



Test report No:
NIE: 63330RRF.006

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	Wireless Charger Secondary Side
(*) Trademark	DELTA
(*) Model and /or type reference	WSU 1000W 48V
Other identification of the product	HW version: P2.5 SW version: 4.0 FCC ID: Not provided IC: Not provided
(*) Features	Supports 802.15.4 @ 2.4GHz RF transceiver
Applicant	DELTA ENERGY SYSTEMS (GERMANY) GMBH Tscheulinstrasse 21 79331 TENINGEN GERMANY
Test method requested, standard	USA FCC Part 15.247 (10-1-18) Edition: Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz. 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. FCC 15.247 (d) / RSS-247 5.5. Emission limitations radiated (Transmitter)
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2020-05-22
Report template No	FDT08_22 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

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

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

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

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

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General conditions

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

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

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
2. The sample of the model DELTA WSU 1000W 48V is the Secondary side of an automotive wireless charger (load receiver) feeded at 48 Vdc. Secondary side includes On-Board-Pad and On-Board-Electronics, and a cable between them. Normally secondary side is installed on moving devices like AGVs.

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 result.

Usage of samples

Samples undergoing test have been selected by: The client.

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

Control N°	Description	Model	Serial N°	Reception
63330/004	Wireless Charger	WSU 1000W 48V	--	2020/01/20

Auxiliary elements used with the Sample S/01:

Control N°	Description	Model	Serial N°	Reception
63330/002	Power Supply 48 Vdc	EOE14010803	EOE140108031943000126P2.5	2020/01/20

Sample S/01 has undergone the test(s): All the 48 Vdc 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⁾
	AC input.	1m	☒	☐	☐
	Power output.	0.5m	☒	☐	☐
	Signal interface for CAN-Bus.	0.5m	☒	☐	☐
	Signal inputs for Ext_Enable function and Sleep mode function.	0.5m	☒	☐	☐
Temperature sensor	0.5m	☒	☐	☐	
Supplementary information to the ports..... :	Not provided.				
Rated power supply	Voltage and Frequency				
	☒ DC: 48 Vdc				
Rated Power	1000W				
Clock frequencies.....	160...300kHz, 2.4GHz bands.				
Other parameters	Not provided.				
Software version	4.0.				
Hardware version	P2.5				
Dimensions in cm (W x H x D)	Secondary side: 16 * 8.2 * 2.8 + 16 (diameter) * 1.9				
Mounting position	☒ Other: Secondary side can be mounted vertically on the side of a vehicle, or horizontally on the bottom/top of a vehicle.				
Modules/parts..... :	Module/parts of test item	Type	Manufacturer		
	Secondary side.	WSU 1000W 48V	DELTA ENERGY SYSTEMS (GERMANY) GMBH		
Accessories (not part of the test item)	Description	Type	Manufacturer		
	Not provided.				
Documents as provided by the applicant	Description	File name	Issue date		
	User manual.	1kW Wireless Charger User Manual P2.3 RevD.2 22_Jan_2020	Jan 22 nd , 2020		

⁽³⁾ Only applicable to medical equipments.

Identification of the client

DELTA ENERGY SYSTEMS (GERMANY) GMBH
Tscheulinstrasse 21, 79331 TENINGEN, GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-03-05
Date (finish)	2020-03-09

Document history

Report number	Date	Description
63330RRF.006	2020-05-22	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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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

Remarks and comments

The tests have been performed by the technical personnel: José Manuel Jiménez, Nicolás Salguero, Cristina Calle.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	Shielded Room ETS LINDGREN S101	N.A.	N.A.
3.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2017/04	2020/04
4.	Pre-Amplifier G>40dB 10MHz-6GHz, BONN ELEKTRONIK, BLNA 0160-01N	2020/02	2021/02
5.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
6.	Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
7.	RF Pre-amplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2019/04	2020/04
8.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/09	2021/09
9.	Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
10.	Pre- Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02

Testing verdicts

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

Summary

1. 802.15.4 - 2.4 GHz.

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(1) / RSS-247 5.1. (b)	20 dB Bandwidth and Carrier frequency separation	N/M	
FCC 15.247 (a)(1)(iii) / RSS-247 5.1. (d)	Number of hopping channels	N/M	
FCC 15.247 (a)(1)(iii) / RSS-247 5.1. (d)	Time of occupancy (Dwell Time)	N/M	
FCC 15.247 (b) / RSS-247 5.4. (b)	Maximum peak output power and antenna gain	N/M	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	(1)
Supplementary information and remarks:			
(1) Only test requested.			

Appendix A: Test results. 802.15.4 - 2.4 GHz

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 48 Vdc
Type of Power Supply: External (battery of the vehicle).

ANTENNA:

Maximum Declared Antenna Gain: +2.09 dBi
Type of Antenna: Integral.

TEST FREQUENCIES:

Low Channel: 2405 MHz
Middle Channel: 2445 MHz
High Channel: 2480 MHz

RADIATED MEASUREMENTS:

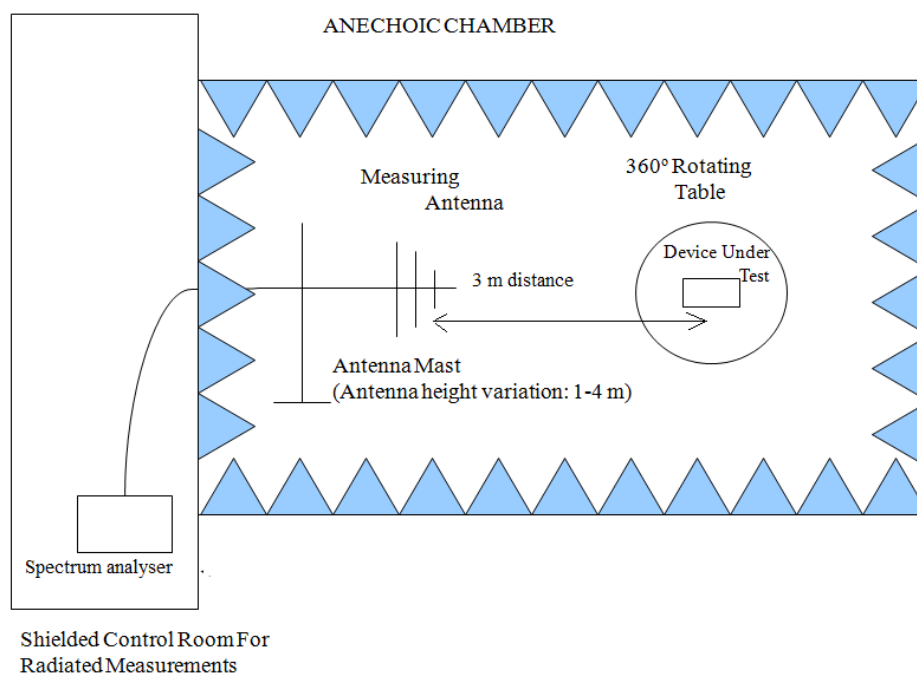
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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

