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FCC and IC Test report for parts 15.107, 15.109 15.207, 15.209 RSS-Gen, RSS-210

Product name	: VP1007B
Applicant	: NEDAP N.V.
FCC ID	: CGDVP1007B
IC ID	: 1444A-VP1007B

Test report No. : 210200001 004 Ver 2.0

Laboratory information

Accreditation

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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	Kiwa Telefication BV
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	16-08-2021	First draft	PvW
v1.00	03-09-2021	Initial release	PvW
V1.5	18-10-2021	Added RSS-210 to relevant parts Added 20 dB and 99% BW measurements Removed VP3008B results to separate test report	PvW
V2.0	22-10-2021	V2.0 release	PvW

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Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.209 (a) 15.109 (a)	RSS-Gen 8.9 RSS-210 7.2	Radiated spurious emissions	3.1	Pass
15.205 (a)	RSS Gen 8.10 RSS-210 7.1	Spurious emissions in the restricted bands	3.1	Pass
15.207 (c) 15.107 (a)	RSS-Gen 8.8	Conducted spurious emissions on AC mains	3.2	Pass
15.215 (c)	RSS-Gen 6.7	20 dB bandwidth	3.3	Pass
--	RSS-Gen 6.7	99% occupied bandwidth	3.4	Pass

1 General Description

1.1 Applicant

Client name:	NEDAP N.V.
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Telephone:	+31 (0)544 471 111
E-mail:	Annepieter.haytema@nedap.com
Contact name:	Anne Pieter Haytema

1.2 Manufacturer

Manufacturer name:	NEDAP N.V.
Address:	Parallelweg 2, 7141 DC, Groenlo, the Netherlands
Telephone:	+31 (0)544 471 111
E-mail:	Annepieter.haytema@nedap.com
Contact name:	Anne Pieter Haytema

1.3 Tested Equipment Under Test (EUT)

Product name:	VP1007B
Brand name:	Nedap
FCC ID:	CGDVP1007B
IC ID:	1444A-VP1007B
Product type:	ISO reader I/O control
Model(s):	VP1007B
Batch and/or serial No.	--
Software version:	--
Hardware version:	--
Date of receipt:	29-04-2021
Tests started:	18-05-2021
Testing ended:	12-10-2021

1.4 Product specifications of Equipment under test

Tx Frequency:	RFID tag reader: 134.2 kHz
Rx frequency:	FDX mode: 129.0 – 133.2 kHz HDX mode: 124.2 kHz and 134.2 kHz
Antenna type:	Magnetic loop antenna
Antenna gain:	Not applicable
Type of modulation:	Non modulated pulsed electromagnetic field
Emission designator	270HP0N

Disclaimer: the operating frequency and modulation type are declared by the applicant

1.5 Environmental conditions

Test date	18-05-2021	21-05-2021	12-10-2021
Ambient temperature	19.8°C	20.4°C	21.0°C
Humidity	47.1%	42.6%	49.7%

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 §15.107
- FCC Part 15 Subpart C §15.109
- FCC Part 15 Subpart C §15.207
- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart C §15.215
- RSS-Gen Issue 5
- RSS-210 Issue 10

1.8 Observation and remarks

The VP1007B can have up to two antennas connected simultaneously, but only one antenna is active at any one time.

The table below shows an overview of the max cable length for each port of the EUT

Port	Max cable length
CAN (DC output)	> 30m
FSYNC	< 3m
CAN (DC input)	> 30m
Lamp	< 30m
Switches	< 3m
Antenna 1 (only VP1007B)	< 10m
Antenna 2 (only VP1007B)	< 10m
RS232 (same port as RS485)	< 3m
RS485 (same port as RS232)	< 10m

The VP1007B can be equipped with different antennas with a maximum antenna current of 0.5A. The antennas used for testing are the smallest and largest antenna size available and the results are considered representative for all possible antennas. All possible antennas are listed in the table below. The antennas used for testing are highlighted.

Antenna	Dimensions (cm)	Transformer ratio	No. of windings	Surface * Ratio * Windings
Antenna Single Loop Walk Through	100 by 195-210	01:10	1	200.000
Antenna Single Loop Walk Over	80 by 120	01:10	1	96.000
Antenna VP6011	24 by 12,5	01:10	3	9.000
Antenna VP6012	24 by 12,5	01:10	3	9.000
Antenna for VP6030	28 by 39	01:36	1	39.312
Antenna VP6040[a]	2 times 64,6 x 30,3 and 64,6 by 59,2	02:31	1	59.892
Antenna VP6041[a]	2 times 47,6 by 38,8	01:22	1	40.631
Antenna VP6042[a]	2 times 47,6 by 38,8	01:22	1	40.631
Antenna VP6050	47,6 by 117,6	01:22	1	123.150

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 : P. van Wanrooij, BASc

Review of test methods and report by:

Name : ing. P.A. Suringa

The above conclusions have been verified by the following signatory:

Date : 22-10-2021

Name : ing. R. van Barneveld

Function : Test Engineer

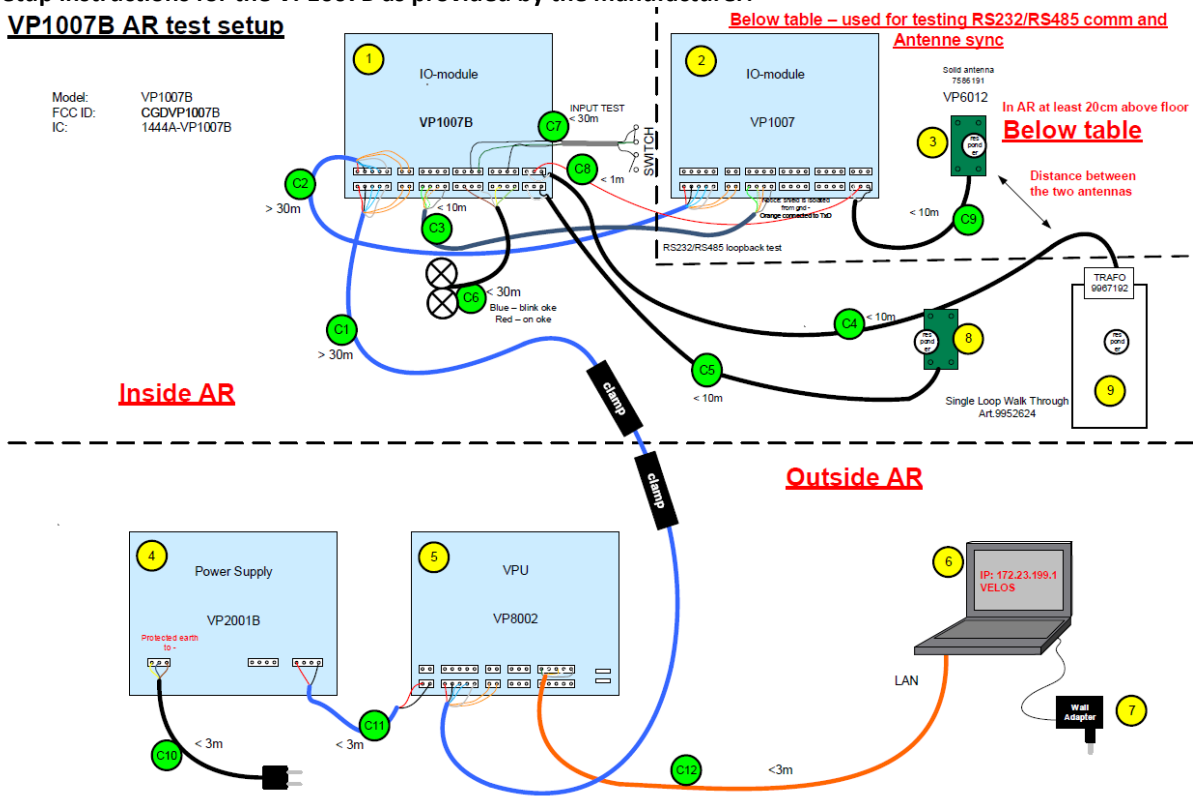
Signature :

