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Applicant:

BlueQ Services GmbH
Holterhöfe 15
47877 Willich
Tel.: +49 151 5077 5488

Test report no.:

240410-AU01+E01

for:

BlueQ Services GmbH
Bluetooth extension board
TST RBA-B

according to:

47 CFR Part 15 Subpart B
ICES-003 Issue 7

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12155-01-00

Accreditation:

FCC test firm accreditation expiration date: 2025-09-19
MRA US-EU, FCC designation number: DE0010
Test firm registration number: 997268
FCC Registration Number (FRN): 0032245045
BNetzA-CAB-02/21-02/7 Valid until 2028-11-26

Recognized until 2025-03-16 by the
Department of Innovation, Science and Economic Development Canada (ISED)
as a recognized testing laboratory
CAB identifier: DE0011
Company number: 3472A

Location of Testing:

Element Materials Technology Straubing GmbH
Tel.: +49 9421 56868-0
Fax: +49 9421 56868-100
Email: info.straubing@element.com
Gustav-Hertz-Straße 35
94315 Straubing, Germany

The technical accuracy is guaranteed through the quality management of
Element Materials Technology Straubing GmbH.

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1 Summary of test results

1.1 Emission

Reference:		47 CFR Part 15 Subpart B / ICES-003 Issue 7			
Environment:		Class B			
Section		*Test*	*Result*	*Note(s)*	*Page*
47 CFR	*ICES-003*				
Part	Clause	Conducted disturbances			
15.107	3.2.1 Table 1	Mains terminals (150 kHz – 30 MHz)	Passed	1	18
Part	Clause	Radiated disturbances			
15.109	3.2.2 Table 2	30 MHz – 1 GHz	Passed	1	25
15.109	3.2.2 Table 3	above 1 GHz	Passed	1	31

Note(s):

1 If the highest frequency of the internal sources of the EUT is below 1.705 MHz, the measurement shall only be made up to 30 MHz.
Between 1.705 MHz and 108 MHz, the measurement shall only be made up to 1 GHz.
Between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz.
Between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz.
Above 1 GHz, the measurement shall be made up to the 5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Straubing, April 1, 2025

Florian Ebner
EMC Test Engineer

Franz Achatz
Department Manager EMC

2 Referenced publications

In this report any reference to publications without stating the issue date explicitly refers to the versions as listed below.

Publication	*Title*
47 CFR Part 2: 10-2023	Code of Federal Regulations Title 47 Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
47 CFR Part 15:10-2023	Code of Federal Regulations Title 47 Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
ANSI C63.4-2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.4a-2017	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz Amendment 1: Test Site Validation
ICES-003 Issue 7 Published: October, 2020	Information Technology Equipment (including Digital Apparatus)

3 Equipment under test (EUT)

3.1 General Information

Product type:	Bluetooth extension board
Model name:	TST RBA-B
Serial number:	N/A
Manufacturer:	FEIG ELECTRONIC GmbH
Hardware version:	FE1218-1-B
Software version:	TST RBA BLE-DTM V01.01
Modifications:	No modifications were carried out during testing.
Sampling:	The samples have been provided by the customer. Therefore, the results apply to the samples as received.
Date of receipt of test item:	05.03.2025
Highest internal frequency:	2480 MHz

3.2 Power Supply

The tested device is intended to be supplied by an AC/DC converter and may be operated in DC distribution networks.

3.2.1 Host device (Notebook)

Power input characteristics:	
Input power type:	AC
Default voltage 1:	120 V 60 Hz
Default voltage 2:	---
Nominal voltage range:	100 V – 240 V
Nominal frequencies:	50 Hz, 60 Hz
Rated current:	≤ 16 A

3.2.2 EUT

Power input characteristics:	
Input power type:	DC
Default voltage 1:	5 V
Default voltage 2:	---
Rated current:	≤ 1 A

3.3 Classification

Classification according to 47 CFR Part 15:

☐ Class A digital device

☒ Class B digital device

Included modular transmitter: (If applicable)	FCC ID: PJMTSTRBA IC: 6633A-TSTRBA

3.4 Equipment modifications

To achieve compliance with the regulations, the following modifications were made by a responsible employee of the manufacturer directly or via appropriate instructions:

No modifications were carried out during testing.

3.5 Photographs

Photographs of the test setups and the EUT are set out in the documents: Annex A and Annex B.

4 Test configuration and mode of operation

4.1 Test configuration

Device	*Type designation*	*Serial or inventory no.*	*Manufacturer*
	EUT		
Bluetooth extension board	TST RBA-B	N/A	FEIG ELECTRONIC GmbH
	Support devices		
Notebook	Latitude 3410	E01551	DELL
AC-adapter for Notebook	LA65NS2-01	CN-0MGJN9-LOC00-06H-0IB8-A09	DELL

Table 1: Devices used for testing

Port	*Classification*	*Cable type*	*Cable length*		*Note(s)*
			used	*maximum*[1]	
Port 1 (Antenna)	Antenna port	Yes	---	---	1
Port 2 (USB)	Signal/control port	No	1.5 m	< 3.0 m	
Note(s): 1. Not used.					

Table 2: Ports of EUT and appropriate cables

4.2 Mode of operation

EUT was tested in following mode(s) of operation:

- BT low energy (local) RX mode

The EUT was connected to a notebook for power supply.
The Notebook was connected to an AC-adapter for charging.

[1] As specified by applicant

5 Supplier’s Declaration of Conformity

5.1 Labeling requirements according to 47 CFR Part 15.19

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Picture 1: FCC Label (example)

5.2 Identification according to 47 CFR Part 2.1074

Devices subject only to Supplier's Declaration of Conformity shall be uniquely identified by the party responsible for marketing or importing the equipment within the United States. However, the identification shall not be of a format which could be confused with the FCC Identifier required on certified equipment. The responsible party shall maintain adequate identification records to facilitate positive identification for each device.

Devices subject to authorization under Supplier's Declaration of Conformity may be labeled with the following logo on a voluntary basis as a visual indication that the product complies with the applicable FCC requirements. The use of the logo on the device does not alleviate the requirement to provide the compliance information required by §2.1077.

Picture 2: FCC logo (example)

5.3 Compliance information according to 47 CFR Part 2.1077

1. If a product must be tested and authorized under Supplier's Declaration of Conformity, a compliance information statement shall be supplied with the product at the time of marketing or importation, containing the following information:

    a. Identification of the product, e.g., name and model number

    b. A compliance statement as applicable, e.g., for devices subject to 47 CFR Part 15 as specified in §15.19(a)(3), that the product complies with the rules (see 5.1)

    c. The identification, by name, address and telephone number or Internet contact information, of the responsible party, as defined in §2.909. The responsible party for Supplier's Declaration of Conformity must be located within the United States.

