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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue | Description of Change | Date of Issue |
|-------|-----------------------------------|---------------|
| 1 | First Issue | 08 March 2019 |
| 2 | To include references to ICES-003 | 21 March 2019 |
| 3 | To amend the FCC and IC IDs. | 09 April 2019 |

Table 1

1.2 Introduction

| | |
|-------------------------------|---|
| Applicant | DETNET SOUTH AFRICA (PTY) LTD |
| Manufacturer | DETNET SOUTH AFRICA (PTY) LTD |
| Model Number(s) | 1) Blast BCU 2) BlastWeb |
| Serial Number(s) | 1) 0890004BB 2) 078000493 |
| Hardware Version(s) | V3A |
| Software Version(s) | 36694 |
| Number of Samples Tested | 1 plus power supply |
| Test Specification/Issue/Date | FCC 47 CFR Part 15B: 2017 ICES-003: 2016 |
| Order Number | 4500366033 |
| Date | 30-January-2019 |
| Date of Receipt of EUT | 18-February-2019 |
| Start of Test | 04-March-2019 |
| Finish of Test | 04-March-2019 |
| Name of Engineer(s) | Graeme Lawler |
| Related Document(s) | ANSI C63.4: 2014 |



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15B and ICES-003 is shown below.

| Section | Specification Clause | | Test Description | Result | Comments/Base Standard |
|--|----------------------|----------|--|--------|------------------------|
| | Part 15B | ICES-003 | | | |
| Configuration and Mode: AC Powered - Charging and Ethernet Data Transfer | | | | | |
| 2.1 | 15.107 | 6.1 | Conducted Disturbance at Mains Terminals | Pass | ANSI C63.4: 2014 |
| 2.2 | 15.109 | 6.2 | Radiated Disturbance | Pass | ANSI C63.4: 2014 |

Table 2



1.4 Application Form

| EQUIPMENT DESCRIPTION | |
|---|--|
| Model Name/Number | Blast BCU |
| Part Number | 073000XX |
| Hardware Version | V3A |
| Software Version | 36694 |
| FCC ID (if applicable) | 2ARNH-0743337A |
| Industry Canada ID (if applicable) | 24476-0743337A |
| Technical Description (Please provide a brief description of the intended use of the equipment) | Fixed installation underground electronic detonator blast controller for mining and tunnel development |

| INTENTIONAL RADIATORS | | | | | | | | | |
|-----------------------|----------------------|---------------------------------------|--------------------|-------------------------------|----------------------|-------------------------|---------------------|--------|-----|
| Technology | Frequency Band (MHz) | Conducted Declared Output Power (dBm) | Antenna Gain (dBi) | Supported Bandwidth (s) (MHz) | Modulation Scheme(s) | ITU Emission Designator | Test Channels (MHz) | | |
| | | | | | | | Bottom | Middle | Top |
| | | | | | | | | | |

| UN-INTENTIONAL RADIATOR | |
|--|--------|
| Highest frequency generated or used in the device or on which the device operates or tunes | 192MHz |
| Lowest frequency generated or used in the device or on which the device operates or tunes | 1200Hz |
| Class A Digital Device (Use in commercial, industrial or business environment) <input checked="" type="checkbox"/> | |
| Class B Digital Device (Use in residential environment only) <input type="checkbox"/> | |

| Power Source | | | |
|--|-----------------|---|-------------------------------------|
| AC | Single Phase | Three Phase | Nominal Voltage |
| | 230 | | 230 |
| External DC | Nominal Voltage | | Maximum Current |
| | | | |
| Battery | Nominal Voltage | | Battery Operating End Point Voltage |
| | 12 | | 14.2 |
| Can EUT transmit whilst being charged? | | Yes <input checked="" type="checkbox"/> | No <input type="checkbox"/> |



EXTREME CONDITIONS

| | | | | | |
|---------------------|----|----|---------------------|-----|----|
| Maximum temperature | 70 | °C | Minimum temperature | -20 | °C |
|---------------------|----|----|---------------------|-----|----|

Ancillaries

Please list all ancillaries which will be used with the device.

PC blast controller via ethernet connection

ANTENNA CHARACTERISTICS

| | | |
|--|-----------------|-----|
| <input type="checkbox"/> Antenna connector | State impedance | Ohm |
| <input type="checkbox"/> Temporary antenna connector | State impedance | Ohm |
| <input type="checkbox"/> Integral antenna | Type | |
| <input type="checkbox"/> External antenna | Type | |

I hereby declare that the information supplied is correct and complete.

