PHOENIX TESTLAB

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Test Report

Report Number:

F210823E2

Equipment under Test (EUT):

EnOcean IP Gateway
AL-512-00-902 IP EnOcean Bridge POE LSA EnoDISC

Applicant:

DEUTA Controls GmbH

Manufacturer:

DEUTA Controls GmbH

ilac-MRA

DAkkS
Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

[1] **ANSI C63.4:2014** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

[2] **FCC 47 CFR Part 2:** General Rules and Regulations

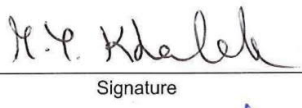
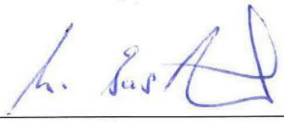
[3] **FCC 47 CFR Part 15:** Radio Frequency Devices (Subpart B)

[4] **ICES-003 Issue 7 (October 2020)**
Spectrum Management and Telecommunications Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) —Limits and Methods of Measurement

Test Result

The requirements of the tests performed as shown in the overview (clause 4) were fulfilled by the equipment under test. The complete test results are presented in the following.

“Passed” indicates that the equipment under test conforms with the relevant limits of the testing standard without taking any measurement uncertainty into account. However, the measurement uncertainty is calculated and shown in this test report

Tested and written by:	Mohamed Yassine KHALEK		05.07.2021
	Name	Signature	Date
Reviewed and approved by:	Manuel BASTERT		05.07.2021
	Name	Signature	Date

This test report is only valid in its original form.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT NUMBER.

Contents: Page

1 Identification

1.1 Applicant

Name:	DEUTA Controls GmbH
Address:	Hauptstr. 76, 32479 Hille
Country:	Germany
Name for contact purposes:	Mr Michael Pohl
Phone:	05734-51466-10
eMail address:	info@deuta-controls.de
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	DEUTA Controls GmbH
Address:	Hauptstr. 76, 32479 Hille
Country:	Germany
Name for contact purposes:	Mr Michael Pohl
Phone:	05734-51466-10
eMail address:	info@deuta-controls.de
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out by:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

Accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-06 and D-PL-17186-01-05, FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	EnOcean IP Gateway
Model name: *	AL-512-00-902 IP EnOcean Bridge POE LSA EnoDISC
Model number: *	12395
Order number: *	12395
FCC ID: *	2AZTH-AL-512-00-902
IC certification number: *	27242-51200902
PMN: *	AL-512-00-902
HVIN: *	1.0
FVIN: *	2.0

	EUT number		
	1	2	3
Serial number: *	26177	-	-
PCB identifier: *	0.95	-	-
Hardware version: *	1.0	-	-
Software version: *	2.1	-	-

* Declared by the applicant

1 EUT was used for the tests using two connector boards 1 and 2 as described in chapter 2.

Note: PHOENIX TESTLAB GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical Data of Equipment

General:

Power supply EUT: *	POE		
Supply voltage EUT: *	Unom = 48 V	Umin = 44 V	Umax = 54 V
Temperature range: *	0 °C to +45 °C		
Lowest / highest internal frequency: *	12 MHz / 902.875 MHz		

RF part

Power supply RF module: *	DC		
Supply voltage RF module: *	U_{nom} = 3.3V	U_{min} = 3.3V	U_{max} = 3.3V
Operating frequency: *	902.875 MHz		
Number of channels: *	1		
Type of modulation: *	FSK		
Data rate: *	125 kbps		
Antenna type: *	PCB Antenna		
Antenna connector: *	None		

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
Ethernet	LSA	RJ45	~40 cm	Yes

Equipment used for testing	
Laptop AC adapter *1	Lenovo ADLX45NCC3A
Laptop *1	Lenovo G70-80 Model: 80FF, S/N: PF0DJ9H6
POE Ethernet Switch*1	TP-link Model: TL-SG108PE
Ethernet switch power adapter*1	TP-link Model: T480125-2-DT

*1 Provided by the applicant
*2 Provided by the laboratory

Ancillary equipment	
-	-
-	-
-	-

*1 Provided by the applicant

1.6 Dates

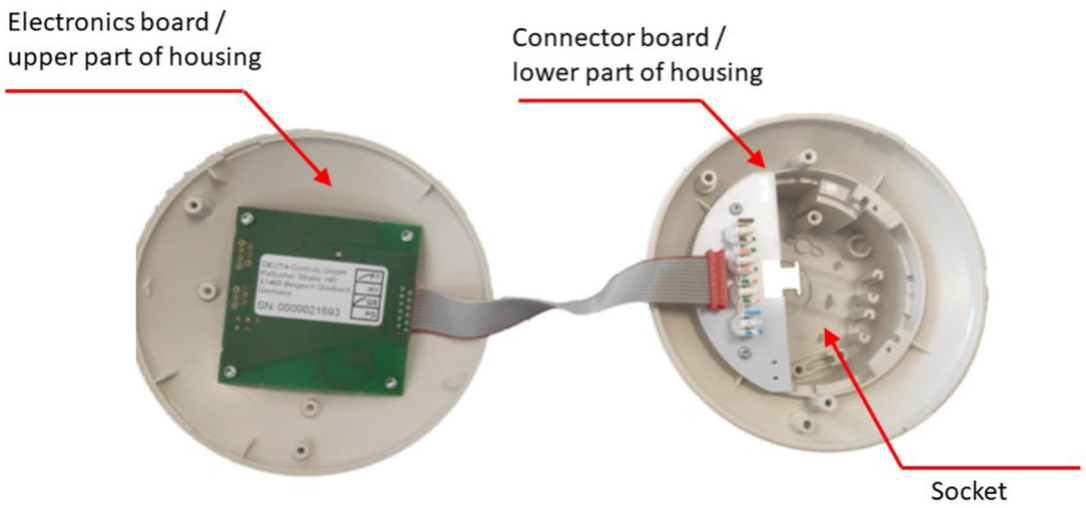
Date of receipt of test sample:	10.06.2021
Start of test:	16.06.2021
End of test:	18.06.2021

2 Operational States

Description of function of the EUT:

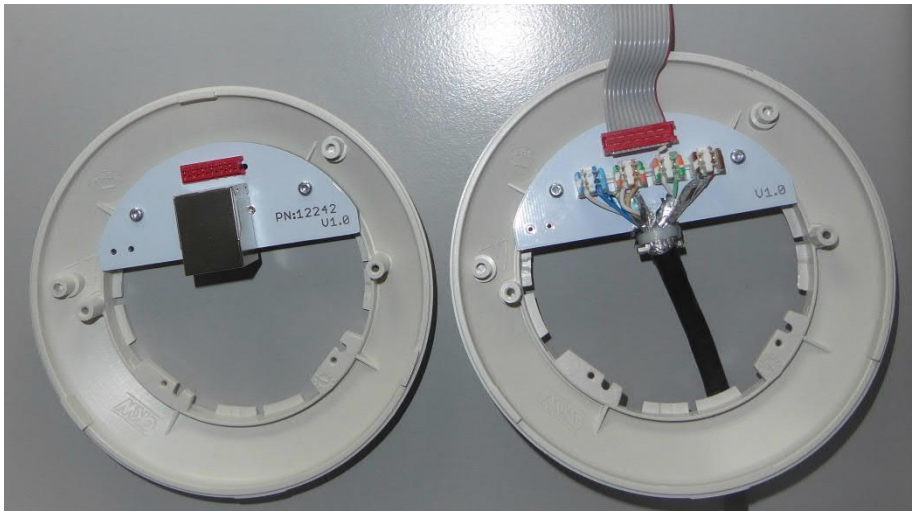
The EUT is an IP Gateway used to interface sensors and actuators with EnOcean® wireless interface to an Ethernet based automation system. The integrated radio interface (EnOcean) receives data like room temperature, humidity or presence detection from sensors and can send data to actuators.
At the same time, data is transferred to / from an automation system via the integrated Ethernet interface. For more information, refer to the user manual of the EUT.
The standardized protocol used by the communication layer is the ESP3 format (EnOcean Serial Protocol Version 3). The EnoDisc does not interpret data. The EnoDisc is supplied via PoE (Power Over Ethernet).

The EnoDisc is composed of three parts (see picture below)
• Socket
• Connector board / lower part of housing
• Controller board / upper part of housing



EUT composition

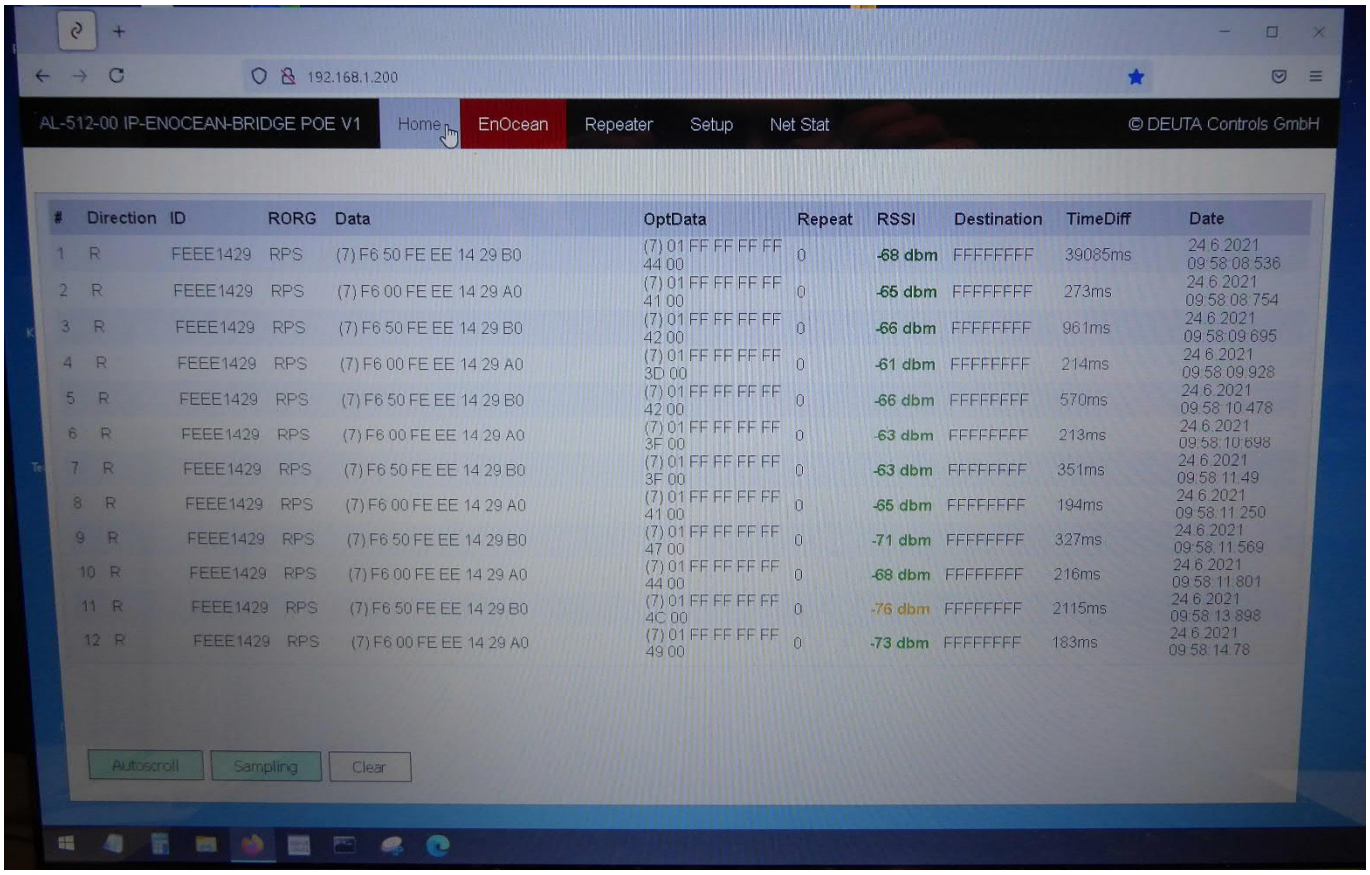
The manufacturer has provided two variants of connector boards, one with an LSA connector (connector board 1) and the other one with an Ethernet port (connector board 2) as shown in the picture below:



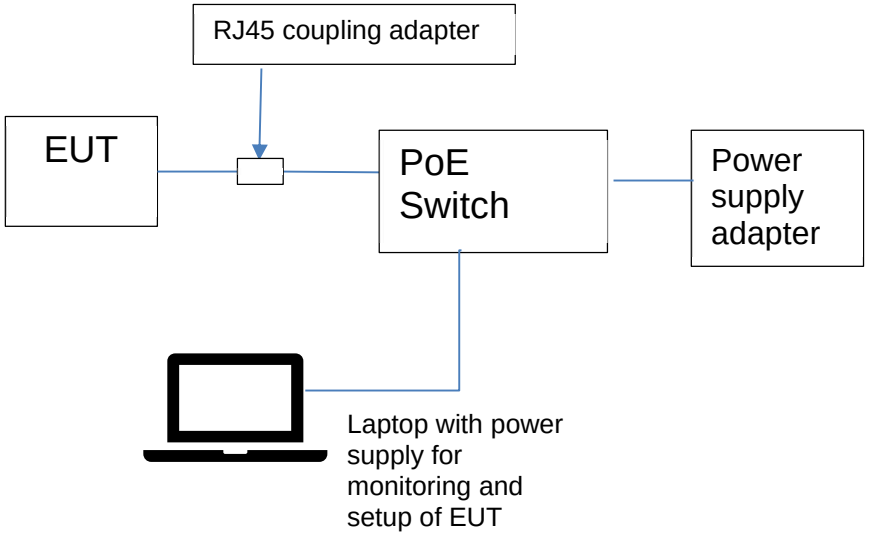
Two types of connector boards connector 1 right and connector 2 left

The following states were defined as the operating conditions:

The EUT was supplied by 48 V DC / 120 V 60 Hz AC during all tests.
The EUT connection through the ethernet port was monitored using a Webserver with an EnOcean Monitor provided by the manufacturer to simulate the data traffic.



