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# EMC Test-report
# FCC 47 CFR PART 15 B
# INCL. ICES-003

TÜVRheinland®

| | | | | |
|---|---|---|---|---|
| **Prüfbericht-Nr.:** *Test Report No.:* | **P00232095.f01** | **Auftrags-Nr.:** *Order No.:* | 89218689 | Seite 1 von 37 *Page 1 of 37* |
| **Kunden-Referenz-Nr.:** *Client Reference No.:* | PO # 3002038178 | **Auftragsdatum:** *Order date:* | March 29, 2021 | |
| **Auftraggeber:** *Client:* | Intel Corporation SAS, Le Cargo B6 / 424 Rue de Goa, 06600 Antibes, France | | | |
| **Prüfgegenstand:** *Test item:* | Wireless Network Card | | | |
| **Bezeichnung / Typ-Nr.:** *Identification / Type No.:* | AX411E2W | | | |
| **Auftrags-Inhalt:** *Order content:* | Testing compliance with EMC Standards | | | |
| **Prüfgrundlage:** *Test specification:* | 47 CFR PART 15 (10-1-19 EDITION), Subpart 15B<br>ICES-003 (Issue 7, October 2020) | | | |

| | |
|---|---|
| **Wareneingangsdatum:** *Date of receipt:* | July 22, 2021 |
| **Prüfmuster-Nr.:** *Test sample No.:* | A003097340-001 |
| **Prüfzeitraum:** *Testing period:* | July 28, 2021 – July 29, 2021 |
| **Ort der Prüfung:** *Place of testing:* | Leek |
| **Prüflaboratorium:** *Testing laboratory:* | TÜV Rheinland Nederland B.V.<br>Leek Laboratory |
| **Prüfergebnis*:** *Test result*:* | Pass |

**Geprüft von / Tested by: W. Brouwer**

X_____

**Datum:**
*Issue date:* Aug. 10, 2021

**Stellung** / Position: EMC Expert

**Genehmigt von / Authorized by: T.E.T. Koning**

X_____

**Ausstelldatum:**
*Issue date:* Aug. 11, 2021

**Stellung** / Position: EMC Expert

**Sonstiges** / *Other:* *None*

| | |
|---|---|
| **Zustand des Prüfgegenstandes be Anlieferung: 1**<br>*Condition of the test item at delivery: 1* | Prüfmuster vollständig und unbeschädigt<br>*Test item complete and undamaged* |

| | | | | | |
|---|---|---|---|---|---|
| * Legende: | 1 = sehr gut<br>P(ass) = entspricht o.g. | 2 = gut<br>Prüfgrundlage(n) | 3 = befriedigend<br>F(ail) = entspricht nicht o.g. Prüfgrundlage(n) | 4 = ausreichend<br>N/A = nicht anwendbar | 5 = mangelhaft<br>N/T/ = nicht getested |
| *Legend:* | *1 = very good*<br>*P(ass) = passed a.m.* | *2 = good*<br>*Test specification(s)* | *3 = satisfactory*<br>*F(ail) a.m. test specification(s)* | *4 = sufficient*<br>*N/A = not applicable* | *5 = poor*<br>*N/T = not tested* |

**Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwending eines Prüfzeichens.**
*This test report only relates to the a.m. testsample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This report does not entitle to carry any test mark*

If the place of testing differs from the location given on page 1 this is given under the respective test clause in the report.
This test report consists of multiple pages, the number of pages can be seen in the header on the top right of each page. The report ends when the last page is reached.

For the influence of the measuring uncertainties on the results, reference is made to the validation of the respective methods.

The test results exclusively relate to the tested sample.

This report is only to be read is a whole, no sections from this report may be copied.

No opinions or interpretation are included in this report.

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Statements
- This document does not represent type approval or certification of the product.
- The test results only relate to the behaviour of the test specimens of the examined product under the particular conditions of the test in laboratory conditions
- The validity of this report will expire directly after alterations or modifications of the examined product (combination)(s) and/or the criteria.

All underlying Standards under the mentioned Main Standard on page 1 of this report are dated as given in the mentioned Main Standard.

Each test result below is marked with:

| | |
|---|---|
| Under accreditation: | ☒ Yes ☐ No |

To confirm tests carried out under ISO 17025: 2017 accreditation. If not tested “Under Accreditation” “No” will be checked and “Yes” will be unchecked

This report contains:

☒ No Subcontracting

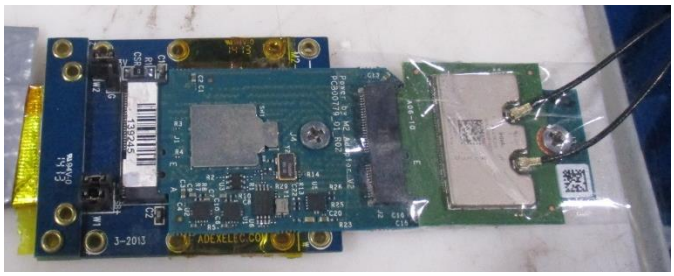
☐ Subcontracting. Subcontracted measurements and results are marked with an “*” and subcontracted to qualified subcontractors and descripted under the respective test clause in the report.

## Liste der verwendenten Prüfmittel
## *List of used test equipment*

| **Prüfmittel Nr. / ID-Nr.** *Equipment No. / ID-No.* | | **Prüfmittel** *Test equipment* | | **Nächste Kalibrierung** *Next calibration* |
|---|---|---|---|---|
| **Conducted emission** | | | | |
| 2789421 | Rohde & Schwarz | ESCS30 | Measurement Receiver | November 12, 2021 |
| 2790495 | Rohde & Schwarz | ESH3-Z2 | Impulse Limiter | April 28, 2022 |
| 2788823 | Rohde & Schwarz | ESH3-Z2 | Impulse Limiter | September 24, 2021 |
| 2788795 | Emco | 3625/2 | LISN 5 uH / 50 ohm | September 24, 2021 |
| 2789124 | Rohde & Schwarz | ESH2-Z5 | LISN- artificial Network | August 12, 2021 |
| 2788791 | Rohde & Schwarz | ESH2-Z5 | LISN- artificial Network | July 21, 2022 |
| 2788866 | COMTEST | 1415 | Conducted Reference Source 9kHz-50MHz | April 28, 2022 |
| 2790528 | Rohde & Schwarz | ESH 3-Z5 | LISN | September 24, 2021 |
| 2789211 | Extech | SD 500 | Humidity / Temperature Data logger | June 28, 2022 |
| **Radiated emission** | | | | |
| 2789083 | Rohde & Schwarz | ESCI | Measurement Receiver (9kHz-3GHz) | April 12, 2022 |
| 2789106 | R&S | FSV30 | Signal Analyzer/Spectrum Analyzer | August 28, 2021 |
| 2790260 | R&S | FSV40 | Signal Analyzer/Spectrum Analyzer | August 20, 2021 |
| 2788801 | Emco | 4610 | Gen. field source | February 10, 2022 |
| 2789009 | Siepel | FCC | FCC Test Site Registration nr 786213 | March 8, 2022 |
| 2789082 | Comtest | | Site registration filing Industry Canada | May 8, 2023 |
| 2789206 | Siepel | | S-AR | May 4, 2023 |
| 2789217 | Gigalink | APG0500 | RF Cable S-AR | March 12, 2022 |
| 2789237 | Teseq | CBL 6111D | Antenne S-AR, BiLog 30MHz-1GHz | August 4, 2021 |
| 2790499 | Rohde & Schwarz | ESR7 | EMI Test Receiver 7GHz | September 18, 2021 |
| 2788776 | Emco | 3115 | Guide ant. 1-18GHz | July 14, 2023 |
| 2788777 | Emco | 3115 | Guide ant. 1-18GHz | February 26, 2022 |
| 2788779 | Emco | 3116 | Guide ant. 18-40GHz | February 12, 2022 |
| 2788780 | Emco | 3160-09 | Gain horn 18-26.5GHz | February 12, 2022 |
| 2788982 | Emco | 3160-09 | Gain horn 18-26.5GHz | February 12, 2022 |
| 2788983 | Emco | 3160-10 | Gain horn 26.5-40GHz | February 12, 2022 |
| 2789108 | H&S | 18/Sucoflex 102 | Cable RF S-AR >1G setup | June 28, 2022 |
| 2789109 | H&S | 18/Sucoflex 102 | Cable RF | June 28, 2022 |
| 2789110 | H&S | 18/Sucoflex 102 | Cable RF | June 28, 2022 |
| 9001993 | Teseq | CMAD 20B | CM Absorption Device | January 2, 2022 |
| 9001994 | Teseq | CMAD 20B | CM Absorption Device | January 2, 2022 |
| 9001995 | Teseq | CMAD 20B | CM Absorption Device | January 2, 2022 |
| 2789214 | Extech | SD 500 | Humidity / Temperature Data logger | June 28, 2022 |

| | | |
|---|---|---|
| **1** | **Produktdetails**<br>*Product details* | Wireless Network Card AX411E2W |
| **2** | **Maße / Gewicht**<br>*Dimensions / Weight* | << 50 gr |
| **3** | **Bedienelemente**<br>*Operating elements* | Built inside Extender, processed by laptop |
| **4** | **Ausstattung / Zubehör**<br>*Equipment / Accessories* | Laptop PSU, Extender card |
| **5** | **Verwendete Materialien**<br>*Used materials* | None |
| **6** | **Sonstiges**<br>*Other* | None |
| **7** | **Dieser raport betrifft**:<br>*This report concerns:* | **EMC Verification** |

| *Absatz* | | | |
|---|---|---|---|
| *Clause* | *Anforderungen – Prüfungen / Requirements - Tests* | | |
| 1 | 47 CFR Part 15 (10-1-19 Edition) - 15.107(a)<br>ICES-003 (Issue 7, October 2020) –<br>Section 6.1 Table 2 | AC Power Line Conducted Emissions | P ☒<br>F ☐<br>N/A ☐<br>N/T ☐ |
| 2 | 47 CFR Part 15 (10-1-19 Edition) - 15.109<br>ICES-003 (Issue 7, October 2020) –<br>Section 6.2.1 Table 5 | Radiated unwanted emissions | P ☒<br>F ☐<br>N/A ☐<br>N/T ☐ |

| EUT: | EUT in Extender card: |
|---|---|
| |  |

| **Zusammenfassung der Prüfergebnisse**<br>***Summary of test results*** | | | | | |
|---|---|---|---|---|---|
| **Prüfung**<br>*Test* | **Anwendbar**<br>*Applicable* | **Prüfergebnis**<br>*Test result* | **Paragraf**<br>*Paragraph* | **Messungen unter Akkreditierung ausgeführt**<br>*under accreditation* | **Kommentar**<br>*Remark* |
| Radiated emission < 1000 MHz | Yes | Pass | 3.1 | Yes | |
| Radiated emission > 1000 GHz | Yes | Pass | 3.2 | Yes | |
| Conducted emission AC port | Yes | Pass | 3.3 | Yes | |

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| **Revisions**<br>***Revisions*** | | | |
|---|---|---|---|
| **Revision**<br>Revision | **Datum**<br>Date | **Anmerkung**<br>Remark | **Verfasser**<br>Author |
| 00 | Aug. 10, 2021 | First Release | W. Brouwer |
| | | | |
| | | | |
| Note: Latest revision report will replace all previous reports | | | |

# CONDITIONS FOR TESTING

## 1 General test configuration.

| | |
|---|---|
| Communication with access point is established and data is transferred and monitored with Iperf. Three modes were tested. 1 : 5GHz WIFI communication , auto channel including Bluetooth (receiving dummy file from smartphone). 2 : 2.4GHz WIFI communication, auto channel. 3 : 6GHz WIFI communication, auto channel. | |
| Remarks | All EMC Emission and Immunity testing has taken place:<br>1) within an environmental temperature range between 15 and 35 degrees Celsius<br>2) within an environmental relative humidity range between 20 and 85%<br>3) within an environmental air pressure range between 860 and 1060 mbar |

| List of tested cables | | | | | |
|---|---|---|---|---|---|
| **Number** | **Function** | **From** | **To** | **Length** | **Remarks** |
| 1 | AC | Mains | Laptop | < 3m | |

