

Test Report

Report Number:

F260475E5

Equipment under Test (EUT):

Capacitive level sensor with LED indicator

Liquicap FMI43-2

Applicant:

Endress+Hauser SE+Co. KG

Manufacturer:

Endress+Hauser SE+Co. KG



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **ANSI C63.10-2020 + Cor. 1-2023 + C63.10a-2024 + Errata to C63.10a-2024***, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
*Remark: This standard is not in the annex of the laboratory yet
- [2] **FCC CFR 47 Part 15**, Radio Frequency Devices
- [3] **558074 D01 15.247 Meas Guidance v05r02 (April 2019)**, GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
- [4] **RSS-247, Issue 4 (2025-07)** Digital Transmission Systems, Frequency Hopping Systems and Licence-Exempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands
- [5] **RSS-Gen, Issue 5 (2018-04) + Amendment 1 (2019-03) + Amendment 2 (2021-02)** General Requirements for Compliance of Radio Apparatus

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 [1]. However, the measurement uncertainty is calculated and shown in this test report.

Tested and
written by:

A blue ink signature of Martin Eppinger.

Martin Eppinger
22.07.2026

Signature

Reviewed and
approved by:

A blue ink signature of Bernward Rohde.

Bernward ROHDE
23.07.2026

Signature

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The test results herein refer only to the tested sample. NMI 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 NMI TESTLAB Logo and the TEST REPORT NUMBER.

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1 Identification

1.1 Applicant

Name:	Endress+Hauser SE+Co. KG
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Country:	Germany
Name for contact purposes:	Mr. Florian SEIDLER
Phone:	+49 7622 28 1450
eMail address:	florian.seidler@endress.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	Endress+Hauser SE+Co. KG
Address:	Hauptstr. 1, 79689 Maulburg
Country:	Germany
Name for contact purposes:	Mr. Florian SEIDLER
Phone:	+49 7622 28 1450
eMail address:	florian.seidler@endress.com
Manufacturer represented during the test by the following person:	-

1.3 Test Laboratory

The tests were carried out by: **NMI TESTLAB GmbH formerly 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: *	Capacitive level sensor with LED indicator
Model name: *	Liquicap
Model number: *	FMI43-2
Order number: *	-
FCC ID: *	LCGFMI43
ISED certification number: *	2519A-FMI43
PMN: *	FMI43
HVIN: *	FMI43-2
FVIN: *	-

* Declared by the applicant

		EUT number		
		1	2	3
Serial number: *		2G0010G9A57	2G0010G9ACU	2G0010G9A81
PCB identifier: *	Mainboard:	71439136	71439136	71439136
	Terminal Board:	71439136	71439136	71439136
	Visualisation Board:	71599585	71599585	71599585
	Sensor Board:	71700041	71700041	71700041
Hardware version: *		01.00.00	01.00.00	01.00.00
Software version: *		S140 V7.2.0 (Soft device)	S140 V7.2.0 (Soft device)	S140 V7.2.0 (Soft device)

* Declared by the applicant

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

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

1.5 Technical Data of Equipment

General EUT data			
Power supply EUT: *	DC		
Supply voltage EUT: *	$U_{\text{nom}} = 24.0 \text{ V}_{\text{DC}}$	$U_{\text{min}} = 12.0 \text{ V}_{\text{DC}}$	$U_{\text{max}} = 30.0 \text{ V}_{\text{DC}}$
Temperature range: *	-40 °C to +85 °C		
Lowest / highest internal frequency: *	11.0592 MHz / 2480 MHz		

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
4-wire I/O link communication & DC *	M12	USB-A	≈ 2 m	No

* Declared by the applicant

Bluetooth® low energy frequencies			
Channel 00	2402 MHz	Channel 01	2404 MHz
Channel 02	2406 MHz	Channel 03	2408 MHz
...	...	...	...
...	...	...	...
Channel 18	2438 MHz	Channel 19	2440 MHz
...	...	...	...
...	...	...	...
Channel 36	2474 MHz	Channel 37	2476 MHz
Channel 38	2478 MHz	Channel 39	2480 MHz

Bluetooth® low energy radio mode			
Fulfilis radio specification: *1	Bluetooth® low energy (BLE) 5.2		
Radio module: *1	Nordic nRF52840 (SoC)		
Antenna type: *1	PCB IFA Antenna		
Antenna name: *1	-		
Antenna gain: *2	-0.2 dBi		
Antenna connector: *1	-		
Supply voltage radio module: *1	$U_{nom} = 3.3 V_{DC}$	$U_{min} = 3.2 V_{DC}$	$U_{max} = 3.4 V_{DC}$
Type of modulation: *1	BLE (1 Mbps PHY)	GFSK	
	BLE (2 Mbps PHY)	GFSK	
	BLE (500 kbps coded PHY)	GFSK	
	BLE (125 kbps coded PHY)	GFSK	
Operating frequency range: *1	BLE (1 Mbps PHY)	2402 – 2480 MHz	
	BLE (2 Mbps PHY)	2402 – 2480 MHz	
	BLE (500 kbps coded PHY)	2402 – 2480 MHz	
	BLE (125 kbps coded PHY)	2402 – 2480 MHz	
Number of channels: *1	BLE (1 Mbps PHY)	40 (2 MHz channel spacing)	
	BLE (2 Mbps PHY)	40 (2 MHz channel spacing)	
	BLE (500 kbps coded PHY)	40 (2 MHz channel spacing)	
	BLE (125 kbps coded PHY)	40 (2 MHz channel spacing)	

*1 Declared by the applicant

*2 Based on antenna report **F260784E2** issued by NMI TESTLAB GmbH

Antenna Gain:

		f_{low}	f_{mid}	f_{high}
Conducted output power [dBm]		6.6	6.8	6.7
Radiated EIRP [dBm]		6.4	5.7	3.3
Antenna Gain [dBi]		-0.2	-1.1	-3.4
Position		3	2	3
Position of maximum gain	Azimuth [°]	12	299	21
	Polarisation	V	V	V

Remark: These measurements are taken from and reported in more detail in the antenna test report **F260784E2** issued by NMI TESTLAB GmbH

1.5.1 Ancillary Equipment / Equipment used for testing

Equipment used for testing	
FTDI adapter: *1	Used for test mode configuration
AC/DC adapter *2	bel HC24-2.4-AG
Laptop *2	Fujitsu LIFEBOOK U748

*1 Provided by the applicant

*2 Provided by the laboratory

1.6 Dates

Date of receipt of test sample:	10.06.2026
Start of test:	18.06.2026
End of test:	21.07.2026

2 Operational States

2.1 Description of function of the EUT

The EUT is a capacitive level sensor for hygienic application with BLE communication and visual LED indicator.

2.1.1 Operation modes

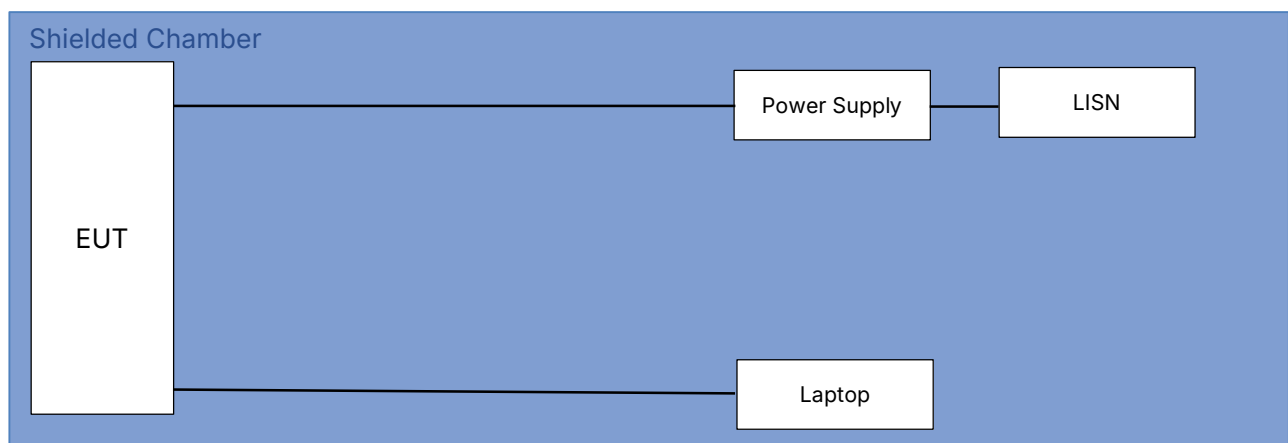
Operation mode	Radio technology	Frequency [MHz]	Channel / Band	Modulation / Mode	Data rate	Power setting
1	Bluetooth® LE	2402	0	GFSK	125 kbps	"pos8dBm"
2	Bluetooth® LE	2402	0	GFSK	1 Mbps	"pos8dBm"
3	Bluetooth® LE	2440	19	GFSK	1 Mbps	"pos8dBm"
4	Bluetooth® LE	2480	39	GFSK	1 Mbps	"pos8dBm"
5	Bluetooth® LE	2402	0	GFSK	2 Mbps	"pos8dBm"
6	Bluetooth® LE	2480	39	GFSK	2 Mbps	"pos8dBm"

These are the worst cases as pretests have shown.