The system was setup as follows:



Setup diagram

Setup for measurements below and above 1 GHz

The radiated emission measurement is divided into three stages:
1. A preliminary measurement inside a semi anechoic chamber with 3 m distance;
2. A final measurement inside a semi anechoic chamber with 3 m distance for frequencies above 30 MHz;

Additional Information:
The EUT was labeled as follows:

Label of the sample

3 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (a),(b) [3] ICES-003 Issue 7 section 3.2.1[4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
AC supply line Class A	0.15 to 0.5 MHz 0.5 to 30 MHz	79 dB(µV) QP 66 dB(µV) AV 73 dB(µV) QP 60 dB(µV) AV	ANSI C63.4	-	N/A
AC supply line Class B	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dB(µV) QP* 56 to 46 dB(µV) AV* 56 dB(µV) QP 46 dB(µV) AV 60 dB(µV) QP 50 dB(µV) AV	ANSI C63.4	1 with connector boards 1 and 2	Passed
*: Decreases with the logarithm of the frequency					

Radiated emissions FCC 47 CFR Part 15 section 15.109 (a),(b) [3]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	39.0 dB(µV/m) QP at 10 m 43.5 dB(µV/m) QP at 10 m 46.5 dB(µV/m) QP at 10 m 49.5 dB(µV/m) QP at 10 m 49.5 dB(µV/m) AV at 10 m and 69.5 dB(µV/m) PK at 10 m	ANSI C63.4	-	N/A
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(µV/m) QP at 3 m 43.5 dB(µV/m) QP at 3 m 46.0 dB(µV/m) QP at 3 m 54.0 dB(µV/m) QP at 3 m 54.0 dB(µV/m) AV at 3 m and 74.0 dB(µV/m) PK at 3 m	ANSI C63.4	1 with connector boards 1 and 2	Passed

Radiated emissions ICES-003 Issue 7 section 3.2.2 [4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status

Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(µV/m) QP at 10 m 43.5 dB(µV/m) QP at 10 m 46.4 dB(µV/m) QP at 10 m 47.0 dB(µV/m) QP at 10 m 49.5 dB(µV/m) QP at 10 m No limit available for 10 m	ANSI C63.4	-	N/A
Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	50.0 dB(µV/m) QP at 3 m 54.0 dB(µV/m) QP at 3 m 56.9 dB(µV/m) QP at 3 m 57.0 dB(µV/m) QP at 3 m 60.0 dB(µV/m) QP at 3 m 60 dB(µV/m) AV at 3 m and 80 dB(µV/m) PK at 3 m	ANSI C63.4	-	N/A
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	30.0 dB(µV/m) QP at 10 m 33.1 dB(µV/m) QP at 10 m 35.6 dB(µV/m) QP at 10 m 37.0 dB(µV/m) QP at 10 m 43.5 dB(µV/m) QP at 10 m No limit available for 10 m	ANSI C63.4	-	N/A
Radiated Emission Class B	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz above 1000 MHz	40.0 dB(µV/m) QP at 3 m 43.5 dB(µV/m) QP at 3 m 46.0 dB(µV/m) QP at 3 m 47.0 dB(µV/m) QP at 3 m 54.0 dB(µV/m) QP at 3 m 54 dB(µV/m) AV at 3 m and 74 dB(µV/m) PK at 3 m	ANSI C63.4	1 with connector boards 1 and 2	Passed

Remark: As declared by the applicant the highest internal clock frequency is 902.875 MHz.
Therefore the radiated emission measurement must be carried out up to 5th of the highest internal clock frequency in this case 5 GHz.

The EUT was classified by the applicant as CLASS B equipment.

4 Results

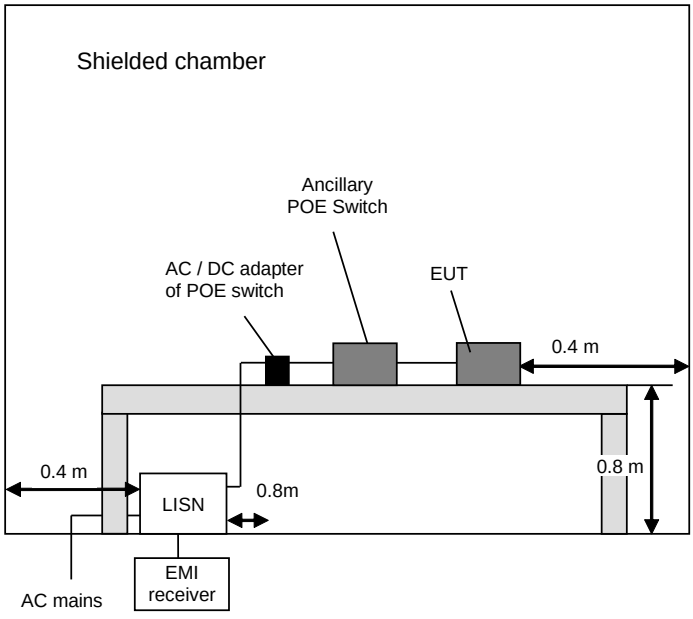
4.1 Conducted emissions on power supply lines

4.1.1 Test method

The test is carried out in a shielded chamber. Table-top devices are set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices are placed directly on the ground plane. In case of DC powered equipment, which is not exclusively powered by a battery, it is connected to the LISN via a suitable AC/DC adaptor. The setup of the equipment under test is in accordance to [1].

The frequency range 150 kHz to 30 MHz is measured with an EMI receiver set to MAX hold mode with Peak and Average detectors and a resolution bandwidth of 9 kHz. A scan is carried out on the phase and neutral line of the AC mains network. If emissions less than 10 dB below the appropriable limit are detected, these emissions are measured with an Average and Quasi-Peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz



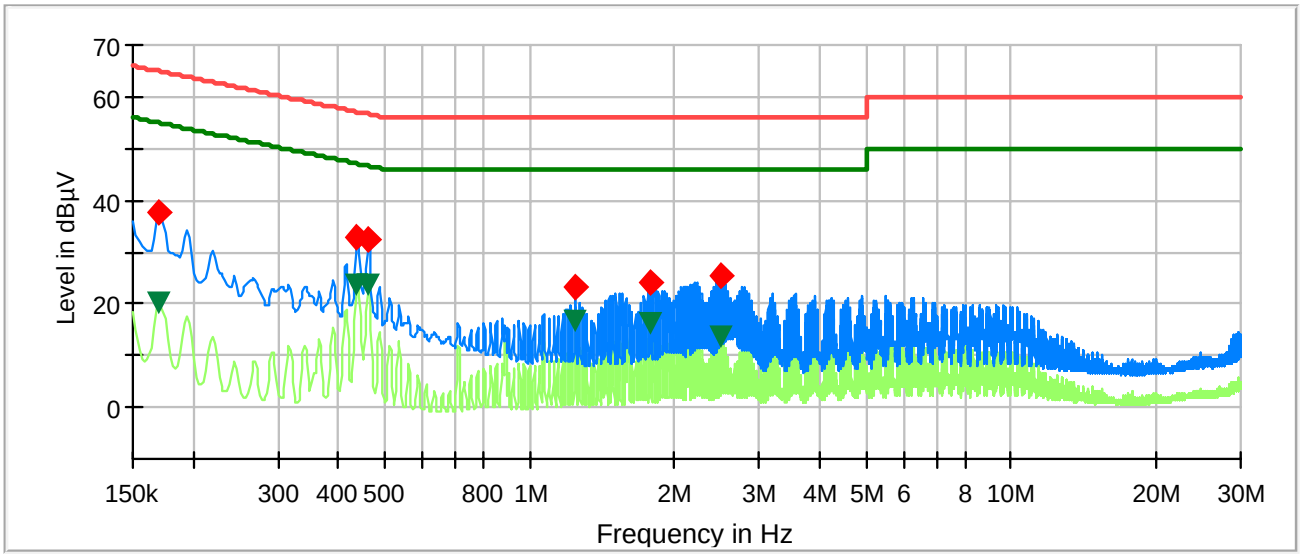
4.1.2 Test results

Ambient temperature:	25 °C
Relative humidity:	70 %

Date:	18.06.2021
Tested by:	Y. KHALEK

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by ◆ and the average measured points by ▼.

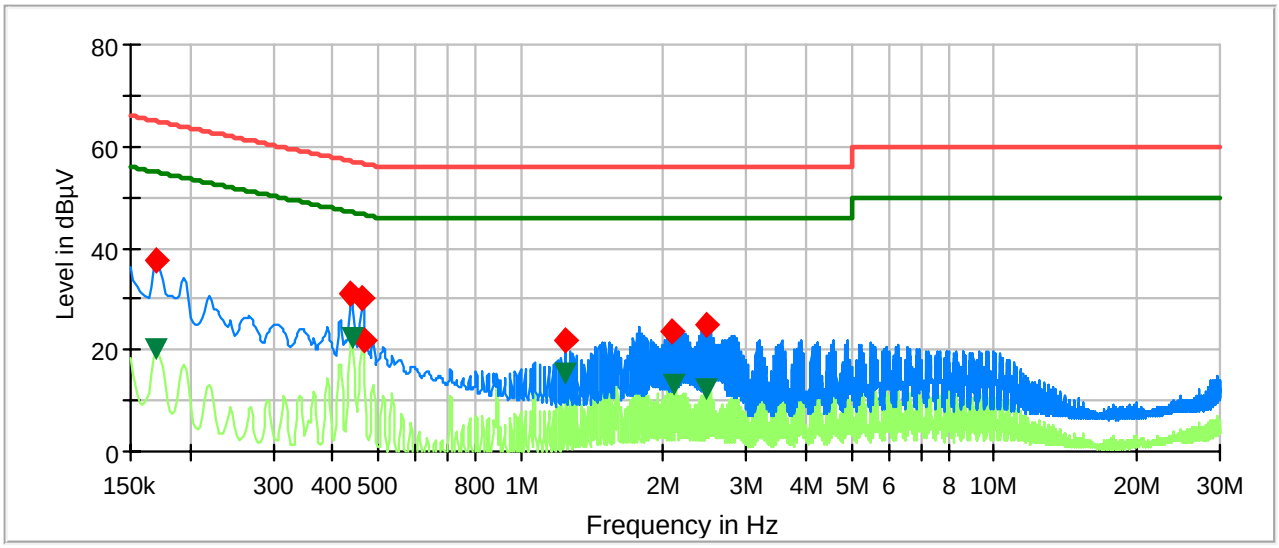
Results for EUT 1 with Connector board 1



Frequency in MHz	QuasiPeak in dB(µV)	Average in dB(µV)	Limit in dB(µV)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Line	PE	Corr. in dB
0.170250	37.73	---	64.95	27.22	15000.0	9.000	N	GND	9.8
0.170250	---	20.26	54.95	34.69	15000.0	9.000	N	FLO	9.8
0.438000	32.78	---	57.10	24.32	15000.0	9.000	N	GND	9.8
0.438000	---	23.69	47.10	23.41	15000.0	9.000	N	GND	9.8
0.462750	---	23.47	46.64	23.17	15000.0	9.000	N	FLO	9.8
0.462750	32.40	---	56.64	24.24	15000.0	9.000	N	GND	9.8
1.243500	---	16.71	46.00	29.29	15000.0	9.000	L1	GND	9.8
1.243500	23.08	---	56.00	32.92	15000.0	9.000	L1	FLO	9.8
1.779000	---	16.33	46.00	29.67	15000.0	9.000	L1	GND	9.9

1.781250	24.13	---	56.00	31.87	15000.0	9.000	L1	FLO	9.9
2.487750	25.40	---	56.00	30.60	15000.0	9.000	L1	GND	10.2
2.487750	---	13.62	46.00	32.38	15000.0	9.000	L1	GND	10.2

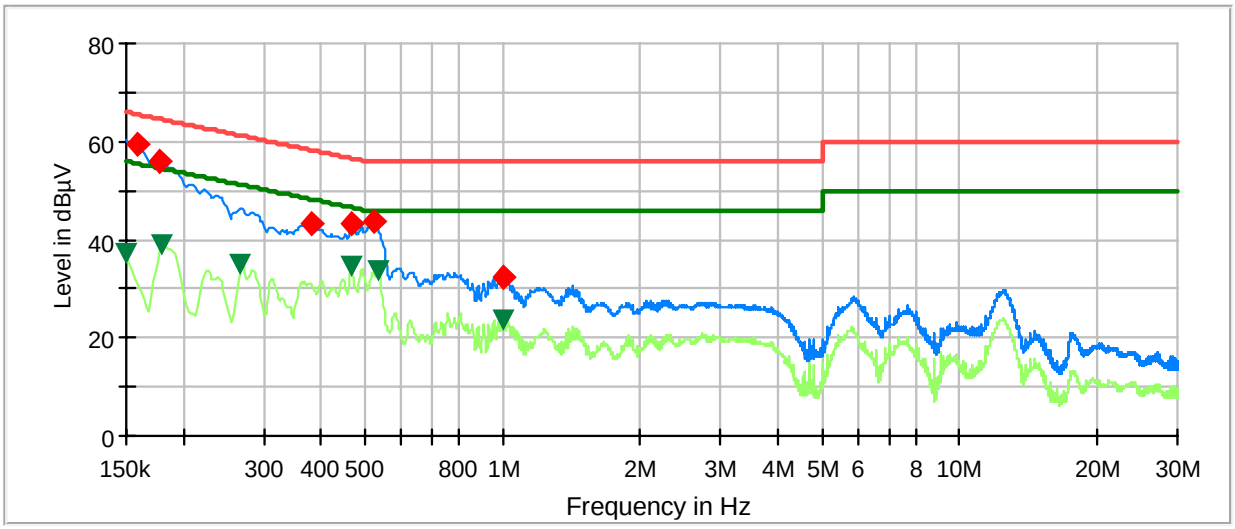
Results for EUT 1 with Connector board 2



