TEST REPORT CONCERNING THE COMPLIANCE OF A 134 kHz INDUCTIVE RFID TAG READER, BRAND NEDAP, MODEL VP1004 VELOS

WITH 47 CFR PART 15 (10-1-09) AND THE REQUIREMENTS OF INDUSTRY CANADA: RSS-GEN AND RSS-210 (ISSUE 8, DECEMBER 2010)

11041301.fcc02_Rev02
November 14, 2011

FCC listed : 90828
Industry Canada : 2932G-1
VCCI Registered : R-1518, C-1598
R&TTE, LVD, EMC Notified Body : 1856

TÜV Rheinland EPS B.V.
P.O. Box 15
9822 ZG Niekerk (NL)
Smidshornerweg 18
9822 TL Niekerk (NL)

Telephone: +31 594 505005
Telefax: +31 594 504804

E-mail: info@tuv-eps.com
Web: www.tuv-eps.com

MEASUREMENT/TECHNICAL REPORT

N.V. Nederlandsche Apparatenfabriek "Nedap"
Model : VP1004 VELOS

FCC ID: CGDVELOS5
IC: 1444A-VELOS5

This report concerns:	Original grant/certification ~~Class 2 change Verification~~
Equipment type:	134 kHz Inductive RFID Tag Reader

Report prepared by:	Name	: Richard van der Meer
	Company name	: TÜV Rheinland EPS B.V.
	Address	: Smidshornerweg 18
	Postal code/city	: 9822 TL Niekerk
	Mailing address	: P.O. Box 15
	Postal code/city	: 9822 ZG Niekerk
	Country	: The Netherlands
	Telephone number	: + 31 594 505 005
	Telefax number	: + 31 594 504 804
	E-mail	: info@tuv-eps.com

The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-09 edition) and the measurement procedures of ANSI C63.4-2009. TÜV Rheinland EPS B.V. at Niekerk, 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: November 14, 2011

Signature:

O. Hoekstra
Senior 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	:	Inductive RFID Tag Reader, operating on 134.2 kHz
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek "Nedap"
Brand	:	Nedap
Model	:	VP1004 VELOS
Serial number(s)	:	--
Revision	:	n.a.
In combination with antennas	:	VP6020, VP6030 and VP6012

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	:	+31 544 463 475

Test(s) performed

Location	:	Niekerk
Test(s) started	:	August 13, 2011
Test(s) completed	:	September 21, 2011
Purpose of test(s)	:	Equipment Authorization (Original grant/certification)
Test specification(s)	:	47 CFR Part 15 (10-1-09 edition) and RSS-GEN (ISSUE 3, DECEMBER 2010) AND RSS-210 (ISSUE 8, DECEMBER 2010)
Test engineer(s)	:	R. van der Meer
Report written by	:	R. van der Meer
Report date	:	November 14, 2011

Table of contents

1 General information.

1.1 Product description.

1.1.1 Introduction.

VP1004 VELOS is a module for animals RF detection at a farm with an integrated antenna. It consists of a long wave transmitter and receiver and has a CAN communication interface. The transmitter / receiver is made to read passive tags in or carried by animals. It has one transmitter and two receivers. The first one reads the full duplex tags, the second one the half duplex ones. Full duplex tags transmit the label code with AM modulation at the same frequency as the transmitter, in this case 134.2 kHz. The half duplex tags send their information with help of FSK modulation in the 118 – 140 kHz band.

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 **FCC ID: CGDVELOS5** and **IC: 1444A-VELOS5.**

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.

Test item (EUT)	:	ISO Reader Multiplexer
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek Nedap
Brand	:	Nedap
Models	:	VP1004 VELOS
Serial number	:	---
Voltage input rating	:	From VP8001
Current input rating	:	---

Test item (AUX1)	:	Velos Processing Unit (V-pu)
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek Nedap
Brand	:	Nedap
Models	:	VP8001
Serial number	:	---
Voltage input rating	:	From VP2001
Current input rating	:	---
Remarks	:	-pu : Velos Processing Unit. Embedded PC used for running applications like identification or feeding, CAN communication, embedded database and web server.

