

VentilatorPAL Pro, EMC pre-compliance evaluation report. EN/IEC 60601-1-2.

| | |
|-------------------|-------------------|
| Report No. | 8042020 |
| Product: | VentilatorPAL Pro |
| Date: | 10 April 2020 |

CONTENTS:

EMC pre-compliance evaluation report according to:

EN-IEC 60601-1-2:2016+A:12013: Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral Standard: Electromagnetic disturbances – Requirements.

Title VentilatorPAL Pro Pre-compliance EMC evaluation report

Keywords EMC; SRD

Abstract This report describes the EMC pre-compliance evaluations which were performed for the VentilatorPAL Pro according to:
NEN-EN-IEC 60601-1-2:2016+A:12013.

The Stogger B.V.; VentilatorPAL Pro complies with the requirements of the NEN-EN-IEC 60601-1-2:2016+A:12013

Number of Pages 69

Applicant : Stogger B.V.

Evaluation Date : 07-04-2020

Evaluated by : R. Brett / W. Ophelders
(Canon production printing)

Date : 10-04-2020

Signature :



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1 Introduction

This report describes the EMC measurements which are performed for the VentilatorPAL according to the 2014/30/EU Directive. This apparatus is from now on called the EUT (Equipment Under Test).



Figure 1: : Photo of the VentilatorPAL Pro

FreeBreathing started with the mission to provide a high-quality, low-cost and open-source solution to the shortage of medical ventilators during the coronavirus pandemic.

The VentilatorPAL Pro was developed to meet the requirements of healthcare workers at the forefront of the COVID-19 crisis. The device makes it possible to treat patients when conventional ventilators are not available.

1.1 Equipment classification

Equipment for use in professional healthcare facilities or home healthcare environments.

2 Evaluation Report Information

Equipment Under Test (EUT):

| | | | |
|------------------------|---------------------------------------|---------------------|----------|
| Equipment: | VentilatorPAL Pro | | |
| Model #: | 1032-455-00 | Serial #: | M0056200 |
| Software & Firmware #: | N/A | Mains configuration | N/A |
| Supply voltage | 24V d.c. | | D.C. |
| AC/DC power cords are: | Adapter | N/A | N/A |
| Equipment is: | Medical and Wireless (WiFi/Bluetooth) | | |
| Wireless Class | Class 1 | | |

Company:

| | | | |
|---------------|-------------------|----------|-------------|
| Company name: | Stogger B.V. B.V. | | |
| Address: | Haagveld 1a | Zip: | 5981PK |
| City: | Panningen | Country: | Netherlands |

Optional Equipment (OE): AC/DC adapter

| | | |
|----------------|------------------------------------|------------------------------|
| Model #: | MeanWell GSM25E24-P1J | Compliance test report |
| Input voltage: | 80-264Vac, 47 - 63Hz; 0.35A (230V) | Report No. S4C-M020-1304-409 |
| Output voltage | 24V 1.04A | |

NOTE:

The above option was included during the EMC evaluations.

3 Applied standards

The following EMC standards were used:

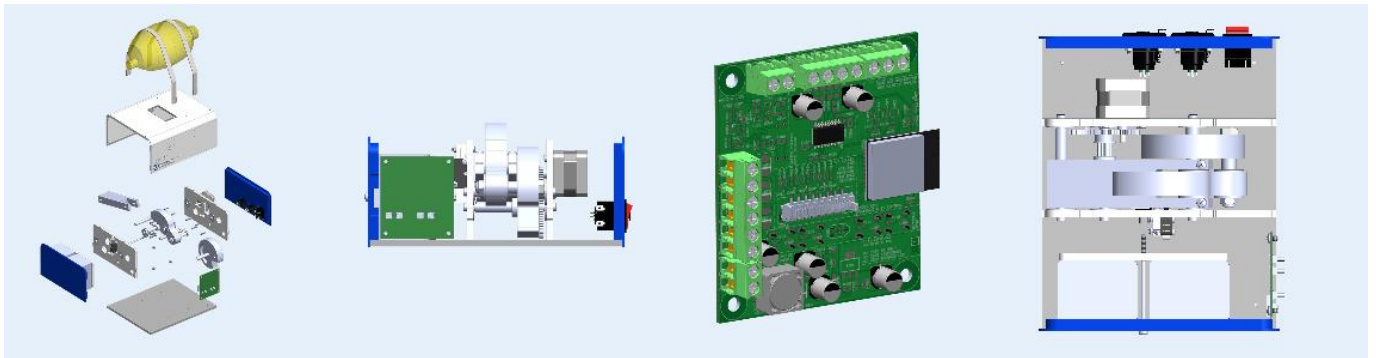
| | |
|-----------------------|---|
| [1] | NEN-EN-IEC 60601-1-2:2016 Medical electrical equipment - Part 1-2: General requirements for basic safety and |
| EN61000-4-2:2009 | Electrostatic Discharge Immunity test |
| EN61000-4-3:2006 | Radiated, radio-frequency electromagnetic field immunity test |
| EN 61000-4-4:2004 | AC/DC adapter configuration |
| EN 61000-4-5:2006 | AC/DC adapter configuration |
| EN 61000-4-6:2009 | AC/DC adapter configuration |
| EN 61000-4-8:2010 | Power frequency magnetic field immunity test |
| EN 61000-4-11:2004 | AC/DC adapter configuration |
| EN/IEC 61000-3-2:2014 | Harmonic current emissions |
| EN 61000-3-3 :2013 | Voltage fluctuations and Flicker |

4 Applied performance criteria

Reference: Annex A of EN-IEC 60601-1-2:2016+ A:12013:.

If it is required that during or after the test the equipment continue to operate as intended, the test should be included in an EMC IMMUNITY standard (or clause) of a product (product family).

5 SPECIFICATIONS



Size (LxWxH): 250x200x110

Operating voltage: 18-24 Vdc

Power options:

Mains Power supply -and/or- External battery -and- Internal emergency battery

Human interface: Machine -and/or- mobile app

Control, Machine:

- Tidal Volume (TV)
- Inhale/Exhale ratio (I/E)
- Respiratory Rate (RR)

Aux port I/O:

- 4x digital I/O
- 2x Analog inputs

Control, Mobile app:

- Tidal Volume (TV) ml/kg
- Inhale/Exhale ratio (I/E)
- Respiratory Rate (RR)
- Automatic calculation of tidal volume by Gender and length

Future optional features:

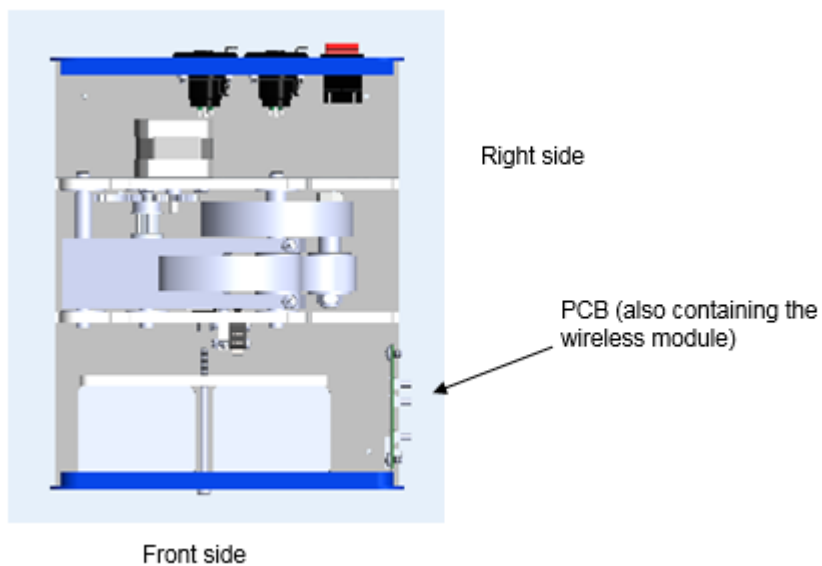
- Air pressure sensor
- SPo2 sensor
- O2 Inlet valve

6 Evaluation:

A test plan was drawn up taking into account the EUT (Equipment Under Test) which is the VentilatorPAL Pro and its external Power Supply.

The external Power Supply (type: MeanWell GSM25E24-P1J) was tested according to the standard EN 60601-1-1-2 as documented in the Compliance test report (see par. 2).

In general, there is a desire to avoid unnecessarily repeating the performance assessment at the final product level, if compliance can be justified on the basis of technical analysis, test data and information provided power supply manufacturer. However, if the assessment indicates that a measurement is required, then this must be performed to demonstrate compliance.



For the purpose of the radiated emissions and immunity evaluations/testing, the above figure shows what is meant by “Front side”, and “Right side”.

Some Radiated Immunity measurements were only performed on these two sides due to fact that these sides are considered as the most sensitive sides due to the PCB location.

6.1 Test plan

| EMC- phenomena | <u>VentelatorPAL</u> | | |
|--------------------|---|----------------|---------------------------|
| | DC-power port (note 1) | Enclosure port | AC-power port (note 2) |
| Conducted emission | N/A | N/A | (note 1) |
| Radiated emission | Complete construction (including cables and Power supply) | | |
| Radiated immunity | Complete construction (including cables and Power supply) | | |
| Conducted immunity | (note 1) | N/A | NOTE 3 |
| EFT | (note 1) | N/A | NOTE 3 |
| Surge | (note 1) | N/A | (note 2) |
| Voltage sags/dips | (note 1) | N/A | (note 2) |
| ESD | N/A | Enclosure | (note 2) |
| PFMF | N/A | N/A | (note 2) |
| Harmonics | (note 1) | N/A | (note 2) |
| Flicker | (note 1) | N/A | (note 2) |

Highlighted EMC phenomena indicates that an EMC measurement is required for the evaluation

N/A = Not Applicable

Note 1: Evaluation may not need to be proven by measurement (the DC cable is <3m)

Note 2: : Evaluation may not need to be proven by measurement (see compliance report No. S4C-M020-1304-409)

Note 3: Due to the HF content of this phenomena, some noise could be conducted to the VentilatorPAL due to parasitic effects.

The external Power Supply (type: Mean Well GSM25E24-P1J) was tested according to the standard EN 60601-1-1-2 as documented in the Compliance test report (see par. 2). Therefore for some EM-phenomena there is no need to repeat the performance assessment at the final product level with the knowledge that compliance can be justified on the basis of technical analysis and test data which is documented in the Power Supply test report (see paragraph 2).

7 Used equipment and calibration dates

Table 1: List of used equipment

| Used equipment and calibration dates | | | | | |
|---|---|---------------------|---------------------|------------|------------|
| Reg. No. | Equipment | manufacturer | Type | cal. Date | due |
| EMC measurement software | | | | | |
| | For tests according to EN55032/EN55024 | D.A.R.E.!! | Radimation 2018.2.6 | N.A. | N.A. |
| | For test according to EN61000- 3-2 & 3-3 | EM test | DPA control 5.4.9.0 | N.A. | N.A. |
| | For test according to EN61000- 4-4, 4-5 & 4-8 | EM test | iec.control 5.2.3 | N.A. | N.A. |
| | For test according to EN61000- 4-11 3ph | Spitzenberger+Spies | SPS EMC 1.72 | N.A. | N.A. |
| | For test according to EN61000- 4-11 1ph | EM test | iec.control 5.2.3 | N.A. | N.A. |
| Voltage dips & interruptions/ Voltage fluctuations & flicker/ harmonics equipment | | | | | |
| 21533 | Configurable mains system 2 | Spitzenberger+Spies | PAS5000 | N.A. | N.A. |
| 21532 | Configurable mains system 3 | Spitzenberger+Spies | PAS15000 | N.A. | N.A. |
| 24345 | Configurable mains system 4 | Spitzenberger+Spies | PAS5000 | N.A. | N.A. |
| 24924 | 3ph harmonics & flicker analyser | EM test | DPA503N | 18-04-2018 | 18-04-2021 |
| 24925 | 3ph flicker impedance 16A | EM test | AIF503N | 18-04-2018 | 18-04-2021 |
| 24987 | Current clamp L1 | Universal Technic | M1.U | 18-04-2018 | 18-04-2021 |
| 24988 | Current clamp L2 | Universal Technic | M1.U | 18-04-2018 | 18-04-2021 |
| 24989 | Current clamp L3 | Universal Technic | M1.U | 18-04-2018 | 18-04-2021 |
| ESD equipment | | | | | |
| 24191 | ESD pistol | Teseq | NSG 435 | 06-09-2018 | 07-09-2021 |
| 24298 | ESD pistol | Teseq | NSG 435 | 02-03-2018 | 07-03-2021 |
| 24898 | ESD pistol | EM Test | P-30N | 15-06-2018 | 15-06-2021 |
| | Vertical Coupling Plane | Océ | | N.A. | N.A. |
| Conducted immunity equipment emclab | | | | | |
| 21162 | 50Ohm Attenuator, 300W fixed 0-1GHz | JFW Industries | 50FH-006-300-N | N.A. | N.A. |
| 21155 | 50Ohm Attenuator, 20dB/10W | JFW Industries | 50FH-020-10N | N.A. | N.A. |
| 21156 | 50Ohm Termination, 10W | JFW Industries | 50T-172 | N.A. | N.A. |
| 21152 | Bulk current injection probe 100kHz-1GHz | FCC | F-140A | N.A. | N.A. |
| 21153 | Current sensor probe 10kHz-500MHz | FCC | F-51 | N.A. | N.A. |
| 21154 | Calibration JIG 10kHz-400MHz | FCC | BCICF-1 | N.A. | N.A. |
| 21182 | CDN 1-phase L+N+PE 0.15 – 230MHz | Lüthi | L801-M3 | N.A. | N.A. |
| 21183 | CDN 1-phase L+N+PE 0.15 – 230MHz | Lüthi | L801-M3 | N.A. | N.A. |
| 23049 | CDN 1-phase L+N+PE 0.15-230MHz / DC power | Lüthi | L801-M2/ M3 | N.A. | N.A. |
| 21184 | CDN 3-phase L1+L2+L3+N+PE 0.15 - 230MHz | Lüthi | L801-M5 | N.A. | N.A. |
| 22880 | CDN telecom ports 0.15 – 230MHz | Lüthi | L801-T8 | N.A. | N.A. |
| 25049 | CDM 3-phase L1+L2+L3+N+PE(75A) 0.15 - 80MHz | EM-test | CDN M5 75A | N.A. | N.A. |
| 24120 | Signal generator 9kHz – 1.1GHz | Rohde & Schwarz | SMB 100A | 12-02-2018 | 12-02-2021 |
| 21157 | Power meter 150kHz – 80MHz | Rohde & Schwarz | URV5 | 09-02-2018 | 09-02-2021 |
| 21158 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | 09-02-2018 | 09-02-2021 |
| 21159 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | 09-02-2018 | 09-02-2021 |
| 21160 | RF coupler 10kHz – 250MHz | Amplifier Research | DC2600 | N.A. | N.A. |
| 22763 | RF amplifier 150kHz – 100MHz | Amplifier research | 500A100M3 | N.A. | N.A. |
| EFT, PFME, Dips 1ph & surge equipment | | | | | |
| 21211 | Magnetic field coil 100A | EM-test | MS100 | N.A. | N.A. |
| 24513 | Current transformer | EM-test | MV2616 | 21-03-2018 | 21-03-2021 |
| 21211 | Immunity simulator 6kV | EM-test | UCS500-M6 | 21-03-2018 | 21-03-2021 |

| | | | | | |
|------------------------------|---|---------------------|-----------------|--|--|
| 25048 | CDN 7kV/ 63A | EM-test | CNI-503-A9/ 63A | 21-03-2018 | 21-03-2021 |
| 21211 | PFMF Antenna | REO transformatoren | RFTVS BV 113-97 | N.A. | N.A. |
| 21211 | PFMF amplifier | REO transformatoren | RFTVS BV 113-97 | N.A. | N.A. |
| 20975 | Current Clamp | FLUKE | T5-600 | N.A. | N.A. |
| 18195 | Coupling Clamp | Schaffner | CDN 125 | N.A. | N.A. |
| Radiated immunity equipment | | | | | |
| 22776 | Signal generator 9kHz – 3.3GHz | Rohde & Schwarz | SML03 | 12-06-2019 | 12-06-2022 |
| 25924 | Signal generator 9kHz – 6GHz | Rohde & Schwarz | SMB 100A | 02-03-2018 | 02-03-2021 |
| 22774 | Power meter 80MHz – 1GHz | Rohde & Schwarz | NRVD | 23-07-2018 | 23-07-2021 |
| 23050 | RF coupler 80MHz – 1GHz | Amplifier Research | DC6080 | N.A. | N.A. |
| 22799 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | 23-07-2018 | 23-07-2021 |
| 23001 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | 23-07-2018 | 23-07-2021 |
| 26211 | RF amplifier 80MHz – 1GHz | Amplifier research | 500W1000B3 | N.A. | N.A. |
| 25597 | Field probe DC- 6GHz | D.A.R.E. | RSS1006A | 12-03-2019 | 06-03-2022 |
| 25736 | Controller DC-6GHz | D.A.R.E. | CTR1009B | 12-03-2019 | 12-03-2022 |
| 25737 | RadiField DC-6GHz | D.A.R.E. | RFS1006B | N.A. | N.A. |
| Used antennae | | | | | |
| 19949 | Biconilog antenna 26MHz-2GHz | EMCO | 3141 | 17-06-2019 | 17-06-2022 |
| 22576 | Biconilog antenna 26MHz-2GHz | EMCO | 3142C | 06-05-2019 | 06-05-2022 |
| 21528 | Biconilog antenna 26MHz-2GHz | Schaffner | CBL 6141A | 11-09-2018 | 11-09-2021 |
| 17596 | Biconical antenna 20MHz – 200MHz | EMCO | 3104C | 07-09-2018 | 07-09-2021 |
| 17598 | Log-per antenna 200MHz – 2GHz | EMCO | 3146 | 11-09-2018 | 11-09-2021 |
| 22759 | Log-per antenna 1GHz-20GHz | Schwarzbeck | STLP9148 | 12-06-2019 | 12-06-2022 |
| 24441 | Double-Ridged Waveguide Horn antenna | EMCO | 3115 | 01-03-2019 | 01-03-2022 |
| 18658 | Biconical antenna 20MHz – 200MHz | EMCO | 3104C | 19-02-2018 | 19-02-2021 |
| 18657 | Log-per antenna 200MHz – 2GHz | EMCO | 3146 | 20-02-2018 | 20-02-2021 |
| 25448 | Double-Ridge Horn antenna | ETS-Lindgren | 3116C-PA | 13-02-2017 | 13-02-2020 |
| 25005 | Log-per antenna 80MHz – 6GHz | Amplifier Research | ATR80M6G | N.A. | N.A. |
| Conducted emission equipment | | | | | |
| 21720 | 3-phase LISN 200A 150kHz-30MHz | Rohde & Schwarz | ENV4200 | 09-02-2018 | 14-02-2021 |
| 24187 | 2/4/8 wire ISN for Telecomports | Teseq (Accelonix) | ISN T800 | 07-03-2018 | 07-03-2021 |
| Radiated emission equipment | | | | | |
| 22637 | EMI test receiver 1 | Rohde & Schwarz | ESIB 7 | 13-06-2019 | 13-06-2022 |
| 24270 | EMI test receiver 3 | Narda | PMM9010 | 01-02-2019 | 01-02-2022 |
| 24442 | EMI test receiver 4 | Rohde & Schwarz | ESU26 | 01-03-2019 | 01-03-2022 |
| 22540 | Spectrum analyser | Rohde & Schwarz | FSP 3 | 05-05-2017 | 05-05-2020 |
| General Facilities | | | | | |
| 21566 | Full Anechoic Room (lxwxh = 10mx6mx3m) - Verification NSA - Calibration for Radiated Immunity (80MHz-1GHz) - Calibration for Radiated Immunity (1GHz-6GHz) | Rainford | 30MHz – 18GHz | 13-07-2018 24-01-2019 07-02-2019 | 13-07-2021 24-01-2022 07-02-2022 |
| 22966 | OATS - Verification NSA | Canon | 30MHz – 1GHz | 17-04-2018 | 17-04-2021 |

