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Chamber of Commerce
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FCC and IC Test report for Part 15B, 15.109 and Parts 15.209, 15.225, RSS-210, RSS-Gen

Product name	: AXA IN ERL BLE 2
Applicant	: AXA Stenman Nederland B.V
FCC ID	: 2AIQH-AXA-IN-ERL-2
ISED ID	: 21586-AXAINERL2

Test report No. : 190100025 004 v2.00

Laboratory information

Accreditation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001.

Telefication is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.
The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands.

Testing Location

Test Site	Telefication BV
Test Site location	Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31889983600 Fax. +31316583189
Test Site FCC	NL0001

Revision History

Version	Date	Remarks	By
v0.50	05-02-2019	First draft	RvB
v1.00	14-02-2019	Initial release	RvB
v2.00	09-04-2019	Updated FCC and ISED id and emission designator	RvB

Table of Contents

Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.225(a),(b),(c)	RSS-210 B.6	Field strength of emissions	3.1	Pass
15.225(d) 15.209 (a) 15.109	RSS-Gen 8.9	Radiated spurious emissions	3.2	Pass
15.205 (a)	RSS Gen 8.10	Spurious emissions in the restricted bands	3.2	Pass
15.225(e)	RSS-210 B.6	Frequency Stability	3.3	Pass
15.215 (c)	RSS Gen 6.6	Occupied Bandwidth/ 20 dB bandwidth	3.4	Pass

1 General Description

1.1 Applicant

Client name:	AXA Stenman Nederland B.V
Address	Energiestraat 2, Veenendaal, Utrecht, The Netherlands
Zip code:	3903 AV
Telephone:	+31 318 536 111
E-mail:	Gerbrand.hutten@allegion.com
Contact name:	Mr. G. Hutten

1.2 Manufacturer

Manufacturer name:	AXA Stenman Nederland B.V
Address:	Energiestraat 2, Veenendaal, Utrecht, The Netherlands
Zip code:	3903 AV
Telephone:	+31 318 536 111
E-mail:	Gerbrand.hutten@allegion.com
Contact name:	Mr. G. Hutten

1.3 Tested Equipment Under Test (EUT)

Product name:	AXA IN ERL BLE2
Brand name:	AXA
Product Description:	Electronic bicycle lock with BLE
FCC ID:	2AIQH-AXA-IN-ERL-2
ISED ID:	21586-AXAINERL2
Software version:	--
Hardware version:	--
Date of receipt	22-01-2019
Tests started:	22-01-2019
Testing ended:	30-01-2019

1.4 Product specifications of Equipment under test

TX Frequency range :	BLE:2400 – 2483.5 MHz RFID: 125 kHz
RX frequency range :	BLE:2400 – 2483.5 RFID: 125 kHz NFC: 13.56 MHz
Antenna type:	BLE: PCB Antenna RFID: loop antenna NFC: PCB loop antenna
Antenna gain :	BLE: - 2 dBi
Emission designators	BLE: 831KF1D 125kHz: 21K5K1D

1.5 Environmental conditions

Test date	28-01-2019	31-01-2019
Ambient temperature	20.5 °C	20.2 °C
Humidity	35.1 %	32.7 %

1.6 Measurement standards

- ANSI C63.4:2014
- ANSI C63.10:2013

1.7 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart B §15.109
- FCC Part 15 Subpart C §15.225
- RSS-Gen Issue 5
- RSS-210 Issue 9

1.8 Observation and remarks

The EUT is an Electronic bicycle lock with BLE, RFID and NFC.
With the BLE function the lock can be locked and unlocked. RFID is used to detect a RFID tag embedded inside a chain and the NFC function is used during programming in the factory.
The manufacturer provided both a radiated sample and conducted sample for radio testing.

The NFC radio is in listening mode only. It doesn't transmit a 13.56 MHz carrier. So it was tested with a host device. (Samsung Galaxy A3 (2016)).

1.9 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 *"Applicable standards"*.