2. If a product is assembled from modular components (e.g., enclosures, power supplies and CPU boards) that, by themselves, are authorized under a Supplier's Declaration of Conformity and/or a grant of certification, and the assembled product is also subject to authorization under Supplier's Declaration of Conformity but, in accordance with the applicable regulations, does not require additional testing, the product shall be supplied, at the time of marketing or importation, with a compliance information statement containing the following information:

    a. Identification of the assembled product, e.g., name and model number.

    b. Identification of the modular components used in the assembly. A modular component authorized under Supplier's Declaration of Conformity shall be identified as specified in paragraph (1)(a) of this section. A modular component authorized under a grant of certification shall be identified by name and model number (if applicable) along with the FCC Identifier number.

    c. A statement that the product complies with part 15 of the FCC rules (see 5.1).

    d. The identification, by name, address and telephone number or Internet contact information, of the responsible party who assembled the product from modular components, as defined in §2.909. The responsible party for Supplier's Declaration of Conformity must be located within the United States.

    e. Copies of the compliance information statements for each modular component used in the system that is authorized under Supplier's Declaration of Conformity.

3. The compliance information statement shall be included in the user's manual or as a separate sheet. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form. The information may be provided electronically as permitted in 47 CFR Part 2, §2.935.

5.4 Example for Supplier's Declaration of Conformity

Supplier's Declaration of Conformity

Unique Identifier: (*e.g.*, Trade Name, Model Number)

Party issuing Supplier's Declaration of Conformity
ABC Corporation
Street Address
City, State
Postal Code
Country
Telephone number or internet contact information

Responsible Party – U.S. Contact Information
Street Address
City, State
Postal Code
United States
Telephone number or internet contact information

FCC Compliance Statement (for products subject to Part 15)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The Commission does not have a required SDoC format. This is an example only and is provided to illustrate the type of information that may be supplied with the product at the time of marketing or importation for meeting the FCC SDoC requirement.

5.5 Devices using certified modular transmitters[2]

FCC ID: PJMTSTRBA

[2] Must be labelled in addition to 5.1
Additional requirements according to integration manual of certified transmitter can be applicable

5.6 Information to the user for Class A devices to be stated in the user manual according to Part 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

5.7 Information to the user for Class B devices to be stated in the user manual according to Part 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

5.8 Special accessories according to 47 CFR Part 15.27

1. Equipment marketed to a consumer must be capable of complying with the necessary regulations in the configuration in which the equipment is marketed. Where special accessories, such as shielded cables and/or special connectors, are required to enable an unintentional or intentional radiator to comply with the emission limits in this part, the equipment must be marketed with, i.e., shipped and sold with, those special accessories. However, in lieu of shipping or packaging the special accessories with the unintentional or intentional radiator, the responsible party may employ other methods of ensuring that the special accessories are provided to the consumer, without additional charge, at the time of purchase. Information detailing any alternative method used to supply the special accessories shall be included in the application for a grant of equipment authorization or retained in the Supplier's Declaration of Conformity records, as appropriate. The party responsible for the equipment, as detailed in §2.909 of 47 CFR Part 2, shall ensure that these special accessories are provided with the equipment. The instruction manual for such devices shall include appropriate instructions on the first page of the text concerned with the installation of the device that these special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

2. If a device requiring special accessories is installed by or under the supervision of the party marketing the device, it is the responsibility of that party to install the equipment using the special accessories. For equipment requiring professional installation, it is not necessary for the responsible party to market the special accessories with the equipment. However, the need to use the special accessories must be detailed in the instruction manual, and it is the responsibility of the installer to provide and to install the required accessories.

3. Accessory items that can be readily obtained from multiple retail outlets are not considered to be special accessories and are not required to be marketed with the equipment. The manual included with the equipment must specify what additional components or accessories are required to be used in order to ensure compliance with this part, and it is the responsibility of the user to provide and use those components and accessories.

4. The resulting system, including any accessories or components marketed with the equipment, must comply with the regulations.

6 Product labeling according to ICES-003

6.1 Label and Location

Each unit of an ITE model shall bear a label (see below) that represents the manufacturer's or the importer's SDoC with Innovation, Science and Economic Development Canada's ICES-003. This label shall be permanently affixed to the ITE or displayed electronically and its text must be clearly legible. If the dimensions of the device are too small or if it is not practical to place the label on the ITE and electronic labelling has not been implemented, the label shall be, upon agreement with Innovation, Science and Economic Development Canada, placed in a prominent location in the user manual supplied with the ITE. The user manual may be in an electronic format and must be readily available.

Innovation, Science and Economic Development Canada ICES-003 Compliance Label:

CAN ICES-3 (*)/NMB-3(*)[3]

6.2 Devices using certified modular transmitters

IC: 6633A-TSTRBA

[3] * Insert either "A" or "B" but not both to identify the applicable Class of ITE
Additional requirements according to integration manual of certified transmitter can be applicable

7 Test results

This clause gives details about the test results as collected in the summary of test results starting on page 5. For information about measurement uncertainties see clause 9.

The climatic conditions are recorded during the tests. It is ensured that the climatic conditions are within the following ranges:

Ambient temperature	*Ambient humidity*	*Ambient pressure*
15 °C to 35 °C	30 % to 75 %	86 kPa to 106 kPa

7.1 Conducted disturbance at mains terminals

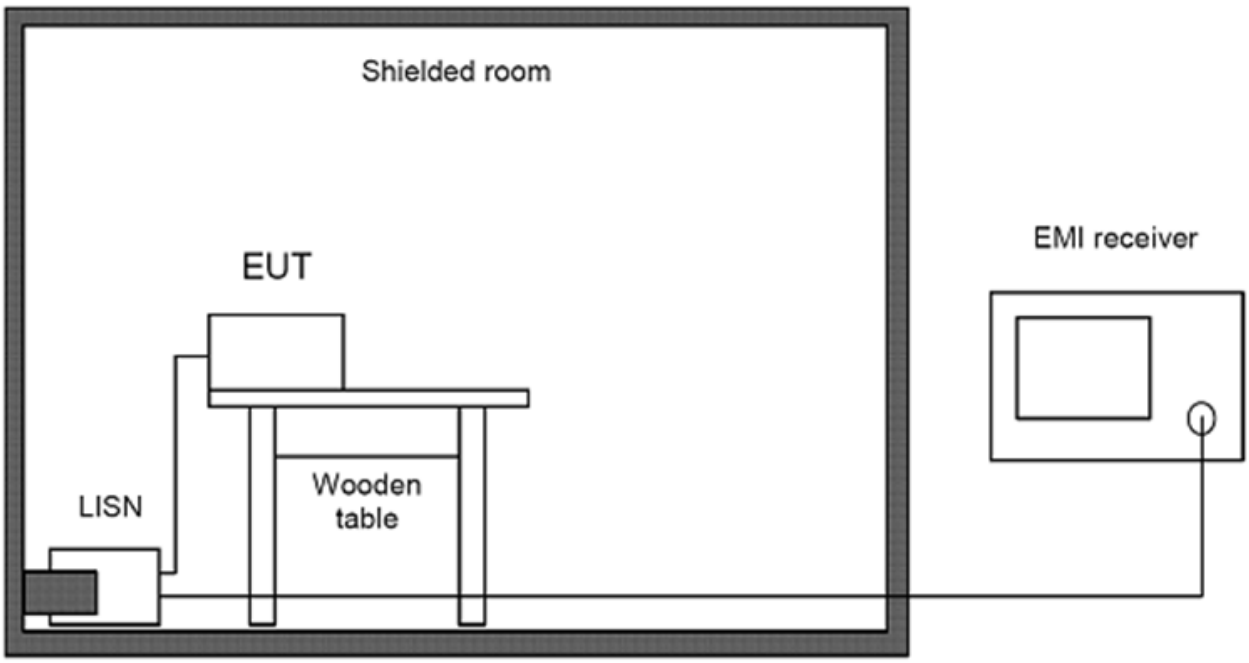
Reference:	47 CFR Part 15.107 / ICES-003 Chapter 3.2.1
Basic standard:	ANSI C63.4

