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Chamber of Commerce
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FCC and IC Test report for parts 15.207, 15.109, 15.209, 15.225, RSS-GEN, RSS-210

Product name	: NFC driver incl. antenna
Applicant	: Bosch Security Systems B.V.
FCC ID	: UX8-DCNM-FIDP
IC	: 1249D-DCNMFIDP

Test report No. : P000158766 01 Ver 5.00

Laboratory information

Accreditation

Telefication 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 L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

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The Industry Canada company number for Telefication is: 4173A. The CABID is NL0001.

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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	24-10-2022	First draft	PS
v1.00	03-11-2022	Final issue	PS
v2.00	09-11-2022	Revised edition • References to ANSI C63.10: 2013 changed to ANSI C63.10: 2020 • DUT and auxiliary set up added to section 2.2	PS
v2.10	08-12-2022	Revised edition • FCC ID changed • References to ANSI C63.10: 2020 changed back to ANSI C63.10: 2013	PS
v3.00	03-01-2023	• AC mains conducted emissions results added (section 3.4); • RSS-GEN Table 6 results added in section 3.1; • 140 -1000 MHz test results added in section 3.1 • Frequency stability set up added in section 2.2	PS
v4.00	16-01-2023	• Tables on pages 16 and 18 provided with a header; • On page 14 note 3 added; • On page 11 climate chamber cal dates added	PS
V5.00	24-01-2023	• Section 1.6 update year of standard • Section 2.3 update cal due climate chamber • Section 3.4.4 update year of standard	PS

Table of Contents

Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.109 (a)	ICES-003	Radiated spurious emissions	3.1	Pass
15.225(d) 15.209 (a)	RSS-Gen 8.9	Radiated spurious emissions	3.1	Pass
15.205 (a)	RSS Gen 8.10	Spurious emissions in the restricted bands	3.1	Pass
15.225(a),(b),(c)	RSS-210 B.6	Field strength of emissions	3.2	Pass
15.225(e)	RSS-210 B.6	Frequency Stability	3.3	Pass
15.207 (c)	RSS-Gen 8.8	Conducted spurious emissions on AC mains	3.4	Pass

1 General Description

1.1 Applicant

Client name:	Bosch Security Systems B.V.
Address:	Torenallee 49
Zip code:	5617 BA
Telephone:	+31 40 2577 044
E-mail:	Roel.vanzon@nl.bosch.com
Contact name:	Mr. Roel van Zon

1.2 Manufacturer

Manufacturer name:	Bosch Security Systems B.V.
Address:	Torenallee 49
Zip code:	5617 BA
Telephone:	+31 40 2577 044
E-mail:	Roel.vanzon@nl.bosch.com
Contact name:	Mr. Roel van Zon

1.3 Tested Equipment Under Test (EUT)

Product name:	NFC panel
Brand name:	Bosch
FCC ID:	UX8-DCNM-FIDP
IC :	1249D-DCNMFIDP
Product type:	NFC driver incl. antenna
Model(s):	DCNM-FIDP
Batch and/or serial No.	--
Software version:	--
Hardware version:	--
Date of receipt	09-09-2022
Tests started:	05-10-2022
Testing ended:	06-10-2022

1.4 Product specifications of Equipment under test

Tx Frequency:	13.56 MHz
Rx frequency:	13.56 MHz
Antenna type:	Loop
Type of modulation:	ASK
Emission designator	200HA1D

1.5 Environmental conditions

Test date	05-10-2022	06-10-2022
Ambient temperature	20.8 °C	20.8 °C
Humidity	50.8 %	50.8 %

1.6 Measurement standards

- 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 B §15.109
- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart C §15.225
- FCC Part 15 Subpart C §15.207
- RSS-Gen issue 5
- RRS-210 issue 9

1.8 Observation and remarks

None

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 : ing P.A. Suringa

Review of test methods and report by:

Name : R. Tolud, MSc

The above conclusions have been verified by the following signatory:

Date : 26-01-2023

Name : ing. R. van Barnveld

Function : Test Engineer

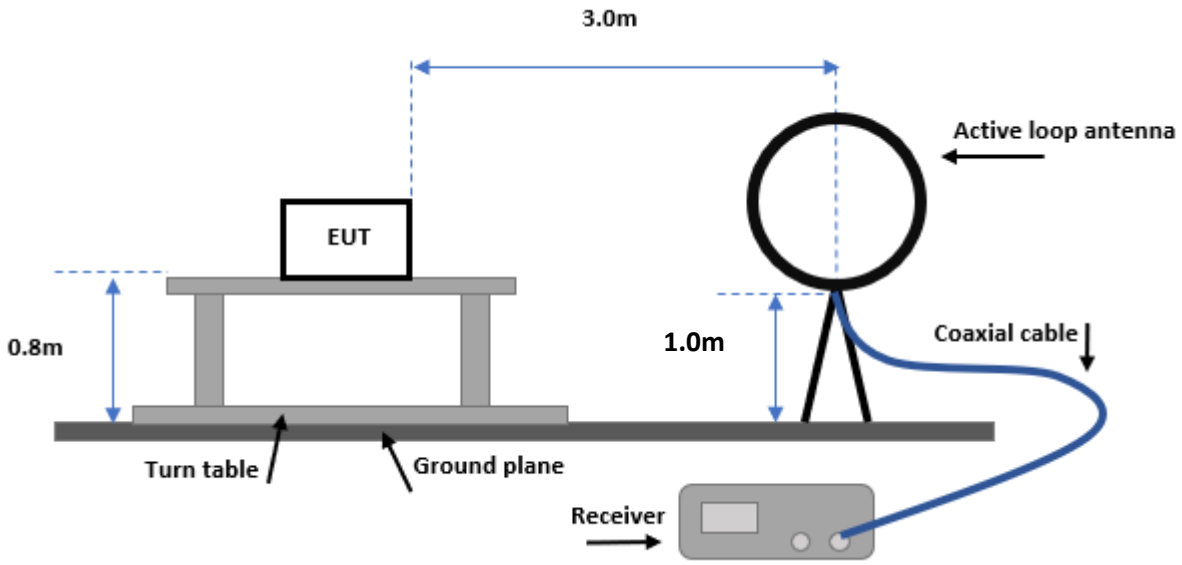
Signature :