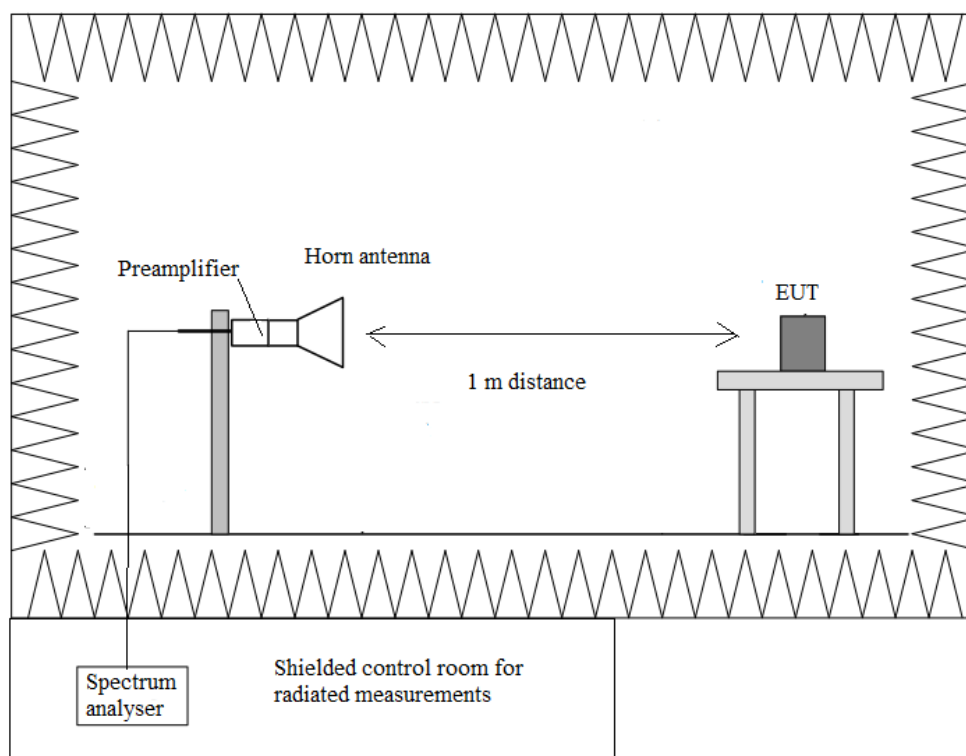
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup $f > 1$ GHz:



FCC 15.247 (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.

- **48 Vdc:**

Frequency range 30 MHz - 1 GHz:

The spurious frequencies detected do not depend neither on the operating channel or the modulation mode.

Spurious frequencies detected at less than 20 dB below the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
146.998	Quasi peak	32.6	V	<± 3.81
186.025	Quasi peak	26.1	V	<± 3.81
261.200	Quasi peak	26.3	V	<± 3.81
292.854	Quasi peak	26.4	H	<± 3.81
305.787	Quasi peak	26.0	V	<± 3.81
320.240	Quasi peak	27.5	H	<± 3.81
576.029	Quasi peak	26.0	V	<± 3.81

Verdict: PASS

Frequency range 1 - 26 GHz:

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

Spurious frequencies 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. Spurious frequencies detected below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
2.38609	Peak	50.15	V	<± 4.70
4.80997	Peak	43.41	V	<± 4.70

- MIDDLE CHANNEL. Spurious frequencies detected below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dBμV/m)	Polarization	Measurement Uncertainty (dB)
4.88977	Peak	40.63	V	<± 4.70

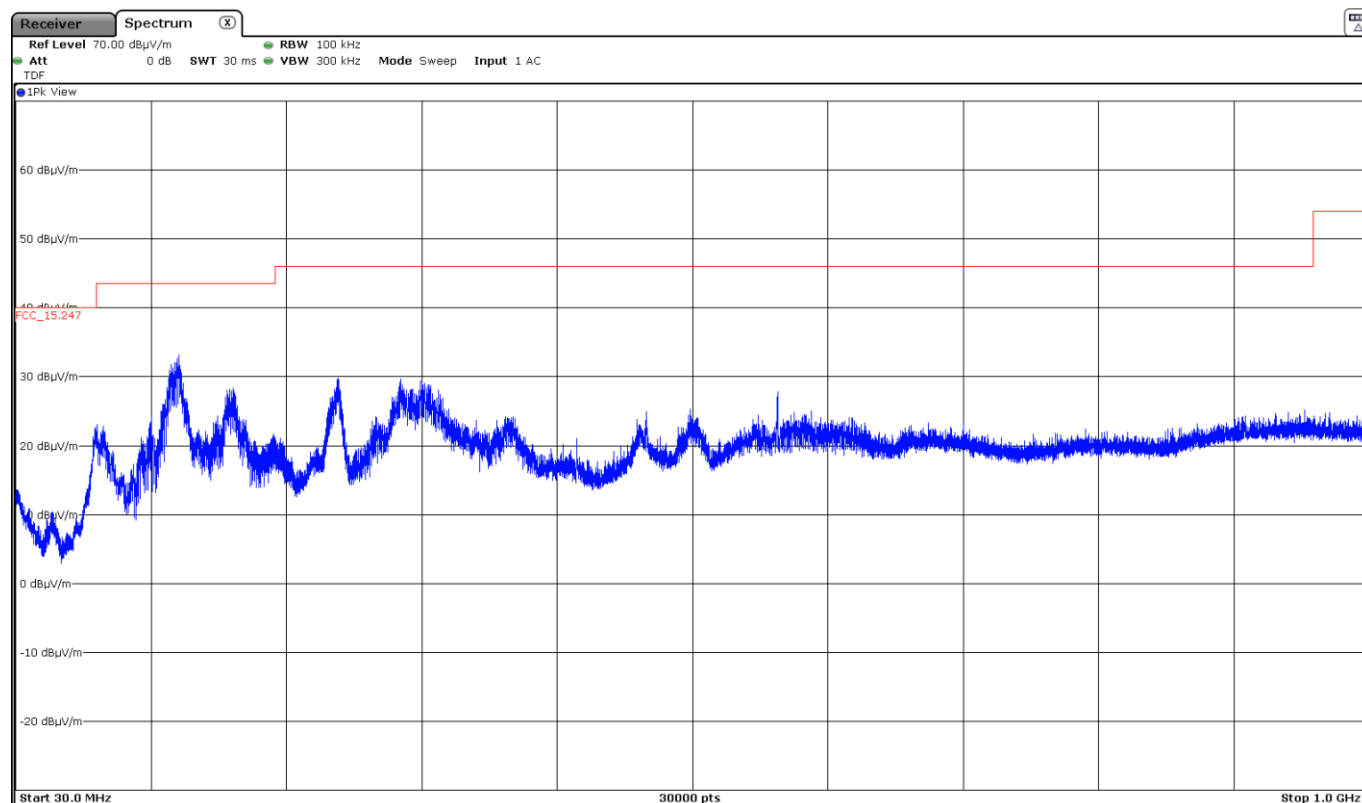
- HIGH CHANNEL. Spurious frequencies detected below the limit:

Spurious frequency (GHz)	Detector	Emission Level (dB μ V/m)	Polarization	Measurement Uncertainty (dB)
2.48354	Peak	56.73	V	< $\pm$ 4.70
	Average	51.38		< $\pm$ 4.70
4.96023	Peak	36.78	V	< $\pm$ 4.70
5.09790	Peak	34.58	H	< $\pm$ 4.70

