



FCC LISTED,
REGISTRATION NUMBER:
720267

ISED LISTED
REGISTRATION NUMBER
4621A-4

Test report No:
NIE: 58836RRF.001

Partial test report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

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

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

Identification of item tested	Gateway including all mechanical variants.
Trademark	SALTO RFnet Gateway
Model and /or type reference	RFnet Gateway / (type reference P0908)
Other identification of the product	Contains FCC ID: UKCRF2MODULE Contains IC: 10088A-RF2MODULE
Features	Contains a certified IEEE802.15.4 standard based module (RF2MODULE)
Applicant	SALTO Systems, S.L. Arkotz 9, Polígono Lanbarren 20180, Oiartzun, Gipuzkoa, SPAIN
Test method requested, standard	USA FCC Part 15.247 10-1-17 Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 10-1-17 Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). Section 15.247 Subclause (d) / RSS-247 5.5.: Emission limitations radiated (Transmitter) 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 v05 dated August 24, 2018. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

Approved by (name / position & signature)	A. Llamas RF Lab. Manager		Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2018.12.13 14:47:53 +01'00'
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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 laboratory with a measurement facility in compliance with the requirements of Section 2.948 of the FCC rules and has been added to the list of facilities whose measurements data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Registration Number: 720267.

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.

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General conditions

1. This report is only referred to the item that has undergone the test.
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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 consists of a SALTO RFnet Gateway, based on IEEE802.15.4 standard. Bridge between SALTO SPACE software and Nodes / Locks.

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
57476B/013	RFnet Gateway	RFnet Gateway / P0908	--	2018-06-08
57476B/014	AC/DC Adaptor	6A-181WP12	--	2018-06-08

1. Sample M/01 has undergone the following test(s):

All radiated 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⁾	
	Ethernet	100	☒	☐	☐	
Supplementary information to the ports..... :						
Rated power supply..... :	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	☐	AC:	☐	☐	☐	☐
☒	DC: Power Supply: 12Vdc					
Rated Power..... :	7.5 W (max)					
Clock frequencies..... :	25 MHz					
Other parameters..... :	RS485 communication					
Software version..... :	Control Firmware: 0083 RF2MODULE Firmware: 0089					
Hardware version..... :	1.0					
Dimensions in cm (W x H x D) ... :	12 x 16.1 x 2.9 cm					
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
	RF2MODULE	IEEE802.15.4 standard based module	SALTO Systems, S.L.
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

Copy of marking plate:



Identification of the client

SALTO Systems, S.L.
Arkotz 9, Polígono Lanbarren
20180, Oiartzun, Gipuzkoa, SPAIN

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2018-09-14
Date (finish)	2018-09-26

Document history

Report number	Date	Description
58836RRF.001	2018-12-13	First release

Environmental conditions

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

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

Remarks and comments

The tests have been performed by the technical personnel: Miguel Ángel Torres, Ignacio Cabra and Carlos Contreras.

Used instrumentation:

Radiated Measurements

		Last Cal. date	Cal. due date
1.	Semianechoic Absorber Lined Chamber ETS FACT3 200STP	N.A.	N.A.
2.	BiconicalLog antenna ETS LINDGREN 3142E	2018/07	2021/07
3.	Multi Device Controller EMCO 2090	N.A.	N.A.
4.	Double-ridge Guide Horn antenna 1-18 GHz SCHWARZBECK BBHA 9120 D	2016/12	2019/12
5.	Broadband Horn antenna 18-40 GHz SCHWARZBECK BBHA 9170	2017/03	2020/03
6.	EMI Test Receiver R&S ESR7	2017/08	2019/08
7.	Spectrum analyser Rohde & Schwarz FSV40	2018/02	2020/02
8.	RF pre-amplifier 30 MHz-6 GHz Bonn Elektronik BLNA 0360-01N	2018/07	2019/07
9.	RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-3A	2018/03	2019/03
10.	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

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
Section 15.247 Subclause (a) (2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/M	(1)
Section 15.247 Subclause (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5	Emission limitations conducted (Transmitter)	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Conducted Band-edge emissions compliance (Transmitter)	N/M	(1)
Section 15.247 Subclause (e) / RSS-247 5.2. (b)	Power spectral density	N/M	(1)
Section 15.247 Subclause (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
(1): Test not requested by the client.			

Appendix A: Test results.

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TEST CONDITIONS

Power supply (V):

Vnominal = 12 Vdc

Type of power supply = DC voltage from AC/DC adaptor.

Type of antenna = Internal antenna.

Declared Gain for antenna (maximum) = 1.7 dBi.

TEST FREQUENCIES:

Lowest channel: 2405 MHz

Middle channel: 2445 MHz

Highest channel: 2480 MHz

The sample was used to configure the EUT to continuously transmit at a specified output power in all channels.

RADIATED MEASUREMENTS

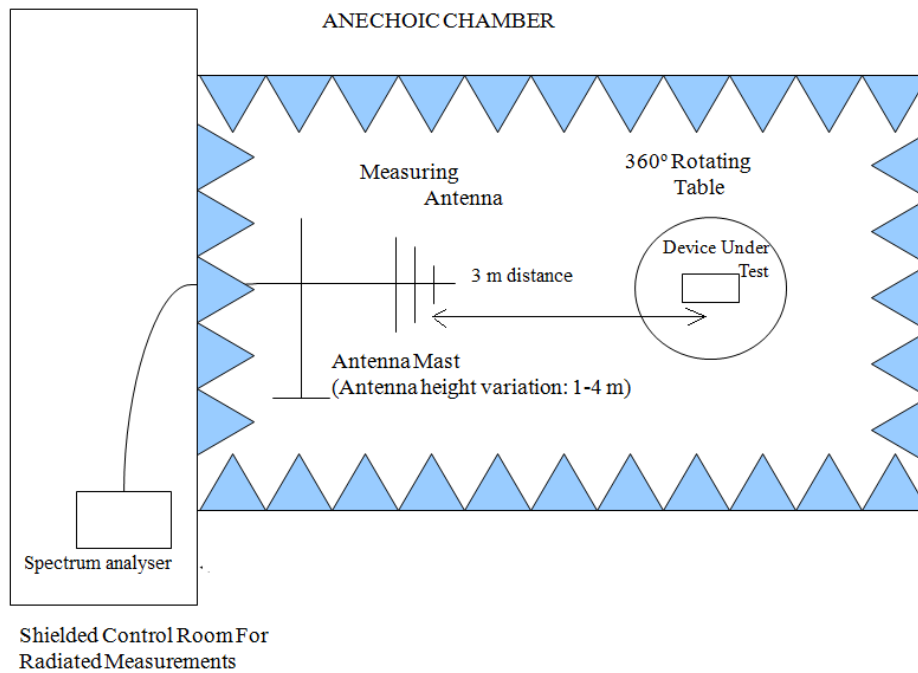
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m for the frequency range 30 MHz-1000 MHz (30 MHz-1000 MHz Bilog antenna) and at a distance of 1m for the frequency range 1 GHz-25 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40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