2 Test configuration of the Equipment Under Test

2.1 Test mode

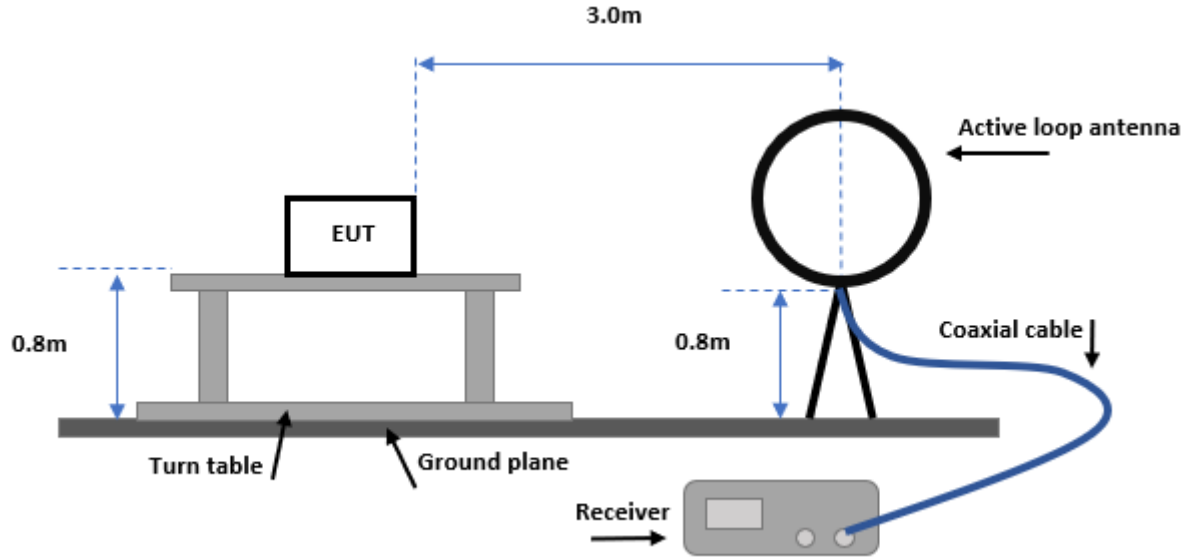
The EUT is partially tested in operating mode, and partially with a loopback test mode. The manufacturer provided a software tool to monitor the performance of the various inputs.

Setup instructions for the VP1007B as provided by the manufacturer:

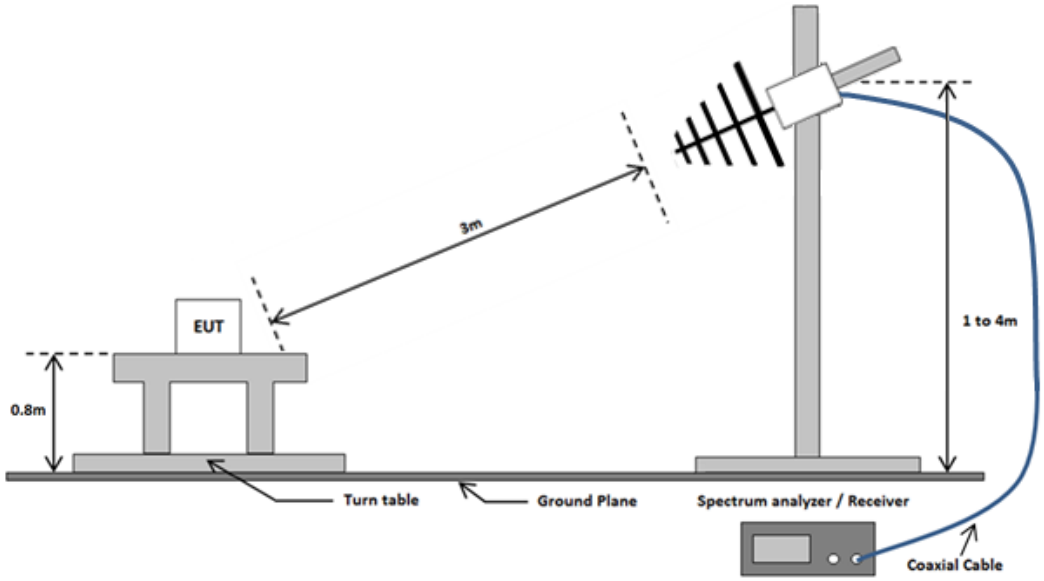


2.2 Test setups

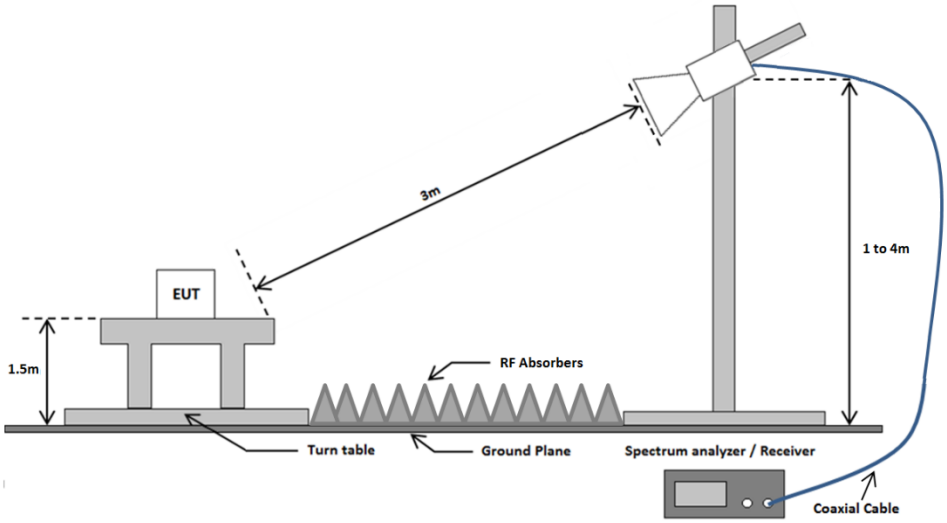
Radiated emissions test setup 9 kHz – 30 MHz



Radiated emissions test setup 30 MHz - 1 GHz

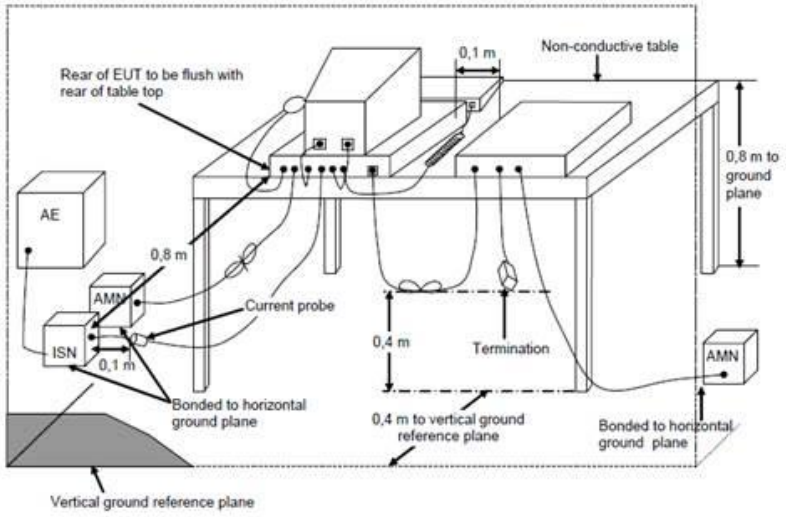


Radiated emissions test setup above 1 GHz



Conducted emissions test setup

Emissions test at AC mains



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
EMI Receiver	Rohde & Schwarz	ESR7	TE01220	3.1; 3.2
Spectrum analyzer	Rohde & Schwarz	FSP40	TE11125	3.1
Active loop antenna	EMCO	6502	TE11171	3.1
Biconilog antenna	Chase	CBL6112A	TE00967	3.1
Horn antenna	EMCO	3115	TE00531	3.1
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	TE11175	3.1
Test software	DARE	Radimation Version 2020.2.8	--	3.1; 3.2
LISN	Rohde & Schwarz	ENV216	114379	3.2
Variable AC source	Chroma	61601	114363	3.2

2.4 Sample calculations

All formulas for data conversions and conversion factors are reported in chapter 4 of this test report.