### 1.1 Tested system auxiliary details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

## Description of test configuration.

| | |
|---|---|
| Test item (EUT1) | : Wireless Communication Card WIFI 6E |
| Manufacturer | : Intel Corporation SAS |
| Brand mark | : Intel |
| Model | : AX411E2W |
| Serial number | : Engineering Sample |
| Remark | : Tested in Laptop (AUX1) |
| | |
| Test item (AUX1) | : Extender board |
| Manufacturer | : Intel Corporation SAS |
| Brand mark | : Intel |
| Remark | : Used to have a functional EUT outside a laptop |
| | |
| Test item (AUX2) | : Laptop including PSU |
| Manufacturer | : Dell |
| Brand mark | : Dell |
| Model | : E5401 |
| Remark | : Used as Host for EUT1 |
| | |
| Test item (AUX3) | : Mobile Phone |
| Manufacturer | : Samsung |
| Brand mark | : Samsung |
| Model | : Galaxy J7 (2016) |
| Remark | : Used for BT communication |

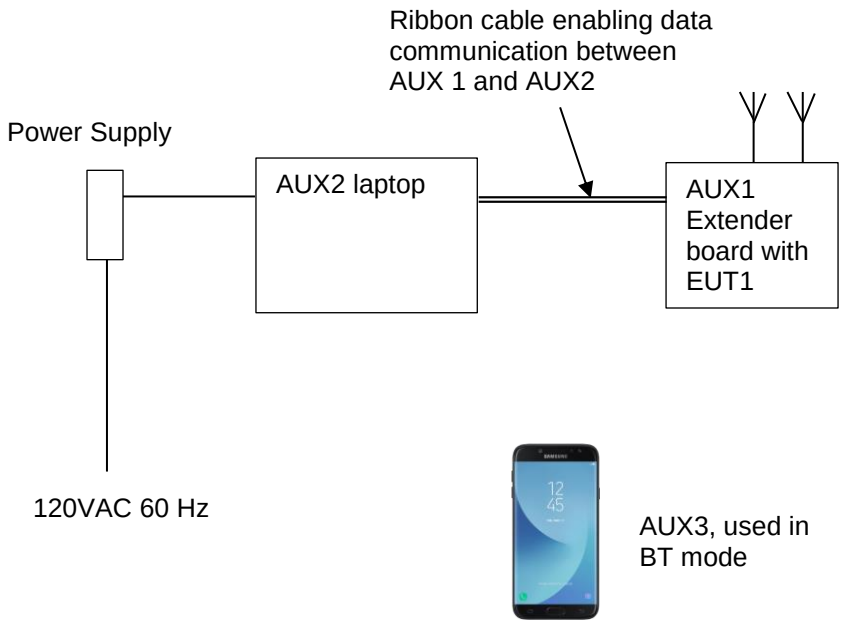



Figure 1. Total set-up used during testing

### 1.2 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-19 Edition), sections 15.31, 15.107 and 15.109 and ICES-003 Issue 7 (October 2020) Sections 6.1 and 6.2. The EUT was tested in horizontal position only and is regarded as floor standing equipment.

The test methods, which have been used, are based on ANSI C63.4-2014.

Radiated emission tests were performed at a measurement distance of 3 meters.
The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

### 1.3 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V., located at Eiberkamp 10, 9351 VT Leek, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 786213. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

### 1.4 Test conditions.

Normal test conditions:

| | |
|---|---|
| Temperature (*) | : +15°C to +35°C |
| Relative humidity(*) | : 20 % to 75 % |
| Supply voltage | : 120 Vac / 60 Hz |

**When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately*.

# 2 System test configuration.

## 2.1 Justification.

The system was configured for testing in a typical situation as a customer would normally use it. The test sample was configured by the applicant to enable continuous transmit.

The justification and manipulation of cables and equipment in order to simulate a worst-case behaviour of the test setup has been carried out as prescribed in ANSI C63.4-2014.

## 2.2 EUT mode of operation.

The unintentional radiator tests have been performed with a complete functioning EUT.

## 2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

## 2.4 Equipment modifications.

No modifications have been made to the equipment.

# 3 Test results Emission according to FCC CRF47 Part 15B

## 3.1 Enclosure Radiated Emission 30-1000 MHz

### 3.1.1 Definition

Result of the measurements concerning radiated electromagnetic fields (electric component) emitted by the total set-up of the EUT.

### 3.1.2 Basic standard

The test is performed according to FCC CRF 47 Part 15B § 15.109

### 3.1.3 Limit

FCC 15.109(a) and IC ICES-003 section 6.2

Except for Class A digital devices, the field strength of radiated emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field strength (µV/meter) | Field strength (dBµV/m) | Measurement distance (meters) |
|---|---|---|---|
| 30-88 | 100 | 40.0 | 3 |
| 88-216 | 150 | 43.5 | 3 |
| 216-960 | 200 | 46.0 | 3 |
| Above 960 | 500 | 54.0 | 3 |

Table of applicable limits

### 3.1.4 Test procedures

ANSI C63.4-2014.

Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling and the EUT orientation (X, Y, Z) were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to 35625 MHz, the fifth harmonic of the highest intentional generated frequency. Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission’s maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit.

### 3.1.5 Test deviation

There is no deviation with the original standard

### 3.1.6 Test results

| Test conditions | | | |
|---|---|---|---|
| | | Test location | Leek |
| Applied Standard(s) | FCC CRF 47 Part 15B § 15.109 | Under accreditation: | ☒ Yes ☐ No |
| Test engineer | W. Brouwer | Test result | Pass |
| Test date | July 28, 2021 | | |

| Results and limits, 5GHz + Bluetooth mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Result (dBµV/m) | Antenna polarization | Limit (dBµV/m) | Margin | Height (cm) | Angle (deg) |
| 72.00 | 22.4 | Horizontal | 40.0 | 17.6 | 221.8 | 113.8 |
| 96.00 | 25.8 | Horizontal | 43.5 | 17.7 | 156.4 | 134.2 |
| 213.05 | 23.3 | Horizontal | 43.5 | 20.2 | 99.7 | 194.7 |
| 221.87 | 25.7 | Horizontal | 46.0 | 20.3 | 99.8 | 343.9 |
| 426.13 | 31.7 | Vertical | 46.0 | 14.3 | 99.8 | 240.5 |
| 954.90 | 28.4 | Vertical | 46.0 | 17.6 | 99.8 | 347.2 |

Table 1 Results Enclosure Radiated Emission 30.0 – 1000 MHz, 5GHz + BT mode

| Results and limits, 2.4GHz mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Result (dBµV/m) | Antenna polarization | Limit (dBµV/m) | Margin | Height (cm) | Angle (deg) |
| 31.12 | 17.5 | Vertical | 40.0 | 22.5 | 99.7 | 156.7 |
| 103.18 | 22.6 | Vertical | 43.5 | 20.9 | 99.8 | 79.8 |
| 214.97 | 21.7 | Horizontal | 43.5 | 21.8 | 99.8 | 92.0 |
| 255.10 | 22.6 | Horizontal | 46.0 | 23.4 | 99.8 | 251.1 |
| 374.40 | 22.5 | Horizontal | 46.0 | 23.5 | 99.7 | 157.0 |
| 423.87 | 31.1 | Vertical | 46.0 | 14.9 | 114.8 | 247.3 |

Table 2 Results Enclosure Radiated Emission 30.0 – 1000 MHz, 2.4GHz mode

| Results and limits, 6GHz mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Result (dBµV/m) | Antenna polarization | Limit (dBµV/m) | Margin | Height (cm) | Angle (deg) |
| 30.61 | 17.9 | Vertical | 40.0 | 22.1 | 99.7 | 270.4 |
| 92.95 | 25.0 | Horizontal | 43.5 | 18.5 | 122.4 | 123.7 |
| 229.27 | 22.4 | Horizontal | 46.0 | 23.6 | 99.7 | 113.9 |
| 248.69 | 23.2 | Horizontal | 46.0 | 22.9 | 99.8 | 264.6 |
| 426.23 | 32.2 | Vertical | 46.0 | 13.8 | 109.6 | 248.3 |
| 955.43 | 27.1 | Vertical | 46.0 | 18.9 | 99.7 | 101.9 |

Table 3 Results Enclosure Radiated Emission 30.0 – 1000 MHz, 6GHz mode

Used Equipment

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2790499 | 2789109 | 2789237 | 2789217 | 2789110 | 2789029 | 2789206 | 2789214 |

**Notes:**

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is +/- 5.22 dB.
3. The EUT was tested in horizontal orientation only-it's normal operation orientation, the measuring antenna was varied in horizontal and vertical orientations and also around its axis and height. The reported value is the worst case found at the reported frequency.
4. A selection of Photos and Graphical Displays is provided on the next pages.

### 3.1.7 Photograph test setup

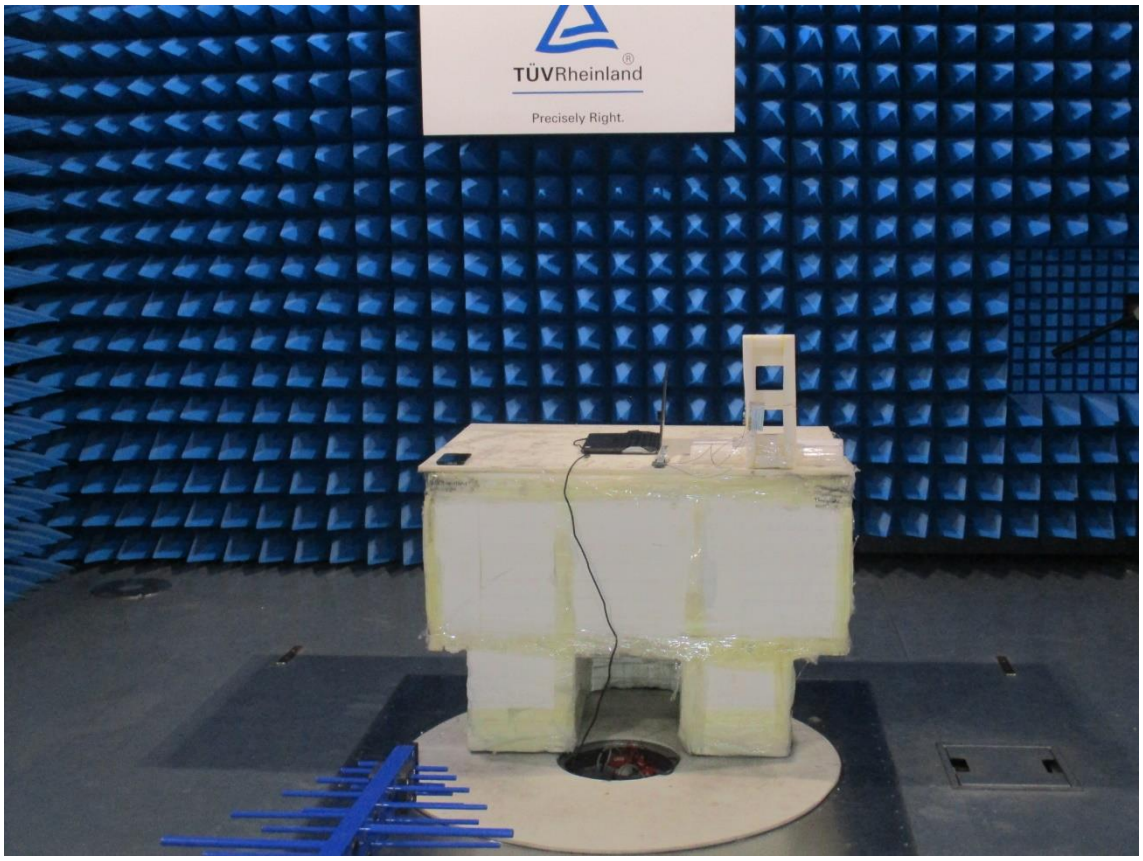
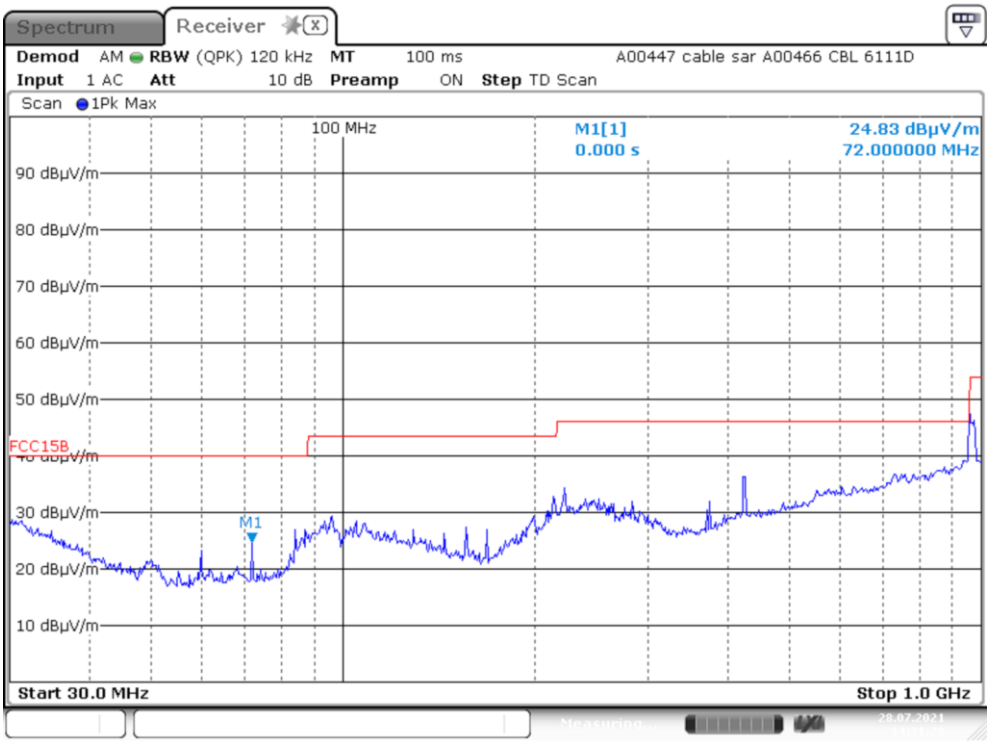