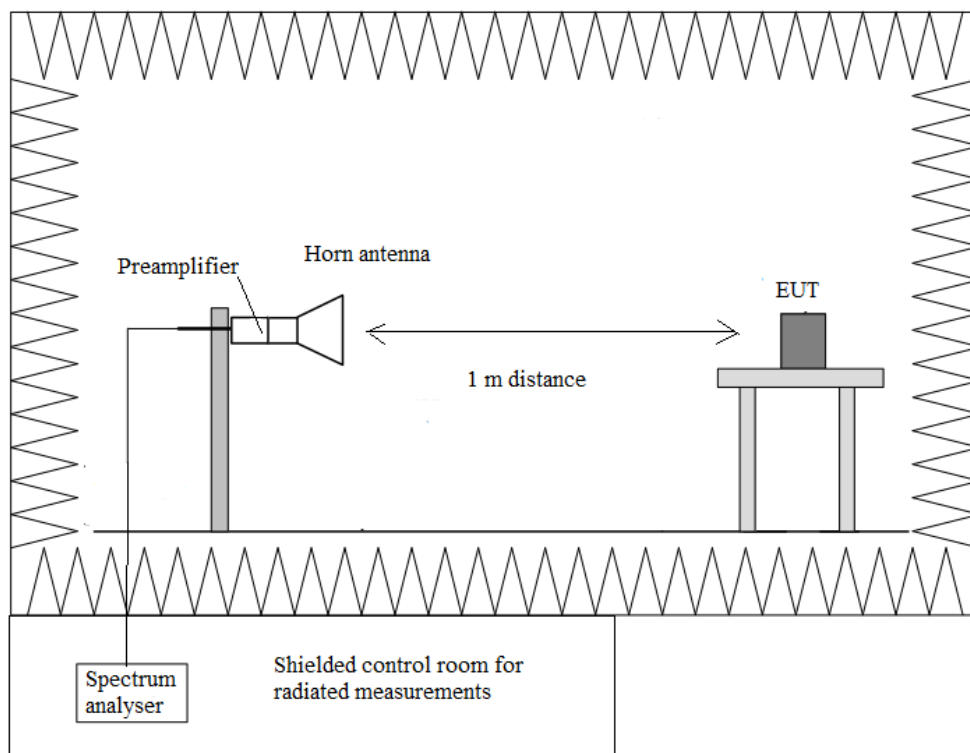
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



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

SPECIFICATION

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

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

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

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

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

RESULTS:

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

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

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

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

Frequency range 30 MHz-1000 MHz.

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

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
74.992	V	Quasi-peak	27.04	± 3.88
174.999	H	Quasi-peak	28.3	± 3.88
375.013	V	Quasi-peak	28.7	± 3.88
700.028	V	Quasi-peak	32.6	± 3.88
750.015	H	Quasi-peak	40.3	± 3.88
775.009	H	Quasi-peak	35.0	± 3.88
850.022	H	Quasi-peak	35.6	± 3.88
900.009	H	Quasi-peak	38.4	± 3.88
925.003	V	Quasi-peak	34.8	± 3.88
949.997	H	Quasi-peak	41.4	± 3.88

Frequency range 1 GHz-25 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 (see next plots).

NOTE: Marker-delta method was used for checking compliance in range 2.4835 GHz to 2.4855 GHz (Band-edge compliance of radiated emissions) for the highest operating channel. See tables and plots below.

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.

Lowest Channel (2405 MHz)

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.3409836	H	Peak	58.63	± 3.70
		Average	49.63	
2.3509693	H	Peak	57.67	± 3.70
		Average	50.16	
4.80997	V	Peak	52.21	± 3.70

Middle Channel (2445 MHz)

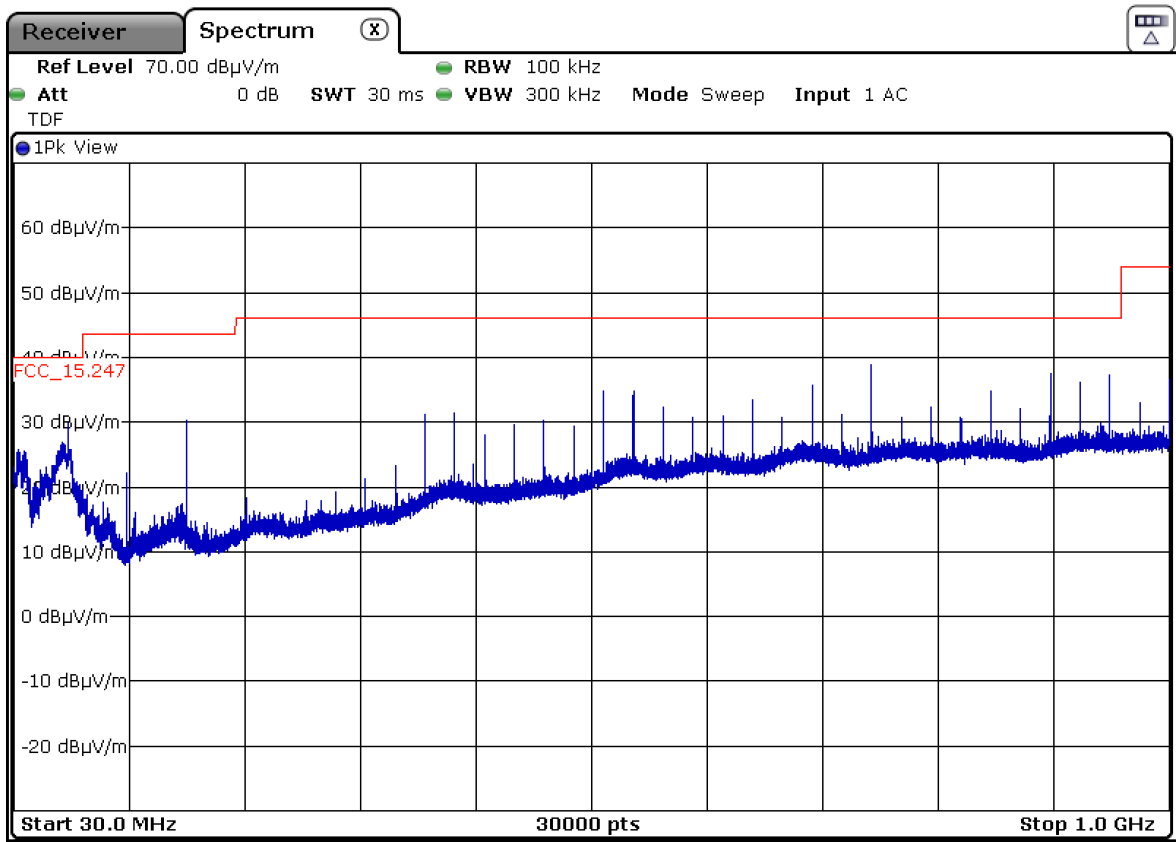
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.535667	H	Peak	60.12	± 3.70
		Average	51.33	
4.84221	V	Peak	54.32	± 3.70
		Average	49.92	

Highest Channel (2480 MHz)

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
2.535534	H	Peak	60.51	± 3.70
		Average	51.46	
2.4835	H	Peak	53.05	± 3.70
		Average	50.47	
4.88977	V	Peak	54.56	± 3.70
		Average	50.90	

