

Test Report

Report Number:

F250250E2

Equipment under Test (EUT):

UHF Reader

TN-UHF-Q150-NA

Applicant:

TURCK GmbH

Manufacturer:

Werner Turck GmbH & Co. KG



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 and
written by:

A blue ink signature of Daniel BRUSCHINSKI.

Daniel BRUSCHINSKI
16.06.2026

Signature

Reviewed and
approved by:

A blue ink signature of Manuel BASTERT.

Manuel BASTERT
16.06.2026

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:	TURCK GmbH
Address:	Witzlebenstraße 7, 45472 Mülheim an der Ruhr
Country:	Germany
Name for contact purposes:	Dr. Matthias LINDE
Phone:	+49 2353 709 6198
eMail address:	matthias.linde@turck.com
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	Werner Turck GmbH & Co. KG
Address:	Goethestr. 7, 58553 Halver
Country:	Germany
Name for contact purposes:	Mr. Markus TEUBNER
Phone:	+49 2353 709 6124
eMail address:	markus.teubner@turck.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: *	UHF Reader
FCC ID: *	YQ7-TN-UHF-Q150
IC certification number: *	8821A-TNUHFQ150

* Declared by the applicant

		EUT number	
		1	2
Model name: *		TN-UHF-Q150-NA-EN	TN-UHF-Q150-NA-EC
PMN: *		TN-UHF-Q150-NA-EN	TN-UHF-Q150-NA-EC
HVIN: *		2.0	2.0
FVIN: *		1.0.0.0	1.1.0.0
Model number: *		100018055	100018056
Order number: *		100018055	100018056
Serial number: *		0002480132	0002480699
PCB identifier: *	PCB 1:	3692/2	3692/2
	PCB 2:	7901/5	7901/5
	PCB 3:	12927143	12927142
Hardware version: *		2.0	2.0
Software version: *		1.0.0.0	1.1.0.0

* Declared by the applicant

Two 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: *	$U_{nom} = 24.0 \text{ V}_{DC}$	$U_{min} = 12.0 \text{ V}_{DC}$	$U_{max} = 30.0 \text{ V}_{DC}$
Temperature range: *	-30 °C to +50 °C		
Lowest / highest internal clock frequency:	12 MHz * / 927.250 MHz		

* Declared by the applicant

Ports / Connectors EUT 1				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
DC power	5 pole M12 plug	4 mm laboratory plug	< 3 m	No
Ethernet 1 / PoE	4 pole M12 plug	4 pole M12 plug	> 3 m	Yes
Ethernet 2	4 pole M12 plug	4 pole M12 plug	> 3 m	Yes
External antenna	RP-TNC male	50 Ω termination	-	-

Ports / Connectors EUT 2				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
DC power	5 pole M12 plug	4 mm laboratory plug	< 3 m	No
XF1	4 pole M12 plug	4 pole M12 plug	> 3 m	Yes
XF2	4 pole M12 plug	4 pole M12 plug	> 3 m	Yes
External antenna	RP-TNC male	50 Ω termination	-	-

Equipment used for testing	
Unmanaged ethernet switch * ¹	TURCK TBEN-LL-SE-U1
PLC * ¹	TURCK TBEN-L5-PLC-10
I/O module for ethernet * ¹ * ²	TURCK TBEN-L5-16DXP
Network communication module * ³	Keyence NQ-EC8L
Test laptop * ⁴	Fujitsu Lifebook U759
AC adapter * ⁴	Phoenix Contact QUINT4-PS/1AC/24DC/10

*¹ Provided by the applicant

*² This device was used for tests with EUT 1

*³ This device was used for tests with EUT 2

*⁴ Provided by the laboratory

1.6 Dates

Date of receipt of test sample:	11.11.2025
Start of test:	12.12.2025
End of test:	05.03.2026

2 Operational States

2.1 Description of function of the EUT:

The EUT is used for contactless data exchange with RFID tags via UHF-RFID.