All conducted tests are performed by:

Name : ing. R. van Barneveld

Review of test methods and report by:

Name : ing. P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 09-04-2019

Name : ing K.A. Roes

Function : Coordinator Radio Laboratory

Signature :

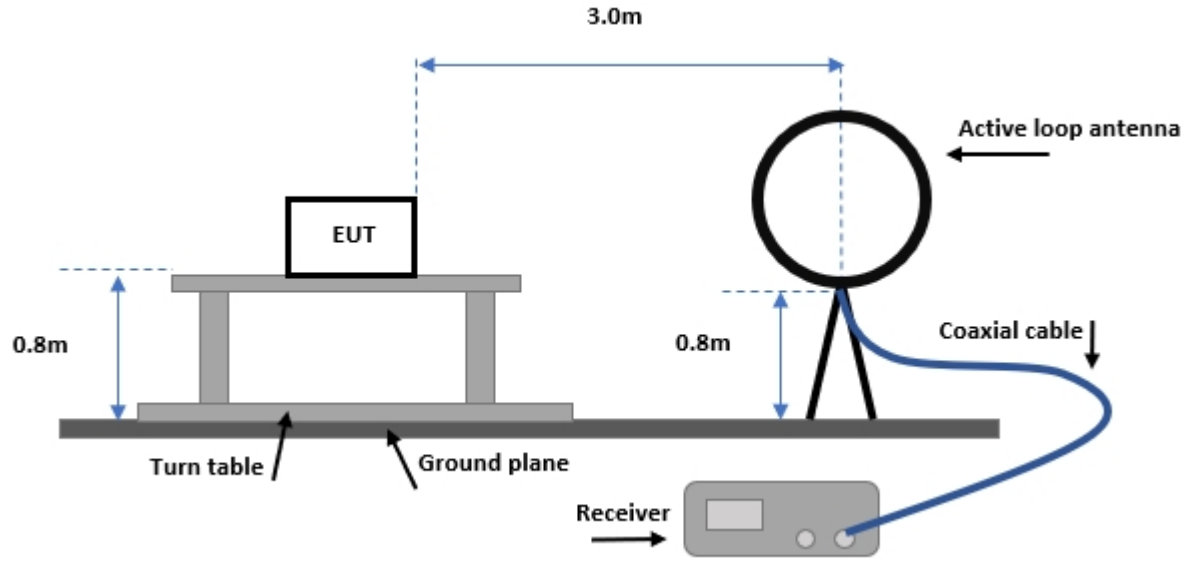
2 Test configuration of the Equipment Under Test

2.1 Test mode

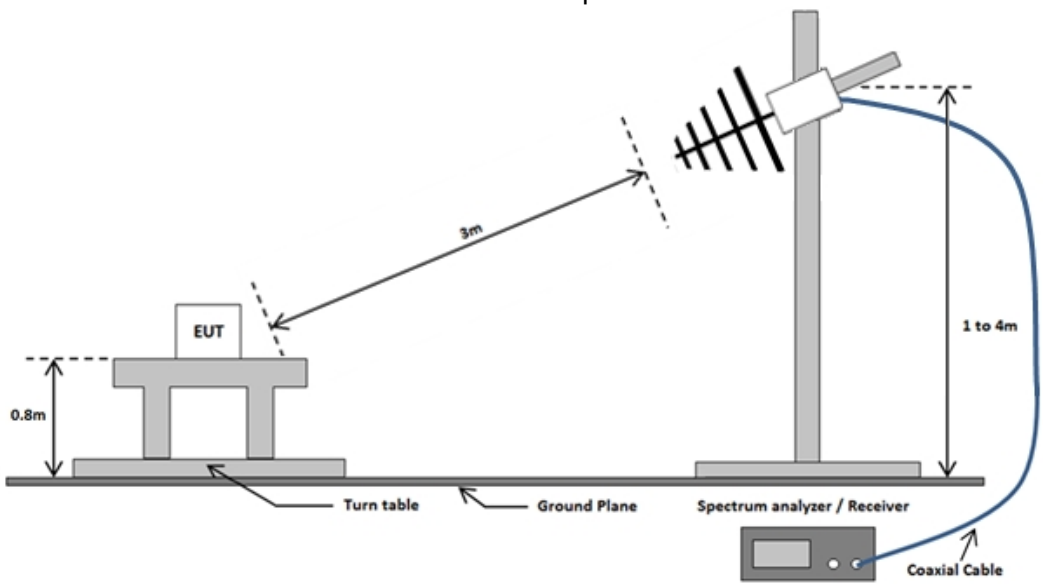
The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT to transmit/receive continuously.

