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C.I.F. A29 507 456

ENSAYOS Nº 51/LE147

Test report No:
NIE: 60063RRF.002

Test Report

USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.
Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.
General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Ring with 9x5 Led matrix and 3 buttons. 60mAh battery, USB connector, BLE radio
(*) Trademark	Wave by Genki Instruments
(*) Model and /or type reference	G1W1
Other identification of the product	HW version: 0201 SW version: SWR1 FCC ID: 2ATPJ-G1W1 IC: 24946-G1W1
(*) Features	Bluetooth BLE radio, USB micro connector for charging. 9x5 LED matrix display, 3 buttons
Applicant	Genki Instruments Eidistorg 13-15, 170, Seltjarnarnes ICELAND
Test method requested, standard	USA FCC Part 15.247 (10-1-18 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-18 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE

Approved by (name / position & signature)	A. Llamas RF Lab. Manager	Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2019.07.18 10:32:54 +02'00'
Date of issue	2019-07-18	
Report template No	FDT08_22 (*) “Data provided by the client”	

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

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification 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.

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General conditions

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

Uncertainty

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

Data provided by the client

The following data has been provided by the client:

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

2. The sample consists of a product that sends MIDI (Musical Instrument Digital Interface) data over the BLE to control (musical) devices based on the mode of the ring and gestures made with the ring.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
60063/010	Ring with 9x5 Led matrix and 3 buttons. 60mAh battery, USB connector, BLE radio	G1W1	--	2019/05/10

Sample S/01 has undergone the following test(s): All RADIATED tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
60063/002	Ring with 9x5 Led matrix and 3 buttons. 60mAh battery, USB connector, BLE radio	G1W1	--	2019/05/07

Sample S/02 has undergone the following test(s): All CONDUCTED tests indicated in Appendix A.

Test sample description

Ports…… :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
			☐	☐	☐
			☐	☐	☐
Supplementary information to the ports…… :					

Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	DC:					
Rated Power .....:	+4 dBm.						
Clock frequencies .....:	Data not provided.						

Other parameters.....:	Data not provided.		
Software version .....:	SWR1		
Hardware version.....:	0201		
Dimensions in cm (W x H x D)....:	Data not provided.		
Mounting position.....:	☐	Table top equipment	
	☐	Wall/Ceiling mounted equipment	
	☐	Floor standing equipment	
	☐	Hand-held equipment	
	☐	Other:	
Modules/parts .....:	Module/parts of test item	Type	Manufacturer
	Data not provided.		
Accessories (not part of the test item) .....:	Description	Type	Manufacturer
	USB cable	A to micro B	Jianghan Electronics Co., Ltd
Documents as provided by the applicant.....:	Description	File name	Issue date
	Data not provided.		

(3) Only for Medical Equipment

Identification of the client

Genki Instruments
Eidistorg 13-15, 170, Seltjarnarnes, ICELAND

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2019-06-03
Date (finish)	2019-06-11

Document history

Report number	Date	Description
60063RRF.002	2019-07-18	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

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

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

Remarks and comments

The tests have been performed by the technical personnel: José Alberto Aranda, Francisco José Alcaide.

Used instrumentation:

Conducted Measurements:

		Last Calibration	Due Calibration
1.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2017/07	2019/07
2.	DC Power Supply AGILENT TECHNOLOGIES N5744A	---	---
3.	Multimeter Fluke 179	2019/06	2020/06

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	RF Pre-amplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/08
4.	Biconical/Log Antenna 30MHz - 6GHz ETS LINDGREN 3142E	2017/09	2020/09
5.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2018/02	2020/02
6.	RF Pre-amplifier G>30dB, 1-18GHz BONN ELEKTRONIK BLMA 0118-3A	2019/04	2020/04
7.	Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2018/01	2021/01
8.	RF pre-amplifier 18-40 GHz Bonn Elektronik BLMA 1840-1M	2019/03	2020/03
9.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2017/04	2020/04

Testing verdicts

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

Summary

1. Bluetooth Low Energy

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		**Verdict**	**Remark**
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	6 dB Bandwidth	P	
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
Section 15.247 Subclause (d) / RSS-247 5.5	Emission limitations conducted (Transmitter)	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	P	
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: None.			

Appendix A: Test results. Bluetooth Low Energy.

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TEST CONDITIONS

POWER SUPPLY (V):

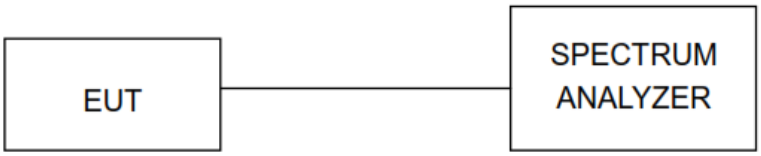
V nonimal:	3.8 Vdc
Type of Power Supply:	Internal battery.
Type of Antenna:	Internal (IFA).
Maximum Declared Antenna Gain:	-5.4 dBi

TEST FREQUENCIES:

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

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and directly connected to the spectrum analyzer.



The DC supply voltage is applied using an external power supply calibrated with a multimeter.

RADIATED MEASUREMENTS

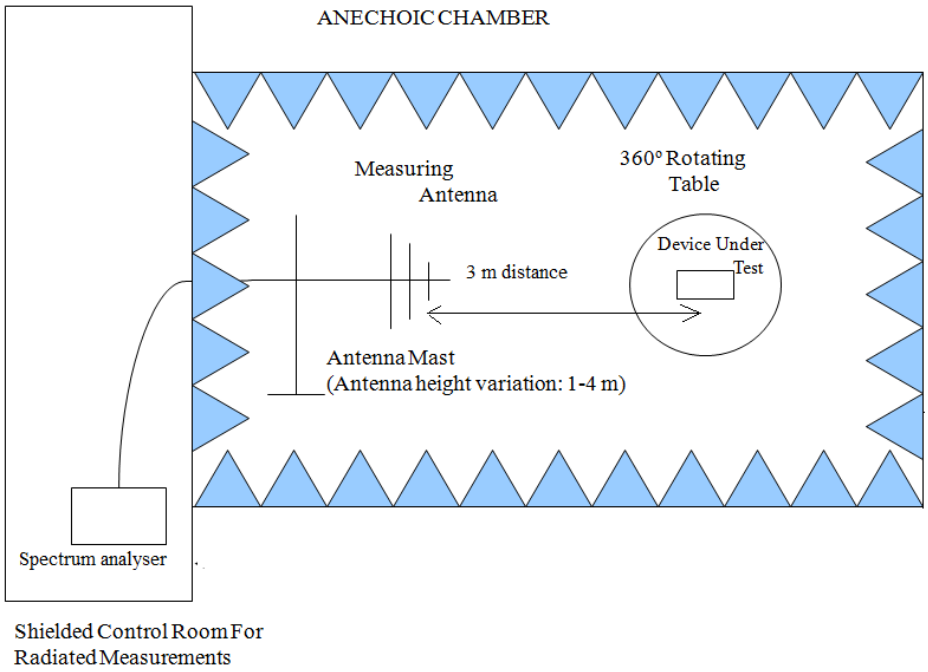
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

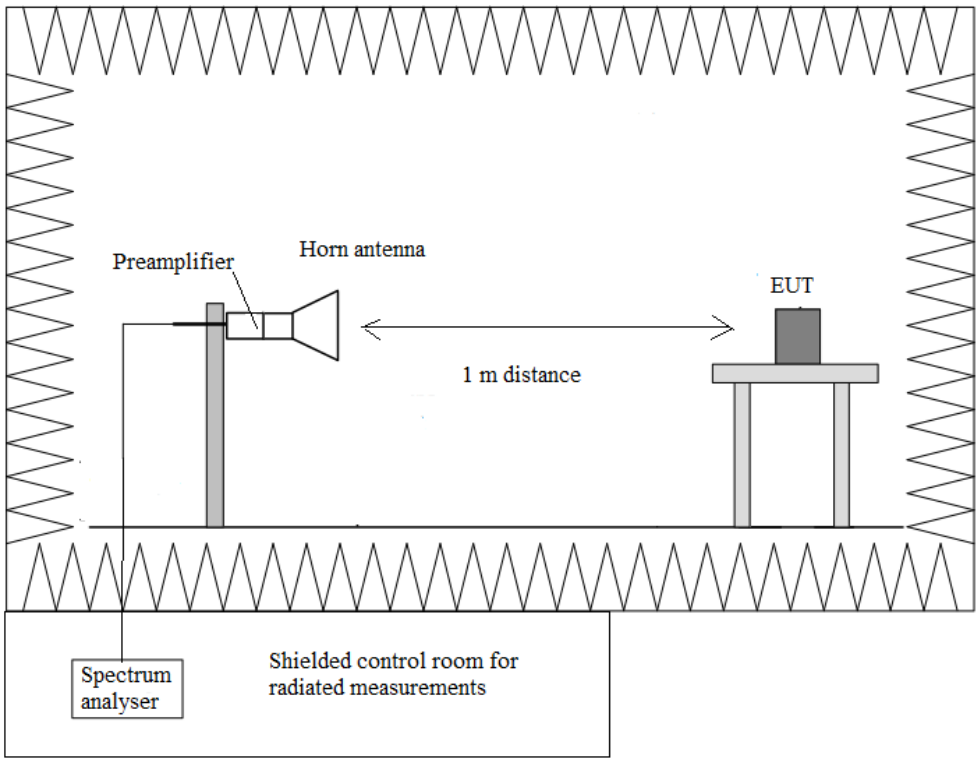
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup f > 1 GHz:

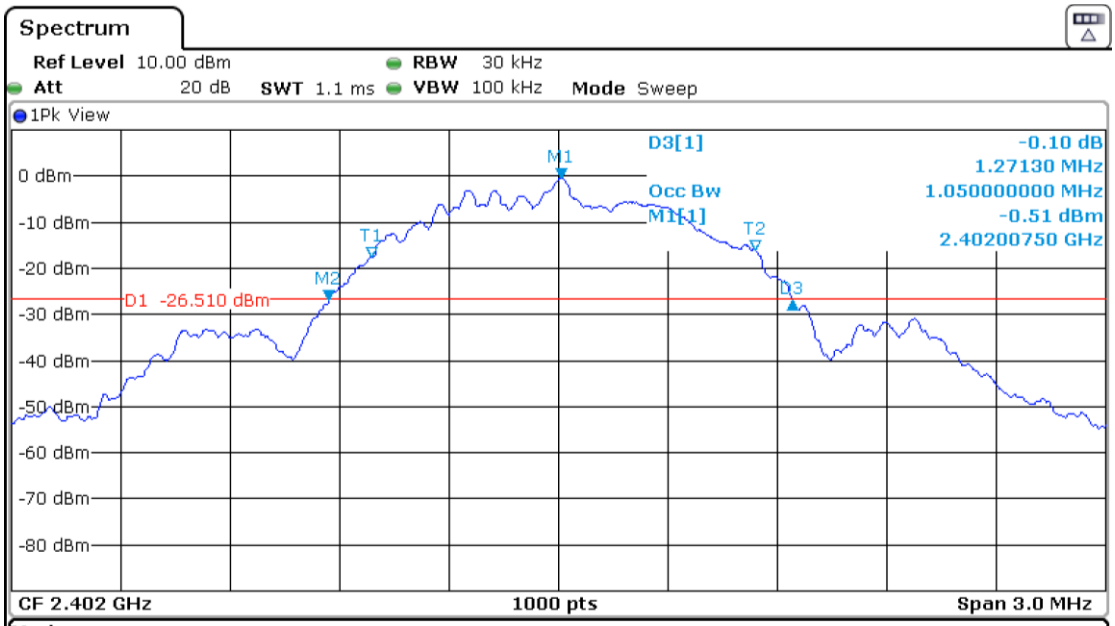


Occupied Bandwidth

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% Bandwidth (MHz)	1.050	1.059	1.056
-26 dBc Bandwidth (MHz)	1.271	1.287	1.273
Measurement uncertainty (kHz)	<± 1.80		

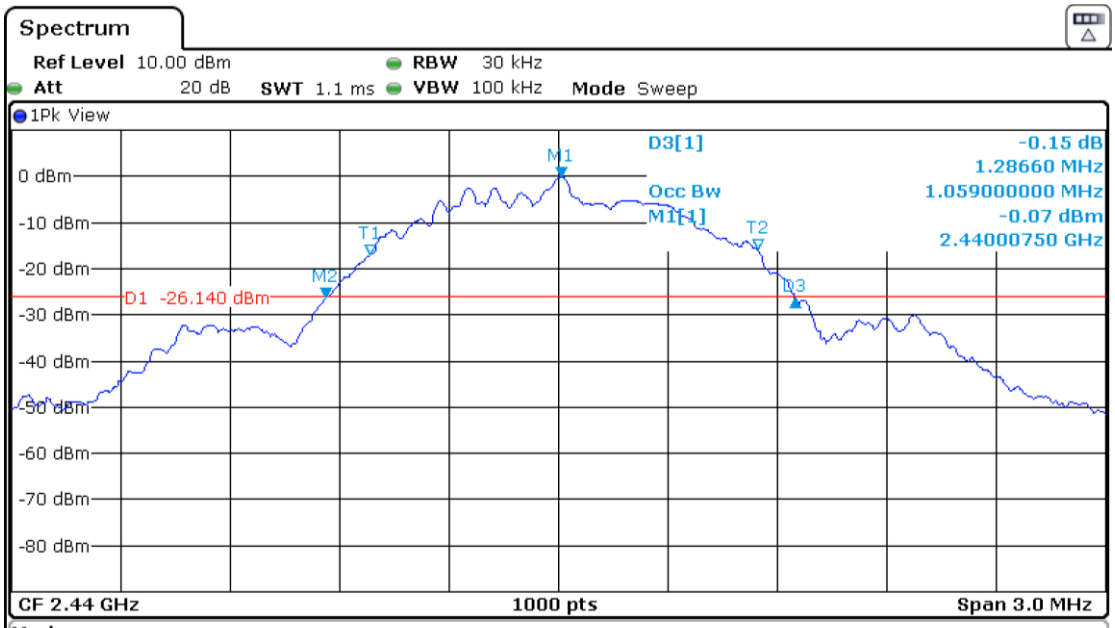
- Low Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4020075 GHz	-0.51 dBm		
T1		1	2.4014885 GHz	-17.48 dBm	Occ Bw	1.05 MHz
T2		1	2.4025385 GHz	-16.11 dBm		
M2		1	2.4013702 GHz	-26.81 dBm		
D3	M2	1	1.2713 MHz	-0.10 dB		