2 Test configuration of the Equipment Under Test

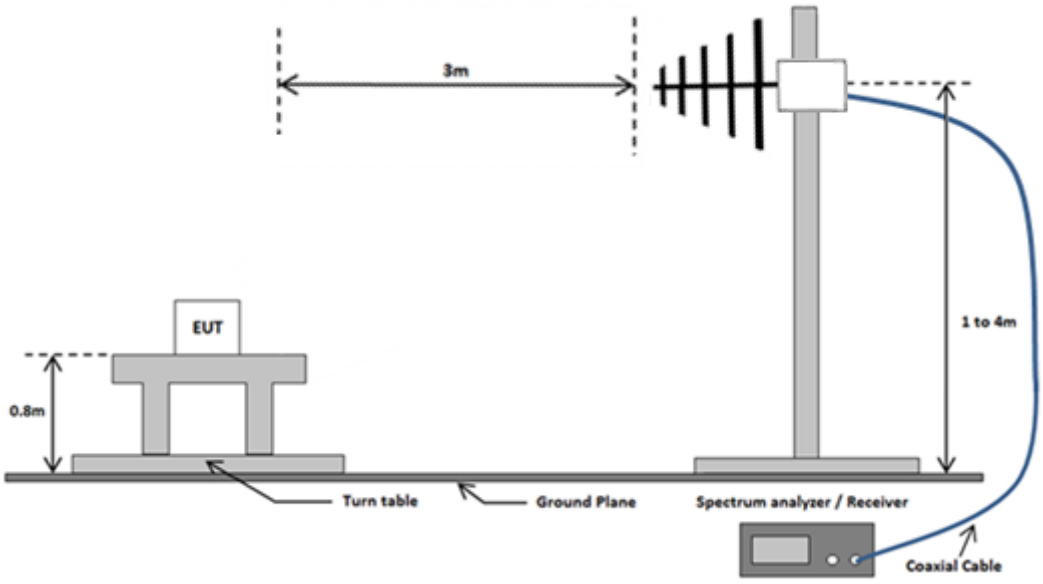
2.1 Test mode

The applicant provided test software to start the device in NFC test mode.

2.2 Test setups

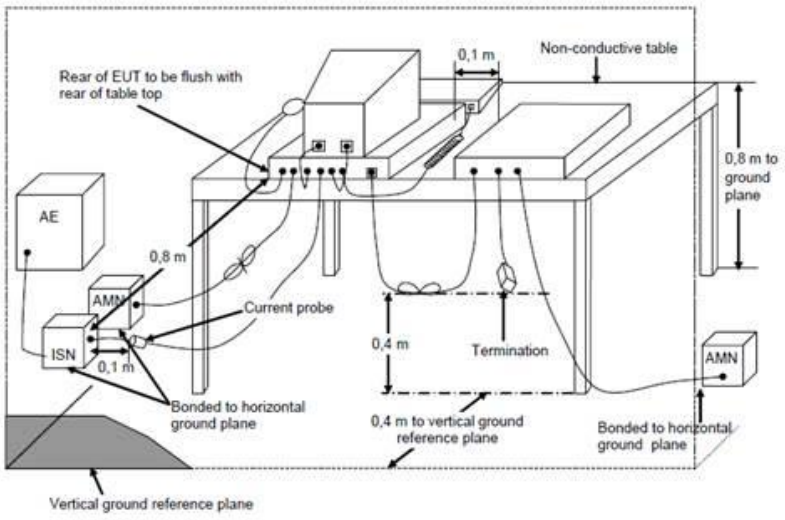


Radiated emissions test setup 9 kHz – 30 MHz

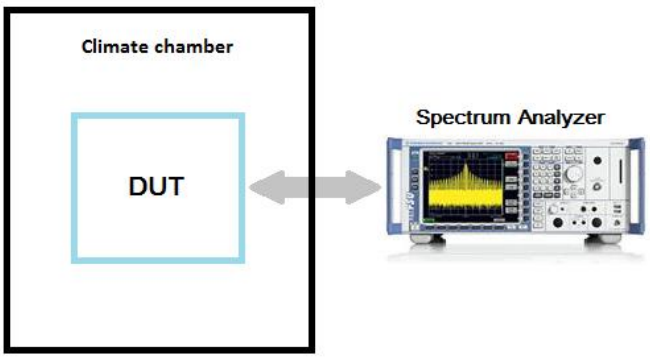


Radiated emissions test setup 30 MHz - 1 GHz

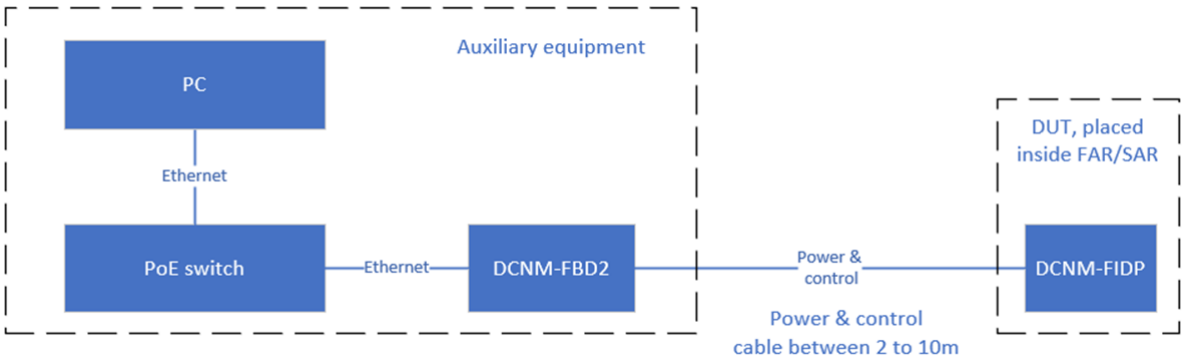
Emissions test at AC mains



Test set up for frequency stability



DUT (Device Under Test) and auxiliary test setup



Note: the DCNM-FBD2 is powered by the 110 V AC mains.

List of used cables					
Number	**Function**	**From**	**To**	**Length**	**Remarks**
1	Power & Control (RJ10)	DCNM-FB02	DCNM-FIDP	> 3m	--
2	Ethernet (RJ 45)	PoE switch	DCNM-FBD2	< 3m	--
3	Ethernet (RJ 45)	PC	PoE switch	<3m	--

2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Cal. Done date	Cal. due date	Used at Par.
EMI Receiver	Rohde & Schwarz	ESR7	114534	01-2022	01-2023	3.1, 3.2, 3.3, 3.4
Active loop antenna	EMCO	6502	114515	01-2022	01-2024	3.1, 3.2
Biconical antenna + 6dB attenuator	Schwarzbeck + HP	VHA9103 + 8491A	114436 + 114254	03-2021	03-2024	3.1
Test software	Raditeq	Radimation Version 2021.1.9	TE 02008	--	--	3.1, 3.2
Two line V-network	Rohde & Schwarz	ENV 216	114379	07-2021	07-2023	3.4
Climate chamber	CTS	C-40/350	114509	10-2021	10-2023	3.3

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

15.225 (d)

The field strength of any emissions appearing outside of the 13.110 -14.010 MHz band shall not exceed the general radiated emission limits in part 15.209.

Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance(m)
0.009 - 0.490	2400/F(kHz)	67.6-20 log(F(kHz))	300
0.490 – 1.705	24000/F(kHz)	87.6-20 log(F(kHz))	30
1.705 – 13.11	30	29.5	30
14.010 - 30	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: Measured values in the plots 9 kHz to 30 MHz are corrected to 300/30m measurement distance according to the method described in ANSI C63.10-2013, clause 6.4

RSS-GEN, Table 6

Frequency	Magnetic field strength (H-Field) (µA/m)	Measurement distance (m)
9 - 490 kHz [1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

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

The plane of the EUT's loop antenna is vertical.

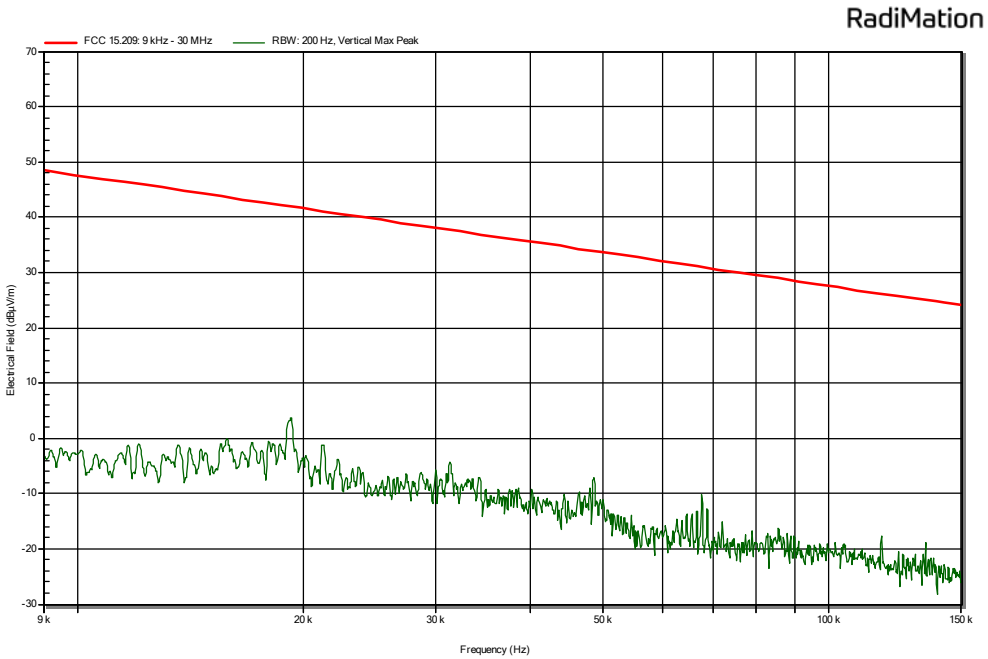
30 MHz to 1 GHz: According to ANSI C63.10-2013, section 6.5
0.09 – 30 MHz: IRN 026 – Method 10
30 MHz to 1 GHz: IRN 026 – Method 1

3.1.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB

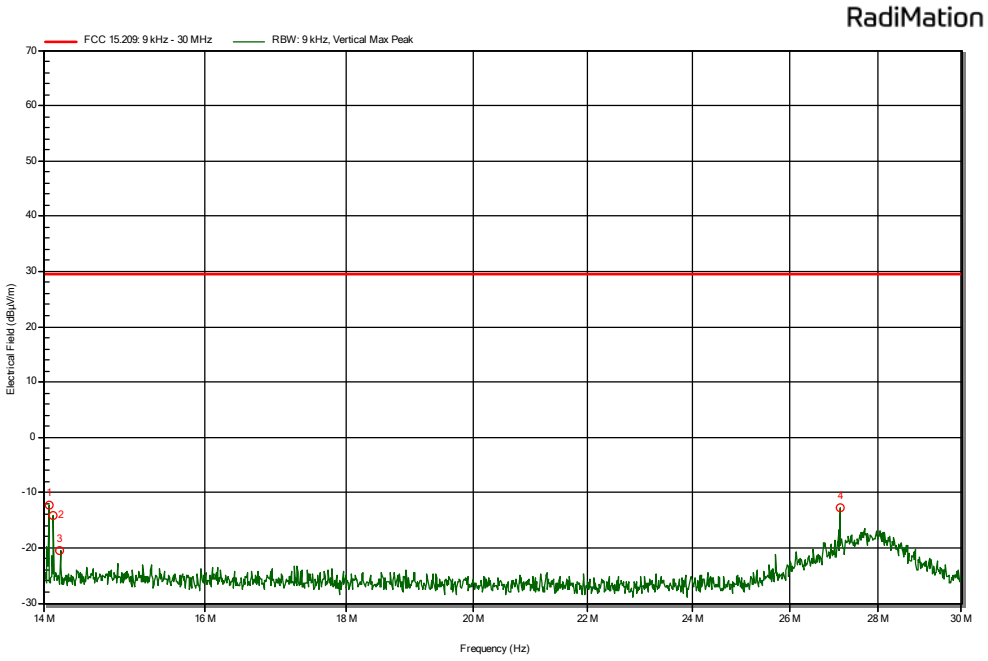
3.1.6 Plots of the radiated spurious measurement

9 kHz – 150 kHz



Note: the measurement is corrected for 300 m distance according to the procedure as given in ANSI C63.10; 2013, §6.4.4.2

