Report on the FCC and IC Testing of the BALTECH AG Model: 10115-301 In accordance with FCC 47 CFR Part 15C and Industry Canada RSS-210 and Industry Canada RSS-GEN

Product Service

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Prepared for: BALTECH AG
Lilienthalstr. 27
85399 Hallbergmoos - Germany

FCC ID: OKY10115301A06A
IC: 7657A-10115301

COMMERCIAL-IN-CONFIDENCE

Date: 2019-10-17
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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Alex Fink	2019-10-17	
Authorised Signatory	Matthias Stumpe	2019-10-17	

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

ENGINEERING STATEMENT
The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and Industry Canada RSS-210 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Alex Fink	2019-10-17	

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

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN:2016, Issue 09 (08-2016) and Issue 05 (03-2019).

Trade Register Munich
HRB 85742
VAT ID No. DE129484267
Information pursuant to Section 2(1)
DL-InfoV (Germany) at
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94315 Straubing
Germany

Product Service

Contents

Product Service

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	2019-09-11
2	Number of samples tested corrected from “2” to “1” Serial number of EUR corrected from “18032457” to “18032456”	2019-09-13
3	Page 13 and 15: Bandwidth results corrected in table	2019-10-17

Table 1

1.2 Introduction

Applicant	BALTECH AG
Manufacturer	BALTECH AG
Model Number(s)	10115-301
Serial Number(s)	18032456
Hardware Version(s)	---
Software Version(s)	---
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN:2016, Issue 09 (08-2016) and Issue 05 (03-2019)
Test Plan/Issue/Date	---
Order Number Date	5231881 2019-07-16
Date of Receipt of EUT	2019-07-25
Start of Test	2019-08-08
Finish of Test	2019-08-23
Name of Engineer(s)	Alex Fink
Related Document(s)	ANSI C63.10 (2013)

Product Service

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and Industry Canada RSS-210 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
Configuration and Mode: Transmitting continuously and waiting for badge (RFID card)				
2.1	15.215 (c), N/A and 6.6	20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.2	15.225 (a)(b)(c)(d), B.1 to B.9, 6.4 and 6.5.	Field Strength of any Emission	Pass	ANSI C63.10 (2013)
2.3	15.225 (e), B.1 to B.9 and 6.11.	Frequency Tolerance Under Temperature Variations	Pass	ANSI C63.10 (2013)
2.4	15.207, N/A and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.5	15.107 and 6.1	Exposure of Humans to RF Fields	Pass	ANSI C63.4: 2014

Table 2

Product Service

1.4 Declaration of Build Status

General information	
Order number	---
Applicant (incl. address and contact person)	BALTECH AG Lilienthalstr. 27 85399 Hallbergmoos - Germany Mr. Iftekhar Alam
Manufacturer (when different to applicant)	Applicant
Name and address of factory(ies)	Applicant

Table 3

Equipment characteristics:	
Type of equipment:	RFID Reader, 13,56 MHz, 125 kHz
Type designation*:	10115-301
Parts of the system:	Reference device is a single unit
Version of EUT	As received
Serial number:	18032456
Power supply:	DC on USB interface (5 V nom.)
highest frequency generated or used within the EUT	generated frequency < 108 MHz

Table 4

Product Service

Marking plate


Table 5

Product Service

1.5 Product Information

1.5.1 Technical Description

The RFID Reader 10115-301 controls and monitors accesses.

1.5.2 EUT Port/Cable Identification

Port	Usage	Type	Screened
P1 – USB	approx. 1.0 m	DC power serial interface	Yes

Table 6

1.5.3 EUT Accessories / AE Identification

Accessory / AE description	Type designation	S/N or ID	Manufacturer
RFID Tag card	“TestCard”	10091-307	Baltech AG
Notebook	E406	NA	lenovo

Table 7

Product Service

1.5.4 Test Configuration

Configuration	Description
DC Powered	Connected to Notebook for power supply

Table 8

1.5.5 Modes of Operation

Mode	Description
Reading TAG continuously	Reading TAG continuously

Table 9

1.6 Deviations from the Standard

none

Product Service

1.7 EUT Modification Record

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

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Serial Number:			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 10

1.8 Test Location

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

Test Name	Name of Engineer(s)
Configuration and Mode: Transmitting continuously and waiting for badge (RFID card)	
20 dB Bandwidth	Alex Fink
Field Strength of any Emission	Alex Fink
Frequency Tolerance Under Temperature Variations	Alex Fink
AC Power Line Conducted Emissions	Alex Fink
Exposure of Humans to RF Fields	Alex Fink

Table 11

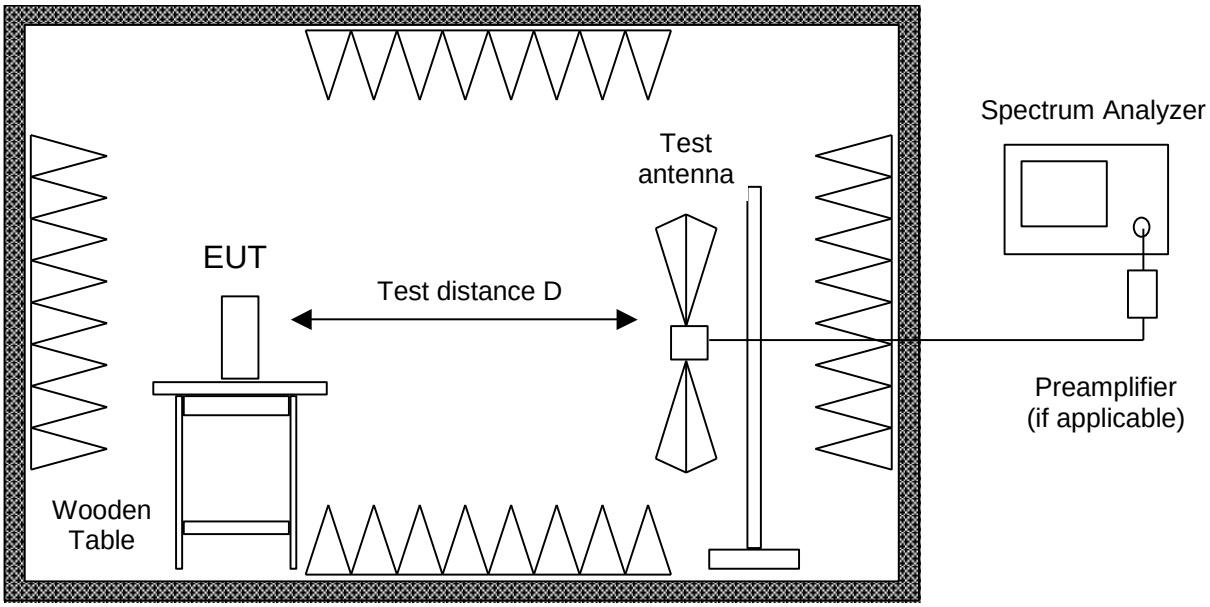
Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

Product Service

2 Test Setups

2.1.1.1 Radiated Emission in Fully or Semi Anechoic Room



Fully or semi anechoic room

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 for alternative test sites is used (see 2.1.1.2). If prescans are recorded in fully anechoic room they are indicated appropriately.

Product Service

According to section 13 of KDB558074 the requirement for radiated emissions on the band edges was performed with a reduced bandwidth of 100 kHz instead of 1 MHz.

Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

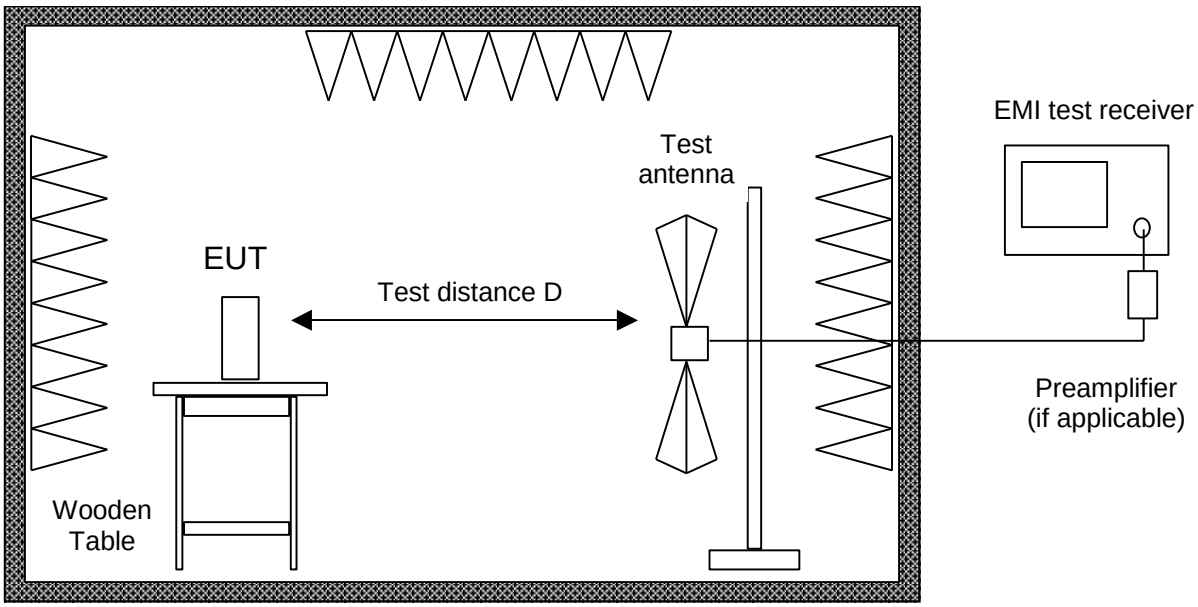
EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Product Service

2.1.1.2 Radiated Emission at Alternative Test Site



Alternate test site (semi anechoic room)

Radiated emission in the frequency range 30 MHz to 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 polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels. Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.
With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is dircharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

Product Service

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.

Product Service

3 Test Details

3.1 20 dB Bandwidth

3.1.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.225 (c), N/A and 6.6

3.1.2 Equipment Under Test and Modification State

10115-301, S/N: 18032456 - Modification State 0

3.1.3 Date of Test

2019-08-12

3.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.1.

3.1.5 Environmental Conditions

Ambient Temperature	22,0 °C
Relative Humidity	31,0 %

3.1.6 Test Results

Transmitting continuously and waiting for badge (RFID card)

Frequency (MHz)	20 dB Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	F_{LOWER} (MHz)	F_{UPPER} (MHz)
13.5606	433.673	986.907	13.1318	14.1187

Table 12

Product Service

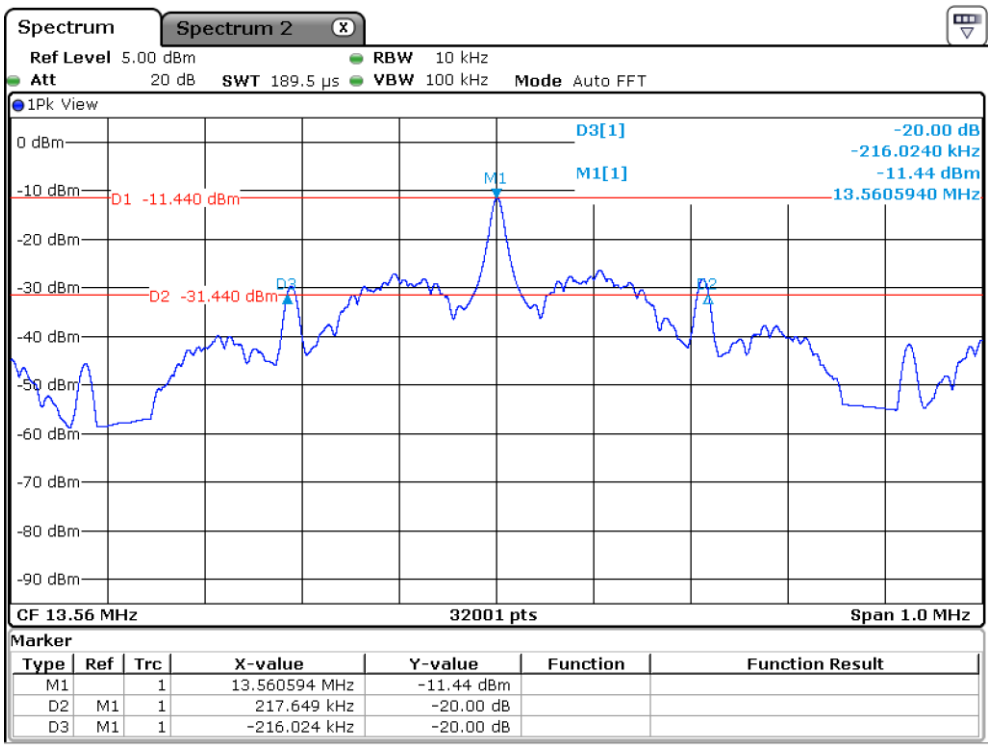


Figure 1 - 20 dB Bandwidth

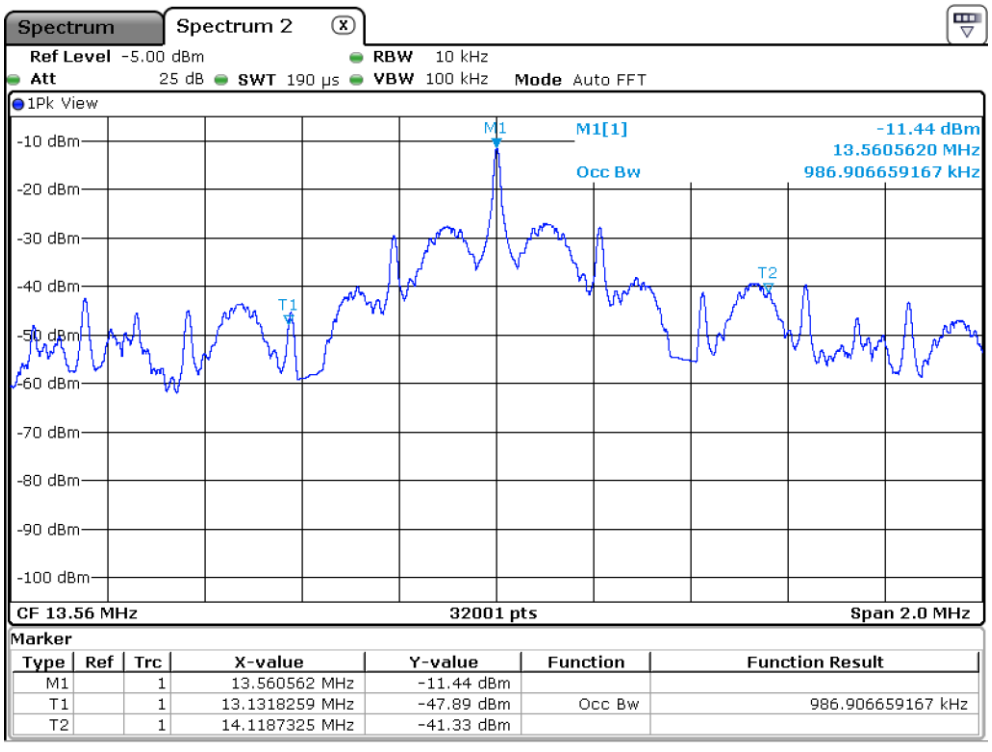
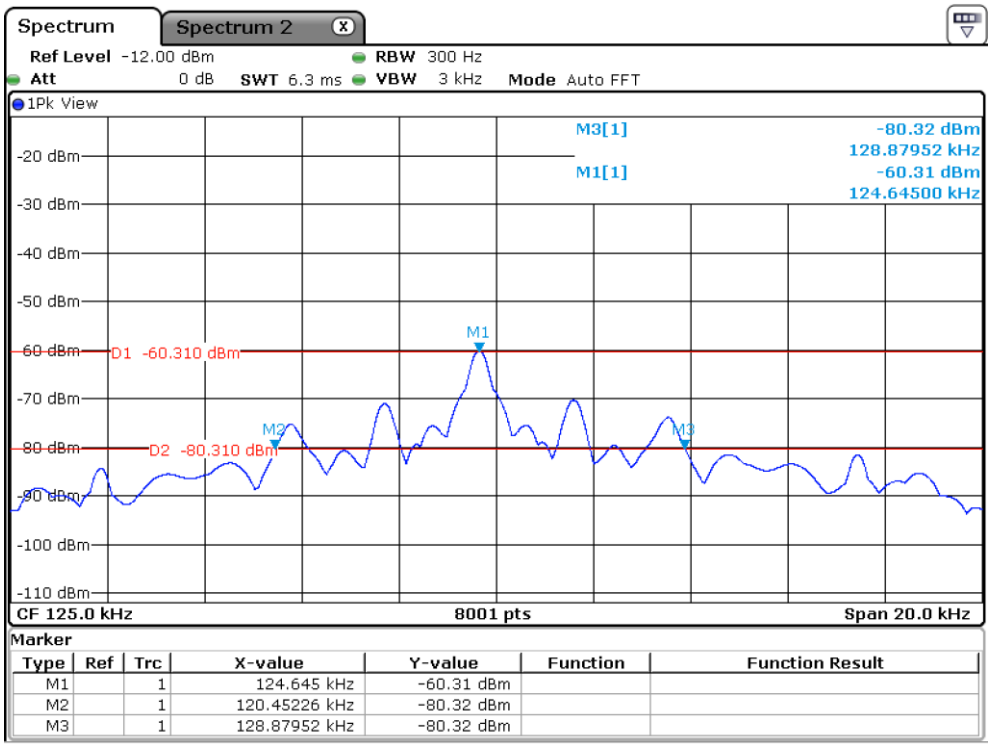


