Report on the FCC and IC Testing of the Sphinx Electronics GmbH & Co. KG Model: ES110 In accordance with FCC 47 CFR Part 15C and Industry Canada RSS-210 and Industry Canada RSS-GEN

Prepared for: Sphinx Electronics GmbH & Co. KG
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Product Service

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Authorised Signatory	Markus Biberger	2019-02-27	

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	Michael Ingerl	2019-02-27	

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 04 (11-2014).

This is a C2PC Test Report.

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Product Service

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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	2018-12-20
2	Added EMC32 Test Software to the Test Equipment; Changed 99% Bandwidth (Misspelling); Changed Separation distance from greater than 20 cm to less than 20 cm in Exposure of Humans to RF Fields Test and added SAR Evaluation	2019-01-31
3	Changed ICES in IC; Changed Model number from ES 110 in ES110	2019-02-27

Table 1

1.2 Introduction

Applicant	Sphinx Electronics GmbH & Co. KG
Manufacturer	Sphinx Electronics GmbH & Co. KG
Model Number(s)	ES110
Serial Number(s)	381803F7
Hardware Version(s)	SPS-20 V1.5, SPS-21 V1.1
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 04 (11-2014)
Test Plan/Issue/Date	---
Order Number Date	926642 2018-11-22
Date of Receipt of EUT	2018-12-06
Start of Test	2018-12-17
Finish of Test	2018-12-18
Name of Engineer(s)	Michael Ingerl
Related Document(s)	ANSI C63.10 (2013)

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: 120 V / 60 Hz AC Powered - Transmitting continuously				
2.1	15.225 (a)(b)(c)(d), B.1 to B.9, 6.4 and 6.5.	Field Strength of any Emission <30 MHz	Pass	ANSI C63.10 (2013)
2.2	15.225 (e), B.1 to B.9 and 6.11.	Frequency Tolerance Under Temperature Variations	Pass	ANSI C63.10 (2013)
2.3	15.207, N/A and 8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.4	15.215 (c), N/A and 6.6	20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.5	15.205, 4.1 and 8.10	Restricted Band Edges	Pass	ANSI C63.10 (2013)
2.6	15.209, 4.3 and 6.13	Field Strength of any Emission >30 MHz	Pass	ANSI C63.10 (2013)

Table 2

1.4 Product Information

1.4.1 Technical Description

Within the Dialock access control system the encoding station ES110 is used to program the transponder media used as keys.

1.5 Deviations from the Standard

None

1.6 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
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.7 Test Location

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

Test Name	Name of Engineer(s)
Configuration and Mode: 120 V / 60 Hz AC Powered - Transmitting continuously	
Field Strength of any Emission	Michael Ingerl
Frequency Tolerance Under Temperature Variations	Michael Ingerl
AC Power Line Conducted Emissions	Michael Ingerl
20 dB Bandwidth	Michael Ingerl
Restricted Band Edges	Michael Ingerl
Field Strength of any Emission	Michael Ingerl

Table 4

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany

2 Test Details

2.1 Field Strength of any Emission <30 MHz

2.1.1 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.

2.1.2 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.1.3 Date of Test

2018-12-17

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5.

Measurements were made at a distance of 3 m. The limit lines shown on the plot were extrapolated from either 300 m or 30 m to the measurement distance of 3 m in accordance with ANSI C63.10 Clause 6.4.4.2.

