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Chamber of Commerce
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FCC and IC Test Report for Parts 15.231, 15.209, RSS Gen and RSS-210

Product name	: Neck Tag
Applicant	: NEDAP
FCC ID	: CGDIFERP
IC ID	: 1444A-IFERP

Test report No. : 180700731 003 Ver 1.00

Laboratory information

Accreditation

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.

The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

Documentation

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).

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	23-08-2018	First draft	PvW
v1.00	23-11-2018	Initial release	PvW

Table of Contents

Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.231 (c)	--	20dB Bandwidth	3.1	Pass
--	RSS-Gen 6.7	99% Bandwidth	3.2	Pass
15.231 (e)	RSS-Gen 6.12	RF output power	3.3	Pass
15.209 (a) 15.231 (e)	RSS-Gen 6.13	Radiated Spurious emissions	3.4	Pass
15.231 (e)	--	Transmission time	3.5	Pass

1 General Description

1.1 Applicant

Client name:	N.V. Nederlandsche Apparatenfabriek “NEDAP”
Address	Parallelweg 2, Groenlo, the Netherlands
Zip code:	7141 DC
Telephone:	+31 544 471 825
E-mail:	Annepieter.haytema@nedap.com
Contact name:	Mr. A.P. Haytema

1.2 Manufacturer

Manufacturer name:	N.V. Nederlandsche Apparatenfabriek “NEDAP”
Address:	Parallelweg 2, Groenlo, the Netherlands
Zip code:	7141 DC
Telephone:	+31 544 471 825
E-mail:	Annepieter.haytema@nedap.com
Contact name:	Mr. A.P. Haytema

1.3 Tested Equipment Under Test (EUT)

Product name:	SMARTTAG NECK
Brand name:	NEDAP
Product type:	RFID Tag transmitter for animal position/activity sensor
FCC ID:	CGDIFERP
IC ID	1444A-IFERP
Software version:	FER: VT2013b01 FERP: VT2213b01 IFER: VT1013b01 IFERP: VT1213b01
Hardware version:	4
Date of receipt	24-07-2018
Tests started:	24-07-2018
Testing ended:	29-08-2018

1.4 Product specifications of Equipment under test

TX Frequency range (MHz)	433.1 – 434.7 MHz
RX frequency range (MHz)	433.1 – 434.7 MHz
Maximum output power (dBm)	-15.7
Antenna type	PCB Antenna
Antenna gain (dBi)	-2
Type of modulation	FSK
Emission designator	Activity: 126KF1D Cow positioning: 359KF1D

1.5 Modification of the Equipment Under Test (EUT)

None.

1.6 Observations and remarks

The tested model was the IFERP, this model contains both coils and is considered to be the worst case configuration. It has Identification, Fertility, Eating, Rumination and Positioning features.

1.7 Environmental conditions

Test date	24-07-2018	25-07-2018	29-08-2018
Ambient temperature	26.3 °C	28.3 °C	23.9 °C
Humidity	50.3 %	43.2 %	45.3 %

1.8 Measurement Standards

- ANSI C63.10:2013

1.9 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, §15.231
- RSS-210 Issue 9, RSS-Gen Issue 5

1.10 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.9 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 1.9 *"Applicable standards".*

All tests are performed by:

Name : P. van Wanrooij, BASc

Review of test methods and report by:

Name : ing. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 23-11-2018

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 into different test channels.