3 Test results

3.1 Radiated spurious emissions

3.1.1 Limit

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 corrected to 3m measurement distance according to the method described in ANSI C63.10-2013, clause 6.4

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

9 kHz – 30 MHz: According to ANSI C63.4-2014, section 5.4.2 and 8.2.3
30 MHz to 6 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
1 GHz to 6 GHz: IRN 026 – Method 2

3.1.5 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
1 – 6 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB

3.1.6 Measured peaks of the radiated spurious emissions measurement

9-150 kHz perpendicular (VP1007B with VP6012 antenna)

Peak Number	Frequency	Peak*	Average Limit	Status	Polarization
1	134.199 kHz	15.8 dBµV/m	25.1 dBµV/m	Pass	Perpendicular

*Note: Since average values are always less than or equal to peak values, and the measured peak value is less than the average limit, the average value will also be less than the average limit.

9-150 kHz perpendicular (VP1007B with Walk-through antenna)

Peak Number	Frequency	Average	Average Limit	Status	Polarization
1	134.199 kHz	-15.0 dBµV/m	25.1 dBµV/m	Pass	Perpendicular

30-1000 MHz (VP1007B with VP6012 antenna)

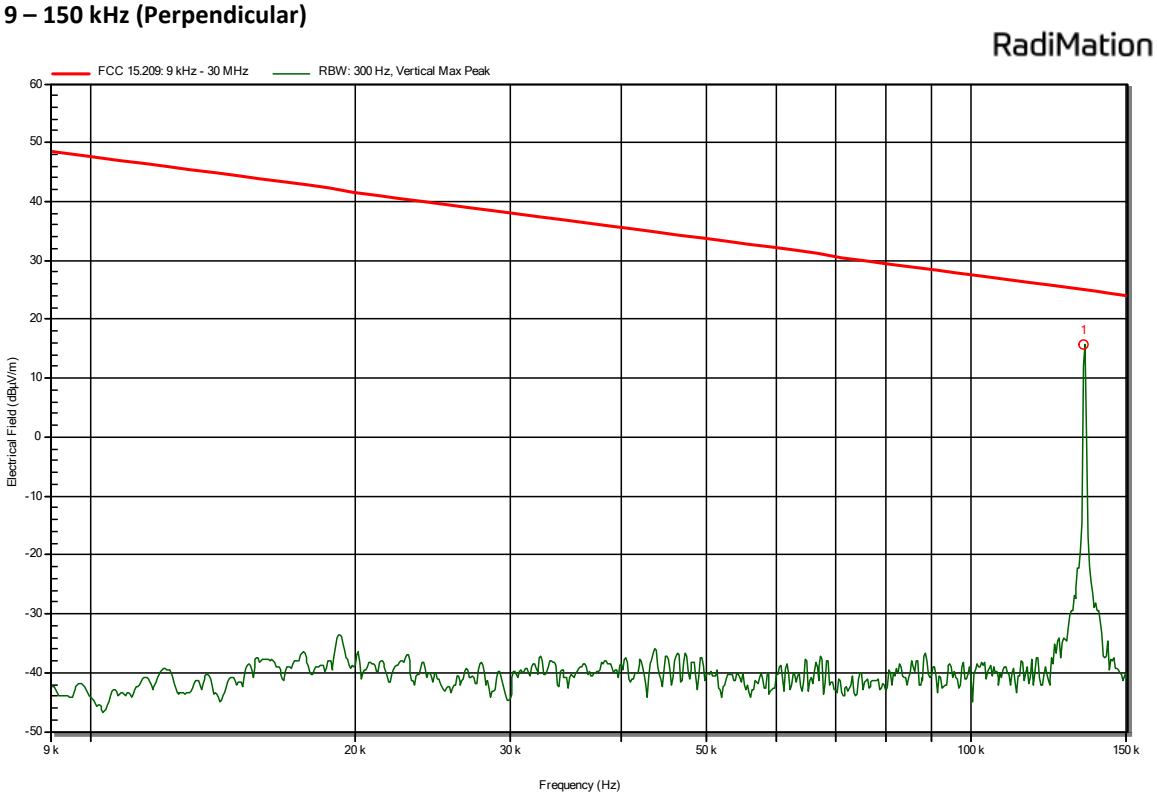
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Status	Polarization
1	347.041 MHz	42.0 dBµV/m	46.0 dBµV/m	Pass	Vertical

30-1000 MHz (VP1007B with Walk-through antenna)

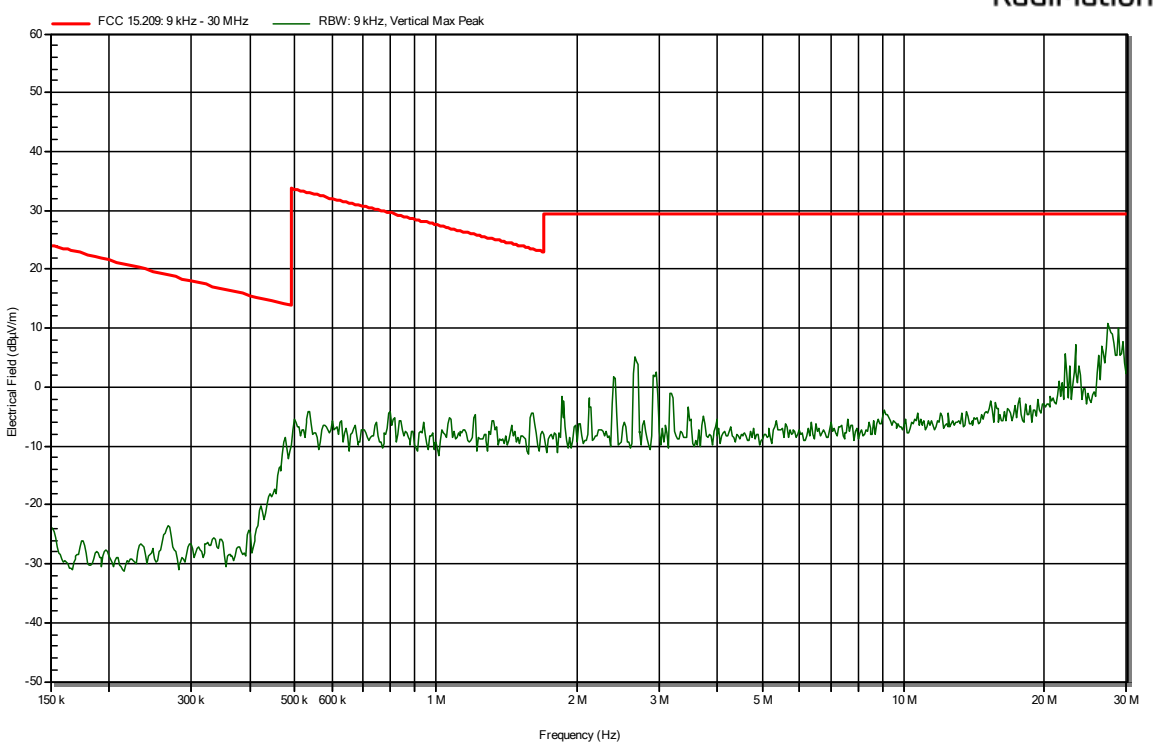
Peak Number	Frequency	Quasi-Peak	Quasi-Peak Limit	Status	Polarization
1	347.04 MHz	40.8 dBµV/m	46.0 dBµV/m	Pass	Vertical

3.1.7 Plots of the Radiated Spurious Emissions Measurement (VP1007B with VP6012 antenna)

9 – 150 kHz (Perpendicular)