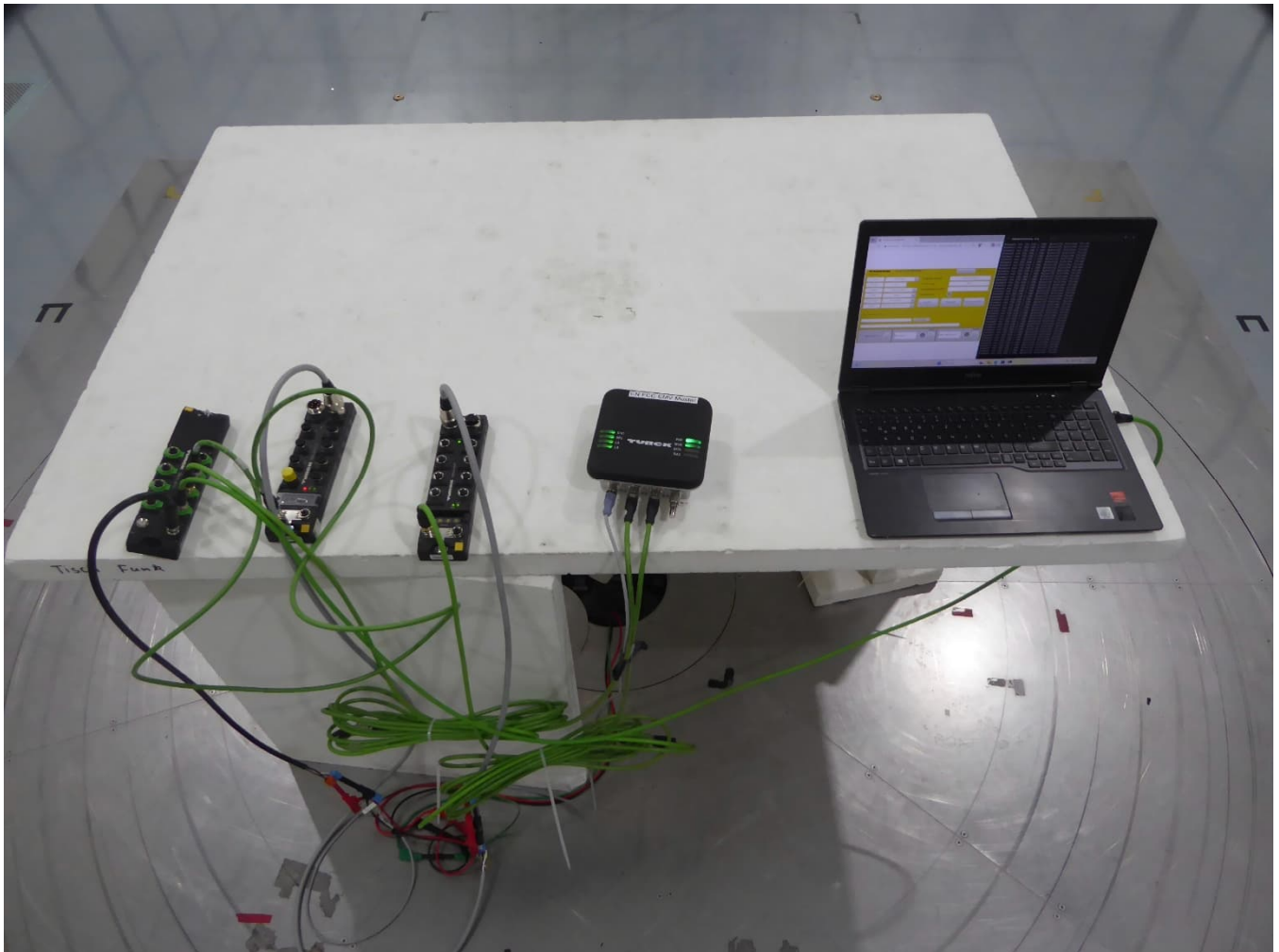
The following states were defined as the operating conditions:

During all tests, the EUT was supplied with 24 V_{DC} by an external power supply.