Verdict: PASS

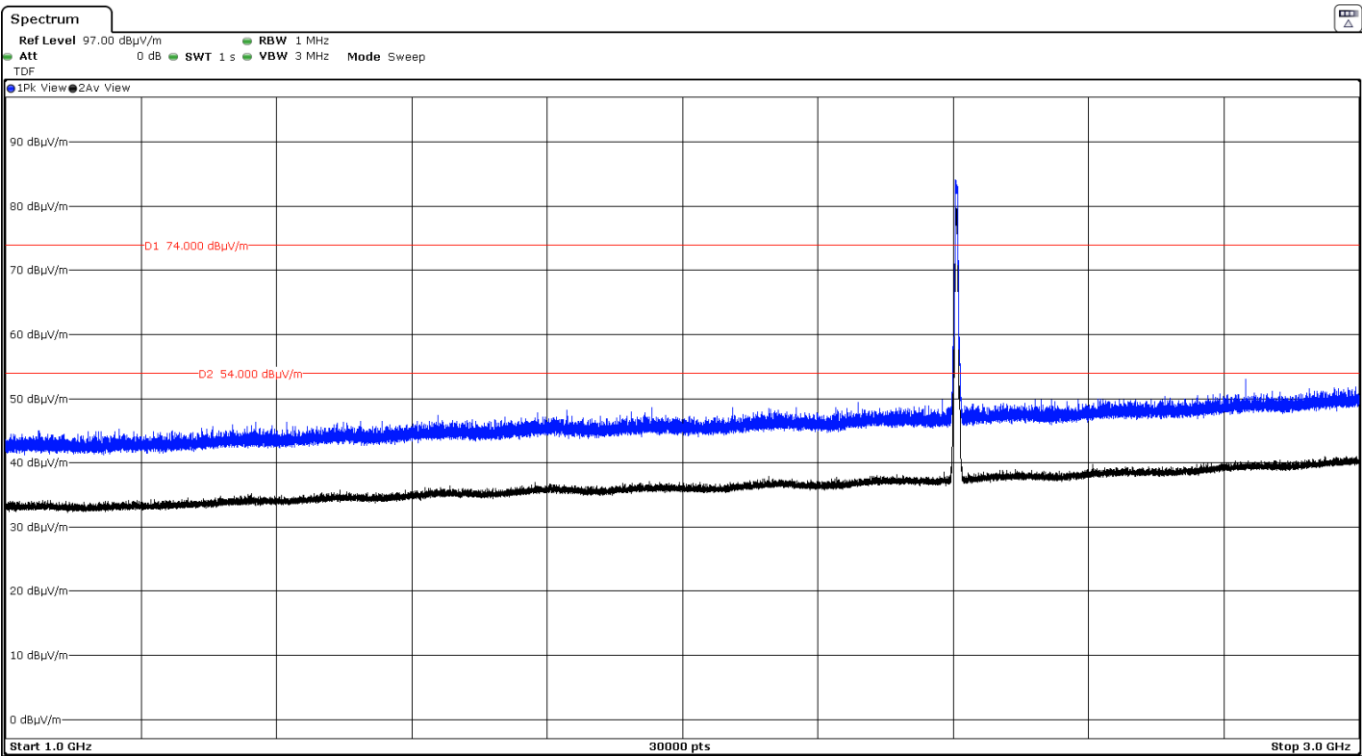
FREQUENCY RANGE 30 MHz - 1 GHz

The spurious frequencies do not depend on the operating channel.



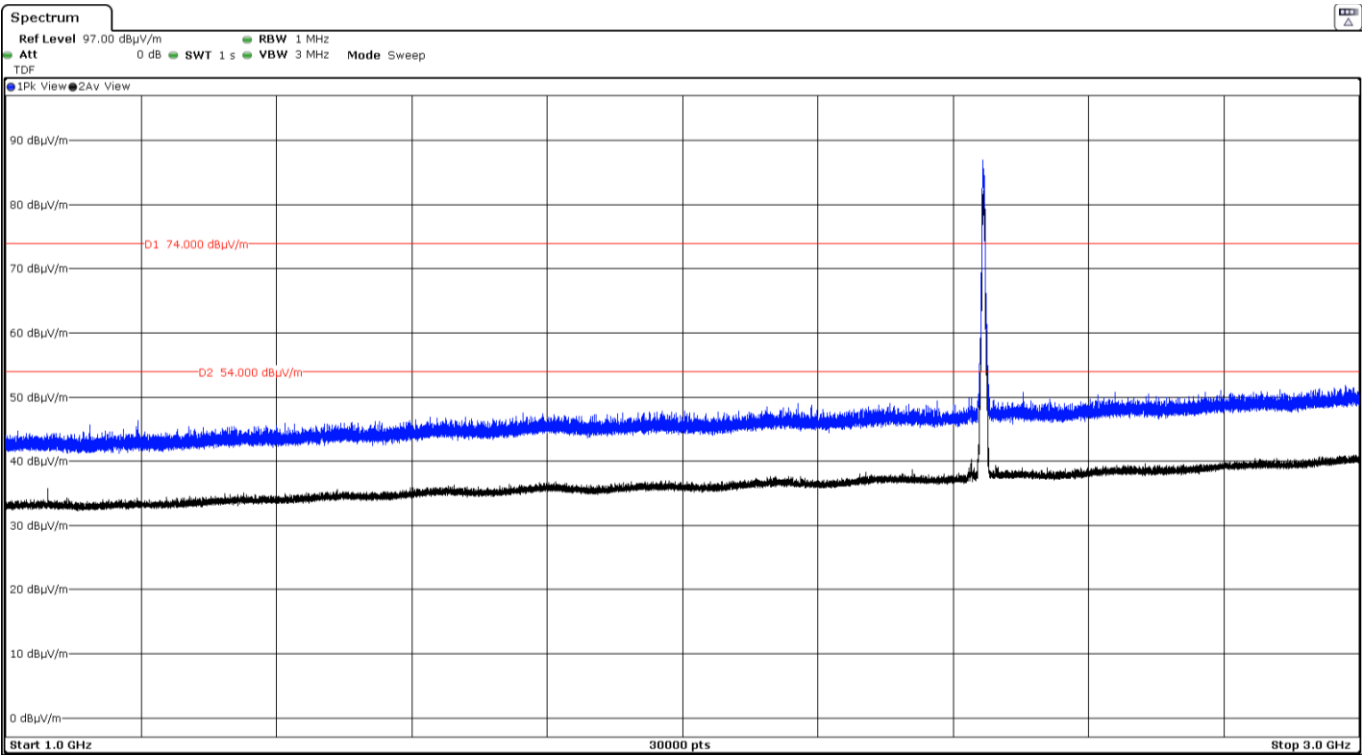
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



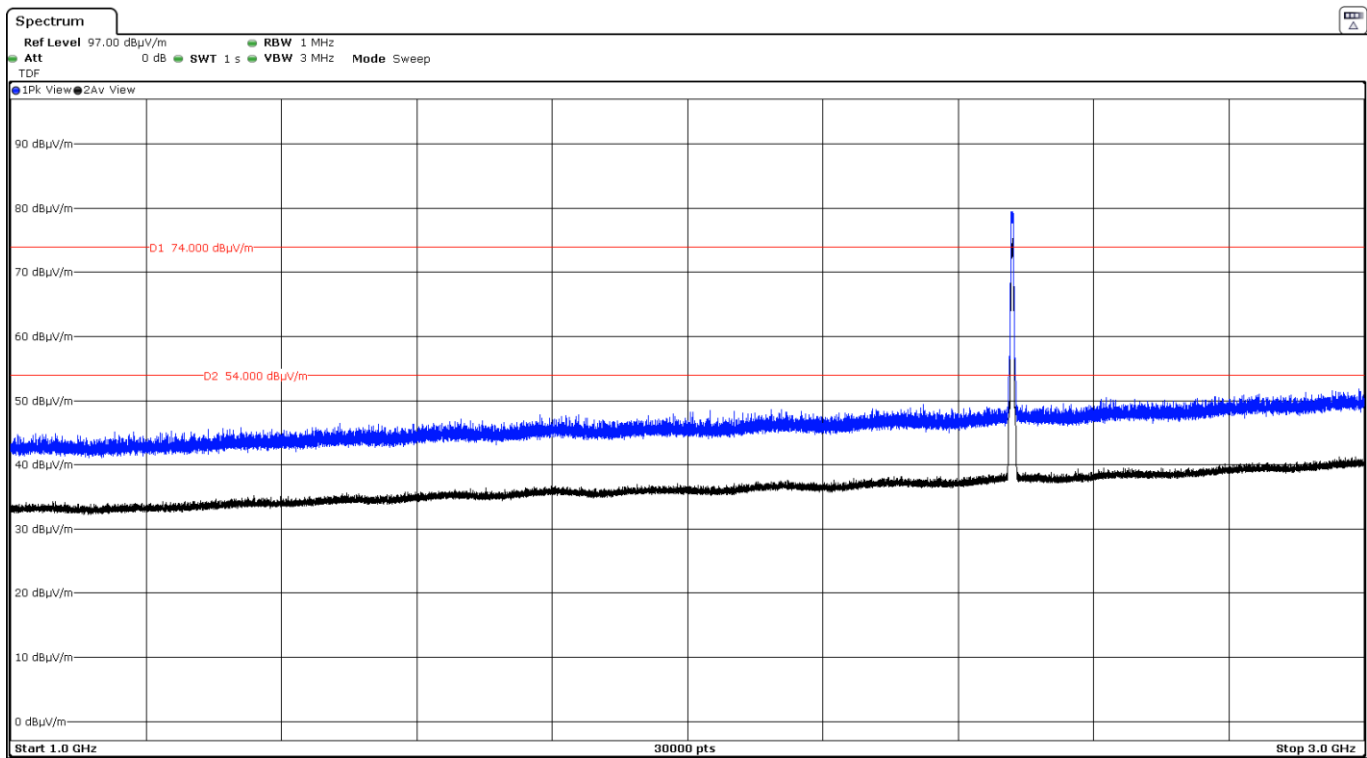
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