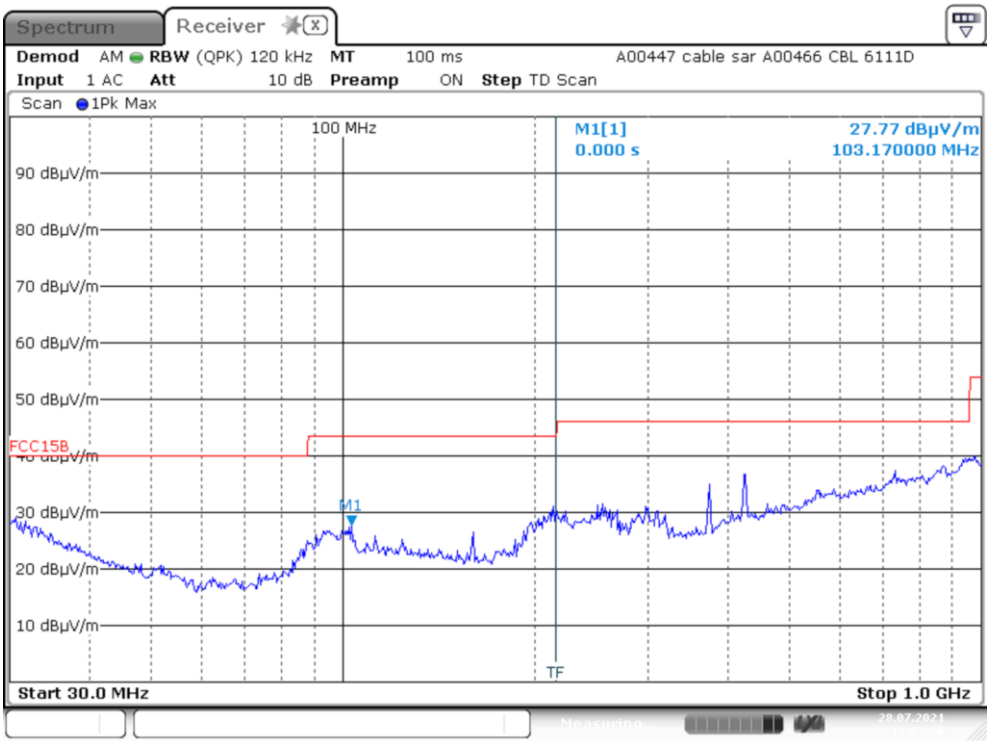

*Photo 1 Photograph test setup radiated emissions 30-1000 MHz*

### 3.1.8 Spectrum plot



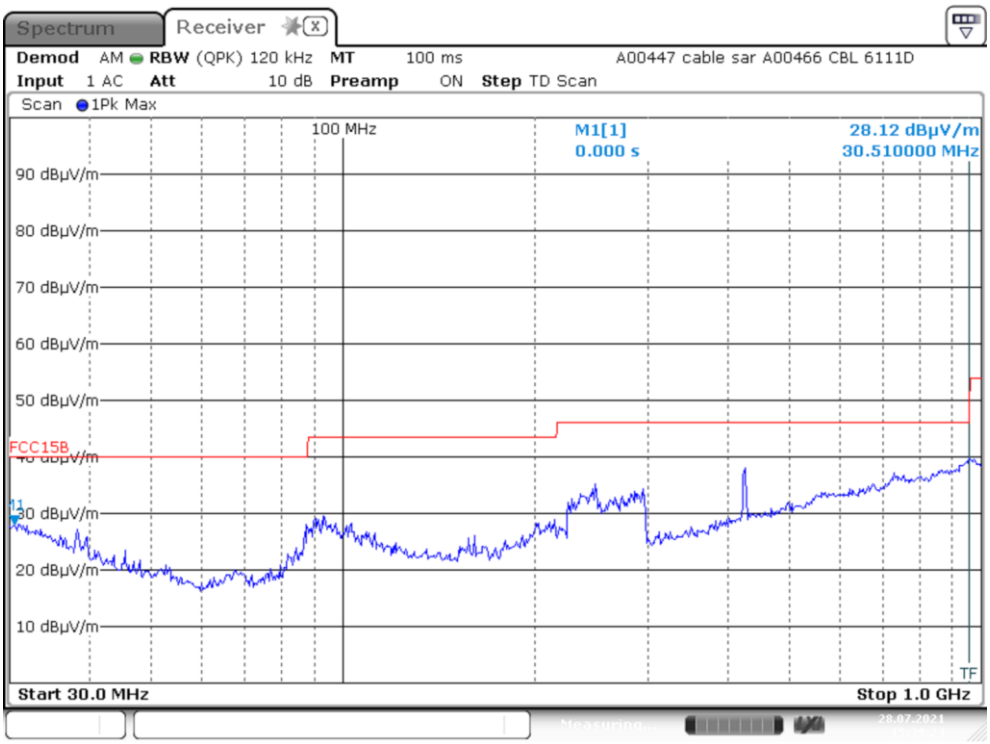

Date: 28.JUL.2021 14:31:28

*Plot 1: Pre-scan plot with peak detector. Radiated emissions from 30 MHz to 1000 MHz 5GHz + BT mode*




Date: 28.JUL.2021 15:07:56

*Plot 2: Pre-scan plot with peak detector. Radiated emissions from 30 MHz to 1000 MHz 2.4GHz mode*




Date: 28.JUL.2021 15:39:25

*Plot 3: Pre-scan plot with peak detector. Radiated emissions from 30 MHz to 1000 MHz 6GHz mode*

## 3.2 Enclosure Radiated emission 1000 MHz – 35625 MHz

| Results and limits 5GHz + Bluetooth mode | | | | | | |
|---|---|---|---|---|---|---|
| **Frequency** | **Peak Results** | | | **Average Results** | | |
| **(GHz)** | **Vertical (dBµV/m)** | **Horizontal (dBµV/m)** | **Limit (dBµV/m)** | **Vertical (dBµV/m)** | **Horizontal (dBµV/m)** | **Limit (dBµV/m)** |
| 4.85 | 65.8 | 66.0 | 74.0 | 52.2 | 52.2 | 54.0 |
| 5.89 | 71.8 | 72.2 | 74.0 | 52.8 | 52.8 | 54.0 |
| 6.93 | 55.9 | 56.5 | 74.0 | 44.0 | 44.0 | 54.0 |
| 11.36 | 64.2 | 64.6 | 74.0 | 52.2 | 52.1 | 54.0 |
| 13.94 | 61.7 | 60.9 | 74.0 | 48.2 | 48.2 | 54.0 |
| 17.89 | 72.8 | 72.8 | 74.0 | 52.9 | 52.8 | 54.0 |
| 20.47 | 55.2 | 55.4 | 74.0 | 42.4 | 42.4 | 54.0 |
| 28.93 | 55.2 | 54.5 | 74.0 | 42.0 | 42.0 | 54.0 |
| 34.39 | 52.8 | 53.3 | 74.0 | 40.2 | 40.2 | 54.0 |

Table 4 Results Enclosure Radiated Emission 1000.0 – 35625 MHz 5GHz + BT mode

| Results and limits 2.4GHz mode | | | | | | |
|---|---|---|---|---|---|---|
| **Frequency** | **Peak Results** | | | **Average Results** | | |
| **(GHz)** | **Vertical (dBµV/m)** | **Horizontal (dBµV/m)** | **Limit (dBµV/m)** | **Vertical (dBµV/m)** | **Horizontal (dBµV/m)** | **Limit (dBµV/m)** |
| 4.82 | 66.0 | 66.7 | 74.0 | 52.2 | 52.2 | 54.0 |
| 5.81 | 71.7 | 72.0 | 74.0 | 52.8 | 52.9 | 54.0 |
| 6.95 | 57.0 | 55.6 | 74.0 | 44.0 | 44.0 | 54.0 |
| 11.39 | 64.2 | 64.6 | 74.0 | 52.7 | 52.8 | 54.0 |
| 14.06 | 60.8 | 60.4 | 74.0 | 48.4 | 48.4 | 54.0 |
| 17.89 | 72.8 | 72.9 | 74.0 | 52.8 | 52.8 | 54.0 |
| 20.57 | 54.8 | 55.7 | 74.0 | 42.7 | 42.7 | 54.0 |
| 29.00 | 54.9 | 56.2 | 74.0 | 42.2 | 42.2 | 54.0 |

Table 5 Results Enclosure Radiated Emission 1000.0 – 35625 MHz 2.4GHz mode

| Results and limits 6GHz mode | | | | | | |
|---|---|---|---|---|---|---|
| **Frequency** | **Peak Results** | | | **Average Results** | | |
| **(GHz)** | **Vertical (dBµV/m)** | **Horizontal (dBµV/m)** | **Limit (dBµV/m)** | **Vertical (dBµV/m)** | **Horizontal (dBµV/m)** | **Limit (dBµV/m)** |
| 4.82 | 66.2 | 66.5 | 74.0 | 52.4 | 52.4 | 54.0 |
| 5.89 | 71.7 | 72.1 | 74.0 | 52.9 | 52.9 | 54.0 |
| 6.91 | 56.8 | 56.4 | 74.0 | 43.8 | 43.8 | 54.0 |
| 11.39 | 64.6 | 65.1 | 74.0 | 52.8 | 52.8 | 54.0 |
| 13.77 | 60.2 | 60.5 | 74.0 | 47.3 | 47.3 | 54.0 |
| 17.94 | 71.9 | 71.6 | 74.0 | 52.7 | 52.8 | 54.0 |
| 20.59 | 56.0 | 55.0 | 74.0 | 42.8 | 42.8 | 54.0 |
| 28.79 | 54.1 | 54.7 | 74.0 | 42.0 | 42.0 | 54.0 |

Table 6 Results Enclosure Radiated Emission 1000.0 – 35625 MHz 6GHz mode

**Notes:**

Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.

1. Measurement uncertainty is +/- 5.1 dB
2. The reported field strength values are the worst case values at the indicated frequency. The receiving antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
3. A Peak and Average detector was used with a resolution bandwidth of 1MHz.

Used Equipment

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2790499 | 2789109 | 2788776 | 2789217 | 2789110 | 2789029 | 2789206 | 2789108 | 2789214 |

### 3.2.1 Photograph test setup

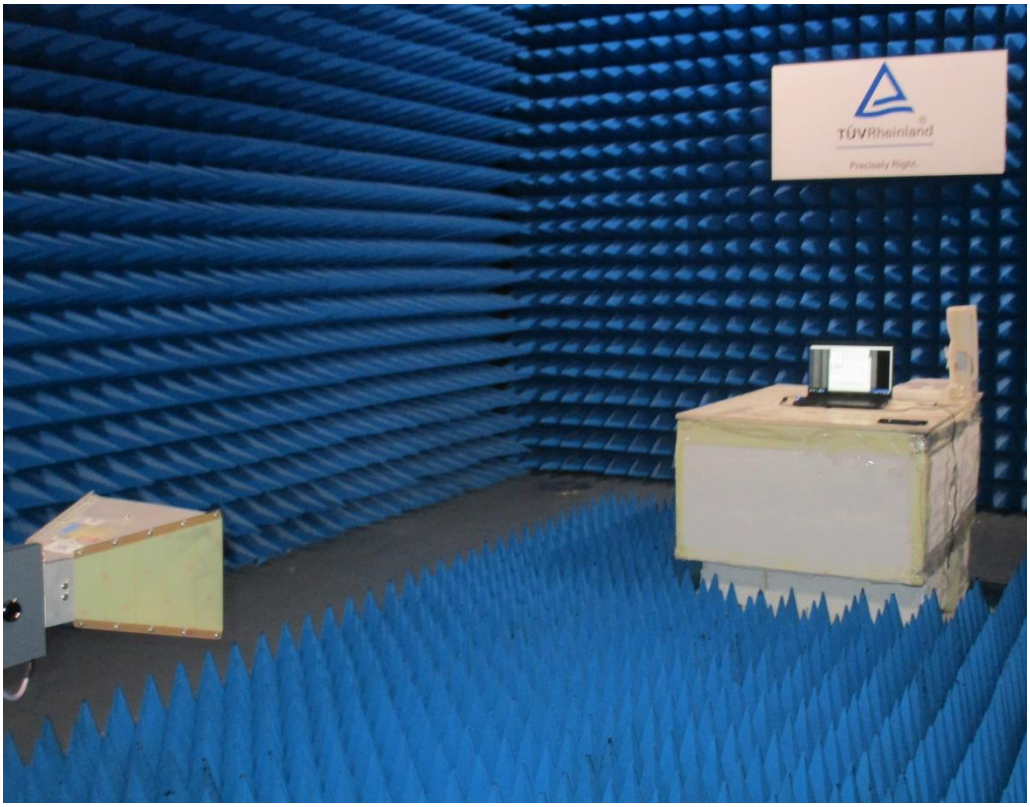



*Photo 2: Photograph radiated emissions 1 – 18 GHz*

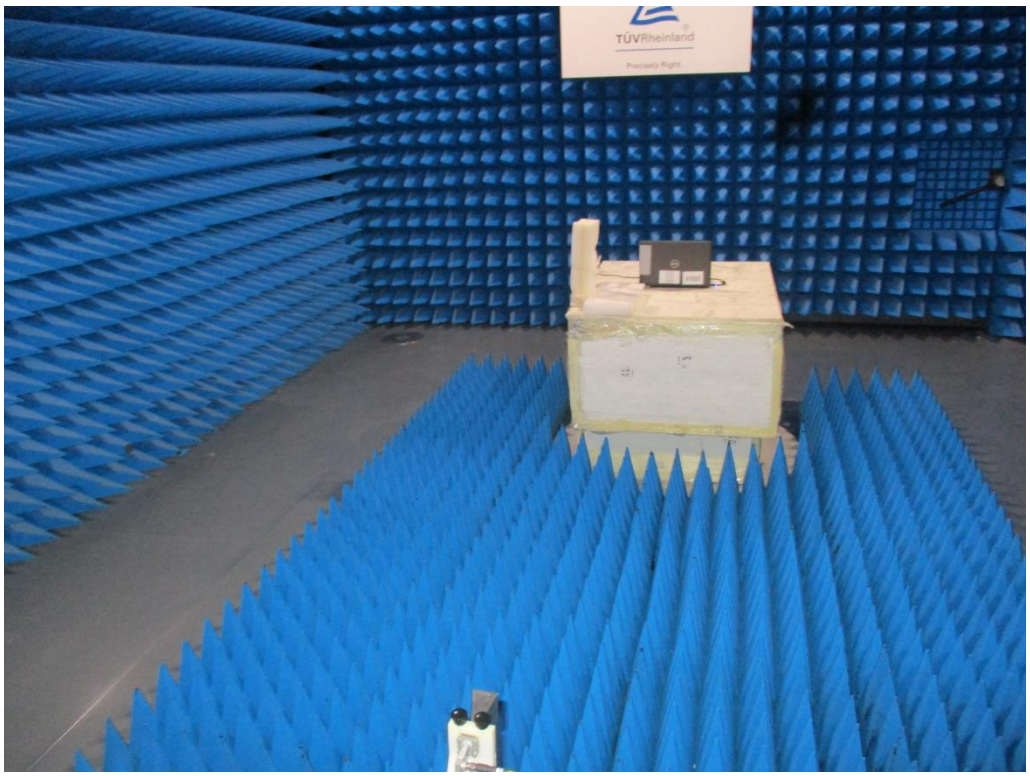



*Photo 3: Photograph radiated emissions 18 – 26.5 GHz*

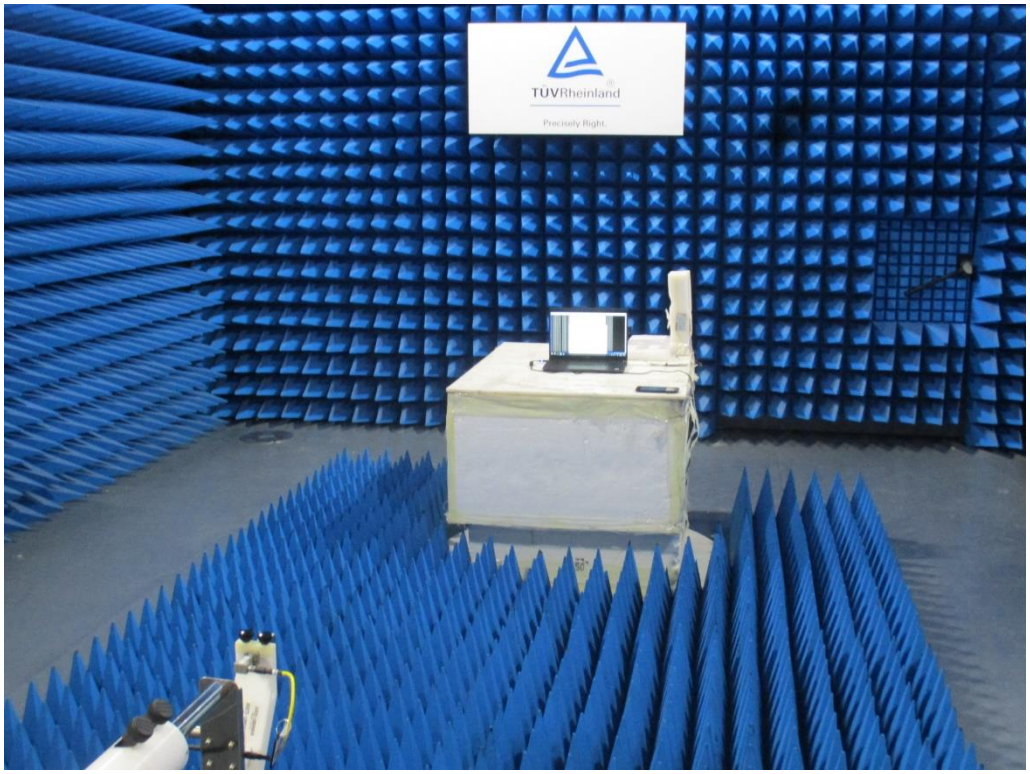
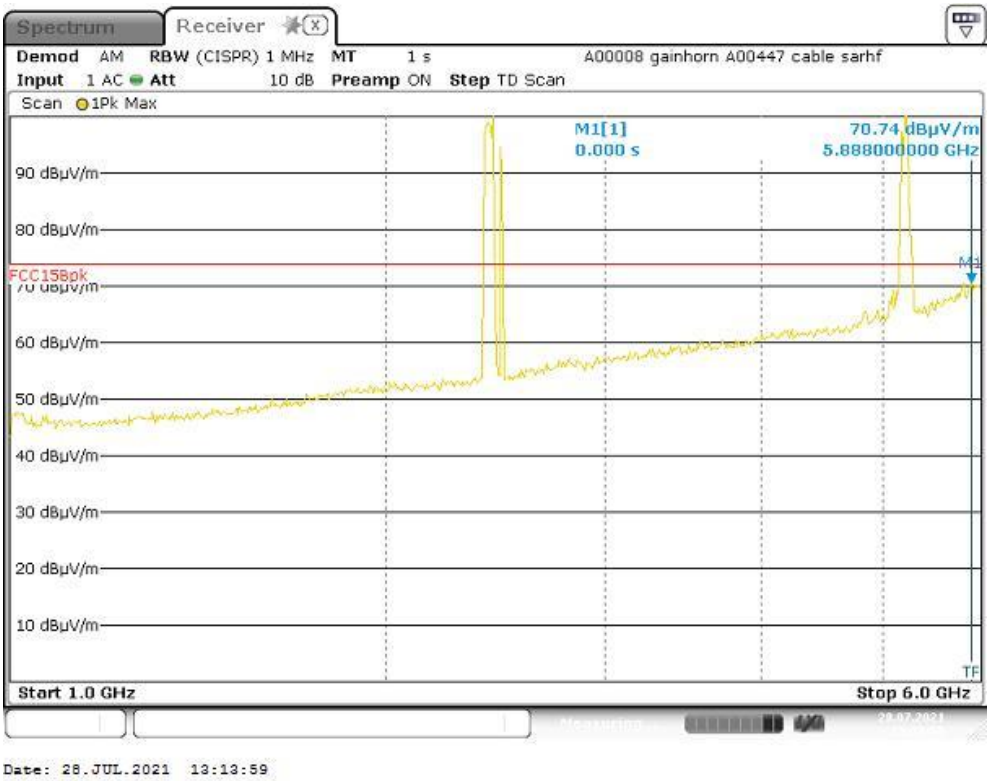
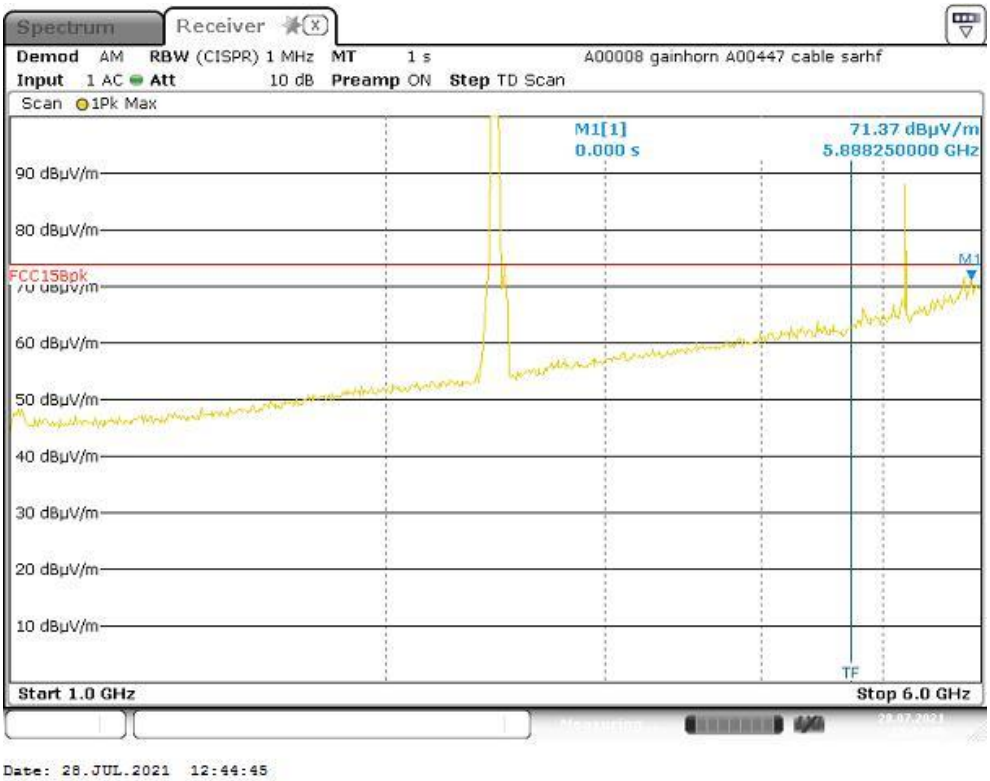



*Photo 4: Photograph radiated emissions 26.5 – 36 GHz*

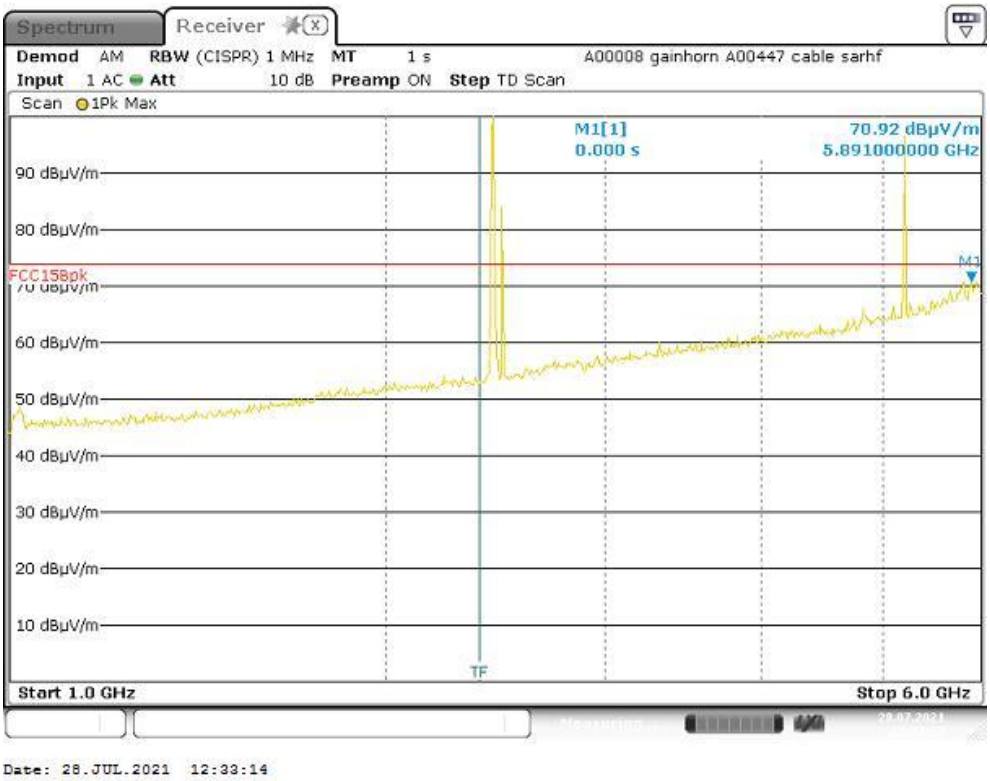
### 3.2.2 Spectrum plot



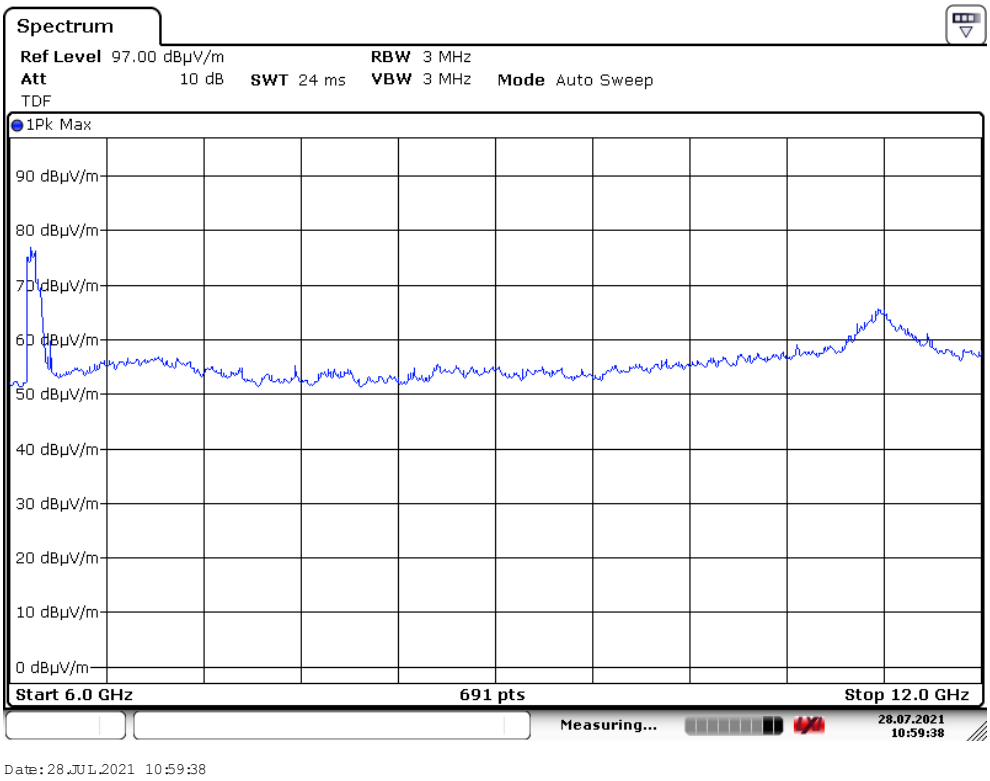

*Plot 4: Pre-scan plot with peak detector. Radiated emissions from 1 GHz – 6 GHz, 5GHz + BT mode*



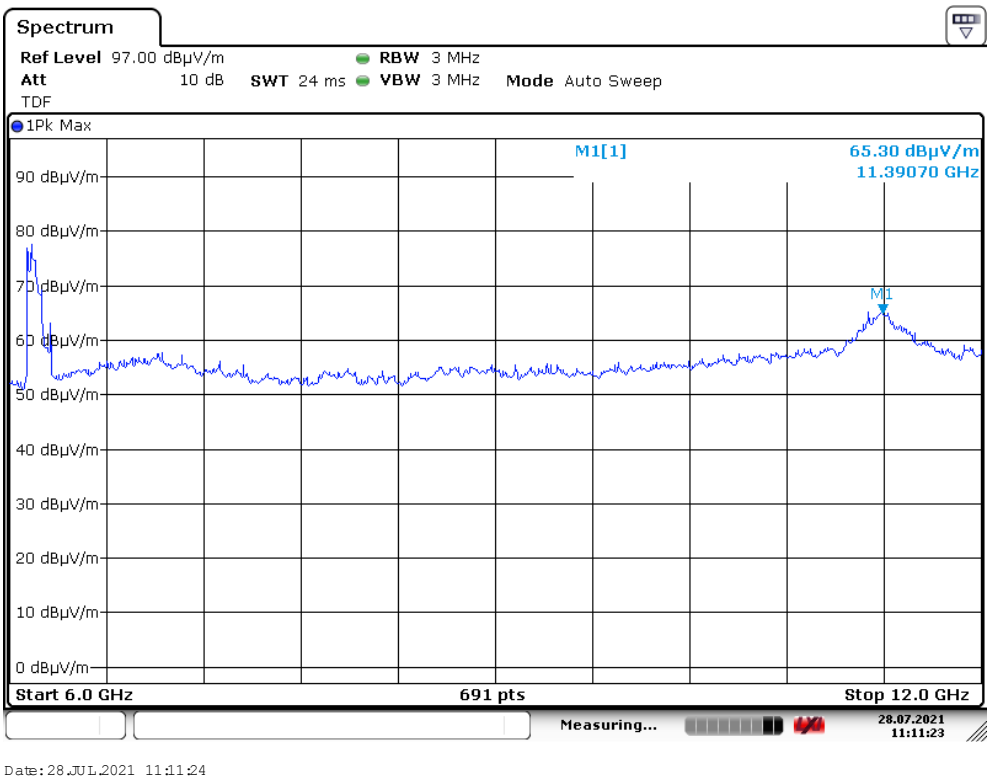

*Plot 5: Pre-scan plot with peak detector. Radiated emissions from 1 GHz – 6 GHz, 2.4GHz mode*



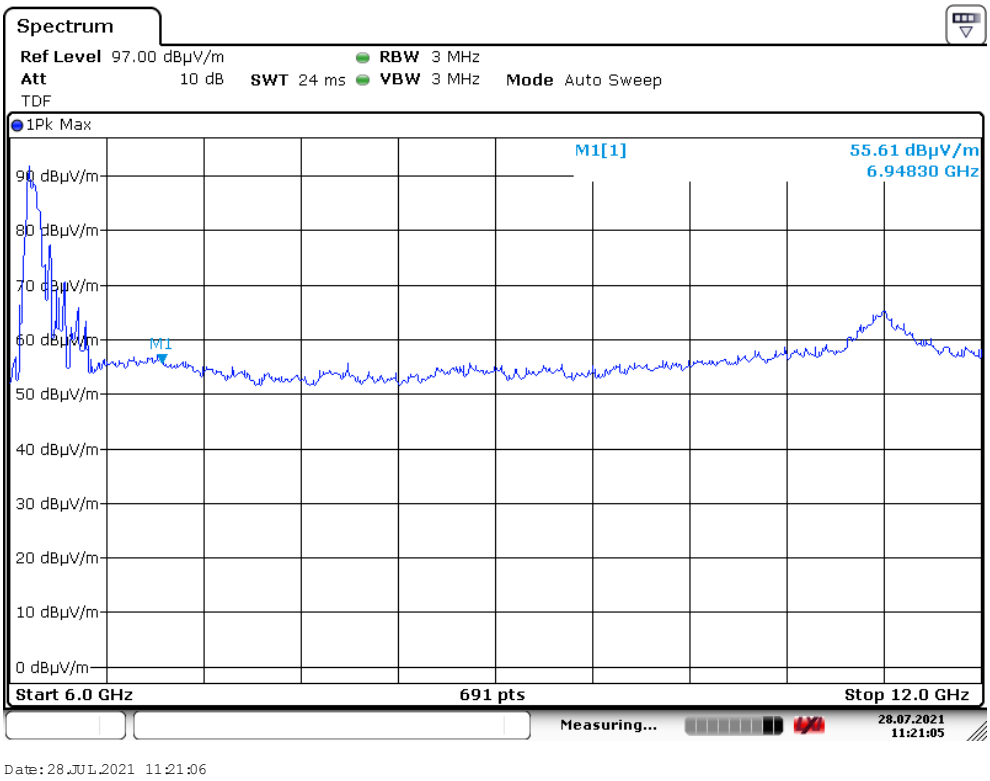

*Plot 6: Pre-scan plot with peak detector. Radiated emissions from 1 GHz – 6 GHz, 6GHz mode*



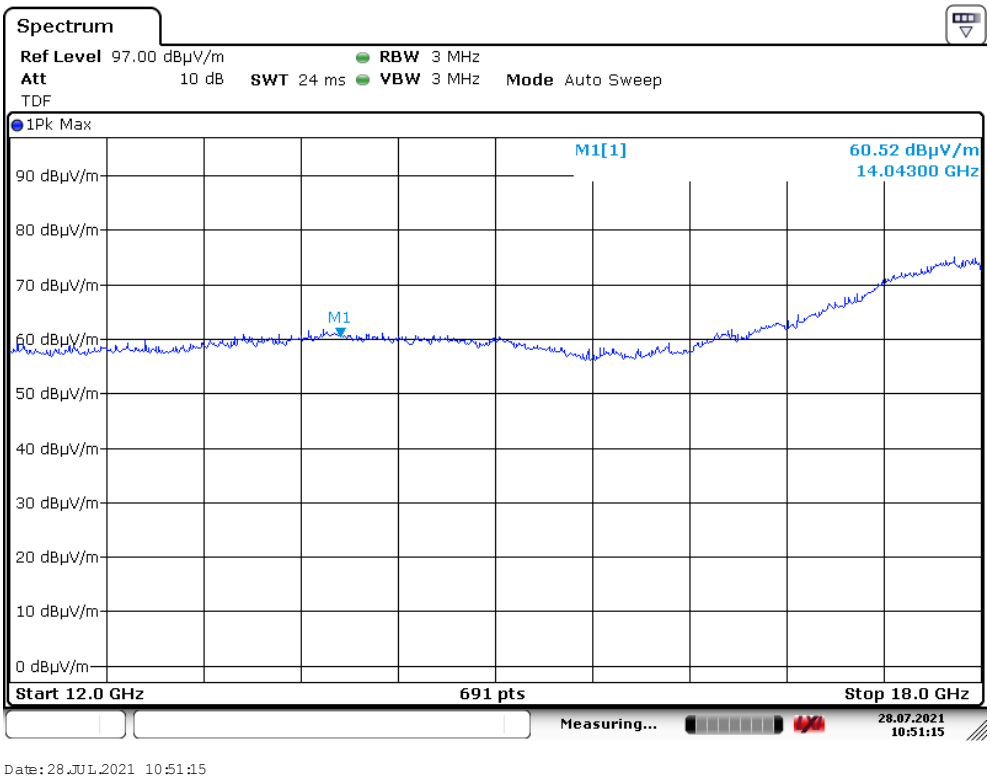

*Plot 7: Pre-scan plot with peak detector. Radiated emissions from 6 GHz – 12 GHz, 5GHz + BT mode*



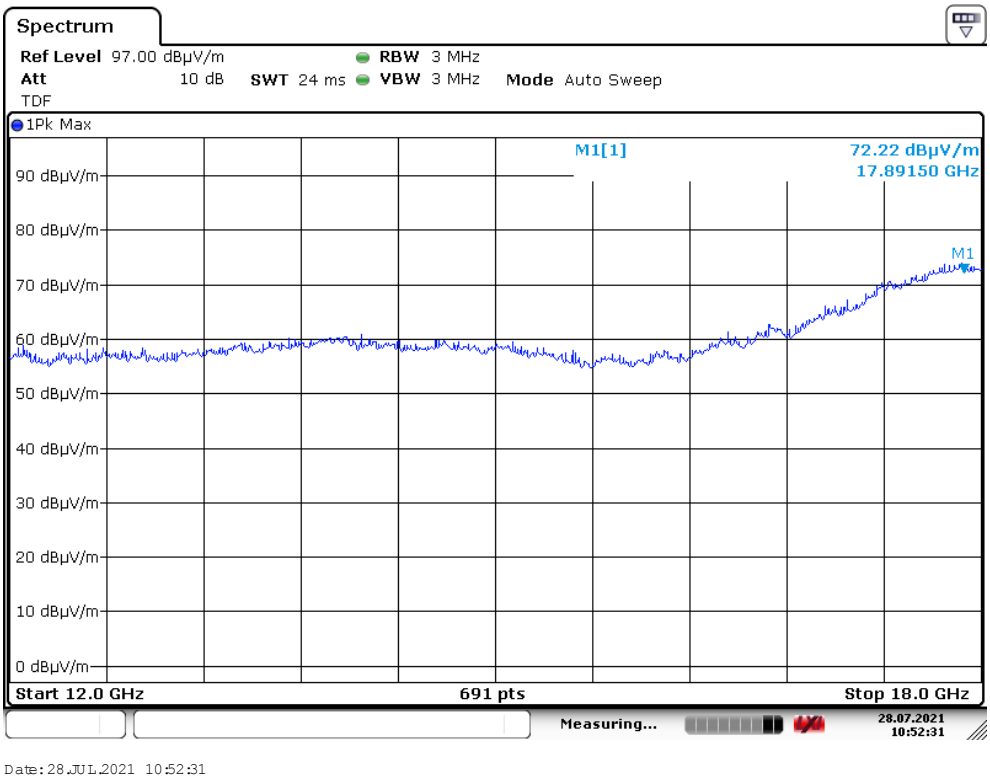

*Plot 8: Pre-scan plot with peak detector. Radiated emissions from 6 GHz – 12 GHz, 2.4GHz mode*



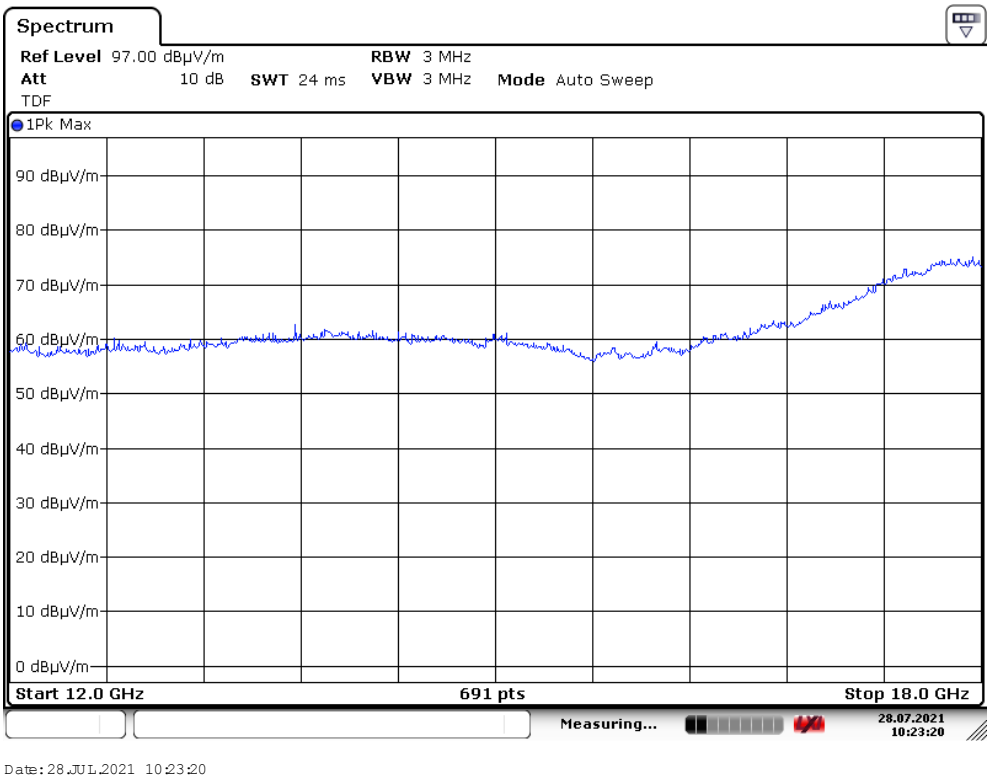

*Plot 9: Pre-scan plot with peak detector. Radiated emissions from 6 GHz – 12 GHz, 6GHz mode*



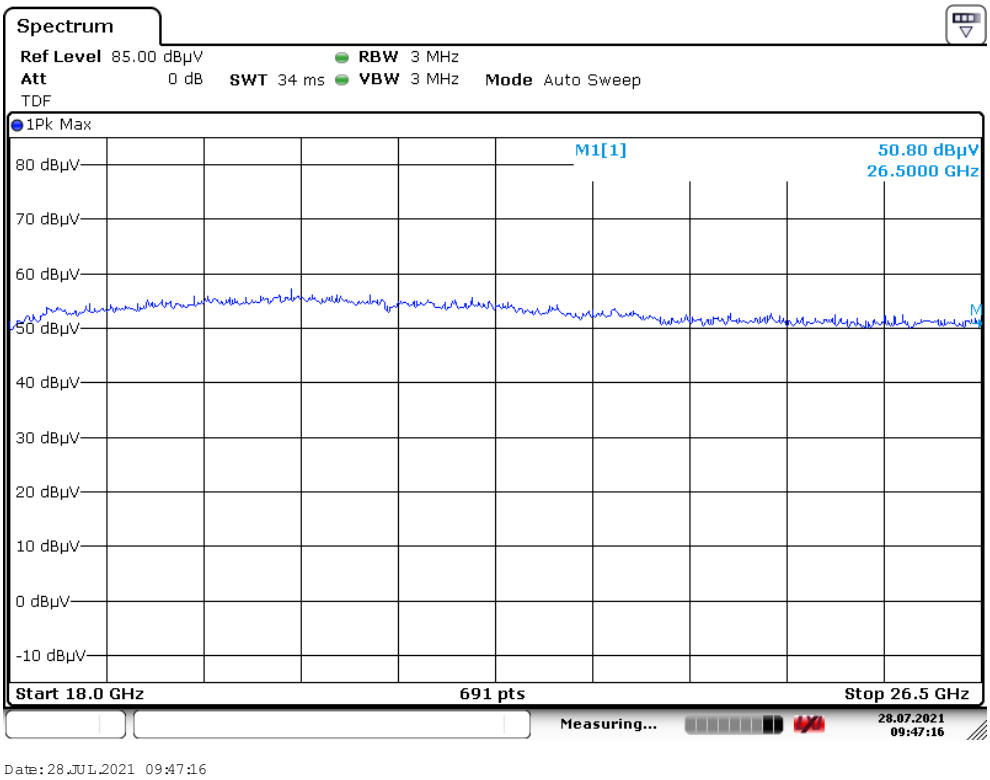

*Plot 10: Pre-scan plot with peak detector. Radiated emissions from 12 GHz – 18 GHz, 5GHz + BT mode*



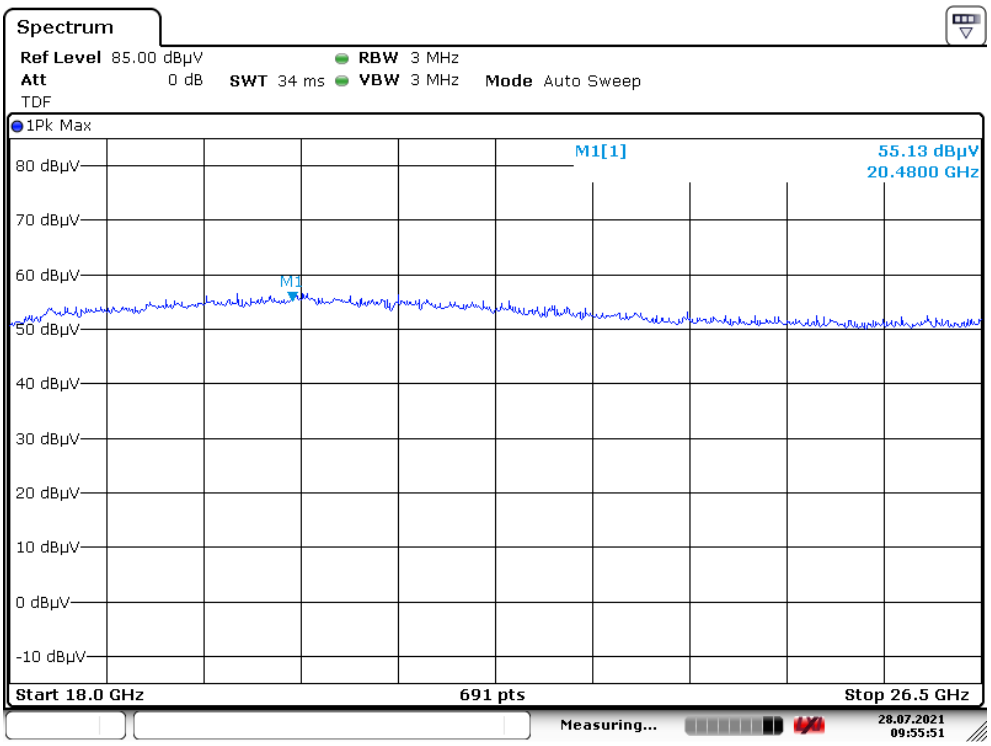

*Plot 11: Pre-scan plot with peak detector. Radiated emissions from 12 GHz – 18 GHz, 2.4GHz mode*



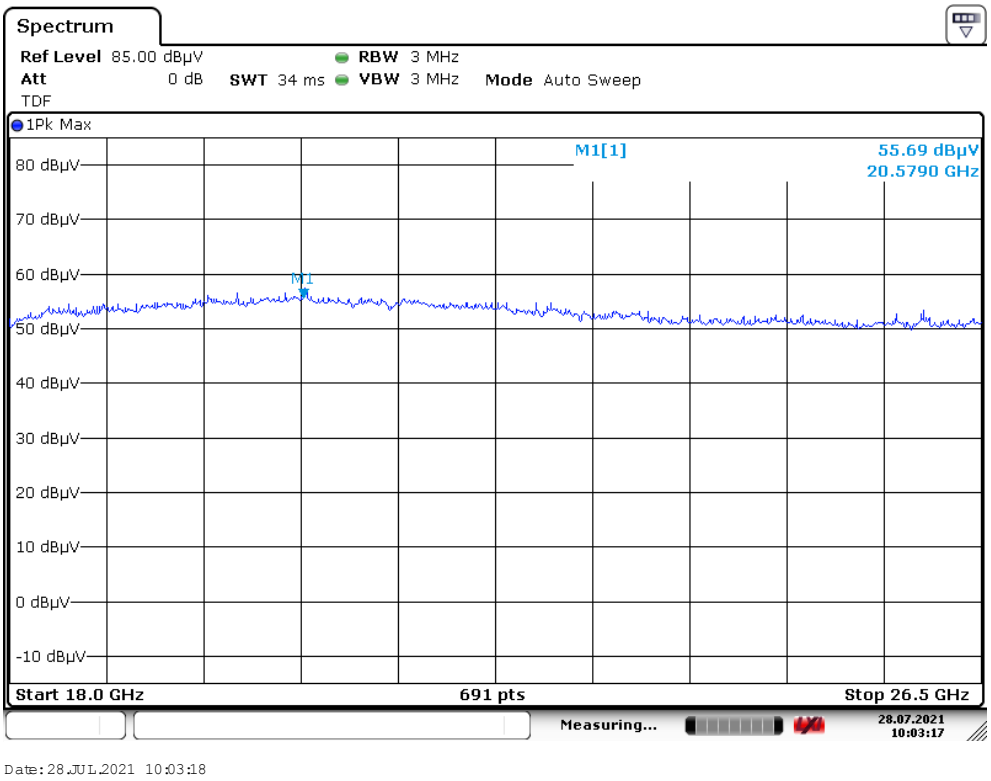

*Plot 12: Pre-scan plot with peak detector. Radiated emissions from 12 GHz – 18 GHz, 6GHz mode*



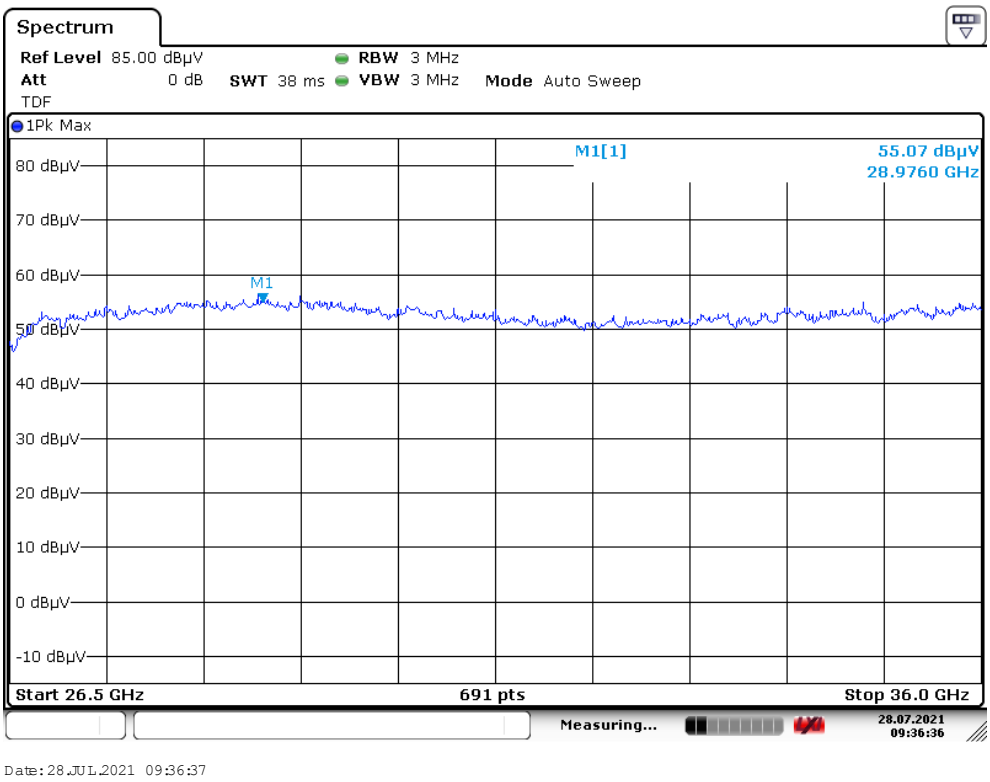

*Plot 13: Pre-scan plot with peak detector. Radiated emissions from 18 GHz – 26.5 GHz, 5GHz + BT mode*



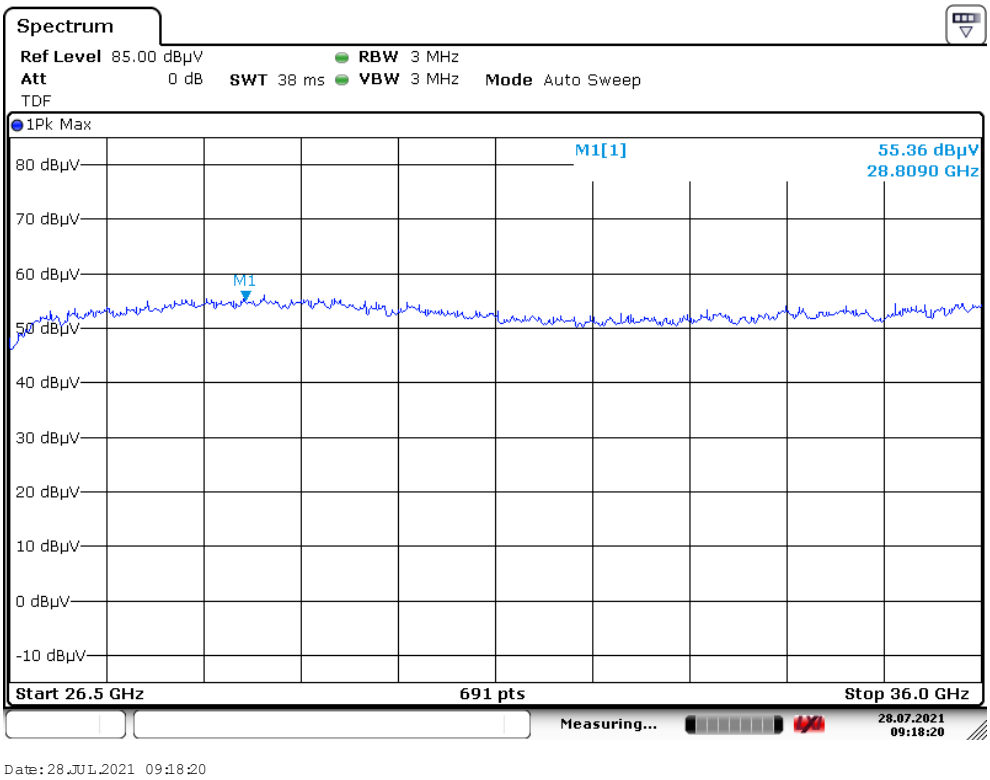

*Plot 14: Pre-scan plot with peak detector. Radiated emissions from 18 GHz – 26.5 GHz, 2.4GHz mode*



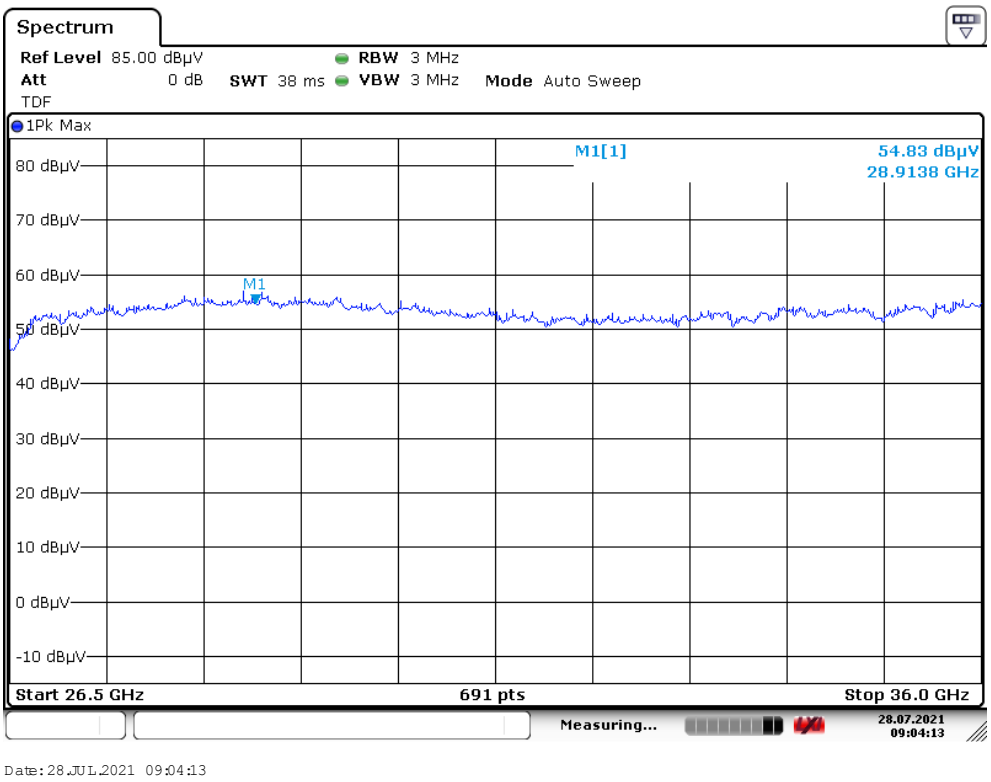

*Plot 15: Pre-scan plot with peak detector. Radiated emissions from 18 GHz – 26.5 GHz, 6GHz mode*




*Plot 16: Pre-scan plot with peak detector Radiated emissions from 26.5 GHz – 36 GHz, 5GHz + BT mode*




*Plot 17: Pre-scan plot with peak detector Radiated emissions from 26.5 GHz – 36 GHz, 2.4GHz mode*




*Plot 18: Pre-scan plot with peak detector Radiated emissions from 26.5 GHz – 36 GHz, 6GHz mode*

## 3.3 AC Mains Conducted Emission 0.15-30 MHz

### 3.3.1 Definition

Result of the measurements concerning the disturbance voltage level at the power input port emitted by the total set-up of the EUT.

### 3.3.2 Basic standard

The test is performed according to FCC CRF 47 Part 15B § 15.107

### 3.3.3 Limit

| Frequency (MHz) | Limit Quasi-peak(dBμV) | Limit Average(dBμV) |
|---|---|---|
| 0.15 - 0.50 | 66.0 – 56.0 | 56.0 – 46.0 |
| 0.50 - 5.0 | 56.0 | 46.0 |
| 5.0 – 30.0 | 60.0 | 50.0 |

### 3.3.4 Test procedures

Requirements: 15.107 (a) Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the table above, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Test procedure according to ANSI C63.4-2014: Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 μH / 50 Ω LISN. The frequency range from 150kHz to 30MHz was examined. The six highest EUT emissions relative to the limit were noted. The EUT was positioned at least 40cm from a vertical ground reference plane and at least 80cm from the LISN.

### 3.3.5 Test deviation

There is no deviation with the original standard

### 3.3.6 Test results

| Test conditions | | | |
|---|---|---|---|
| | | Test location | Leek |
| Applied Standard(s) | to FCC CRF 47 Part 15B § 15.107 | Under accreditation: | ☒ Yes ☐ No |
| Test engineer | W. Brouwer | Test result | Pass |
| Test date | July 29, 2021 | | |

| Results and limits Neutral, 5GHz + Bluetooth mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Quasi peak detector | | | Average detector | | |
| | Result | Limit | Margin | Result | Limit | Margin |
| 0.46 | 39.2 | 56.7 | 17.5 | 19.6 | 46.7 | 27.1 |
| 0.51 | 37.6 | 56.0 | 18.4 | 23.7 | 46.0 | 22.4 |
| 0.62 | 39.4 | 56.0 | 16.6 | 31.4 | 46.0 | 14.6 |
| 0.87 | 38.6 | 56.0 | 17.4 | 28.5 | 46.0 | 17.5 |
| 1.01 | 33.3 | 56.0 | 22.7 | 20.0 | 46.0 | 26.0 |
| 1.12 | 38.2 | 56.0 | 17.8 | 27.6 | 46.0 | 18.4 |
| **Results and limits L1, 5GHz + Bluetooth mode** | | | | | | |
| Frequency (MHz) | Quasi peak detector | | | Average detector | | |
| | Result | Limit | Margin | Result | Limit | Margin |
| 0.46 | 36.7 | 56.7 | 20.0 | 16.9 | 46.7 | 29.8 |
| 0.51 | 33.7 | 56.0 | 22.4 | 19.2 | 46.0 | 26.8 |
| 0.62 | 40.9 | 56.0 | 15.1 | 31.5 | 46.0 | 14.5 |
| 0.87 | 38.3 | 56.0 | 17.7 | 27.9 | 46.0 | 18.1 |
| 1.01 | 31.9 | 56.0 | 24.1 | 14.4 | 46.0 | 31.6 |
| 1.12 | 38.0 | 56.0 | 18.0 | 26.8 | 46.0 | 19.3 |

Table 7 Results Conducted Emission 0.15 - 30 MHz, 5GHz + BT mode

| Results and limits Neutral, 2.4GHz mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Quasi peak detector | | | Average detector | | |
| | Result | Limit | Margin | Result | Limit | Margin |
| 0.15 | 49.0 | 66.0 | 17.0 | 24.6 | 56.0 | 31.4 |
| 0.21 | 41.5 | 63.2 | 21.7 | 15.7 | 53.2 | 37.5 |
| 0.49 | 38.5 | 56.3 | 17.7 | 22.0 | 46.3 | 24.3 |
| 0.51 | 37.6 | 56.0 | 18.4 | 21.5 | 46.0 | 24.5 |
| 0.87 | 38.2 | 56.0 | 17.8 | 27.2 | 46.0 | 18.9 |
| 1.10 | 37.3 | 56.0 | 18.7 | 23.1 | 46.0 | 22.9 |
| **Results and limits L1, 2.4GHz mode** | | | | | | |
| Frequency (MHz) | Quasi peak detector | | | Average detector | | |
| | Result | Limit | Margin | Result | Limit | Margin |
| 0.15 | 48.5 | 66.0 | 17.5 | 24.3 | 56.0 | 31.8 |
| 0.21 | 41.7 | 63.2 | 21.6 | 15.6 | 53.2 | 37.7 |
| 0.49 | 35.0 | 56.3 | 21.2 | 18.3 | 46.3 | 27.9 |
| 0.51 | 34.4 | 56.0 | 21.7 | 18.2 | 46.0 | 27.8 |
| 0.87 | 38.1 | 56.0 | 17.9 | 27.0 | 46.0 | 19.0 |
| 1.10 | 37.3 | 56.0 | 18.7 | 23.6 | 46.0 | 22.4 |

Table 8 Results Conducted Emission 0.15 - 30 MHz, 2.4GHz mode

| Results and limits Neutral, 6GHz mode | | | | | | |
|---|---|---|---|---|---|---|
| Frequency (MHz) | Quasi peak detector | | | Average detector | | |
| | Result | Limit | Margin | Result | Limit | Margin |
| 0.18 | 29.9 | 64.5 | 34.6 | 9.2 | 54.5 | 45.3 |
| 0.45 | 30.4 | 56.9 | 26.5 | 11.5 | 46.9 | 35.4 |
| 0.47 | 30.2 | 56.5 | 26.3 | 11.7 | 46.5 | 34.8 |
| 0.62 | 30.5 | 56.0 | 25.6 | 21.1 | 46.0 | 24.9 |
| 0.87 | 30.0 | 56.0 | 26.0 | 19.2 | 46.0 | 26.9 |
| 1.12 | 28.5 | 56.0 | 27.5 | 16.3 | 46.0 | 29.7 |
| **Results and limits L1, 6GHz mode** | | | | | | |
| Frequency (MHz) | Quasi peak detector | | | Average detector | | |
| | Result | Limit | Margin | Result | Limit | Margin |
| 0.18 | 37.8 | 64.5 | 26.7 | 13.9 | 54.5 | 40.6 |
| 0.45 | 28.1 | 56.9 | 28.8 | 9.9 | 46.9 | 37.0 |
| 0.47 | 27.3 | 56.5 | 29.2 | 9.9 | 46.5 | 36.6 |
| 0.62 | 31.1 | 56.0 | 24.9 | 21.6 | 46.0 | 24.4 |
| 0.87 | 29.9 | 56.0 | 26.1 | 18.8 | 46.0 | 27.2 |
| 1.12 | 27.0 | 56.0 | 29.0 | 15.1 | 46.0 | 30.9 |

Table 9 Results Conducted Emission 0.15 - 30 MHz, 6GHz mode

The results of the AC power line conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.107 and ICES-003 Section 6.1, at the 120 Volts AC mains connection terminals of the system, are depicted in Table 4. Maximum values were recorded. The system is tested as in whole, so with all equipment as shown in Figure 1 in place and functioning. Being the worst case situation.

Notes:

1. Measurement uncertainty is ±3.5dB
2. The resolution bandwidth used was 9 kHz.
3. The six highest values relative to the applicable limits were noted.
4. Photo and Graphical Display is provided on the next page.

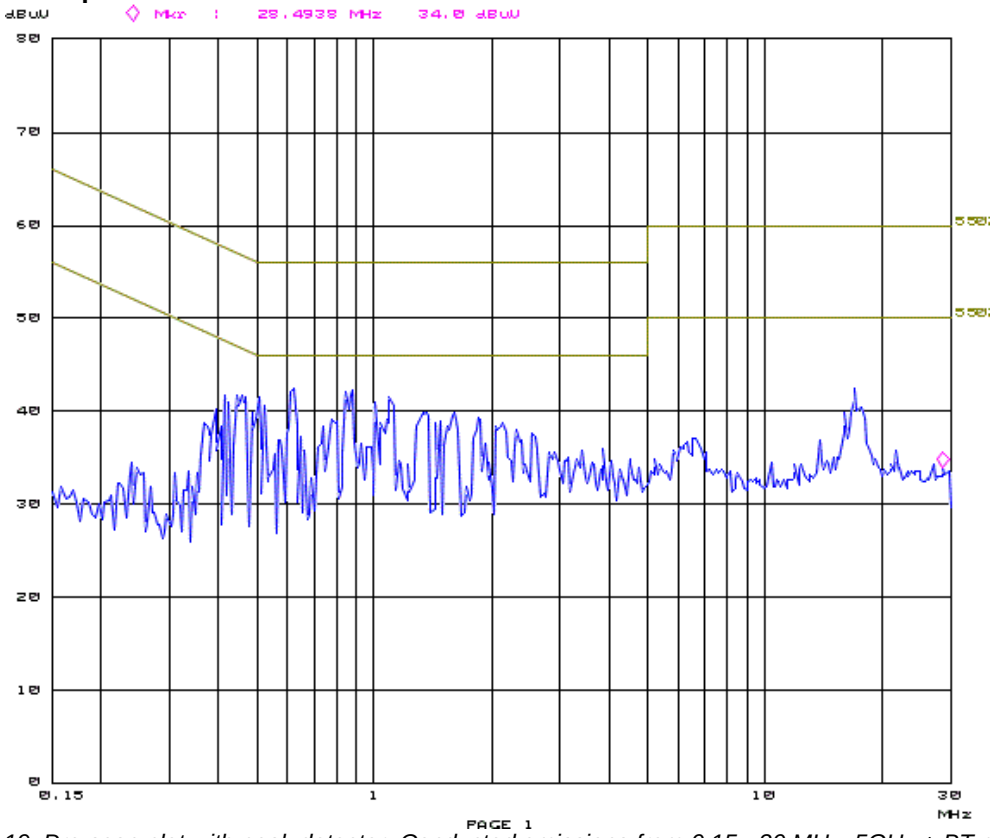
Used Equipment

| | | | | | | |
|---|---|---|---|---|---|---|
| 2789421 | 2790495 | 2788791 | 2789124 | 2788866 | 2790513 | 2789211 |

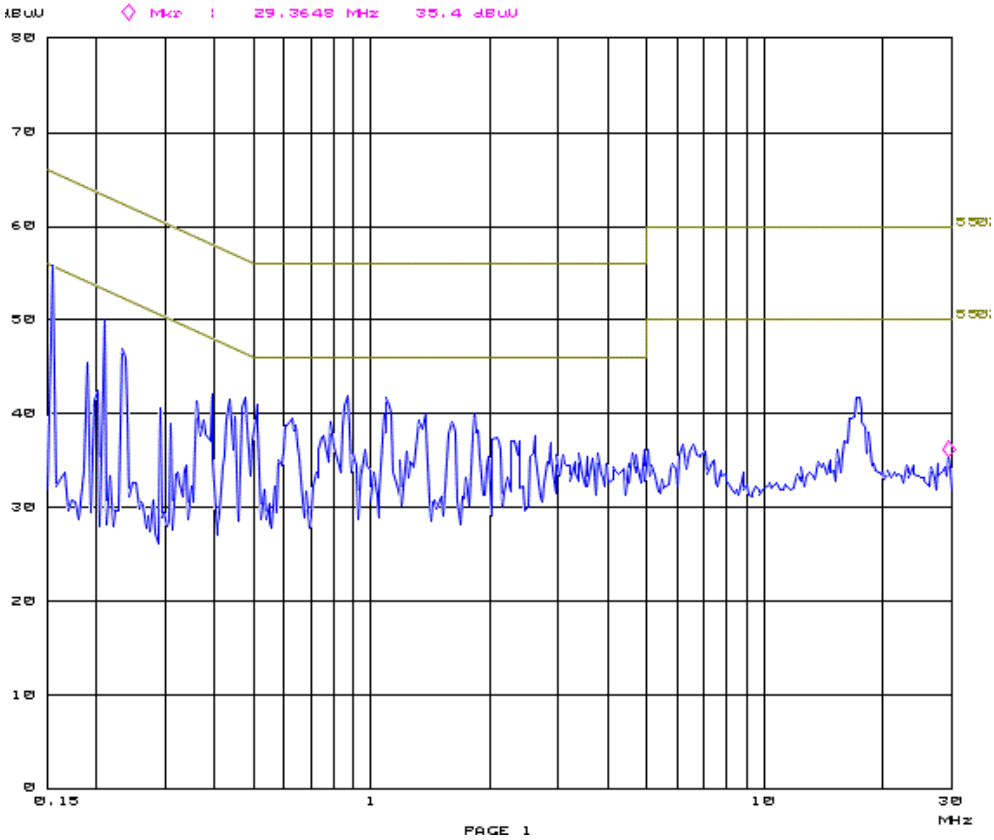
### 3.3.7 Photograph test setup

*Photo 5: Photograph conducted emissions 0.15-30 MHz*

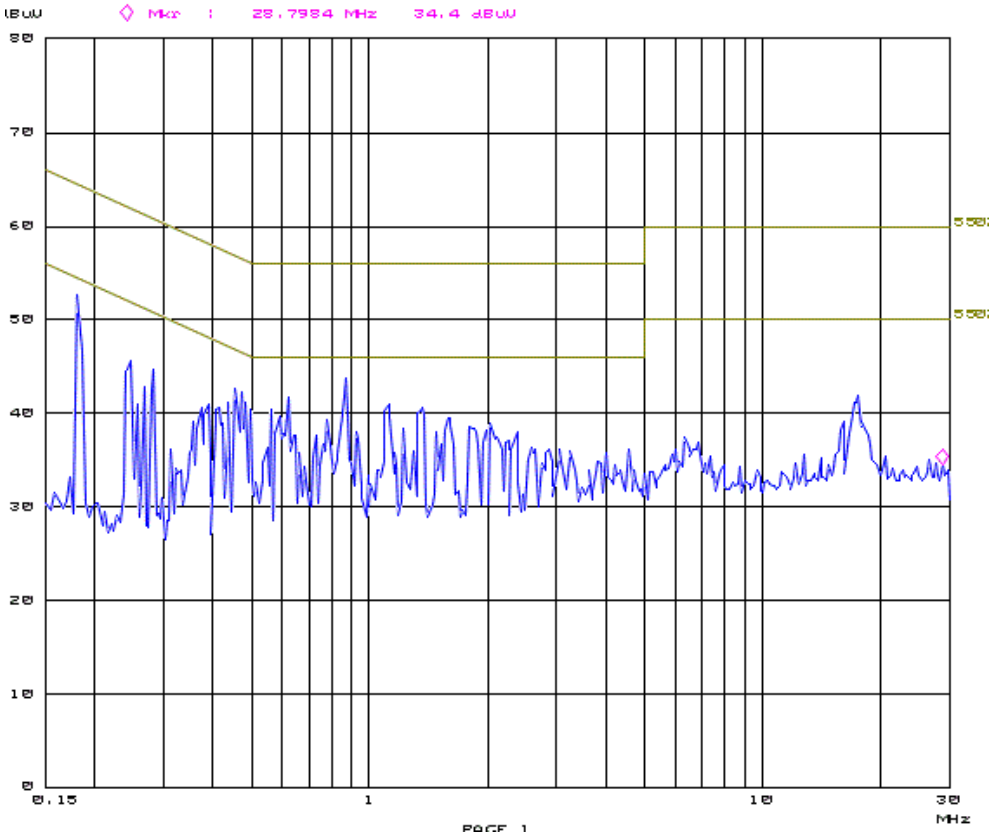
### 3.3.8 Spectrum plot




*Plot 19: Pre-scan plot with peak detector. Conducted emissions from 0.15 - 30 MHz, 5GHz + BT mode*




*Plot 20: Pre-scan plot with peak detector. Conducted emissions from 0.15 - 30 MHz, 2.4GHz mode*




*Plot 21: Pre-scan plot with peak detector. Conducted emissions from 0.15 - 30 MHz, 6GHz mode*

END OF THIS EMC TESTREPORT