Verdict: PASS

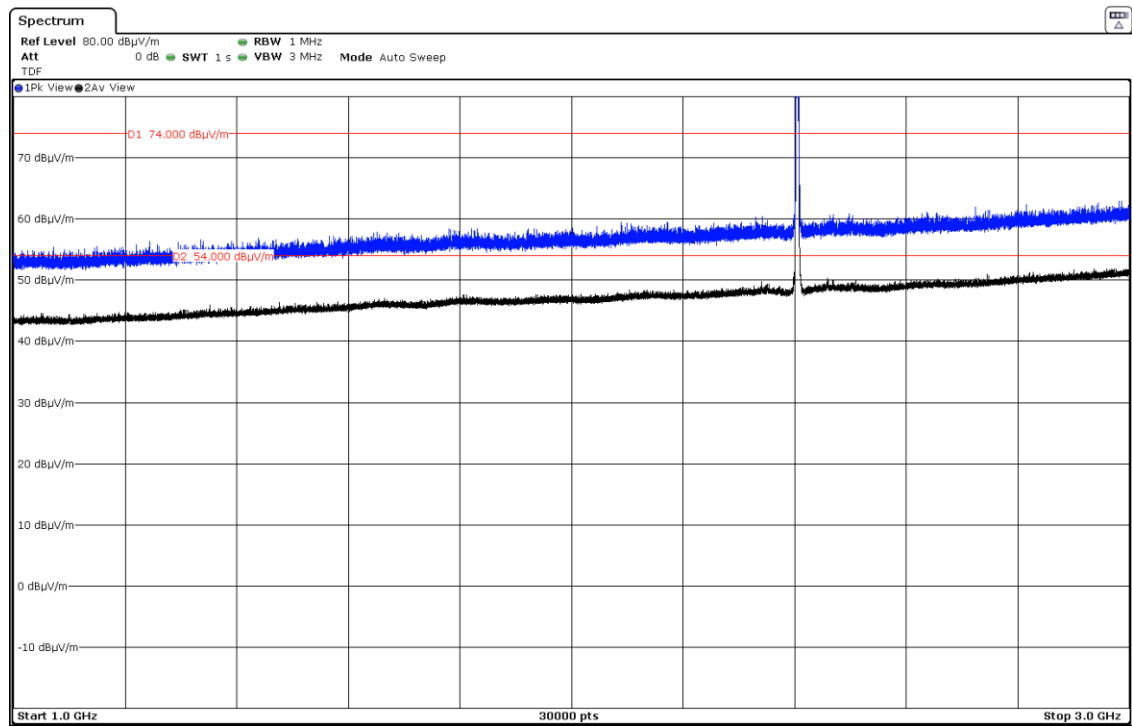
FREQUENCY RANGE 30 MHz-1000 MHz.



(This plot is valid for all three channels).

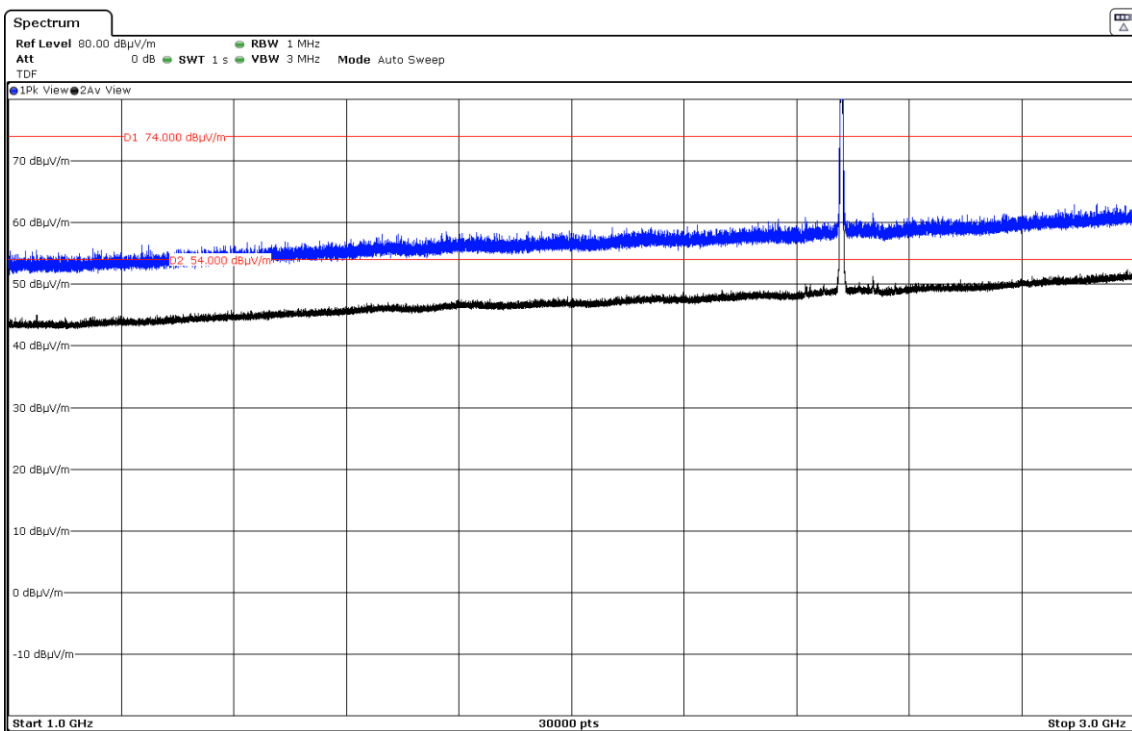
FREQUENCY RANGE 1 GHz to 3 GHz.

CHANNEL: Lowest (2405 MHz).



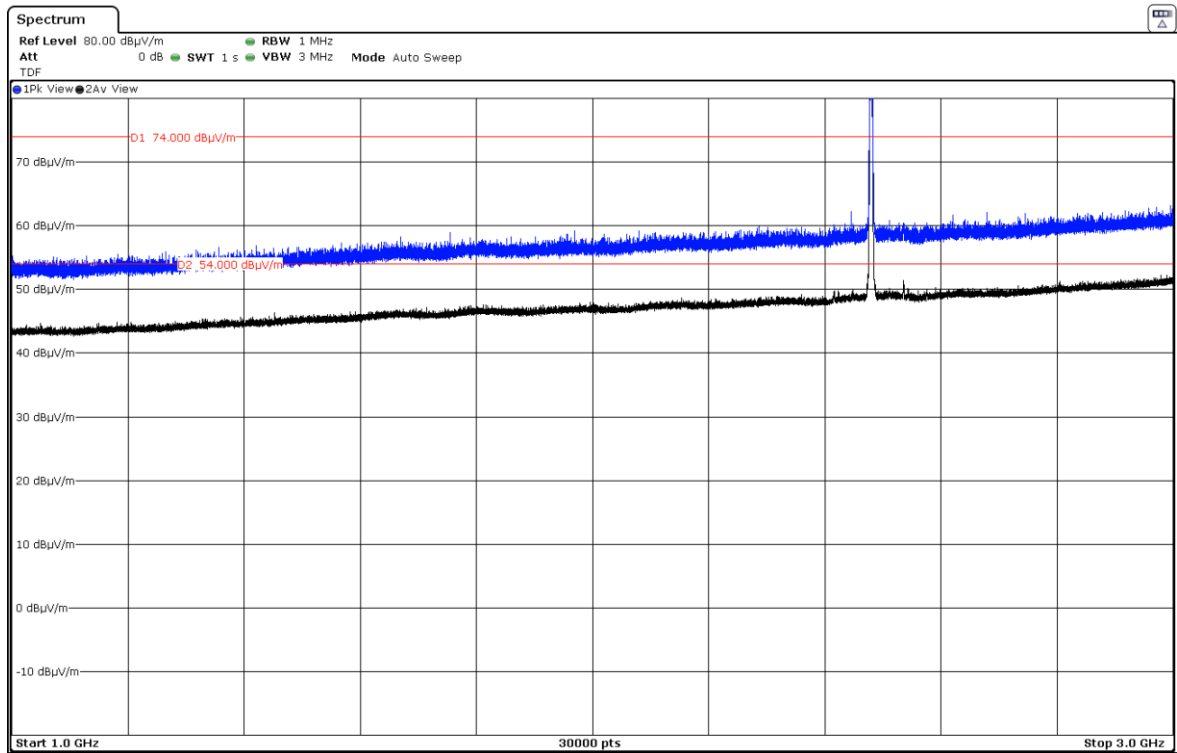
Note: The peak shown in the plot above the limit is the carrier frequency.