Figure 2 - 99% Occupied Bandwidth

Product Service

Frequency (kHz)	20 dB Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	F_{LOWER} (kHz)	F_{UPPER} (kHz)
124.645	8.427	16.018	117.073	128.880



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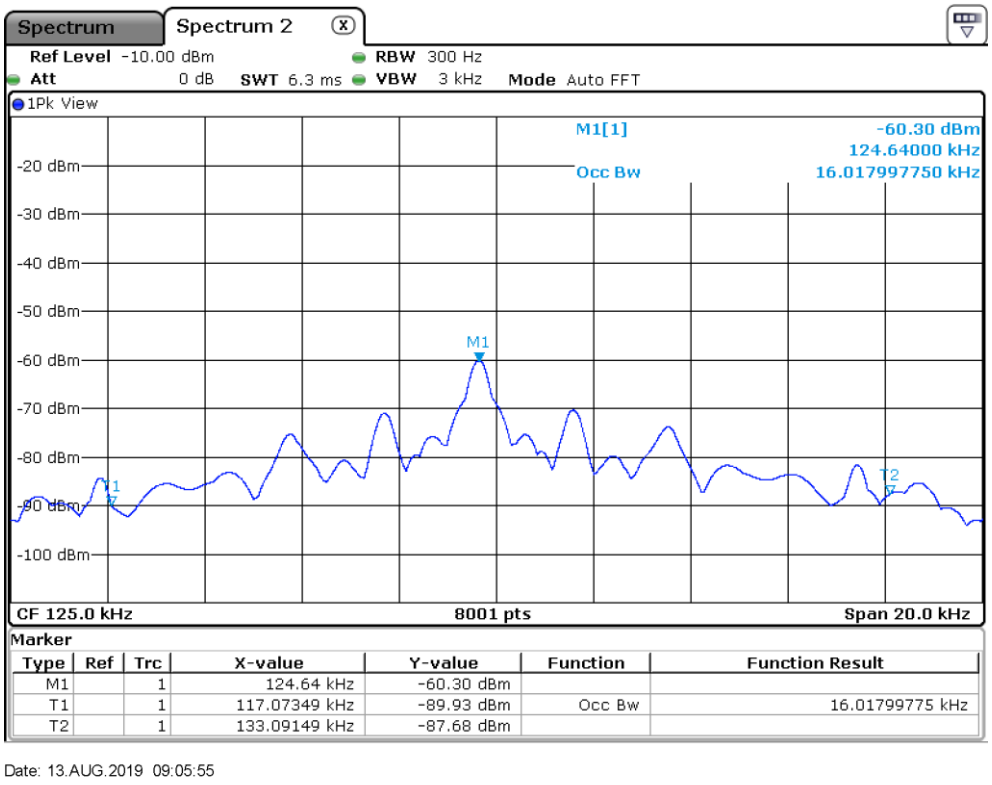


FCC 47 CFR Part 15, Limit Clause 15.215 (c)

The 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Industry Canada RSS 210 and Industry Canada RSS GEN, Limit Clause

None specified.

3.1.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2020-01-31
Climatic test chamber	ESPEC	PL-2J	18843	24	2020-03-31

Table 13

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

3.2 Field Strength of any Emission

3.2.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.225 (a)(b)(c)(d), B.1 to B.9, 6.4 and 6.5.

3.2.2 Equipment Under Test and Modification State

10115-301, S/N: 18032456 - Modification State 0

3.2.3 Date of Test

2019-08-23

3.2.4 Test Method

3.2.5 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	33.0 %

Product Service

3.2.6 Test Results

Transmitting continuously and waiting for badge (RFID card), Carrier Results

Frequency (MHz)	Quasi-Peak Level (dBµV/m) at 10m	Extrapolation distance (m)	Quasi-Peak Level (dBµV/m) at Extrapolation distance	Limit Level (dBµV/m) at Extrapolation distance
13.56	44.39	30	25.3	29.5
0.125	18.37	300	-40.6	25.7

Table 14

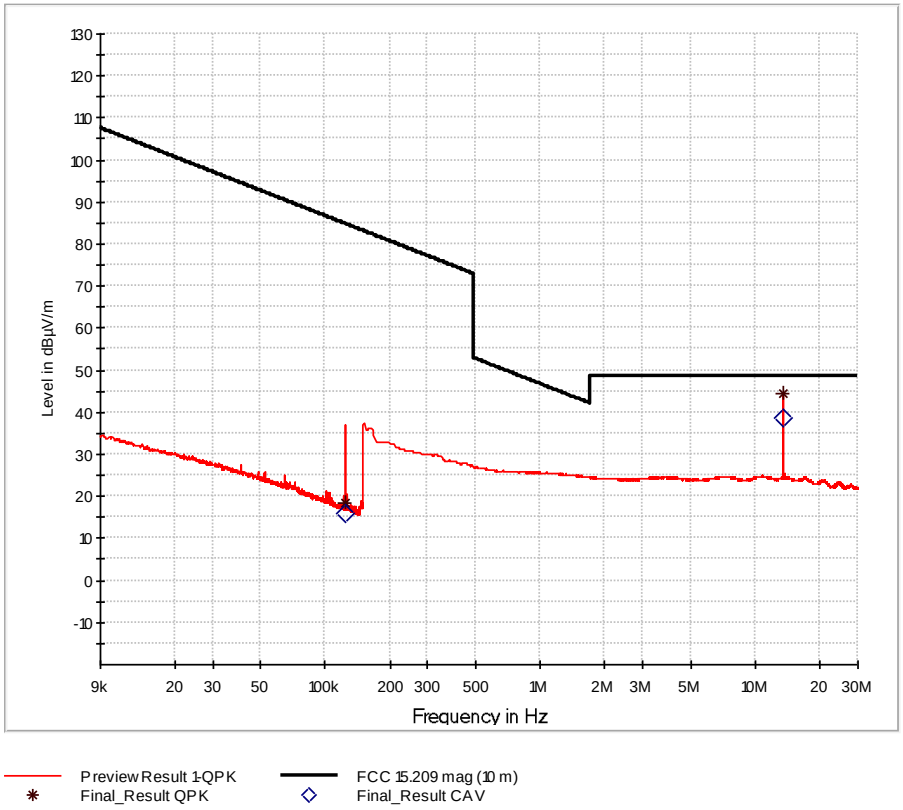


Figure 3 – 9kHz to 30MHz

Final Results 1:

Frequency MHz	QuasiPeak dBµV/m	CAverage dBµV/m	Limit dBµV/m	Margin dB	Meas. Time ms	Bandwidth kHz	Pol	Azimuth deg	Corr. dB
0.124700	---	16.06	---	---	1000.0	0.200	H	-54.0	20.0
0.124700	18.37	---	84.78	66.41	1000.0	0.200	H	-54.0	20.0
13.560000	---	38.78	---	---	1000.0	9.000	H	-51.0	20.0
13.560000	44.39	---	48.60	4.21	1000.0	9.000	H	-51.0	20.0