2.1.2 Block Diagram (Radiated)



2.1.3 Block Diagram (Conducted)



3 Additional Information

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

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-247 [4] RSS-Gen [5]	Tested EUT	Status
Maximum peak conducted output power	2400.0 - 2483.5	15.247 (b) (3), (4)	6.3.2 [4]	3	Passed
Maximum (average) conducted output power	2400.0 - 2483.5	15.247 (b) (3), (4)	6.3.2 [4]	3	Passed
DTS Bandwidth / 99% Bandwidth	2400.0 - 2483.5	15.247 (a) (2)	6.3.1 [4]	-	Not tested* ²
Peak Power Spectral Density	2400.0 - 2483.5	15.247 (e)	6.3.1 [4]	-	Not tested* ²
Average Power Spectral Density	2400.0 - 2483.5	15.247 (e)	6.3.1 [4]	-	Not tested* ²
Band edge compliance	2400.0 - 2483.5	15.247 (d) 15.205 (a) 15.209 (a)	6.6 [4]	2, 3	Passed
Maximum unwanted emissions	0.009 – 26,500* ¹	15.247 (d) 15.205 (a) 15.209 (a)	8.9 [5]	1, 2	Passed* ¹
Antenna Requirement	-	15.203 15.247 (b)	6.8 [5] 6.5 (c) (ii) [4]	-	Not tested* ²
Conducted emissions on supply line	0.15 – 30	15.207 (a)	8.8 [5]	-	Not tested* ²

*¹: As declared by the applicant the highest radio frequency of the EUT is 2.4 GHz. Therefore, the radiated emission measurement must be carried out up to the 10th of the highest radio frequency, in this case 26.5 GHz.

*²: Not tested because the tests were not ordered by the applicant.

5 Results

5.1 Test setups

5.1.1 Radiated: 9 kHz to 30 MHz

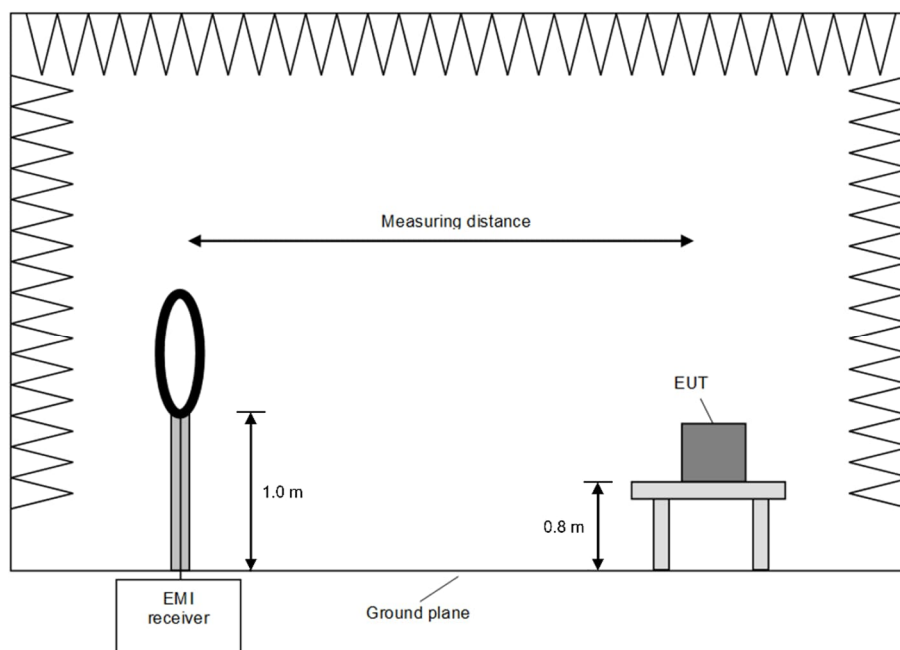
5.1.1.1 Preliminary measurement 9 kHz to 30 MHz

In the first stage a preliminary measurement is performed in a semi-anechoic chamber 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].

The frequency range 9 kHz to 30 MHz is monitored with an EMI receiver while the system and its cables are manipulated to find out the configuration with the maximum emission levels if applicable. The EMI receiver is set to MAX hold mode. The EUT and the measuring antenna are rotated around their vertical axis to find the maximum emission levels.

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

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Procedure preliminary measurement:

Pre-scans are performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure is used:

- 1) Monitor the frequency range with the measuring antenna facing the EUT and an EUT / turntable azimuth of 0 °.
- 2) Manipulate the system cables to produce the maximum levels of emissions.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Measure the frequencies of the highest detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency values.
- 5) If the EUT is portable or ceiling mounted, repeat steps 1 to 4 with other orientations (x,y,z) of the EUT.
- 6) Rotate the measuring antenna and repeat steps 1 to 5.

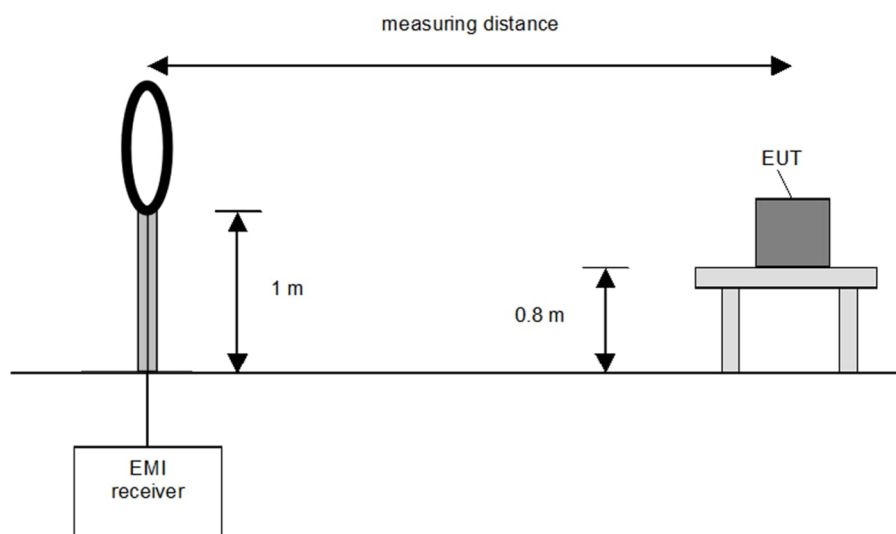
5.1.1.2 Final measurement 9 kHz to 30 MHz

In the second stage a final measurement is performed on an open area test site with no conducting ground plane at a measuring distance of 3 m, 10 m, or 30 m. If the standard requires larger measuring distances for a given frequency, the results are extrapolated according to section 15.31 (f) (2) [2]. The final measurement is performed with an EMI receiver set to Quasi-Peak detector, except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an Average detector is used according section 15.209 (d) [2].

At the frequencies, which were detected during the preliminary measurements, the final measurement is performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum level value is found.

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

Frequency range	Resolution bandwidth	Measuring time
9 kHz to 150 kHz	200 Hz	1 s
150 kHz to 30 MHz	9 kHz	1 s



Procedure final measurement:

The following procedure is used:

- 1) Monitor the selected frequencies from the preliminary measurement with the measuring antenna facing the EUT and an EUT azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals.
- 3) Rotate the measuring antenna and repeat steps 1 to 2 until the maximum value is found and note it.
- 4) If the EUT is portable or ceiling mounted, repeat steps 1 to 3 with other orientations (x,y,z) of the EUT.

5.1.2 Radiated: 30 MHz to 1 GHz

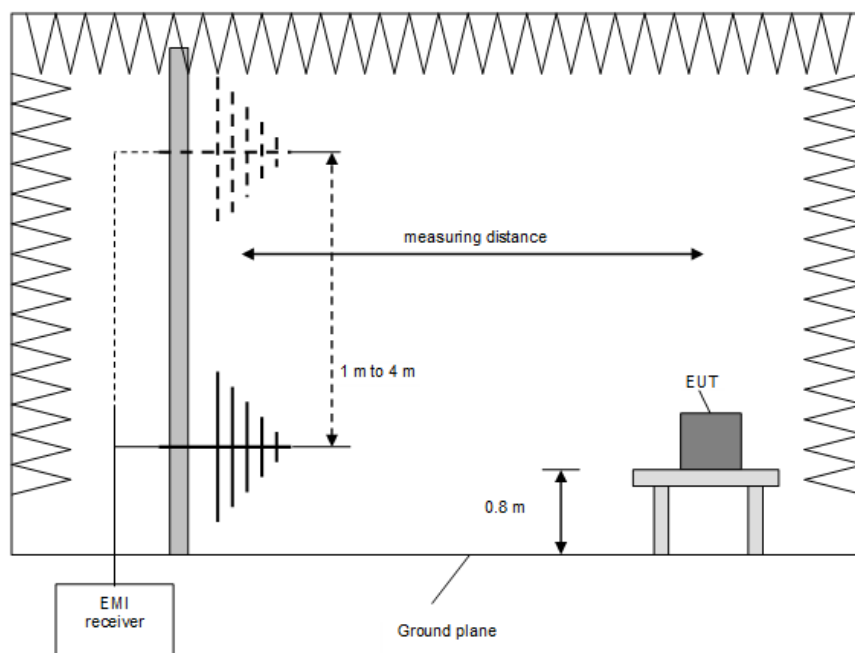
5.1.2.1 Preliminary and final measurement 30 MHz to 1 GHz

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.