CHANNEL: Middle (2445 MHz).



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

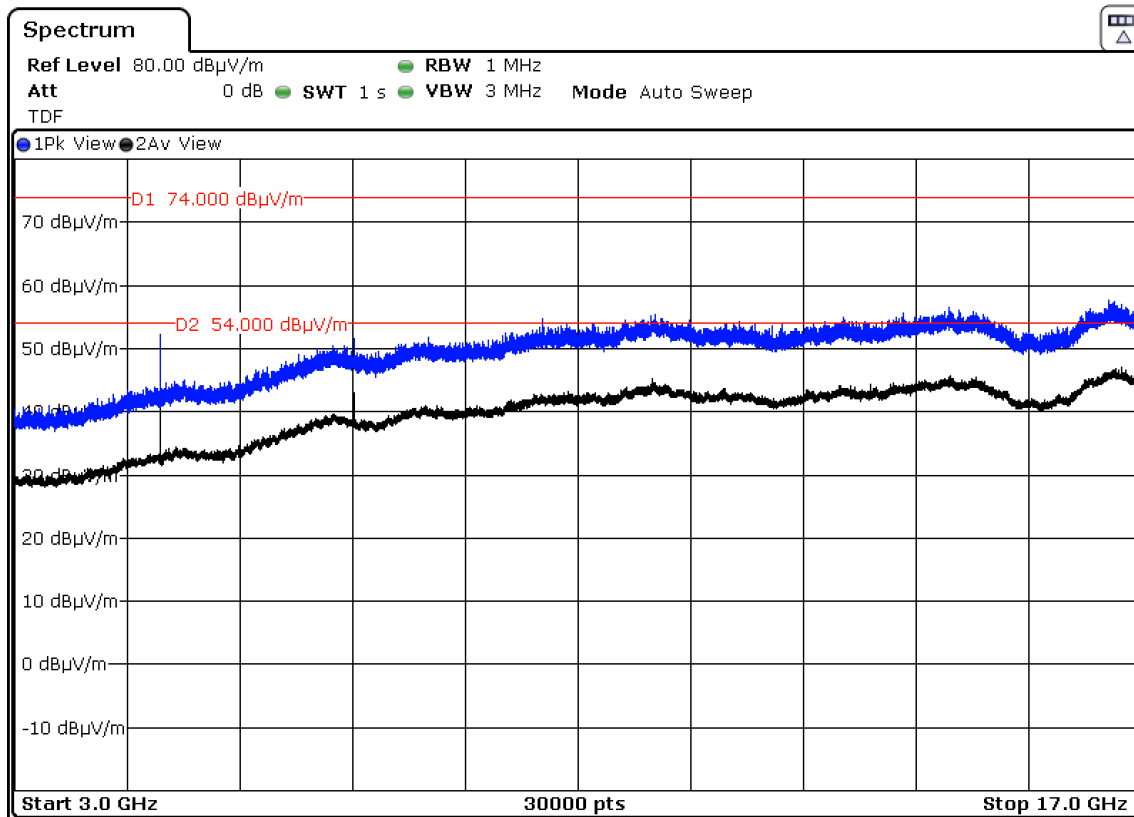
CHANNEL: Highest (2480 MHz).



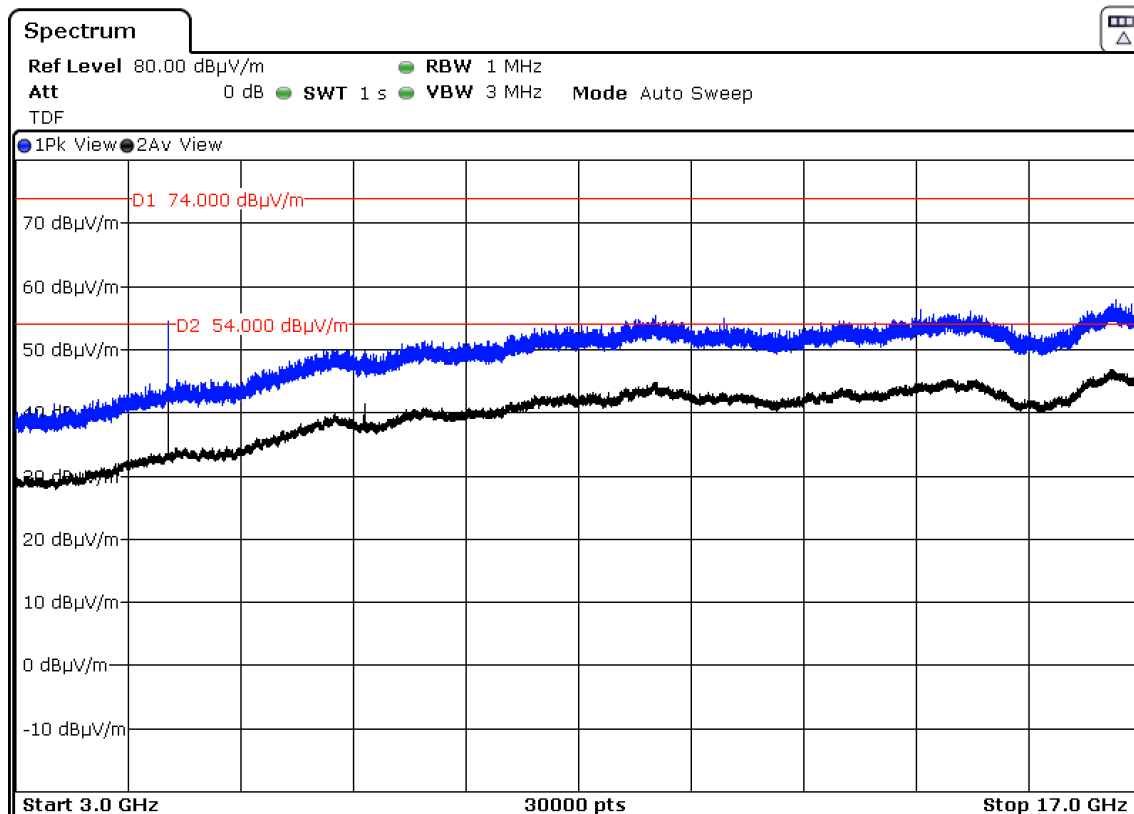
Note: The peak shown in the plot above the limit is the carrier frequency.

FREQUENCY RANGE 3 GHz to 17 GHz.