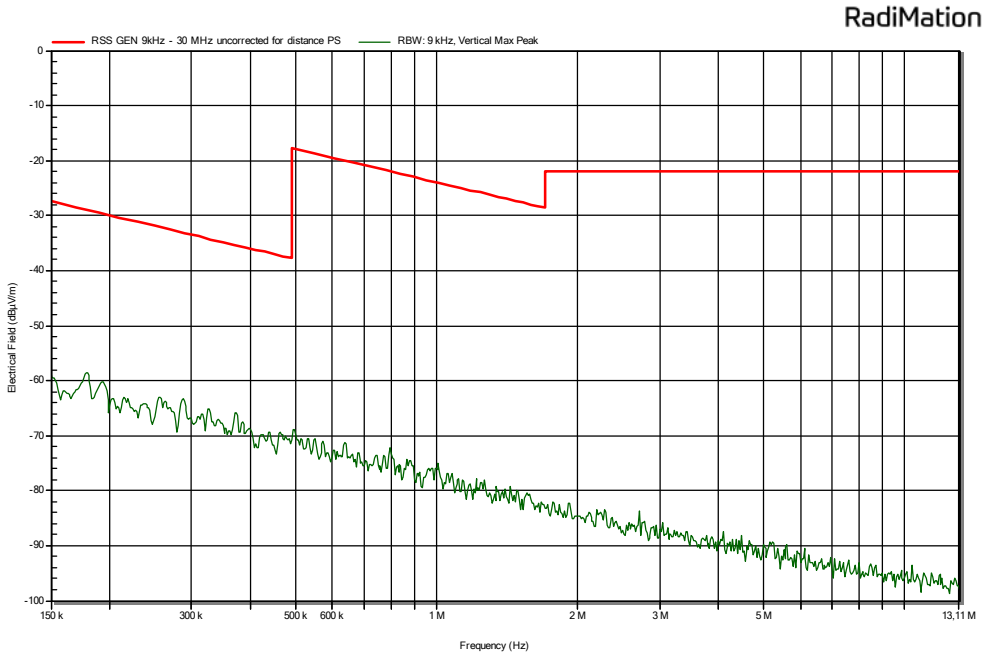
14.01 MHz to 30 MHz



Note: the measurement is converted to 30 m distance according to the procedure as given in ANSI C63.10; 2013, §6.4.4.2

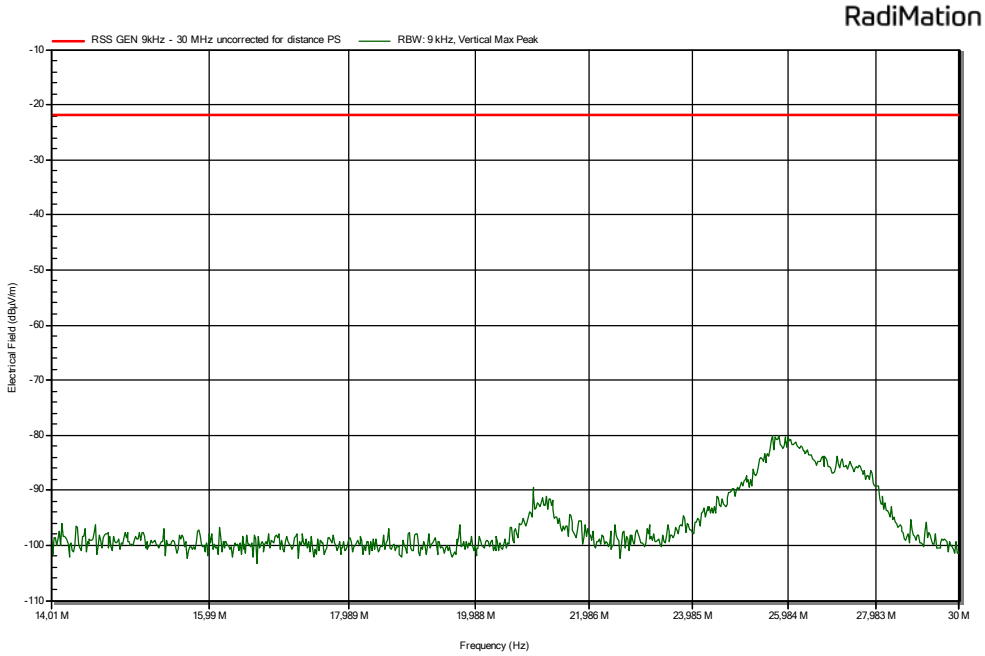
RSS-GEN Table 6

0.15 – 13.11 MHz



Note 1: read dBµV/m as dBµA/m
Note 2: measured data without corrections for distance
Note 3: measured values are below the limit of 0.08 µA/m @30 m