Table 15 - Emissions Results – 9 KHz to 30 MHz

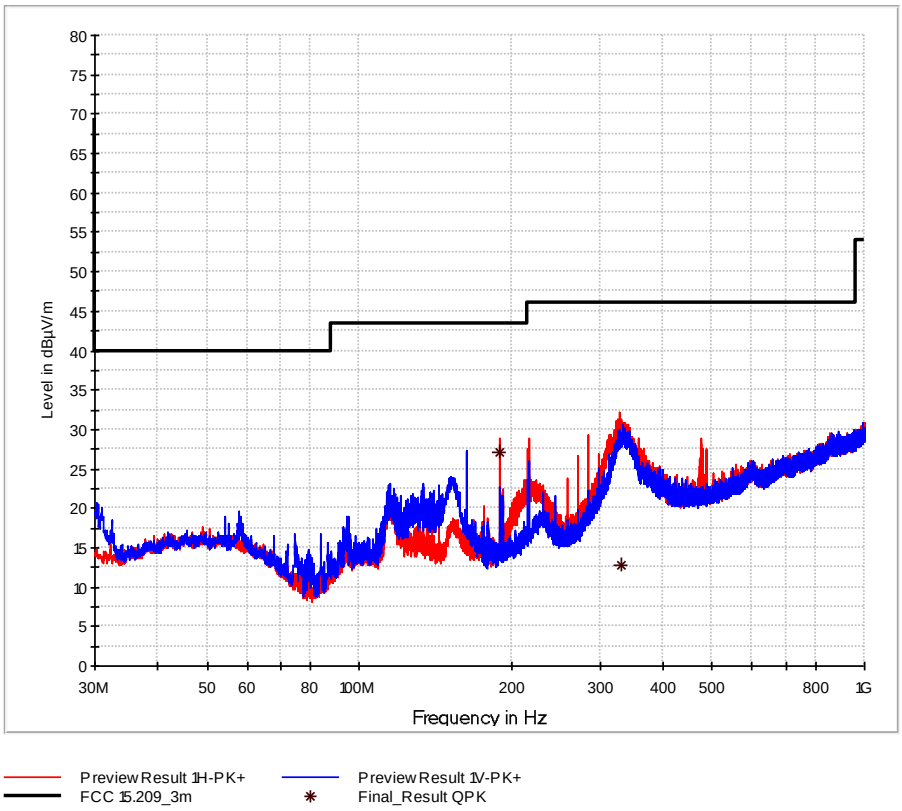


Figure 4 - 30M to 1 GHz

Frequency MHz	*QuasiPeak dBµV/m*	*Limit dBµV/m*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Height cm*	*Pol*	*Azimuth deg*	*Corr. dB*
189.840000	27.21	43.50	16.29	1000.0	120.000	171.0	H	-22.0	12.0
329.045000	12.89	46.00	33.11	1000.0	120.000	105.0	H	-94.0	16.3

Table 9 - Emissions Results – 30 MHz to 1 GHz

Sample calculation of field final values:

Final Value (dBµV/m) = Reading Value (dBµV) +(Antenna Correction Factor (dB/m) + Cable Correction Factor (dB))

FCC 47 CFR Part 15, Limit Clause 15.225 (a)(b)(c)(d)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 m.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 m.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 m.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (m)
0.009 to 0.490	2400/F (kHz)	300
0.490 to 1.705	24000/F (kHz)	30
1705 to 30	30	30
30 to 88	100**	3
88 to 216	150**	3
216 to 960	200**	3
Above 960	500	5

Table 10 - FCC Radiated Emission Limit

Industry Canada RSS-210, Limit Clause B.6

The field strength of any emission shall not exceed the following limits:

(a) 15.848 mW/m (84 dBµV/m) at 30 m, within the band 13.553 – 13.567 MHz.

(b) 334 µV/m (50.5 dBµV/m) at 30 m, withing the bands 13.410 – 13.553 MHz and 13.567 – 13.710 MHz.

(c) 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110 – 13.410 MHz and 13.710 – 14.010 MHz.

(d) RSS-GEN general field strength limits for frequencies outside the band 13.110 – 14.010 MHz.

Industry Canada RSS-GEN, Limit Clause

Frequency	Electric Field Strength (µV/m)	Magnetic Field Strength (H-Field) (µA/m)	Measurement Distance (m)
9 - 490 kHz	2,400/F (F in kHz)	2,400/377F (F in kHz)	300
490 - 1,705 kHz	24,000/F (F in kHz)	24,000/377F (F in kHz)	30
1,705 kHz - 30 MHz	30	N/A	30

Table 16 - Industry Canada Radiated Emission Limit - Less than 30 MHz

Frequency (MHz)	Field Strength (µV/m at 3 m)
30 - 88	100
88 - 216	150
216 - 960	200
> 960	500

Table 17 - Industry Canada Radiated Emission Limit - 30 MHz to 1 GHz

3.2.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room and Semi anechoic room - cabin no. 8.

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	36	2022-08-31
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2020-12-31
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2020-06-30
Test Software	Rohde & Schwarz	EMC32 – v10.50.10	19927	NA	NA

Table 18

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

3.3 Frequency Tolerance Under Temperature Variations

3.3.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.225 (e), B.1 to B.9 and 6.11.

3.3.2 Equipment Under Test and Modification State

10115-301, S/N: 18032456 - Modification State 0

3.3.3 Date of Test

2019-08-09

3.3.4 Test Method

3.3.5 Environmental Conditions

Ambient Temperature	23,0 °C
Relative Humidity	31,0 %

3.3.6 Test Results

Transmitting continuously and waiting for badge (RFID card)

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
-20.0 °C	5 V	13.560539	0.000295	-2.950
-10.0 °C	5 V	13.560579	0.000000	0.000
0.0 °C	5 V	13.560599	0.000148	1.475
+10.0 °C	5 V	13.560599	0.000148	1.475
+20.0 °C	5 V	13.560579	0.000000	0.000
+30.0 °C	5 V	13.560579	0.000000	0.000
+40.0 °C	5 V	13.560599	0.000148	1.475
+50.0 °C	5 V	13.560599	0.000148	1.475

Table 19 - Frequency Tolerance Under Temperature Variation

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
+20.0 °C	4.25 V	13.560599	0.000148	1.475
+20.0 °C	5 V	13.560579	0.000000	0.000
+20.0 °C	5.75 V	13.560579	0.000000	0.000

Table 20 - Frequency Tolerance Under Voltage Variation

FCC 47 CFR Part 15, Limit Clause 15.225 (e)

The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % of the operating frequency.

Industry Canada RSS-210, Limit Clause B.6

Carrier frequency stability shall be maintained to ±0.01% (±100 ppm)

3.3.7 Test Location and Test Equipment Used

This test was carried out in Non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Network Analyzer	Rohde & Schwarz	ZVL	19894	36	2019-10-31
Climatic test chamber	ESPEC	PL-2J	18843	24	2020-03-31

Table 21

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

3.4 AC Power Line Conducted Emissions

3.4.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.207, N/A and 8.8

3.4.2 Equipment Under Test and Modification State

10115-301, S/N: 18032456 - Modification State 0

3.4.3 Date of Test

2019-08-08

3.4.4 Environmental Conditions

Ambient Temperature	22.0 °C
Relative Humidity	29.0 %

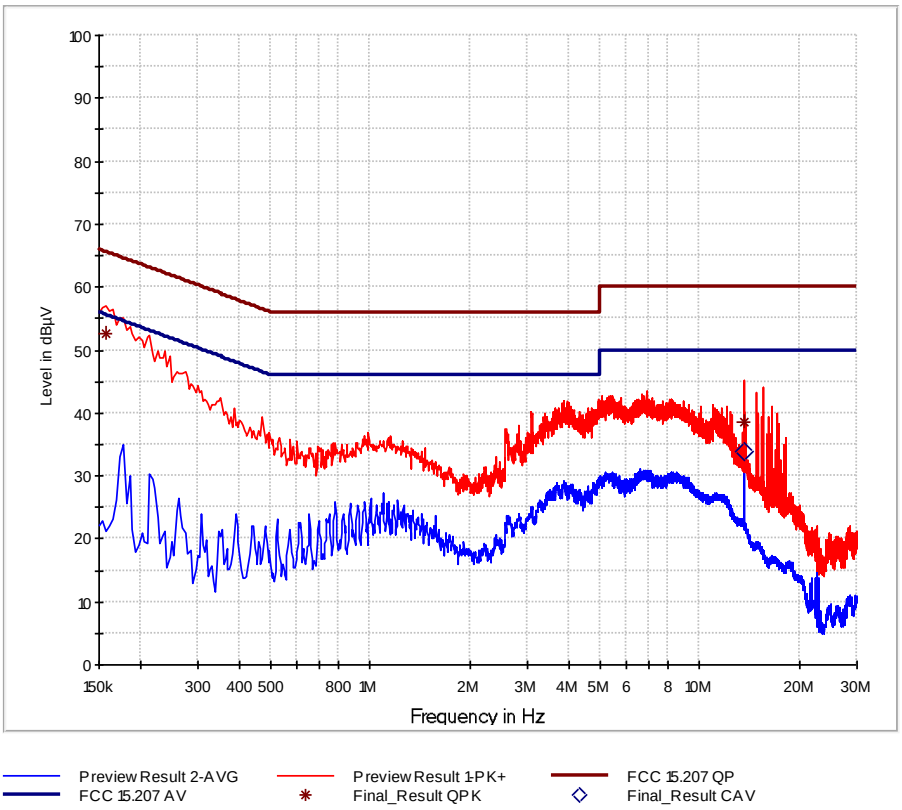
Product Service

3.4.5 Test Results

Transmitting continuously and waiting for badge (RFID card)

