

# RADIO TEST REPORT

No. 1812019STO-002, Ed. 2

## RF Performance

### EQUIPMENT UNDER TEST

Equipment: IC card reader  
Type/Model: LV-700CW/UC  
Additional type/model\*: LV-700W/UC  
Manufacturer: Lecip Arcontia AB  
Tested by request of: Lecip Arcontia AB

\*See opinions and interpretations clause 2.6

### SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

47 CFR Part 15: Subpart C: Intentional radiators. Section 15.207  
47 CFR Part 15: Subpart C: Intentional radiators. Section 15.209  
47 CFR Part 15: Subpart C: Intentional radiators. Section 15.225

RSS-GEN Issue 5 (2018): General requirements of compliance of radio apparatus (2018)

RSS-210 Issue 9 Licence-exempt Radio Apparatus (All Frequency Bands):  
Category I Equipment (2016)

For details, see clause 2 – 4.

Date of issue: 2019-09-25

Tested by:

  
Robert Hietala

Approved by:

  
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**Revision History**

Edition	Date	Description	Changes
1	2019-02-25	First release	--
2	2019-09-25	Second release	Updated with 15.225 references and 13.56 MHz spectrum mask.

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## 2.2 Additional information about the EUT

The EUT consists of the following units:

Unit	Type	Serial number
Main unit	LV-700CW/UC	Sample 7

During the tests the EUT supported following software:

Software	Version	Comment
TA	3.00.00	Reader firmware
LV700 peripheral	V1.0	Test application

The EUT was tested with the following cables:

Port	Type	Length [m]	Specifications
DC	DC Power	1.5	Two-core
Ethernet	Telecom	1.5	--

## 2.3 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

Equipment	Type / Model
24 V battery	Rechargeable lead type

## 2.4 Test signals

Continuous CW signal.

## 2.5 Modifications made to improve EMC-characteristics

No modifications were made.

## 2.6 Opinions and interpretations

The following types are also included as additional types in this report:

LV-700W/UC

All types use the same radio solution as the tested type.

The differences as compared to the tested type are (according to the manufacturer):

Part no.	Model name	Description
8-0027	LV-700CW/UC	WiFi/Bluetooth, 3G/4G Modem (US)- with camera (tested type)
8-0014	LV-700W/UC	3G/4G Modem (US)/WiFi/Bluetooth/No camera

The difference is considered not to imply different Radio-characteristics when compared to the tested type. Therefore, these types are not tested, but considered to have the same Radio-characteristics as the tested type.

**3. TEST SPECIFICATIONS**

**3.1 Standards**

Requirements:

47 CFR Part 15: Radio frequency device, Subpart C: Unintentional radiators (2017).

RSS-GEN Issue 5: General requirements of compliance of radio apparatus (2018).

RSS-210 Issue 9 Licence-exempt Radio Apparatus (All Frequency Bands):  
Category I Equipment (2016)

Test methods:

ANSI C63.10-2013: American National Standard for testing Unlicensed Wireless Devices

**3.2 Additions, deviations and exclusions from standards and accreditation**

No additions, deviations or exclusions have been made from standards and accreditation.

**3.3 Test site**

Measurements were performed at:

Intertek Semko AB  
Torshamnsgatan 43  
Box 1103  
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913  
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002  
Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G  
Intertek Semko AB is ISED recognized wireless testing laboratory with CAB identifier SE0003

Measurement chambers

Measurement Chamber	Type of chamber	IC Site filing #
STORA HALLEN	Semi-anechoic 10 m and 3 m	2042G-2
Radiohallen	Fully anechoic 3 m	2042G-4

**3.4 Mode of operation during the test**

The EUT was tested with 24 VDC.

Continuous transmission of CW signal.