2.2 Test setups

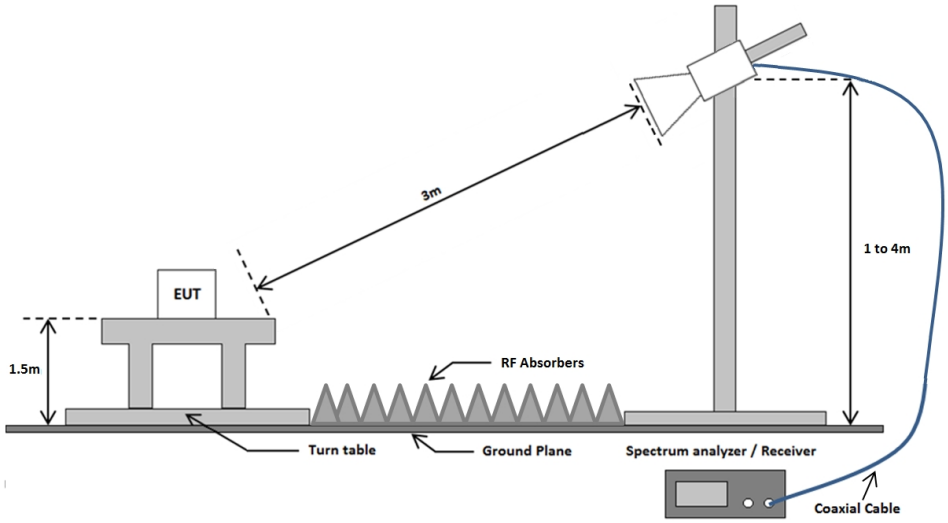
Radiated emissions test setup 9 kHz – 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum Analyzer	Rohde & Schwarz	ESCI	TE11128	3.1 – 3.2
Spectrum Analyzer	Rohde & Schwarz	FSP40	TE11125	3.3
Spectrum Analyzer	Rohde & Schwarz	FSV40	TE01269	3.1 – 3.2
Climate Chamber	TE 00741	CTS	-40/350	3.3
Biconilog Antenna	Chase	CBL6112a	TE00967	3.1 – 3.2
SAC Chamber	Comtest Engineering BV	-	TE00861	3.1 – 3.2
Active loop antenna	Rohde & Schwarz	HFH 2-Z2	TE00746	3.1 – 3.2
Software	D.A.R.E Instruments	Radimation 2018.1.3	--	3.2

2.4 Sample calculations

Field Strength Measurement example(see chapter 3.3):

Frequency (MHz)	Polarization	Height(m)	Quasi-Peak (dBµV/m)
135,6	Horizontal	1	40,4

The following relation applies:

E (dBµV/m) = U(dBµV) + AF (dB/m) + CL (dB)

Where:

E = Electric field strength
U = Measuring reveiver voltage
AF = Antenna factor
CL = Cable loss

(40.4 = 27.23 + 11.8 + 1.37)

3 Test results

3.1 Field strength of emissions

3.1.1 Limit

15.225(a),(b),(c)

Frequency (MHz)	µV/m at 30 meter	dBµV/m at 30 meter
13.553 – 13.567	15,848	84
13.410 – 13.553 and 13.567 – 13.710	334	50.5
13.110 – 13.410 and 13.710 - 14.010	106	40.5

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.1.4 Test procedure

According to ANSI C63.10-2013, section 6.4.4.2.
IRN 026 – Method 10.