Test item (AUX2)	:	Power Supply
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek Nedap
Brand	:	Nedap
Models	:	VP2002
Serial number	:	---
Voltage input rating	:	100 - 240 V AC 50/60 Hz
Current input rating	:	---

Test item (ANT1)	:	Antenna (tube-shaped) V-stick
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek NEDAP
Brand	:	Nedap
Model	:	VP6020
Serial number	:	A 301 0005
Voltage input rating	:	---
Current input rating	:	---

Test item (ANT2)	:	Antenna (Solid)
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek NEDAP
Brand	:	Nedap
Model	:	VP6012
Serial number	:	S404 A 0003
Voltage input rating	:	---
Current input rating	:	---

Test item (ANT3)	:	Antenna V-SENSE SAM ALU 280*390
Manufacturer	:	N.V. Nederlandsche Apparatenfabriek NEDAP
Brand	:	Nedap
Model	:	VP6030
Serial number	:	---
Voltage input rating	:	---
Current input rating	:	---

1.4 Test Summary

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

Test Standard		Description	Page	Pass / Fail
47 CFR Part 15 (10-1-09 Edition)	**RSS-210 Issue 8, December 2010**			
15.207(a)	RSS-Gen(7.2.4)	Conducted emissions	17	Pass
15.209	RSS-Gen(4.9 and 7.2.5) and RSS-210(2.5)	Radiated emissions	10 – 16	Pass
15.215(c)	RSS-Gen(4.6.1)	Occupied bandwidth	18	Pass

Table: Test specifications

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

1.4.1 Description of tested input and output ports EUT.

Number	Terminal	From	To	Length
1	AC Power	Mains	VP2002	> 3 m
2	Power/Comm	VP2002	VP8001	> 10 m
3	Power/Comm	VP8001	VP1004 VELOS	> 3 m
4	Antenna cable	VP1004	Antenna (ANT1,2 or 3)	< 10 m, shielded

