# EMC TEST REPORT

**Title 47 CFR Part 15B, ISED ICES-003 Issue 7**

| | |
|---|---|
| **Report Reference No** | G0M-2111-1145-EF0115B-V01 |
| **Testing Laboratory** | Eurofins Product Service GmbH |
| Address | Storkower Str. 38c<br>15526 Reichenwalde<br>Germany |
| Accreditation | A2LA - Registration number: 1983.01 (ISED)<br>ISED wireless device testing laboratory: CN 3470A<br>DAkkS - Registration number : D-PL-12092-01-04 (FCC)<br>FCC Filed Test Laboratory, Reg.-No.: 96970 |
| **Applicant** | Adolf Würth GmbH |
| Address | Reinhold-Würth-Str. 12-17<br>74653 Künzelsau-Gaisbach<br>Germany |
| **Test Specification**<br>Standard(s) | Title 47 CFR Part 15 Subpart B<br>ISED ICES-003 Issue 7<br>ANSI C63.4:2014+A1:2017 |
| Non-Standard Test Method | None |
| **Equipment under Test (EUT):** | |
| Product Description | Laser Distance Meter |
| Model(s) | WDM 6-22 |
| Additional Model(s) | None |
| Brand Name(s) | Würth |
| Hardware Version(s) | V09 |
| Software Version(s) | V05 |
| FCC-ID | RFF-LD3BT |
| IC | 3177A-LD3BT |
| **Test Result** | **PASSED** |

| | | |
|---|---|---|
| **Possible test case verdicts:** | | |
| required by standard but not tested | N/T | |
| not required by standard | N/R | |
| required by standard but not appl. to test object | N/A | |
| test object does meet the requirement | P(PASS) | |
| test object does not meet the requirement | F(FAIL) | |
| **Testing:** | | |
| Date of receipt of test item | 2021-11-19 | |
| **Report:** | | |
| Compiled by | Ruslan Colbasiuc | |
| Tested by (+ signature)<br>(Responsible for Test) | Ruslan Colbasiuc |  |
| Approved by (+ signature)<br>(EMC Test Technician) | Matthias Handrik |  |
| Date of Issue | 2022-01-31 | |
| Total number of pages | 35 | |
| **General Remarks:** | | |
| **The test results presented in this report relate only to the object tested.**<br>**The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.**<br>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. | | |
| **Additional Comments:** | | |
| | | |

## ABBREVIATIONS AND ACRONYMS

| Acronyms | |
|---|---|
| Acronym | Description |
| EUT | Equipment Under Test |
| FCC | Federal Communications Commission |
| ISED | Innovation, Science and Economic Development Canada |
| $T_{NOM}$ | Nominal operating temperature |
| $V_{NOM}$ | Nominal supply voltage |

## VERSION HISTORY

| Version History | | | |
|---|---|---|---|
| Version | Issue Date | Remarks | Revised By |
| 01 | 2022-01-31 | Initial Release | - |

## REPORT INDEX

# 1 Equipment (Test Item) Under Test

| | | |
|---|---|---|
| Description | Laser Distance Meter | |
| Model | WDM 6-22 | |
| Additional Model(s) | None | |
| Brand Name(s) | Würth | |
| Serial Number(s) | 1614270022 (Eurofins ID 37319) | |
| Hardware Version(s) | V09 | |
| Software Version(s) | V05 | |
| EUT Dimensions [cm] | 13.3x2.9x5.5 | |
| FCC-ID | RFF-LD3BT | |
| IC | 3177A-LD3BT | |
| Class | Class B | |
| Equipment type | Table top | |
| Highest internal frequency [MHz] | 2480 | |
| Radio Module | Type | Bluetooth LE |
| | Model | nRF52832-QFAA-R |
| | Manufacturer | Nordic |
| | FCC-ID | - |
| | IC | - |
| Supply Voltage | $V_{NOM}$ | 3 V DC non rechargeable battery |
| Manufacturer | Leica Geosystems AG<br>Heinrich-Wild-Strasse<br>9435 Heerbrugg<br>SWITZERLAND | |
| Factory | flex<br>Munkas u. 28<br>8660 Tab<br>Ungarn | |

## 1.1 Equipment Ports

| Name | Type | Attributes | Comment |
|---|---|---|---|
| None | | | |
| Description: | | | |
| AC | AC mains power input/output port | | |
| DC | DC power input/output port | | |
| BAT | DC power input port connected to external battery | | |
| IO | Input/Output port | | |
| TP | Telecommunication port | | |
| NE | Non-electrical port | | |

