



Test report No:  
NIE: 63330RRF.005

## 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 24V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Other identification of the product       | HW version: P2.5<br>SW version: 5.0<br>FCC ID: Not provided<br>IC: Not provided                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| (*) Features                              | Supports 802.15.4 @ 2.4GHz RF transceiver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Applicant                                 | DELTA ENERGY SYSTEMS (GERMANY) GMBH<br>Tscheulinstrasse 21<br>79331 TENINGEN<br>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.<br>USA FCC Part 15.209 (10-1-18) Edition: Radiated emission limits; general requirements.<br>CANADA RSS-247 Issue 2 (February 2017).<br>CANADA RSS-Gen Issue 5 (April 2018).<br>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.<br>ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.<br>FCC 15.247 (d) / RSS-247 5.5. Emission limitations radiated (Transmitter) |
| Approved by (name / position & signature) | Rafael López Martín<br>EMC Consumer & RF Lab. Manager<br><br>RAFAEL LÓPEZ MARTÍN<br>2020.05.23<br>08:38:03 +02'00'                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Date of issue                             | 2020-05-22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Report template No                        | FDT08_22<br>(*) "Data provided by the client"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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## Competences and guarantees

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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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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

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1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
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## Uncertainty

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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 24V is the Secondary side of an automotive wireless charger (load receiver) feeded at 24 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  |
|------------|------------------|---------------|-----------|------------|
| 63330/017  | Wireless Charger | WSU 1000W 24V | --        | 2020/01/20 |

Auxiliary elements used with the Sample S/01:

| Control N° | Description         | Model       | Serial N°            | Reception  |
|------------|---------------------|-------------|----------------------|------------|
| 63330/016  | Power Supply 24 Vdc | EOE14010740 | E140107401943000289P | 2020/01/20 |

Sample S/01 has undergone the test(s): All the 24 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 <sup>(3)</sup> |
|                                               | AC input.                                                                                                                                                     | 1m                                                       | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          |
|                                               | Power output.                                                                                                                                                 | 0.5m                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          |
|                                               | Signal interface for CAN-Bus.                                                                                                                                 | 0.5m                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          |
|                                               | Signal inputs for Ext_Enable function and Sleep mode function.                                                                                                | 0.5m                                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>          |
| Temperature sensor                            | 0.5m                                                                                                                                                          | <input checked="" type="checkbox"/>                      | <input type="checkbox"/>            | <input type="checkbox"/> |                                   |
| Supplementary information to the ports..... : | Not provided.                                                                                                                                                 |                                                          |                                     |                          |                                   |
| Rated power supply .....                      | Voltage and Frequency                                                                                                                                         |                                                          |                                     |                          |                                   |
|                                               | <input checked="" type="checkbox"/> DC: 24 Vdc                                                                                                                |                                                          |                                     |                          |                                   |
| Rated Power .....                             | 1000W                                                                                                                                                         |                                                          |                                     |                          |                                   |
| Clock frequencies.....                        | 160...300kHz, 2.4GHz bands.                                                                                                                                   |                                                          |                                     |                          |                                   |
| Other parameters .....                        | Not provided.                                                                                                                                                 |                                                          |                                     |                          |                                   |
| Software version .....                        | 5.0.                                                                                                                                                          |                                                          |                                     |                          |                                   |
| 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 .....                       | <input checked="" type="checkbox"/> 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 24V                                            | 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 <sup>nd</sup> , 2020         |                          |                                   |

<sup>(3)</sup> 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.005  | 2020-05-22 | First release |

## Environmental conditions

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

|                   |                                     |
|-------------------|-------------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C        |
| Relative humidity | Min. = 20 %<br>Max. = 75 %          |
| Air pressure      | Min. = 860 mbar<br>Max. = 1060 mbar |

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

|                   |                                     |
|-------------------|-------------------------------------|
| Temperature       | Min. = 15 °C<br>Max. = 35 °C        |
| Relative humidity | Min. = 20 %<br>Max. = 75 %          |
| Air pressure      | Min. = 860 mbar<br>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)    |
| <u>Supplementary information and remarks:</u> |                                                  |         |        |
| (1) Only test requested.                      |                                                  |         |        |

## Appendix A: Test results. 802.15.4 - 2.4 GHz

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## TEST CONDITIONS

### POWER SUPPLY (V):

Vn: 24 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:

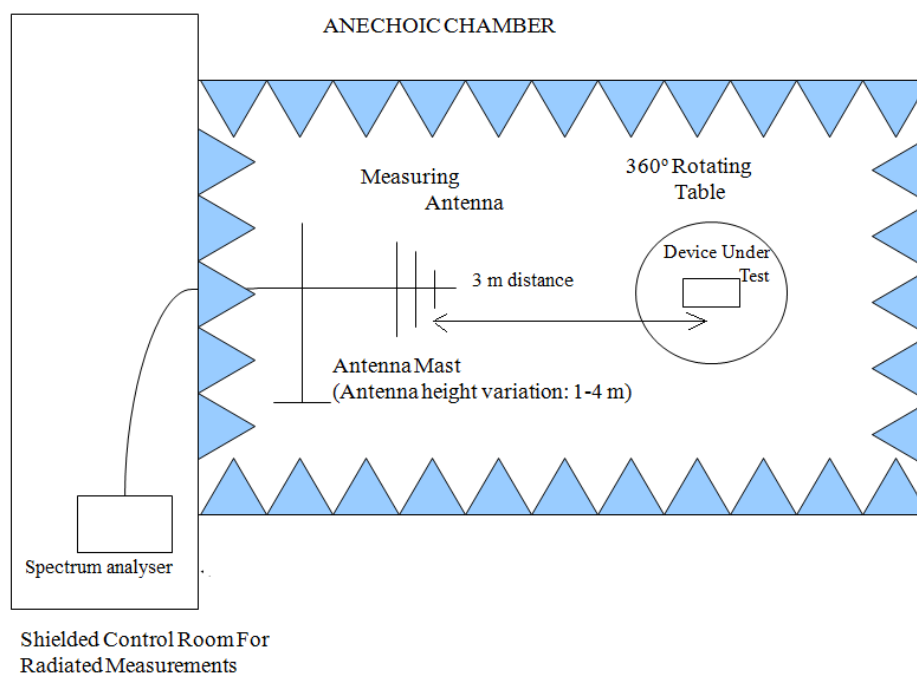
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) is situated at a distance of 3 m and at a distance of 1m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

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.

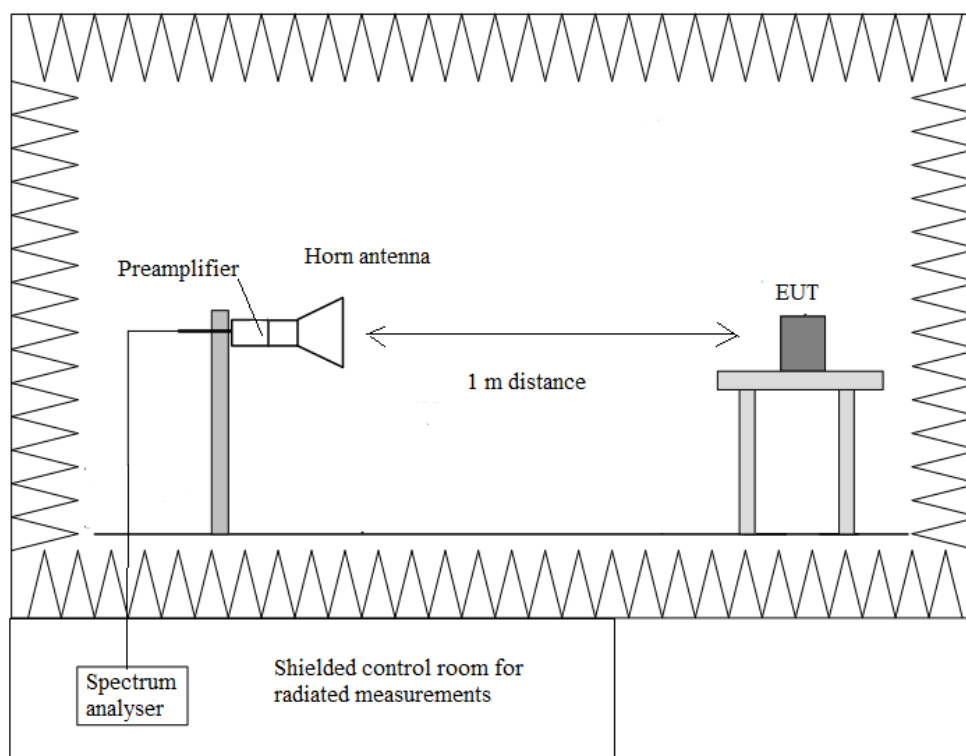
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