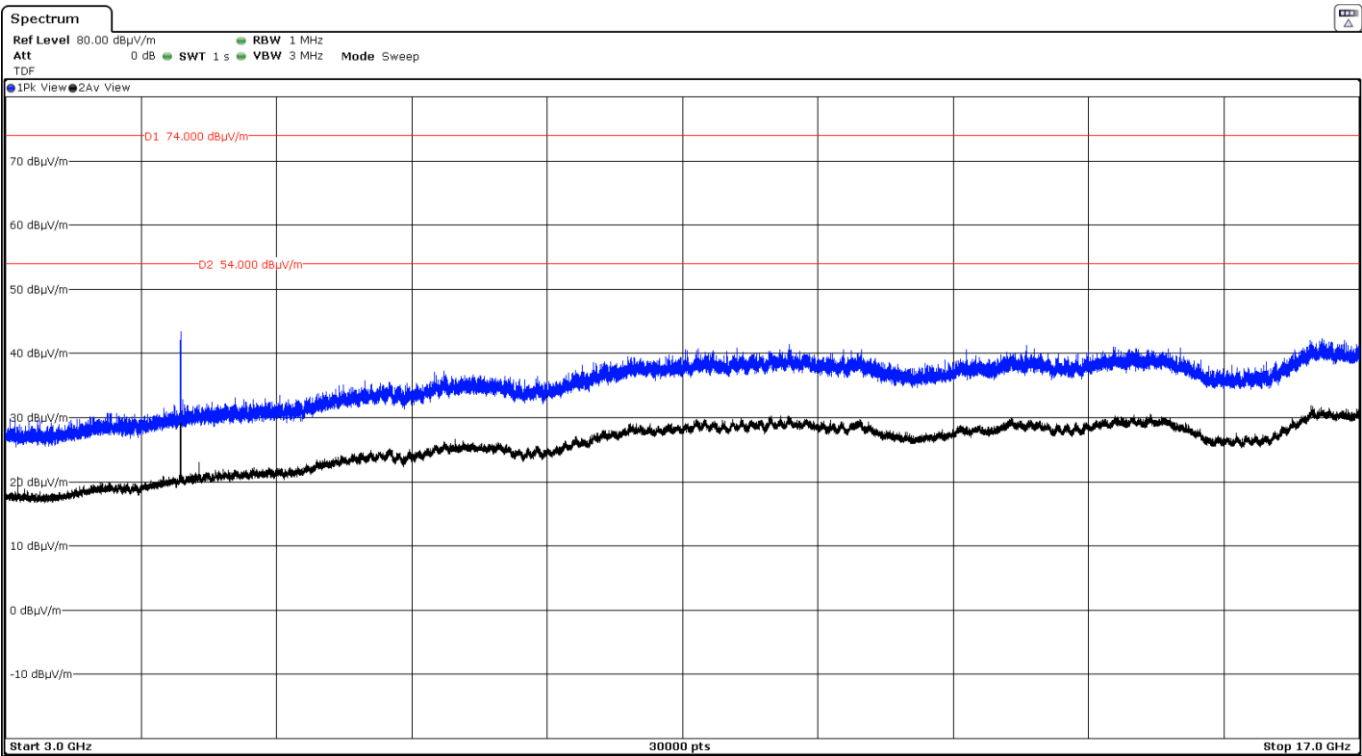
- High Channel:



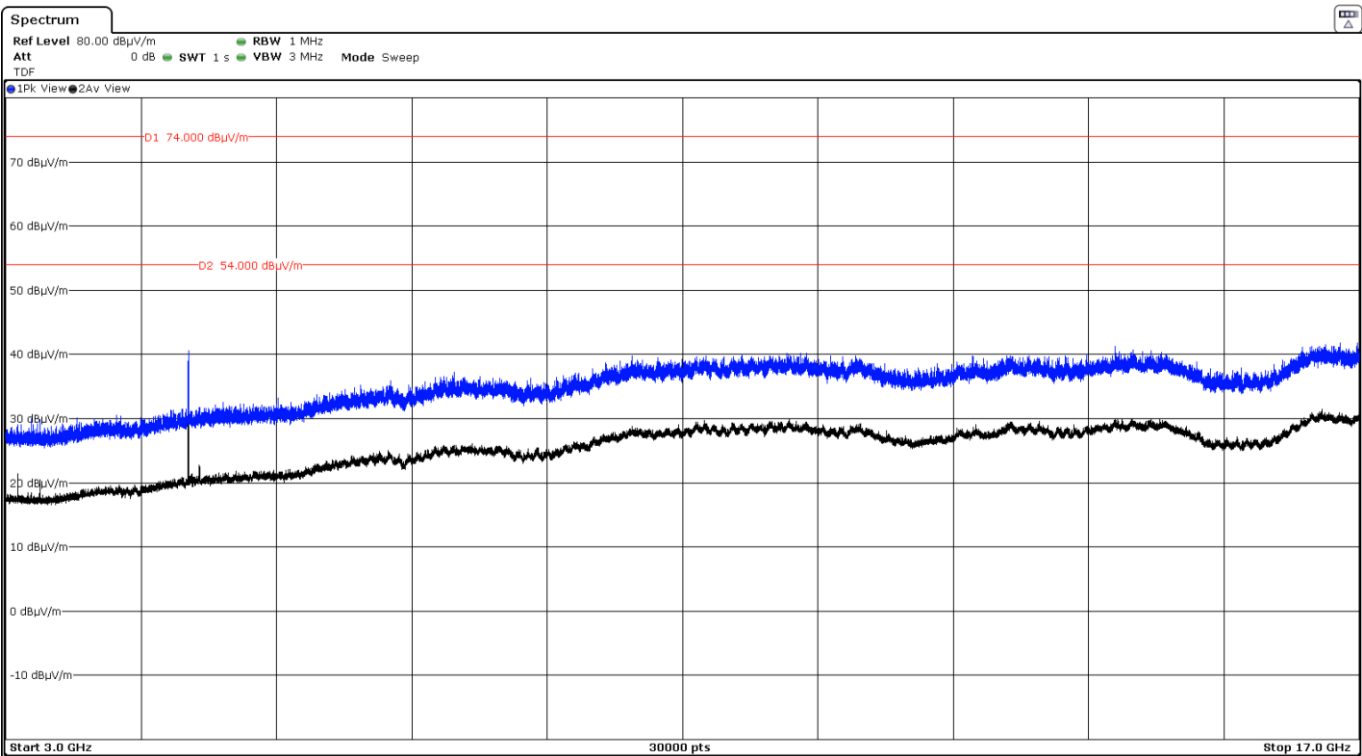
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