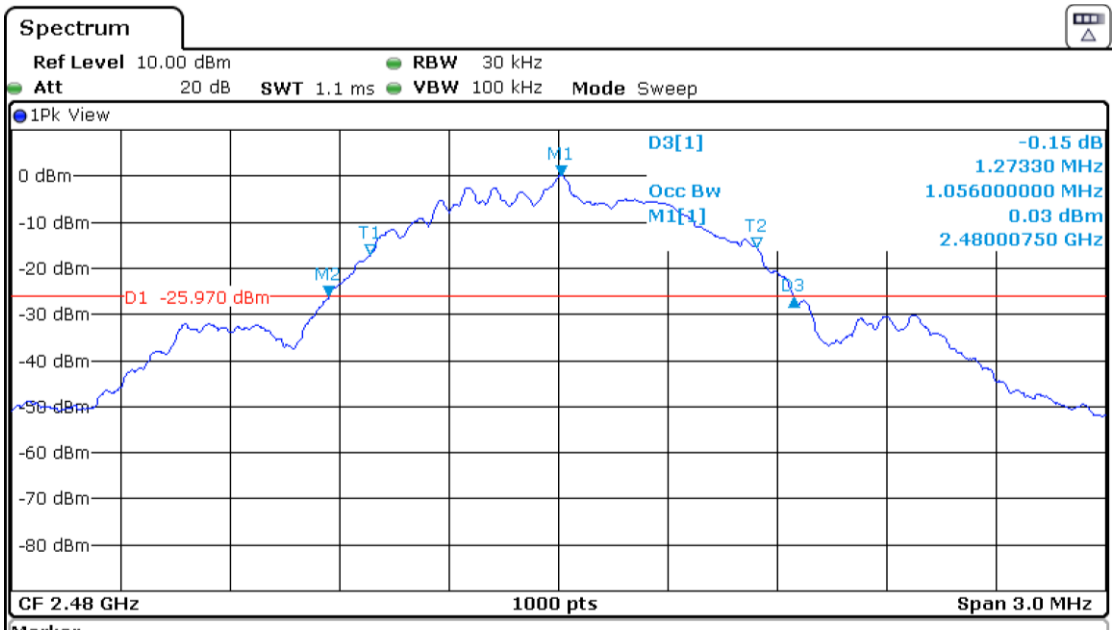
- Middle Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4400075 GHz	-0.07 dBm		
T1		1	2.4394855 GHz	-16.90 dBm	Occ Bw	1.059 MHz
T2		1	2.4405445 GHz	-15.89 dBm		
M2		1	2.4393612 GHz	-26.21 dBm		
D3	M2	1	1.2866 MHz	-0.15 dB		

- High Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4800075 GHz	0.03 dBm		
T1		1	2.4794855 GHz	-16.90 dBm	Occ Bw	1.056 MHz
T2		1	2.4805415 GHz	-15.49 dBm		
M2		1	2.4793712 GHz	-26.04 dBm		
D3	M2	1	1.2733 MHz	-0.15 dB		

FCC Section 15.247 Subclause (a) (2) / RSS-247 Clause 5.2 (a) 6 dB Bandwidth.

SPECIFICATION:

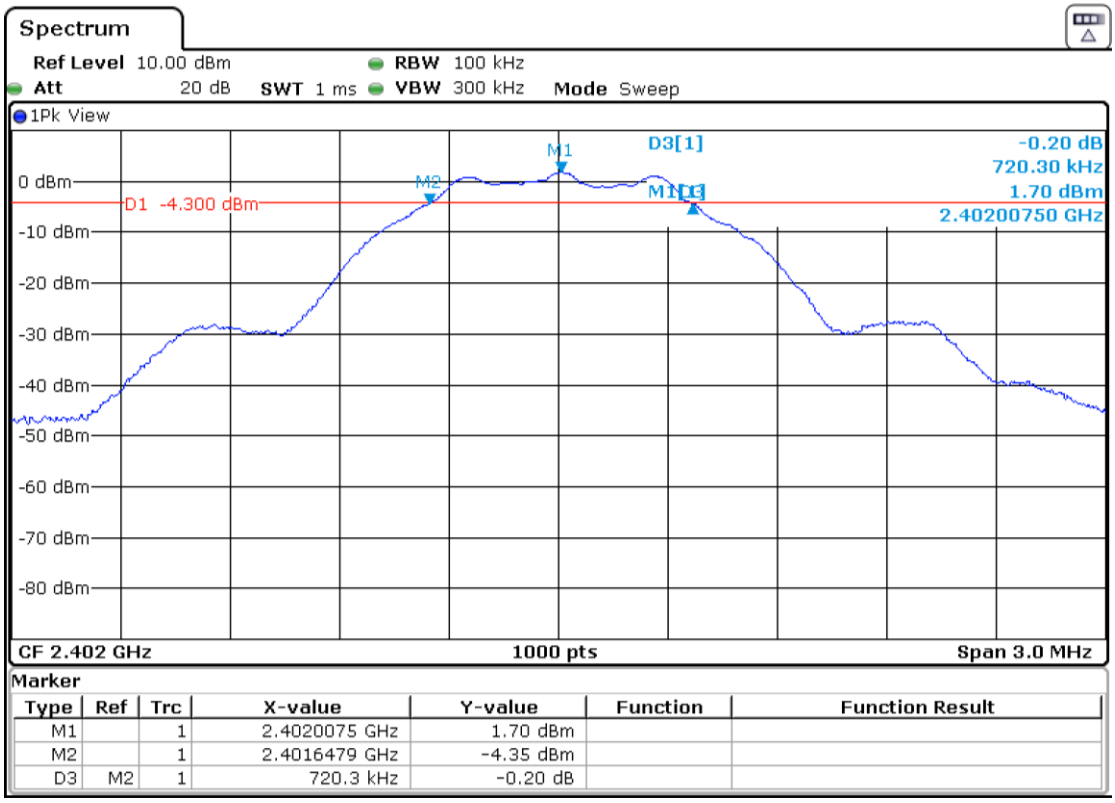
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS:

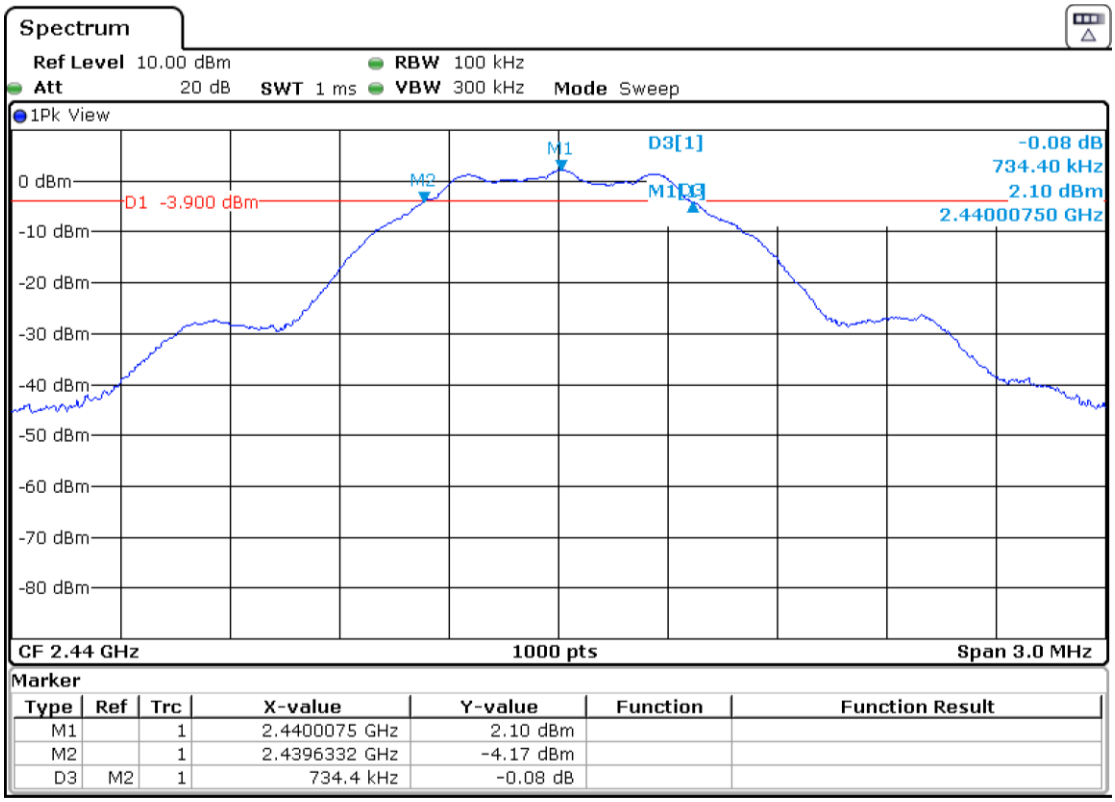
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum Bandwidth (kHz)	720.3	734.4	725.0
Measurement uncertainty (kHz)	<±2.50		

Verdict: PASS

- Low Channel:



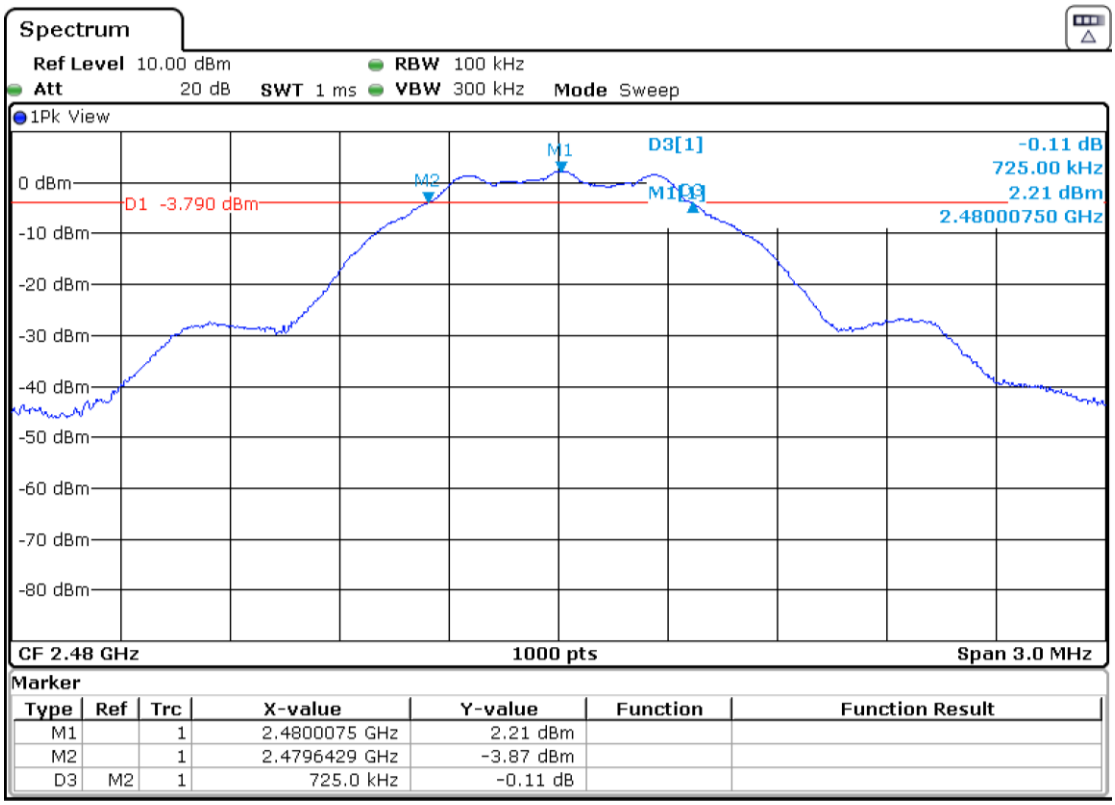
- Middle Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4400075 GHz	2.10 dBm		
M2		1	2.4396332 GHz	-4.17 dBm		
D3	M2	1	734.4 kHz	-0.08 dB		

- High Channel:



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4800075 GHz	2.21 dBm		
M2		1	2.4796429 GHz	-3.87 dBm		
D3	M2	1	725.0 kHz	-0.11 dB		

FCC Section 15.247 Subclause (b) / RSS-247 Clause 5.4 (d) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).