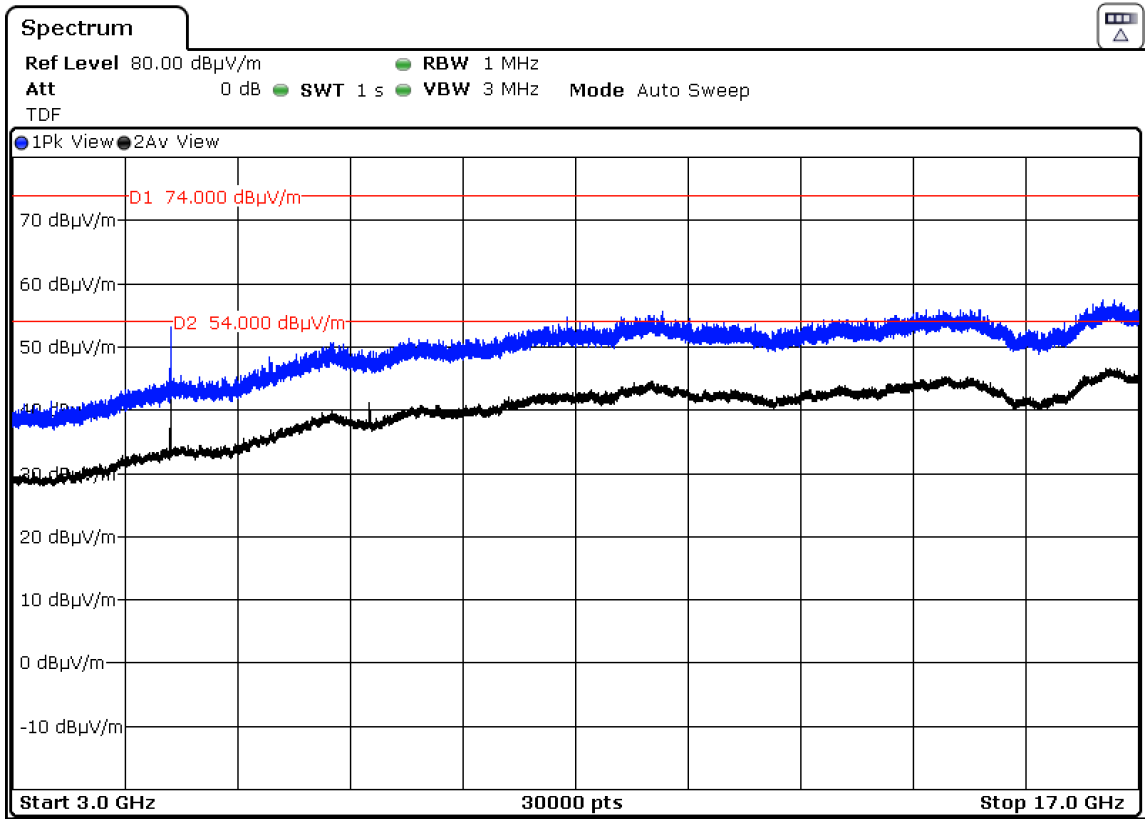
CHANNEL: Lowest (2405 MHz).



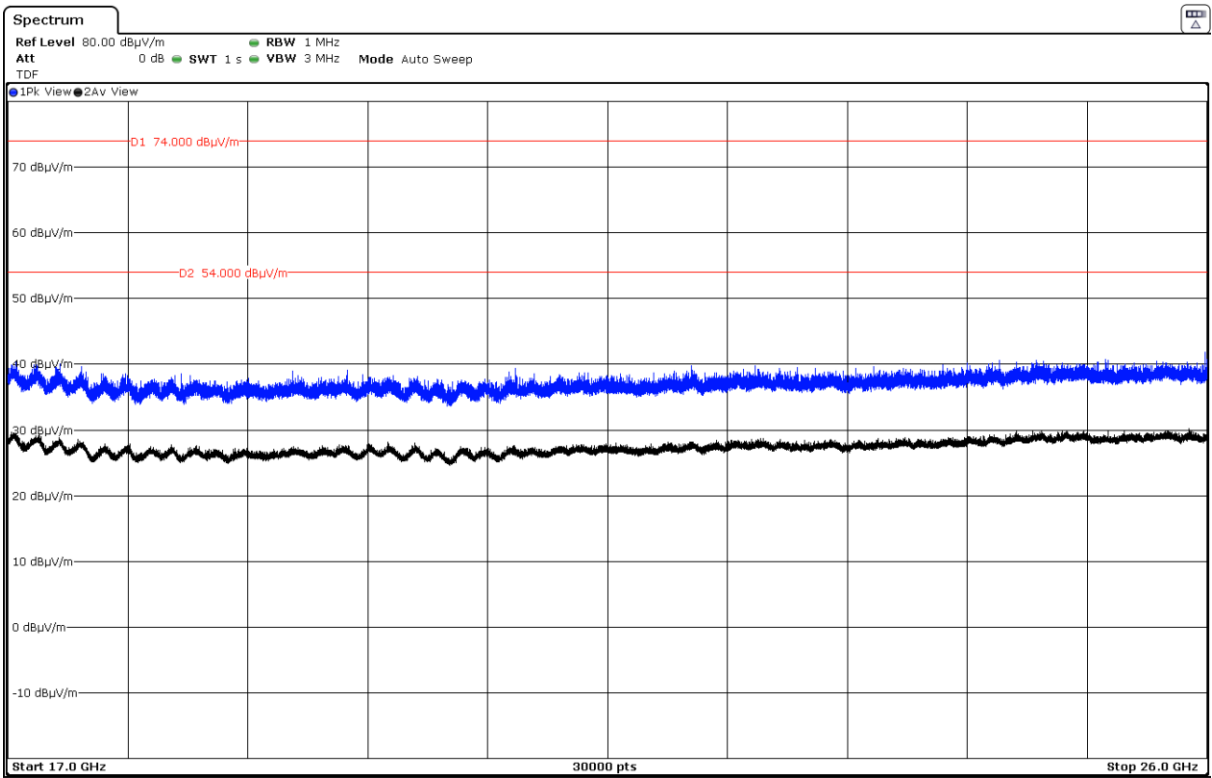
CHANNEL: Middle (2445 MHz).



CHANNEL: Highest (2480 MHz).



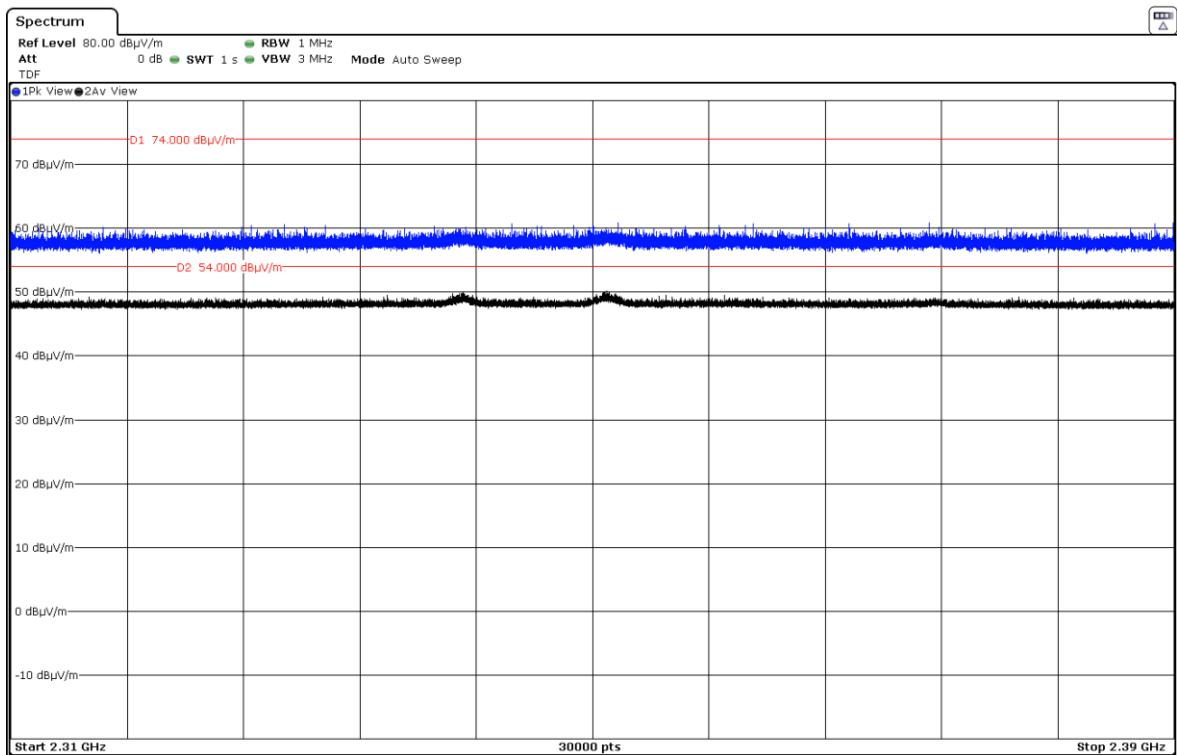
FREQUENCY RANGE 17 GHz to 26 GHz.