• **24 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 | 29.1                    | V            | <± 3.81                      |
| 288.004                  | Quasi peak | 28.8                    | V            | <± 3.81                      |
| 320.014                  | Quasi peak | 27.3                    | H            | <± 3.81                      |
| 575.997                  | Quasi peak | 27.9                    | 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) |
|--------------------------|----------|-------------------------|--------------|------------------------------|
| 2.35780                  | Peak     | 52.72                   | H            | <± 4.70                      |
| 2.38663                  | Peak     | 53.16                   | V            | <± 4.70                      |
| 2.38629                  | Peak     | 53.69                   | V            | <± 4.70                      |
| 2.48585                  | Peak     | 53.46                   | V            | <± 4.70                      |
| 4.80763                  | Peak     | 41.77                   | 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     | 42.73                   | V            | <± 4.70                      |
| 4.99617                  | Peak     | 35.51                   | H            | <± 4.70                      |

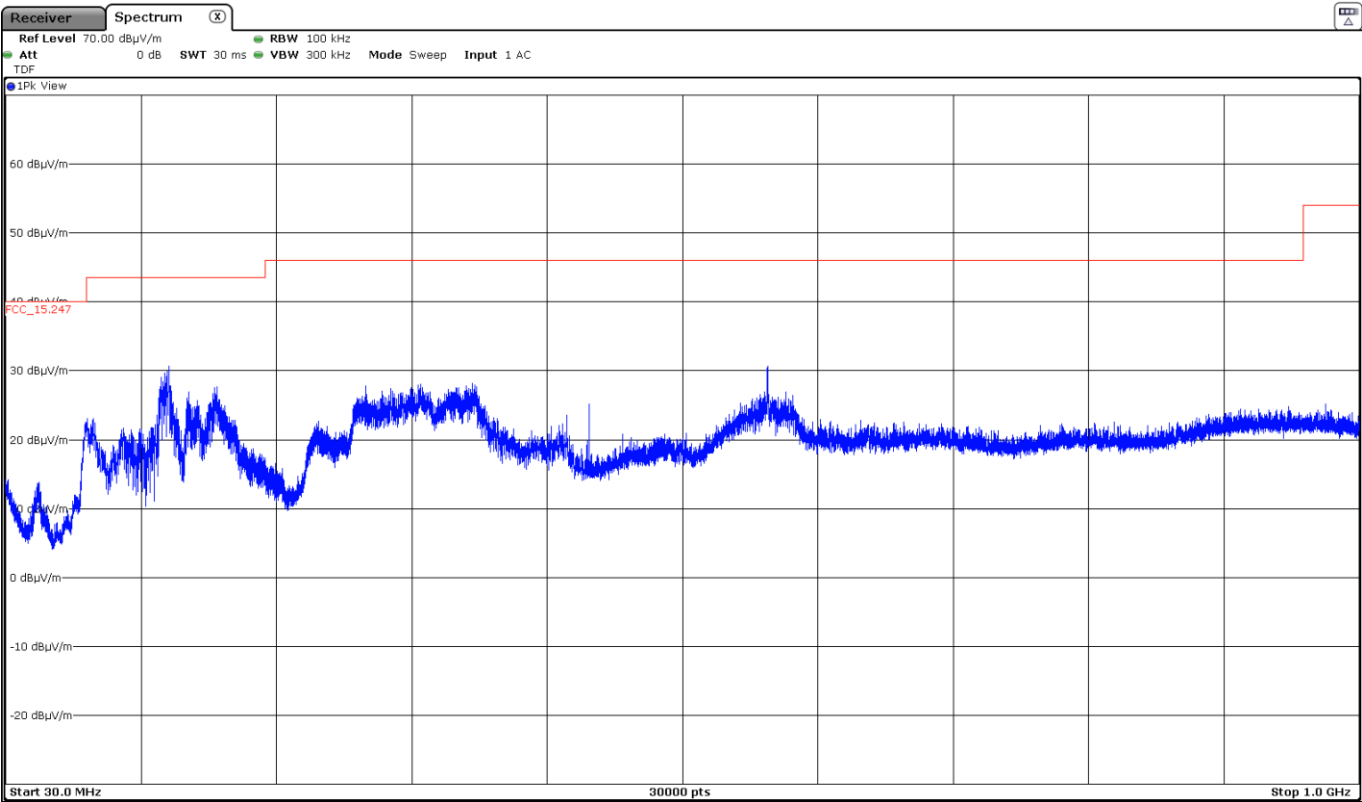
- HIGH CHANNEL. Spurious frequencies detected below the limit:

| Spurious frequency (GHz) | Detector | Emission Level (dB $\mu$ V/m) | Polarization | Measurement Uncertainty (dB) |
|--------------------------|----------|-------------------------------|--------------|------------------------------|
| 2.48351                  | Peak     | 58.85                         | V            | < $\pm$ 4.70                 |
|                          | Average  | 53.77                         |              |                              |
| 2.49843                  | Peak     | 49.20                         | V            | < $\pm$ 4.70                 |
| 4.96023                  | Peak     | 37.36                         | V            | < $\pm$ 4.70                 |

Verdict: PASS

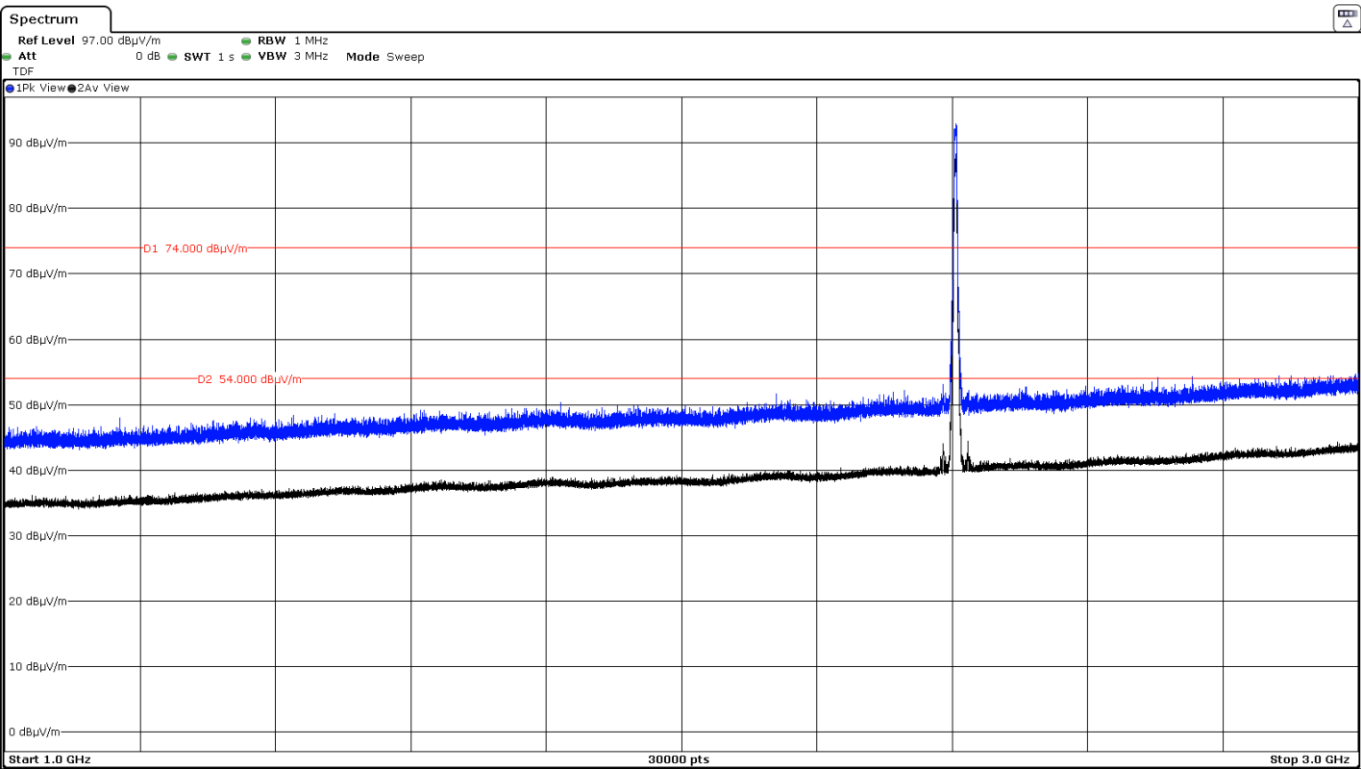
FREQUENCY RANGE 30 MHz - 1 GHz

The spurious frequencies do not depend on the operating channel.



