

Test Report

Report Number:

F241004E14, 2nd version

Equipment under Test (EUT):

Steering unit for welding inverters

Einschub TPS/i Touch G3

Applicant:

Fronius International GmbH

Manufacturer:

Fronius International GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **ANSI C63.4-2014+C63.4a-2017** 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 as stated in clause 10.2.8.2 of ANSI C63.4 (2014). However, the measurement uncertainty is calculated and shown in this test report.

Tested by:

Signature

Written by:

Signature

Reviewed and
approved by:

Signature

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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	5
1.1 Applicant.....	5
1.2 Manufacturer	5
1.3 Test Laboratory	5
1.4 EUT (Equipment under Test)	6
1.5 Technical Data of Equipment	7
1.6 Dates	8
2 Operational States	9
3 Additional Information	9
4 Overview.....	10
5 Results.....	11
5.1 Test setups	11
5.2 Radiated emissions	16
5.3 AC power-line conducted emissions	23
6 Measurement Uncertainties	25
7 Test Equipment used for Tests	26
8 Test site Verification.....	26
9 Report History.....	26
10 List of Annexes	27

1 Identification

1.1 Applicant

Name:	Fronius International GmbH
Address:	Günter-Fronius-Straße 1, 4600 Wels-Thalheim
Country:	Austria
Name for contact purposes:	Mr. Jan HERNDLER
Phone:	+43-7242-241-0
eMail address:	herndler.jan@fronius.com
Applicant represented during the test by the following person:	---

1.2 Manufacturer

Name:	Fronius International GmbH
Address:	Günter-Fronius-Straße 1, 4600 Wels-Thalheim
Country:	Austria
Name for contact purposes:	Mr. Jan HERNDLER
Phone:	+43-7242-241-0
eMail address:	herndler.jan@fronius.com
Manufacturer represented during the test by the following person:	---

1.3 Test Laboratory

The tests were carried out by: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by *Deutsche Akkreditierungsstelle GmbH (DAkkS)* according to DIN EN ISO/IEC 17025:2018. The accreditation is only valid for the scope of accreditation listed in the annex of the certificate D-PL-17186-01-00. 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: *	Steering unit for welding inverters
Model name: *	Einschub TPS/i Touch G3
Model number: *	43,0001,1785
Order number: *	-
FCC ID: *	QKWMCU3
IC certification number: *	12270A-MCU3
PMN: *	Einschub TPS/i Touch G3
HVIN: *	V0.3B
FVIN: *	N/A

	EUT number		
	1	2	3
Serial number: *	N/A (MCU 3 EMV Sample 1)	N/A (MCU 3 Radio Sample 4)	-
PCB identifier: *	MCU3	MCU3	-
Hardware version: *	V0.3B	V0.3B	-
Software version: *	V4.3.3946	V4.3.10	-

* Declared by the applicant

2 EUTs were used for the tests. In the overview (chapter 4) is shown which EUT was used for each test case.

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: *	DC		
Supply voltage EUT: *	$U_{nom} = 24 \text{ V}_{DC}$	$U_{min} = 21.6 \text{ V}_{DC}$	$U_{max} = 26.4 \text{ V}_{DC}$
Temperature range: *	-10 °C to +65 °C		
Lowest / highest internal frequency: *	20 kHz / 2480 MHz		

* Declared by the applicant

WLAN part			
Fulfil WLAN specification: *	IEEE 802.11™ (b/g/n-HT20/ax-HE20)		
Operating frequency range: *	2412 to 2462 MHz		
Number of channels: *	11		
Type of modulation: *	IEEE 802.11 b: DSSS (1Mbps DBPSK, 2Mbps DQPSK, 5.5/11Mbps CCK) IEEE 802.11 g: OFDM (6/9Mbps BPSK, 12/18Mbps QPSK, 24/36Mbps 16-QAM, 48/54Mbps 64-QAM) IEEE 802.11n (HT20): OFDM (BPSK, QPSK, 16-QAM, 64-QAM) IEEE 802.11ax (HE20): OFDM (BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM)		
Supply voltage module: *	$U_{nom} = 3.3 \text{ VDC}$	$U_{min} = 3.14 \text{ VDC}$	$U_{max} = 3.46 \text{ VDC}$
Antenna type: *	Dipole antenna		
Antenna name: *	TAOGLAS FXP831.07.0100C		
Antenna gain: *	Peak: 3.28 dBi		
Antenna connector: *	U.FL		

* Declared by the applicant

Bluetooth part			
Fulfil Bluetooth specification: *	Bluetooth Low Energy (BLE) 5.3		
Operating frequency range: *	2402 to 2480 MHz		
Number of channels: *	BLE: 40		
Type of modulation: *	GFSK (1 Mbit/s; 2 Mbit/s; 500 kbit/s; 125 kbit/s)		
Supply voltage module: *	$U_{nom} = 3.3 \text{ VDC}$	$U_{min} = 3.14 \text{ VDC}$	$U_{max} = 3.46 \text{ VDC}$
Antenna type: *	Dipole antenna		
Antenna name: *	TAOGLAS FXP831.07.0100C		
Antenna gain: *	Peak: 3.28 dBi		
Antenna connector: *	U.FL		