#### 4. TEST SUMMARY

The results in this report apply only to sample tested:

Standard	Description	Result
	<b>Emission</b>	
<b>FCC Part 15.203</b> <b>RSS-GEN 6.8</b>	<b>Antenna</b> EUT has an integrated antenna which can't be removed without breaking the EUT	<b>PASS</b>
<b>FCC Part 15.205</b> <b>RSS-GEN 8.10</b>	<b>Restricted bands of operations</b> The transmit frequency, including fundamental components of modulation, of licence-exempt radio apparatus shall not fall within the restricted frequency bands listed in CFR 47 §15.205 and in RSS-GEN section 8.10 EUT operates in unrestricted 13.110-14.010 MHz frequency band.	<b>PASS</b>
<b>FCC Part 15.207,</b> <b>RSS-GEN 8.8</b> <b>table 4</b>	<b>Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port</b> No AC port at EUT	<b>NT</b>
<b>FCC Part.209,</b> <b>15.225 (d)</b> <b>RSS-GEN, 8.9</b> <b>RSS-210, 4.3</b>	<b>Radiated emission of electromagnetic fields in the frequency range 9 kHz - 30 MHz</b> The EUT complies with the limits. The margin to the limit was more than 10 dB. See clause 5.4.	<b>PASS</b>
<b>FCC Part 15.209</b> <b>RSS-GEN, 8.9</b> <b>RSS-210, 4.3</b>	<b>Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz</b> The EUT complies with the limits. See clause 5.5.	<b>PASS</b>
<b>FCC Part 15.225(a)(b)(c)</b> <b>RSS-210 Annex B.6</b>	<b>Transmitter spectrum mask</b> The EUT complies with the limits. The margin to the limit was at least 10 dB at any frequency. See clause 6.3.	<b>PASS</b>
<b>RSS-GEN, 6.7</b>	<b>Occupied bandwidth</b> Occupied bandwidth shall be reported but there's no applicable limit.	<b>--</b>

NT = Not Tested

**5. RADIATED RF EMISSION IN THE FREQUENCY-RANGE 0.009 MHZ TO 40 GHZ**

<b>Date of test:</b>	2019-02-21	<b>Test location:</b>	Stora Hallen
<b>EUT Serial:</b>	Sample 7	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	MGN	<b>Relative humidity:</b>	41 %
<b>Test result:</b>	Pass	<b>Margin:</b>	> 10 dB

**5.1 Test set-up and test procedure.**

The test method is in accordance with ANSI C63.10.

The EUT was set up in order to emit maximum disturbances.

The EUT was placed on an insulating support 0.8 m above the turntable which is part of the reference ground plane.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated.

**5.2 Test conditions**

**Test set-up:**

Test receiver set-up:

Preview test:

Final test:

Measuring distance:

Measuring angle:

Antenna

Height above ground plane:

orientation:

Type:

**9 kHz to 30 MHz**

Peak, RBW 200 Hz / 9 kHz. VBW 30 kHz

Quasi-Peak, RBW 200 Hz / 9 kHz

Average RBW 200 Hz / 9 kHz

10 m

0 – 359°

1 m

Vertical

Loop

**Test set-up:**

Test receiver set-up:

Preview test:

Final test:

Measuring distance:

Measuring angle:

Antenna

Height above ground plane:

Polarisation:

Type:

**30 MHz to 1000 MHz**

Peak, RBW 120 kHz. VBW 1 MHz

Quasi-Peak, RBW 120 kHz

10 m

0 – 359°

1 – 4 m

Vertical and Horizontal

Bilog

### 5.3 Radiated Emission requirements

The EUT shall meet the limits for the standards.

Reference: CFR 47 §15.225, §15.209, §15.109, RSS-Gen section 8.9.

