Report on the FCC and IC Testing of the Kronegger RFID Reader Module Model: Kronegger PuP small RS232 In accordance with FCC 47 CFR Part 15 C and ISED RSS-210 and ISED RSS-Gen

Product Service

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Prepared for: Kronegger GmbH
Parkring 1
8074 Grambach
Austria

COMMERCIAL-IN-CONFIDENCE

FCC ID: ZKCPP9912-2009-5

Date: 2023-12-14
Document Number: TR-713313045-01 | Revision 0

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Martin Steindl	2023-12-14	Skindl Martin SIGN-ID 864601
Authorised Signatory	Matthias Stumpe	2023-12-18	Stump SIGN-ID 865519

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 compilance with with FCC 47 CFR Part 15 C and ISED RSS-210 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	2023-12-14	Skindl Martin SIGN-ID 864602

Laboratory Accreditation	Laboratory recognition	Industry Canada test site registration
DAkkS Reg. No. D-PL-11321-11-02 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 RSS210:2019 and ISED RSSGen:2019

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Product Service

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.

Revision	*Description of changes*	*Date of Issue*
0	First Issue	2014-12-14

Table 1: Report of Modifications

1.2 Introduction

Applicant	Kronegger GmbH Parkring 1 8074 Grambach Austria
Manufacturer	Kronegger GmbH
Model Number(s)	Kronegger PuP small RS232
FCC ID	ZKCPP9912-2009-5
Serial Number(s)	072301991
Version(s)	prod-05.2-01.0 Vers. 4.1
Number of Samples Tested	1
Test Specification(s) / Issue / Date	FCC 47 CFR Part 15 C : 2019 and ISED RSS-210, Issue 10, Amd. 1 : 2019 ISED RSS-Gen, Issue 5, Amd. 1 : 2019
Test Plan/Issue/Date	N/A
Order Number Date	2023102402
Date of Receipt of EUT	2023-12-05
Start of Test	2023-12-13
Finish of Test	2023-12-14
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 and ISED RSS-210 and RSS-Gen is shown below.

Section	*Specification Clause*	*Test Description*	*Result*
2.1	15.203	Antenna requirement	Pass
2.2	15.215(c)	Bandwidth of Signal	Pass
2.3	15.207	Conducted Disturbance at Mains Terminal	Pass
2.4	15.209, 15.225	Radiated Disturbance	Pass
2.5	15.225(e)	Frequency Tolerance	Pass

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

Section	*Specification Clause*	*Test Description*	*Result*
2.3	7.3	Radiated Emissions	Pass
2.4	7.3	AC Power Line Conducted Emissions	Pass
2.5	B.6 b.	Frequency Tolerance	Pass

Table 3: Results according to ISED RSS-210

Section	*Specification Clause*	*Test Description*	*Result*
2.2	6.7	Bandwidth of Signal	Pass
2.4	8.8	AC Power Line Conducted Emissions	Pass
2.3	8.9, 8.10	Radiated Emissions	Pass
2.5	6.11	Frequency Tolerance	Pass

Table 4: Results according to ISED RSS-Gen

1.4 Product Information

1.4.1 Technical Description

The EUT is a RFID reader module

Frequency Band	13.110 – 14.010 MHz
Number of frequency channels:	1
Supply Voltage:	5 V
Supply Frequency:	DC (0 Hz)
Highest clock frequency (non-radio part):	48 MHz

1.4.2 List of Antennas

Manufacturer	*Model*	*Antenna impedance*	*Antenna Type*	*Antenna gain*
Kronegger	N/A	N/A	Integrated loop antenna	N/A

Table 5: List of antennas

1.4.3 EUT Ports / Cables identification

Port	Max Cable Length specified	Usage	Screened
RS-232 with 5 V DC supply	N/A	Signal-Control port	yes

Table 6

1.5 Test Configuration

The EUT was configured as RS-232 interface device of a laptop PC.

1.6 Modes of Operation

Continuous polling mode

Product Service

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 7

1.8 Test Location

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

Test Name	Name of Engineer(s)
Antenna requirement	M. Steindl
Bandwidth of Signal	M. Steindl
Radiated Emission	M. Steindl
Conducted Emission at Mains Terminal	M. Steindl
Frequency Tolerance	M. Steindl

Office Address:
Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Details

2.1 Antenna requirement

2.1.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.203

2.1.2 Equipment under Test and Modification State

Kronegger PuP small RS232; S/N 072301991; Modification State 0

2.1.3 Date of Test

2023-12-14

2.1.4 Specification Limits

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some fields disturbance sensors, or to other intentional radiators which must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits are not exceeded.