2.1.5 Environmental Conditions

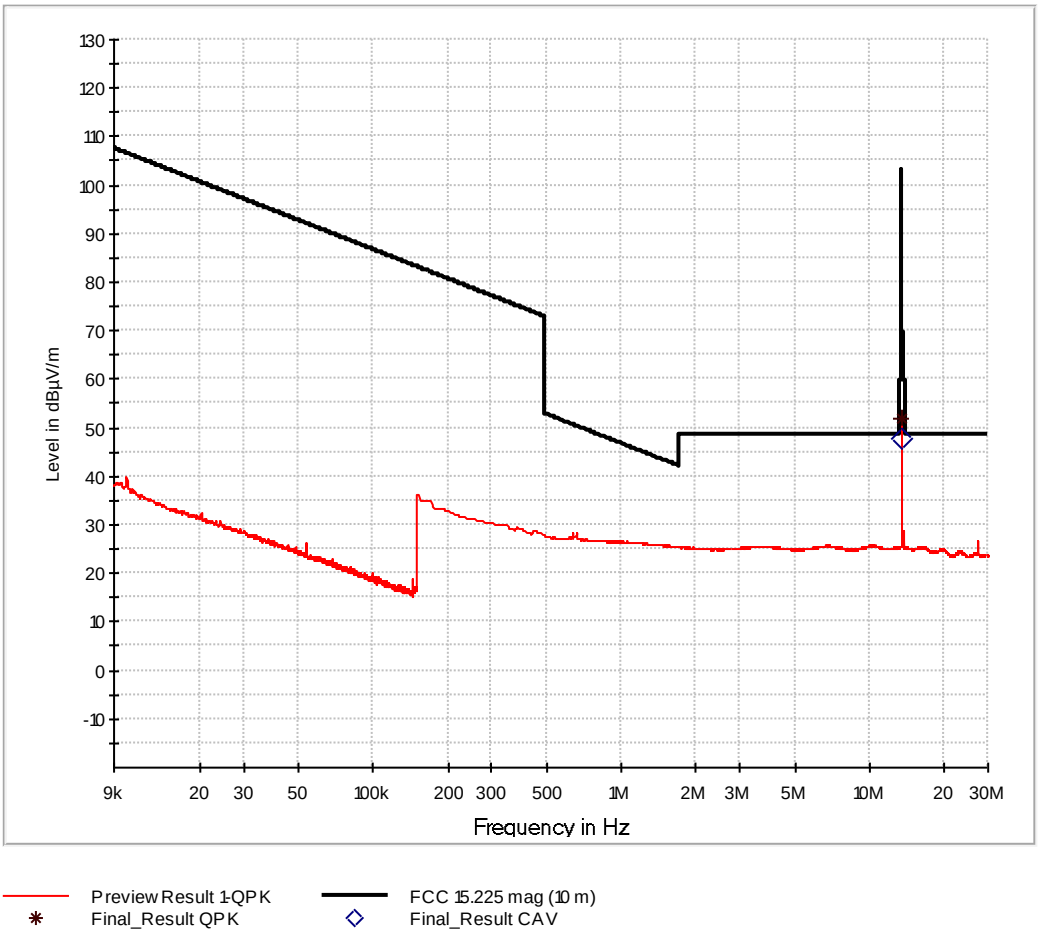
Ambient Temperature	22,0 °C
Relative Humidity	30,0 %

2.1.6 Test Results

<u>120 V / 60 Hz AC Powered - Transmitting continuously, Carrier Results</u>

Frequency (MHz)	Quasi-Peak Level (dBµV/m) at 10m	Quasi-Peak Level (dBµV/m) at 30m
13.56	52.10	33.00

Table 5



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*
13.560000	---	47.90	---	---	1000.0	9.000	H	42.0	20.0
13.560000	52.10	---	103.10	51.00	1000.0	9.000	H	42.0	20.0

Emissions Results - 9 kHz to 30 MHz

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	3

Table 6 - 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 7 - 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 8 - Industry Canada Radiated Emission Limit - 30 MHz to 1 GHz

2.1.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	24	2019-07-31
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.20.01	19719	---	---

Table 9

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

2.2 Frequency Tolerance Under Temperature Variations

2.2.1 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.

2.2.2 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.2.3 Date of Test

2018-12-17

2.2.4 Test Method

2.2.5 Environmental Conditions

Ambient Temperature 21,0 °C
Relative Humidity 35,0 %

2.2.6 Test Results

120 V / 60 Hz AC Powered - Transmitting continuously

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
-20.0 °C	5 V	13.560019	0.000138	1.379
-10.0 °C	5 V	13.560044	0.000322	3.223
0.0 °C	5 V	13.560044	0.000322	3.223
+10.0 °C	5 V	13.560022	0.000162	1.615
+20.0 °C	5 V	13.560000	0.000000	0.000
+30.0 °C	5 V	13.559938	-0.000461	-4.609
+40.0 °C	5 V	13.559909	-0.000668	-6.681
+50.0 °C	5 V	13.559894	-0.000783	-7.832

Table 10 - Frequency Tolerance Under Temperature Variation

Temperature	Voltage	Measured Frequency (MHz)	Frequency Deviation (%)	Frequency Error (ppm)
+20.0 °C	4.25 V	13.559984	-0.000115	-1.150
+20.0 °C	5 V	13.560000	0.000000	0.000
+20.0 °C	5.75 V	13.559984	-0.000115	-1.150

Table 11 - 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)

2.2.7 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	2019-01-31
Climatic test chamber	ESPEC	PL-2J	18843	24	2019-03-31