* Declared by the applicant

RFID part	
Operating frequency: *	13.56 MHz
Number of channels: *	N/A
Type of modulation: *	ISO 14443A/B, ISO15693, ISO18092, NFCIP-2
Data rate: *	106-848 kbps
Antenna type: *	PCB antenna
Antenna connector: *	PCB connector

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
DC mains	Customized	4 mm laboratory plug	≥ 3 m	No
Ethernet *	HSD	RJ45	≥ 3 m	Yes (CAT6)
Speednet *	HSD	RJ45	-	Yes (CAT6)
USB *	USB-A	-	-	Yes

* Declared by the applicant

Equipment used for testing	
Laptop* ¹	Fujitsu Lifebook U Series
-	-

*¹ Provided by the applicant

1.6 Dates

Date of receipt of test sample:	02.12.2024
Start of test:	23.12.2024
End of test:	06.02.2025

2 Operational States

Description of function of the EUT:

The EUT is a steering unit for welding inverters.
 Bluetooth® LE is used for data communication.
 WLAN is used for data communication.
 RFID is used for access control to the EUT
 USB can be used to update FW and shall not be used during normal operation.

The following states were defined as the operating conditions:

The EUT was supplied by 24 V DC during all tests.

WLAN / Bluetooth / RFID were active but in standby mode.

LAN

The performance was tested with an Fping command (Fping_32.exe IP_EUT -c -t 100 -s 65000) which simulates a continuous data load.

USB:

USB-stick was plugged into USB-port of the EUT and data exchange was done.

	Mode 1	Mode 2
WLAN	standby	standby
Bluetooth	standby	standby
RFID	standby	standby
USB	connected	Not connected

The system was setup as follows:



3 Additional Information

The EUT was not labeled as required by FCC / IC.

4 Overview

Conducted emissions FCC 47 CFR Part 15 section 15.107 (a) [3] (Class B) ICES-003 Issue 7 section 3.2.1[4] (Class B)					
Frequency range	Limits		Reference standard	Tested EUT	Status
[MHz]	dB(μV)	Detector			
0.15 – 0.5	66 to 56*	QP	ANSI C63.4 [1]	2	Passed
	56 to 46*	AV			
0.5 - 5	56	QP			
	46	AV			
5 - 30	60	QP			
	50	AV			
*: Decreases with the logarithm of the frequency					

Radiated emissions (Class B) FCC 47 CFR Part 15 section 15.109 (a) [3]							
Frequency range	Limits				Reference standard	Tested EUT	Status
[MHz]	[μV/m]	dB(μV/m)	Detector	Distance			
30 - 88	100	40.0	QP	3m	ANSI C63.4 [1]	1	Passed
88 - 216	150	43.5	QP	3m			
216 - 960	200	46.0	QP	3m			
960 - 1000	500	54.0	QP	3m			
Above 1000	500	54.0	AV	3m			
	5000	74.0	Pk	3m			

Radiated emissions (Class B) ICES-003 Issue 7 section 3.2.2 [4]						
Frequency range	Limits			Reference standard	Tested EUT	Status
[MHz]	[dB(μV/m)]	Detector	Distance			
30 - 88	40.0	QP	3m	ANSI C63.4 [1]	1	Passed
88 - 216	43.5	QP	3m			
216 - 230	46.0	QP	3m			
216 - 960	47.0	QP	3m			
960 - 1000	54.0	QP	3m			
Above 1000	54.0	AV	3m			
	74.0	Pk	3m			

Remark: As declared by the applicant the highest internal clock frequency is 2.48 GHz.
Therefore the radiated emission measurement must be carried out up to 5th of the highest internal clock frequency up to 12.4 GHz, in this case the measurement was carried out up to 13 GHz.

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

5 Results

5.1 Test setups

5.1.1 Radiated: 30 MHz to 1 GHz

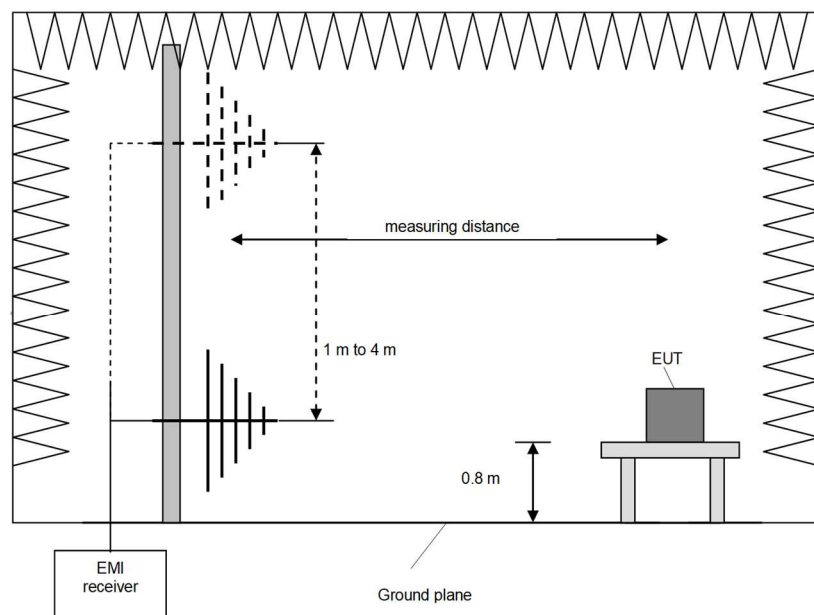
5.1.1.1 Preliminary and final measurement 30 MHz to 1 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber with a metal ground plane at a measuring distance of 3 meters. 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. Floor-standing devices are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