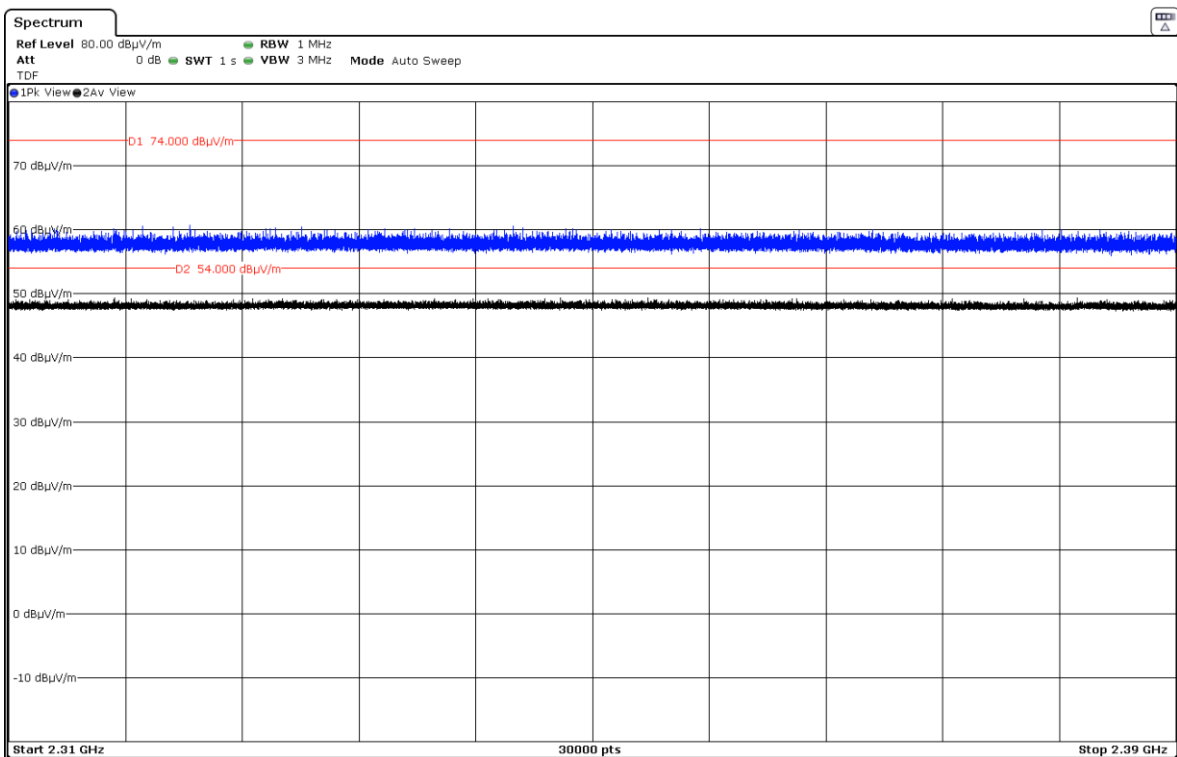
(This plot is valid for all three channels).

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

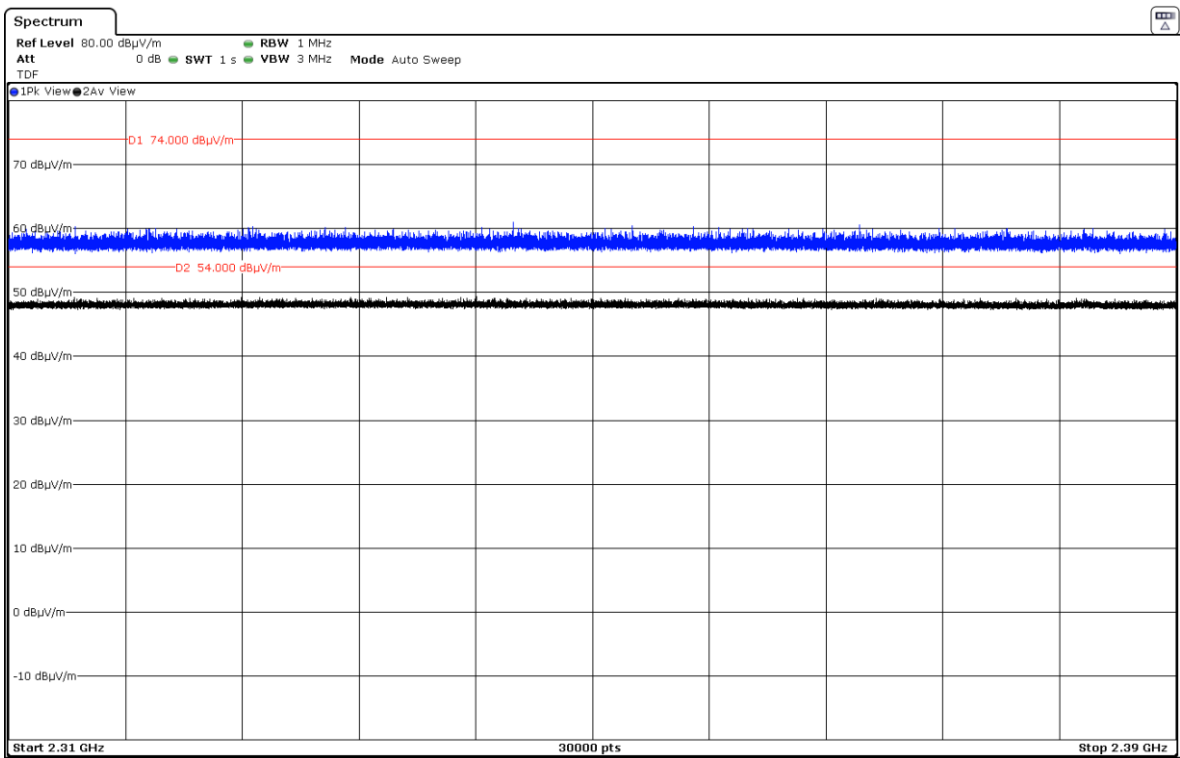
CHANNEL: Lowest (2405 MHz).



CHANNEL: Middle (2445 MHz).