Table 12

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

2.3 AC Power Line Conducted Emissions

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.3.3 Date of Test

2018-12-18

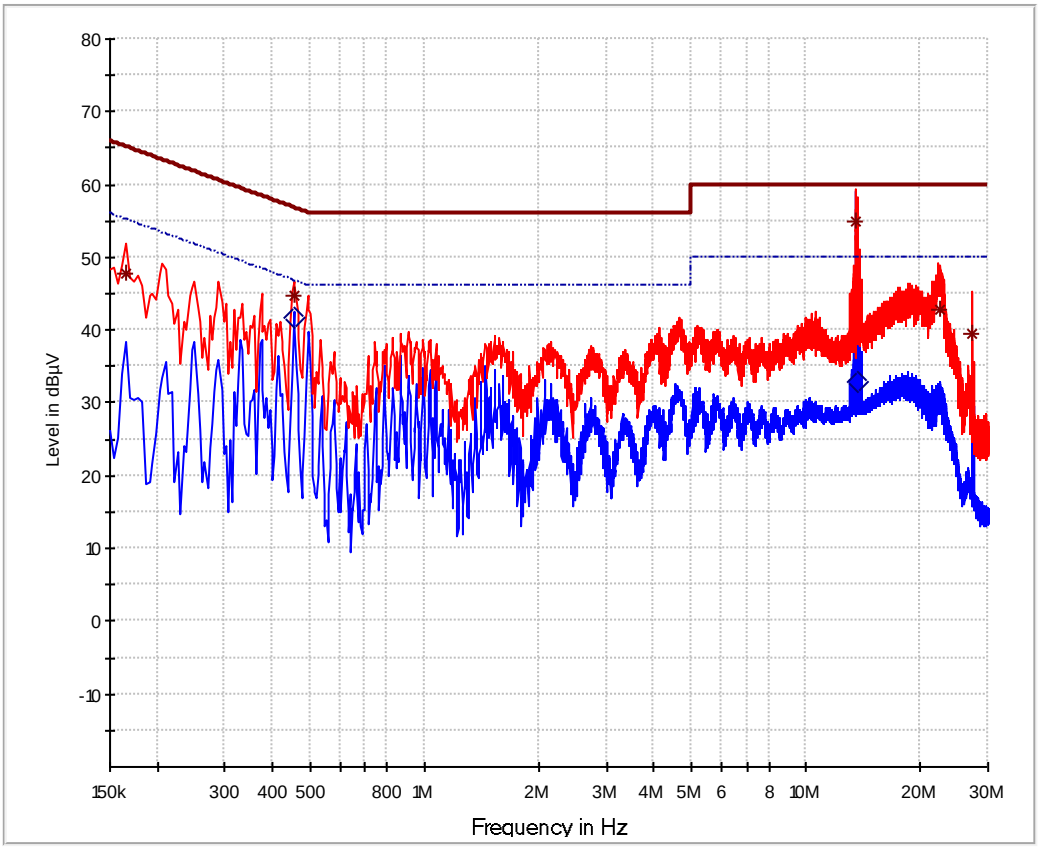
2.3.4 Test Method

2.3.5 Environmental Conditions

Ambient Temperature	21,0 °C
Relative Humidity	33,0 %

2.3.6 Test Results

120 V / 60 Hz AC Powered - Transmitting continuously



Preview Result 2-AVG
FCC 15.107 Class B AV
Preview Result 1-PK+
Final_Result QPK
FCC 15.107 Class B QP
Final_Result CAV

Final Results 1:

Frequency MHz	*QuasiPeak dBµV*	*CAverage dBµV*	*Limit dBµV*	*Margin dB*	*Meas. Time ms*	*Bandwidth kHz*	*Line*	*PE*	*Corr. dB*
0.166000	47.89	---	65.16	17.27	1000.0	9.000	N	GND	0.0
0.454000	---	41.82	46.80	4.98	1000.0	9.000	L1	GND	0.0
0.454000	44.64	---	56.80	12.16	1000.0	9.000	L1	GND	0.0
13.558000	54.83	---	60.00	5.17	1000.0	9.000	N	GND	0.2
13.590000	---	32.76	50.00	17.24	1000.0	9.000	N	GND	0.2
22.402000	42.81	---	60.00	17.19	1000.0	9.000	N	GND	0.4
27.118000	39.64	---	60.00	20.36	1000.0	9.000	L1	GND	0.4

Live and Neutral Line - 150 kHz to 30 MHz

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 13

*Decreases with the logarithm of the frequency.

2.3.7 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	ESPI7	19578	18	2019-03-31
V-network	Rohde & Schwarz	ESH 3-Z5	18919	36	2019-10-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V9.26.01	20090	---	---

Table 14

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

2.4 20 dB Bandwidth

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.215 (c), N/A and 6.6

2.4.2 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.4.3 Date of Test

2018-12-17

2.4.4 Test Method

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

2.4.5 Environmental Conditions

Ambient Temperature 21,0 °C
Relative Humidity 35,0 %

2.4.6 Test Results

<u>120 V / 60 Hz AC Powered - Transmitting continuously</u>

Frequency (MHz)	20 dB Bandwidth (Hz)	99% Occupied Bandwidth (Hz)	F_{LOWER} (MHz)	F_{UPPER} (MHz)
13.56	275805	472110	13.502814	13.778619