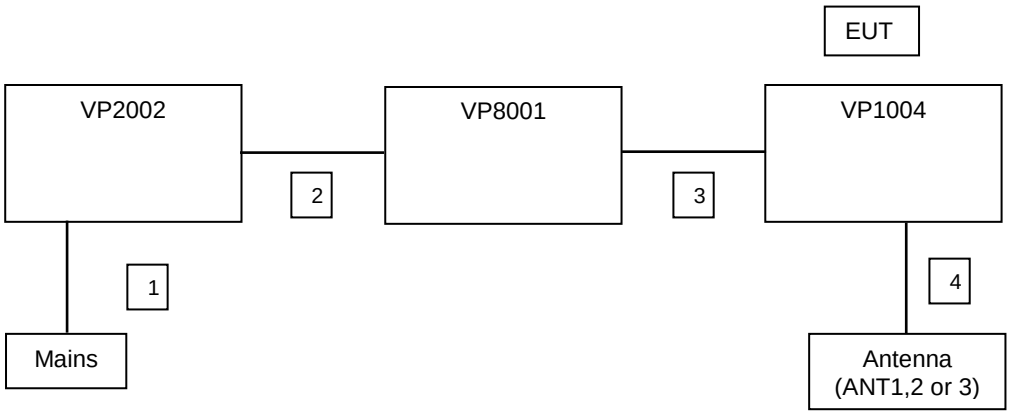


Figure 1a. Basic set-up

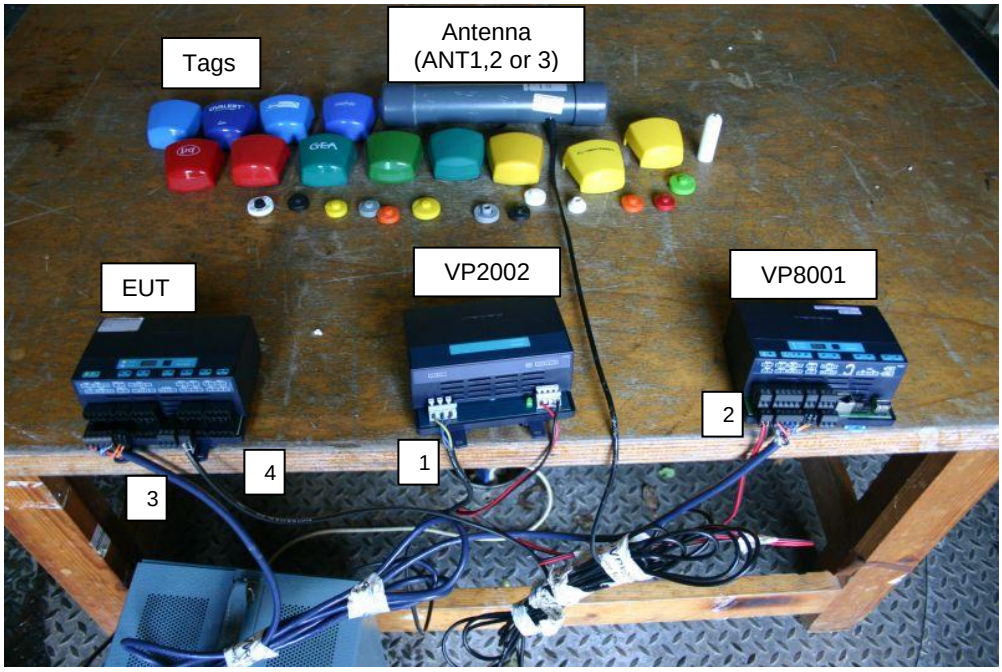


Figure 1b: Basic set-up photograph (including all types of tags)

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, 15.207 and 15.209, RSS-GEN (ISSUE 3, DECEMBER 2010) 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 and 10 meters.

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 in Niekerk, 9822 TL Smidshornerweg 18, 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-1. 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	: 120VAC/60Hz
Air pressure	: 950 – 1050 hPa

When is 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. Three different types of antennas were tested and the antenna giving the highest field strength levels was used for conducted emission measurements.

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.

Operation mode 1: System "Passive", not detecting a tag
Operation mode 2: System "Active", detecting a cattle tag and respond.

To assess the behavior of the EUT while reading the tag, the EUT is tested with a tag presented such that it continuously reads the tag. The intentional radiator tests (47 CFR Part 15 sections, 15.207 and 15.209) have been performed with a complete functioning EUT and interconnections.

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 in order to achieve compliance.

2.5 Product Labelling

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), in combination with ANT1

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
133.33	6.5	6.3	14.2	20.7	20.5	43.5	Pass
163.925	6.4	6.4	12.8	19.2	19.2	43.5	Pass
166.65	6.5	6.4	12.4	18.9	18.8	43.5	Pass
199.995	6.8	6.3	12.2	19.0	18.5	43.5	Pass
233.32	7.4	6.4	14.4	21.8	20.8	46.0	Pass
266.65	9.0	8.0	16.8	25.8	24.8	46.0	Pass
333.326	6.8	6.8	18.9	25.7	25.7	46.0	Pass
399.992	9.0	8.1	21.4	30.4	29.5	46.0	Pass
466.658	7.4	7.8	23.3	30.7	31.1	46.0	Pass

Table 1a Radiated emissions of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT (with ANT1) operating on 134.2 kHz are depicted in Table 1a. The system is tested as in whole, so with all equipment as shown in Figure.1a and 1b in place and functioning. Being the worst case situation.

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 reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz.
5. The EUT was tested in both passive mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity). Maximum values have been noted.

Used test equipment and ancillaries:

99580	99070	99071	99107	99608	99609	99699	99547	15633

Test engineer

Signature : 

Name : Richard van der Meer
Date : September 15, 2011

3.2 Radiated field strength measurements (30 MHz – 1 GHz, E-field), in combination with ANT2

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
133.33	6.7	6.4	14.2	20.9	20.6	43.5	Pass
163.925	6.5	6.5	12.8	19.3	19.3	43.5	Pass
166.65	6.5	6.4	12.4	18.9	18.8	43.5	Pass
199.995	6.7	6.4	12.2	18.9	18.6	43.5	Pass
233.32	7.6	6.2	14.3	21.9	20.5	46.0	Pass
266.65	9.5	7.5	16.8	26.3	24.3	46.0	Pass
333.326	7.0	6.0	18.9	25.9	24.9	46.0	Pass
399.992	9.0	8.5	21.4	30.4	29.9	46.0	Pass
466.658	7.4	8.7	23.3	30.7	32.0	46.0	Pass

Table 1b Radiated emissions of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT (with ANT2) operating on 134.2 kHz are depicted in Table 1b. The system is tested as in whole, so with all equipment as shown in Figure.1a and 1b in place and functioning. Being the worst case situation.

