TEST REPORT CONCERNING THE COMPLIANCE OF AN INDUCTIVE PROXIMITY CARD READER, OPERATING ON 13.56 MHz BRAND NEDAP, MODEL INVEXS MDK170B, WITH 47 CFR PART 15 (10-1-09 EDITION) AND THE REQUIREMENTS OF INDUSTRY CANADA: RSS-GEN AND RSS-210 (ISSUE 8, DECEMBER 2010)

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Industry Canada : 2932G-2
VCCI Registered : R-1518, C-1598
R&TTE, LVD, EMC Notified Body : 1856

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MEASUREMENT/TECHNICAL REPORT

N.V. Nederlandsche Apparatenfabriek "Nedap"

Brand: Nedap
Model: INVEXS MDK170B
FCC ID: CGDINVEXS170
IC: 1444A-INVEXS170

This report concerns:	Original grant/certification ~~Class 2 Permissive Change~~ ~~Verification~~
Equipment type:	Inductive Proximity Card Reader

Report prepared by:		
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The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-09 Edition), RSS-GEN AND RSS-210 and the measurement procedures of ANSI C63.4-2009. TÜV Rheinland EPS B.V. at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: July 05, 2012 Signature: 

R. van der Meer
Engineer Telecom TÜV Rheinland EPS B.V.

Summary

The device under test does:

- ● fulfill the general approval requirements as identified in this test report
- ○ not fulfill the general approval requirements as identified in this test report

Description of test item

Test item (EUT)	:	Inductive Proximity Card Reader
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek “Nedap”
Brand	:	Nedap
Model(s)	:	INVEXS MDK170B
Serial number(s)	:	C303 A 0873
FCC ID	:	CGDINVEXS170
IC	:	1444A-INVEXS170
Receipt date	:	May 25, 2012

Applicant information

Applicant's representative	:	Mr. J. Hulshof
Company	:	N.V. Nederlandsche Apparatenfabriek “Nedap”
Address	:	Parallelweg 2
Postal code	:	7141 DC
City	:	Groenlo
Country	:	The Netherlands
Telephone number	:	+31 544 471 162
Telefax number	:	+31 544 466 475

Test(s) performed

Location	:	Leek
Test(s) started	:	June 4, 2012
Test(s) completed	:	June 22, 2012
Purpose of test(s)	:	Equipment Authorization (Original grant/certification)
Test specification(s)	:	47 CFR Part 15 (10-1-09 Edition) and RSS-GEN AND RSS-210
Compliance statement	:	The test has demonstrated that this unit complies with stipulated standards.
Test engineer(s)	:	O.H. Hoekstra
Report written by	:	O.H. Hoekstra
Report date	:	July 05, 2012

Table of contents

1 General information.

1.1 Product description.

1.1.1 Introduction.

The Inductive Proximity Card Reader, brand Nedap, model INVEXS MDK170W, hereafter refered to as EUT is an inductive proximity card reader intended to be used for access control. It is capable of reading 13.56 MHz inductive tags.

The content of this report and measurement results have not been changed other than the way of presenting the data.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original grant/certification in equipment authorization files under registration number.
FCC ID: CGDINVEXS170 and IC: 1444A-INVEXS170.

1.3 Tested system details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

EUT	:	Inductive Proximity Card Reader
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek “Nedap”
Brand	:	Nedap
Model	:	INVEXS MDK170B
Serial number	:	--
Voltage input rating	:	120 Vac
Voltage output rating	:	--
Current input rating	:	--
Antenna	:	Integral
Operating frequency	:	13.56 MHz
Remarks	:	n.a.

Photo 1a: EUT (front)


Photo 1b: EUT (back)

1.3.1 Description of input and output ports.

EUT has no specific input and output ports.

1.4 Test Summary

The EUT was tested in accordance with the specifications given in Table 1 below.

