





| EMC TEST REPORT | | | | | | | | | | | | | |
|--|---|-------------|------------|--------------|------------|-----------------|------------|----------------|---------|------------------|--------|------------------------|---------|
| FCC Title 47 CFR Part 15B, ISED ICES-003 Issue 7 | | | | | | | | | | | | | |
| Report Reference No | G0M-2202-1347-EF0115B-V01 | | | | | | | | | | | | |
| Testing Laboratory | Eurofins Product Service GmbH | | | | | | | | | | | | |
| Address | Storkower Str. 38c 15526 Reichenwalde Germany | | | | | | | | | | | | |
| Accreditation |     <p> A2LA - Registration number: 1983.01 (ISED) ISED wireless device testing laboratory: CN 3470A DAKKS - Registration number : D-PL-12092-01-04 (FCC) FCC Filed Test Laboratory, Reg.-No.: 96970 </p> | | | | | | | | | | | | |
| Applicant | Emberion Oy | | | | | | | | | | | | |
| Address | Metsänneidonkuja 8 02130 Espoo Finland | | | | | | | | | | | | |
| Test Specification Standard(s) | Title 47 CFR Part 15 Subpart B ISED ICES-Gen Issue 1 ; Amendment 1 (February 2021) ISED ICES-003 Issue 7 ANSI C63.4:2014+A1:2017 | | | | | | | | | | | | |
| Non-Standard Test Method | None | | | | | | | | | | | | |
| Equipment under Test (EUT): | | | | | | | | | | | | | |
| Product Description | VIS-SWIR Camera | | | | | | | | | | | | |
| Model(s) | VS20 CL | | | | | | | | | | | | |
| Additional Model(s) | None | | | | | | | | | | | | |
| Brand Name(s) | None | | | | | | | | | | | | |
| Hardware Version(s) | <table border="1"> <thead> <tr> <th>Description</th> <th>HW Version</th> </tr> </thead> <tbody> <tr> <td>Sensor board</td> <td>EMB000043B</td> </tr> <tr> <td>Front-end board</td> <td>EMB000040A</td> </tr> <tr> <td>Front-end flex</td> <td>VMNF 02</td> </tr> <tr> <td>Processing board</td> <td>VMN 02</td> </tr> <tr> <td>Camera link rigid-flex</td> <td>VMNC 02</td> </tr> </tbody> </table> | Description | HW Version | Sensor board | EMB000043B | Front-end board | EMB000040A | Front-end flex | VMNF 02 | Processing board | VMN 02 | Camera link rigid-flex | VMNC 02 |
| Description | HW Version | | | | | | | | | | | | |
| Sensor board | EMB000043B | | | | | | | | | | | | |
| Front-end board | EMB000040A | | | | | | | | | | | | |
| Front-end flex | VMNF 02 | | | | | | | | | | | | |
| Processing board | VMN 02 | | | | | | | | | | | | |
| Camera link rigid-flex | VMNC 02 | | | | | | | | | | | | |
| Software Version(s) | 1.10.4 | | | | | | | | | | | | |
| FCC-ID | 2A7MFVS20CL | | | | | | | | | | | | |
| IC | - | | | | | | | | | | | | |
| 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 | 2022-06-22 | |
| Report: | | |
| Compiled by | Stephan Liebich | |
| Tested by (+ signature) (Responsible for Test) | Stephan Liebich |  |
| Approved by (+ signature) (Senior Test Lab Technician) | Andreas Pflug |  |
| Date of Issue | 2022-08-03 | |
| Total number of pages | 42 | |
| General Remarks: | | |
| <p>The test results presented in this report relate only to the object tested.</p> <p>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.</p> <p>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p> | | |
| Additional Comments: | | |
| None | | |

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 | 2022-08-03 | Initial Release | - |

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1 Equipment (Test Item) Under Test

| | | | |
|----------------------------------|---|-------------------------------------|---------------|
| Description | VIS-SWIR Camera | | |
| Intended Use | VS20 CL is a VIS-SWIR camera based on a proprietary image sensor technology with wide spectral range up to 2000 nm. The VGA-resolution image sensor comprises a light-absorbing Colloidal Quantum Dots (CQD) layer built monolithically on a tailor-made CMOS readout integrated circuit. The CQDs provide an extremely wide spectral response range spanning from visible (VIS) to near infrared (NIR) and up to short-wave infrared (SWIR) wavelengths. The dynamic operation range of the image sensor is very large, owing both to the low noise and non-saturating characteristics of the photodetector. A stable performance over a wide environmental temperature range is ensured with a thermo-electric cooling (TEC) element built in the image sensor package. | | |
| Model | VS20 CL | | |
| Additional Model(s) | None | | |
| Brand Name(s) | None | | |
| Hardware Version(s) | Description | HW Version | |
| | Sensor board | EMB000043B | |
| | Front-end board | EMB000040A | |
| | Front-end flex | VMNF 02 | |
| | Processing board | VMN 02 | |
| | Camera link rigid-flex | VMNC 02 | |
| Software Version(s) | 1.10.4 | | |
| Number of tested samples | 1 | | |
| Sample Identification | EUT # | Sample-ID | Serial Number |
| | EUT 1 | 40249 | 2123-00001 |
| EUT Dimensions [cm] | 15 x 10 x 10 | | |
| FCC-ID | 2A7MFVS20CL | | |
| IC | - | | |
| Class | Class A | | |
| Equipment type | Table top | | |
| Highest internal frequency [MHz] | 320 MHz (clock frequency) | | |
| Protective Earth | Yes | | |
| Functional Earth | Yes | | |
| Radio Module | None | | |
| Supply Voltage | V _{NOM} | 12 V DC via dedicated AC/DC-adaptor | |
| AC/DC-Adaptor | Model | FSP040-RHAN3 | |
| | Manufacturer | FSP | |
| | Input | 100 – 240 V AC, 50 – 60 Hz | |
| | Output | 12 V DC | |
| Manufacturer | Emberion Oy Metsänneidonkuja 8 02130 Espoo Finland | | |


1.1 Equipment Ports

| Name | Type | Attributes | Comment |
|--------------|---|--|---|
| AC Mains | AC | Count: 1 Cable length [m]: 3 Direction: IO Service only: No Shielded: No | Port of dedicated AC/DC-adapter |
| DC Mains | DC | Count: 1 Cable length [m]: 1.5 Direction: In Service only: No Shielded: No | EUT port |
| Camera Link | IO | Count: 1 Cable length [m]: 5 Direction: IO Service only: No Shielded: Yes | Control / video interface; Cable: 1SF26-L120-00C-500; Cable Length: 5 m |
| Trigger I/O | IO | Count: 1 Cable length [m]: 5 Direction: IO Service only: No Shielded: Yes | SMA trigger; Cable Length: 3 m; |
| USB | IO | Count: 1 Cable length [m]: 5 Direction: IO Service only: Yes Shielded: Yes | For FW updates |
| 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 | | |