The EUTs were connected to the equipment used for testing as shown in clause 2.2.

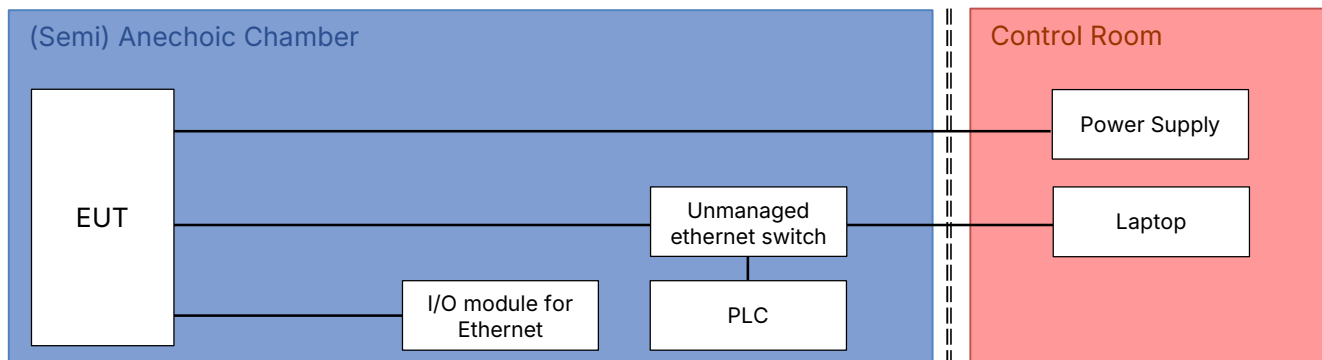
A connection to the test laptop via Ethernet was established. In the browser, the web interface of the EUT was opened and with the fping command "fping.exe 192.168.1.100 -c -t 10 -s 65500" a continuous data load was simulated.

The system was set up as follows:

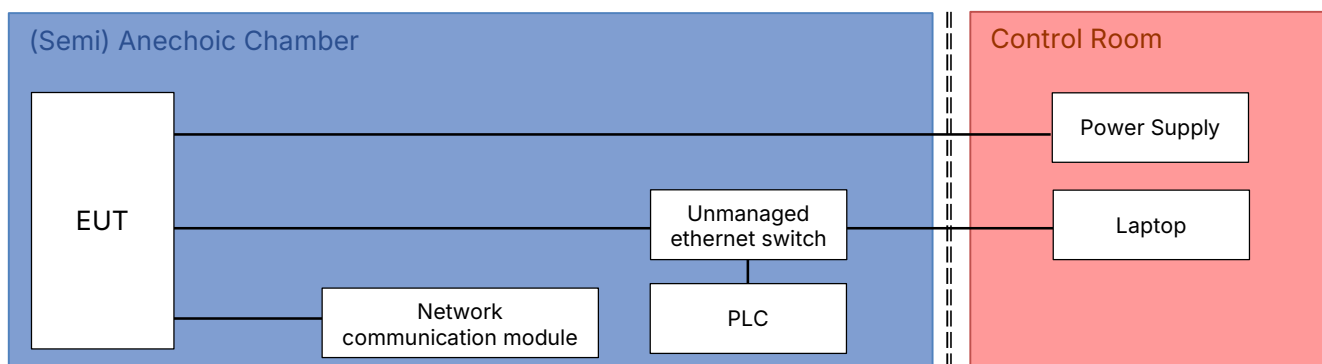


2.2 Block diagrams

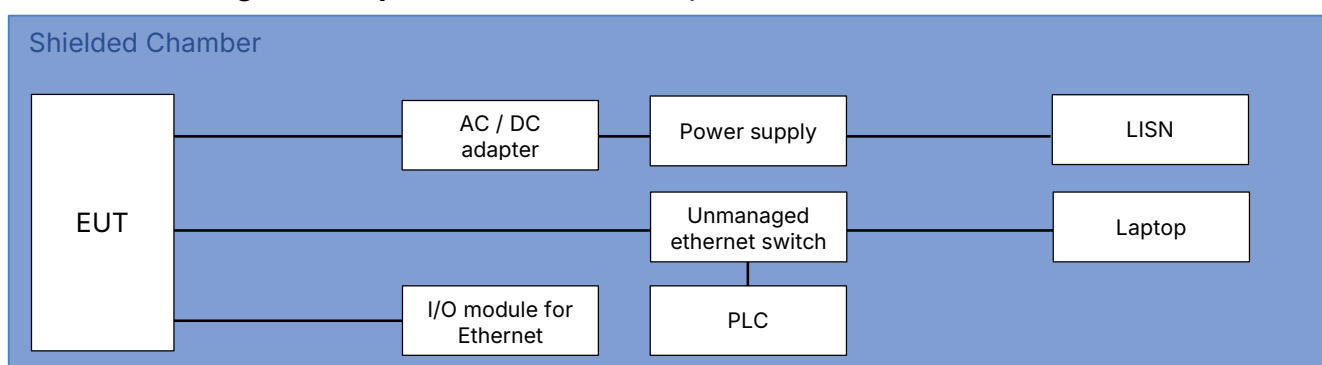
2.2.1 Block diagram (radiated, EUT 1)



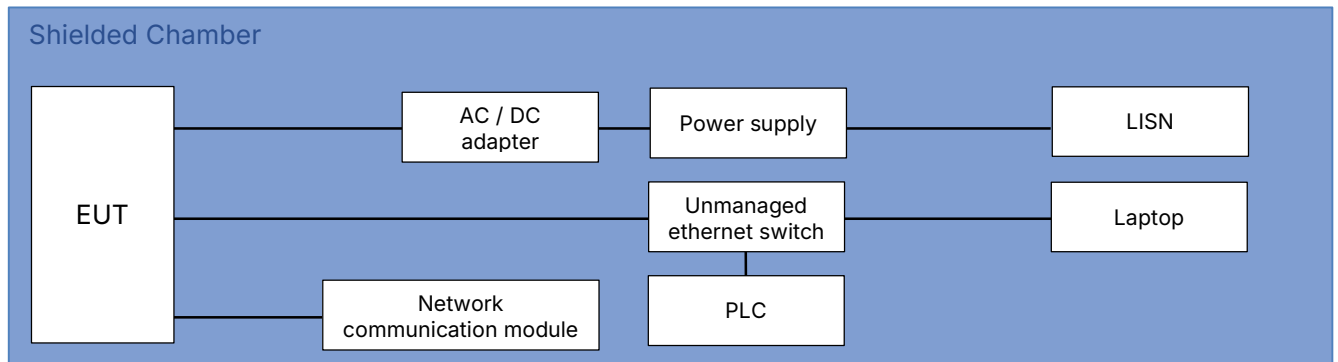
2.2.2 Block diagram (radiated, EUT 2)



2.2.3 Block diagram (AC power line conducted, EUT 1)



2.2.4 Block diagram (AC power line conducted, EUT 2)



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), (b) [3] ICES-003 Issue 7 section 3.2.1[4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
AC supply line Class B	0.15 to 0.5 MHz	66 to 56 dB(μV) QP*	ANSI C63.4	1, 2	Passed
	0.5 to 5 MHz	56 to 46 dB(μV) AV*			
	5 to 30 MHz	56 dB(μV) QP 46 dB(μV) AV 60 dB(μV) QP 50 dB(μV) AV			
*: Decreases with the logarithm of the frequency					

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

Radiated emissions ICES-003 Issue 7 section 3.2.2 [4]					
Application	Frequency range	Limits	Reference standard	Tested EUT	Status
Radiated Emission Class A	30 to 88 MHz 88 to 216 MHz 216 to 230 MHz 230 to 960 MHz 960 to 1000 MHz	50.0 dB(μV/m) QP at 3 m 54.0 dB(μV/m) QP at 3 m 56.9 dB(μV/m) QP at 3 m 57.0 dB(μV/m) QP at 3 m 60.0 dB(μV/m) QP at 3 m	ANSI C63.4	1, 2	Passed
	above 1000 MHz	60 dB(μV/m) AV at 3 m and 80 dB(μV/m) PK at 3 m	ANSI C63.4	1	Passed

Remark: The highest internal radio frequency of the EUT is 927.250 MHz.