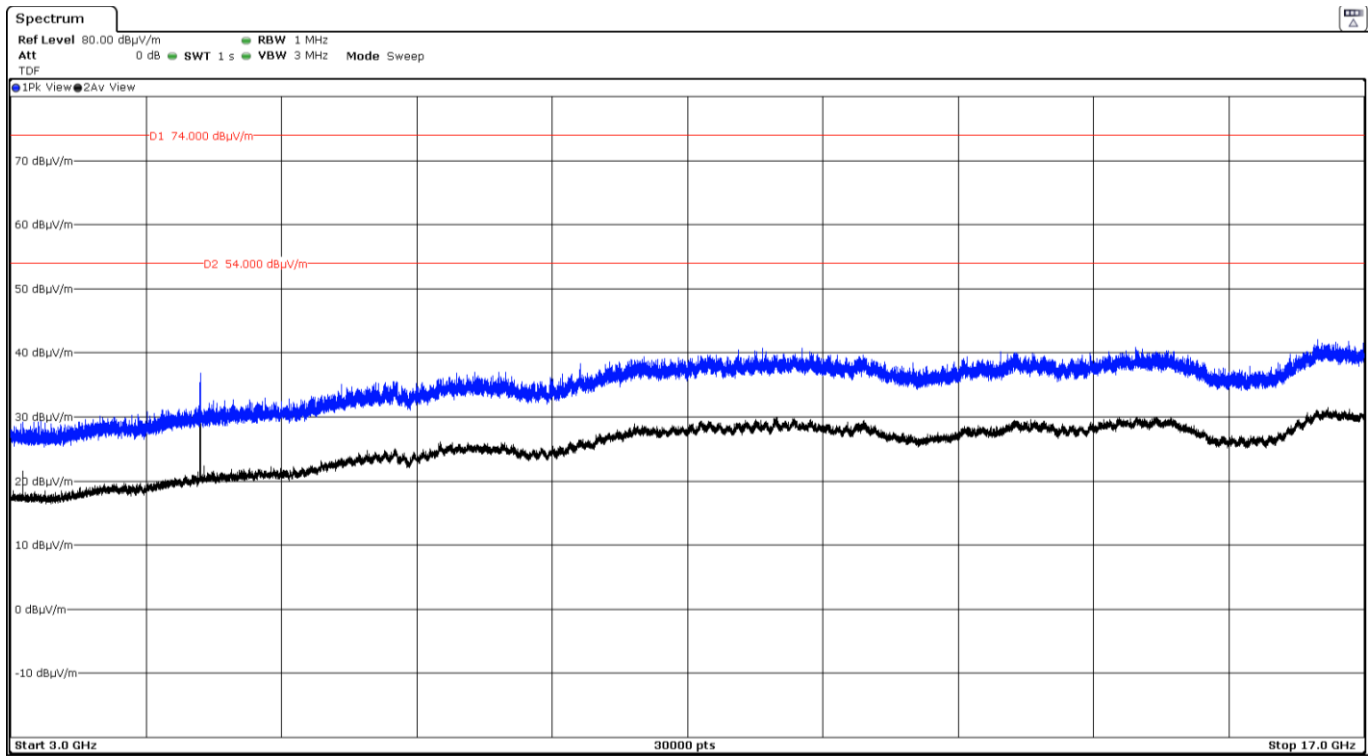
- Low Channel:



- Middle Channel:

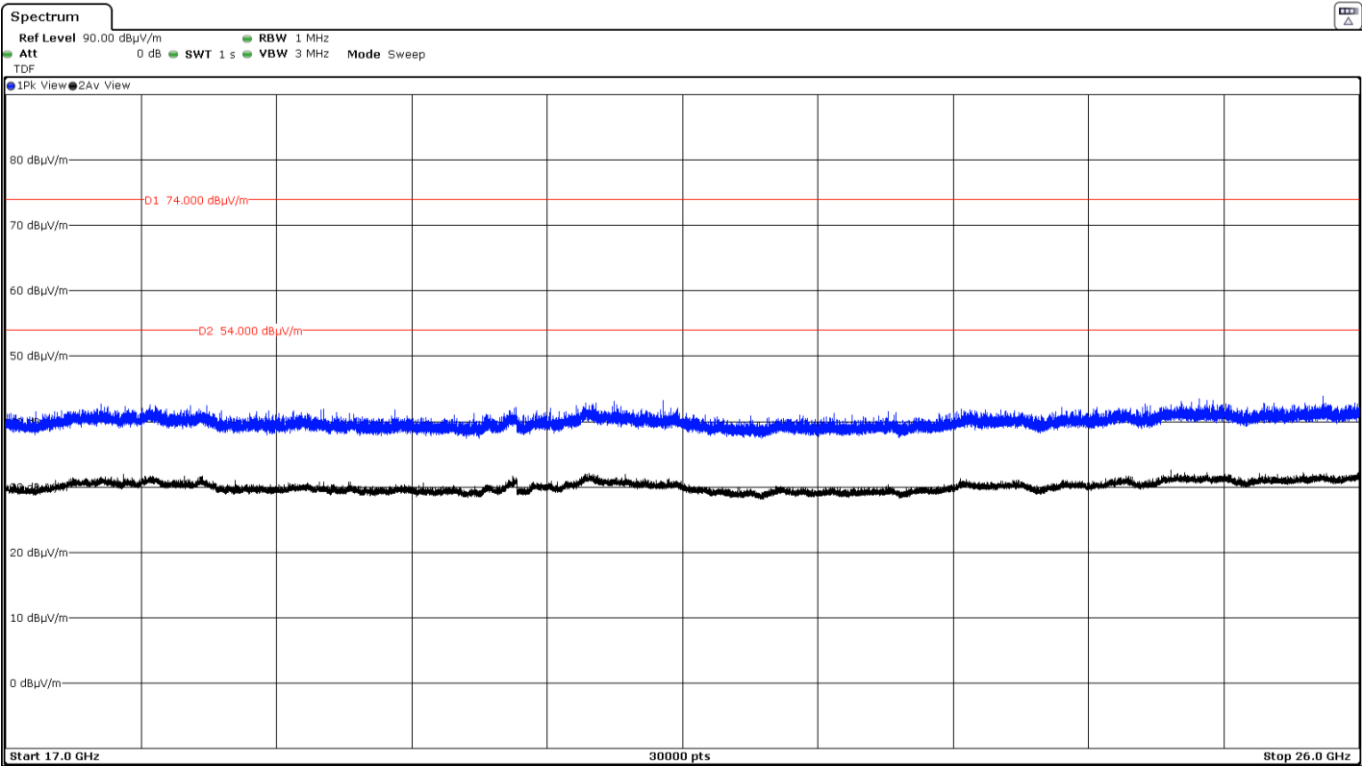


- High Channel:



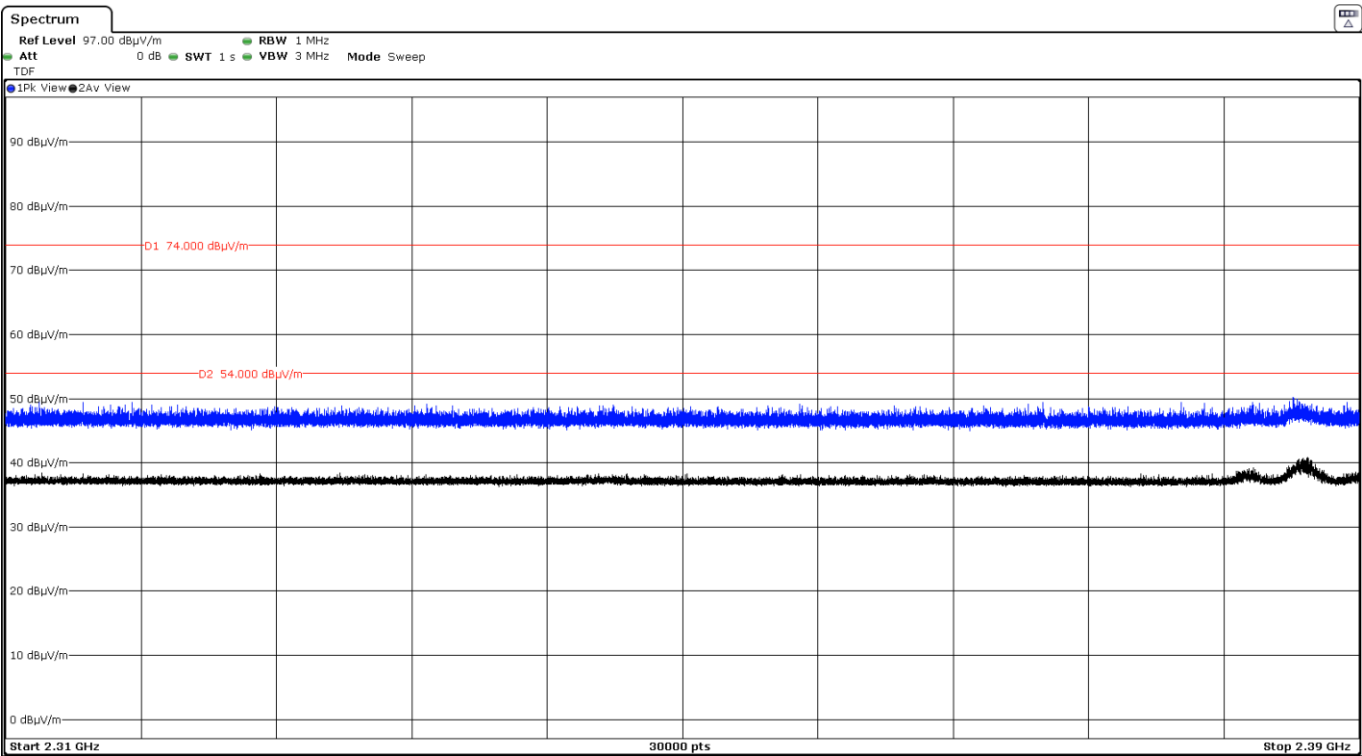
FREQUENCY RANGE 17 - 26 GHz

The spurious frequencies do not depend on the operating channel.