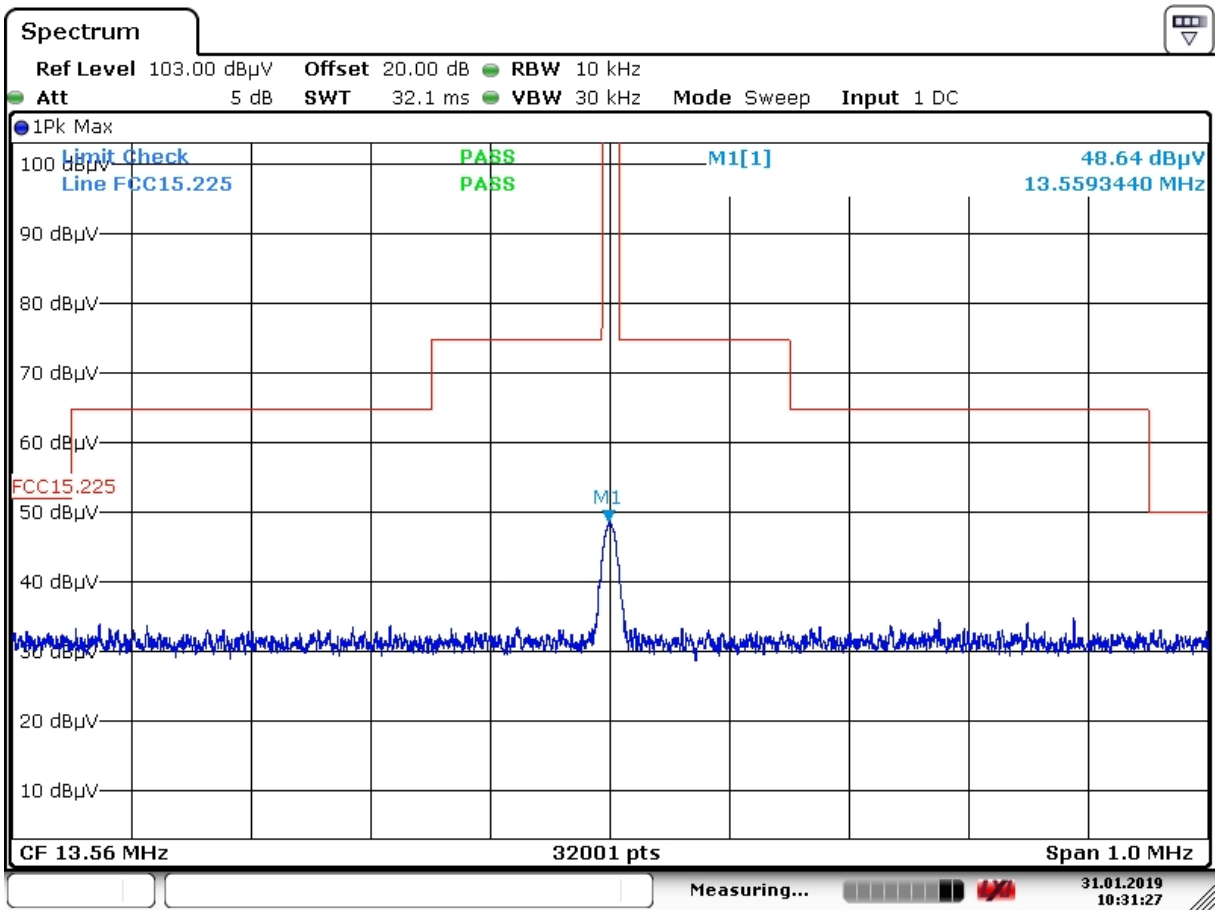
3.1.5 Test results of Field strength of emissions

Frequency (MHz)	Max Field strength at 30m (dBµV/m)
13.56	21.36
Uncertainty	+3.0 / -2.5 dB

Note: the measured value is corrected according to ANSI 63.10, Par. 6.4.4.2.

3.1.6 Plots of Field strength of emissions Measurement

13.56 MHz



Note 1: in the plots above a distance factor of - 40 dB/decade to convert to 3 m distance has been used (ref. 47 CFR part 15B, §15.31 f (2)).
Note 2: dBµv reads as dBµV/m

3.2 Radiated spurious emissions

3.2.1 Limit

15.225(d)/15.109
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 part 15.209/15.109.

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	20*{log[2400]-log[F(kHz)]}	300*
0.490 – 1.705	24000/F(kHz)	20*{log[24000]-log[F(kHz)]}	30*
1.705 – 13.11 14.01 – 30.0	30	29.5	30*
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

*Note: Limit lines in the plots are corrected to 3m measurement distance according to the method described in ANSI C63.10-2013, clause 6.4

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.2.4 Test procedure

9 kHz – 30 MHz: According to ANSI C63.4-2014, section 5.4.2 and 8.2.3.
30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3.