2.1.5 Test Results

Antenna connector type:	Integrated antenna
Antenna connector impedance:	N/A

Product Service

2.2 Bandwidth of Signal

2.2.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.215(c)
ISED RSS-Gen, Clause 6.7

2.2.2 Equipment under Test and Modification State

Kronegger PuP small RS232; S/N 072301991; Modification State 0

2.2.3 Date of Test

2023-12-14

2.2.4 Environmental Conditions

Ambient Temperature	24 °C
Relative Humidity	34 %

2.2.5 Specification Limits

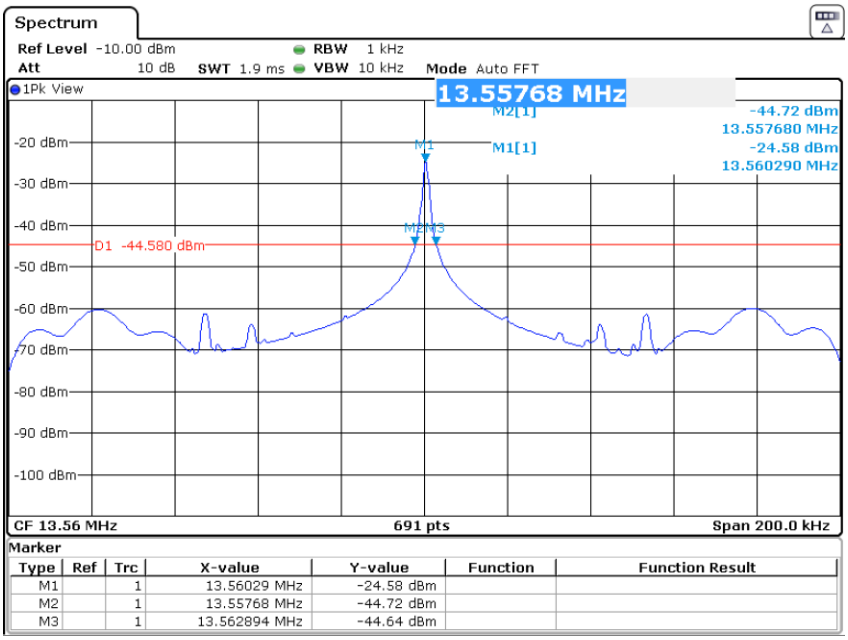
No limitation – Bandwidth noted

2.2.6 Test Method

The test was performed according to ANSI C63.10, clauses 6.9
See section 2.3 of this test report for details.

Product Service

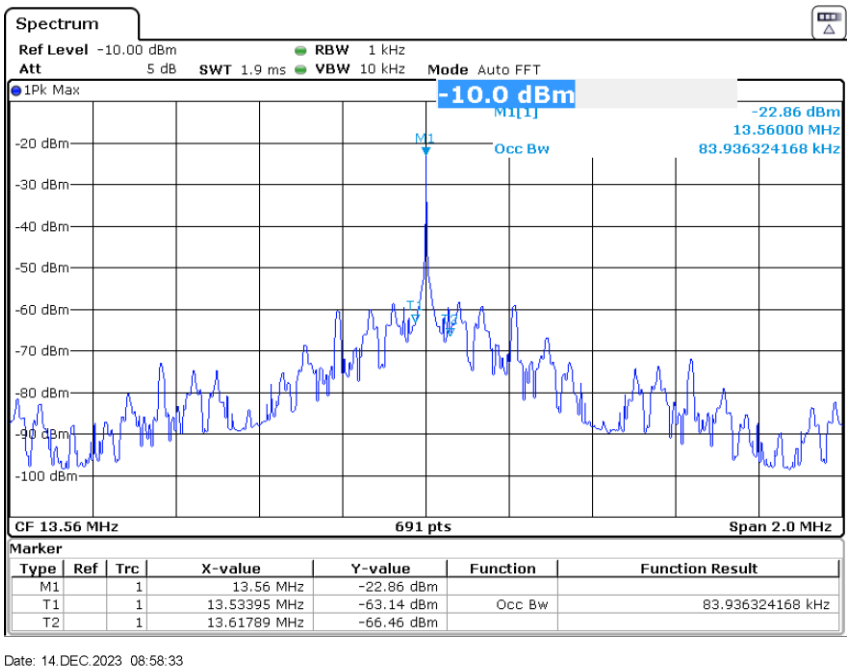
2.2.7 Test Results



Center frequency	*20 dB Bandwidth*
13.56 MHz	5.214 kHz

Table 8: 20 dB bandwidth

Product Service



Centre Frequency	*99% Bandwidth*
13.56 MHz	83.936324168 kHz

Table 9: 99% bandwidth

2.2.8 Test Location and Test Equipment

The test was carried out in radio test laboratory.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Radio and Spectrum Analysator	Rohde & Schwarz	FSV40	20219	24	2024-02-29
Temperature test chamber	Feutron	KPK200-2	19868	36	2024-08-31

Table 10

Product Service

2.3 Radiated Emissions

2.3.1 Specification Reference

FCC 47 CFR Part 15 C, Clauses 15.205, 15.209 and 15.225
ISED RSS-210, Clause 7.7 and B.6
ISED RSS-Gen, Clauses 8.9 and 8.10

2.3.2 Equipment under Test and Modification State

Kronegger PuP small RS232; S/N 072301991; Modification State 0

2.3.3 Date of Test

2023-12-14

2.3.4 Environmental Conditions

Ambient Temperature	24 °C
Relative Humidity	34 %

Product Service

2.3.5 Specification Limits

Radiated emission limits:					
Frequency Range	*Test distance*	*Field strength*		*Field strength*	
(MHz)	*(m)*	*(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 – 13.110	30	0.08	-21.94	30	29.54
13.110 – 13.410	30	0.283	-11.0	106	40.5
13.410 – 13.553	30	0.891	-1.0	334	50.5
13.553 – 13.567	30	42.26	32.5	15848	84
13.567 – 13.710	30	0.891	-1.0	334	50.5
13.710 – 14.010	30	0.283	-11.0	106	40.5
14.010 - 30	30	0.08	-21.94	30	29.54
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 11 Radiated emission limits

At frequencies at or above 30 MHz, measurements may be performed at distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 m, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements.