Performed by:	Florian Ebner	Date of test:	March 5, 2025
Result:	☒ Test passed	☐ Test not passed	

7.1.1 Test equipment

Type	*Designation*	*Manufacturer*	*Inventory no.*
Shielded room	P92007	Siemens Matsushita	E00107
Measurement software	EMC 32 Version 10.60.20	Rohde & Schwarz	---
EMI test receiver	ESR 7	Rohde & Schwarz	E01549
Attenuator (10 dB)	HFP 50	Trilithic	E00355
Artificial mains network	ENV432	Rohde & Schwarz	E01733

7.1.2 Test setup



Picture 3: Test setup for conducted emission

Phase	*Frequency (MHz)*	*Reading value (dBµV)*	*AMN correction (dB)*	*Cable attenuation + 10 dB attenuator (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV/m)*
L1	10	10	0.6	10.9	11.5	21.5
N	10	10	1.0	10.9	11.9	21.9

Table 3: Sample calculation

Correction factor = Artifical mains network correction + Cable attenuation + 10 dB

Level = Reading value + Correction factor = 10 dBµV + 11.5 dB = 21.5 dBµV

7.1.3 Test method to demonstrate compliance

The AC power-line conducted emissions test is performed in the following steps:

a) The EUT is arranged as tabletop or floor-standing equipment, as applicable, and connected to a line impedance stabilization network (LISN) with 50 µH / 50 Ω. If required, a second LISN of the same type and terminated by 50 Ω is used for peripheral devices. The EUT is switched on.
b) The measurement equipment is connected to the LISN for the EUT and set-up according to the specifications of the test. At the LISN, the neutral line is selected to be tested.
c) The prescan is performed with both detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescan, but not for final scan.
d) When the prescan is completed, maximum levels with less margin than 10 dB or exceeding the limit are determined and collected in a list.
e) With the first frequency of the list selected, a frequency zoom over a range of ten times of the measurement receiver bandwidth around this frequency is performed. If the EUT has no significant drift in frequency, the frequency zoom can be skipped.
f) For final scan, the emission level is measured and the maximum is recorded.
g) Steps e) to f) are repeated for all other frequencies in the list. At least the six highest EUT emissions relative to the limit have to be recorded.
h) Steps c) to g) are repeated for all current-carrying conductors of all of the power cords of EUT, i.e. all phase and (if used) neutral line(s).

7.1.4 Limits

Class A digital devices		
Frequency [MHz]	Quasi-peak [dBµV]	Average [dBµV]
0.15 – 0.5	79	66
0.5 – 30	73	60

Class B digital devices		
Frequency [MHz]	Quasi-peak [dBµV]	Average [dBµV]
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

7.1.5 Test parameters

Power supply of EUT: (see clause 3.2)	☒ Default voltage 1 ☐ Default voltage 2 ☐ Minimum rated input voltage ☐ Maximum rated input voltage
Operation mode:	See clause 4.2
Frequency range:	150 kHz – 30 MHz
Step size:	4 kHz
IF Bandwidth:	9 kHz
Preamplifier:	No
Prescan detector:	QPK / CAV
Prescan measurement time:	7 s (FFT)
Final scan detector:	QPK / CAV
Final scan measurement time:	1 s