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	Step-size	Resolution bandwidth	Measuring time	Detector
Preliminary measurement	30 MHz to 1 GHz	30 kHz	120 kHz	-	Peak Average
Frequency peak search	± 120 kHz	10 kHz	120 kHz	1 s	Peak
Final measurement	30 MHz to 1 GHz	-	120 kHz	1 s	QuasiPeak



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarization 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 polarization 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 step size 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.

5.1.2 Radiated: 1 GHz to 40 GHz

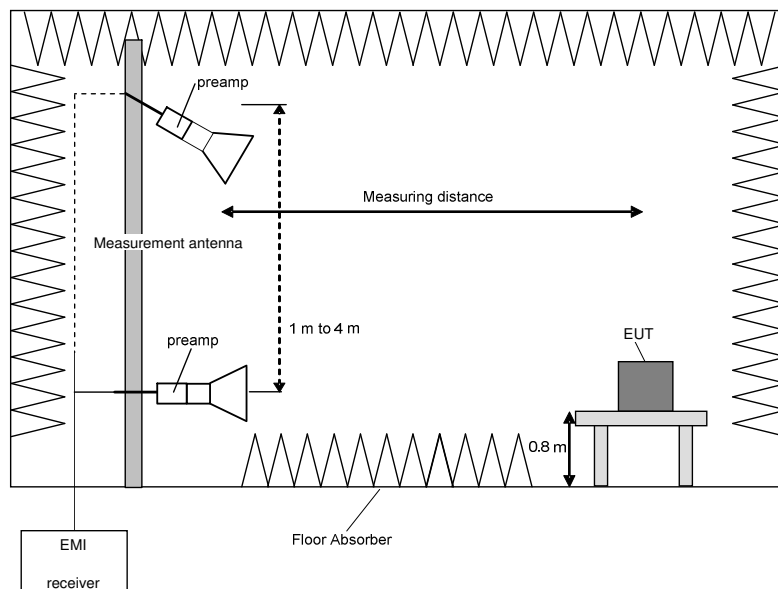
5.1.2.1 Preliminary and final measurement 1 to 13 GHz

The preliminary and final measurements are performed in a semi-anechoic chamber at a measuring distance of 3 meters, with floor absorbers between EUT and measuring antenna. 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. Floor-standing devices are placed directly on the turntable / ground plane. The setup of the equipment under test is in accordance with [1].

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. 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	Step-size	Resolution bandwidth	Measuring time	Detector
Preliminary measurement	1 - 40 GHz	250 kHz	1 MHz	-	Peak Average
Frequency peak search	+ / - 1 MHz	50 kHz	1 MHz	100 ms	Peak
Final measurement	1 - 40 GHz	-	1 MHz	100 ms	Peak Average



Procedure preliminary measurement:

The following procedure is used:

- 1) Set the measuring antenna to 1 m height.
- 2) Monitor the frequency range at horizontal polarization 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 polarization 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:

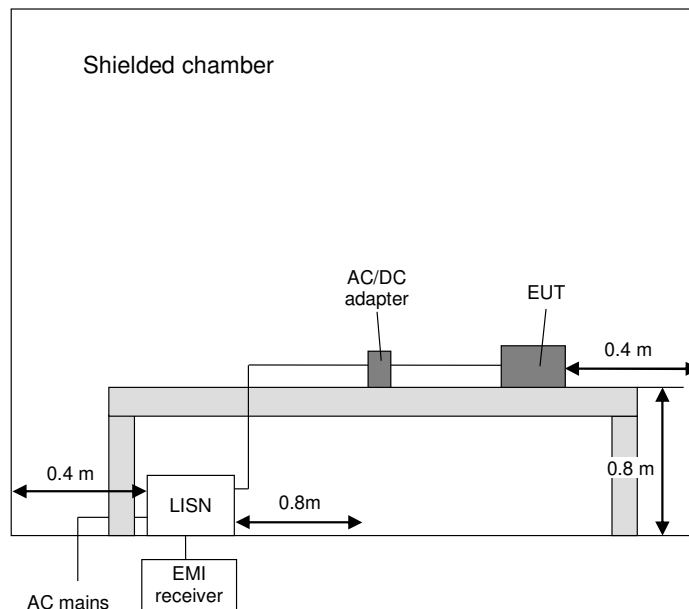
- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case 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.