## 1.2 Equipment Photos - Internal

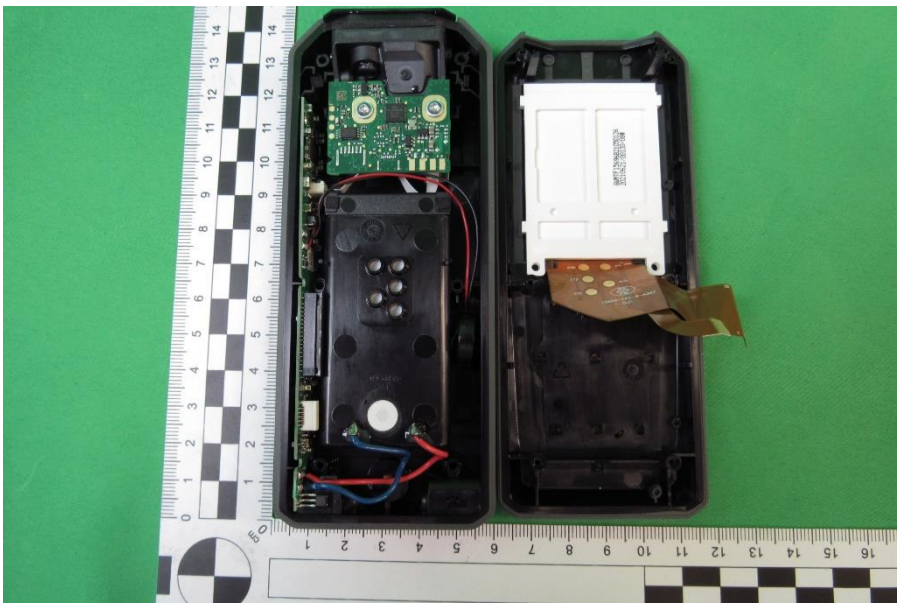
**EUT Internal Architecture View 1**


**EUT Internal Architecture View 2**

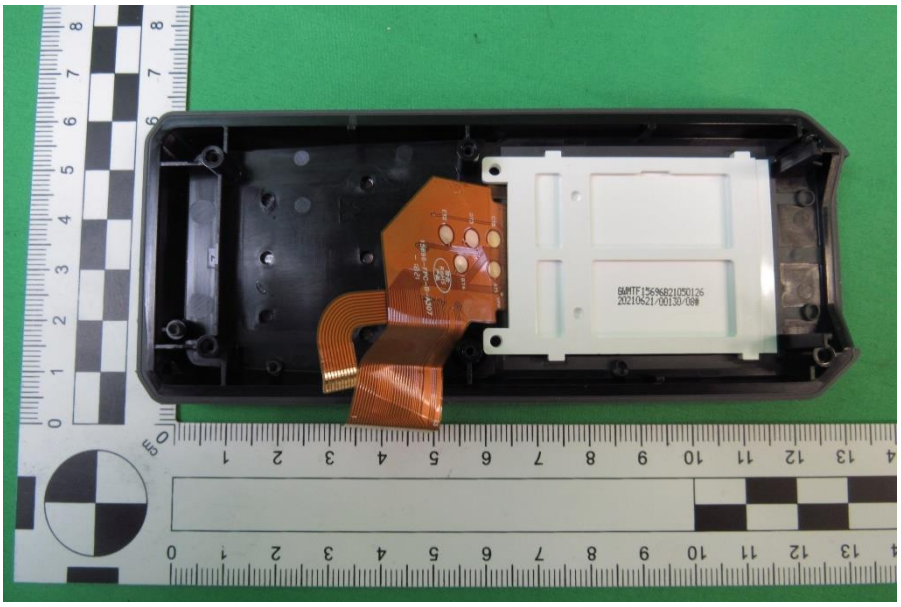
**EUT Internal Architecture View 3**

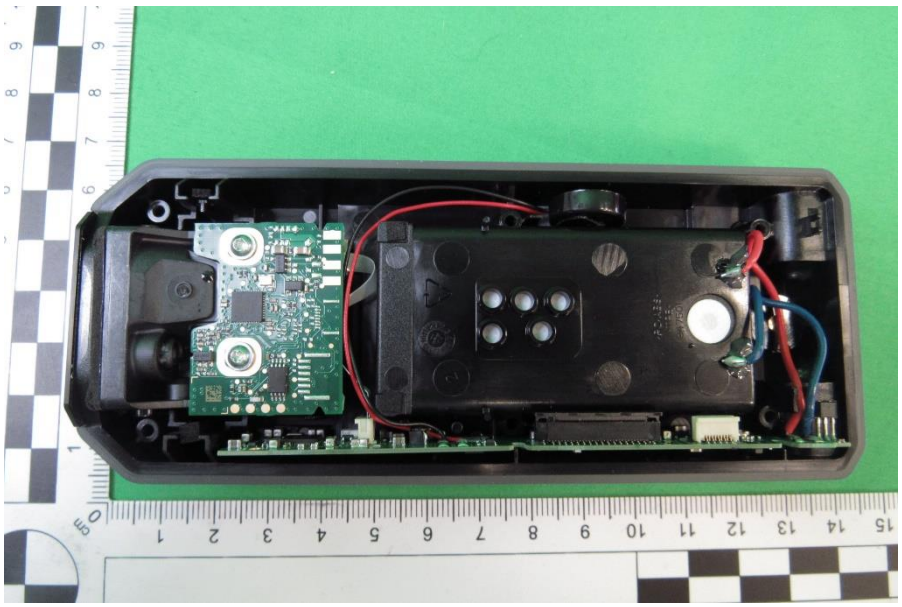

**EUT Internal Architecture View 4**

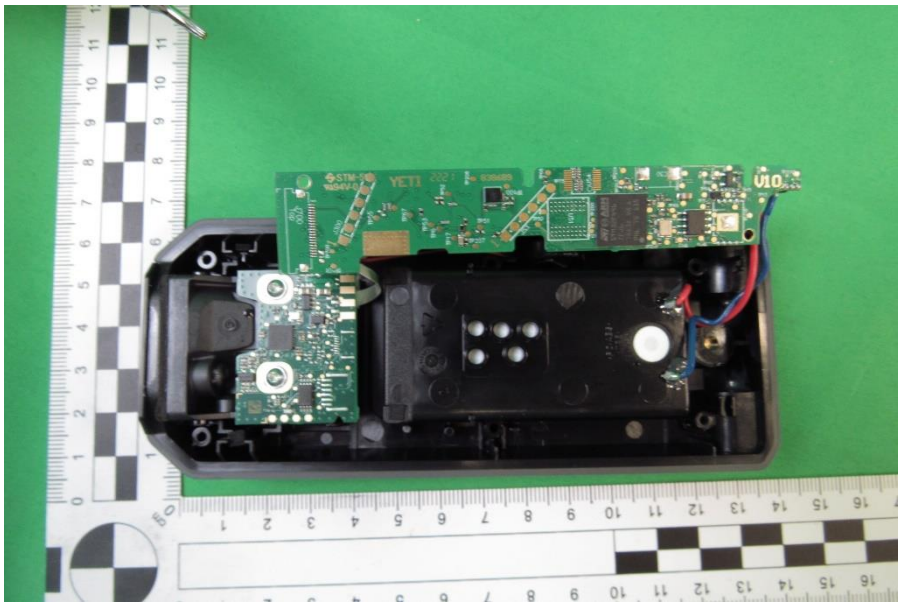
**EUT Internal Architecture View 5**



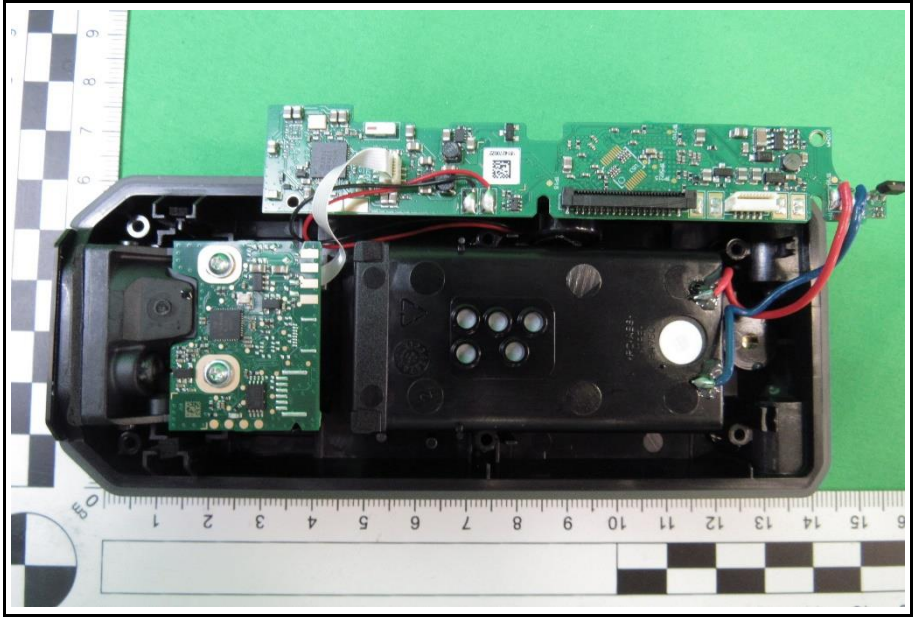
**EUT Internal Architecture View 6**



| EUT Internal Architecture View 7 |
| --- |
|  |

| EUT Internal Architecture View 8 |
| --- |
|  |

**EUT Internal Architecture View 9**



## 1.3 Equipment Photos - External

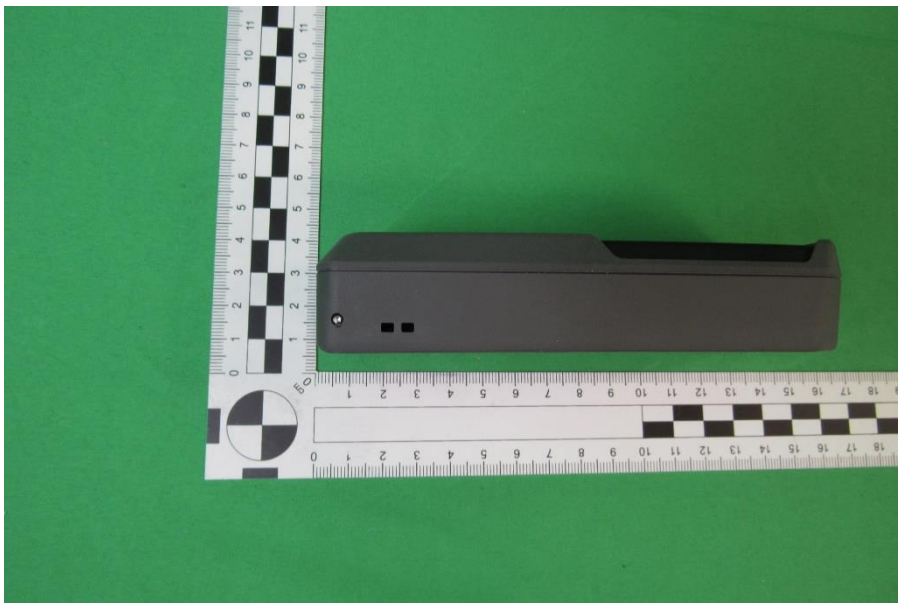
| EUT with Transport Bag View 1 |
| --- |
|  |

| EUT with Transport Bag View 1 |
| --- |
|  |

**EUT with Transport Bag View 1**

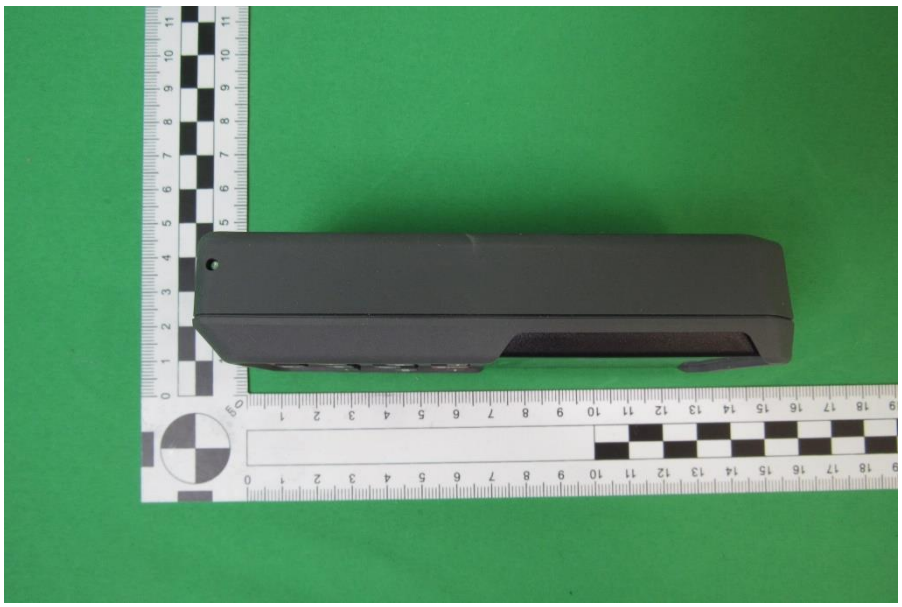

**EUT Front View**

**EUT Right Side View**



**EUT Back View**

**EUT Left Side View**



**EUT Bottom View**

**EUT Top View**

**EUT Back Side View with Eurofins ID Label**

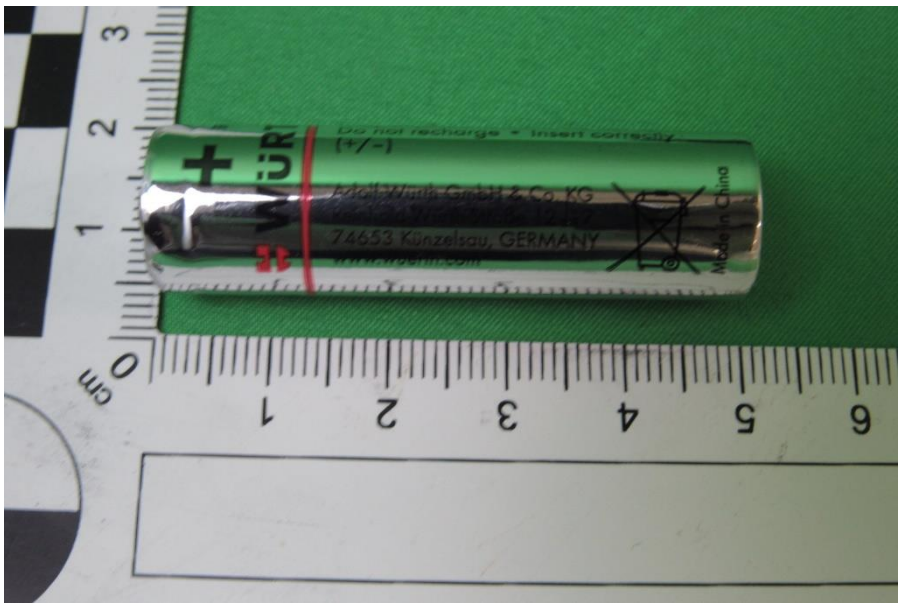
**EUT Label**


**EUT Back Side View 2**

| EUT Non Rechargeable Batteries View 1 |
|---|
|  |



| EUT Non Rechargeable Batteries View 2 |
|---|
|  |

| EUT Non Rechargeable Batteries View 3 |
| --- |
|  |

## 1.4 Support Equipment

| Product Type | Device | Manufacturer | Model | Comment |
|---|---|---|---|---|
| AE | Smartphone | Samsung | A71 | - |
| Description: | | | | |
| AE | Auxiliary Equipment | | | |
| SIM | Simulator | | | |
| MON | Monitoring Equipment | | | |
| CBL | Connecting Cable | | | |
| Comment: | | | | |

## 1.5 Operational Modes

| Mode # | Description |
|---|---|
| 1 | Continuous distance measurement and Bluetooth low energy connection, without active data transfer. |
| Comment: | |

## 1.6 EUT Configuration

| Configuration # | Description |
|---|---|
| 1 | EUT powered on and connected with a test smartphone via Bluetooth low energy. |