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 reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz.
5. The EUT was tested in both passive mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity). Maximum values have been noted.

Used test equipment and ancillaries:

99580	99070	99071	99107	99608	99609	99699	99547	15633

Test engineer

Signature : 

Name : Richard van der Meer
Date : September 15, 2011

3.3 Radiated field strength measurements (30 MHz – 1 GHz, E-field), in combination with ANT3

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
133.33	7.1	6.4	14.2	21.3	20.6	43.5	Pass
163.925	6.4	6.5	12.8	19.2	19.3	43.5	Pass
166.65	6.4	6.4	12.4	18.8	18.8	43.5	Pass
199.995	6.5	6.3	12.2	18.7	18.5	43.5	Pass
233.32	6.2	6.4	14.4	20.6	20.8	46.0	Pass
266.65	10.0	7.7	16.8	26.8	24.5	46.0	Pass
333.326	6.9	6.9	18.9	25.8	25.8	46.0	Pass
399.992	8.9	8.5	21.4	30.3	29.9	46.0	Pass
466.658	7.4	8.4	23.3	30.7	31.7	46.0	Pass

Table 1c Radiated emissions of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT (with ANT3) operating on 134.2 kHz are depicted in Table 1c. The system is tested as in whole, so with all equipment as shown in Figure. 1a and 1b in place and functioning. Being the worst case situation.

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 reported field strength values are the worst case values at the indicated frequency. The EUT was varied in three positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz.
5. The EUT was tested in both passive mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity). Maximum values have been noted.

Used test equipment and ancillaries:

99580	99070	99071	99107	99608	99609	99699	99547	15633

Test engineer

Signature : 

Name : Richard van der Meer
Date : September 15, 2011

3.4 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), in combination with ANT1, Peak and Quasi Peak values.

Frequency (MHz)	Measurement results	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits
	dBµV @3m		dB	dB	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	35.4	Pk	20.1	1	80	-23.5 @300m	39.0 @300m
0.4026	18.6	Pk	20.0	1	80	-40.4 @300m	35.5 @300m
0.5368	18.2	Qp	20.0	1	40	-0.8	33.0
0.8052	14.7	Qp	20.0	1	40	-4.3	29.5
0.9394	12.4	Qp	20.0	1	40	-6.6	28.2
1.0736	16.1	Qp	19.7	1	40	-3.2	27.0
4.166 (noise floor)	12.8	Qp	19.5	1	40	-6.7	29.5
5.812 (noise floor)	29.4	Qp	19.5	1	40	9.9	29.5

Table 2a Radiated emissions of the EUT

Fundamental Frequency (MHz)	Measurement results (dBµV)		Detector	Antenna factor	Cable loss	Measurement results (Calculated) (dBµV/m)		Measurement results (calculated according Appendix1)	Limits Part 15.209
	3 m	10 m		dB	dB	3m	10m	dBµV/m @ 300m	dBµV/m @ 300m
0.1342	61.2	40.4	Pk	20.1	1	82.3	61.5	2.74	45.05

Table 2b Emissions of the fundamental of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT operating in continuous transmit mode on 134.2 kHz, are depicted in Table 2a & 2b.

Notes:

1. Calculated measurement results for the fundamental at 134.2 kHz are obtained by using the calculation as mentioned in Appendix 1.
2. A resolution bandwidth of 9kHz was used during testing
3. Field strength values of radiated emissions at frequencies not listed in Table 2a are more than 20 dB below the applicable limit
4. The EUT was varied in three positions, 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 both normal mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity). Worst case noted.
6. Measurement uncertainty is ±5.0dB
7. In combination with ANT1.

3.5 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), in combination with ANT1, Average values.

Frequency (MHz)	Measurement results Peak	Correction factor	Average value	Limits
	dBµV @300m	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	-23.5	0.0	-23.5	19.00 @300m
0.1342	2.74	0.0	2.74	25.05 @300m
0.4026	-40.4	0.0	-40.4	15.50 @300m

Table 2c Radiated emissions of the EUT

Correction factor (Cf) for Pulse operation:

$Cf = 20 \text{ Log } (T^{ON} / T^{Period})$

Where T^{ON} is the On time of the pulse, T^{ON} = 100 msec
Where T^{Period} is the total time of one pulse period, T^{Period} = 104 msec
Period time exceeds 100msec, the Correction factor in that case:

Cf= 20 log (100/100)= 0.0 dB

Note: T^{ON} time varies between 70msec and 100 msec, depending on the quality of reception and the distance between the EUT and the tag. In a worstcase situation the T^{ON} time will be 100msec, while the total time remains 104 msec.