At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempts should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

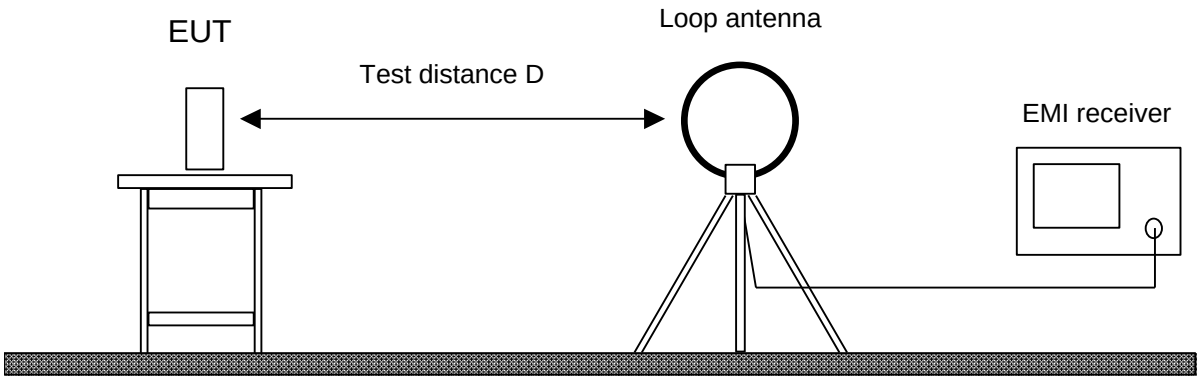
Product Service

2.3.6 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.

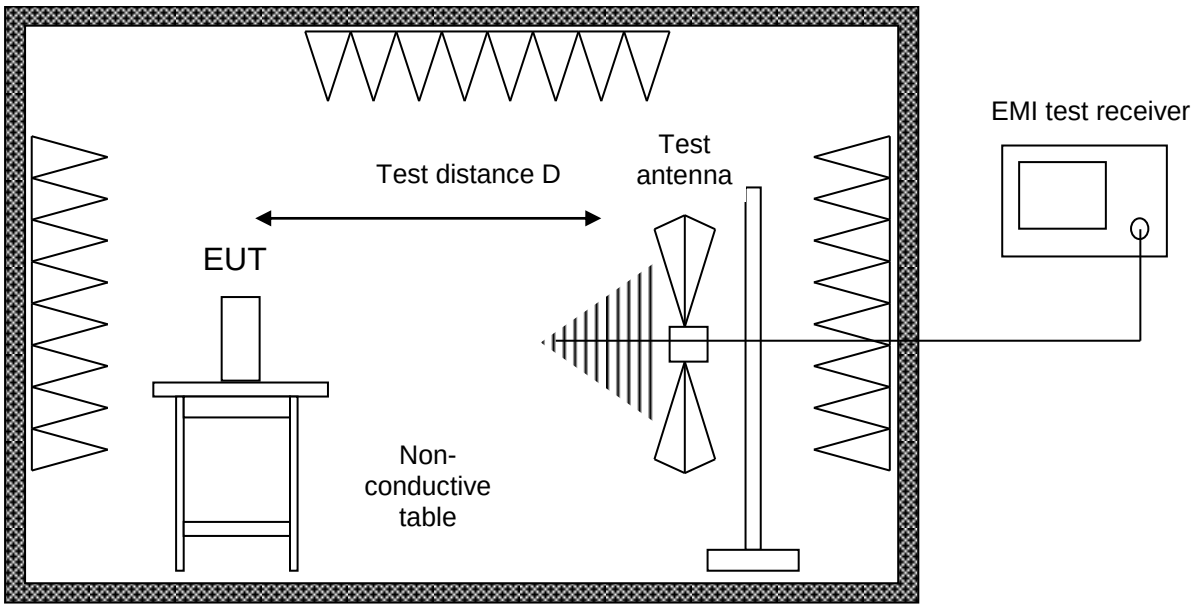
2.3.6.1 Frequency range 9 kHz – 30 MHz



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.

Product Service

2.3.6.2 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.

2.3.7 Test Results

Frequency range	*Limit applied*	*Test distance*
9 kHz – 1 GHz	§ 15.209, § 15.225	3 m