Comment:

## 1.7 Sample emission level calculation

The following is a description of terms and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyser in dBµV. Any external preamplifiers used are taken into account through internal analyser settings.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strengths to voltages, which can be measured directly on the spectrum analyser. It is treated as a loss in dB. Cable losses have been included with the A.F. to simplify the calculations. The antenna factor is used in calculations as follows:

Reading on Analyser (dBµV) + A.F. (dB/m) = Net field strength (dBµV/m)

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBµV/m). The FCC limits are given in units of µV/m. The following formula is used to convert the units of µV/m to dBµV/m:

Limit (dBµV/m) = 20*log (µV/m)

Margin:

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

| | | | | |
|---|---|---|---|---|
| Reading + AF | = Net Reading | : | Net reading - FCC limit | = Margin |
| +21.5 dBµV + 26 dB/m | = 47.5 dBµV/m | : | 47.5 dBµV/m - 57.0 dBµV/m | = -9.5 dB |

## 2 Result Summary

| Title 47 CFR Part 15B, ISED ICES-003 Issue 7 | | | | |
|---|---|---|---|---|
| **Reference** | **Requirement** | **Reference Method** | **Result** | **Remarks** |
| Emission | | | | |
| FCC 15.109<br>ICES-003, 3.2.2 | Radiated emissions | ANSI C63.4:2014<br>+A1:2017 | PASS | - |
| FCC 15.107<br>ICES-003, 3.2.1 | AC power line conducted emissions | ANSI C63.4:2014<br>+A1:2017 | N/R | Battery powered device |
| Comment: | | | | |

| Possible Test Case Verdicts | |
|---|---|
| PASS | Test object does meet the requirements |
| FAIL | Test object does not meet the requirements |
| N/T | Required by standard but not tested |
| N/R | Not required by standard for the test object |

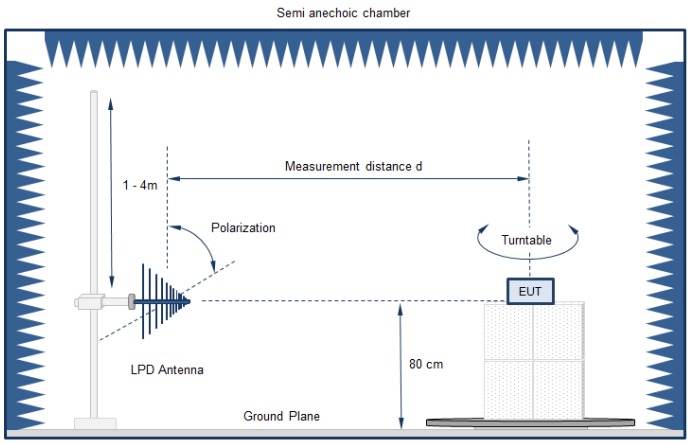
## 2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

### 2.1.1 Information

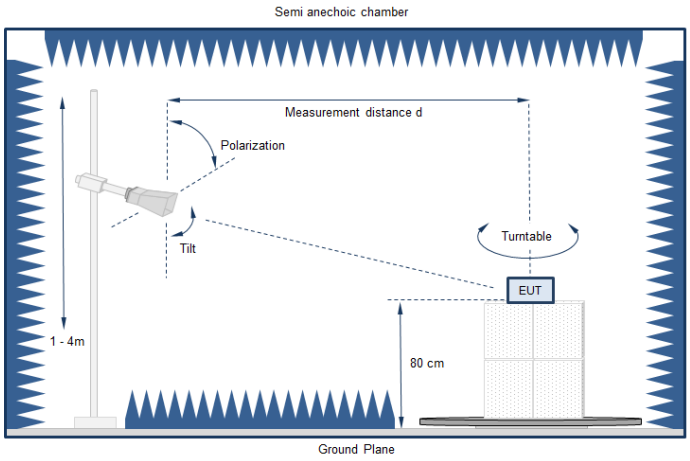
| Test Information | |
|---|---|
| Reference | FCC 15.109, ICES-003, 3.2.2 |
| Reference method | ANSI C63.4:2014+A1:2017 Section 8 |
| Equipment class | Class B |
| Equipment type | Table top |
| Highest internal frequency [MHz] | 2480 |
| Measurement range | 30 MHz to 12500 MHz |
| Temperature [°C] | 23 |
| Humidity [%] | 40 |
| Operator | Ruslan Colbasiuc |
| Date | 2021-12-23 |

### 2.1.2 Setup

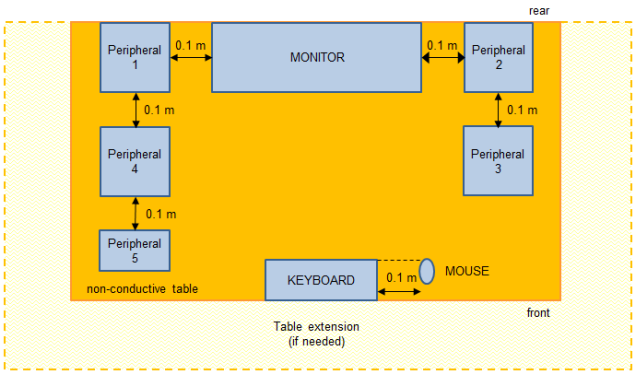
**Measurement up to 1 GHz**



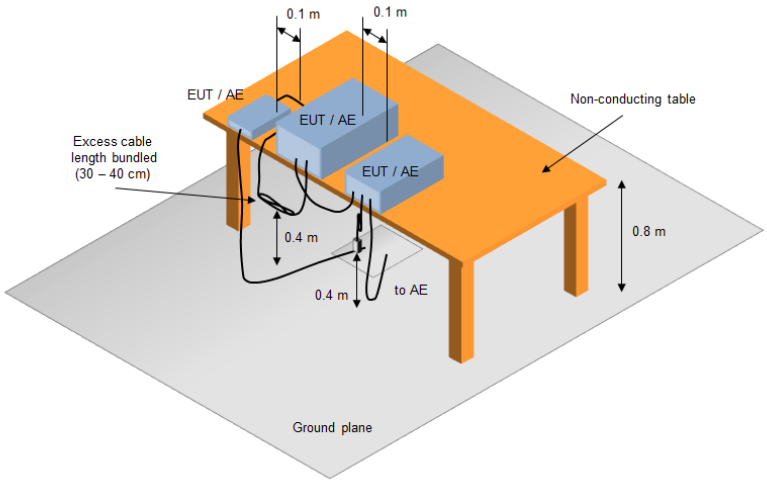

**Measurement above 1 GHz**



**Equipment placement - Table top**




**Test Setup**




2.1.3 Equipment

| Test Software | | | |
|---|---|---|---|
| Description | Manufacturer | Name | Version |
| EMC Software | DARE Instruments | Radimation | 2020.1.8 |

| Test Equipment | | | | | |
|---|---|---|---|---|---|
| Description | Manufacturer | Model | Identifier | Cal. Date | Cal. Due |
| Anechoic chamber | Frankonia | AC6 | EF00910 | 2021-07 | 2024-07 |
| EMI Test Receiver | R&S | ESU26 | EF00887 | 2021-07 | 2022-07 |
| TRILOG Broadband Antenna | Schwarzbeck | VULB 9162 | EF00978 | 2019-10 | 2022-10 |
| Horn Antenna | ETS-Lindgren | 3117 | EF00976 | 2019-03 | 2022-03 |
| Climatic Sensor | Embedded Data Systems, LLC. | 9A00100000254 77E | EF01124 | 2021-03 | 2022-03 |