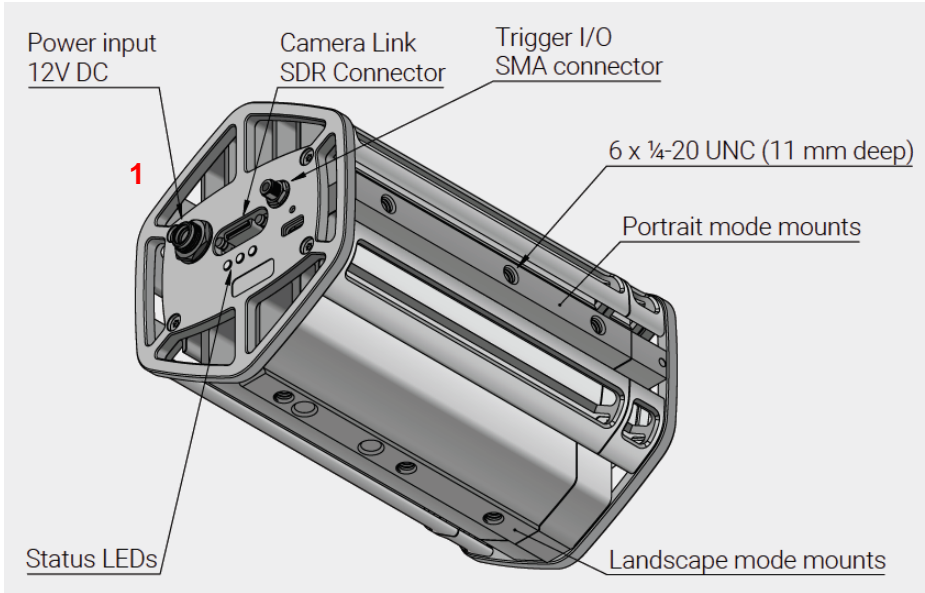
1.4 Support Equipment

| Product Type | Device | Manufacturer | Model | Comment |
|--------------|-----------------------|----------------------|--------------------|--|
| AE | PC | lenovo | P340 | Customer Support Equipment; Sample-ID: 40252 |
| AE | Pleora Frame Grabber | Pleora | iPort CL-U3 | Customer Support Equipment; Sample-ID: 40255 |
| MON | Monitor | lenovo | T2324pA | -- |
| CBL | HDMI cable | KTL | SU01001-4001 | shielded cable; Cable Length: 2 m |
| SW | Monitoring Software | Emberion | EMBERION VS20 | Customer Support Equipment; Version 1.2.0.4 |
| CBL | Trigger cable | Pickering | unspecified | Customer Support Equipment; shielded cable; Cable Length: 3 m; Sample-ID: 40256 |
| CBL | CameraLink cable | 3M | 1SF26-L120-00C-500 | Customer Support Equipment; shielded cable; Cable Length: 5 m |
| CBL | USB cable | AWM | E357566-ALY-C | Customer Support Equipment; shielded cable; Cable Length: 3 m |
| CBL | PoCL.MDR to SDR cable | National Instruments | 199745B-05 | Customer Support Equipment; shielded cable; Cable Length: 5 m; Sample-ID: 40259 |
| AE | Temperature Sensor | Emberion | unspecified | Customer Support Equipment; shielded cable; Cable Length: 3 m; Sample-ID: 40261 |
| Description: | | | | |
| AE | Auxiliary Equipment | | | |
| SIM | Simulator | | | |
| MON | Monitoring Equipment | | | |
| CBL | Connecting Cable | | | |
| SW | Software | | | |
| Comment: -- | | | | |

1.5 Operational Modes

| Mode # | Description |
|--------|--|
| 1 | <p>EUT is transferring every 0.5 ms a 640x512 unsigned 16-bit image with a FPS of 86 to PC (Monitoring Software). Sensor temperature is +5°C.</p>  <p>Comment: --</p> |

1.6 EUT Configuration

| Configuration # | Description |
|-----------------|---|
| 1 | <p>EUT is powered by 12 V DC [1] via dedicated AC/DC-adapter [2]. Dedicated AC/DC-adapter is powered by external laboratory power supply unit. The EUT is grounded via earth potential [3]. EUT is connected to Pleora Frame Grabber [4] via CameraLink cable [5]. Pleora Frame Grabber is connected to PC [6] via USB cable [7]. EUT is connected to PC [6] via Trigger cable [8]. PC is connected to Monitor [9] via HDMI cable [10]. PC is connected to Temperature Sensor [11] via PoCL.MDR to SDR cable [12].</p> <p>Shield of all shielded cables are connected on both sides with EUT or Support Equipment.</p> <p>PC connectors connected to PE.</p>  |

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:

$$\text{Reading on Analyser (dB}\mu\text{V)} + \text{A.F. (dB/m)} = \text{Net field strength (dB}\mu\text{V/m)}$$

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:

$$\text{Limit (dB}\mu\text{V/m)} = 20 \cdot \log(\mu\text{V/m})$$

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 ICES-003, 3.2.2 | Radiated emissions | ANSI C63.4:2014 +A1:2017 | PASS | -- |
| FCC 15.107 ICES-003, 3.2.1 | AC power line conducted emissions | ANSI C63.4:2014 +A1:2017 | PASS | -- |
| Comment: | | | | |

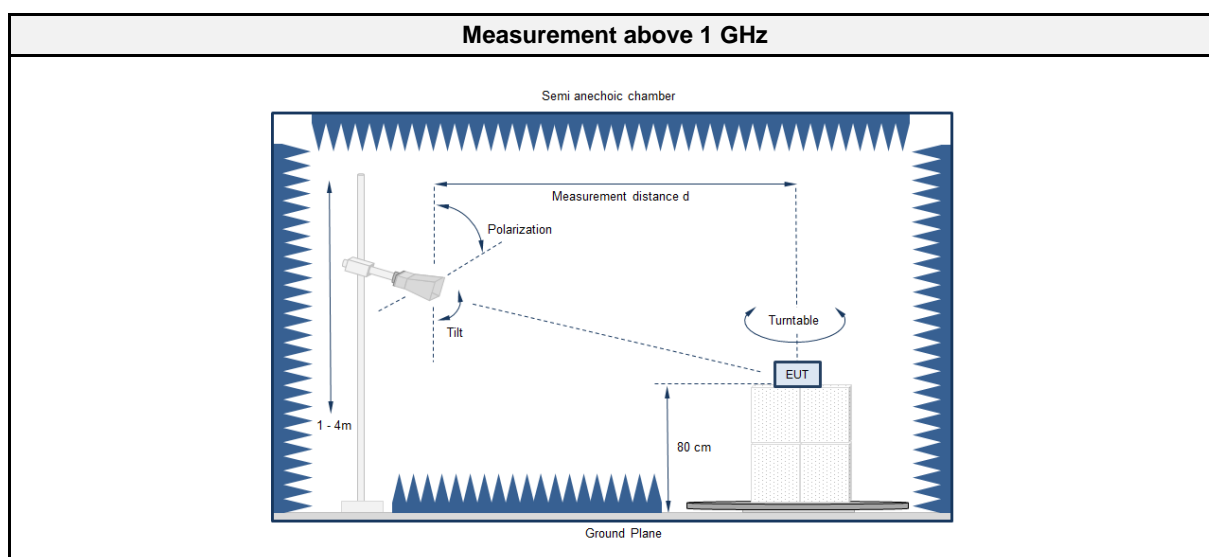
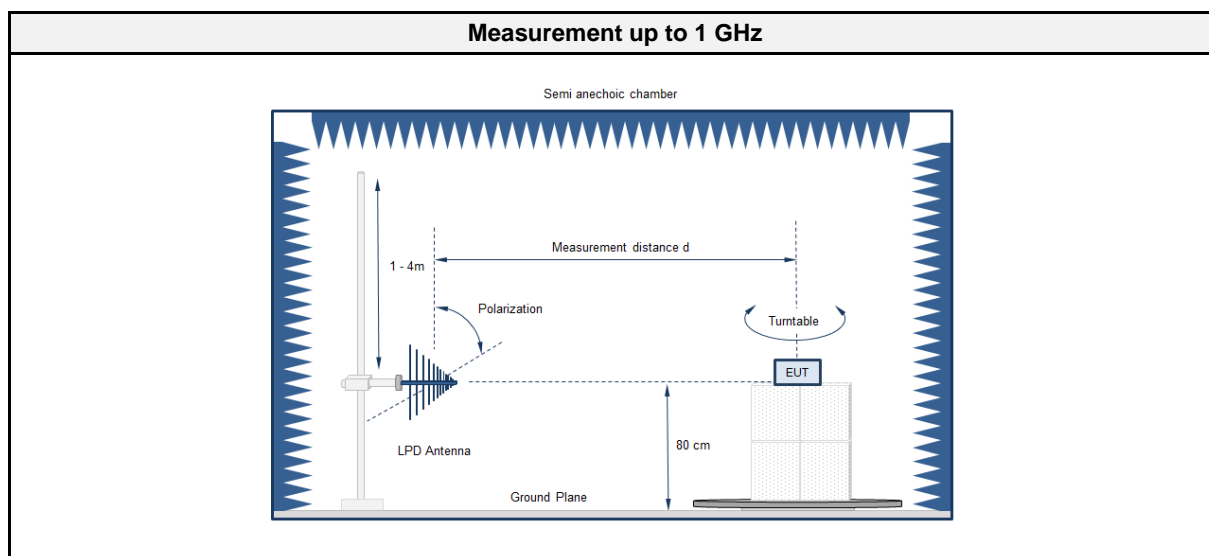
| Possible Test Case Verdicts | |
|-----------------------------|--|
| PASS | Test object does meet the requirements |
| FAIL | Test object does not meet the requirements |
| N/T | Required by standard but not tested |
| N/R | Not required by standard for the test object |