5.1.3 Radiated: 1 GHz to 40 GHz

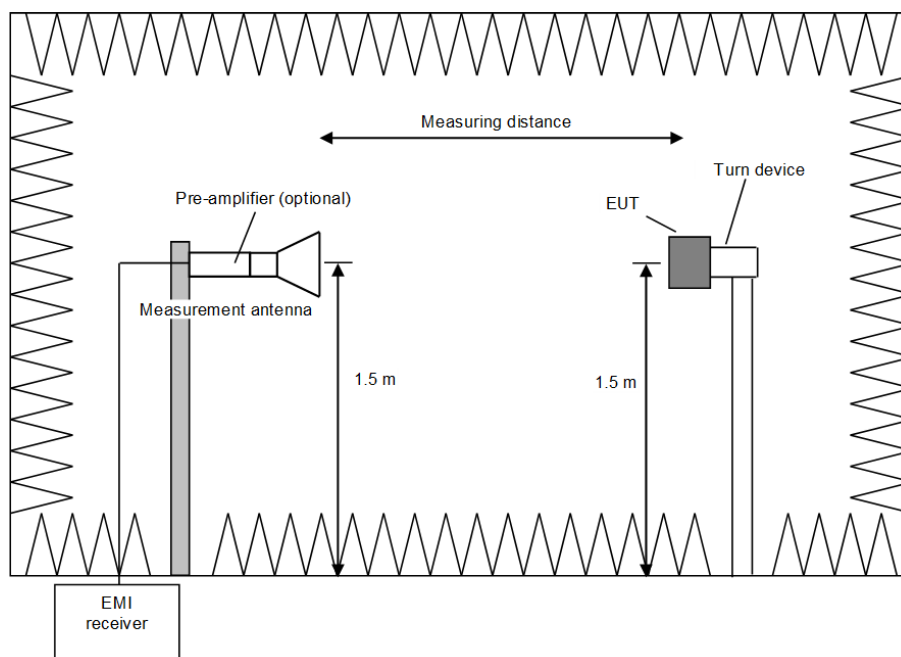
5.1.3.1 Preliminary and final measurement 1 to 40 GHz

The preliminary and final measurements are performed in a fully anechoic chamber at a measuring distance of 3 meters. Table-top devices are set up on a non-conducting turn device at the height of 1.5 m. 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 ° and the measuring antenna is set to horizontal and vertical polarization to find the maximum level of emissions. After these steps, the measurement is repeated after reorientating the EUT in 30 ° steps.

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
Final measurement	1 - 40 GHz	-	1 MHz	100 ms	Peak Average



Procedure preliminary measurement:

The following procedure is used:

- 1) Monitor the frequency range at horizontal polarisation of the measuring antenna and an EUT / turntable azimuth of 0 °.
- 2) Rotate the EUT by 360° to maximize the detected signals.
- 3) Repeat steps 1 to 2 with the vertical polarisation of the measuring antenna.
- 4) Repeat steps 1 to 3 with the EUT reorientated by an angle of 30° (60°, 90°, 120° and 150°), according to 6.6.5.4 in [1].
- 5) The highest values for each frequency are saved by the software, including the measuring antenna polarization, the turntable azimuth and the turn device elevation for that value.

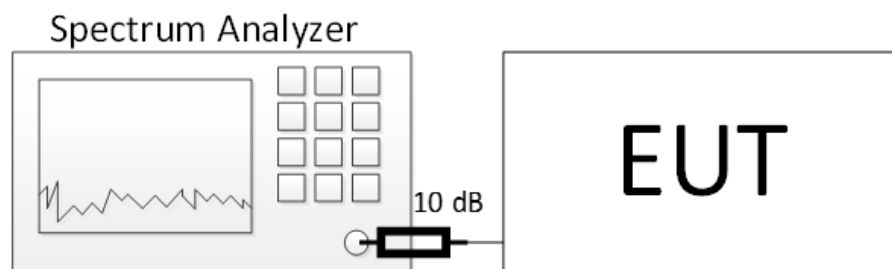
Procedure final measurement:

The following procedure is used:

- 1) Set the turntable and the turn device to the position which leads to the highest emission for the first frequency identified in the preliminary measurements.
- 2) Set the measurement antenna to the polarisation which leads to the highest emission for the first frequency identified in the preliminary measurements.
- 3) Set the spectrum analyser to EMI mode with Peak and Average detector activated.
- 4) The worst-case turntable position is found via varying the turntable azimuth by $\pm 30^\circ$ from the value obtained in the preliminary measurement while monitoring the emission level.
- 5) The final measurement is performed at the worst-case turntable azimuth.
- 6) Repeat steps 1 to 5 for each frequency detected during the preliminary measurements.

5.1.4 Conducted: Antenna port

Test setup (conducted)		
Used	Antenna connector	Comment
☒	Temporary antenna connector	As provided by the applicant
☐	Normal antenna connector	-



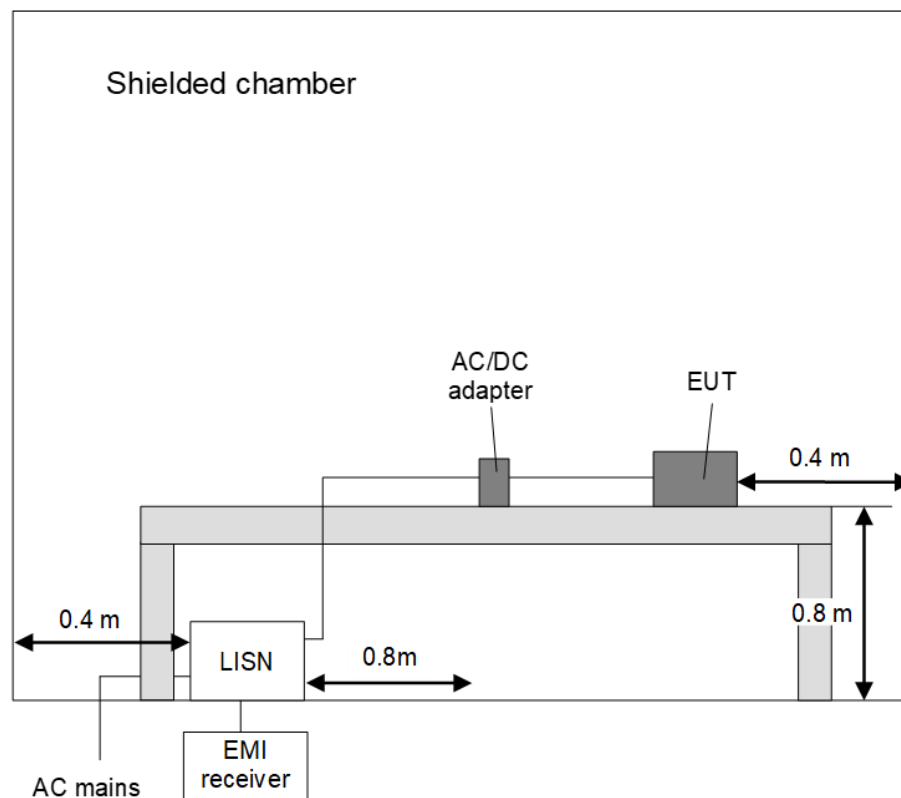
The 10 dB external attenuation is considered in all relevant plots

5.1.5 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 Duty cycle

5.2.1 Test setup (Duty cycle)

Test setup (Duty cycle)			
Used	Setup	See sub-clause	Comment
☐	Radiated: 1 GHz to 40 GHz	-	-
☒	Conducted: Antenna port	5.1.4	-

5.2.2 Test method (Duty cycle)

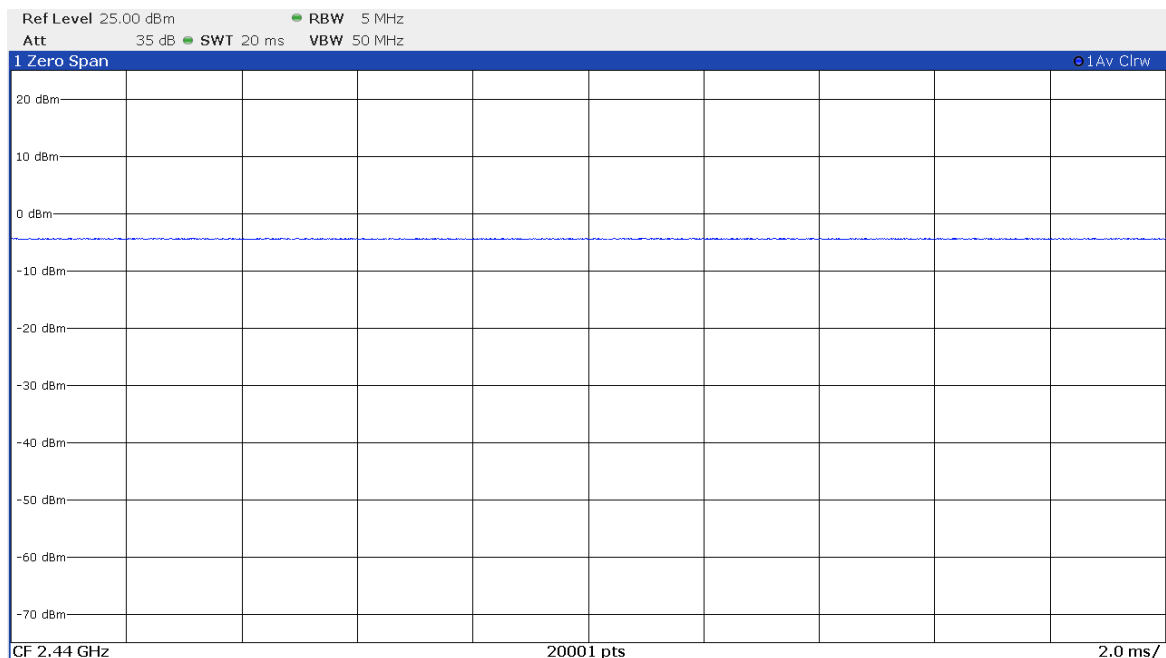
Test method (Duty cycle)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
☐	11.6. a)	Diode detector	No limitation	-
☒	11.6. b)	Zero span	No limitation	-

5.2.3 Test results (Duty cycle)

Ambient temperature:	26 °C
Relative humidity:	71 %

Date:	25.06.2026
Tested by:	M. EPPINGER

Worst case plot (operation mode 3):



No DCCF is applied for all modes because the duty cycle is greater than 98%.