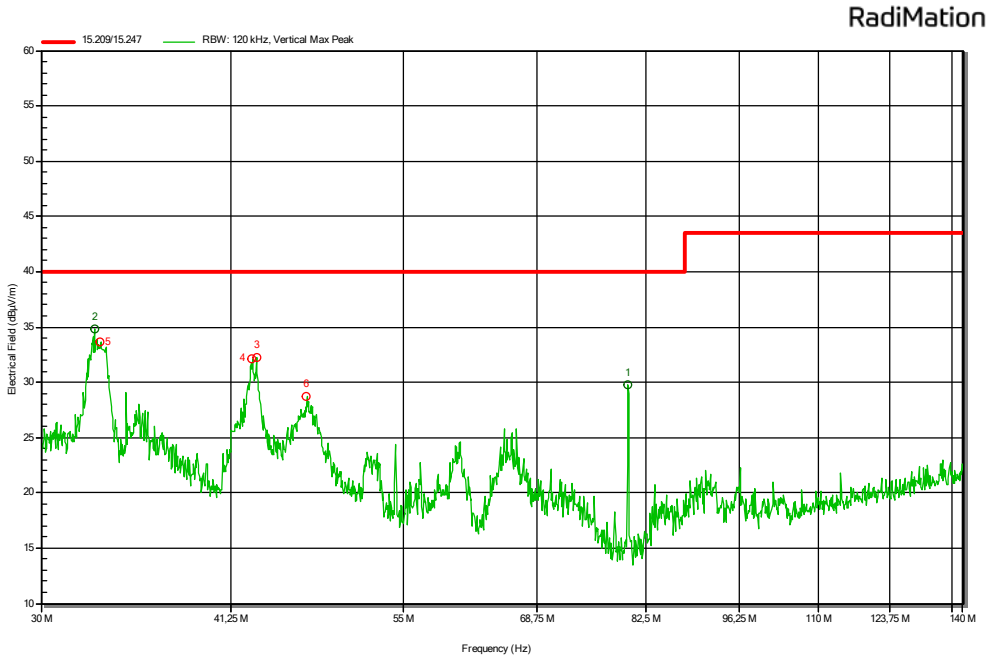
14.01 – 30 MHz



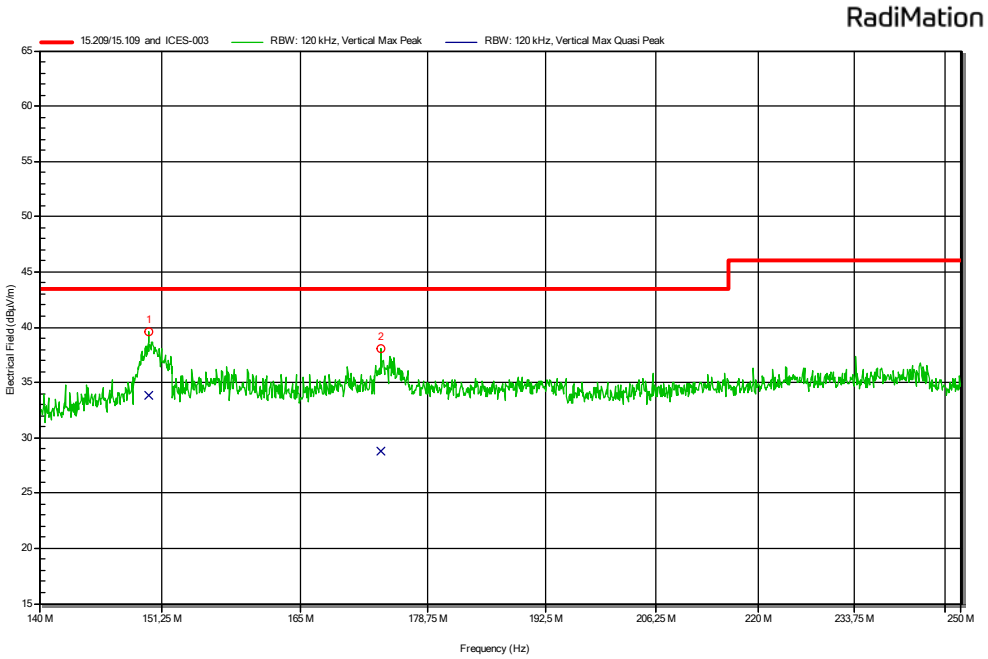
Note 1: read dBµV/m as dBµA/m
Note 2: measured data without corrections for distance
Note 3: measured values are below the limit of 0.08 µA/m @30 m

Vertical polarization

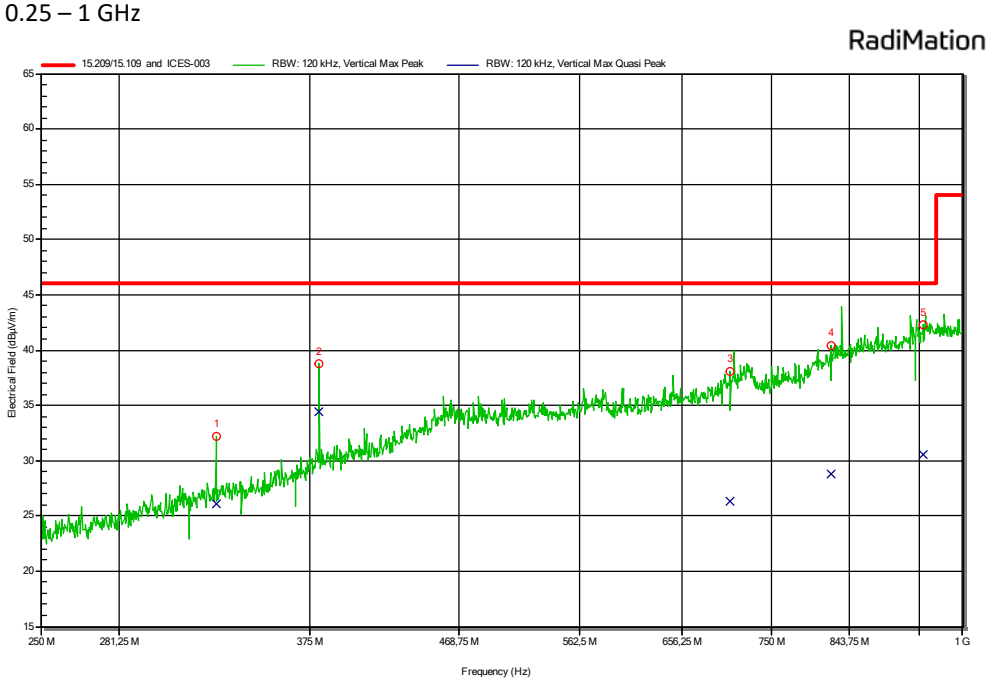
30 -140 MHz



140 – 250 MHz



0.25 – 1 GHz



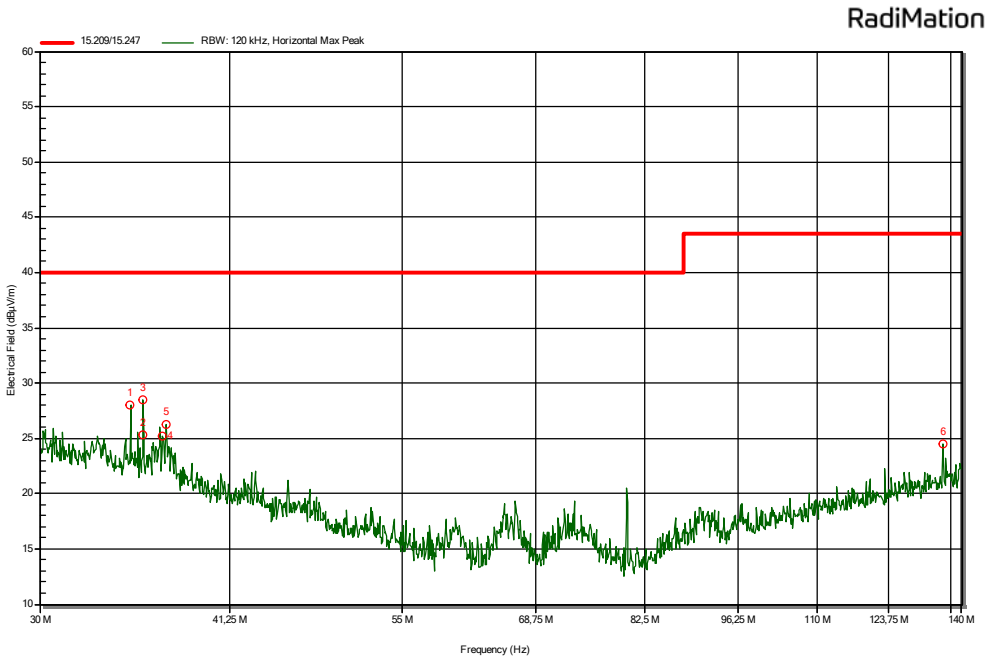
Tables (pre-scan values)

Frequency	Peak	Peak Correction	Height	Polarization
79,995 MHz	29,8 dBµV/m	15,3 dB	1 m	Vertical
32,805 MHz	34,8 dBµV/m	25,5 dB	1,5 m	Vertical
43,008 MHz	32,2 dBµV/m	21,7 dB	1 m	Vertical
42,678 MHz	32,1 dBµV/m	21,8 dB	1 m	Vertical
33,135 MHz	33,6 dBµV/m	25,3 dB	1 m	Vertical
46,761 MHz	28,7 dBµV/m	20,4 dB	1 m	Vertical