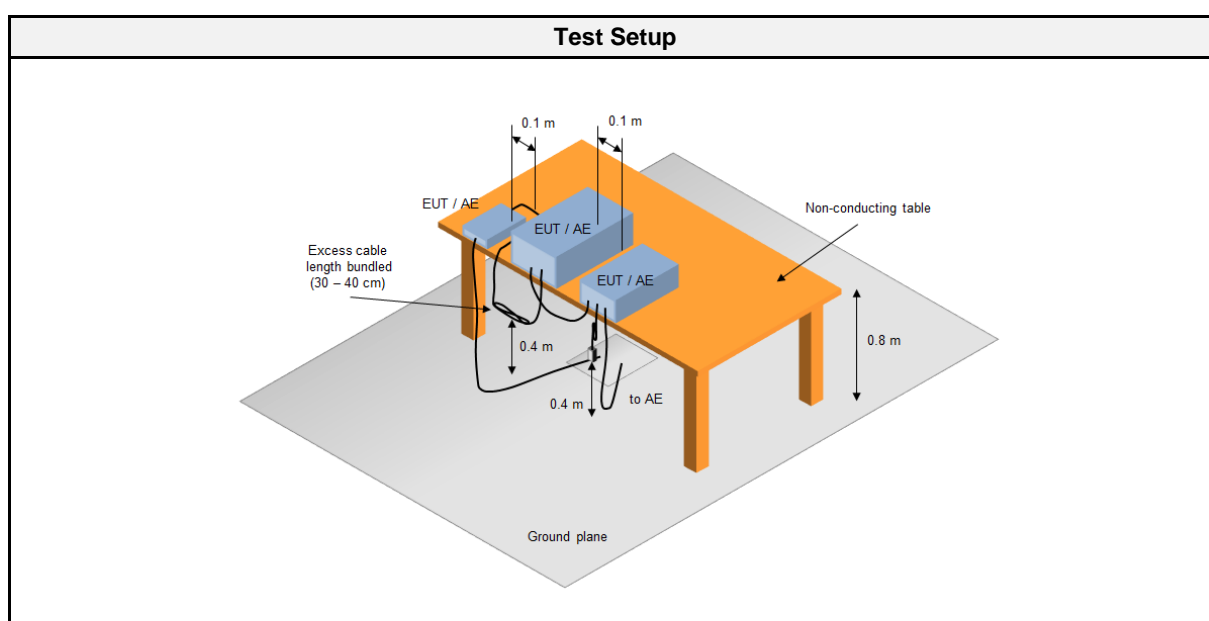
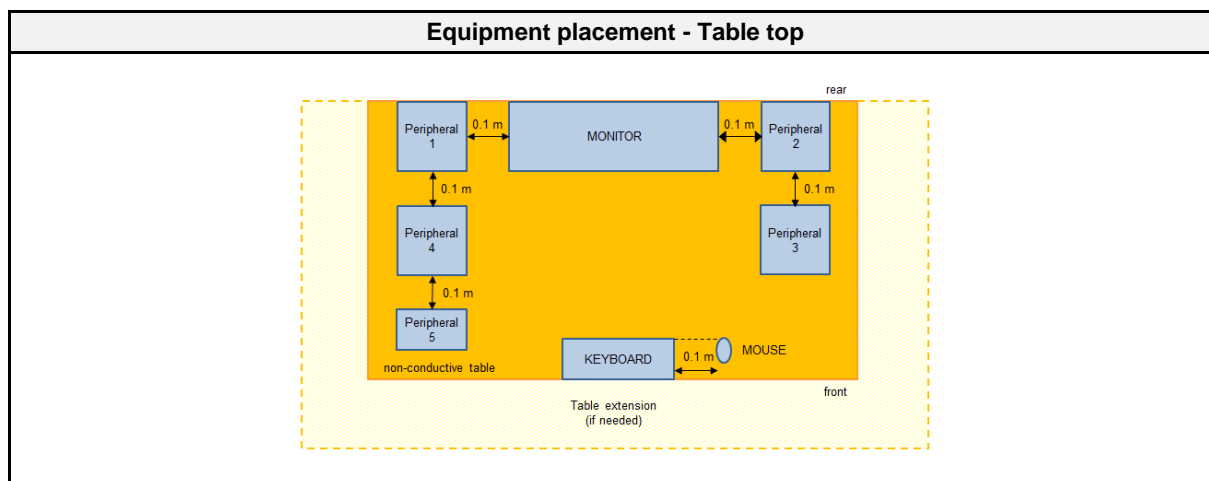
2.1 Test Conditions and Results - Radiated emissions acc. to ANSI C63.4

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 A |
| Equipment type | Table top |
| Highest internal frequency [MHz] | 320 |
| Measurement range | 30 MHz to 6000 MHz |
| Temperature [°C] | 23 – 25 |
| Humidity [%] | 35 – 41 |
| Operator | Stephan Liebich |
| Date | 2022-07-05 |

2.1.2 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 (NSA) | Frankonia | AC1 | EF00062 | 2021-02 | 2024-02 |
| Anechoic chamber (SVSWR) | Frankonia | AC 1 | EF01011 | 2022-06 | 2025-06 |
| Programmable AC Source | Chroma ATE Inc. | 61604 | EF01068 | 2021-07 | 2022-07 |
| EMI Test Receiver | Keysight | N9038A-526/WXP | EF01070 | 2021-07 | 2022-07 |
| Biconical Antenna | R&S | HK 116 | EF00030 | 2021-05 | 2024-05 |
| LPD Antenna | R&S | HL 223 | EF00187 | 2022-06 | 2025-06 |
| Horn Antenna | Schwarzbeck | BBHA9120D | EF00018 | 2019-10 | 2022-10 |
| Climatic Sensor | Embedded Data Systems, LLC. | 2800100000254 17E | EF01054 | 2022-04 | 2023-04 |

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Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

2.1.4 Procedure

| Exploratory measurement | |
|-------------------------|--|
| 1. | The EUT was placed on a non-conductive table at a height of 0.8m. |
| 2. | The EUT and support equipment, if needed, were set up to simulate typical usage. |
| 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. |
| 4. | The antenna was placed at a distance of 3 or 10 m. |
| 5. | The received signal was monitored at the measurement receiver. |
| 6. | This procedure has to be performed in both antenna polarizations, horizontal and vertical. |
| 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. |
| 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. |
| 3. | The EUT and cable arrangement were based on the exploratory measurement results. |
| 4. | Emissions were maximized at each frequency by rotating the EUT and adjusting the receive antenna height and polarization. The maximum values were recorded. |
| 5. | The test data of the worst-case conditions were recorded and shown on the next pages. |

2.1.5 Limits

| Class A @ 10 m (3 m for > 1000 MHz) | | |
|-------------------------------------|------------|----------------|
| 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 | 69.5 |
| | Average | 49.5 |

