Test report for

FCC and IC Test Report for

47 CFR Part 15 Subpart C

RSS Gen and RSS-210

The RvA is signatory to ILAC - MRA

Product name	: SmartTag-B neck
Manufacturer	: Nedap N.V.
FCC ID	: CGDIFERB
IC	: 1444A-IFERB

Test report No. : P000296052 001 Ver 8.0

Laboratory information

Accreditation

Kiwa Nederland B.V. complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. 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 L248 and is granted by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

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Documentation

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Testing Location

Test Site	Kiwa Nederland B.V.
Test Site location	Wilmersdorf 50 7327 AC Apeldoorn The Netherlands Tel. +31 88998 3393
Test Site FCC	NL0001
CABID	NL0001

Revision History

Version	Date	Remarks	By
v0.50	24-02-2023	First draft	MK
v1.00	14-03-2023	Final release	MK
v1.50	04-04-2023	Revision	MK
v2.0	13-04-2023	Revision	MK
v3.0	24-04-2023	Revision	MK
v4.0	16-05-2023	Removed Rx frequencies Section 1.4 (customer request)	MK
v5.0	15-06-2023	Applicant name change	MK
v6.0	26-06-2023	FCC & IC ID change, removed Tx 134Khz (section 1.4) added plots for Tx time measurement (sect 3.5.6)	MK
v7.0	06-07-2023	Added Output Power section 3.3	MK
v8.0	18-07-2023	Model update, 1.4 Product specifications of Equipment under test, Aux equipment update.	MK

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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	3.5	Pass
15.231 (e)	--	Transmission time	3.6	Pass

1 General Description

1.1 Applicant

Client name:	Nedap N.V.
Address:	Parallelweg 2, Groenlo, Netherlands
Zip code:	7141 DC
Telephone:	+31 544 471 825
E-mail:	annepieter.haytema@nedap.com
Contact name:	Mr Anne Pieter Haytema

1.2 Manufacturer

Manufacturer name:	Nedap N.V.
Address:	Parallelweg 2, Groenlo, Netherlands
Zip code:	7141 DC
Telephone:	+31 544 471 825
E-mail:	annepieter.haytema@nedap.com
Contact name:	Mr Anne Pieter Haytema

1.3 Tested Equipment Under Test (EUT)

Product name:	SmartTag-B neck
Brand name:	Nedap
FCC ID:	CGDIFERB
IC:	1444A-IFERB
Product description:	Active RFID tag for cow activity monitoring
Variant model(s):	FE4, IFE4, FER4 and IFER4
Batch and/or serial No.	----
Software version:	----
Hardware version:	----
Date of receipt	24 January 2023
Tests started:	13 February 2023
Testing ended:	06 April 2023

1.3.1 Auxiliary items

AUX1

Product name:	Nedap, VP4102 reader and VSCAN
Product type:	Tag reader
Remarks:	To verify the functional working of the tags

AUX2

Product name:	134Khz, rsp. 434MHz tag reader
Product type:	Tag reader
Remarks:	To verify the functional working of the tags

AUX3

Product name:	Notebook
Product type:	--
Remarks:	Reader with PC sniffer software is used.

1.4 Product specifications of Equipment under test

TX Frequency range (MHz)	433.6 - 434.2 MHz
RX frequency range (MHz)	--
Maximum output power (dBm)	--
Antenna type	Integrated 434 MHz trace on PCB & 134 kHz Coil antenna
Antenna gain (dBi)	0 dBi & 134 kHz Coil antenna gain unknown
Type of modulation	FSK
Emission designator	106KF1D

1.5 Modification of the Equipment Under Test (EUT)

None.

1.6 Observations and remarks

The tested model was the SmartTag Neck IFER4, 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	13-02-2023	14-02-2023	06-04-2023
Ambient temperature	21.1	20.6	21.5
Humidity	34.5	25.3	26.2

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 47 CFR part 15 (10-1-21 Edition)
- RSS-210 Issue 10 (2019)
- RSS-Gen Issue 5 (2018)

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. Kiwa Nederland B.V. 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 : Ing. Maaz Harris Khan under the supervision of Ing, Peter Suringa.

Review of test methods and report by:

Name : ing P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 09-08-2023

Name : ing. R. van Barneveld

Function : Test Engineer

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.

