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The Netherlands
Chamber of Commerce
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FCC and IC Test report for parts

15.109

RSS-Gen

Product name	: Deeper Smart Sonar PRO+2
Applicant	: Deeper UAB
FCC ID	: 2AHKO-PRO
IC	: 21307-PRO

Test report No. : P000117944 001 Ver 1.0

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).

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.

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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	17-03-2022	First draft	PvW
v1.00	04-05-5022	Initial release	PvW

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Summary of Test results

FCC	ISED	Description	Section in report	Verdict
15.109	RSS-Gen 8.9	Radiated spurious emissions	3.1	Pass

1 General Description

1.1 Applicant

Client name:	Deeper UAB
Address	Antakalnio str. 17, Vilnius, Lithuania
Zip code:	LT-10312
Telephone:	+37065657151
E-mail:	M. Špelveris
Contact name:	Mindaugas.spelveris@deeper.eu

1.2 Manufacturer

Manufacturer name:	Deeper UAB
Address:	Antakalnio str. 17, Vilnius, Lithuania
Zip code:	LT-10312
Telephone:	+37065657151
E-mail:	M. Špelveris
Contact name:	Mindaugas.spelveris@deeper.eu

1.3 Tested Equipment Under Test (EUT)

Product name:	Deeper Smart Sonar PRO+2
Trademark:	Deeper
FCC ID:	2AHKO-PRO
IC :	21307-PRO
Product type:	Wireless smart sonar
Model(s):	DP5H10S10
Batch and/or serial No.	--
Software version:	--
Hardware version:	--
Date of receipt:	05-02-2022
Tests started:	04-03-2022
Testing ended:	04-03-2022

1.4 Product specifications of Equipment under test

Tx Frequency:	2412 – 2462 MHz
Rx frequency:	2412 – 2462 MHz
Antenna type and Gain	Omnidirectional antenna, -2.3 dBi
Type of modulation:	According to IEEE 802.11b/g/n
Emission designator	22M0G1D

Disclaimer: The antenna gain is declared by the applicant

1.5 Environmental conditions

Test date	04-03-2022
Ambient temperature	20.4°C
Humidity	22.6%

1.6 Measurement standards

- ANSI C63.4:2014

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
- RSS-Gen Issue 5

1.8 Observation and remarks

This report covers the required tests after hardware changes (new MCU) made to the EUT. The new MCU has the same package as the old MCU, pin to pin compatible.

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. R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 23-05-2022

Name : Raoul Tolud

Function : Test engineer

Signature :

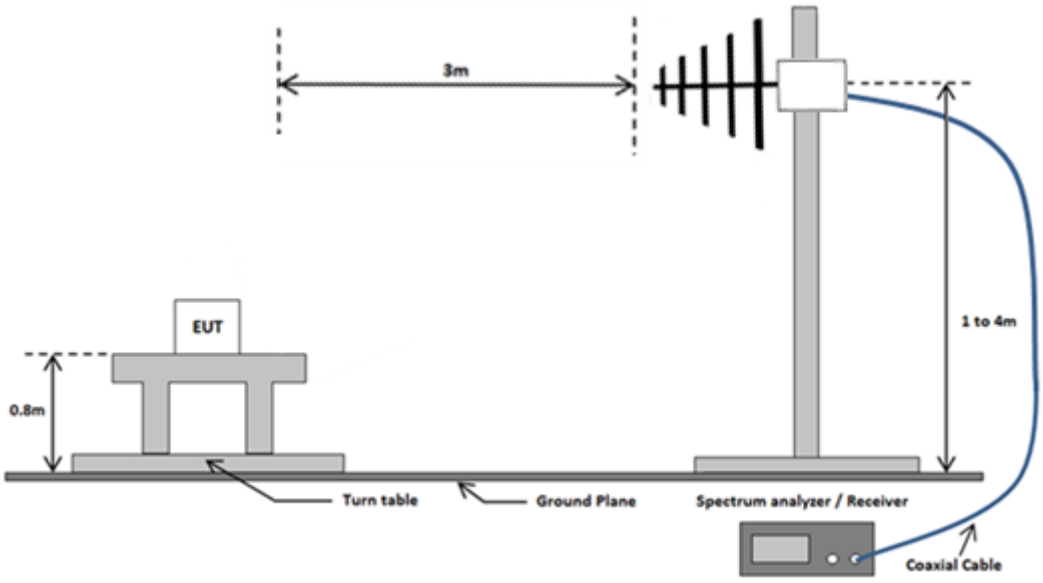
2 Test configuration of the Equipment Under Test