Test equipment (please refer to chapter 7 for details)
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5.3 DTS fundamental emission output power

5.3.1 Test setup (DTS fundamental emission output power)

Test setup (DTS fundamental emission output power)			
Used	Setup	See sub-clause	Comment
☐	Radiated: 1 GHz to 40 GHz	-	-
☒	Conducted: Antenna port	5.1.4	-

5.3.2 Test method (DTS fundamental emission output power)

Test method (Maximum peak conducted output power)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
☒	11.9.1.1	RBW $\geq$ DTS bandwidth	-	-
☐	11.9.1.2	PKPM1 Peak power meter method* ¹	-	-

*¹ VBW of the peak power meter must be $>$ OBW of the fundamental.

Test method (Maximum conducted (average) output power)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
☒	11.9.2.2.2	Method AVGSA-1	$D \geq 98\%$	-
☐	11.9.2.2.3	Method AVGSA-1A (alternative)	$D \geq 98\%$	-
☐	11.9.2.2.4	Method AVGSA-2	Constant D ($\pm 2\%$)	-
☐	11.9.2.2.5	Method AVGSA-2A (alternative)	Constant D ($\pm 2\%$)	-
☐	11.9.2.2.6	Method AVGSA-3A	-	-
☐	11.9.2.2.7	Method AVGSA-3A (alternative)	-	-
☐	11.9.2.3.1	Method AVGPM	Constant D ($\pm 2\%$)	-
☐	11.9.2.3.2	Method AVGPM-G	-	-

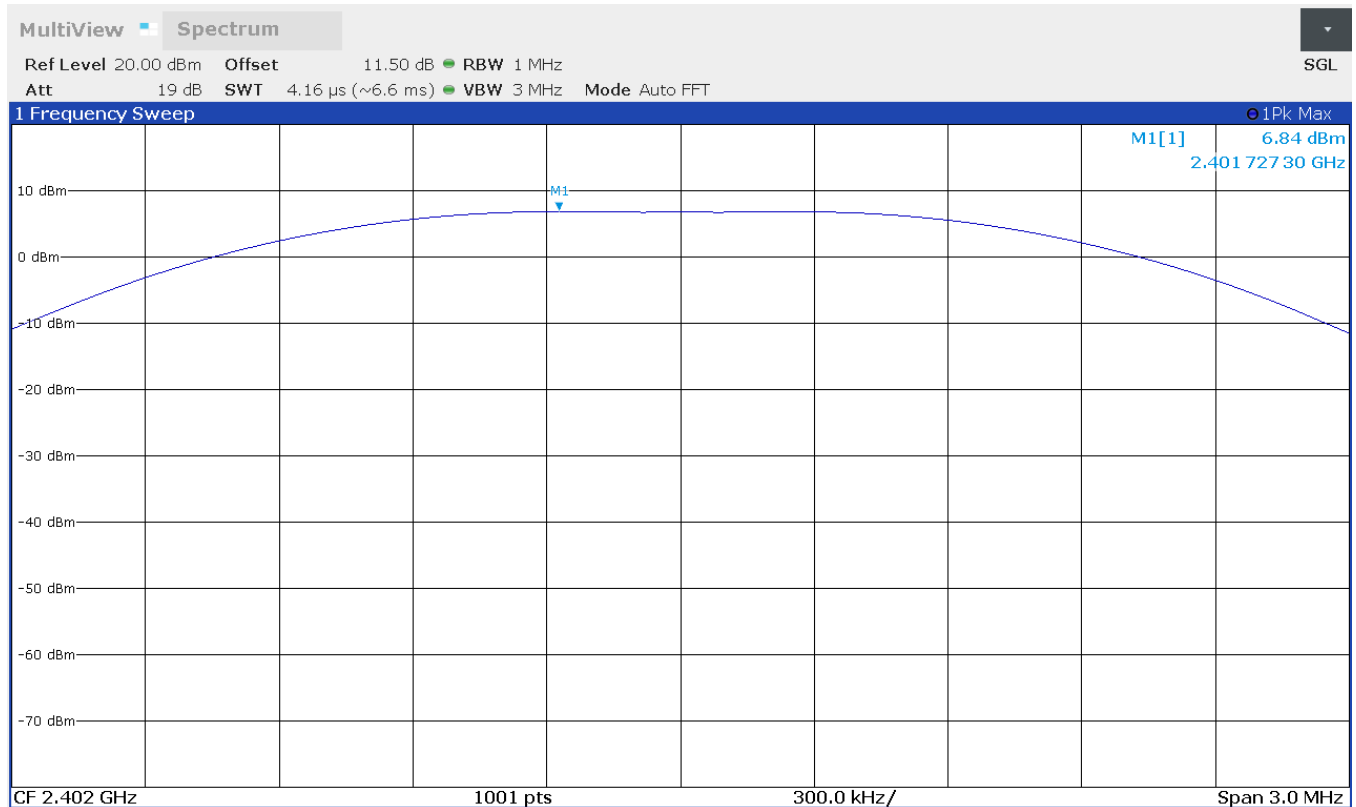
5.3.3 Test results (DTS fundamental emission output power)

Ambient temperature:	21 °C
Relative humidity:	51 %

Date:	21.07.2026
Tested by:	M. EPPINGER

5.3.3.1 Maximum peak conducted output power:

Worst case plot (operation mode 1):

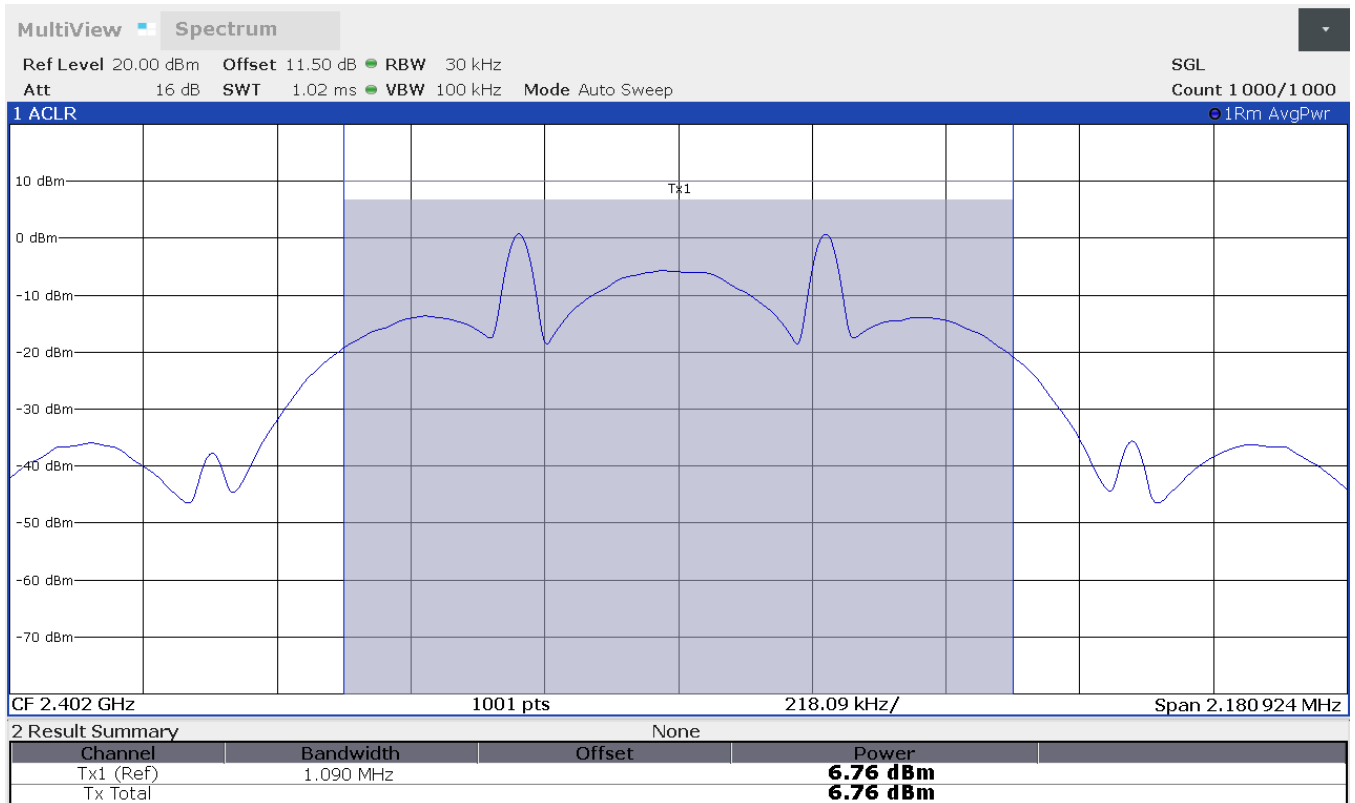


Operation mode	Result [dBm]	Limit [dBm]	Gain [dBi]	e.i.r.p. [dBm]	Limit e.i.r.p. [dBm]
1	6.8	30	-0.2	6.6	36.0

Test result: Passed

5.3.3.2 Maximum conducted (average) output power

Worst case plot (operation mode 1):



Operation mode	DCCF [dB]	Result [dBm]	Limit [dBm]	Antenna Gain [dBi]	Result e.i.r.p. [dBm]	Limit [dBm]
1	0.0	6.8	30.0	-0.2	6.6	36.0

Test result: Passed

Test equipment (please refer to chapter 7 for details)
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5.4 DTS band-edge emission measurements

5.4.1 Test setup (Band edge – restricted bands)

Test setup (Band edge – restricted bands)			
Used	Setup	See sub-clause	Comment
☒	Radiated: 1 GHz to 40 GHz	5.1.3	-
☐	Conducted: Antenna port	-	-