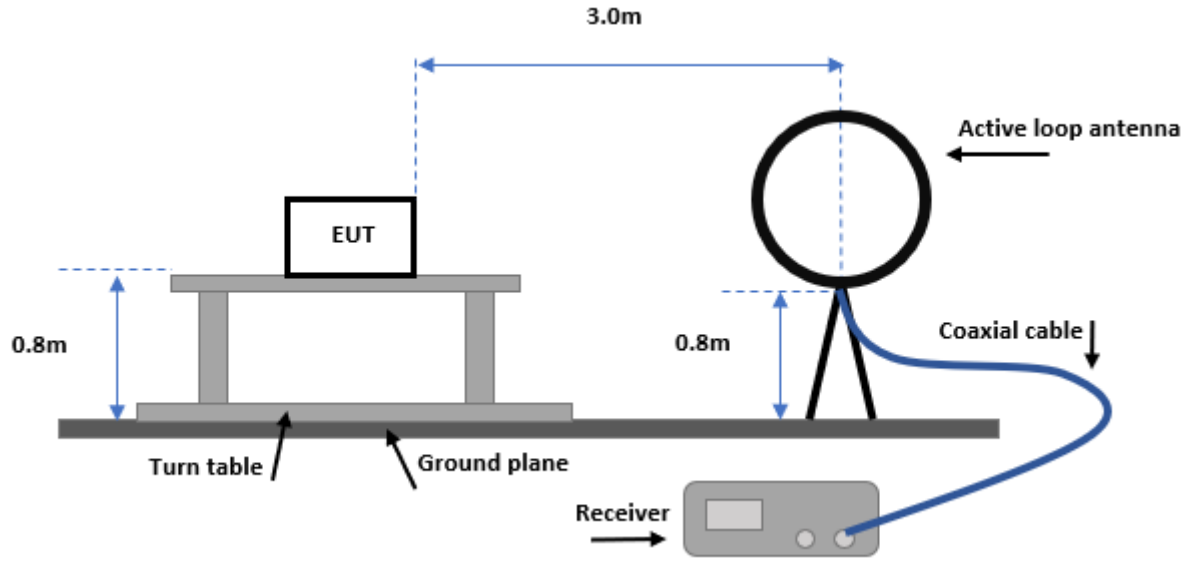
2.2 Tested channels and Data rates

The SmartTag-B Neck series sends a signal of maximum duration of 10 ms with at least 5 seconds interval at one of the four frequencies. This interval increases to 10 seconds according to FCC. The SmartTag-B Neck series scrolls the four frequencies to reduce disturbances by other systems working in the same frequency band.

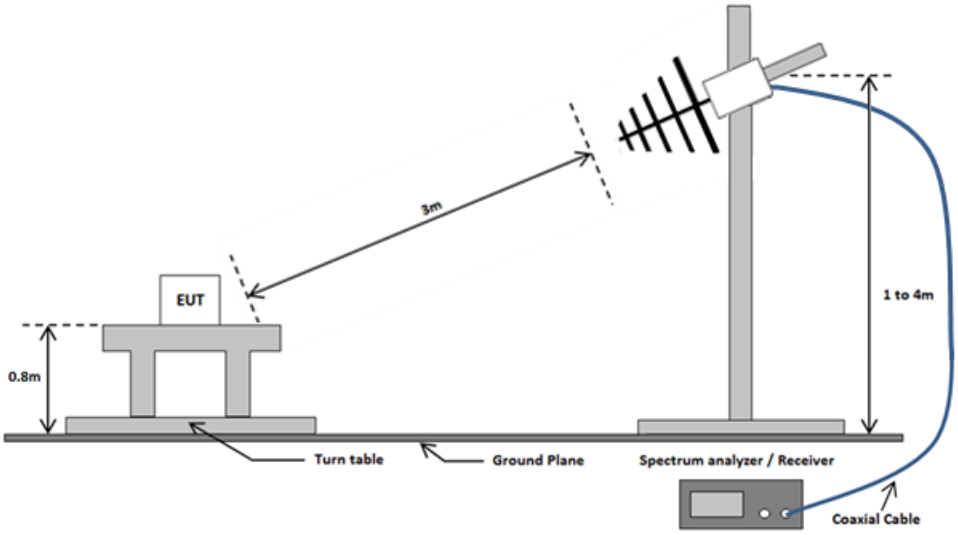
Technology	Channels	Data rate (kb/s)	Frequency (MHz)
433MHz	--	100	433.6

2.3 Test setups

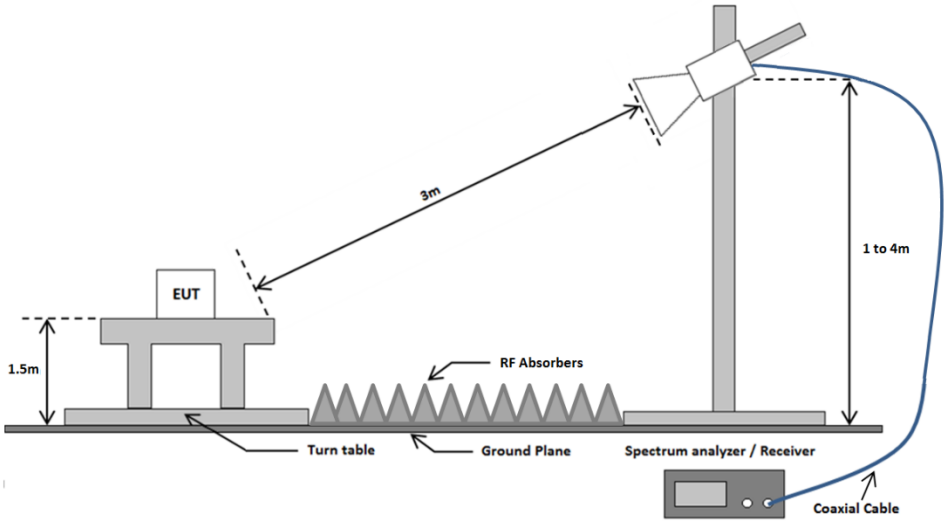
Radiated emissions test setup 9 kHz – 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz

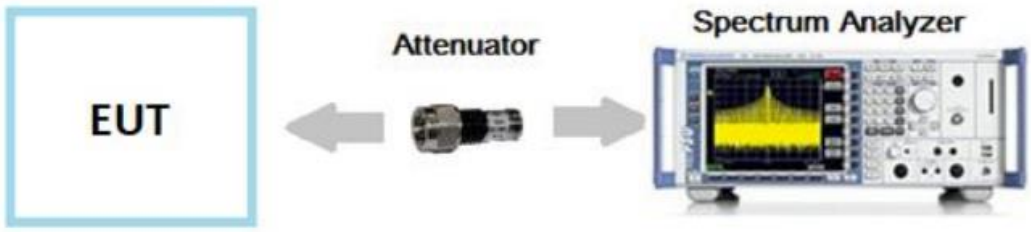


Radiated emissions test setup above 1 GHz



Antenna port conducted tests

Conducted test setup



2.4 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Cal. Done date	Cal. due date	Used at Par.
EMI Receiver	Rohde & Schwarz	ESCI	114161	01-2023	01-2024	3.4
EMI Receiver	Rohde & Schwarz	ESR7	114534	02-2023	02-2025	3.3, 3.4, 3.5
Spectrum Analyzer	Rohde & Schwarz	FSV40	114527	05-2022	05-2023	3.1, 3.2, 3.4, 3.5
1.1 GHz HPF	Wainwright	WHK1.1/15G-10EF	114682	09-2021	09-2024	3.4
Biconical antenna + 6dB attenuator	Schwarzbeck + HP	VHA9103 + 8491A	114436 + 114254	03-2021	03-2024	3.4
Logperiodic antenna	EMCO	3147	114385	03-2021	03-2024	3.3,3.4
Horn antenna	EMCO	3115	114607	01-2021	01-2024	3.4
Preamplifier 1-18 GHz	Schwarzbeck	BBV 9718D	114874	12-2022	12-2023	3.3
Test software	Raditeq	Radimation Version 2021.1.9	--	--	--	3.3, 3.4
Test Site SAR	ETS-Lindgren	--	114624	--	--	3.3, 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.

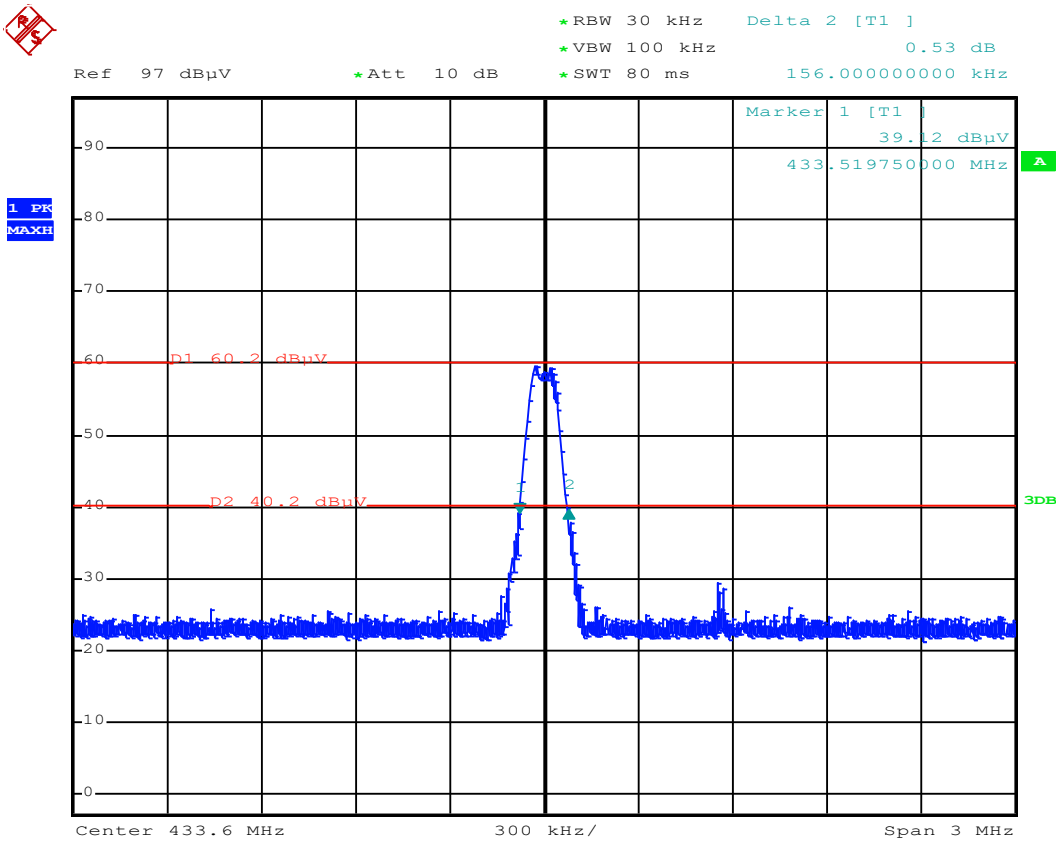
3.1.4 Test procedure

According to ANSI C63.10 (2013).
IRN 404 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)
433 MHz	--	433.6	100	156
Uncertainty	± 6.4 kHz			