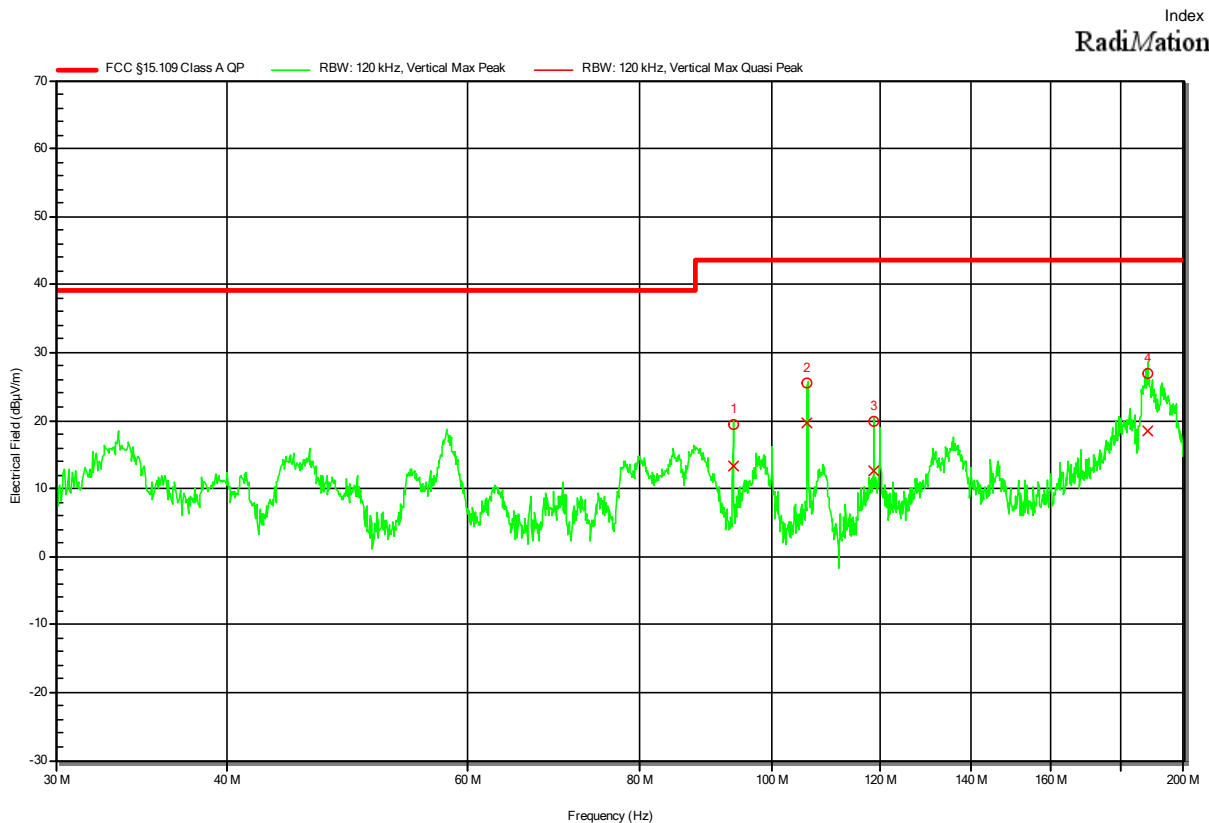
2.1.6 Results

| Test Results | | | |
|---|-------------------|---------|------------------|
| Operational mode | EUT Configuration | Verdict | Remark |
| 1 | 1 | PASS | 120 V AC / 60 Hz |
| Comment: Cable length of functional earth is 1 m. | | | |

2.1.8 Records

**Radiated emissions
according to FCC part 15B**

Project Number: G0M-2202-1347
 Applicant: Emberion Oy
 Model Description: VIS-SWIR Camera
 Model: VS20 CL
 Test Sample ID: 40249
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2022-07-05
 Operating Conditions: ambient temperature: 24 °Celsius
 power input: 12 V DC via dedicated AC/DC-adaptor
 (120 V AC / 60 Hz)
 Antenna: Rohde & Schwarz HK 116, Vertical
 Measurement Distance: 3m, converted to 10m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1
 Note 1: --



| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|-------------|-------------|--------------|------------------|-----------------------|-------------------|-------------|--------|
| 1 | 93.748 MHz | 13.24 dBµV/m | 43.52 dBµV/m | -30.28 dB | Pass | 160 degrees | 1 m |
| 2 | 106.248 MHz | 19.55 dBµV/m | 43.52 dBµV/m | -23.98 dB | Pass | 160 degrees | 1 m |
| 3 | 118.747 MHz | 12.68 dBµV/m | 43.52 dBµV/m | -30.84 dB | Pass | 160 degrees | 1 m |
| 4 | 188.173 MHz | 18.4 dBµV/m | 43.52 dBµV/m | -25.12 dB | Pass | 160 degrees | 1 m |

Test Report No.: G0M-2202-1347-EF0115B-V01

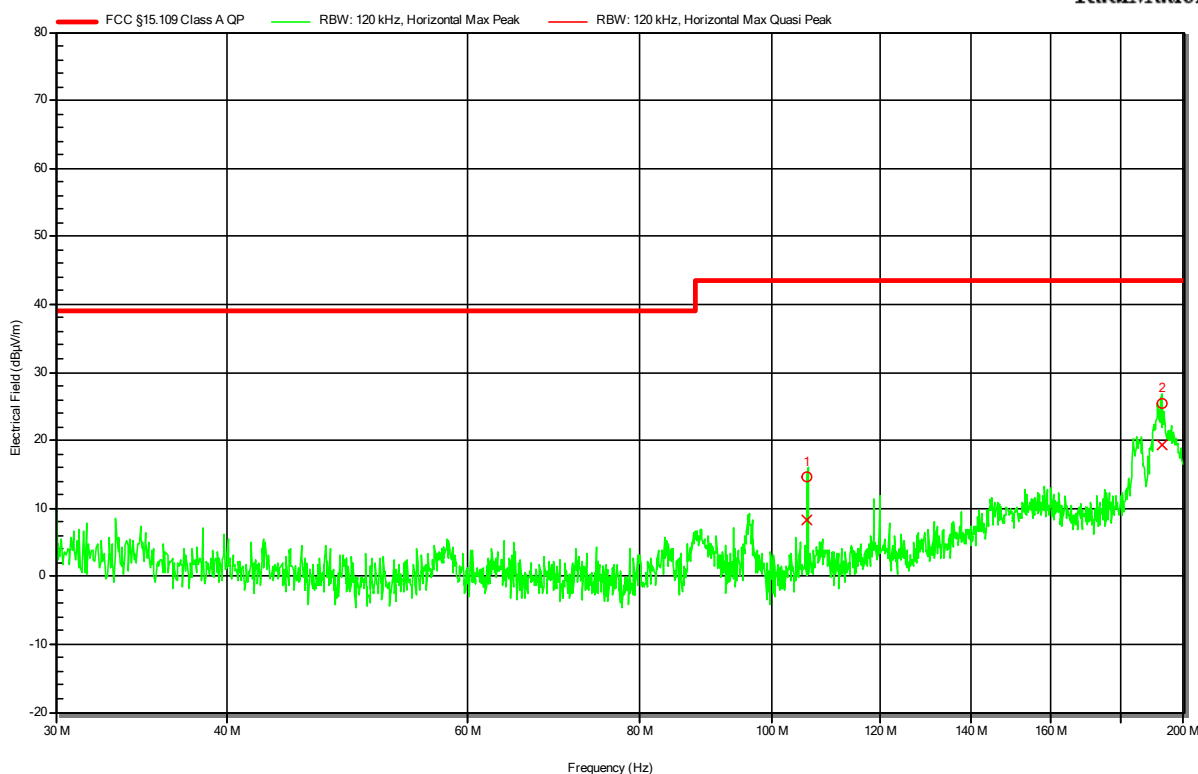
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated emissions according to FCC part 15B

Project Number: G0M-2202-1347
Applicant: Emberion Oy
Model Description: VIS-SWIR Camera
Model: VS20 CL
Test Sample ID: 40249
Test Site: Eurofins Product Service GmbH
Operator: Mr. Liebich
Test Date: 2022-07-05
Operating Conditions: ambient temperature: 24 °Celsius
power input: 12 V DC via dedicated AC/DC-adapter
(120 V AC / 60 Hz)
Antenna: Rohde & Schwarz HK 116, Horizontal
Measurement Distance: 3m, converted to 10m
Operational Mode: Mode 1
EUT Configuration: Configuration 1
Note 1: --

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RadiMation



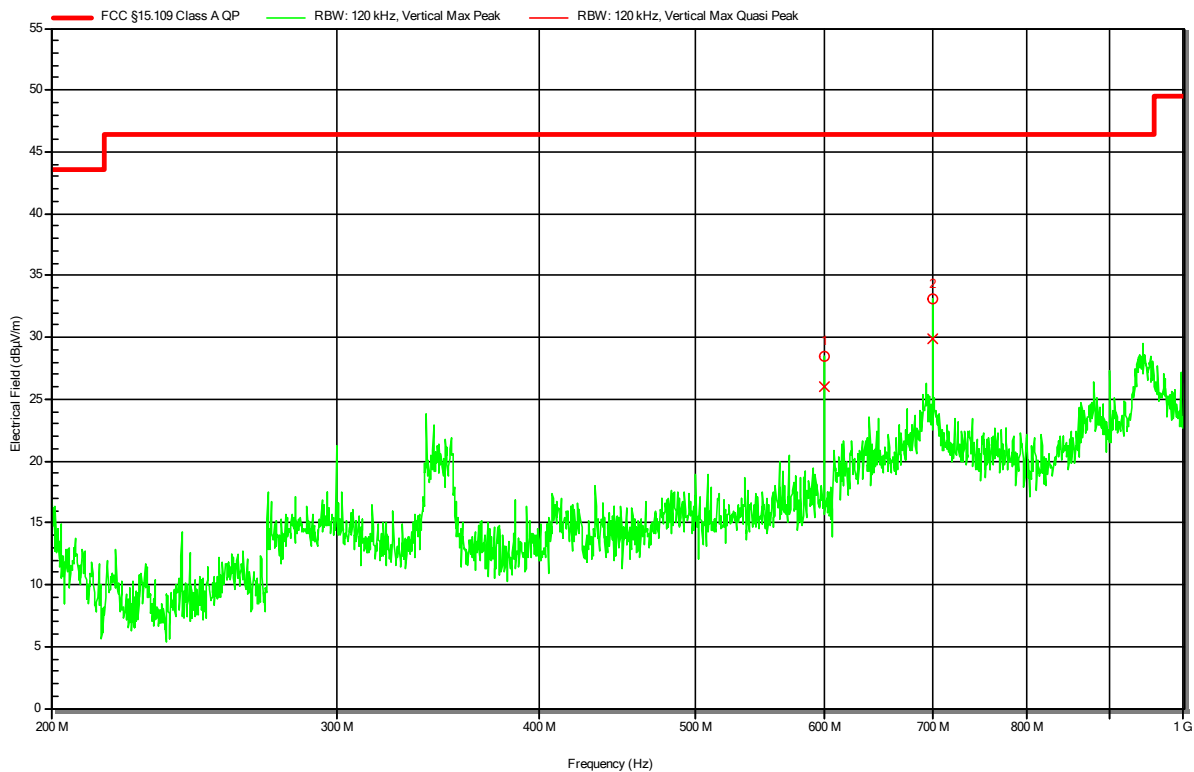
| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|-------------|-------------|--------------|------------------|-----------------------|-------------------|------------|--------|
| 1 | 106.237 MHz | 8.25 dBμV/m | 43.52 dBμV/m | -35.27 dB | Pass | 80 degrees | 1 m |
| 2 | 192.697 MHz | 19.41 dBμV/m | 43.52 dBμV/m | -24.12 dB | Pass | 80 degrees | 1 m |