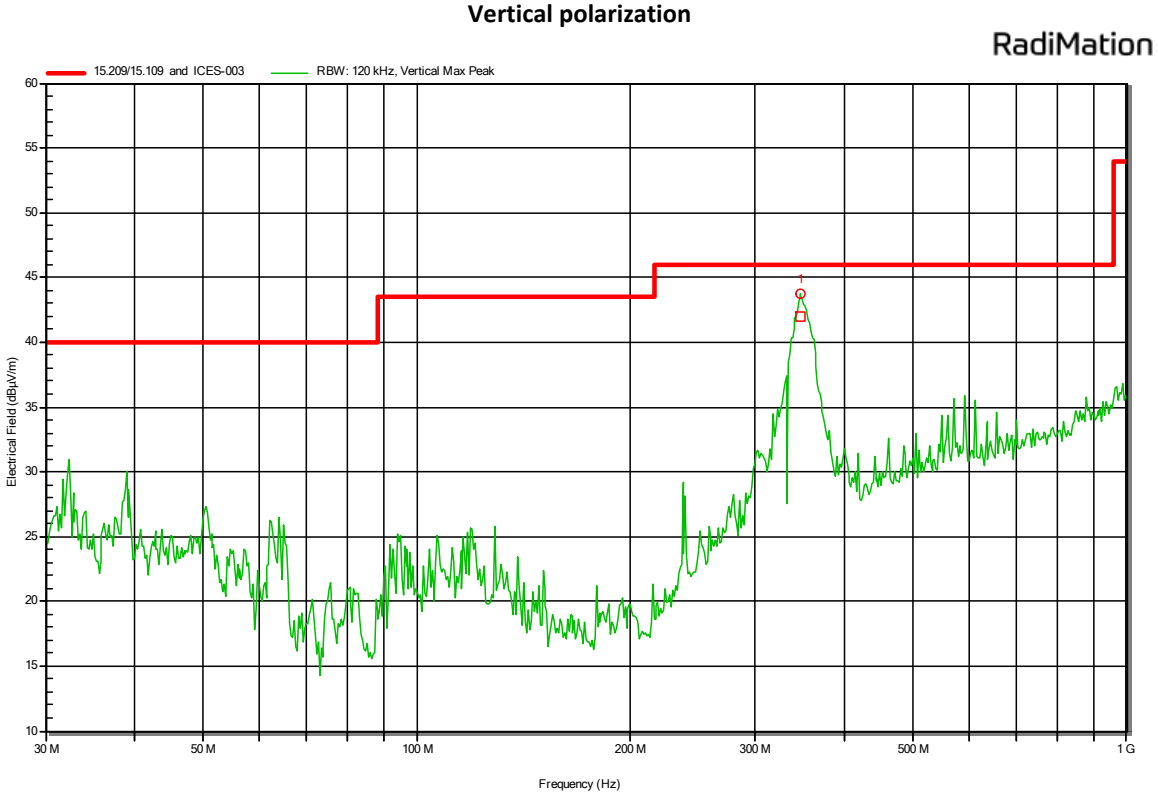


150 kHz – 30 MHz (Perpendicular)