2.1.4 Procedure

| Exploratory measurement |
|---|
| 1. The EUT was placed on a non-conductive table at a height of 0.8m.<br>2. The EUT and support equipment, if needed, were set up to simulate typical usage.<br>3. Cables, of type and length specified by the manufacturer, were connected to at least one port of each type and were terminated by a device or simulating load of actual usage.<br>4. The antenna was placed at a distance of 3 or 10 m.<br>5. The received signal was monitored at the measurement receiver.<br>6. This procedure has to be performed in both antenna polarizations, horizontal and vertical.<br>7. The arrangement of the equipment with the maximum emission level is shown on the setup picture at item 2.1.2 |

| Final measurement |
|---|
| 1. The EUT was placed on a 0.8 m non-conductive table at a 3 m distance from the receive antenna. The antenna output was connected to the measurement receiver.<br>2. A biconical antenna was used for the frequency range 30 – 200 MHz, a logarithmic periodical antenna was used for the frequency range from 200 – 1000 MHz. Above one 1 GHz a Double Ridged Broadband Horn antenna was used. The antenna was placed on an adjustable height antenna mast.<br>3. The EUT and cable arrangement were based on the exploratory measurement results.<br>4. Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded.<br>5. The test data of the worst-case conditions were recorded and shown on the next pages. |

2.1.5 Limits

| Class B @ 3 m | | |
|---|---|---|
| Frequency [MHz] | Detector | Limit [dBµV/m] |
| 30 - 88 | Quasi-peak | 40 |
| 88 - 216 | Quasi-peak | 43.5 |
| 216 - 960 | Quasi-peak | 46 |
| 960 - 1000 | Quasi-peak | 54 |
| > 1000 | Peak<br>Average | 74<br>54 |

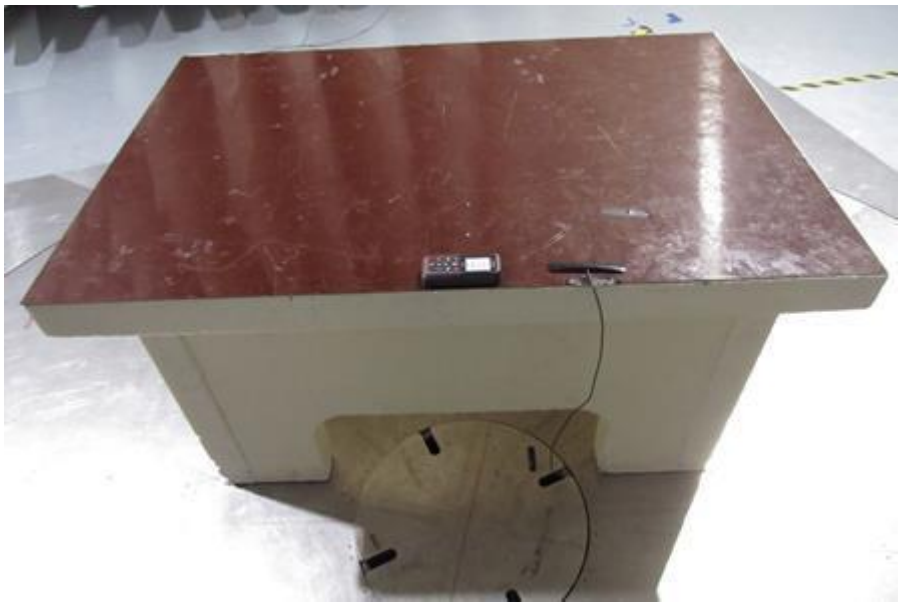
| Class A @ 10 m | | |
|---|---|---|
| Frequency [MHz] | Detector | Limit [dBµV/m] |
| 30 - 88 | Quasi-peak | 39 |
| 88 - 216 | Quasi-peak | 43.5 |
| 216 - 960 | Quasi-peak | 46.5 |
| 960 - 1000 | Quasi-peak | 49.5 |
| > 1000 | Peak<br>Average | 69.5<br>49.5 |

2.1.6 Results

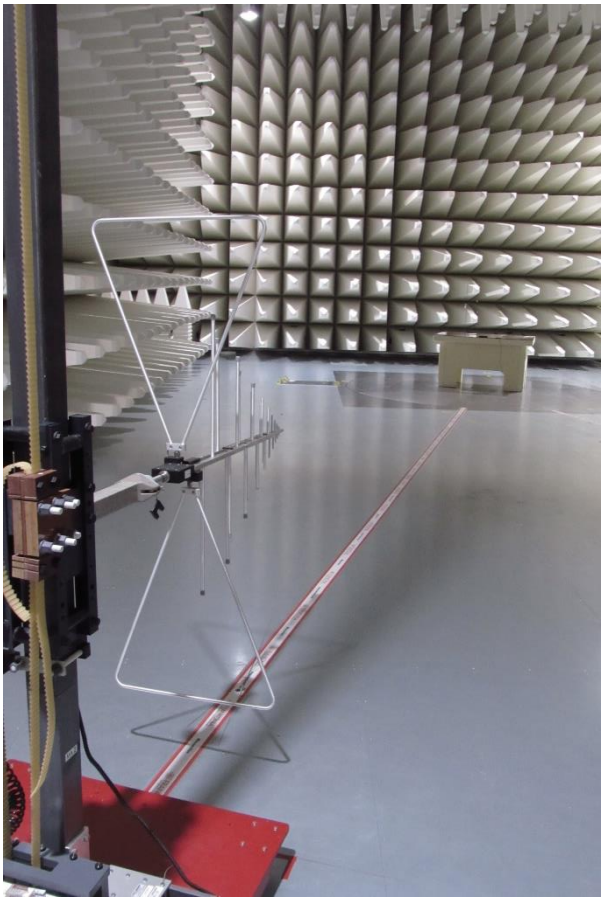
| Test Results | | | |
|---|---|---|---|
| Operational mode | EUT Configuration | Verdict | Remark |
| 1 | 1 | PASS | - |