5.1.3 Conducted: AC power line

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 with [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 appropriate limit are detected, these emissions are measured with an Average and Quasi-Peak detector on all lines.

Frequency range	Resolution bandwidth	Measuring time
150 kHz to 30 MHz	9 kHz	5 s



5.2 Radiated emissions

5.2.1 Test setup (Maximum unwanted emissions)

Test setup (Maximum unwanted emissions)			
Used	Setup	See sub-clause	Comment
☒	Radiated: 30 MHz to 1 GHz / 1 GHz to 40 GHz	5.1.1 / 5.1.2	-

5.2.2 Test method (Maximum unwanted emissions)

☒ Test method (radiated) see sub-clause 5.1.1 / 5.1.2 as described herein

5.2.3 Test results (Maximum unwanted emissions)

5.2.3.1 Test results (30 MHz – 1 GHz)

Ambient temperature:	22 °C
Relative humidity:	22 %

Date:	27.12.2024 30.12.2024
Tested by:	Y. KHALEK

Position of EUT: For tests for f between 30 MHz to 1 GHz, the EUT was set-up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Plots for each frequency range are submitted below.

Remark: Only nominal position was tested
 Mode1: Ethernet and USB connected
 Mode2: Ethernet connected

Calculations:

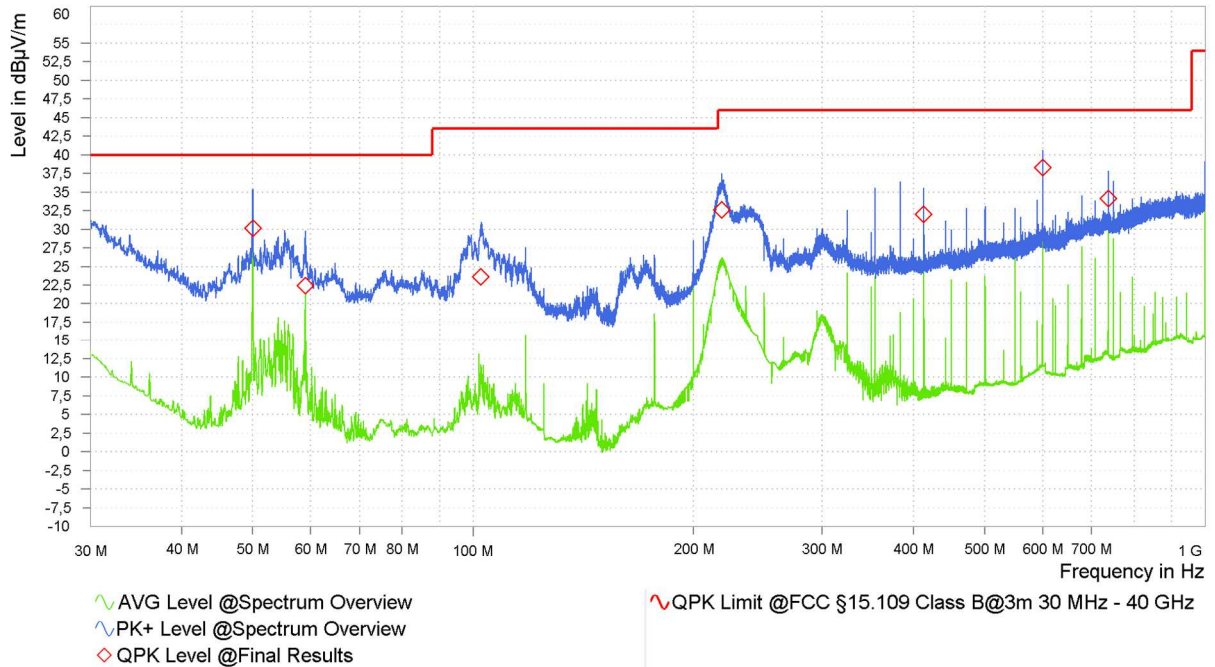
Result [dBμV/m] = Reading [dBμV] + Correction [dB/m]

Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

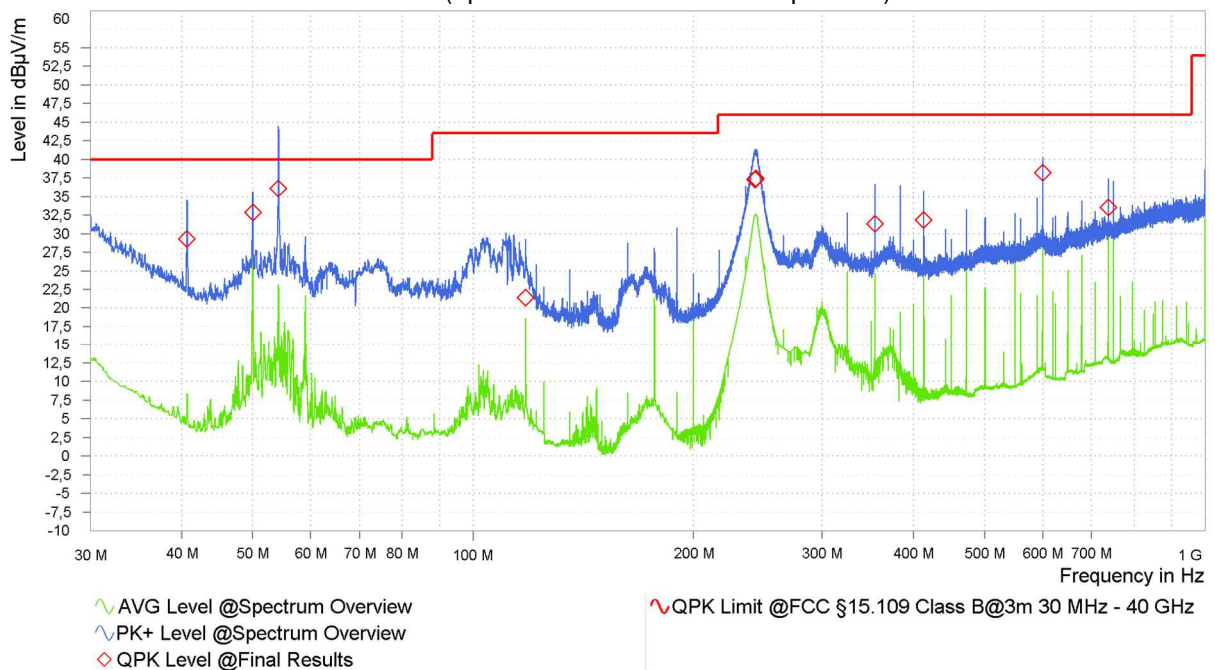
Margin [dB] = Limit [dBμV/m] - Result [dBμV/m]

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.

Spurious emissions from 30 MHz to 1 GHz (operation mode 1 – nominal position):



Spurious emissions from 30 MHz to 1 GHz (operation mode 2 – nominal position):



Result tables:

(Operation mode 1):

Results according to FCC 47 CFR Part 15 section 15.109 (a) [3]

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Readings [dBμV]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol. (H/V)	Position #
40.68	29.3	40.0	10.7	9.4	19.9	1.02	132	V	1
50.01	32.8	40.0	7.2	19.1	13.8	1.03	8	V	1
54.21	36.1	40.0	3.9	23.9	12.2	1.08	132	V	1
117.99	21.4	43.5	22.1	3.9	17.6	1.06	138	V	1
243.06	37.2	46.0	8.8	20.2	17.0	1.03	180	H	1
243.57	37.4	46.0	8.6	20.4	17.0	1.03	184	H	1
354.00	31.3	46.0	14.7	10.7	20.6	1.00	207	H	1
413.01	31.8	46.0	14.2	9.9	21.9	1.01	207	V	1
600.00	38.2	46.0	7.8	12.5	25.8	1.08	190	H	1
737.52	33.5	46.0	12.5	5.8	27.7	1.00	346	V	1

Results according to ICES-003 Issue 7 section 3.2.2 [4]

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Readings [dBμV]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol. (H/V)	Position #
40.68	29.3	40.0	10.7	9.4	19.9	1.02	132	V	1
50.01	32.8	40.0	7.2	19.1	13.8	1.03	8	V	1
54.21	36.1	40.0	3.9	23.9	12.2	1.08	132	V	1
117.99	21.4	43.5	22.1	3.9	17.6	1.06	138	V	1
243.06	37.2	47.0	9.8	20.2	17.0	1.03	180	H	1
243.57	37.4	47.0	9.6	20.4	17.0	1.03	184	H	1
354.00	31.3	47.0	15.7	10.7	20.6	1.00	207	H	1
413.01	31.8	47.0	15.2	9.9	21.9	1.01	207	V	1
600.00	38.2	47.0	8.8	12.5	25.8	1.08	190	H	1
737.52	33.5	47.0	13.5	5.8	27.7	1.00	346	V	1

(Operation mode 2):

Results according to FCC 47 CFR Part 15 section 15.109 (a) [3]

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Readings [dBμV]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol. (H/V)	Position #
50.01	30.2	40.0	9.8	16.4	13.8	1.05	85	V	1
59.01	22.4	40.0	17.6	10.2	12.2	1.69	56	V	1
102.54	23.6	43.5	19.9	6.2	17.4	1.00	180	V	1
218.73	32.6	46.0	13.4	16.7	15.9	1.14	205	H	1
413.01	32.0	46.0	14.0	10.0	21.9	1.07	182	V	1
600.00	38.3	46.0	7.7	12.5	25.8	1.09	197	H	1
737.52	34.2	46.0	11.8	6.4	27.7	1.05	152	H	1

Results according to ICES-003 Issue 7 section 3.2.2 [4]