Name: Herman van der Walt

Position held: Quality and Compliance Manager

Date: 2019-02-01

1.5 Product Information

1.5.1 Technical Description

Fixed installation underground electronic detonator blast controller for mining and tunnel development

1.5.2 Test Setup Diagram(s)

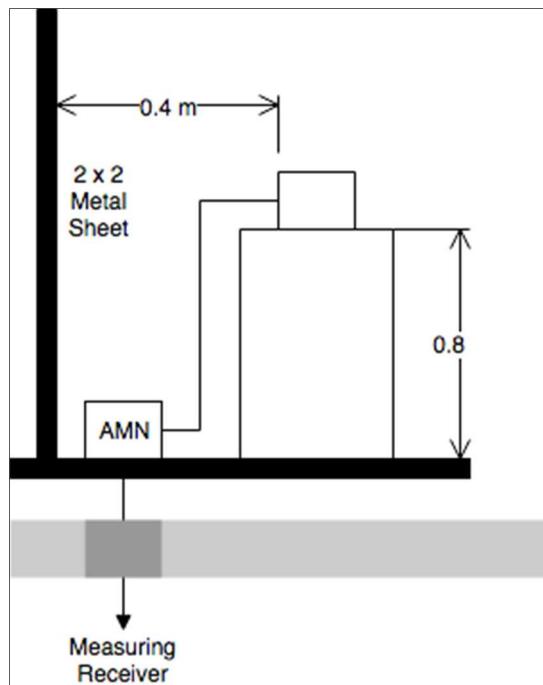


Figure 1 - Conducted Disturbance at Mains Terminals

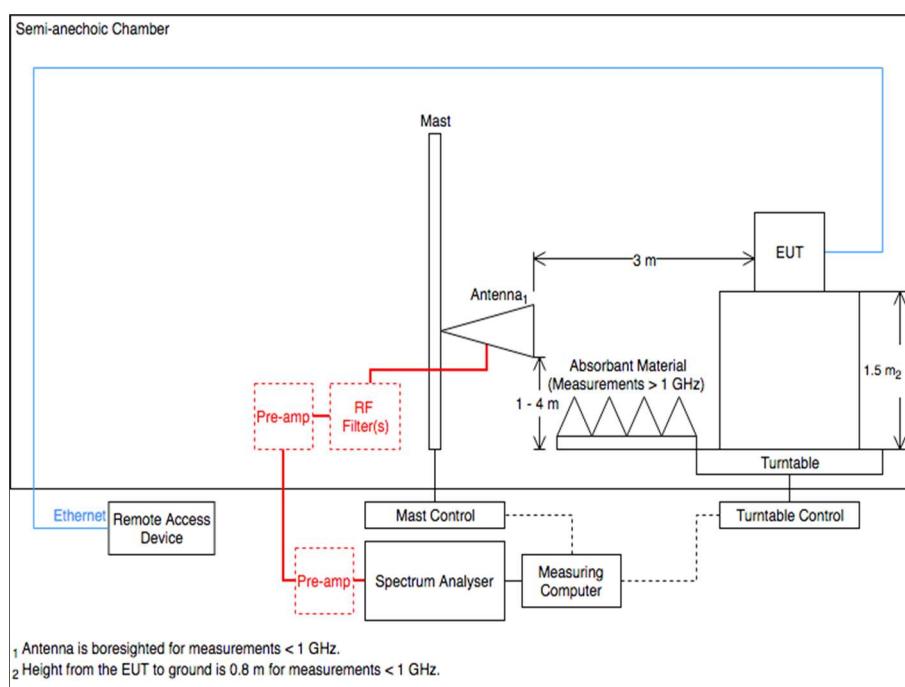


Figure 2 - Radiated Disturbance



1.5.3 EUT Configuration and Rationale for Radiated Spurious Emissions

The EUT was setup on a non-conductive platform 0.8m above a horizontal ground reference plane. All six output channels were representatively loaded.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme. The modifications incorporated during each test are recorded on the appropriate test pages.

| Modification State | Description of Modification still fitted to EUT | Modification Fitted By | Date Modification Fitted |
|--|---|------------------------|--------------------------|
| Blast Web - Blast Control Unit: Serial Number: 078000493 | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |
| Blast Web – Power Supply Unit: Serial Number: 0890004BB | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |

Table 3

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Fareham Test Laboratory.

| Test Name | Name of Engineer(s) | Accreditation |
|--|---------------------|---------------|
| Configuration and Mode: AC Powered - Charging and Ethernet Data Transfer | | |
| Conducted Disturbance at Mains Terminals | Graeme Lawler | UKAS |
| Radiated Disturbance | Graeme Lawler | UKAS |

Table 4

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom



2 Test Details

2.1 Conducted Disturbance at Mains Terminals

2.1.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.107
ICES-003, Clause 6.1

2.1.2 Equipment Under Test and Modification State

Blast Web - Blast Control Unit, S/N: 0890004BB - Modification State 0
Blast Web - Power Supply Unit, S/N: 078000493 - Modification State 0

2.1.3 Date of Test

04-March-2019

2.1.4 Test Method

The EUT was placed on a non-conductive table 0.8m above a reference ground plane and 0.4m from a vertical reference ground plane.

All power was connected to the EUT through an Artificial Mains Network (AMN). Conducted disturbance voltage measurements on mains lines were made at the output of the AMN. The AMN was placed 0.8m from the boundary of the EUT and bonded to the reference ground plane.

2.1.5 Environmental Conditions

| | |
|---------------------|---------|
| Ambient Temperature | 20.2 °C |
| Relative Humidity | 42.4 % |



2.1.6 Test Results

Results for Configuration and Mode : AC Powered - Charging and Ethernet Data Transfer.

This test was tested in accordance with the Class A limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

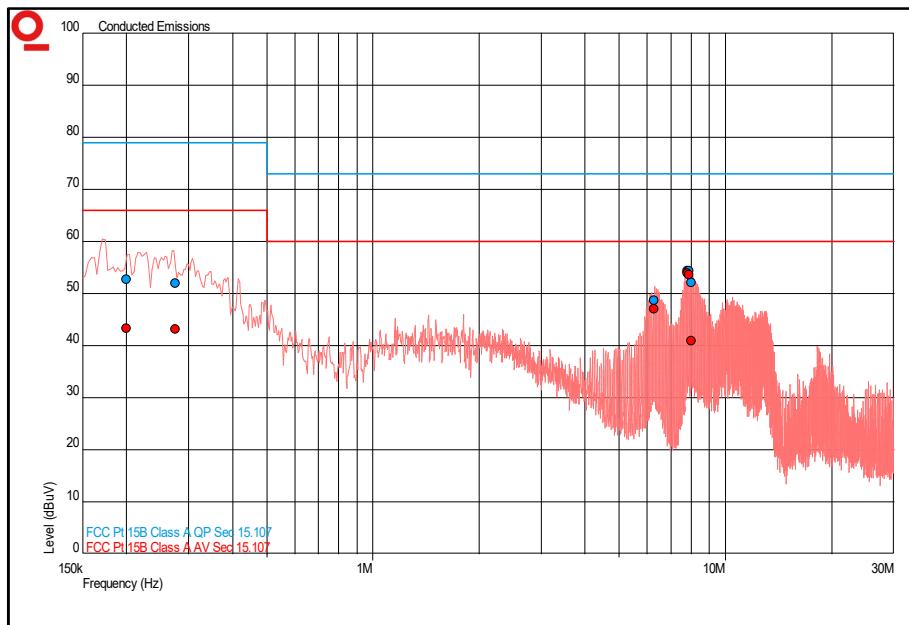


Figure 3 - Graphical Results - AC Mains Neutral

| Frequency (MHz) | QP Level (dBuV) | QP Limit (dBuV) | QP Margin (dBuV) | AV Level (dBuV) | AV Limit (dBuV) | AV Margin (dBuV) |
|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|------------------|
| 0.200 | 52.8 | 79.0 | -26.2 | 43.4 | 66.0 | -22.6 |
| 0.275 | 52.0 | 79.0 | -27.0 | 43.2 | 66.0 | -22.8 |
| 6.284 | 48.7 | 73.0 | -24.3 | 47.1 | 60.0 | -12.9 |
| 7.807 | 54.4 | 73.0 | -18.6 | 54.0 | 60.0 | -6.0 |
| 7.870 | 54.4 | 73.0 | -18.6 | 53.7 | 60.0 | -6.3 |
| 7.988 | 52.2 | 73.0 | -20.8 | 41.0 | 60.0 | -19.0 |

Table 5

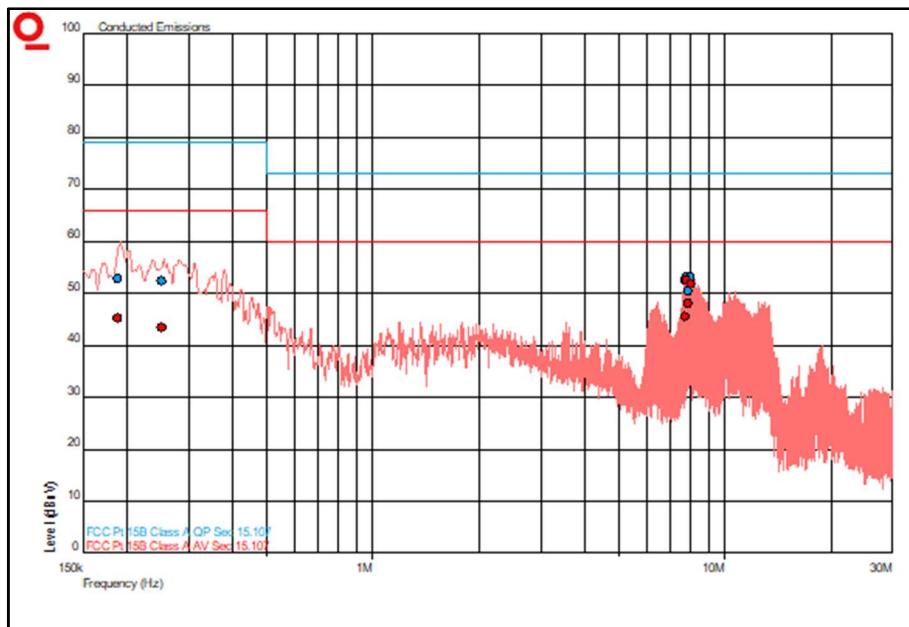


Figure 4 - Graphical Results - AC Mains Live

| Frequency (MHz) | QP Level (dBuV) | QP Limit (dBuV) | QP Margin (dBuV) | AV Level (dBuV) | AV Limit (dBuV) | AV Margin (dBuV) |
|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|------------------|
| 0.188 | 53.0 | 79.0 | -26.0 | 45.4 | 66.0 | -20.6 |
| 0.251 | 52.4 | 79.0 | -26.6 | 43.5 | 66.0 | -22.5 |
| 7.729 | 52.6 | 73.0 | -20.4 | 45.7 | 60.0 | -14.3 |
| 7.792 | 53.2 | 73.0 | -19.8 | 52.6 | 60.0 | -7.4 |
| 7.862 | 50.5 | 73.0 | -22.5 | 48.1 | 60.0 | -11.9 |
| 7.989 | 53.1 | 73.0 | -19.9 | 51.9 | 60.0 | -8.1 |

Table 6

2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|------------------------|-----------------|---------------|-------|-----------------------------|-----------------|
| Transient Limiter | Hewlett Packard | 11947A | 15 | 12 | 26-Jul-2019 |
| LISN (1 Phase) | Chase | MN 2050 | 336 | 12 | 10-Apr-2019 |
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 23-Jan-2021 |
| Digital Multimeter | Iso-tech | IDM-101 | 2895 | 12 | 04-Oct-2019 |
| Compliance 5 Emissions | Teseq | V5.26.51 | 3275 | - | Software |
| EMI Test Receiver | Rohde & Schwarz | ESU40 | 3506 | 12 | 17-Dec-2019 |
| Hygrometer | Rotronic | HP21 | 4989 | 12 | 26-Apr-2019 |
| 8 Meter Cable | Teledyne | PR90-088-8MTR | 5212 | 6 | 28-Jul-2019 |

Table 7



2.2 Radiated Disturbance

2.2.1 Specification Reference

FCC 47 CFR Part 15B, Clause 15.109
ICES-003, Clause 6.2

2.2.2 Equipment Under Test and Modification State

Blast Web - Blast Control Unit, S/N: 0890004BB - Modification State 0
Blast Web - Power Supply Unit, S/N: 078000493 - Modification State 0

2.2.3 Date of Test

04-March-2019

2.2.4 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable and placed on a non-conductive table 0.8m above a reference ground plane.

A pre-scan of the EUT emissions profile was made while varying the antenna-to-EUT azimuth and antenna-to-EUT polarisation using a peak detector; measurements were taken at a 3m distance. Using the pre-scan list of the highest emissions detected, their bearing and associated antenna polarisation, the EUT was then formally measured using a Quasi-Peak, Peak, Average detector as appropriate. The readings were maximised by adjusting the antenna height, polarisation and turntable azimuth, in accordance with the specification.

2.2.5 Environmental Conditions

| | |
|---------------------|---------|
| Ambient Temperature | 20.2 °C |
| Relative Humidity | 42.4 % |



2.2.6 Test Results

Results for Configuration and Mode: AC Powered - Charging and Ethernet Data Transfer.

This test was tested in accordance with the Class B limits.

Performance assessment of the EUT made during this test: Pass.

Detailed results are shown below.

Highest frequency generated or used within the EUT: 198 MHz
Which necessitates an upper frequency test limit of: 2 GHz

| Frequency (MHz) | Level | Limit | Margin | Detector | Unit | Angle (°) | Height (cm) | Polarisation |
|-----------------|-------|-------|--------|----------|--------|-----------|-------------|--------------|
| 32.000 | 30.30 | 39.5 | 9.20 | Q-Peak | dBuV/m | 17 | 103 | Vertical |
| 45.248 | 31.53 | 39.5 | 7.97 | Q-Peak | dBuV/m | 15 | 100 | Vertical |

Table 8 - Emissions Results: 30 MHz to 1 GHz, Horizontal and Vertical Polarity

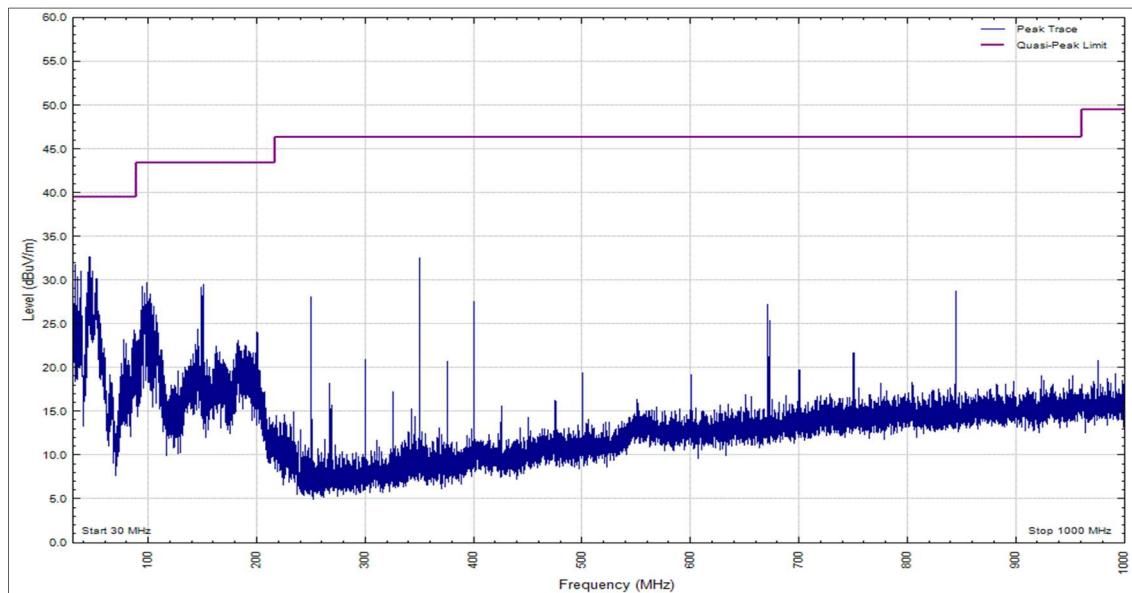


Figure 5 - Graphical Results - 30 MHz to 1 GHz - Vertical Polarity

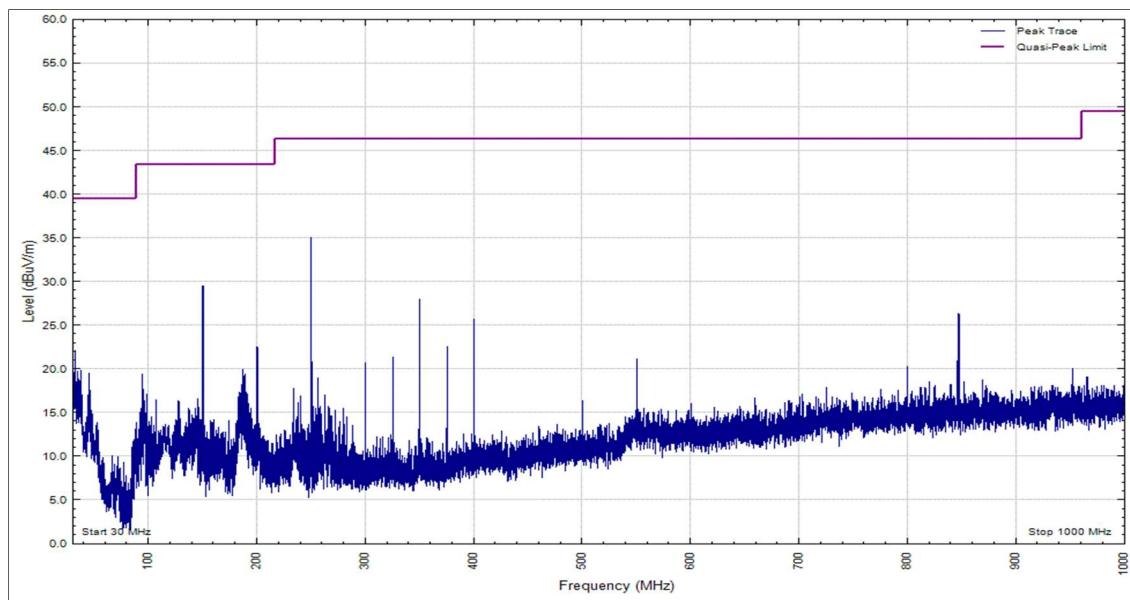


Figure 6 - Graphical Results - 30 MHz to 1 GHz - Horizontal Polarity-

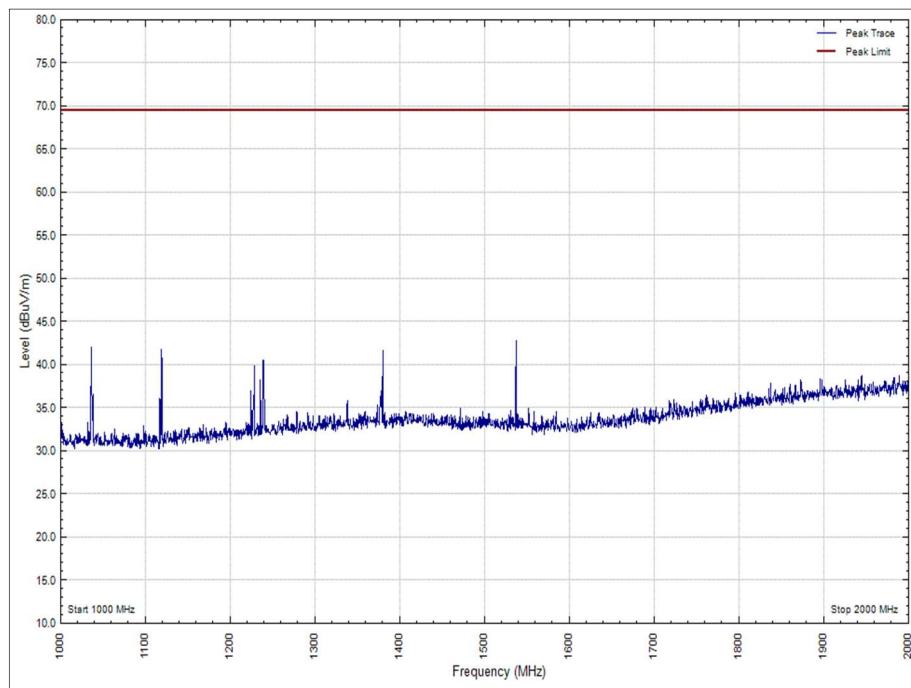


Figure 7 - Graphical Results - 1 GHz to 2 GHz – Peak Vertical Polarity

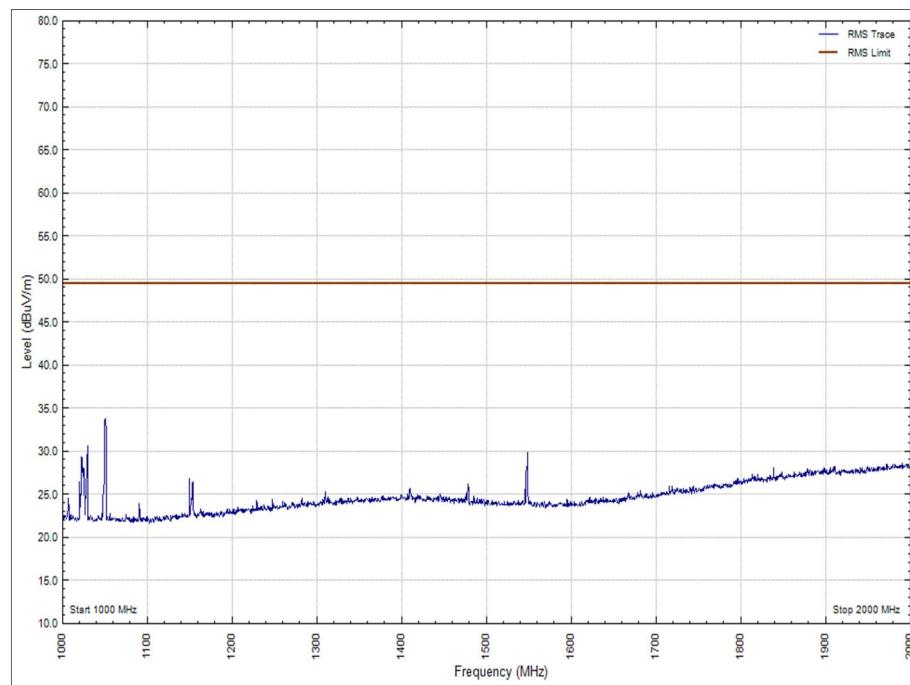


Figure 8 - Graphical Results - 1 GHz to 2 GHz – Average - Vertical Polarity

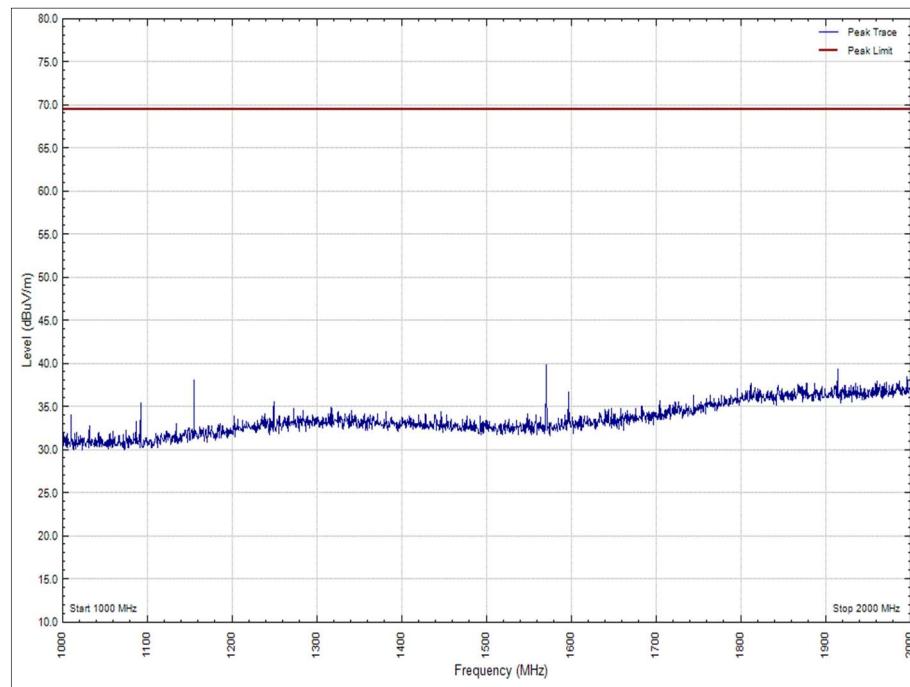


Figure 9 - Graphical Results - 1 GHz to 2 GHz – Peak - Horizontal Polarity

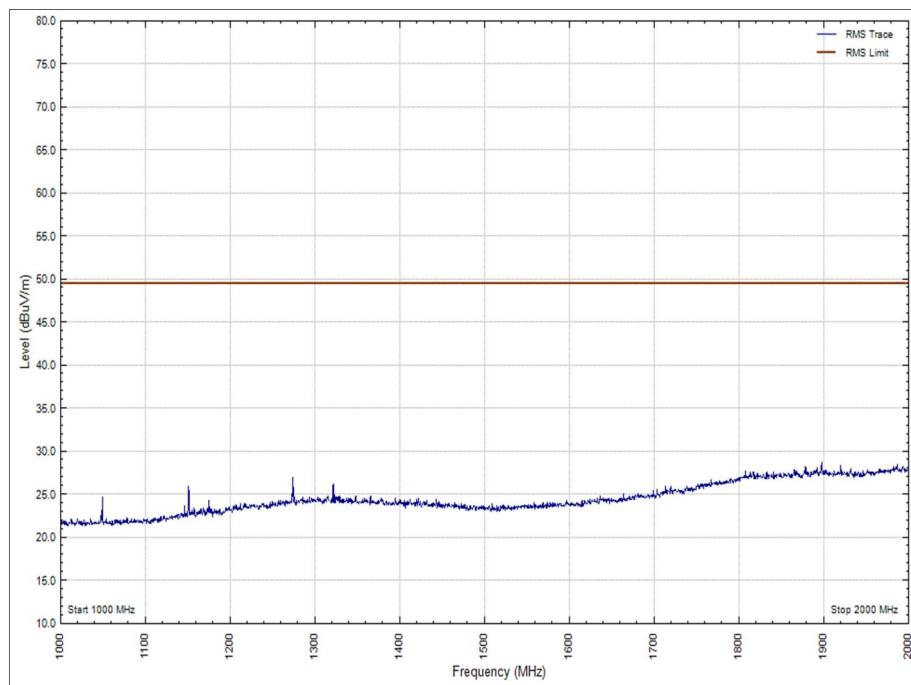


Figure 10 - Graphical Results - 1 GHz to 2 GHz – Average - Horizontal Polarity

| Frequency (GHz) | Result (dB μ V/m) | | Limit (dB μ V/m) | | Margin (dB μ V/m) | | Angle (°) | Height (m) | Polarisation | EUT Orientation |
|-----------------|-----------------------|---------|----------------------|---------|-----------------------|---------|-----------|------------|--------------|-----------------|
| | Peak | Average | Peak | Average | Peak | Average | | | | |
| * | | | | | | | | | | |

Table 9

*No emissions were detected within 10 dB of the limit.



2.2.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|-----------------|-------------------|-------|-----------------------------|-----------------|
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 23-Jan-2021 |
| Turntable Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Digital Multimeter | Iso-tech | IDM-101 | 2895 | 12 | 04-Oct-2019 |
| Antenna with permanent attenuator (Bilog) | Chase | CBL6143 | 2904 | 24 | 08-Aug-2019 |
| Comb Generator | Schaffner | RSG1000 | 3034 | - | TU |
| EMI Test Receiver | Rohde & Schwarz | ESU40 | 3506 | 12 | 17-Dec-2019 |
| Cable (Rx, Km-Km 2m) | Scott Cables | KPS-1501-2000-KPS | 4526 | 6 | 26-Apr-2019 |
| Double Ridged Waveguide Horn Antenna | ETS-Lindgren | 3117 | 4722 | 12 | 01-Mar-2019 |
| Mast Controller | Maturo GmbH | NCD | 4810 | - | TU |
| Tilt Antenna Mast | Maturo GmbH | TAM 4.0-P | 4811 | - | TU |
| 4dB Attenuator | Pasternack | PE7047-4 | 4935 | 24 | 28-Nov-2019 |
| Hygrometer | Rotronic | HP21 | 4989 | 12 | 26-Apr-2019 |
| 8m N-Type RF Cable | Teledyne | PR90-088-8MTR | 5093 | 12 | 04-Oct-2019 |

Table 10

TU - Traceability Unscheduled



3 Photographs

3.1 Test Setup Photographs



Figure 11 – Conducted Disturbance at Mains Terminals



Figure 12 – Radiated Disturbance (30 MHz to 1 GHz)

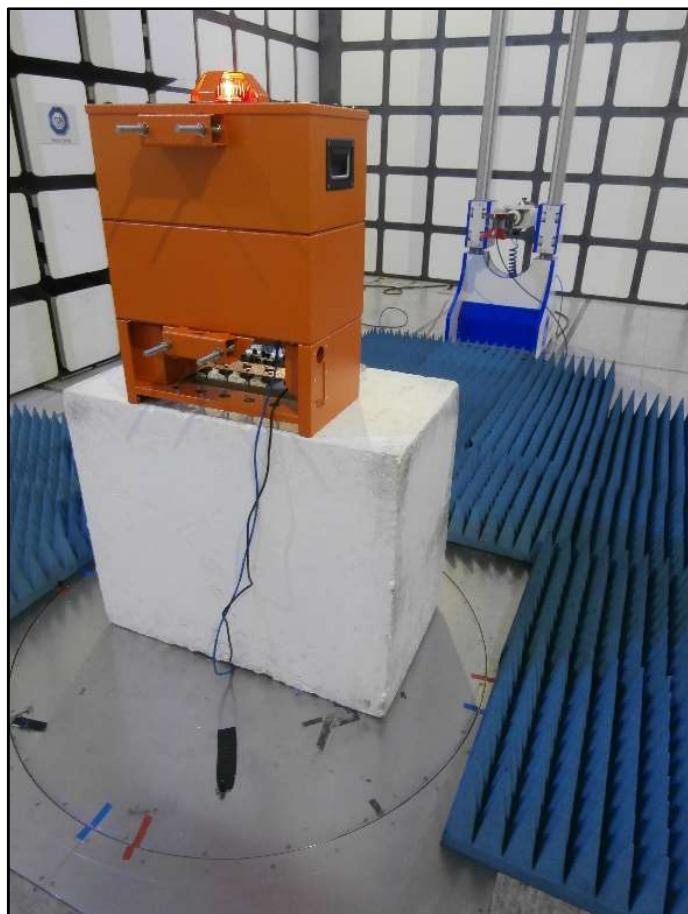


Figure 13 – Radiated Disturbance (1 GHz to 2 GHz)



4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

| Test Name | Measurement Uncertainty |
|--|---|
| Radiated Disturbance | 30 MHz to 1 GHz, Bilog Antenna, ± 5.2 dB 1 GHz to 40 GHz, Horn Antenna, ± 6.3 dB |
| Conducted Disturbance at Mains Terminals | 150 kHz to 30 MHz, LISN, ± 3.7 dB |

Table 11