Test Standard		Description	Pass / Fail
47 CFR Part 15.225 (10-1-09 Edition)	**RSS-210 Issue 8, December 2010**		
15.207(a)	RSS-Gen(7.2.4)	Conducted emissions	Pass
15.225(a)	RSS-210(A2.6(a))	Emissions in the band 13.553-13.567 MHz	Pass
15.225(d), 15.209	RSS-210(A2.6)	Emissions outside the band 13.110-14.010 MHz	Pass
15.225(e)	RSS-210(A2.6)	Frequency stability	Pass
15.215(c)	RSS-Gen(4.6.1)	Occupied bandwidth	Pass

Table 1: Test specifications

Test methods: ANSI C63:2009 and RSS-Gen Issue 3, December 2010

1.5 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-09 Edition), sections 15.31, 15.35, 15.205, 15.209, 15.209 and 15.225 and RSS-GEN AND RSS-210 (ISSUE 8, DECEMBER 2010).

The test methods, which have been used, are based on ANSI C63.4: 2009.

Radiated emission tests above 30 MHz were performed at a measurement distance of 3 meters.
Radiated emission tests below 30 MHz were performed at a measurement distance of 3 meters.
To calculate the field strength level from these results to the appropriate distance at which the limit is specified, the appropriate extrapolation factor is used.

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

1.6 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland EPS B.V., located at Eiberkamp 10, 9351 VT Leek, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948(10-1-06 edition).

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

1.7 Test conditions.

Normal test conditions:

Temperature (*)	: +15°C to +35°C
Relative humidity(*)	: 20 % to 75 %
Supply voltage	: 120 Vac
Air pressure	: 950 – 1050 hPa

When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

2 System test configuration.

2.1 Justification.

The system was configured for testing in a typical situation as a customer would normally use it. The test sample was configured by the applicant to enable continuous transmit.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.4: 2009.

2.2 EUT mode of operation.

The EUT has been tested in active mode, i.e. the EUT is ready to detect a card. To assess the behavior of the EUT while reading the card, the EUT is tested with a card presented such that it continuously reads the card. The intentional radiator tests have been performed with a complete functioning EUT.

2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

2.4 Equipment modifications.

No modifications have been made to the equipment.

2.5 Product Labeling

The product labeling information is available in the technical documentation package.

2.6 Block diagram of the EUT.

The block diagram is available in the technical documentation package.

2.7 Schematics of the EUT.

The schematics are available in the technical documentation package.

2.8 Part list of the EUT.

The part list is available in the technical documentation package.

3 Radiated emission data.

3.1 Radiated field strength measurements (30 MHz – 1 GHz, E-field)

Frequency (MHz)	Measurement results @3m Vertical (dBµV)	Measurement results @3m Horizontal (dBµV)	Correction factor (dB)	Results after correction Vertical (dBµV/m)	Results after correction Horizontal (dBµV/m)	Limits @3m (dBµV/m)	Pass/Fail
40.68	23.1	13.3	13.4	36.5	26.7	40.0	Pass
46.07	22.3	10.6	10.2	32.5	20.8	40.0	Pass
51.15	29.2	13.1	8.2	37.4	21.3	40.0	Pass
67.80	23.0	16.4	5.7	28.7	22.1	40.0	Pass
76.80	24.0	19.8	6.9	30.9	26.7	40.0	Pass
114.6	22.1	17.8	11.6	33.7	29.4	43.5	Pass
153.6	21.7	29.1	11.0	32.7	40.1	43.5	Pass
173.4	24.6	23.5	10.1	34.7	33.6	43.5	Pass
184.3	30.5	24.0	9.6	40.1	33.6	43.5	Pass
202.9	24.5	20.4	10.4	34.9	30.8	43.5	Pass
215.0	26.1	24.3	11.3	37.4	35.6	43.5	Pass
216.9	26.8	23.4	11.4	38.2	34.8	46.0	Pass

Table 2 Radiated emissions of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.205, 15.209 and 15.225 and RSS-210 and RSS-Gen, section 2.2 and 2.6 are depicted in Table 2.