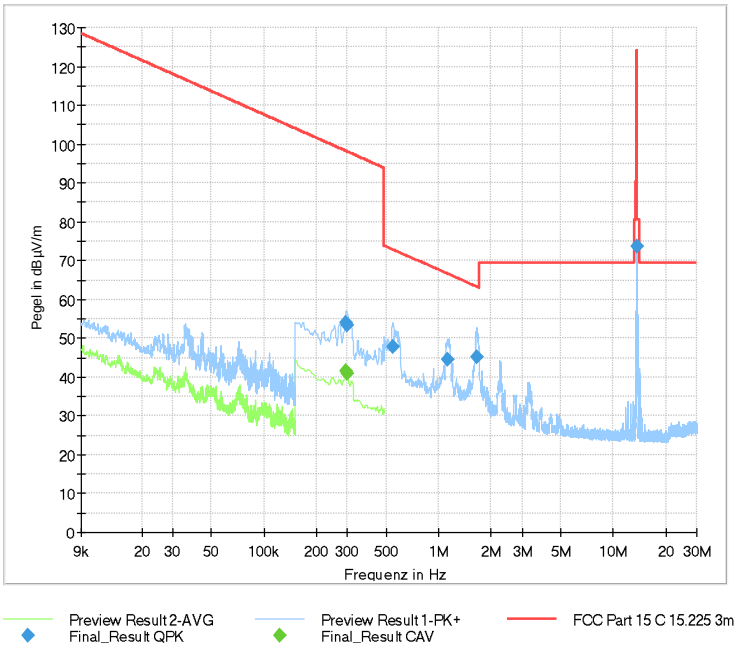
Table 12

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

Additional correction of limit in the frequency range 9 – 490 kHz (300 m to 3 m): +80.0 dB
Additional correction of limit in the frequency range 490 kHz – 30 MHz (30 m to 3 m): +40.0 dB
Additional correction of limit in the frequency ranges above 1 GHz (3 m to 1 m): +9.54 dB

Product Service

Frequency range 9 kHz – 30 MHz:



Extrapolation factor: -40 dB/decade

Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
0.29625	Average	3	300	22.2	20.0	-80.0		-37.8	18.2	56.0
0.29850	Average	3	300	21.6	20.0	-80.0		-38.4	18.1	56.5
0.54850	Quasi-Peak	3	30	28.5	20.0	-40.0		8.5	32.8	24.3
1.12225	Quasi-Peak	3	30	25.3	20.0	-40.0		5.3	26.6	21.3
1.65550	Quasi-Peak	3	30	25.9	20.0	-40.0		5.9	23.2	**17.3**
13.56025	Quasi-Peak	3	30	54.5	20.0	-40.0		34.5	84.0	49.5

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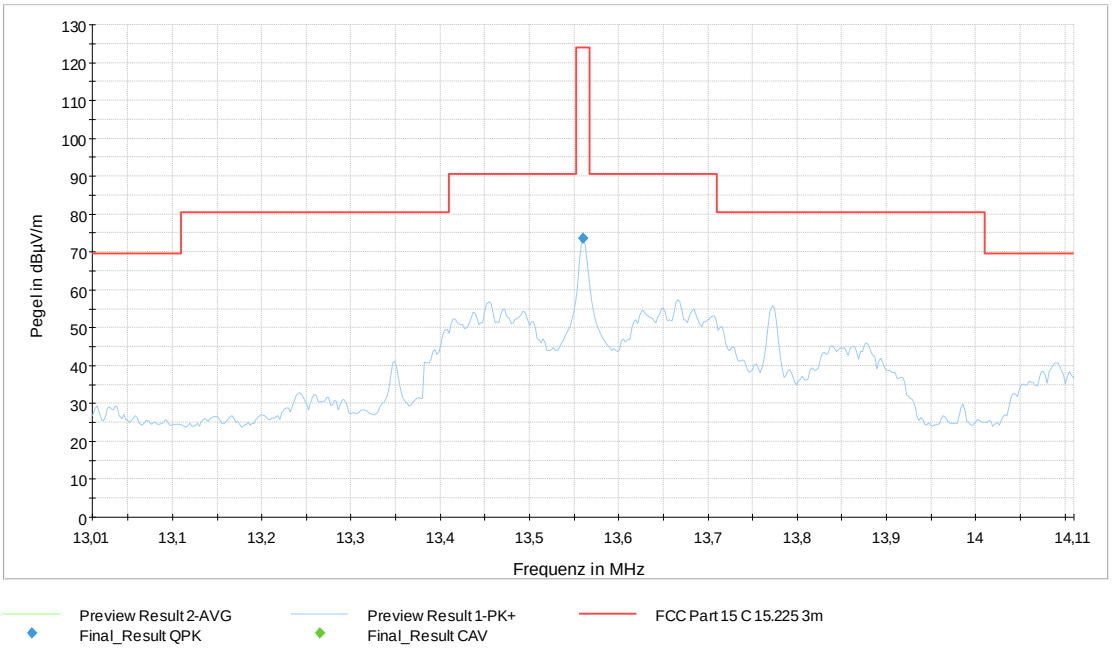
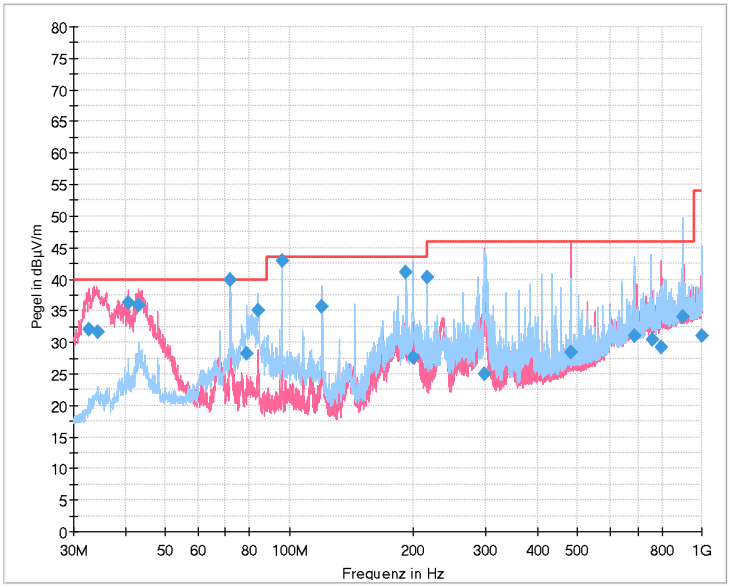
Frequency range 13.01 MHz – 14.11 MHz (Spectrum Mask acc. 15.225(a)-(c)):