8 Conclusions

The EUT complies with the requirements in EN-IEC 60601-1-2:2016

| Standard | Test type | Test interface | Tested against limit | Result | Appendix |
|------------------|--------------------|-------------------------|--------------------------------|--------------------------|----------------------|
| EN55032: 2016 | Conducted emission | AC power port (1-Phase) | Class B limit | Pass | 9.3 |
| | Radiated emission | Enclosure port | Class B limit | Pass | 9.4 & 9.5 |
| EN/IEC 61000-3-2 | Harmonics | AC power port (1-Phase) | Class A | Compliance by assessment | 9.14 |
| EN/IEC 61000-3-3 | Flicker | AC power port (1-Phase) | Plt (0.65) ; Pst (1), dmax, dc | Compliance by assessment | 9.15 |

| Standard | Test type | Test interface | Minimum test level | Minimum performance criterion | Applied test level | Observed performance criterion | remarks | Appendix |
|---------------------|--|-----------------------|--|-------------------------------|--|--------------------------------|--------------------------------|--------------------------|
| EN 301 489-1 V2.2.0 | EN6100 0-4-3 (RI) | Enclosure port | 10V/m; 80MHz-2.7GHz | A | 10V/m 80MHz-2.7GHz | A | Pass | 9.6 9.7 |
| | EN6100 0-4-3 (RI) | Enclosure port | EN 60601-1-2; Table 9 | A | EN 60601-1-2; Table 9 | A | Pass | 9.8 |
| | EN6100 0-4-6 (CI) | AC power port | 3Vrms (6V/m at ISM frequencies) | A | 6Vrms | A | Pass | 9.9 |
| | EN6100 0-4-5 (Surge) | AC power port | L-PE; 2kV | B | Compliance by assessment | N.A. | N.A. (ungrounded equipment) | 9.10 |
| | | AC power port | L-L; 1kV | B | L-L 1kV | Compliance by assessment | Pass | |
| | EN6100 0-4-4 (EFT) | AC power port | 2kV | B | 2kV | A | Pass | 9.11 |
| | EN6100 0-4-8 (PFMF) | Enclosure port | 30A/m | A | 30A/m | Compliance by assessment | Pass | 9.12 |
| | EN6100 0-4-11 (dips and interruptions) | 1-Phase AC power port | >95% 1 period; 30% 25 periods 60% 10 periods >95% 250 periods | B C C C | >95% 0.5 period; >95% 1 period; 30% 25 periods >95% 250 periods | Compliance by assessment | Pass | 9.13 |
| | EN6100 0-4-2 (ESD) | Enclosure port | +/-8kV contact discharge | B | +/- 8kV | A | Pass | 9.16 |
| | | | +/-15kV air discharge | B | +/- 15kV | A | Pass | |

8.1 Evaluation results

The following chapters give the evaluation results of all of the measured EMC phenomena which are described in the conclusion.

8.2 : Conducted emission 1-Phase AC power: EN-IEC 60601-1-2:2016+ A:12013

| | |
|-----------------------|---------------------------|
| Report title: | EN 60601-1-2 |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |

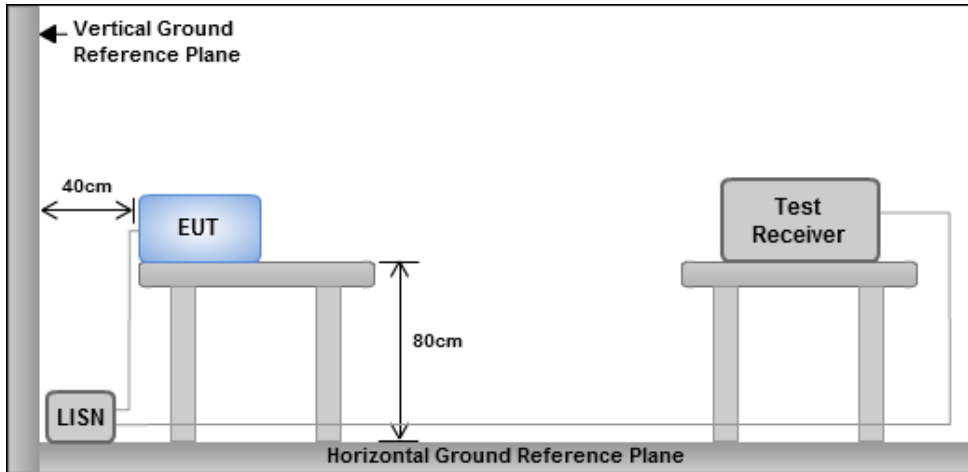
| Test Result | |
|--------------------|--|
| Result: | The EUT complies with the Class B conducted limits |
| Notes: | AC/DC Adaptor used as described in chapter 2 |

Used equipment

Used equipment. For calibration dates see Chapter 6.

| Reg. No. | Equipment | Manufacturer | Type | Used in this test |
|----------|--------------------------------|-----------------|---------|-------------------|
| 21720 | 3-phase LISN 200A 150kHz-30MHz | Rohde & Schwarz | ENV4200 | |
| 24270 | EMI test receiver | PMM | 9010 | Y |
| 22876 | Faraday Cage | Comtest | | Y |

Measurement method



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

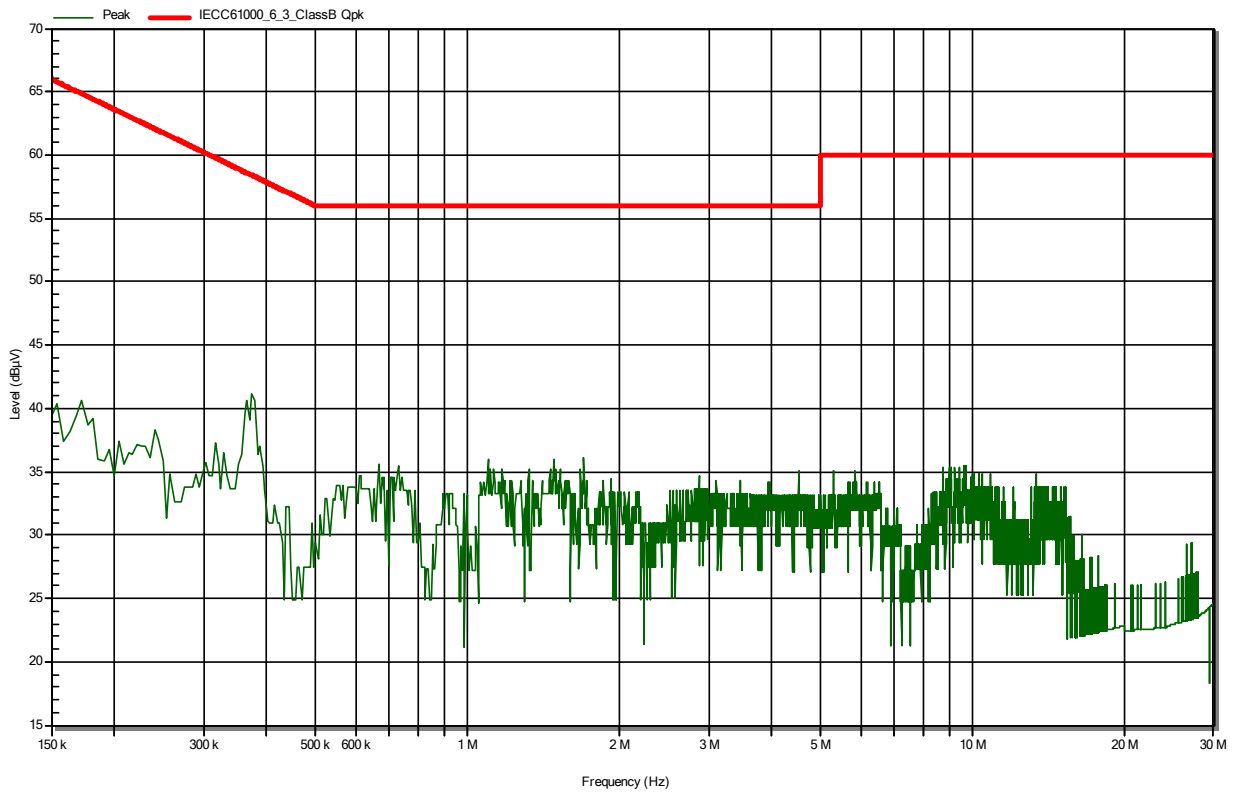
Equipment information:

| Overview of receiver settings | |
|-------------------------------|----------------|
| Attenuator | 0 dB |
| RBW | 9 kHz |
| Step frequency | 4,5 kHz |
| Measure time | 10 ms |
| Reference level | 100 dB μ V |
| Internal Preamp. | used |

Applied limits:

The AC power port is used for power supply only as described in chapter 8.4.3.2 of EN-IEC 60601-1-2:2016.

Since the equipment is intended to be used in an industrial environment, the class A limits given in EN-IEC 60601-1-2:2016, Table 6 were used.

230V/50Hz*Line 1 (Peak)***Max hold peak Graph****RadiMation****Notes**

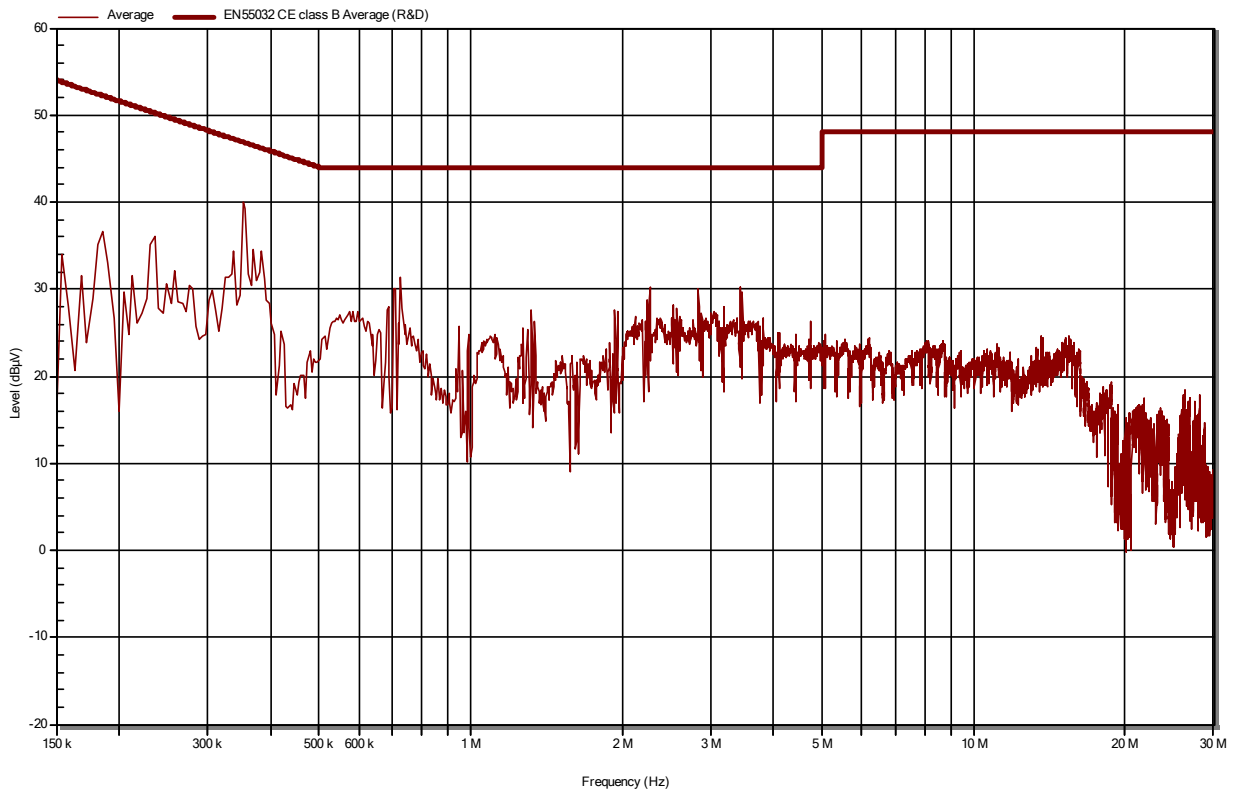
Conducted emission; L1 (Pk)

Emission Table

None

*Line 1 (Average)***Max hold peak Graph**

RadiMation

**Notes**

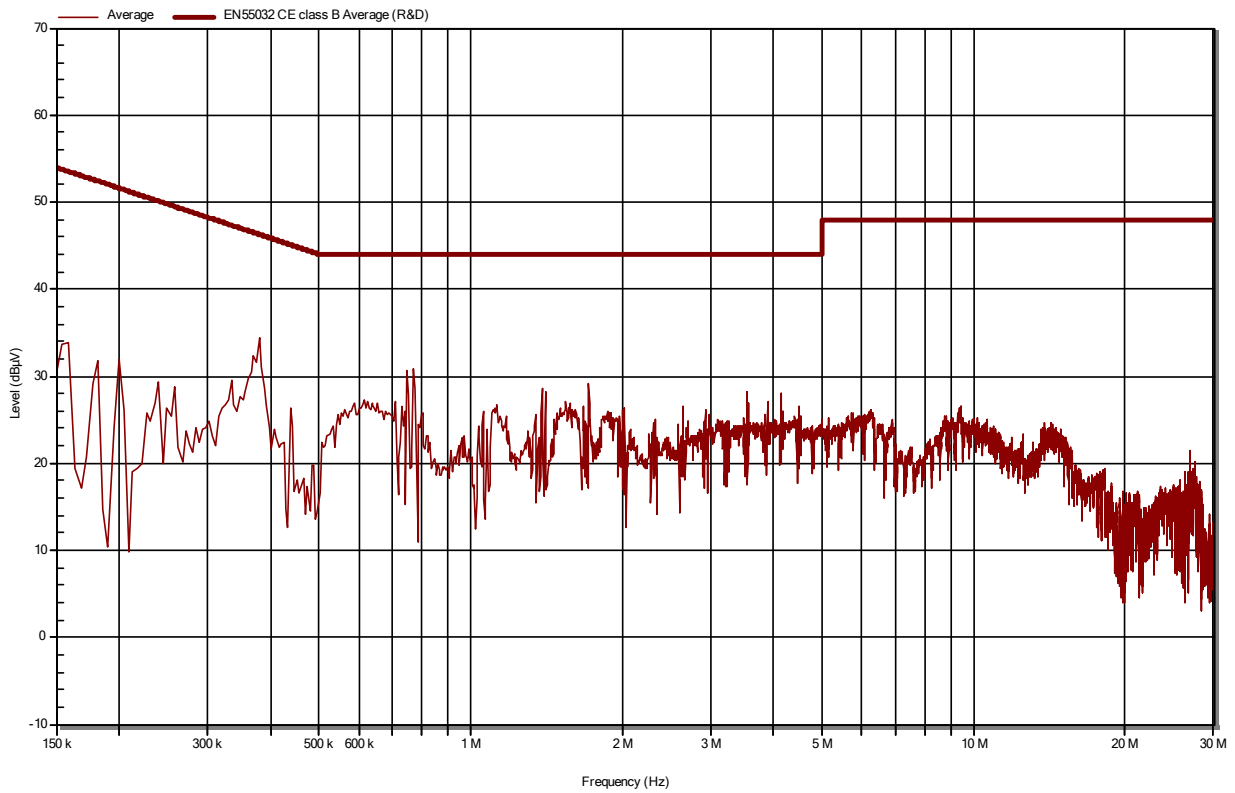
Conducted emission; L1 (Avg)