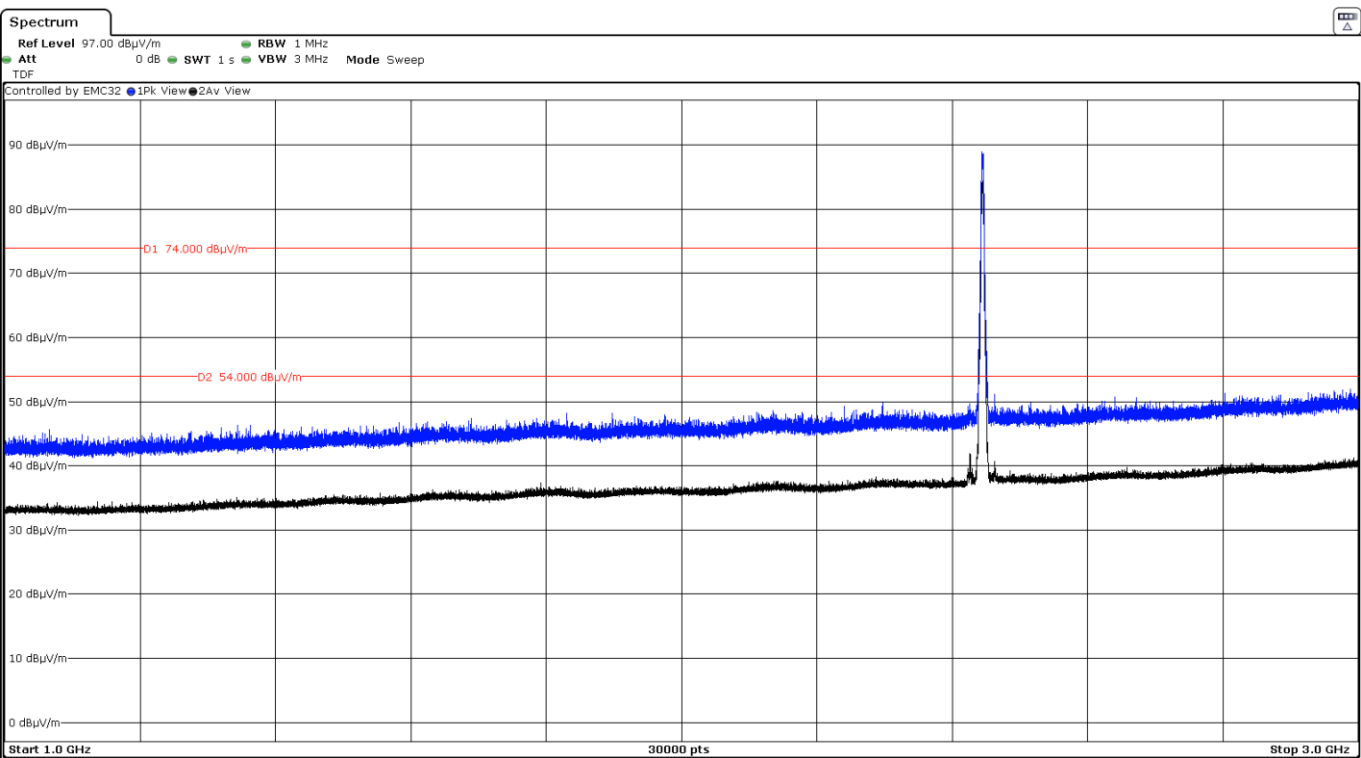
FREQUENCY RANGE 1 - 3 GHz

- Low Channel:



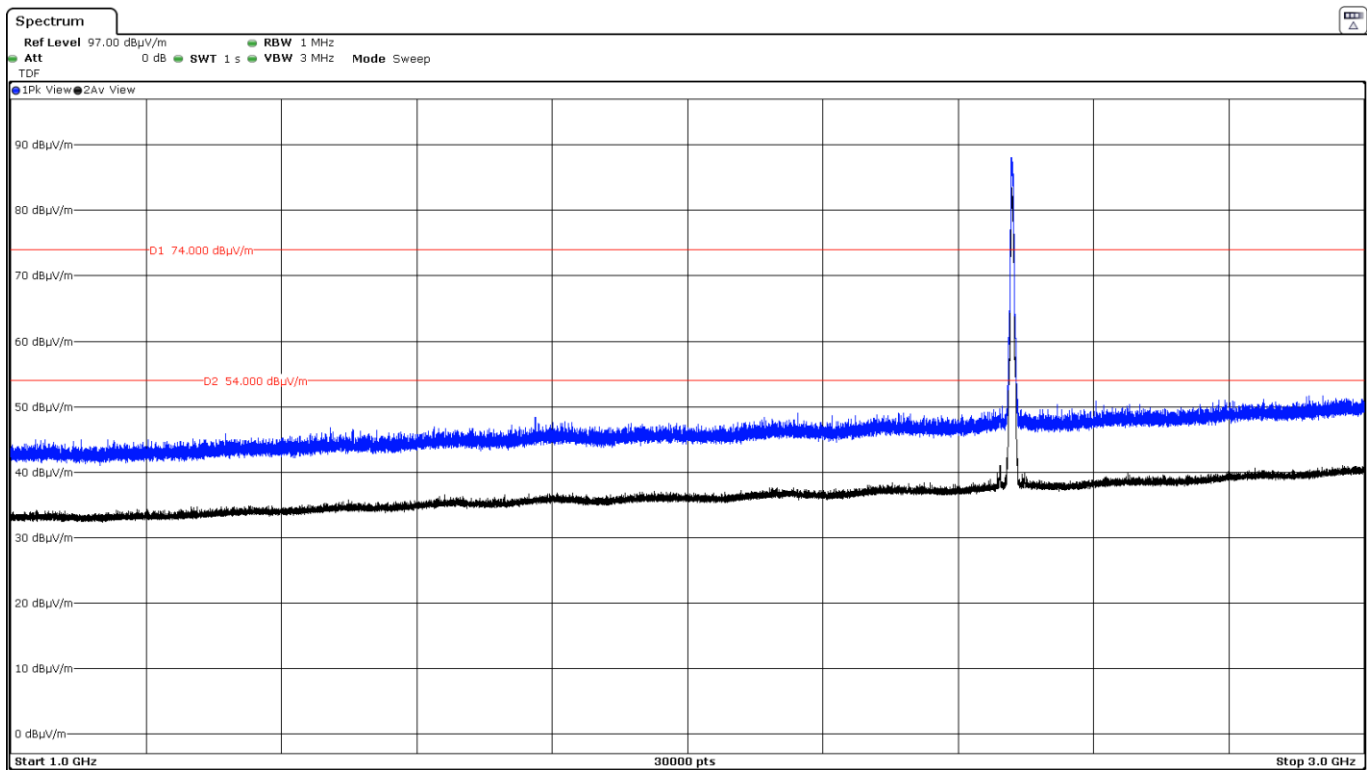
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