2.2 Tested channels and Data rates

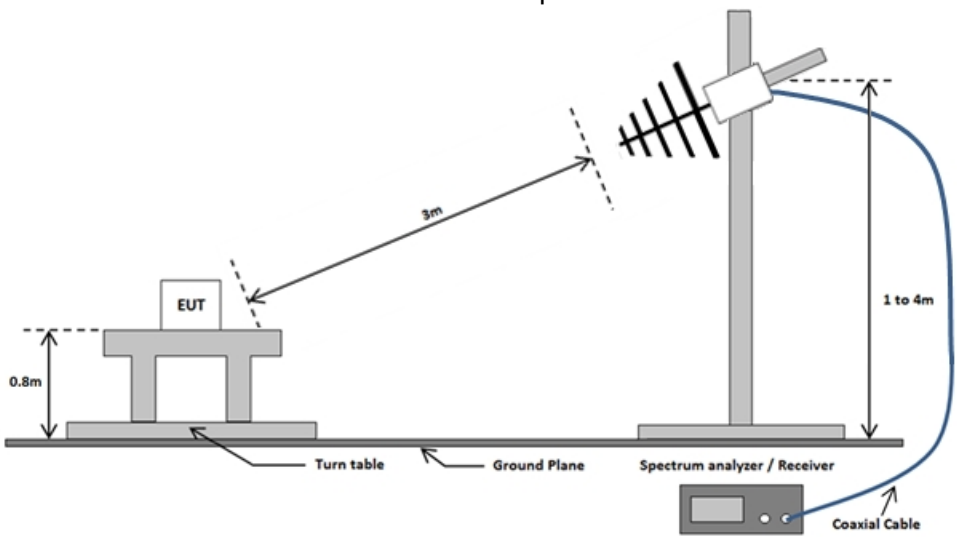
The EUT contains two types of tracking, Activity and Cow Positioning.
Activity transmits once every 236 to 363 seconds while hopping between channels 2, 3, 4 and 5.
Cow positioning transmits once every 5 seconds while hopping between channels 1 and 6.

Technology	Channels	Data rate (kb/s)	Frequency (MHz)
Activity tracker	2 (Low)	100	433.6
	5 (High)	100	434.2

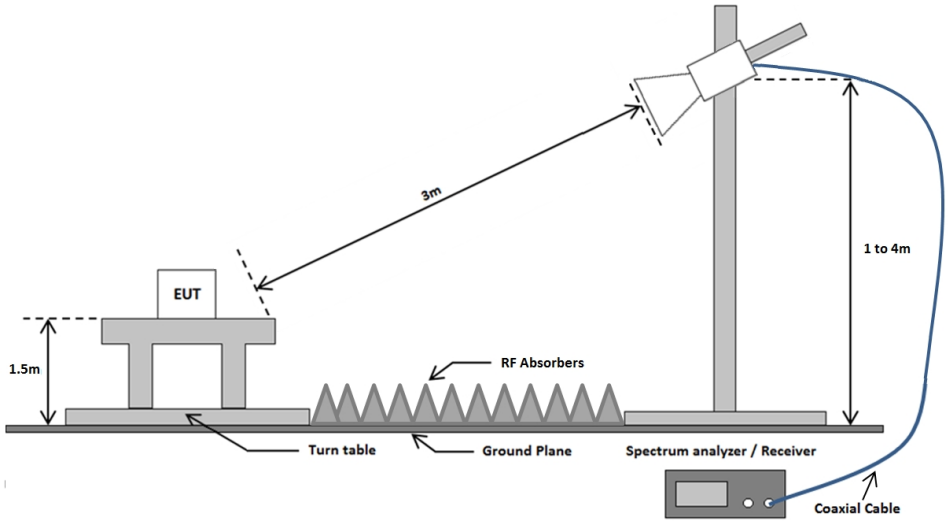
Technology	Channels	Data rate (kb/s)	Frequency (MHz)
Cow Positioning Tracker	1 (Low)	300	433.3
	6 (High)	300	434.5

2.3 Test setups

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.4 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Radiated emission (SAR)	--	TS 00004	--	3.4
Spectrum Analyzer	Rohde & Schwarz	ESR7	TE 01220	3.1 – 3.5
Software	D.A.R.E Instruments	Radimation 2018.1.3	--	3.4

2.5 Sample calculation

Field Strength Measurement example:

Frequency (GHz)	Polarization	Height(m)	Peak (dBµV/m)
7,236	Horizontal	2	52.5

The following relation applies:

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

Where:

E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
G = Gain of the pre-amplifier
CL = Cable loss

(52.5 = 48.12 + 36.1 - 37.42 + 5.7)

3 Test results

3.1 20dB bandwidth Measurement

3.1.1 Limit

The maximum 20 dB Bandwidth is 0.25% of the centre frequency. At the lowest frequency this is 1083 kHz.