Emission Table

None

*Line Neutral (Average)***Max hold peak Graph**

RadiMation

**Notes**

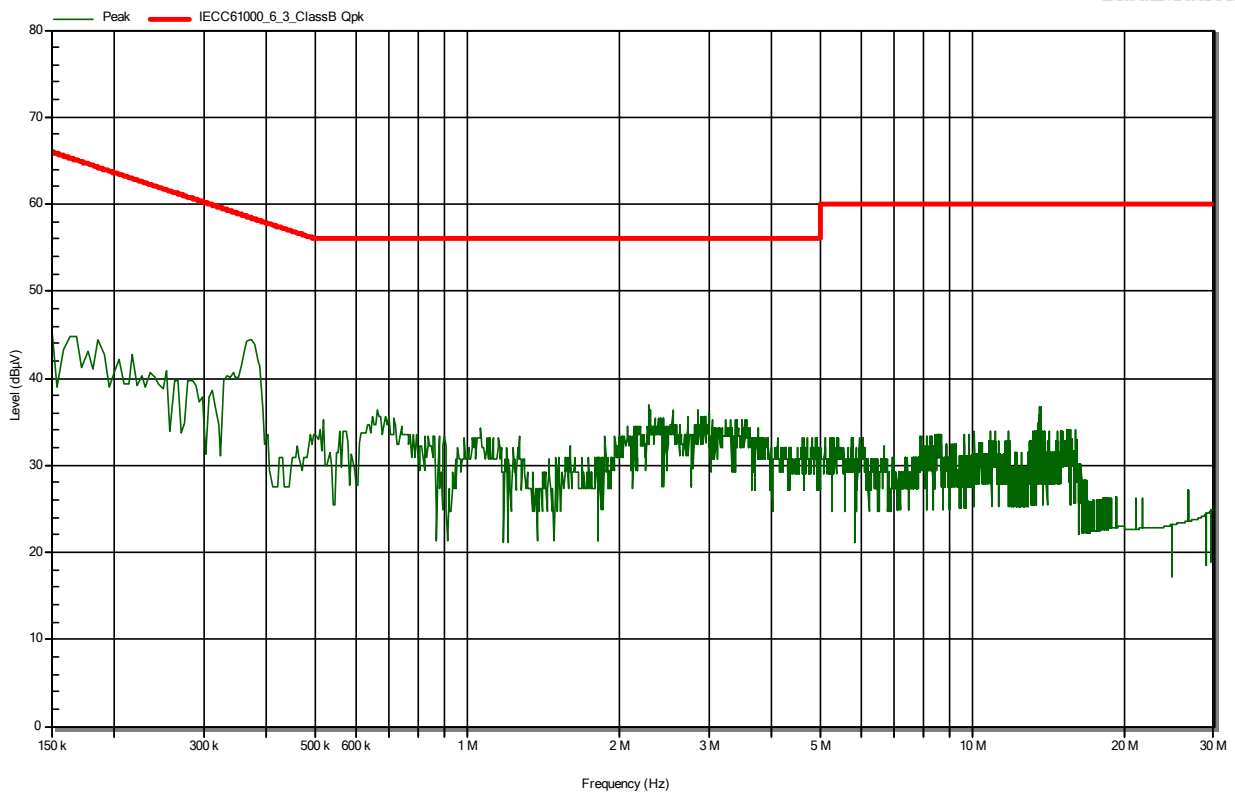
Conducted emission; Neutral (Avg)

Emission Table

None

*Line Neutral (Peak)***Max hold peak Graph**

RadiMation

**Notes**

Conducted emission; Neutral (Pk)

Emission Table

None

8.3 : Radiated emission 30MHz – 1Ghz ; EN-IEC 60601-1-2:2016+ A:12013

| | |
|-----------------------|---------------------------|
| Report title: | EN 60601-1-2 |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |

**Test Result**

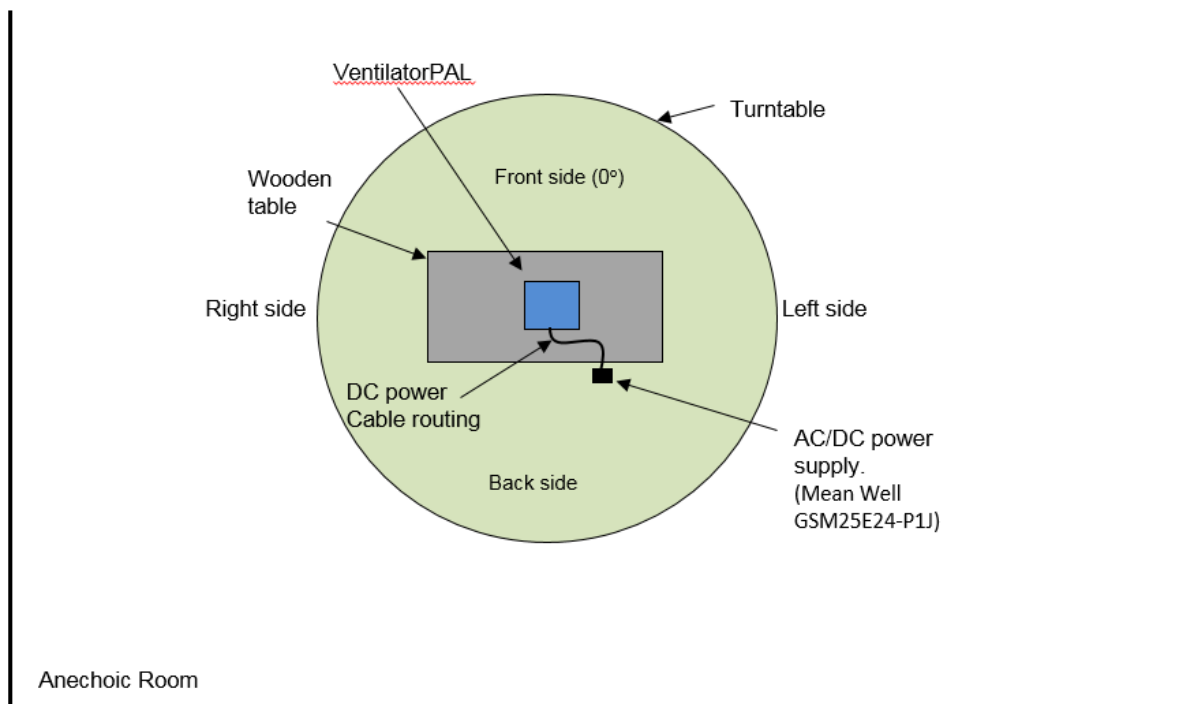
| | |
|---------|---|
| Result: | The EUT Passes the EN 55032 standard Class B limits for radiated emission (30MHz – 1GHz). |
|---------|---|

Used equipment

Used equipment. For calibration dates see Chapter 6.

| Reg. No. | Equipment | manufacturer | Type | Used in this test |
|----------|--|-----------------|---------------|-------------------|
| 22637 | EMI test receiver 1 | Rohde & Schwarz | ESIB 7 | |
| 22879 | EMI test receiver 2 | Rohde & Schwarz | ESPI 7 | |
| 24442 | EMI test receiver 4 | Rohde & Schwarz | ESU 26 | Y |
| 22540 | Spectrum analyser | Rohde & Schwarz | FSP 3 | |
| 19949 | Biconilog antenna 26MHz-2GHz | EMCO | 3141 | |
| 22576 | Biconilog antenna 26MHz-2GHz | EMCO | 3142C | Y |
| 21528 | Biconilog antenna 26MHz-2GHz | Schaffner | CBL 6141A | |
| 17596 | Biconical antenna 20MHz – 200MHz | EMCO | 3104 | |
| 17598 | Log-per antenna 200MHz – 2GHz | EMCO | 3146 | |
| 22759 | Log-per antenna 1GHz-20GHz | Schwarzbeck | STLP9148 | |
| 21566 | Full Anechoic Room (lxwxh = 10mx6mx3m) | Rainford | 30MHz – 18GHz | Y |
| 22966 | OATS | Océ | | Y |

Measurement method



The EUT was placed on a wooden table 0.8, height as shown in the figure. The turntable was rotated so that all 4 sided were measured. The critical frequencies were investigated by rotating the turntable to the worst-case angle.

Equipment information:

| Overview of receiver settings | |
|-------------------------------|----------------|
| Attenuator | Auto [10 dB] |
| RBW | 120 kHz |
| Step frequency | 50 kHz |
| Measure time | 1 ms |
| Reference level | 100 dB μ V |
| Internal Preamp. | 20 dB |

Measurement uncertainty

The uncertainty for radiated emission (enclosure port - FAR) in the frequency band 30-200MHz is 5.26dB. In the frequency band 200MHz-1GHz this comes down to 5.09dB. These values lie below the CISPR_{FAR} requirement of 5.3dB.

The uncertainty for radiated emission (enclosure port - OATS) in the frequency band 30-200MHz is 4.66dB. In the frequency band 200MHz-1GHz this comes down to 4.64dB. These values lie below the CISPR_{OATS} requirement of 6.3dB

Report 1010261850_01 describes the complete analysis.

Applied limits

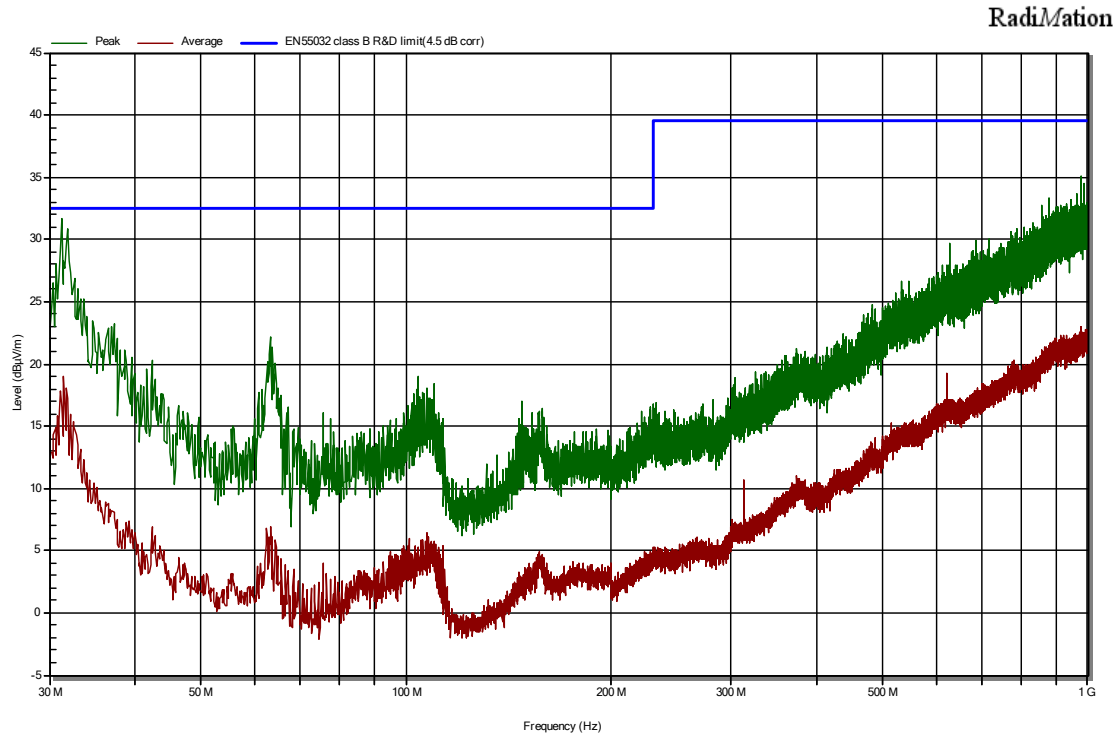
The applied limits for a 3m. FAR are derived from the limits of the standard by applying the following procedure:

| | | |
|---------------|---|---------------------------------------|
| Applied limit | = | standard limit |
| | + | conversion factor 10m to 3m (+10.5dB) |
| | - | ground plane reflection (-6dB) |
| | - | extra margin (-2.5dB) |

The Class B emission limits were used.

A.1 Vertical, front 0°

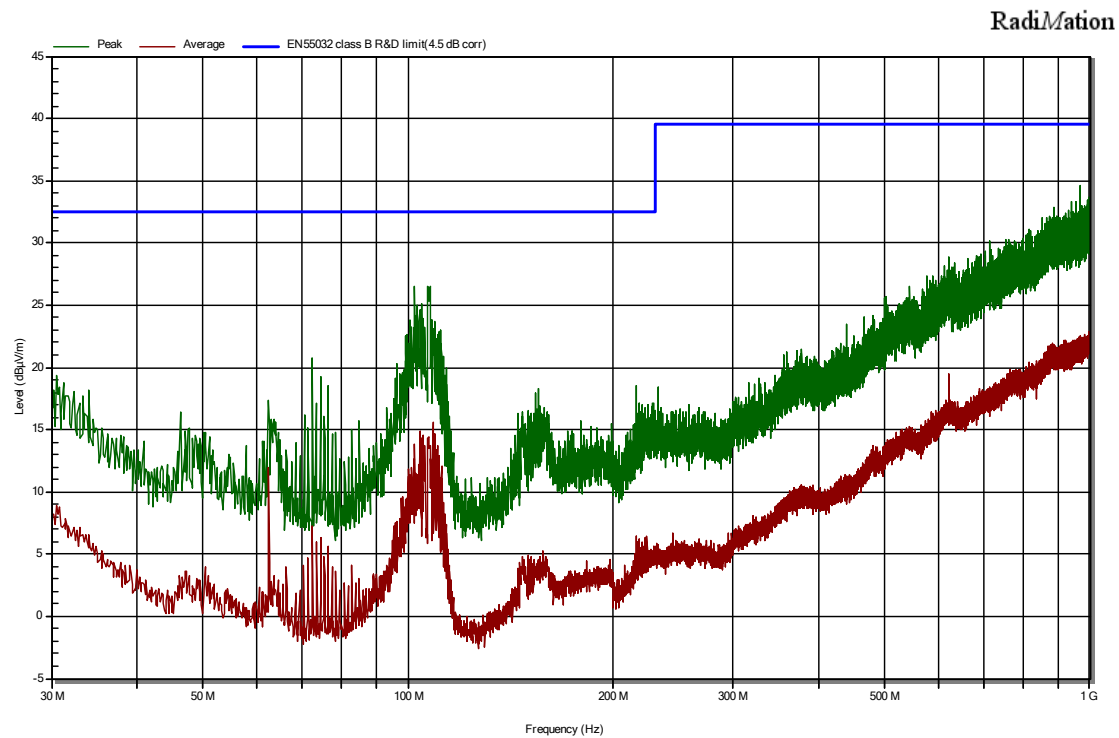
VentilatorPAL Pro: Class B; Vertical antenna, Front site.
Operational



| Nr | Frequency (MHz) | PK MaxHold (dBμV/m) | QP Value (dBμV/m) | QP Limit (dBμV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|---------------------|-------------------|-------------------|--------|-----------------|------------|-----|
| 1 | 31,35 | 31,681 | 26,518 | 32,5 | Pass | 0 | 1,5 | V |
| 2 | 31,95 | 30,903 | 25,187 | 32,5 | Pass | 0 | 1,5 | V |

A.2 Horizontal, front 0°

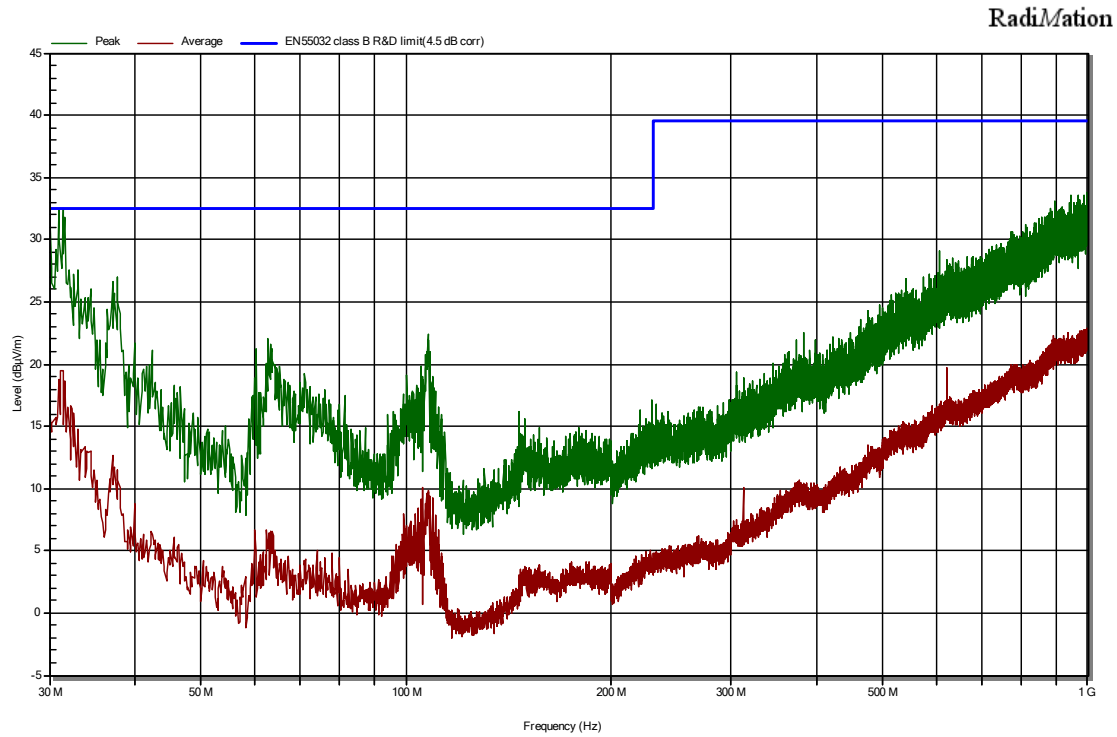
VentilatorPAL Pro: Class B; Horizontal antenna, Front site.
Operational