7.1.6 Test results

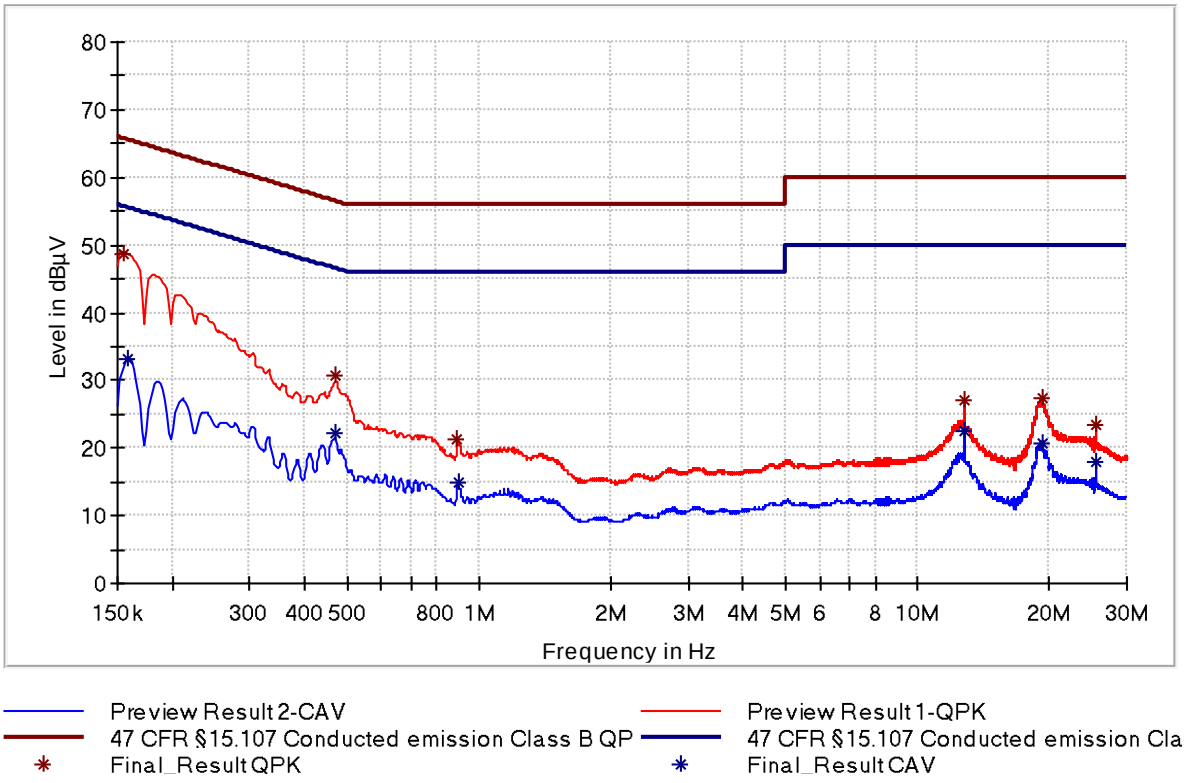


Figure 1: Chart of conducted disturbance test at mains terminals – line conductor (L)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.154500	48.65	---	65.75	17.10	1000.0	9.000	L1	20.3
0.159000	---	33.20	55.52	22.32	1000.0	9.000	L1	20.3
0.469500	---	22.28	46.52	24.24	1000.0	9.000	L1	20.3
0.471750	30.58	---	56.48	25.90	1000.0	9.000	L1	20.3
0.892500	21.32	---	56.00	34.68	1000.0	9.000	L1	20.3
0.894750	---	14.98	46.00	31.02	1000.0	9.000	L1	20.3
12.799500	27.10	---	60.00	32.90	1000.0	9.000	L1	20.9
12.799500	---	22.55	50.00	27.45	1000.0	9.000	L1	20.9
19.187250	27.27	---	60.00	32.73	1000.0	9.000	L1	21.2
19.209750	---	20.68	50.00	29.32	1000.0	9.000	L1	21.2
25.599750	---	18.00	50.00	32.00	1000.0	9.000	L1	21.3
25.599750	23.44	---	60.00	35.56	1000.0	9.000	L1	21.3

Table 4: Final results of conducted disturbance test at mains terminals – line conductor (L)

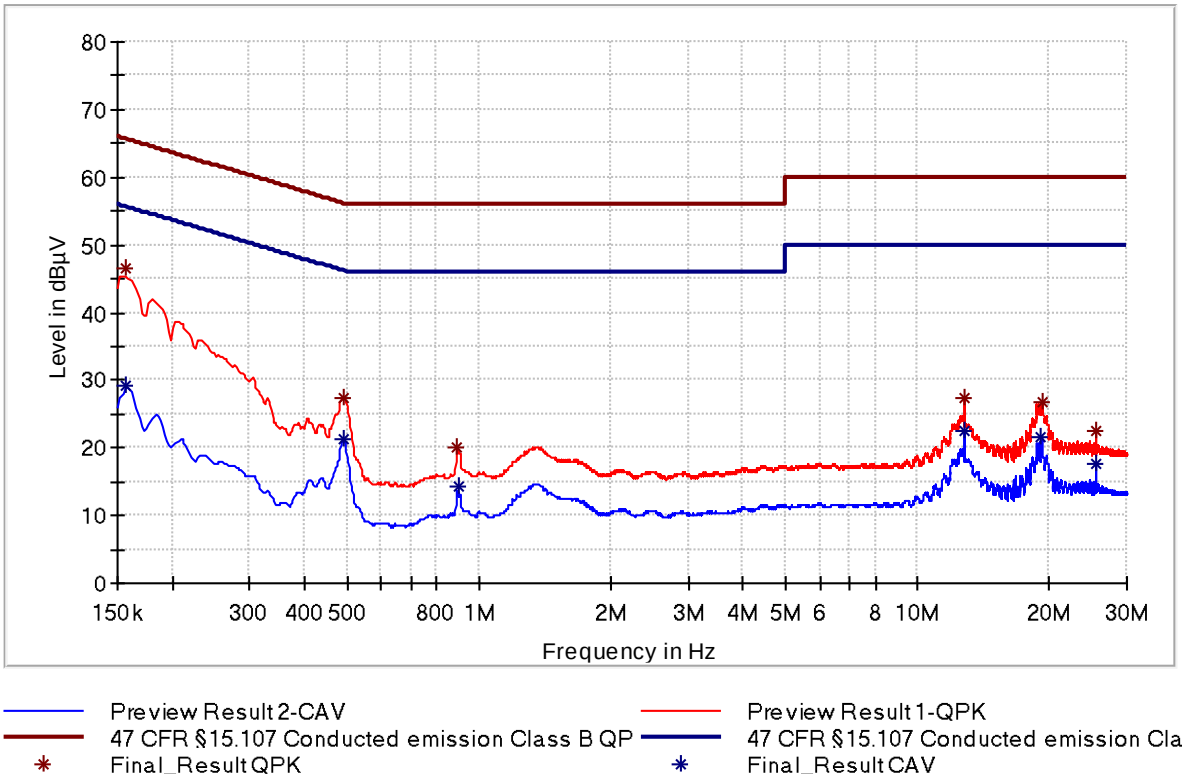


Figure 2: Chart of conducted disturbance test at mains terminals – neutral conductor (N)

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.156750	---	29.15	55.63	26.48	1000.0	9.000	N	20.3
0.156750	46.64	---	65.63	18.99	1000.0	9.000	N	20.3
0.492000	---	21.43	46.13	24.70	1000.0	9.000	N	20.3
0.492000	27.50	---	56.13	28.63	1000.0	9.000	N	20.3
0.892500	20.10	---	56.00	35.90	1000.0	9.000	N	20.3
0.894750	---	14.38	46.00	31.62	1000.0	9.000	N	20.3
12.799500	27.48	---	60.00	32.52	1000.0	9.000	N	21.1
12.799500	---	22.58	50.00	27.42	1000.0	9.000	N	21.1
19.131000	---	21.51	50.00	28.49	1000.0	9.000	N	21.4
19.209750	26.87	---	60.00	33.13	1000.0	9.000	N	21.4
25.599750	---	17.54	50.00	32.46	1000.0	9.000	N	21.7
25.599750	22.52	---	60.00	37.48	1000.0	9.000	N	21.7

Table 5: Final results of conducted disturbance test at mains terminals – neutral conductor (N)