Table 15

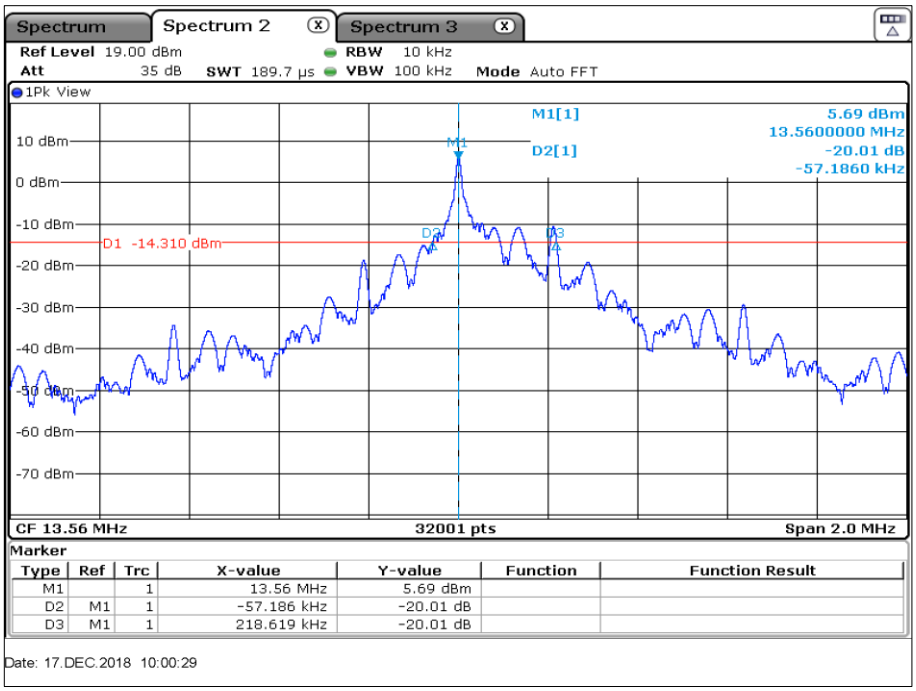


Figure 1 - 20 dB Bandwidth

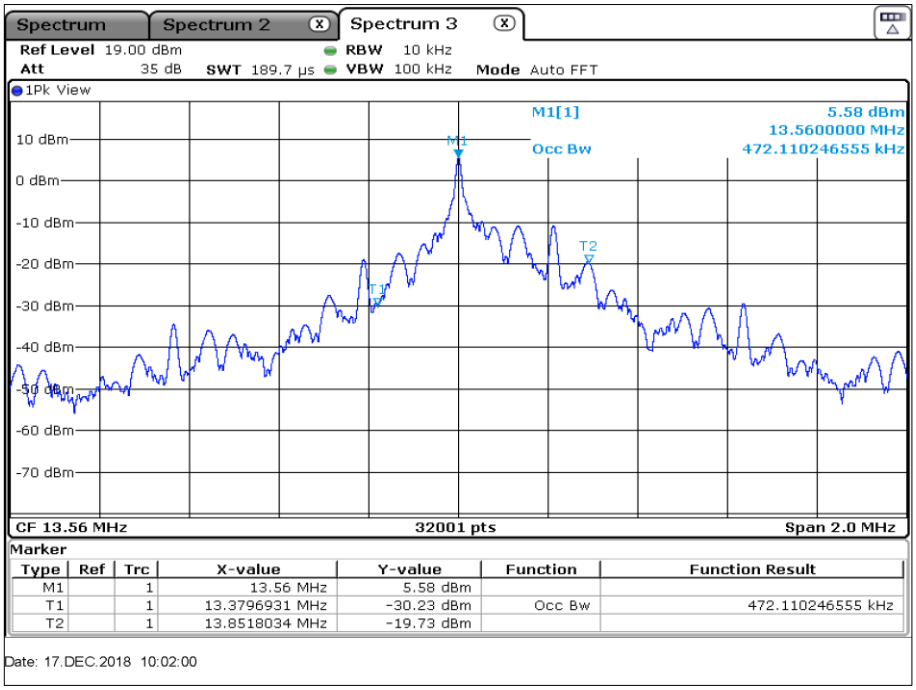


Figure 2 - 99% Occupied Bandwidth

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.

2.4.7 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	2019-01-31

Table 16

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

2.5 Restricted Band Edges

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.205, 4.1 and 8.10

2.5.2 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.5.3 Date of Test

2018-12-17

2.5.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.13.1.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3.

Final average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.2.