Radiated emissions according to FCC part 15B

Project Number: G0M-2202-1347
 Applicant: Emberion Oy
 Model Description: VIS-SWIR Camera
 Model: VS20 CL
 Test Sample ID: 40249
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2022-07-05
 Operating Conditions: ambient temperature: 24 °Celsius
 power input: 12 V DC via dedicated AC/DC-adapter
 (120 V AC / 60 Hz)
 Antenna: Rohde & Schwarz HL 223, Vertical
 Measurement Distance: 3m, converted to 10m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1
 Note 1: --

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RadiMation



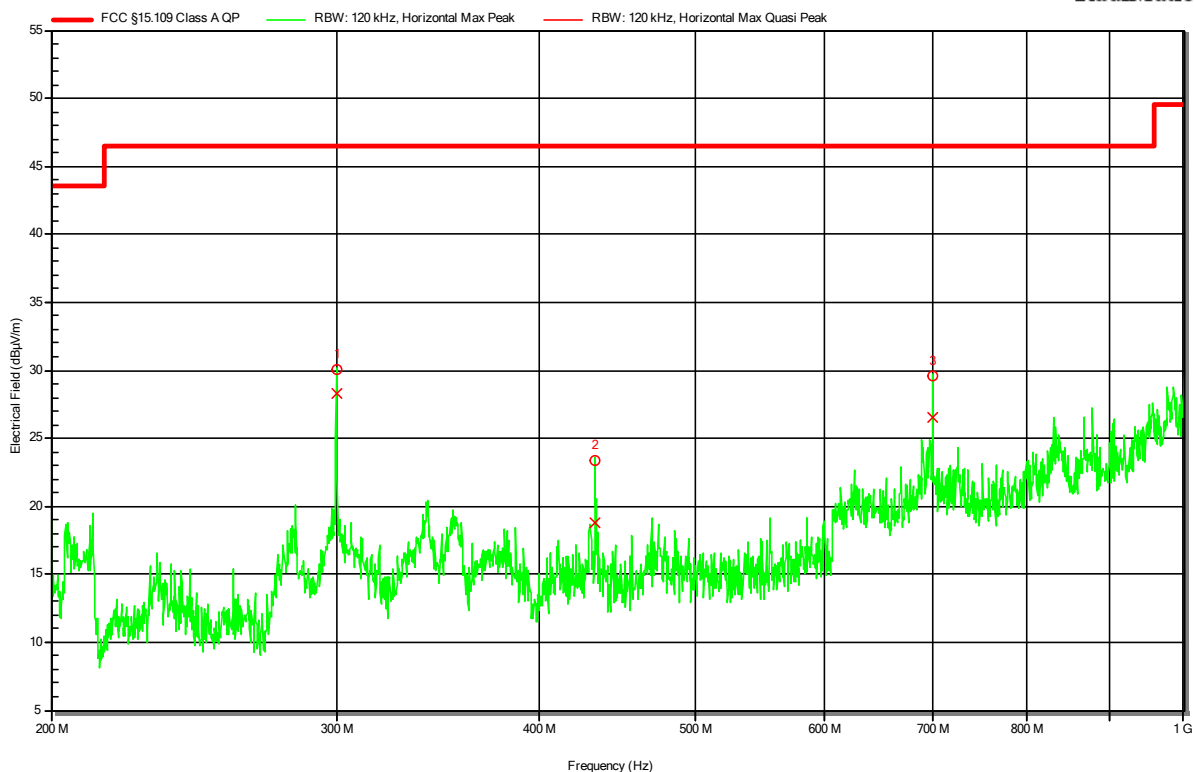
| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|-------------|-------------|--------------|------------------|-----------------------|-------------------|--------------|--------|
| 1 | 599.988 MHz | 26.02 dBµV/m | 46.44 dBµV/m | -20.42 dB | Pass | -140 degrees | 1 m |
| 2 | 699.992 MHz | 29.84 dBµV/m | 46.44 dBµV/m | -16.61 dB | Pass | -140 degrees | 1 m |

Radiated emissions according to FCC part 15B

Project Number: G0M-2202-1347
Applicant: Emberion Oy
Model Description: VIS-SWIR Camera
Model: VS20 CL
Test Sample ID: 40249
Test Site: Eurofins Product Service GmbH
Operator: Mr. Liebich
Test Date: 2022-07-05
Operating Conditions: ambient temperature: 24 °Celsius
power input: 12 V DC via dedicated AC/DC-adapter
(120 V AC / 60 Hz)
Antenna: Rohde & Schwarz HL 223, Horizontal
Measurement Distance: 3m, converted to 10m
Operational Mode: Mode 1
EUT Configuration: Configuration 1
Note 1: --

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RadiMation



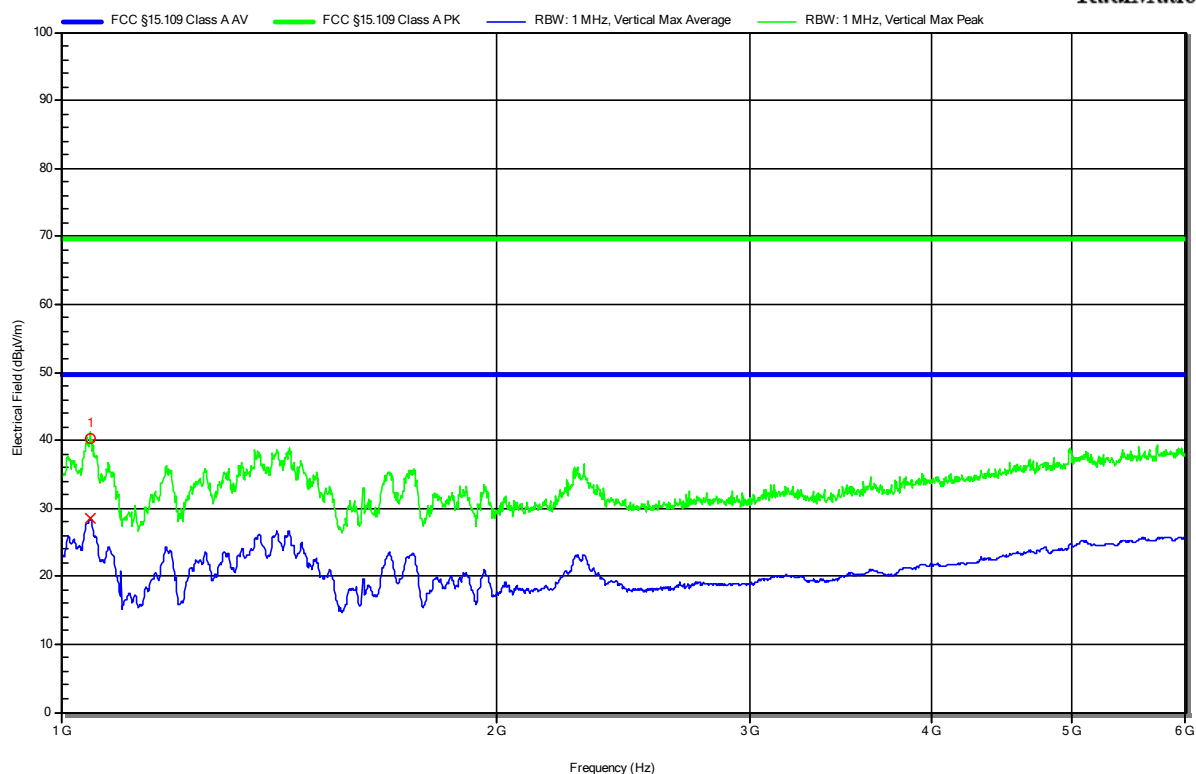
| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | Angle | Height |
|-------------|-------------|--------------|------------------|-----------------------|-------------------|-------------|--------|
| 1 | 299.995 MHz | 28.27 dBμV/m | 46.44 dBμV/m | -18.18 dB | Pass | 180 degrees | 1 m |
| 2 | 433.45 MHz | 18.81 dBμV/m | 46.44 dBμV/m | -27.63 dB | Pass | 180 degrees | 1 m |
| 3 | 699.985 MHz | 26.58 dBμV/m | 46.44 dBμV/m | -19.87 dB | Pass | 180 degrees | 1 m |