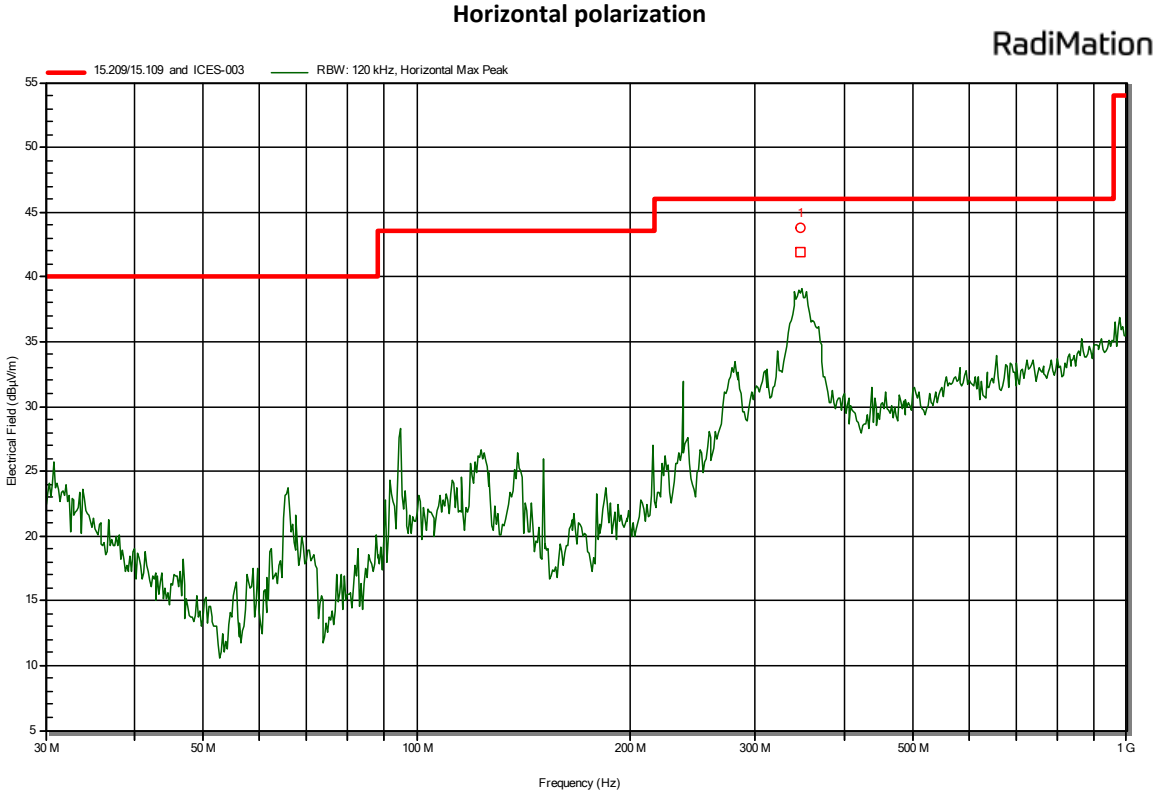


30 -1000 MHz

Vertical polarization

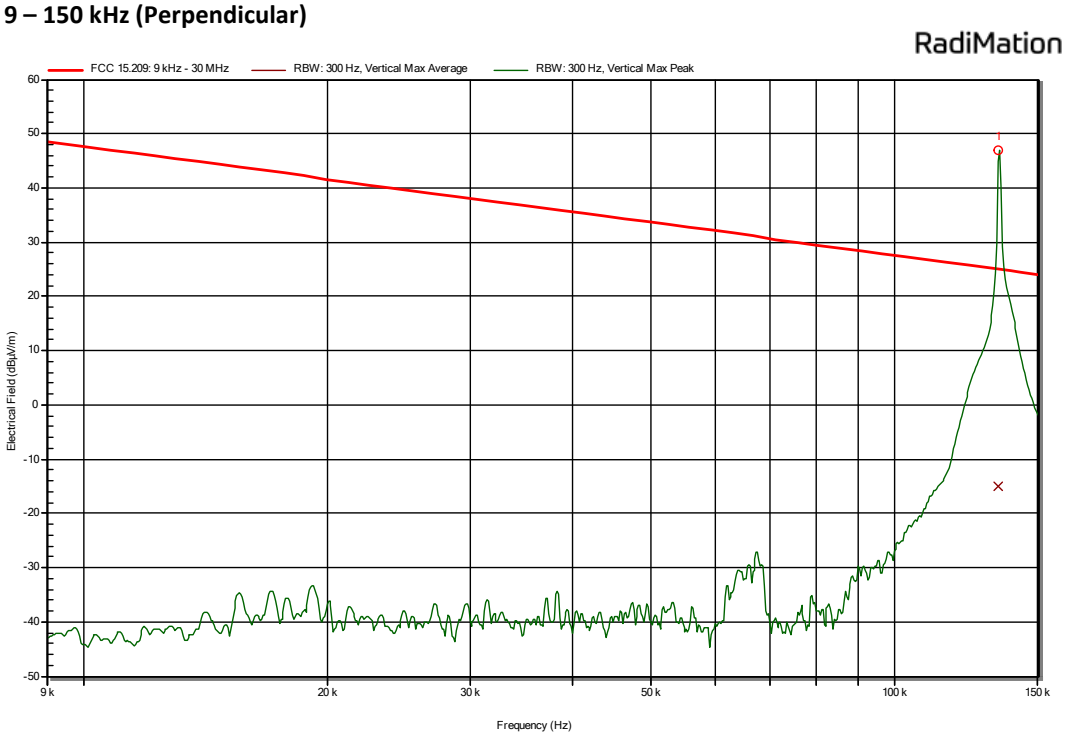


Horizontal polarization



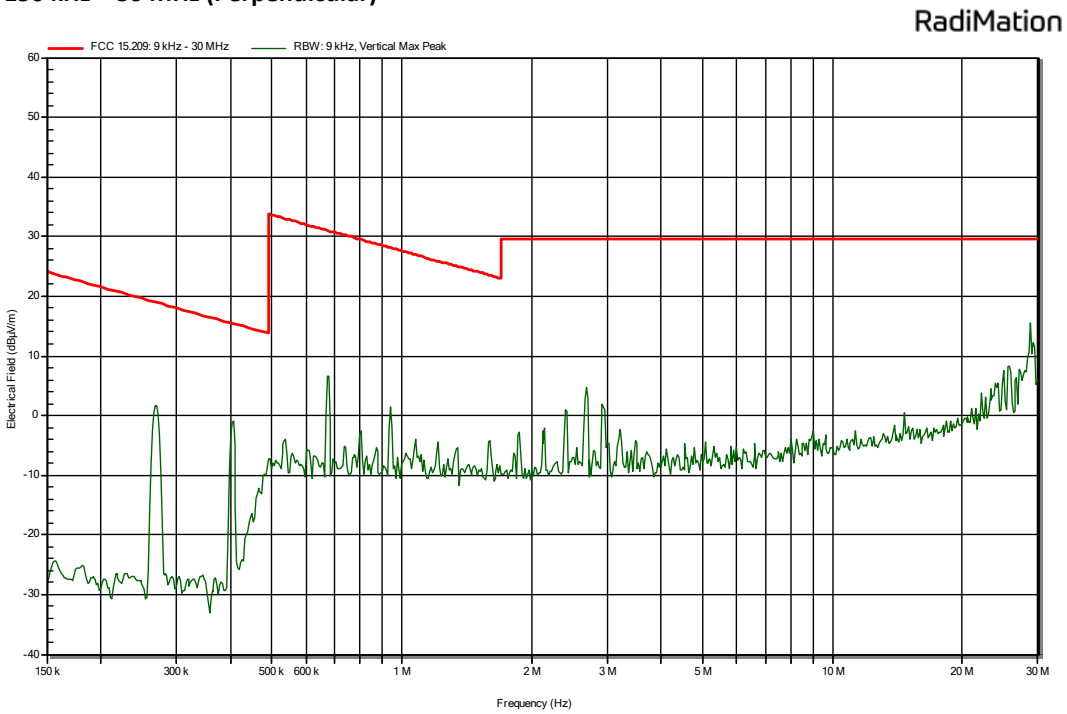
3.1.8 Plots of the Radiated Spurious Emissions Measurement (VP1007B with Walk-through antenna)

9 – 150 kHz (Perpendicular)



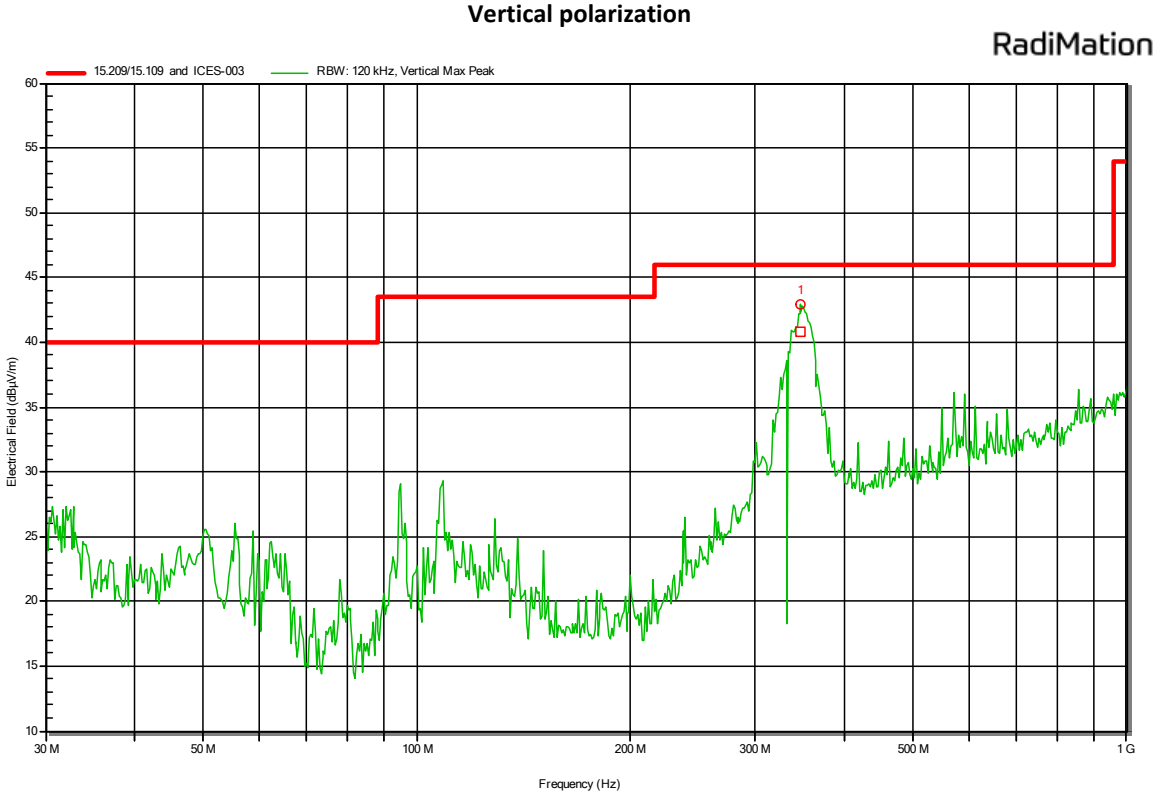
Note: The marked peak in the plot above is the transmission frequency at 134.2 kHz. According to FCC part 15.209, clause (d), the emission limit in the frequency band 110-490 kHz is based on measurements employing an average detector. See the table in clause 3.1.6 for the measured peak value using an average detector.

150 kHz – 30 MHz (Perpendicular)