2.5.5 Environmental Conditions

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

2.5.6 Test Results

<u>120 V / 60 Hz AC Powered - Transmitting continuously</u>

No restricted band in the range

Product Service

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBµV/m)	Average (dBµV/m)
Restricted Bands of Operation	74	54

Table 17

Industry Canada RSS-GEN, Limit Clause 8.9

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

Table 18

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.5.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	24	2019-07-31
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2020-12-31
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31

Table 19

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

2.6 Field Strength of any Emission >30MHz

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-210 and Industry Canada RSS-GEN, Clause 15.209, 4.3 and 6.13

2.6.2 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.6.3 Date of Test

2018-12-17

2.6.4 Test Method

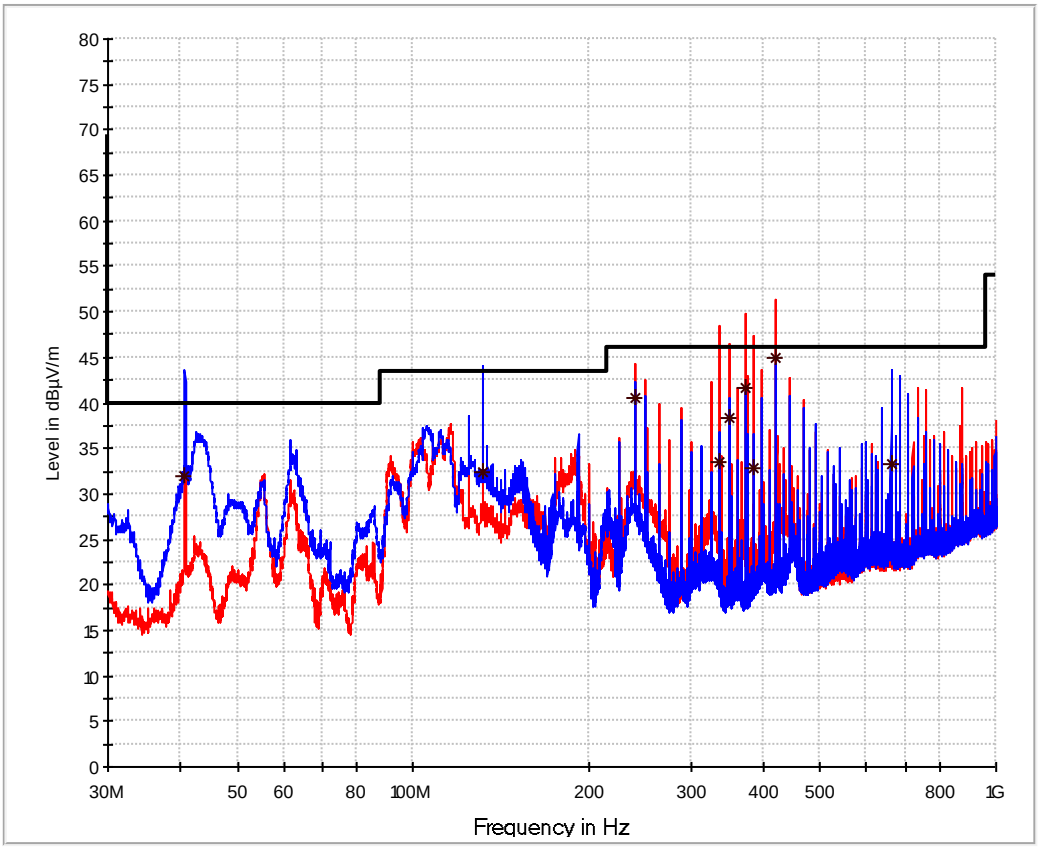
This test was performed in accordance with ANSI C63.10, clause 6.3, 6.4 and 6.5. and Industry Canada RSS-Gen clause 6.13.
Measurements were made at a distance of 3 m. The limit lines shown on the plot were extrapolated from either 300 m or 30 m to the measurement distance of 3 m in accordance with ANSI C63.10 Clause 6.4.4.2.
For any emissions detected within 20 dB of the limit, a final measurement was made and recorded in the table below. The detector used for these measurements was a quasi-peak detector except for emissions within the bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where a CISPR average detector was used.

2.6.5 Environmental Conditions

Ambient Temperature	22,0 °C
Relative Humidity	30,0 %

2.6.6 Test Results

<u>120 V / 60 Hz AC Powered - Transmitting continuously</u>



Final Results 1:

Frequency MHz	*QuasiPeak* dBµV/m	*Limit* dBµV/m	*Margin* dB	*Meas. Time* ms	*Bandwidth* kHz	*Height* cm	*Pol*	*Azimuth* deg	*Corr.* dB
40.680000	31.97	40.00	8.03	1000.0	120.000	100.0	V	198.0	14.9
132.000000	32.48	43.50	11.02	1000.0	120.000	100.0	V	-107.0	10.3
240.000000	40.54	46.00	5.46	1000.0	120.000	120.0	H	-117.0	13.9
336.030000	33.52	46.00	12.48	1000.0	120.000	150.0	H	112.0	16.4
348.030000	38.25	46.00	7.75	1000.0	120.000	105.0	H	106.0	17.0
372.030000	41.69	46.00	4.31	1000.0	120.000	102.0	H	106.0	17.0
384.030000	32.85	46.00	13.15	1000.0	120.000	253.0	H	89.0	17.3
420.030000	44.86	46.00	1.14	1000.0	120.000	104.0	H	118.0	18.4
660.030000	33.28	46.00	12.72	1000.0	120.000	114.0	V	-90.0	22.0

Emissions Results - 30 MHz to 1 GHz

Product Service

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	3

Table 20 - FCC Limit

NOTE: The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.