None

A.3 Vertical, right 90°

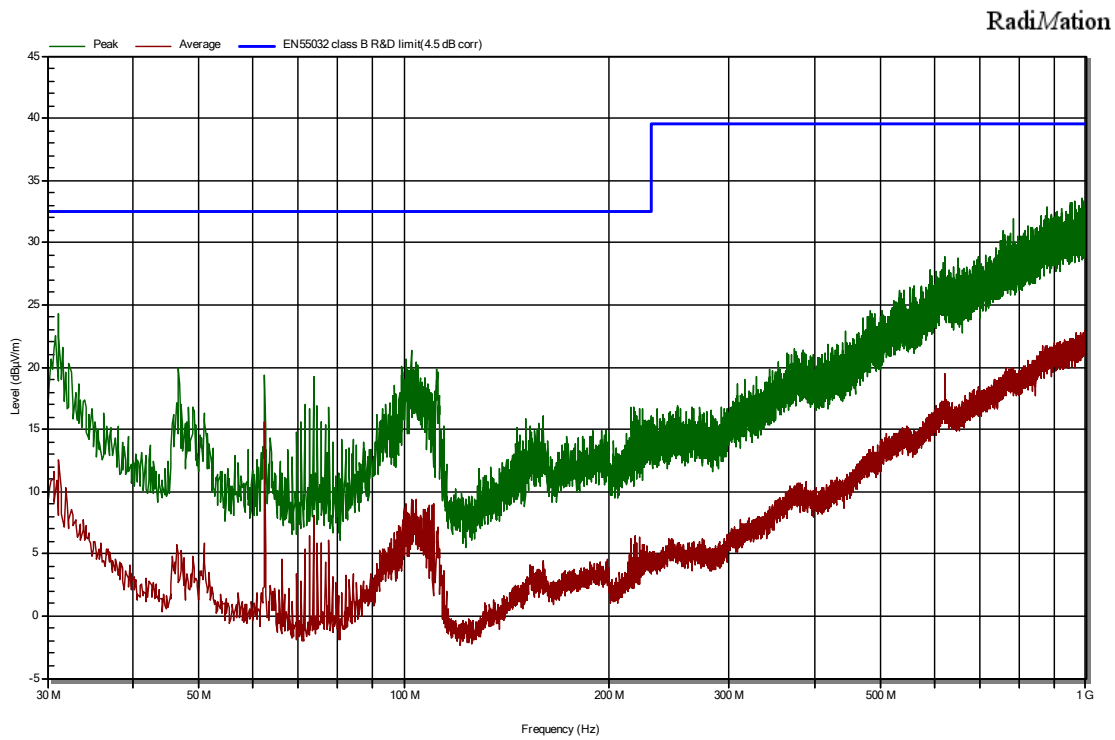
VentilatorPAL Pro: Class B; Vertical antenna, Right side.
Operational



| Nr | Frequency (MHz) | PK MaxHold (dBμV/m) | QP Value (dBμV/m) | QP Limit (dBμV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|---------------------|-------------------|-------------------|--------|-----------------|------------|-----|
| 1 | 30 | 31,04 | 24,809 | 32,5 | Pass | 0 | 1,5 | V |
| 2 | 30,35 | 29,709 | 25,747 | 32,5 | Pass | 0 | 1,5 | V |
| 3 | 31 | 32,335 | 27,67 | 32,5 | Pass | 0 | 1,5 | V |
| 4 | 31,4 | 32,557 | 27,479 | 32,5 | Pass | 0 | 1,5 | V |
| 5 | 31,9 | 29,427 | 26,351 | 32,5 | Pass | 0 | 1,5 | V |

A.4 Horizontal, right 90°

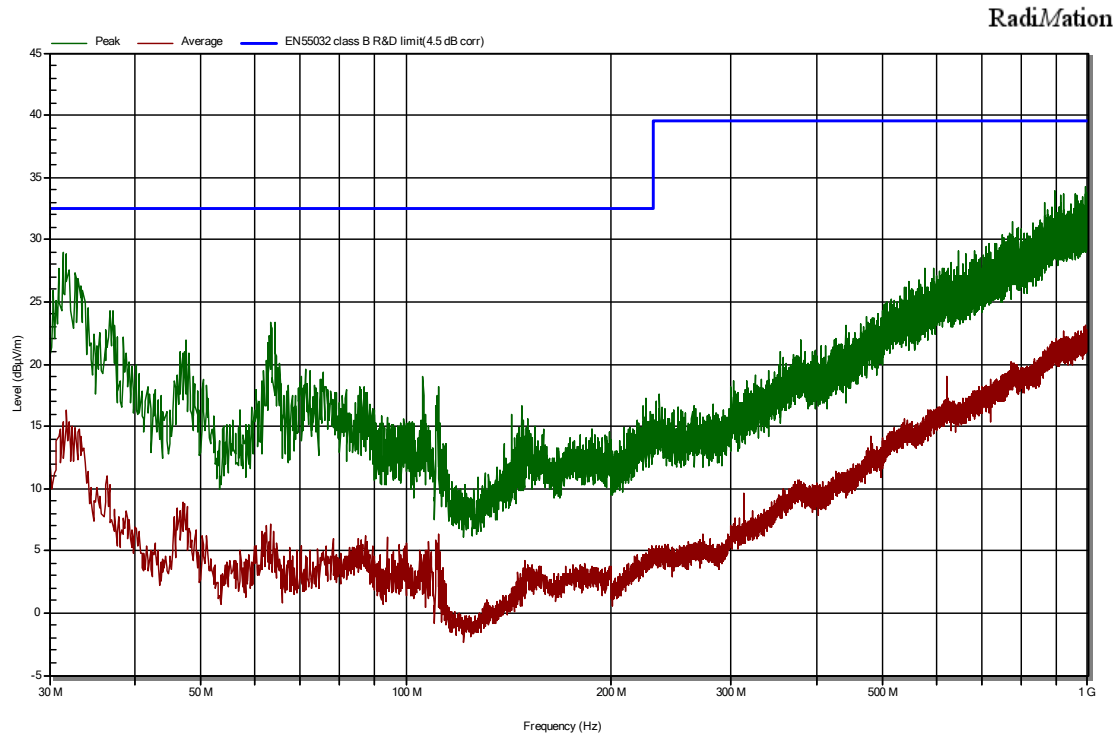
VentilatorPAL Pro: Class B; Horizontal antenna, Right side.
Operational



None

A.5 Vertical, back 180°

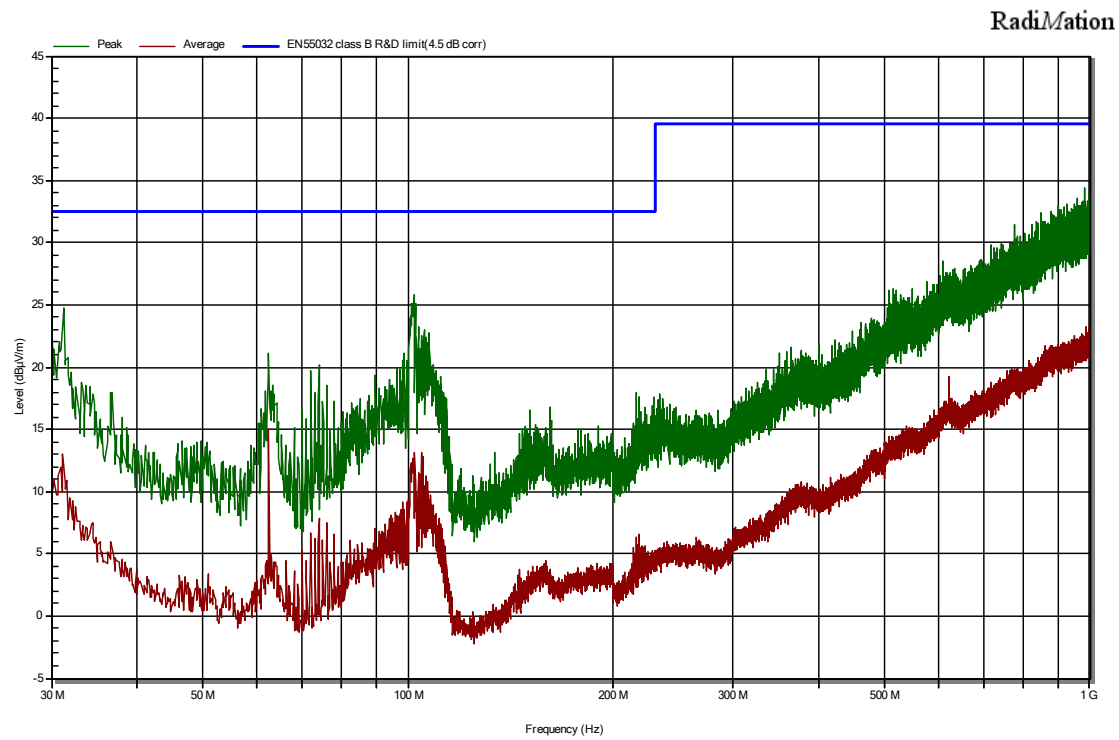
VentilatorPAL Pro: Class B; Vertical antenna, Back side.
Operational



| Nr | Frequency (MHz) | PK MaxHold (dBμV/m) | QP Value (dBμV/m) | QP Limit (dBμV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|---------------------|-------------------|-------------------|--------|-----------------|------------|-----|
| 1 | 31,4 | 28,947 | 24,461 | 32,5 | Pass | 0 | 1,5 | V |
| 2 | 31,7 | 28,892 | 24,205 | 32,5 | Pass | 0 | 1,5 | V |

A.6 Horizontal, back 180°

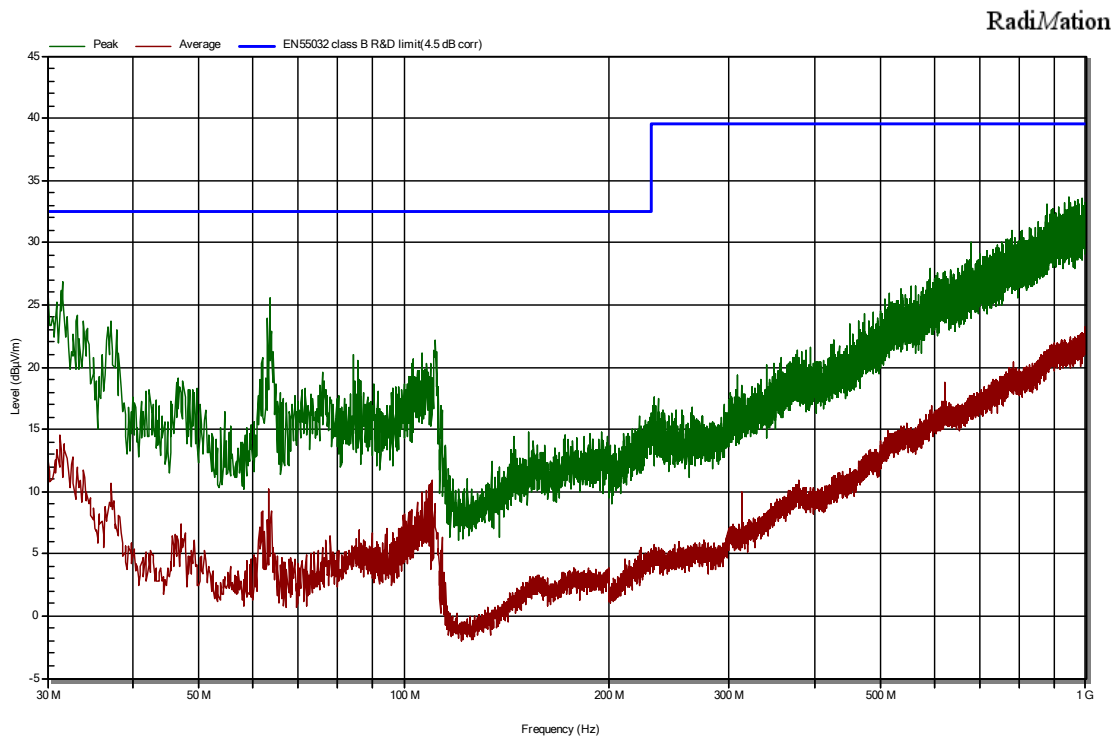
VentilatorPAL Pro: Class B; Horizontal antenna, Back side.
Operational



None

A.7 Vertical, left 270°

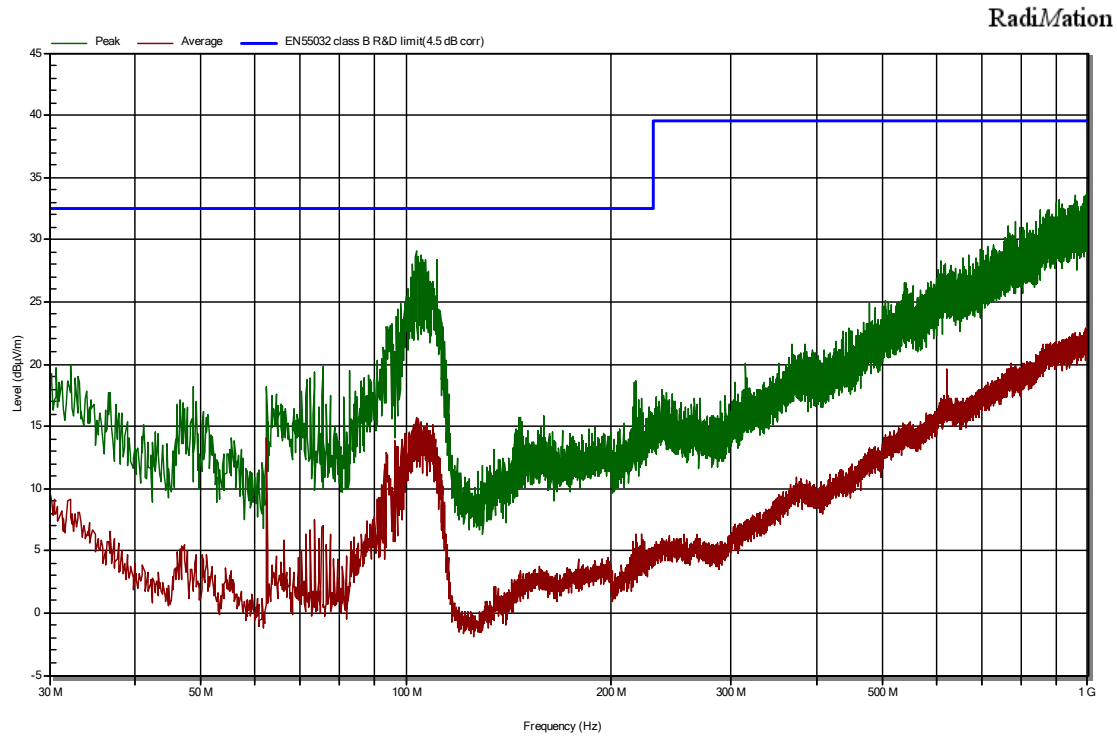
VentilatorPAL Pro: Class B; Vertical antenna, Left side.
Operational



None

A.8 Horizontal, left 270°

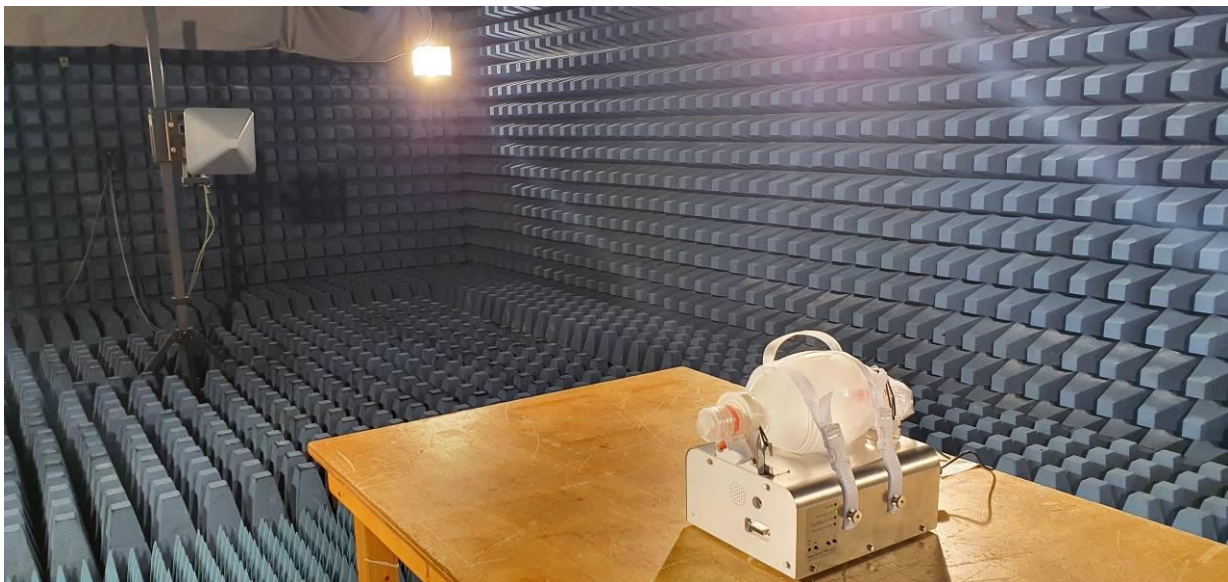
VentilatorPAL Pro: Class B; Horizontal antenna, Left side.
Operational



| Nr | Frequency (MHz) | PK MaxHold (dBµV/m) | QP Value (dBµV/m) | QP Limit (dBµV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|---------------------|-------------------|-------------------|--------|-----------------|------------|-----|
| 1 | 103,65 | 29,154 | 24,766 | 32,5 | Pass | 0 | 1,5 | H |
| 2 | 103,9 | 29,026 | 24,628 | 32,5 | Pass | 0 | 1,5 | H |
| 3 | 104,3 | 28,599 | 24,937 | 32,5 | Pass | 0 | 1,5 | H |
| 4 | 105,25 | 28,798 | 24,787 | 32,5 | Pass | 0 | 1,5 | H |

8.4 Radiated emission 1 – 6GHz

| | |
|-----------------------|---------------------------|
| Report title: | EN 60601-1-2 |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |



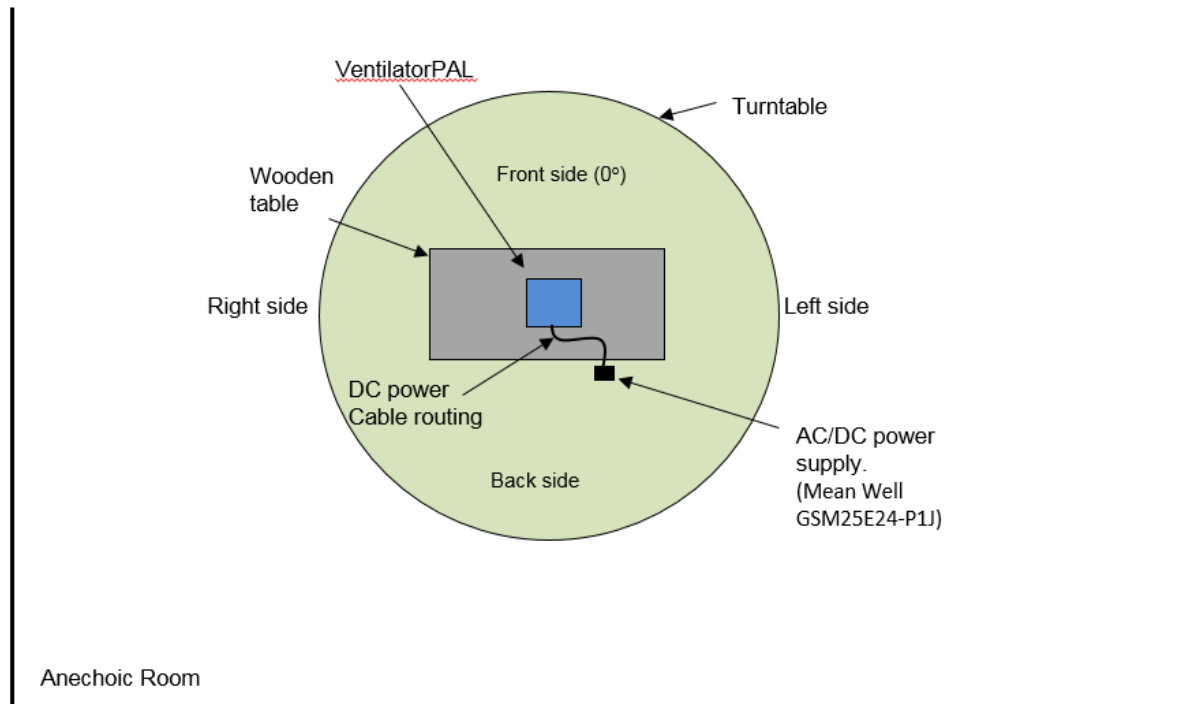
Test Result

| | |
|---------|---|
| Result: | The EUT Passes the EN 55032 standard Class B limits for radiated emission (30MHz – 1GHz). |
|---------|---|

A.9 Used equipment

| Used equipment. For calibration dates see Chapter 6. | | | | |
|--|--|-----------------|---------------|-------------------|
| Reg. No. | Equipment | manufacturer | Type | Used in this test |
| 22637 | EMI test receiver 1 | Rohde & Schwarz | ESIB 7 | Y |
| 22879 | EMI test receiver 2 | Rohde & Schwarz | ESPI 7 | |
| 24442 | EMI test receiver 4 | Rohde & Schwarz | ESU 26 | |
| 22540 | Spectrum analyser | Rohde & Schwarz | FSP 3 | |
| 19949 | Biconilog antenna 26MHz-2GHz | EMCO | 3141 | |
| 22576 | Biconilog antenna 26MHz-2GHz | EMCO | 3142C | |
| 21528 | Biconilog antenna 26MHz-2GHz | Schaffner | CBL 6141A | |
| 17596 | Biconical antenna 20MHz – 200MHz | EMCO | 3104 | |
| 17598 | Log-per antenna 200MHz – 2GHz | EMCO | 3146 | |
| 22759 | Log-per antenna 1GHz-20GHz | Schwarzbeck | STLP9148 | Y |
| 21566 | Full Anechoic Room (l _x w _x h = 10mx6mx3m) | Rainford | 30MHz – 18GHz | Y |
| 22966 | OATS | Océ | | |

A.10 Measurement method



The EUT was placed on a wooden table 0.8, height as shown in the figure. The turntable was rotated so that all 4 sided were measured. The critical frequencies were investigated by rotating the turntable to the worst-case angle.

Equipment information:

| Overview of receiver settings | |
|-------------------------------|----------------|
| Attenuator | 0 dB |
| RBW | 1 MHz |
| Step frequency | 500 kHz |
| Measure time | 1 ms |
| Reference level | 100 dB μ V |
| Internal Preamp. | 20 dB |

A.1 Measurement uncertainty

The uncertainty for radiated emission (enclosure port) 1 - 6GHz is 4.31dB. . This value lies beneath the CISPR requirement of 5.2dB. Report 1010261850_01 describes the complete analysis.

A.2 Applied limits

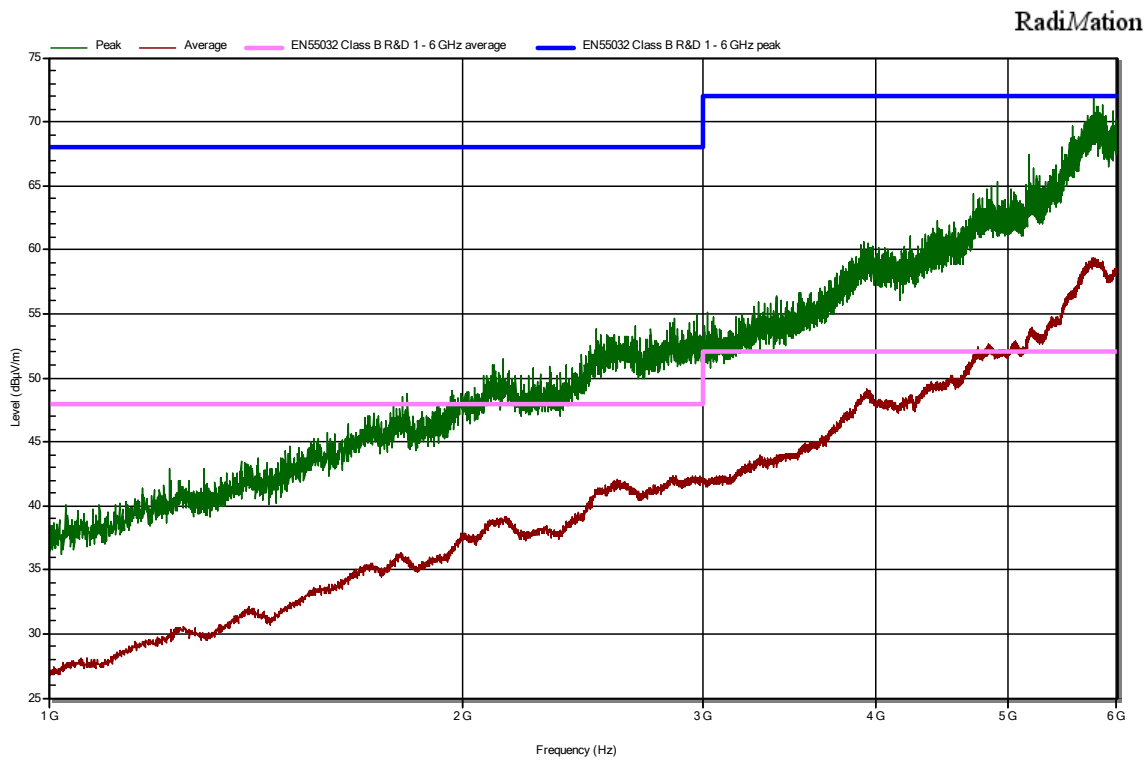
For extra margin the applied limits are 2dB below limits in standard.

A.3 Antenna correction factor and cable loss correction factors

Due to the antenna correction factor, the Anechoic room factor and cable loss correction factor, the EMI noise floor exceeds the average limits near 6GHz using the vertical antenna correction factor.

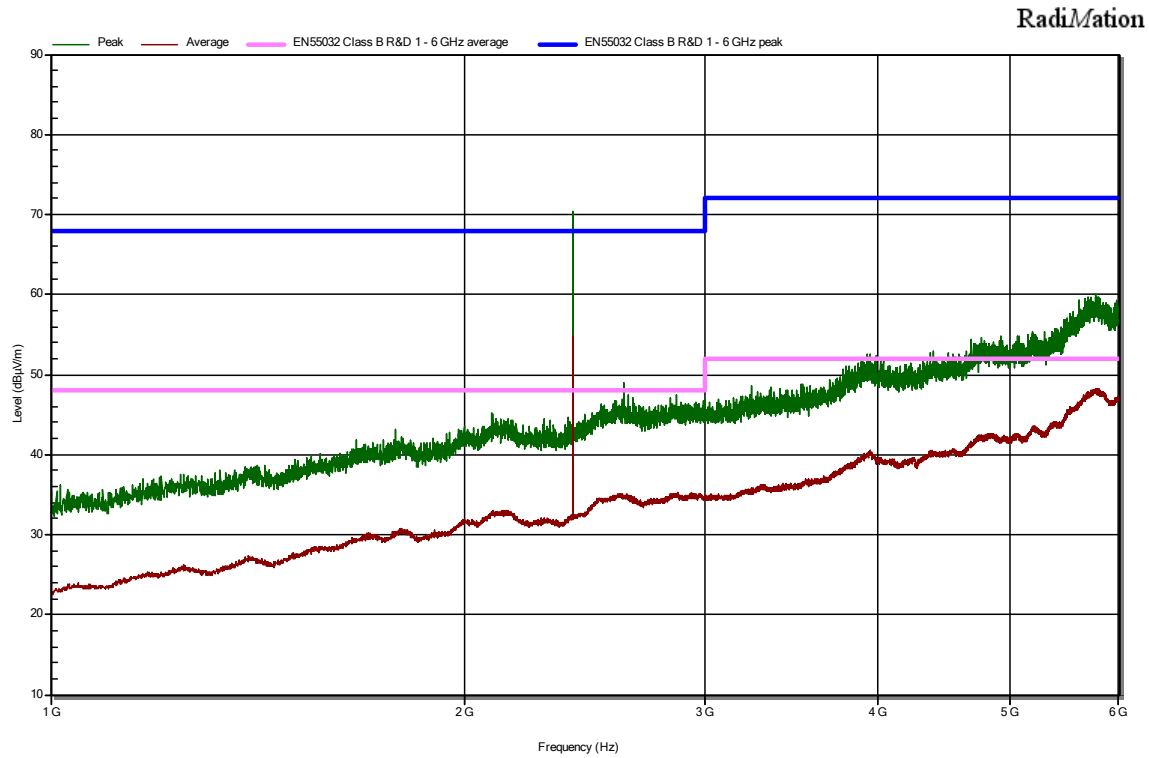
A.4 Vertical, front 0°

VentilatorPAL Pro: Class B; Vertical antenna, Front side.
Operational



A.5 Horizontal, front 0°

VentilatorPAL Pro: Class B; Horizontal antenna, Front side.
Operational

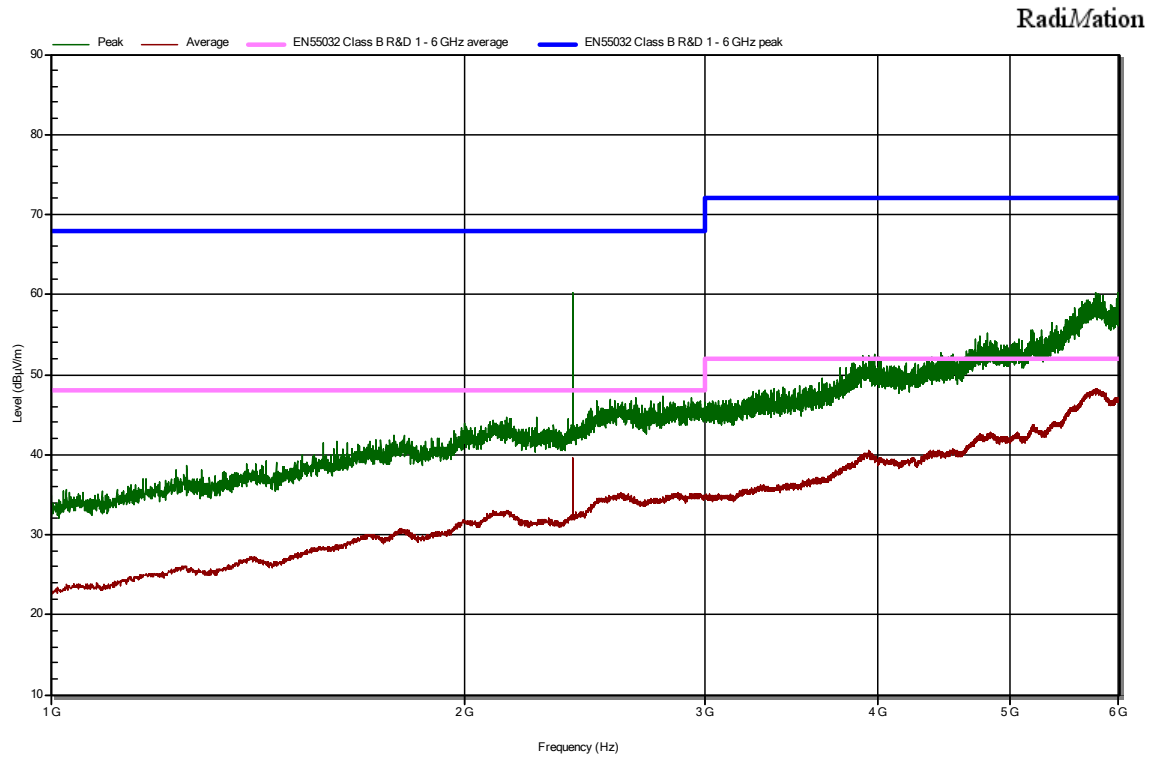


| Nr | Frequency (MHz) | PK Value (dBµV/m) | AVG Value (dBµV/m) | PK Limit (dBµV/m) | AVG Limit (dBµV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|-------------------|--------------------|-------------------|--------------------|--------|-----------------|------------|-----|
| 1 | 2403 | 69,752 | 33,493 | 68 | 48 | NOTE | 0 | 1,5 | H |

NOTE: This is the WiFi frequency

A.6 Horizontal, left 270°

VentilatorPAL Pro: Class B; Horizontal antenna, Left side.
Operational

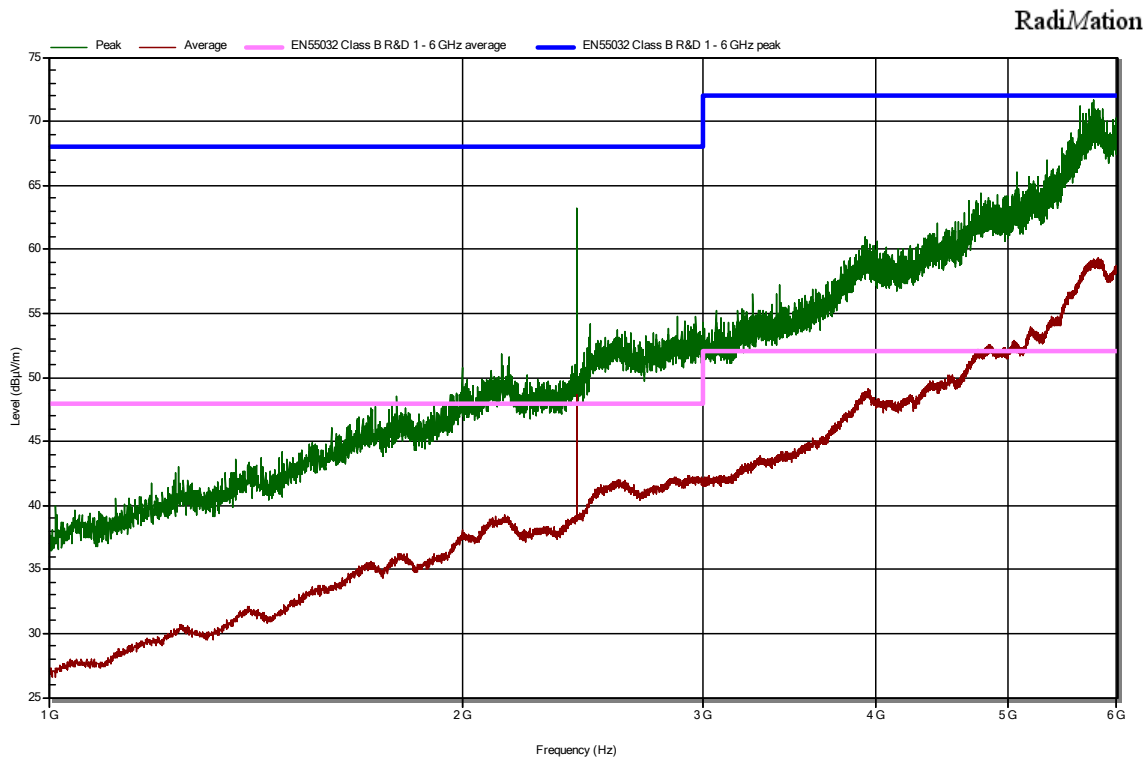


| Nr | Frequency (MHz) | PK Value (dBμV/m) | AVG Value (dBμV/m) | PK Limit (dBμV/m) | AVG Limit (dBμV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|-------------------|--------------------|-------------------|--------------------|--------|-----------------|------------|-----|
| 1 | 2403 | 59,534 | 32,484 | 68 | 48 | NOTE | 0 | 1,5 | H |