Product Service

Frequency range 30 MHz – 1 GHz:



Frequenz MHz	Qua-siPeak dBµV/m	Limit dBµV/m	Margin dB	Messzeit ms	Band-breite kHz	Höhe cm	Pol	Azimut deg	Korr. dB/m
32.640000	31.98	40.00	8.02	1000	120	107.0	V	195.0	15.9
34.290000	31.56	40.00	8.44	1000	120	101.0	V	55.0	16.2
40.680000	36.30	40.00	3.70	1000	120	106.0	V	60.0	18.5
43.230000	35.79	40.00	4.21	1000	120	100.0	V	-109.0	19.2
72.000000	39.87	40.00	0.13	1000	120	294.0	H	-94.0	15.4
79.020000	28.25	40.00	11.75	1000	120	234.0	H	-32.0	13.1
84.000000	35.11	40.00	4.89	1000	120	194.0	H	-50.0	13.8
95.970000	43.00	43.50	0.50	1000	120	234.0	H	-50.0	17.4
119.970000	35.69	43.50	7.81	1000	120	188.0	V	179.0	15.8
191.970000	41.02	43.50	2.48	1000	120	173.0	H	10.0	17.3
199.770000	27.70	43.50	15.80	1000	120	278.0	H	-33.0	18.5
215.970000	40.24	43.50	3.26	1000	120	163.0	H	9.0	18.0
297.630000	24.94	46.02	21.08	1000	120	110.0	V	-62.0	20.2
479.880000	28.38	46.02	17.64	1000	120	134.0	V	180.0	24.3
686.460000	30.97	46.02	15.05	1000	120	150.0	H	-76.0	27.9
755.760000	30.42	46.02	15.60	1000	120	100.0	H	-75.0	28.8
797.130000	29.23	46.02	16.79	1000	120	178.0	V	-130.0	29.1
898.830000	34.01	46.02	12.02	1000	120	270.0	H	-73.0	30.4
999.510000	30.97	53.98	23.01	1000	120	213.0	H	-85.0	31.7

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2.3.8 Test Location and Test Equipment

The test was carried out in semi anechoic room, cabin No. 3

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESU8	19904	12	2024-02-29
Loop antenna	Schwarzbeck	FMZB 1519 B	44334	36	2026-06-30
TRILOG Broadband Antenna	Schwarzbeck	VULB 9162	20116	36	2025-01-31
Fixed attenuator	Aeroflex	Model 6 dB	39625	36	2025-01-31
Semi anechoic room	Frankonia	Cabin No. 3	56311		

Table 13

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2.4 Conducted Emissions on Mains Terminals

2.4.1 Specification Reference

FCC 47 CFR Part 15 C, Clause 15.207
ISED RSS-Gen, Clause 8.8

2.4.2 Equipment under Test and Modification State

Kronegger PuP small RS232; S/N 072301991; Modification State 0

2.4.3 Date of Test

2023-12-14

2.4.4 Environmental Conditions

Ambient Temperature	24 °C
Relative Humidity	34 %

2.4.5 Specification Limits

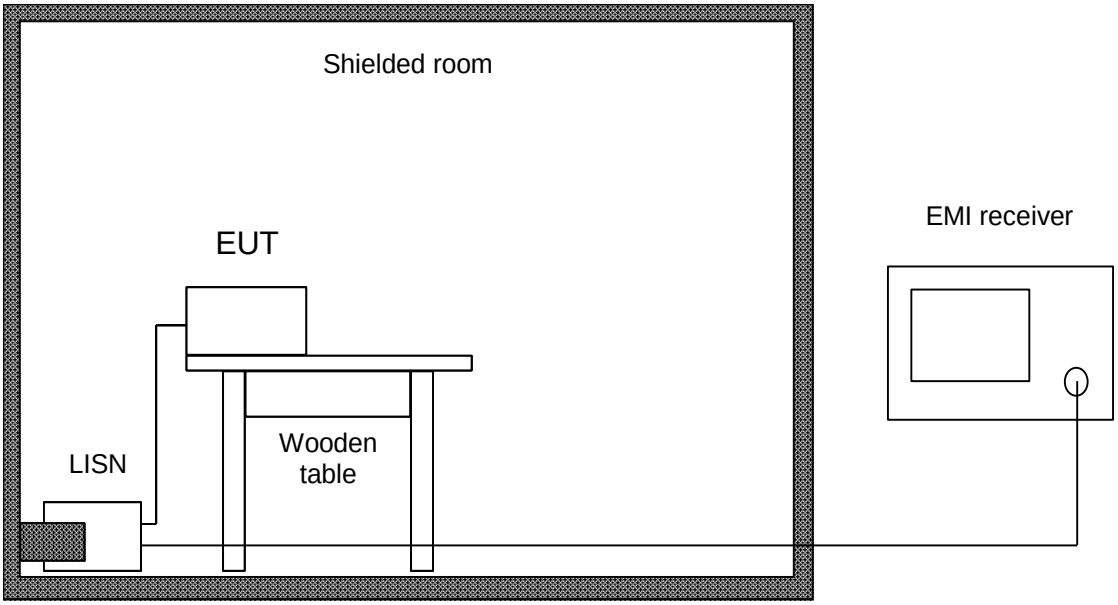
Required Specification Limits			
Line Under Test	*Frequency Range (MHz)*	*Quasi-peak (dBµV)*	*Average (dBµV)*
AC Power Port	0.15 to 0.5	66 to 56*	56 to 46*
	0.5 to 5	56	46
	5 to 30	60	50
Supplementary information: *Decreases with the logarithm of the frequency.			