RESULTS:

The maximum peak conducted output power was measured using the method according to point 8.3.1.1. of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 558074 D01 DTS Meas Guidance v05r02 dated 2019/04/02.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

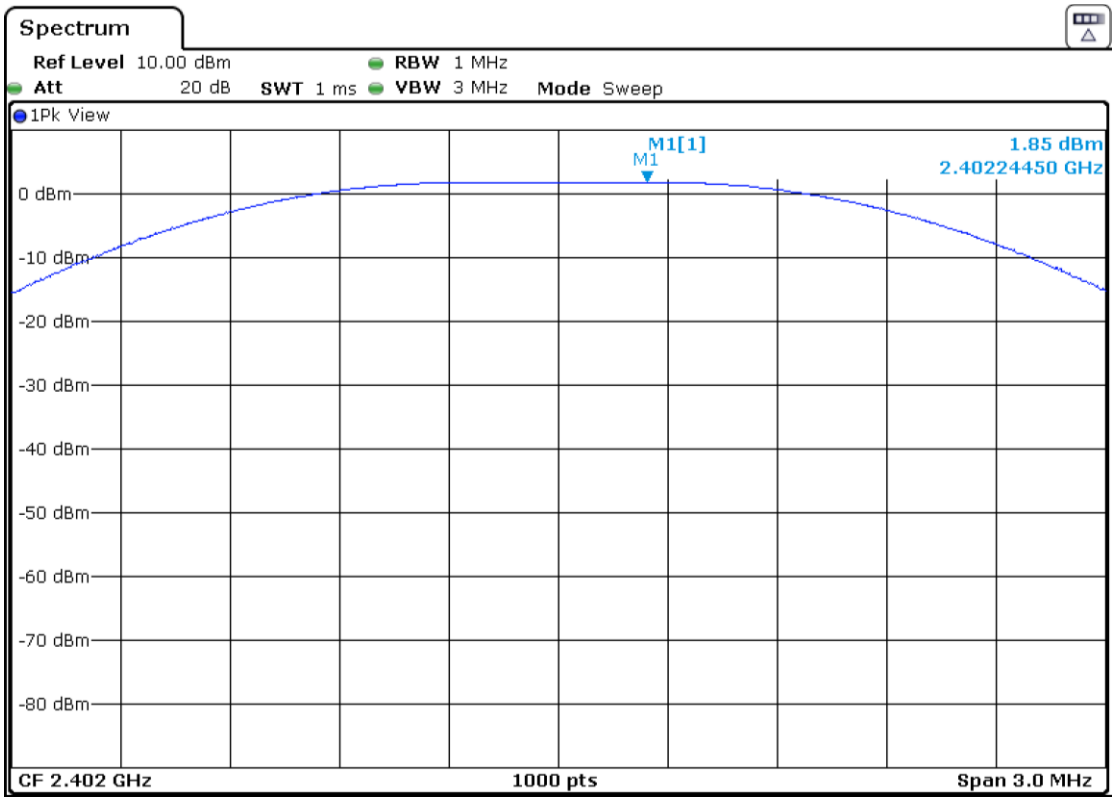
Maximum Declared Antenna Gain: -5.4 dBi

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)	1.85	2.17	2.37
Maximum EIRP Power (dBm)	-3.55	-3.23	-3.03
Measurement uncertainty (dB)	<±1.20		

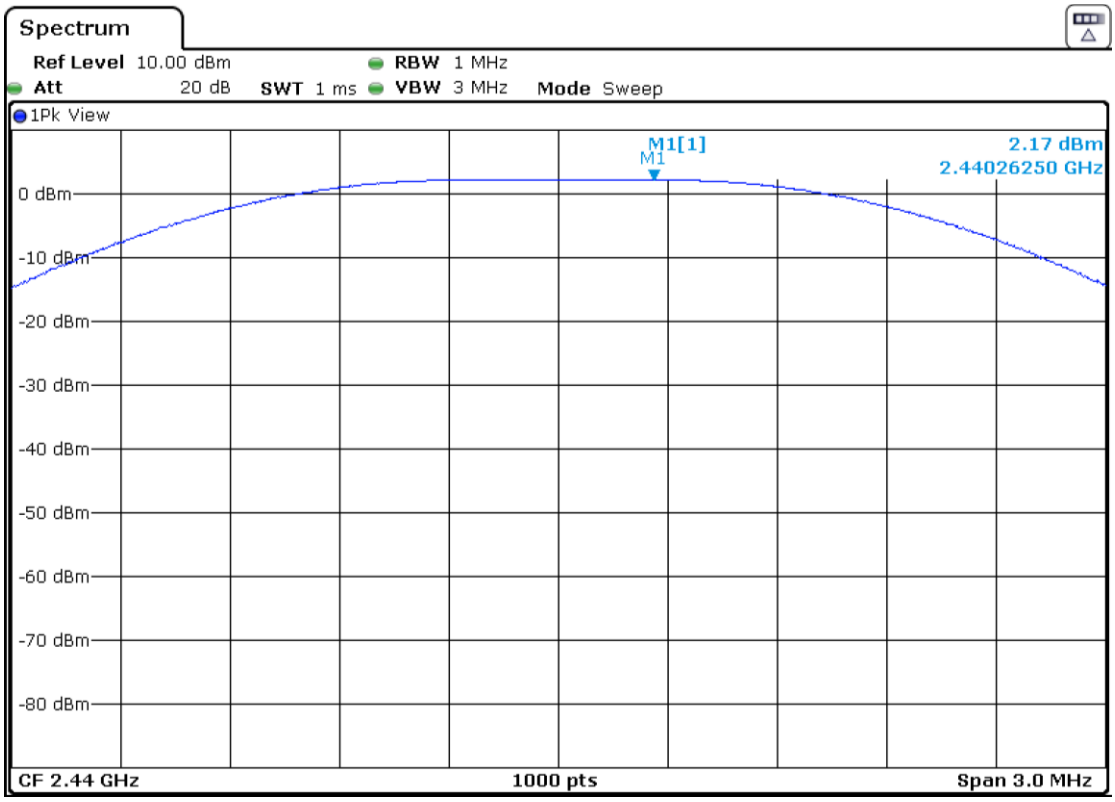
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

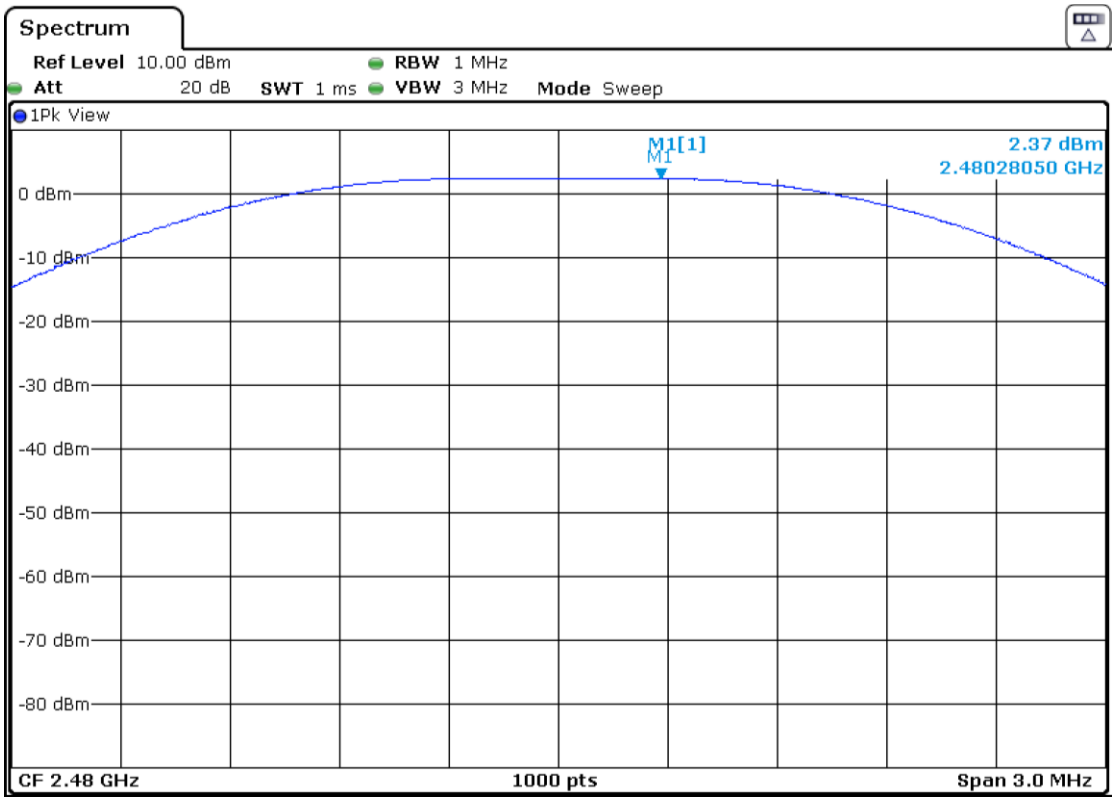
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations conducted (Transmitter)

SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Reference Level Measurement (dBm)	1.82	2.16	2.25
Measurement uncertainty (dB)	<±0.78		

- Low Channel:

All peaks are more than 20 dB below the limit.

- Middle Channel:

All peaks are more than 20 dB below the limit.

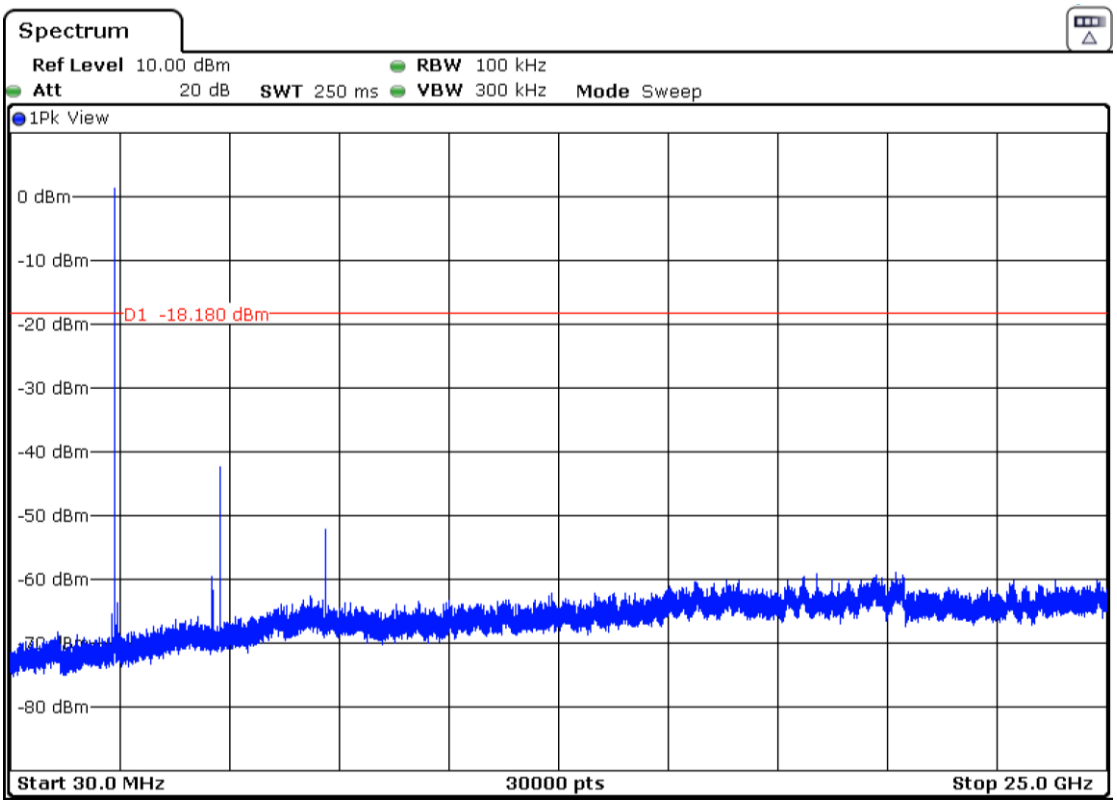
- High Channel:

All peaks are more than 20 dB below the limit.