2.1.7 Setup Photos

**Radiated Emission EUT Setup < 1 GHz**

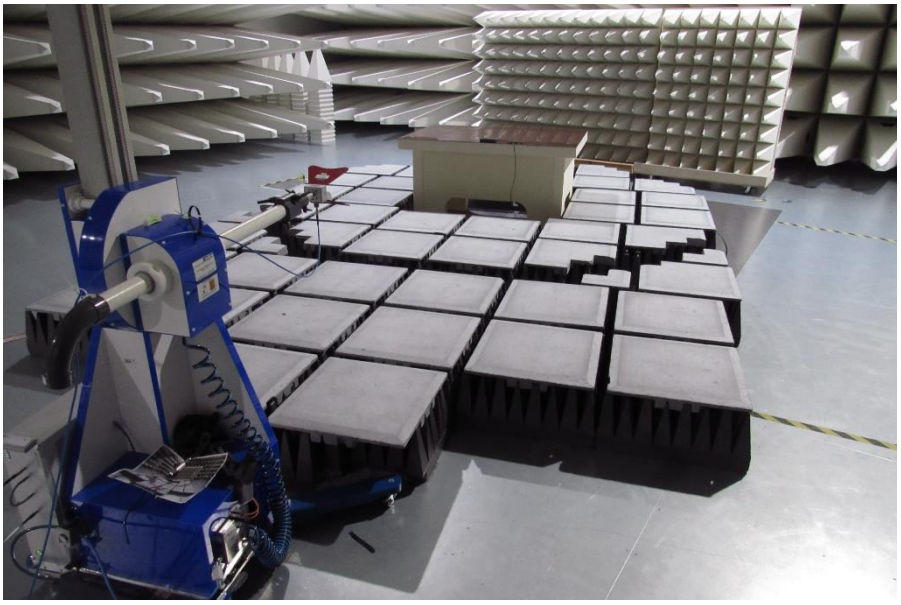


**Radiated Emission Antenna Setup < 1 GHz**



**Radiated Emission EUT Setup > 1 GHz**

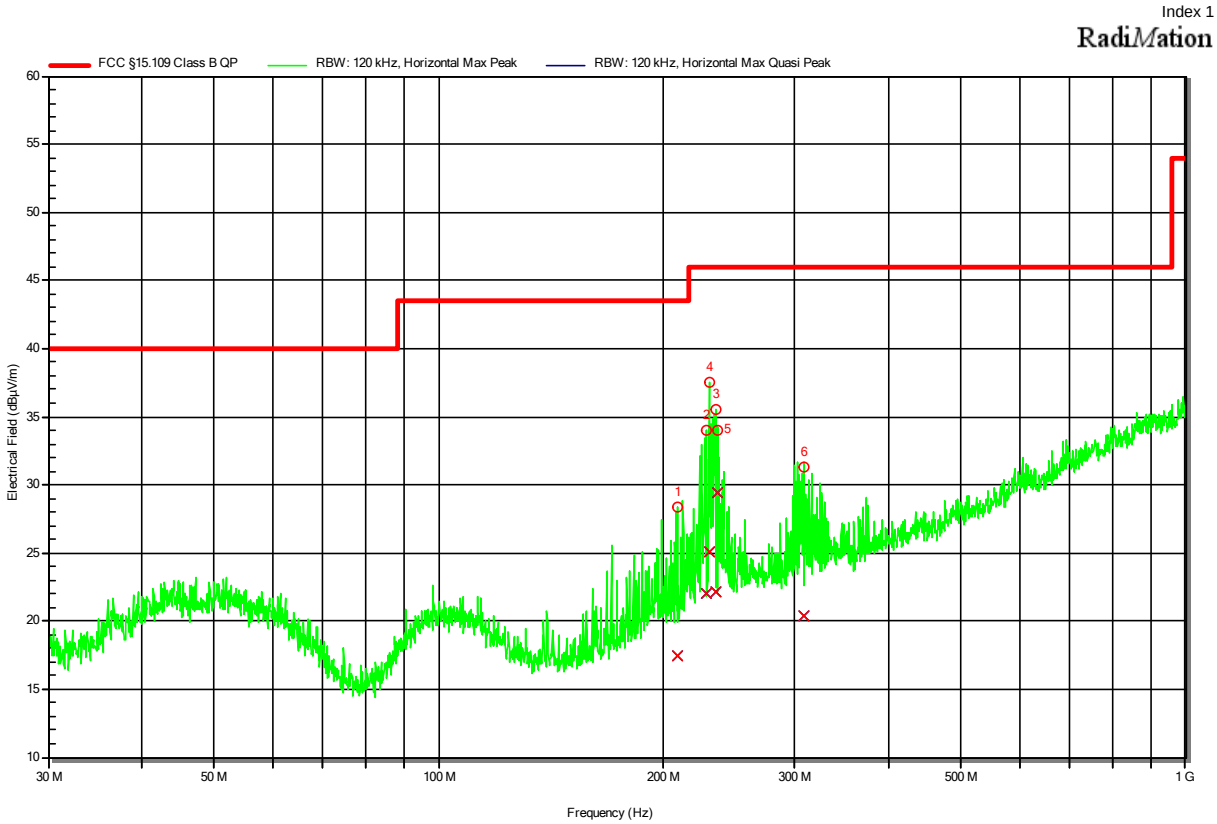
**Radiated Emission Antenna Setup > 1 GHz**