3.1.6 Plots of the 20dB bandwidth measurement



Date: 13.FEB.2023 15:44:52

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

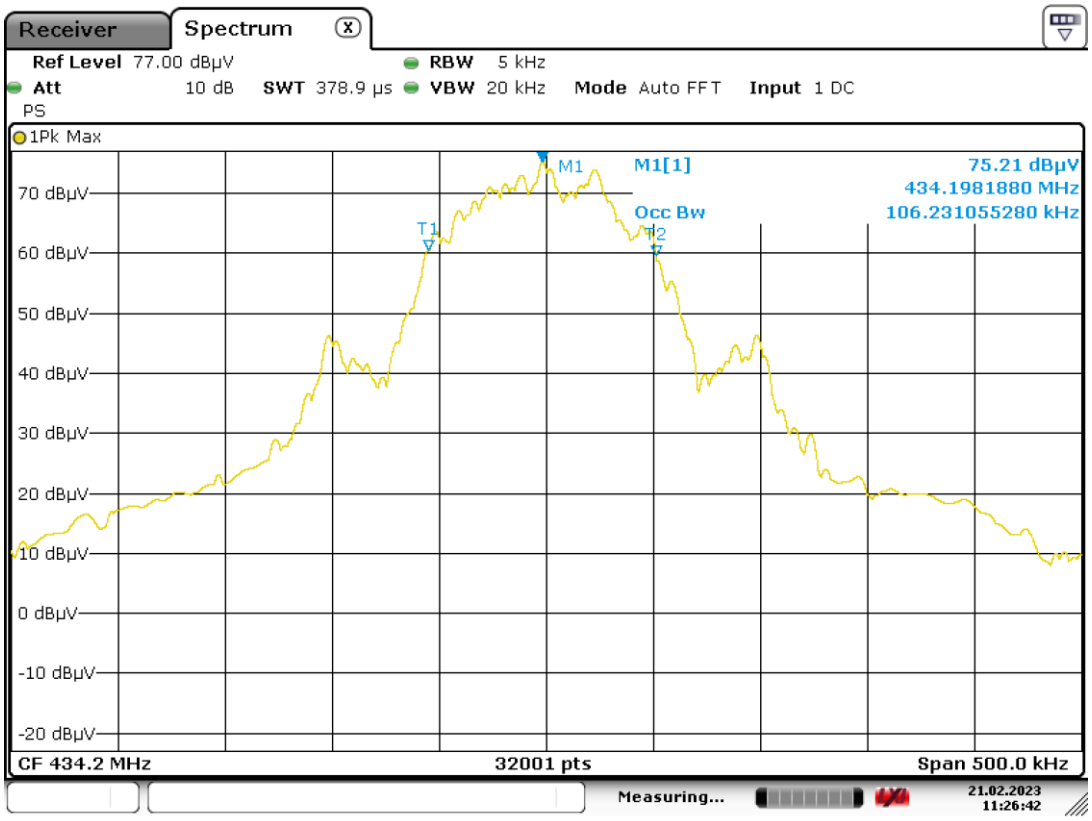
IRN 404 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

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)
433 MHz	--	434.2	100	106.23
Uncertainty	± 6.4 kHz			

3.2.6 Plots of the 99% occupied bandwidth measurement



Date: 21.FEB.2023 11:26:42

3.3 Output Power Measurement

3.3.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 1W (30 dBm). If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measurement instruments

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

3.3.3 Test setup

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

3.3.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02.
IRN 402 - RF power (W) - Method 1 – AVGSA (DTS) according to ANSI C63.10.

3.3.5 Test results of Output Power Measurement

Peak method

Technology Std.	Channel	Frequency (MHz)	Data rate	Peak output power conducted*(dBm)
433 MHz	--	433.6	100k	3.0
	--	434.2	100k	3.1
Uncertainty	±0.71 dB/±5.7 *dB			

3.4 Field strength Measurement

3.4.1 Limit

Fundamental frequency (MHz)	Average field strength of fundamental (dBµV/m)	Peak field strength of fundamental (dBµV/m)
40.66 – 40.70	60.0	80.0
70 – 130	54.0	74.0
130 – 170	54.0 to 63.5[1]	74.0 to 83.5[1]
174 – 260	63.5	83.5
260 – 470	63.5 to 74.0[1]	83.5 to 94.0[1]
Above 470	74.0	94.0

[1] Linear interpolation
The average limit at 434 MHz is 72.2 dBµV/m.
The peak limit at 434 MHz is 92.2 dBµV/m.

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

According to ANSI C63.10 (2013), chapter 7.6.
IRN 441 Radiated electrical disturbance – Method 1: 30 MHz – 1 GHz in SAR.

3.4.5 Test results of field strength 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.

Signal	Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Detector or calculated value
Activity	433.6	81.7	92.2	Quasi-Peak
Uncertainty	± 4.6 dB			

3.5 Radiated Spurious Emissions Measurement

3.5.1 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.

15.209

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

15.231

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

3.5.2 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

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 441 - Radiated electrical disturbance (V per m) Method 1 – 30 MHz – 1 GHz in SAR.
IRN 441 - Radiated electrical disturbance (V per m) Method 2 – 1 - 18 GHz in SAR.

3.5.5 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.

3.5.6 Radiated Spurious Emissions Peak tables

9 – 150 kHz (Tag 5499 and Reader Perpendicular)

Frequency	Peak	Peak Limit	Status	Distance	Polarization
134.208 kHz	23.2 dBµV/m	25.1 dBµV/m	Pass	3 m	Perpendicular

9 – 150 kHz (Tag 5499 and Reader Parallel)

Frequency	Peak	Peak Limit	Status	Distance	Polarization
134.208 kHz	17.7 dBµV/m	25.1 dBµV/m	Pass	1 m	Parallel

30MHz – 250MHz (Tag ID 5499 and tag reader)

Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Polarization
49.7 MHz	39.4 dBµV/m	35.7 dBµV/m	40 dBµV/m	Pass	Horizontal

250MHz – 1000MHz (Sample 7)

Frequency	Peak	Quasi-Peak	Quasi-Peak Limit	Status	Height	Polarization
433.629 MHz	85.7 dBµV/m	81.7 dBµV/m	46 dBµV/m	**	1.2 m	Vertical

1GHz – 5GHz (Sample 7)