Frequency in MHz	QuasiPeak in dB(µV)	Average in dB(µV)	Limit in dB(µV)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Line	PE	Corr. in dB
0.170250	37.64	---	64.95	27.31	15000.0	9.000	N	FLO	9.8
0.170250	---	20.02	54.95	34.93	15000.0	9.000	L1	FLO	9.8
0.438000	30.85	---	57.10	26.24	15000.0	9.000	N	FLO	9.8
0.440250	---	22.11	47.06	24.95	15000.0	9.000	N	GND	9.8
0.462750	30.34	---	56.64	26.30	15000.0	9.000	N	GND	9.8
0.469500	21.95	---	56.52	34.57	15000.0	9.000	N	GND	9.8
1.243500	---	15.48	46.00	30.52	15000.0	9.000	L1	FLO	9.8
1.243500	22.00	---	56.00	34.00	15000.0	9.000	L1	GND	9.8
2.096250	23.60	---	56.00	32.40	15000.0	9.000	L1	GND	10.1
2.098500	---	13.10	46.00	32.90	15000.0	9.000	L1	GND	10.1
2.463000	24.84	---	56.00	31.16	15000.0	9.000	L1	FLO	10.2
2.463000	---	12.14	46.00	33.86	15000.0	9.000	L1	GND	10.2

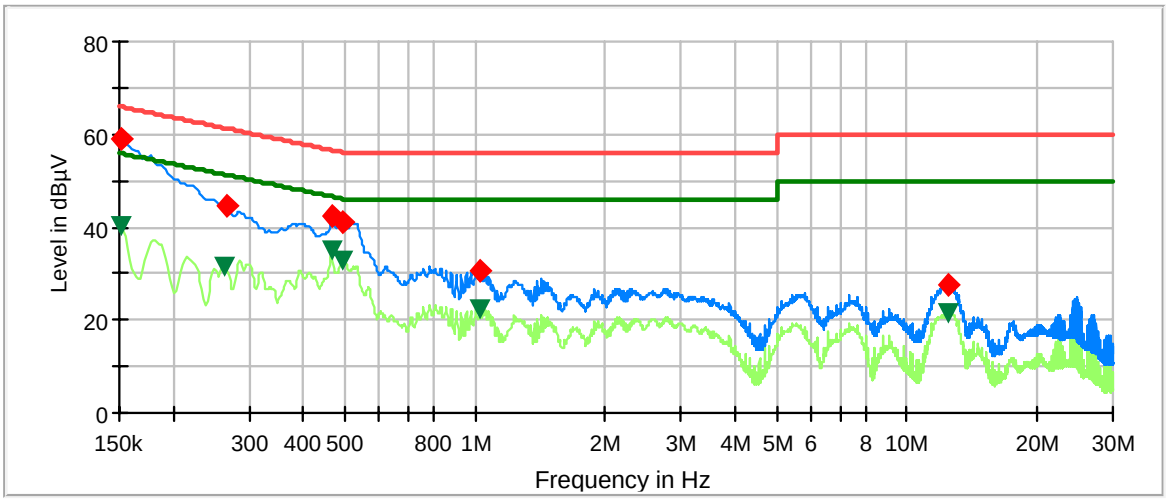
Measurement uncertainty ±2.76 dB

Results for EUT 1 with Connector board 1 and Laptop



Frequency in MHz	QuasiPeak in dB(µV)	Average in dB(µV)	Limit in dB(µV)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Line	PE	Corr. in dB
0.150000	---	37.05	56.00	18.95	15000.0	9.000	N	GND	9.8
0.159000	59.27	---	65.52	6.25	15000.0	9.000	N	GND	9.8
0.177000	55.98	---	64.63	8.64	15000.0	9.000	N	FLO	9.8
0.179250	---	38.72	54.52	15.80	15000.0	9.000	N	FLO	9.8
0.267000	---	34.83	51.21	16.38	15000.0	9.000	N	FLO	9.8
0.379500	43.33	---	58.29	14.96	15000.0	9.000	N	GND	9.8
0.467250	---	34.55	46.56	12.01	15000.0	9.000	N	GND	9.8
0.467250	43.31	---	56.56	13.25	15000.0	9.000	L1	GND	9.8
0.521250	43.55	---	56.00	12.45	15000.0	9.000	N	GND	9.8
0.532500	---	33.68	46.00	12.32	15000.0	9.000	N	FLO	9.8
1.005000	32.29	---	56.00	23.71	15000.0	9.000	N	GND	9.8
1.005000	---	23.80	46.00	22.20	15000.0	9.000	N	GND	9.8

Results for EUT 1 with Connector board 2 and Laptop



Frequency in MHz	QuasiPeak in dB(µV)	Average in dB(µV)	Limit in dB(µV)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Line	PE	Corr. in dB
0.152250	59.01	---	65.88	6.87	15000.0	9.000	N	GND	9.8
0.152250	---	40.38	55.88	15.49	15000.0	9.000	N	GND	9.8
0.262500	---	31.59	51.35	19.76	15000.0	9.000	N	GND	9.8
0.264750	44.59	---	61.28	16.69	15000.0	9.000	N	GND	9.8
0.465000	---	34.76	46.60	11.85	15000.0	9.000	N	FLO	9.8
0.467250	42.40	---	56.56	14.16	15000.0	9.000	N	FLO	9.8
0.494250	41.03	---	56.10	15.06	15000.0	9.000	L1	GND	9.8
0.496500	---	32.64	46.06	13.41	15000.0	9.000	L1	FLO	9.8
1.027500	---	22.47	46.00	23.53	15000.0	9.000	N	FLO	9.8
1.027500	30.41	---	56.00	25.59	15000.0	9.000	N	FLO	9.8
12.522750	---	21.30	50.00	28.70	15000.0	9.000	N	GND	10.6
12.531750	27.63	---	60.00	32.37	15000.0	9.000	N	GND	10.6