3.6 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), in combination with ANT2, Peak and Quasi Peak values.

Frequency (MHz)	Measurement results	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits
	dBµV @3m		dB	dB	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	36.1	Pk	20.1	1	80	-22.8 @300m	39.0 @300m
0.4026	26.2	Pk	20.0	1	80	-32.8 @300m	35.5 @300m
0.5368	18.5	Qp	20.0	1	40	-0.5	33.0
0.8052	14.8	Qp	20.0	1	40	-4.2	29.5
0.9394	11.7	Qp	20.0	1	40	-7.3	28.2
1.0736	15.4	Qp	19.7	1	40	-3.9	27.0
4.166 (noise floor)	12.8	Qp	19.5	1	40	-6.7	29.5
5.812 (noise floor)	29.4	Qp	19.5	1	40	9.9	29.5

Table 2d Radiated emissions of the EUT

Fundamental Frequency (MHz)	Measurement results (dBµV)		Detector	Antenna factor	Cable loss	Measurement results (Calculated) (dBµV/m)		Measurement results (calculated according Appendix1)	Limits Part 15.209
	3 m	10 m		dB	dB	3m	10m	dBµV/m @ 300m	dBµV/m @ 300m
0.1342	71.0	42.4	Pk	20.1	1	92.1	63.5	-17.29	45.05

Table 2e Emissions of the fundamental of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT operating in continuous transmit mode on 134.2 kHz, are depicted in Table 2d & 2e.

Notes:

1. Calculated measurement results for the fundamental at 134.2 kHz are obtained by using the calculation as mentioned in Appendix 1.
2. A resolution bandwidth of 9kHz was used during testing
3. Field strength values of radiated emissions at frequencies not listed in Table 2d are more than 20 dB below the applicable limit
4. The EUT was varied in three positions, 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 both normal mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity). Worst case noted.
6. Measurement uncertainty is ±5.0dB.
7. In combination with ANT2.

3.7 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), in combination with ANT2, Average values.

Frequency (MHz)	Measurement results Peak	Correction factor	Average value	Limits
	dBµV @300m	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	-22.8	0.0	-22.8	19.0 @300m
0.1342	-17.29	0.0	-17.29	25.05 @300m
0.4026	-36.8	0.0	-36.8	15.5 @300m

Table 2f Radiated emissions of the EUT

Correction factor (Cf) for Pulse operation:

Cf= 20 Log (T^{ON} / T^{Period})

Where T^{ON} is the On time of the pulse, T^{ON} = 100 msec
Where T^{Period} is the total time of one pulse period, T^{Period} = 104 msec
Period time exceeds 100msec, the Correction factor in that case:

Cf= 20 log (100/100)= 0.0 dB

Note: T^{ON} time varies between 70msec and 100 msec, depending on the quality of reception and the distance between the EUT and the tag. In a worstcase situation the T^{ON} time will be 100msec, while the total time remains 104 msec.

3.8 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), in combination with ANT3, Peak and Quasi Peak values.

Frequency (MHz)	Measurement results	Detector	Antenna factor	Cable loss	Extrapolation factor	Measurement results (calculated)	Limits
	dBµV @3m		dB	dB	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	40.4	Pk	20.1	1	80	-18.5 @300m	39.0 @300m
0.4026	29.3	Pk	20.0	1	80	-29.7 @300m	35.5 @300m
0.5368	17.6	Qp	20.0	1	40	-1.4	33.0
0.8052	13.1	Qp	20.0	1	40	-5.9	29.5
0.9394	12.9	Qp	20.0	1	40	-6.1	28.2
1.0736	17.3	Qp	19.7	1	40	-2.0	27.0
4.166 (noise floor)	12.8	Qp	19.5	1	40	-6.7	29.5
5.812 (noise floor)	29.4	Qp	19.5	1	40	9.9	29.5

Table 2g Radiated emissions of the EUT

Fundamental Frequency (MHz)	Measurement results (dBµV)		Detector	Antenna factor	Cable loss	Measurement results (Calculated) (dBµV/m)		Measurement results (calculated according Appendix1)	Limits Part 15.209
	3 m	10 m		dB	dB	3m	10m	dBµV/m @ 300m	dBµV/m @ 300m
0.1342	80.7	55.5	Pk	20.1	1	101.8	76.6	5.41	45.05

Table 2h Emissions of the fundamental of the EUT

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, RSS-210 and RSS-Gen with the EUT operating in continuous transmit mode on 134.2 kHz, are depicted in Table 2g & 2h.