7.2 Radiated disturbance (30 MHz – 1000 MHz)

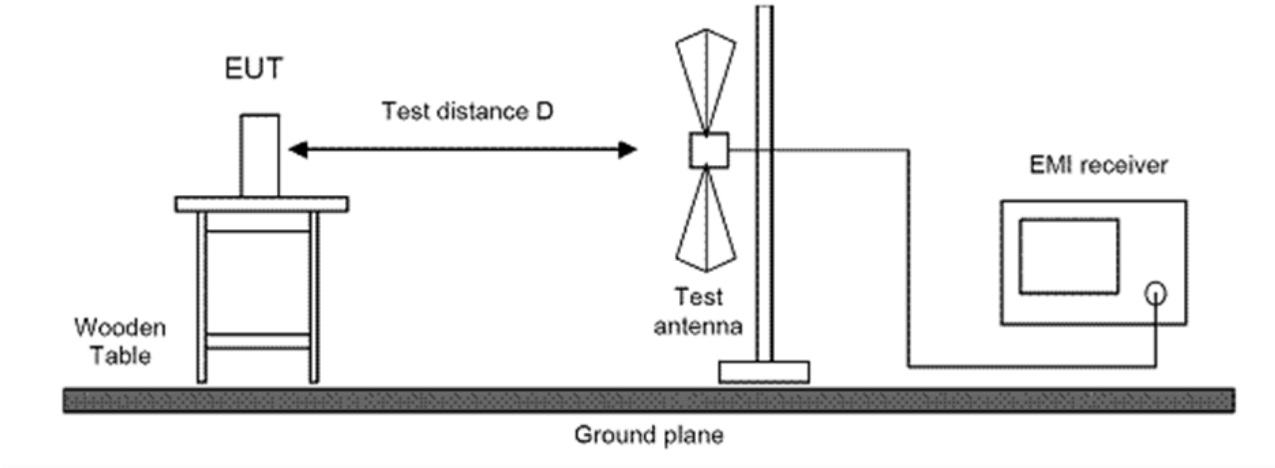
Reference:	47 CFR Part 15.109 / ICES-003 Chapter 3.2.2
Basic standard:	ANSI C63.4

Performed by:	Florian Ebner	Date of test:	March 10, 2025
Result:	☒ Test passed	☐ Test not passed	

7.2.1 Test equipment

Type	*Designation*	*Manufacturer*	*Inventory no.*
Semi Anechoic Chamber (SAC)	SAC3	Albatross Projects	E00716
EMI test receiver	ESR 7	Rohde & Schwarz	E01549
TRILOG broadband antenna (SAC)	VULB 9162	Schwarzbeck	E00643
Measurement software	EMC 32 Version 10.60.20	Rohde & Schwarz	---

7.2.2 Test setup



Picture 4: Test setup of radiated emission (30 MHz – 1000 MHz)

Frequency (MHz)	*Reading value (dBµV)*	*Antenna correction (dB/m)*	*Cable attenuation (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV/m)*
100	30.00	11.71	1.06	12.77	42.77

Table 6: Sample calculation

Correction factor = Antenna correction + Cable attenuation

Level = Reading value + Correction factor = 30 dBµV + 12.77 dB = 42.77 dBµV/m

7.2.3 Test method to demonstrate compliance

The measurement antenna is a combination of a biconical antenna and a logarithmic-periodic dipole array antenna. It is mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarization and in a height between 1 m and 4 m above the ground plane.

If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans.

The radiated emissions test from 30 MHz to 1 GHz is performed in the following steps:

a) The measurement antenna is oriented initially for vertical polarization.
b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
c) The measurement equipment is connected to the measurement antenna and set-up according to the specifications of the test.
d) The table position is set to 0°.
e) The antenna height is set to 1 m.
f) The spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the polarization and height of the measurement antenna as well as the current table position are noted as the maximum position.
g) The antenna height is increased to 4 m in steps of 50 cm. At each height, step f) is repeated.
h) The polarization of the measurement antenna is changed to horizontal.
i) The antenna height is decreased from 4 m to 1 m in steps of 50 cm. At each height, step f) is repeated.
j) The EUT is rotated in a horizontal plane through 360° in steps of 60°. At each table position, steps e) to i) are repeated.
k) After the last prescan, the significant maximum emissions with their polarizations and heights of the measurement antenna as well as their table positions are determined and collected in a list.
l) With the test receiver set to the first frequency of the list, the measurement antenna is set to the polarization and height and the table is moved to the position as determined during prescans.
m) The antenna is moved by ±50 cm around this height and the EUT is rotated by ±60° around this table position while measuring the emission level continuously.
n) For final scan, the worst-case positions of antenna and table are set and the maximum emission level is recorded.
o) Steps l) to n) are repeated for all other frequencies in the list. At least, frequency and level of the six highest emissions relative to the limit have to be recorded. However, emissions more than 20 dB below the limit do not need to be reported.

If the EUT may be used in various positions, steps a) to o) are repeated in two other orthogonal positions.

7.2.4 Limits

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 – 108	1000

Class A digital devices			
Frequency [MHz]	Field strength [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
30 – 88	90	39	10
88 – 216	150	43.5	10
216 – 960	210	46.5	10
Above 960	300	49.5	10

Class A digital devices			
Frequency [MHz]	Field strength [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
30 – 88	300	49.5	3
88 – 216	500	54	3
216 – 960	707	57	3
Above 960	1000	60	3

Class B digital devices			
Frequency [MHz]	Field strength [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
30 – 88	100	40	3
88 – 216	150	43.5	3
216 – 960	200	46	3
Above 960	500	54	3

To calculate the limit for 3 m measurement distance for Class A digital devices the following calculation is used according to Part 15.31.

$$L_{dm} = L_d + (-20\frac{dB}{dec} * (log(dm) - log(d)))$$

Ldm = Limit at the new distance
Ld = Limit according FCC Part 15.109
d = Distance according to FCC Part 15.109
dm = New distance for limit

$$L_{dm} = 39.0\frac{dB\mu V}{m} + (-20\frac{dB}{dec} * (log(3m) - log(10m))) = 49.5dB\frac{dB\mu V}{m}$$

7.2.5 Test parameters

Power supply of EUT: (see clause 3.2)	☒ Default voltage 1 ☐ Default voltage 2 ☐ Minimum rated input voltage ☐ Maximum rated input voltage
Operation mode:	See clause 4.2
Test distance:	3 m
Frequency range:	30 MHz – 1 GHz
Step size:	50 kHz
IF Bandwidth:	120 kHz
Preamplifier:	internal
Prescan detector:	QPK
Prescan measurement time:	1 s (FFT)
Final scan detector:	QPK
Final scan measurement time:	1 s