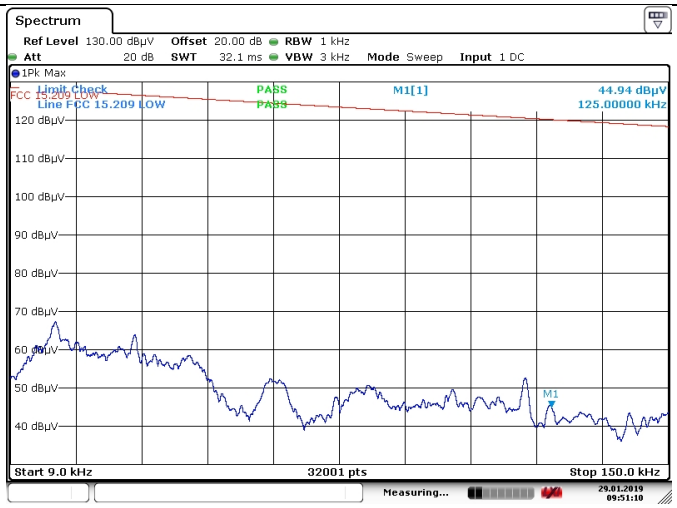
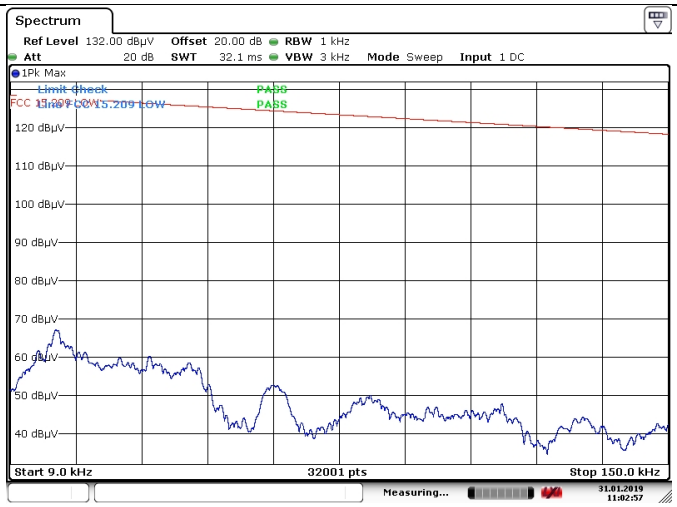
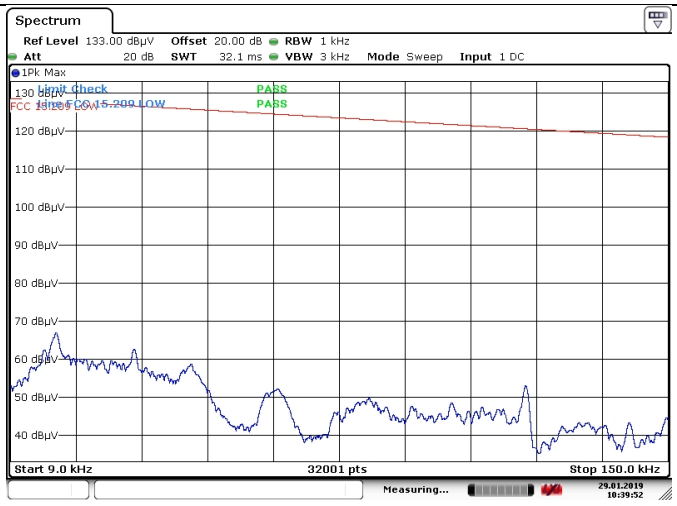
9 kHz to 30 MHz: IRN 026 – Method 10.
30 MHz to 1 GHz: IRN 026 – Method 1.