5.4.2 Test method (Band edge – restricted bands)

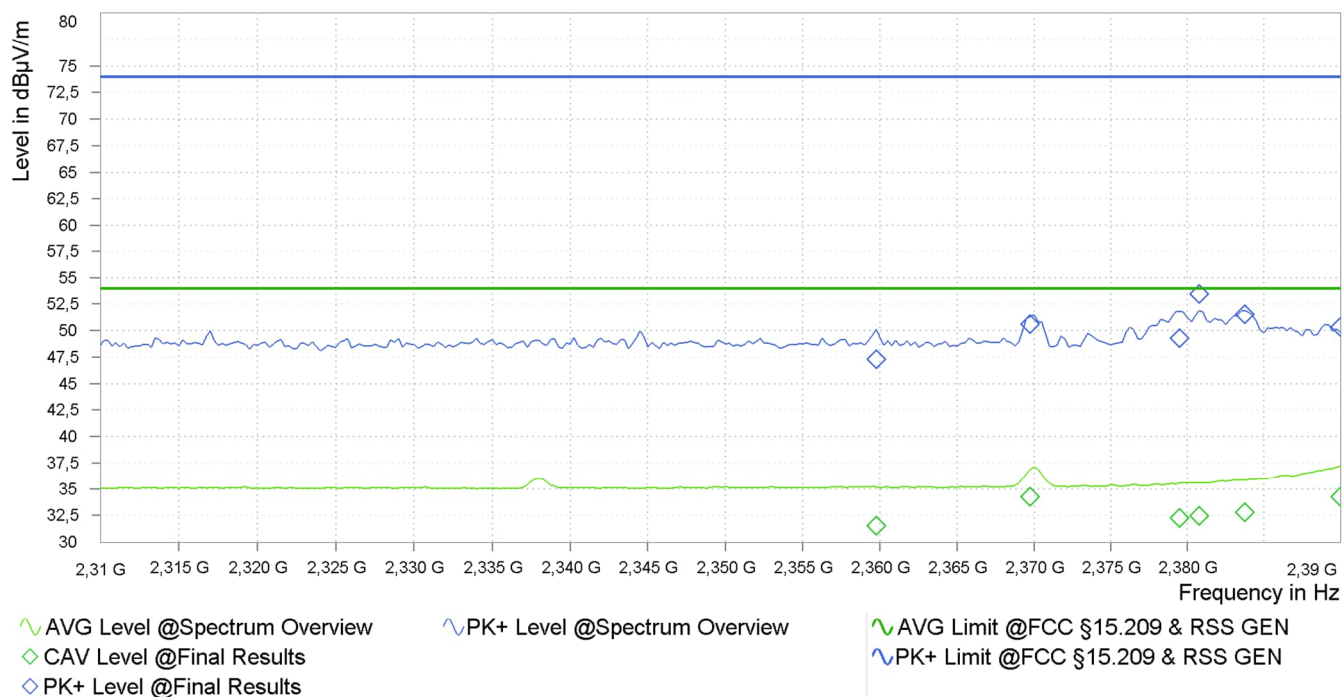
Test method (Band edge – restricted bands)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
☒	11.12.1	Standard method	No limitations	-
☐	11.12.3.1	Marker-delta method	-	See 6.10.6 [3] 2 MHz from band
☐	11.12.3.2	Integration method	-	2 MHz from band

5.4.3 Test results (Band edge – restricted bands)

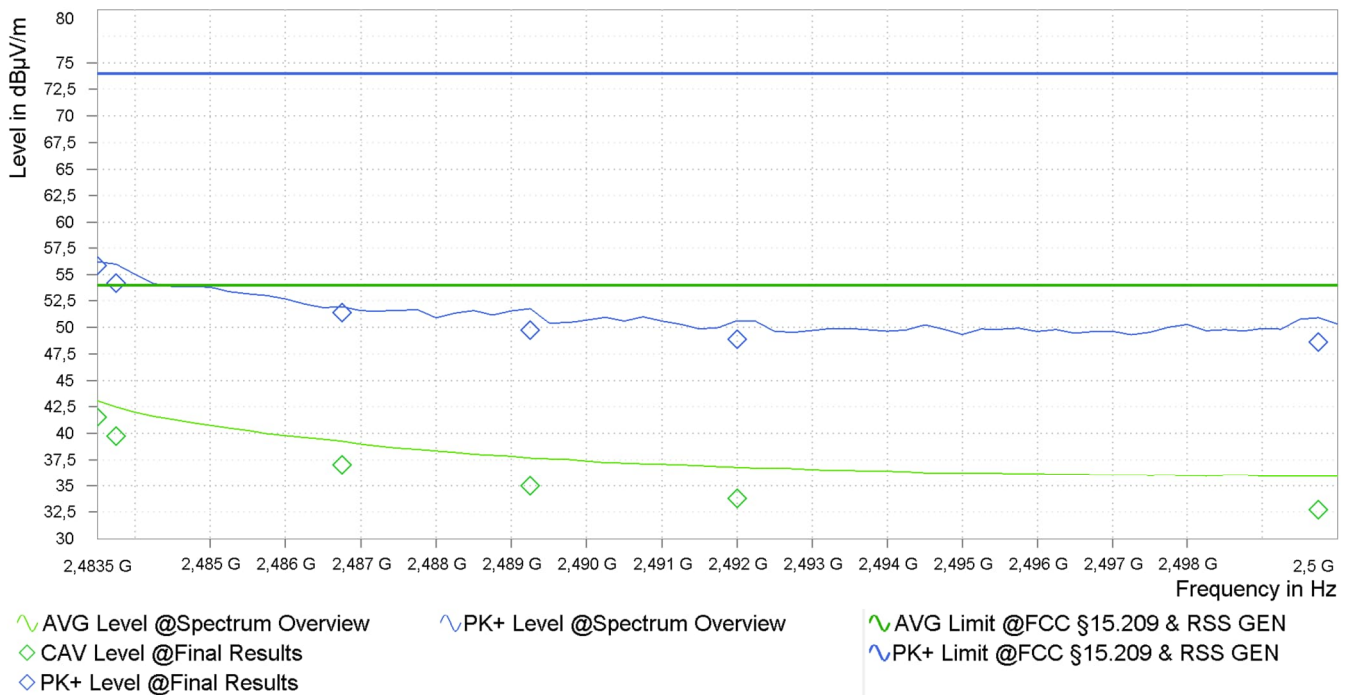
Ambient temperature:	23 °C
Relative humidity:	66 %

Date:	30.06.2026
Tested by:	M. EPPINGER

Worst case plot lower band edge (operation mode 5):



Worst case plot upper band edge (operation mode 6):



Lower band edge (operation mode 5):

Frequency [MHz]	MaxPeak [dB(μV/m)]	Peak limit [dB(μV/m)]	Peak Margin [dB]	Average [dB(μV/m)]	Avg limit [dB(μV/m)]	Avg Margin [dB]	Pol [H/V]	Azimuth [deg]	Elevation [deg]	Corr. [dB/m]
2359.750	47.32	74.00	26.68	31.55	54.00	22.45	H	283	138	34.27
2369.750	50.59	74.00	23.41	34.24	54.00	19.76	V	45	129	34.25
2379.500	49.27	74.00	24.73	32.25	54.00	21.75	V	48	105	34.27
2380.750	53.44	74.00	20.56	32.45	54.00	21.55	V	52	117	34.28
2383.750	51.51	74.00	22.49	32.79	54.00	21.21	V	50	135	34.30
2390.000	50.34	74.00	23.66	34.23	54.00	19.77	V	34	132	34.36

Upper band edge (operation mode 6):

Frequency [MHz]	MaxPeak [dB(μV/m)]	Peak limit [dB(μV/m)]	Peak Margin [dB]	Average [dB(μV/m)]	Avg limit [dB(μV/m)]	Avg Margin [dB]	Pol [H/V]	Azimuth [deg]	Elevation [deg]	Corr. [dB/m]
2483.500	55.80	74.00	18.20	41.55	54.00	12.45	V	54	129	34.65
2483.750	54.18	74.00	19.82	39.72	54.00	14.28	V	18	140	34.65
2486.750	51.40	74.00	22.60	36.99	54.00	17.01	V	61	120	34.65
2489.250	49.73	74.00	24.27	34.95	54.00	19.05	V	24	134	34.64
2492.000	48.84	74.00	25.16	33.80	54.00	20.20	V	29	134	34.63
2499.750	48.62	74.00	25.38	32.72	54.00	21.28	V	17	134	34.61

Test result: Passed

Test equipment (please refer to chapter 7 for details)
2, 4 - 10, 23

5.5 Radiated emissions

5.5.1 Test setup (Maximum unwanted emissions)

Test setup (Maximum unwanted emissions)			
Used	Setup	See sub-clause	Comment
☒	Radiated: 9 kHz to 30 MHz / 30 MHz to 1 GHz / 1 GHz to 40 GHz	5.1.1 / 5.1.2 / 5.1.3	-
☐	Conducted: Antenna port	-	-

5.5.2 Test method (Maximum unwanted emissions)

☒ Test method (radiated) see sub-clause 5.1.1 / 5.1.2 / 5.1.3 as described herein

5.5.3 Test results (Maximum unwanted emissions)

5.5.3.1 Test results preliminary measurement 9 kHz to 30 MHz

Ambient temperature:	25 °C	Date:	18.06.2026
Relative humidity:	63 %	Tested by:	M. EPPINGER

Position of EUT: For tests for f between 9 kHz to 30 MHz, 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 detailed information of the test setup and the cable guide refer to the pictures in annex A of this test report.