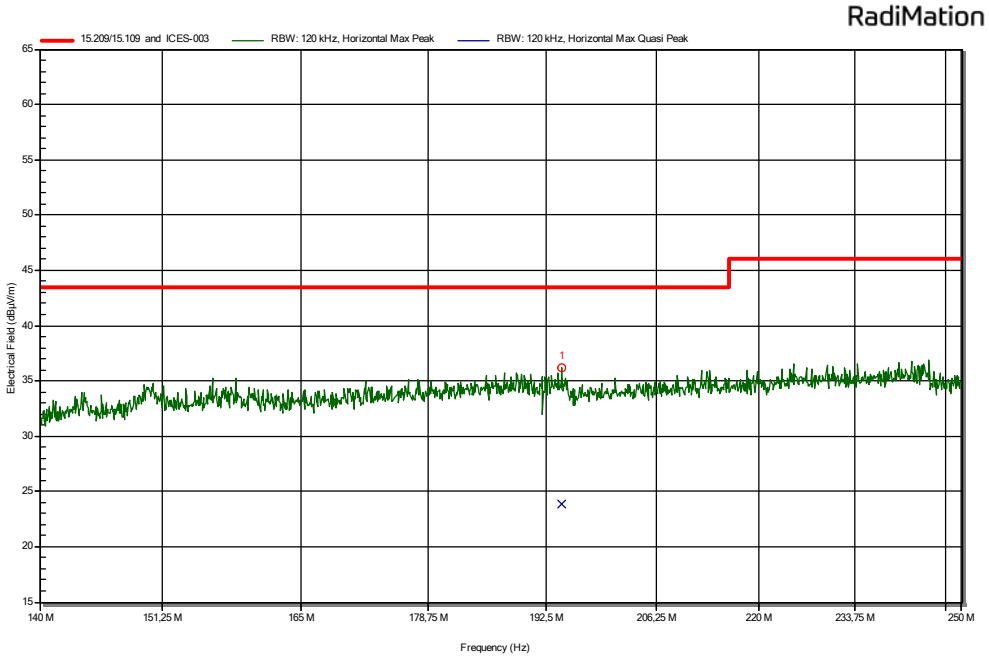
Frequency MHz	Peak dBµV/m	Quasi-Peak dBµV/m	Quasi-Peak Limit dBµV/m	Height	Polarization
149,96	39,6	33,8	43,5	1 m	Vertical
173,583	38	28,8	43,5	1 m	Vertical
325,41	32,2	26,2	46	1 m	Vertical
379,647	38,7	34,5	46	1 m	Vertical
705,006	38,1	26,3	46	1,2 m	Vertical
820,571	40,4	28,7	46	2 m	Vertical
942,771	42,3	30,5	46	3 m	Vertical

Horizontal polarization

30 -140 MHz



140 – 250 MHz



0.250 – 1 GHz

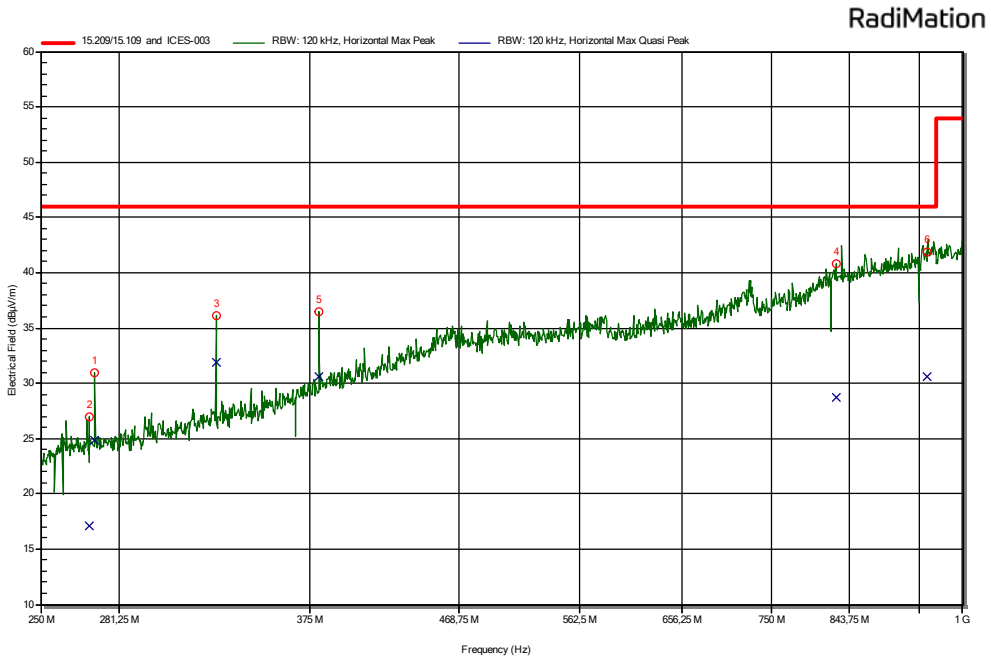


Table (pre-scan values)

Frequency	Peak	Peak Correction	Height	Polarization
34,909 MHz	28 dBµV/m	24,7 dB	2,5 m	Horizontal
35,665 MHz	25,4 dBµV/m	24,4 dB	2 m	Horizontal
35,651 MHz	28,5 dBµV/m	24,4 dB	2 m	Horizontal
36,82 MHz	25,2 dBµV/m	23,9 dB	1,5 m	Horizontal
37,026 MHz	26,3 dBµV/m	23,9 dB	4 m	Horizontal
135,6 MHz	24,5 dBµV/m	23,0 dB	2 m	Horizontal

Table (final scan values)

Frequency MHz	Peak dBµV/m	Quasi Peak dBµV/m	Quasi Peak Limit dBµV/m	Height	Polarization
271,213	31	24,9	46	1 m	Horizontal
269,061	26,9	17,1	46	3,7 m	Horizontal
325,423	36,1	31,9	46	1 m	Horizontal
826,636	40,8	28,7	46	3 m	Horizontal
379,672	36,5	30,6	46	2,8 m	Horizontal
947,838	41,9	30,6	46	1,8 m	Horizontal

3.2 Field strength of emissions

3.2.1 Limit

15.225 (a) (b) (c)

Frequency (MHz)	µV/m at 30 meter	dBµV/m at 30 meter
13.553 – 13.567	15,848	84
13.410 – 13.553 and 13.567 – 13.710	334	50.5
13.110 – 13.410 and 13.710 - 14.010	106	40.5