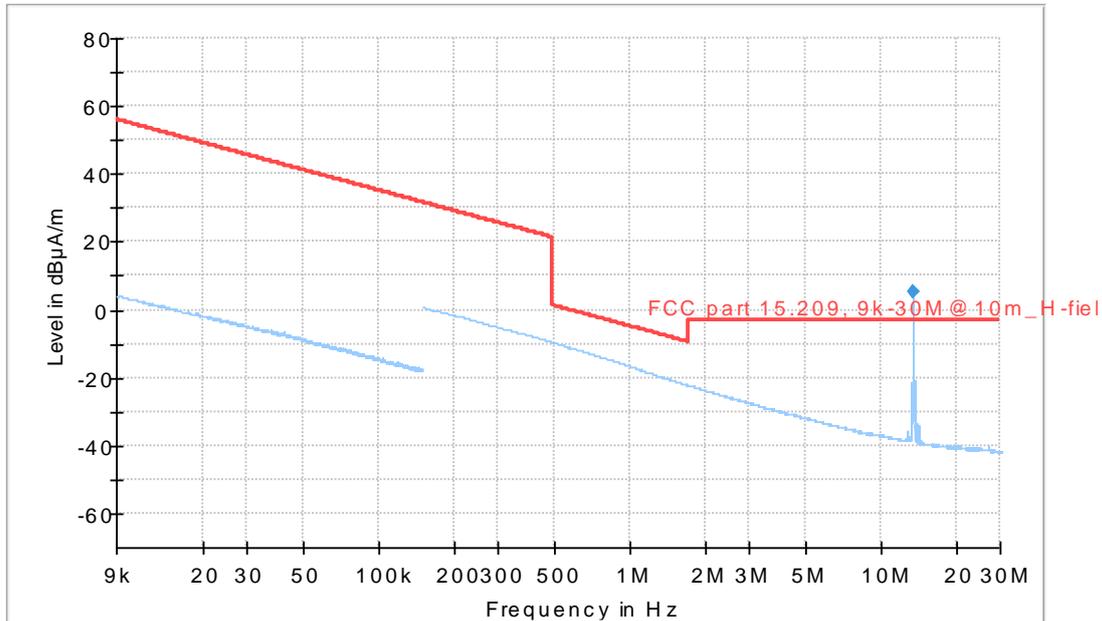
#### Limits for general radiated emission

Frequency range [MHz]	Field strength at 3 m (dB $\mu$ V/m)	Field strength at 10 m (dB $\mu$ V/m)	Detector (dB $\mu$ V/m)
0.009 – 0.09	-	107.6 – 87.6	Average
0.09 – 0.110	-	87.6 – 85.9	Quasi Peak
0.110 – 0.490	-	85.9- 72.9	Average
0.490 – 1.705	-	68.1 – 42.1	Quasi Peak
1.735 – 30	30	49.1	Quasi Peak
30 – 88	40.0	29.5	Quasi Peak
88 – 216	43.5	33.0	Quasi Peak
216 – 960	46.0	35.5	Quasi Peak
960 – 1000	54.0	43.5	Quasi Peak
Above 1000	54.0 / 74.0	-	Average / Peak

The values for each measurement distance are given using an extrapolation factor of 20 dB/decade above 30 MHz and 40 dB/decade below 30 MHz according to §15.31(f)(1), §15.31(f)(2) and RSS-GEN sections 6.4 and 6.5.

5.4 Test results 9 kHz – 30 MHz

Full Spectrum



Diagram, Peak overview sweep, 0.009 – 30 MHz at 10 m distance.

Measurement results, Quasi Peak

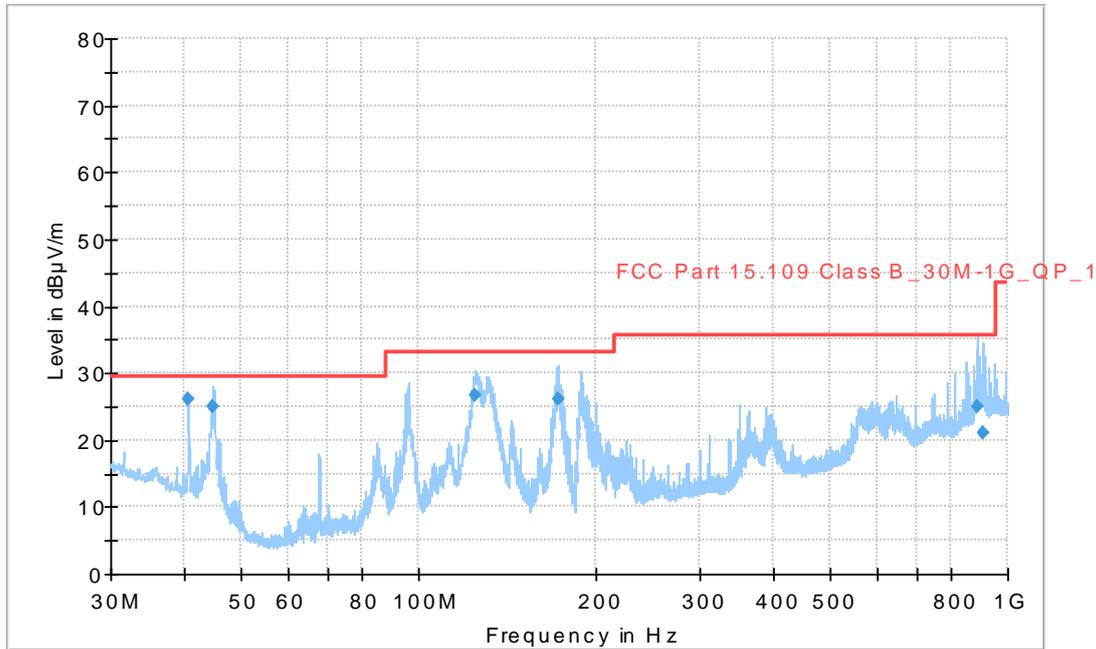
Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
13.560*	56.7	--	V	--