3.1.2 Measurement instruments

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

3.1.3 Test setup

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

3.1.4 Test procedure

According to ANSI C63.10 (2013).
IRN 017 Occupied bandwidth – Method 2: Relative method.

3.1.5 Test Results of the 20 dB bandwidth Measurement

Technology Std.	Channel	Frequency (MHz)	Data rate (kb/s)	20dB bandwidth (kHz)
Activity	2	433.6	100	125.2
	5	434.2	100	125.9
Uncertainty	± 6.4 kHz			

Technology Std.	Channel	Frequency (MHz)	Data rate (kb/s)	20dB bandwidth (kHz)
Cow positioning	1	433.3	300	358.9
	6	434.5	300	358.9
Uncertainty	± 23.3 kHz			

3.2 99% Occupied Bandwidth

3.2.1 Limit

According to RSS-Gen 6.7

3.2.2 Measurement instruments

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

3.2.3 Test setup

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

3.2.4 Test procedure

IRN 017 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW ≥ 3x RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

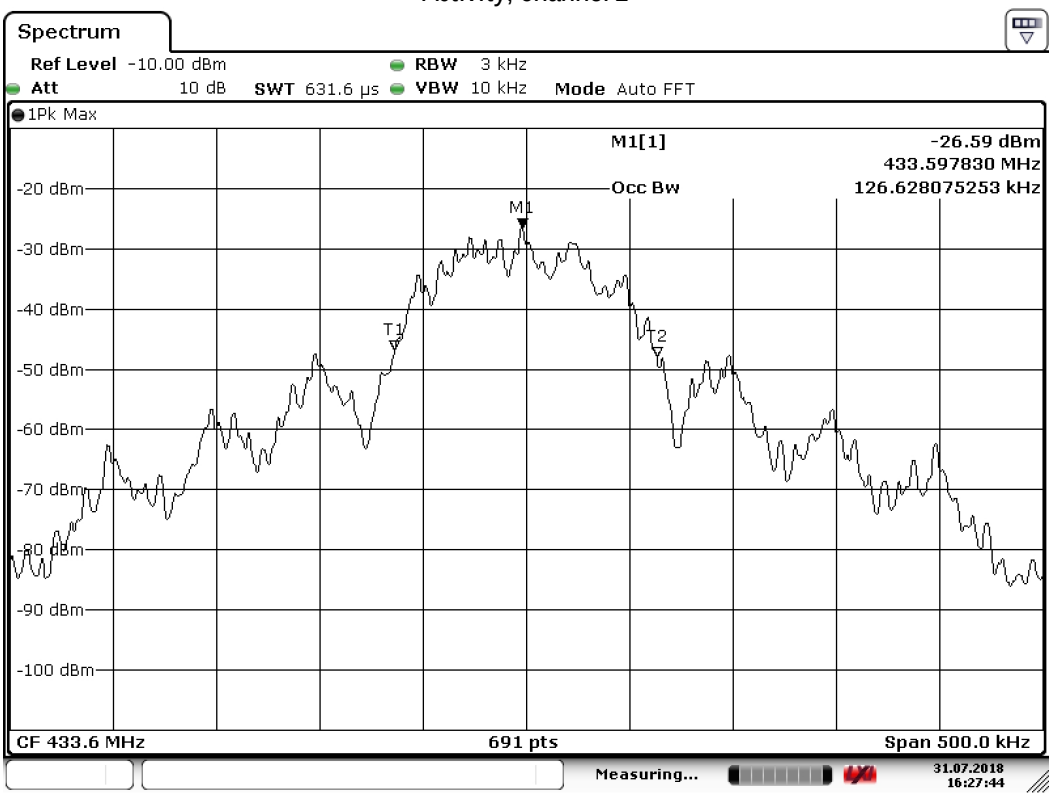
3.2.5 Test results of the 99% occupied bandwidth measurement

Technology Std.	Channel	Frequency (MHz)	Data rate (kb/s)	99% bandwidth (kHz)
Activity	2	433.6	100	126.6
	5	434.2	100	126.6
Uncertainty	± 6.4 kHz			