Applied supply Voltage: 5 V / DC USB

Plus Emissions Results



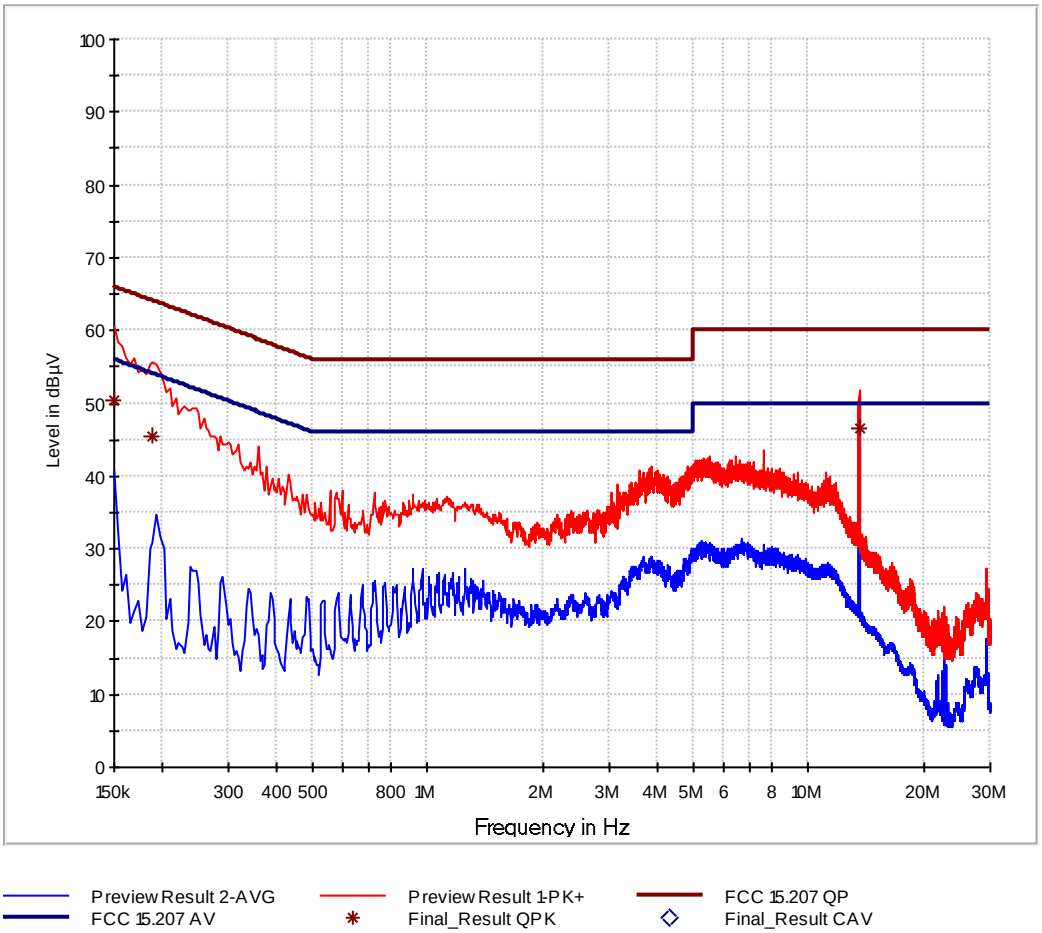
Final Results 1:

Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Line*	*PE*	*Corr. dB*
0.158000	52.68	---	65.57	12.89	1000.0	9.000	Plus	GND	10.0
13.566000	---	33.82	50.00	16.18	1000.0	9.000	Plus	GND	10.2
13.566000	38.69	---	60.00	21.31	1000.0	9.000	Plus	GND	10.2

Figure 5 – Line L1- 150 kHz to 30 MHz

Product Service

Neutral N Emissions Results



Final Results 1:

Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Line*	*PE*	*Corr. dB*
0.150000	50.38	---	66.00	15.62	1000.0	9.000	N	GND	10.0
0.190000	45.44	---	64.04	18.60	1000.0	9.000	N	GND	10.0
13.562000	46.42	---	60.00	13.58	1000.0	9.000	N	GND	10.2

Sample calculation of field final values:

Final Value (dBµV/m) = Reading Value (dBµV) +(LISN Transducer Factor (dB) + Cable Correction Factor (dB))

Product Service

FCC 47 CFR Part 15, Limit Clause 15.207 and Industry Canada RSS-GEN, Limit Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 22

*Decreases with the logarithm of the frequency.

3.4.6 Test Location and Test Equipment Used

This test was carried out in Shielded room - cabin no. 4.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
EMI test receiver	Rohde & Schwarz	100008	19730	12	2020-11-30
V-network	Rohde & Schwarz	894785/005	18919	36	2019-10-31
Test Software	Rohde & Schwarz	EMC32 – v9.26.01	20090	NA	NA

Table 23

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment
N/A - Not Applicable

Product Service

3.5 Exposure of Humans to RF Fields

3.5.1 Specification Reference

Industry Canada RSS-102

3.5.2 Guide

Industry Canada RSS-102 Issue 5 and
Industry Canada SPR-002, Issue 1

3.5.3 Equipment Under Test and Modification State

10115-301, S/N: 18032456 - Modification State 0

3.5.4 Date of Test

2019-08-20

3.5.5 Test Results

$$EIRP = \frac{(FS \cdot D)^2}{30}$$

In accordance with Industry Canada RSS-102, Issue 5, chapter 2.5:

Maximum Radiated Fields Strength: (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** of this test report)	44.39 dBµV/m (at 10 m distance and 13,56kHz)
Calculated Equivalent Radiated Power:	91.6 nW (e.i.r.p.)
Minimum separation distance:	≤ 5 mm
SAR Evaluation Exemption Limit:	71 mW

In accordance with Industry Canada SPR-002, Issue 1, chapter 6.5:

Test distance:	Direct contact to EUT	
Tested frequency:	125 kHz	
Measured maximum value:	15.51 V/m	0.4330 A/m
Limb Exposure Limit:	83 V/m	90 A/m
Relaxation Factor:	1.0	

Product Service

3.5.6 Test Location and Test Equipment Used

This test was carried out in a non shielded room.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Electromagnetic radiation meter	Narda Safety	EMR-200	19590	36	2019-10-31
Electric field probe	Narda Safety	Type 8.3	19591	36	2019-10-31
Magnetic field probe	Narda Safety	Type 12.1	19592	36	2019-10-31