Measurement uncertainty (dB)	<±1.20

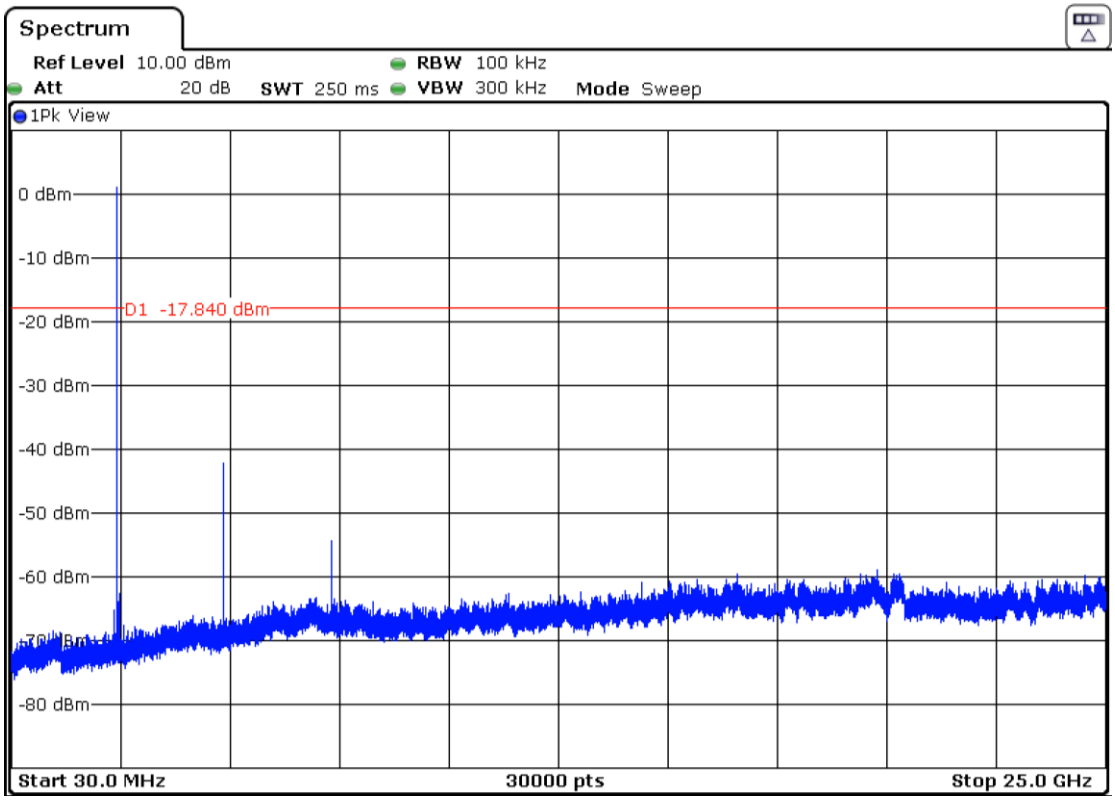
Verdict: PASS

- Low Channel:



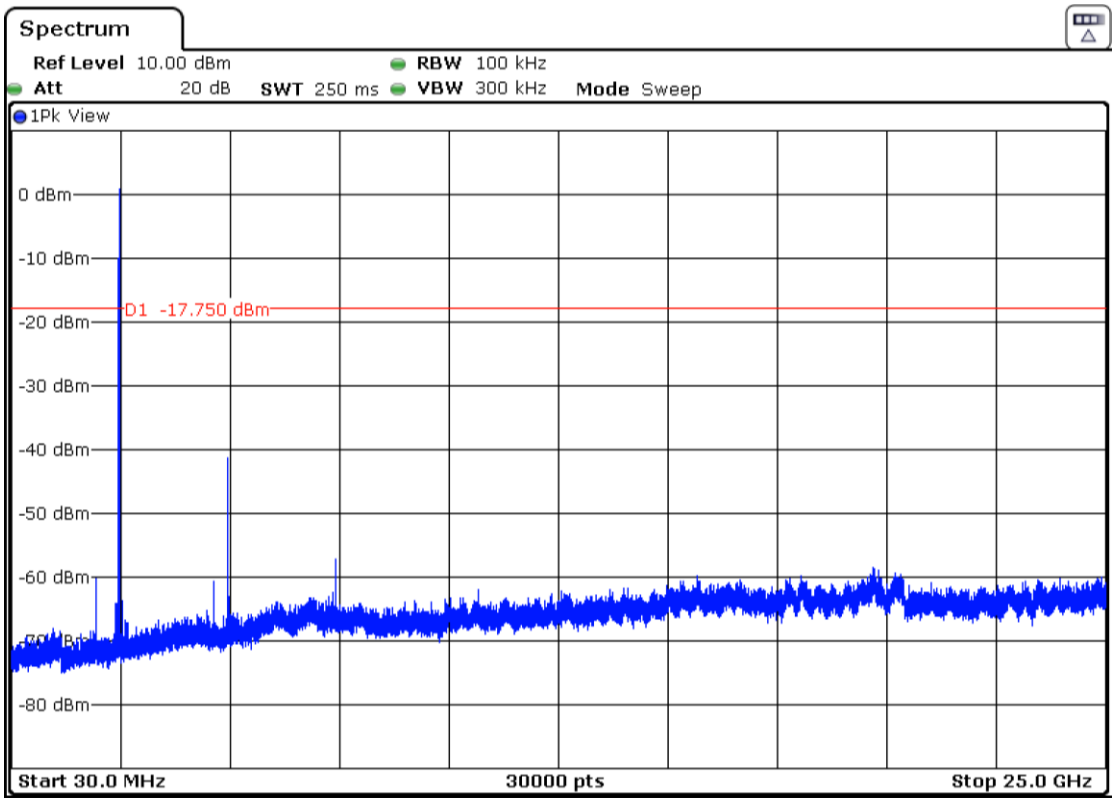
The peak shown in the plot above the limit is the carrier frequency.

- 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.

FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Band-edge emissions compliance (Transmitter)

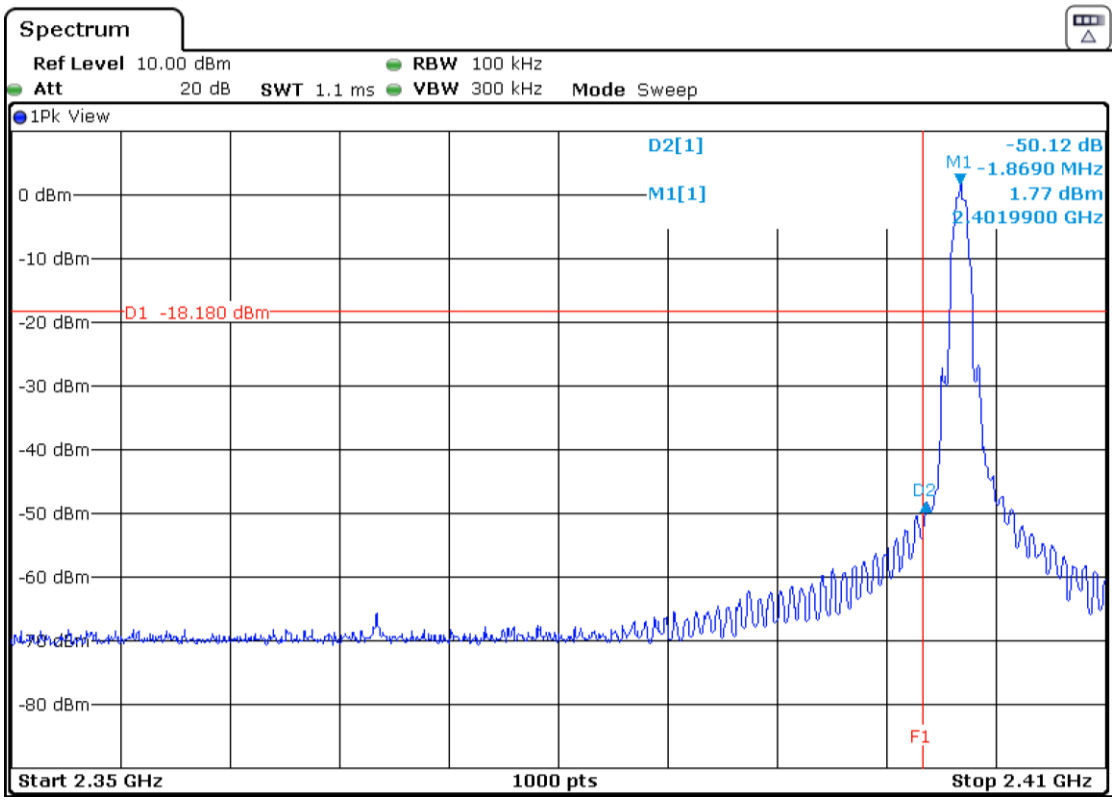
SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

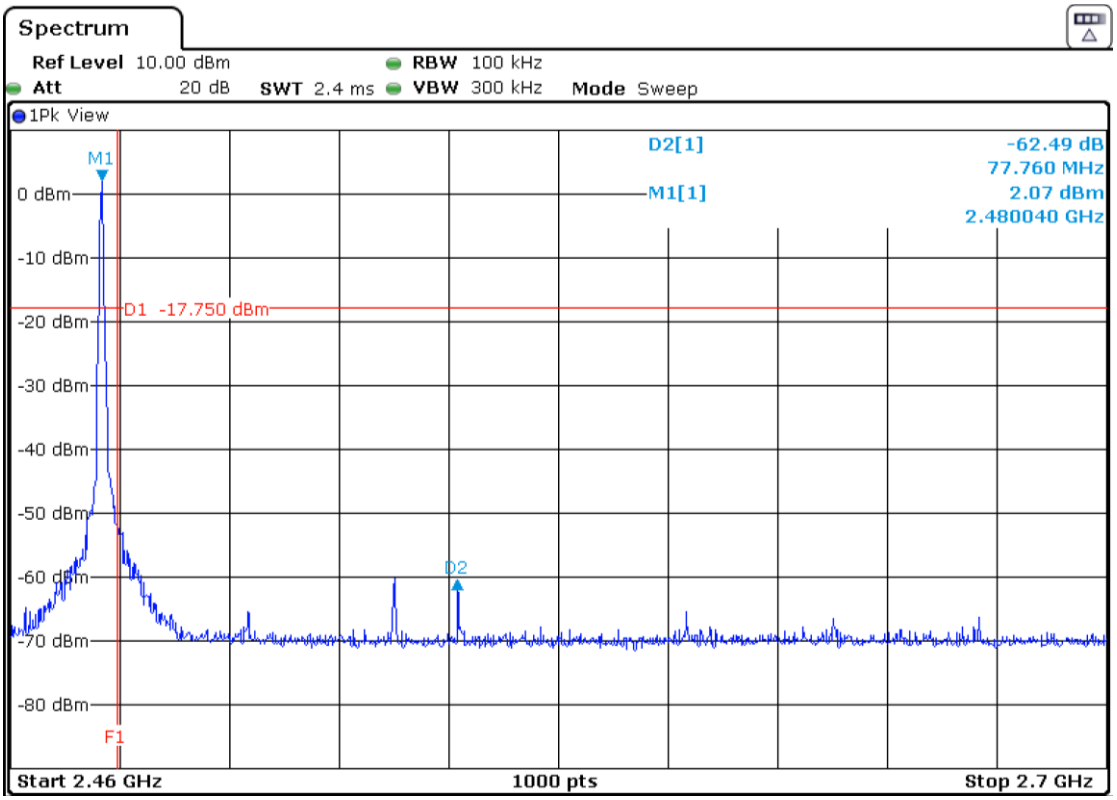
Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

- LOW FREQUENCY SECTION (conducted):



Verdict: PASS

- HIGH FREQUENCY SECTION (conducted):



Measurement uncertainty (dB)	< ±1.20

Verdict: PASS

FCC Section 15.247 Subclause (e) / RSS-247 5.2. (b) Power spectral density

SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

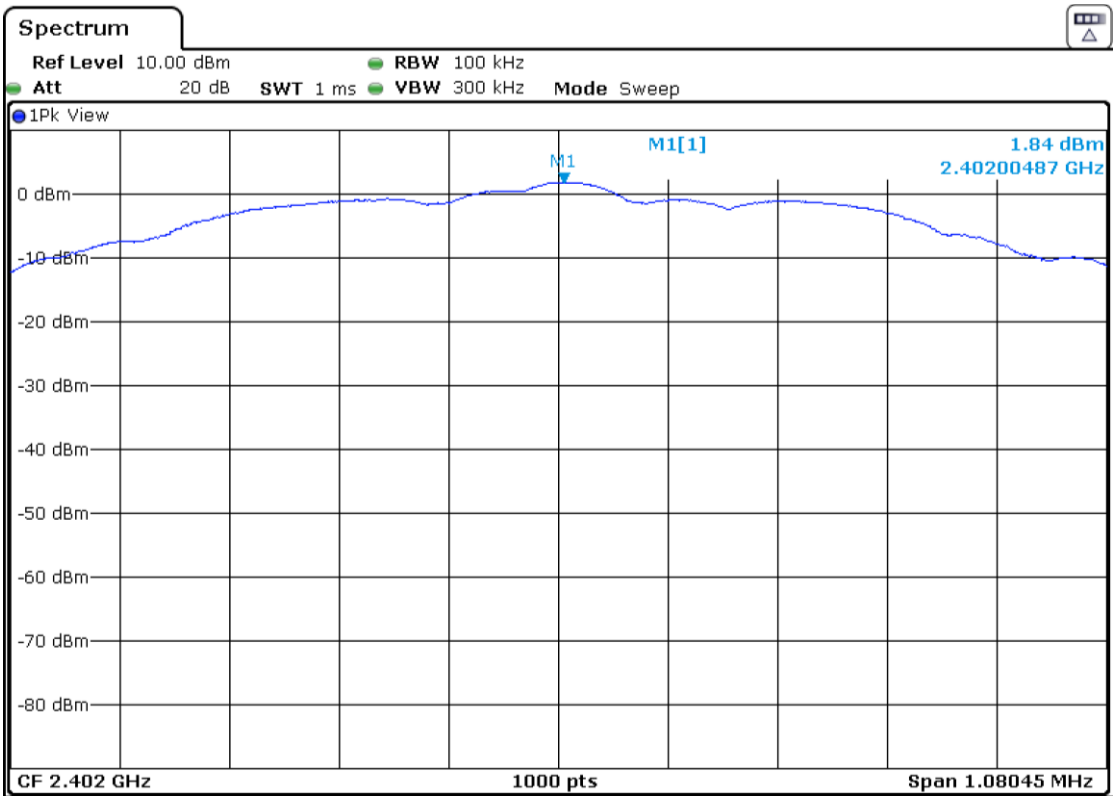
RESULTS:

The maximum power spectral density level in the fundamental emission was measured using the method PKPSD (Peak PSD) according to point 8.4.of Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under Section 15.247 558074 D01 DTS Meas Guidance v05r02 dated 2019/04/02.