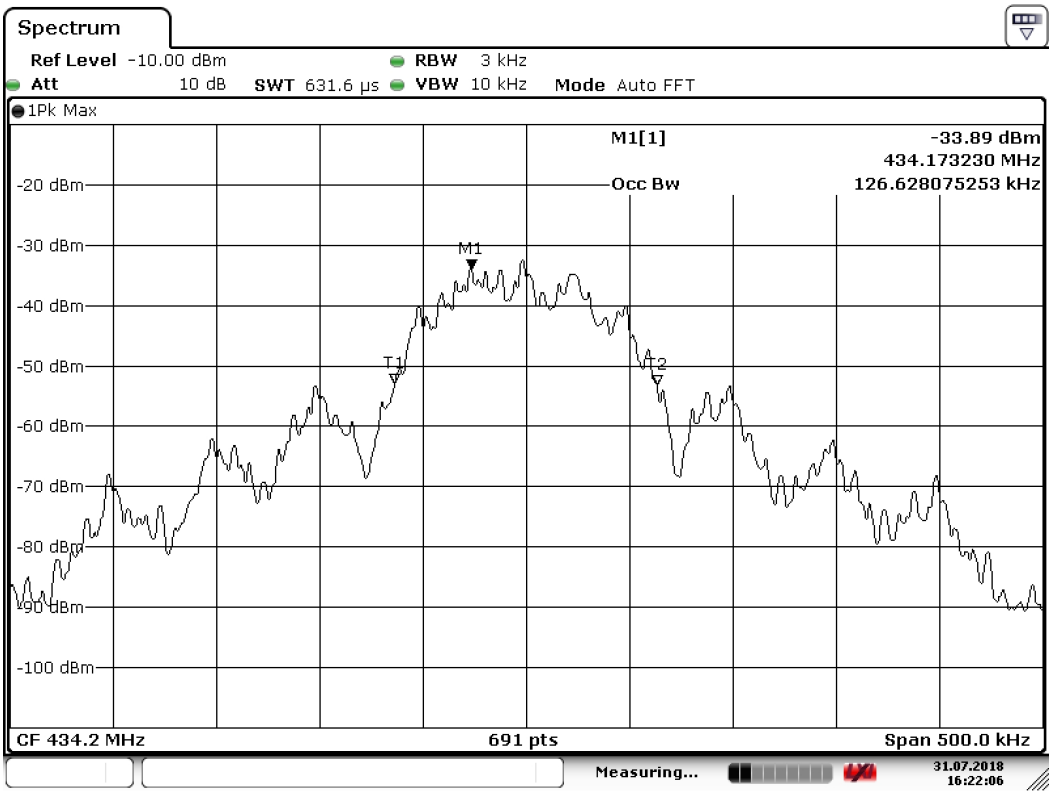
Technology Std.	Channel	Frequency (MHz)	Data rate (kb/s)	99% bandwidth (kHz)
Cow positioning	1	433.3	300	384.9
	6	434.5	300	384.9
Uncertainty	± 23.3 kHz			