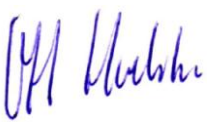
Notes:

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is ±5.0dB.
3. The EUT was varied in three positions, the measuring antenna was varied in horizontal and vertical orientations and also around its axis. The reported value is the worst case found at the reported frequency.
4. The EUT was tested in both normal mode (i.e. without a label in its proximity) and in activated mode (i.e. with a label in its proximity). Worst case noted.
5. A Quasi-peak detector was used with a bandwidth of 120 kHz.

3.1.1 Test equipment used (for reference see test equipment listing).

15633	99580	99609	99857	99699	99733	

Test engineer

Signature : 

Name : O.H. Hoekstra
Date : June 22, 2012

3.2 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field).

Frequency (MHz)	Measurement results	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits	Pass/Fail
	dBµV @3m		dB	dB	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)	
13.058	-4.4	Qp	19.7	1	40	-23.7	29.5	Pass
13.349	6.3	Qp	19.7	1	40	-13.0	40.5	Pass
13.482	9.2	Qp	19.7	1	40	-10.1	50.5	Pass
13.560	43.4	Qp	19.7	1	40	24.1	84.0	Pass
13.639	9.4	Qp	19.7	1	40	-9.9	50.5	Pass
13.772	6.8	Qp	19.7	1	40	-12.5	40.5	Pass
14.063	-2.9	Qp	19.7	1	40	-22.2	29.5	Pass
27.120	-7.7	Qp	19.7	1	40	-27.0	29.5	Pass

Table 3 Radiated emissions of the EUT, in the frequency range 0.009 – 30 MHz

The results of the radiated emission tests in the frequency range 0.009 – 30 MHz, carried out in accordance with 47 CFR Part 15 section 15.209, 15.225 and RSS-210 and RSS-Gen are depicted in Table 3.

Notes:

1. Calculated measurement results are obtained by using the 40dB/decade factor (antenna factor and cable loss is included). i.e at 13.562 MHz: 43.4 dBµV + 19.7 dB + 1dB - 40dB= 24.1 dBµV/m.
2. A resolution bandwidth of 9 kHz was used during testing
3. Field strength values of radiated emissions at frequencies not listed in Table 3 are more than 20 dB below the applicable limit
4. The loop antenna was varied in horizontal and vertical orientations and also around it's axis. The reported value is the worst case found at the reported frequency.
5. The EUT was tested in horizontal and vertical orientations. Worst case values noted.
6. Measurement uncertainty is ±5.0dB

3.2.1 Test equipment used (for reference see test equipment listing).

15453	99413	99699	99733	99857		

Test engineer

Signature : 

Name : O.H. Hoekstra
Date : June 22, 2012

4 Conducted emission data.

4.1 Conducted emission data of the EUT (full configuration).

Frequency (MHz)	Measurement results dB(µV) Neutral		Measurement results dB(µV) Line 1		Limits dB(µV)		Pass/Fail
	QP	AV	QP	AV	QP	AV	
0.18	34.4	21.2	35.0	24.2	64.5	54.5	Pass
0.20	31.3	15.8	31.0	19.6	63.6	53.6	Pass
0.35	22.0	16.3	31.7	22.6	59.0	49.0	Pass
0.50	20.0	15.5	28.5	21.3	56.0	46.0	Pass
0.69	34.4	32.3	43.6	38.7	56.0	46.0	Pass
9.85	33.4	25.3	37.7	34.2	60.0	50.0	Pass
13.56	25.1	18.8	28.3	24.9	60.0	50.0	Pass
15.46	28.5	21.5	33.0	29.0	60.0	50.0	Pass
17.28	22.0	15.5	32.2	26.6	60.0	50.0	Pass
27.12	25.3	19.6	27.6	23.6	60.0	50.0	Pass

Table 4 Conducted emission measurements

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207 & RSS-Gen, section 7.2.4, at the 120 Volts AC mains connection terminals of the AC/DC power supply which was connected to the EUT, are depicted in Table 4.