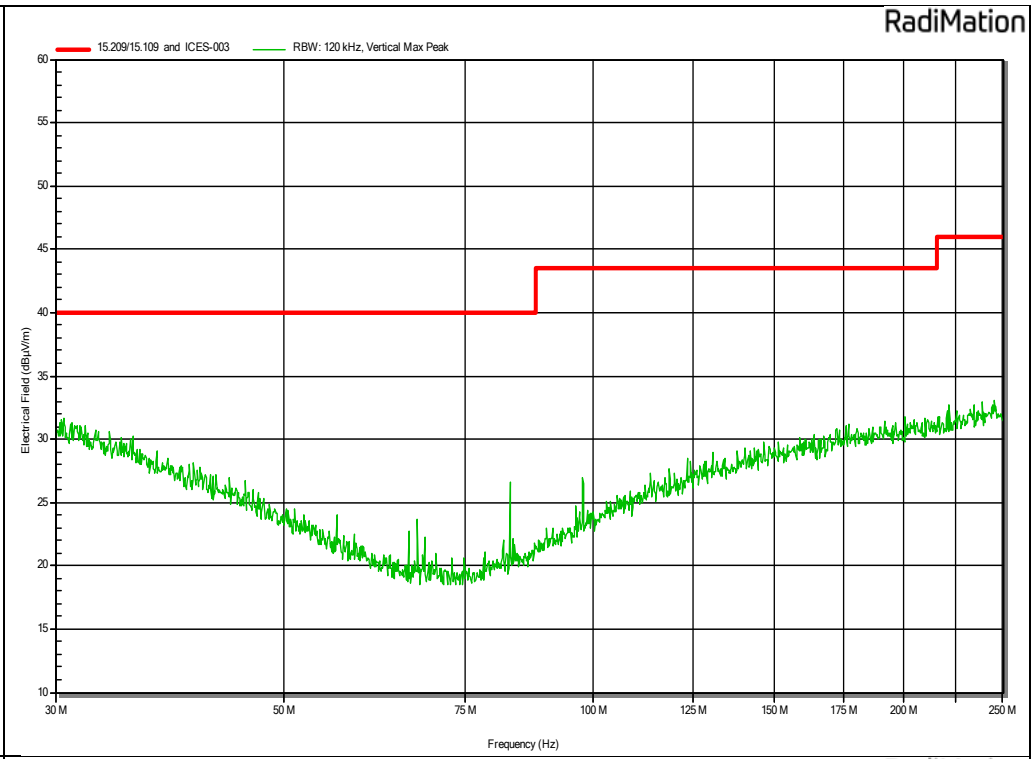
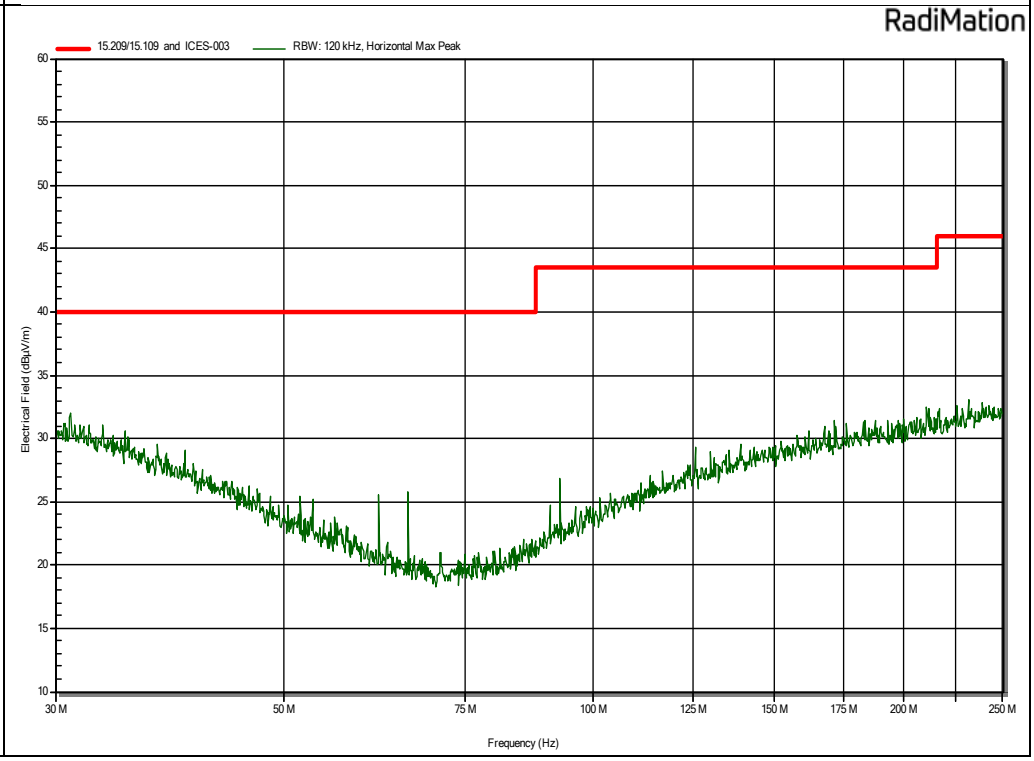
Frequency	Peak	Peak Limit	Average	Average Limit	Status	Height	Polarization
1.301 GHz	45 dBµV/m	74 dBµV/m	41.2 dBµV/m	54 dBµV/m	Pass	3 m	Vertical
2.133 GHz	40.8 dBµV/m	74 dBµV/m	28.6 dBµV/m	54 dBµV/m	Pass	1 m	Horizontal
2.168 GHz	48.1 dBµV/m	74 dBµV/m	44.9 dBµV/m	54 dBµV/m	Pass	2.5 m	Vertical
2.21 GHz	41.5 dBµV/m	74 dBµV/m	28.8 dBµV/m	54 dBµV/m	Pass	1 m	Horizontal
3.087 GHz	45.9 dBµV/m	74 dBµV/m	34 dBµV/m	54 dBµV/m	Pass	3.2 m	Vertical
4.361 GHz	48.6 dBµV/m	74 dBµV/m	36.1 dBµV/m	54 dBµV/m	Pass	1.3 m	Vertical