3.2.6 Plots of the 99% occupied bandwidth measurement

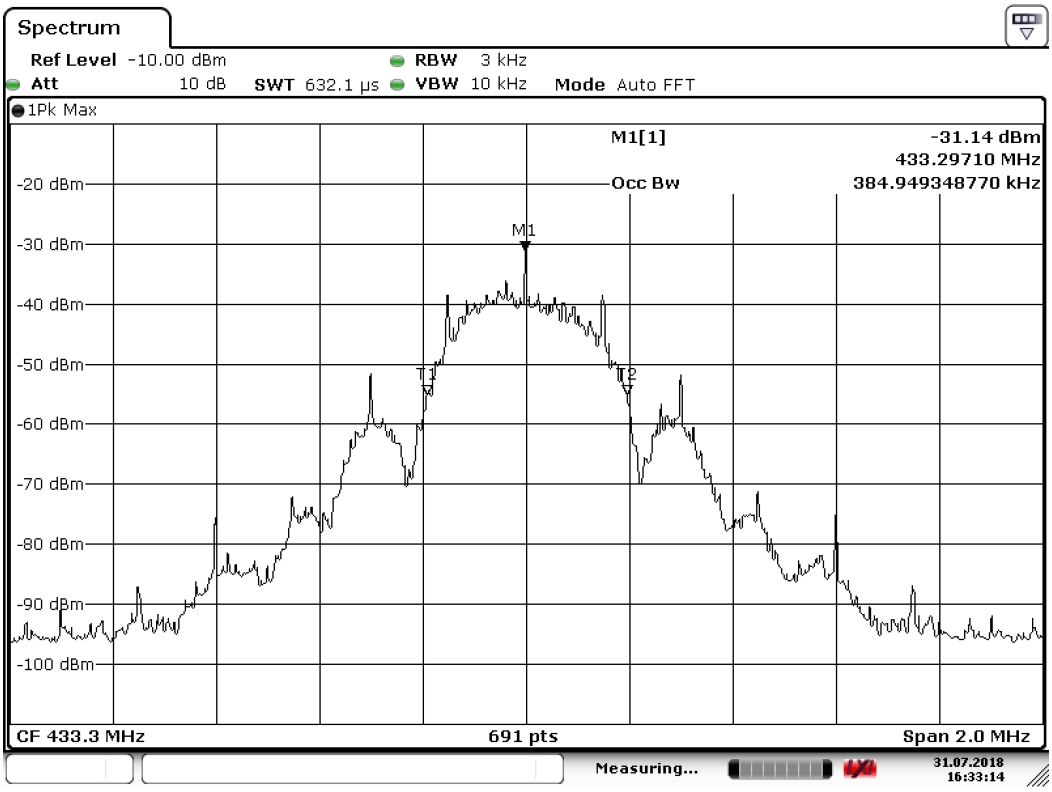
Activity, Channel 2



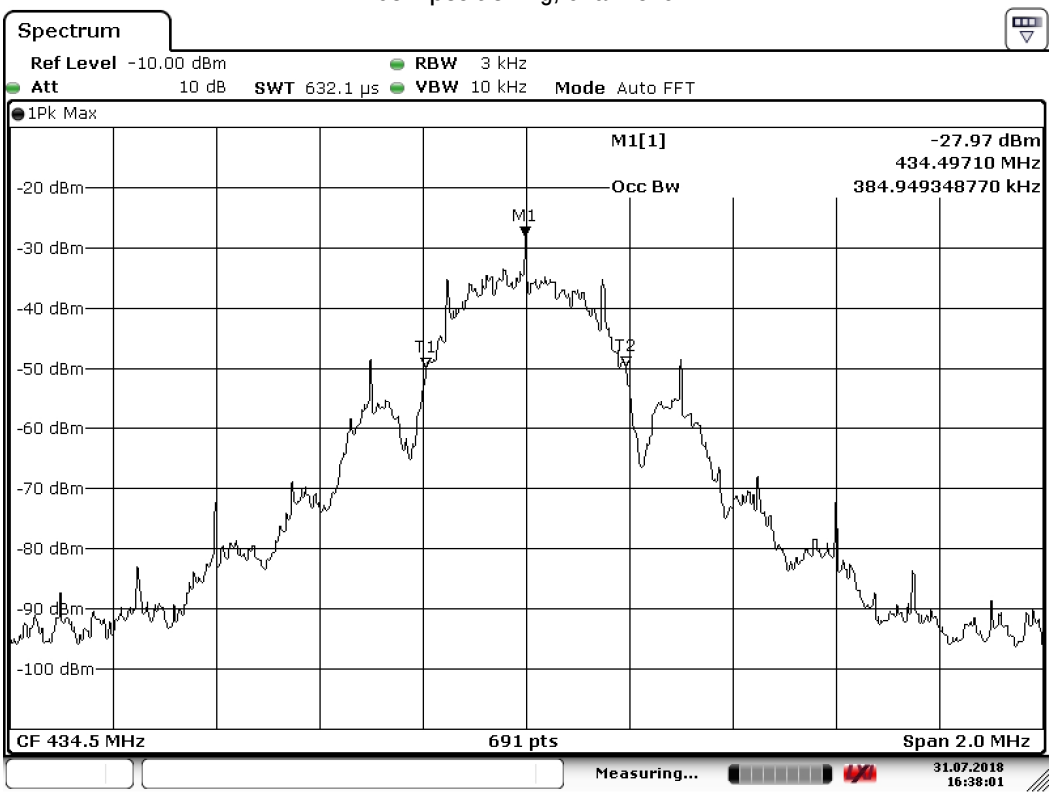
Activity, Channel 5



Cow positioning, Channel 1



Cow positioning, Channel 6



3.3 Output Power Measurement

3.3.1 Limit

Fundamental frequency (MHz)	Field strength of fundamental (dBµV/m)
40.66 – 40.70	60.0
70 – 130	54.0
130 – 170	54.0 to 63.5[1]
174 – 260	63.5
260 – 470	63.5 to 74.0[1]
Above 470	74.0

[1] Linear interpolation
The limit at 434 MHz is 72.2 dBµV/m.

3.3.2 Measurement instruments

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

3.3.3 Test setup

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

3.3.4 Test procedure

According to ANSI C63.10 (2013), chapter 7.6.
IRN 026 Radiated electrical disturbance – Method 1: 30 MHz – 1 GHz in SAR.

3.3.5 Test results of Output Power Measurement

The highest output power values were measured with vertical polarization, with the measuring antenna at a height of 1.5m, tilted towards the EUT.
The output power of a pulse train is corrected for the total on-time (t_1) relative to the total duration between pulses (T). The correction (δ) in dB is determined with the following equation:

$$\delta(dB) = 20\log(\frac{t_1}{T})$$

Output power of both signals was measured in a test mode where duration between pulses (T) was 1000.0 ms.
Activity t_1 = 10.125 ms
Cow positioning t_1 = 1.84 ms

