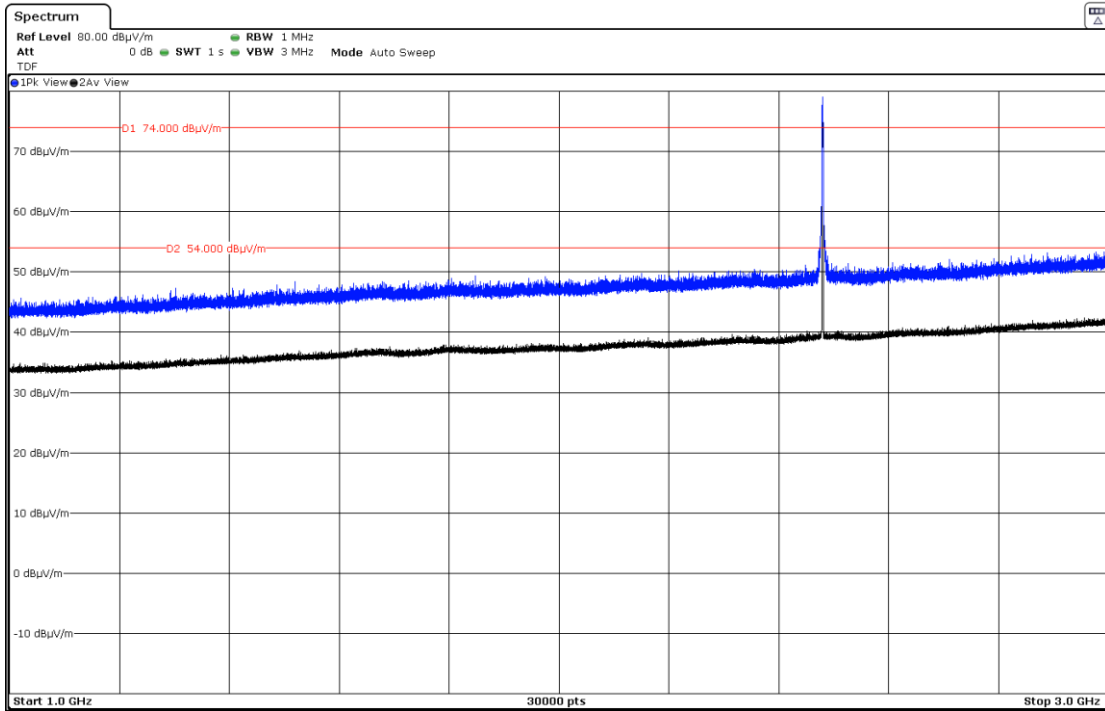
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Middle (2440 MHz).



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

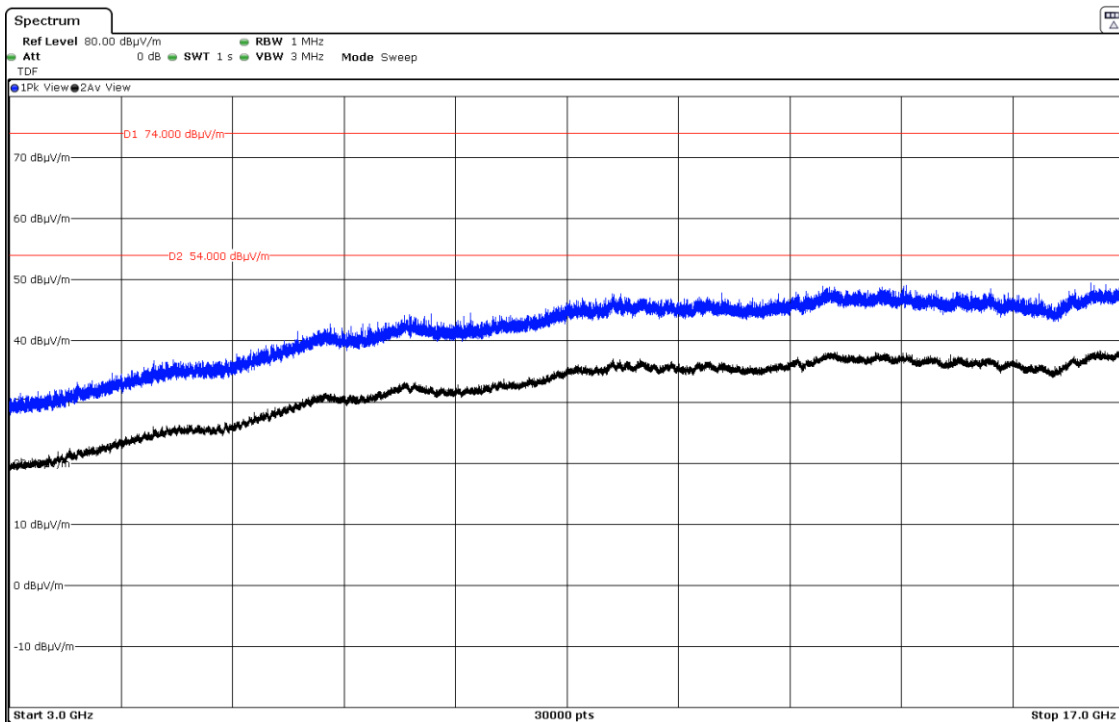
CHANNEL: Highest (2480 MHz).



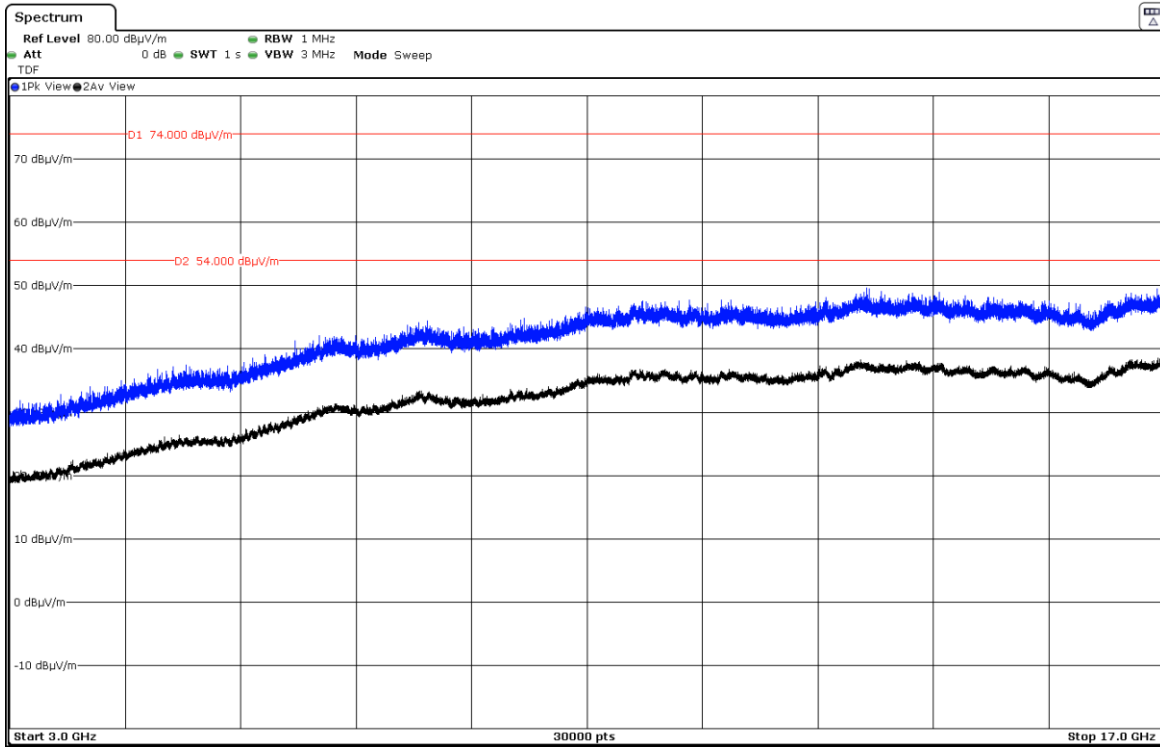
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 17 GHz.

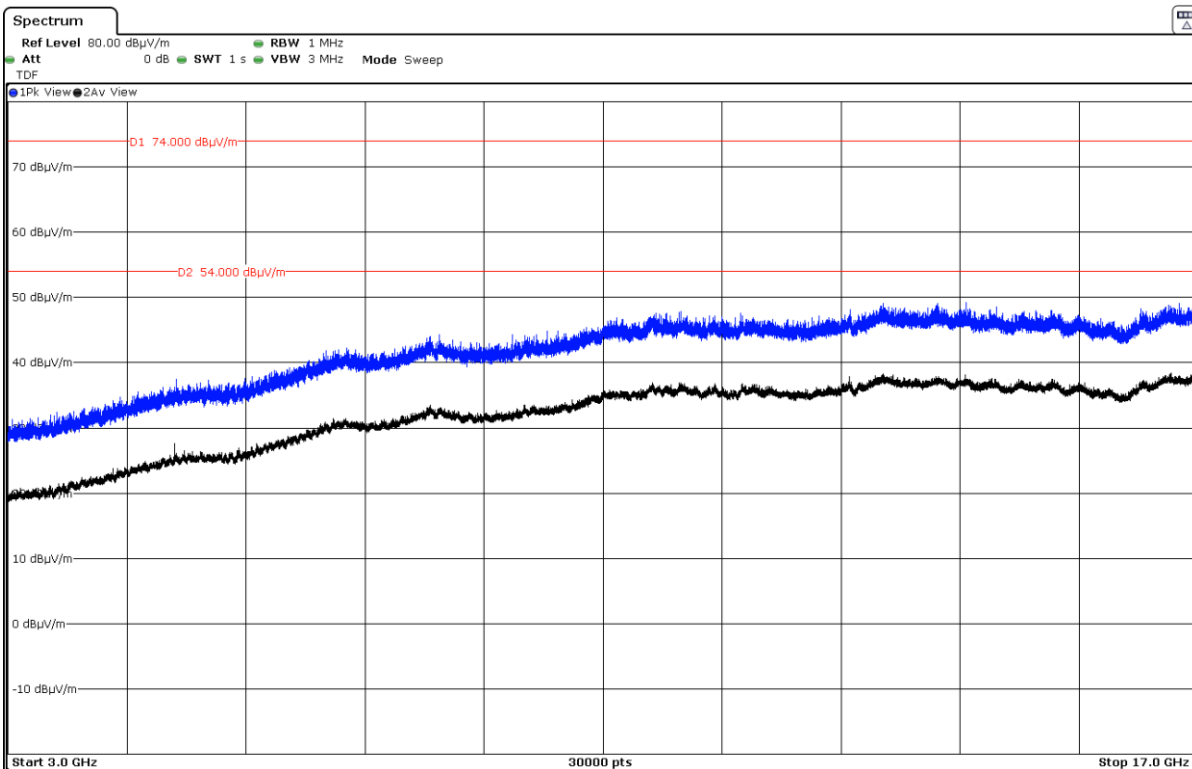
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

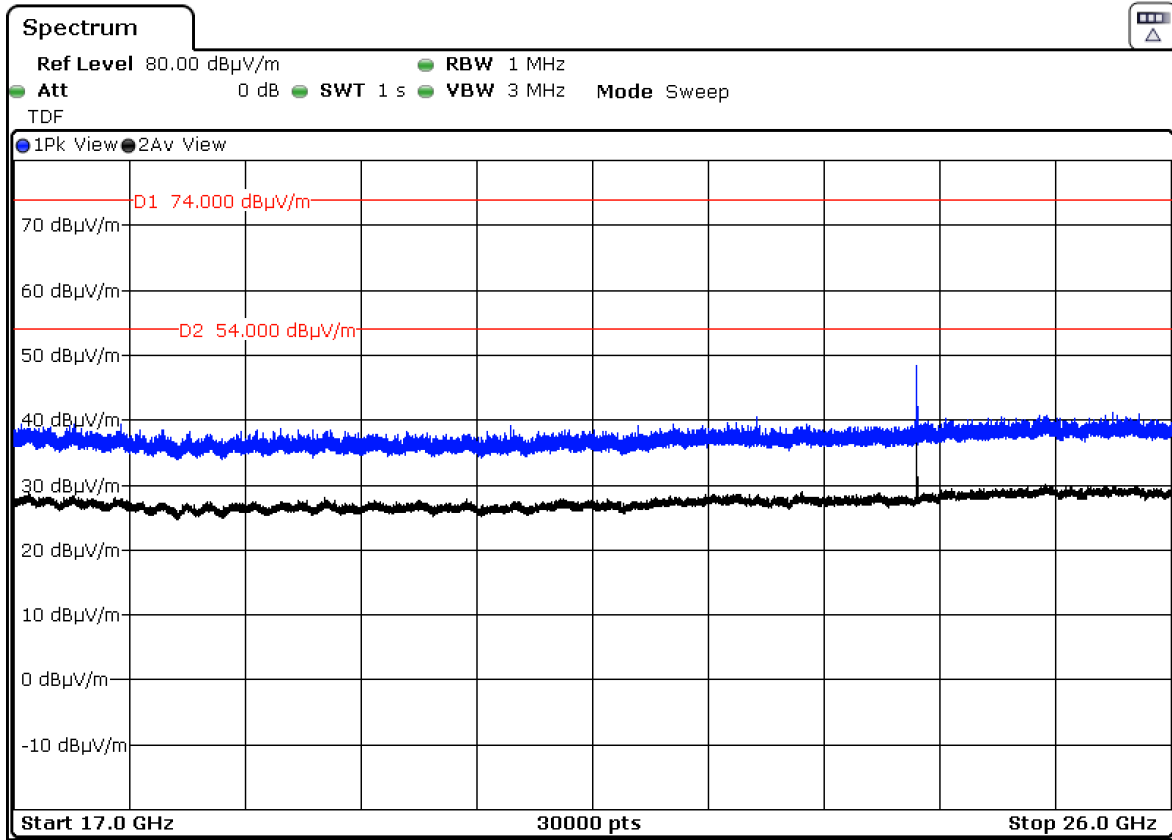


CHANNEL: Highest (2480 MHz).

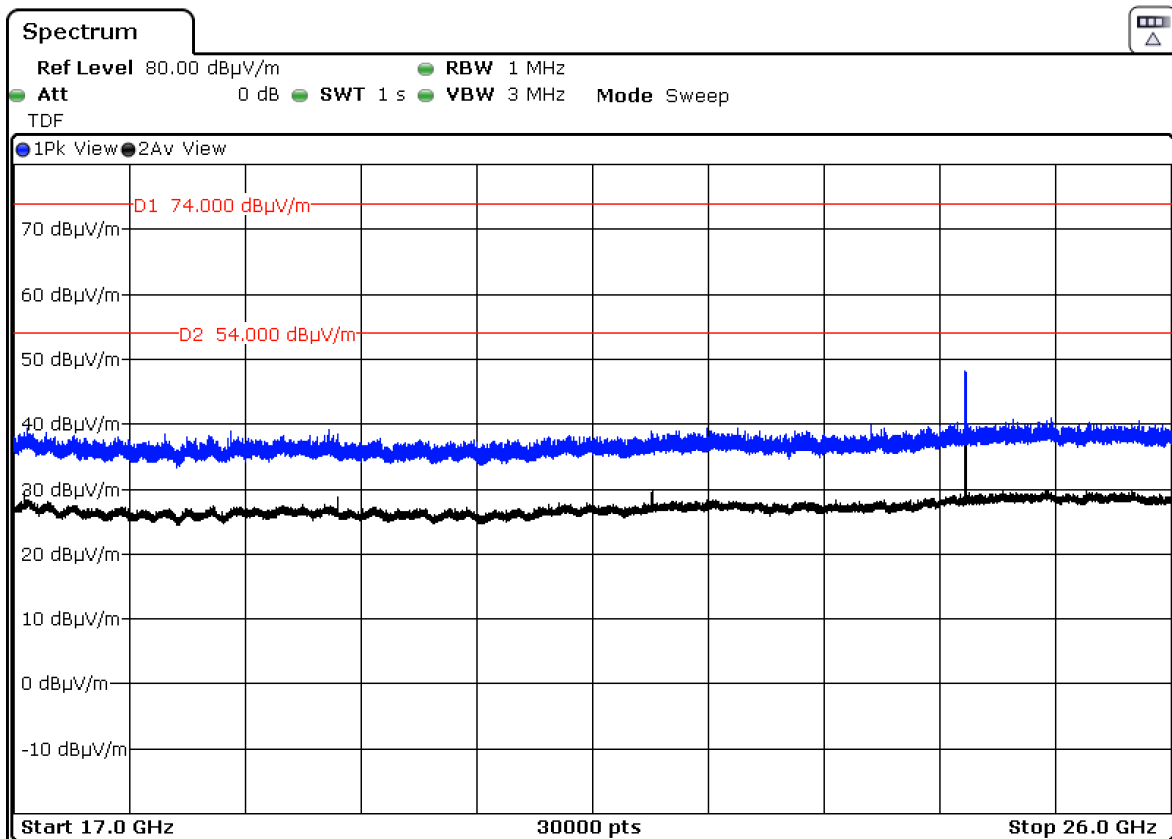


FREQUENCY RANGE 17 GHz to 26 GHz.

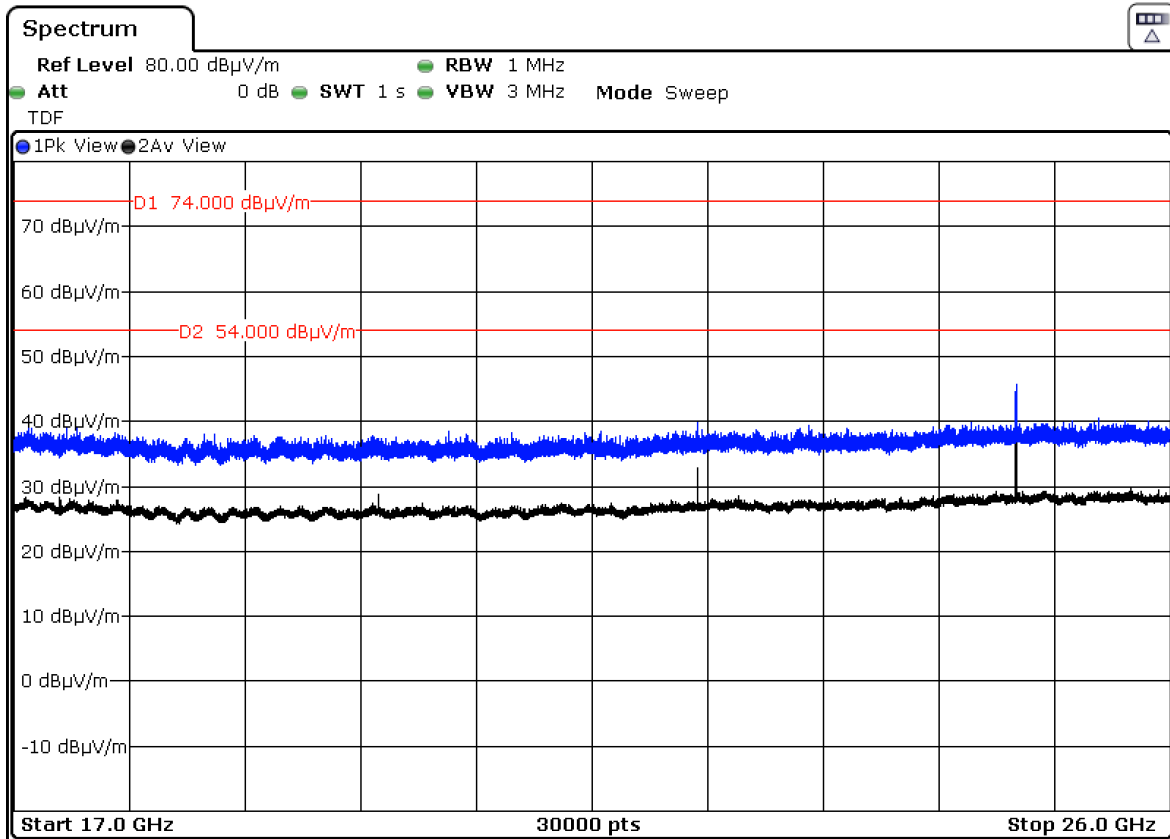
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

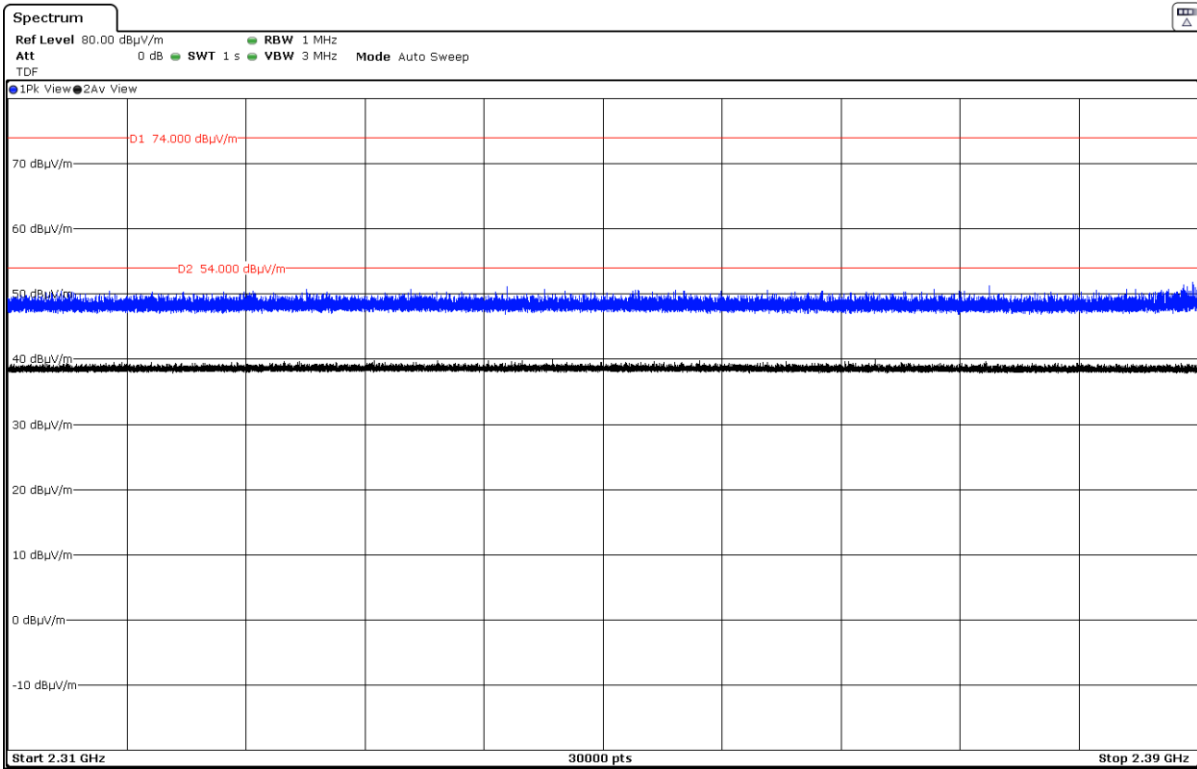


CHANNEL: Highest (2480 MHz).