Table 14 Emission limits

Product Service

2.4.6 Test Method

The test was performed according to ANSI C63.10, section 6.2.



The EUT was placed on a non-conductive table 0.8 m above a reference ground plane and 0.4 m away from a vertical coupling plane
All power was connected to the EUT through an Line Impedance Stabilization Network (LISN). Conducted disturbance voltage measurements on mains lines were made at the output of the LISN. The LISN was placed 0.8 m from the boundary of the EUT and bounded to the reference ground plane. To simplify testing with quasi-peak and linear average (cispr-average) detector the following procedure is used:
First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with the detectors set to peak and average using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with the detectors set to quasi-peak and average. If the average limit is kept with quasi-peak levels measurement with average detector is optional. In cases of emission levels between quasi-peak and average limit an additional measurement with average detector has to be performed.

The test was performed with the internal antenna attached and disconnected.

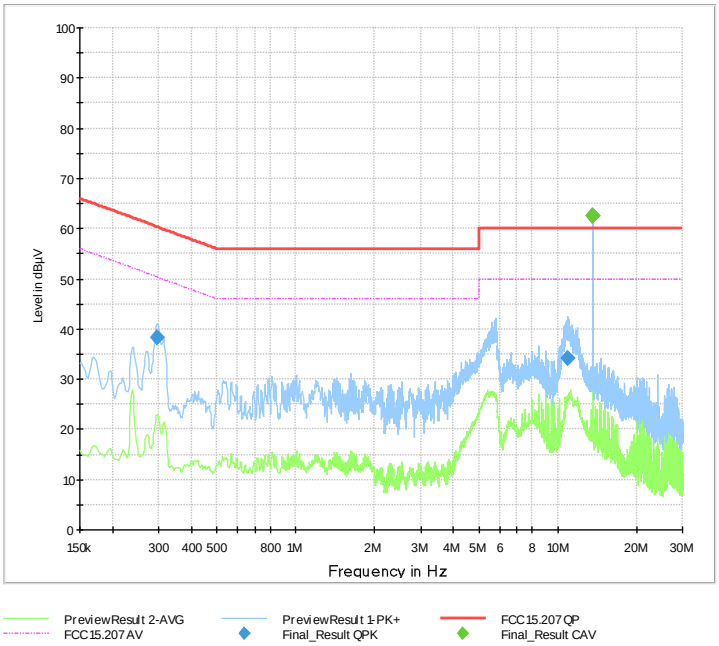
Product Service

2.4.7 Test Results

Sample calculation:

Final Value (dBµV) = Reading Value (dBµV) + (Cable attenuation (dB) + LISN Transducer (dB))

L1, with antenna



Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Corr. dB*
0.296250	38.42		60.35	21.93	1000	9	10.1
10.911750	34.03		60.00	25.97	1000.0	9.000	10.3
13.560000		62.62	50.00	*	1000.0	9.000	10.3
13.560000	62.51		60.00	*	1000.0	9.000	10.3

*: Carrier emission – not evaulated

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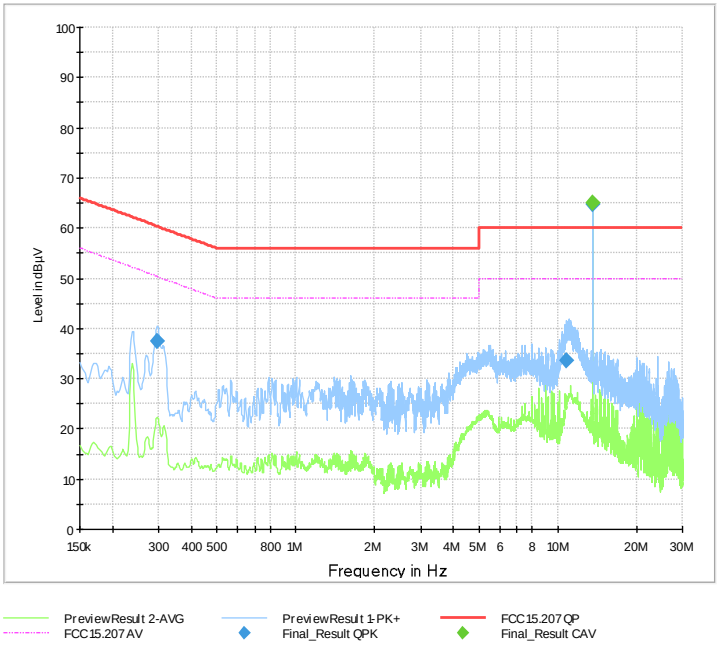
N, with antenna



Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Corr. dB*
0.296250	37.47		60.35	22.88	1000	9	10.1
10.837500	33.68		60.00	26.32	1000	9	10.3
13.560000		65.01	50.00	*	1000	9	10.3
13.560000	64.86		60.00	*	1000	9	10.3