Radiated emissions according to FCC part 15B

Project Number: G0M-2202-1347
 Applicant: Emberion Oy
 Model Description: VIS-SWIR Camera
 Model: VS20 CL
 Test Sample ID: 40249
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2022-07-05
 Operating Conditions: ambient temperature: 24 °Celsius
 power input: 12 V DC via dedicated AC/DC-adapter
 (120 V AC / 60 Hz)
 Antenna: Schwarzbeck BBHA 9120D, Vertical
 Measurement Distance: 3m
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1
 Note 1: --

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RadiMation



| Peak Number | Frequency | Peak | Peak Limit | Peak Difference | Peak Status | Angle | Height |
|-------------|-----------|--------------|--------------|-----------------|-------------|-------------|--------|
| 1 | 1.048 GHz | 40.35 dBμV/m | 69.54 dBμV/m | -29.19 dB | Pass | -30 degrees | 1 m |

| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status | Angle | Height |
|-------------|-----------|--------------|---------------|--------------------|----------------|-------------|--------|
| 1 | 1.048 GHz | 28.43 dBμV/m | 49.54 dBμV/m | -21.11 dB | Pass | -30 degrees | 1 m |

Test Report No.: G0M-2202-1347-EF0115B-V01

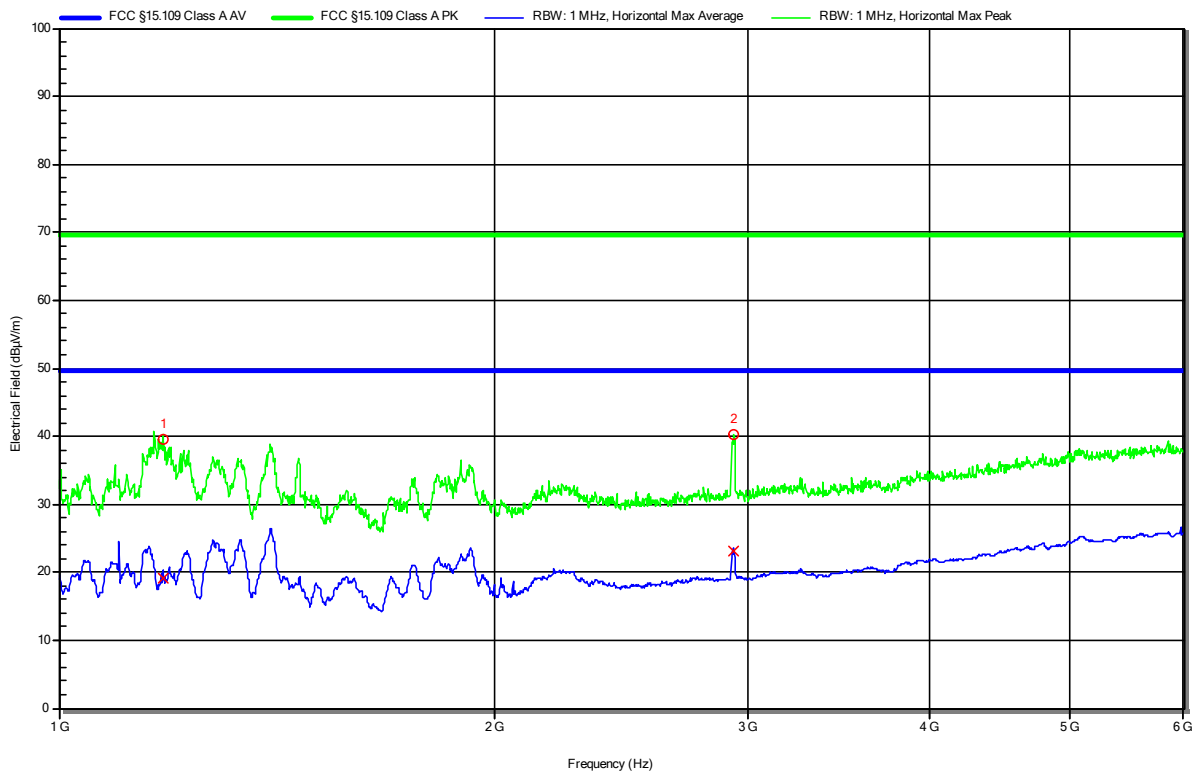
Eurofins Product Service GmbH
 Storkower Str. 38c, D-15526 Reichenwalde, Germany

Radiated emissions according to FCC part 15B

Project Number: G0M-2202-1347
Applicant: Emberion Oy
Model Description: VIS-SWIR Camera
Model: VS20 CL
Test Sample ID: 40249
Test Site: Eurofins Product Service GmbH
Operator: Mr. Liebich
Test Date: 2022-07-05
Operating Conditions: ambient temperature: 24 °Celsius
power input: 12 V DC via dedicated AC/DC-adaptor
(120 V AC / 60 Hz)
Antenna: Schwarzbeck BBHA 9120D, Horizontal
Measurement Distance: 3m
Operational Mode: Mode 1
EUT Configuration: Configuration 1
Note 1: --°

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RadiMation



| Peak Number | Frequency | Peak | Peak Limit | Peak Difference | Peak Status | Angle | Height |
|-------------|-----------|--------------|--------------|-----------------|-------------|-------------|--------|
| 1 | 1.181 GHz | 39.55 dBμV/m | 69.54 dBμV/m | -29.99 dB | Pass | 160 degrees | 1 m |
| 2 | 2.932 GHz | 40.25 dBμV/m | 69.54 dBμV/m | -29.3 dB | Pass | 160 degrees | 1 m |

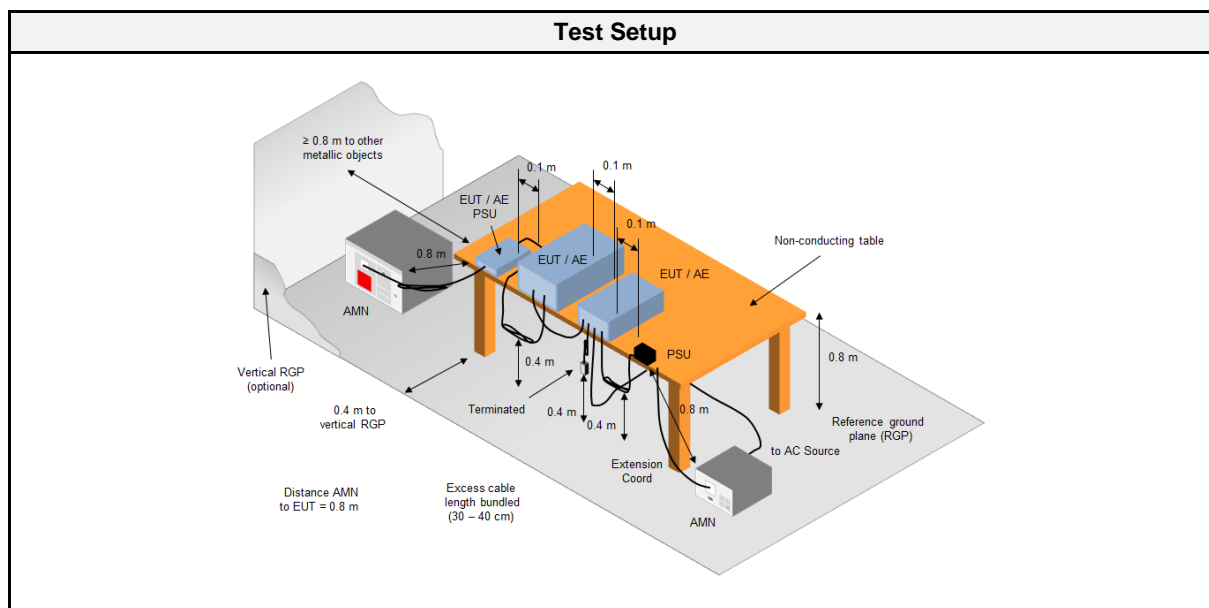
| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status | Angle | Height |
|-------------|-----------|--------------|---------------|--------------------|----------------|-------------|--------|
| 1 | 1.181 GHz | 19.07 dBμV/m | 49.54 dBμV/m | -30.47 dB | Pass | 160 degrees | 1 m |
| 2 | 2.932 GHz | 23.04 dBμV/m | 49.54 dBμV/m | -26.51 dB | Pass | 160 degrees | 1 m |