**Transmitted signal, not subject to limit line.

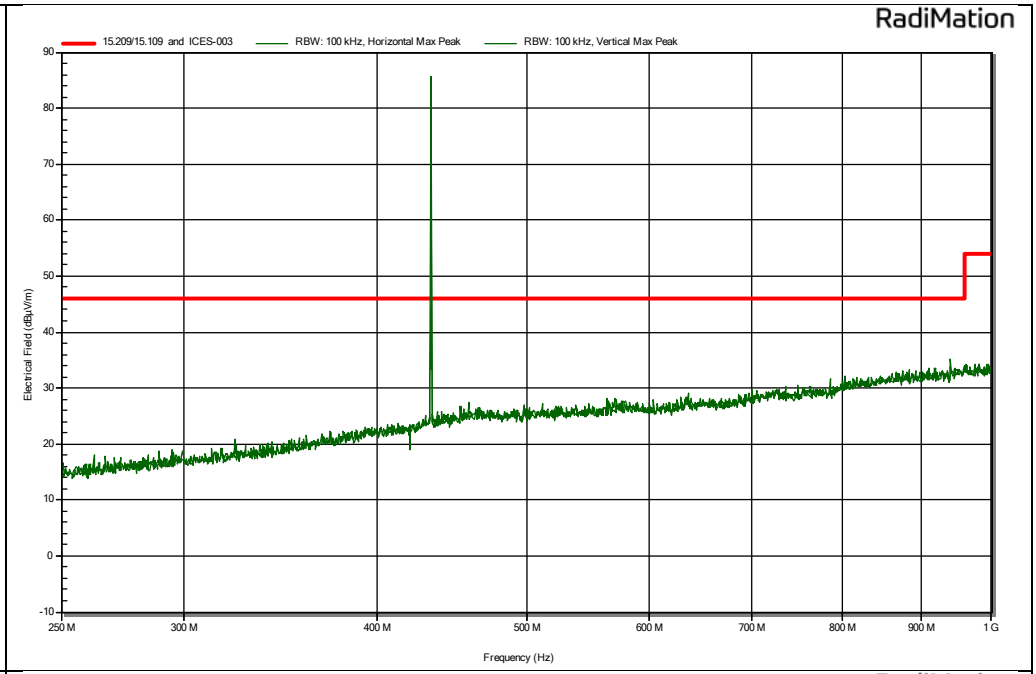
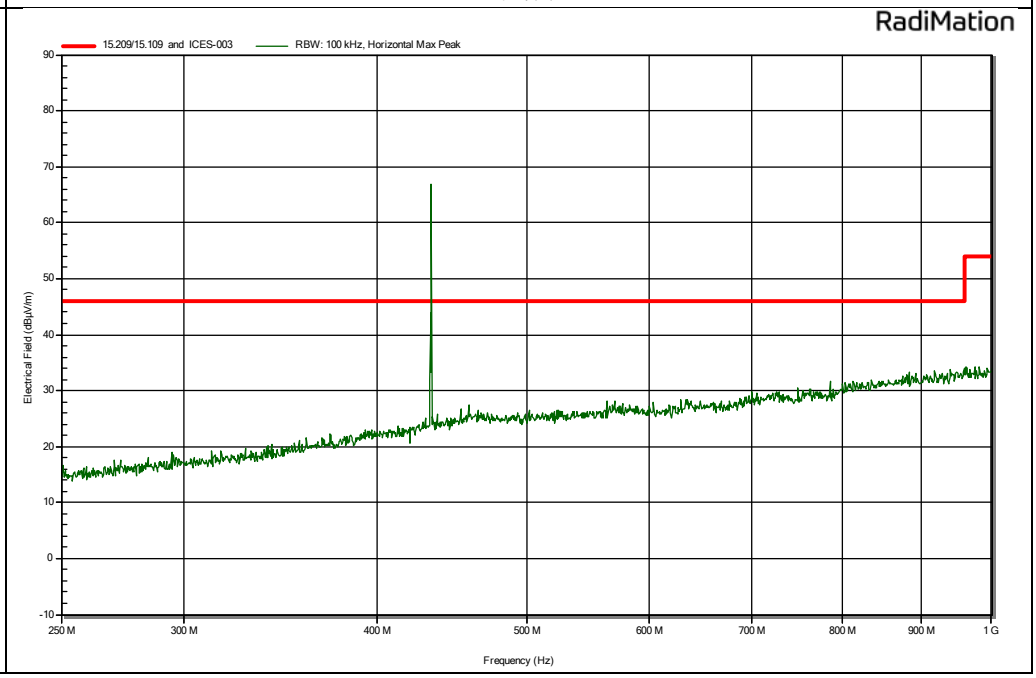
The results of the radiated emission tests are depicted in the table above. A selection of plots is provided on the next pages