Industry Canada RSS-210, Limit Clause 4.4

Under no circumstance shall the level of any unwanted emissions exceed the level of the fundamental emissions.

Industry Canada RSS-Gen, Limit Clause 8.9

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

Table 21 - IC Limit, Below 30 MHz

Frequency (MHz)	Field Strength (µV/m at 3 metres)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 22 - IC Limit, Above 30 MHz

2.6.7 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2020-12-31
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.20.01	19719	---	---

Table 23

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

2.7 Exposure of Humans to RF Fields

2.7.1 Specification Reference

FCC 47 CFR Part 15B and ICES-003, Clause 15.107 and 6.1

2.7.2 Guide

IC RSS-102 Issue 5, section 2.5

2.7.3 Equipment Under Test and Modification State

ES110, S/N: 381803F7 - Modification State 0

2.7.4 Date of Test

2018-12-17

2.7.5 Test Results

120 V / 60 Hz AC Powered - Transmitting continuously

Product Service

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = **..... W**			☐	
The effective isotropic radiated power (EIRP in watts) is calculated using				
☐ the numerical antenna gain: G = **.....** $EIRP = G \cdot CP \Rightarrow EIRP$ = **..... W**		☐		
☐ the field strength[1] in V/m: FS = **..... V/m** $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **..... W**			☐	
with: Distance between the antennas in m: D = **..... m**			☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **541.36 nW**				
with: Field strength in V/m: FS **= 0.000403**			☒	
Distance between the two antennas in m: D = **10**			☒	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **541.36 nW**				

[1] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Exposure of Humans to RF Fields (continued)		Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is					
☒ less than or equal to 20 cm	☐ greater than 20 cm		☒		
Transmitting device is					
☐ in the vicinity of the human head	☐ body-worn		☐		

Product Service

SAR evaluation				
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.				

Frequency (MHz)	Exemption limits (mW)[2] at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 [3]	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

Carrier frequency:	f	=	**13.56 MHz**	
Distance:	d	=	**5 mm**	
Transmitter output power:	TP	=	**541.36 nW**	
Limit:	TP_{limit}	=	**71 mW**	☒
☐ SAR evaluation is documented in test report no. …				

[2] The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separaton distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from alinear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from athird order polynomial fit.

[3] Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

2.7.6 Test Location and Test Equipment Used

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

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	24	2019-07-31
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31