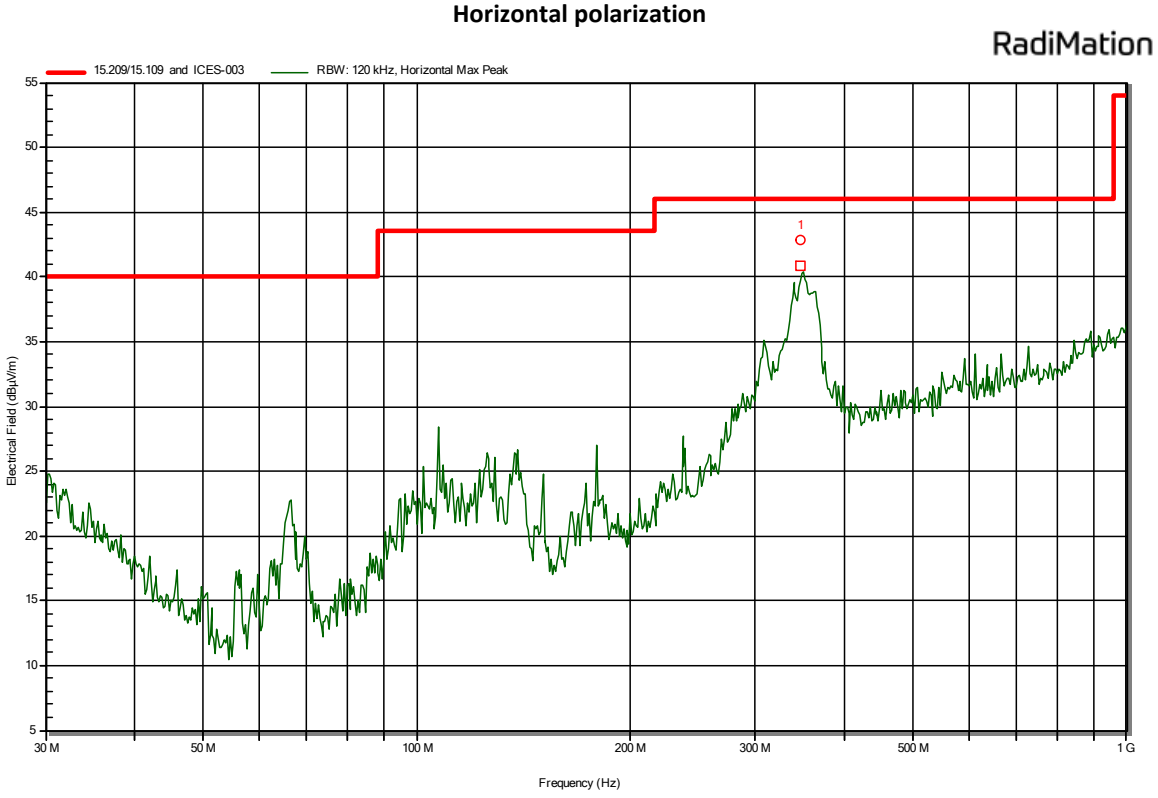


30 -1000 MHz

Vertical polarization

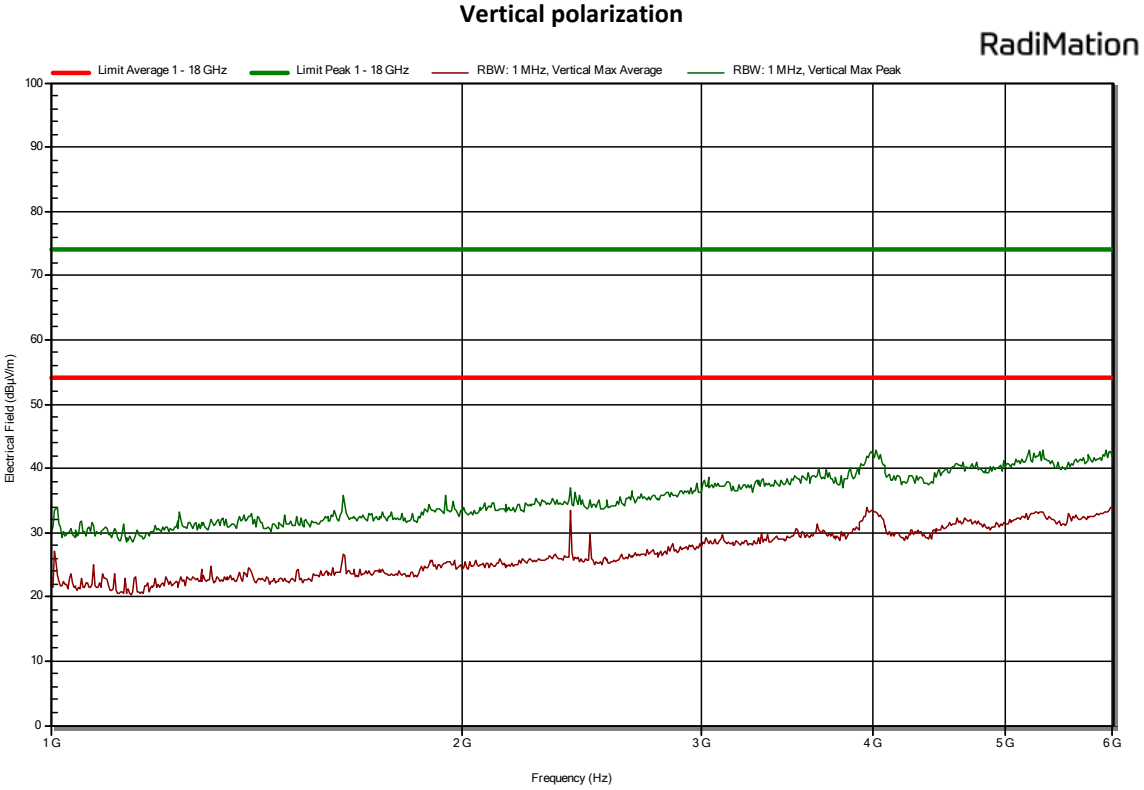


Horizontal polarization

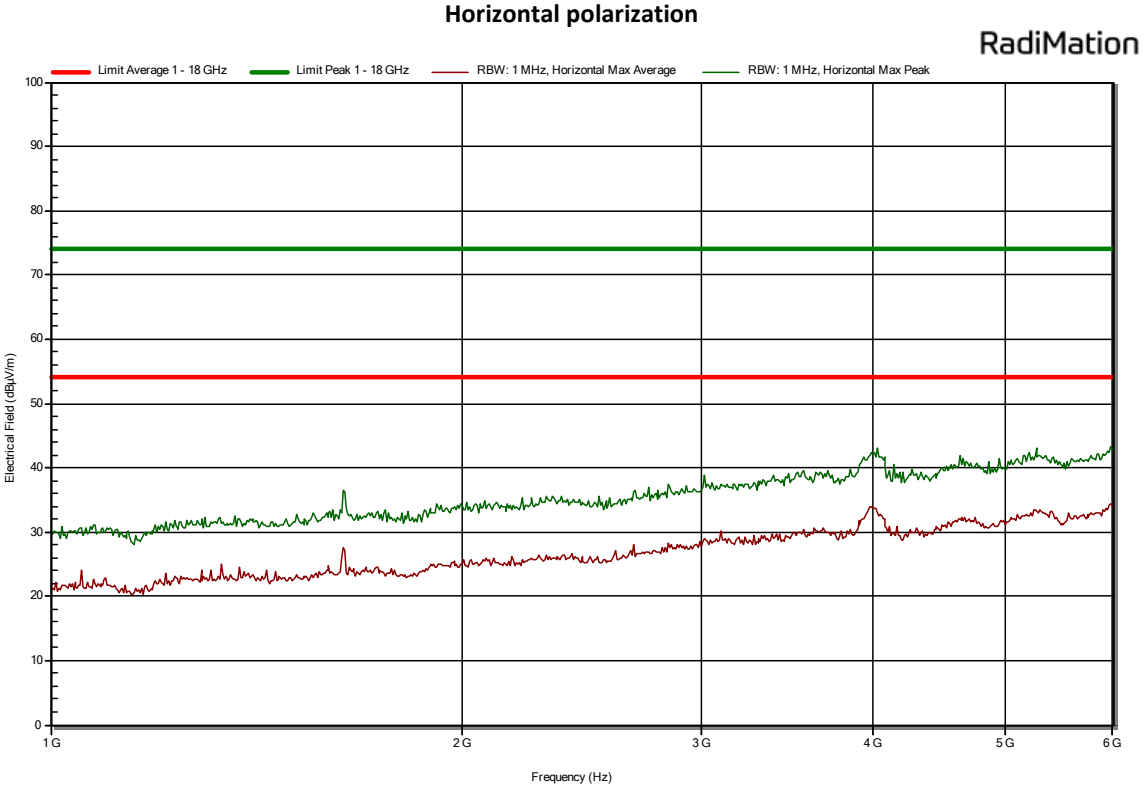


1 – 6 GHz

Vertical polarization



Horizontal polarization



3.2 Conducted emissions

3.2.1 Limit

According to 15.207 (c)

Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

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

According to ANSI C63.4: 2014, section 13.3
IRN 029 – Method 1

3.2.5 Test results and plots of the AC mains conducted measurement

AC mains - Phase

Peak Number	Frequency	Average	Average Limit	Quasi-Peak	Quasi-Peak Limit	Status
1	395.25 kHz	30.9 dBµV	48.0 dBµV	38.6 dBµV	58.0 dBµV	Pass