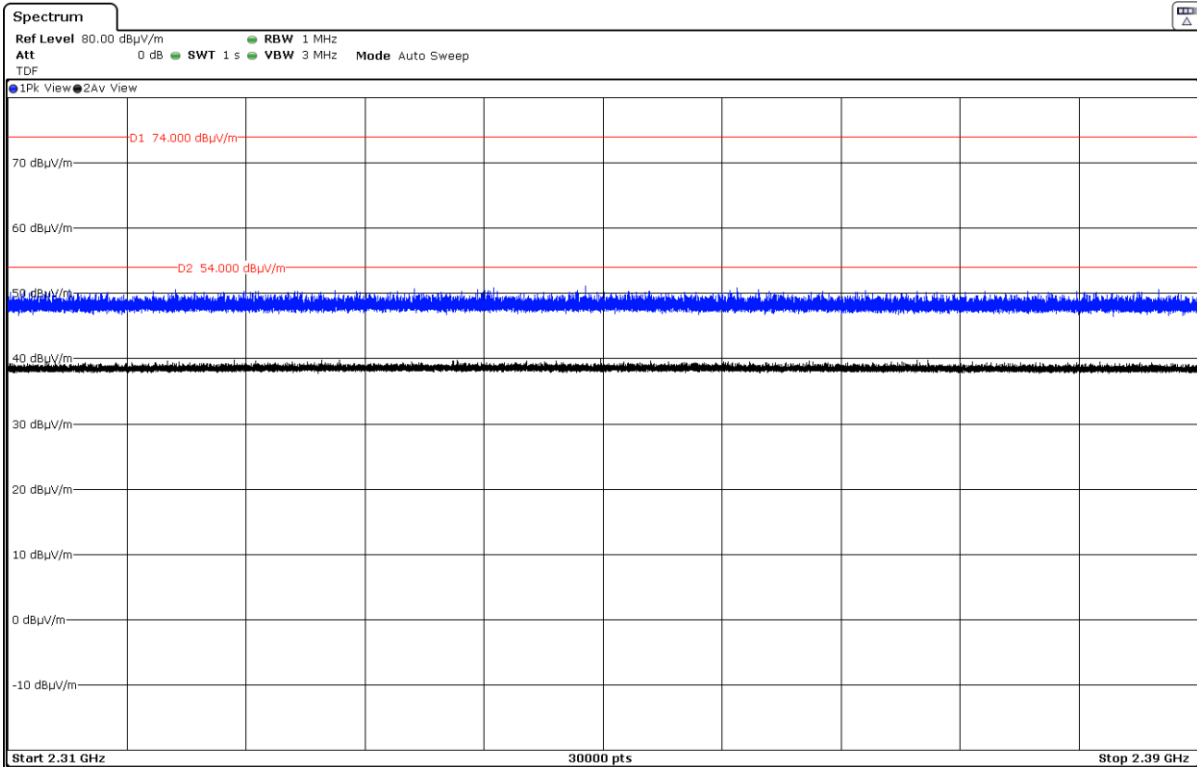


FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

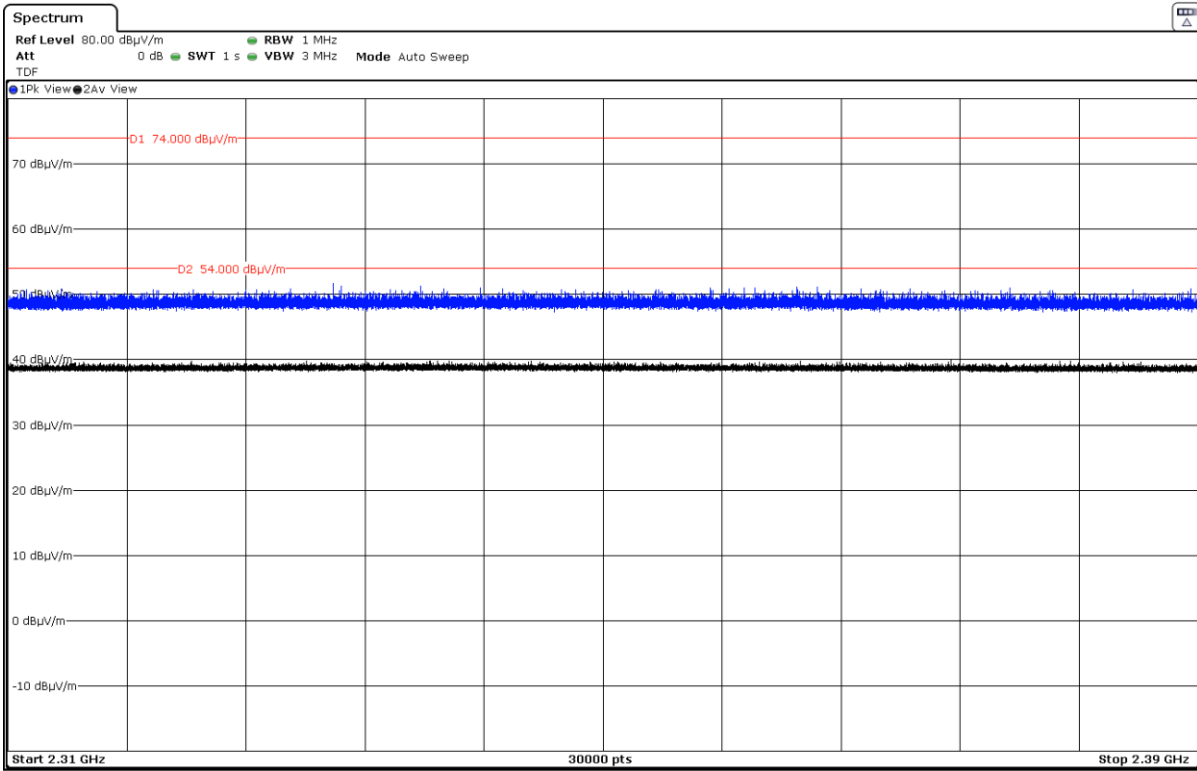
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

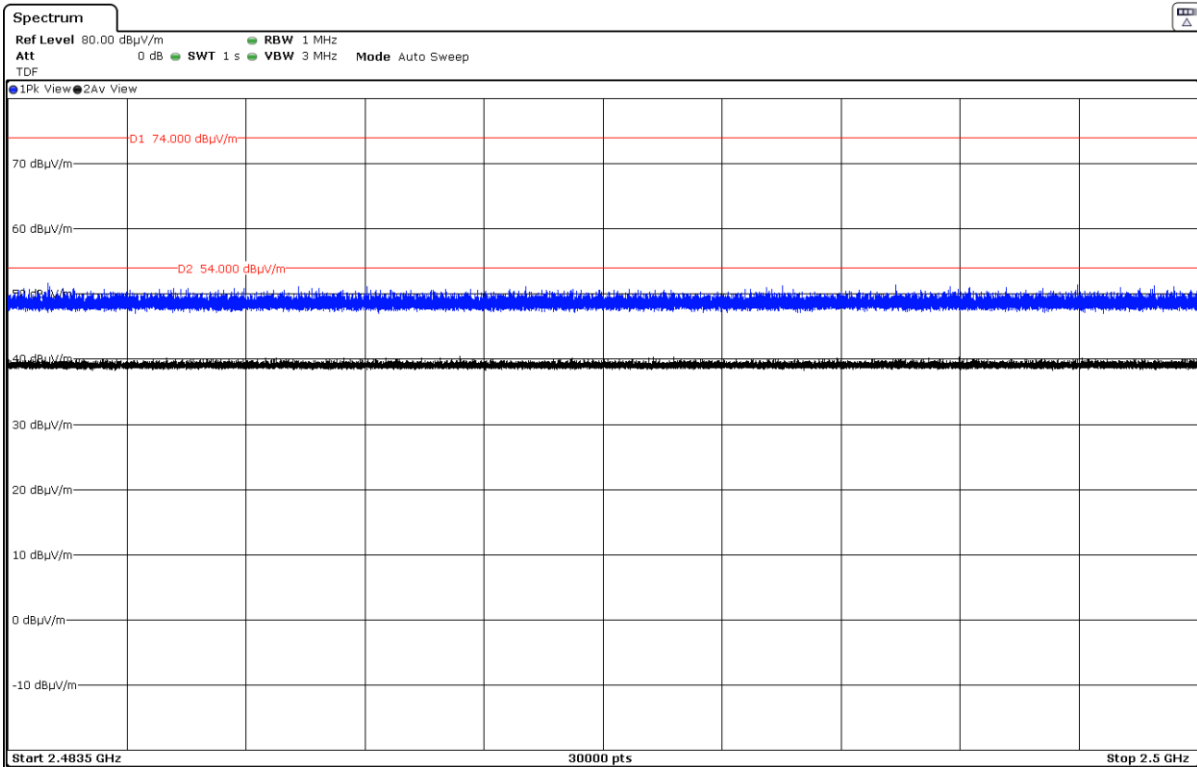


CHANNEL: Highest (2480 MHz).

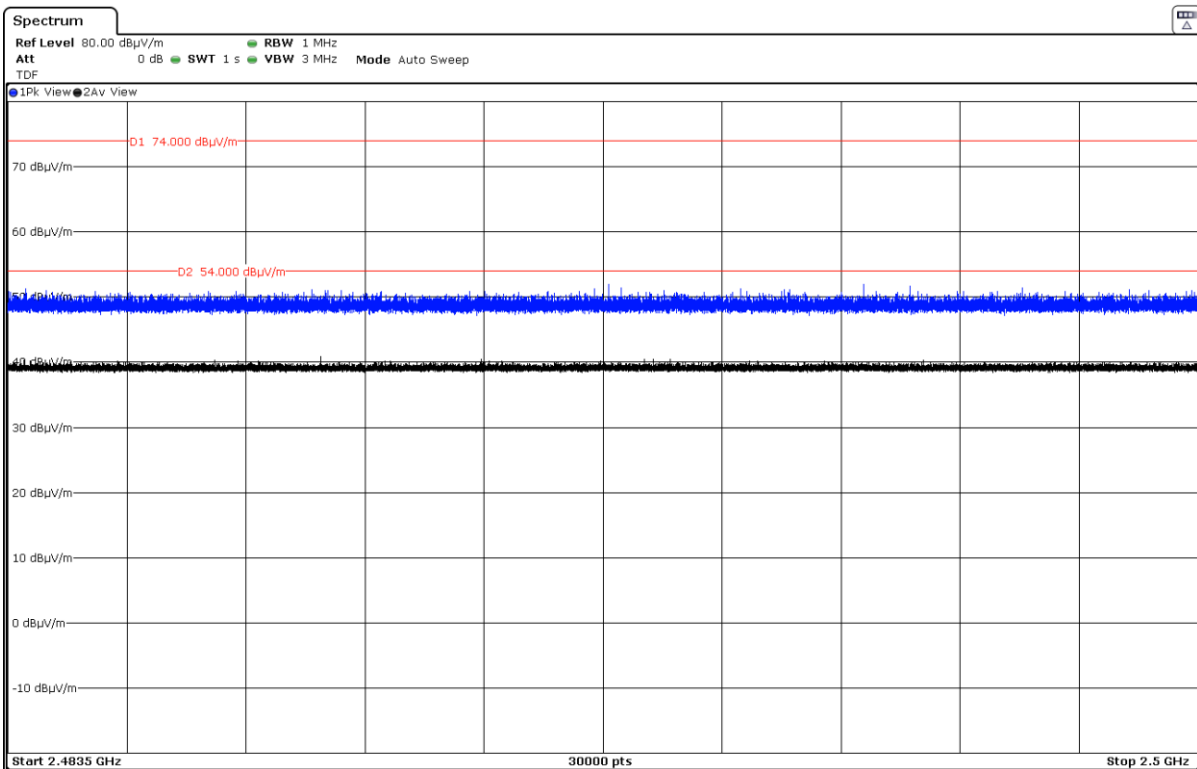


FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

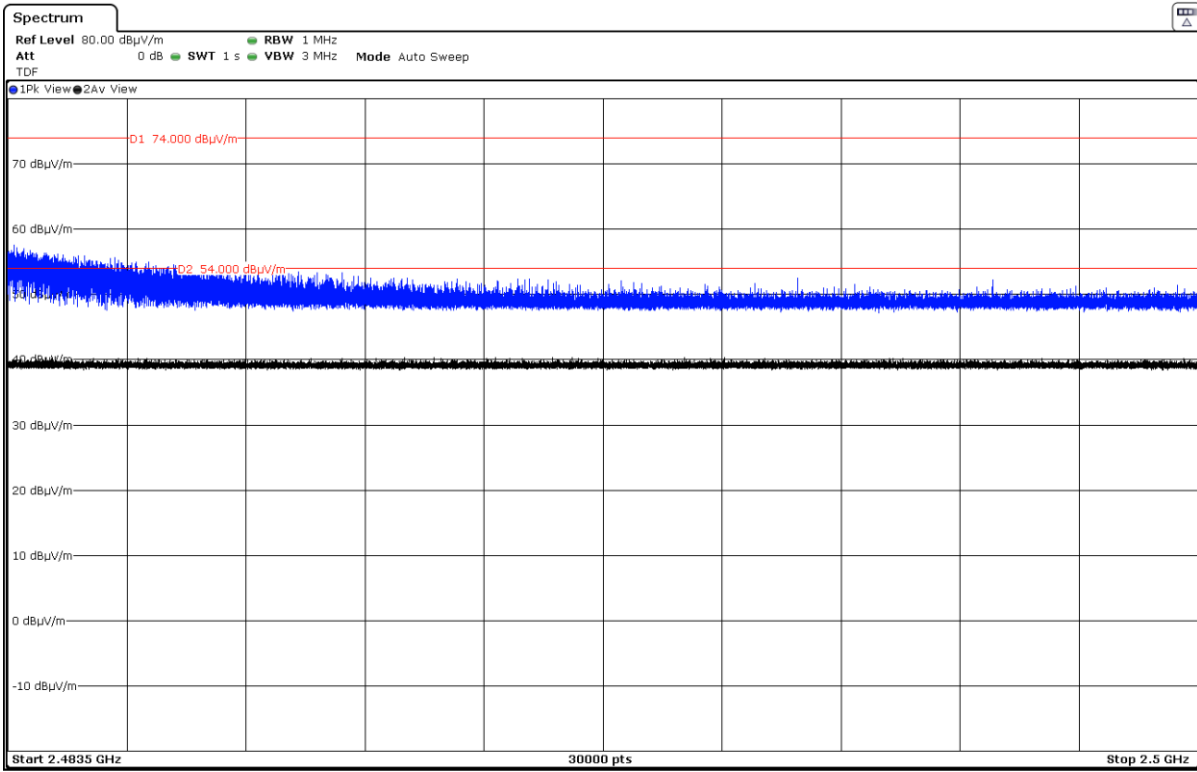
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).



CHANNEL: Highest (2480 MHz).



Appendix B: Test results. Bluetooth Basic Rate

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TEST CONDITIONS

Power supply (V):

$V_{\text{nominal}} = 1.4 \text{ Vdc}$

Type of power supply = DC voltage from battery.

Type of antenna = Integral antenna.

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2441 MHz

Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

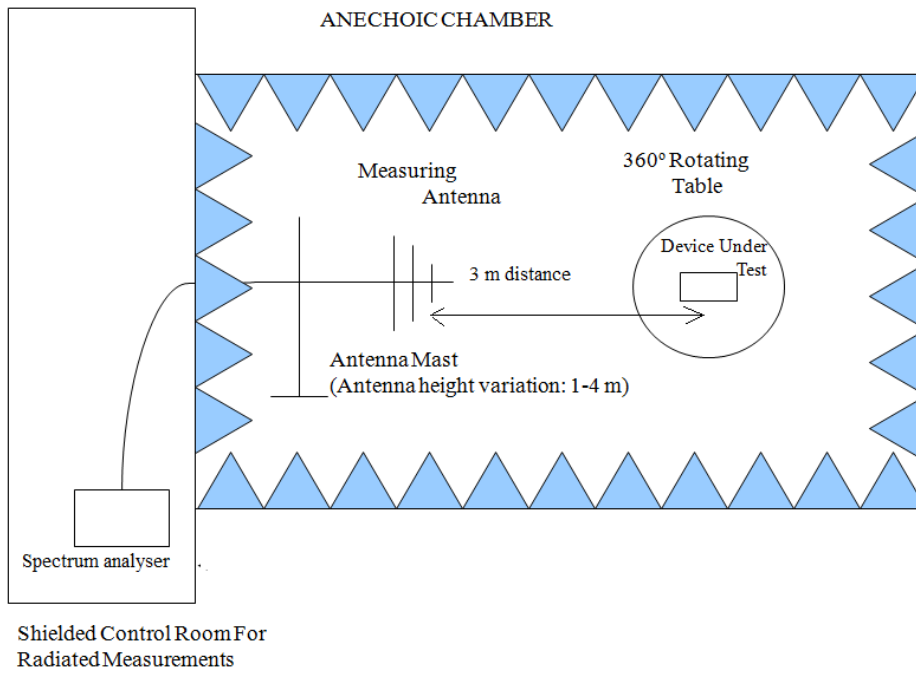
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 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.

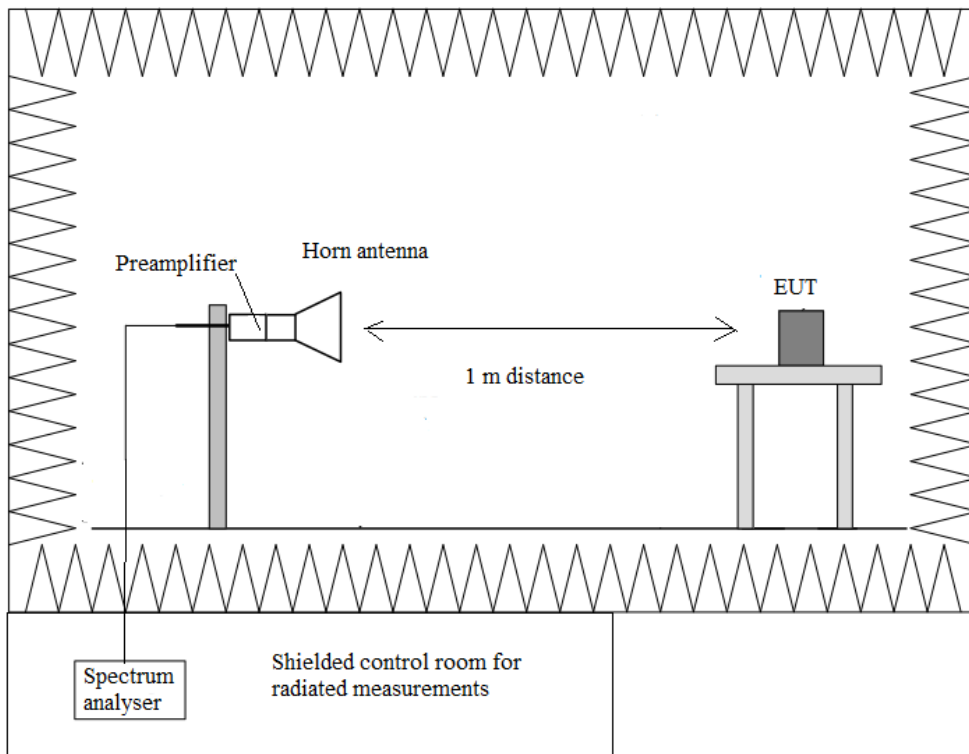
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



