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# Test Report for the EMC Testing of AirGlu2 for Time Code Systems

Test Report number 14473TR2

Project number B5200_1

Author: .....
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Checked: .....
Mr. Martin Nicholson, BEng (Hons)

Approved: .....
Mr. Martin Nicholson, BEng (Hons)

| Issue | Description | | | | | | Issue by | Date |
|---|---|---|---|---|---|---|---|---|
| *2* | *Copy 1* | | *Copy 2* | | *PDF* | *X* | *MJN* | *12/04/2022* |





**Registered Address:**
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Registered in England and Wales
Company Reg. No. 6048589
VAT Reg. No. GB 887 1276 83

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# Test Report Change History

| Issue | Date | Modification Details |
|---|---|---|
| 1 | 14/01/2022 | Original issue of test report |
| 2 | 12/04/2022 | FCC ID added to product information |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |

# Section 1Test Location

All testing was performed at;

| | |
|---|---|
| **Eurofins York Ltd** | Unit 5 |
| | Speedwell Road |
| | Castleford |
| | WF10 5PY |
| | |
| **Tel:** | 01977 731173 |
| | |
| **Website** | https://www.yorkemc.com |
| **UKAS Testing No.** | 1574 |

## 1.1 UKAS Accreditation

Tests marked "Not UKAS Accredited" in this report are not included in the UKAS Accreditation Schedule for our laboratory.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Eurofins York, Castleford latest accreditation schedule can be found at:

http://www.ukas.org/testing/lab_detail.asp?lab_id=989&location_id=&vMenuOption=3

Eurofins York Castleford Laboratory, is an Accredited facility recognised by the Federal Communications Commission (FCC) for certification testing. The appropriate FCC Designation Number is UK2013, dated 1st March 2021.

## Section 2 Customer Information

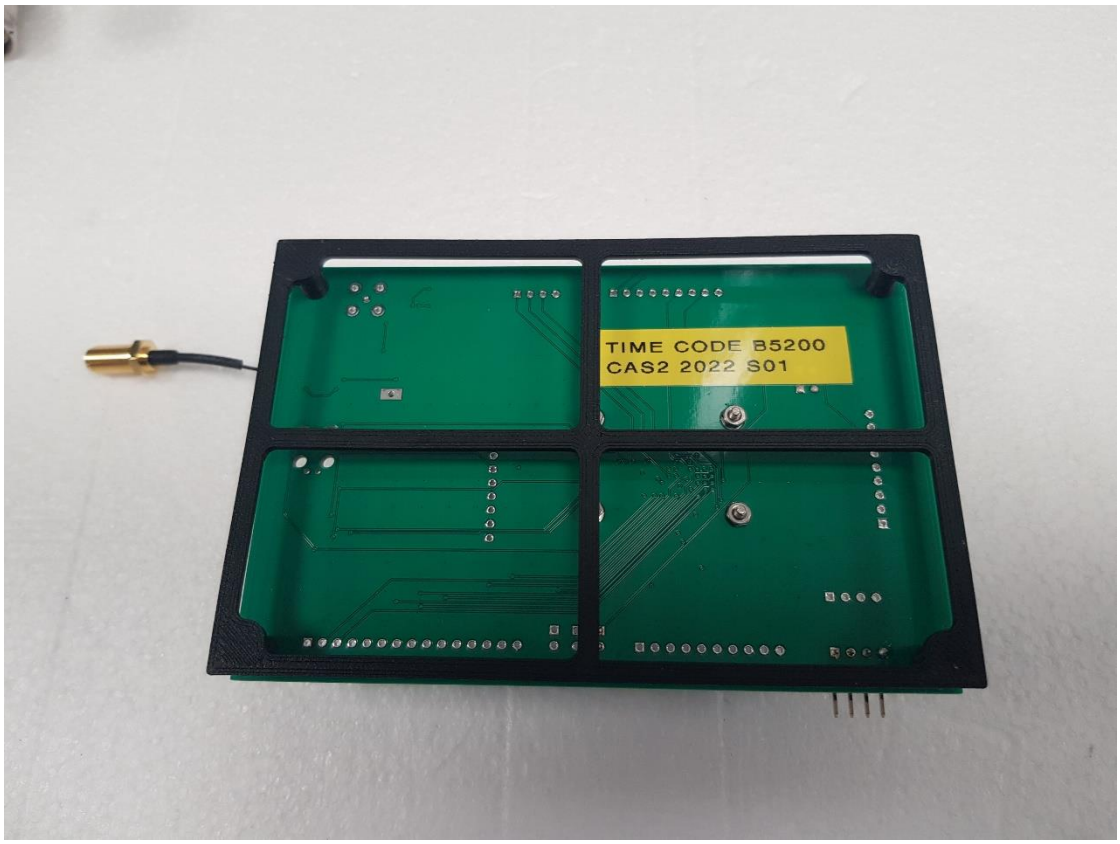
| | |
|---|---|
| **Company name** | Time Code Systems |
| **Address** | Unit 6 |
| | Elgar Business Centre |
| | Mosely Road |
| | Hallow |
| | Worcester |
| | WR2 6NJ |
| **Tel:** | 07497 150 722 |
| **Contact** | Paul Scurrell |
| **Email** | Paul.scurrell@atomos.com |
| **Customer Representative(s) present during testing** | No |

# Section 3Equipment Details

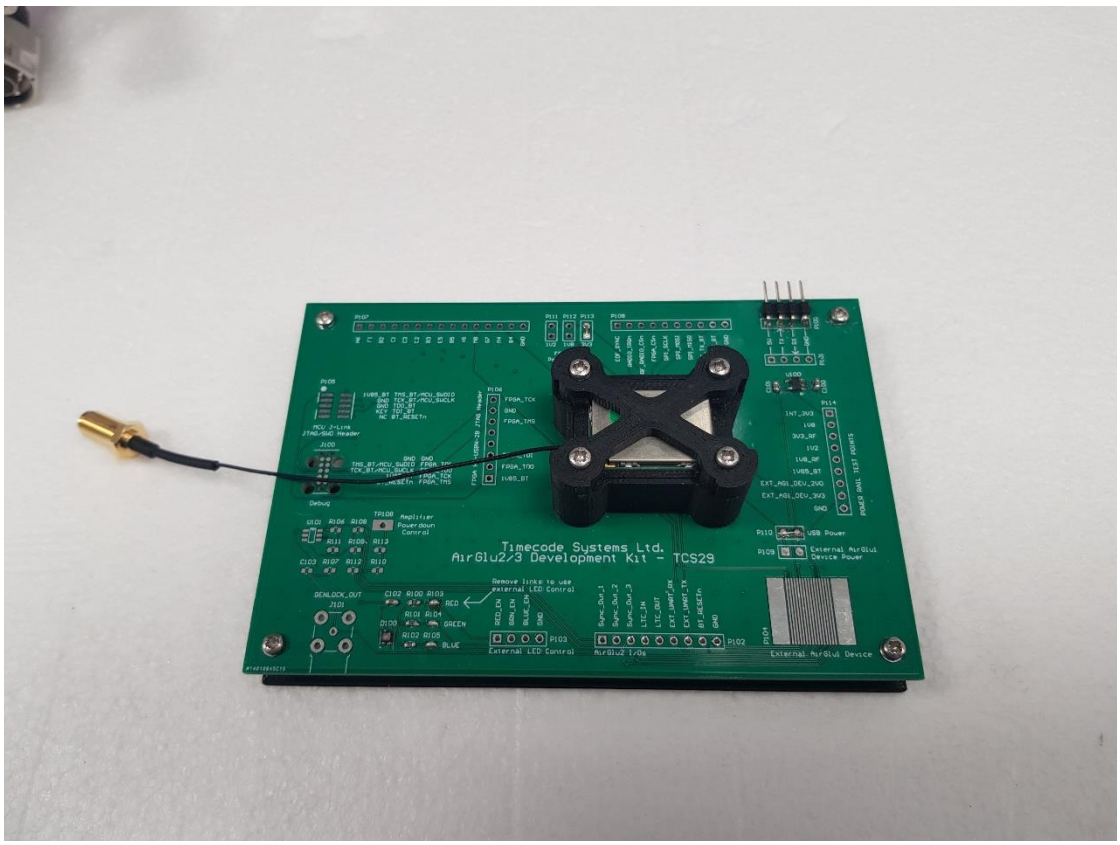
## 3.1 Equipment Under Test (EUT)

| | | | | | | |
|---|---|---|---|---|---|---|
| **Date received:** | 17th November 2021 | | | | | |
| **EUT name:** | AirGlu2 | | | | | |
| **Type/Part no:** | CAS2 2022 S01 | | | | | |
| **Serial no/s:** | CAS2 2022 S01 | | | | | |
| **FCC ID:** | AYV-AGLU02 | | | | | |
| **EUT description:** | EUT is a battery powered radio module with WIFI and Bluetooth | | | | | |
| **No of units tested:** | One | | | | | |
| **EUT power:** | | | | | | |
| | 5 | V | Battery operation (Powered via USB to simulate battery supply) | | | |
| **Highest internal frequency:** | 2400MHz | | | | | |
| **Cables: USB Power Only** | Cable 1 | 3 | m | Unscreened | Terminated | |
| **Tested as** | Table top | | | | | |
| **Mode/s of operation** | Powered by 5V simulated battery supply running internal software. | | | | | |
| **Client modification statement:** | None | | | | | |
| **Modifications incorporated during testing:** | None | | | | | |

## 3.2 EUT Photos




Bottom of PCB




Top of PCB and module

### 3.3 Configuration of EUT

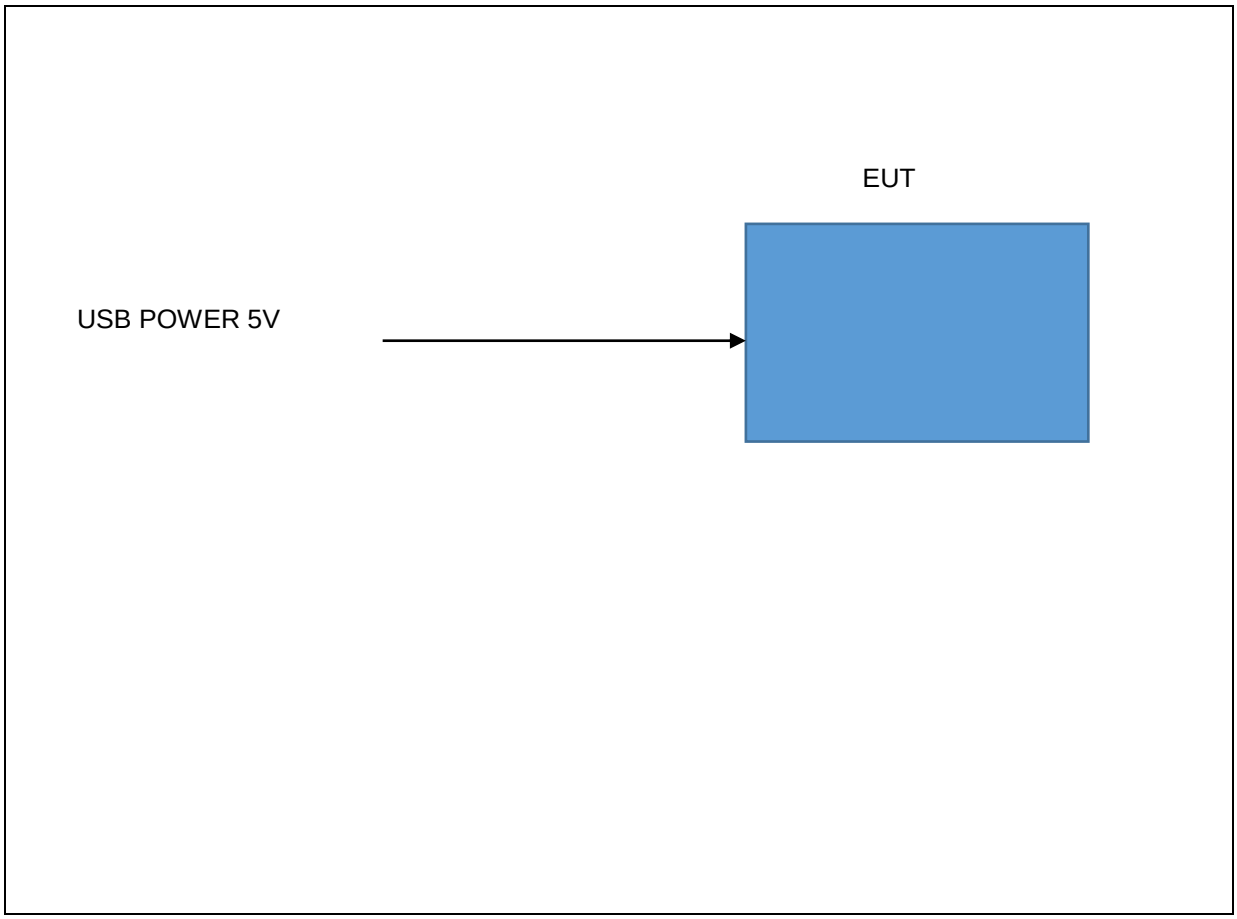



**Figure 1: Diagram of EUT**

## Section 4Test Specifications

The tests were performed in accordance with Eurofins York Ltd Quotation B5200-1.

| **47CFR Part 15, Sub Part B Unintentional Radiators** | | | |
|---|---|---|---|
| **Which references the following specification: -** | | | |
| **ANSI C63-4: 2014 Methods of Measurements of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range 9kHz to 40GHz.** | | | |
| **Test** | **Method** | **Levels** | **Result** |
| Conducted Emissions<br>(0.15 – 30MHz) | ANSI C63.4: 2014<br>Section 7 | Part 15 Clause 15.107<br>Class B | N/A |
| Radiated Emissions<br>Magnetic Field Measurements<br>(9kHz to 30MHz) | ANSI C63.4: 2014<br>Section 8 | Part 15 Clause 15.109(e)<br>Part 15 Clause 15.209 | N/A |
| Radiated Emissions<br>Electric Field Measurements<br>(30 – 18000MHz) | ANSI C63.4: 2014<br>Section 8 | Part 15 Clause 15.109<br>Class B | Pass |

Note 1 :Applies to carrier current systems see reference 47CFR Part 15Clause 15.109(e).

**The Decision Rule is applied on the basis of the following:**

As the decision is generally inherent in the standard for Commercial EMC a simple acceptance rule can be applied. The following statement will be added to EMC quotes and reports.

“The Decision Rule is applied on the basis of CISPR16-4-2 and/or EN61000-4-x (TR61000-1-6)

These standards provide guidance on how to calculate and apply measurement uncertainty whilst providing maximum uncertainties allowance. Due consideration will also be given to JCGM 106:2012, ILAC-G8:09/2019 and LAB 48.

This laboratory has demonstrated by calibrating its equipment and facilities, and calculating its own uncertainties, that it complies with the above requirements and therefore no allowance of uncertainties has been given to the tolerances.”

Where a result is considered marginal in respect of its proximity to the limit line, for example, the customer would be made aware of situation so that they can make an informed decision on how to proceed.

### 4.1 Knowledge Database References

The following KDBs were referenced during the testing of the AirGlu2:

The latest knowledge database references are available via the FCC KDB website at:

https://apps.**fcc**.gov/kdb

#### 4.1.1 Radiated Emissions (1GHz to 40GHz)

| Publication Number | Keyword | Publication Date |
|---|---|---|
| 714737 | 15B, Average Detector for Unintentional Radiator | 30/11/2010 |
| 704992 | Test Site Validation Requirements above 1 GHz. | 12/06/2015 |
| 149045 | Comparison Noise Emitter (CNE), reference noise source, .pdf | 05/04/2007 |

### 4.2 Compliance Statement

The AirGlu2, as tested, was shown to meet requirements of the standards listed in Section 4 of this report.

# Section 5 Radiated Emission Results

## 5.1 Test Specification

| | |
|---|---|
| Standard | ANSI C63.4:2014 |
| Measurement Uncertainty | The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95% is<br>+/- 6.23dB for the frequency range 30MHz to 1GHz<br>+/- 5.04dB for the frequency range from 1GHz to 6GHz<br>+/- 5.35dB for the frequency range from 6GHz to 18GHz |

## 5.2 Procedure and Test Software Version

| | |
|---|---|
| Eurofins York test procedure (30MHz to 1GHz) | CEP23 Issue 7 |
| Eurofins York test procedure (1GHz to 40GHz) | CEP64 Issue 8 |
| Test software | RadiMation Version 2016.2.8 |

## 5.3 Radiated Emissions (30MHz to 1GHz)

### 5.3.1 Limits at 3m

| Frequency (MHz) | Class A (dBµV/m) | Class B (dBµV/m) |
|---|---|---|
| | Quasi Peak | Quasi Peak |
| 30 - 88 | 49.5 | 40.0 |
| 88 -216 | 53.5 | 43.5 |
| 216 - 960 | 56.4 | 46.0 |
| 960- 1000 | 59.5 | 54.0 |

Note: FCC 47 CFR Part 15 Section 15.109 specifies test limits at 10m for Class A and 3m for Class B.
Please note that for Class A, limits have adjusted by 10dB to correct for the measurement distance of 3m.

### 5.3.2 Receiver Settings

| Receiver Parameters | Setting |
|---|---|
| Detector Function | Quasi Peak |
| Start Frequency | 30MHz |
| Stop Frequency | 1000MHz |
| Resolution Bandwidth | 120kHz |
| Video Bandwidth | Auto |

### 5.3.3 Emissions measurements

### 5.3.4 Date of Test

8th December 2021

### 5.3.5 Test Area

LAB 1 (SAC)

### 5.3.6 Tested by

Colin Greenfield

### 5.3.7 Test Setup

The EUT was configured in the SAC on an 80cm high table.

The measurement was performed with an antenna to EUT separation distance of 3m. The Quasi peak limits are therefore increased by 10dB (from the 10m values), to allow for the reduction in the measurement distance.

The results were maximised in orientation 0-360 degrees and height 1-4m.

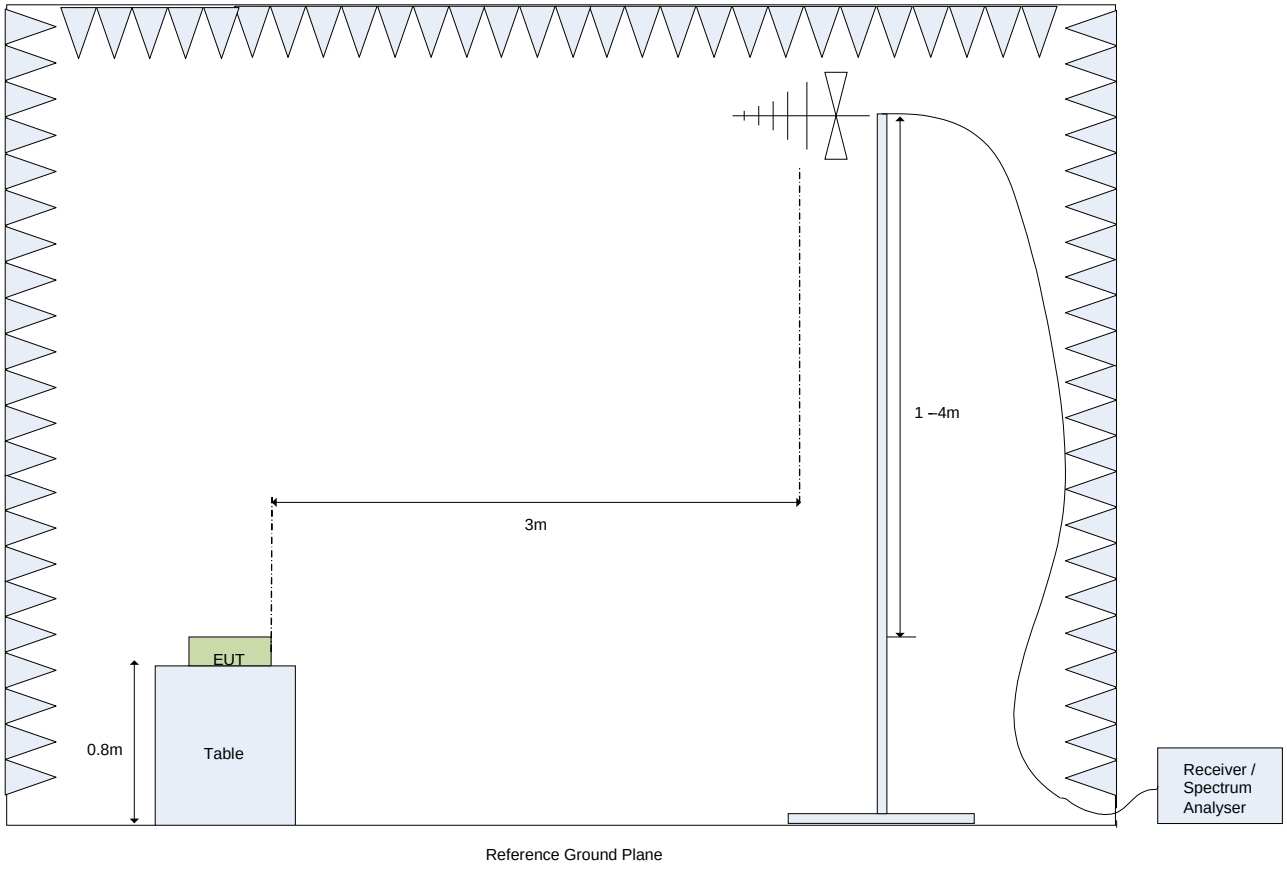



**Figure 2: Test Setup for E-Field Measurements from 30MHz to 1GHz**

Note 1 : With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.4-2014 Clause 5.1.3.

Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

### 5.3.8 Electric field emissions, 30MHz to 1GHz

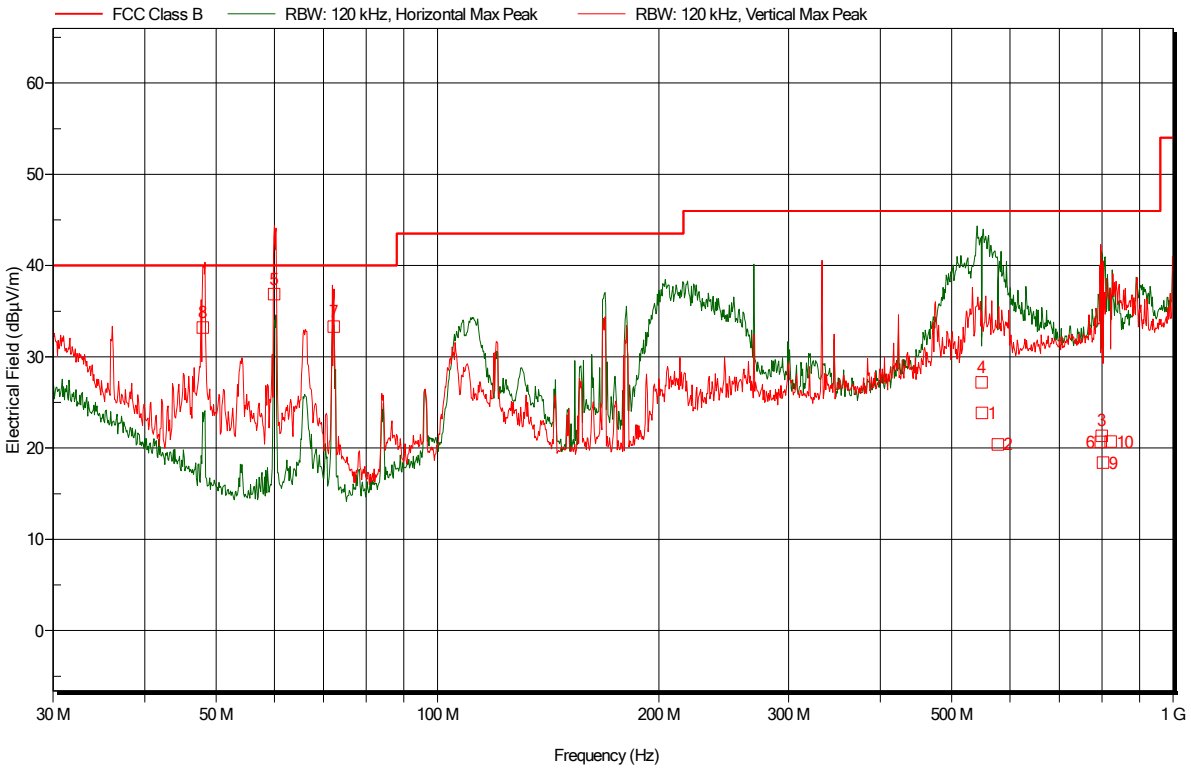



**Figure 3: Electric field emissions Plot, 30MHz to 1GHz**

| No | Frequency | Quasi-Peak | Quasi-Peak Limit | Quasi-Peak Difference | Status | Angle | Height | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1 | 549.294 MHz | 23.8 dBµV/m | 46 dBµV/m | -22.2 dB | Pass | 125 degrees | 3.9 m | Horizontal |
| 2 | 577.8 MHz | 20.4 dBµV/m | 46 dBµV/m | -25.6 dB | Pass | 135 degrees | 1.6 m | Horizontal |
| 3 | 799.56 MHz | 21.3 dBµV/m | 46 dBµV/m | -24.7 dB | Pass | 110 degrees | 2.6 m | Horizontal |
| 4 | 548.916 MHz | 27.2 dBµV/m | 46 dBµV/m | -18.8 dB | Pass | 265 degrees | 1.9 m | Horizontal |
| 5 | 59.958 MHz | 36.9 dBµV/m | 40 dBµV/m | -3.1 dB | Pass | 310 degrees | 1.4 m | Vertical |
| 6 | 797.262 MHz | 20.7 dBµV/m | 46 dBµV/m | -25.3 dB | Pass | 245 degrees | 2.3 m | Vertical |
| 7 | 72.216 MHz | 33.3 dBµV/m | 40 dBµV/m | -6.7 dB | Pass | 50 degrees | 1 m | Vertical |
| 8 | 47.958 MHz | 33.2 dBµV/m | 40 dBµV/m | -6.8 dB | Pass | 30 degrees | 1.1 m | Vertical |
| 9 | 802.704 MHz | 18.4 dBµV/m | 46 dBµV/m | -27.6 dB | Pass | 360 degrees | 1.5 m | Vertical |
| 10 | 821.922 MHz | 20.7 dBµV/m | 46 dBµV/m | -25.3 dB | Pass | 345 degrees | 1.4 m | Vertical |

**Table 1: Electric Field Emissions Peaks, 30MHz to 1GHz**

### 5.3.9 Quasi Peak correction factors

The quasi peak correction is shown in the above table. This correction figure consists of Antenna factor (AF); and Cable loss (CL).

Field strength (FS) is calculated as follows:

FS (dBµV/m) = Indicated Signal Level (dBµV) + AF (dB) + CL (dB)

### 5.3.10 Sample Data

The Quasi-Peak level at 72.216MHz

FS (dBµV/m) = 33.3dB = 19.7dBµV + 12.7dB + 0.9dB

## 5.4 Radiated Emissions (1GHz to 18GHz)

### 5.4.1 Limits

| Frequency (GHz) | Class A (dBµV/m) | Class B (dBµV/m) |
|---|---|---|
| | Average | Average |
| 1-18 | 59.5 | 54.0 |

### 5.4.2 Receiver Settings

| Receiver Parameters | Setting |
|---|---|
| Detector Function | Average |
| Start Frequency | 1GHz |
| Stop Frequency | 18GHz |
| Resolution Bandwidth | 1MHz |
| Video Bandwidth | Auto |

### 5.4.3 Emissions measurements

### 5.4.4 Date of Test

8th December 2021

### 5.4.5 Test Area

LAB 1 (SAC)

### 5.4.6 Tested by

Colin Greenfield

### 5.4.7 Test Setup

The EUT was configured in the SAC on an 80cm high table.

Exploratory measurements on the EUT were carried out to identify suspect frequencies and worst case orientations, see Section 5.4.8.

The measurement was then performed with an antenna to EUT separation distance of 3m.

The antenna was kept in the “cone of radiation” from the EUT and pointed at the area both in azimuth and elevation using the tilt mechanism on the antenna mast.

The results were maximised in orientation 0-360 degrees and height 1-4m.

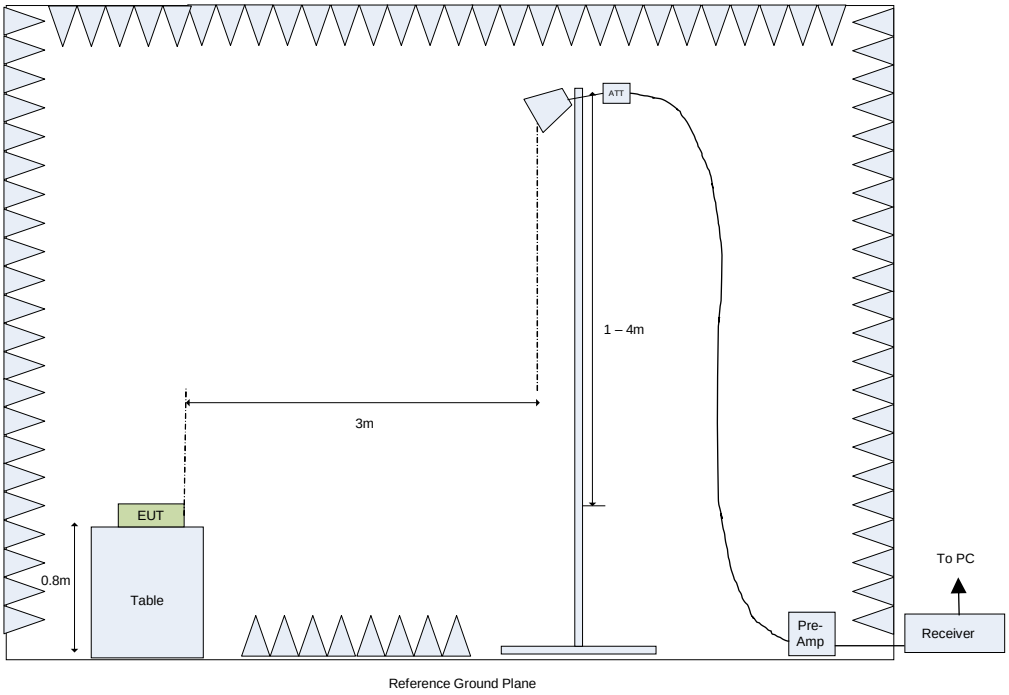



**Figure 4: Test Setup for Final E-Field Measurements from 1GHz to 18GHz**

Note 1 : With the EUT de-energized the ambient radio noise and signals met the 6dB peak detection requirement of ANSI C63.4-2014 Clause 5.1.3.

Note 2 : There were no significant environmental temperature changes during the test duration and hence it was not considered necessary to consider any variation in cable loss.

### 5.4.8 Exploratory Radiated Emission Maximization

During exploratory testing, suspect emissions from the EUT were identified both in terms of the frequency and directionality. This was achieved by manually positioning the antenna close to the EUT and also by scanning it over all sides of the EUT whilst observing a spectral display. The typical distance between the surface of the EUT and the scanning antenna was circa 30cm.

| Frequency (GHz) | Mode of operation | EUT face * | Emissions Angle (w.r.t. turntable) | Height | Polarization |
|---|---|---|---|---|---|
| 1.012* | 1 | Front | 90 | 1m | H |
| 1.209 | 1 | Front | 90 | 1m | H |
| 1.604 | 1 | Front | 90 | 1m | H |
| 4.998 | 1 | Front | 90 | 1m | H |
| 6.007 | 1 | Front | 90 | 1m | H |

**Table 2: Frequencies identified during Exploratory Radiated Emission maximization**

Note 1 : The front face of the EUT is deemed to be 0°, which is then turned in a clockwise direction through 360°.

Note 2 : The method for the exploratory radiated emission maximisation is as detailed in Annex E of ANSI C63.4-2014.

Note 3: 1.012GHz identified as worst case point in exploratory testing.

### 5.4.9 Electric field emissions, 1GHz to 18GHz

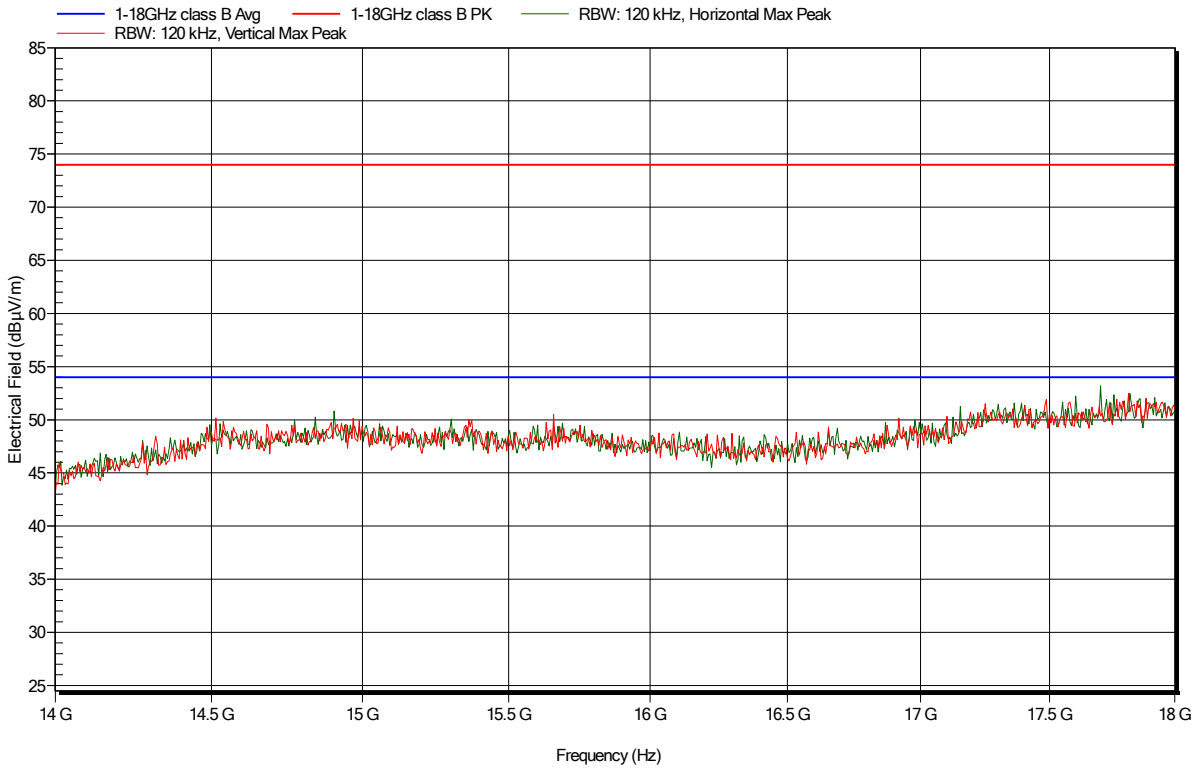



**Figure 5: Electric field emissions Plot, 14GHz to 18GHz investigative Pre-scan with reduced BW to prove no emissions from the EUT were present in the range of 14GHz and 18GHz**

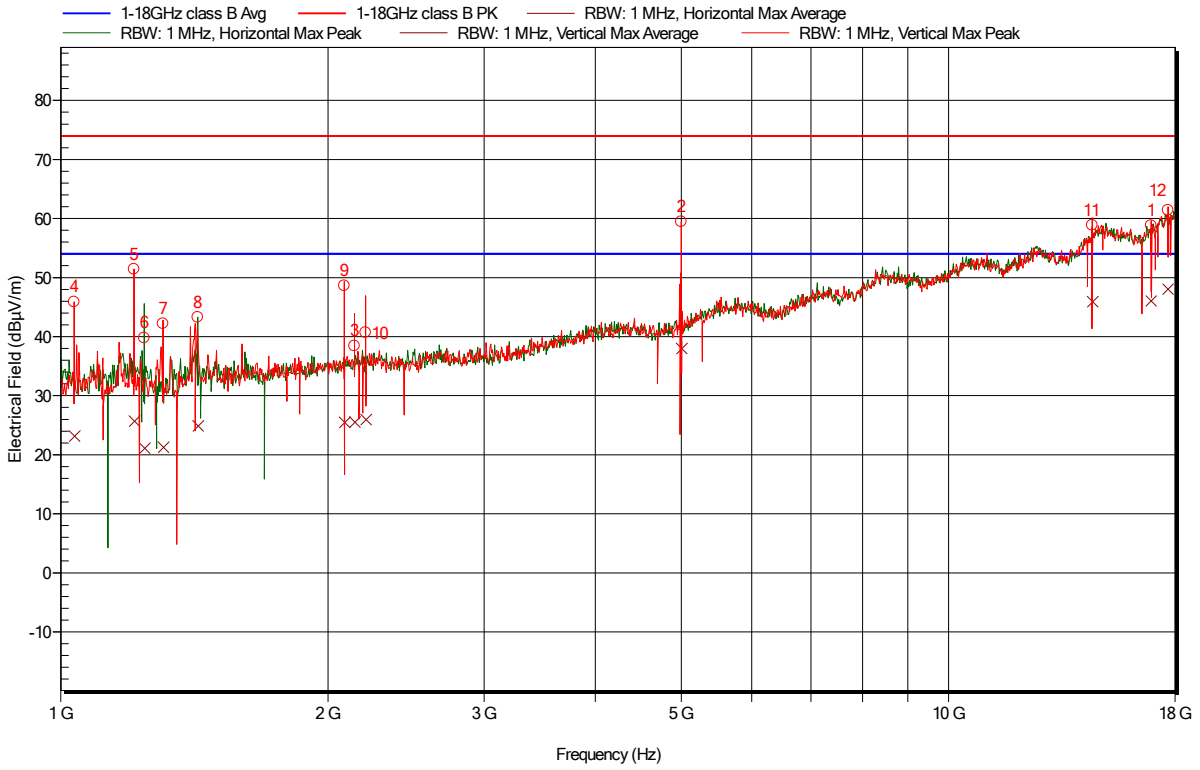



**Figure 6: Electric field emissions Plot, 1GHz to 18GHz**

| No | Frequency | Peak | Peak Limit | Peak Difference | Average | Average Limit | Average Difference | Status | Angle | Height | Polarization |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 16.911 GHz | 58.82 dBµV/m | 74 dBµV/m | -15.18 dB | 46.02 dBµV/m | 54 dBµV/m | -7.98 dB | Pass | 125 degrees | 2.8 m | Vertical |
| 2 | 4.999 GHz | 59.49 dBµV/m | 74 dBµV/m | -14.51 dB | 38.08 dBµV/m | 54 dBµV/m | -15.92 dB | Pass | 5 degrees | 2.9 m | Vertical |
| 3 | 2.143 GHz | 38.46 dBµV/m | 74 dBµV/m | -35.54 dB | 25.59 dBµV/m | 54 dBµV/m | -28.41 dB | Pass | 205 degrees | 2.9 m | Vertical |
| 4 | 1.035 GHz | 45.86 dBµV/m | 74 dBµV/m | -28.14 dB | 23.2 dBµV/m | 54 dBµV/m | -30.8 dB | Pass | 10 degrees | 2.2 m | Vertical |
| 5 | 1.21 GHz | 51.45 dBµV/m | 74 dBµV/m | -22.55 dB | 25.78 dBµV/m | 54 dBµV/m | -28.22 dB | Pass | 5 degrees | 3.5 m | Vertical |
| 6 | 1.242 GHz | 39.78 dBµV/m | 74 dBµV/m | -34.22 dB | 21.18 dBµV/m | 54 dBµV/m | -32.82 dB | Pass | 150 degrees | 1.7 m | Horizontal |
| 7 | 1.304 GHz | 42.19 dBµV/m | 74 dBµV/m | -31.81 dB | 21.35 dBµV/m | 54 dBµV/m | -32.65 dB | Pass | 185 degrees | 2.6 m | Vertical |
| 8 | 1.427 GHz | 43.29 dBµV/m | 74 dBµV/m | -30.71 dB | 24.97 dBµV/m | 54 dBµV/m | -29.03 dB | Pass | 60 degrees | 1.7 m | Horizontal |
| 9 | 2.087 GHz | 48.65 dBµV/m | 74 dBµV/m | -25.35 dB | 25.52 dBµV/m | 54 dBµV/m | -28.48 dB | Pass | 240 degrees | 3 m | Vertical |
| 10 | 2.206 GHz | 40.68 dBµV/m | 74 dBµV/m | -33.32 dB | 26.03 dBµV/m | 54 dBµV/m | -27.97 dB | Pass | 210 degrees | 3.3 m | Vertical |
| 11 | 14.511 GHz | 58.88 dBµV/m | 74 dBµV/m | -15.12 dB | 45.99 dBµV/m | 54 dBµV/m | -8.01 dB | Pass | 285 degrees | 2.9 m | Vertical |
| 12 | 17.671 GHz | 61.39 dBµV/m | 74 dBµV/m | -12.61 dB | 48.05 dBµV/m | 54 dBµV/m | -5.95 dB | Pass | 290 degrees | 1.4 m | Vertical |

**Table 3: Electric Field Emissions Peaks, 1GHz to 18GHz**

### 5.4.10 Average correction factors

The total average corrections are shown in the above table. This correction figure consists of Preamplifier gain (PG), Antenna factor (AF); Attenuator loss (AL) and Cable loss (CL).

Field strength (FS) is calculated as follows:

FS (dBµV/m) = Indicated Signal Level (dBµV) - PG (dB) + AF (dB) + CL (dB)

### 5.4.11 Sample Data

The Average level at 1.304GHz

FS (dBµV/m) = 21.4dBµV/m = 44.0dBµV – 50.23dB + 23.9dB + 3.7dB

# Appendix A EUT Test Photos

## Radiated Emissions

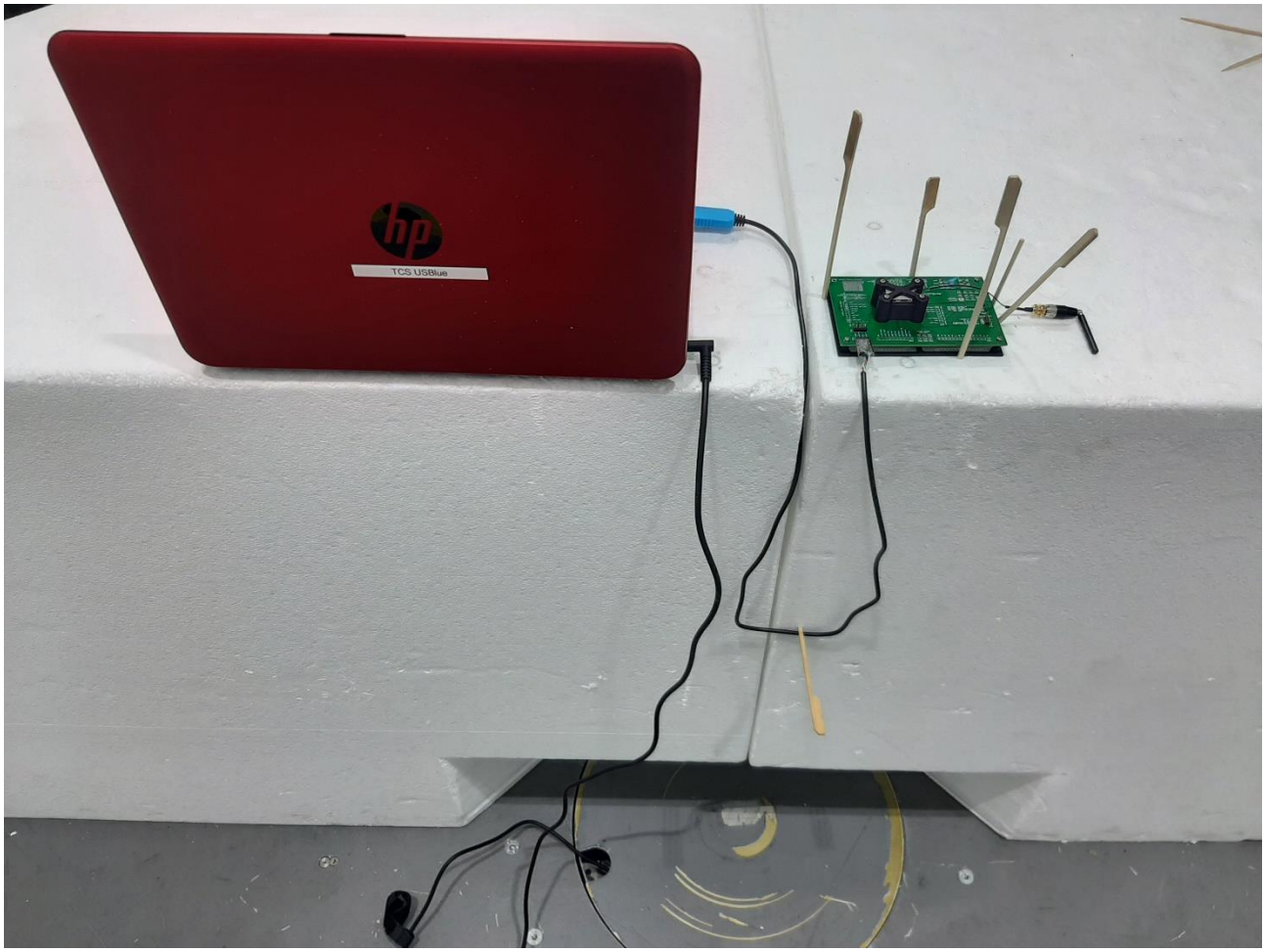



**Photo 1: Radiated Emissions, close-up shot**

The cable/wire placement on the test site was setup to produce the highest radiated emissions. The above photograph(s) illustrates the setup tested.


**Photo 2: Radiated Emissions, 30MHz to 1GHz**

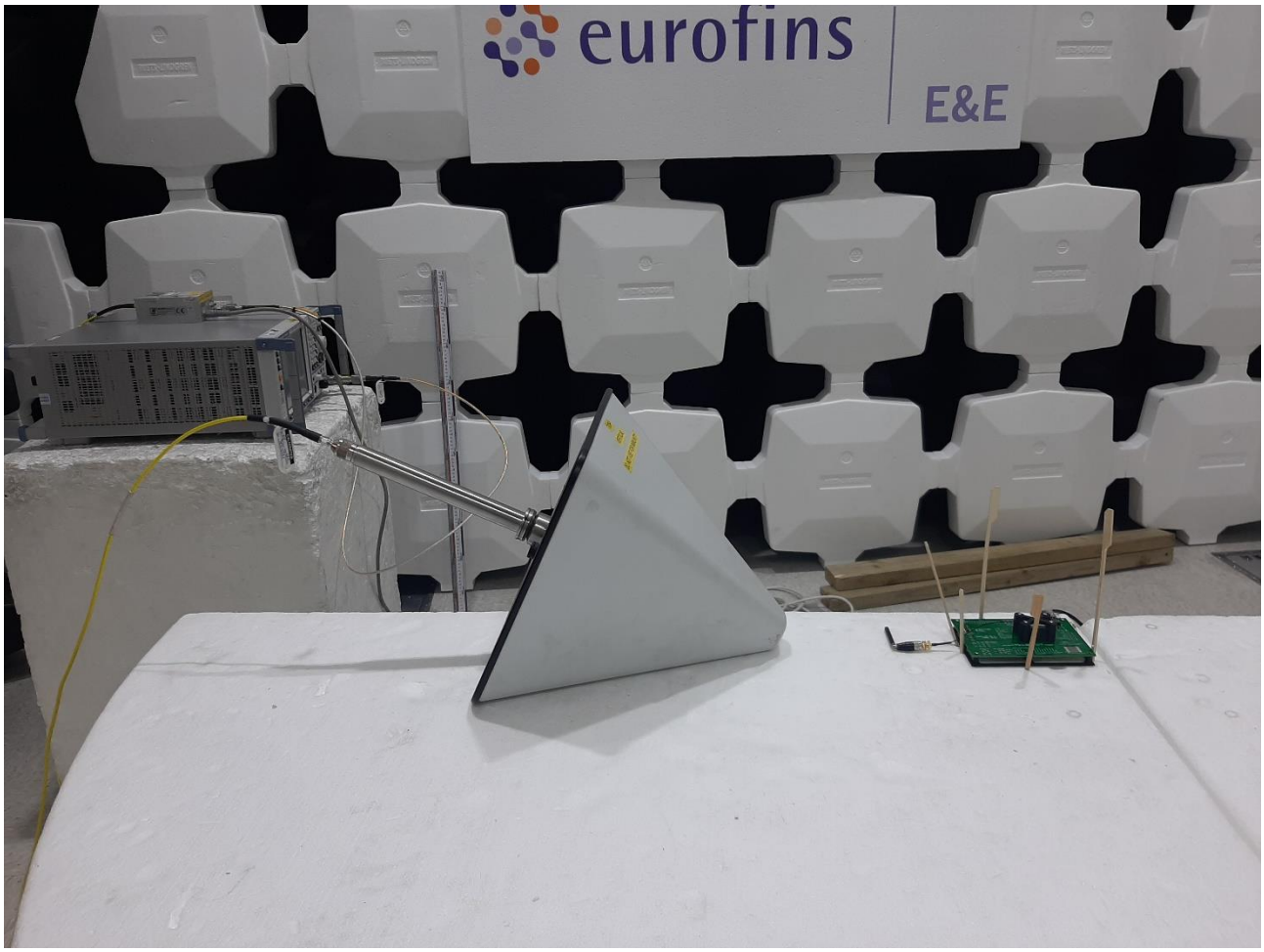



**Photo 3: Exploratory Radiated Emissions Maximization, 1GHz to 18GHz**


**Photo 4: Radiated Emissions, 1GHz to 18GHz**

# Appendix B Test Equipment List

## Radiated Emissions Equipment

| Item | Serial No. | Last Calibration Date | Calibration Interval |
|---|---|---|---|
| Laboratory 1 Semi-Anechoic Chamber | Lab 1 | 04/11/2019 (NSA)<br>28/01/2020 (Svswr) | 36 Months |
| ETS Lindgren 2017B Mast (1 – 4m) with tilting mechanism | -- | N/A | N/A |
| EMCO Loop antenna 6512 | 00148043 | 02/06/20 | 24 Months |
| Rohde & Schwarz ESR 26 | 101464 | 10/11/20 | 18 Months |
| Teseq CBL6112D Bilog Antenna | 49040 | 15/07/2021 | 24 Months |
| 6dB Attenuator (For use with Bilog Antenna) | C0506B | 15/08/2018 | 36 Months |
| HF 26 Cable | 19148_06_13_001 | 5/01/2021 | 12 Months |
| HF 27 Cable | 19149.03.13.004 | 5/01/2021 | 12 Months |
| HF17 Cable | 167002-001 | 5/01/2021 | 12 Months |
| Schwarzbeck STLP9148 Stacked log periodic Antenna | 179 | 17/11/20 | 12 Months |
| BONN BLMA 0118-5A Preamplifier | 149759 | 09/03/2021 | 12 Months |
| ETS Lindgren 3116C-PA Horn Antenna with Integral Pre-amplifier | 00209121 | 17/10/2019 | 36 Months |
| HF29 Cable (For use from 18GHz to 40GHz) | HF29 | 4/01/2021 | 12 Months |