3.5.7 Plots of the Radiated Spurious Emissions

30 MHz to 250 MHz

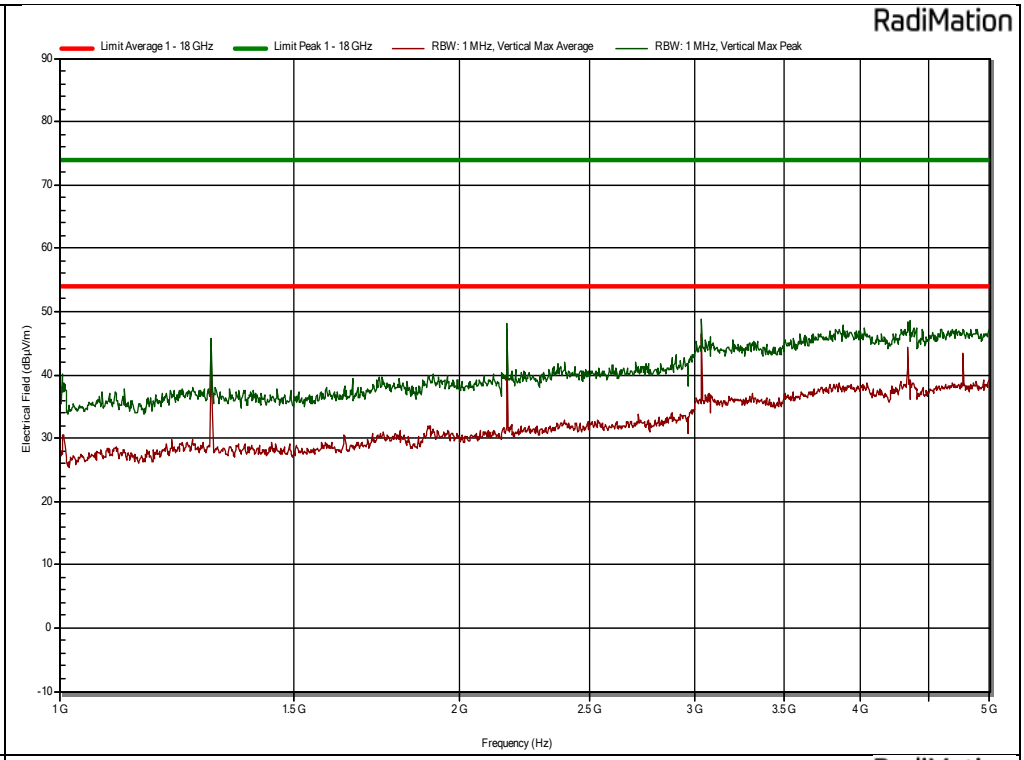
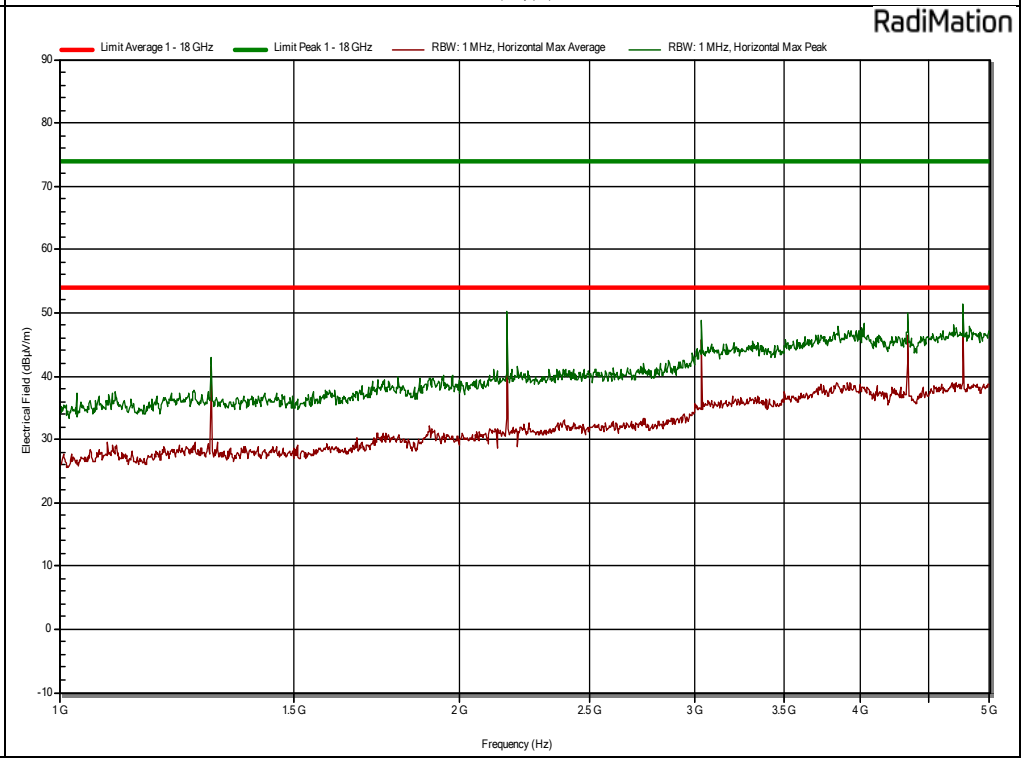
Vertical	
Horizontal	

250 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 5 GHz

Vertical	
Horizontal	

3.5.8 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

3.6 Transmission time measurement

3.6.1 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.

3.6.2 Measurement instruments

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

3.6.3 Test setup

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

3.6.4 Test procedure

According to ANSI C63.10 (2013), chapter 7.6.

IRN 401 Duty cycle – Method 2 - Spectrum analyser.