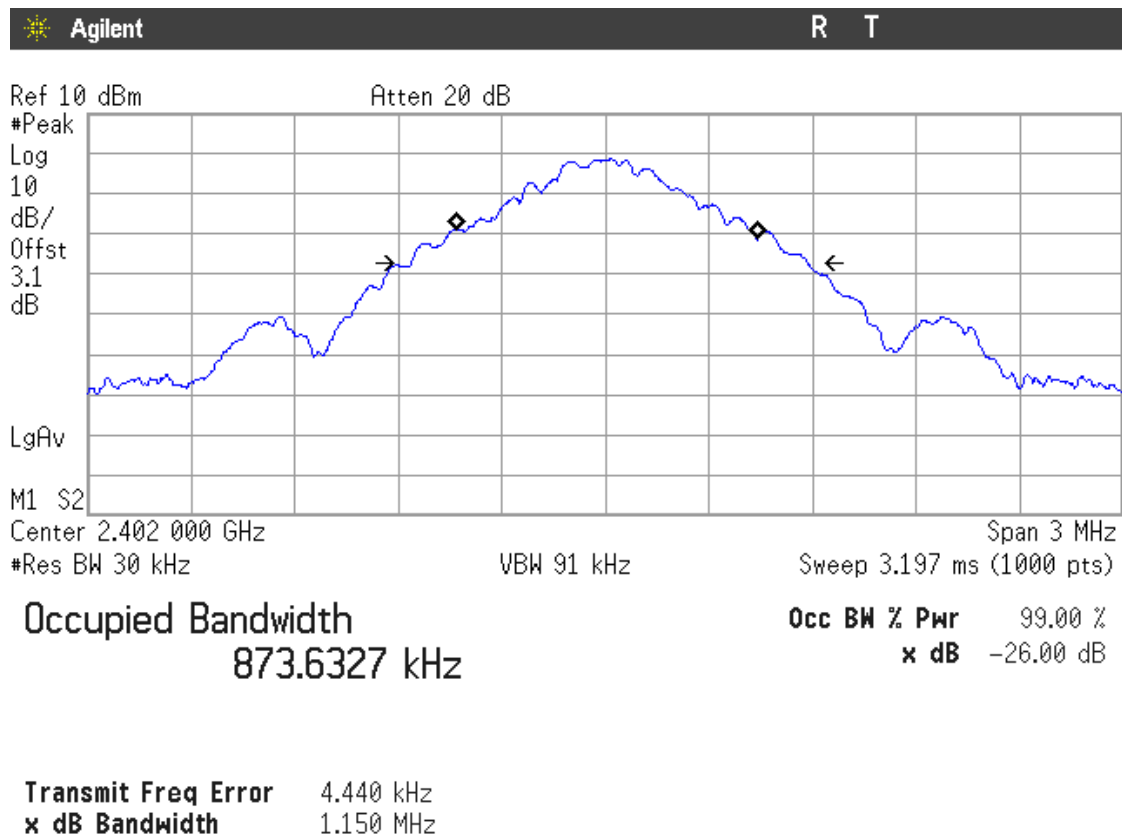
Occupied Bandwidth

RESULTS

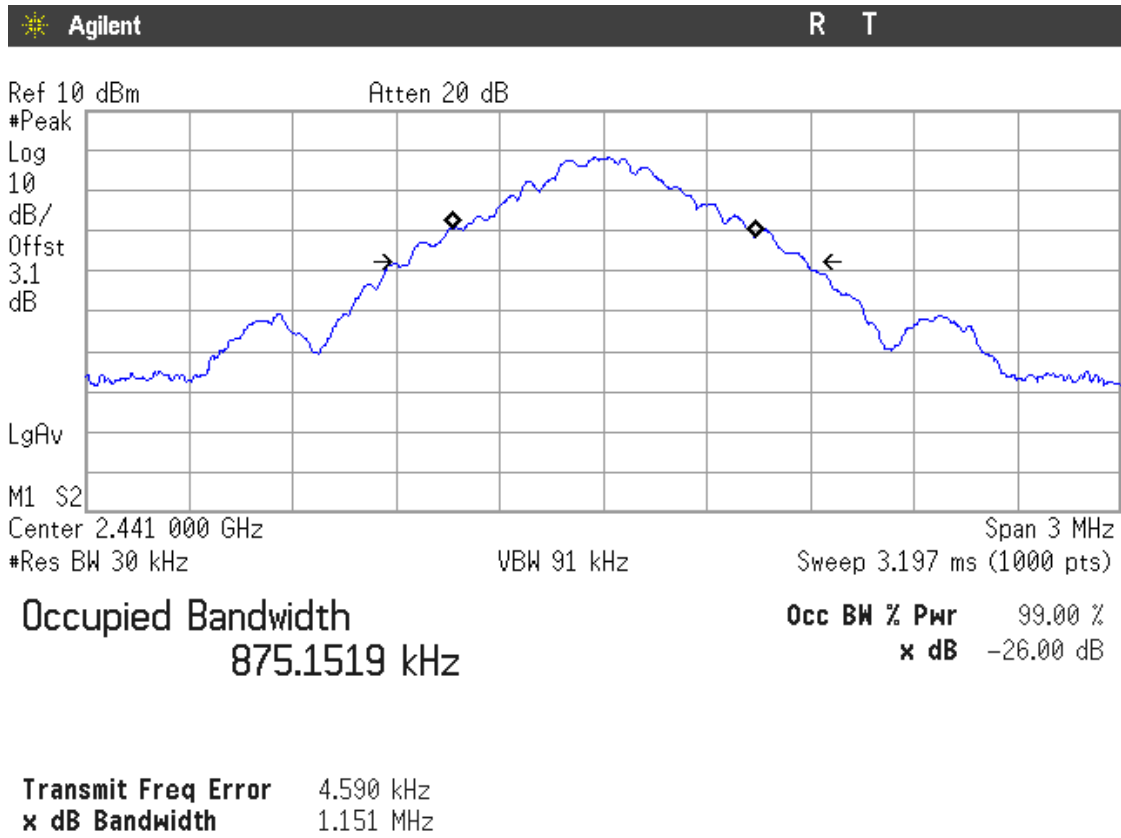
(see next plots).

	Lowest frequency	Middle frequency	Highest frequency
	2402 MHz	2441 MHz	2480 MHz
99% bandwidth (MHz)	0.8736327	0.8751519	0.8758756
-26 dBc bandwidth (MHz)	1.150	1.151	1.151
Measurement uncertainty (kHz)	<±5.00		

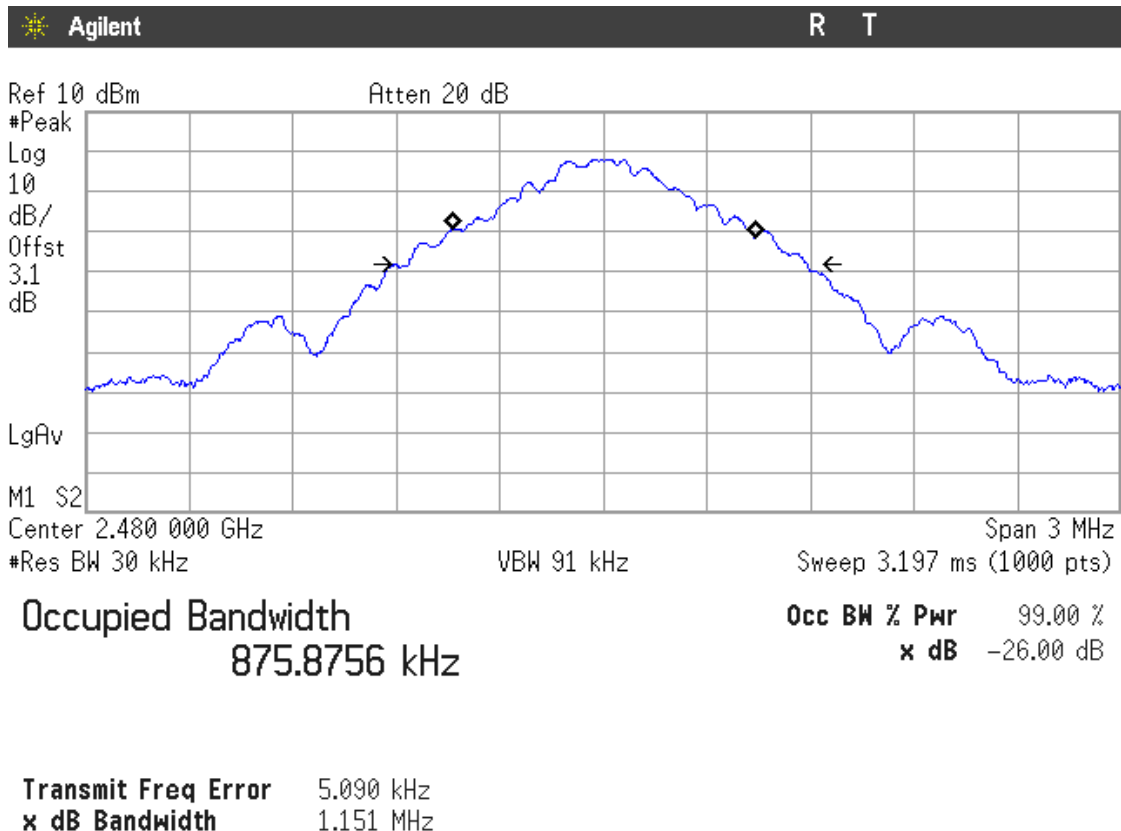
Lowest Channel



Middle Channel



Highest channel



Section 15.249 Subclause (a) / RSS-210 B.10 (a). Field strength of Fundamental

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 (dB μ V/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.

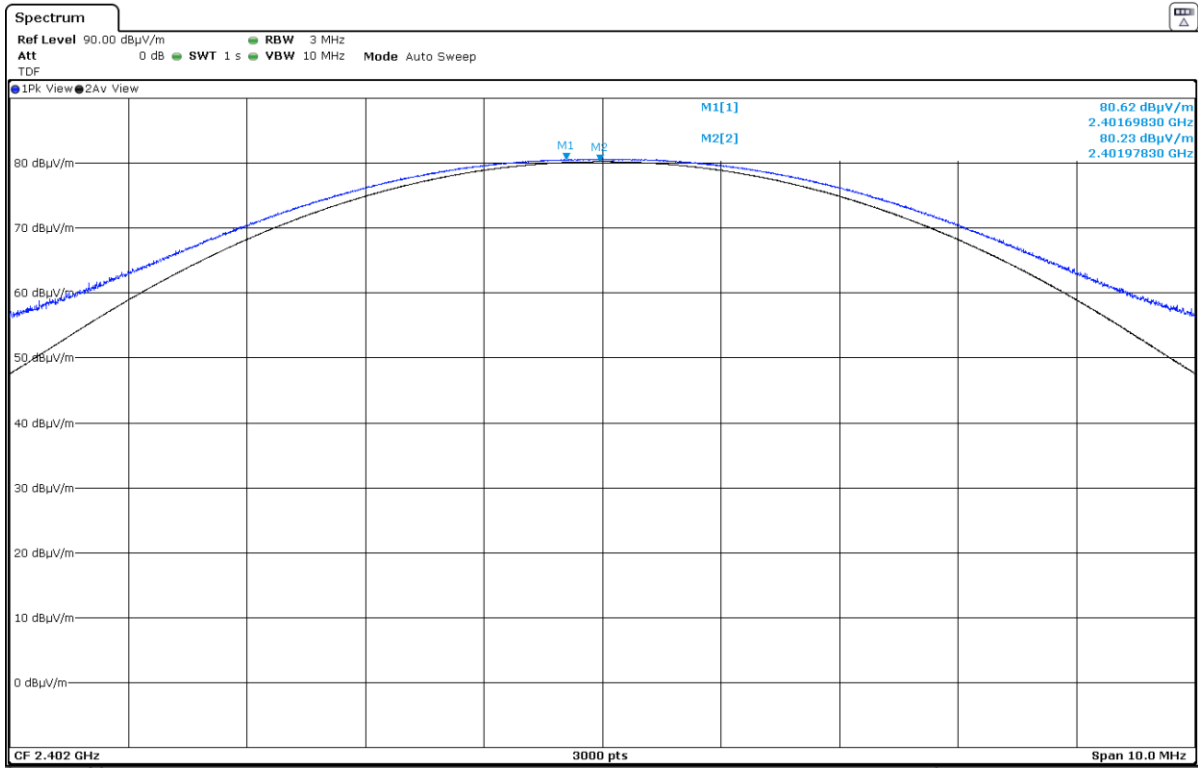
RESULTS

	Lowest frequency 2402 MHz	Middle frequency 2441 MHz	Highest frequency 2480 MHz
Field strength (dB μ V/m) average	80.23	81.06	78.90
Field strength (dB μ V/m) peak	80.62	81.42	79.36
Measurement uncertainty (dB)	< \pm 4.87		

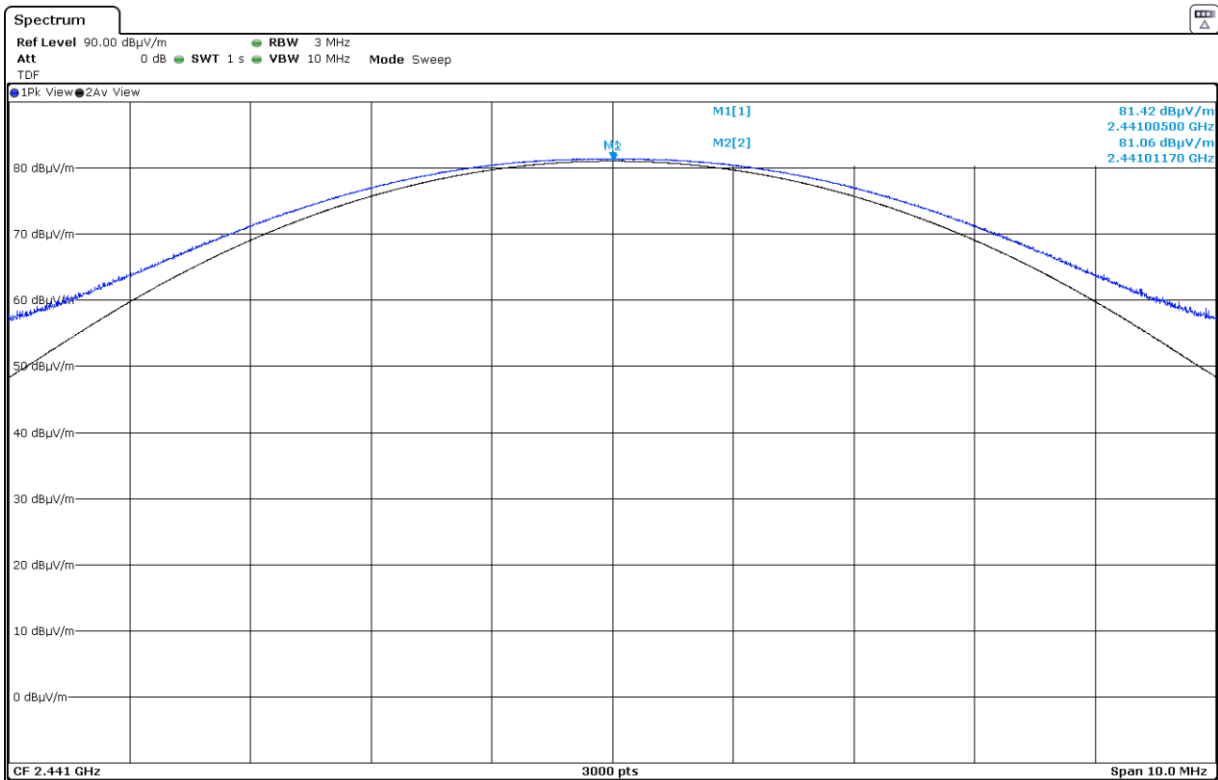
Verdict: PASS

FIELD STRENGTH

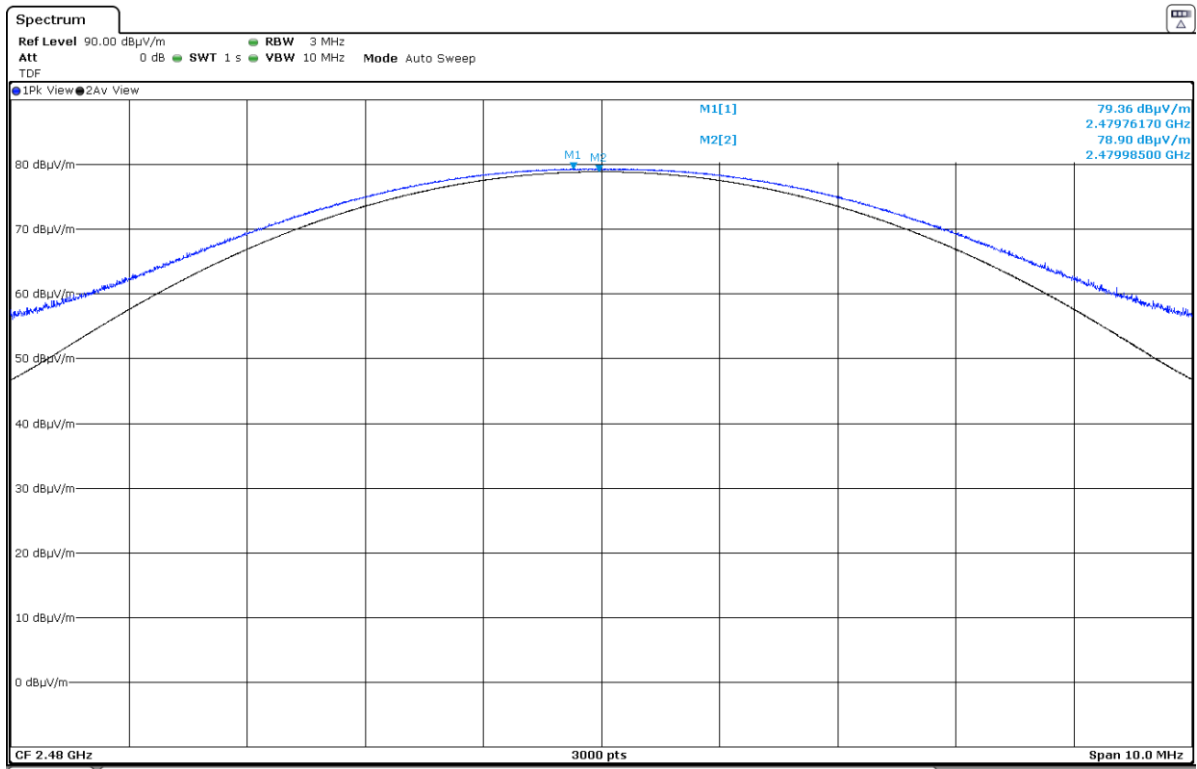
Lowest Channel



Middle Channel



Highest Channel



Section 15.249 Subclause (a) and (d) / RSS-210 B.10 (b). Emissions limitations radiated (Transmitter)

SPECIFICATION

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

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

Whichever is the lesser attenuation.

RESULTS:

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

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

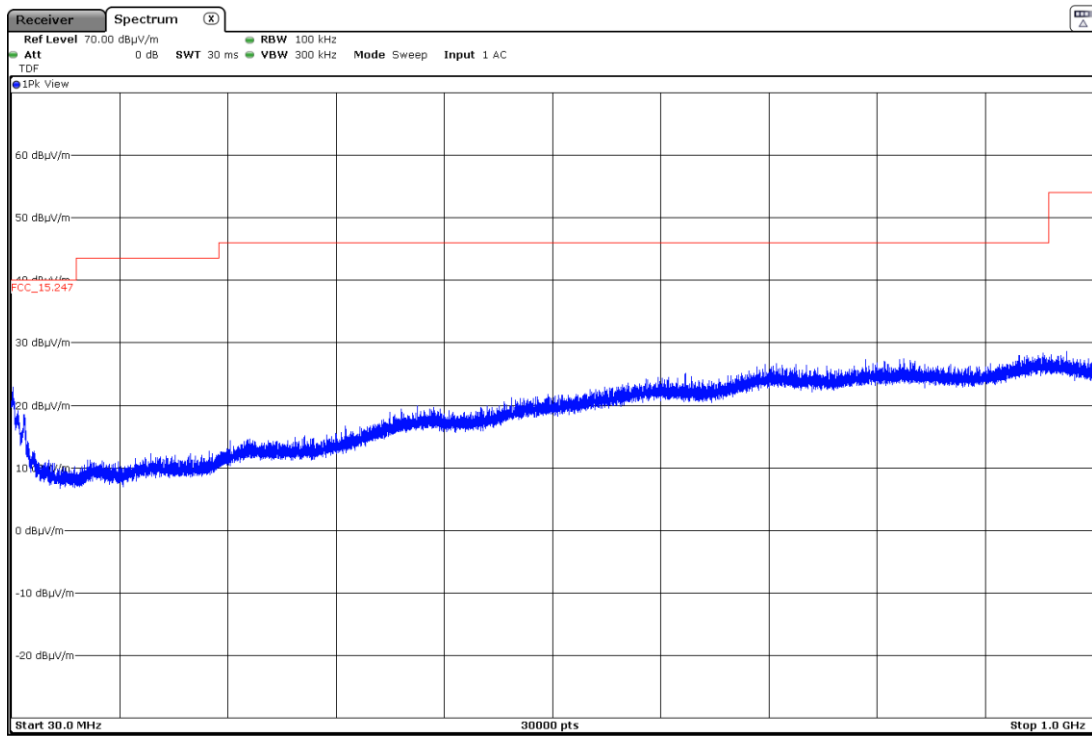
All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-25 GHz.

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

Frequency range 30 MHz-1000 MHz.

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

No spurious signals found.



(This plot is valid for all three channels).