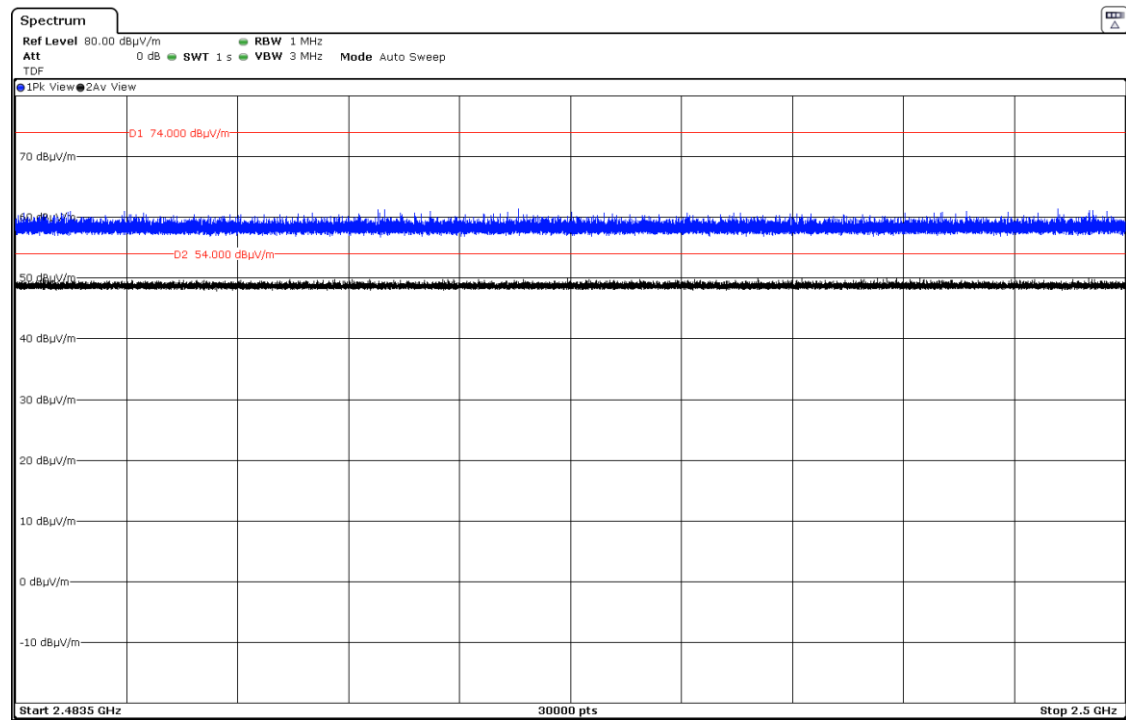
CHANNEL: Highest (2480 MHz).



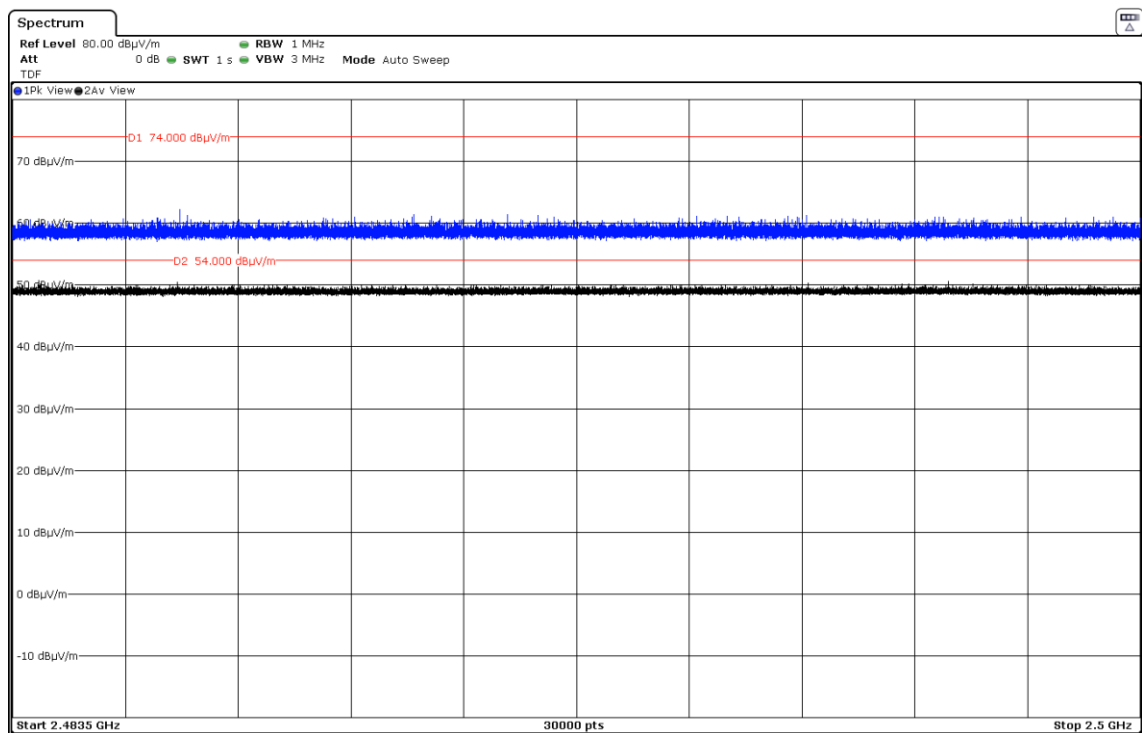
FREQUENCY RANGE 2.4835 GHz to 2.5 GHz. (RESTRICTED BAND).

NOTE: See Marker-delta method below for compliance in range 2.4835 GHz to 2.4855 GHz (Band-edge compliance of radiated emissions) for the highest operating channel.

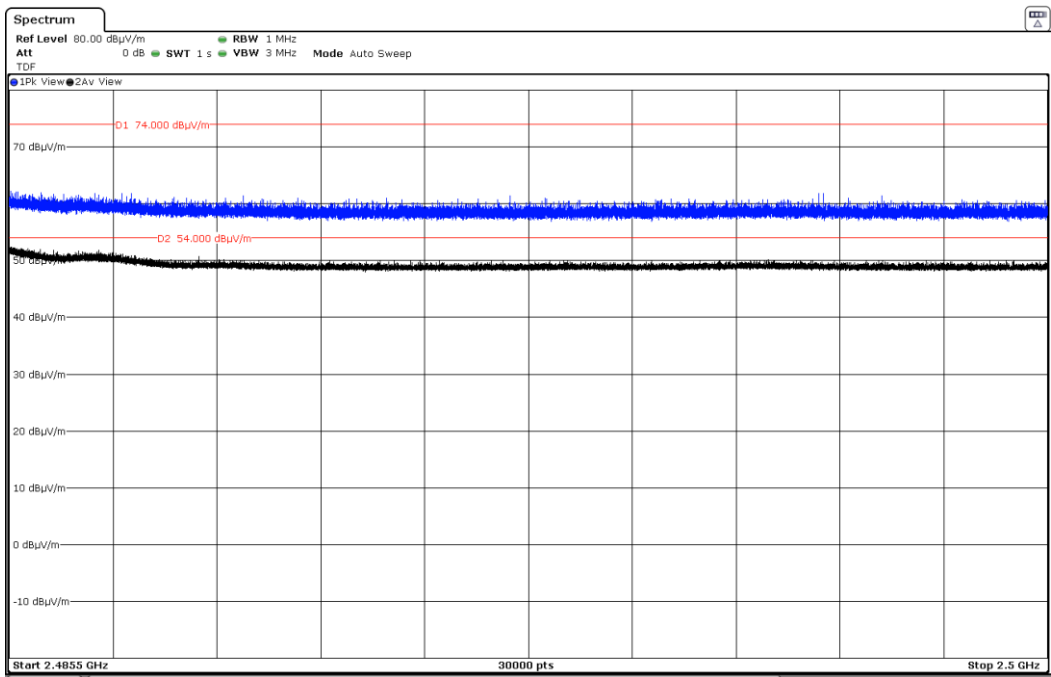
CHANNEL: Lowest (2405 MHz).



CHANNEL: Middle (2445 MHz).