Therefore, the radiated emission measurement must be carried out up to 5th of the highest internal clock frequency, in this case tests were carried out up to 13 GHz.

The EUT was classified by the applicant as Class A equipment.

5 Results

5.1 Test setups

5.1.1 Radiated: 30 MHz to 1 GHz

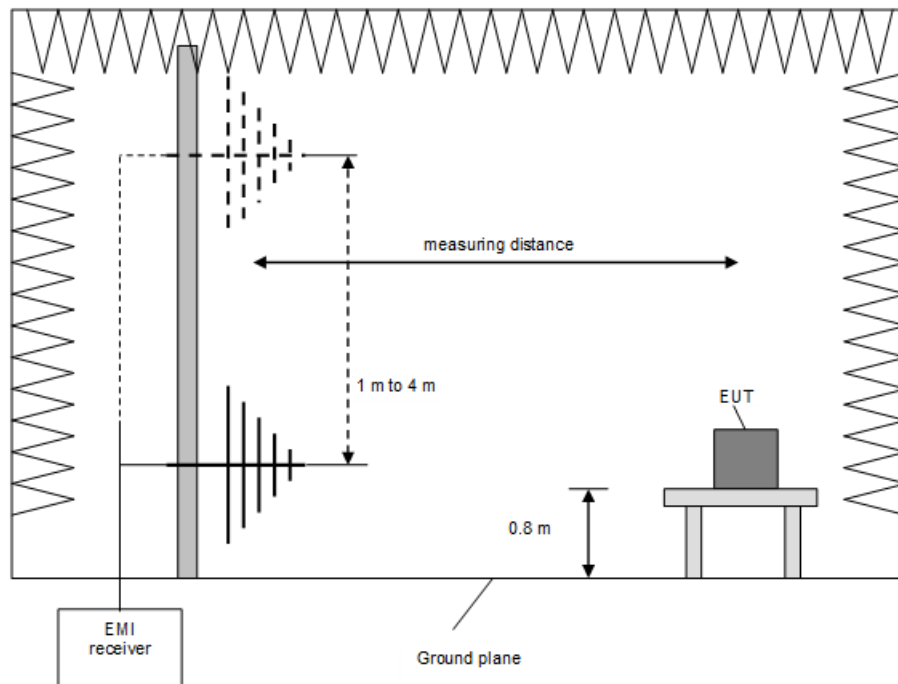
5.1.1.1 Preliminary and final measurement 30 MHz to 1 GHz

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 $\pm 30^\circ$ 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