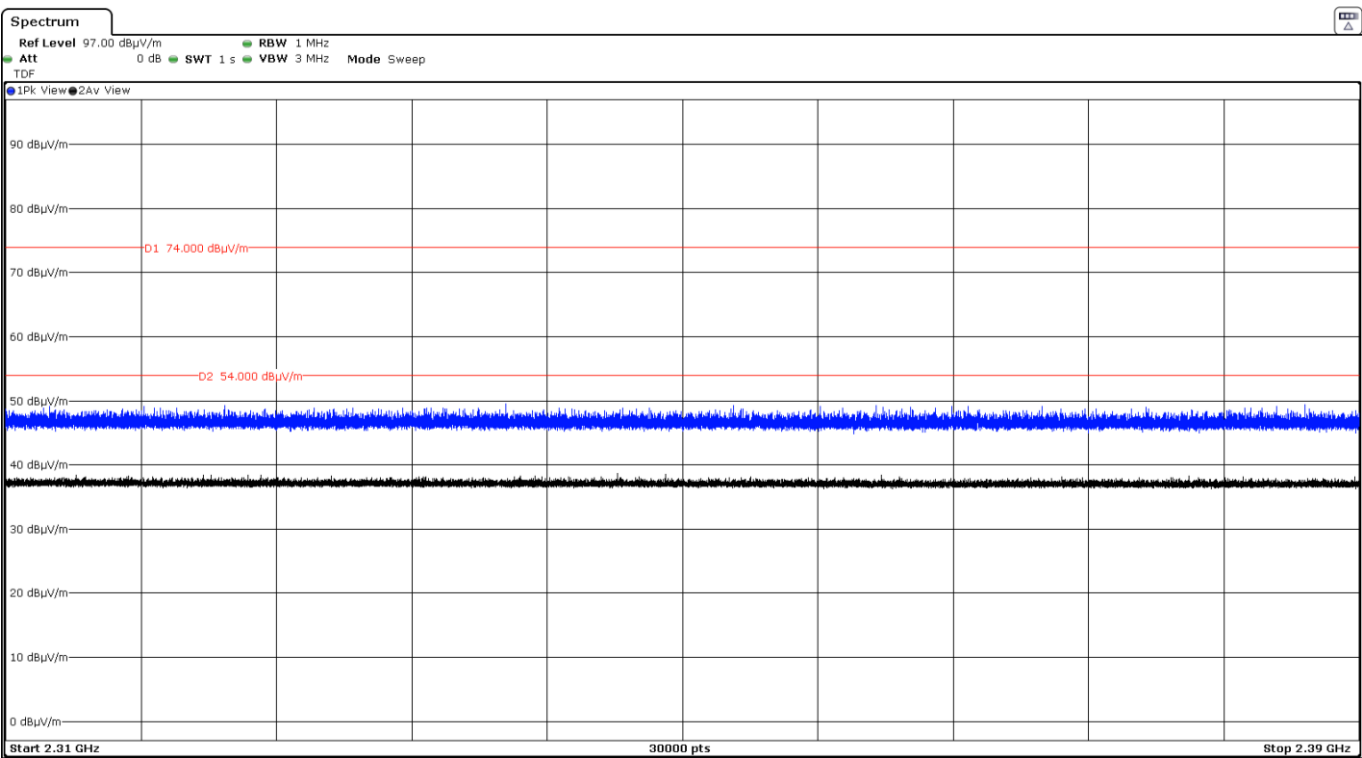


FREQUENCY RANGE 2.31 - 2.39 GHz

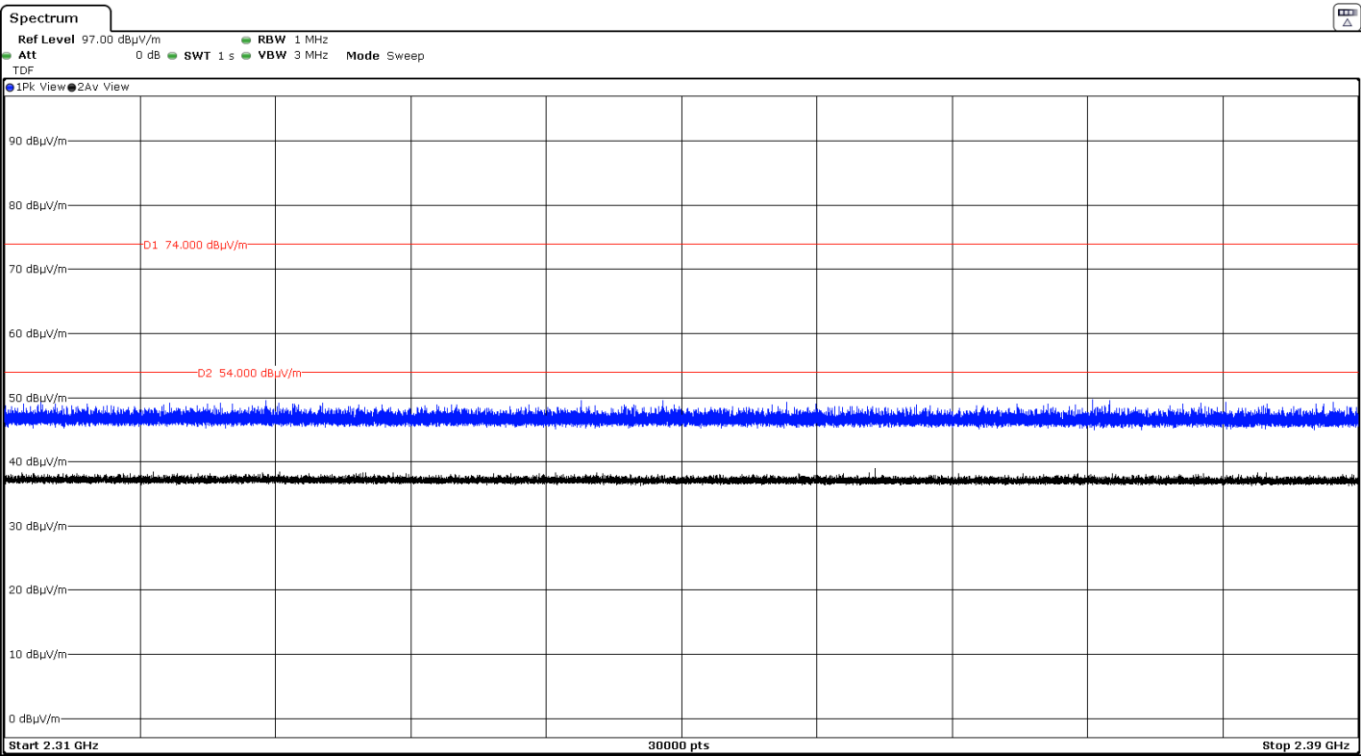
- Low Channel:



- Middle Channel:

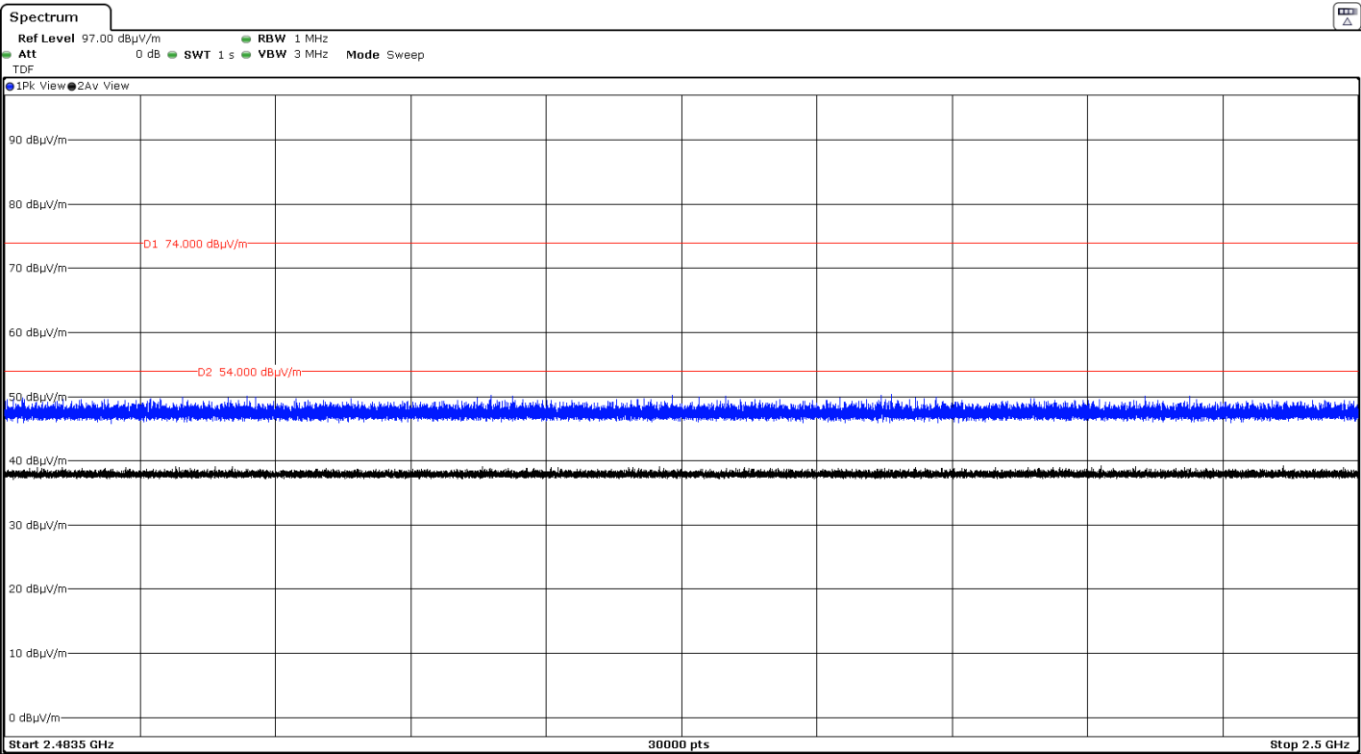


- High Channel:

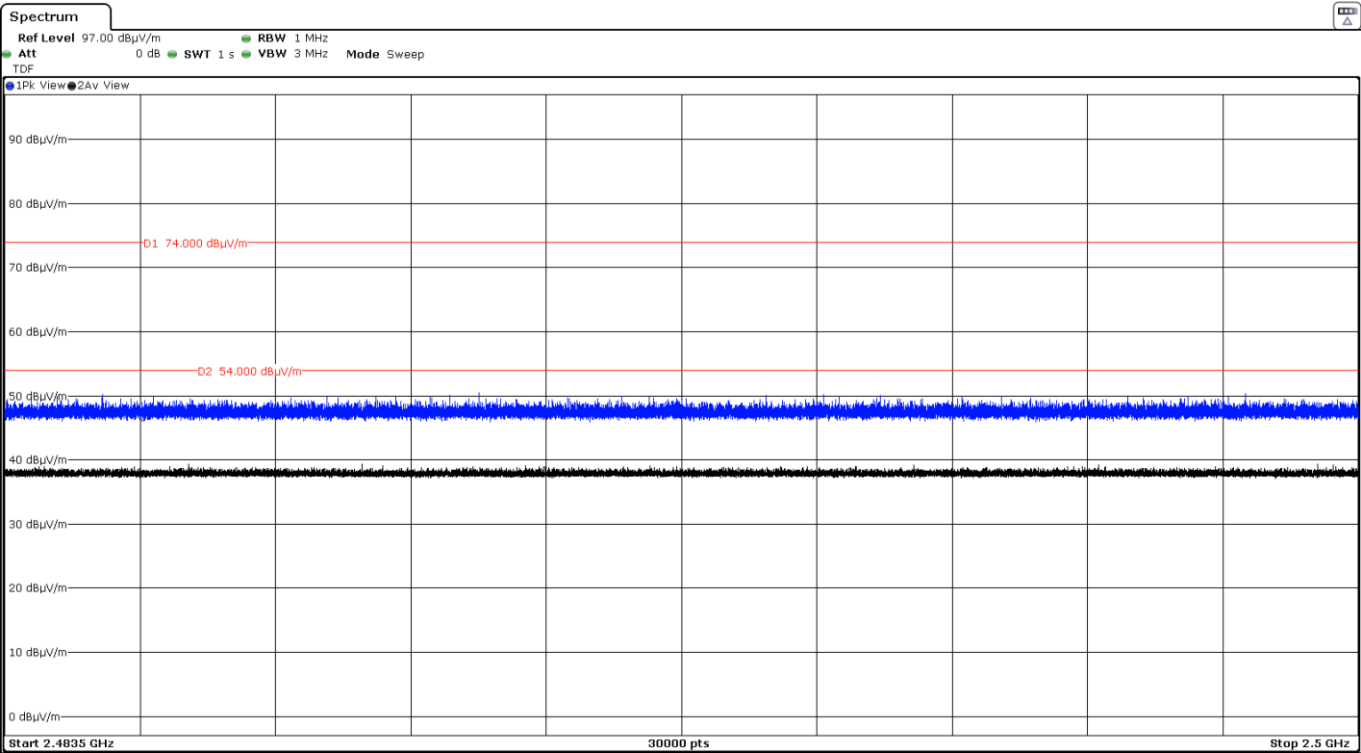


FREQUENCY RANGE 2.4835 - 2.5 GHz

- Low Channel:



- Middle Channel:

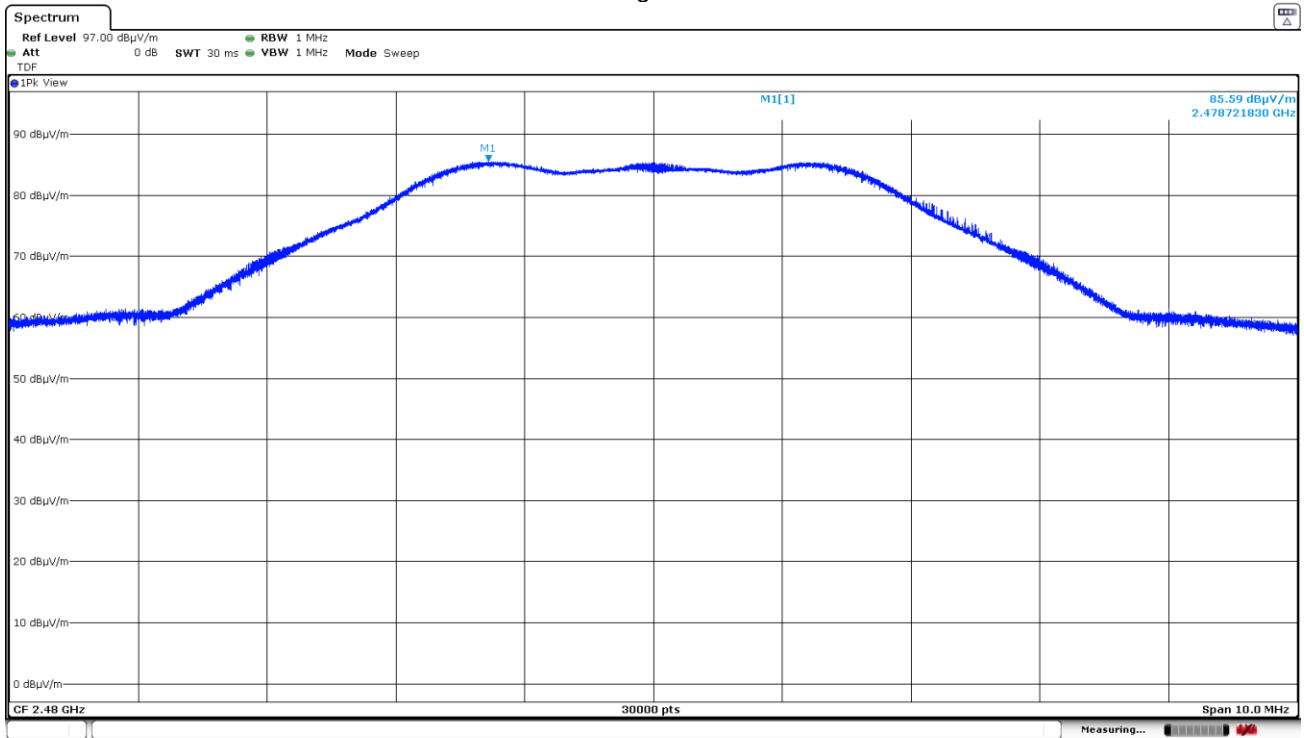


- High Channel:

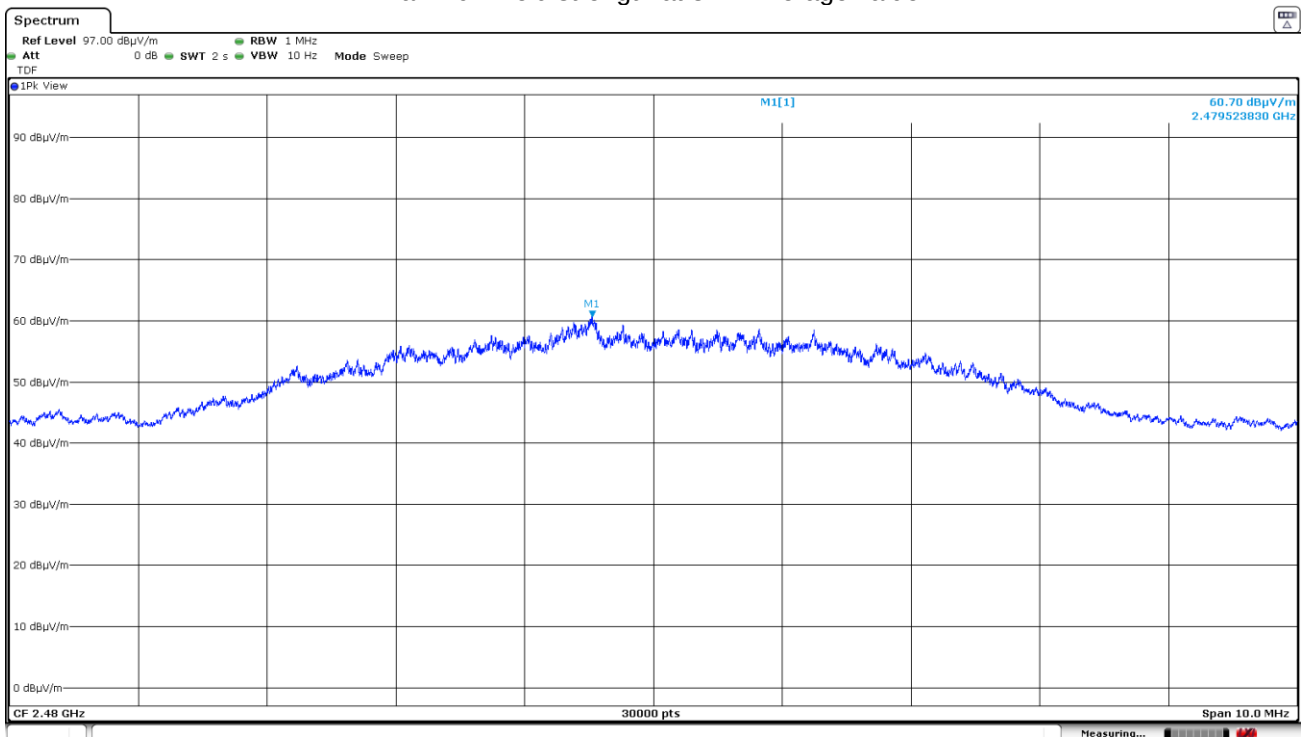
Delta Marker Method

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

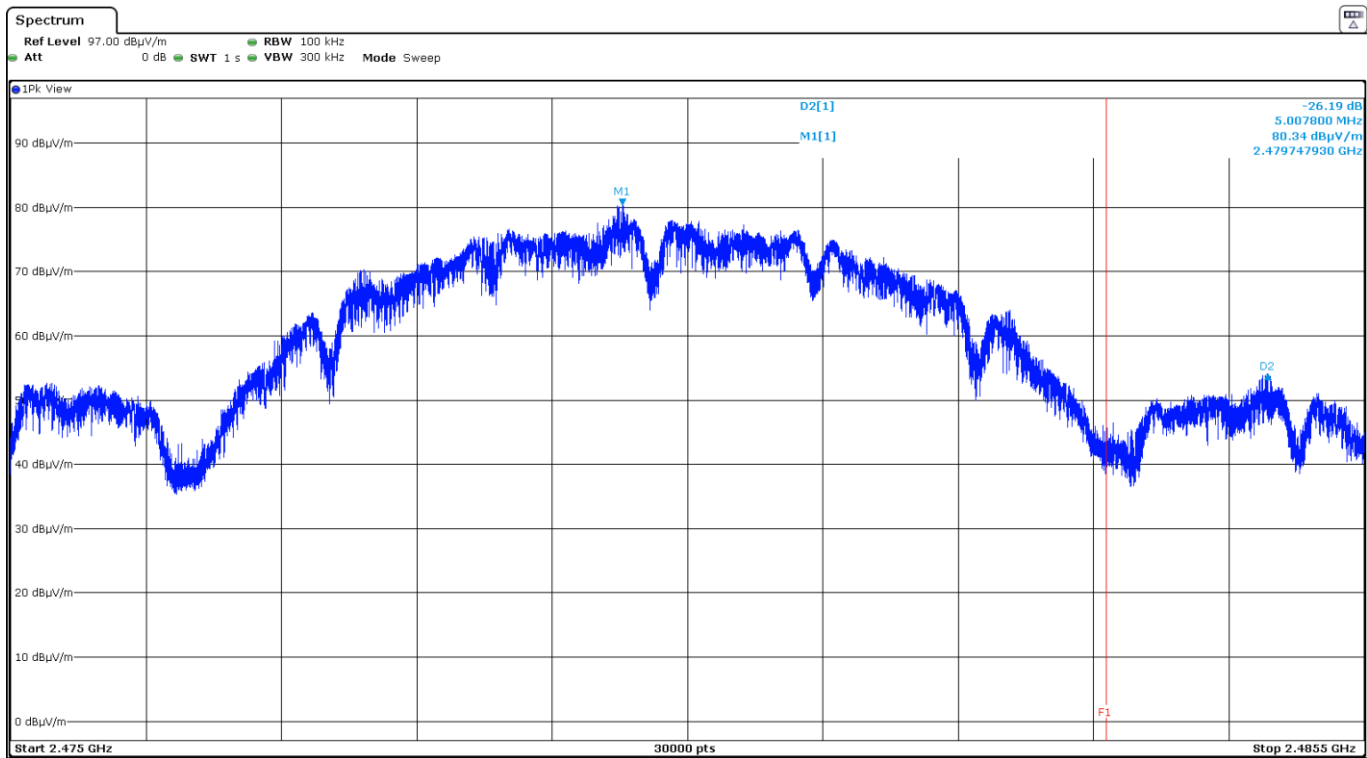
Maximum field strength at 3 m. Peak value:



Maximum field strength at 3 m. Average value:



- Band-edge compliance radiated



- Band-edge compliance of radiated emissions.

Fundamental max. Average value 3 m	Delta value	Calculated value 3 m	Limit
60.70 dBμV/m	26.19 dB	34.51 dBμV/m	54 dBμV/m

Fundamental max. Peak value 3 m	Delta value	Calculated value 3 m	Limit
85.59 dBμV/m	26.19 dB	59.40 dBμV/m	74 dBμV/m

- Restricted band