7.2.6 Test results

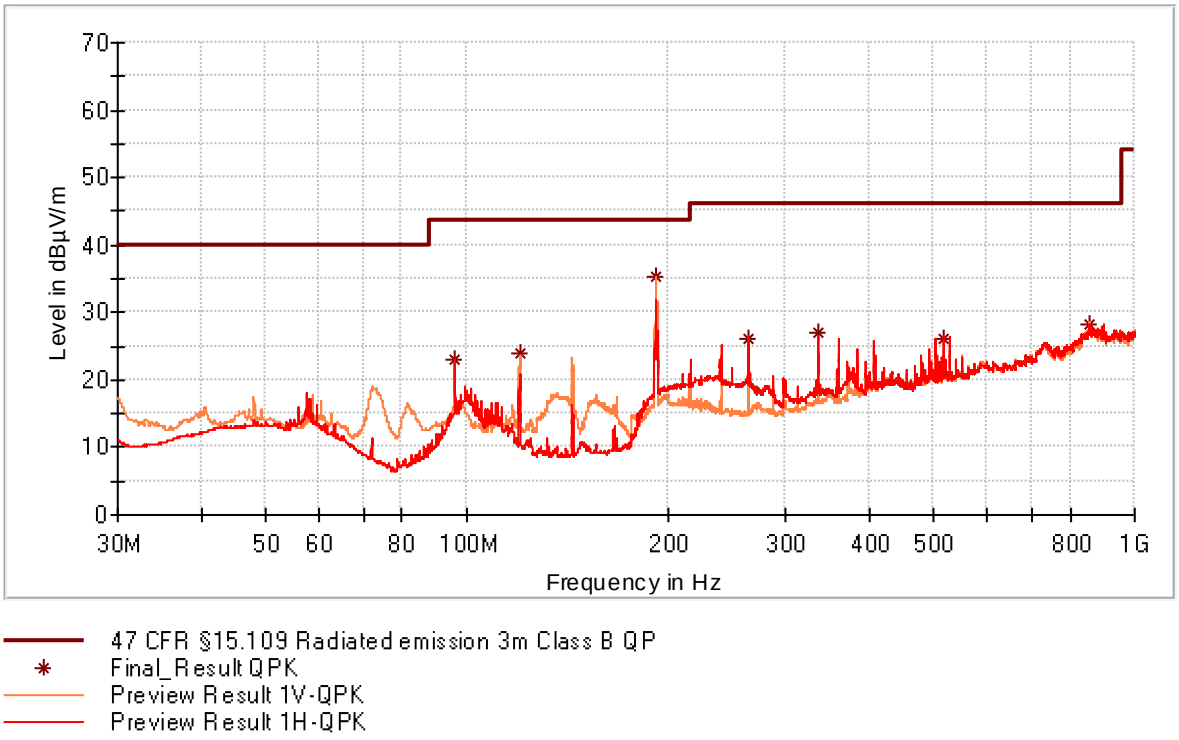


Figure 3: Chart of radiated disturbance test

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
96.000000	23.02	43.50	20.48	1000.0	120.000	380.0	H	0.0	12.3
120.000000	23.82	43.50	19.68	1000.0	120.000	100.0	V	232.0	10.9
192.000000	35.38	43.50	8.12	1000.0	120.000	100.0	V	172.0	12.2
264.030000	26.16	46.00	19.84	1000.0	120.000	113.0	H	318.0	14.5
336.030000	27.08	46.00	18.92	1000.0	120.000	100.0	H	189.0	16.4
516.060000	26.12	46.00	19.88	1000.0	120.000	113.0	H	155.0	19.8
856.320000	28.14	46.00	17.86	1000.0	120.000	158.0	V	292.0	25.3

Table 7: Final results of radiated disturbance test

7.3 Radiated disturbance (above 1 GHz)

Reference: 47 CFR Part 15.109 / ICES-003 Chapter 3.2.2

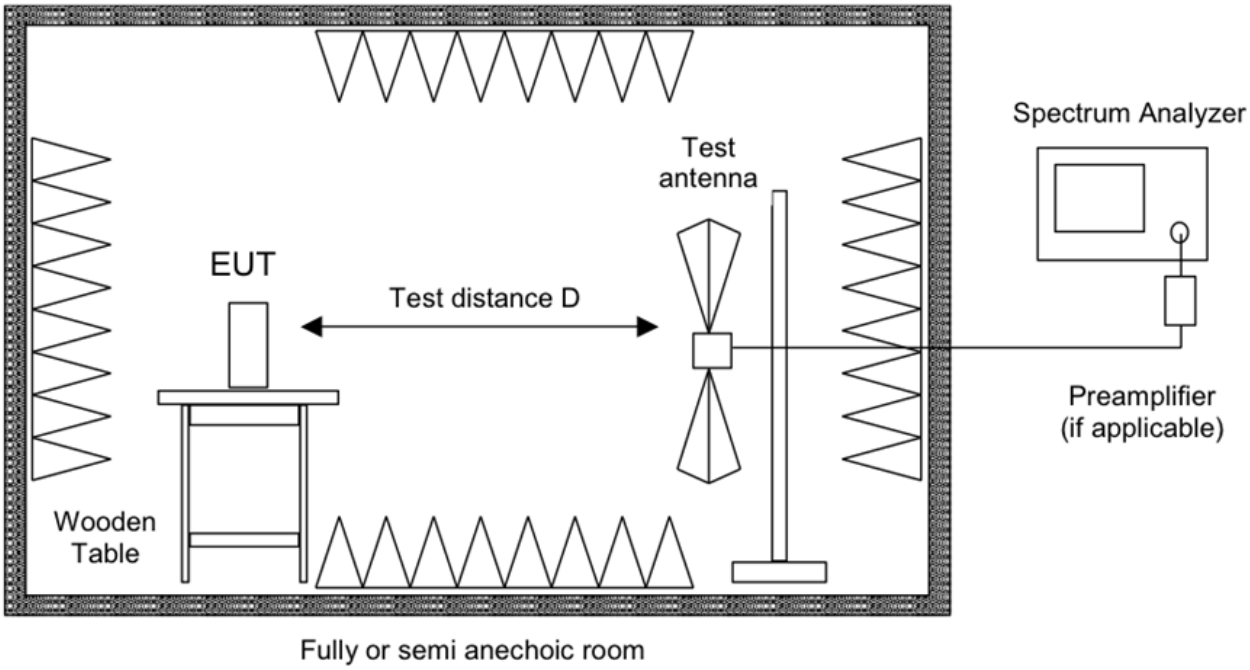
Basic standard: ANSI C63.4

Performed by:	Florian Ebner	Date of test:	March 12, 2025
Result:	☒ Test passed	☐ Test not passed	

7.3.1 Test equipment

Type	*Designation*	*Manufacturer*	*Inventory no.*
Semi Anechoic Chamber (SAC)	SAC3	Albatross Projects	E00716
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
Preamplifier	ALS05749	Aldetec	W01007
Horn antenna	BBHA 9120D	Schwarzbeck	W00053
Measurement software	EMC 32 Version 10.60.20	Rohde & Schwarz	---

7.3.2 Test setup



Picture 5: Test setup of radiated emission (above 1 GHz)