Frequency range 1 GHz-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 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
24.01865	V	Peak	47.4	< \pm 3.70

2. CHANNEL: MIDDLE (2441 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
21.9675	H	Peak	39.55	< \pm 3.70
24.4083	V	Peak	47.72	< \pm 3.70

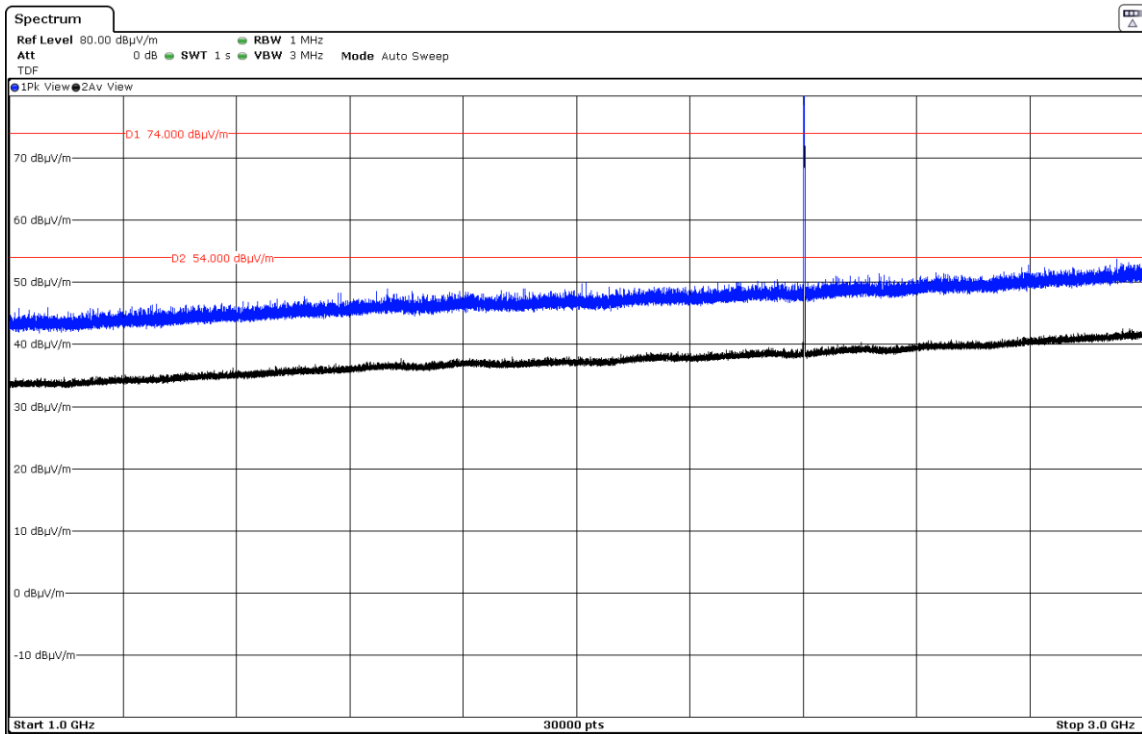
3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
19.8384	H	Peak	40.51	< \pm 3.70
22.31885	H	Peak	40.18	< \pm 3.70
24.80165	V	Peak	45.72	< \pm 3.70

Verdict: PASS

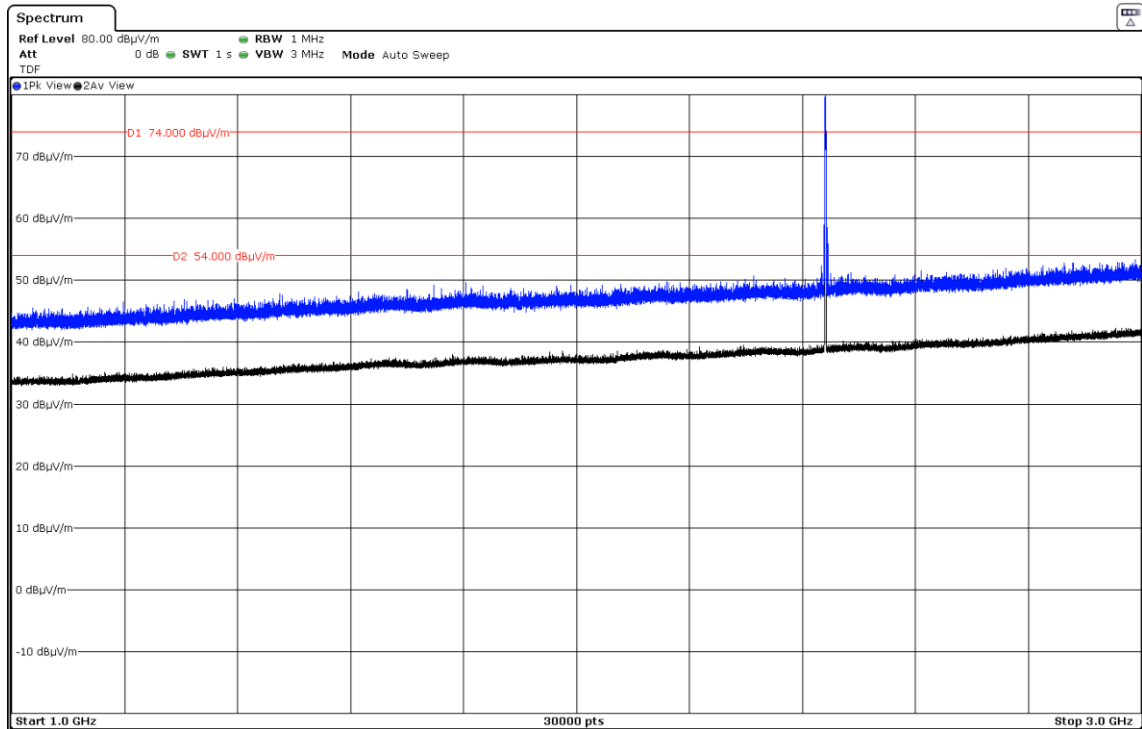
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2402 MHz).



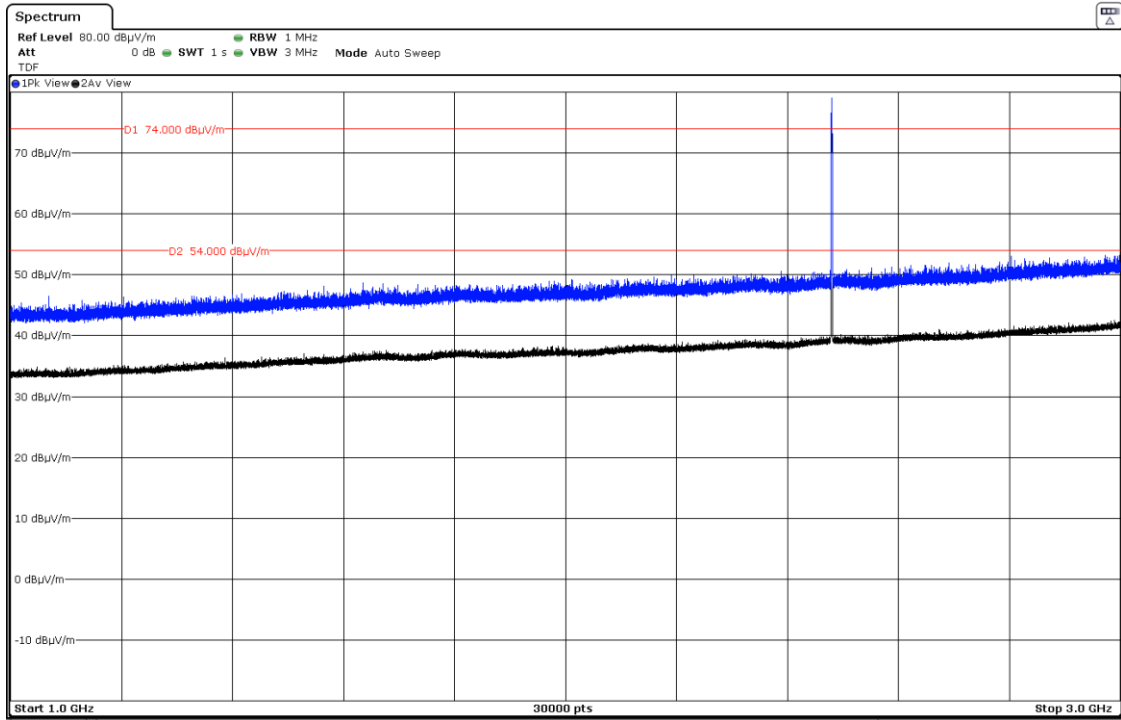
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Middle (2441 MHz).



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

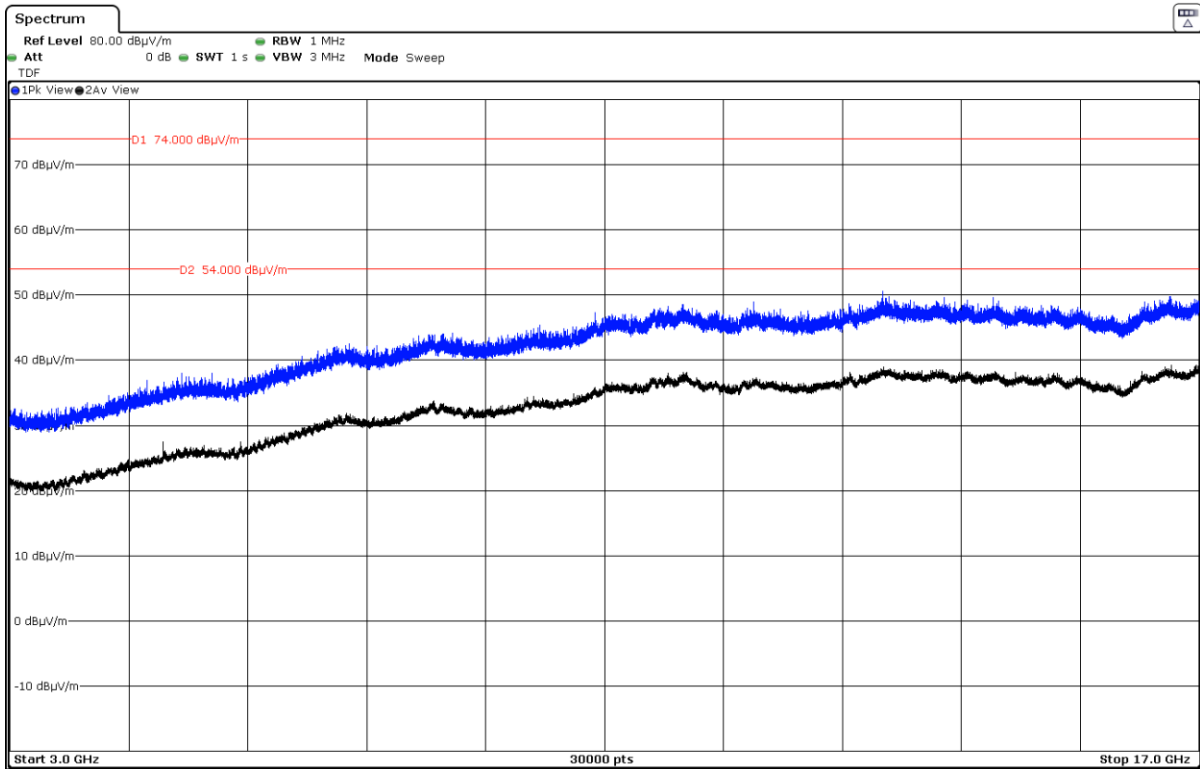
CHANNEL: Highest (2480 MHz).



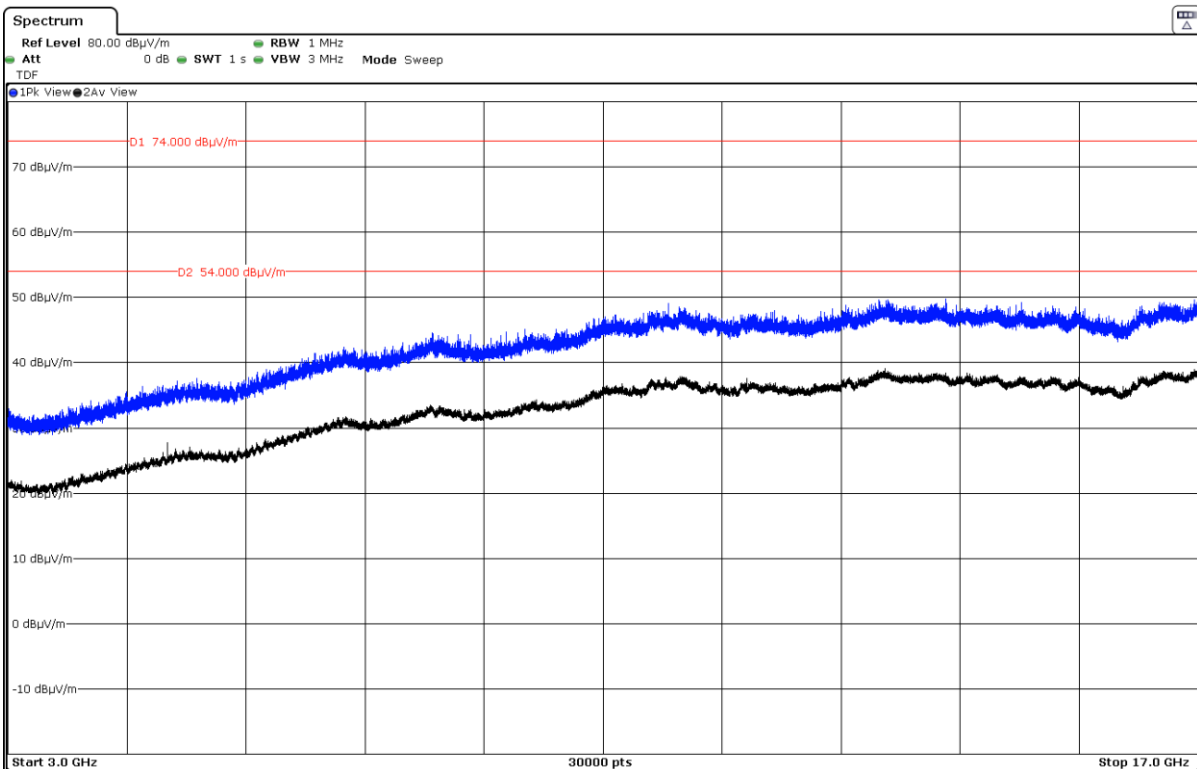
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 17 GHz.

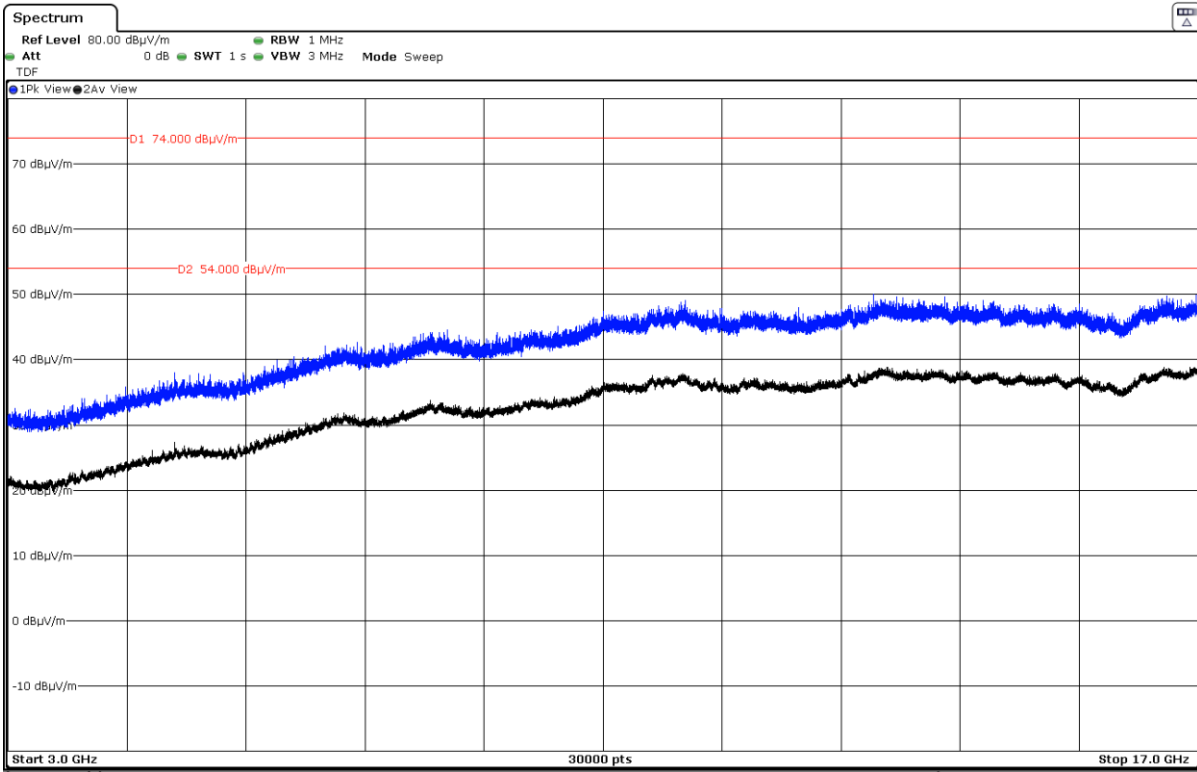
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2441 MHz).

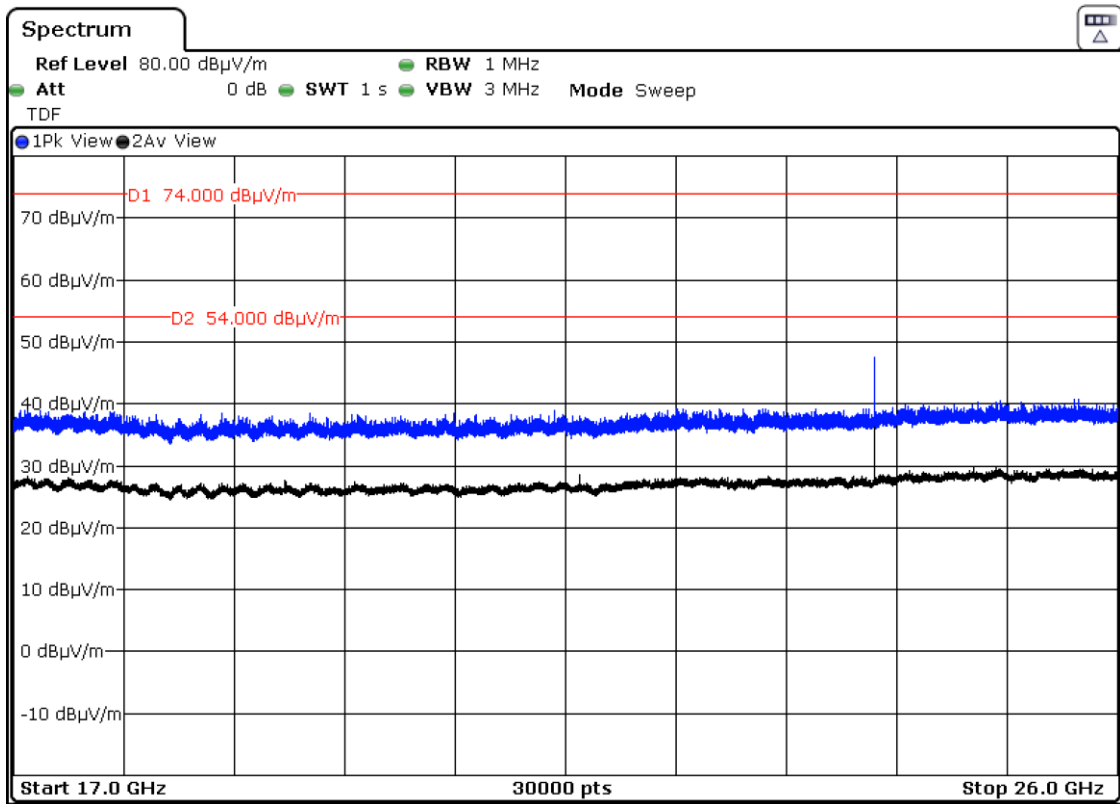


CHANNEL: Highest (2480 MHz).

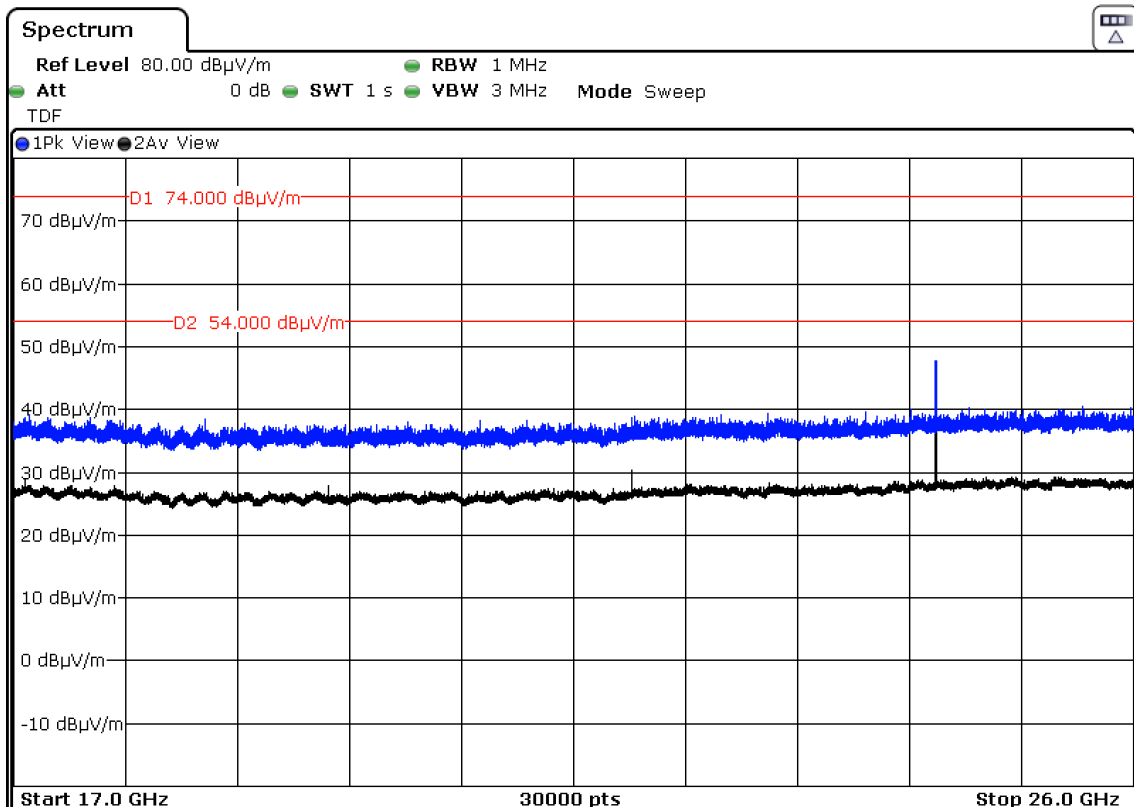


FREQUENCY RANGE 17 GHz to 26 GHz.