Test record: The measurement value was already corrected by 40 dB/decade as described in 47 CFR 15.31(f)(2) regarding to the measurement distance as requested in 47 CFR 15.209(a)

Remark:

Calculations:

Result @ norm. dist. [dBμV/m] = Reading [dBμV] + AF [dB/m] + Distance corr. fact. [dB]

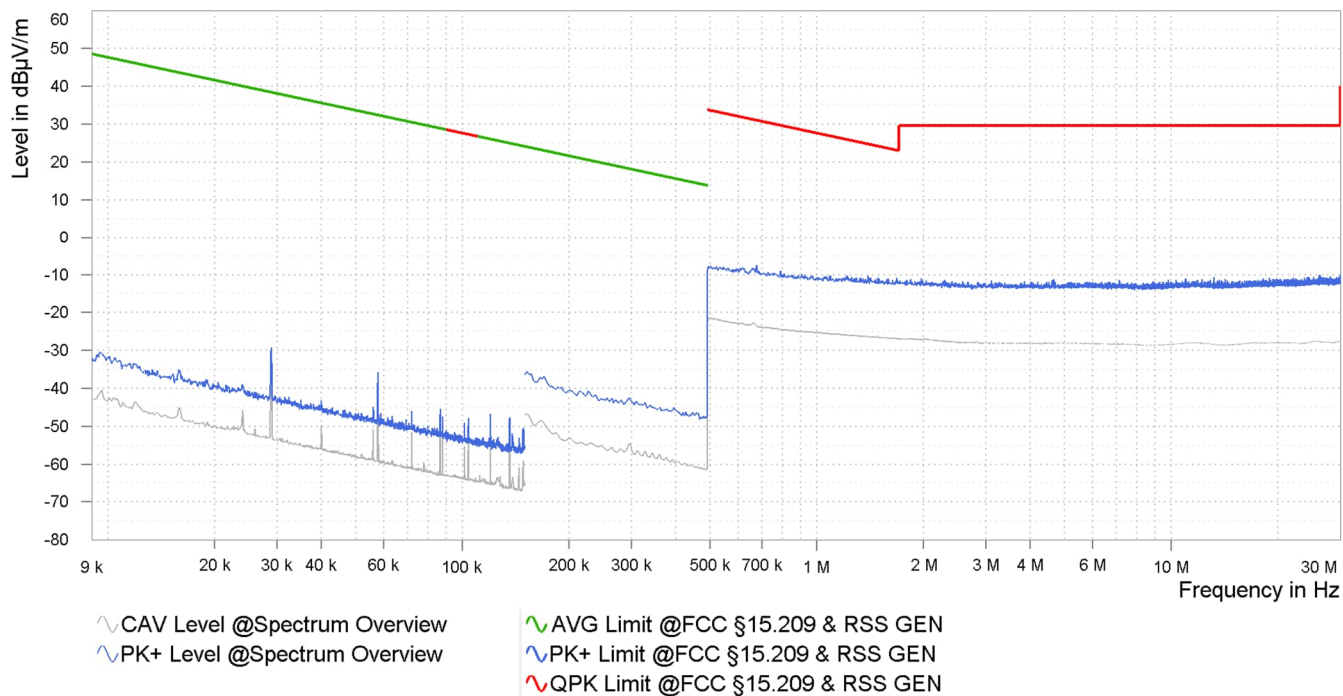
Result @ norm. dist. [dBμA/m] = Result @ norm. dist. [dBμV/m] – 20 x log₁₀ (377 Ω)

Margin [dB] = Limit [dB(μV|μA)/m] - Result [dB(μV|μA)/m]

The test results are presented on the following page.

Worst case plot:

Spurious emissions from 9 kHz to 30 MHz (operation mode 4 – pos 3):



Remark: No emissions closer than 20 dB to the limit, so no final measurement was carried out.

Test result: Passed

Test equipment (please refer to chapter 7 for details)

4 - 6, 8 - 10, 16

5.5.3.2 Test results (30 MHz – 1 GHz)

Ambient temperature:	25 °C
Relative humidity:	63 %

Date:	18.06.2026
Tested by:	M. EPPINGER

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 detailed information of test setup and the cable guide refer to the pictures in annex A of this test report.

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

Remark: -

Calculations:

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

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

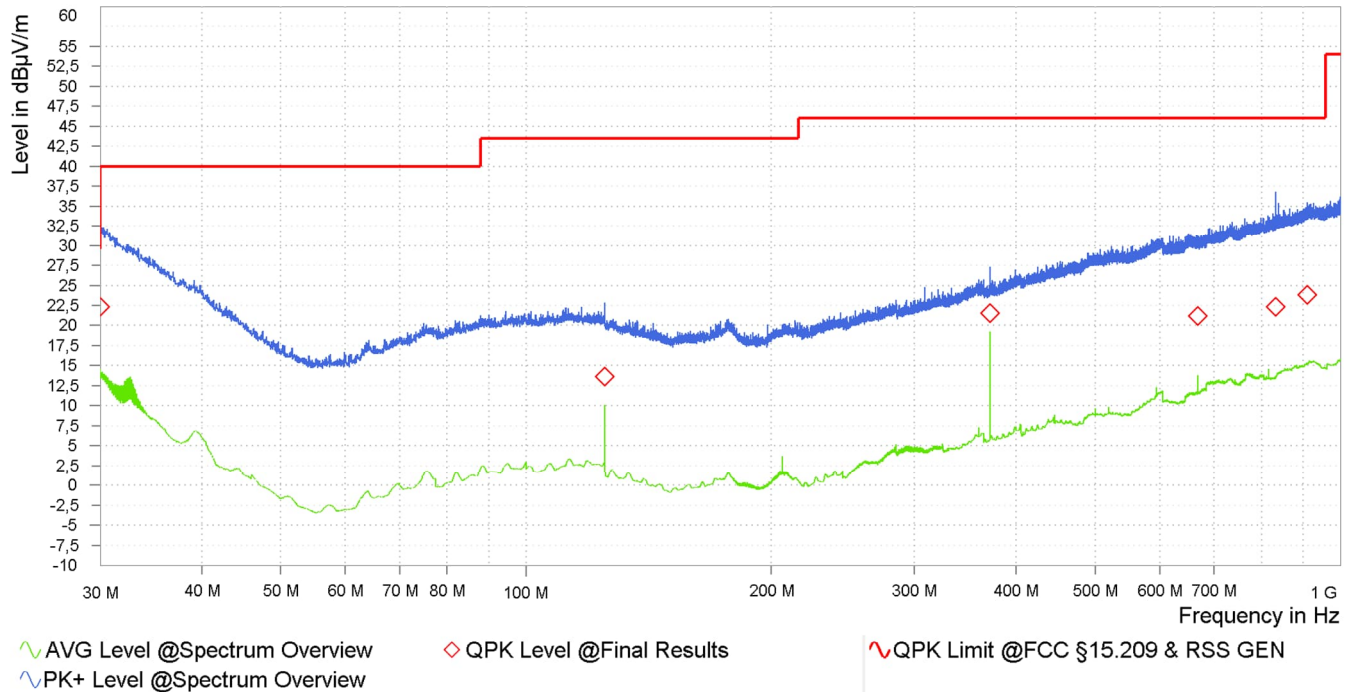
Margin [dB] = Limit [dBμV/m] - Result [dBμV/m]

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.

The test results are presented on the following page.

Measurement plot:

Spurious emissions from 30 MHz to 1 GHz (operation mode 4):



Result table:

Operation mode 4:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Height [m]
30.000	22.34	40.00	17.66	26.66	V	101	1.05
125.010	13.65	43.50	29.85	17.11	V	11	1.06
371.280	21.55	46.00	24.45	20.87	V	245	2.54
668.280	21.18	46.00	24.82	26.69	H	163	2.07
832.590	22.31	46.00	23.69	28.91	H	43	2.04
910.860	23.80	46.00	22.20	29.93	V	91	1.25

Test result: Passed

Test equipment (please refer to chapter 7 for details)
4 – 10, 12, 13

5.5.3.3 Test results (radiated 1 GHz to 40 GHz)

Ambient temperature:	25 °C
Relative humidity:	68 %

Date:	18.06.2026 / 23.06.2026
Tested by:	M. EPPINGER

Position of EUT: For tests for f between 1 GHz and the 10th harmonic, the EUT was set-up on a positioner device with a height of 150 cm. The distance between EUT and antenna was 3 m.

Cable guide: For detailed information of test setup and the cable guide refer to the pictures in annex A of this test report.

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

Remark: -

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]

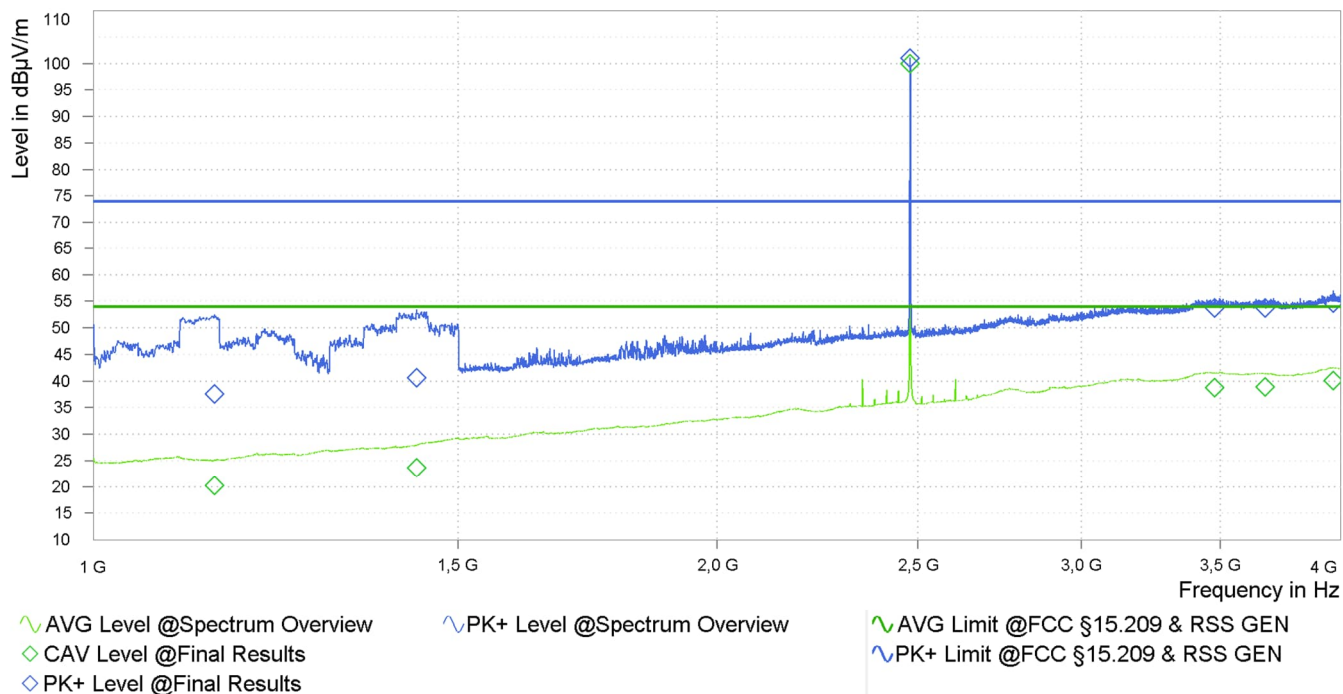
The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with various EUT and antenna positions.