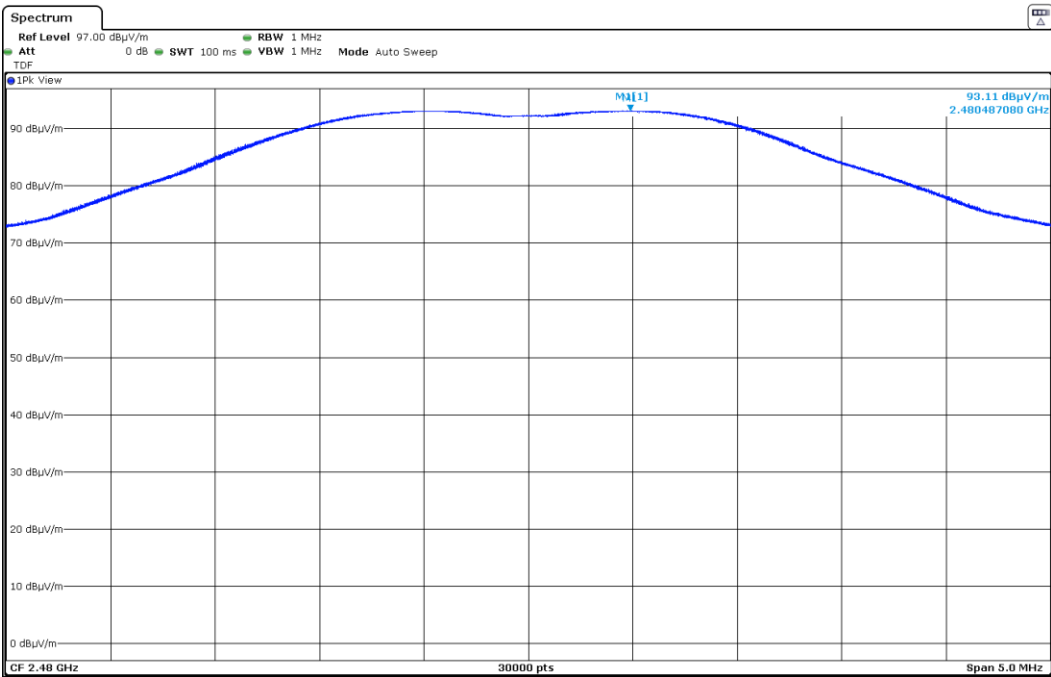
CHANNEL: Highest (2480 MHz).



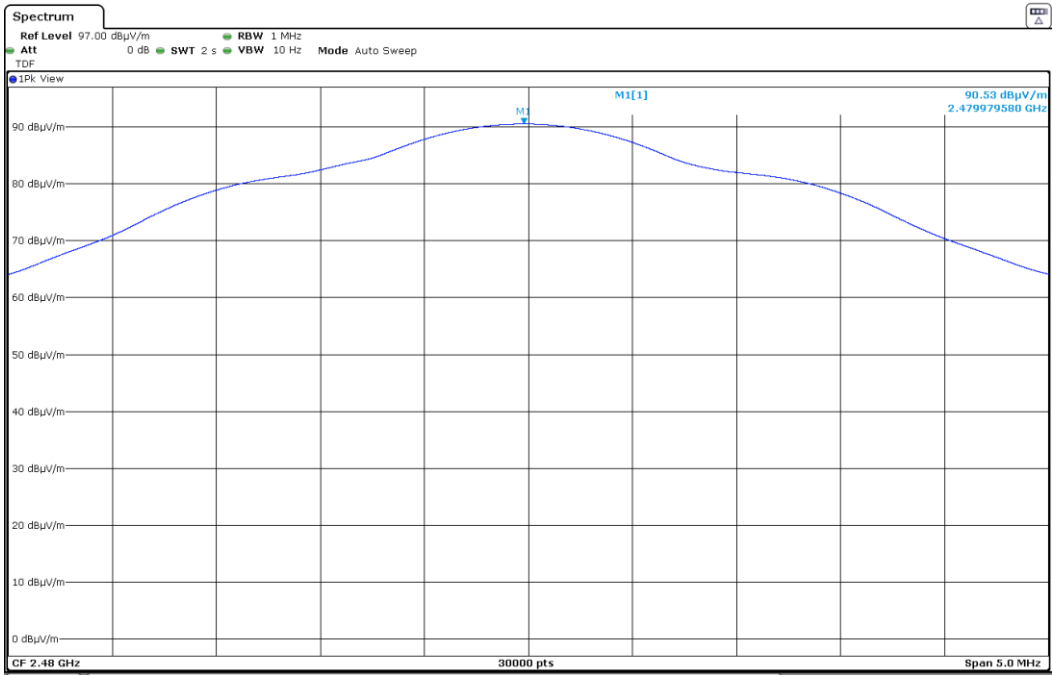
Band-edge compliance of radiated emissions in range 2.4835 GHz to 2.4855 GHz.

Maximum peak and average field strength of fundamental emission at 3 m distance.

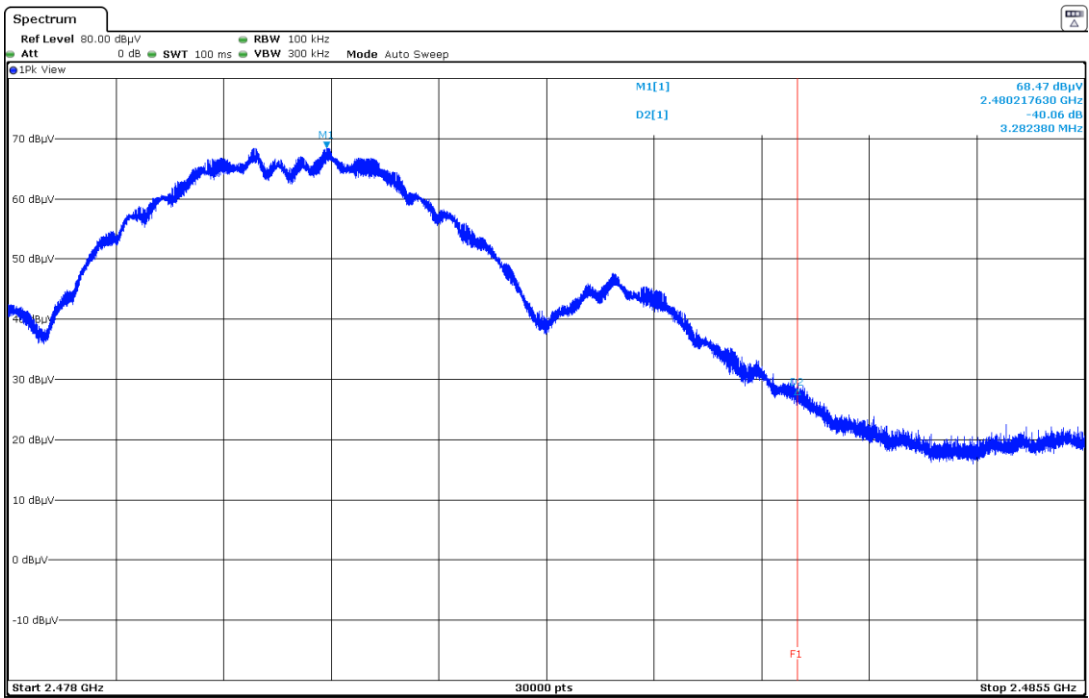
Maximum field strength at 3 m. Peak value.



Maximum field strength at 3 m. Average value.



BAND-EDGE COMPLIANCE. RADIATED. Marker-Delta Method.



Note: No correction is applied for this relative measurement.

Band edge compliance of radiated emissions

Fundamental max. average value 3 m	Delta value	Calculated value 3 m	Limit
90.53 dB μ V/m	40.06 dB	50.47 dB μ V/m	54 dB μ V/m

Fundamental max. Peak value 3 m	Delta value	Calculated value 3 m	Limit
93.11 dB μ V/m	40.06 dB	53.05 dB μ V/m	74 dB μ V/m

Verdict: PASS