Test Report No.: G0M-2202-1347-EF0115B-V01

Eurofins Product Service GmbH
Storkower Str. 38c, D-15526 Reichenwalde, Germany

2.2.1 Information

2.2.2 Setup



2.2.3 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 |
| AMN | Schwarzbeck | NSLK 8127 | EF01592 | 2021-07 | 2022-07 |
| AMN | R&S | ESH3-Z5 | EF00036 | 2021-08 | 2023-08 |
| Pulse Limiter | R&S | ESH3-Z2 | EF01063 | 2021-07 | 2022-07 |
| EMI Test Receiver | R&S | ESR 7 | EF00943 | 2021-08 | 2022-08 |
| Climatic Sensor | Embedded Data Systems, LLC. | 2800100000254 17E | EF01054 | 2022-04 | 2023-04 |

2.2.4 Procedure

| Exploratory measurement | |
|-------------------------|---|
| 1. | The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1) |
| 2. | The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN. |
| 3. | The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length). |
| 4. | The LISN measurement port was connected to a measurement receiver |
| 5. | I/O cables were bundled not longer than 0.4 m |
| 6. | Measurement was performed in the frequency range 0.15 – 30MHz on each current-carrying conductor |
| 7. | To maximize the emissions the cable positions were manipulated |
| 8. | The worst configuration of EUT and cables is shown on a test setup picture at item 2.2.2 |

| Final measurement | |
|-------------------|---|
| 1. | The EUT was placed on a non conductive table 0.8 m above the reference ground plane and 0.4 m away from the vertical conducting plane (ANSI C63.4: 2014 item 7.3.1) |
| 2. | The power cord that is normally supplied or recommended by the manufacturer was connected to the LISN. |
| 3. | The distance between the outer edge of the EUT and the LISN shall be set to 0.8 m. A longer power cord shall be bundled to this length (bundling shall not exceed 40 cm in length). |
| 4. | The LISN measurement port was connected to a measurement receiver |
| 5. | The EUT and cable arrangement were based on the exploratory measurement results |
| 6. | The test data of the worst-case conditions were recorded and shown on the next pages |

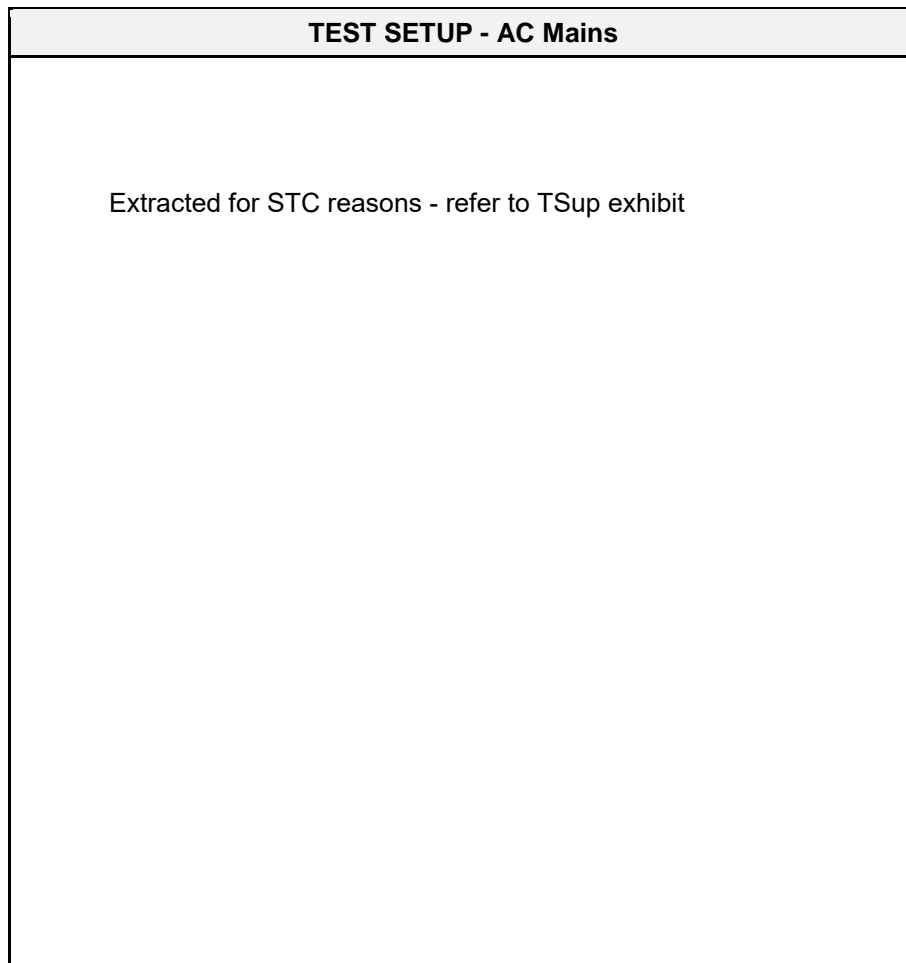
2.2.5 Limits

| Class A | | |
|-----------------|-------------------------------|----------------------------|
| Frequency [MHz] | Quasi-peak Limit [dB μ V] | Average Limit [dB μ V] |
| 0.15 - 0.5 | 79 | 66 |
| 0.5 - 30 | 73 | 60 |

2.2.6 Results

| AC power line conducted emissions | | | | | |
|---|----------|------------------|-------------------|---------|------------------|
| Port | Coupling | Operational mode | EUT Configuration | Verdict | Remark |
| AC Mains | AMN | 1 | 1 | PASS | 120 V AC / 60 Hz |
| Comment: Cable length of functional earth is 1 m. | | | | | |