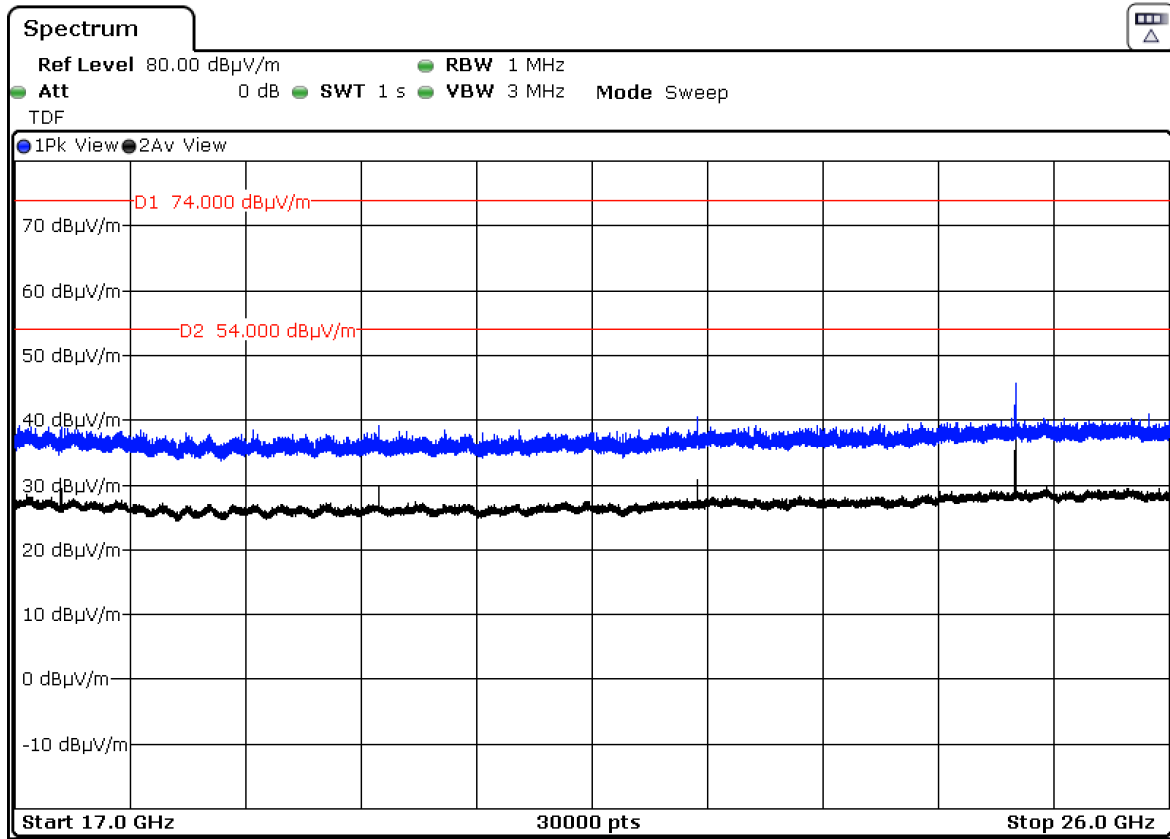
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2441 MHz).

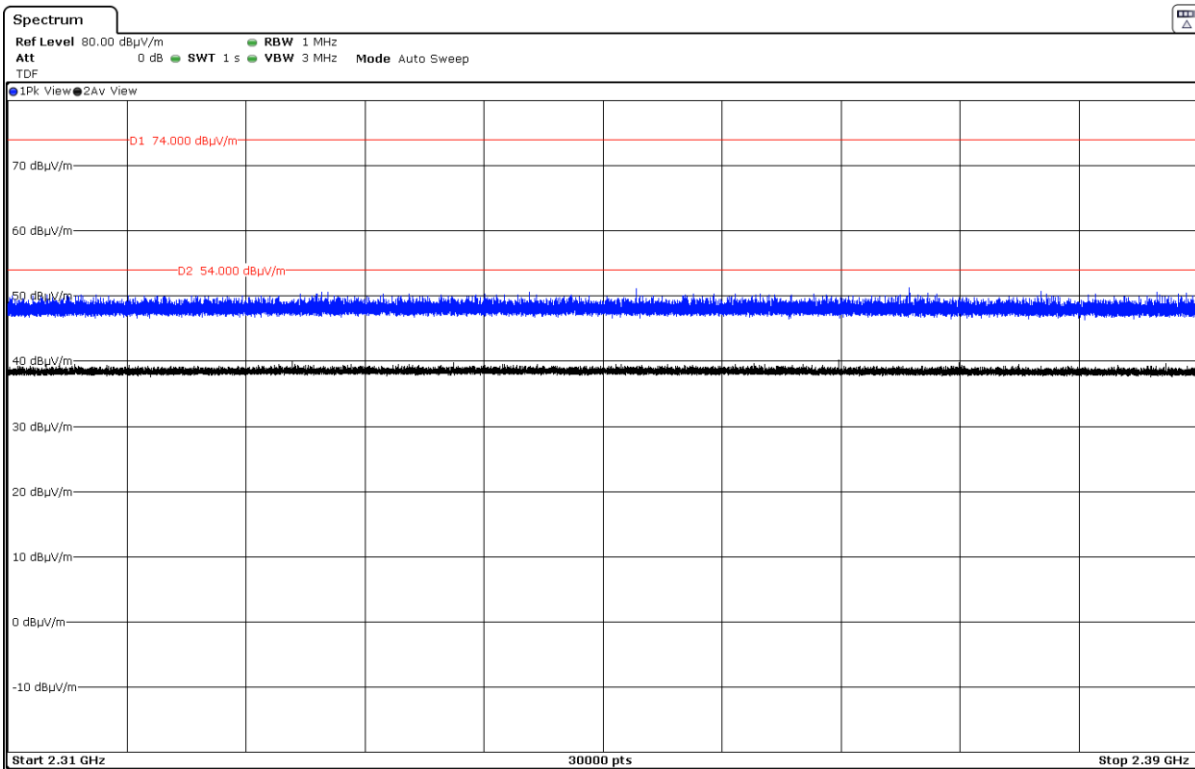


CHANNEL: Highest (2480 MHz).

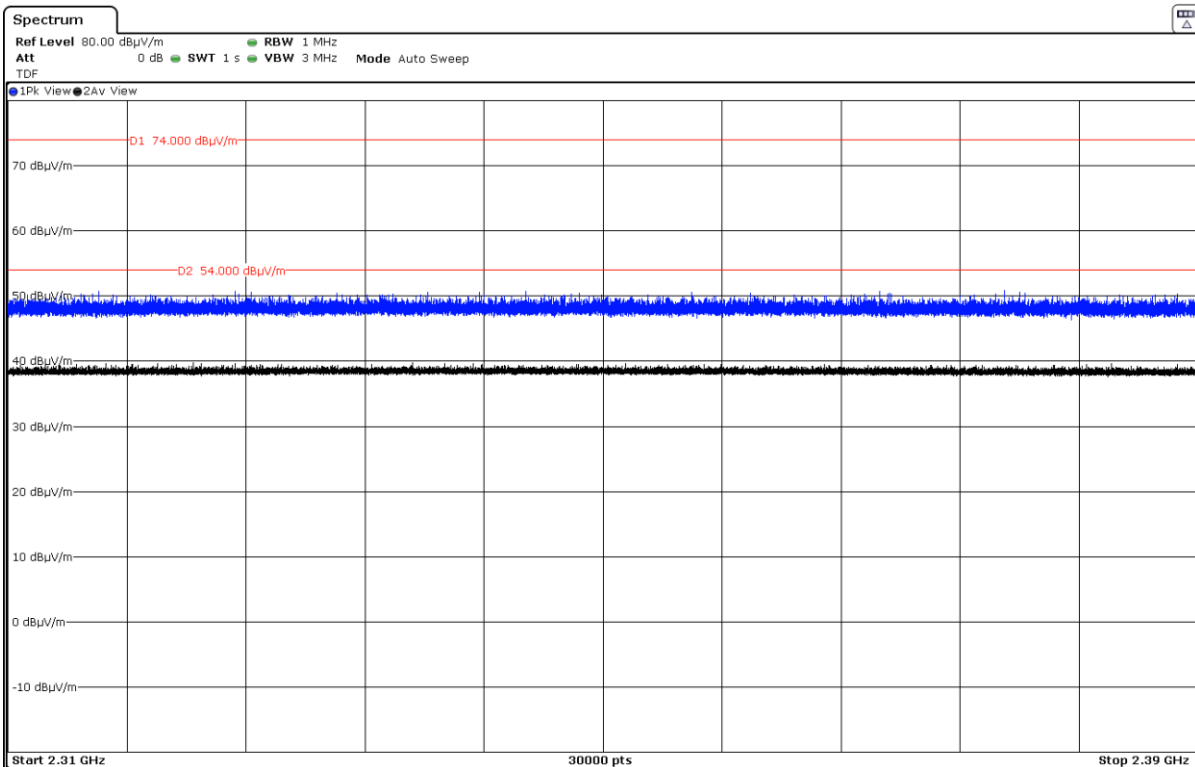


FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

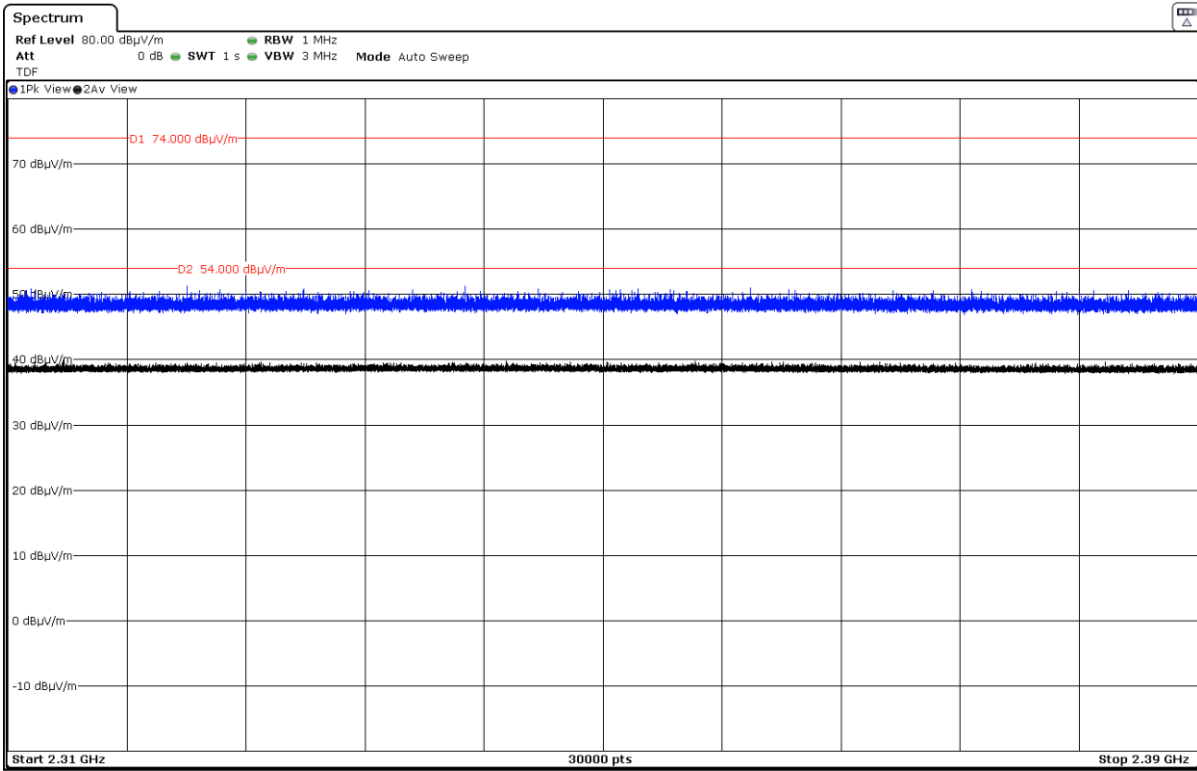
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2441 MHz).

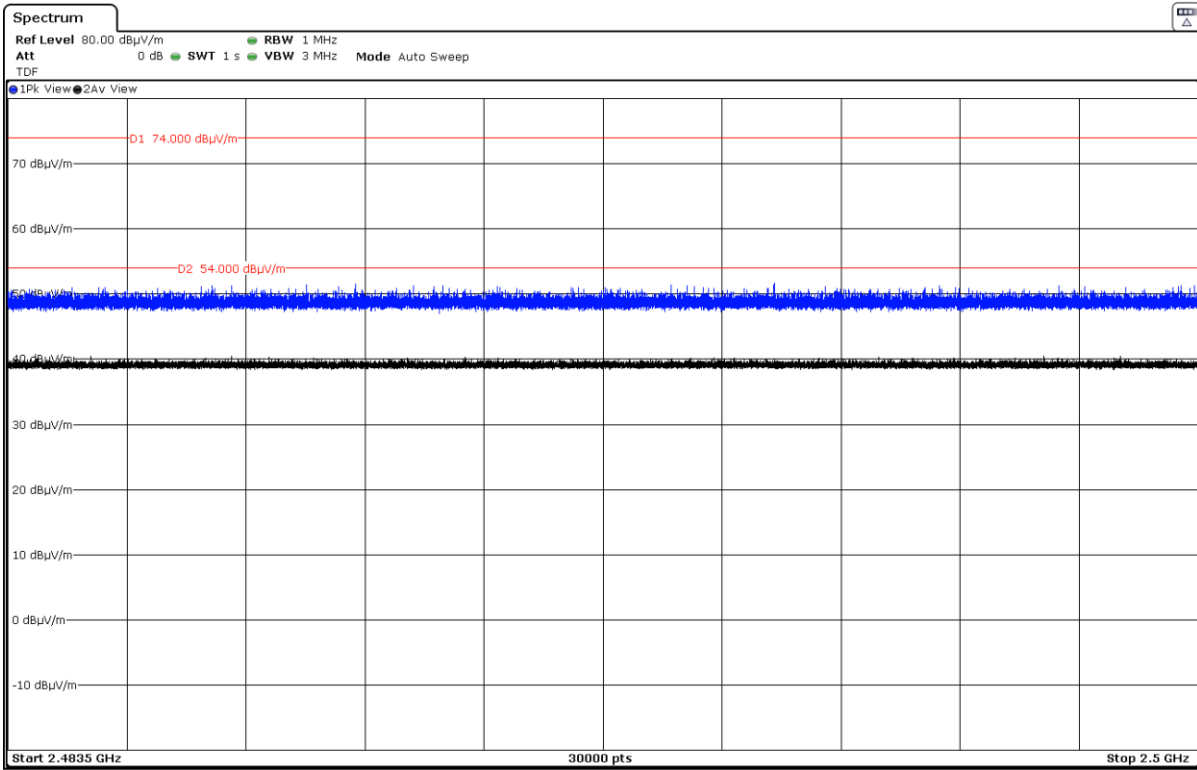


CHANNEL: Highest (2480 MHz).

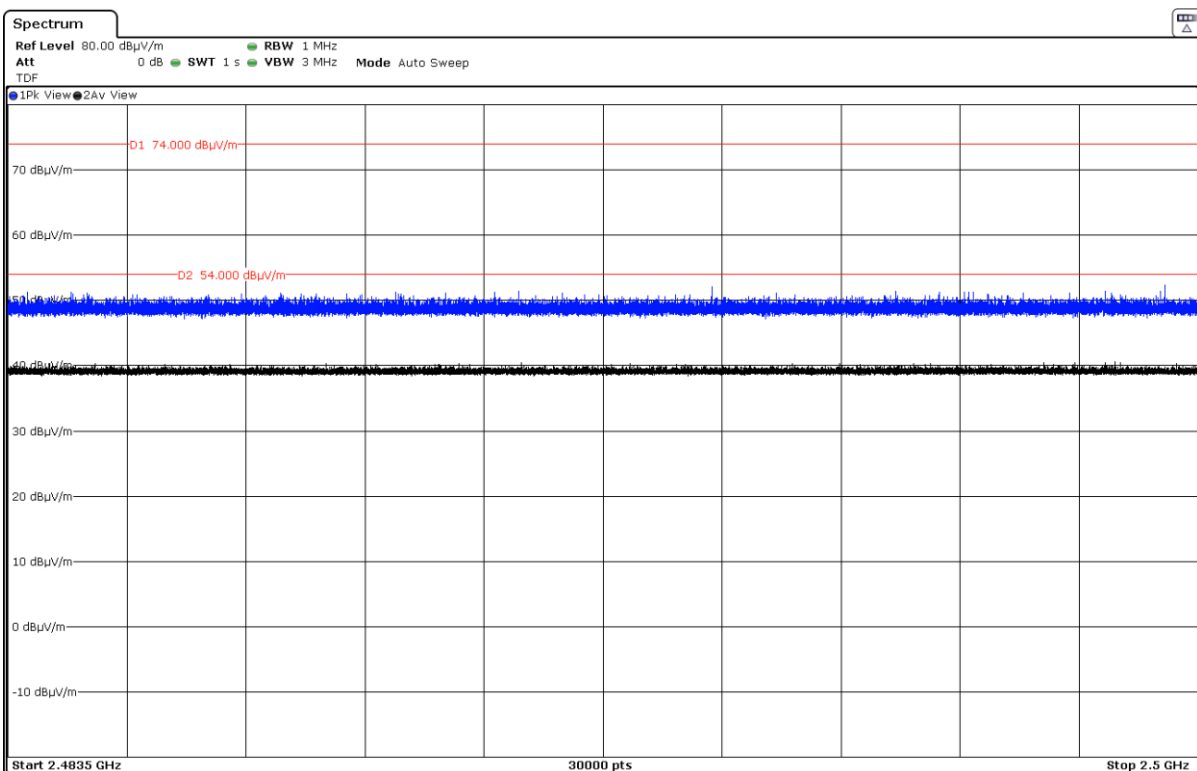


FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

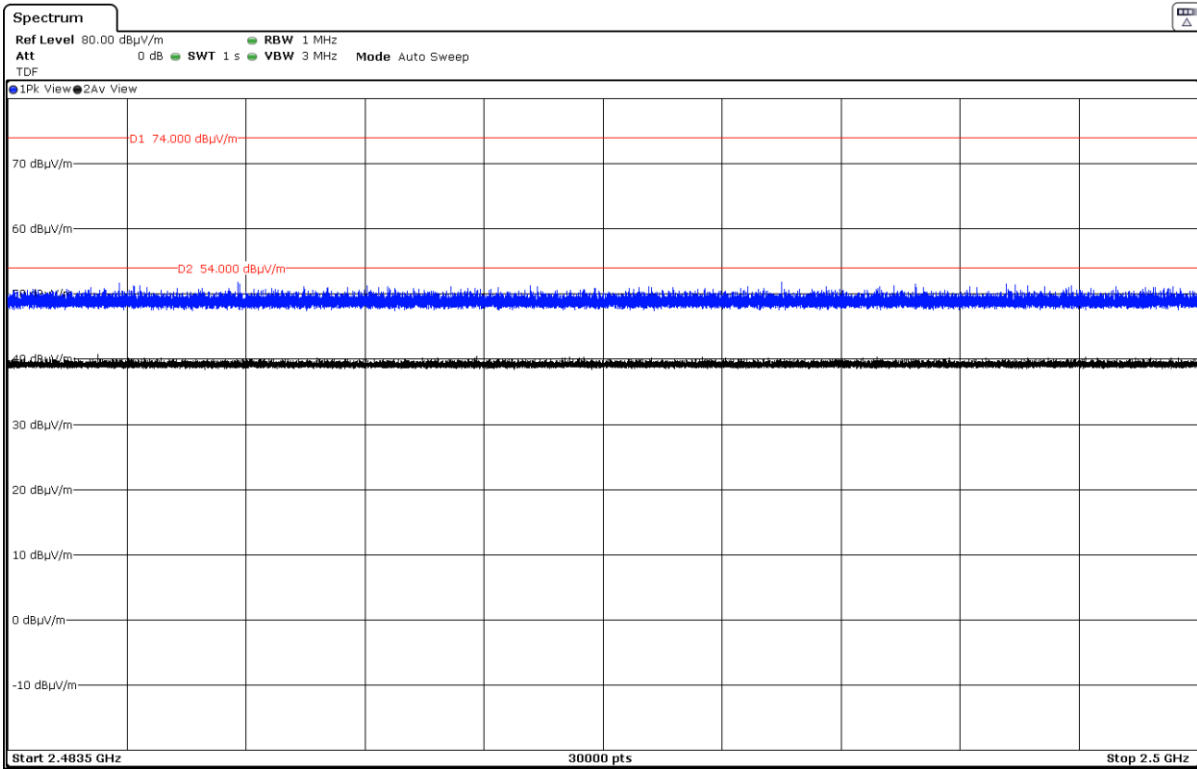
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2441 MHz).



CHANNEL: Highest (2480 MHz).



Appendix C: Test results. Proprietary protocol DM

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 1.4 \text{ Vdc}$$

Type of power supply = DC voltage from battery.

Type of antenna = Integral antenna.

TEST FREQUENCIES:

Lowest channel: 2402 MHz

Middle channel: 2440 MHz

Highest channel: 2480 MHz

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyser using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



RADIATED MEASUREMENTS

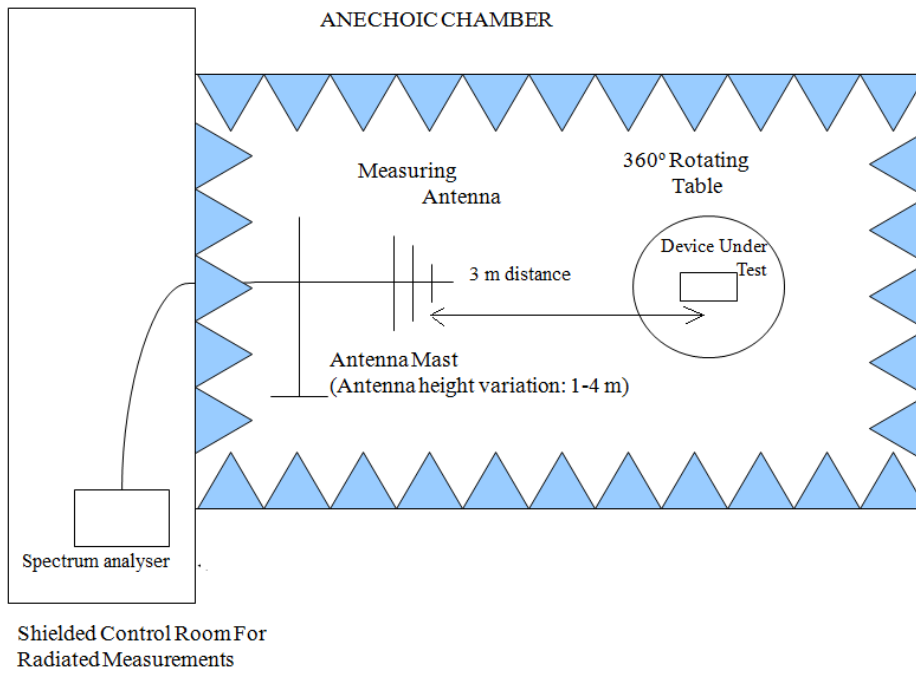
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-25 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.