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.

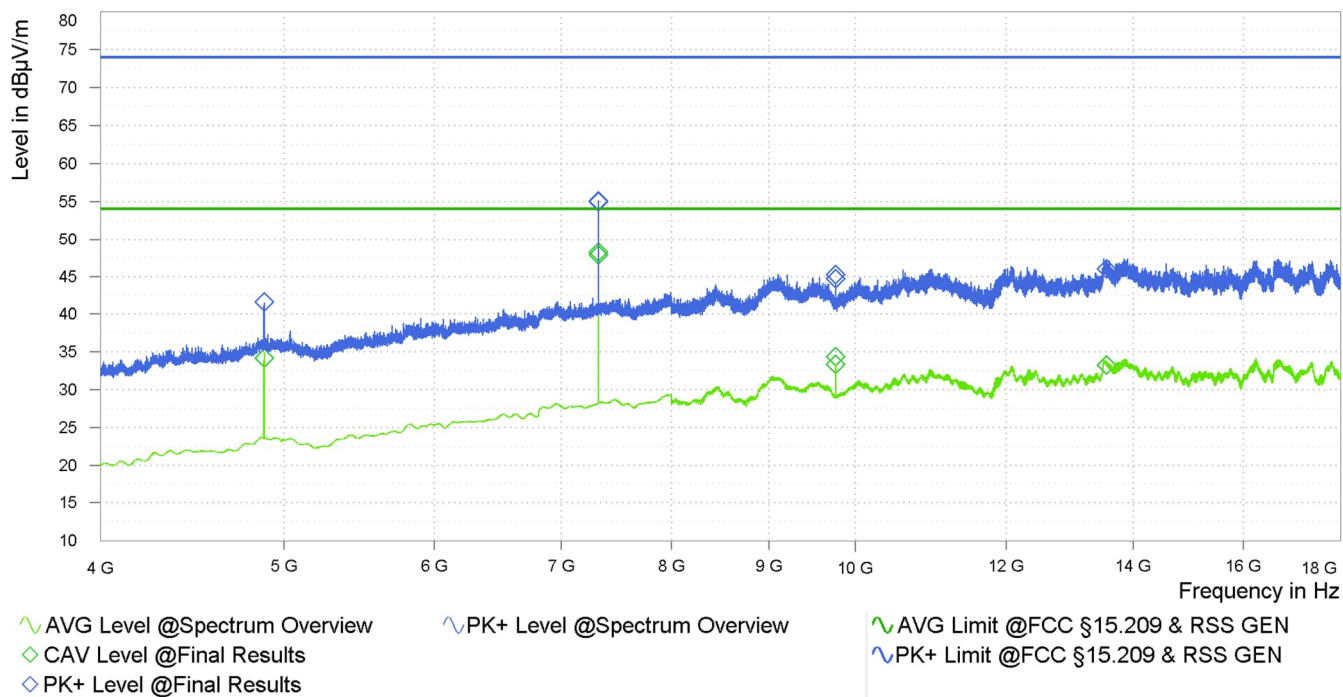
The bottom measured curve represents the average measurement. The measured points marked with "◇" are frequency points for the final average detector measurement.

Worst case plots:

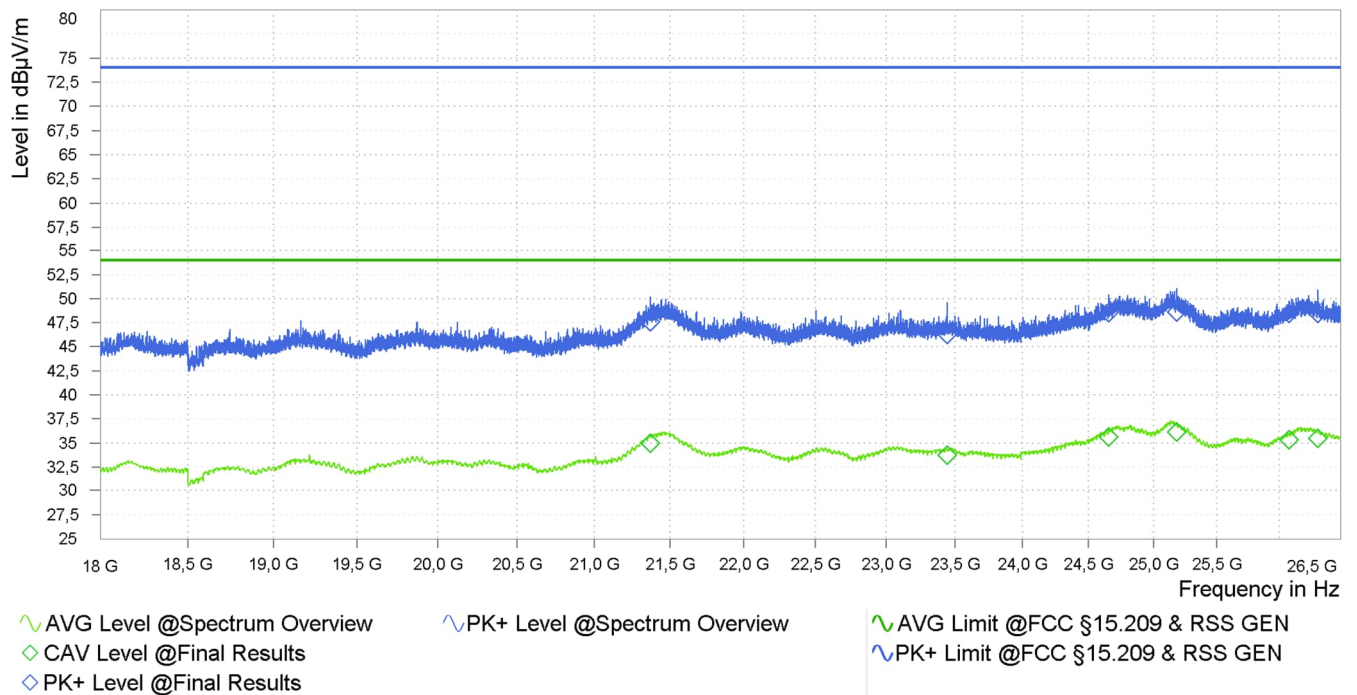
Spurious emissions from 1 GHz to 4 GHz (operation mode 4):



Spurious emissions from 4 GHz to 18 GHz (operation mode 3):



Spurious emissions from 18 GHz to 26.5 GHz (operation mode 2):



The result tables are presented on the following page.

Result tables:

Operation mode 4:

Frequency [MHz]	Pk Level [dB(μV/m)]	Pk Limit [dB(μV/m)]	Pk Margin [dB]	AV Level [dB(μV/m)]	AV Limit [dB(μV/m)]	AV Margin [dB]	Corr. [dB/m]	Pol [H/V]	Elevation [deg]	Azimuth [deg]	Restr. Band Y/N
1144.250	37.57	74.00	36.43	20.17	54.00	33.83	25.84	H	-9	202	-*
1432.500	40.65	74.00	33.35	23.62	54.00	30.38	28.41	V	117	211	-*
2480.000	100.95	Fund.		99.92	Fund.		34.66	V	87	44	-*
3479.500	53.72	74.00	20.28	38.79	54.00	15.21	39.30	V	33	363	-*
3679.750	53.76	74.00	20.24	38.85	54.00	15.15	38.95	V	165	300	-*
3968.000	54.62	74.00	19.38	40.10	54.00	13.90	39.87	H	42	68	-*

* All results were below the stricter limits for the restricted bands. Therefore, the indication is omitted.

Operation mode 3:

Frequency [MHz]	Pk Level [dB(μV/m)]	Pk Limit [dB(μV/m)]	Pk Margin [dB]	AV Level [dB(μV/m)]	AV Limit [dB(μV/m)]	AV Margin [dB]	Corr. [dB/m]	Pol [H/V]	Elevation [deg]	Azimuth [deg]	Restr. Band Y/N
4880.000	41.63	74.00	32.37	34.17	54.00	19.83	7.61	H	90	98	-*
7319.250	55.10	74.00	18.90	47.87	54.00	6.13	12.65	V	150	44	-*
7320.500	54.98	74.00	19.02	48.20	54.00	5.80	12.66	V	150	36	-*
9759.000	45.23	74.00	28.77	34.35	54.00	19.65	16.43	H	150	56	-*
9760.750	44.71	74.00	29.29	33.41	54.00	20.59	16.43	H	150	72	-*
13556.750	45.99	74.00	28.01	33.26	54.00	20.74	22.72	H	150	56	-*

* All results were below the stricter limits for the restricted bands. Therefore, the indication is omitted.