3.6.5 Test results of Transmission time measurement

EUT	Transmission duration (ms)[1]	Time between transmissions (min)[1]	Duty cycle (%)
Standard Tag: 984 0000 07475458	10.2	2.5-3	0.0068

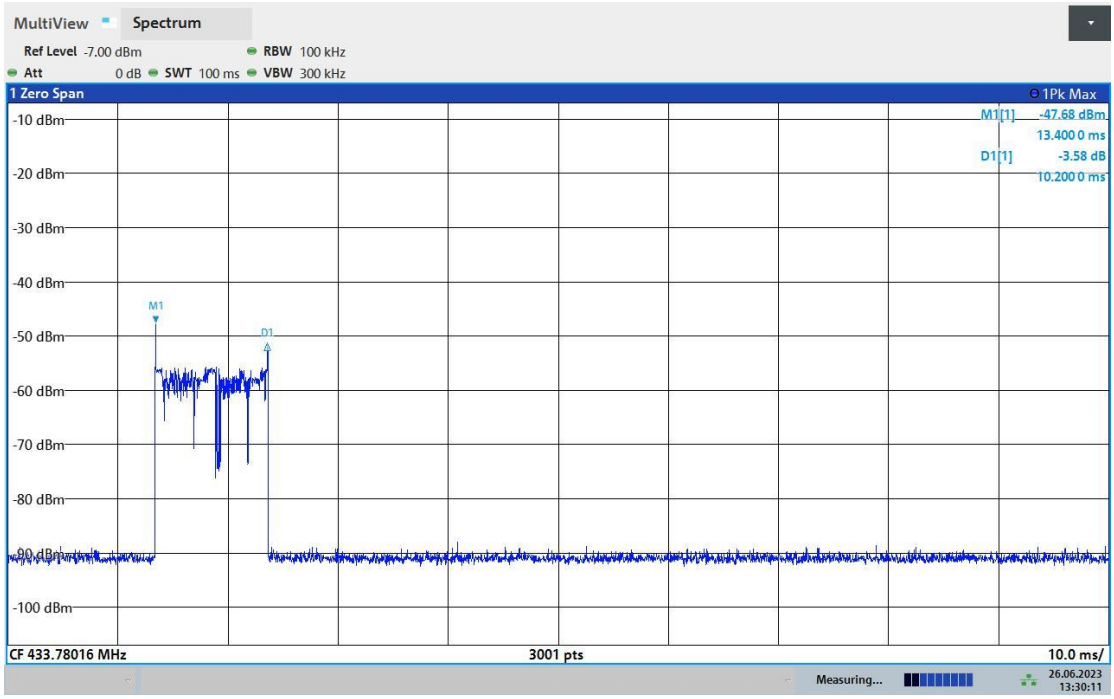
[1] Time between transmissions on the same channel

3.6.6 Measurement uncertainty

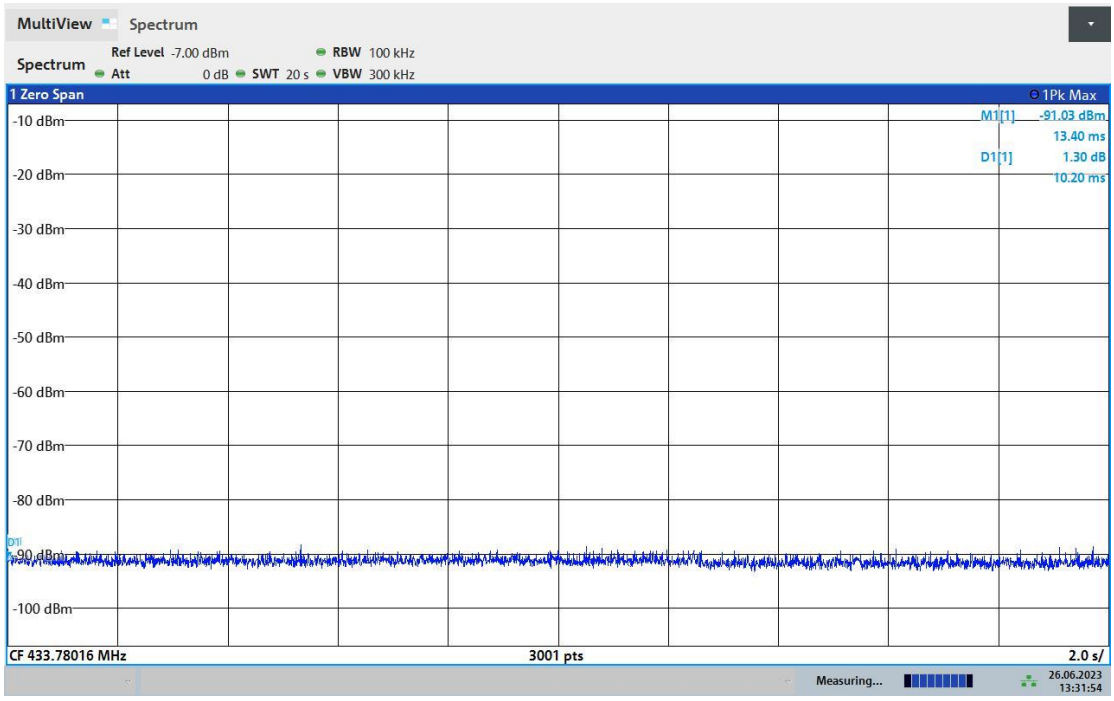
Duration uncertainty: ±0.41 ms.

3.6.7 Plots of transmission time measurement

Transmission time (Standard Tag: 984 0000 07475458)



Dead time between bursts (Standard Tag: 984 0000 07475458)



End of report