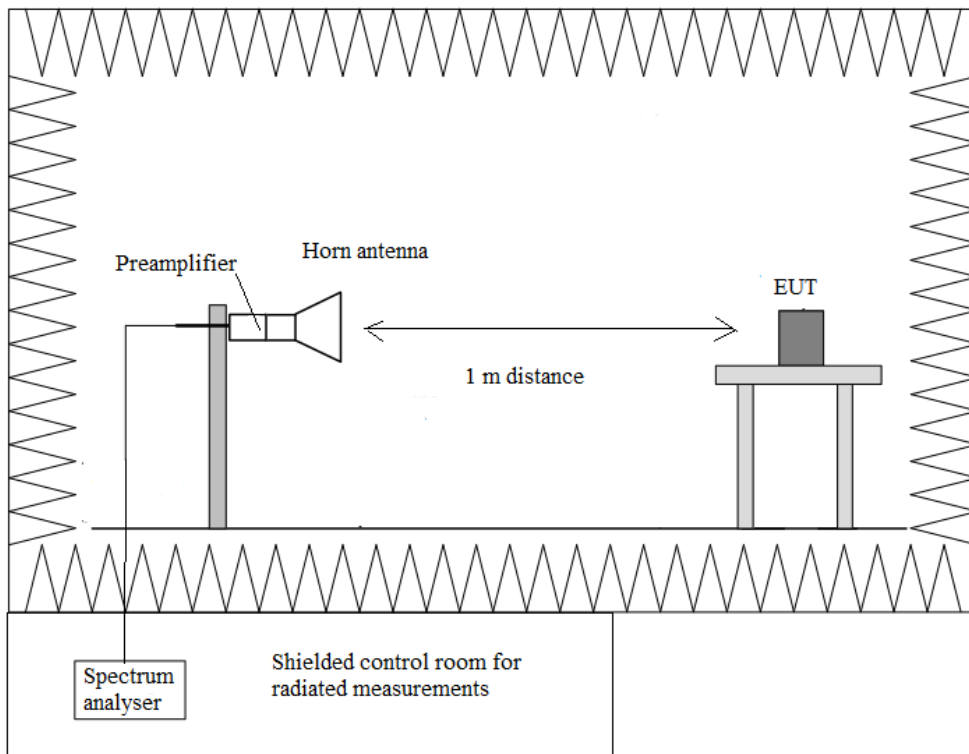
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



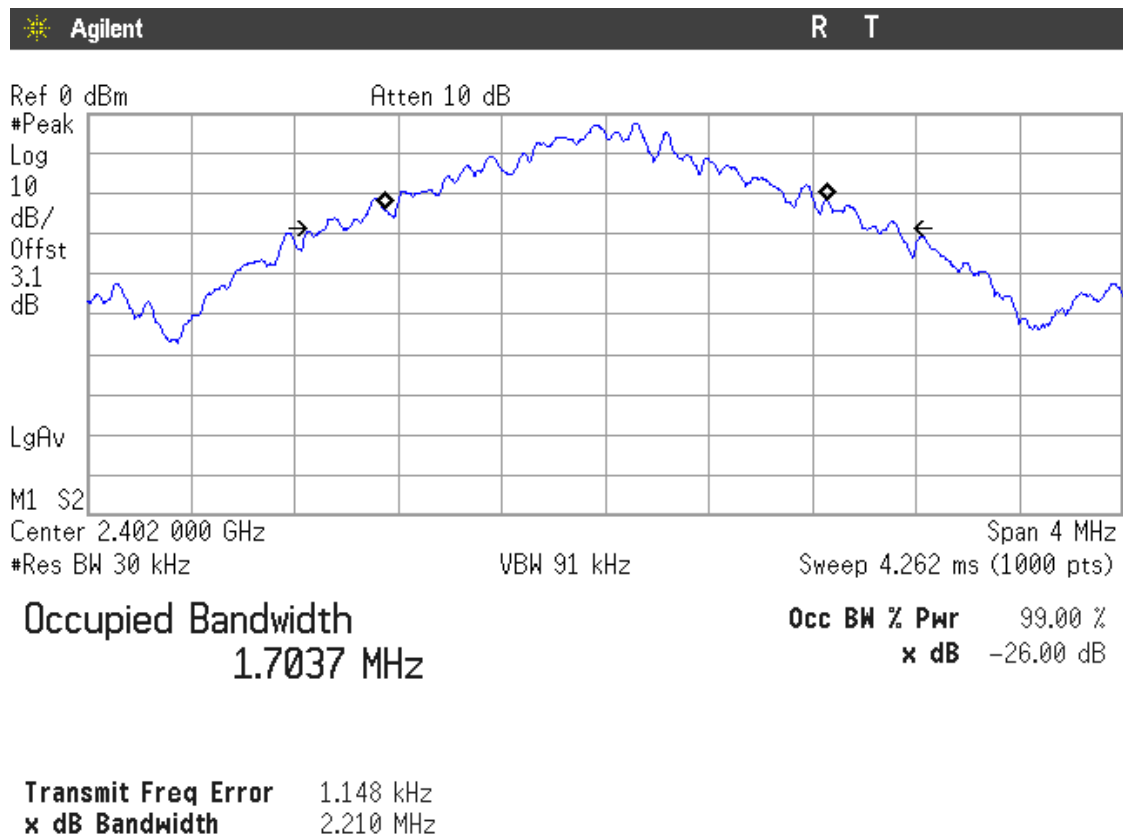
Occupied Bandwidth

RESULTS

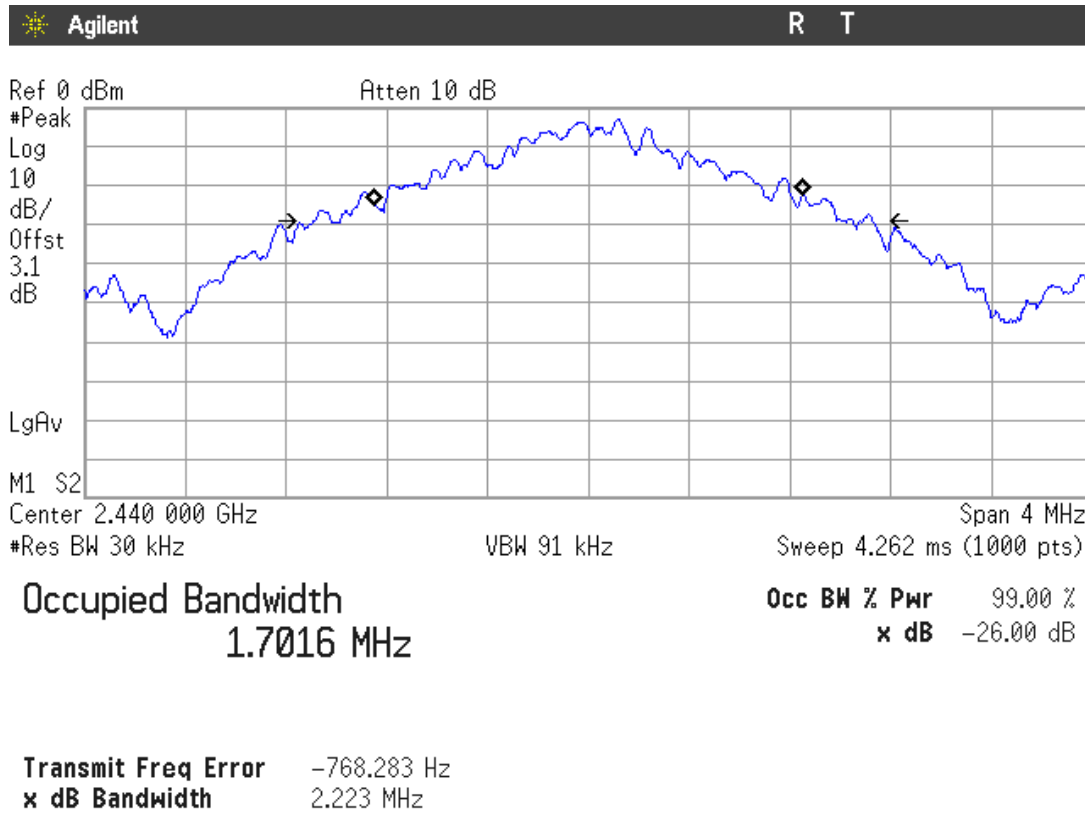
(see next plots).

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
99% bandwidth (MHz)	1.7037	1.7016	1.7056
-26 dBc bandwidth (MHz)	2.210	2.223	2.210
Measurement uncertainty (kHz)	<±5.00		

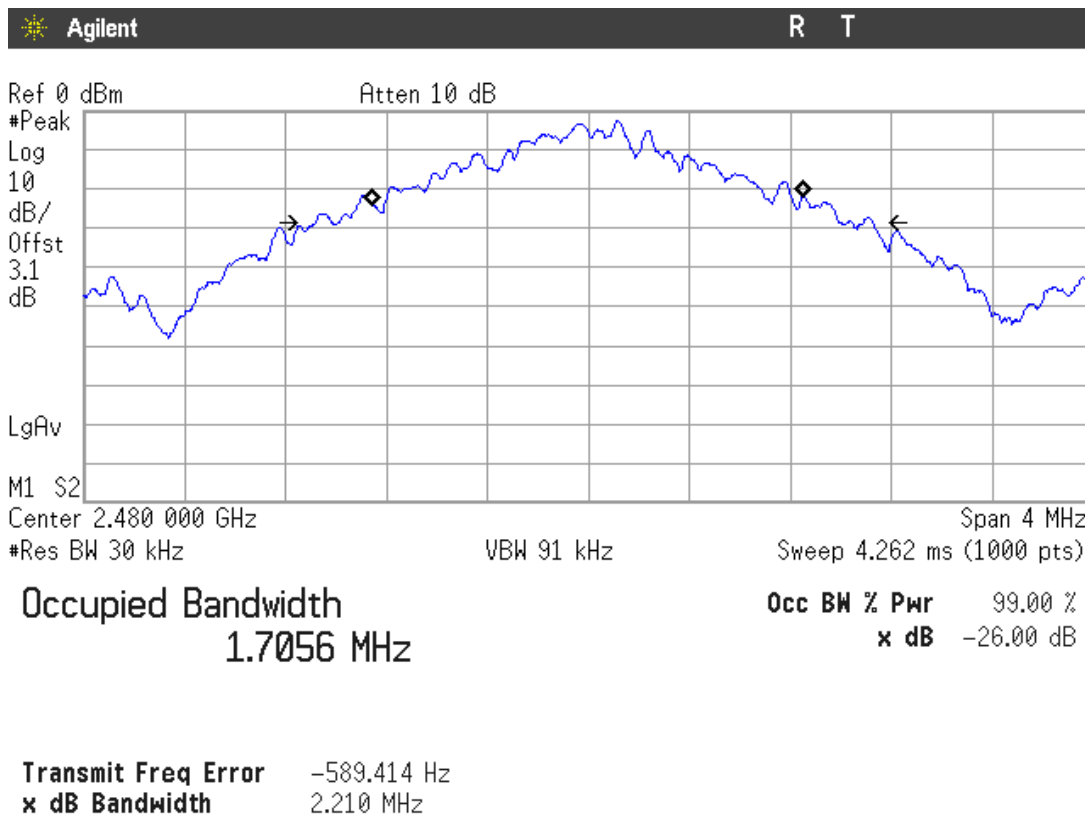
Lowest Channel



Middle Channel



Highest channel



Section 15.249 Subclause (a) / RSS-210 B.10 (a). Field strength of Fundamental

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.

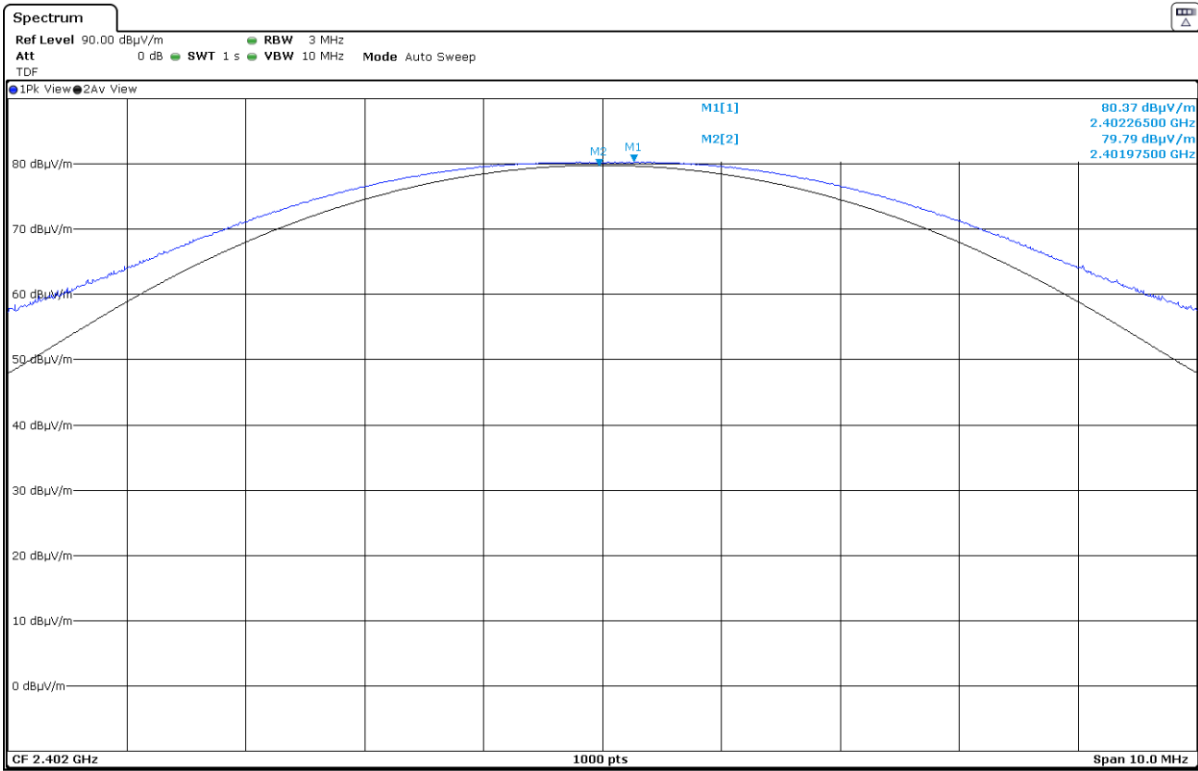
RESULTS

	Lowest frequency 2402 MHz	Middle frequency 2440 MHz	Highest frequency 2480 MHz
Field strength (dBµV/m) average	79.79	82.15	78.95
Field strength (dBµV/m) peak	80.37	82.54	79.46
Measurement uncertainty (dB)	<±4.87		

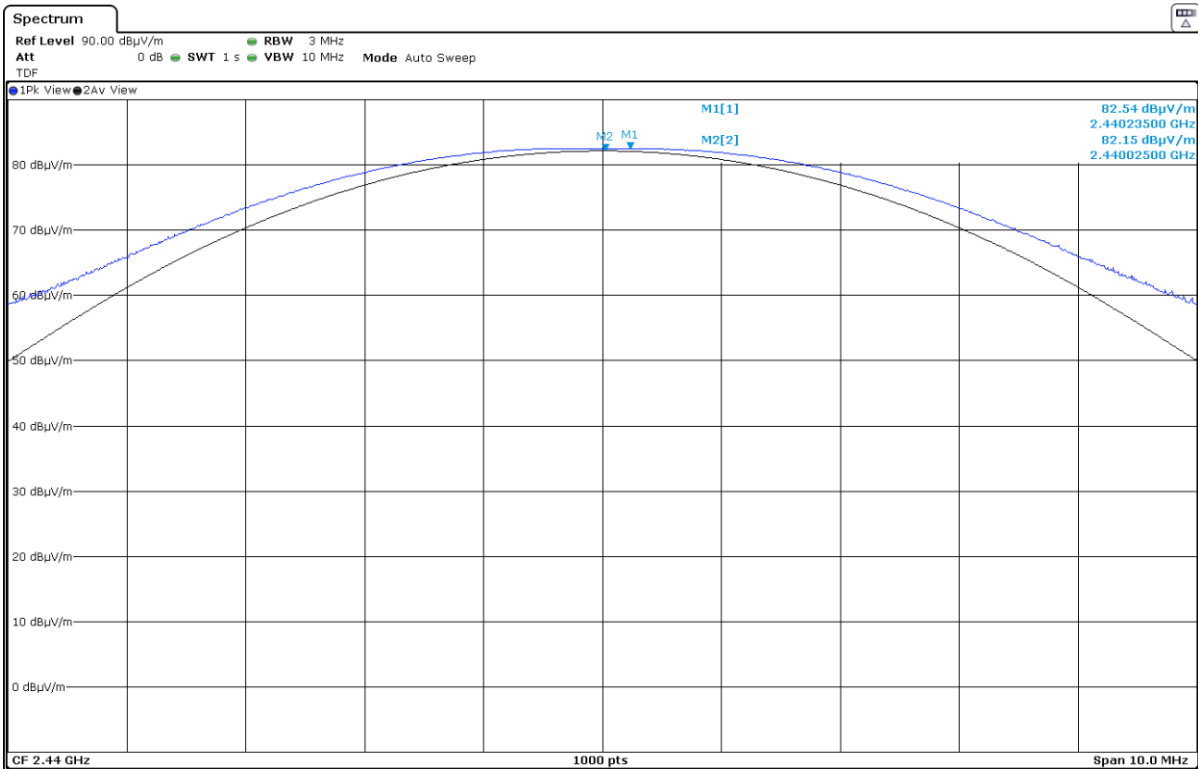
Verdict: PASS

FIELD STRENGTH

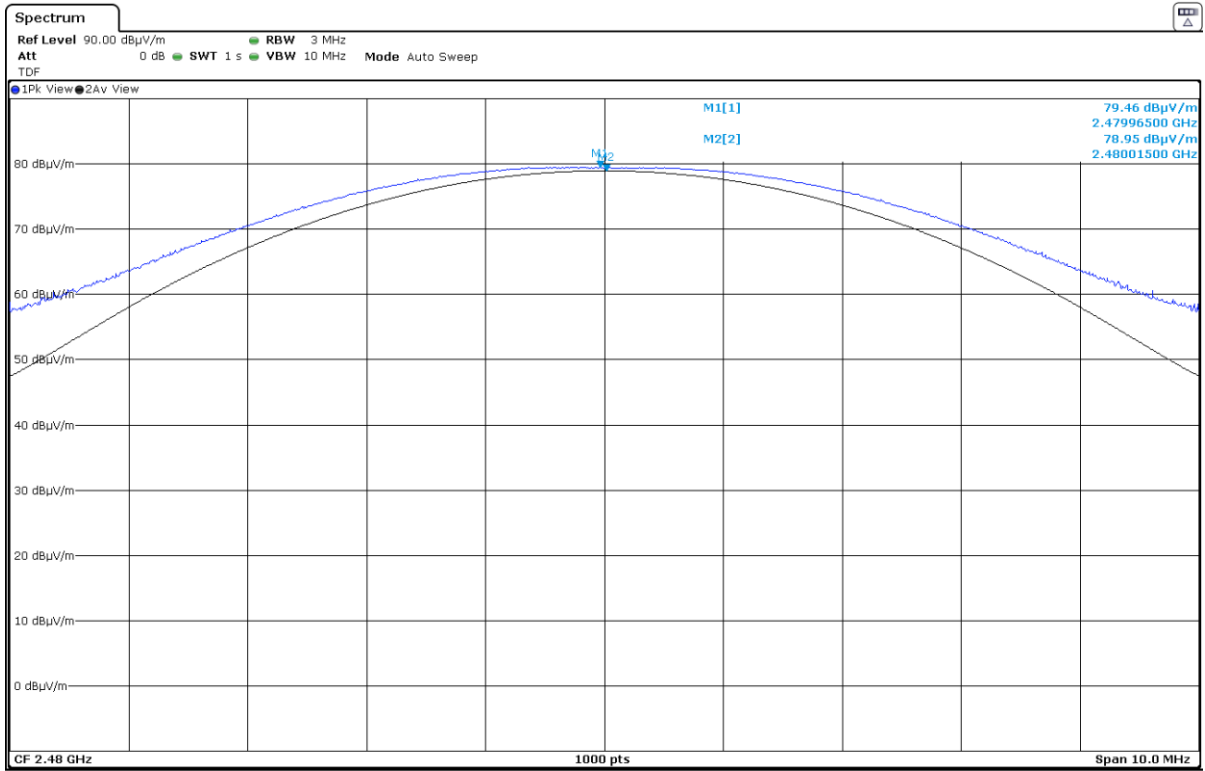
Lowest Channel



Middle Channel



Highest Channel



Section 15.249 Subclause (a) and (d) / RSS-210 B.10 (b). Emissions limitations radiated (Transmitter)

SPECIFICATION

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

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

Whichever is the lesser attenuation.

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.