Test chamber	*Frequency (MHz)*	*Reading value (dBµV)*	*Antenna correction (dB/m)*	*Correction pre-amplifier (dB)*	*Cable attenuation (dB)*	*Correction factor (Corr.) (dB)*	*Level (dBµV/m)*
SAC3	2400	50.00	27.76	-47.91	5.24	-14.92	35.08

Table 8: Sample calculation

Correction factor = Antenna correction + Correction pre-amplifier + Cable attenuation

SAC3:
Level = Reading value + Correction factor = 50.00 dBµV - 14.92 dB/m = 35.08 dBµV/m

7.3.3 Test method to demonstrate compliance

1. The EUT is configured according to ANSI C63.4 and placed on top of the turntable 0.8 m above ground. The receiving antenna is placed 3 meters from the turntable. The test setup is placed inside a semi anechoic chamber with floor absorbers between receiving antenna and EUT.
2. Power on the EUT and all peripherals.
3. Exploratory radiated emissions measurements are performed by moving the receiving antenna over all sides of the EUT at a closer distance while observing the display of the test receiver to find the emissions to be re-tested during final radiated emission measurements. As a result a list of frequencies containing position of EUT as well as polarization of receiving antenna is created.
4. If during exploratory radiated emissions measurements no levels to be re-tested are found, the final radiated emissions measurement may be omitted. In this case, the chart of the exploratory radiated emissions measurements has to be reported. (Step 5-9 will not be used)
5. For final radiated emission measurements the receiving antenna is placed 3 meters from the turntable.
6. The receiving antenna is set to vertical polarization.
7. The EMI receiver performs a scan from 1000 MHz to maximal the 5th harmonic of the highest generated or used frequency with the detector set to Peak and Average and the measurement bandwidth set to 1 MHz (VBW ≥ 3 MHz).
8. The turn table is rotated to 12 different positions (360° / 12 = 30°) and the antenna is moved between 1 m and 4 m height. The tilt of the antenna is changed automatically together with the height of the antenna.
9. Polarization is changed to horizontal and steps 7 and 8 are repeated.

7.3.4 Limits

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
108 – 500	2000
500 – 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Class A digital devices			
Frequency [MHz]	Field strength [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
Above 960	300	49.5	10

Class A digital devices			
Frequency [MHz]	Field strength [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
Above 960	1000	60	3

Class B digital devices			
Frequency [MHz]	Field strength [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
Above 960	500	54	3

To calculate the limit for 3 m measurement distance for Class A digital devices the following calculation is used according to Part 15.31.

$$L_{dm} = L_d + (-20\frac{dB}{dec} * (log(dm) - log(d)))$$

Ldm = Limit at the new distance
Ld = Limit according FCC Part 15.109
d = Distance according to FCC Part 15.109
dm = New distance for limit

$$L_{dm} = 49.5\frac{dB\mu V}{m} + (-20\frac{dB}{dec} * (log(3m) - log(10m))) = 60dB\frac{dB\mu V}{m}$$ above 960 MHz

7.3.5 Test parameters

Power supply of EUT: (see clause 3.2)	☒ Default voltage 1 ☐ Default voltage 2 ☐ Minimum rated input voltage ☐ Maximum rated input voltage
Operation mode:	See clause 4.2
Test distance:	3 m
Frequency range:	> 1 GHz
Step size:	500 kHz
IF Bandwidth:	1 MHz
Preamplifier:	external
Prescan detector:	PK / AV
Prescan measurement time:	100 ms (FFT)
Final scan detector:	PK / CAV
Final scan measurement time:	1 s

7.3.6 Test results

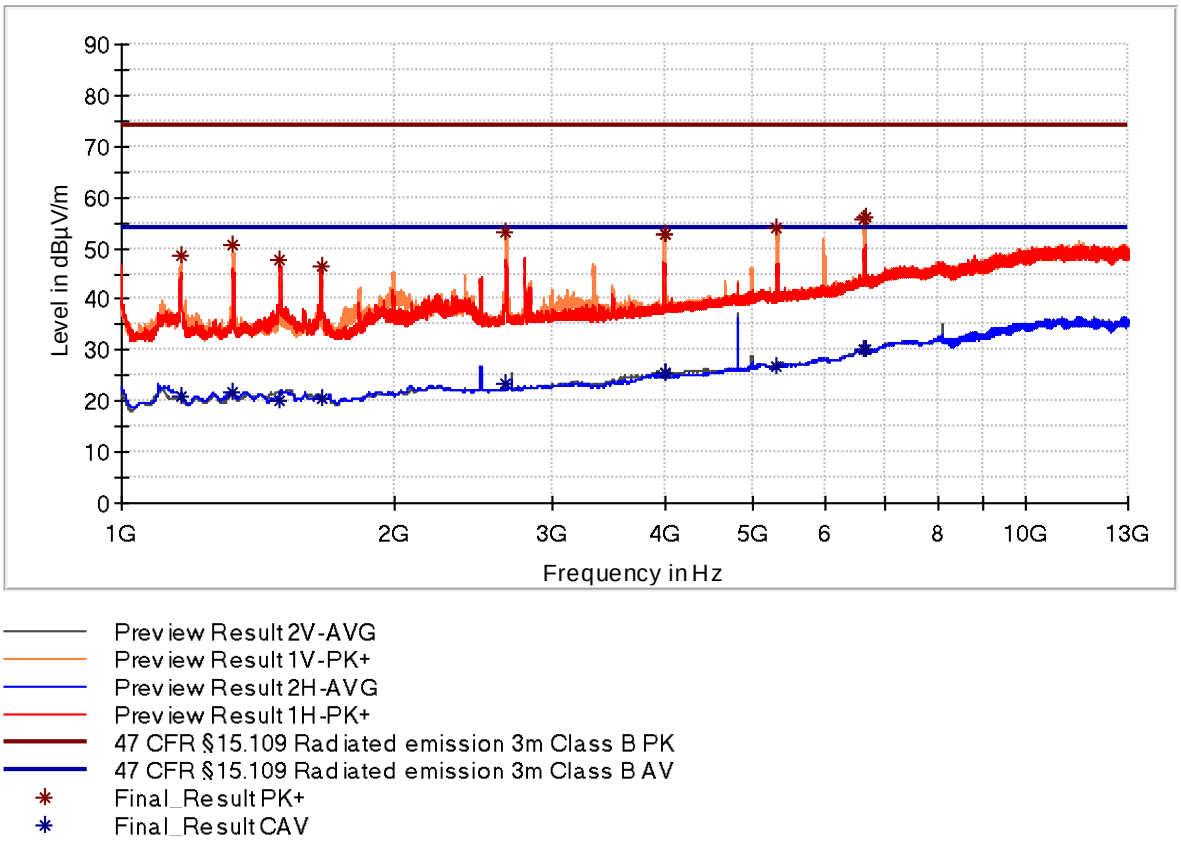


Figure 4: Chart of radiated disturbance test – (1 GHz to 13 GHz)