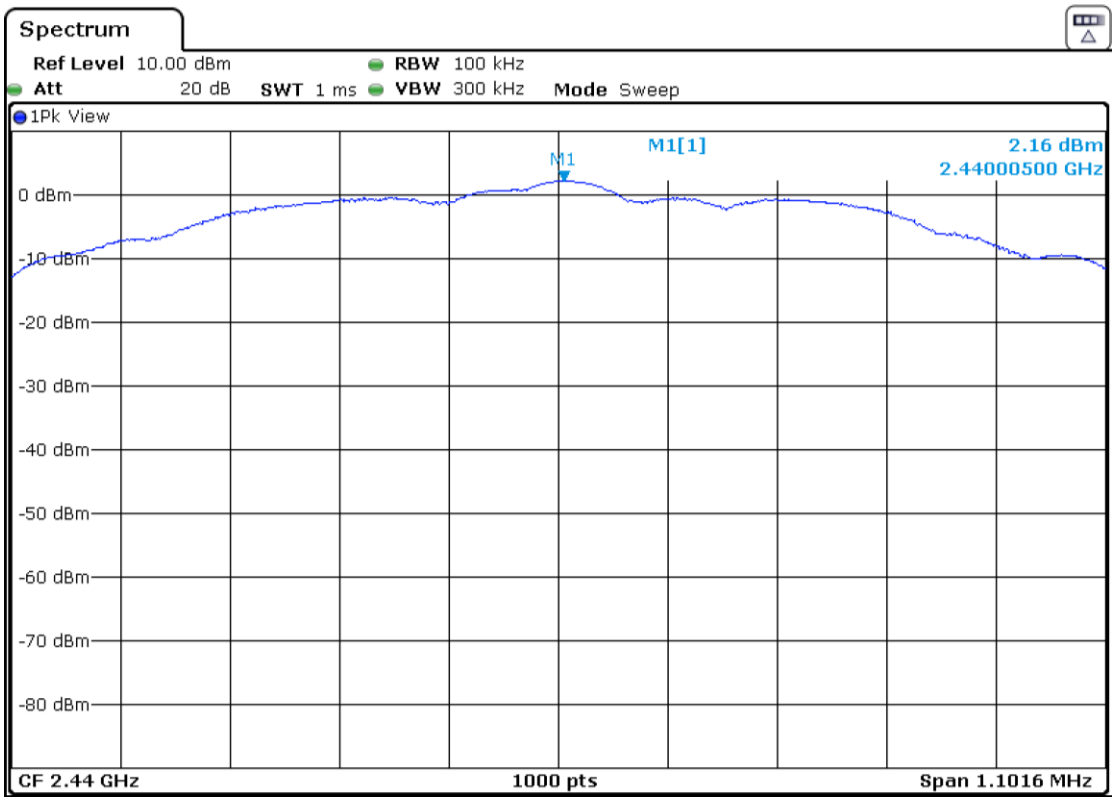
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Power Spectral Density (dBm)	1.84	2.16	2.29
Measurement uncertainty (dB)	<±1.20		

Verdict: PASS

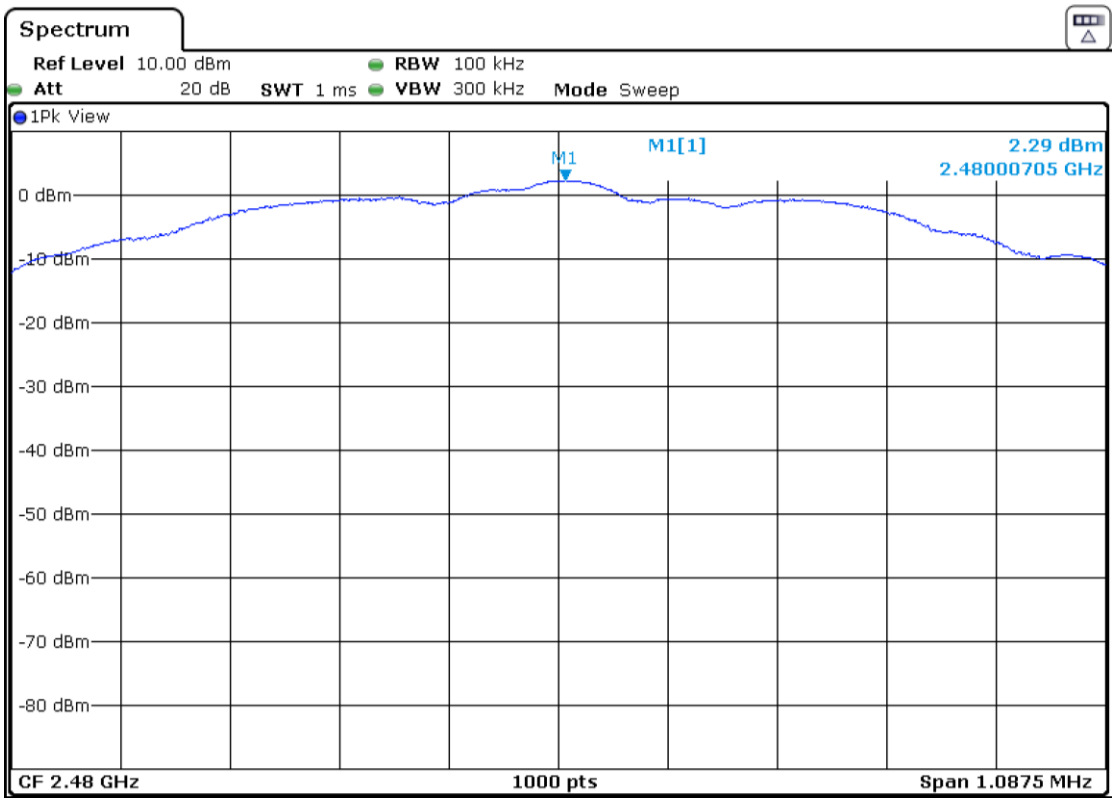
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 Subclause (d) / RSS-247 Clause 5.5. Emission limitations radiated (Transmitter)

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)/RSS-Gen):

Frequency Range (MHz)	Field strength (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 - 10000	500	54	3

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

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

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

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 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 frequencies detected do not depend on the operating channel.

No spurious frequencies at less than 20 dB below the limit.

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-25 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

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

- LOW CHANNEL (2402 MHz):

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
5.21923	H	Peak	44.65	<± 4.88
7.20537	H	Peak	56.95	<± 4.88
		Average	53.73	

- MIDDLE CHANNEL (2440 MHz):

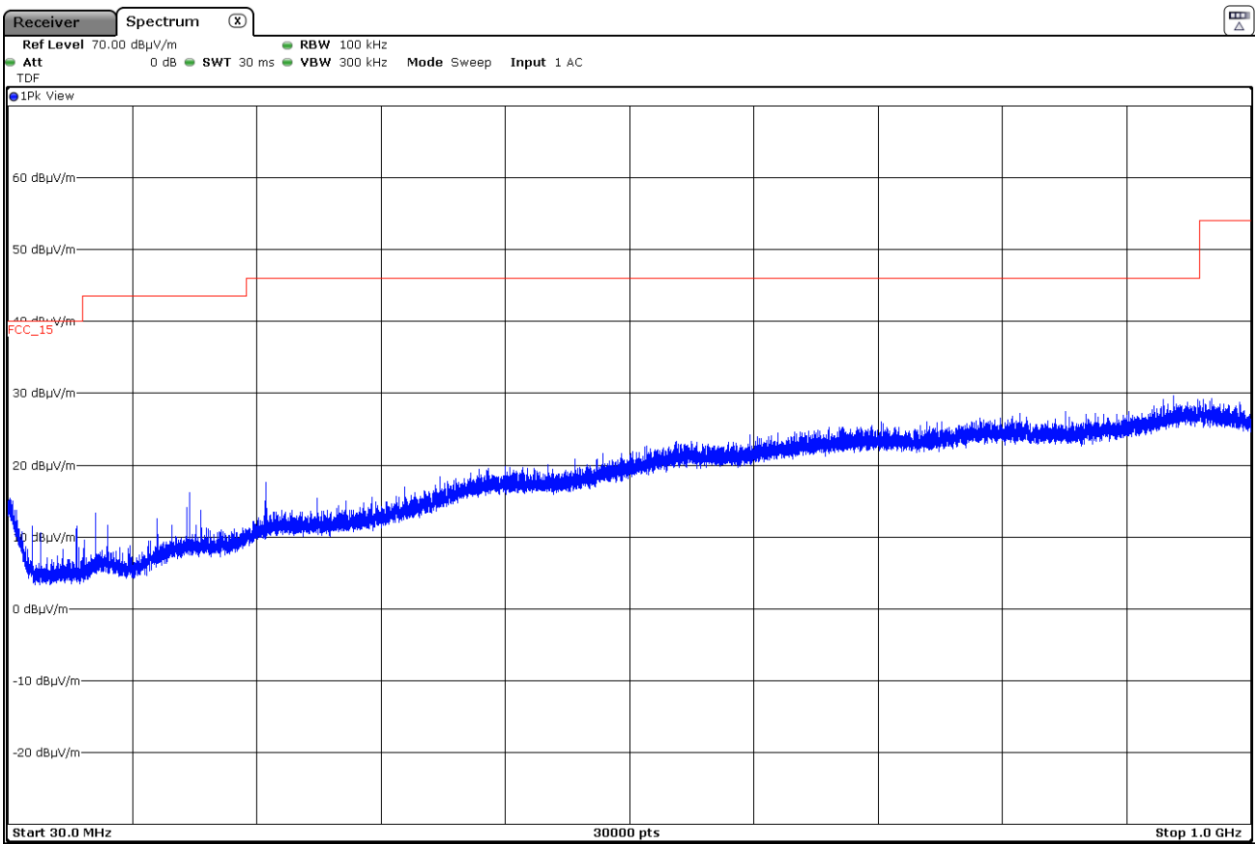
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
5.21597	V	Peak	46.41	<± 4.88
7.31923	H	Peak	55.69	<± 4.88
		Average	52.25	

- HIGH CHANNEL (2480 MHz):

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBµV/m)	Measurement Uncertainty (dB)
2.48359	H	Peak	56.84	<± 3.04
		Average	40.71	
5.22717	V	Peak	42.81	<± 4.88
7.43917	H	Peak	54.79	<± 4.88
		Average	50.68	

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

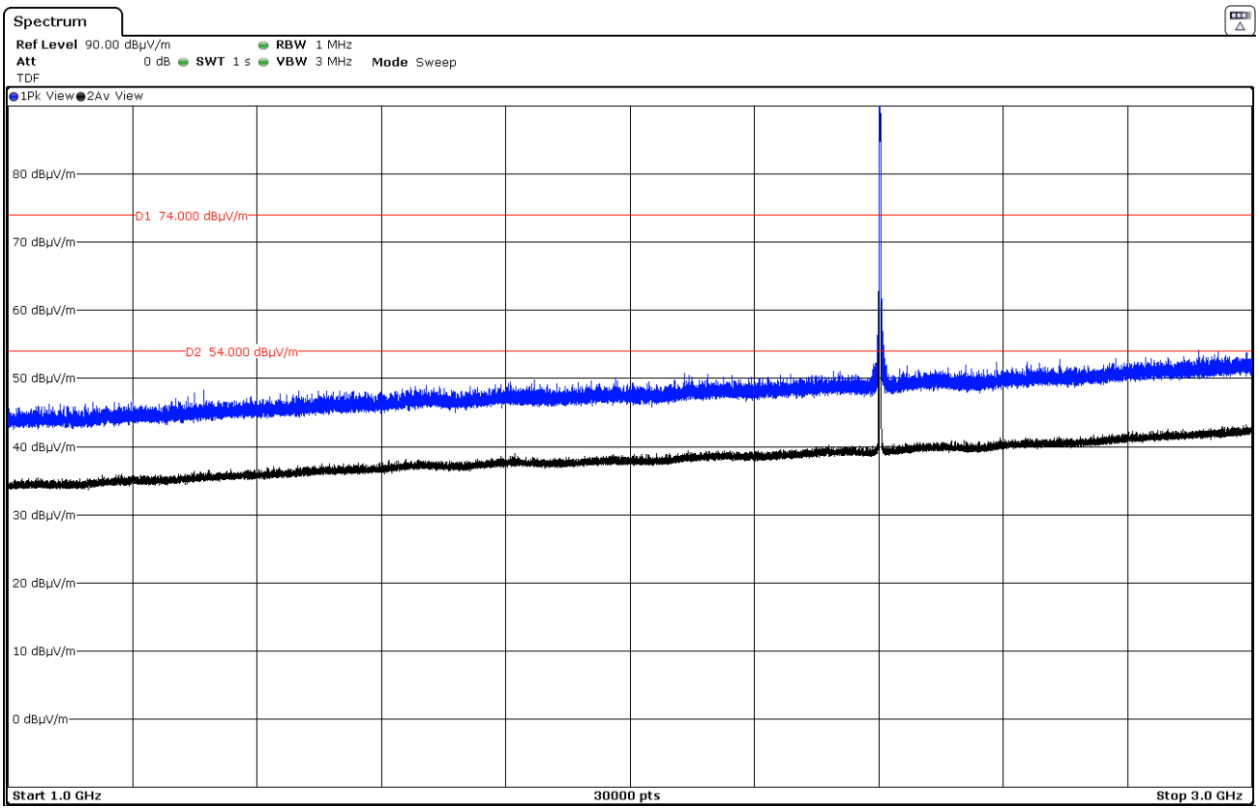


The spurious signals detected do not depend on the operating channel.