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Readings [dBμV]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol. (H/V)	Position #
50.01	30.2	40.0	9.8	16.4	13.8	1.05	85	V	1
59.01	22.4	40.0	17.6	10.2	12.2	1.69	56	V	1
102.54	23.6	43.5	19.9	6.2	17.4	1.00	180	V	1
218.73	32.6	46.0	13.4	16.7	15.9	1.14	205	H	1
413.01	32.0	47.0	15.0	10.0	21.9	1.07	182	V	1
600.00	38.3	47.0	8.7	12.5	25.8	1.09	197	H	1
737.52	34.2	47.0	12.8	6.4	27.7	1.05	152	H	1

Test result: Passed

Test equipment (please refer to chapter 7 for details)

3 - 12

5.2.3.2 Test results (radiated 1 to 13 GHz)

Ambient temperature:	22 °C
Relative humidity:	23 %

Date:	27.12.2024
Tested by:	Y. KHALEK

Position of EUT: For tests for f between 1 GHz and the 5th harmonic, the EUT was set-up on a table with a height of 80 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detail information of test set-up and the cable guide refer to the pictures in the annex A in the test report.

Test record: Plots for each frequency range are submitted below.

Remark: Nominal position was tested only

Calculation:

Max Peak [dBμV/m] = Reading [dBμV] + Correction [dB/m]

Average [dBμV/m] = Reading [dBμV] + Correction [dB/m]

Correction [dB/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB] + DCCF* [dB]
* (if applicable – only for Average values, that are fundamental related)

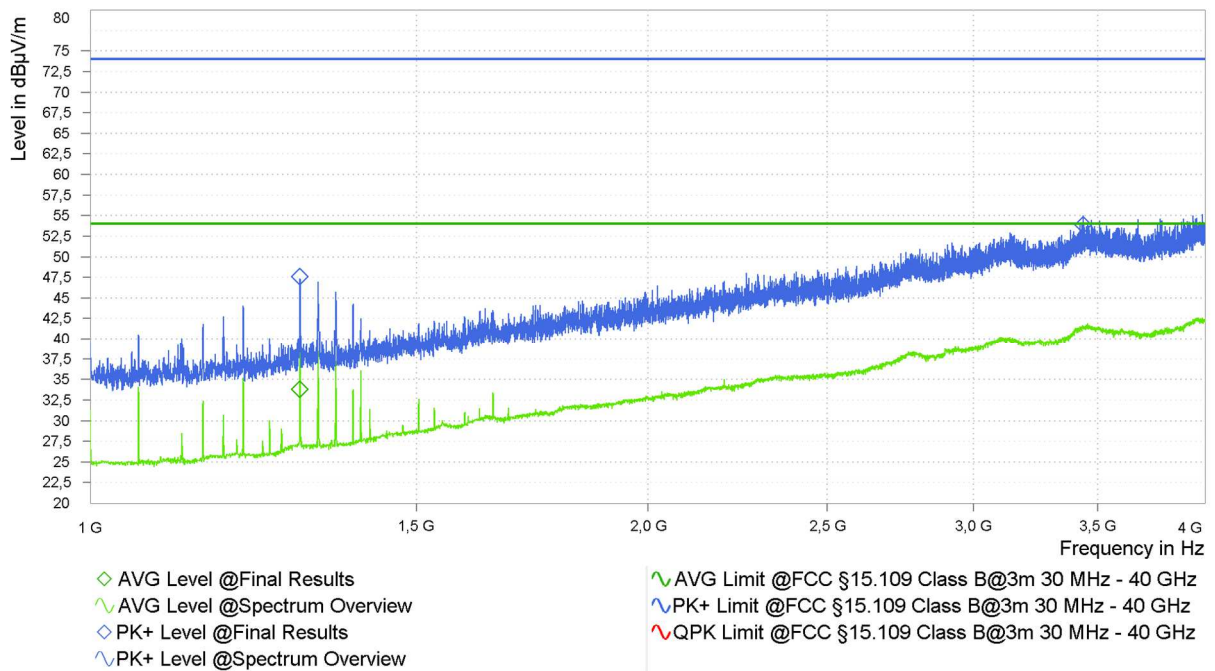
Margin [dB] = Limit [dBμV/m] – Max Peak | Average [dBμV/m]

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.