2.1 Test mode

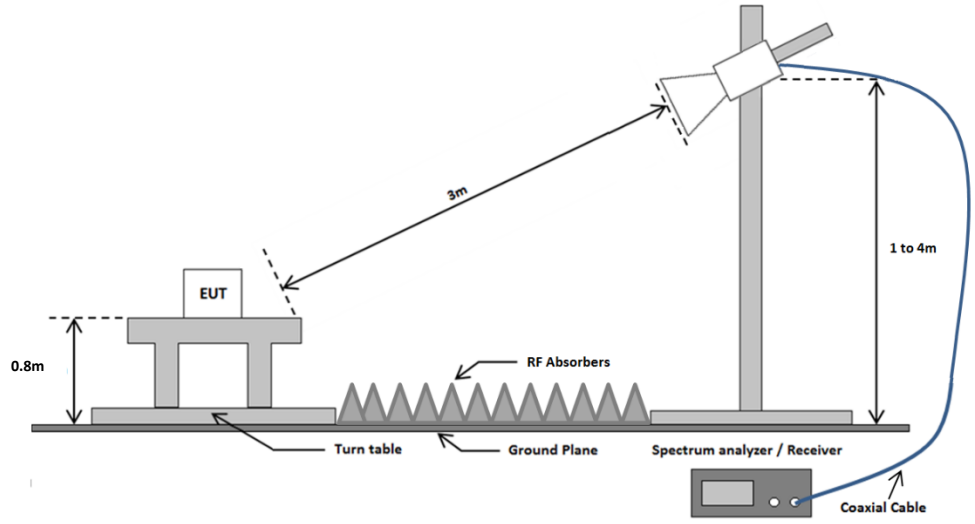
The EUT is tested in normal operating mode, floating in a small volume of water to activate the device. A smartphone running the Deeper FishFinder app was connected to the EUT during testing in order to activate all functions.

2.2 Test setups

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.3 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Cal. date	Cal. due date	Used at Par.
EMI Receiver	Rohde & Schwarz	ESCI	114161	02-2022	02-2023	3.1
Spectrum analyzer	Rohde & Schwarz	FSP40	114792	03-2020	03-2022	3.1
Biconical antenna + 6dB attenuator	Schwarzbeck + HP	VHA9103 + 8491A	114436 + 114254	03-2021	03-2024	3.1
Logperiodic antenna	EMCO	3147	114385	03-2021	03-2024	3.1
Horn antenna	EMCO	3115	114607	01-2021	01-2024	3.1
Preamplifier 1-18 GHz	µComp Nordic	MCNA-40-0010800-25-10P	114690	01-2022	01-2023	3.1
Standard gain horn antenna 18 – 26 GHz	FLANN-MICROWAVE	20240-25	114518	NA*	NA*	3.1
Preamplifier 18 – 40 GHz	Miteq	JS4-18004000-33-8P	114693	01-2022	01-2023	3.1
Radimation EMC test software 2021-1-9	Raditeq	RMS1001A	TE 02008	--	--	3.1

*Note: Standard gain horn antennas do not need calibration

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)
30 -88	100	40	3
88 - 216	150	43,5	3
216-960	200	46	3
Above 960	500	54	3

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

30 MHz to 26.5 GHz: According to ANSI C63.4-2014, section 8.3

30 MHz to 1 GHz: IRN 026 – Method 1
1 GHz to 18 GHz: IRN 026 – Method 2
18 to 26.5 GHz: IRN 026 – Method 3

Prior to testing the EUT is investigated in the X, Y and Z dimensions in order to position it in the worst case orientation with regards to radiated emissions.

3.1.5 Measurement Uncertainty

Frequency range	Polarization	Uncertainty
30 – 200 MHz	Horizontal	±4.5 dB
	Vertical	±5.4 dB
200 -1000 MHz	Horizontal	±3.6 dB
	Vertical	±4.6 dB
1 – 18 GHz	Horizontal	±5.7 dB
	Vertical	±5.7 dB
18 – 26.5 GHz	Horizontal	±4.9 dB
	Vertical	±4.9 dB

3.1.6 Peak tables of the radiated spurious emissions measurement

30 – 250 MHz

Frequency	Peak	Peak Limit	Quasi-Peak	Quasi-Peak Limit	Status	Polarization
30,561 MHz	29,2 dBµV/m	40 dBµV/m	17,4 dBµV/m	40 dBµV/m	Pass	Vertical
33,528 MHz	29 dBµV/m	40 dBµV/m	18,4 dBµV/m	40 dBµV/m	Pass	Vertical
217,303 MHz	29 dBµV/m	46 dBµV/m	--	--	Pass	Vertical
204,845 MHz	29 dBµV/m	43,5 dBµV/m	--	--	Pass	Horizontal
188,785 MHz	27,8 dBµV/m	43,5 dBµV/m	--	--	Pass	Vertical
149,57 MHz	25,6 dBµV/m	43,5 dBµV/m	--	--	Pass	Vertical