Notes:

1. Calculated measurement results for the fundamental at 134.2 kHz are obtained by using the calculation as mentioned in Appendix 1.
2. A resolution bandwidth of 9kHz was used during testing
3. Field strength values of radiated emissions at frequencies not listed in Table 2g are more than 20 dB below the applicable limit
4. The EUT was varied in three positions, 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 both normal mode (i.e. without a tag in its proximity) and in activated mode (i.e. with a tag in its proximity).
6. Measurement uncertainty is ±5.0dB.
7. In combination with ANT3.

3.9 Radiated field strength measurements (frequency range of 0.009-30 MHz, H-field), in combination with ANT3, Average values.

Frequency (MHz)	Measurement results Peak	Correction factor	Average value	Limits
	dBµV @300m	dB	dBµV/m@30m (unless otherwise stated)	dBµV/m@30m (unless otherwise stated)
0.2684	-18.5	0.0	-18.5	19.0 @300m
0.1342	5.41	0.0	5.41	25.05 @300m
0.4026	-29.7	0.0	-29.7	15.5 @300m

Table 2i Radiated emissions of the EUT

Correction factor (Cf) for Pulse operation:

$Cf = 20 \text{ Log } (T^{ON} / T^{Period})$

Where T^{ON} is the On time of the pulse, T^{ON} = 100 msec
Where T^{Period} is the total time of one pulse period, T^{Period} = 104 msec
Period time exceeds 100msec, the Correction factor in that case:

Cf= 20 log (100/100)= 0.0 dB

Note: T^{ON} time varies between 70msec and 100 msec, depending on the quality of reception and the distance between the EUT and the tag. In a worstcase situation the T^{ON} time will be 100msec, while the total time remains 104 msec.

Used test equipment and ancillaries:

99069	99070	99107	99120	15453	99608	99609	99699	99547
99580								

Test engineer

Signature : 

Name : R. van der Meer

Date : September 15, 2011

4 Conducted emission data.

4.1 Conducted emission data of the EUT

Frequency (MHz)	Measurement results dB(µV) Neutral		Measurement results dB(µV) Line 1		Limits dB(µV)		Pass/Fail
	QP	AV	QP	AV	QP	AV	
0.1500	42.0	Note 4	40.8	Note 4	66.0	56.0	Pass
0.1620	40.6	//	38.7	//	65.5	55.5	Pass
0.1700	<20	//	42.9	//	65.0	55.0	Pass
0.1860	43.2	//	40.3	//	64.0	54.0	Pass
0.2180	39.9	//	36.7	//	62.8	52.8	Pass
0.2420	38.1	//	35.1	//	62.1	52.1	Pass
0.2700	35.1	//	33.6	//	61.1	51.1	Pass
0.2780	35.4	//	33.7	//	60.8	50.8	Pass
0.3740	39.2	//	37.9	//	58.5	48.5	Pass
0.3860	40.2	//	36.4	//	58.3	48.3	Pass
0.4100	35.1	//	34.9	//	57.6	47.6	Pass
0.5580	34.1	//	24.4	//	56.0	46.0	Pass
1.0380	33.5	//	25.8	//	56.0	46.0	Pass
11.8180	36.9	//	35.5	//	60.0	50.0	Pass
12.0660	<20	//	35.5	//	60.0	50.0	Pass
14.1540	34.9	//	33.1	//	60.0	50.0	Pass
17.7260	34.9	//	30.6	//	60.0	50.0	Pass

Table 3 Conducted emission measurements

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207 and RSS-Gen section 7.2.4, at the 120 Volts AC mains connection terminals of the system, are depicted in Table 3. The EUT was tested in both passive and active mode (while detecting a tag). Maximum values recorded. The system is tested as in whole, so with all equipment as shown in Figure.1a and 1b in place and functioning. Being the worst case situation.