See section 6.3.

No other disturbances above noise floor found.

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

5.5 Test results 30 MHz – 1000 MHz



Diagram, Peak overview sweep, 30 – 1000 MHz at 10 m distance.

Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
40.680	26.0	29.5	V	3.5
44.610	24.9	29.5	V	4.7
124.890	26.8	33.1	V	6.3
172.650	26.1	33.1	H	7.0
889.110	25.1	35.6	H	10.5
910.800	21.1	35.6	V	14.4

Result [dBµV/m] = Analyser reading [dBµV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

## 6. TRANSMITTER SPECTRUM MASK

<b>Date of test:</b>	2019-02-20	<b>Test location:</b>	Stora Hallen
<b>EUT Serial:</b>	No visible	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	Magnus Thorildsson	<b>Relative humidity:</b>	16 %
<b>Test result:</b>	Pass	<b>Margin:</b>	> 10 dB

### 6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10.

#### Test set-up:

Test receiver set-up:

Preview test: Peak RBW 9 kHz. VBW 30 kHz  
 Final test: Quasi-Peak RBW 9 kHz

Measuring distance: 10 m

Measuring angle: 0 – 359°

Antenna

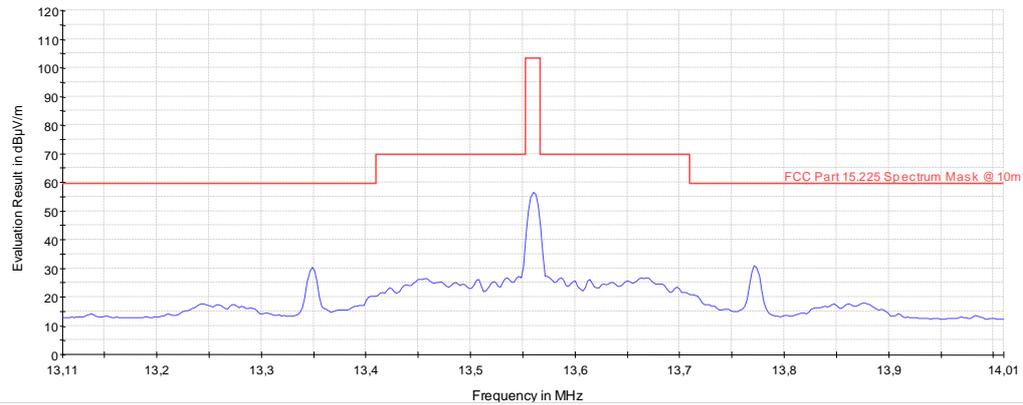
Height above ground plane: 1 m  
 orientation: 2 orthogonal axis  
 Type: Loop

### 6.2 Requirement

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

Frequency [MHz]	Field strength at 30 m [ $\mu\text{V/m}$ ]	Field strength at 10 m [ $\text{dB}\mu\text{V/m}$ ]	Field strength at 3 m [ $\text{dB}\mu\text{V/m}$ ]
< 13.110	30	48.6	69.5
13.110 – 13.410	106	59.6	80.5
13.410 – 13.553	334	69.6	90.5
13.553 – 13.567	15.848	103.1	124.0
13.567 – 13.710	334	69.6	90.5
13.710 – 14.010	106	59.6	80.5
>14.010	30	48.6	69.5

6.3 Test result spectrum mask 13.110 – 14.010 MHz



Diagram, Peak overview sweep, at 10 m distance.