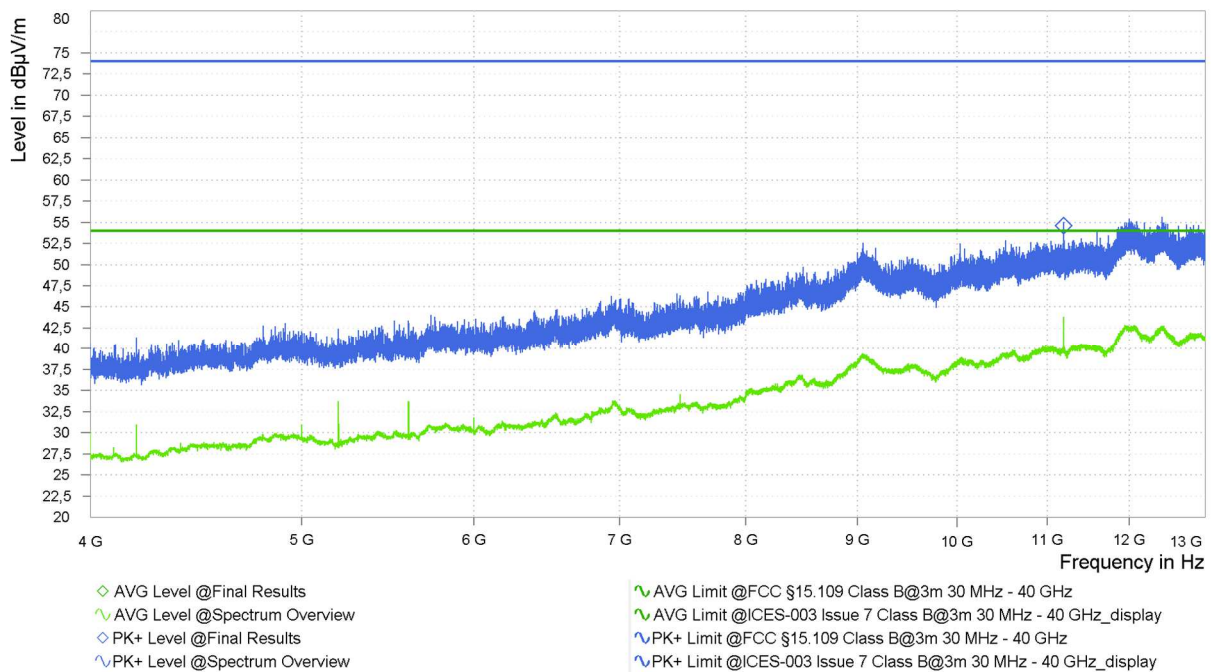
The top measured curve represents the peak measurement. The measured points marked with "♦" are frequency points for the final peak detector measurement. These values are indicated in the following table. The bottom measured curve represents the average measurement. The measured points marked with "◆" are frequency points for the final average detector measurement.

Worst case plots:

Spurious emissions from 1 GHz to 4 GHz (operation mode 1):



Spurious emissions from 4 GHz to 13 GHz (operation mode 1):



Result tables:

Operation mode 1:

Frequency [MHz]	MaxPeak [dB(μV/m)]	Average [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB(μV/m)]	Height [m]	Pol [H/V]	Azimuth [deg]	Corr. [dB]
1298.00	47.6	---	74.0	26.4	1.24	V	186	27.7
1298.00	---	33.8	54.0	20.2	1.00	V	215	27.7
3438.00	53.9	---	74.0	20.1	3.47	V	25	39.4
11195.25	54.6	---	74.0	19.4	1.10	H	199	19.6
12425.50	52.5	---	74.0	21.5	2.57	V	331	21.9

Test result: Passed

Test equipment (please refer to chapter 7 for details)

1 - 2; 5 - 12

5.3 AC power-line conducted emissions

5.3.1 Test setup (Conducted emissions on power supply lines)

Test setup (Conducted emissions on power supply lines)			
Used	Setup	See sub-clause	Comment
☒	Conducted: AC power line	5.1.3	-
☐	Not applicable, because ...	-	-

5.3.2 Test method (Conducted emissions on power supply lines)

Test setup (Conducted emissions on power supply lines)				
Used	Clause [1]	Name of method	Sub-clause	Comment
☒	7.3; 11.5; 11.8	Tabletop equipment testing	5.1.3	Provided AC switching power adaptor
☐	7.3; 11.6; 11.8	Floor-standing equipment testing	-	-

The AC power adaptor provided by the laboratory was used for the tests:

Phoenix Contact MINI-PS-100-240AC/24D/1.3

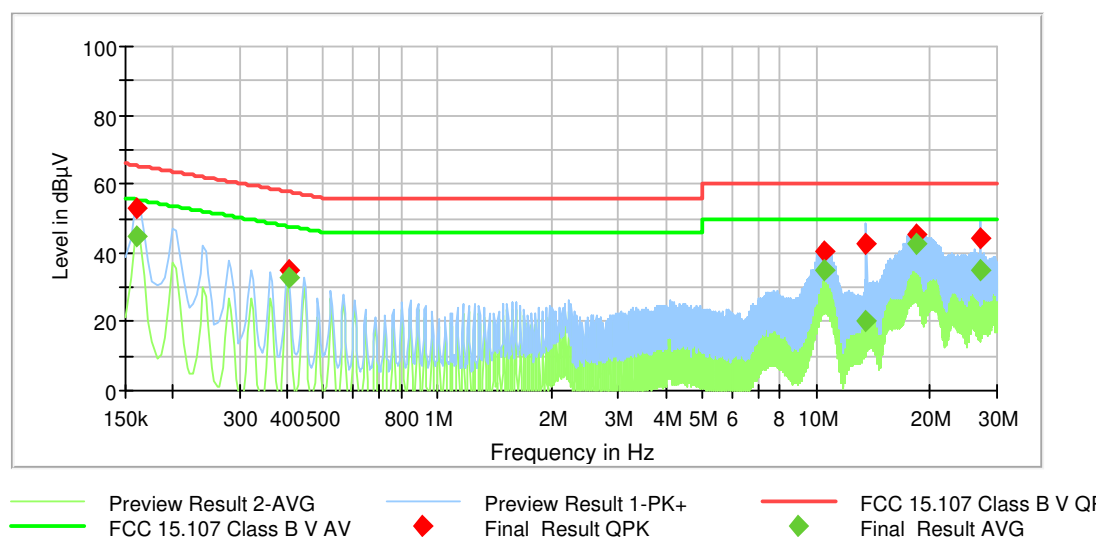
The power adaptor itself was supplied by 120V_{AC} 60Hz.