Notes:

1. The test unit was modified to add a resistive termination in lieu of the antenna as per KDB 174176**.**
2. The test data shown above is of the worst case EUT. Maximum values recorded.
3. The values of conducted emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
4. Measurement uncertainty is ±3.5dB

4.1.1 Test equipment used (for reference see test equipment listing).

12512	99161	99852	99699			

Test engineer

Signature : 

Name : O.H. Hoekstra
Date : June 22, 2012

5 Carrier stability under special conditions.

5.1 Frequency stability (on 13.56 MHz) in accordance with 47 CFR Part 15, section 15.225 (e) & RSS-Gen section 4.7 and 7.2.4 and RSS-210 section A2.6:

1) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 °C to +50 °C at normal supply voltage (see Table 5).

Stability under special conditions	Supply Voltage	Measured frequency (MHz)	Frequency deviation (limit ±0.01%) (%)	PASS/FAIL
Temperature (°C)	(Vac)			
21.0	120.0	13.560346 *(reference)*	N.A.	N.A.
-20.0	120.0	13.560466	< 0.01	PASS
50.0	120.0	13.560301	< 0.01	PASS

Table 5 The frequency tolerance of the carrier signal

5.1.1 At 85% and 115% of rated voltage supply level

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency at 85% and at 115% of the rated power supply voltage (+120.0 Vac) at 20 °C environmental temperature. The results are stated in Table 6.

Stability under special conditions	Measured frequency (MHz)	Frequency deviation (limit ±0.01%) (%)	PASS/FAIL
% variation U			
100.0 (120.0 Vac)	13.560346 *(reference)*	N.A.	N.A.
85.0 (102.0 Vac)	13.560345	< 0.01	PASS
115.0 (138.0 Vac)	13.560345	< 0.01	PASS

Table 6 The frequency tolerance of the carrier signal

5.2 Bandwidth of the emission on 13.56 MHz in accordance with RSS-Gen section 4.7 and 7.2.4 and RSS-210 section A2.6.

Limit: 20 dB of the bandwidth of the emission shall be within the specified frequency band.
Bandwidth of the emission is determined at 99% Occupied Bandwidth.
Specified frequency band: 13553 kHz - 13567 kHz.

Temperature (°C)	Minimum frequency (kHz)	Maximum frequency (kHz)
+20.0	13559.131	13561.563
-20.0	13559.247	13561.679
+50.0	13559.102	13561.505
Bandwidth	13559.102	13561.679

Table 7 Bandwidth of the emission (99% power bandwidth)

The measured minimum frequency of 13.559102 MHz and maximum frequency of 13.561679 MHz are well within the specified frequency bandwidth.