3.2.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
9 kHz – 30 MHz	--	±1.6 dB
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB

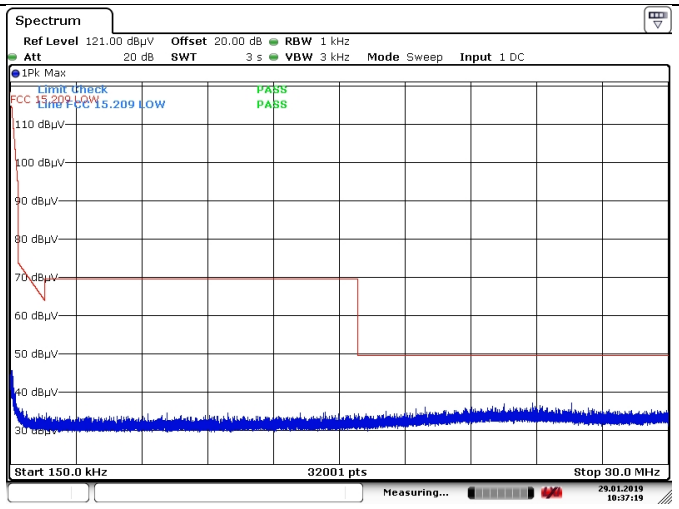
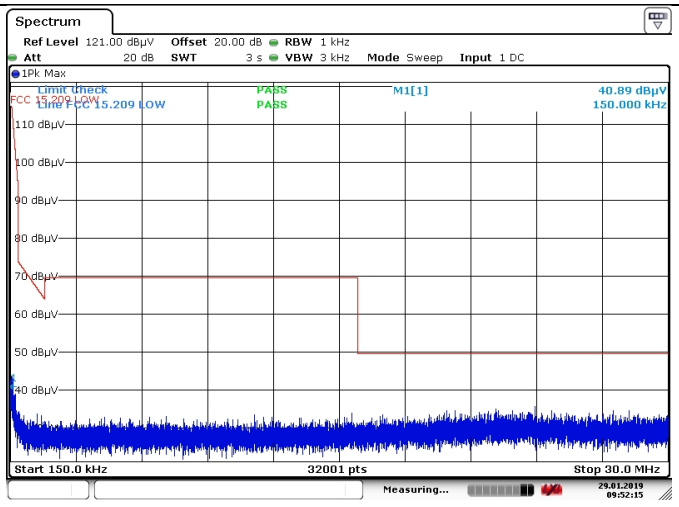
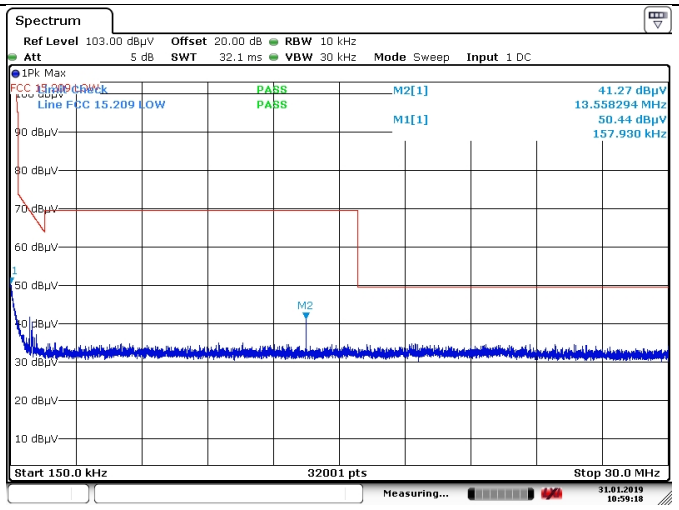
3.2.6 Plots of the Radiated Spurious Emissions Measurement

9 – 150 kHz

RFID	
NFC without host	
NFC with host	

Note: the output power of the 125 kHz transmitter is below the noise floor of the plots above.