5.3.3 Test results (Conducted emissions on power supply lines)

Ambient temperature:	22 °C
Relative humidity:	28 %

Date:	06.02.2025
Tested by:	D. BRUSCHINSKI

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 ▼.



Operation mode 2

Frequency [MHz]	QuasiPeak [dB(μV)]	Average [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Line	PE	Corr. [dB]
0.160800	---	44.73	55.42	10.69	N	GND	9.8
0.160800	53.16	---	65.42	12.27	N	GND	9.8
0.402900	---	32.57	47.79	15.22	L1	GND	9.9
0.402900	34.75	---	57.79	23.05	L1	GND	9.9
10.436100	40.69	---	60.00	19.31	L1	GND	10.6
10.436100	---	34.83	50.00	15.17	L1	GND	10.6
13.560000	42.59	---	60.00	17.41	N	GND	10.8
13.560900	---	20.42	50.00	29.58	N	GND	10.8
18.375000	---	42.68	50.00	7.32	N	GND	10.9
18.375900	45.36	---	60.00	14.64	N	GND	10.9
27.118500	---	35.17	50.00	14.83	N	GND	11.2
27.121200	44.33	---	60.00	15.67	L1	GND	11.1

Test result: Passed

Test equipment (please refer to chapter 7 for details)

12 - 17

6 Measurement Uncertainties

Conducted measurements		
Measurement method	Standard used for calculating measurement uncertainty	Expanded measurement uncertainty (95 %) U_{lab}
Conducted emissions from 150 kHz to 30 MHz with LISN	CISPR 16-4-2	2.8 dB

Radiated measurements		
Radiated field strength M276		
R&S HL562E @ 3 m 30 MHz – 1 GHz	CISPR 16-4-2	4.8 dB
R&S HL050 @ 3 m	-	
1 – 6 GHz	CISPR 16-4-2	5.1 dB
6 – 18 GHz	CISPR 16-4-2	5.4 dB
Flann Standard Gain Horns 18 – 40 GHz	-	5.9 dB

7 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Low Noise Amplifier 10 MHz - 18 GHz	LNA-30- 00101800-25- 10P	Narda-Miteq	2110917	482967	20.02.2024	02.2026
2	Log.-Per. antenna 850 MHz - 26.5 GHz	HL050	Rohde & Schwarz	100908	482977	22.09.2022	09.2025
3	Attenuator 6 dB	WA2-6	Weinschel	-	482793	Calibration not necessary	
4	Ultralog antenna	HL562E	Rohde & Schwarz	101079	482978	24.04.2024	04.2027
5	EMC test software	Elektra V5.10.00	Rohde&Schwarz	--	483755	Calibration not necessary	
6	RF Switch Matrix	OSP220	Rohde & Schwarz	101391	482976	Calibration not necessary	
7	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
8	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
9	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
10	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540- A138-10-0006	483227	Calibration not necessary	
11	EMI receiver / Spectrum analyser	ESW44	Rohde & Schwarz	101828	482979	21.02.2024	02.2026
12	AC power supply	AC6803A AC Quelle 2000VA	Keysight	JPVJ002509	482350	Calibration not necessary	
13	LISN	NSLK8128	Schwarzbeck	8128155	480058	28.02.2024	02.2026
14	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
15	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
16	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	22.02.2024	02.2026
17	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	28.03.2024	03.2026

8 Test site Verification

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Shielded chamber M4	480088	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	08.11.2022	07.11.2025
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4-2014 ANSI C63.4a-2017	01.03.2023	28.02.2026
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	28.02.2023	27.02.2026

9 Report History

Report Number	Date	Comment
F241004E14	09.05.2025	Initial Test Report
F241004E14, 2 nd version	01.10.2025	p.2: Reference [1] corrected
-	-	-

10 List of Annexes

Annex A	Test Setup Photos	4 pages
24-111004_External_Photos	EUT External Photos	5 pages
24-111004_Internal_Photos	EUT Internal Photos	4 pages

----- end of test report -----