2.1.8 Records

**Radiated emissions according to FCC 15B**

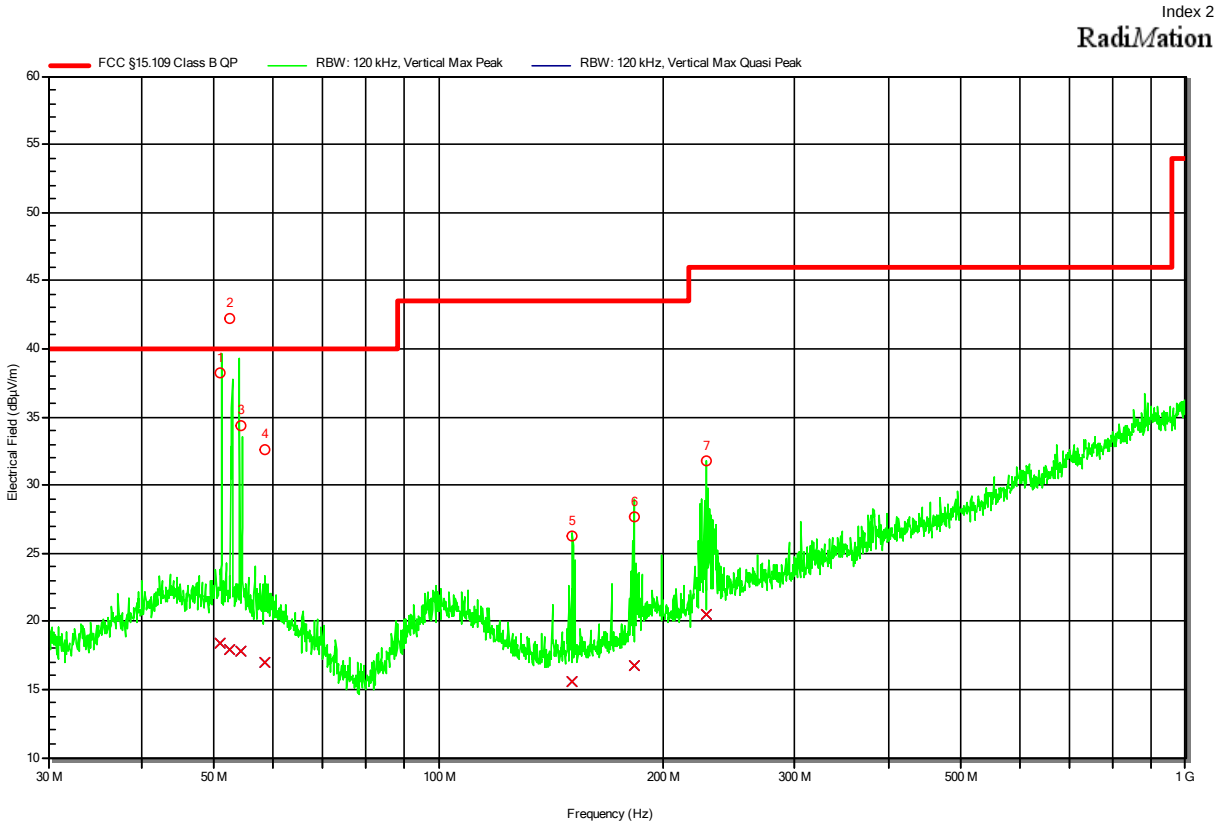
| | |
|---|---|
| Project Number: | G0M-2111-1145 |
| Applicant: | Adolf Würth GmbH |
| Model Description: | Laser Distance Meter |
| Model: | WDM 6-22 |
| Test Sample ID: | 37319 |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Colbasiuc |
| Test Date: | 2021-12-23 |
| Operating Conditions: | ambient temperature: 23 °Celsius<br>power input: 3 V DC |
| Antenna: | Schwarzbeck VULB 9162, Horizontal |
| Measurement Distance: | 10m, converted to 3m |
| Operational Mode& Configuration: | Mode 1<br>Configuration 1 |
| Note 1: | |




| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 209.082 MHz | 17.4 dBµV/m | 43.5 dBµV/m | -26.1 dB | Pass | -170 degrees | 4 m |
| 2 | 228.63 MHz | 22 dBµV/m | 46 dBµV/m | -24.0 dB | Pass | -170 degrees | 4 m |
| 3 | 235.284 MHz | 22.2 dBµV/m | 46 dBµV/m | -23.8 dB | Pass | -170 degrees | 4 m |
| 4 | 230.064 MHz | 25 dBµV/m | 46 dBµV/m | -21.0 dB | Pass | -170 degrees | 4 m |
| 5 | 236.874 MHz | 29.5 dBµV/m | 46 dBµV/m | -16.6 dB | Pass | -170 degrees | 4 m |
| 6 | 307.98 MHz | 20.4 dBµV/m | 46 dBµV/m | -25.6 dB | Pass | -170 degrees | 4 m |

**Radiated emissions according to FCC 15B**

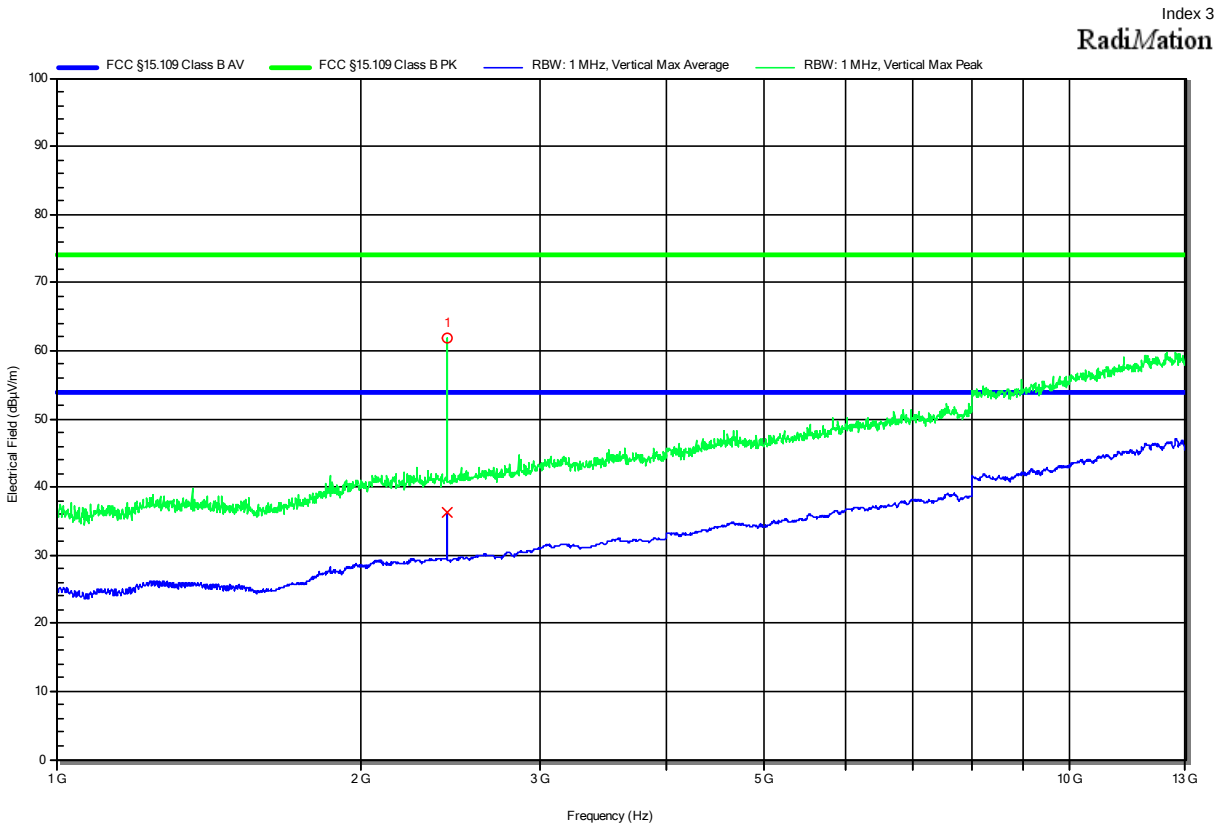
| | |
|---|---|
| Project Number: | G0M-2111-1145 |
| Applicant: | Adolf Würth GmbH |
| Model Description: | Laser Distance Meter |
| Model: | WDM 6-22 |
| Test Sample ID: | 37319 |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Colbasiuc |
| Test Date: | 2021-12-23 |
| Operating Conditions: | ambient temperature: 23 °Celsius<br>power input: 3 V DC |
| Antenna: | Schwarzbeck VULB 9162, Vertical |
| Measurement Distance: | 10m, converted to 3m |
| Operational Mode& Configuration: | Mode 1<br>Configuration 1 |
| Note 1: | |




| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 51 MHz | 18.4 dBµV/m | 40 dBµV/m | -21.6 dB | Pass | 0 degrees | 1 m |
| 2 | 52.5 MHz | 17.9 dBµV/m | 40 dBµV/m | -22.1 dB | Pass | 0 degrees | 1 m |
| 3 | 54.36 MHz | 17.8 dBµV/m | 40 dBµV/m | -22.2 dB | Pass | 0 degrees | 1 m |
| 4 | 58.56 MHz | 17 dBµV/m | 40 dBµV/m | -23.0 dB | Pass | 0 degrees | 1 m |
| 5 | 151.02 MHz | 15.5 dBµV/m | 43.5 dBµV/m | -28.0 dB | Pass | 0 degrees | 1 m |
| 6 | 182.538 MHz | 16.7 dBµV/m | 43.5 dBµV/m | -26.8 dB | Pass | 0 degrees | 1 m |
| 7 | 227.922 MHz | 20.5 dBµV/m | 46 dBµV/m | -25.5 dB | Pass | 0 degrees | 1 m |