Measurement results, Quasi Peak

Frequency [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Polarization H/V	Margin [dB]
13.560	56.7	103.1	V	46.4

7. 99% BANDWIDTH

<b>Date of test:</b>	2018-10-24	<b>Test location:</b>	Radiolabbet
<b>EUT Serial:</b>	Sample 7	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	PLA	<b>Relative humidity:</b>	41 %
<b>Test result:</b>	Pass	<b>Margin:</b>	--

7.1 Test set-up and test procedure.

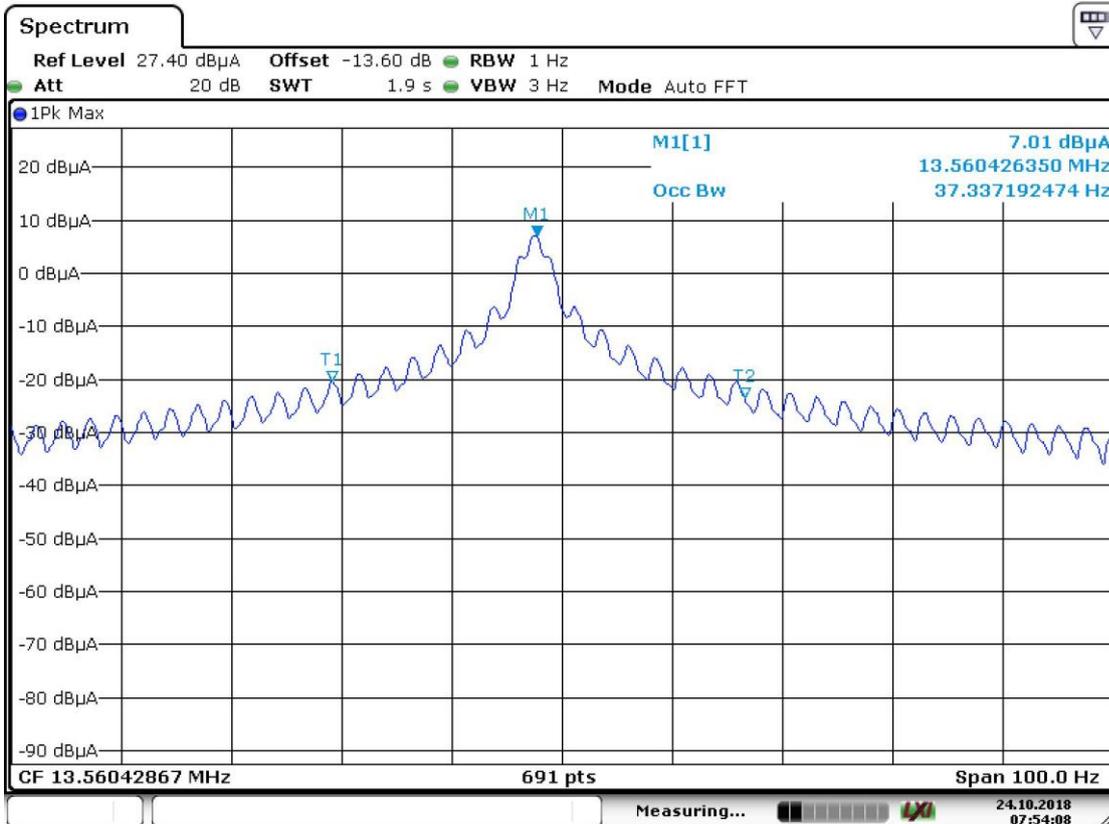
The test method is in accordance with and RSS-GEN section 6.7.

Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth.