5.2.1 Test equipment used (for reference see test equipment listing).

12640	99318	99413	99733	99857		

Test engineer

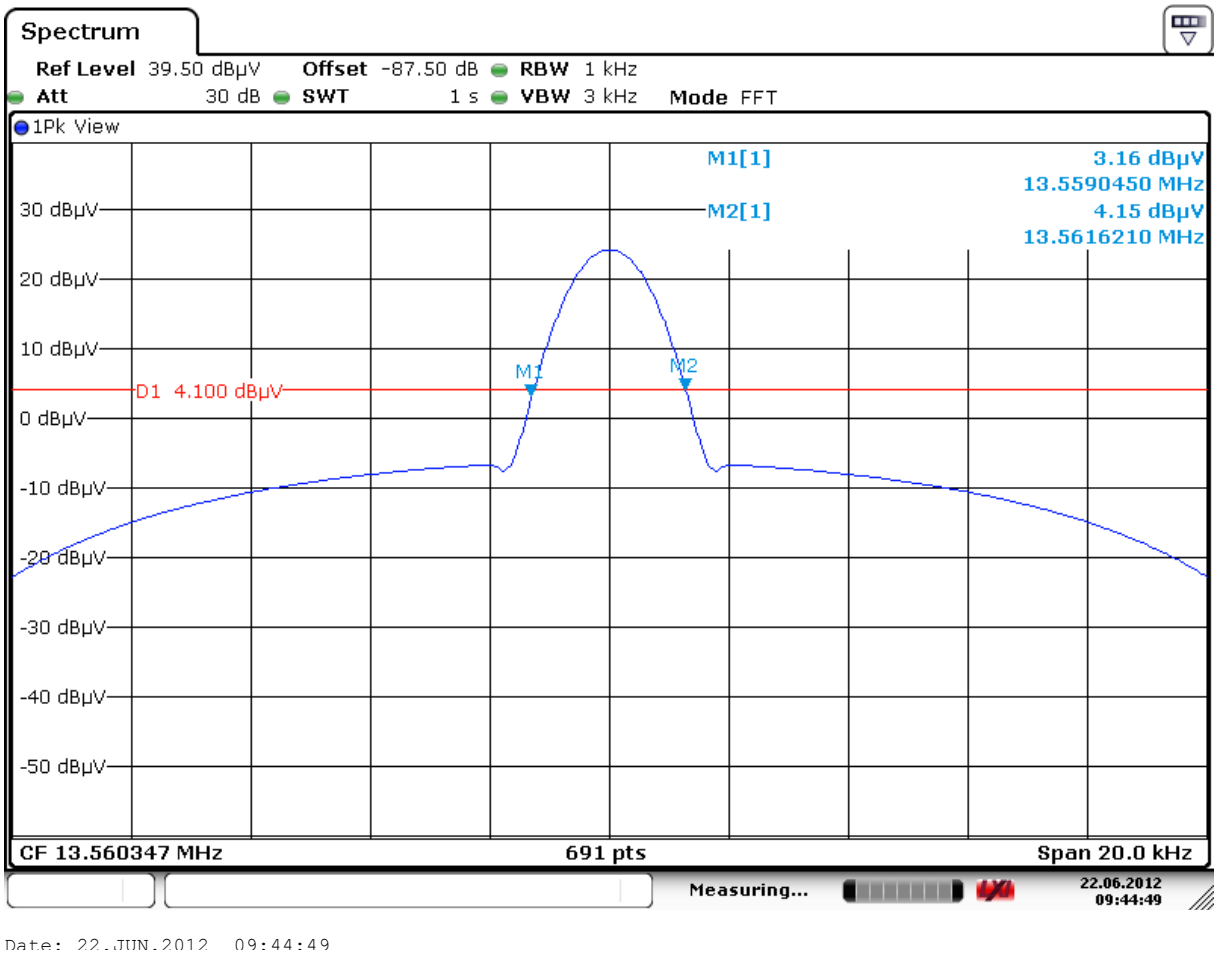
Signature : 