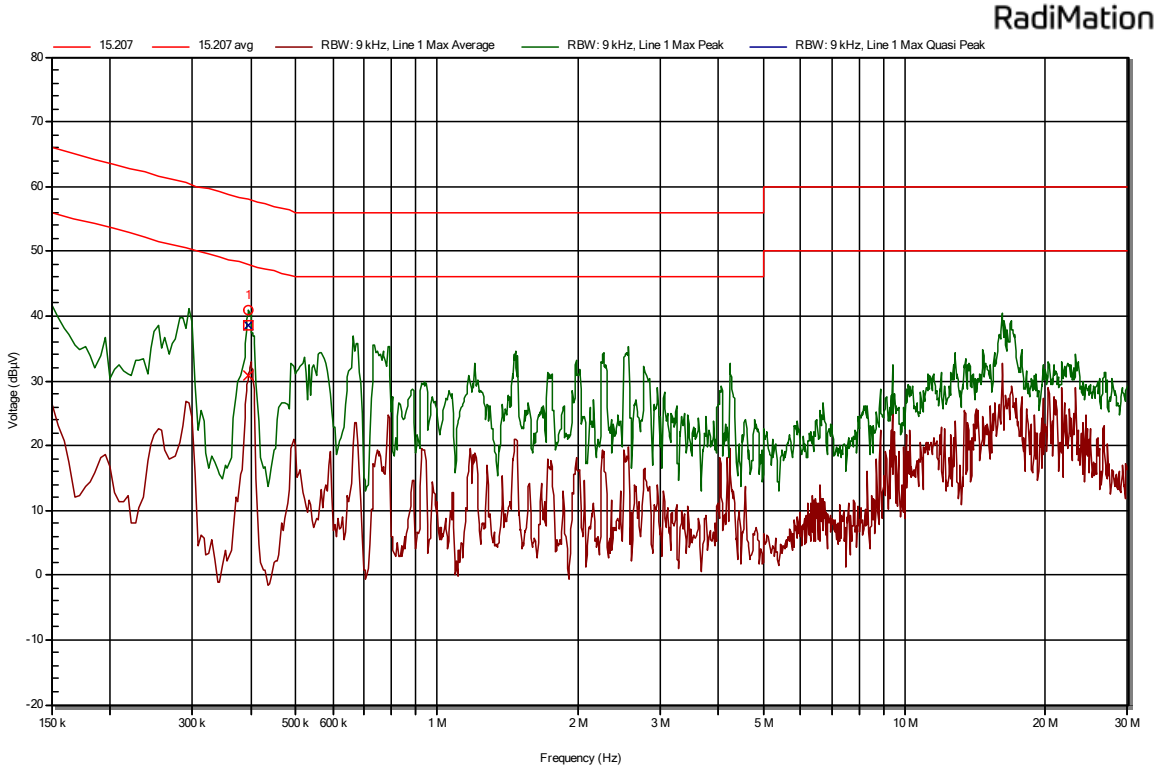
See next page for plots.
Note: AC mains conducted spurious emissions are measured on the AC power input of the VP2001B, which is the point where the EUT power supply comes from. See test setup in clause 2.1 for more details.

3.2.6 Measurement uncertainty

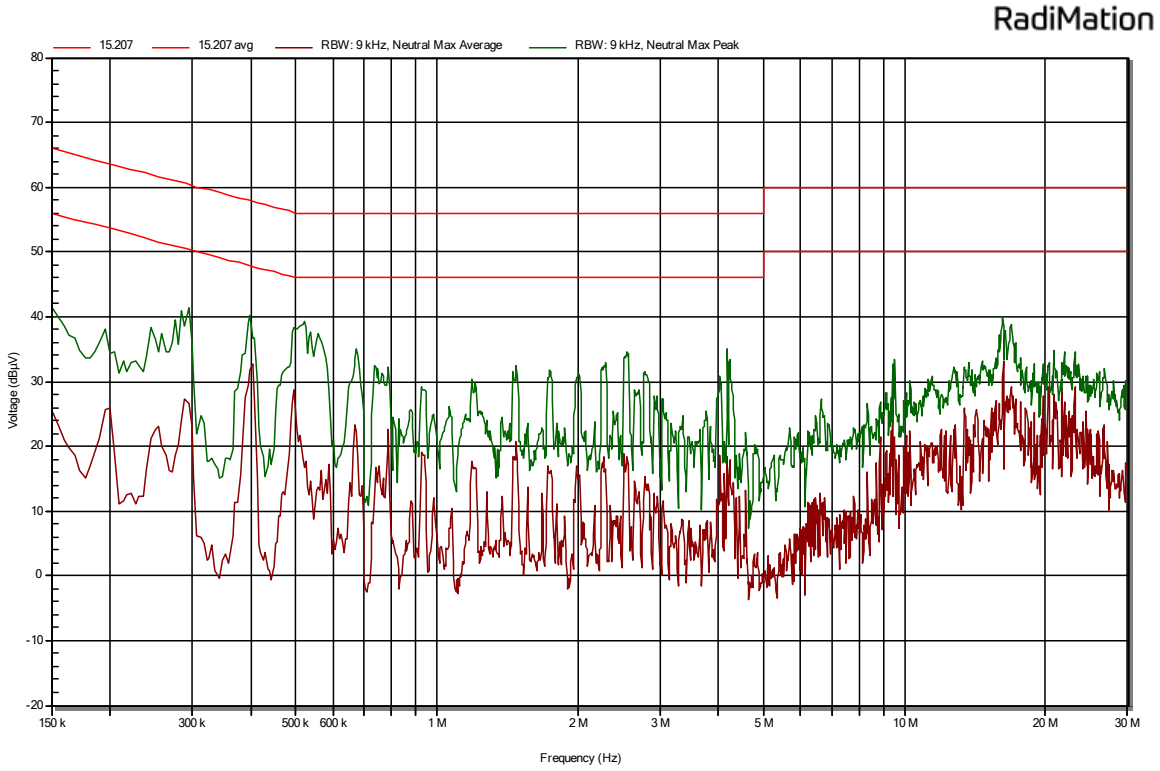
+/- 3.6 dB

3.2.7 Plots of the AC mains conducted spurious measurement

Phase



Neutral



3.3 20 dB bandwidth Measurement

3.3.1 Limit

According to FCC part 15.215 (c): The intentional radiator must ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

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

Tests according to ANSI C63.10

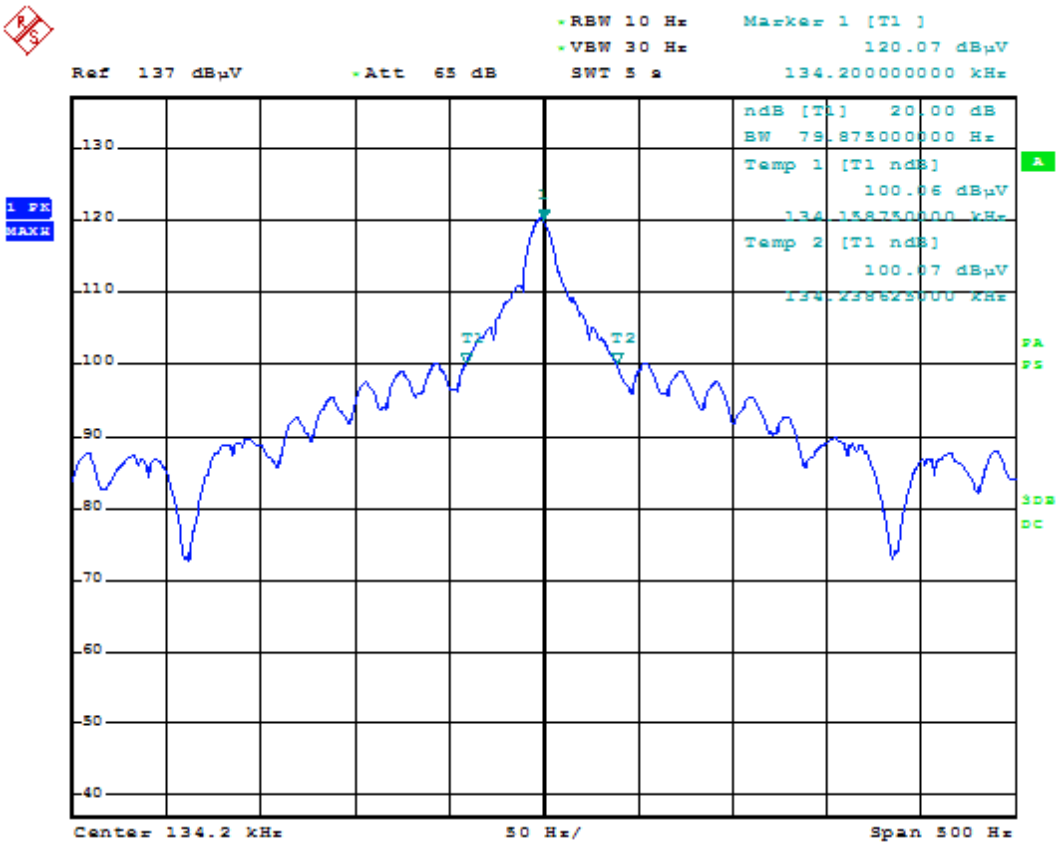
IRN 017 - Occupied bandwidth (Hz) Method 2

3.3.5 Test Result of the 20 dB bandwidth Measurement

Technology Std.	Channel	Frequency (kHz)	Data rate	20 dB bandwidth (Hz)
RFID tag reader	1	134.2	--	80
Uncertainty	± 570 Hz			

Note: The signal is a non-modulated pulsed signal, so the measured bandwidth is limited by the minimum spectrum analyzer resolution bandwith.