NOTE: This is the WiFi frequency

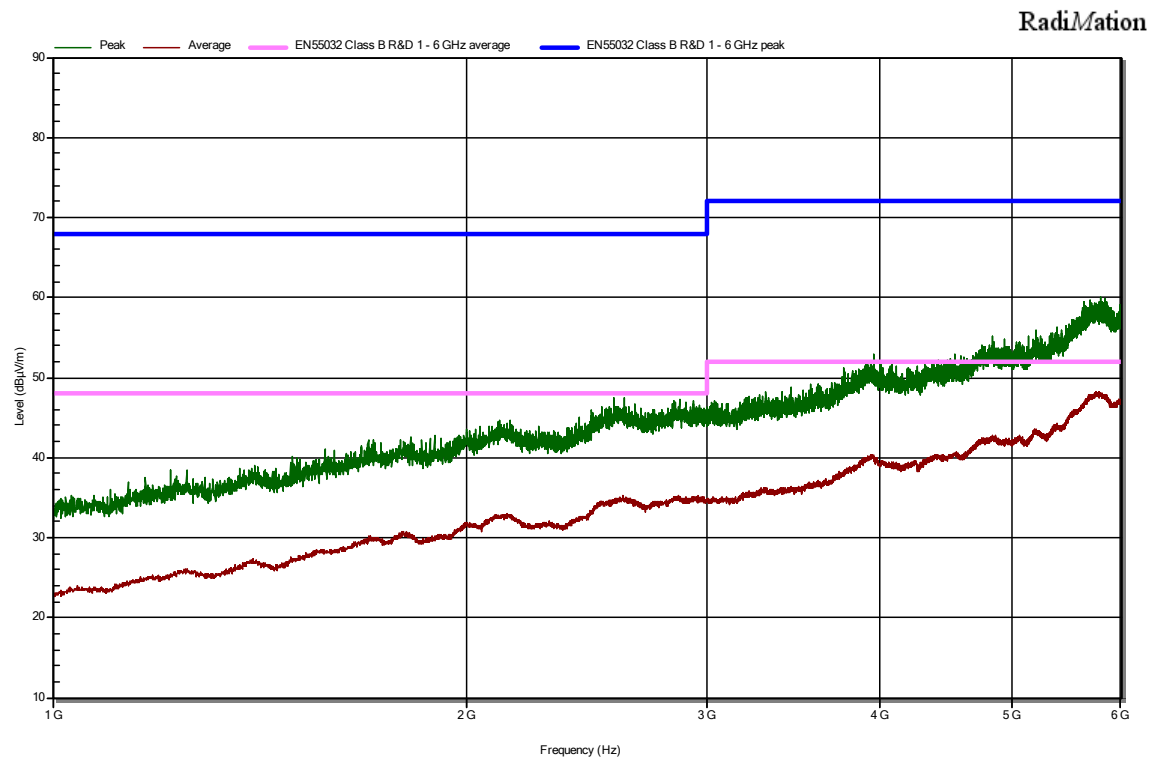
A.7 Vertical, left 270°

VentilatorPAL Pro: Class B; Vertical antenna, Left side.
Operational



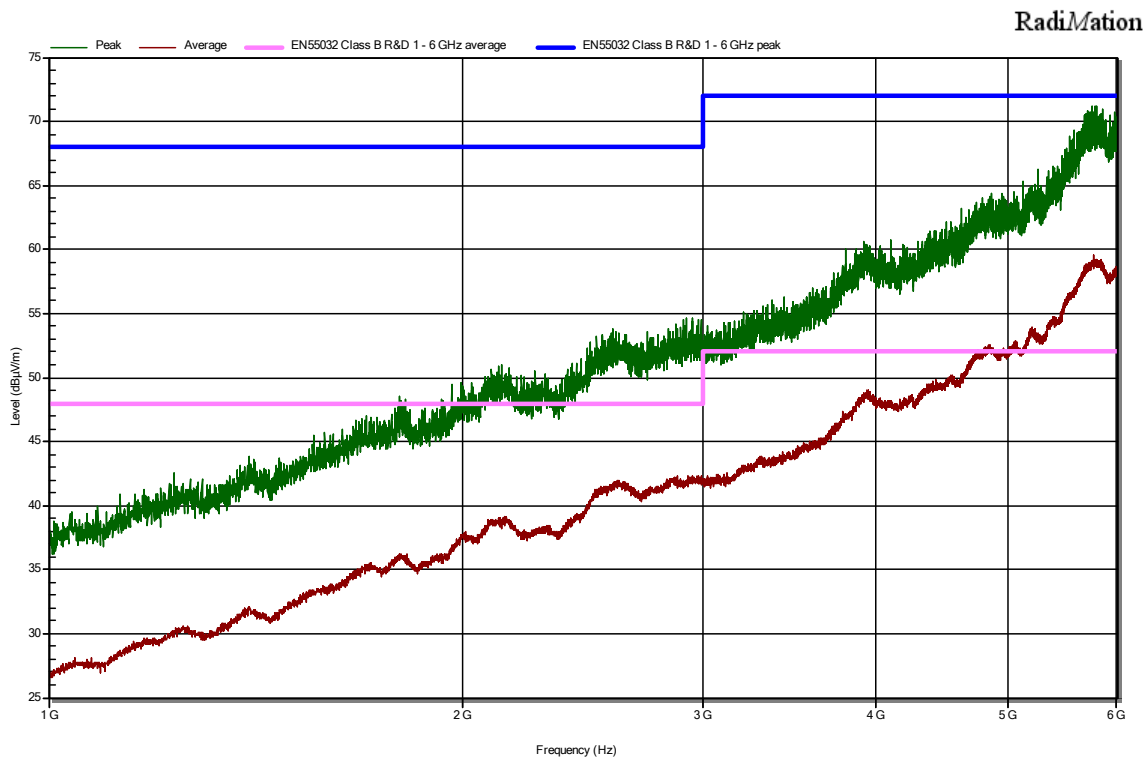
A.8 Horizontal, back 180°

VentilatorPAL Pro: Class B; Horizontal antenna, Back side.
Operational



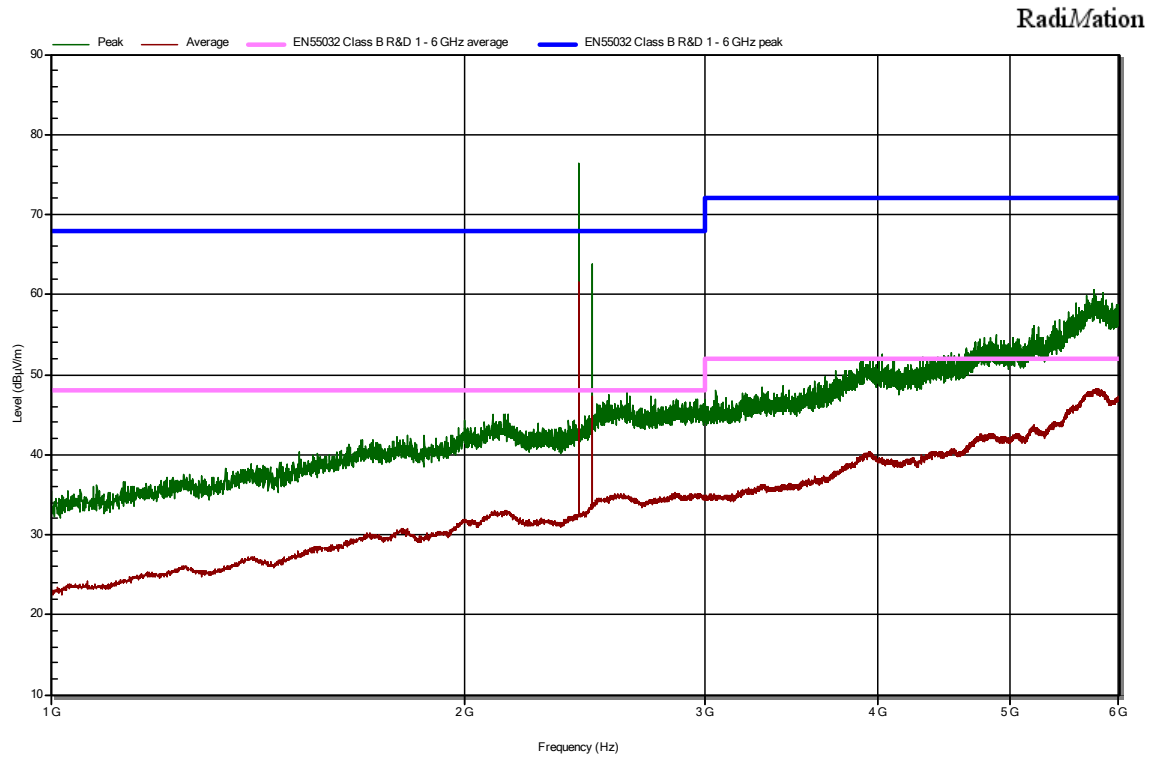
A.9 Vertical, back 180°

VentilatorPAL Pro: Class B; Vertical antenna, Back side.
Operational



A.10 Horizontal, right 90°

VentilatorPAL Pro: Class B; Horizontal antenna, right side.
Operational

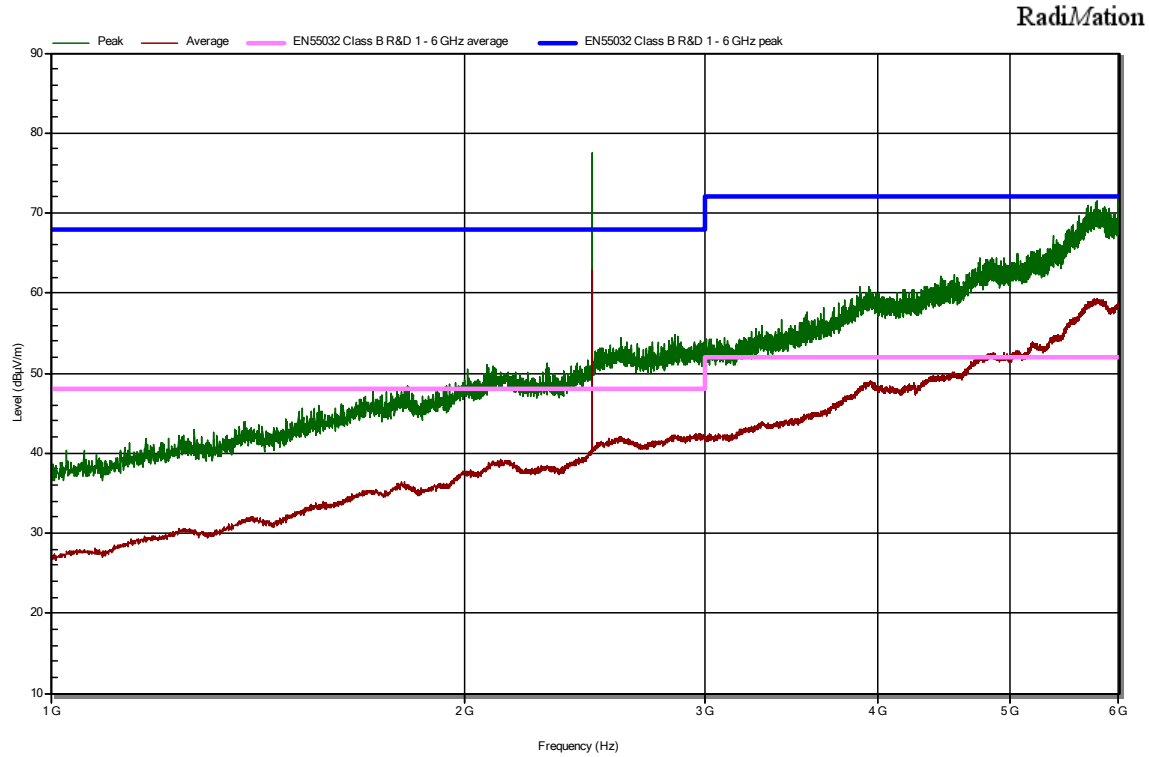


| Nr | Frequency (MHz) | PK Value (dBµV/m) | AVG Value (dBµV/m) | PK Limit (dBµV/m) | AVG Limit (dBµV/m) | Result | Angle (degrees) | Height (m) | H/V |
|----|-----------------|-------------------|--------------------|-------------------|--------------------|--------|-----------------|------------|-----|
| 1 | 2426,5 | 76,504 | 35,4 | 68 | 48 | NOTE | 0 | 1,5 | H |
| 2 | 2481 | 63,958 | 34,145 | 68 | 48 | NOTE | 0 | 1,5 | H |

NOTE: Thiese are the WiFi frequencies

Vertical, right 90°

VentilatorPAL Pro: Class B; Vertical antenna, right side.
Operational



| Nr | Frequency (MHz) | PK Value (dBµV/m) | AVG Value (dBµV/m) | PK Limit (dBµV/m) | AVG Limit (dBµV/m) | Result | Angle (degree s) | Height (m) | H/V |
|----|-----------------|-------------------|--------------------|-------------------|--------------------|--------|------------------|------------|-----|
| 1 | 2479,5 | 78,848 | 41,877 | 68 | 48 | NOTE | 0 | 1,5 | V |

NOTE: This is the WiFi frequency

8.5 : Radiated immunity, (IEC61000-4-3; 80MHz – 1GHz)

| | |
|-----------------------|---------------------------|
| Report title: | EN 60601-1-2 |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |



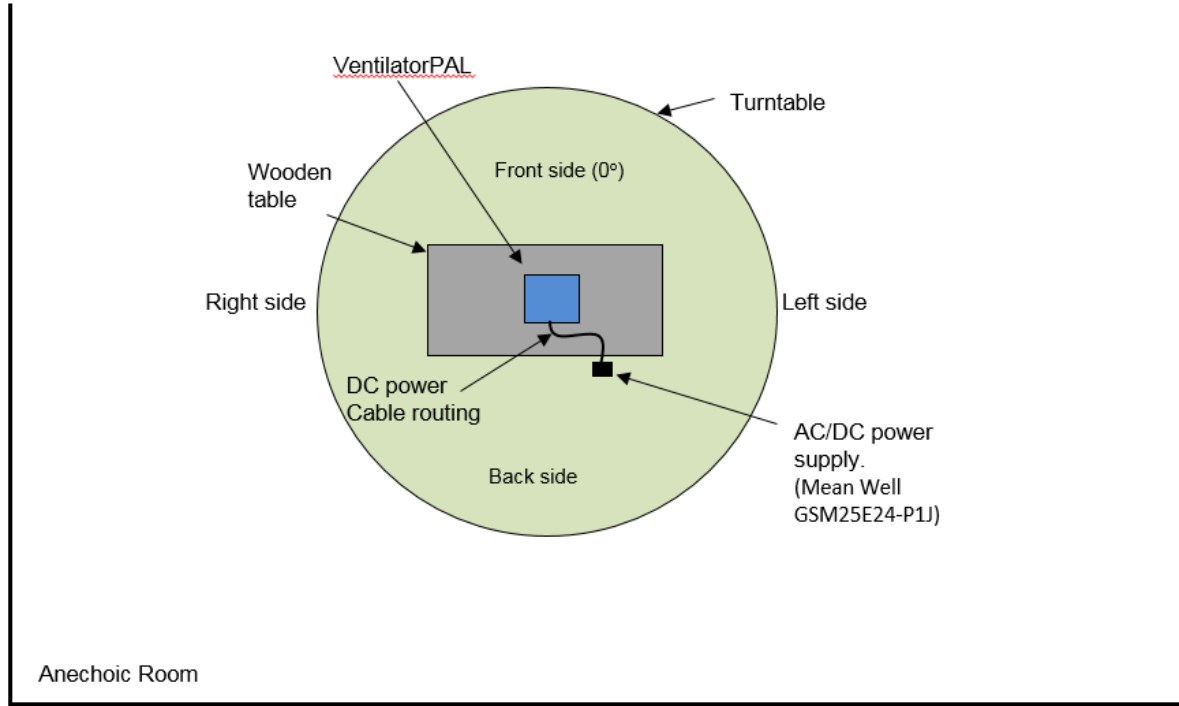
Figure 2: Photo showing the VentilatorPAL Pro set-up

| Test Result | |
|-------------|--|
| Result: | The EUT meets the performance criteria (no loss of performance). |

A.11 Used equipment

| Used equipment. For calibration dates see Chapter 6. | | | | |
|--|--|--------------------|---------------|-------------------|
| Reg. No. | Equipment | manufacturer | Type | Used in this test |
| 22776 | Signal generator 9kHz – 3.3GHz | Rohde & Schwarz | SML03 | Y |
| 22774 | Power meter 80MHz – 1GHz | Rohde & Schwarz | NRVD | Y |
| 22775 | Power meter 1GHz – 3GHz | Rohde & Schwarz | NRVD | |
| 23050 | RF coupler 80MHz – 1GHz | Amplifier Research | DC6080 | Y |
| 23051 | RF coupler 1GHz – 4GHz | Amplifier Research | DC7144 | |
| 22799 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 23001 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 23004 | insertion unit 50 Ohm DC-40GHz | Rohde & Schwarz | URV5-Z4 | |
| 23005 | insertion unit 50 Ohm DC-40GHz | Rohde & Schwarz | URV5-Z4 | |
| 23003 | RF amplifier 80MHz – 1GHz | Amplifier research | 150W1000AM3 | Y |
| 23002 | RF amplifier 800MHz – 4.2GHz | Amplifier research | 10S1G4AM3 | |
| 25597 | Field probe Radisense DC- 6GHz | D.A.R.E. | Radisense VI | Y |
| 19949 | Biconilog antenna 26MHz-2GHz | EMCO | 3141 | |
| 22576 | Biconilog antenna 26MHz-2GHz | EMCO | 3142C | |
| 21528 | Biconilog antenna 26MHz-2GHz | Schaffner | CBL 6141A | |
| 17596 | Biconical antenna 20MHz – 200MHz | EMCO | 3104 | |
| 17598 | Log-per antenna 200MHz – 2GHz | EMCO | 3148 | |
| 22759 | Log-per antenna 1GHz-20GHz | Schwarzbeck | STLP9148 | |
| 25005 | Log-per antenna 80MHz-6GHz | Amplifier research | ATR80M6G | Y |
| 21566 | Full Anechoic Room (lxwxh = 10mx6mx3m) | Rainford | 30MHz – 18GHz | Y |
| 20976 | Full Anechoic Room (lxwxh = 8mx5mx3m) | Euroshield | 30MHz – 1GHz | |

A.12 Measurement method



The EUT was placed on a wooden table 0.8, height as shown in the figure.
 The turntable was rotated so that all 4 sided were illuminated.
 The method used was the substitution method as described in IEC 61000-4-3.
 The 3m pre-calibrated field at the EUT measurement position is 10V/m

| Settings | |
|------------------|---------------------------|
| Distance | 3 m |
| Field strength | 10 V/m |
| Frequency range | 80 MHz - 1 GHz |
| Logarithmic Step | 1% |
| Modulation | 1000 Hz. 80% AM, 80, 1000 |
| Dwell time | 1 s |

A.13 Monitoring

During the **measurements** the EUT was constantly monitored using a camera system.

A.14 Results

VentilatorPAL Pro: 10V/m; 80MHz – 1GHz

| Angle | Field Strength (V/m) | Observation |
|----------------------------------|----------------------|-------------|
| Vertical measurement Front 0° | 10 | Pass |
| Horizontal measurement Front 0° | 10 | Pass |
| Vertical measurement Right 90° | 10 | Pass |
| Horizontal measurement Right 90° | 10 | Pass |
| Vertical measurement Back 180° | 10 | Pass |
| Horizontal measurement Back 180° | 10 | Pass |
| Vertical measurement Left 270° | 10 | Pass |
| Horizontal measurement Left 270° | 10 | Pass |

Pass:

During and after applying the RF interference the EUT remained functional without any loss of performance.

8.6 Radiated immunity, (IEC61000-4-3; 1- 2.7GHz)

| | |
|-----------------------|---------------------------|
| Report title: | EN 60601-1-2 |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |



Figure 3: Photo showing the VentilatorPAL test set-up

Test Result

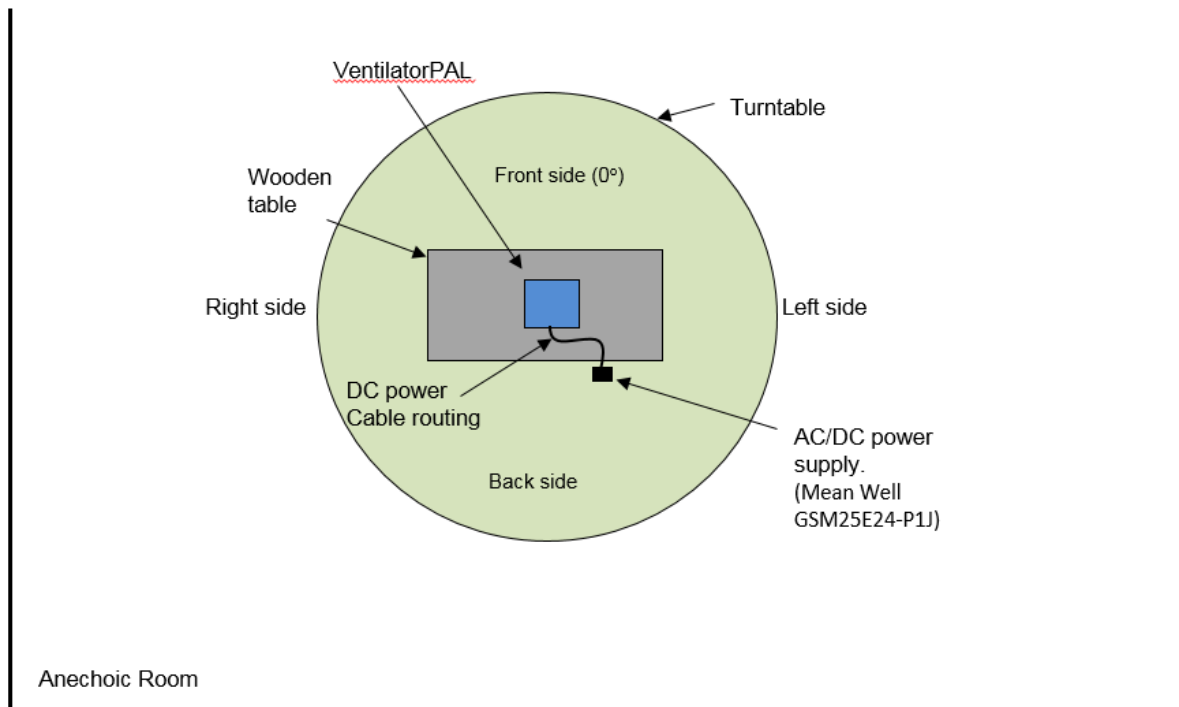
| | |
|---------|--|
| Result: | The EUT meets the performance criteria (no loss of performance). |
|---------|--|

Used equipment

Used equipment. For calibration dates see Chapter 6.

| Reg. No. | Equipment | manufacturer | Type | Used in this test |
|----------|--|--------------------|---------------|-------------------|
| 22776 | Signal generator 9kHz – 3.3GHz | Rohde & Schwarz | SML03 | Y |
| 22774 | Power meter 80MHz – 1GHz | Rohde & Schwarz | NRVD | Y |
| 22775 | Power meter 1GHz – 3GHz | Rohde & Schwarz | NRVD | |
| 23050 | RF coupler 80MHz – 1GHz | Amplifier Research | DC6080 | Y |
| 23051 | RF coupler 1GHz – 4GHz | Amplifier Research | DC7144 | |
| 22799 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 23001 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 23004 | insertion unit 50 Ohm DC-40GHz | Rohde & Schwarz | URV5-Z4 | |
| 23005 | insertion unit 50 Ohm DC-40GHz | Rohde & Schwarz | URV5-Z4 | |
| 26211 | RF amplifier 80MHz – 1GHz | Amplifier research | 500W1000B3 | |
| 23002 | RF amplifier 800MHz – 4.2GHz | Amplifier research | 10S1G4AM3 | |
| 25597 | Field probe Radisense DC- 6GHz | D.A.R.E. | Radisense VI | Y |
| 19949 | Biconilog antenna 26MHz-2GHz | EMCO | 3141 | |
| 25736 | Controller DC-6GHz | D.A.R.E. | CTR1009B | Y |
| 25737 | RadiField DC-6GHz | D.A.R.E. | RFS1006B | Y |
| 22576 | Biconilog antenna 26MHz-2GHz | EMCO | 3142C | |
| 21528 | Biconilog antenna 26MHz-2GHz | Schaffner | CBL 6141A | |
| 17596 | Biconical antenna 20MHz – 200MHz | EMCO | 3104 | |
| 17598 | Log-per antenna 200MHz – 2GHz | EMCO | 3148 | |
| 22759 | Log-per antenna 1GHz-20GHz | Schwarzbeck | STLP9148 | |
| 25737 | RadiField 1GHz – 6GHz | D.A.R.E. | RFS2006B | Y |
| 21566 | Full Anechoic Room (lxwxh = 10mx6mx3m) | Rainford | 30MHz – 18GHz | Y |
| 20976 | Full Anechoic Room (lxwxh = 8mx5mx3m) | Euroshield | 30MHz – 1GHz | |

A.15 Measurement method



The EUT was placed on a wooden table 0.8, height as shown in the figure. The turntable was rotated so that all 4 sided were illuminated.

| Settings | |
|------------------|---------------------------|
| Distance | 3 m |
| Field strength | 10 V/m |
| Frequency range | 1 GHz – 2.7 GHz |
| Logarithmic Step | 1% |
| Modulation | 1000 Hz. 80% AM, 80, 1000 |
| Dwell time | 1 s |

A.16 Monitoring

During the measurements the EUT was constantly monitored using a camera system.

A.17 Results

VentilatorPAL Pro: 10V/m; 1 – 2.7GHz

| Angle | Field Strength (V/m) | Observation |
|----------------------------------|----------------------|-------------|
| Vertical measurement Front 0° | 10 | Pass |
| Horizontal measurement Front 0° | 10 | Pass |
| Vertical measurement Right 90° | 10 | Pass |
| Horizontal measurement Right 90° | 10 | Pass |
| Vertical measurement Back 180° | 10 | Pass |
| Horizontal measurement Back 180° | 10 | Pass |
| Vertical measurement Left 270° | 10 | Pass |
| Horizontal measurement Left 270° | 10 | Pass |

Pass:

During and after applying the RF interference the EUT remained functional without any loss of performance.

8.7 Radiated immunity, (EN 60601-1-2; Table 9; Immunity to RF wireless Communications equipment.

| | |
|-----------------------|---------------------------|
| Report title: | EN 60601-1-2; Table 9 |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |

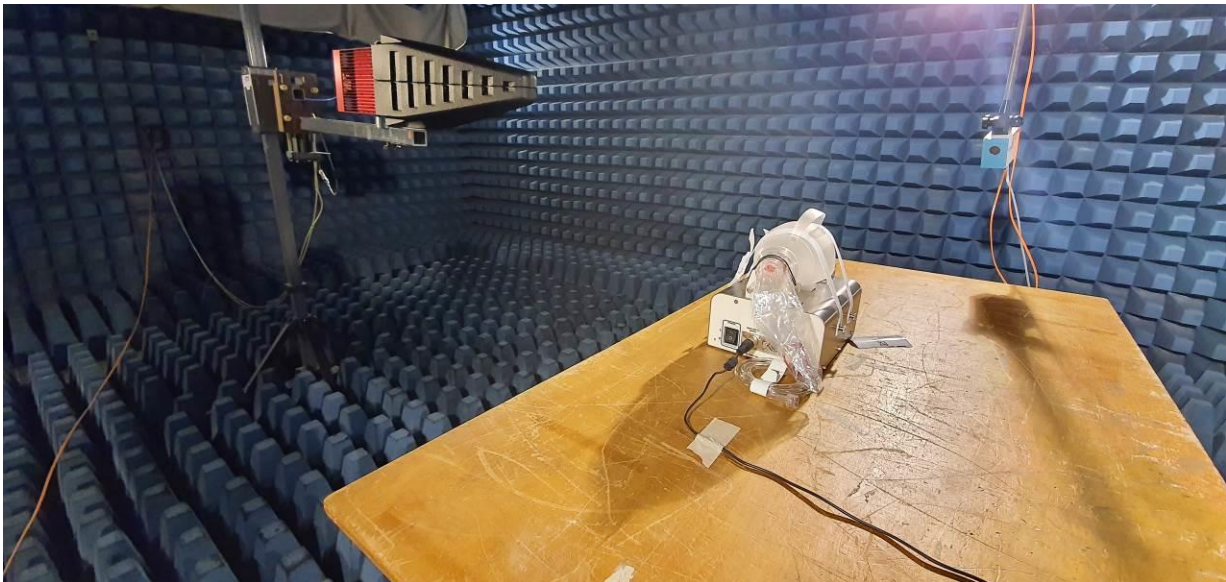


Figure 4: Photo showing the VentilatorPAL test set-up (1 m antenna distance)

Test Result

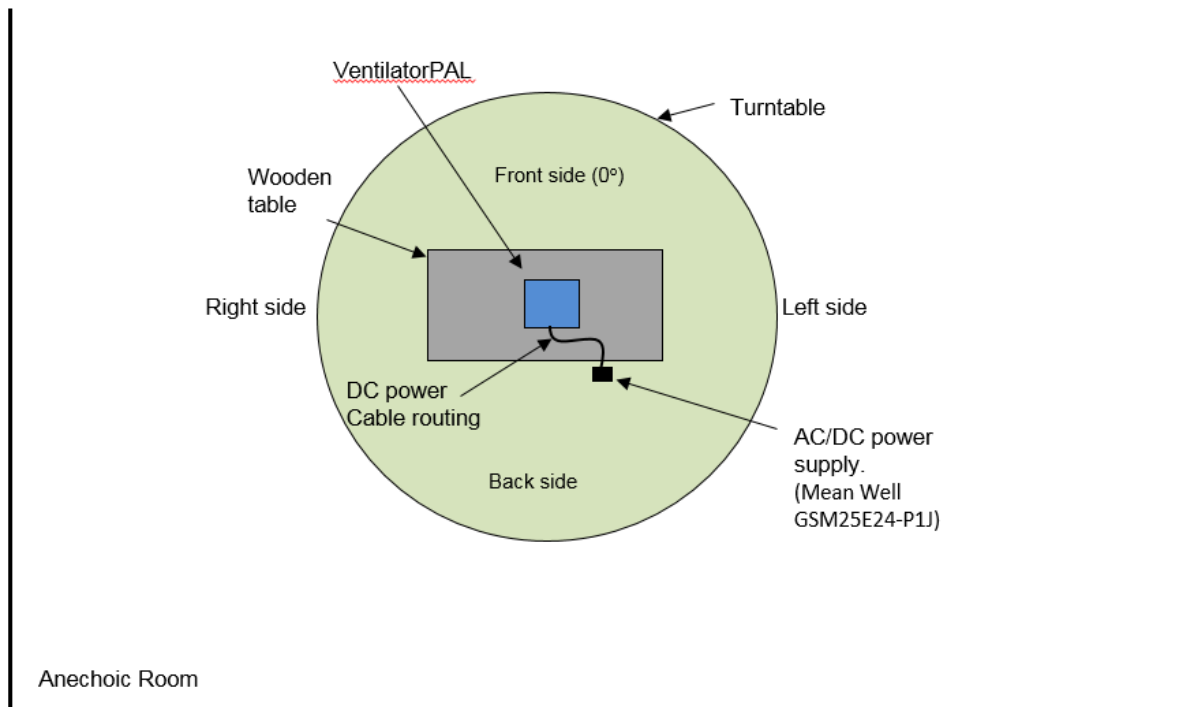
| | |
|---------|--|
| Result: | <p>The EUT complies with EN-IEC 60601-1-2:2016+ A:12013, Table 9: Test specifications for ENCLOSURE PORT IMMUNITY to RF wireless communications equipment.</p> <p>The EUT meets the performance criteria (no loss of performance).</p> |
|---------|--|

Used equipment

Used equipment. For calibration dates see Chapter 6.

| Reg. No. | Equipment | manufacturer | Type | Used in this test |
|----------|--|--------------------|---------------|-------------------|
| 22776 | Signal generator 9kHz – 3.3GHz | Rohde & Schwarz | SML03 | Y |
| 22774 | Power meter 80MHz – 1GHz | Rohde & Schwarz | NRVD | Y |
| 22775 | Power meter 1GHz – 3GHz | Rohde & Schwarz | NRVD | |
| 23050 | RF coupler 80MHz – 1GHz | Amplifier Research | DC6080 | Y |
| 23051 | RF coupler 1GHz – 4GHz | Amplifier Research | DC7144 | |
| 22799 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 23001 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 23004 | insertion unit 50 Ohm DC-40GHz | Rohde & Schwarz | URV5-Z4 | |
| 23005 | insertion unit 50 Ohm DC-40GHz | Rohde & Schwarz | URV5-Z4 | |
| 26211 | RF amplifier 80MHz – 1GHz | Amplifier research | 500W1000B3 | |
| 23002 | RF amplifier 800MHz – 4.2GHz | Amplifier research | 10S1G4AM3 | |
| 25597 | Field probe Radisense DC- 6GHz | D.A.R.E. | Radisense VI | Y |
| 19949 | Biconilog antenna 26MHz-2GHz | EMCO | 3141 | |
| 25736 | Controller DC-6GHz | D.A.R.E. | CTR1009B | Y |
| 25737 | RadiField DC-6GHz | D.A.R.E. | RFS1006B | Y |
| 22576 | Biconilog antenna 26MHz-2GHz | EMCO | 3142C | |
| 21528 | Biconilog antenna 26MHz-2GHz | Schaffner | CBL 6141A | |
| 17596 | Biconical antenna 20MHz – 200MHz | EMCO | 3104 | |
| 17598 | Log-per antenna 200MHz – 2GHz | EMCO | 3148 | |
| 22759 | Log-per antenna 1GHz-20GHz | Schwarzbeck | STLP9148 | |
| 25737 | RadiField 1GHz – 6GHz | D.A.R.E. | RFS2006B | Y |
| 21566 | Full Anechoic Room (lxwxh = 10mx6mx3m) | Rainford | 30MHz – 18GHz | Y |
| 20976 | Full Anechoic Room (lxwxh = 8mx5mx3m) | Euroshield | 30MHz – 1GHz | |

A.18 Measurement method



The EUT was placed on a wooden table 0.8, height as shown in the figure. The table (EUT) was moved to a closer distance of 1m from the antenna to ensure the required field strength could be reached as documented in chapter 8.10 of EN 60601-1-2.

| Settings | |
|------------------|---|
| Distance | 1 m |
| Field strength | Various (see Table 9 of EN-IEC 60601-1-2:2016+ A:12013) |
| Frequency range | Various (see Table 9 of EN-IEC 60601-1-2:2016+ A:12013) |
| Logarithmic Step | 1% |
| Modulation | Various (see Table 9 of EN-IEC 60601-1-2:2016+ A:12013) |
| Dwell time | 1 s |

A.19 Monitoring

During and after the **measurements** the EUT was constantly monitored using a camera system to ensure the basic and essential performance remained functional without any failures/errors.

VentilatorPAL Pro: Immunity to RF wireless Communications equipment.

| Angle | Frequency | Modulation | Field strength | Observation |
|---------------------|------------------|-----------------------|-----------------------|--------------------|
| Vertical Front 0° | 380 - 390MHz | Puls modulation 18Hz | 27V/m | Pass |
| Horizontal Front 0° | 380 - 390MHz | Puls modulation 18Hz | 27V/m | Pass |
| Vertical Right 0° | 380 - 390MHz | Puls modulation 18Hz | 27V/m | Pass |
| Horizontal Right 0° | 380 - 390MHz | Puls modulation 18Hz | 27V/m | Pass |
| Vertical Front 0° | 430 - 470MHz | Sine wave 1kHz | 27V/m | Pass |
| Horizontal Front 0° | 430 - 470MHz | Sine wave 1kHz | 27V/m | Pass |
| Vertical Right 0° | 430 - 470MHz | Sine wave 1kHz | 27V/m | Pass |
| Horizontal Right 0° | 430 - 470MHz | Sine wave 1kHz | 27V/m | Pass |
| Vertical Front 0° | 704 - 787MHz | Puls modulation 217Hz | 10V/m | Pass |
| Horizontal Front 0° | 704 - 787MHz | Puls modulation 217Hz | 10V/m | Pass |
| Vertical Right 0° | 704 - 787MHz | Puls modulation 217Hz | 10V/m | Pass |
| Horizontal Right 0° | 704 - 787MHz | Puls modulation 217Hz | 10V/m | Pass |
| Vertical Front 0° | 800 - 960MHz | Pulse Modulation 18Hz | 27V/m | Pass |
| Horizontal Front 0° | 800 - 960MHz | Pulse Modulation 18Hz | 27V/m | Pass |
| Vertical Right 0° | 800 - 960MHz | Pulse Modulation 18Hz | 27V/m | Pass |
| Horizontal Right 0° | 800 - 960MHz | Pulse Modulation 18Hz | 27V/m | Pass |
| Vertical Front 0° | 2400 - 5800MHz | Puls modulation 217Hz | 28V/m | Pass |
| Horizontal Front 0° | 2400 - 5800MHz | Puls modulation 217Hz | 28V/m | Pass |
| Vertical Right 0° | 2400 - 5800MHz | Puls modulation 217Hz | 28V/m | Pass |
| Horizontal Right 0° | 2400 - 5800MHz | Puls modulation 217Hz | 28V/m | Pass |

Pass:

During and after applying the RF interference the EUT remained functional without any loss of performance.

8.8 Conducted immunity, (IEC61000-4-6; 0.15 – 80MHz);

| | |
|-----------------------|---------------------------|
| Report title: | EFT immunity |
| Company Name: | Canon production Printing |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |
| Operating mode: | continuous |



Figure 5: Conducted immunity set-up. The insulated floor is 10cm above the ground plane.

| Test Result | |
|--------------------|--|
| Result: | <p>Test passed !</p> <p>AC mains, 6V rms</p> <p>The EUT meets the performance criteria (no loss of performance).</p> |

Used equipment

Used equipment. For calibration dates see Chapter 6.

| Reg. No. | Equipment | manufacturer | Type | Used in this test |
|----------|---|--------------------|----------------|-------------------|
| 21162 | 50Ohm Attenuator, 300W fixed 0-1GHz | JFW Industries | 50FH-006-300-N | Y |
| 21155 | 50Ohm Attenuator, 20dB/10W | JFW Industries | 50FH-020-10N | Y |
| 21156 | 50Ohm Termination, 10W | JFW Industries | 50T-172 | |
| 21152 | Bulk current injection probe 100kHz-1GHz | FCC | F-140A | |
| 21153 | Current sensor probe 10kHz-500MHz | FCC | F-51 | |
| 21154 | Calibration JIG 10kHz-400MHz | FCC | BCICF-1 | |
| 21182 | CDN 1-phase L+N+PE 0.15 – 230MHz | Lüthi | L801-M3 | |
| 21183 | CDN 1-phase L+N+PE 0.15 – 230MHz | Lüthi | L801-M3 | |
| 23049 | CDN 1-phase L+N+PE 0.15-230MHz / DC power | Lüthi | L801-M2/ M3 | |
| 21184 | CDN 3-phase L1+L2+L3+N+PE 0.15 - 230MHz | Lüthi | L801-M5 | Y |
| 22880 | CDN telecom ports 0.15 – 230MHz | Lüthi | L801-T8 | |
| 24120 | Signal generator 9kHz – 1.1GHz | Rohde & Schwarz | SMB 100A | Y |
| 21157 | Power meter 150kHz – 80MHz | Rohde & Schwarz | URV5 | Y |
| 21158 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 21159 | 10V insertion unit 50 Ohm 9kHz-3GHz | Rohde & Schwarz | URV5-Z2 | Y |
| 21160 | RF coupler 10kHz – 250MHz | Amplifier Research | DC2600 | Y |
| 22763 | RF amplifier 150kHz – 100MHz | Amplifier research | 500A100M3 | Y |
| 22876 | Faraday Cage | Comtest | | Y |

Measurement method

The CDN 801-M5 was used for the test.

CDN information:

Applied voltage: 6 Vrms
 Frequency range: 150 kHz - 80 MHz
 Logarithmic Step: 1%
 Modulation: 1000 Hz. 80% AM

A.20 Monitoring

During and after the **measurements** the EUT was constantly monitored using a camera system to ensure the basic and essential performance remained functional without any failures/errors.

A.21 Conclusion

The EUT complies with the Conducted immunity standard for AC power ports.

8.9 : Surge immunity (EN 61000-4-5 ; mains AC port; L-L) ; EN-IEC 60601-1-2:2016

| | |
|----------------|---------------------------------|
| Report title: | Power Frequency Magnetic Fields |
| Company Name: | Canon production Printing |
| Date of test: | 7 April 2020 |
| Evaluators: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| E. U. T.: | VentilatorPAL |
| Company Name: | Canon production Printing |

Assessment

The Power supply complies with the Surge immunity requirements as reported I the compliance test report (see ch. 2).

Since the EM-phenomena does not contain high frequency phenomena, the risk of this phenomena affecting the VentilatorPAL Pro due to parasitic effects is negligible.

Therefore there is no need to repeat the performance assessment of the final product combination.

Through this assessment the EUT in combination with the power supply is deemed to pass this immunity phenomena.

8.10 : EFT immunity (EN 61000-4-4; mains AC port) ; EN-IEC 60601-1-2:2016

| | |
|-----------------------|--------------------------------|
| Report title: | EFT immunity |
| Company Name: | I-E-R-S Compliance Engineering |
| Date of test: | 07 April 2020 |
| Testers: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| Mains supply voltage: | AC/DC adapter (230V) |
| Ambient Temperature: | 22.7°C |
| Humidity: | 44%RH |
| E. U. T.: | VentilatorPAL |
| Operating mode: | continuous |



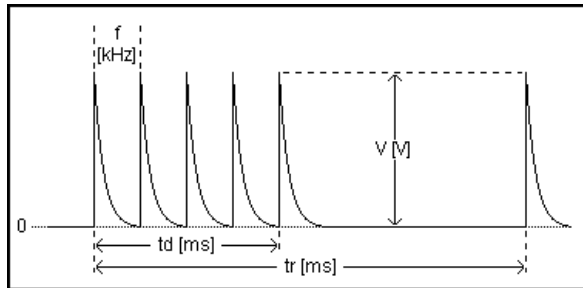
Figure 6: EFT immunity set-up. The insulated floor is 10cm above the ground plane

| Test Result | |
|-------------|---|
| Result: | <p>Test passed (with 2kV immunity level)</p> <p>The EUT in combination with the power supply meets the performance criteria for this EM-phenomena..</p> |

| E . U . T | |
|-----------------|-------------------|
| Name: | VentilatorPAL Pro |
| Operation Mode: | Continuous |
| Connection: | 230V/50Hz |
| Description: | |

| Test Procedure | | | |
|-------------------|--|---------------|---------|
| Pulse Name: | Pulse Overview : Burst | | |
| Test File: | G:\EMTEST\Testfile\61000-4-4 EFT\ACpowerport\1 Phase\4_4_1ph_2.tst | | |
| Comment: | EFT AC power port level 2 single phase | | |
| Test generator: | UCS500 M6 | Software No.: | 000028 |
| | | Serial No.: | 0699-09 |
| Software: | iec.control | Version: | 5.2.3 |
| Coupling network: | CNI503 | Serial No.: | 0200-01 |

| Test Setup | | | |
|---------------------|--------------|-----|--|
| V: | 2000 | V | |
| f: | 5 | kHz | |
| td: | 15 | ms | |
| tr: | 300 | ms | |
| Mode: | Asynchronous | | |
| Polarity: | Alternate | | |
| Coupling: | L1, N, L1+N | | |
| Test duration: | 1 | min | |
| Time between Tests: | 2 | s | |



| Test Result | | | |
|--------------------|------------------------------------|---|------------|
| V: | ±2000 | V | f: 5 kHz |
| | | | td: 15 ms |
| | | | tr: 300 ms |
| Coupling: | L1, N, L1+N | | |
| Elapsed Test time: | 6 min 12 s | | |
| Result: | Test passed ! No problems found | | |

8.11 : PFMF (Power Frequency Magnetic Fields)

| | |
|----------------|---------------------------------|
| Report title: | Power Frequency Magnetic Fields |
| Company Name: | Canon production Printing |
| Date of test: | 7 April 2020 |
| Evaluators: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| E. U. T.: | VentilatorPAL |

Assessment

The Power supply complies with the Surge immunity requirements as reported in the compliance test report (see ch. 2).

There are no components in the EUT which are sensitive to 50/60Hz magnetic fields.

Through this assessment the EUT in combination with the power supply is deemed to pass this immunity phenomena.

8.12 : Voltage dips ; (EN 61000-4-11; mains AC port) ; EN-IEC 60601-1-2:2016

| | |
|----------------|--------------------------------|
| Report title: | Voltage dips and interruptions |
| Company Name: | Canon production Printing |
| Date of test: | 7 April 2020 |
| Evaluators: | R. Brett; W. Ophelders |
| Standard used: | EN-IEC 60601-1-2:2016 |
| Customer: | Stogger B.V. |
| E. U. T.: | VentilatorPAL |

Assessment

The Power supply complies with the Surge immunity requirements as reported in the compliance test report (see ch. 2).

Since the EM-phenomena does not contain high frequency phenomena, the risk of this phenomena affecting the VentilatorPAL Pro due to parasitic effects is negligible.

Therefore there is no need to repeat the performance assessment of the final product combination.

Through this assessment the EUT in combination with the power supply is deemed to pass this immunity phenomena.

8.13 Harmonics emissions

| | |
|----------------|---|
| Report title: | Harmonics |
| Company Name: | Canon production Printing |
| Date of test: | 7 April 2020 |
| Evaluators: | R. Brett; W. Ophelders |
| Standard used: | EN/IEC 61000-3-2 Ed.4 Short cyclic Equipment class A |
| Customer: | Stogger B.V. |
| E. U. T.: | VentilatorPAL |

| Assessment | |
|------------|---|
| | <p>The Power supply complies with the Surge immunity requirements as reported I the compliance test report (see ch. 2).</p> <p>Since the EM-phenomena does not contain high frequency phenomena, the risk of this phenomena affecting the VentilatorPAL Pro due to parasitic effects is negligible.</p> <p>Therefore there is no need to repeat the performance assessment of the final product combination.</p> <p>Through this assessment the EUT in combination with the power supply is deemed to pass this immunity phenomena.</p> |

8.14 Flicker measurement results

| | |
|--------------------|-------------------------------|
| Report title: | Flicker |
| Company Name: | Canon production Printing |
| Date of test: | 7 April 2020 |
| Evaluators: | R. Brett; W. Ophelders |
| Standard used: | EN/IEC 61000-3-3 Ed.3 Flicker |
| Flicker Impedance: | Zref (IEC 60725) |
| Customer: | Stogger B.V. |
| E. U. T.: | VentilatorPAL |

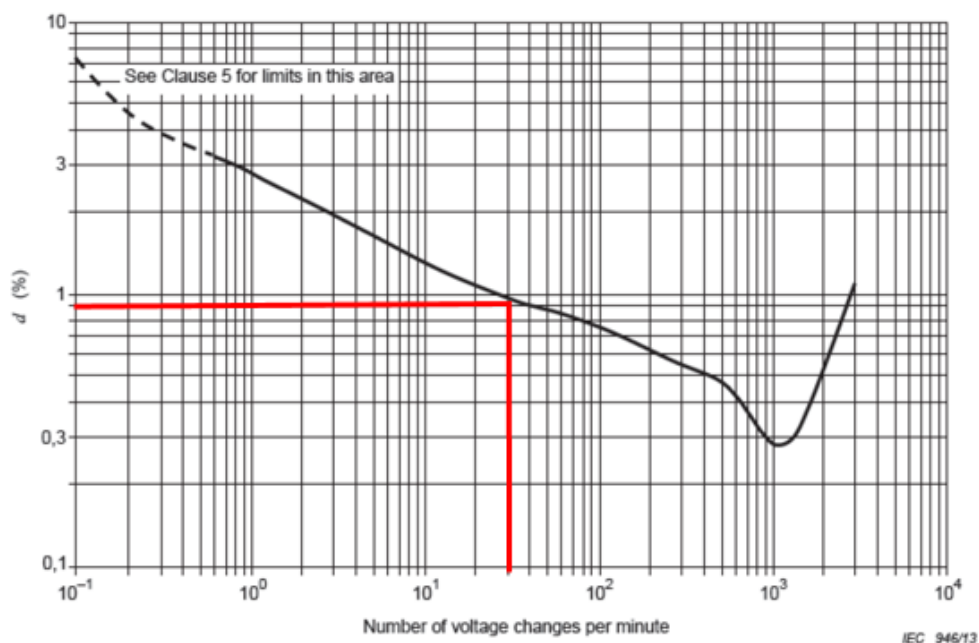
Assessment:

EN 61000-3-3 Reference impedance:

For single phase applications, the Phase and Neutral impedance combine to provide the required single phase Z_{ref} of $Z = 0.40 + j0.25 \Omega$

The modulus of this impedance = 0.472 Ohm

With an AC input supply current of 0.25A (refer to chapter 2), the maximum voltage drop which can occur on the mains due to a max. load change is 0.12V which is approx. 0.06% Unominal (230V). Applying this to the Plt and Pst curves of EN 61000-3-3 using a load change of 120/minute (max. speed) then it's impossible to exceed the flicker limits.



The maximum relative steady state voltage change (dc) will also not be exceeded.

The (dmax) level (i.e. due to inrush effects) has been tested and is documented in the Power Supply test report (see chapter 2).

8.15 ESD immunity test ; (EN 61000-4-2); EN-IEC 60601-1-2:2016.

Test setup

The test setup was prepared as described in the IEC 61000-4-2 ESD standard for ungrounded table-top equipment.

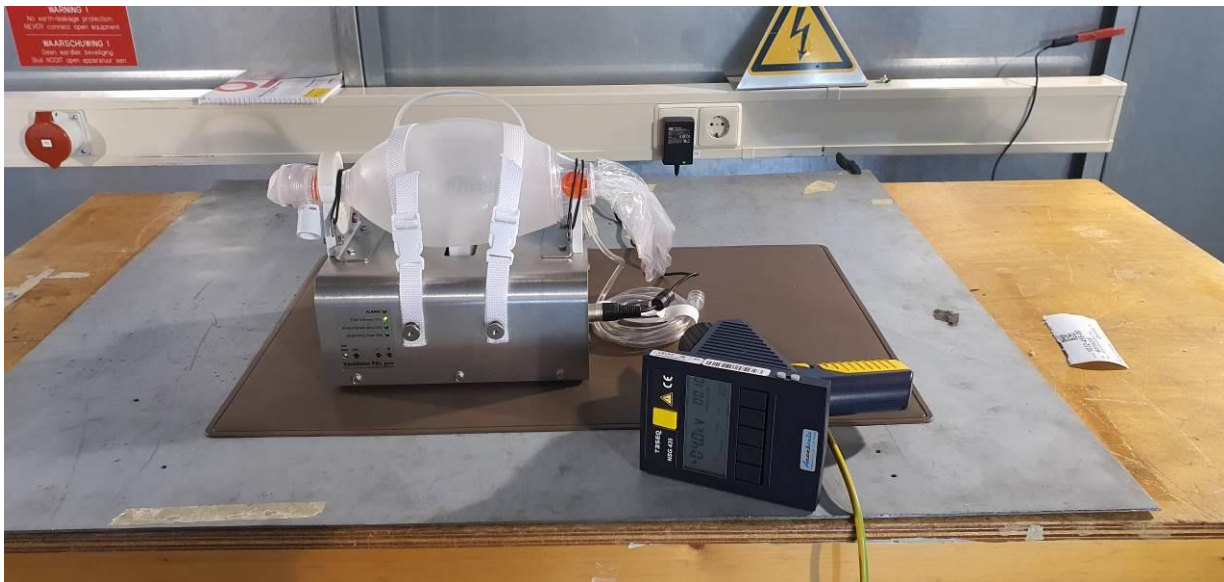
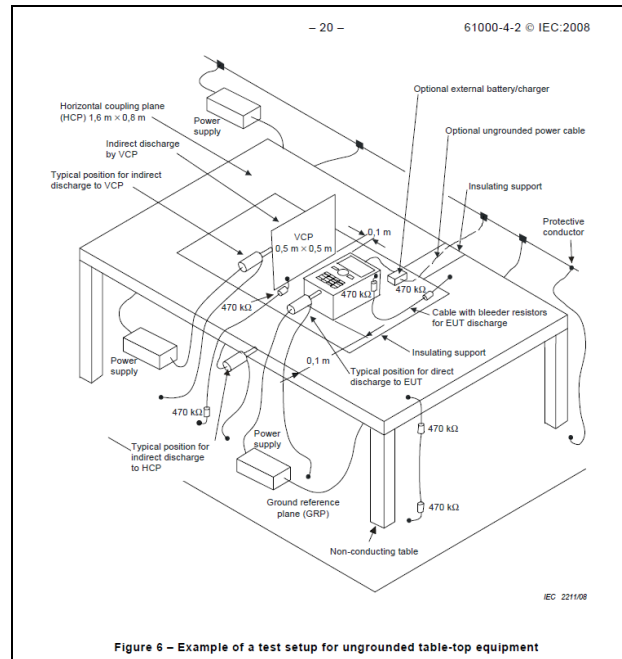


Photo showing the test setup according to the standard IEC 61000-6-2 for ungrounded table-top equipment.

Electrostatic discharges were also applied to the horizontal & vertical coupling planes using the “contact discharge” and “air discharge” functions.

At each discharge point, 10 +ve and 10 -ve discharges were delivered to the EUT.

ESD Test results:

| Discharge points | Test levels | | Test result |
|---|---|---|----------------------|
| Housing – various discharge points (see photos) | +8kV Contact mode | -8kV Contact mode | No problems observed |
| Power switch | +2kV; +4kV; +8kV; +15kV Air discharge | -2kV; -4kV; -8kV; -15kV Air discharge | No problems observed |
| Interface connector shell (see photo) | +8kV Contact mode | -8kV Contact mode | No problems observed |
| Power supply connector (conductive part) see photo. | +8kV Contact mode | -8kV Contact mode | No problems observed |

T e s t R e s u l t

Result: Test passed.
 The EUT meets the performance criteria (no loss of performance).

8.16 Photos

Contact Discharge









Air Discharge