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 C63.10-2013, section 6.4.
IRN 027 – Method 1

3.2.5 Measurement Uncertainty

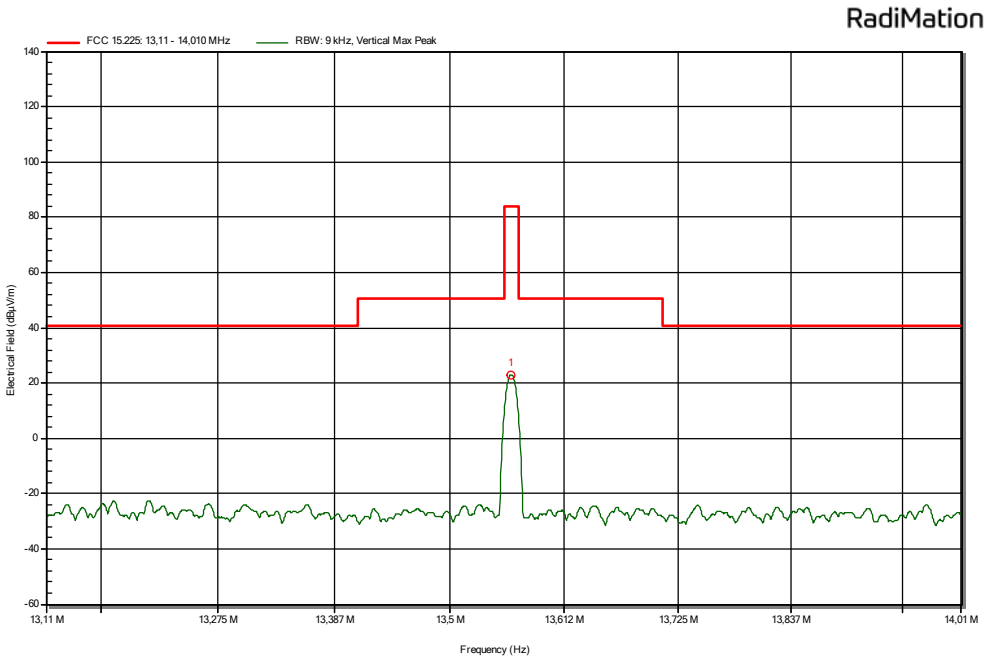
+ 1.5/-1.6 dB

3.2.6 Test results of Field strength of emissions

Frequency (MHz)	Max Field strength (dBµV/m) at 30m (Perpendicular to site axis)	Limit (dBµV/m) at 30m distance
13.56	22	84
Uncertainty	+3.0 / -2.5 dB	

3.2.7 Plot of the field strength of emissions measurement

13.11 MHz to 14.01 MHz



Note: the measurement is corrected for 30 m distance according to the procedure as given in ANSI C63.10; 2013, §6.4.4.2

3.3 Frequency Stability

3.3.1 Limit

The frequency stability of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

The measured frequency for the 13.56 MHz radio should fall within the limits 13558.644 kHz ≤ f ≤ 13561.356 kHz.

3.3.2 Measurement instruments

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

3.3.3 Test setup

The test has been performed in a climatic chamber using a test fixture

3.3.4 Test procedure

According to ANSI C63.10-2013, section 6.8
IRN 005 – Method 2

3.3.5 Test results of Frequency Stability Measurement

Temperature variation:

Frequency (MHz)	Time after power on	2 minutes	5 minutes	10 minutes
Temperature				
50°C	13.559	13.560	13.560	13.560
40°C	13.560	13.560	13.560	13.560
30°C	13.560	13.560	13.560	13.560
20°C	13.560	13.560	13.560	13.560
10°C	13.560	13.560	13.560	13.560
0°C	13.560	13.560	13.560	13.560
-10°C	13.560	13.560	13.560	13.560
-20°C	13.560	13.560	13.560	13.560

Voltage variation:

Not applicable, since the EUT's supply voltage (5 Vdc) is depending on the primary supply voltage source.

3.3.6 Measurement Uncertainty

Measurement uncertainty = + /-600 Hz

3.4 AC power line conducted emissions

3.4.1 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.

3.4.2 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

According to ANSI C63.10: 2013, section 13.3
IRN 029 – Method 1

3.4.5 Peak tables of the AC power line emission measurement

Neutral

Frequency	Peak	Quasi Peak Limit	Average	Average Limit
168 kHz	50,1 dBµV	65,1 dBµV	30,1 dBµV	55,1 dBµV
213 kHz	46,3 dBµV	63,1 dBµV	26,6 dBµV	53,1 dBµV
235,5 kHz	44,5 dBµV	62,3 dBµV	26,3 dBµV	52,3 dBµV
375 kHz	44,3 dBµV	58,4 dBµV	32,9 dBµV	48,4 dBµV
17,516 MHz	41,4 dBµV	60 dBµV	36,1 dBµV	50 dBµV
18,132 MHz	41,5 dBµV/m	60 dBµV	37,5 dBµV	50 dBµV

Phase

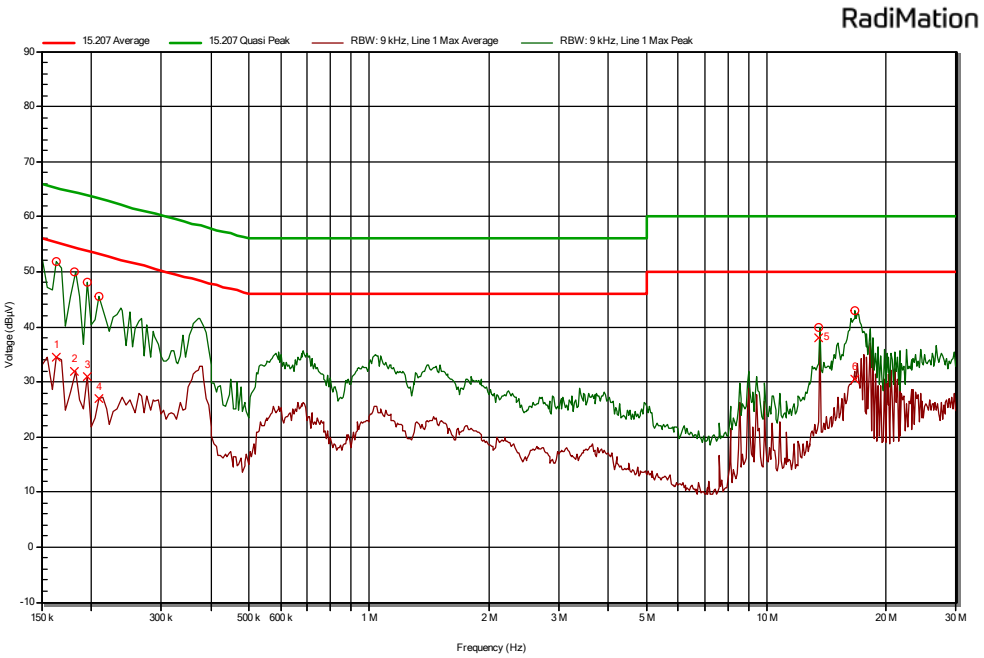
Frequency	Peak	Quasi Peak Limit	Average	Average Limit
163,5 kHz	51,8 dBµV	65,3 dBµV	34,6 dBµV	55,3 dBµV
181,5 kHz	50 dBµV	64,4 dBµV	31,9 dBµV	54,4 dBµV
195 kHz	48 dBµV	63,8 dBµV	30,9 dBµV	53,8 dBµV
208,5 kHz	45,6 dBµV	63,3 dBµV	27 dBµV	53,3 dBµV
13,56 MHz	39,9 dBµV	60 dBµV	38 dBµV	50 dBµV
16,674 MHz	43 dBµV	60 dBµV	30,6 dBµV	50 dBµV