Test result: Passed

Test equipment (please refer to chapter 6 for details)
16-22

4.2 Radiated emissions

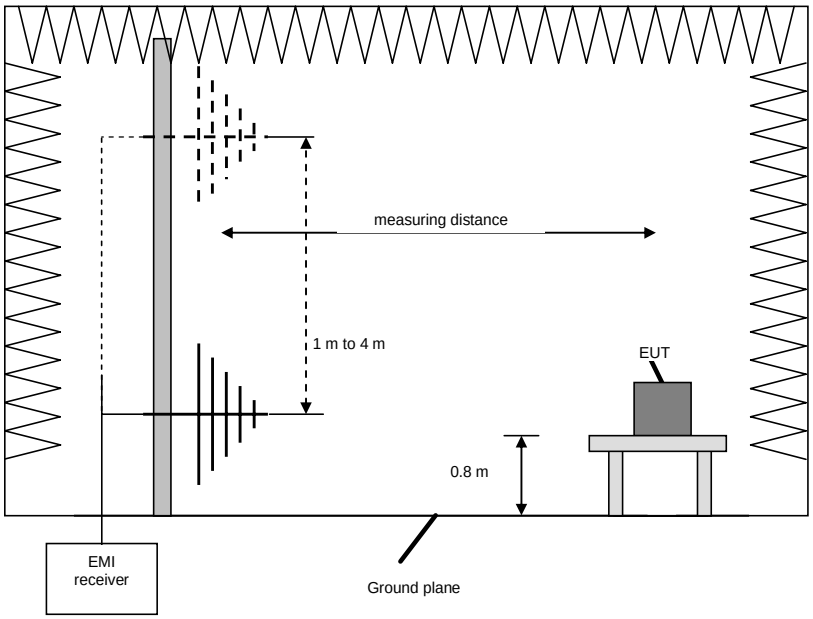
4.2.1 Test method

Preliminary and final measurement 30 MHz to 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane in a 3 m distance.
During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarization and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver is set to the following values:

Test	Frequency range	Resolution bandwidth
Preliminary measurement	30 MHz to 1 GHz	100 kHz
Frequency peak search	+ / - 1 MHz	10 kHz
Final measurement	30 MHz to 1 GHz	120 kHz



Procedure preliminary measurement:

The following procedure is used:

1) Set the measuring antenna to 1 m height.
2) Monitor the frequency range at horizontal polarisation of the measuring antenna and an EUT / turntable azimuth of 0 °.
3) Rotate the EUT by 360° to maximize the detected signals.
4) Repeat steps 2 to 3 with the vertical polarisation of the measuring antenna.
5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

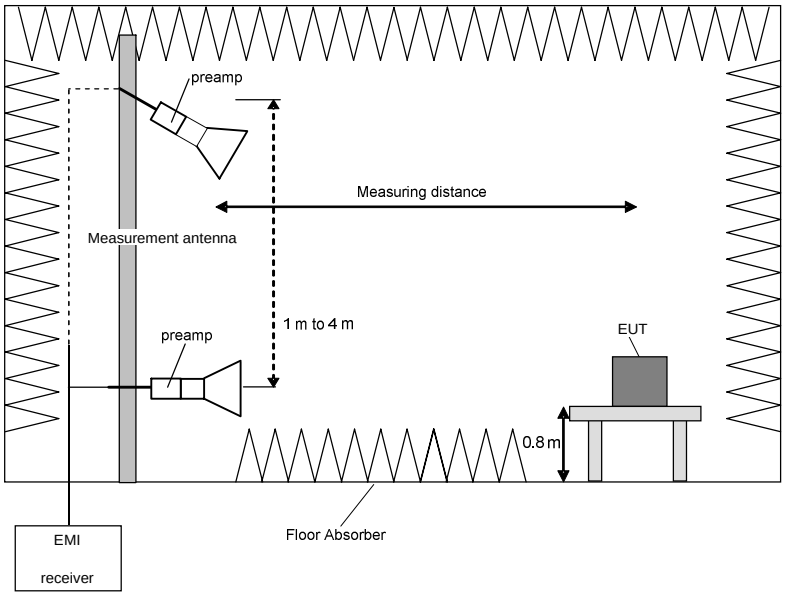
1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
2) The software determines the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

Preliminary and final measurement > 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with floor absorbers between EUT and measuring antenna. The measuring distance is 3 m.
During the tests the EUT is rotated in the range of 0 ° to 360 °, the measuring antenna is set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions. While changing the height, the measuring antenna gets tilted so that it is always aiming at the EUT.

The resolution bandwidth of the EMI Receiver is set to the following values:

Test	Frequency range	Resolution bandwidth
Preliminary measurement	1 - 40 GHz	1 MHz
Frequency peak search	+ / - 10 MHz	100 kHz
Final measurement	1 - 40 GHz	1 MHz



Procedure preliminary measurement:

The following procedure is used:

1) Set the measuring antenna to 1 m height.
2) Monitor the frequency range at horizontal polarisation of the measuring antenna and an EUT / turntable azimuth of 0 °.
3) Rotate the EUT by 360° to maximize the detected signals.
4) Repeat steps 2 to 3 with the vertical polarisation of the measuring antenna.
5) Increase the height of the measuring antenna for 0.5 m and repeat steps 2 to 4 until the final height of 4 m is reached.
6) The highest values for each frequency are saved by the software, including the measuring antenna height and polarization and the turntable azimuth for that value.

Procedure final measurement:

The following procedure is used:

1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
2) The software determines the exact peak frequencies by doing a partial scan with reduced RBW with +/- 10 times the RBW of the pre-scan of the selected peaks.
3) If the EUT is portable or ceiling mounted, find the worst-case EUT orientation (x,y,z) for the final test.
4) The worst-case measuring antenna height is found via varying the height by +/- 0.5 m from the value obtained in the preliminary measurement while monitoring the emission level.
5) The worst-case turntable position is found via varying the turntable azimuth by +/- 30° from the value obtained in the preliminary measurement while monitoring the emission level.
6) The final measurement is performed at the worst-case measuring antenna height and the worst-case turntable azimuth.
7) Steps 2 to 6 are repeated for each frequency peak selected in step 1.

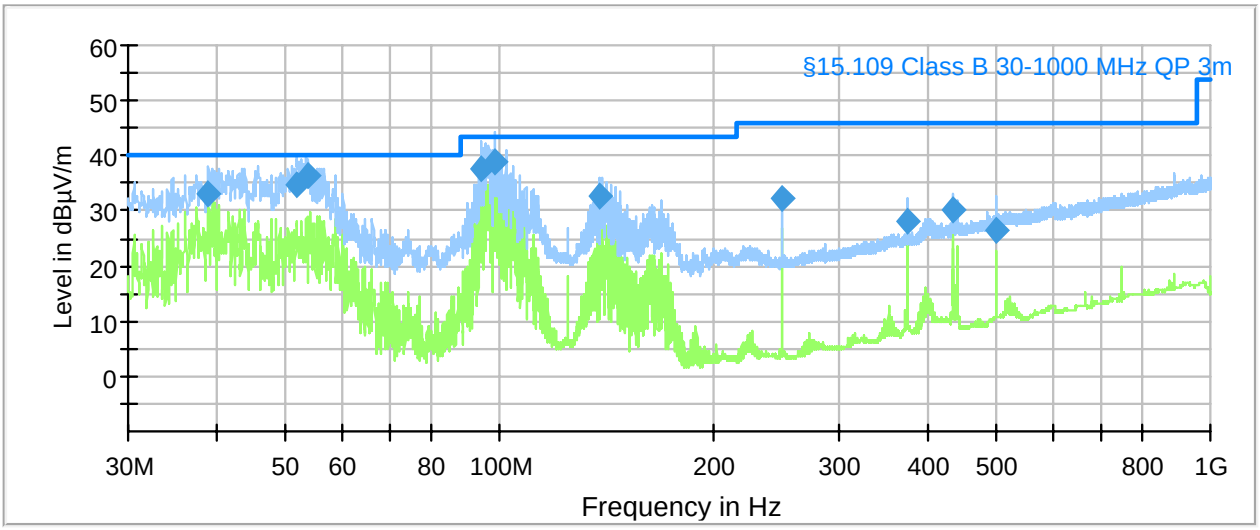
4.2.2 Test results final measurement 30 MHz to 1 GHz

Ambient temperature:	24 °C
Relative humidity:	58 %

Date:	16.06.2021
Tested by:	Y. KHALEK

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with "◆" are the measured results of the standard subsequent measurement in a semi-anechoic chamber.