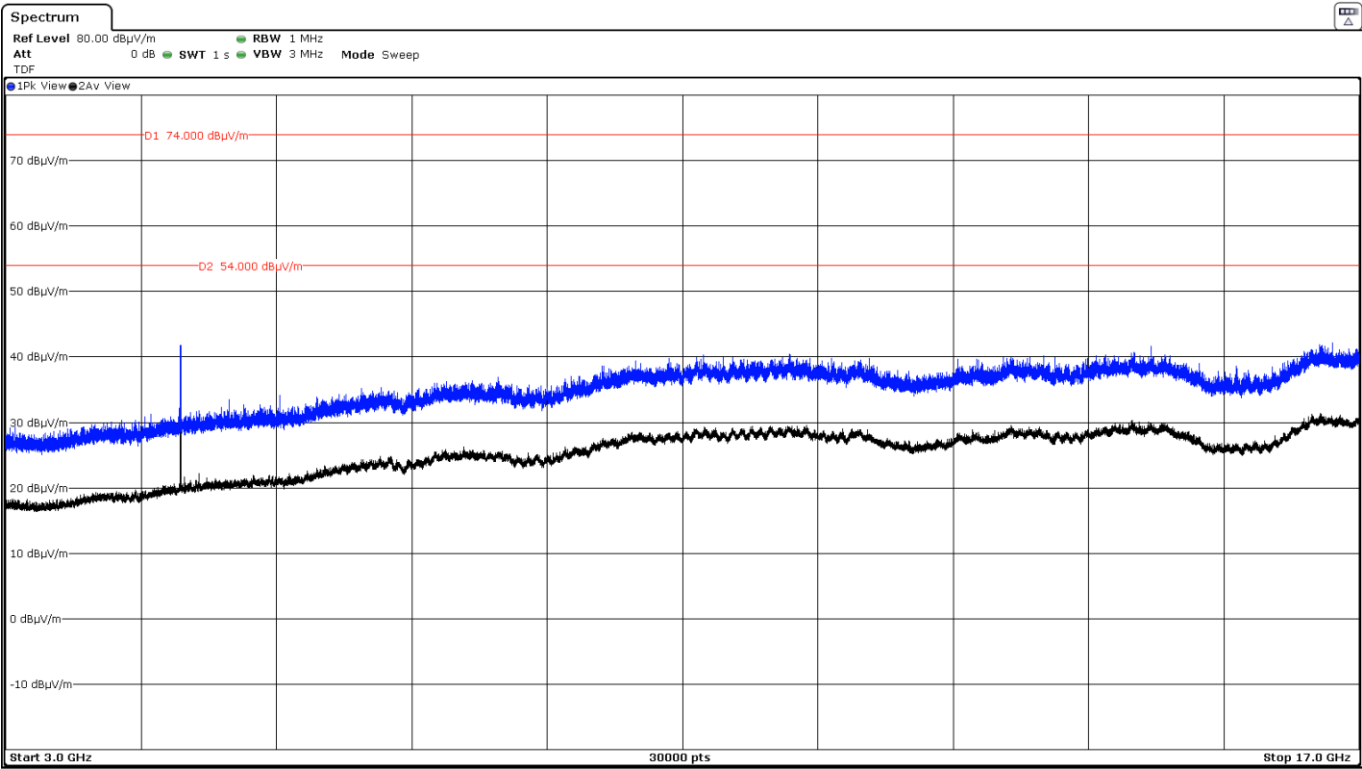
- High Channel:



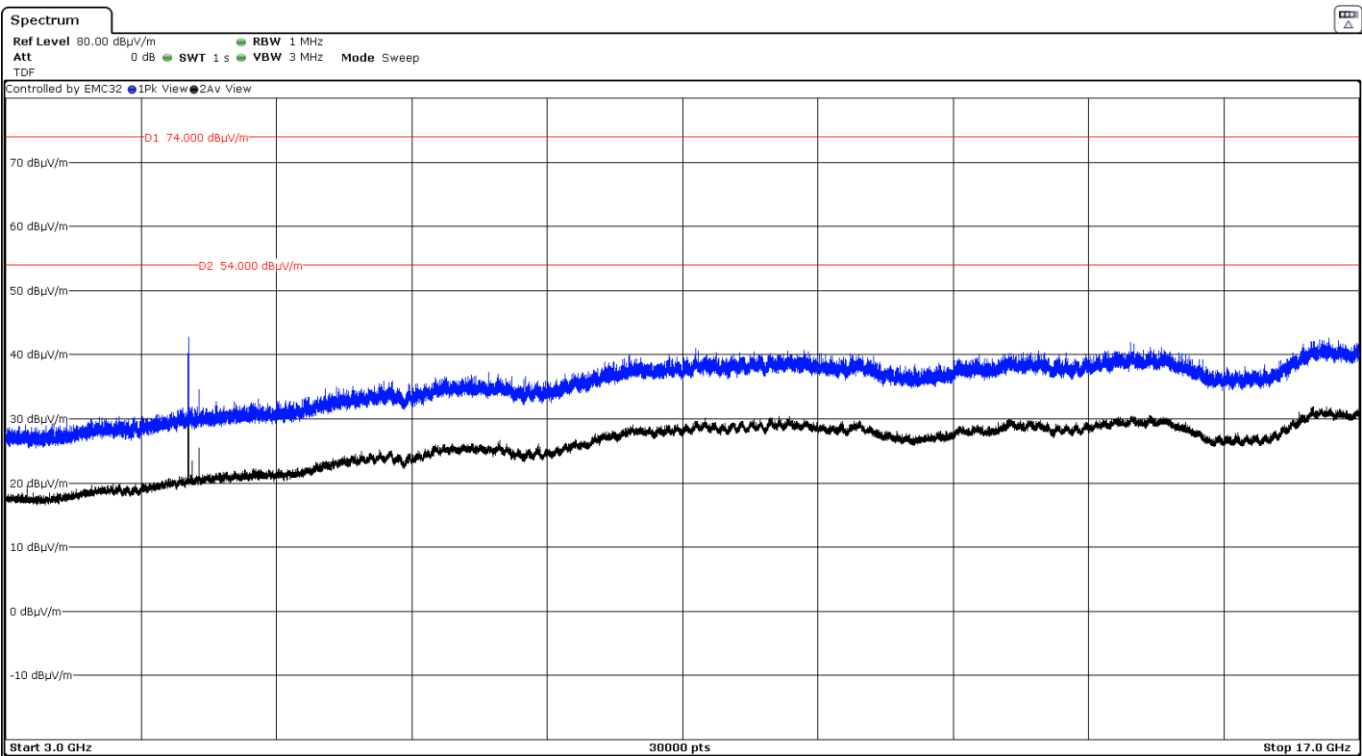
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz

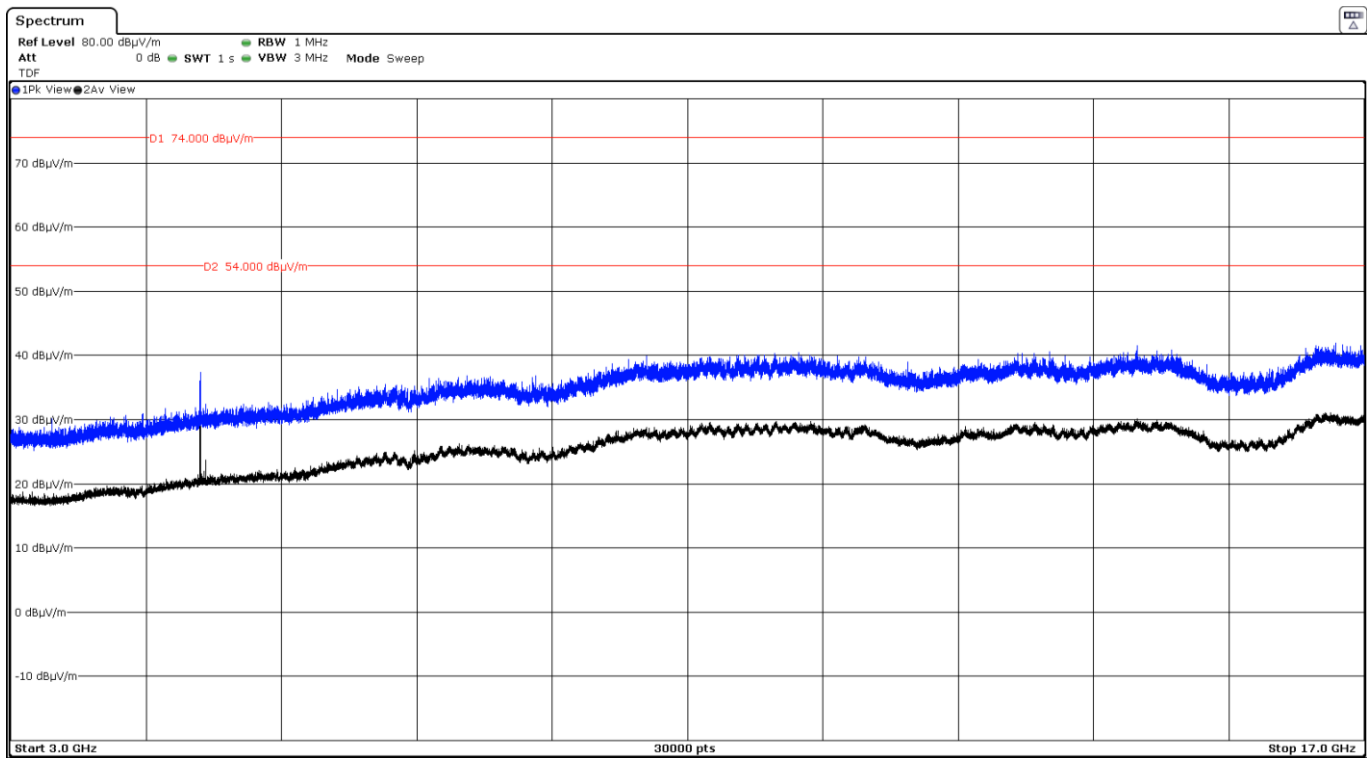
- Low Channel:



- Middle Channel:

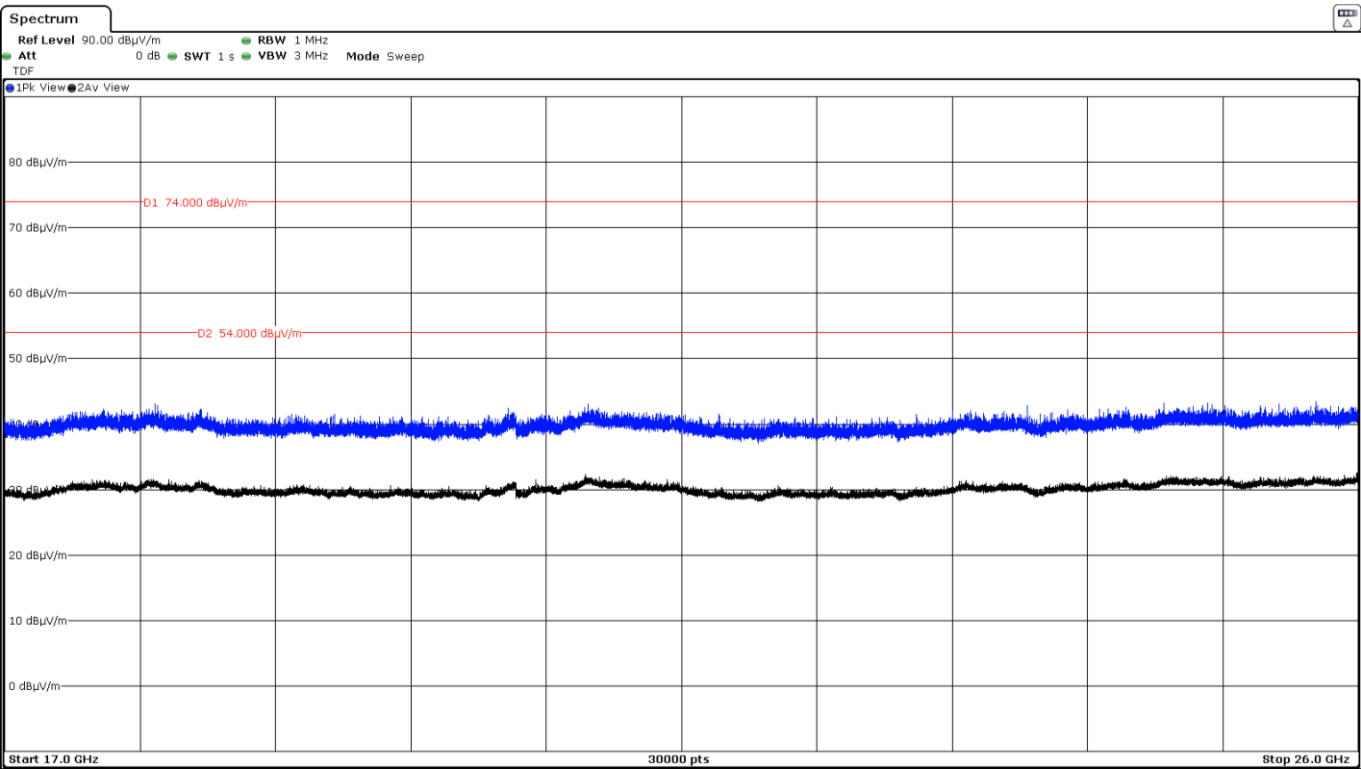


- High Channel:



FREQUENCY RANGE 17 - 26 GHz

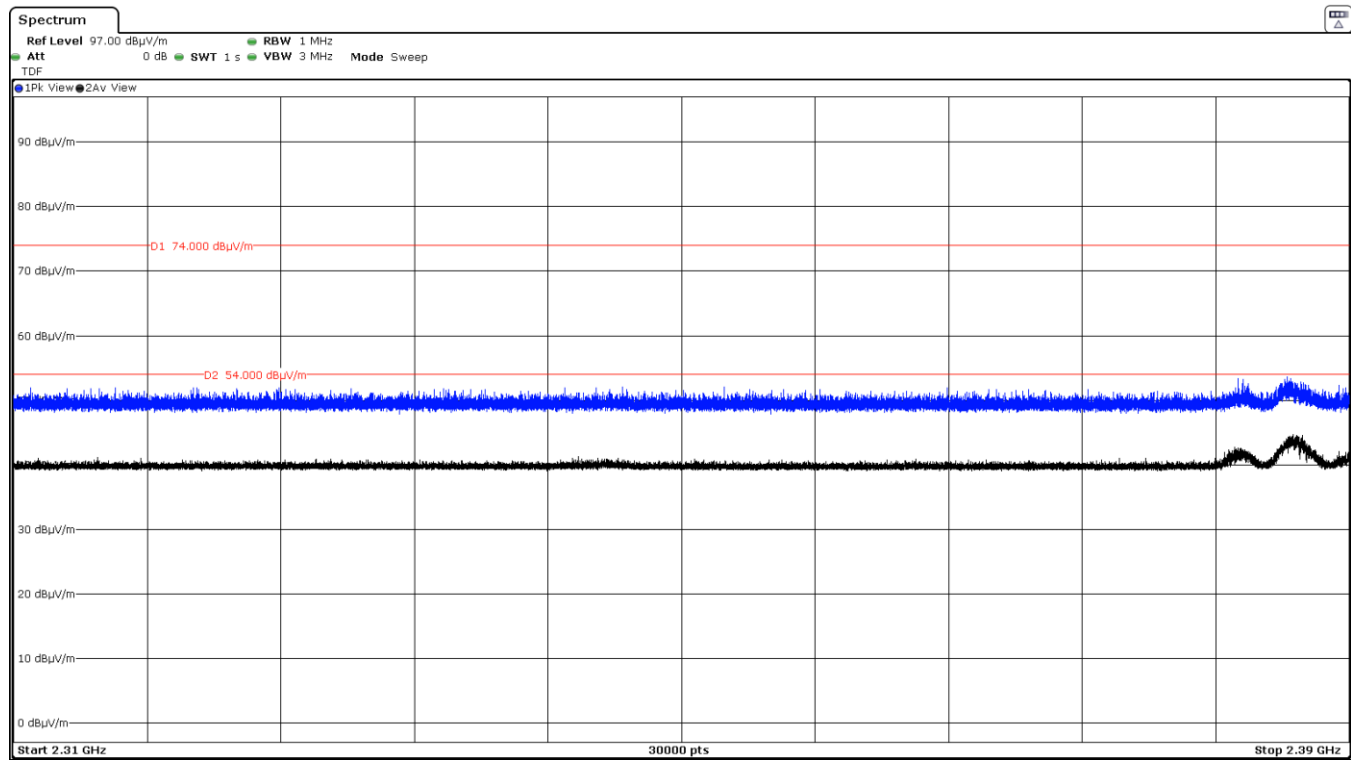
The spurious frequencies do not depend on the operating channel.