250 – 1000 MHz

Frequency	Peak	Peak Limit	Quasi-Peak	Quasi-Peak Limit	Status	Polarization
710,493 MHz	39,3 dBµV/m	46 dBµV/m	26,9 dBµV/m	46 dBµV/m	Pass	Horizontal
890,602 MHz	41,5 dBµV/m	46 dBµV/m	29,4 dBµV/m	46 dBµV/m	Pass	Horizontal
864,719 MHz	41,9 dBµV/m	46 dBµV/m	--	--	Pass	Horizontal
722,219 MHz	39 dBµV/m	46 dBµV/m	--	--	Pass	Horizontal
698,875 MHz	40,2 dBµV/m	46 dBµV/m	--	--	Pass	Horizontal
944,688 MHz	41,9 dBµV/m	46 dBµV/m	--	--	Pass	Vertical

1 – 18 GHz

Frequency	Average	Average Limit	Peak	Peak Limit	Polarization	Status
7,237 GHz	45,5 dBµV/m	54 dBµV/m	51,9 dBµV/m	74 dBµV/m	Vertical	Pass
4,824 GHz	41,2 dBµV/m	54 dBµV/m	46,7 dBµV/m	74 dBµV/m	Vertical	Pass

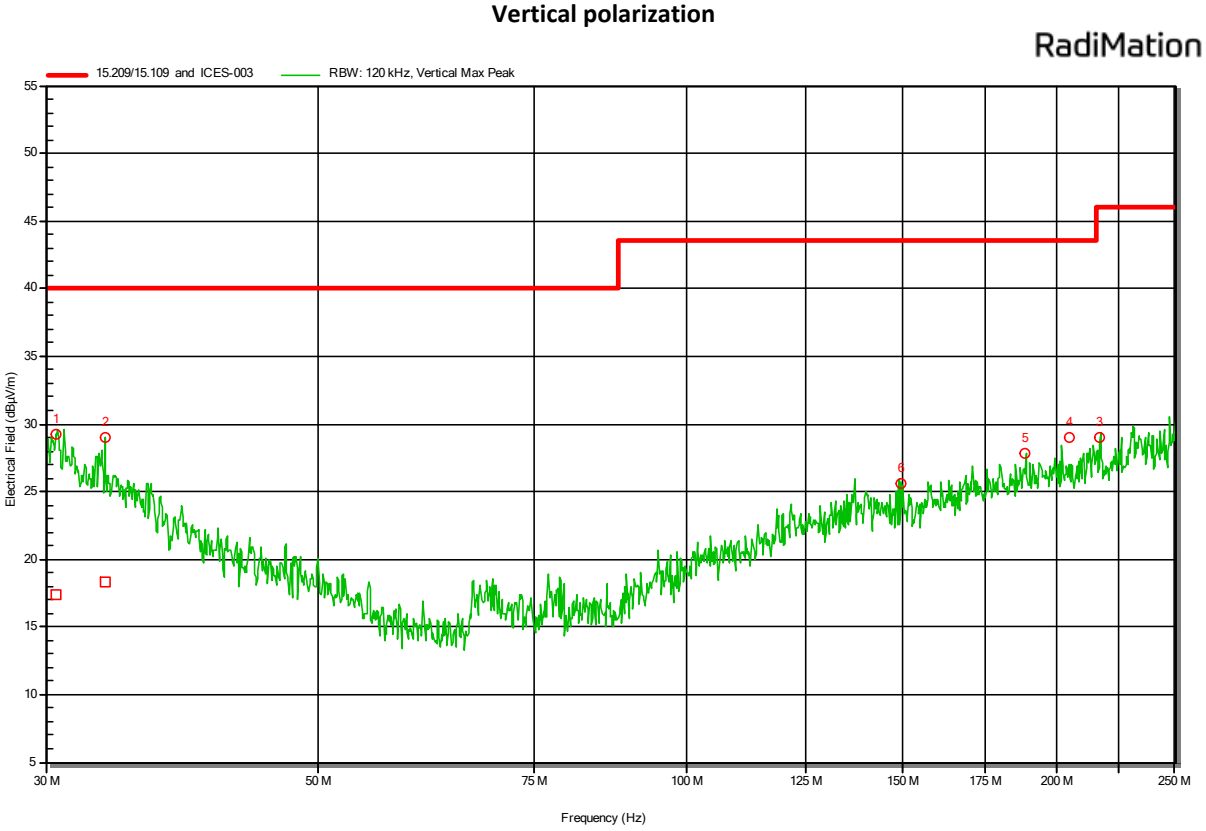
18 – 26 GHz

None.