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

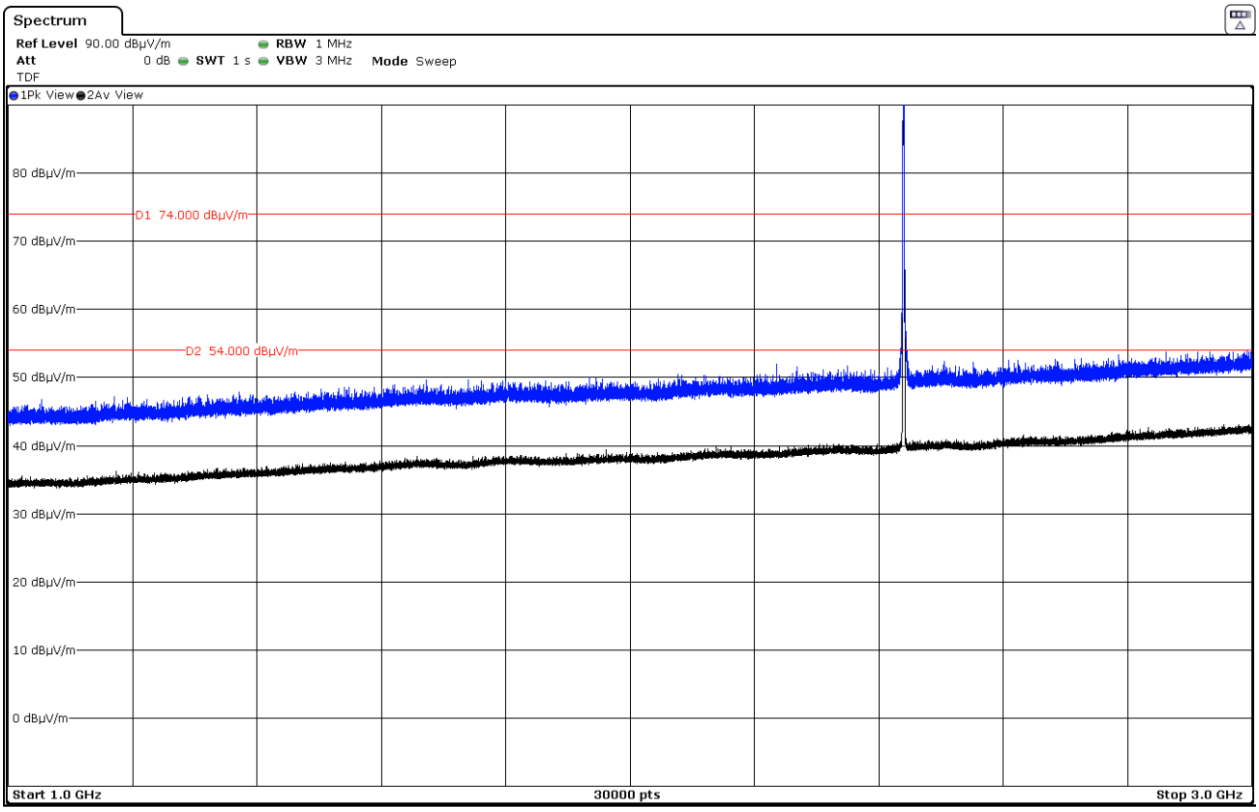
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



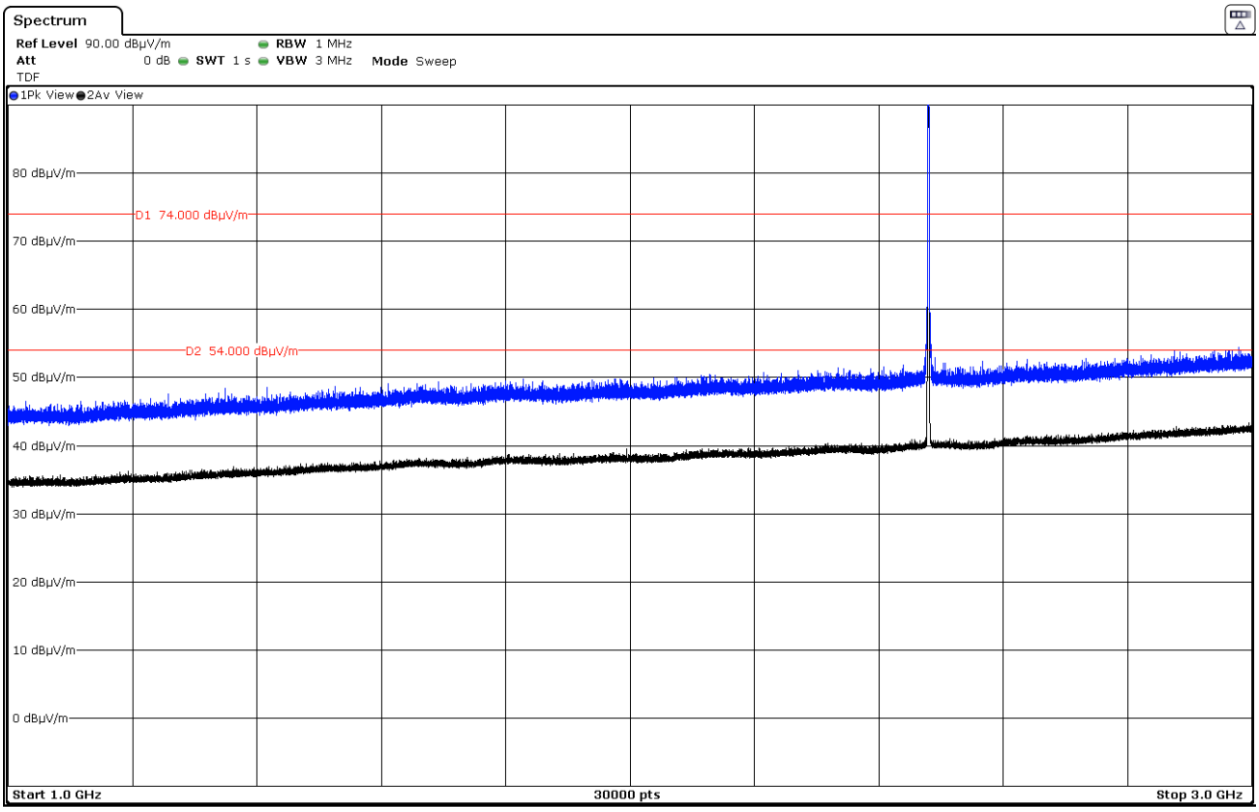
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

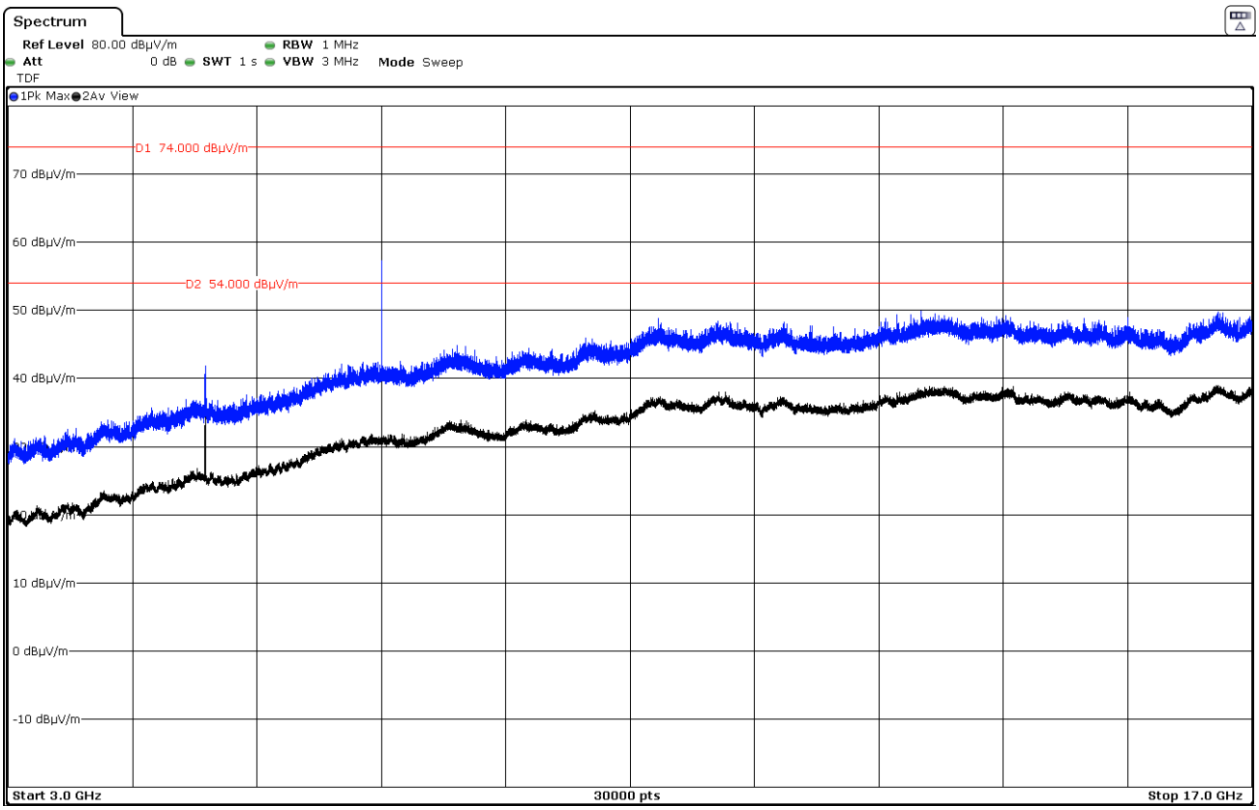
- High Channel:



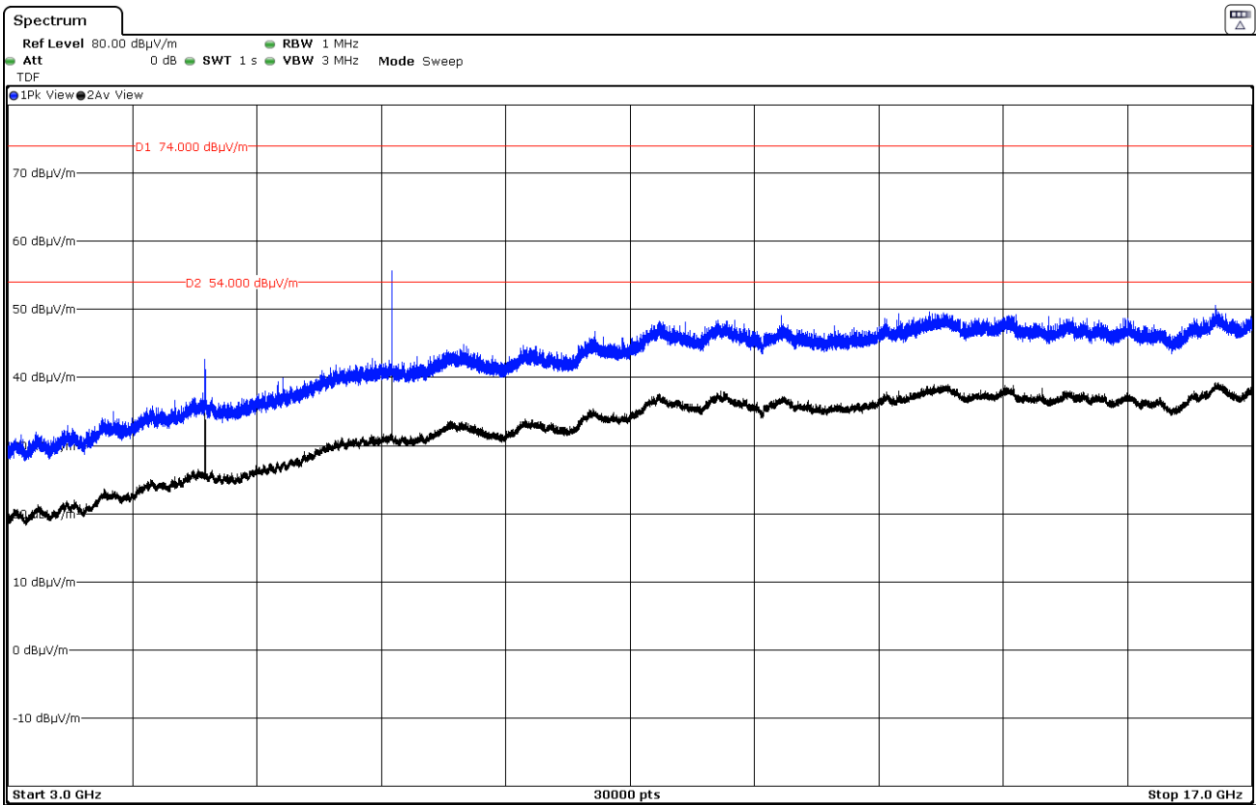
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