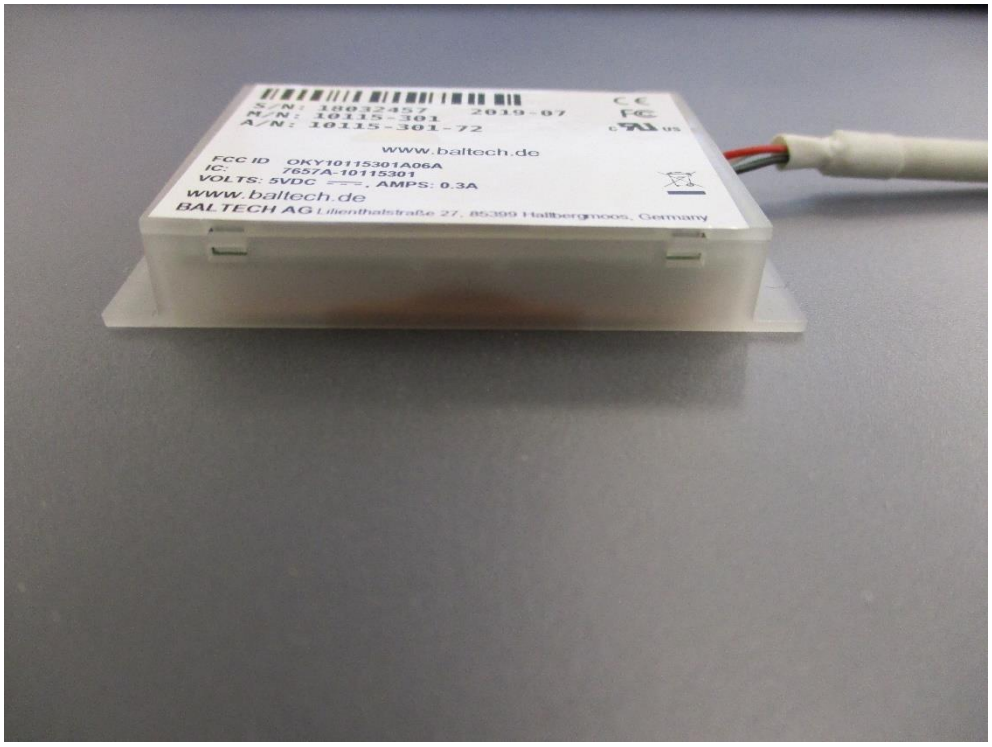
Table 24

Product Service

4 Photographs

4.1 Equipment Under Test (EUT)

Figure 6 - EUT



Product Service

Figure 7 - EUT

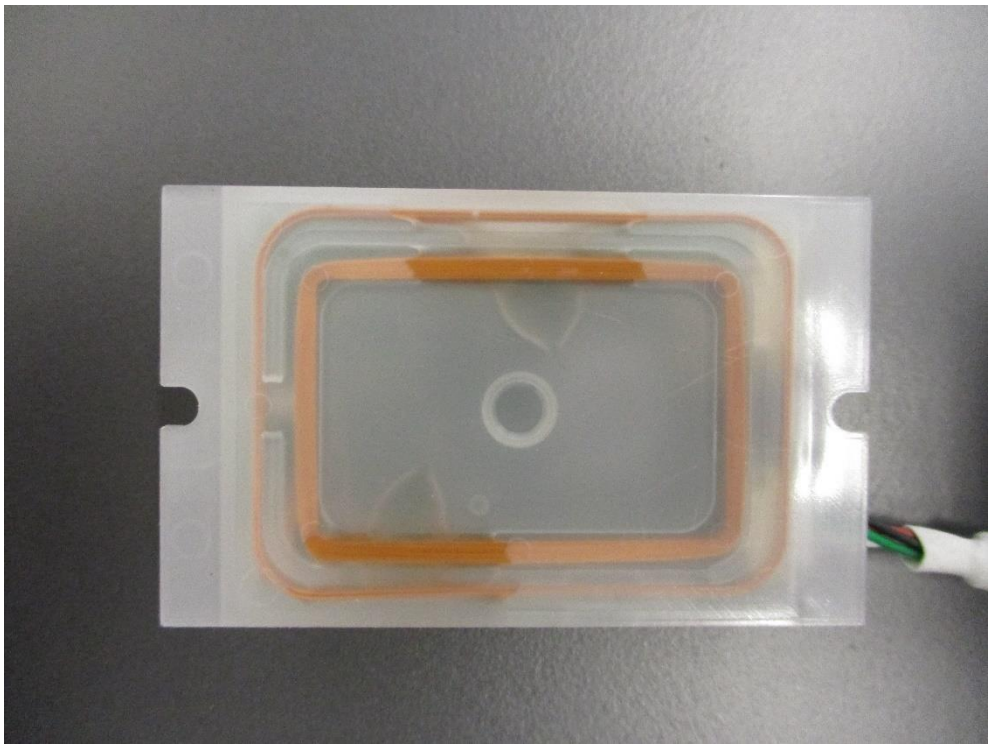


Figure 8 - EUT

Figure 9 - EUT

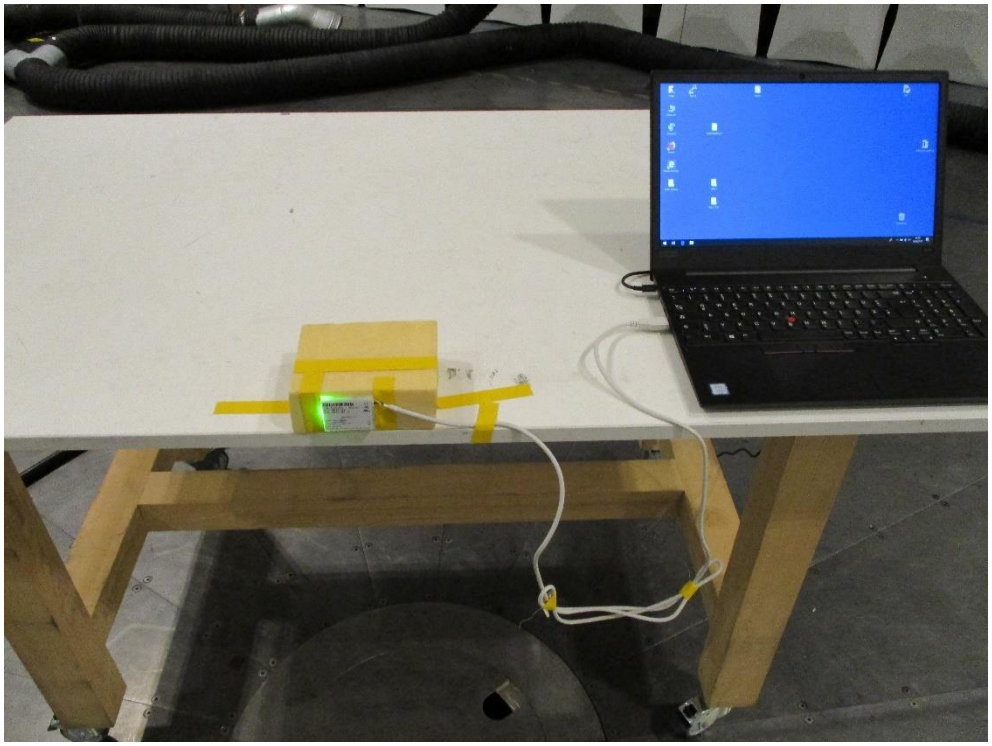


Figure 10 - Test setup for radiated emission

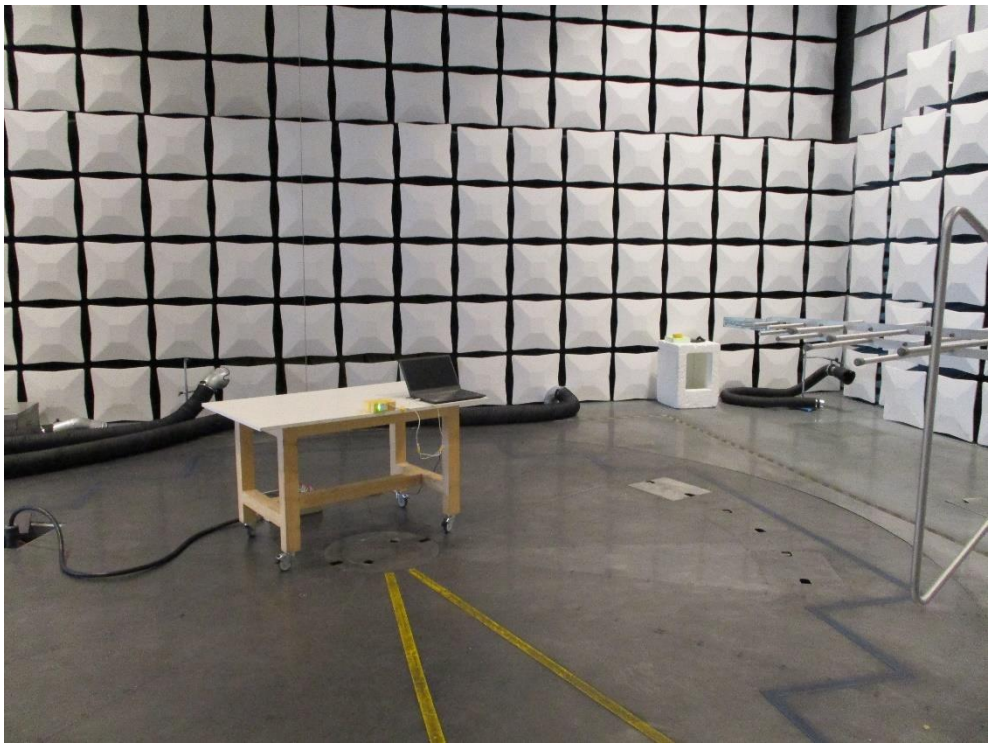


Figure 11 - Test setup for radiated emission

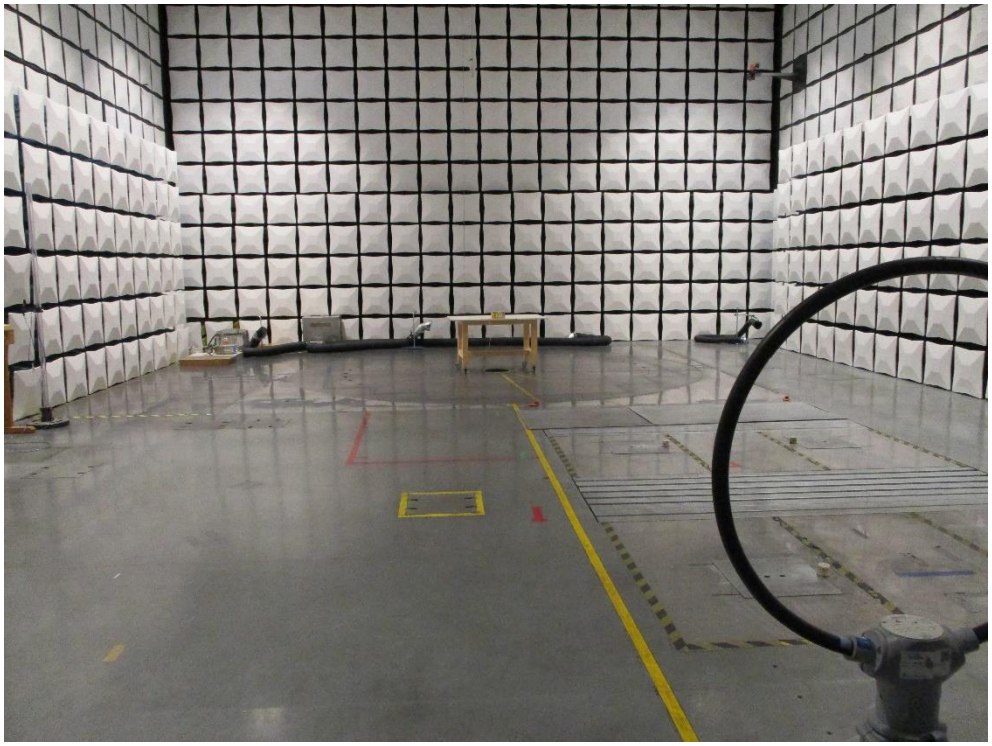


Figure 12 - Test setup for radiated emission 9kHz-30M

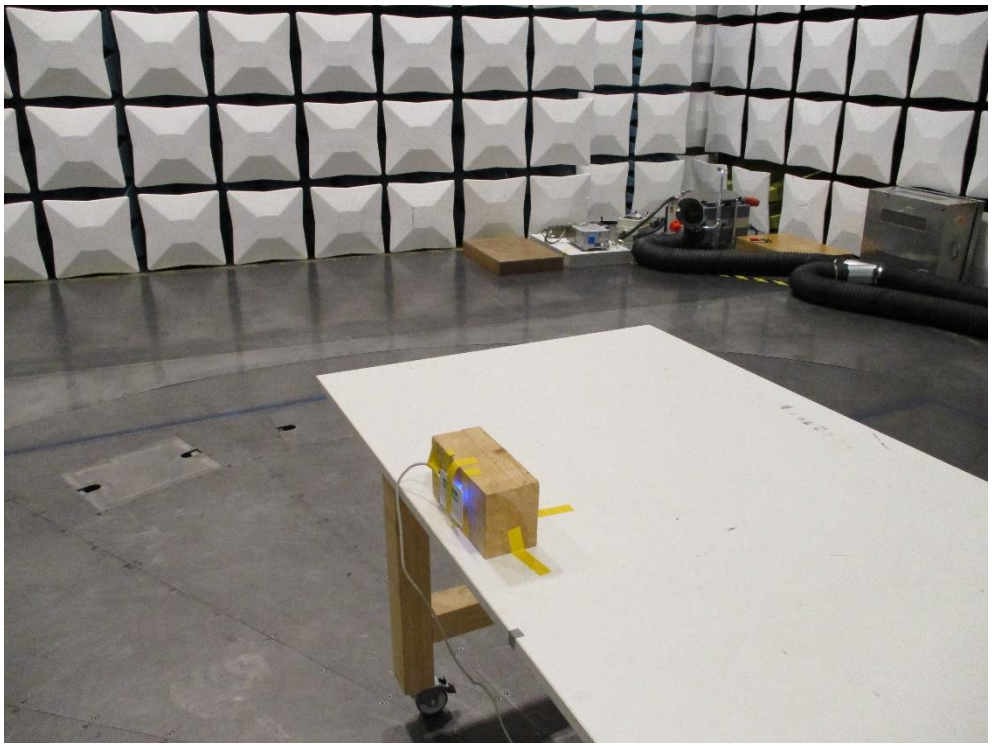


Figure 13 - Test setup for radiated emission 9kHz-30MHz

Figure 14 - Test setup for carrier frequency stability

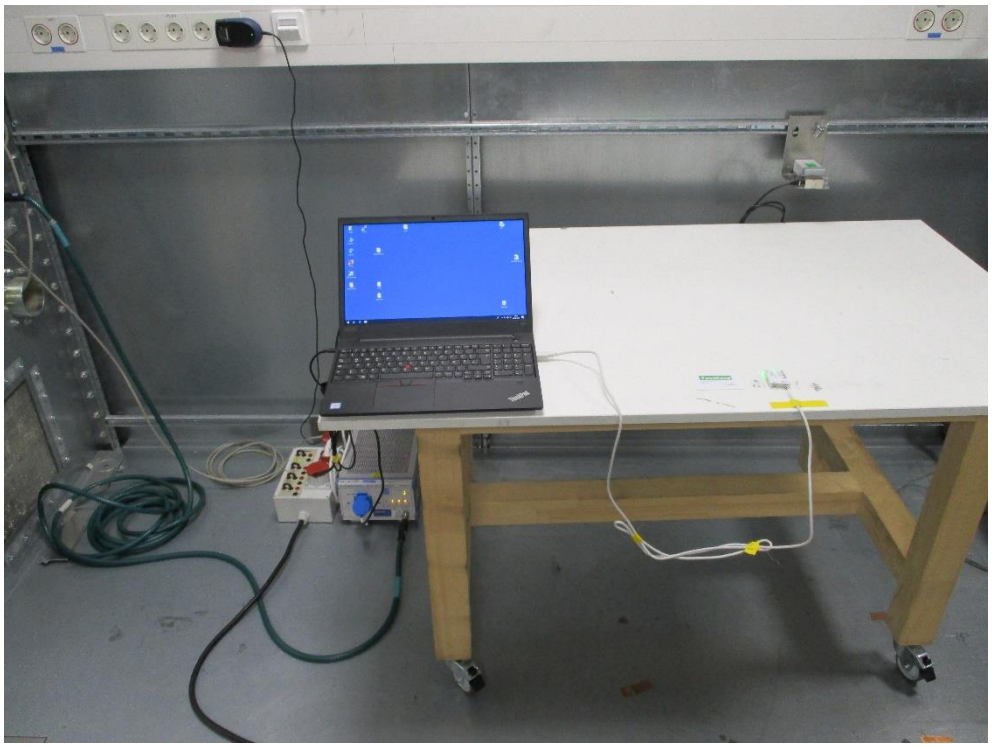


Figure 10 - Test setup for AC Power Line Conducted Emissions

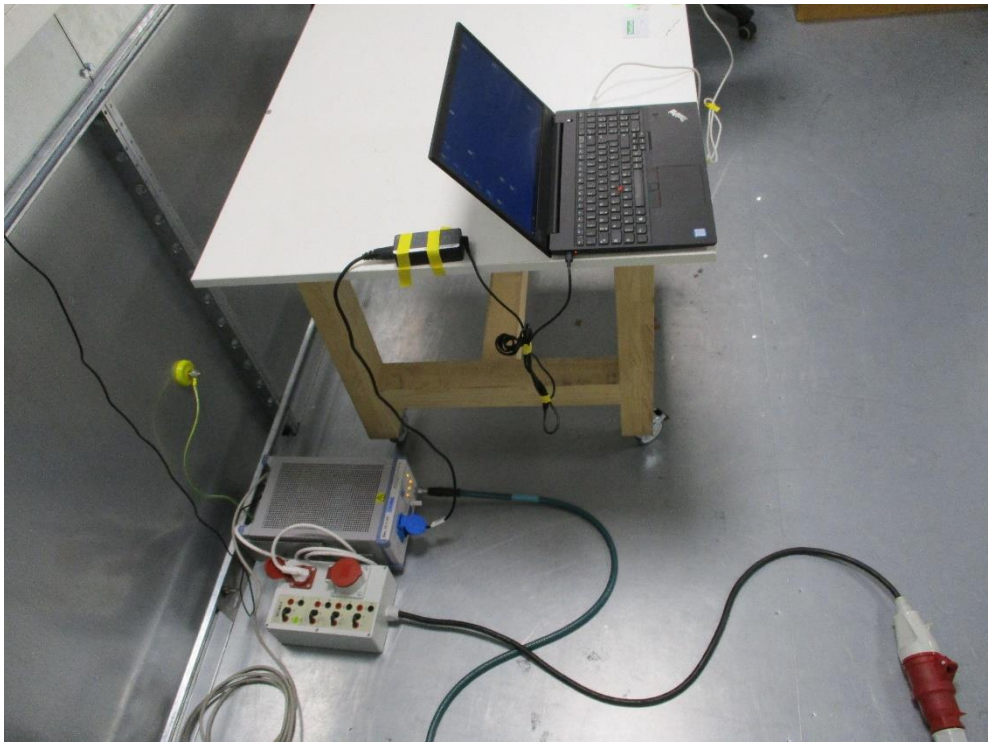
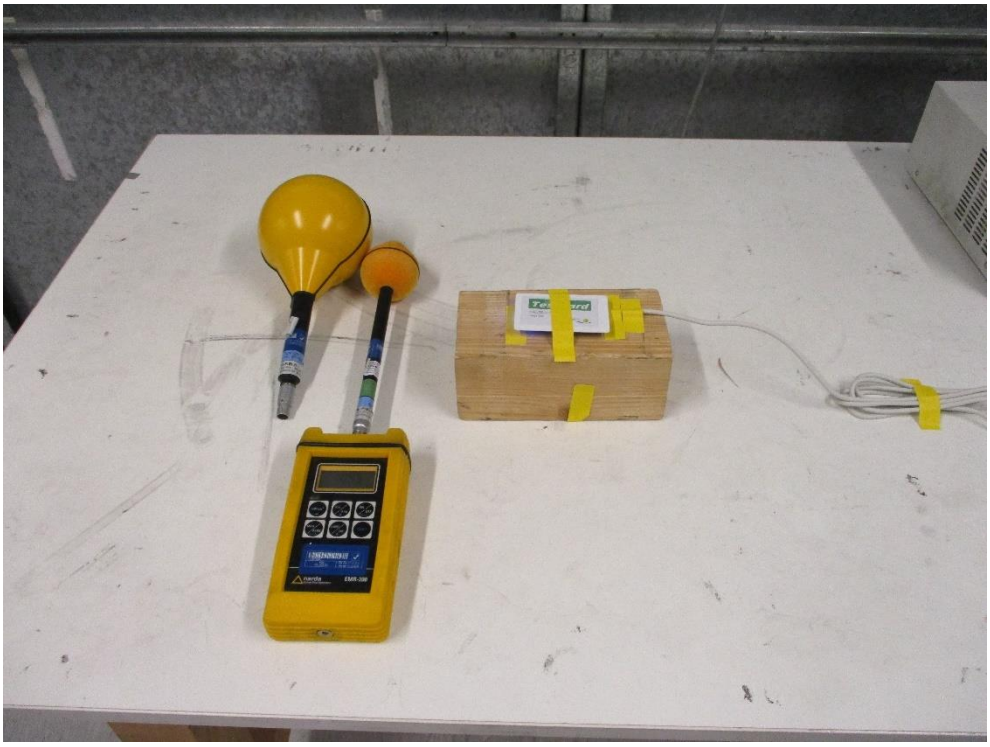


Figure 10 - Test setup for AC Power Line Conducted Emissions



Product Service

5 Measurement Uncertainty

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

Radio Testing			
Test Name	kp	Expanded Uncertainty	Note
Occupied Bandwidth	2.0	±1.14 %	2
RF-Frequency error	1.96	±1 · 10-7	7
RF-Power, conducted carrier	2	±0.079 dB	2
RF-Power uncertainty for given BER	1.96	+0.94 dB / -1.05	7
RF power, conducted, spurious emissions	1.96	+1.4 dB / -1.6 dB	7
RF power, radiated			
25 MHz – 4 GHz	1.96	+3.6 dB / -5.2 dB	8
1 GHz – 18 GHz	1.96	+3.8 dB / -5.6 dB	8
18 GHz – 26.5 GHz	1.96	+3.4 dB / -4.5 dB	8
40 GHz – 170 GHz	1.96	+4.2 dB / -7.1 dB	8
Spectral Power Density, conducted	2.0	±0.53 dB	2
Maximum frequency deviation			
300 Hz – 6 kHz	2	±2,89 %	2