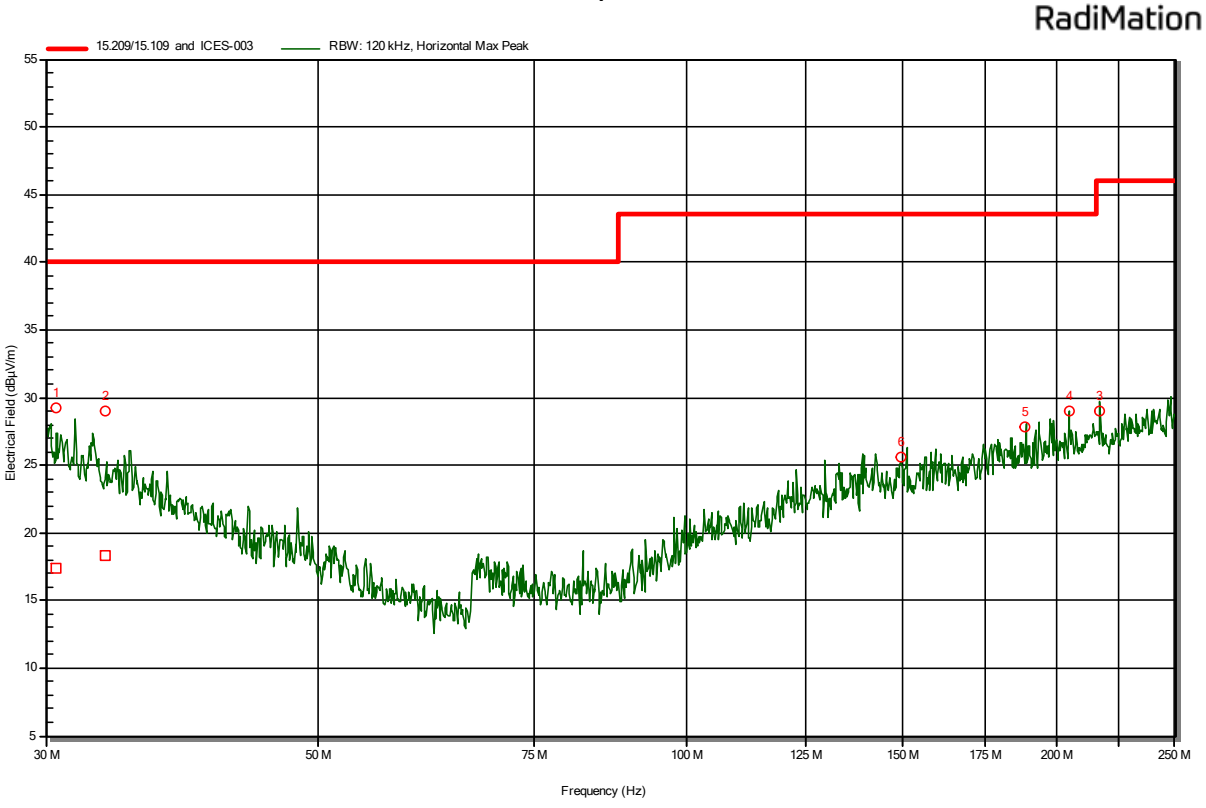
3.1.7 Plots of the Radiated Spurious Emissions Measurement