3.3.6 Plot of the 20 dB bandwidth measurement



3.4 99% Occupied Bandwidth

3.4.1 Limit

According to RSS-Gen 6.7

3.4.2 Measurement instruments

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

3.4.3 Test setup

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

3.4.4 Test procedure

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

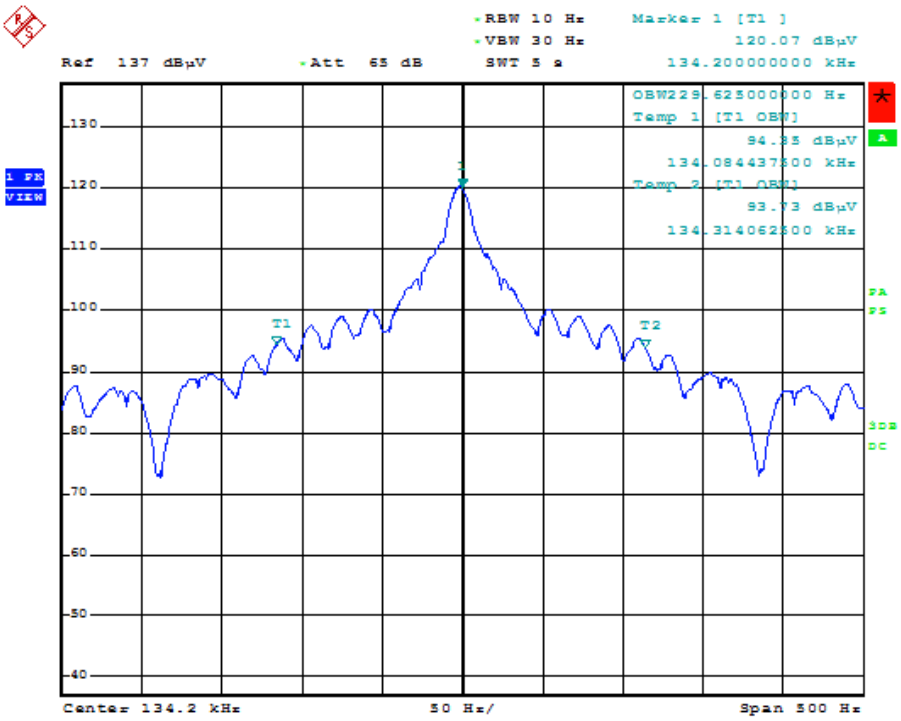
1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW ≥ 3x RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until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

3.4.5 Test results of the 99% occupied bandwidth measurement

Technology Std.	Channel	Frequency (kHz)	Data rate	99% bandwidth (Hz)
RFID tag reader	1	134.2 kHz	--	230
Uncertainty	± 570 Hz			

Note: The signal is a non-modulated pulsed signal, so the measured bandwidth is limited by the minimum spectrum analyzer resolution bandwith.

3.4.6 Plot of the 99% occupied bandwidth measurement



4 Sample calculations

All formulas for data conversions and conversion factors are reported in this chapter.

Conducted emission Measurement:

U_{lisn} (dBµV) = U (dBµV) + Corr. (dB)

Where:
U = Measuring receiver voltage
LISN insertion loss = Voltage division factor of LISN
Corr. = sum of single correction factors of used LISN, cables and pulse limiter.
Linear interpolation will be used for frequencies in between the values in the table.

Frequency (Mhz)	**Voltage division LISN (db)**	**Insertion Loss Pulse limiter (dB)**	**Cable loss (dB)**	**Corr. (dB)**
	TE 00208 SN: 892785/004 Rohde & Schwarz ESH3-Z5	**TE 00756 SN: 5SM03153 Rohde & Schwarz ESH3-Z2**	**TE 11134**	
0.15	0.09	9.87	0.02	9.98
0.2	0.1	9.87	0.03	10
0.3	0.1	9.87	0.03	10
0.5	0.1	9.87	0.08	10.05
0.7	0.12	9.87	0.25	10.24
0.8	0.12	9.87	0.25	10.24
1	0.13	9.87	0.11	10.11
2	0.16	9.87	0.15	10.18
3	0.19	9.87	0.21	10.27
5	0.26	9.88	0.21	10.35
7	0.36	9.89	0.25	10.5
8	0.39	9.89	0.25	10.53
10	0.46	9.91	0.29	10.66
15	0.77	9.93	0.34	11.04
20	0.95	9.96	0.37	11.28
25	1.12	9.99	0.43	11.54
30	1.1	10.04	0.45	11.59

Field Strength Measurement:

E (dBµV/m) = U(dBµV) + AF (dB/m) + Corr. (dB)

Where:
E = Electric field strength
U = Measuring receiver voltage
AF = Antenna factor
CL = Cable loss

Corr. = sum of single correction factors of used cable and amplifier (if applicable).
Linear interpolation will be used for frequencies in between the values in the table.
Tables shows an extract of the values.

Frequency (Mhz)	**AF (dB/m)** **TE 00967** **Chase CBL6112A** **SN: 2308**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
30	18.6	0.68	19.28
100	10.7	1.15	11.85
150	10.6	1.41	12.01
200	9.3	1.63	10.93
250	12.6	1.93	14.53
300	13.3	2.12	15.42
350	14.6	2.2	16.8
400	15.5	2.29	17.79
450	16.9	2.53	19.43
500	17.5	2.67	20.17
550	18.4	2.9	21.3
600	18.8	3.02	21.82
650	19.2	3.09	22.29
700	19	3.22	22.22
750	19.8	3.56	23.36
800	19.7	3.69	23.39
900	20.4	3.81	24.21
950	20.8	3.91	24.71
1000	21.2	4.3	25.5

Frequency (Mhz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
1000	23.6	40.4	2.0	66
1500	25.1	40.5	2.4	68
2000	27.1	40.5	2.7	70.3
2500	28.6	40.7	3.2	72.5
3000	30.5	40.7	3.2	74.4
3500	31.2	40.7	3.4	75.3
4000	32.7	40.9	4.9	78.5
4500	32.4	40.9	4.4	77.7
5000	33.2	40.7	4.6	78.5
5500	34.0	40.5	4.5	79
6000	34.6	40.0	5.2	79.8
6500	34.3	39.4	5.9	79.6
7000	35.2	38.6	5.7	79.5
7500	36.4	39.2	5.9	81.5
8000	37.0	38.9	6.3	82.2
8500	37.5	38.4	6.4	82.3
9000	38.1	37.4	6.5	82
9500	37.8	37.0	7.1	81.9
10000	38.2	36.5	7.3	82
10500	38.1	36.7	7.6	82.4
11000	38.3	36.9	8.3	83.5
11500	38.5	37.6	8.1	84.2
12000	39.1	38.3	8.4	85.8
12500	38.7	38.5	8.3	85.5
13000	39.2	38.9	9.2	87.3
13500	40.5	40.2	8.3	89
14000	41.1	40.0	8.2	89.3
14500	41.4	40.1	8.2	89.7
15000	40.2	41.4	8.3	89.9
15500	37.9	41.4	8.6	87.9
16000	37.5	42.8	9.2	89.5
16500	38.6	42.3	8.8	89.7
17000	41.1	43.1	9.4	93.6
17500	42.7	43.2	9.4	95.3
18000	44.0	44.2	9.8	98

Frequency (Mhz)	AF (dB/m) TE 00531 Emco 3115 SN: 9412-4377	Gain (dB) TE 11132 Miteq JS4-18004000-30-8P-A1	Cable loss (dB) TE 01315	Corr. (dB)
18000	31.3	26.2	9.8	67.3
19000	31.5	26.1	9.6	67.2
20000	31.7	25.9	11	68.6
21000	31.9	24.3	10.7	66.9
22000	32.1	18.3	10.5	60.9
23000	32.2	18.9	10.8	61.9
24000	32.3	23.6	11.4	67.3
25000	32.4	24.5	11.6	68.5
26000	32.5	25.3	11.7	69.5