Signal	Channel	Frequency (MHz)	Data rate (kb/s)	**δ** (dB)	Peak Output power (dBµV/m)	Corrected output power (dBµV/m)
Activity	2	433.6	100	-39.9	86.97	47.1
	5	434.2	100	-39.9	86.38	46.5
Uncertainty	± 4.6 dB					

Signal	Channel	Frequency (MHz)	Data rate (kb/s)	**δ** (dB)	Peak Output power (dBµV/m)	Corrected output power (dBµV/m)
Cow positioning	1	433.3	300	-54.7	86.08	31.4
	6	434.5	300	-54.7	85.74	31.0
Uncertainty	± 4.6 dB					

3.4 Radiated Spurious Emissions Measurement

3.4.1 Limit

The spurious emissions from an intentional radiator shall not exceed the field strength levels specified in the following tables. Note: The tighter limit applies at each frequency.
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Frequency (MHz)	Field strength (µV/m)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 -88	100	3
88 - 216	150	3
216-960	200	3
Above 960	500	3

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Frequency (MHz)	Field strength (µV/m)	Measurement distance(m)
40.66 – 40.70	100	3
70 – 130	50	3
130 – 174	50 to 150[1]	3
174 – 260	150	3
260 – 470	150 to 500[1]	3
Above 470	500	3

[1] Linear interpolations

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

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz.
Radiated emission limits in these three bands are based on measurements employing an average detector.

Other details are according to KDB Publication 558074 V05, sections 11.3 and 12.1.