Notes:

1. Measurement uncertainty is ±3.5dB
2. The resolution bandwidth used was 9 kHz.
3. Tested with ANT3 which in combination with EUT generates the highest fieldstrenghts.
4. Qp values already within Av limits, there for Av not tested.

Used test equipment and ancillaries:

99548	99161	12512	99699			

Test engineer

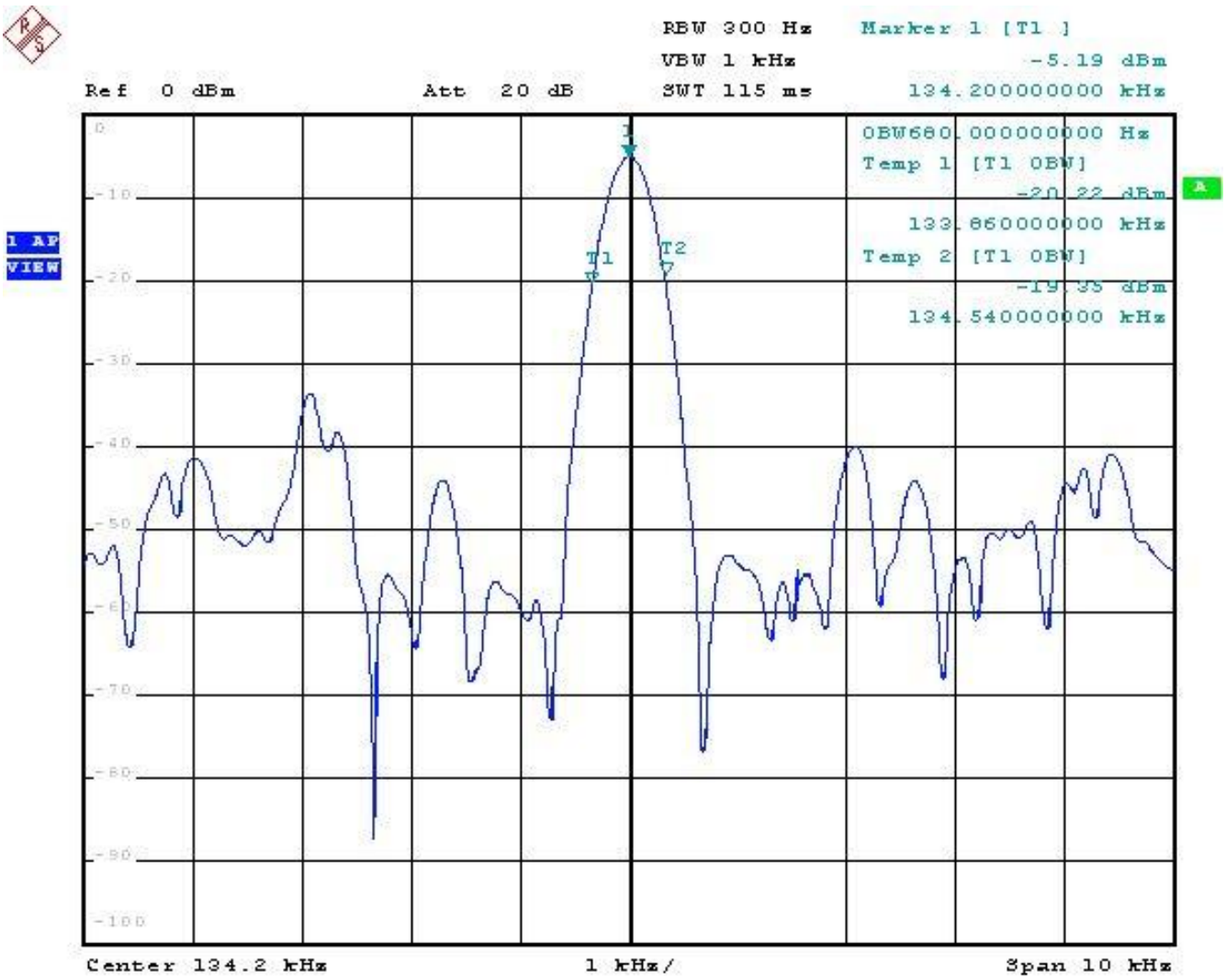
Signature : 

Name : R. van der Meer
Date : September 21, 2011

5 Plots of the emissions

5.1 Occupied bandwidth plot

The plot below shows compliance with the 47 CFR Part 15 section 15.215(c) and Industry Canada, this section requires the 20 dB emission bandwidth is within the frequencyband designated.