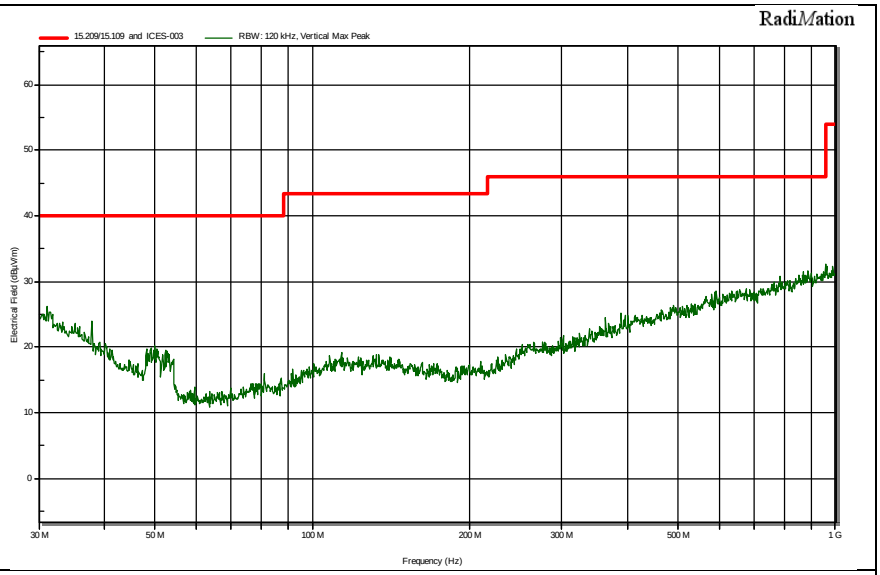
150 kHz – 30 MHz

RFID	
NFC without host	
NFC with host	

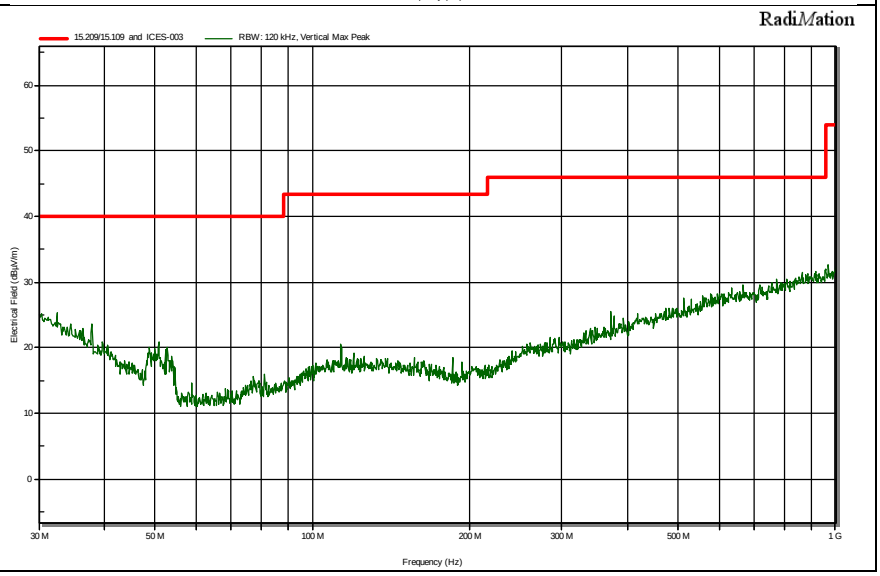
30-1000 MHz

Vertical

RFID

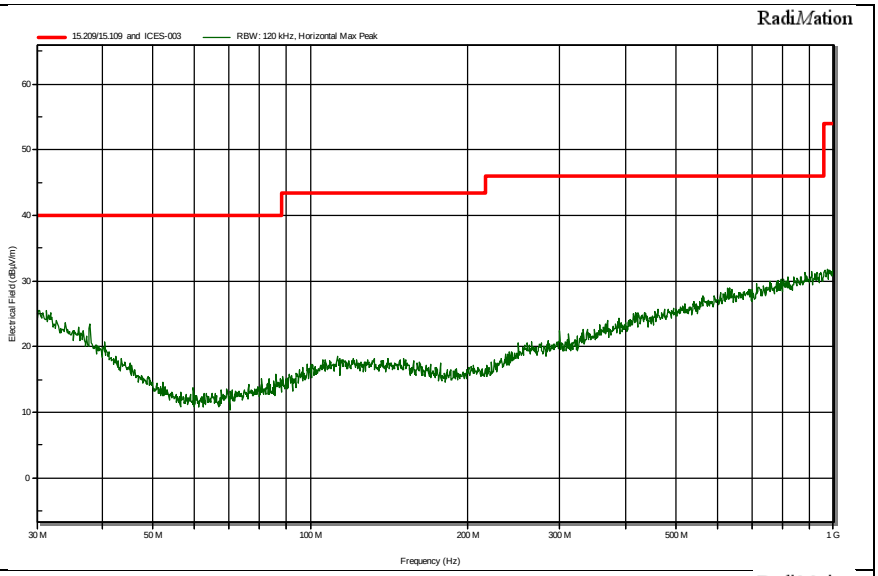
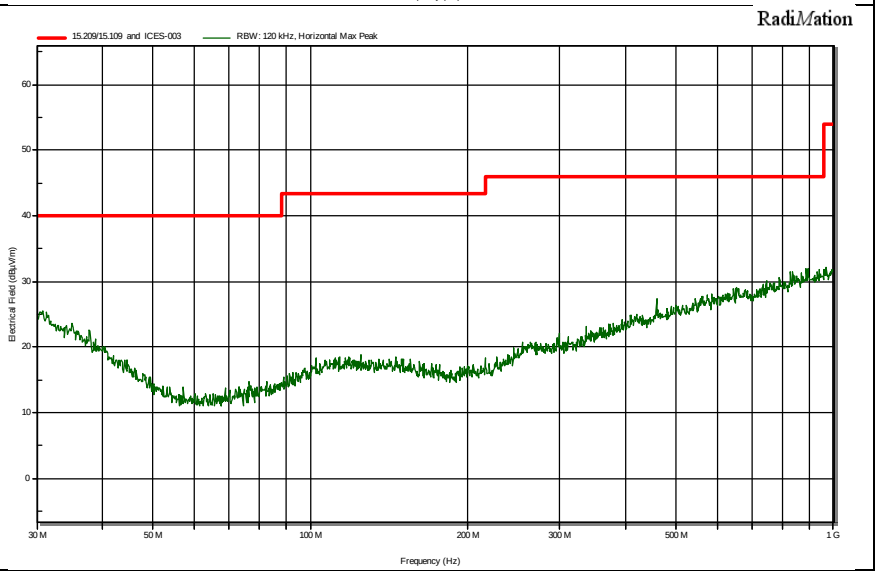


NFC



Note: NFC is tested with a host device

Horizontal

RFID	
NFC	

3.3 Frequency Stability

3.3.1 Limit

The frequency stability of the carrier signal shall be maintained within ±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.

The measured frequency for the 13.56 MHz radio should fall within the limits 13558.644 kHz ≤ f ≤ 13561.356 kHz.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.3.3 Test setup

The test has been performed in a climatic chamber using a test fixture.

3.3.4 Test procedure

According to ANSI C63.10-2013, section 6.8.
IRN 005 – Method 2.

3.3.5 Test results of Frequency Stability Measurements

Temperature variation:

Temp. (ºC)	-20	-10	0	10	20	30	40	50
Frequency (MHz)	13.5598							
After 2 min	13.5598	13.5598	13.5598	13.5598	13.5598	13.5598	13.5598	13.5596