Name : O.H. Hoekstra

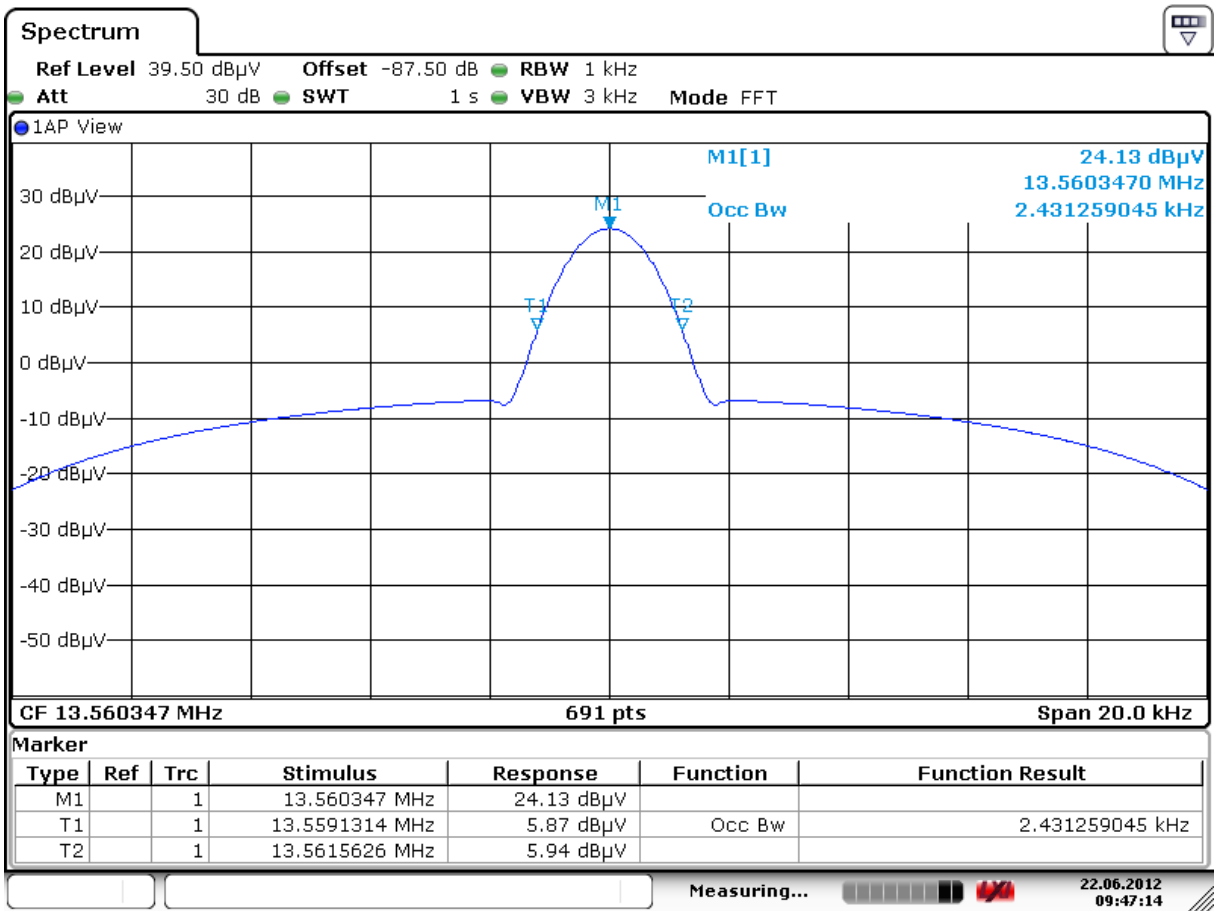
Date : June 22, 2012

6 Plots of measurement data

6.1 Bandwidth of the emission



Plot1
Emission Bandwidth (-20 dB down points) of the emission at 13.56 MHz (Fundamental Carrier).
As measured with a Spectrum Analyzer



Plot2
Occupied Bandwidth **(99% power bandwidth)** of the emission at 13.56 MHz (Fundamental Carrier)
As measured with a Spectrum Analyzer using it's automatic function.

7 List of utilized test equipment.

Inventory number	Description	Brand	Model	Last cal.	Next cal.
12512	LISN FCC 50 uH / 50 ohm	Emco	3725/2	01/2012	01/2014
12640	Temperature chamber	Heraeus	VEM03/500	NA	NA
15453	Active loop antenna 60 cm	Chase	HLA6120	04-2012	04-2013
15633	Biconilog Test antenna	Chase	CBL 6111B	01-2012	01-2013
99161	Variac 250V 6A	RFT	LTS006	NA	NA
99318	Digital multimeter	HP	34401A	10-2011	10-2012
99413	Temperature-Hygrometer	Tempcontrol	P570	01-2012	01-2013
99538	Spectrum Analyzer	R&S	FSP40	11-2011	11-2012
99548	Temperature-Humiditymeter	Europe supplies	WS-7082	10/2011	10/2012
99580	Semi Anechoïc Room	Siepel	FCC listed: 90828	12-2011	12-2014
99609	Antenna mast	EMCS	AP-4702C	NA	NA
99852 / 99857	Temperature-Humiditymeter	Extech	SD500	02-2012	02-2013
99623	Power Supply	EA	PS 2016-050	12-2011	12-2012
99699	Measuring receiver	R&S	ESCI	02-2012	02-2013
99733	Spectrum Analyzer	R&S	FSV30	06-2011	06-2012

NA= Not Applicable