30 - 250 MHz

Vertical polarization

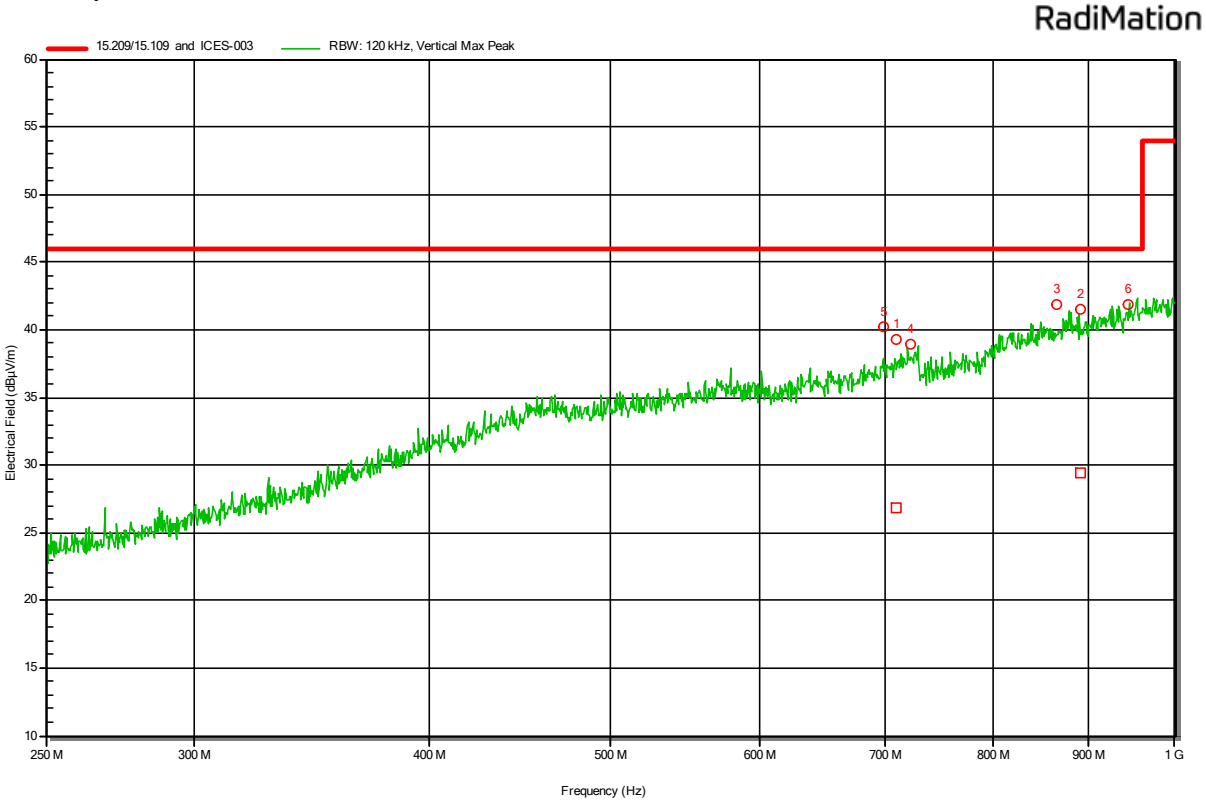


Horizontal polarization

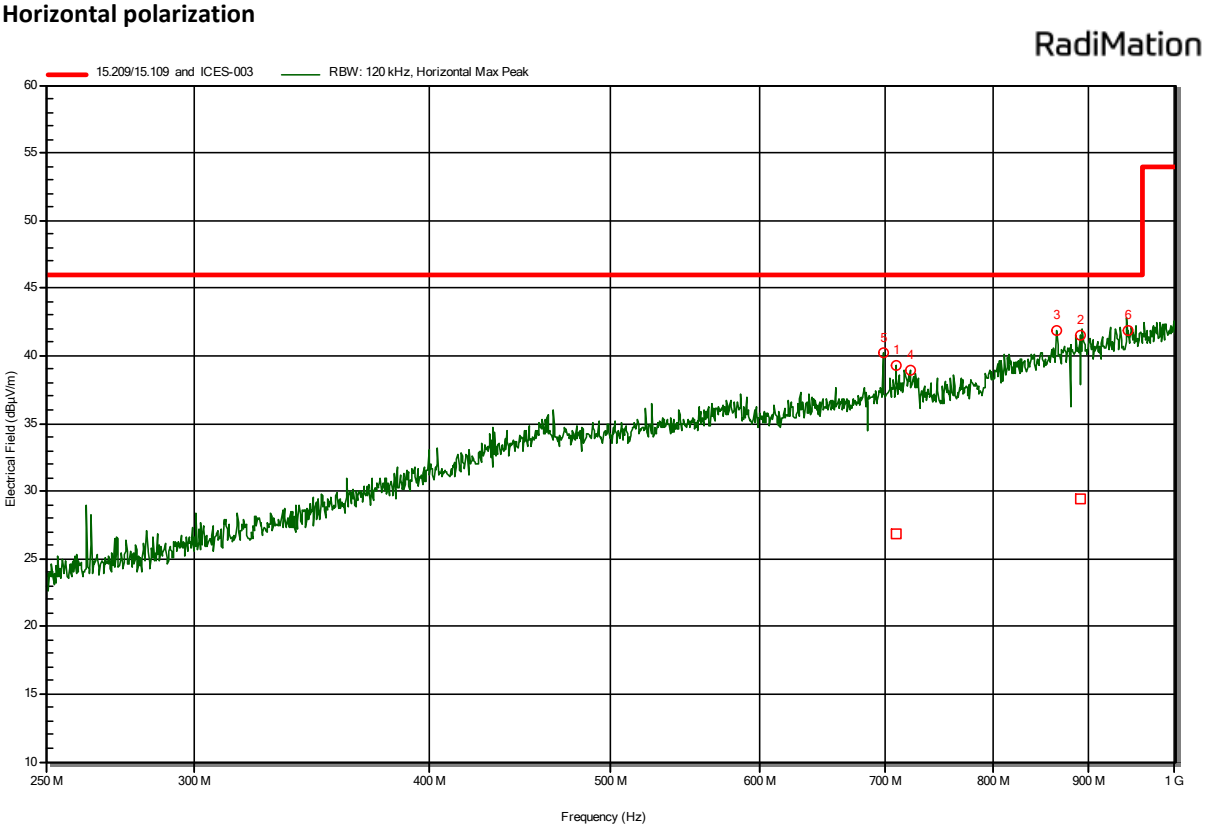


250 – 1000 MHz

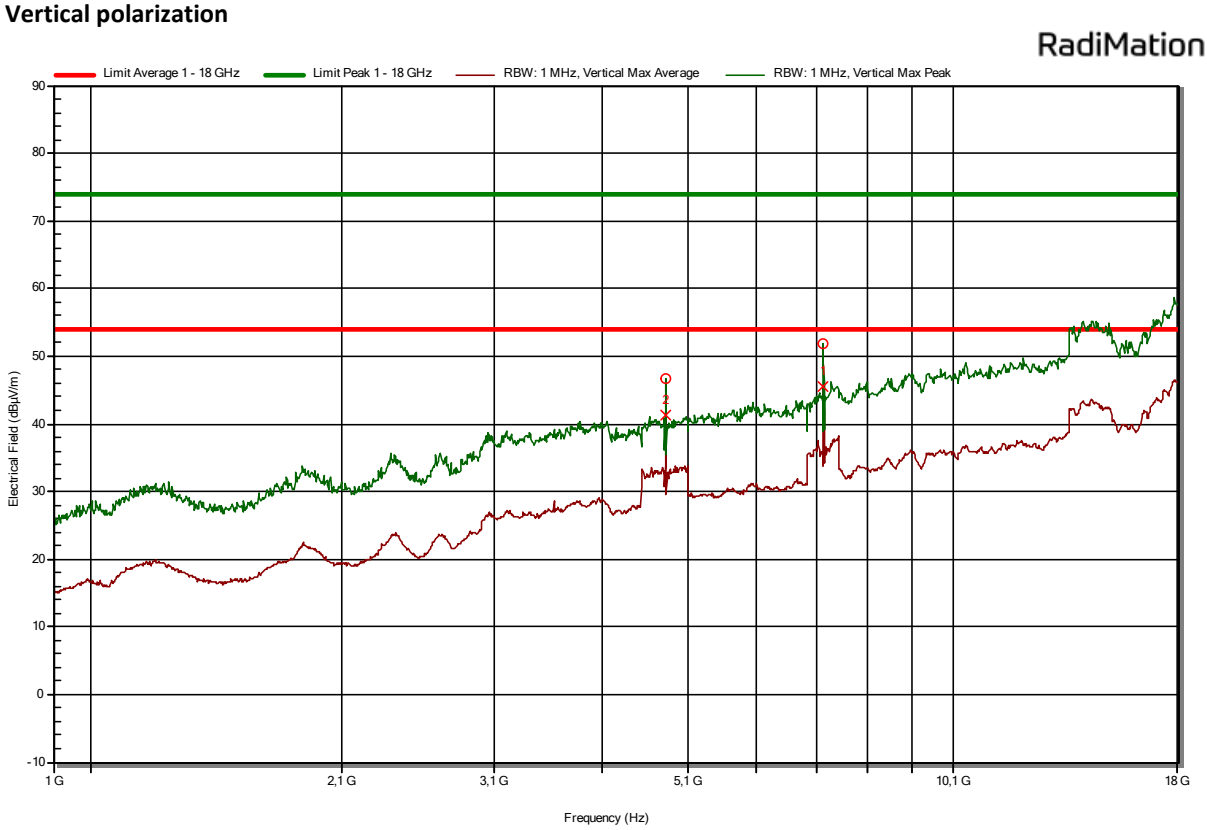
Vertical polarization



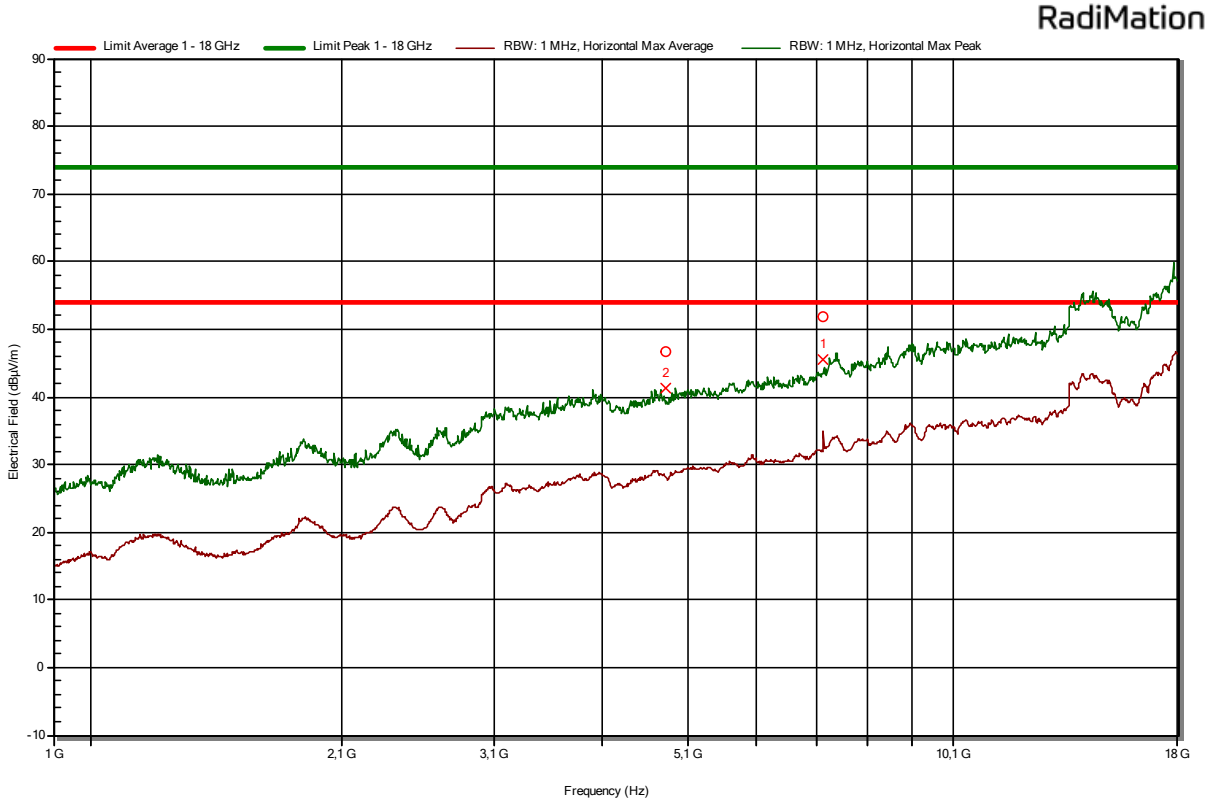