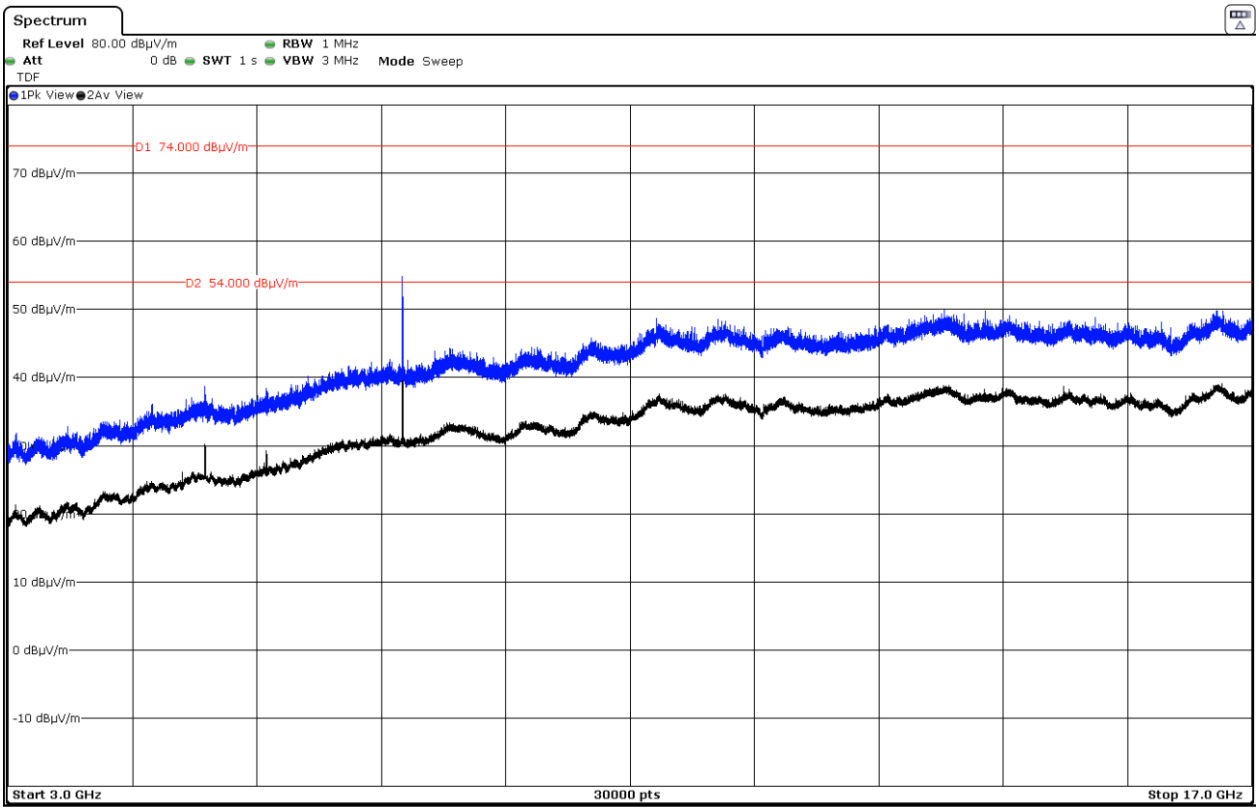
- Low Channel:



- Middle Channel:

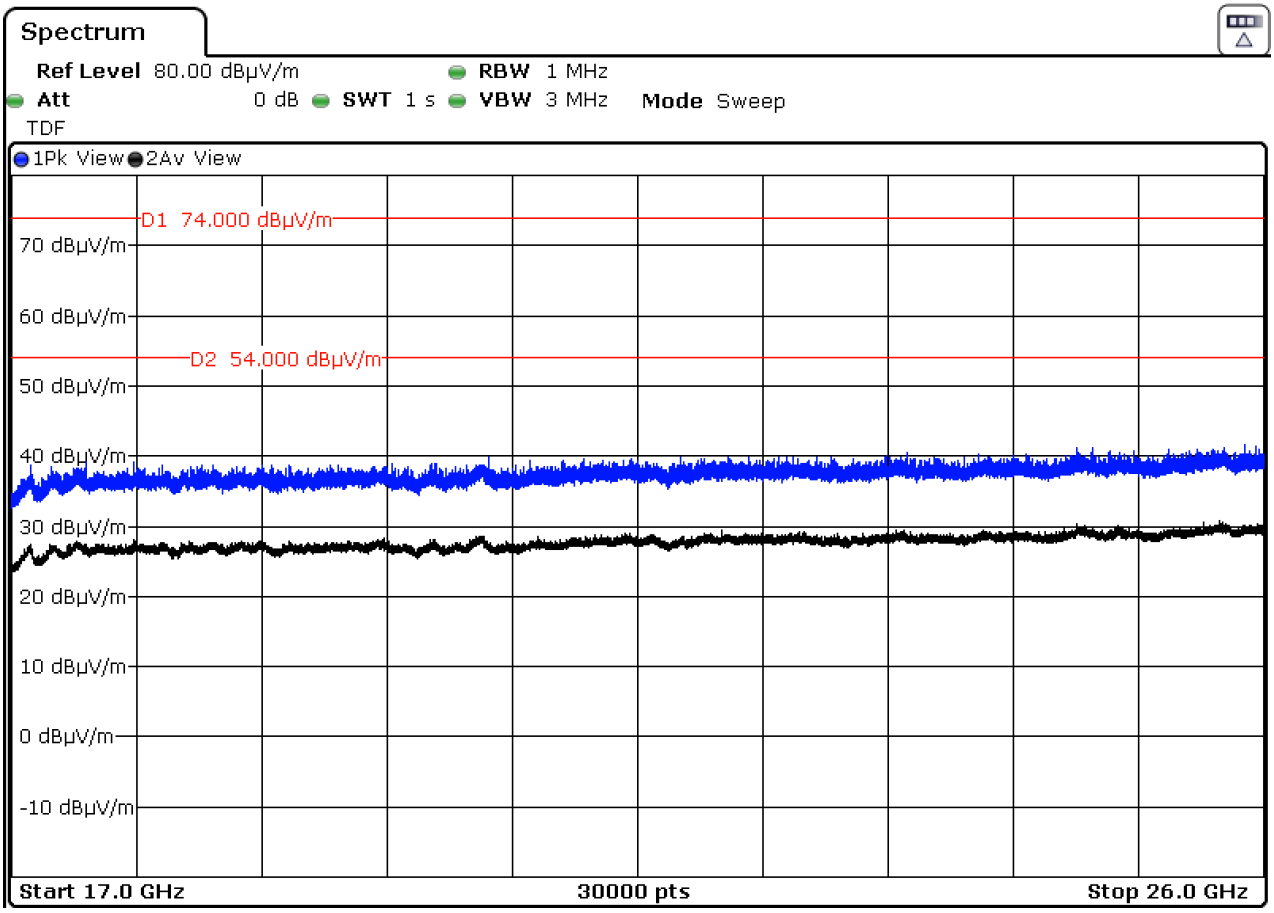


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

- Low Channel:

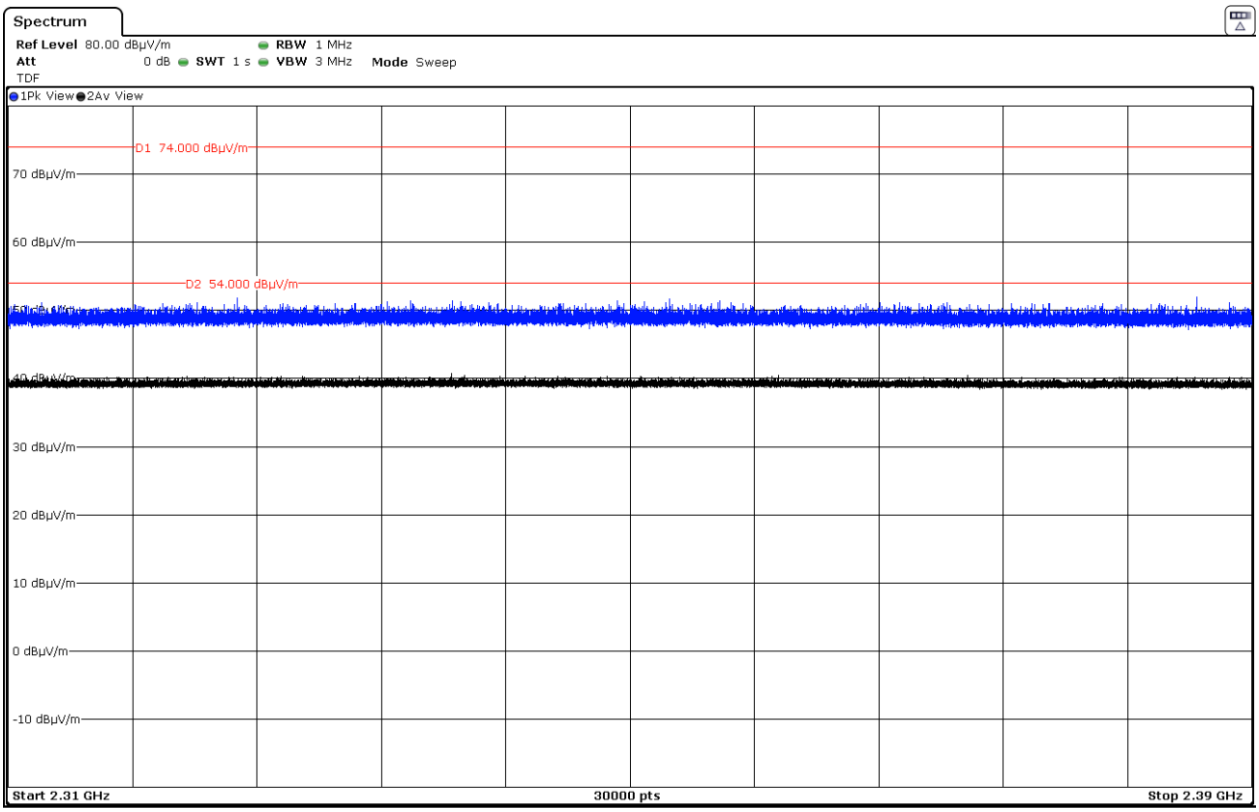


The spurious signals detected do not depend on the operating channel.

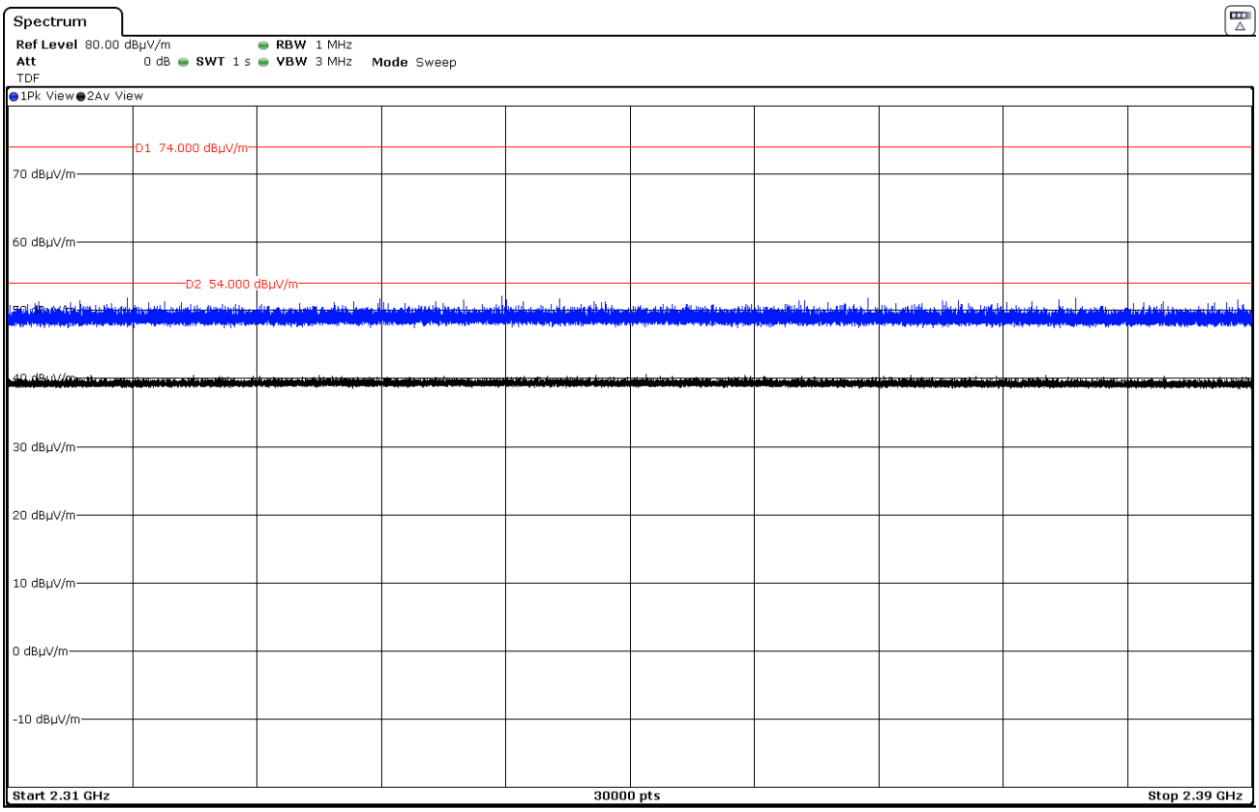
This plot is valid for the Low, Middle and High Channels.