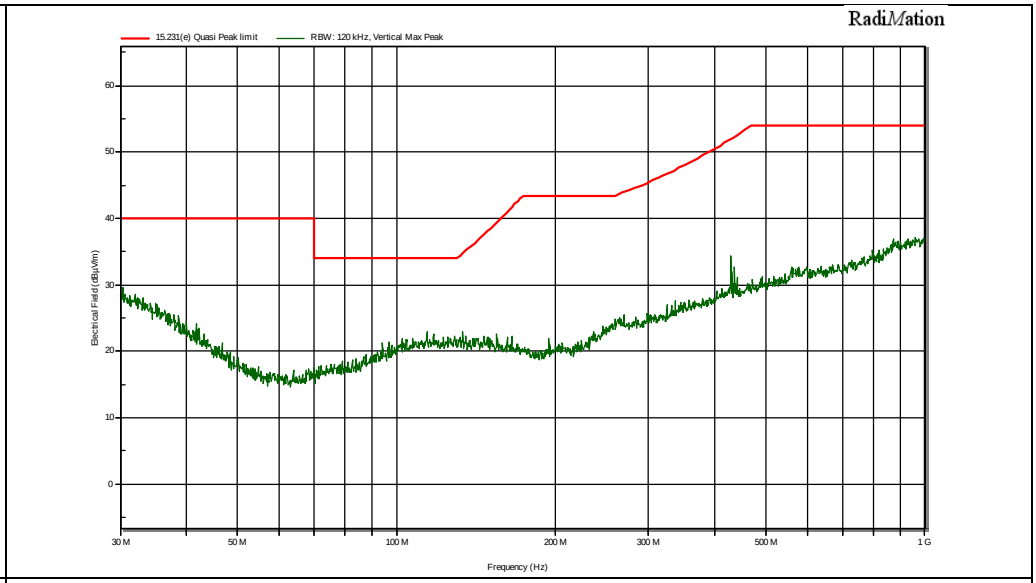
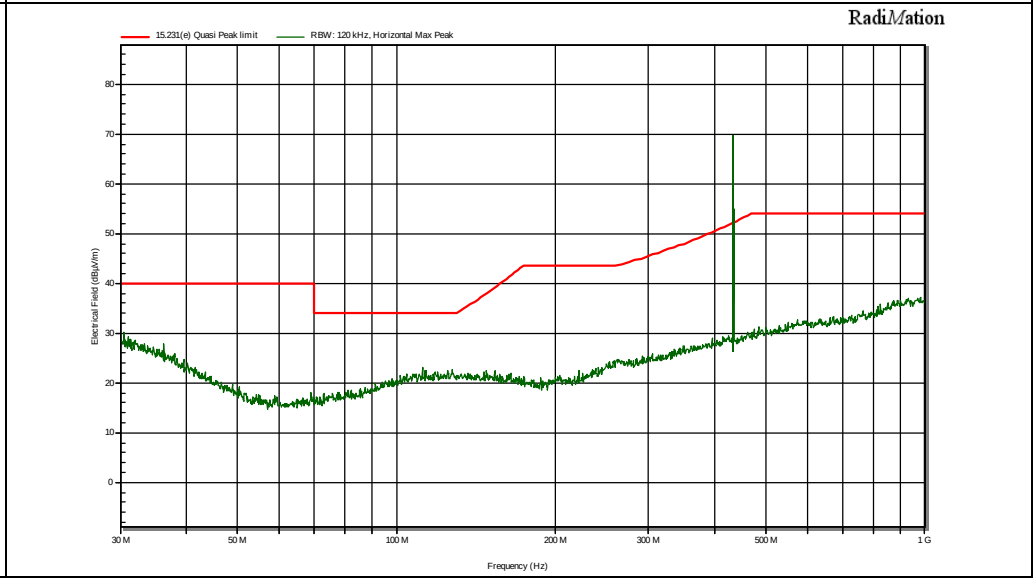
IRN 026 - Radiated electrical disturbance (V per m) Method 1 – 30 MHz – 1 GHz in SAR.
IRN 026 - Radiated electrical disturbance (V per m) Method 2 – 1 - 18 GHz in SAR.

3.4.5 Notes

- In the frequency range of 1 – 18 GHz the green trace is measured using a peak detector and the red trace is measured using an average detector. The top limit line represent the peak limit and the bottom limit represents the average limit.