Results for EUT 1 with Connector board 1



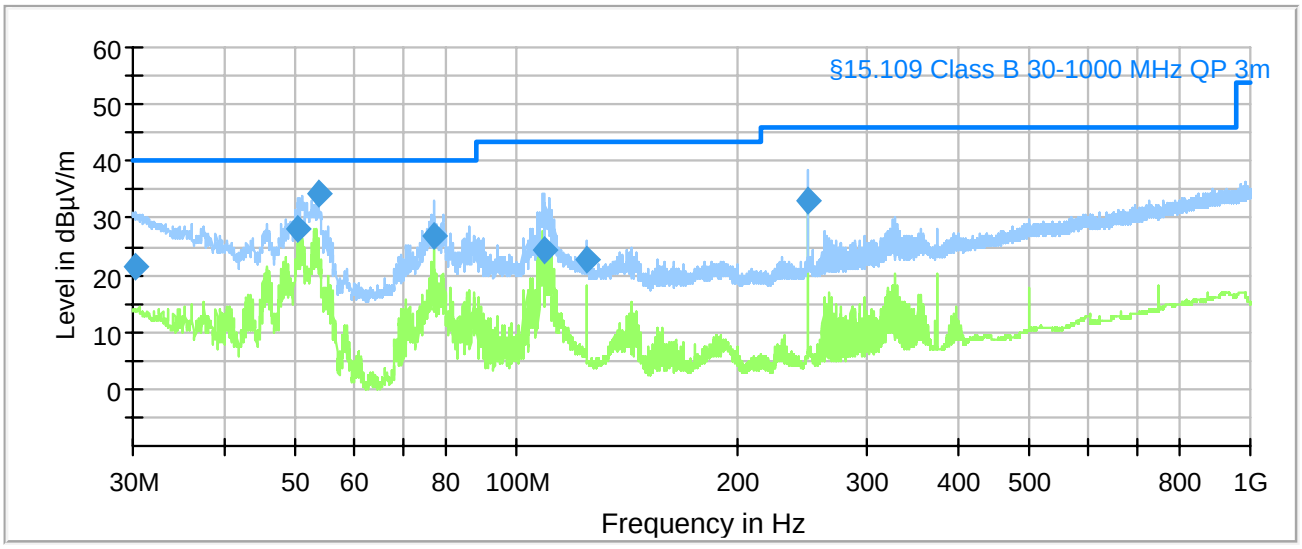
The results of the standard subsequent measurement in a semi-anechoic chamber are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Frequency in MHz	QuasiPeak in dB(µV/m)	FCC Limit in dB(µV/m)	Margin in dB	ISED Limit in dB(µV/m)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Height in cm	Pol	Azimuth in deg	Raw Rec (dBµV)	Corr. in dB
38.960	33.03	40.0	7.0	40.0	7.0	1000	120.000	110.0	V	100	12.3	20.7
51.820	34.55	40.0	5.5	40.0	5.5	1000	120.000	149.0	V	-15	21.6	13.0
53.570	36.34	40.0	3.7	40.0	3.7	1000	120.000	122.0	V	-20	23.9	12.4
94.380	37.71	43.5	5.8	43.5	5.8	1000	120.000	100.0	V	166	20.6	17.1
98.420	38.69	43.5	4.8	43.5	4.8	1000	120.000	106.0	V	68	21.5	17.2
138.390	32.60	43.5	10.9	43.5	10.9	1000	120.000	200.0	H	271	16.4	16.2
250.000	32.45	46.0	13.6	47.0	14.6	1000	120.000	135.0	H	116	15.1	17.3
375.010	28.29	46.0	17.7	47.0	18.7	1000	120.000	104.0	H	141	7.0	21.3

434.030	30.12	46.0	15.9	47.0	16.9	1000	120.000	141.0	V	92	7.5	22.6

Measurement uncertainty ±5.12 dB

Results for EUT 1 with Connector board 2



Frequency in MHz	QuasiPeak in dB(µV/m)	FCC Limit in dB(µV/m)	Margin in dB	ISED Limit in dB(µV/m)	Margin in dB	Meas. Time in ms	Bandwidth in kHz	Height in cm	Pol	Azimuth in deg	Raw Rec (dBµV)	Corr. in dB
30.250	21.61	40.0	18.4	40.0	18.4	1000	120.000	100.0	V	248	-4.2	25.8
50.470	27.93	40.0	12.1	40.0	12.1	1000	120.000	142.0	V	202	14.3	13.6
53.560	34.20	40.0	5.8	40.0	5.8	1000	120.000	120.0	V	293	21.8	12.4
77.200	26.84	40.0	13.2	40.0	13.2	1000	120.000	115.0	V	162	10.8	16.0
108.800	24.49	43.5	19.0	43.5	19.0	1000	120.000	100.0	V	167	6.8	17.7
125.000	22.77	43.5	20.8	43.5	20.8	1000	120.000	100.0	V	202	5.5	17.2
249.960	32.99	46.0	13.0	47.0	14	1000	120.000	104.0	H	252	15.7	17.3

Measurement uncertainty ±5.12 dB

Test result: Passed

The correction factor was calculated as follows:
Corr. (dB) = cable attenuation (dB) + 6 dB attenuator (dB) + antenna factor (dB)

Therefore, the reading can be calculated as follows:
Reading (dBµV/m) = result QuasiPeak (dBµV/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)
3-4, 6-12, 20-22