**Radiated emissions according to FCC 15B**

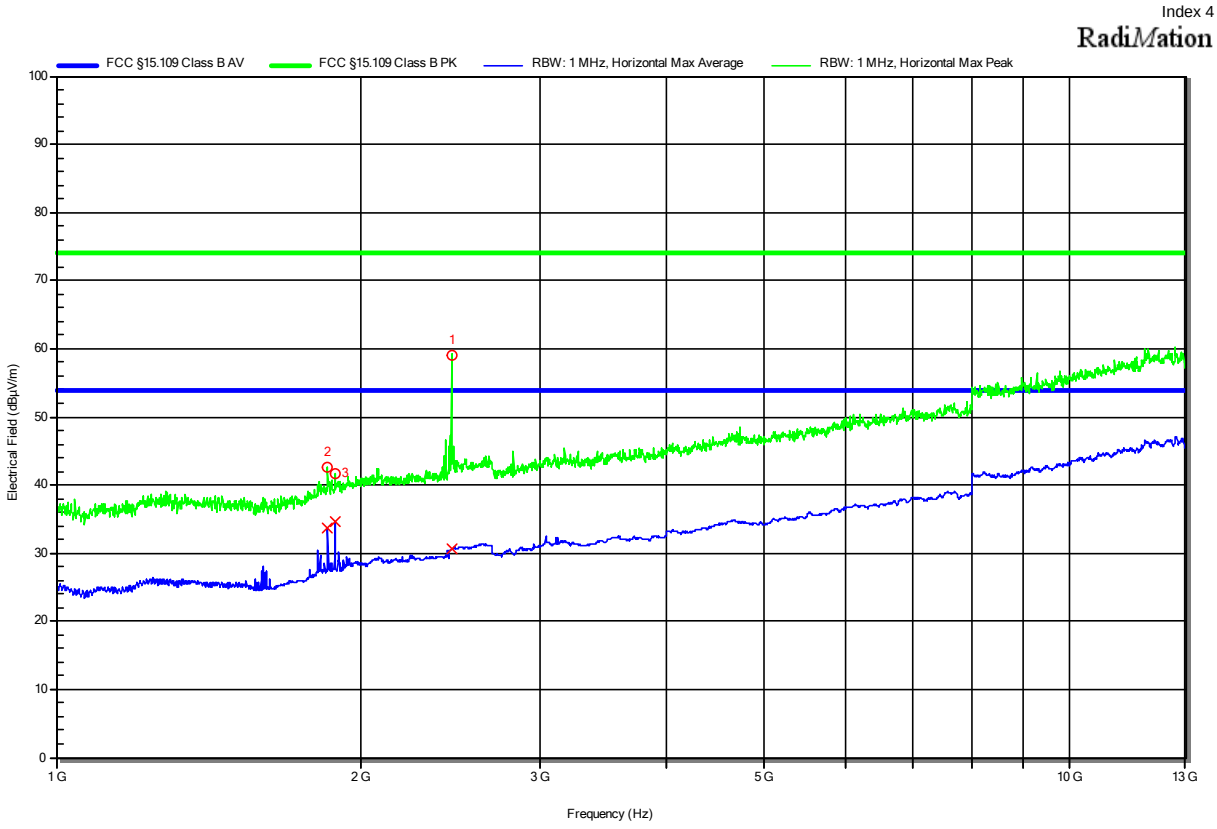
| | |
|---|---|
| Project Number: | G0M-2111-1145 |
| Applicant: | Adolf Würth GmbH |
| Model Description: | Laser Distance Meter |
| Model: | WDM 6-22 |
| Test Sample ID: | 37319 |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Colbasiuc |
| Test Date: | 2021-12-23 |
| Operating Conditions: | ambient temperature: 23 °Celsius<br>power input: 3 V DC |
| Antenna: | ETS-Lindgren 3117, Vertical |
| Measurement Distance: | 3m |
| Operational Mode& Configuration: | Mode 1<br>Configuration 1 |
| Note 1: | Table Position -33°/ Antenna high 1m |




| Peak Number | Frequency | | |
|---|---|---|---|
| 1 | 2.431 GHz | Bluetooth Carrier | LE |

**Radiated emissions according to FCC 15B**

| | |
|---|---|
| Project Number: | G0M-2111-1145 |
| Applicant: | Adolf Würth GmbH |
| Model Description: | Laser Distance Meter |
| Model: | WDM 6-22 |
| Test Sample ID: | 37319 |
| Test Site: | Eurofins Product Service GmbH |
| Operator: | Mr. Colbasiuc |
| Test Date: | 2021-12-23 |
| Operating Conditions: | ambient temperature: 23 °Celsius<br>power input: 3 V DC |
| Antenna: | ETS-Lindgren 3117, Horizontal |
| Measurement Distance: | 3m |
| Operational Mode& Configuration: | Mode 1<br>Configuration 1 |
| Note 1: | |




| Peak Number | Frequency | Peak | Peak Limit | Peak Difference | Peak Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 2.454 GHz | Bluetooth LE Carrier | | | | | |
| 2 | 1.852 GHz | 42.7 dBµV/m | 74 dBµV/m | -31.3 dB | Pass | -135 degrees | 1 m |
| 3 | 1.883 GHz | 41.8 dBµV/m | 74 dBµV/m | -32.2 dB | Pass | -135 degrees | 1 m |

| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status | Angle | Height |
|---|---|---|---|---|---|---|---|
| 1 | 2.454 GHz | Bluetooth LE Carrier | | | | | |
| 2 | 1.852 GHz | 33.8 dBµV/m | 54 dBµV/m | -20.2 dB | Pass | -135 degrees | 1 m |
| 3 | 1.883 GHz | 34.7 dBµV/m | 54 dBµV/m | -19.3 dB | Pass | -135 degrees | 1 m |

# 3 Measurement Uncertainty

All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2.

| Test Name | Measurement Uncertainty |
|---|---|
| Radiated Emission | 30MHz to 1GHz @ 10m, 6.25 dB<br>1GHz to 18GHz @3m, 4.86 dB |