Table 24

3 Photographs

3.1 Equipment Under Test (EUT)

Figure 3

Figure 4

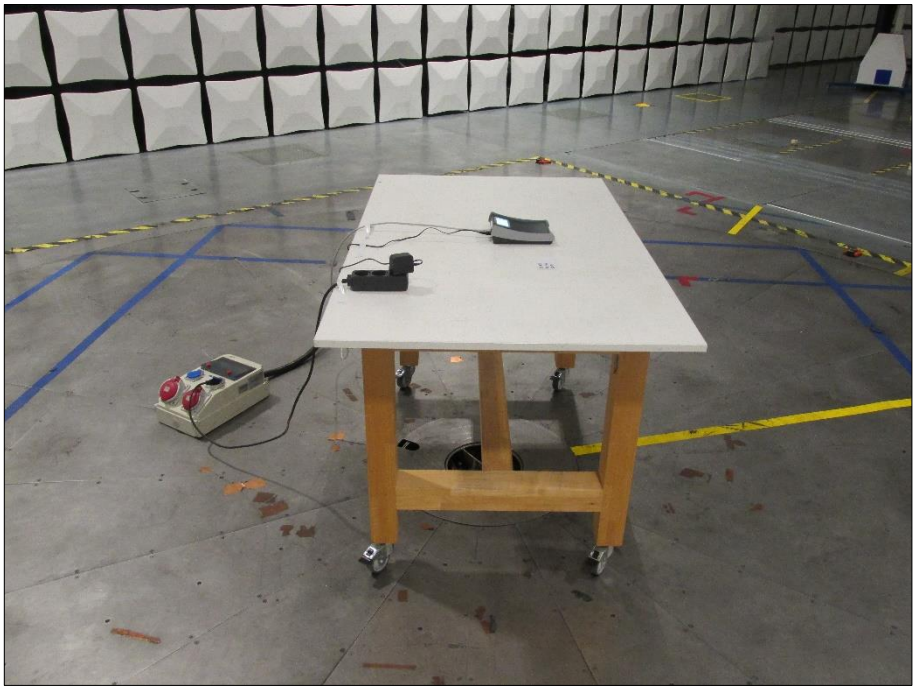


Figure 5

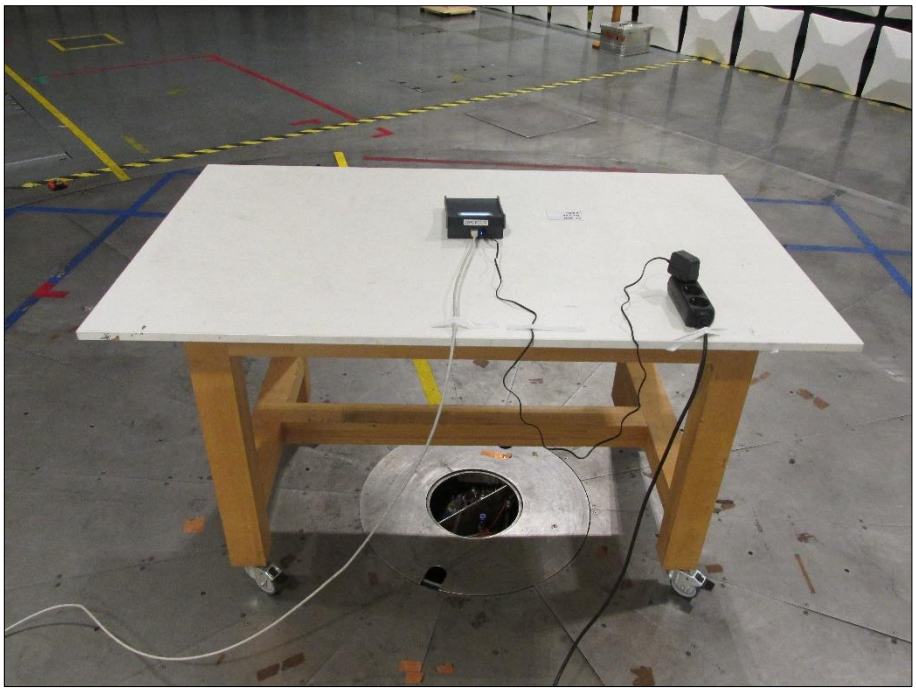


Figure 6

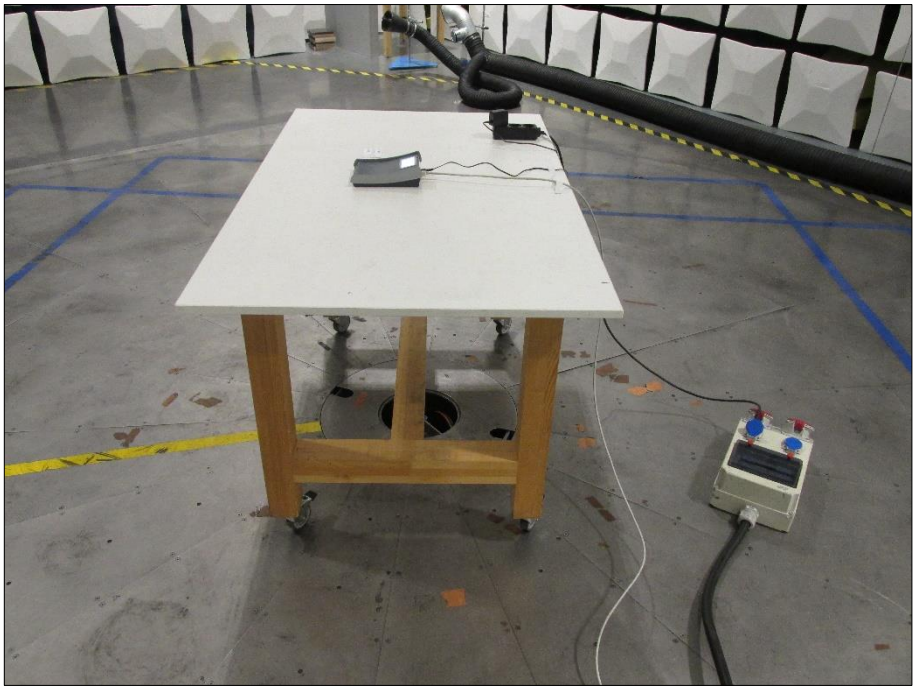


Figure 7

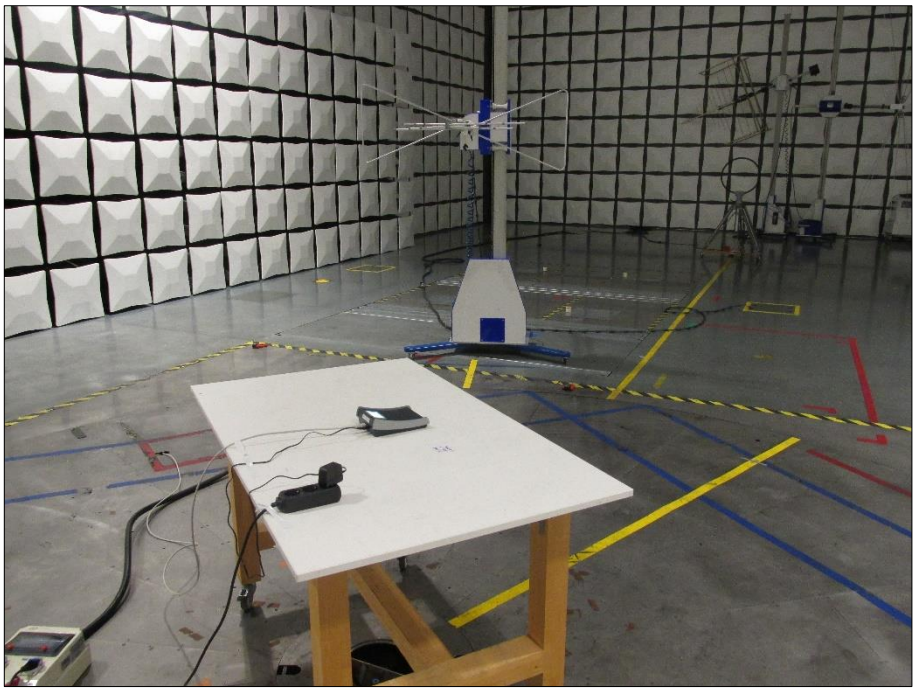


Figure 8

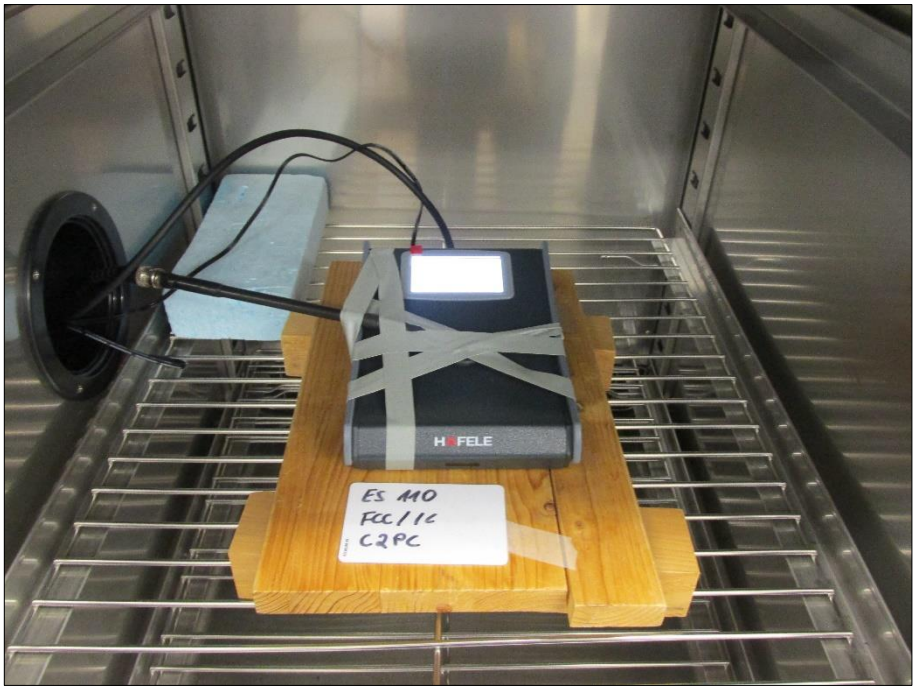


Figure 9

Figure 10

Figure 11

Figure 12

Product Service

Test Equipment Information

3.2 General Test Equipment Used

Instrument	Manufacturer	Type No	T-ID	Calibration Period (months)	Calibration Due
Loop antenna	Rohde & Schwarz	HFH2-Z2	18876	24	2019-07-31
TRILOG Antenna	Schwarzbeck	VULB 9163	19691	24	2020-12-31
EMI test receiver	Rohde & Schwarz	ESW26	28268	12	2019-05-31
EMI test receiver	Rohde & Schwarz	ESPI7	19578	18	2019-03-31
V-network	Rohde & Schwarz	ESH 3-Z5	18919	36	2019-10-31
Spectrum Analyzer	Rohde & Schwarz	FSV40	20219	12	2019-01-31
Climatic test chamber	ESPEC	PL-2J	18843	24	2019-03-31
EMC Measurement Software	Rohde&Schwarz	EMC32 V10.20.01	19719	---	---
EMC Measurement Software	Rohde&Schwarz	EMC32 V9.26.01	20090	---	---

Table 25

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

4 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 26

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 27

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 28

Product Service

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%