7.2 Test conditions

Detector: Peak  
 RBW 1 – 5 % of OBW  
 VBW 3 x RBW

7.3 Test results



Date: 24.OCT.2018 07:54:09

Screenshot: 99 % bandwidth Measurement

## 8. FREQUENCY TOLERANCE EXTREME CONDITIONS

<b>Date of test:</b>	2019-09-18	<b>Test location:</b>	Radiolabbet
<b>EUT Serial:</b>	No visible	<b>Ambient temp:</b>	21 °C
<b>Tested by:</b>	Robert Hietala	<b>Relative humidity:</b>	63 %
<b>Test result:</b>	Pass	<b>Margin:</b>	> 1 kHz

### 8.1 Test set-up and test procedure

Test procedure is according to ANSI C63.10 section 6.8.

The EUT is place inside a temperature chamber and the antenna port is connected to a spectrum analyser.

### 8.2 Requirement

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees 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 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 8.3 Test results

#### Measurement results, variation in primary supply voltage

Voltage	Frequency [MHz]	Frequency error [Hz]	Limit [ $\pm$ Hz]	Margin [Hz]	Result
Nominal	13.5604	--	$\pm 1356$	--	--
115 %	13.5604	$\pm 0$	$\pm 1356$	1356	PASS
85%	13.5604	$\pm 0$	$\pm 1356$	1356	PASS

#### Measurement results, temperature variation

Temp [°C]	f [MHz]	f error [Hz]	Limit [ $\pm$ Hz]	Margin [Hz]	Result
60	13.5605	100	$\pm 1356$	1256	PASS
50	13.5605	100	$\pm 1356$	1256	PASS
40	13.5604	0	$\pm 1356$	1356	PASS
30	13.5604	0	$\pm 1356$	1356	PASS
20	13.5604	0	$\pm 1356$	1356	PASS
10	13.5604	0	$\pm 1356$	1356	PASS
0	13.5604	0	$\pm 1356$	1356	PASS
-10	13.5606	200	$\pm 1356$	1156	PASS
-20	13.5606	200	$\pm 1356$	1156	PASS

## 9. TEST EQUIPMENT

### Stora Hallen

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - 10	--	--	--
Receiver	Rohde & Schwarz	ESW 44	33890	Feb-2018	1 year
Coaxial cable	Suner	Sucoflex100	39122	Dec-2017	1 year
BiLog antenna	Chase	CBL6110A	971	Sept-2017	3 year
Coaxial cable	Suner	Sucoflex100	39162	Mars-2018	1 year
Preamplifier	HP	8447	7992	Nov-2017	1 year
Active loop antenna	EMCO	6502	8853	Nov-2018	3 year
Coaxial cable	Suhner	RG14	9506	April-2018	1 year

### Wireless Center and 3m FAC

Equipment type	Manufacturer	Model	Inv. No.	Last Cal. date	Cal. interval
Measurement software	Rohde & Schwarz	EMC32 - Version 10	--	--	--
Signal analyzer	Rohde & Schwarz	ESU 40	13178	July-2018	1 year
Signal analyzer	Rohde & Schwarz	FSV30	32594	July-2018	1 year
Measurement cable	Huber + Suhner	Sucoflex 104 PE	39138	July-2018	1 year
Measurement cable	Huber + Suhner	Sucoflex 104	5191	July-2018	1 year

## 10. MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz  $\pm 3.7$  dB

Measurement uncertainty for radiated disturbance

Uncertainty for the frequency range 0.09 to 30 MHz at 10 m	$\pm 3.2$ dB
Uncertainty for the frequency range 30 to 1000 MHz at 3 m	$\pm 5.1$ dB
Uncertainty for the frequency range 30 to 1000 MHz at 10 m	$\pm 5.0$ dB
Uncertainty for the frequency range 1.0 to 18 GHz at 3 m	$\pm 4.7$ dB
Uncertainty for the frequency range 18 to 26 GHz at 3 m	$\pm 4.8$ dB
Uncertainty for the frequency range 26 to 40 GHz at 3 m	$\pm 5.7$ dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

## 11. TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1812019STO-003 Annex 1.

Test set up photos are in separate document 1812019STO-004 Annex 2.