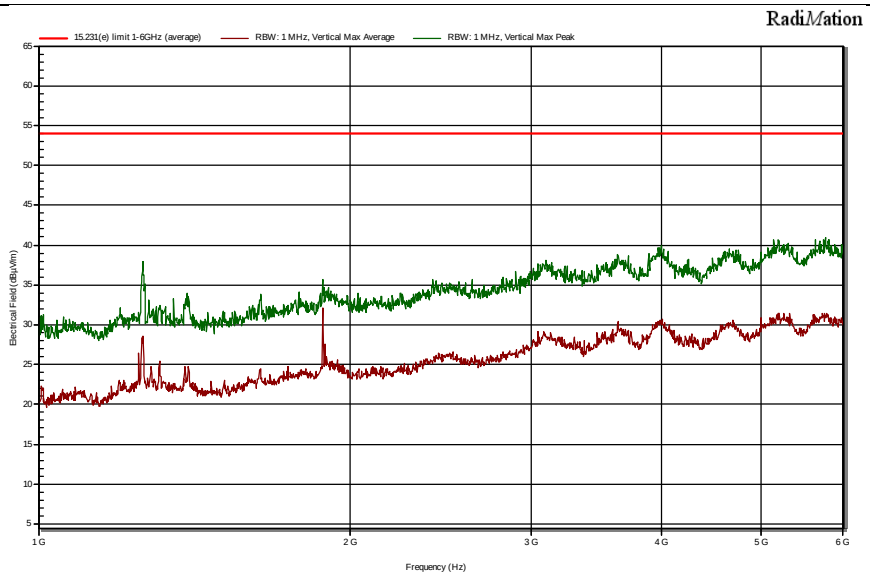
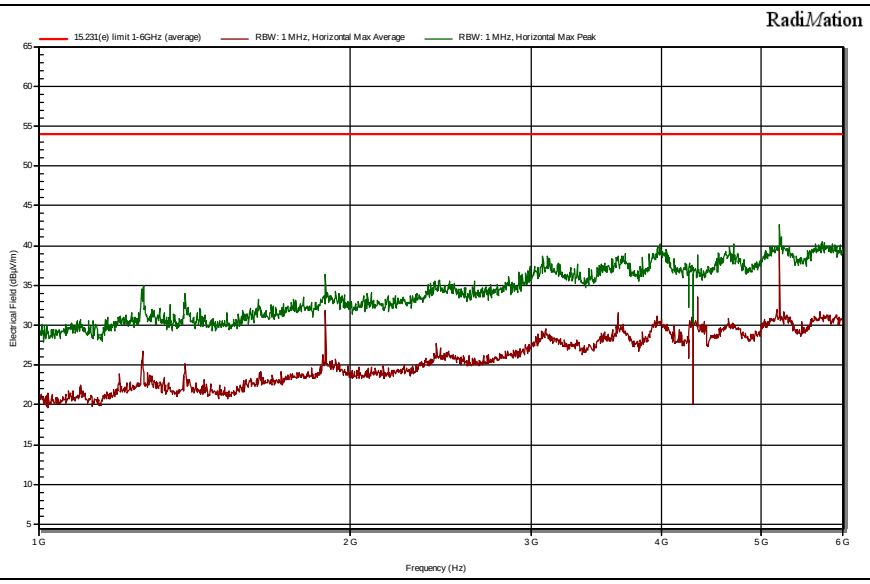
3.4.6 Plots of the Radiated Spurious Emissions

30 MHz to 1 GHz

Vertical	
Horizontal	

Note: The peak at 433 MHz in the horizontal plot is the fundamental frequency and therefore not subject to the spurious limit.

1 GHz to 18 GHz

Vertical	
Horizontal	

3.4.7 Measurement Uncertainty

Measurement uncertainty Radiated emissions below 1 GHz

Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

Measurement uncertainty Radiated emissions above 1 GHz

1000- 18000 MHZ	5.7 dB

3.5 Transmission time measurement

3.5.1 Limit

The duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

3.5.2 Measurement instruments

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

3.5.3 Test setup

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

3.5.4 Test procedure

According to ANSI C63.10 (2013), chapter 7.6.
IRN 013 Duty cycle – Method 2 - Spectrum analyser.

3.5.5 Test results of Transmission time measurement

Tracking	Transmission duration (ms)[1]	Time between transmissions (ms)[1]	Duty cycle (%)
Cow positioning	1.84	10500	0.018
Activity	10.125	944000	0.001

[1] Time between transmissions on the same channel

3.5.6 Measurement uncertainty

Duration uncertainty: ±0.41 ms.