6 kHz – 25 kHz	2	±0.2 dB	2
Maximum frequency deviation for FM	2	±2,89 %	2
Adjacent channel power 25 MHz – 1 GHz	2	±2.31 %	2
Temperature	2	±0.39 K	4
(Relative) Humidity	2	±2.28 %	2
DC- and low frequency AC voltage			
DC voltage	2	±0.01 %	2
AC voltage up to 1 kHz	2	±1.2 %	2
Time	2	±0.6 %	2

Table 25

Radio Interference Emission Testing			
Test Name	kp	Expanded Uncertainty	Note
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	1
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	1
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	1
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	1
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	1
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	1
Radiated Emission			
Test distance 1 m (ALSE)			
9 kHz to 150 kHz	2	± 4.6 dB	1
150 kHz to 30 MHz	2	± 4.1 dB	1
30 MHz to 200 MHz	2	± 5.2 dB	1
200 MHz to 2 GHz	2	± 4.4 dB	1
2 GHz to 3 GHz	2	± 4.6 dB	1
Test distance 3 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 5.0 dB	1
1 GHz to 6 GHz	2	± 4.6 dB	1
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	1
300 MHz to 1 GHz	2	± 4.9 dB	1
Radio Interference Power			
30 MHz to 300 MHz	2	± 3.5 dB	1
Harmonic Current Emissions			4
Voltage Changes, Voltage Fluctuations and Flicker			4

Table 26

Immunity Testing			
Test Name	kp	Expanded Uncertainty	Note
Electrostatic Discharges			4
Radiated RF-Field			
Pre-calibrated field level	2	+32.2 / -24.3 %	5
Dynamic feedback field level	2.05	+21.2 / -17.5 %	3
Electrical Fast Transients (EFT) / Bursts			4
Surges			4
Conducted Disturbances, induced by RF-Fields			
via CDN	2	+15.1 / -13.1 %	6