FREQUENCY RANGE 2.31-2.39 GHz (Restricted Band):

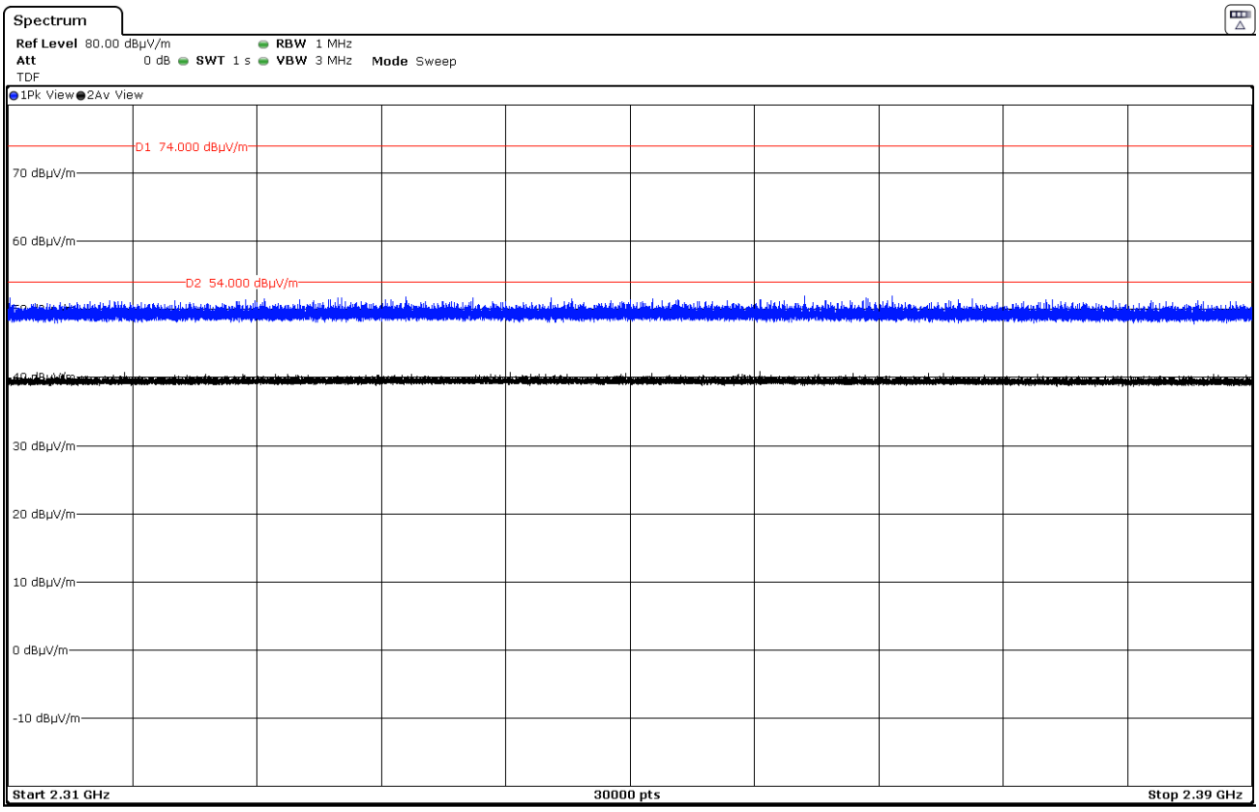
- Low Channel:



- Middle Channel:

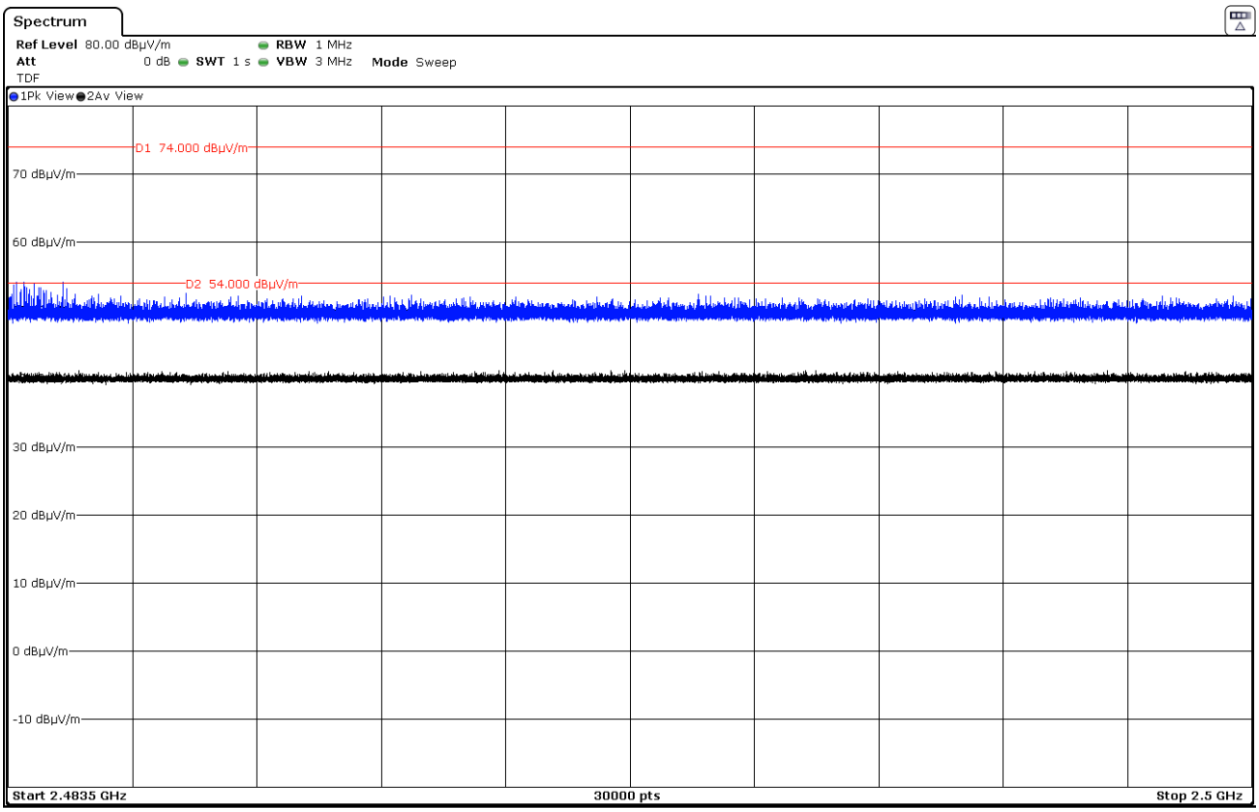


- High Channel:

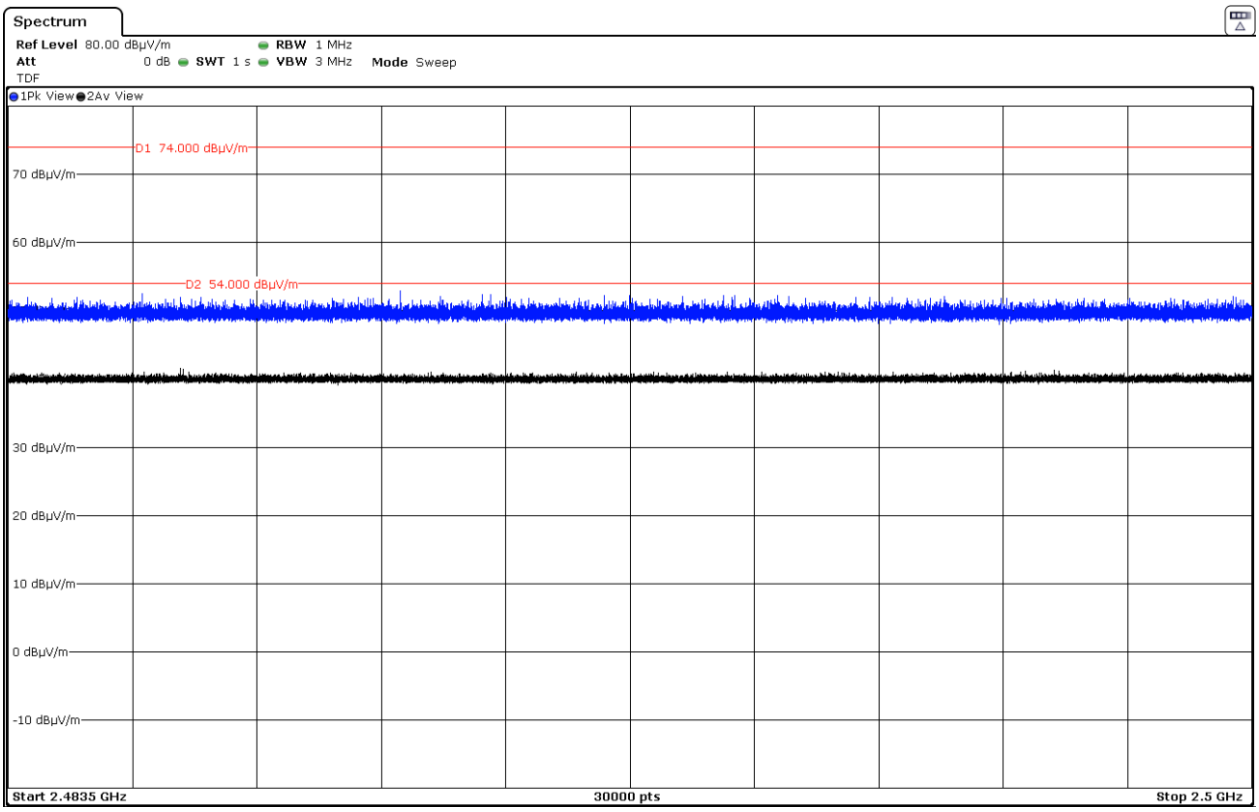
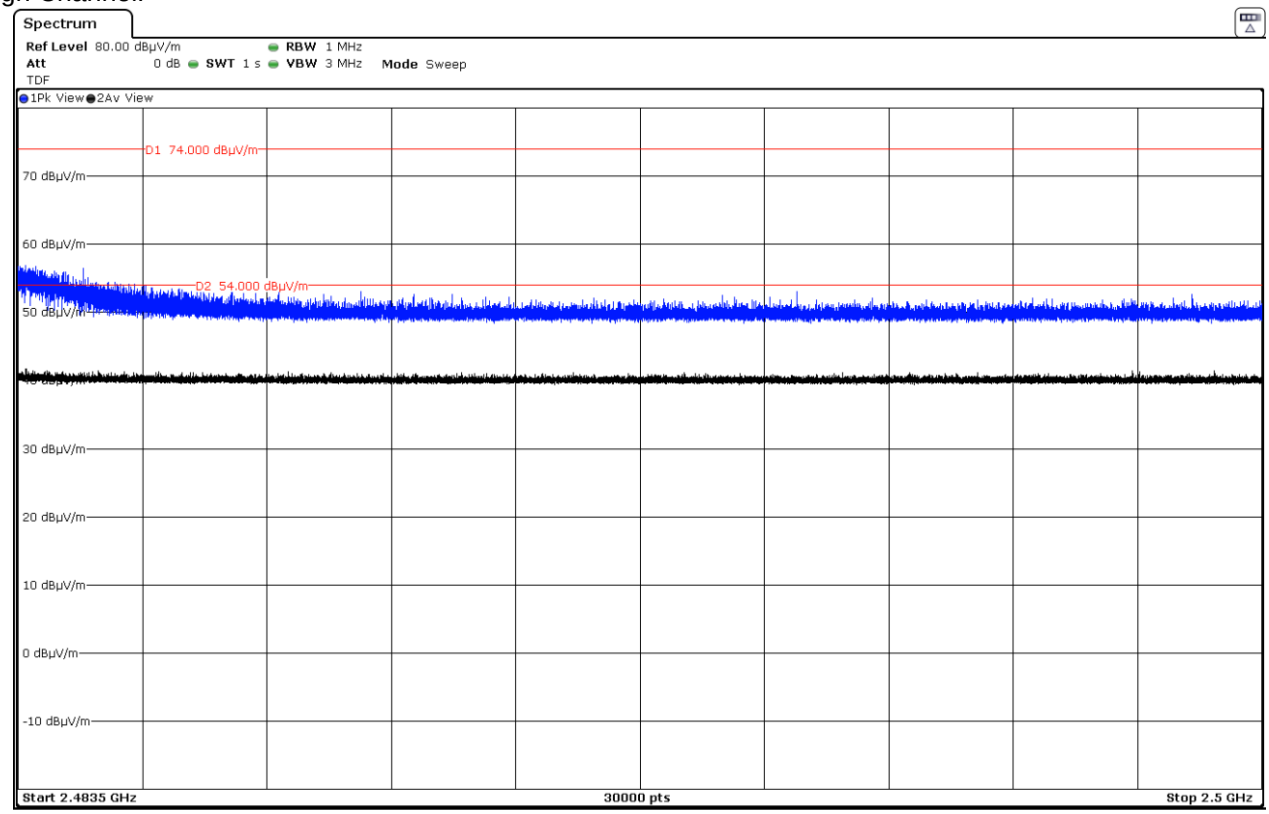


FREQUENCY RANGE 2.4835-2.5 GHz (Restricted Band):

- Low Channel:



- Middle Channel:



- High Channel: