# Report on the FCC and IC Testing of the XTRONIC GmbH Model: MBAC BM V001 In accordance with FCC 47 CFR Part 15 C (partly) and ISED RSS-247 (partly) and ISED RSS-Gen (partly)

Product Service

Add value.
Inspire trust.

Prepared for:

XTRONIC GmbH
Herrenberger Straße 56
71034 Böblingen
Germany

## COMMERCIAL-IN-CONFIDENCE

FCC ID: 2ASIZ-00001
IC: 24737-00001

Date: 2022-05-24
Document Number: TR-713251542-01 (Revision 1)

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| **Project Management** | Martin Steindl | 2022-05-24 | Steindl Martin SIGN-ID 653821 |
| **Authorised Signatory** | Matthias Stumpe | 2022-05-25 | Stumpe SIGN-ID 654764 |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

**Engineering Statement:**
This measurement shown in this report were made in accordance with the procedures described on test pages.
All reporded testing was carried out on a sample equipment to demonstrate limited compliance with with FCC 47 CFR Part 15 C and ISED RSS-247 and RSS-GEN.
The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| **Testing** | Martin Steindl | 2022-05-24 | Steindl Martin SIGN-ID 651383 |

| Laboratory Accreditation | Laboratory recognition | Industry Canada test site registration |
|---|---|---|
| DAkkS Reg. No. D-PL-11321-11-02<br>DAkkS Reg. No. D-PL-11321-11-03 | Registration No. BNetzA-CAB-16/21-15 | 3050A-2 |

**Executive Statement:**
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15 C:2021 and ISED RSS-247:2017 and ISED RSS-Gen:2018 + Amd. 1:2019 + Amd 2:2021 in the tested parts

Bundesnetzagentur
BNetzA-CAB-16/21-15



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# Content

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# 1 Report Summary

## 1.1 Modification Report

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

| *Issue* | *Description of changes* | *Date of Issue* |
|---|---|---|
| 1 | First Issue | 2022-03-21 |
| 2 | Added annexes A, B, C; IC and FCC ID.<br>Moved test setup photos into annex A.<br>Corrections of typo and tables on page 3 | 2022-05-24 |

**Table 1: Report of Modifications**

## 1.2 Introduction

| | |
|---|---|
| Applicant | XTRONIC GmbH<br>Herrenberger Straße 56<br>71034 Böblingen |
| Manufacturer | XTRONIC GmbH |
| Model Number(s) | MBAC BM V001 |
| Serial Number(s) | XD11500107 |
| Hardware Version(s) | A910 901 09 00 ZGS 001 |
| Software Version(s) | SW-GW: A910 902 54 00<br>SW-IO: A910 902 43 00<br>SW-PC: A910 902 55 00 |
| Number of Samples Tested | 1 |
| Test Specification(s) / Issue / Date | FCC 47 CFR Part 15 C : 2019<br>ISED RSS-247, Issue 2 : 2017<br>ISED RSS-GEN, Issue 5 + Amendment 1 :2019+ Amendment:2021 |
| Test Plan/Issue/Date | DO403-05_PRJ592_Funkzulassung_BLE_Anleitung_20191121 |
| Order Number | BE-2022-0042 |
| Date | 2022-02-02 |
| Date of Receipt of EUT | 2022-03-15 |
| Start of Test | 2022-03-21 |
| Finish of Test | 2022-03-21 |
| Name of Engineer(s) | M. Steindl |
| Related Document(s) | ANSI C63.10:2013 |

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## 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15 C, ISED RSS-247 and ISED RSS-GEN is shown below.

| *Section* | *Specification Clause* | *Test Description* | *Result* |
|---|---|---|---|
| | 15.203, 15.247(b) | Antenna requirement | Not performed |
| | 15.247(a)(2) | Emission Bandwidth | Not performed |
| | 15.247(b)(3) | Output Power | Not performed |
| | 15.247(e) | Power Spectral Density | Not performed |
| | 15.247(d) | Frequency Band Edge | Not performed |
| 2.1 | 15.247(d), 15.205, 15.209 | Spurious Emissions | Pass |
| | 15.207 | Conducted Emissions on Mains Terminals | Not applicable |
| | 15.247(i) | RF Exposure | Not performed |

**Table 2: Results according to FCC 47 CFR Part 15 C**

| *Section* | *Specification Clause* | *Test Description* | *Result* |
|---|---|---|---|
| | 5.2 a. | Emission Bandwidth | Not performed |
| | 5.4 d. | Output Power | Not performed |
| | 5.2 b. | Power Spectral Density | Not performed |
| | 5.5 | Frequency Band Edge | Not performed |
| 2.1 | 5.5 | Spurious Emissions | Pass |

**Table 3: Results according to ISED RSS-247**

| *Section* | *Specification Clause* | *Test Description* | *Result* |
|---|---|---|---|
| | 6.7 | Emission Bandwidth | Not performed |
| 2.1 | 8.9, 8.10 | Spurious Emissions | Pass |
| | 8.11 | Frequency Stability | Not performed |
| | 8.8 | Conducted Emissions on Mains Terminals | Not applicable |
| | 3.4 | RF Exposure | Not performed |

**Table 4: Results according to RSS-Gen**

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## 1.4 Product Information

### 1.4.1 Technical Description

| | |
|---|---|
| *Frequency Band:* | 2400.0 MHz – 2483.5 MHz |
| *Supply Voltage:* | DC 12 V |
| *Supply Frequency:* | 0 Hz |
| *Highest clock frequency (radio part):* | 2480 MHz |
| *Highest clock frequency (non-radio part):* | 16 MHz |

### 1.4.2 Marking Plate

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## 1.5 Test Configuration

The applicant provided a test mode for continuously transmission on lowest channel.

## 1.6 Deviations from Standard

none

## 1.7 EUT Modifications 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 |
|---|---|---|---|
| 0 | As supplied by the customer | Not Applicable | Not Applicable |

**Table 5**

## 1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing test laboratory:

| Test Name | Name of Engineer(s) |
|---|---|
| Radiated Emission | M. Steindl |

**Office Address:**
Äußere Frühlingstraße 45
94315 Straubing
Germany

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# 2 Test Details

## 2.1 Radiated Emissions

### 2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.205, 15.209, 15.247(d)
ISED RSS-247, Clause 5.5
ISED RSS-Gen, Clauses 8.9 and 8.10

### 2.1.2 Equipment under Test and Modification State

MBAC BM V001; S/N XD11500107; Modification State 0

### 2.1.3 Date of Test

2022-03-21

### 2.1.4 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 18 °C |
| Relative Humidity | 29 % |

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### 2.1.5 Specification Limits

In any 100 kHz bandwidth outside the frequency band in which the device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either conducted or radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits is not required.
In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

| *General radiated emission limits:* | | | | | |
|---|---|---|---|---|---|
| *Frequency Range (MHz)* | *Test distance (m)* | *Field strength* | | *Field strength* | |
| | | *(µA/m)* | *(dBµA/m)* | *(µV/m)* | *(dBµV/m)* |
| 0.009 – 0.49 | 300 | 6.37 / *f* | 20*lg(6.37 / *f*) | 2400 / *f* | 20*lg(2400 / *f*) |
| 0.49 – 1.705 | 30 | 63.7 / *f* | 20*lg(63.7 / *f*) | 24000 / *f* | 20*lg(24000 / *f*) |
| 1.705 - 30 | 30 | 0.08 | 20*lg(0.08 / *f*) | 30 | 20*lg(30 / *f*) |
| 30 – 88 | 3 | --- | --- | 100 | 40 |
| 88 – 216 | 3 | -- | --- | 150 | 43.5 |
| 126 – 960 | 3 | -- | --- | 200 | 46 |
| above 960 | 3 | -- | --- | 500 | 54 |
| Note 1: *f* in kHz | | | | | |

**Table 6 General radiated emission limits**

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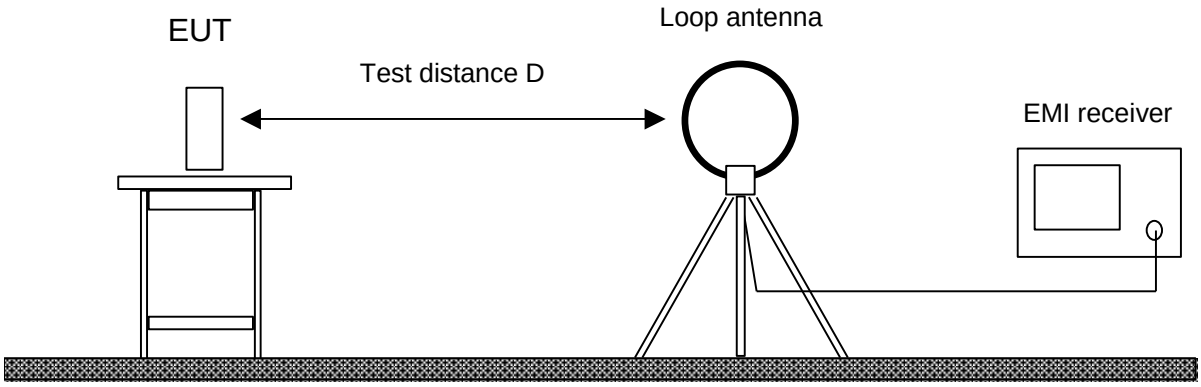
## 2.1.6 Test Method

The test was performed according to ANSI C63.10, sections 11.11 and 11.12

Prescans are performed in six positions of the EUT to get the full spectrum of emission caused by the EUT with the measuring antenna raised and lowered from 1 m to 4 m with vertical and horizontal polarisation to find the combination of table position, antenna height and antenna polarisation for the maximum emission levels.
Data reduction is applied to these results to select those levels having less margin than 10 dB or exceeding the limit using subranges and limited number of maximums.
Further maximisation for adjusting the maximum position is following.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

### *2.1.6.1 Frequency range 9 kHz – 30 MHz*




The EUT was placed on a non-conductive table, 0.8 m above the ground.
Radiated emissions in the frequency 9 kHz – 30 MHz is measured within a semi-anechoic room with an active loop antenna with the measurement detector set to peak. In addition in the frequency range 9 kHz to 490 kHz also an average detector was used. The measurement bandwidth of the receiver was set to 300 Hz in the frequency range 9 kHz to 150 kHz and 10 kHz in the frequency range 150 kHz to 30 MHz. Prescans were performed in six positions of the EUT.
For final measurements the detector was set to CISPR quasi-peak and in addition to CISPR average in the frequency range 9 kHz to 490 kHz with a resolution bandwidth 200 Hz in the frequency range 9 kHz to 150 kHz and 9 kHz in the frequency range 150 kHz to 30 MHz. Final tests were performed immediately after a final frequency and zoom (for drifting disturbances) and maximum adjustment.

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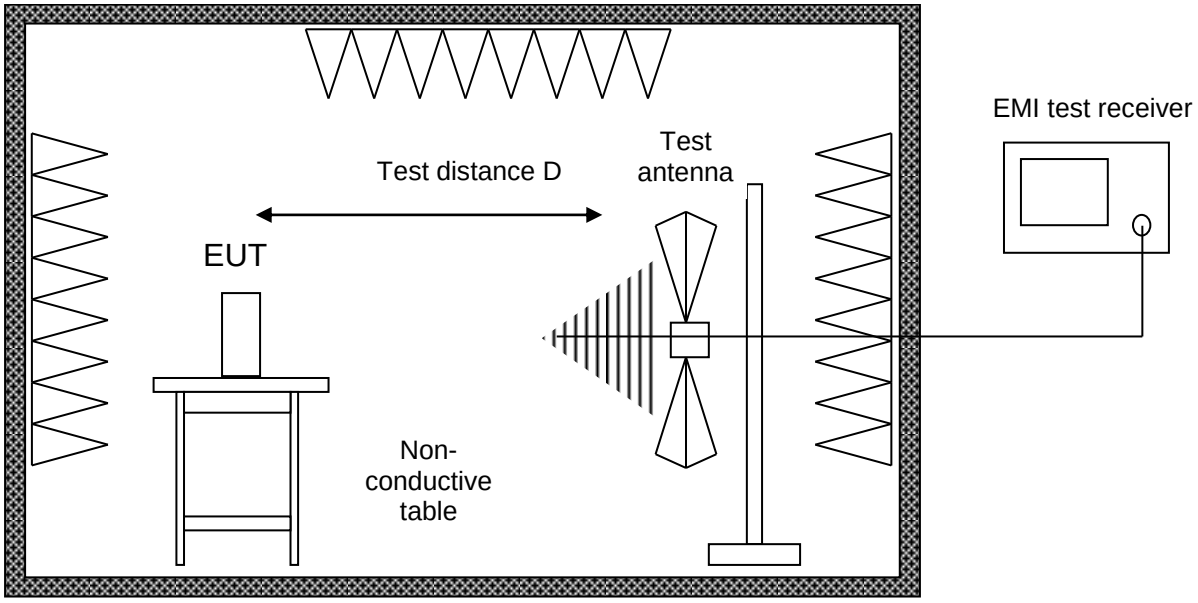
### *2.1.6.2 Frequency range 30 MHz – 1 GHz*




Alternate test site (semi anechoic room)

The EUT was placed on a non-conductive table, 0.8 m above the ground plane
Radiated emissions in the frequency range 30 MHz – 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4. for alternative test sites. A linear polarised logarithmic periodic antenna combined with a 4:1 broadband dipole (“Trilog broadband antenna”) is used.
For prescan tests the test receiver is set to peak-detector with a bandwidth of 120 kHz.
With the measurement bandwidth of the test receiver set to 120 kHz CISPR quasi-peak detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

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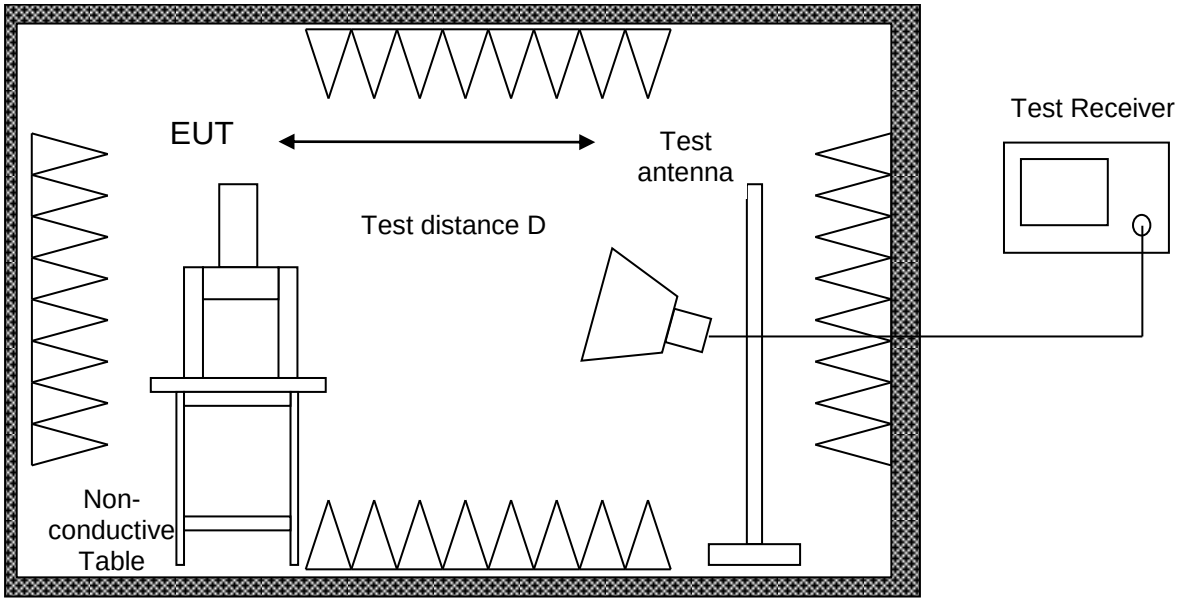
### *2.1.6.3 Frequency range above 1 GHz*




Fully anechoic room

The EUT was placed on a non-conductive table, 1.5 m above the ground plane
Radiated emission tests above 1 GHz are performed in a fully anechoic room with the $S_{VSWR}$ requirements of ANSI C63.4. Measurements are performed both in the horizontal and vertical planes of polarisation using a test receiver with the detector function set to peak and average and the resolution bandwidth set to 1 MHz. Testing above 1 GHz is performed with horn antennas with the EUT in boresight of the antenna.
For prescan tests the test receiver is set to peak- and average-detector with a bandwidth of 1 MHz. With the measurement bandwidth of the test receiver set to 1 MHz and peak- and CISPR average-detector is selected for final measurements following immediately after a final frequency zoom (for drifting disturbances) and maximum adjustment.

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## 2.1.7 Test Results

| *Frequency range* | *Limit applied* | *Test distance* |
|---|---|---|
| 9 kHz – 30 MHz | 15.209 | 3 m |
| 30 MHz – 1 GHz | 15.209, 15.247 | 3 m |
| 1 GHz – 10 GHz | 15.209, 15.247 | 3 m |
| 18 GHz – 18 GHz | 15.209, 15.247 | 1 m |
| 18 GHz – 25 GHz | 15.209, 15.247 | 1 m |

**Table 7**

**Sample calculation:**

Final Value (dBµV/m) = Reading Value (dBµV) + (Cable attenuation (dB) + Antenna Transducer (dB(1/m)))

**Sumary:**

| *Frequency MHz* | *Max-Peak dBµV/m* | *CAver-age dBµV/m* | *Limit dBµV/m* | *Mar-gin dB* | *Meas. Time ms* | *Band-width kHz* | *Height cm* | *Pol* | *Azi-muth deg* | *Corr. dB/m* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1742.500000 | 44.34 | | 74.71 | 30.37 | 1000.0 | 1000.000 | 125.0 | V | -60.0 | 30.9 |
| 2401.750000 | 94.71 | | * | | 1000.0 | 1000.000 | 175.0 | H | -90.0 | 34.0 |
| 3976.750000 | 54.57 | | 73.98 | 19.41 | 1000.0 | 1000.000 | 375.0 | V | -91.0 | 39.6 |
| 3976.750000 | | 39.95 | 53.98 | 20.05 | 1000.0 | 1000.000 | 375.0 | V | -91.0 | 39.6 |
| 4804.250000 | 59.98 | | 73.98 | 14.00 | 1000.0 | 1000.000 | 100.0 | V | 180.0 | 41.5 |
| 4804.250000 | | 46.40 | 53.98 | 13.60 | 1000.0 | 1000.000 | 100.0 | V | 180.0 | 41.5 |
| 9892.000000 | 62.64 | | 74.71 | 12.07 | 1000.0 | 1000.000 | 100.0 | V | -18.0 | 48.2 |
| 9960.250000 | 63.21 | | 74.71 | 11.5 | 1000.0 | 1000.000 | 211.0 | H | -42.0 | 48.2 |

*: Carrier emission

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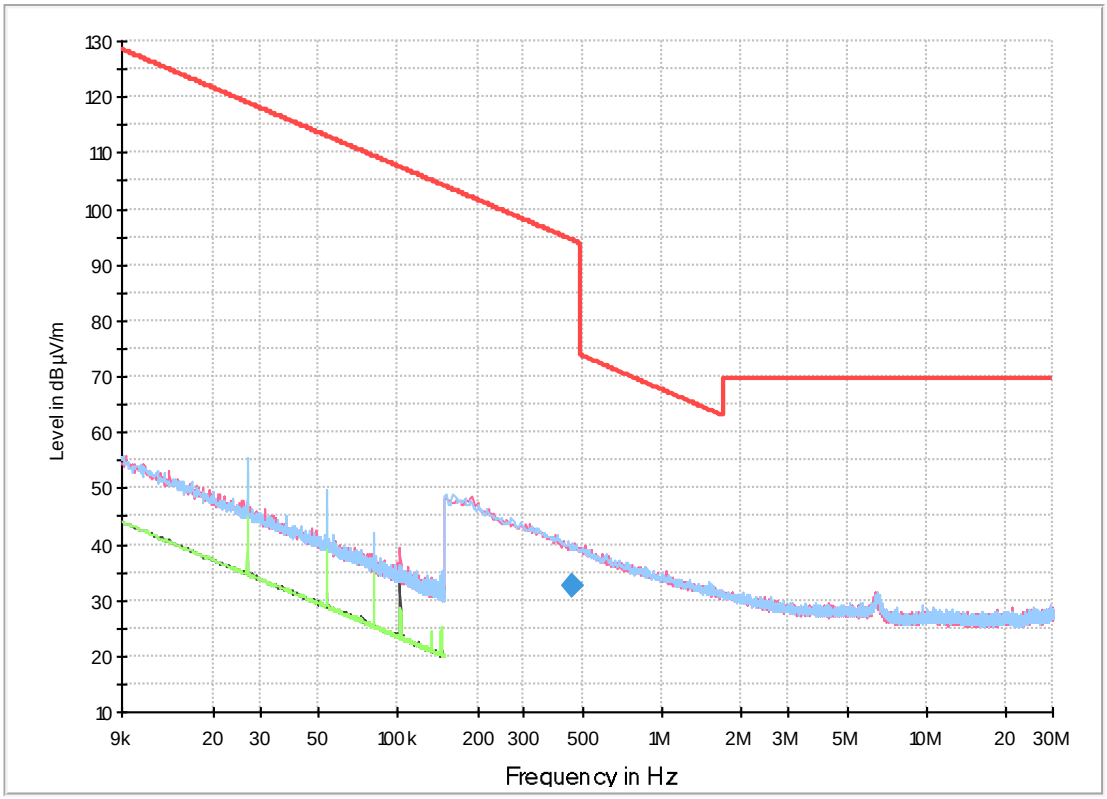
**Frequency range 9 kHz – 30 MHz:**




| *Frequency MHz* | *QuasiPeak dBµV/m* | *CAverage dBµV/m* | *Limit dBµV/m* | *Margin dB* | *Meas. Time ms* | *Bandwidth kHz* | *Height cm* | *Pol* | *Azimuth deg* | *Corr. dB/m* |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.453750 | 32.51 | | 94.47 | 61.96 | 1000.0 | 9.000 | 100.0 | V | 127.0 | 19.2 |

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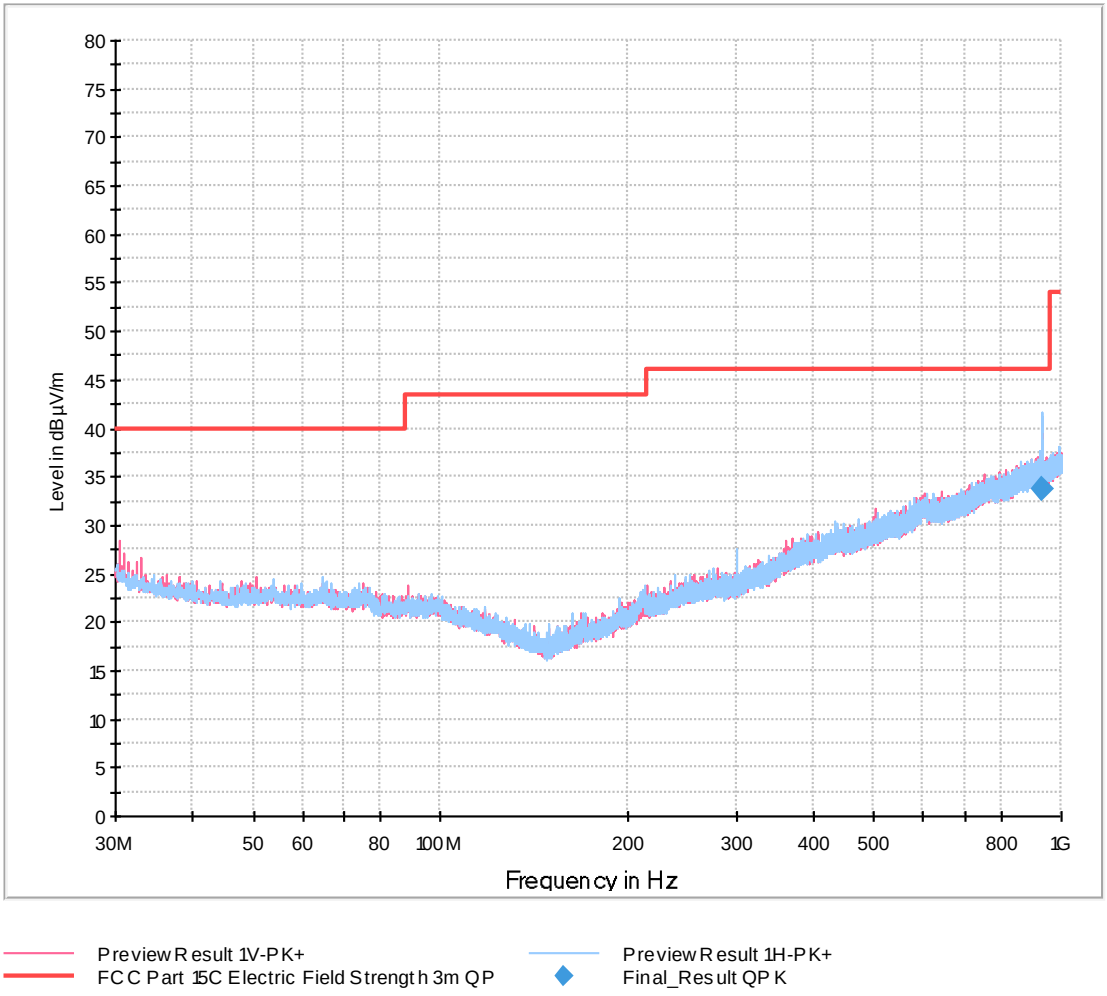
**Frequency range 30 MHz – 1 GHz:**




| Frequency MHz | Quasi-Peak dBµV/m | Limit dBµV/m | Margin dB | Meas. Time ms | Bandwidth kHz | Height cm | Pol | Azi-muth deg | Corr. dB/m |
|---|---|---|---|---|---|---|---|---|---|
| 933.360000 | 33.64 | 46.02 | 12.38 | 1000.0 | 120.000 | 225.0 | H | -35.0 | 31.8 |

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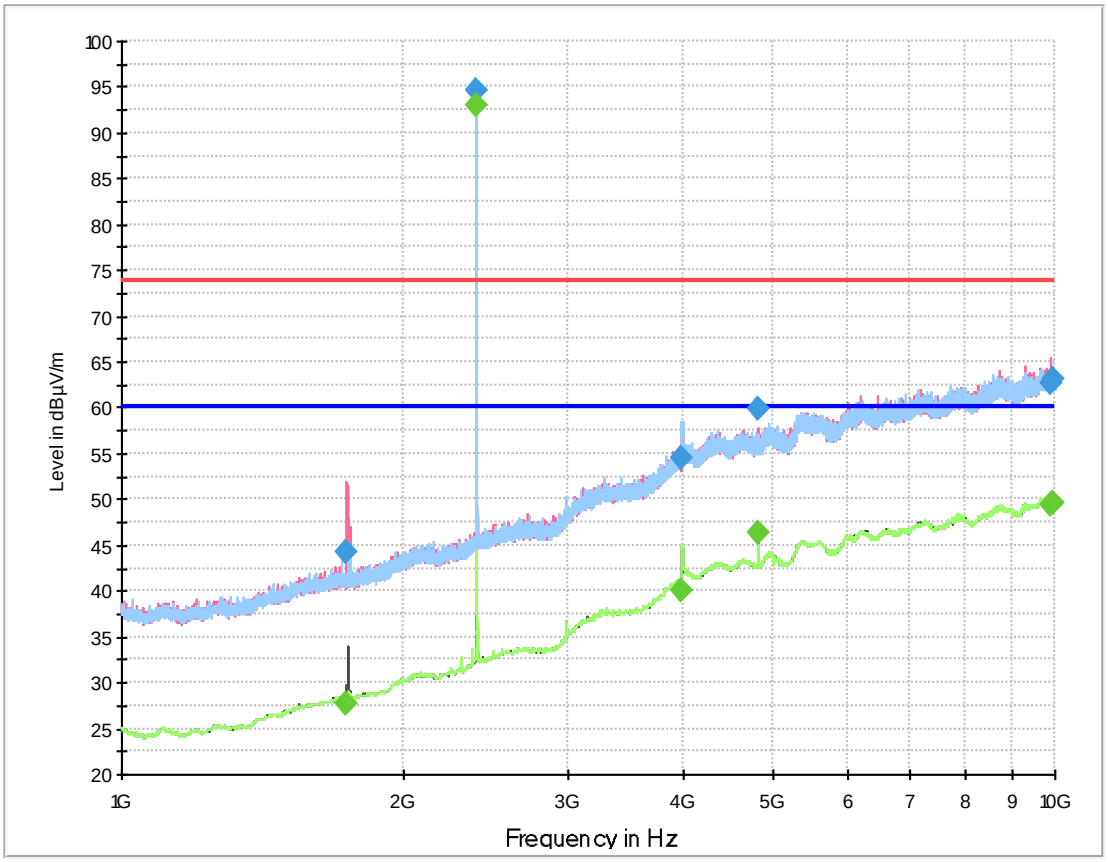
**Frequency range 1 GHz – 10 GHz:**




| *Frequency MHz* | *Max-Peak dBµV/m* | *CAver-age dBµV/m* | *Limit dBµV/m* | *Mar-gin dB* | *Meas. Time ms* | *Band-width kHz* | *Height cm* | *Pol* | *Azi-muth deg* | *Corr. dB/m* |
|---|---|---|---|---|---|---|---|---|---|---|
| 1742.500000 | | 27.79 | 60.00 | 32.21 | 1000.0 | 1000.000 | 125.0 | V | -60.0 | 30.9 |
| 1742.500000 | 44.34 | | 73.98 | 29.64 | 1000.0 | 1000.000 | 125.0 | V | -60.0 | 30.9 |
| 2401.750000 | | 92.97 | * | | 1000.0 | 1000.000 | 175.0 | H | -90.0 | 34.0 |
| 2401.750000 | 94.71 | | * | | 1000.0 | 1000.000 | 175.0 | H | -90.0 | 34.0 |
| 3976.750000 | 54.57 | | 73.98 | 19.41 | 1000.0 | 1000.000 | 375.0 | V | -91.0 | 39.6 |
| 3976.750000 | | 39.95 | 60.00 | 20.05 | 1000.0 | 1000.000 | 375.0 | V | -91.0 | 39.6 |
| 4804.250000 | 59.98 | | 73.98 | 14.00 | 1000.0 | 1000.000 | 100.0 | V | 180.0 | 41.5 |
| 4804.250000 | | 46.40 | 60.00 | 13.60 | 1000.0 | 1000.000 | 100.0 | V | 180.0 | 41.5 |
| 9892.000000 | 62.64 | | 73.98 | 11.34 | 1000.0 | 1000.000 | 100.0 | V | -18.0 | 48.2 |
| 9892.000000 | | 49.37 | 60.00 | 10.63 | 1000.0 | 1000.000 | 100.0 | V | -18.0 | 48.2 |
| 9960.250000 | 63.21 | | 73.98 | 10.76 | 1000.0 | 1000.000 | 211.0 | H | -42.0 | 48.2 |
| 9960.250000 | | 49.53 | 60.00 | 10.47 | 1000.0 | 1000.000 | 211.0 | H | -42.0 | 48.2 |

*: Carrier emission, not evaluated as spurious

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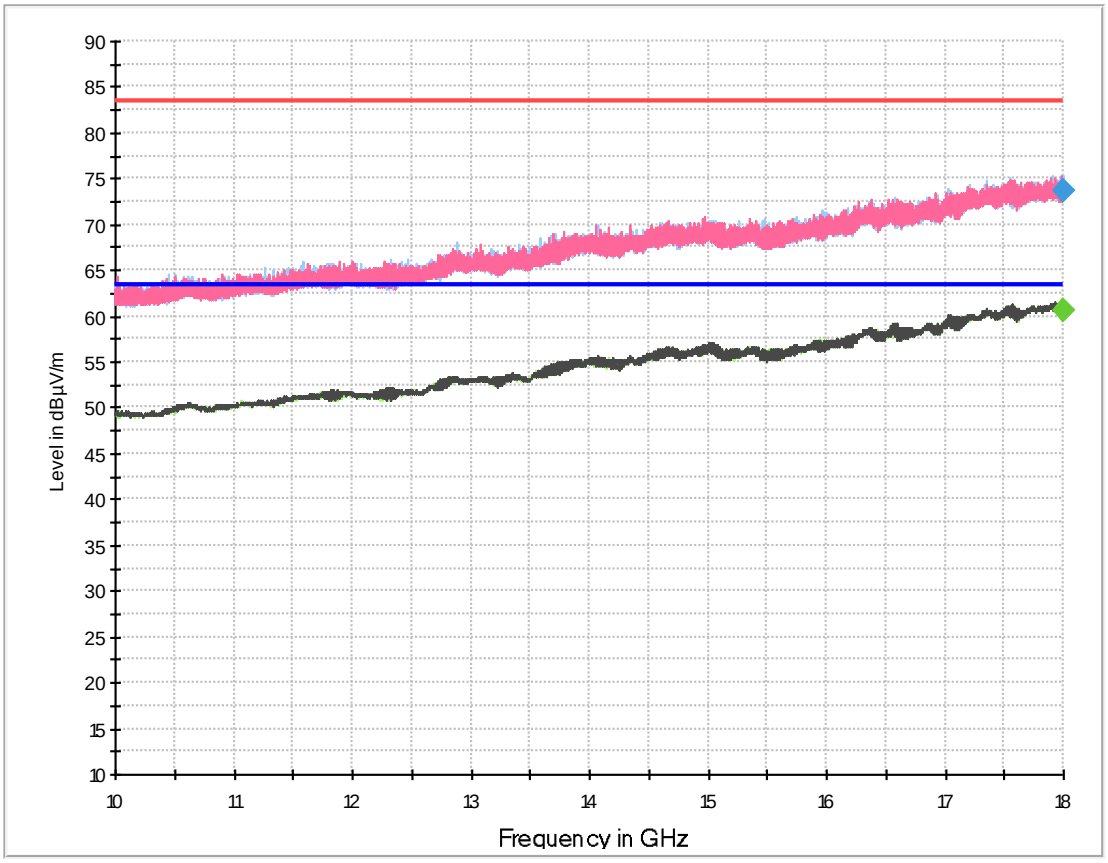
**Frequency range 10 GHz – 18 GHz:**




| *Frequency MHz* | *Max-Peak dBµV/m* | *CAver-age dBµV/m* | *Limit dBµV/m* | *Mar-gin dB* | *Meas. Time ms* | *Band-width kHz* | *Height cm* | *Pol* | *Azi-muth deg* | *Corr. dB/m* |
|---|---|---|---|---|---|---|---|---|---|---|
| 17999.000000 | | 60.62 | 63.50 | 2.88 | 1000.0 | 1000.000 | 225.0 | H | 191.0 | 59.3 |
| 17999.000000 | 73.64 | | 83.50 | 9.86 | 1000.0 | 1000.000 | 225.0 | H | 191.0 | 59.3 |

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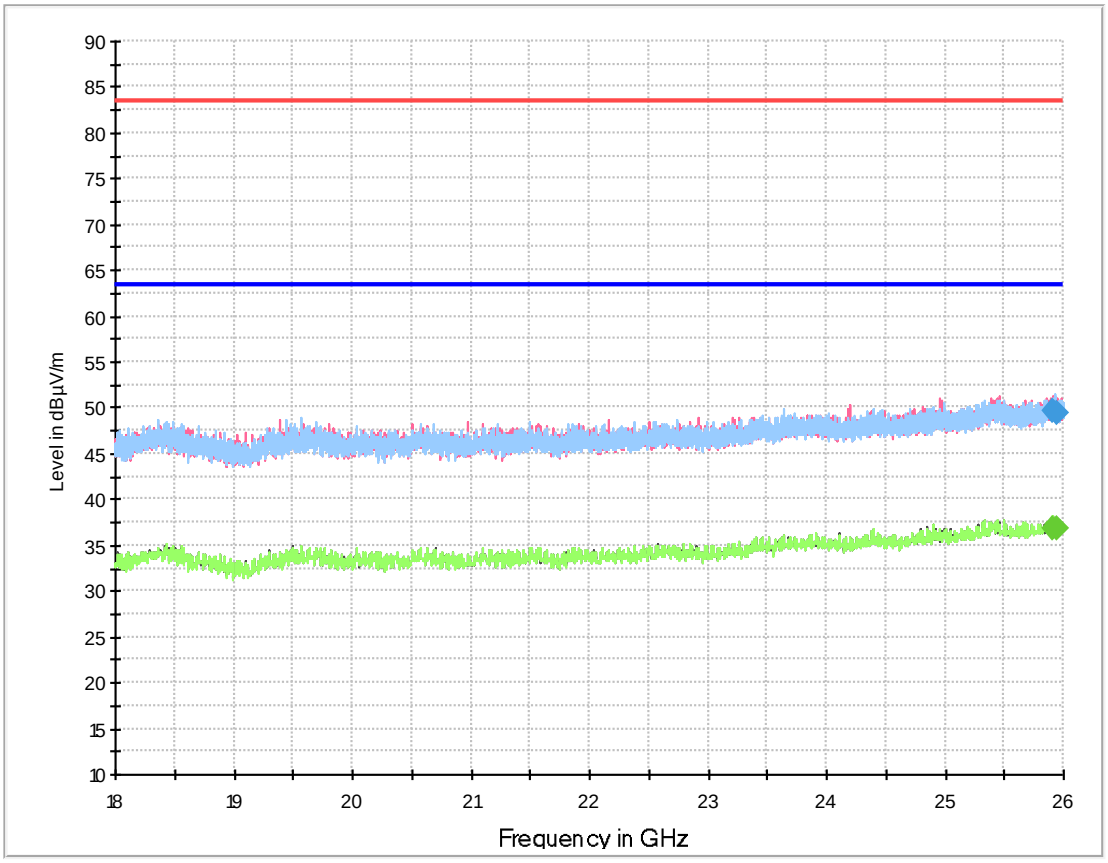
**Frequency range 18 GHz – 26 GHz:**




| *Frequency MHz* | *Max-Peak dBµV/m* | *CAver-age dBµV/m* | *Limit dBµV/m* | *Mar-gin dB* | *Meas. Time ms* | *Band-width kHz* | *Height cm* | *Pol* | *Azi-muth deg* | *Corr. dB/m* |
|---|---|---|---|---|---|---|---|---|---|---|
| 25908.000000 | | 36.73 | 63.50 | 26.77 | 1000.0 | 1000.000 | 138.0 | H | -87.0 | 31.1 |
| 25908.000000 | 49.76 | | 83.50 | 33.74 | 1000.0 | 1000.000 | 138.0 | H | -87.0 | 31.1 |
| 25938.750000 | | 36.76 | 63.50 | 26.74 | 1000.0 | 1000.000 | 175.0 | H | -18.0 | 31.0 |
| 25938.750000 | 49.41 | | 83.50 | 34.09 | 1000.0 | 1000.000 | 175.0 | H | -18.0 | 31.0 |

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### 2.1.8 Test Location and Test Equipment

The test was carried out in semi anechoic room, No. 11

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| EMI test receiver | Rohde & Schwarz | ESW44 | 39897 | 12 | 2022-04-30 |
| Loop antenna | Schwarzbeck | FMZB 1519B | 44334 | 36 | 2023-01-31 |
| TRILOG broadband antenna | Schwarzbeck | VULB9164 | 19918 | 36 | 2022-09-30 |
| Fixed attenuator | Mini-Circuits | BW-S6W2 | 19713 | 36 | 2022-09-30 |
| Double ridged horn antenna | Rohde & Schwarz | HF907 | 40089 | 24 | 2023-02-28 |
| Horn antenna with preamplifier | Rohde & Schwarz | LB-180400H-KF + TS-LNA1840 | 43661 | 24 | 2022-12-31 |
| EMC measurement software | Rohde & Schwarz | EMC32 Emission K11 – V10.60.20 | 42986 | --- | |
| Semi anechoic room | Frankonia | Cabin No. 11 | 42961 | --- | |

**Table 8**

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# 3 Measurement Uncertainty

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

The measurement uncertainty in the laboratory is less than or equal to the maximum measurement uncertainty according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 ($U_{CISPR}$). This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

| *Radio Interference Emission Testing* | | |
|---|---|---|
| *Test Name* | *kp* | *Expanded Uncertainty* |
| Conducted Voltage Emission | | |
| 9 kHz to 150 kHz (50Ω/50µH AMN) | 2 | ± 3.8 dB |
| 150 kHz to 30 MHz (50Ω/50µH AMN) | 2 | ± 3.4 dB |
| 100 kHz to 200 MHz (50Ω/5µH AMN) | 2 | ± 3.6 dB |
| Discontinuous Conducted Emission | | |
| 9 kHz to 150 kHz (50Ω/50µH AMN) | 2 | ± 3.8 dB |
| 150 kHz to 30 MHz (50Ω/50µH AMN) | 2 | ± 3.4 dB |
| Conducted Current Emission | | |
| 9 kHz to 200 MHz | 2 | ± 3.5 dB |
| Magnetic Fieldstrength | | |
| 9 kHz to 30 MHz (with loop antenna) | 2 | ± 3.9 dB |
| 9 kHz to 30 MHz (large-loop antenna 2 m) | 2 | ± 3.5 dB |
| Radiated Emission | | |
| 30 MHz to 300 MHz | 2 | ± 4.9 dB |
| 300 MHz to 1 GHz | 2 | ± 5.0 dB |
| 1 GHz to 6 GHz | 2 | ± 4.6 dB |
| Test distance 10 m | | |
| 30 MHz to 300 MHz | 2 | ± 4.9 dB |
| 300 MHz to 1 GHz | 2 | ± 4.9 dB |
| The expanded uncertainty reported according to to CISPR16-4-2: 2011 + A1 + A2 + Cor1 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45% | | |

**Table 9 Measurement uncertainty based on CISPR 16-4-2**

Product Service

| *Radio Interference Emission Testing* | | |
|---|---|---|
| *Test Name* | *kp* | *Expanded Uncertainty* |
| Occupied Bandwdith | 2 | ± 5 % |
| Conducted Power | | |
| 9 kHz ≤ f < 30 MHz | 2 | ± 1.0 dB |
| 30 MHz ≤ f < 1 GHz | 2 | ± 1.5 dB |
| 1 GHz ≤ f ≤ 40 GHz | 2 | ± 2.5 dB |
| 1 MS/s power sensor (TS8997) | 2 | ± 1.5 dB |
| Occupied Bandwidth | 2 | ± 5 % |
| Power Spectral Density | 2 | ± 3.0 dB |
| Radiated Power | | |
| 9 kHz ≤ f < 26.5 GHz | 2 | ± 6.5 dB |
| 26.5 GHz ≤ f < 60 GHz | 2 | ± 8.0 dB |
| 60 GHz ≤ f < 325 GHz | 2 | ± 10 dB |
| Conducted Spurious Emissions | 2 | ± 3.0 dB |
| Radiated Spurious Emissions | 2 | ± 6.0 dB |
| Voltage | | |
| DC | 2 | ± 1.0 % |
| AC | 2 | ± 2.0 % |
| Time (automatic) | 2 | ± 5 % |
| Frequency | 2 | ± $10^{-7}$ |
| The expanded uncertainty reported according to to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45% | | |

**Table 10 Measurement uncertainty based on ETSI TR 100 028**