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol
1163.000000	---	20.99	54.00	33.01	1000.0	1000.000	117.0	V
1163.000000	48.36	---	74.00	25.64	1000.0	1000.000	117.0	V
1328.250000	50.51	---	74.00	23.49	1000.0	1000.000	200.0	V
1328.250000	---	21.81	54.00	32.19	1000.0	1000.000	200.0	V
1494.250000	---	20.30	54.00	33.70	1000.0	1000.000	100.0	H
1494.250000	47.60	---	74.00	26.40	1000.0	1000.000	100.0	H
1662.500000	---	20.36	54.00	33.64	1000.0	1000.000	150.0	H
1662.500000	46.32	---	74.00	27.68	1000.0	1000.000	150.0	H
2663.500000	---	23.38	54.00	30.62	1000.0	1000.000	100.0	V
2663.500000	53.12	---	74.00	20.88	1000.0	1000.000	100.0	V
3988.500000	52.63	---	74.00	21.37	1000.0	1000.000	100.0	V
3988.500000	---	25.62	54.00	28.38	1000.0	1000.000	100.0	V
3995.500000	---	25.59	54.00	28.41	1000.0	1000.000	100.0	V
3995.500000	52.70	---	74.00	21.30	1000.0	1000.000	100.0	V
5308.250000	---	26.63	54.00	27.37	1000.0	1000.000	100.0	V
5308.250000	53.80	---	74.00	20.20	1000.0	1000.000	100.0	V
6640.000000	55.47	---	74.00	18.53	1000.0	1000.000	100.0	V
6640.000000	---	30.04	54.00	23.96	1000.0	1000.000	100.0	V
6666.500000	55.89	---	74.00	18.11	1000.0	1000.000	100.0	V
6666.500000	---	30.13	54.00	23.87	1000.0	1000.000	100.0	V

Table 9: Final results of radiated disturbance test – (1 GHz to 13 GHz)

8 Equipment calibration status

Type	*Designation*	*Last calibration*	*Next calibration*	*Inventory no.*
EMI test receiver	ESR 7	2024-03	2025-03	E00739
EMI test receiver	ESR 7	2024-07	2025-07	E01549
EMI test receiver	ESW 44	2024-11	2025-11	E00895
Artificial mains network	ENV432	2024-11	2025-11	E01733
Attenuator (10 dB)	50FHB-010-10	---[4]	---	E00471
Semi Anechoic Chamber (SAC)	---	2024-02	2027-02	E00716
TRILOG broadband antenna (SAC)	VULB 9162	2024-04	2027-04	E00643
Horn antenna	BBHA 9120D	2022-09	2025-09	W00053
Horn antenna	BBHA 9170	2022-08	2025-08	W00055
Measurement software	EMC 32 Version 10.60.20	N/A	N/A	E00777

[4] Internal verification every year.

9 Measurement uncertainties

Description	*Uncertainty*	U_{Limit}	*k*	*Note(s)*
Conducted emissions on AC mains power ports				
9 kHz to 150 kHz (V-AMN)	± 3.4 dB	± 3.8 dB	2	1a
150 kHz to 30 MHz (V-AMN)	± 3.0 dB	± 3.4 dB	2	1a
9 kHz to 30 MHz (VP)	± 2.3 dB	± 2.9 dB	2	1a
Conducted emissions on telecommunication ports				
150 kHz to 30 MHz (AAN, unscreened balanced)	± 4.6 dB	± 5.0 dB	2	1a
150 kHz to 30 MHz (AAN, unbalanced or screened)	± 3.0 dB	± 5.0 dB	2	1a
150 kHz to 30 MHz (CP/CVP)	± 3.5 dB	± 4.0 dB	2	1a
150 kHz to 30 MHz (CP)	± 2.6 dB	± 2.9 dB	2	1a
Disturbance power				
30 MHz to 300 MHz	± 4.4 dB	± 4.5 dB	2	1a
Radiated emissions				
9 kHz to 30 MHz (loop antenna)	± 3.8 dB	± 4.0 dB	2	1b
9 kHz to 30 MHz (LLAS)	± 2.7 dB	± 3.3 dB	2	1a
30 MHz to 300 MHz (CDNE)	± 3.5 dB	± 3.8 dB	2	1a
30 MHz to 1 GHz (SAC)	± 6.1 dB	± 6.3 dB	2	1a
30 MHz to 1 GHz (FAR)	± 4.6 dB	± 5.3 dB	2	1a
1 GHz to 6 GHz (FAR, FS-SAC)	± 4.6 dB	± 5.2 dB	2	1a
6 GHz to 18 GHz (FAR, FS-SAC)	± 5.0 dB	± 5.5 dB	2	1a
18 GHz to 26.5 GHz (FAR, FS-SAC)	± 5.5 dB	± 6.0 dB	2	1b
26.5 GHz to 40 GHz (FAR, FS-SAC)	± 6.3 dB	± 6.5 dB	2	1b

Remarks:

The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. For a confidence level of 95 % the coverage factor k is 2.

Simple acceptance is applied as the decision rule while keeping the specified limits for the expanded measurement uncertainty (i.e. Test Uncertainty Ratio TUR ≥ 1:1). That means, compliance is based on the recorded level by the lab irrespective of the expanded measurement uncertainty value but with a limitation to it.
For details on simple acceptance and the level of risk (such as false accept, false reject and false statistical assumptions) associated with this decision rule see ISO/IEC Guide 98-4:2012 and ILAC G8:09/2019 “Guidelines on Decision Rules and Statements of Conformity” (“Binary Statement for Simple Acceptance Rule” according to clause 4.2.1).

All used test instruments as well as the test accessories are calibrated at regular intervals

Note(s):

1 The limits U_{Limit} for the measurement uncertainty as listed above are
   a) equal to U_{CISPR} taken from CISPR 16-4-2:2011-06 + A1:2014-02 + A2:2018-08:
      The values of the measurement uncertainty as listed above are equal to or lower than the required ones stated in CISPR 16-4-2 and listed as U_{Limit}. Therefore, the measured value related to the corresponding limit is used to decide whether equipment meets the requirements.
   b) defined by the test laboratory:
      The values of the measurement uncertainty as listed above are calculated according to the requirements for the test method and equal to or lower than the ones listed as U_{Limit}.

10 Revision history

Revision	*Date*	*Issued by*	*Description of modifications*
0	2025-04-01	Florian Ebner	First edition

Template: EMV_FCC Part 15 Version: 3.3

11 Additional documents

☒ Annex A: Pictures of test setup
☒ Annex B: Pictures of EUT (internal / external)
☐ Annex C: Block diagram / Schematics

12 Signature of responsible party

Responsible party