After 5 min	13.5598	13.5598	13.5597	13.5598	13.5598	13.5599	13.5598	13.5596
After 10 min	13.5598	13.5597	13.5599	13.5598	13.5598	13.5599	13.5598	13.5596
Deviation (%)*)	0	0.00339	0.00339	0	0	0.00339	0	0.00678
Limit (%)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Voltage variation:

Voltage	Frequency (MHz)	Deviation (%)*)	Limit (%)
3V	13.5598	0	0.01
2.55V	13.5598	0	0.01

*) w.r.t. nominal frequency of 13.5598 MHz

3.3.6 Measurement Uncertainty

Measurement uncertainty = + /- 10 Hz.

3.4 99% Occupied bandwidth and 20 dB bandwidth

3.4.1 Limit

15.215c: the 20 dB bandwidth shall be contained within the designated frequency band.
RSS-Gen 6.6 : 99% bandwidth = Reporting only.

3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.4 of this report.

3.4.3 Test setup

The test setup is as shown in chapter 2.3 of this report.

3.4.4 Test procedure

Tests according to ANSI C63.10
IRN 017 - Occupied bandwidth (Hz) Method 4 – DTS Bandwidth.

3.5 Uncertainty

± 1 kHz

3.6 99% Occupied bandwidth and 20 dB bandwidth Measurements

125 kHz 99% / 20 dB bandwidth