Operation mode 2:

Frequency [MHz]	Pk Level [dB(μV/m)]	Pk Limit [dB(μV/m)]	Pk Margin [dB]	AV Level [dB(μV/m)]	AV Limit [dB(μV/m)]	AV Margin [dB]	Corr. [dB/m]	Pol [H/V]	Elevation [deg]	Azimuth [deg]	Restr. Band Y/N
21369.250	47.59	74.00	26.41	35.00	54.00	19.00	14.60	V	0	53	-*
23443.750	46.26	74.00	27.74	33.72	54.00	20.28	15.04	V	30	336	-*
24654.000	48.53	74.00	25.47	35.65	54.00	18.35	15.31	H	0	305	-*
25181.000	48.62	74.00	25.38	36.17	54.00	17.83	15.27	H	0	24	-*
26082.750	48.45	74.00	25.55	35.33	54.00	18.67	15.20	H	0	108	-*
26314.500	48.45	74.00	25.55	35.51	54.00	18.49	15.56	V	0	267	-*

* All results were below the stricter limits for the restricted bands. Therefore, the indication is omitted.

Test result: Passed

Test equipment (please refer to chapter 7 for details)
1 – 11, 14, 23

5.6 AC power-line conducted emissions

5.6.1 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	5.1.5	-
☐	Not applicable	-	-

5.6.2 Test method (Conducted emissions on power supply lines)

Test setup (Conducted emissions on power supply lines)				
Used	Clause [3]	Name of method	Sub-clause	Comment
☒	6.2.3.2	Tabletop equipment testing	5.1.5	-
☐	6.2.3.3	Floor-standing equipment testing	-	-

The AC power adapter as shown in clause 1.5.1 of this test report was used for the tests.

The EUT was supplied with 24 V_{DC} by the power adapter. The power adaptor itself was supplied by 120 V_{AC} 60 Hz.

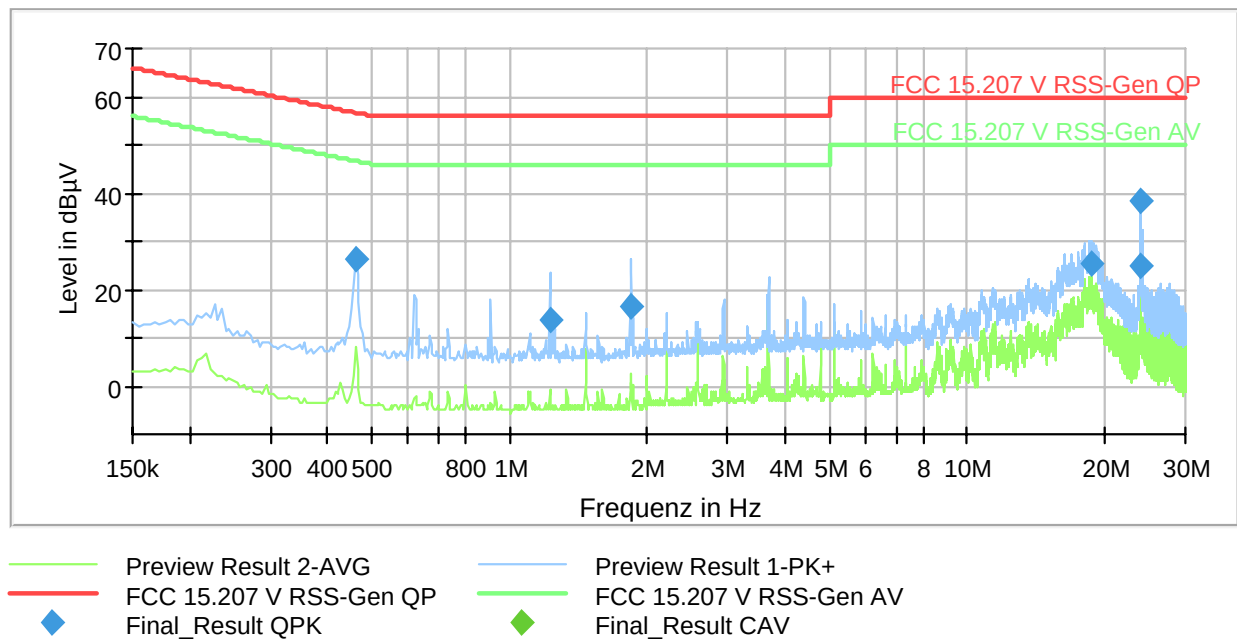
The test results are presented on the following page.

5.6.3 Test results (Conducted emissions on power supply lines)

Ambient temperature:	22 °C
Relative humidity:	62 %

Date:	01.07.2026
Tested by:	M. EPPINGER

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 ◆.



Frequency [MHz]	QuasiPeak [dB(μV)]	Average [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Line	PE	Correction [dB]
0.461000	26.37	-	56.67	30.30	L1	FLO	9.9
1.228500	13.62	-	56.00	42.38	N	FLO	9.9
1.843500	16.47	-	56.00	39.53	N	GND	10.0
18.618500	25.31	-	60.00	34.69	N	FLO	11.0
23.920500	24.76	-	60.00	35.24	N	GND	11.1
23.999500	38.49	-	60.00	21.51	N	FLO	11.1

Test result: Passed

Test equipment (please refer to chapter 7 for details)
17 – 22

6 Measurement Uncertainties

Conducted measurements		
Measurement method	Standard used for calculating measurement uncertainty	Expanded measurement uncertainty (95 %) U_{lab}
Frequency error	ETSI TR 100 028	4.5×10^{-8}
Bandwidth measurements	-	9.0×10^{-8}
Conducted emissions using a spectrum analyzer		
< 3.6 GHz	ETSI TR 100 028	2.3 dB
3.6 – 8 GHz	ETSI TR 100 028	2.8 dB
8 – 22 GHz	ETSI TR 100 028	3.2 dB
22 – 40 GHz	ETSI TR 100 028	3.6 dB
Power measurements		
Power meter	ETSI TR 100 028	0.9 dB
Conducted emissions from 150 kHz to 30 MHz with LISN		
	CISPR 16-4-2	2.8 dB

Radiated measurements		
Frequency error		
(Semi-) Anechoic chamber	ETSI TR 100 028	4.5×10^{-8}
OATS	ETSI TR 100 028	4.5×10^{-8}
Test fixture	ETSI TR 100 028	4.5×10^{-8}
Bandwidth measurements		
(Semi-) Anechoic chamber	-	9.0×10^{-8}
OATS	-	9.0×10^{-8}
Test fixture	-	9.1×10^{-8}
Radiated field strength M20		
CBL6112B @ 3 m 30 MHz – 1 GHz	CISPR 16-4-2	5.3 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 12 – 40 GHz	-	5.9 dB
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 12 – 40 GHz	-	5.9 dB
OATS		
Field strength measurements below 30 MHz on OATS without ground plane	-	4.4 dB

7 Test Equipment used for Tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Low Noise Amplifier 18 GHz - 26.5 GHz	LNA-30- 18002650-20- 10P	Narda-Miteq	2110911	482969	04.02.2026	02.2028
2	Log.-Per. antenna 850 MHz - 26.5 GHz	HL050	Rohde & Schwarz	100908	482977	10.10.2025	10.2028
3	Standard gain horn 18 GHz - 26 GHz	20240-20	Flann	266399	483026	Calibration not necessary	
4	EMC test software	Elektra V5.21	Rohde & Schwarz	---	483755	Calibration not necessary	
5	RF Switch Matrix	OSP220	Rohde & Schwarz	101391	482976	Calibration not necessary	
6	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
7	Antenna support tilt mast	BAM 4.5-P- 10kg	Maturo	222/2612.01	483225	Calibration not necessary	
8	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
9	Semi Anechoic Chamber M276	SAC5-2	Albatross Projects	C62128-A540- A138-10-0006	483227	Calibration not necessary	
10	EMI receiver / Spectrum analyser	ESW44	Rohde & Schwarz	101828	482979	06.02.2026	02.2028
11	Low Noise Amplifier 10 MHz - 18 GHz	LNA-30- 00101800-25- 10P	Narda-Miteq	2110917	482967	04.02.2026	02.2028
12	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
13	Ultralog antenna 30 MHz - 6 GHz	HL562E	Rohde & Schwarz	101079	482978	24.04.2024	04.2027
14	High-pass filter	WHKX4.0/18G- 8SS	Wainwright	1	480587	Calibration not necessary	
15	Spectrum analyser	FSW43	Rohde & Schwarz	102954	483957	04.02.2026	02.2027
16	Loop Antenna	FMZB 1519-60D	Schwarzbeck	00215	484105	25.11.2025	11.2027
17	LISN	NSLK8128	Schwarzbeck	8128155	480058	04.02.2026	02.2028
18	AC / DC power supply	AC6803A AC Power Source 2000VA	Keysight	JPVJ002509	482350	Calibration not necessary	
19	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
20	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	06.02.2026	02.2028
21	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	05.02.2026	02.2028
22	Software	EMC32 V10.60.20	Rohde & Schwarz	100061	481022	Calibration not necessary	
23	Positioner	TG1.5-10kg	Maturo	110/2648.01	483042	Calibration not necessary	

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	21.05.2025	21.05.2028
Semi anechoic chamber M276	483227	30 MHz – 1000 MHz	NSA	ANSI C63.4-2014 ANSI C63.4a-2017	05.06.2025	05.06.2028
Semi anechoic chamber M276	483227	1 GHz - 18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 + A2:2017	21.02.2024	21.02.2027

9 Report History

Report Number	Date	Comment
F260475E5	22.07.2026	Initial test report
-	-	-
-	-	-

10 List of Annexes

Annex A Test Setup Photos

15 pages

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