*: Carrier emission – not evaulated

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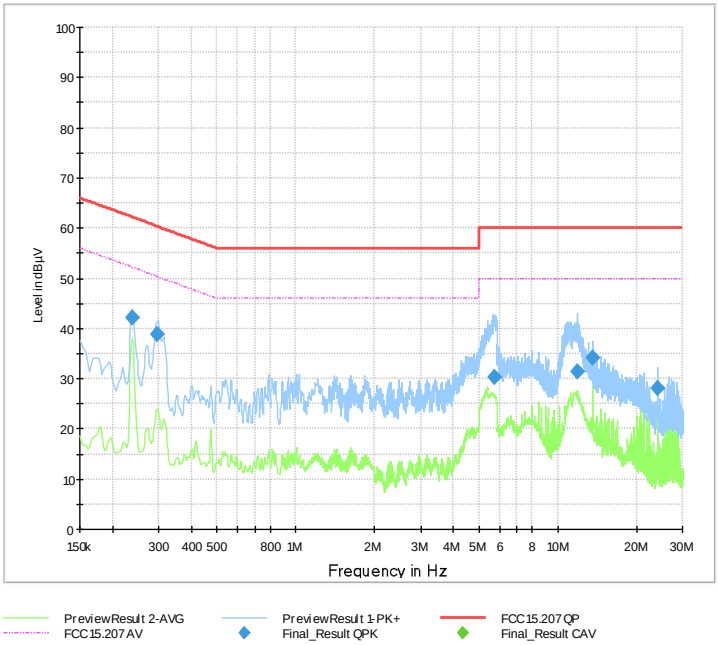
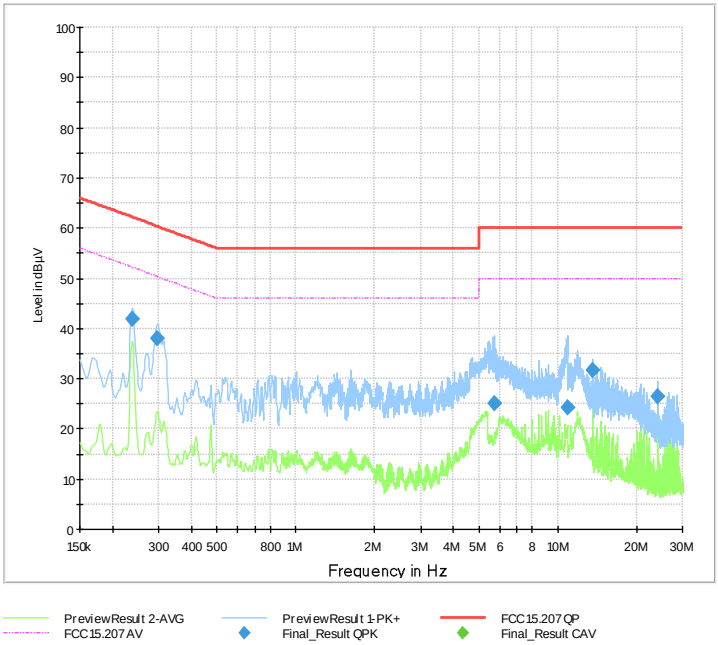
L1, antenna disconnected



Frequency MHz	QuasiPeak dBµV	CAverage dBµV	Limit dBµV	Margin dB	Meas. Time ms	Bandwidth kHz	Corr. dB
0.237750	42.26		62.17	19.92	1000	9	10.1
0.296250	38.85		60.35	21.49	1000	9	10.1
5.750250	30.35		60.00	29.65	1000	9	10.2
11.908500	31.34		60.00	28.66	1000	9	10.3
13.560000	34.21		60.00	25.79	1000	9	10.3
23.995500	28.20		60.00	31.80	1000	9	10.3

Product Service

N, antenna disconnected



Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Corr. dB*
0.237750	41.78		62.17	20.40	1000	9	10.1
0.296250	38.12		60.35	22.23	1000	9	10.1
5.752500	25.02		60.00	34.98	1000	9	10.2
10.893750	24.31		60.00	35.69	1000	9	10.3
13.560000	31.75		60.00	28.25	1000	9	10.3
23.997750	26.31		60.00	33.69	1000	9	10.3

2.4.8 Test Location and Test Equipment

The test was carried out in shielded room, cabin No. 9

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	ESU8	19904	12	2024-02-29
V-network	Rohde & Schwarz	ENV216	39908	12	2024-05-31
V-network	Rohde & Schwarz	ENV216	39910	12	2024-03-31

Table 15

Product Service

2.5 Temperature Stability

2.5.1 Specification Reference

FCC 47 CFR Part 15 E, Clause 15.225(e)
ISSED RSS-210, Clause B.6 b.
ISED RSS-Gen, Clause 6.11