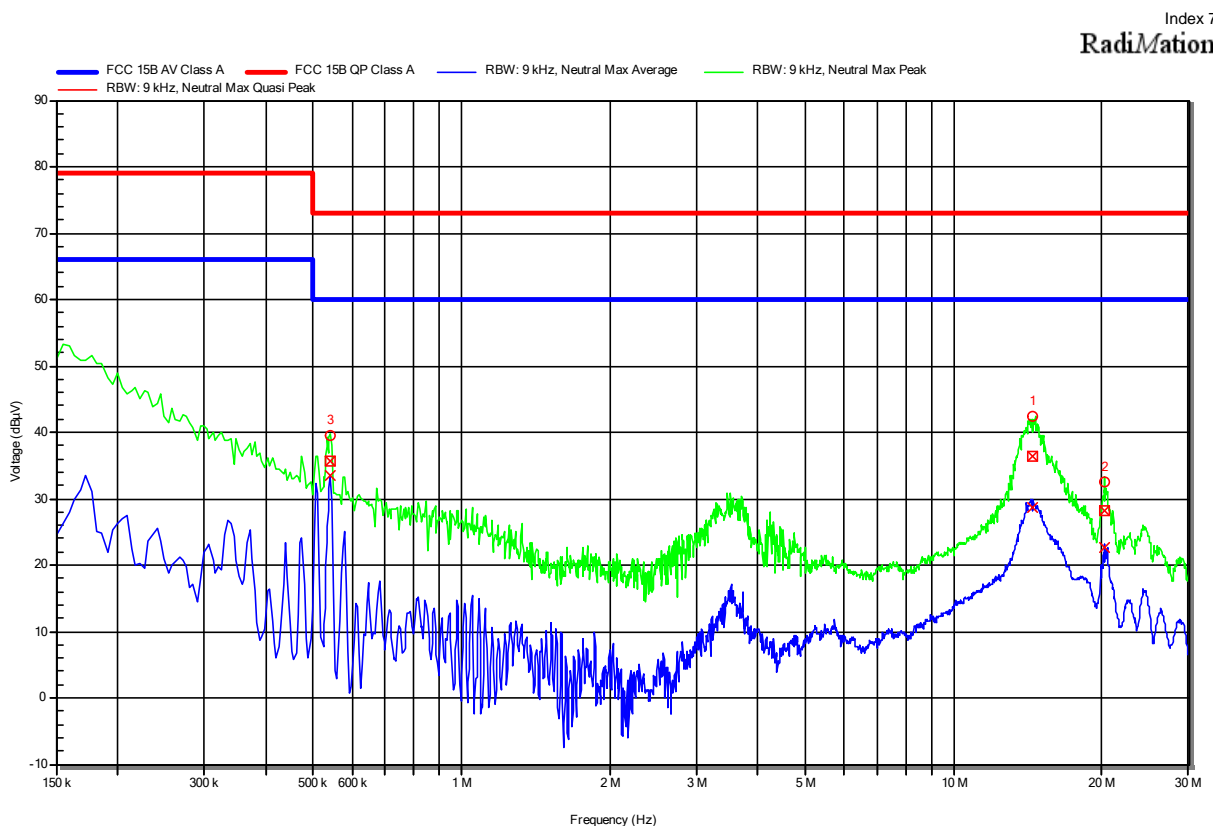
2.2.7 Setup Photos



2.2.8 Records

Conducted emissions at the mains power port according to FCC part 15B

Project Number: G0M-2202-1347
 Applicant: Emberion Oy
 Model Description: VIS-SWIR Camera
 Model: VS20 CL
 Test Sample ID: 40249
 Test Site: Eurofins Product Service GmbH
 Operator: Mr. Liebich
 Test Date: 2022-07-05
 Operating Conditions: ambient temperature: 25 °Celsius
 power input: 12 V DC via dedicated AC/DC-adaptor
 (120 V AC / 60 Hz)
 LISN: Schwarzbeck NSLK 8127
 Operational Mode: Mode 1
 EUT Configuration: Configuration 1
 Applied to Port: AC Mains
 Note 1: --



| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | LISN |
|-------------|------------|------------|------------------|-----------------------|-------------------|---------|
| 1 | 14.465 MHz | 36.37 dBμV | 73 dBμV | -36.63 dB | Pass | Neutral |
| 2 | 20.297 MHz | 28.3 dBμV | 73 dBμV | -44.7 dB | Pass | Neutral |
| 3 | 541.05 kHz | 35.66 dBμV | 73 dBμV | -37.34 dB | Pass | Neutral |

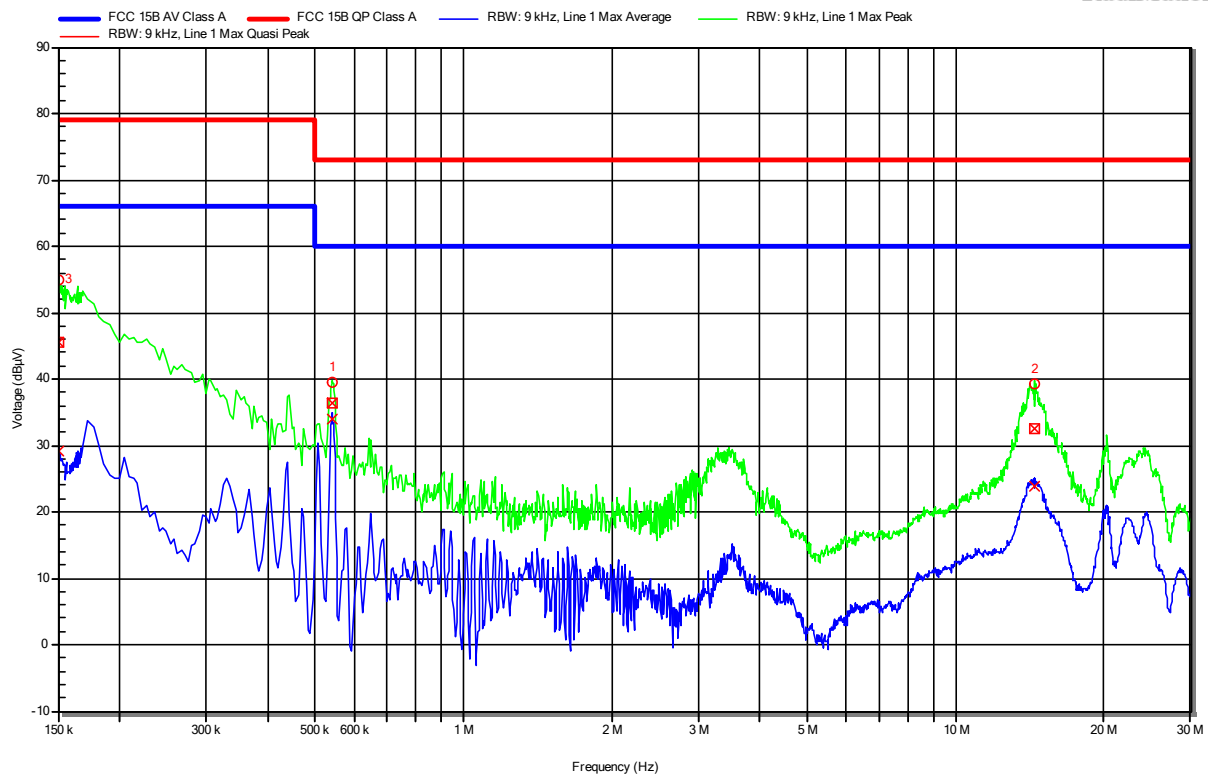
| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status | LISN |
|-------------|------------|------------|---------------|--------------------|----------------|---------|
| 1 | 14.465 MHz | 28.74 dBμV | 60 dBμV | -31.26 dB | Pass | Neutral |
| 2 | 20.297 MHz | 22.66 dBμV | 60 dBμV | -37.34 dB | Pass | Neutral |
| 3 | 541.05 kHz | 33.47 dBμV | 60 dBμV | -26.53 dB | Pass | Neutral |

Conducted emissions at the mains power port according to FCC part 15B

Project Number: G0M-2202-1347
Applicant: Emberion Oy
Model Description: VIS-SWIR Camera
Model: VS20 CL
Test Sample ID: 40249
Test Site: Eurofins Product Service GmbH
Operator: Mr. Liebich
Test Date: 2022-07-05
Operating Conditions: ambient temperature: 25 °Celsius
power input: 12 V DC via dedicated AC/DC-adapter
(120 V AC / 60 Hz)
LISN: Schwarzbeck NSLK 8127 RC L1
Operational Mode: Mode 1
EUT Configuration: Configuration 1
Applied to Port: AC Mains
Note 1: --

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Radiation



| Peak Number | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Quasi-Peak Status | LISN |
|-------------|------------|------------|------------------|-----------------------|-------------------|--------|
| 1 | 542.85 kHz | 36.47 dBµV | 73 dBµV | -36.53 dB | Pass | Line 1 |
| 2 | 14.474 MHz | 32.46 dBµV | 73 dBµV | -40.54 dB | Pass | Line 1 |
| 3 | 150 kHz | 45.62 dBµV | 79 dBµV | -33.38 dB | Pass | Line 1 |

| Peak Number | Frequency | Average | Average Limit | Average Difference | Average Status | LISN |
|-------------|------------|------------|---------------|--------------------|----------------|--------|
| 1 | 542.85 kHz | 33.87 dBµV | 60 dBµV | -26.13 dB | Pass | Line 1 |
| 2 | 14.474 MHz | 23.78 dBµV | 60 dBµV | -36.22 dB | Pass | Line 1 |
| 3 | 150 kHz | 29.17 dBµV | 66 dBµV | -36.83 dB | Pass | Line 1 |

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 |
|---|--|
| Conducted emissions at the mains power port | 150kHz to 30MHz, 3.35dB |
| Radiated Emission | 30MHz to 200MHz @ 3m, 5.1dB 200MHz to 1GHz @ 3m, 5.3dB >1GHz to 6GHz @3m, 5.95dB |