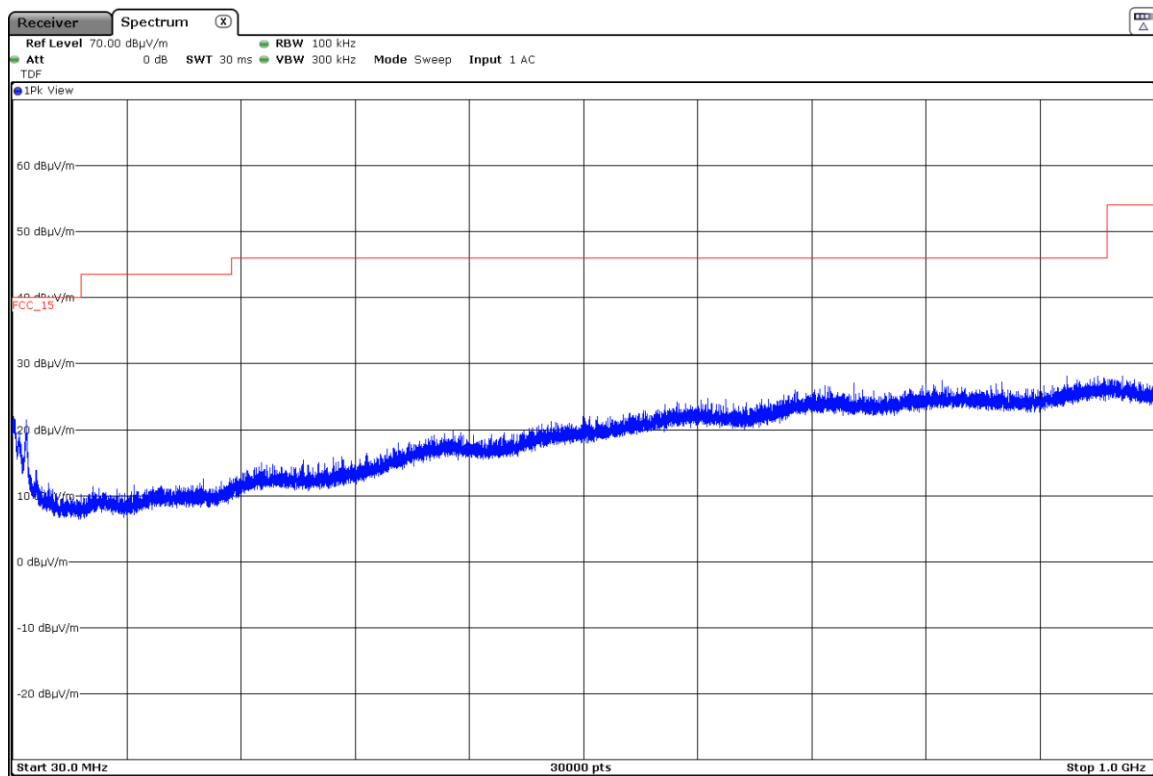
All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

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-1000 MHz.

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

No spurious signals found.



(This plot is valid for all three channels).

Frequency range 1 GHz-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 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

1. CHANNEL: LOWEST (2402 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
24.02285	V	Peak	47.17	< \pm 3.70

2. CHANNEL: MIDDLE (2440 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
24.39665	V	Peak	46.82	< \pm 3.70

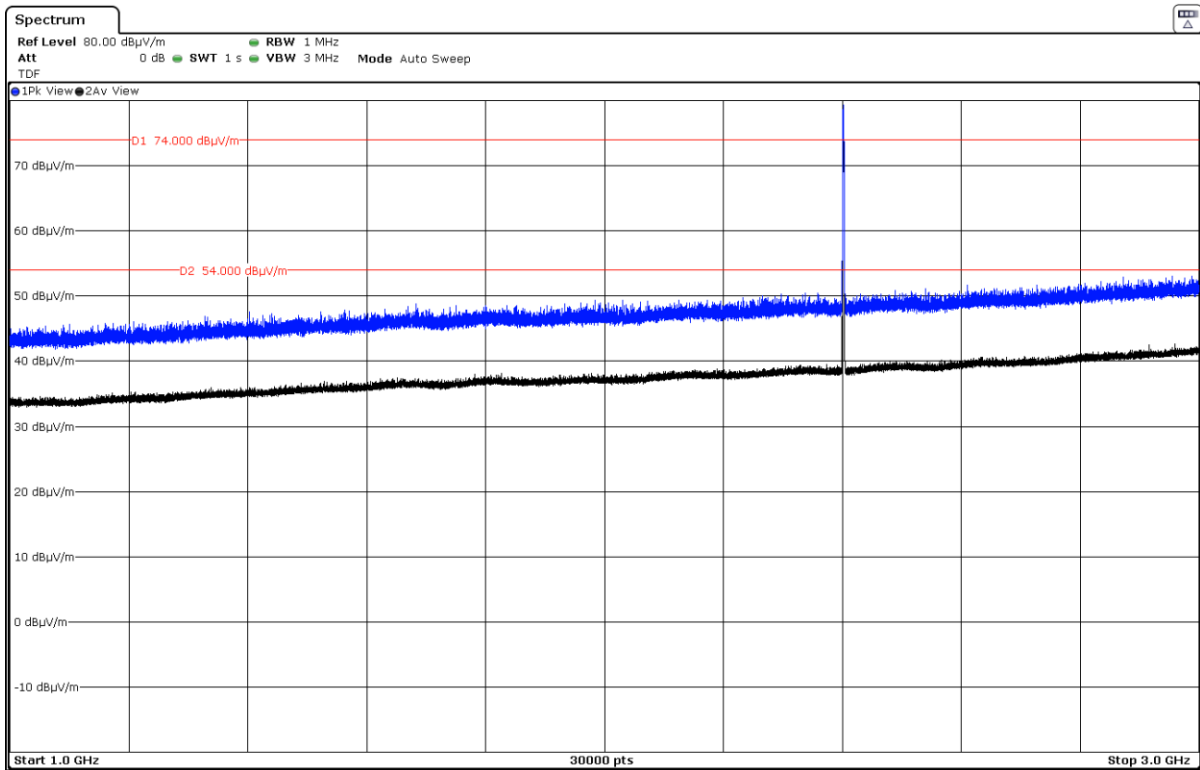
3. CHANNEL: HIGHEST (2480 MHz).

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
24.79715	V	Peak	45.81	< \pm 3.70

Verdict: PASS

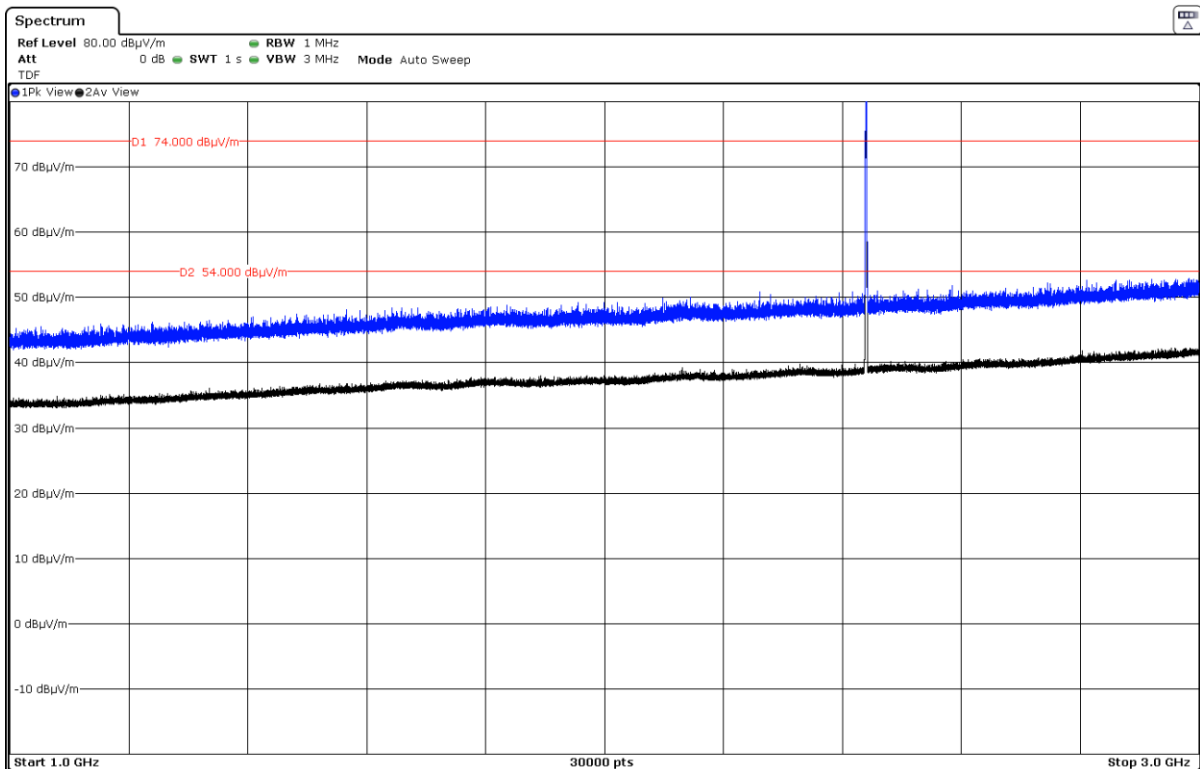
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2402 MHz).



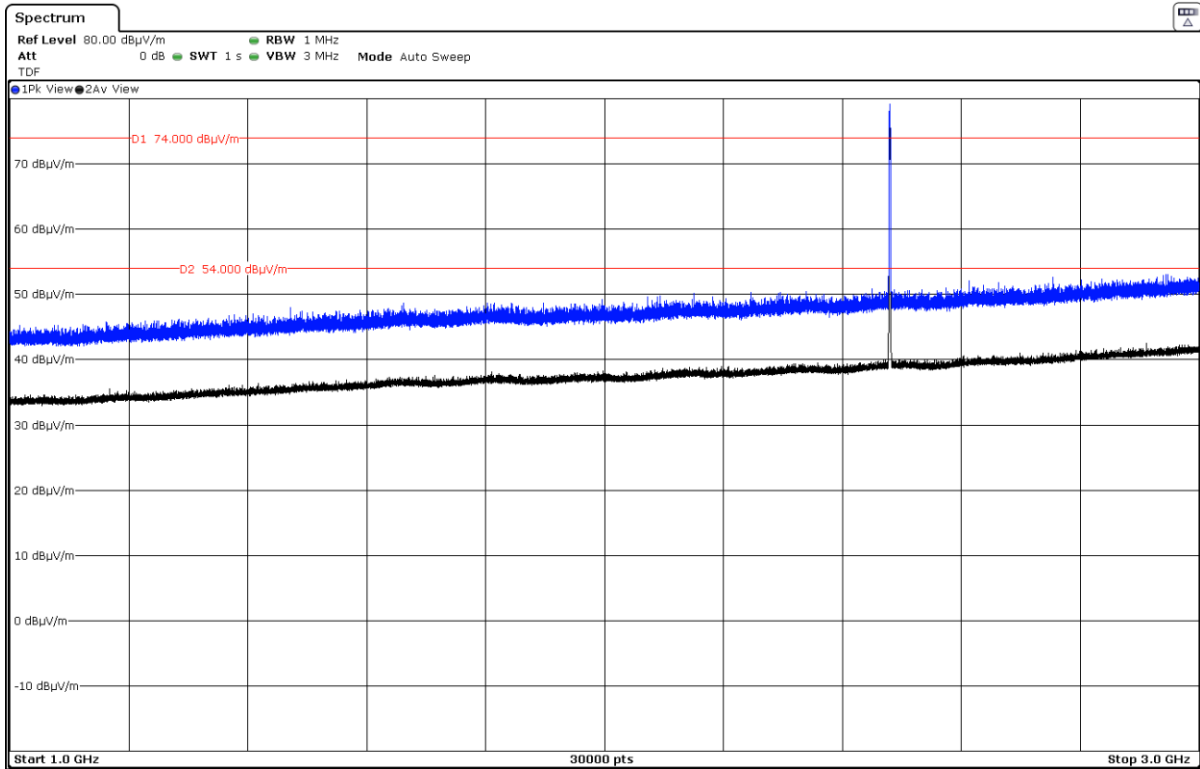
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Middle (2440 MHz).



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

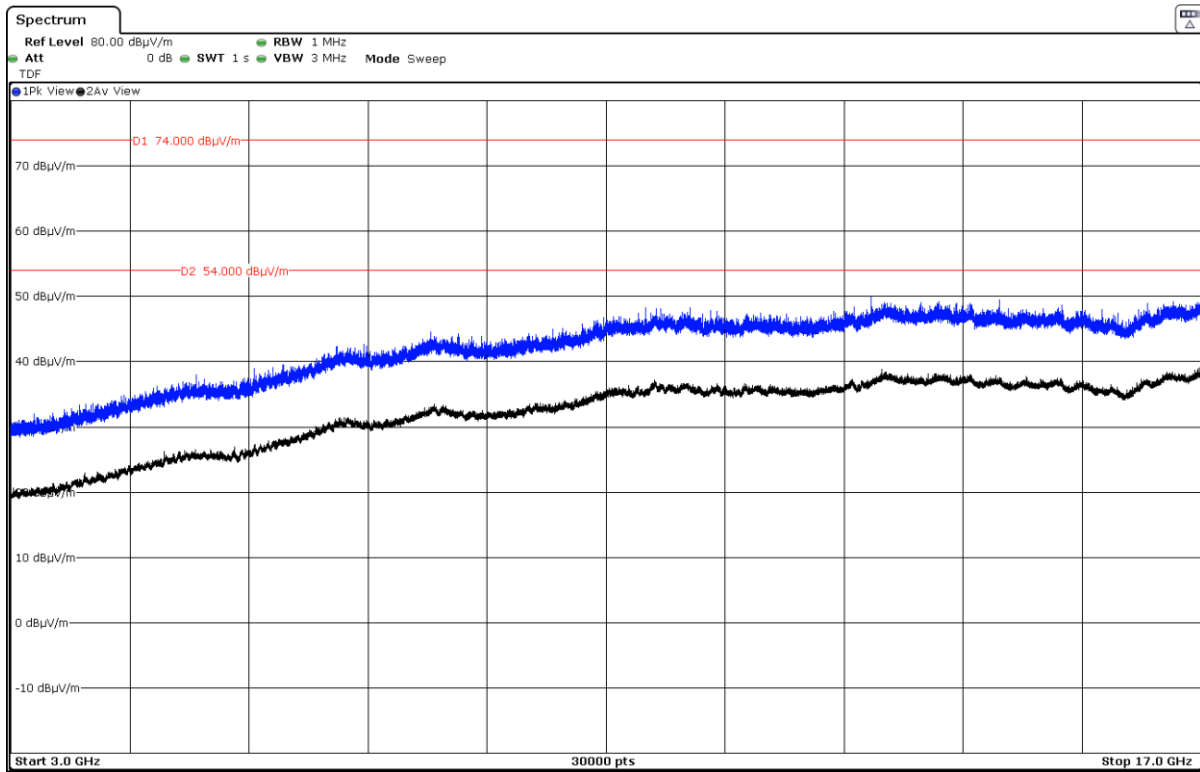
CHANNEL: Highest (2480 MHz).



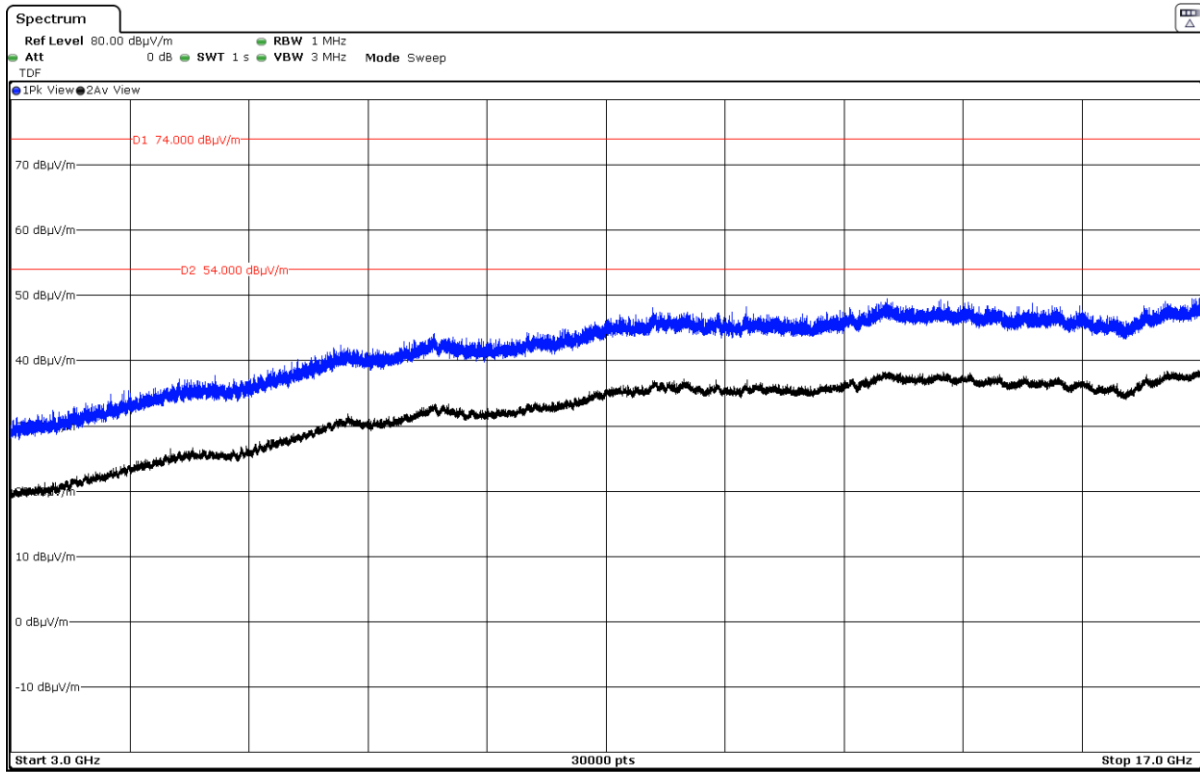
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 17 GHz.

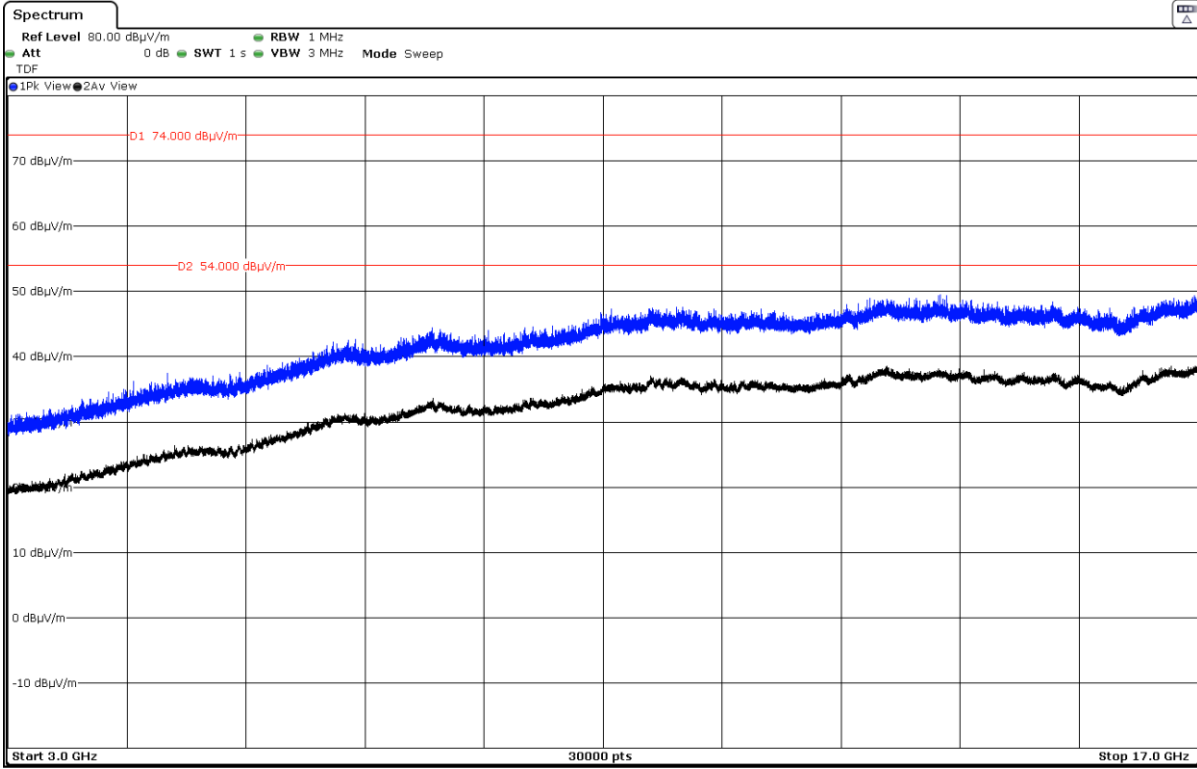
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

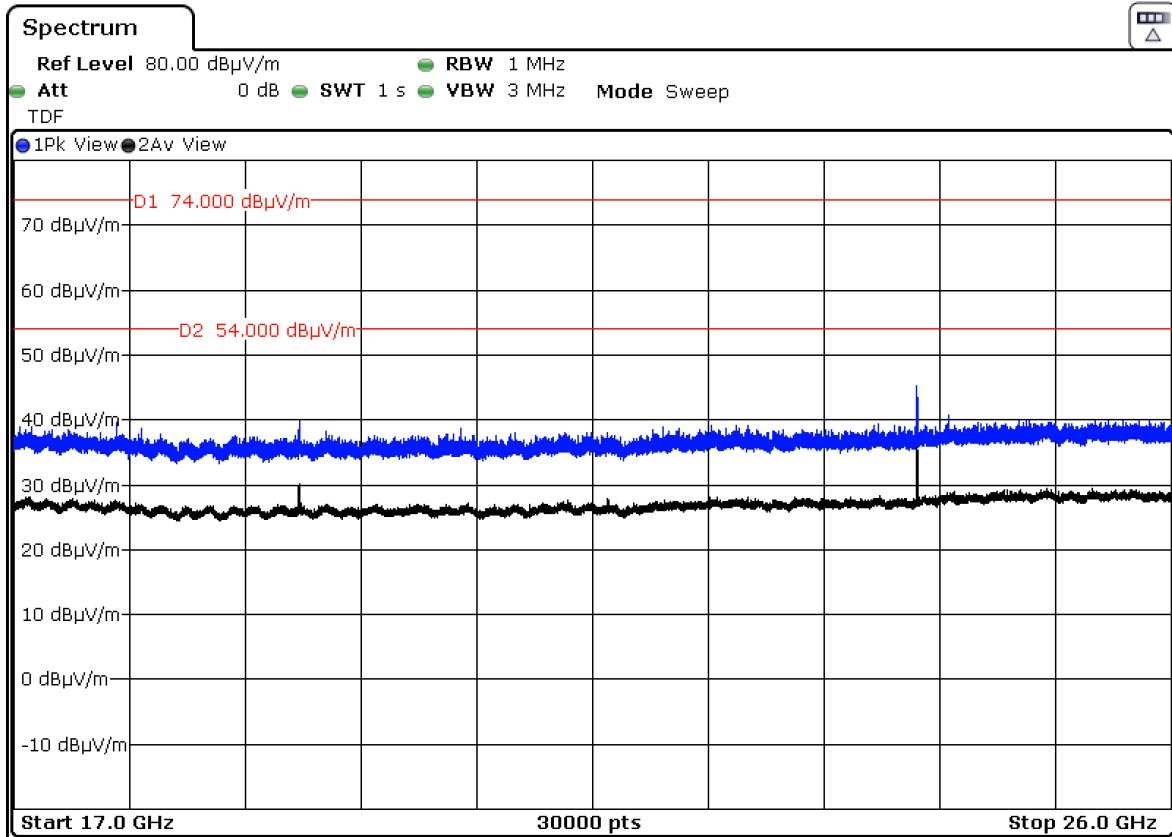


CHANNEL: Highest (2480 MHz).