via EM clamp	2	+42.6 / -29.9 %	6
via current clamp	2	+43.9 / -30.5 %	6
Power Frequency Magnetic Field	2	+20.7 / -17.1 %	2
Pulse Magnetic Field			4
Voltage Dips, Short Interruptions and Voltage Variations			4
Oscillatory Waves			4
Conducted Low Frequency Disturbances			
Voltage setting	2	± 0.9 %	2
Frequency setting	2	± 0.1 %	2
Electrical Transient Transmission in Road Vehicles			4

Table 27

Note 1:
The expanded uncertainty reported according to CISPR 16-4-2:2003-11 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 2:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 3:
The expanded uncertainty reported according to UKAS Lab 34 (Edition 1, 2002-08) is based on a standard uncertainty multiplied by a coverage factor of kp = 2.05, providing a level of confidence of p = 95.45%
Note 4:
It has been demonstrated that the used test equipment meets the specified requirements in the standard with at least a 95%confidence.
Note 5:
The expanded uncertainty reported according to IEC 61000-4-3 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 6:
The expanded uncertainty reported according to IEC 61000-4-6 is based on a standard uncertainty multiplied by a coverage factor of kp = 2, providing a level of confidence of p = 95.45%
Note 7:
The expanded uncertainty reported according ETSI TR 100 028 V1.4.1 (all parts) to is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%
Note 8:
The expanded uncertainty reported according to ETSI TR 102 273 V1.2.1 (all parts) is based on a standard uncertainty multiplied by a coverage factor of kp = 1.96, providing a level of confidence of p = 95.45%