3.4.6 Measurement uncertainty

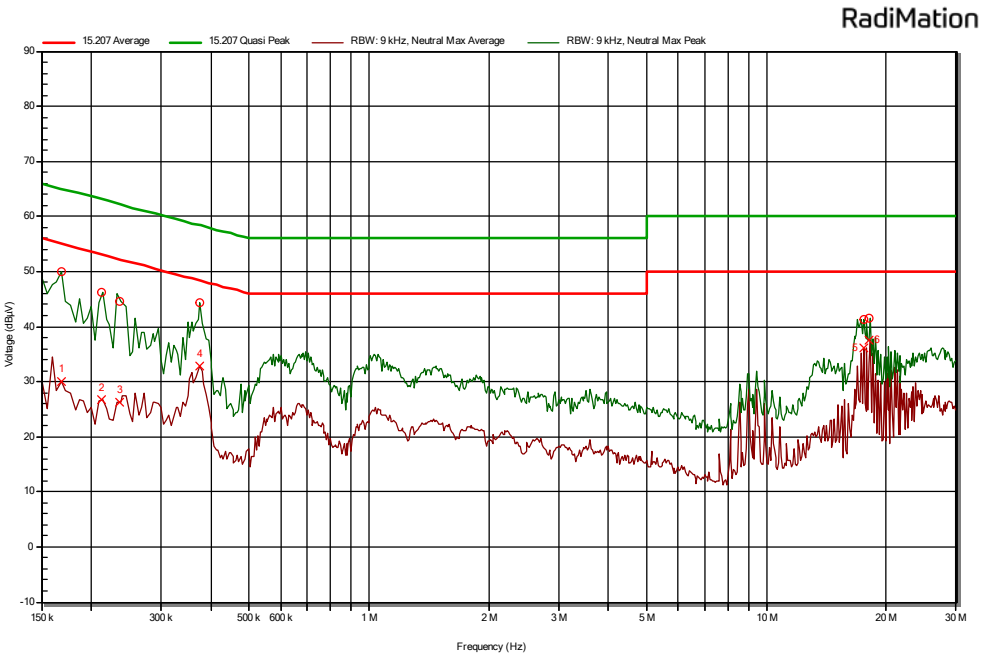
+/- 3.6 dB

3.4.7 Plots of the AC mains conducted spurious measurement

Phase



Neutral



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)**	**Cable loss (dB)**	**Corr. (dB)**
	114379 Rohde & Schwarz ENV216	**TE 11134**	
0,15	9.6	0,02	9.62
0,3	9.6	0,03	9.63
0,5	9.6	0,08	9.68
0,7	9.7	0,25	9.95
1	9.6	0,11	9.71
3	9.6	0,21	9.81
5	9.6	0,21	9.81
7	9.7	0,25	9.95
10	9.7	0,29	9.99
15	9.7	0,34	10.04
20	9.8	0,37	10.17
22	9.6	0,39	9.99
24	9.6	0,43	10.03
30	9.6	0,45	10.05

Magnetic field strength measurement:

$$H\left[dB\left(\mu\frac{A}{m}\right)\right] = V[dB(\mu V)] + L_c[dB] + AF^H[\frac{dB}{\Omega m}]$$

Where:
H is the magnetic field strength (to be compared to the limit)
V is the voltage level measured by the receiver or spectrum analyzer
L_C is the cable loss
AF^H is the magnetic antenna factor

Frequency (MHz)	AF (dB/Ωm) 114515 EMCO 6505 S/N:9112-2710	CL (dB) SAR cable	Corr. (dB)
0,009	-32,35	0,7	-31,65
0,01	-33,16	0,05	-33,11
0,02	-37,56	0,07	-37,49
0,03	-39,29	0,1	-39,19
0,04	-40,11	0,1	-40,01
0,1	-41,27	0,1	-41,17
0,2	-41,48	0,1	-41,38
0,5	-41,58	0,1	-41,48
1	-41,62	0,2	-41,42
3	-41,6	0,2	-41,4
5	-41,65	0,3	-41,35
10	-42,11	0,6	-41,51
15	-42,88	0,9	-41,98
20	-43,78	1	-42,78
25	-44,85	0,7	-44,15
27	-45,36	1,2	-44,16
30	-46,25	1	-45,25

Electric 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)** **Id: 114436** **Schwarzbeck** **VHA9103+BBA9106** **SN: 9856**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
30	18,64	0,68	19,32
100	10,43	1,15	11,58
150	14,76	1,41	16,17
200	16,04	1,63	17,67
250	16,89	1,93	18,82

Frequency (Mhz)	**AF (dB/m)** **Id: 114385** **EMCO 3147** **SN: 9104-1031**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
250	11,8	1,93	13,73
300	13	2,12	15,12
350	14,2	2,2	16,4
400	15,6	2,29	17,89
450	17,1	2,53	19,63
500	17,3	2,67	19,97
550	17,7	2,9	20,6
600	18,4	3,02	21,42
650	19,2	3,09	22,29
700	19,7	3,22	22,92
750	20,3	3,56	23,86
800	21,4	3,69	25,09
900	22,1	3,81	25,91
950	22,6	3,91	26,51
1000	22,5	4,3	26,8

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 00818 Flann 20240-25 SN: 163703	Gain (dB) TE 11131 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

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