2.5.2 Equipment under Test and Modification State

Kronegger PuP small RS232; S/N 072301991; Modification State 0

2.5.3 Date of Test

2022-12-14

2.5.4 Environmental Conditions

Ambient Temperature	23 °C
Relative Humidity	35 %

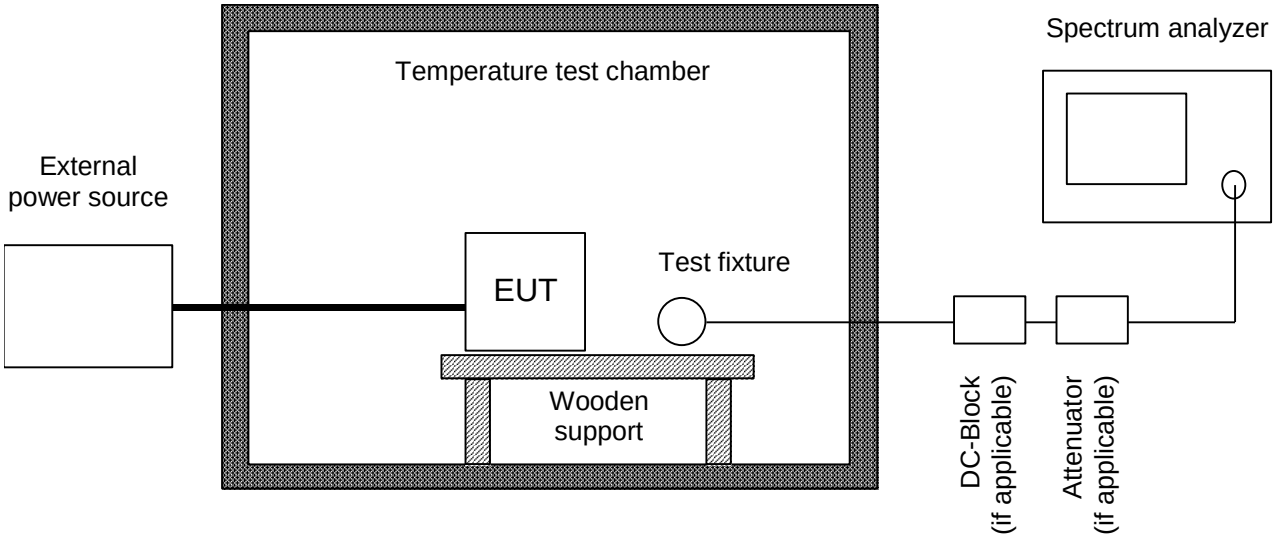
2.5.5 Specification Limits

The frequency tolerance of the carrier signal shall be maintained within ±0.01 % of the operating frequency over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rated supply voltage at a temperature of 20 “C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Product Service

2.5.6 Test Method

The test was performed according to ANSI C63.10, section 6.8.



The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85 % to 115 % of the rates supply voltage at a temperature of 20 °C. Temperature and voltage range may vary if the manufacturer states another temperature or voltage range.
If the EUT provides an antenna connector the spectrum analyzer is connected to this port. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as a DC block and appropriate (50 Ω) attenuators. In case where the EUT does not provide an antenna connector or a test fixture is used.
For battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage can be used and is at least set to:

- The maximum battery voltage as delivered by a new battery or 115 % of the battery nominal voltage;
- The battery nominal voltage
- 85 % of the battery nominal voltage
- The battery operating end point voltage which shall be specified by the equipment manufacturer.

The EUT is operating providing an unmodulated carrier for frequency error tests. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is used to maximize the accuracy of the measured frequency tolerance.
If an unmodulated carrier is not available a significant and stable point of the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1 % of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance is larger than the uncertainty of the measured frequency tolerance.

Product Service

2.5.7 Test Results

Temperature	*Supply Voltage*	*Frequency (MHz)*	*Frequency drift (Hz)*	*Frequency drift (ppm)*
-20	5.0	13.5602687	-38.3	-2.824
-10	5.0	13.5603013	-5.7	-0.420
0	5.0	13.5603132	6.2	0.457
10	5.0	13.5603154	8.4	0.619
20	4.5	13.5603070	0.0	0.000
20	5.0	13.5603070	0.0	0.000
20	5.5	13.5603079	0.9	0.066
30	5.0	13.5602949	-12.1	-0.892
40	5.0	13.5602899	-17.1	-1.261
50	5.0	13.5602929	-14.1	-1.040

Table 16

2.5.8 Test Location and Test Equipment

The test was carried out in radio test laboratory.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Radio and Spectrum Analysator	Rohde & Schwarz	FSV40	20219	24	2024-02-29
Temperature test chamber	Feutron	KPK200-2	19868	36	2024-08-31

Table 17

Product Service

3 Measurement Uncertainty

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

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 18 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		
25 MHz – 6 GHz	1.96	±4.4 dB
1 GHz – 18 GHz	1.96	±4.7 dB
18 GHz – 40 GHz	1.96	±4.9 dB
40 GHz – 325 GHz	1.96	±6.1 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 19 Measurement uncertainty based on ETSI TR 100 028

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}) and as specified in the test report below. This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

Test Name	*Expanded Uncertainty*
Occupied Bandwidth	±5 %
Conducted Power	
9 kHz ≤ f < 30 MHz	±1.0 dB
30 MHz ≤ f < 1 GHz	±1.5 dB
1 GHz ≤ f ≤ 40 GHz	±2.5 dB
1 MS/s power sensor (2.4 / 5 GHz band)	±1.5 dB
Power Spectral Density	±3.0 dB
Radiated Power	
25 MHz – 26.5 GHz	±6.0 dB
26.5 GHz – 66 GHz	±8.0 dB
40 GHz – 325 GHz	±10.0 dB
Conducted Spurious Emissions	±3.0 dB
Radiated Field Strength 9 kHz – 40 GHz	±6.0 dB
Voltage	
DC	± 1.0 %
AC	± 2.0 %
Time (automatic)	± 5 %
Frequency	± 10^{-7}

Table 20 Decision Rule: Maximum allowed measurement uncertainty