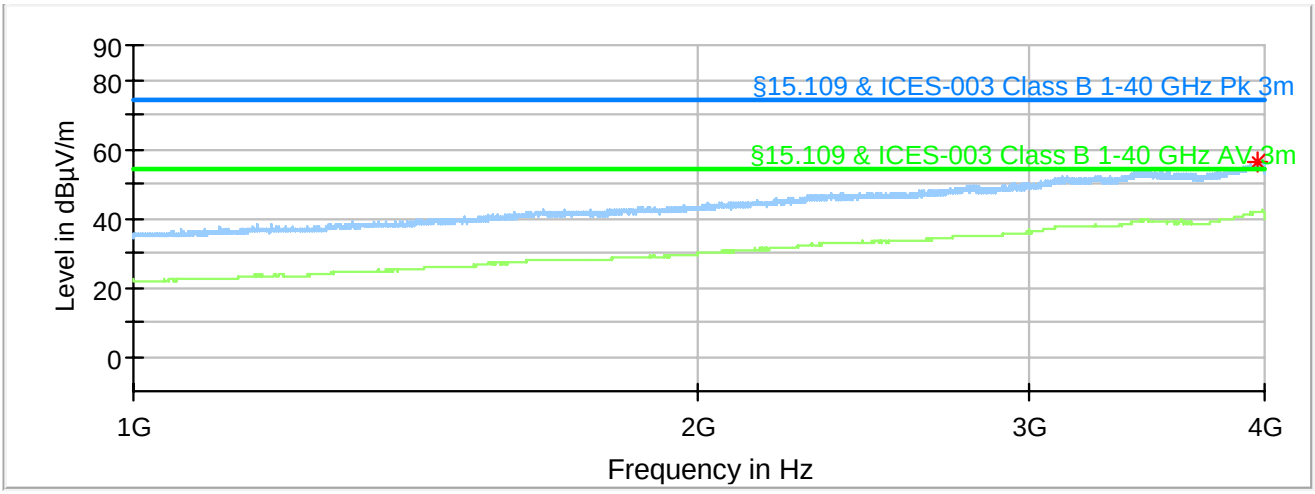
4.2.3 Test results final measurement above 1 GHz

Ambient temperature:	25 °C
Relative humidity:	68 %

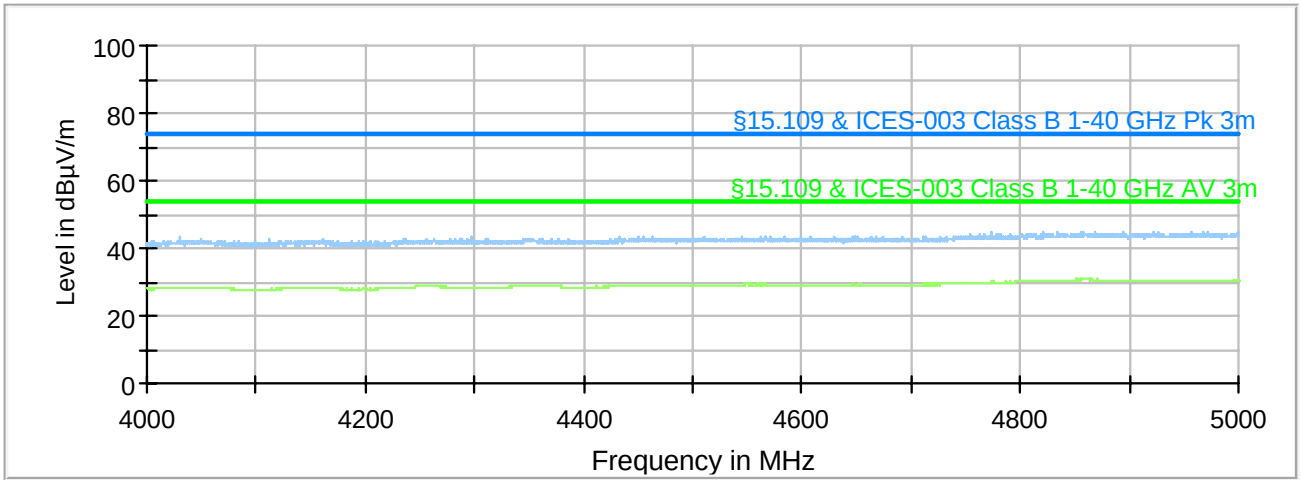
Date:	18.06.2021
Tested by:	Y. KHALEK

The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with various EUT and antenna positions.
The top measured curve represents the peak measurement. The measured points marked with "◆" are frequency points for the final peak detector measurement. These values are indicated in the following table. The bottom measured curve represents the average measurement. The measured points marked with "◆" are frequency points for the final average detector measurement.

Worst case Results for EUT 1 with Connector board 1



Test results from 1 GHz to 4 GHz



Test results from 4 GHz to 5 GHz

The results of the standard subsequent measurement above 1 GHz in a semi-anechoic chamber are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while

taking account of the specified requirements for a 3 m measuring distance.

Frequency in MHz	MaxPeak in dB(µV/m)	Average in dB(µV/m)	Limit in dB(µV/m)	Margin in dB	Meas. Time in ms	Bandwidth in MHz	Height in cm	Pol	Azimuth in deg	Corr. in dB
-										
-										

Measurement uncertainty ±5.14 dB

Test result: Passed

The correction factor was calculated as follows:
Corr. (dB) = cable attenuation (dB) + preamplifier (dB) + antenna factor (dB)

Therefore, the reading can be calculated as follows:
Reading (dBµV/m) = result Peak or Average (dBµV/m) - Corr. (dB)

Test equipment (please refer to chapter 6 for details)
1-2, 6-12, 15, 20-22

5 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Low Noise Amplifier 100 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	18.02.2020	02.2022
2	Log.-Per. antenna	HL050	Rohde & Schwarz	100908	482977	13.08.2019	08.2022
3	Attenuator 6 dB	WA2-6	Weinschel	-	482793	Calibration not necessary	
4	Ultralog Antenna	HL562E	Rohde & Schwarz	101079	482978	18.03.2021	03.2024
5	loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	25.02.2021	02.2022
6	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
7	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
8	EMI Testreceiver	ESW44	Rohde & Schwarz	101828	482979	14.11.2019	11.2021
9	RF Switch Matrix	OSP220	Rohde & Schwarz	-	482976	Calibration not necessary	
10	Systemsoftware EMC32 M276	EMC32	Rohde & Schwarz	100970	482972	Calibration not necessary	
11	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
12	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
13	test fixture	For RF 50 Ohm-System	PHOENIX TESTLAB GmbH	-	410160	Calibration not necessary	
14	Signal & Spectrum Analyzer	FSW43	Rohde & Schwarz	100586 & 100926	481720	30.03.2021	03.2023
15	Highpassfilter 1 GHz	WHKX12-935-1000-15000-40ST	Wainwright Instruments GmbH	12	482908	Calibration not necessary	
16	Shielded chamber M155	SK3	Albatross Projects		482786	Calibration not necessary	
17	System software EMC32	EMC32	Rohde & Schwarz	100619	483182	Calibration not necessary	
18	Test receiver	ESR7	Rohde & Schwarz	101939	482558	18.02.2020	02.2022
19	LISN	NSLK8128RC	Rohde & Schwarz	0412	483186	Calibration not necessary	
20	Software	Software	Spitzenberger & Spies		480114	Calibration not necessary	
21	EMC test system	EMC D 30000 / PAS	Spitzenberger & Spies	A4507 00/1 1110	481301	Calibration not necessary	
22	Control unit	SyCore 1k4	Spitzenberger & Spies	A4507 12/0 1110	481302	21.09.2020	09.2022

6 Test site Validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA/RSM	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	03.03.2021	02.03.2023
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	25.02.2021	24.02.2023

7 Report History

Report Number	Date	Comment
F210823E2	05.07.2021	Initial Test Report
-	-	-
-	-	-

8 List of Annexes

Annex A	Test Setup Photos	6 pages
Annex B	EUT External Photos	3 pages
Annex C	EUT Internal Photos	2 pages