Plot : Occupied bandwidth is 680 Hz, measured on a spectrum analyzer

6 List of utilized test equipment.

Inventory number	Description	Brand	Model	Last cal.	Next cal.
12476	Antenna mast	EMCO	TR3	NA	NA
12477	Antenna mast 1-4 mtr	Poelstra	NA	NA	NA
12512	LISN	EMCO	3625/2	01/2011	01/2012
15453	Active loopant. 60 cm	Chase	HLA6120	05/2011	05/2012
15633	Biconilog Testantenna	Chase	CBL 6111B	02/2011	02/2012
99069	Coax 5m RG213 OATS	NMi Certin B.V.	KABEL 5M OATS	10/2010	10/2011
99070	Coax 15m RG213 OATS	NMi Certin B.V.	KABEL 15M OATS	10/2010	10/2011
99071	Coax OATS ground	NMi Certin B.V.	KABEL GROND OATS	10/2010	10/2011
99107	Controller OATS	Heinrich Deisel	4630-100	NA	NA
99161	Variac 250V 6A	RFT	LTS006	NA	NA
99547/99548	Temperature-Humiditymeter	Europe supplies	WS-7082	10/2010	10/2011
99580	OATS	Comtest	FCC listed: 90828	08/2011	08/2014
99608	Controller (OATS)	EMCS	DOC202	NA	NA
99609	Antenna mast	EMCS	AP-4702C	NA	NA
99699	Measuring receiver	R&S	ESCI	02/2011	02/2012

NA= Not Applicable

Appendix 1

Calculated measurements results radiated field strength, H-Field

The rules of Part 15 section 15.31 allow scaling of the measured values or limits when measurements are made at distances other than those specified. The extrapolation factor for frequencies below 30 MHz are 40 dB/decade which means that for a distance change of 10 to 1 (a decade), the limit, or measured value, may be recalculated by adding(moving closer) or subtracting (moving away) 40 dB, respectively.

It is also possible to make radiated-emission measurements at two different distances and extrapolate to a third distance. The calculation method described below, should then be followed.

General Formula:

d_1 = short distance

d_2 = long distance

So:
$(d_1/d_2)^n = H_{d2}/H_{d1}$

$n \log(d_1/d_2) = \log(H_{d2}/H_{d1})$

Calculation of n:

$n = \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$

Calculation of field strength at distance 300m:

$H_{d2} = H_{d1} (d_1/d_2)^n$

For the fundamental frequency of 134.2 kHz the level at a distance of 300m would be calculated as follows:

EUT in combination with ANT1:

d1= 3m Hd1= 82.3 dBµV/m= 13031.670 µV/m
d2= 10m Hd2= 61.5 dBµV/m= 1188.502 µV/m
Calculation for n: $n= \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$ > n=log(1188.50/13031.670)/ log(3m/10m) > n= 1.989
$H_{d2} = H_{d1} (d_1/d_2)^n$ > $H_{d2} = 13031.670*(3/300)^{1.989}$ = 2.74 dBµV/m.

EUT in combination with ANT2:

d1= 3m Hd1= 92.1 dBµV/m = 40271.700 µV/m
d2= 10m Hd2= 63.5 dB(µV)/m= 1496.236 µV/m
Calculation for n: $n= \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$ > n=log(1496.236/40271.700)/ log(3m/10m) > n=2.735
$H_{d2} = H_{d1} (d_1/d_2)^n$ > $H_{d2} = 40271.700*(3/300)^{2.735}$ = -17.29 dBµV/m

EUT in combination with ANT3:

d1= 3m Hd1= 101.8 dBµV/m = 123026.90 µV/m
d2= 10m Hd2= 76.6 dBµV/m= 6760.83 µV/m
Calculation for n: $n= \log(H_{d2}/H_{d1}) / \log(d_1/d_2)$ > $n=\log(6760.83 / 123026.90)/ \log(3m/10m)$ > n= 2.4097
$H_{d2} = H_{d1} (d_1/d_2)^n$ > $H_{d2} = 123026.90*(3/300)^{2.4097} = 5.41$ dBµV/m