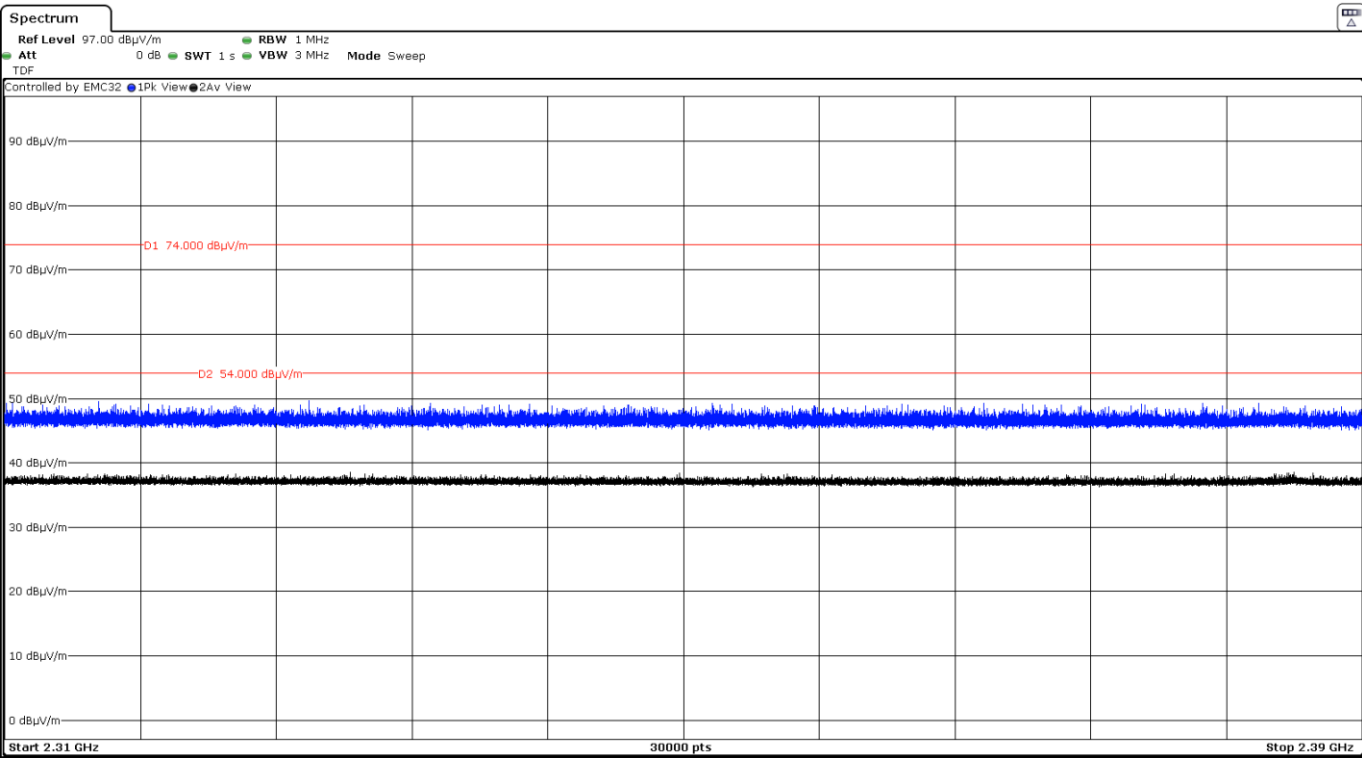
FREQUENCY RANGE 2.31 - 2.39 GHz

- Low Channel:

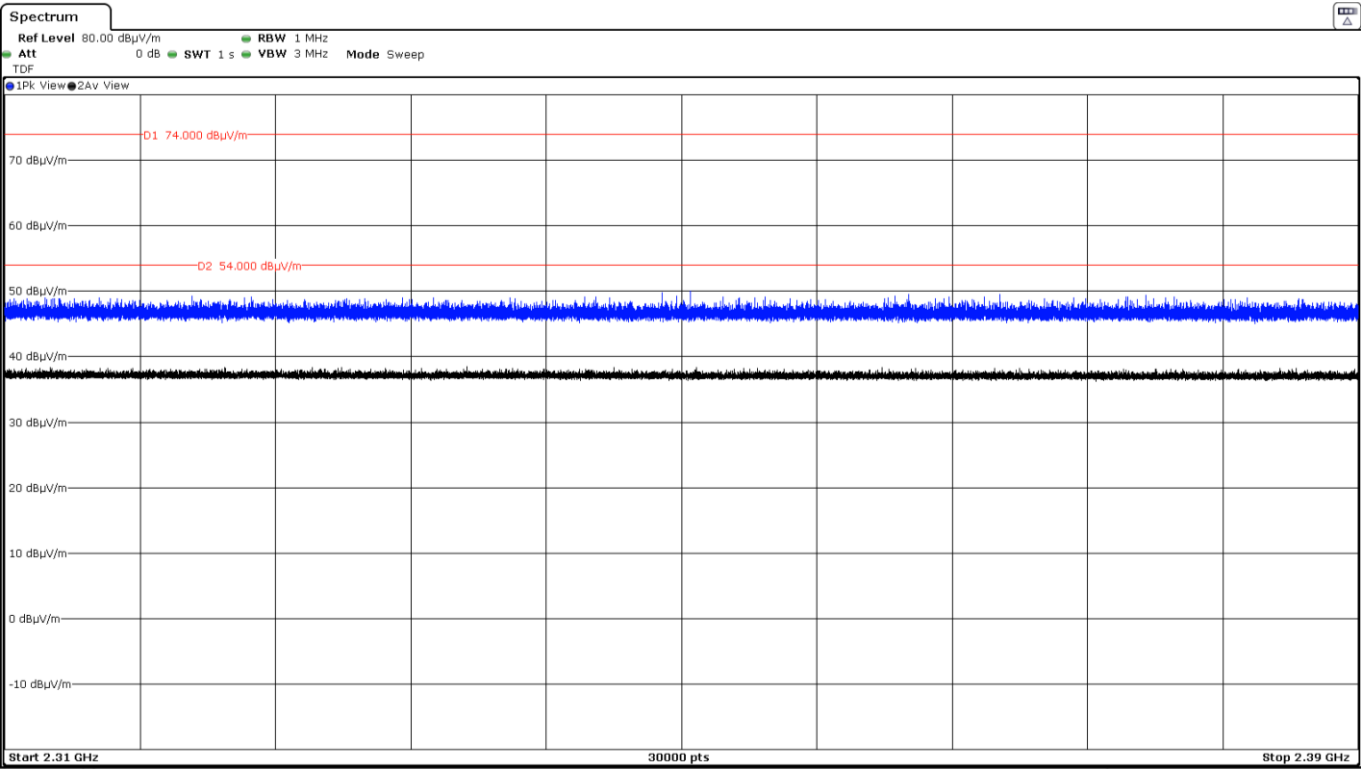
00



- Middle Channel:

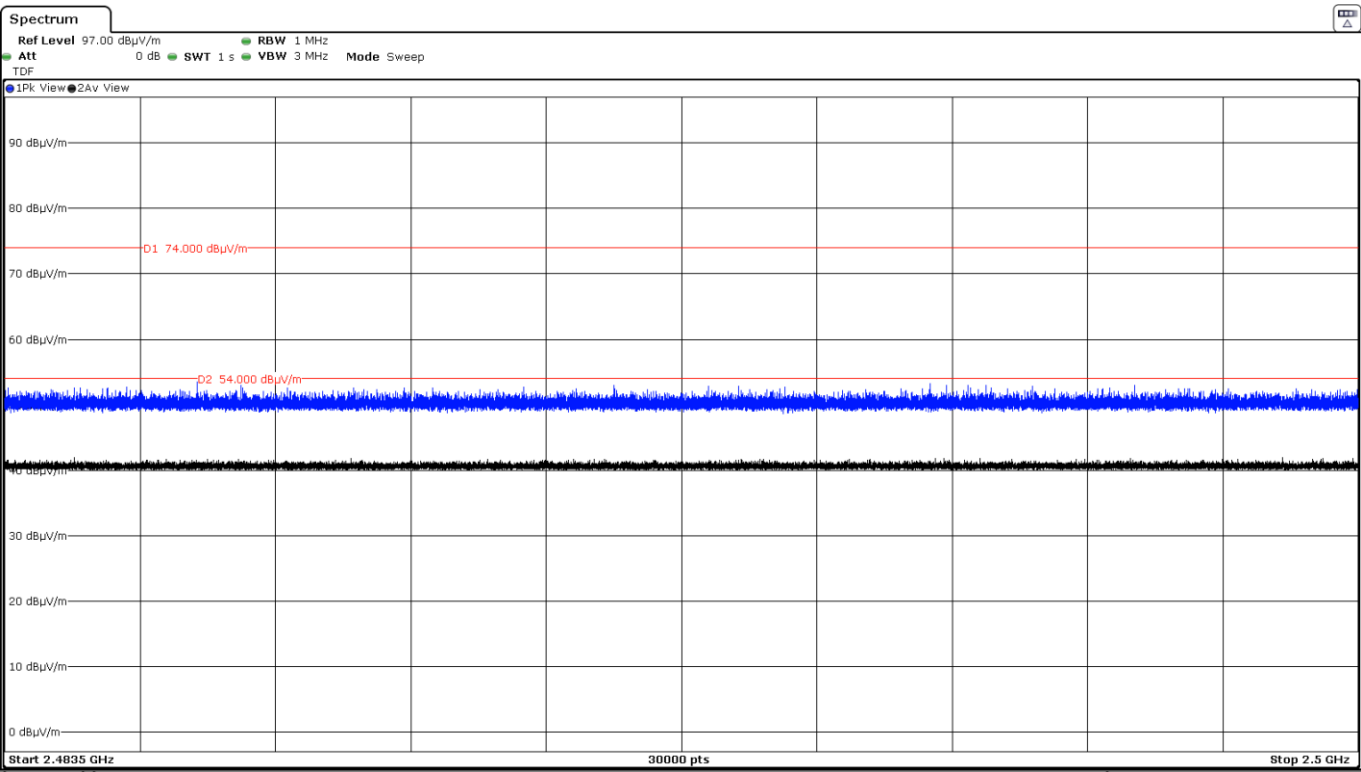


- High Channel:

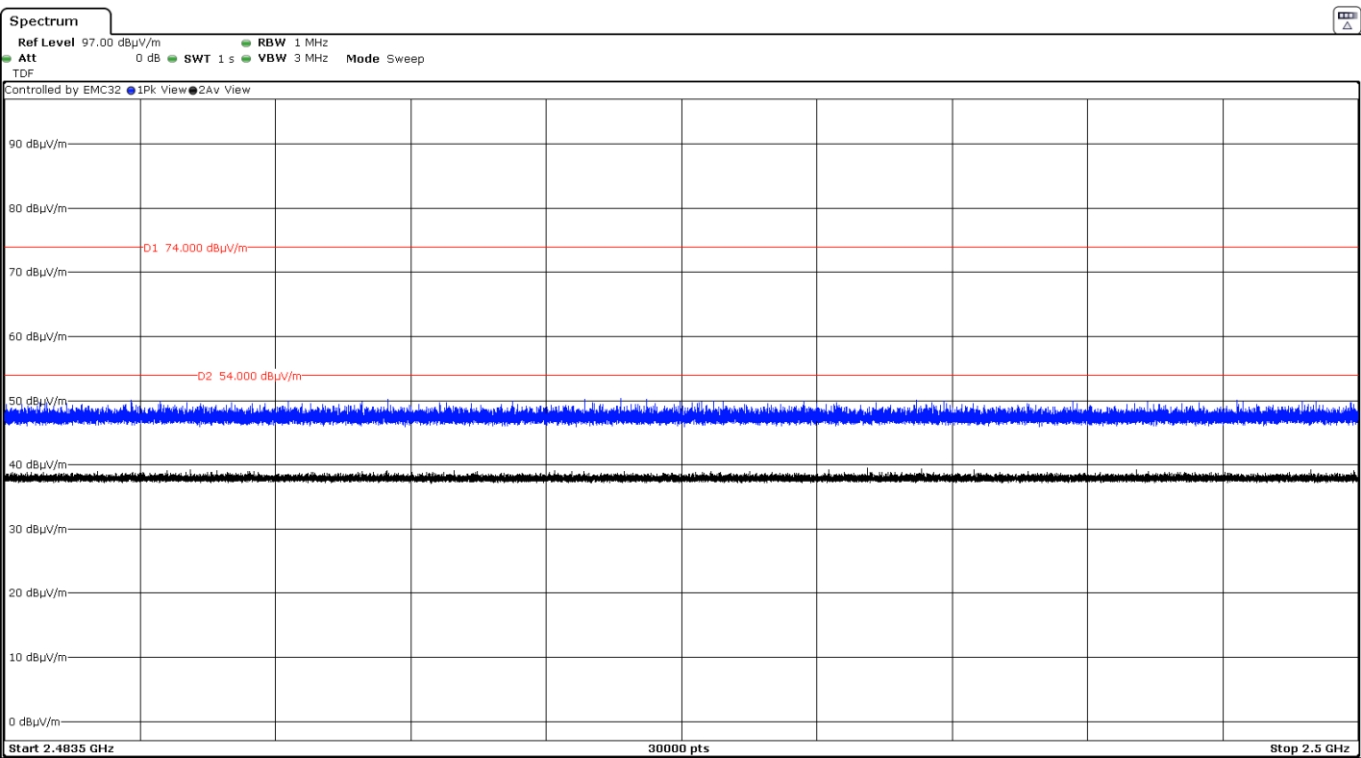


FREQUENCY RANGE 2.4835 - 2.5 GHz

- Low Channel:



- Middle Channel:

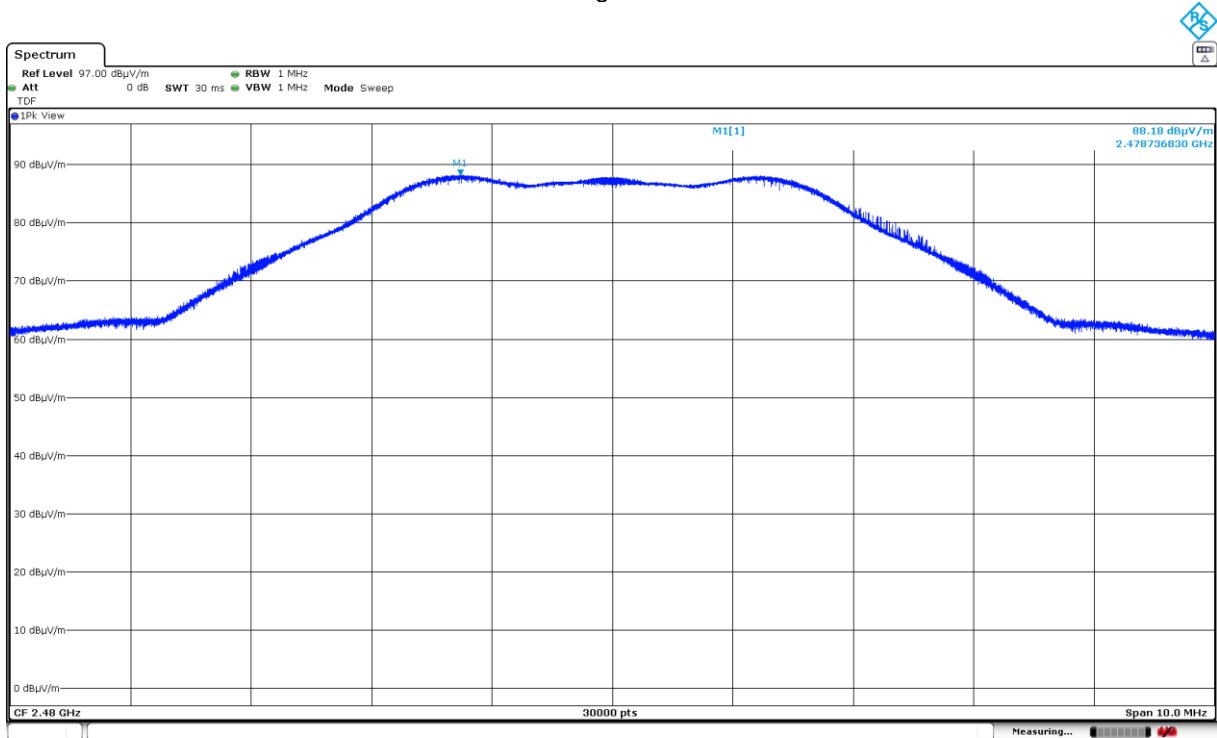


- High Channel:

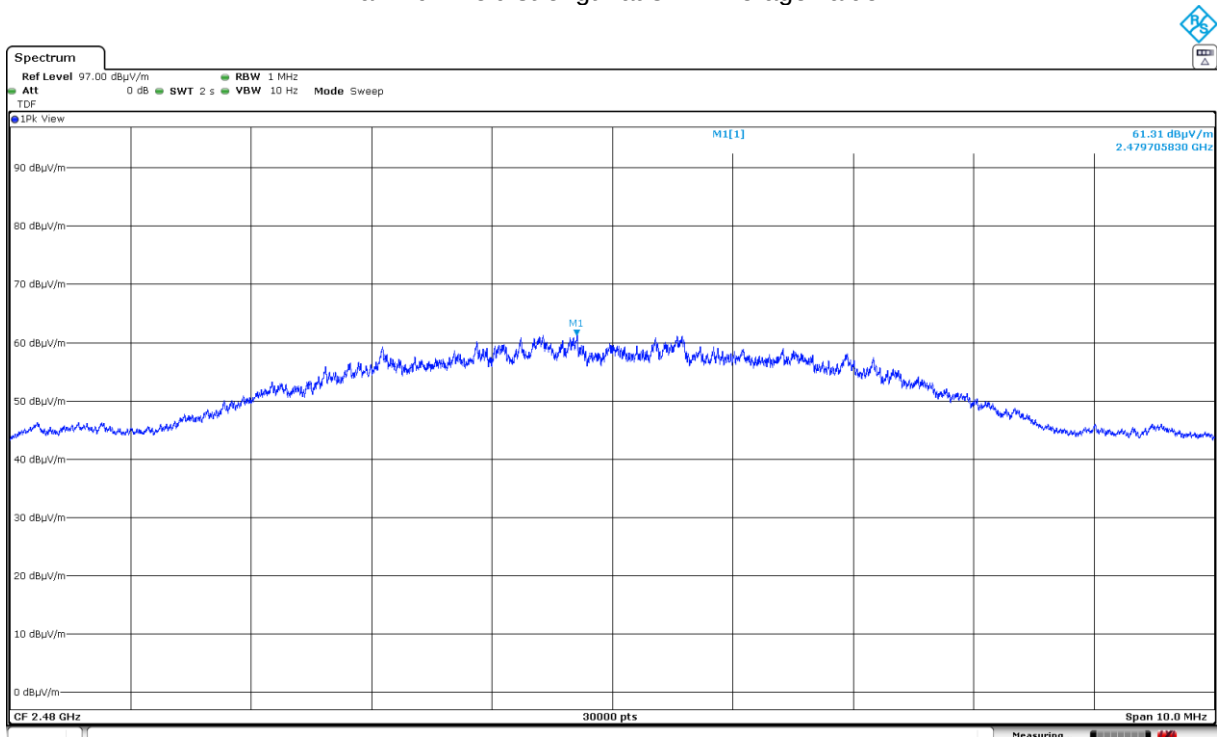
### Delta Marker Method

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

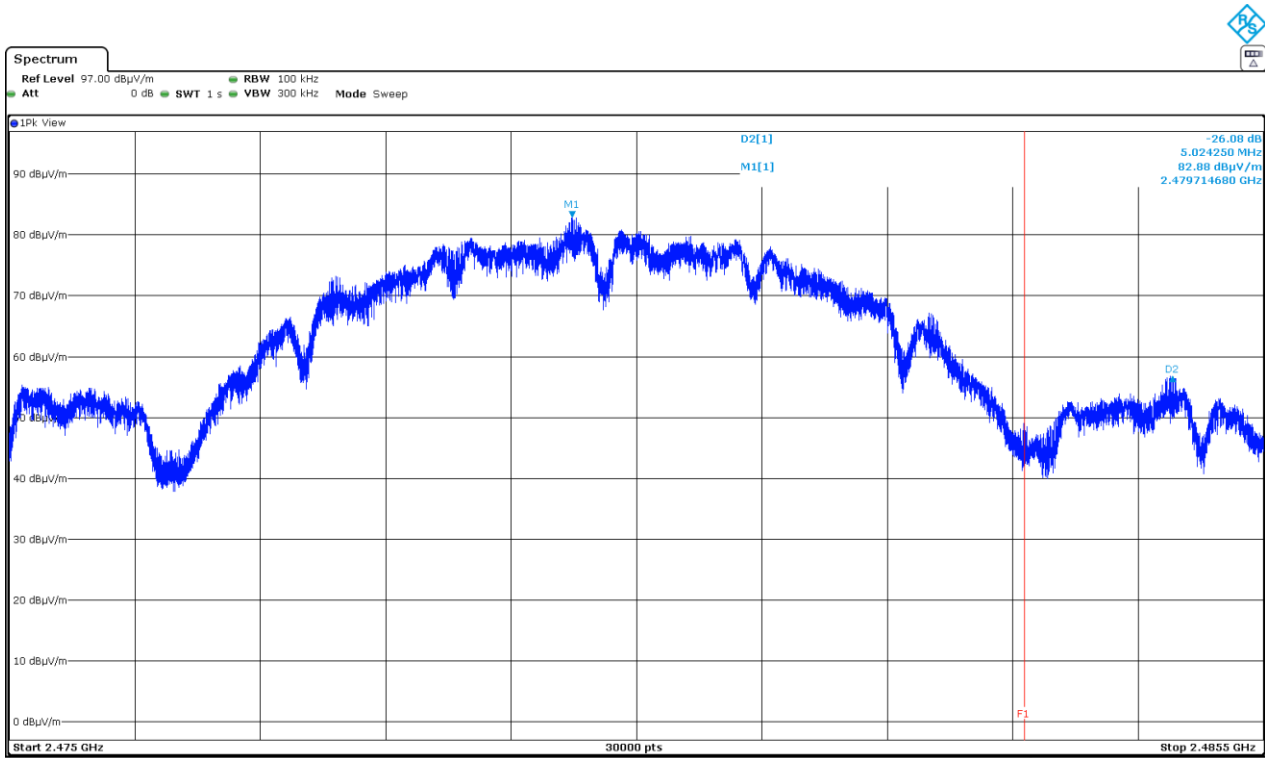
Maximum field strength at 3 m. Peak value:



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     |
|------------------------------------|-------------|----------------------|-----------|
| 61.31 dBμV/m                       | 26.08 dB    | 35.23 dBμV/m         | 54 dBμV/m |

| Fundamental max. Peak value 3 m | Delta value | Calculated value 3 m | Limit     |
|---------------------------------|-------------|----------------------|-----------|
| 88.18 dBμV/m                    | 26.08 dB    | 62.10 dBμV/m         | 74 dBμV/m |

- Restricted band