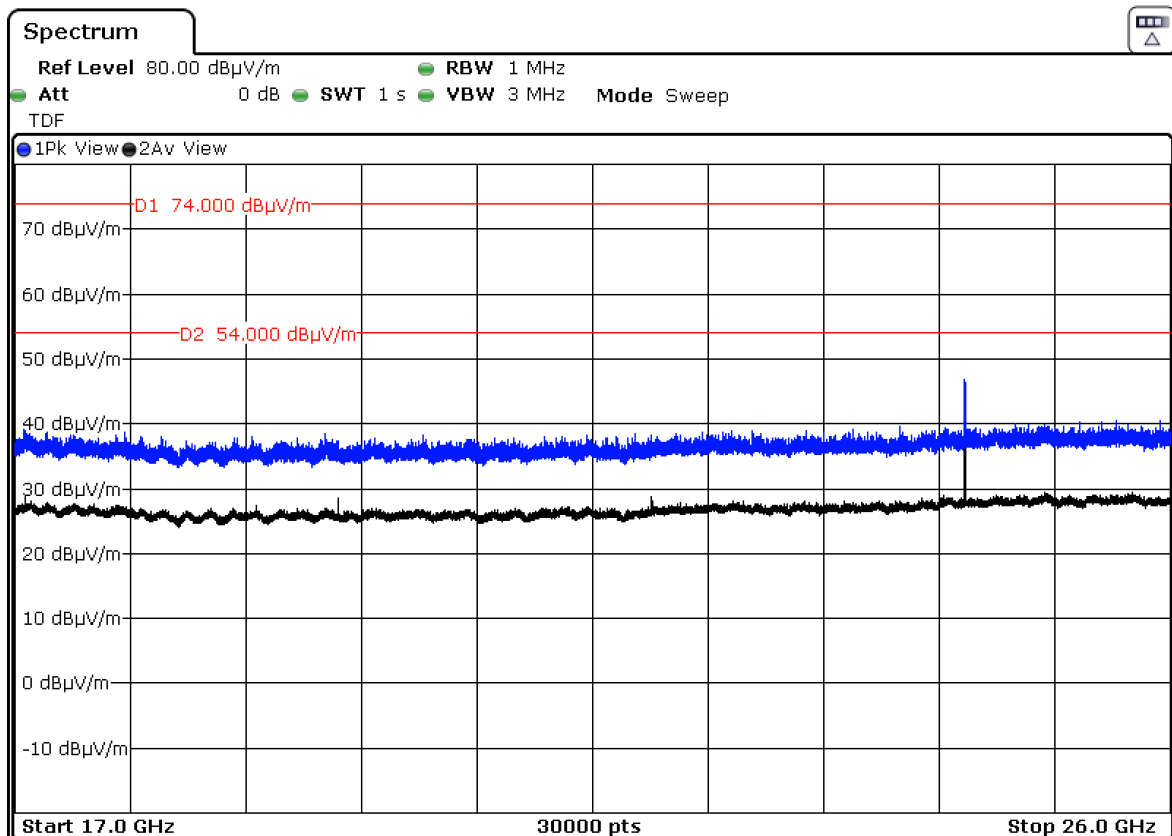


FREQUENCY RANGE 17 GHz to 26 GHz.

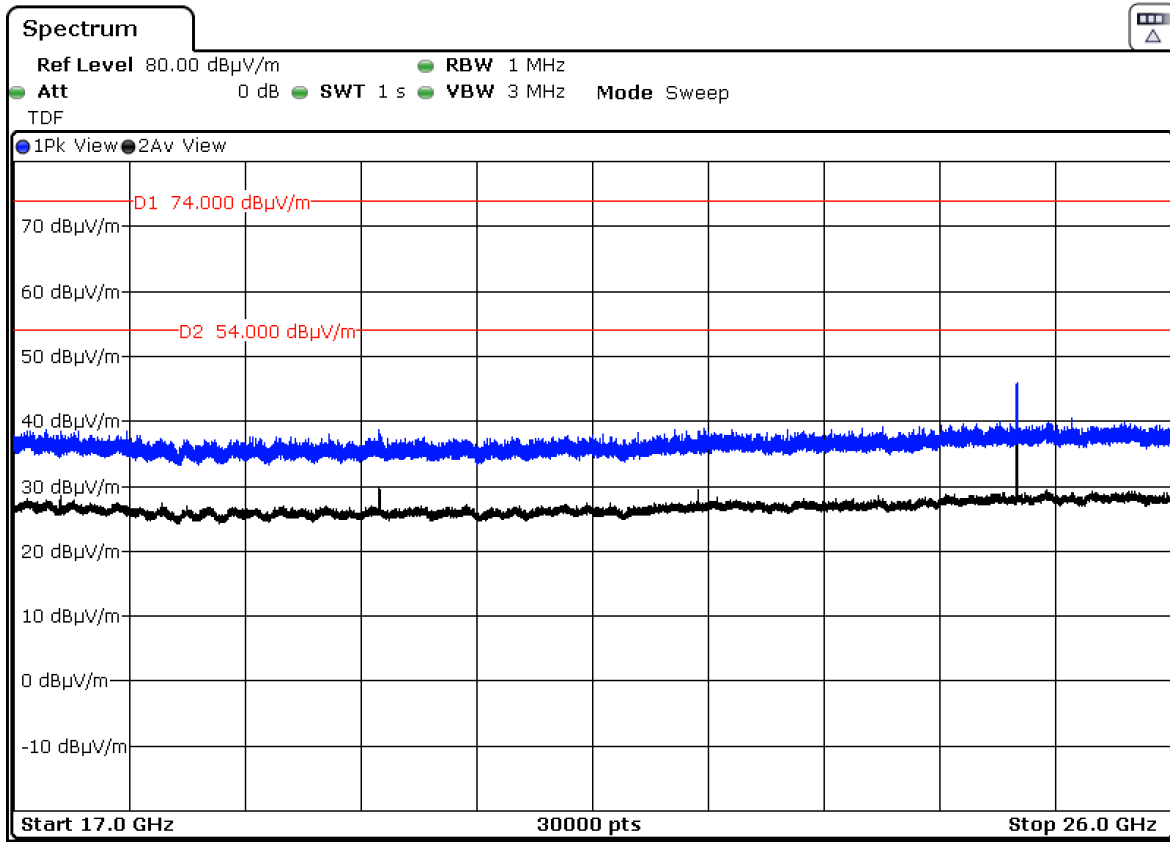
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

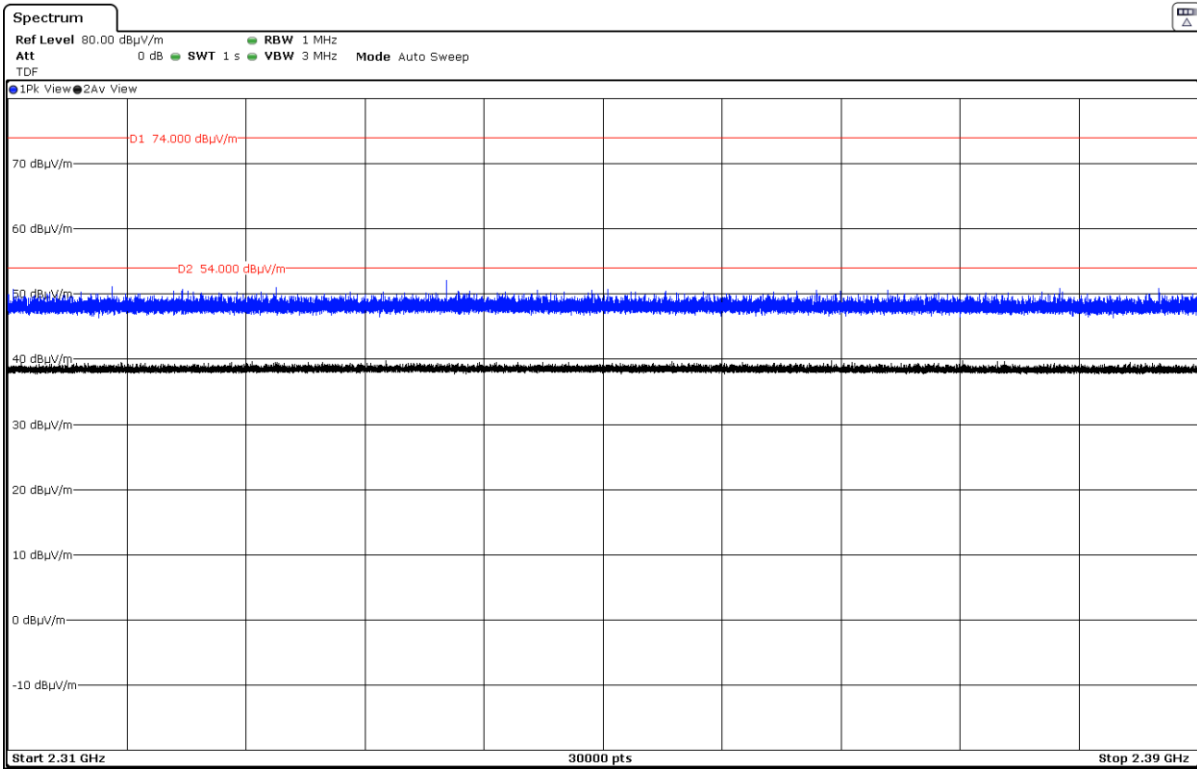


CHANNEL: Highest (2480 MHz).

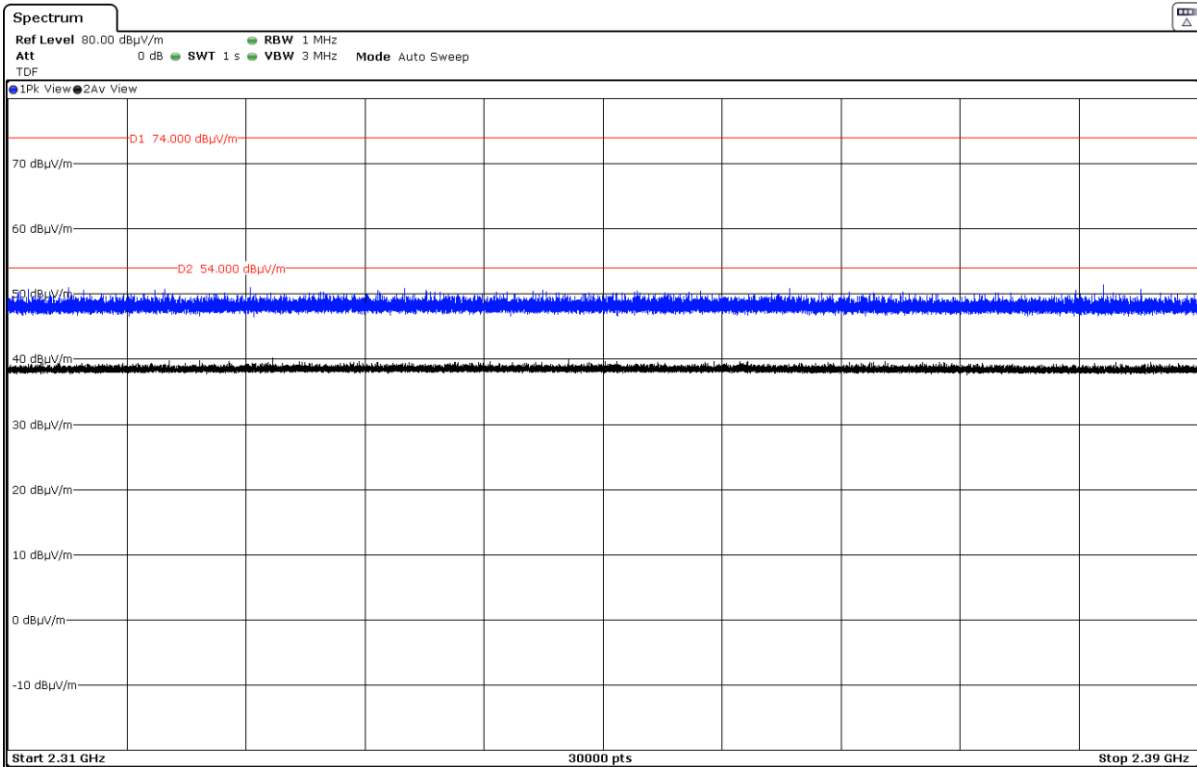


FREQUENCY RANGE 2.31 GHz to 2.39 GHz. (RESTRICTED BAND)

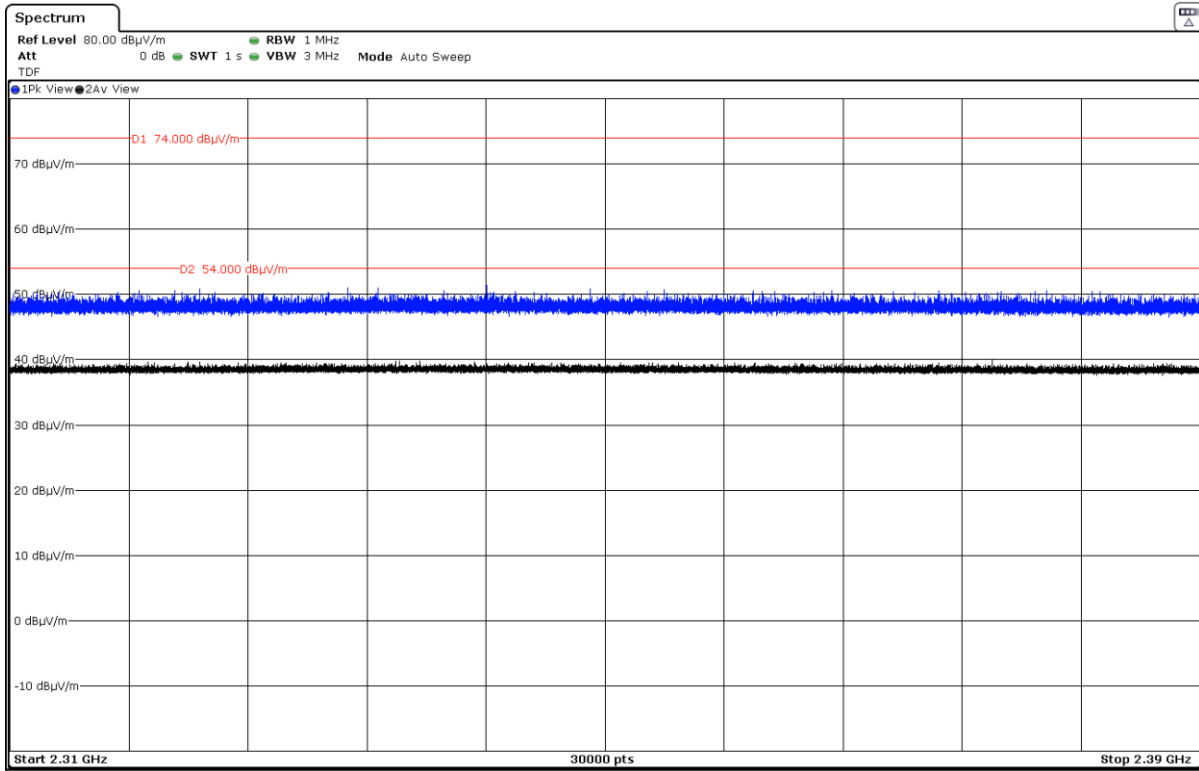
CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).

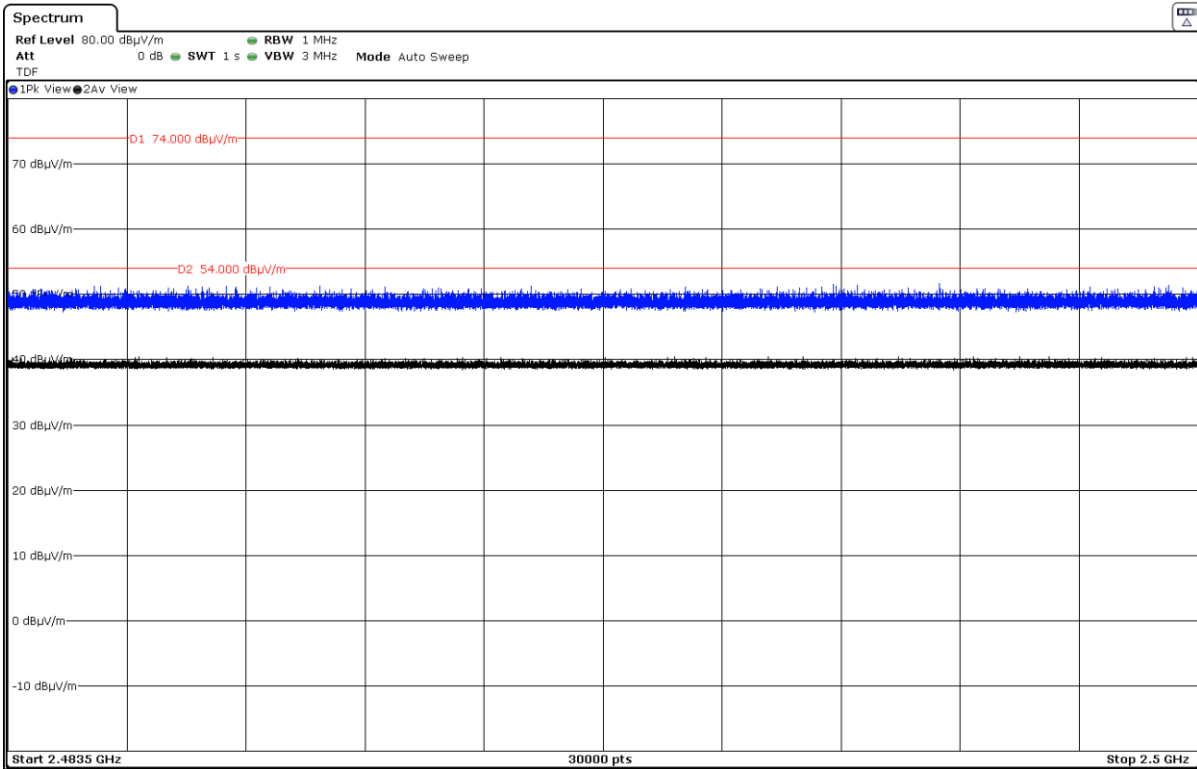


CHANNEL: Highest (2480 MHz).

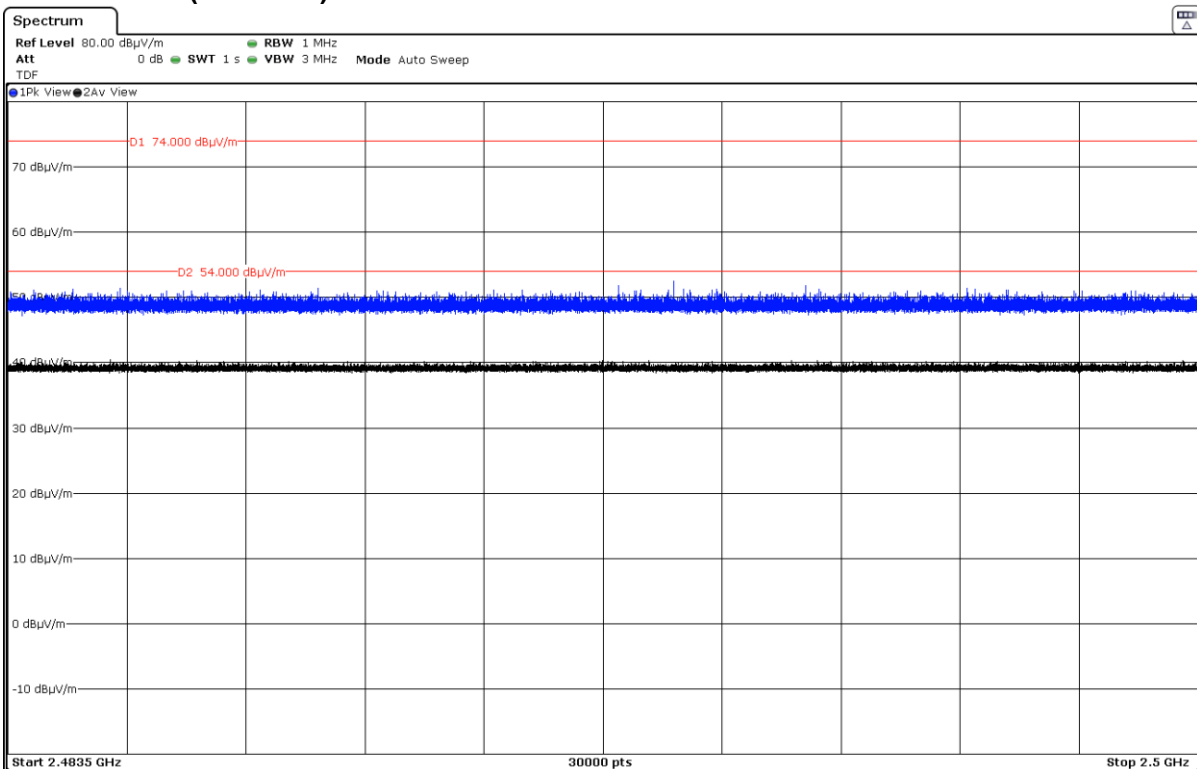


FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND)

CHANNEL: Lowest (2402 MHz).



CHANNEL: Middle (2440 MHz).



CHANNEL: Highest (2480 MHz).