Horizontal polarization



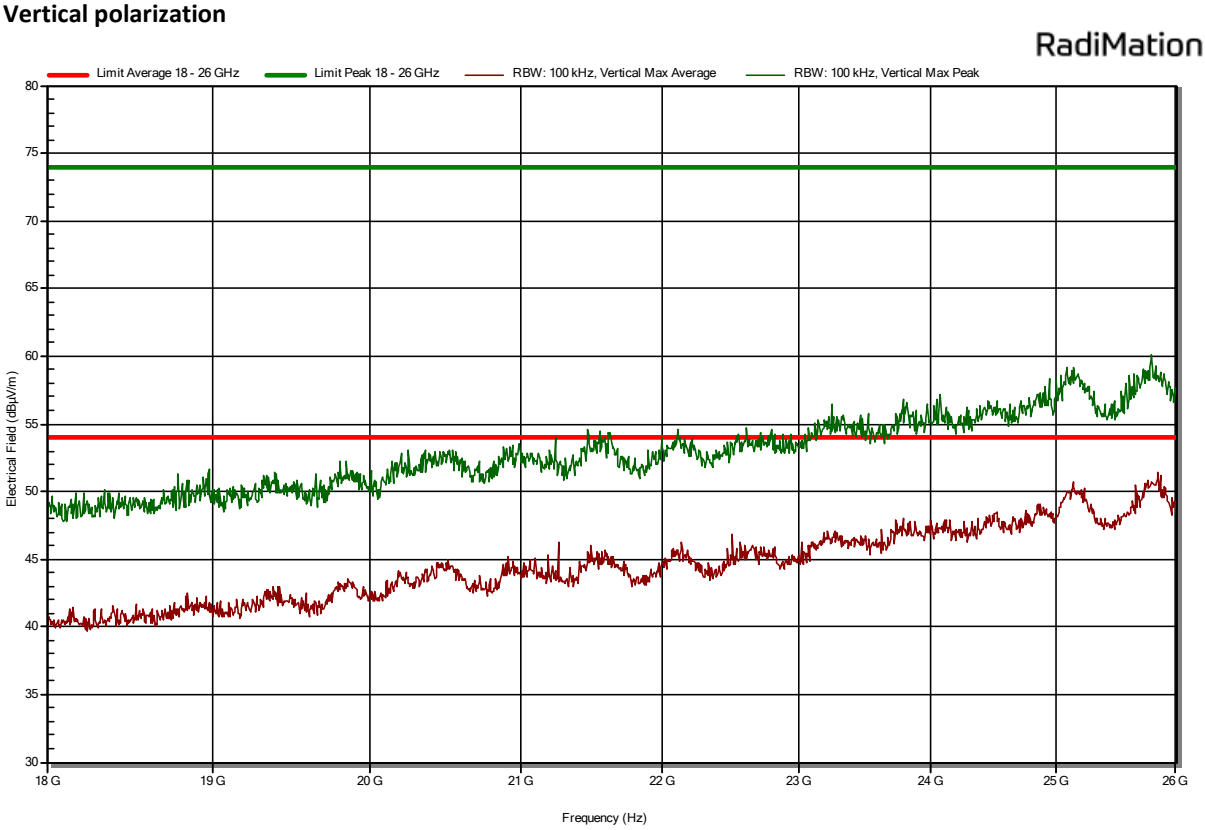
1 – 18 GHz
Vertical polarization



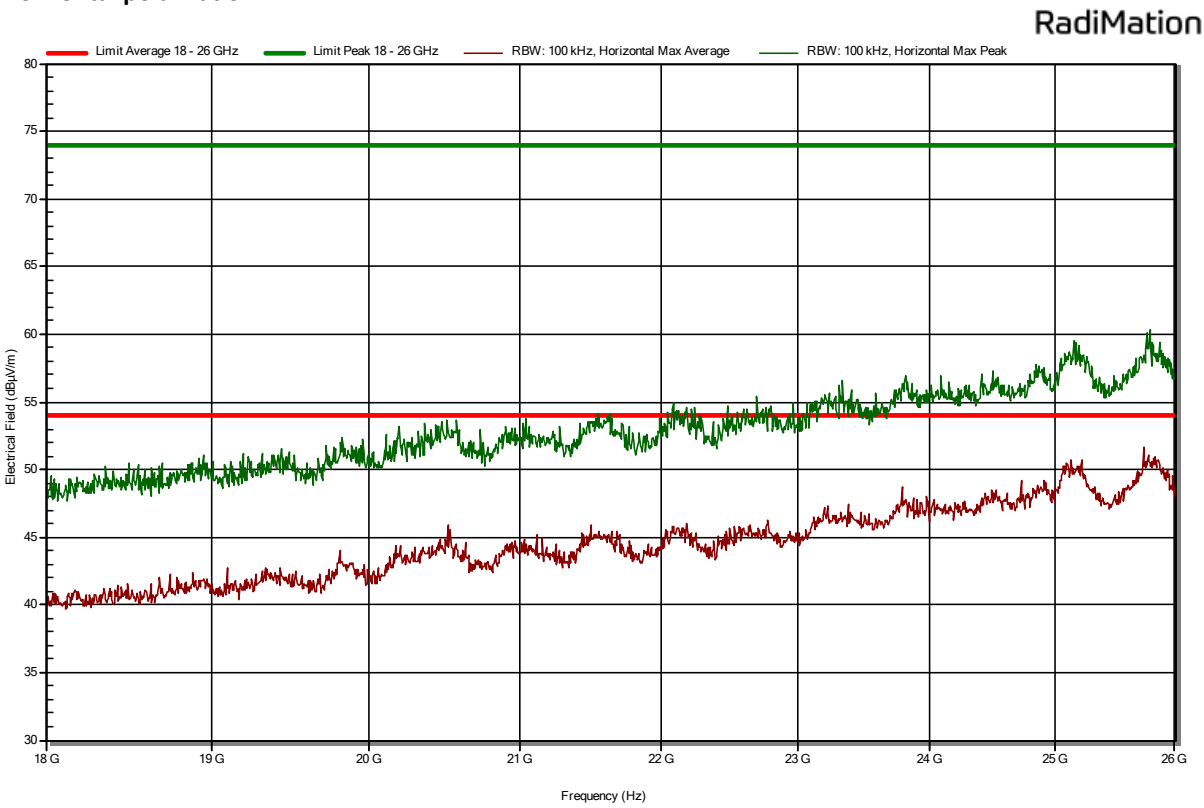
Horizontal polarization



18 – 26 GHz
Vertical polarization



Horizontal polarization



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

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: 109683** **Chase CBL6112B** **SN: 2408**	**Cable loss (dB)** **Id: SAR cable**	**Corr. (dB)**
30	25,4	0,68	26,1
100	16,8	1,15	18,0
150	16,8	1,41	18,2
200	15,3	1,63	16,9
250	19,3	1,93	21,2
300	13,3	2,12	15,4
350	14,6	2,20	16,8
400	22,0	2,29	24,3
450	23,0	2,53	25,5
500	23,8	2,67	26,5
550	25,4	2,90	28,3
600	24,8	3,02	27,8
650	25,2	3,09	28,3
700	25,0	3,22	28,2
750	25,8	3,56	29,4
800	25,8	3,69	29,5
900	26,5	3,81	30,3
950	27,0	3,91	30,9
1000	27,4	4,30	31,7

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