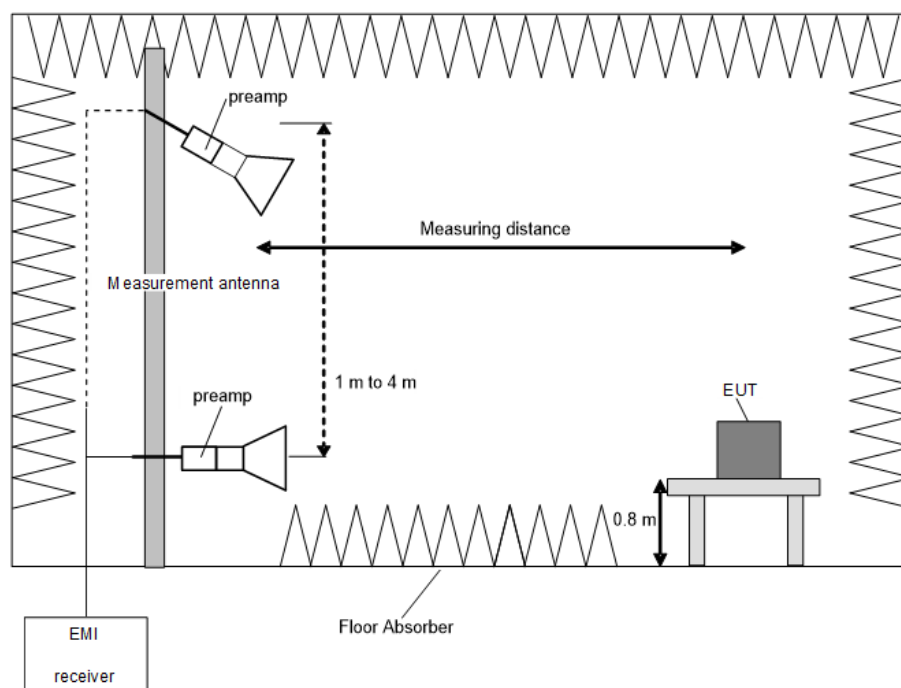
5.1.2.1 Preliminary and final measurement 1 to 40 GHz

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:

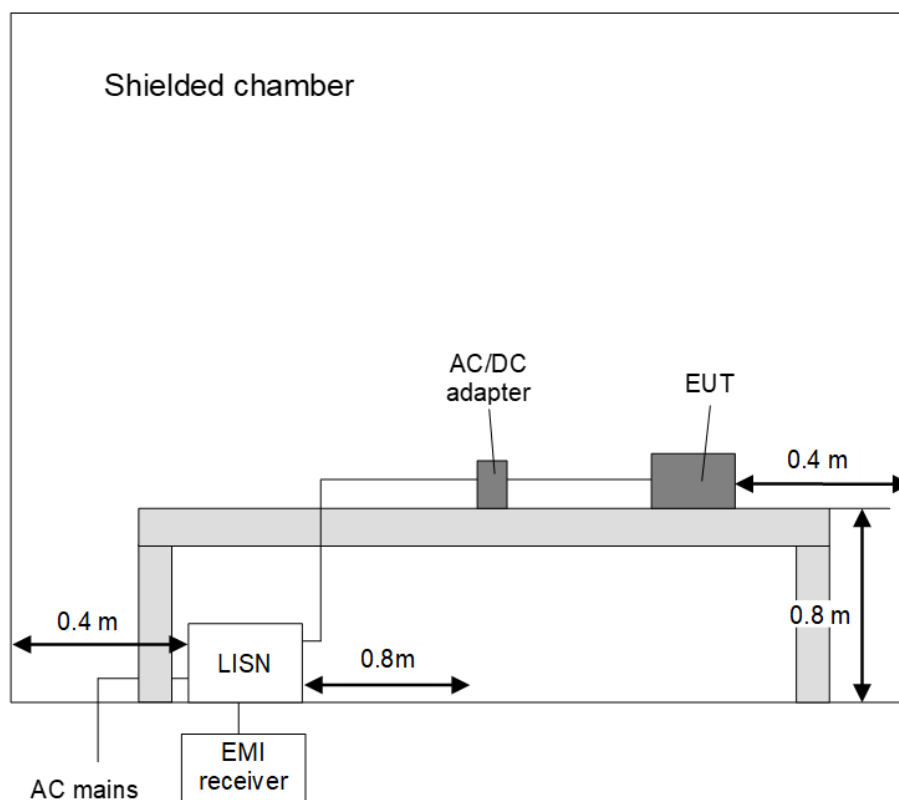
- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case 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 $\pm 30^\circ$ 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:	24 % - 34 %

Date:	15.12.2025 / 17.02.2026
Tested by:	M. BASTERT

Position of EUT: For tests for f between 30 MHz and 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: All 3 orthogonal planes were tested separately.

Calculations:

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

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

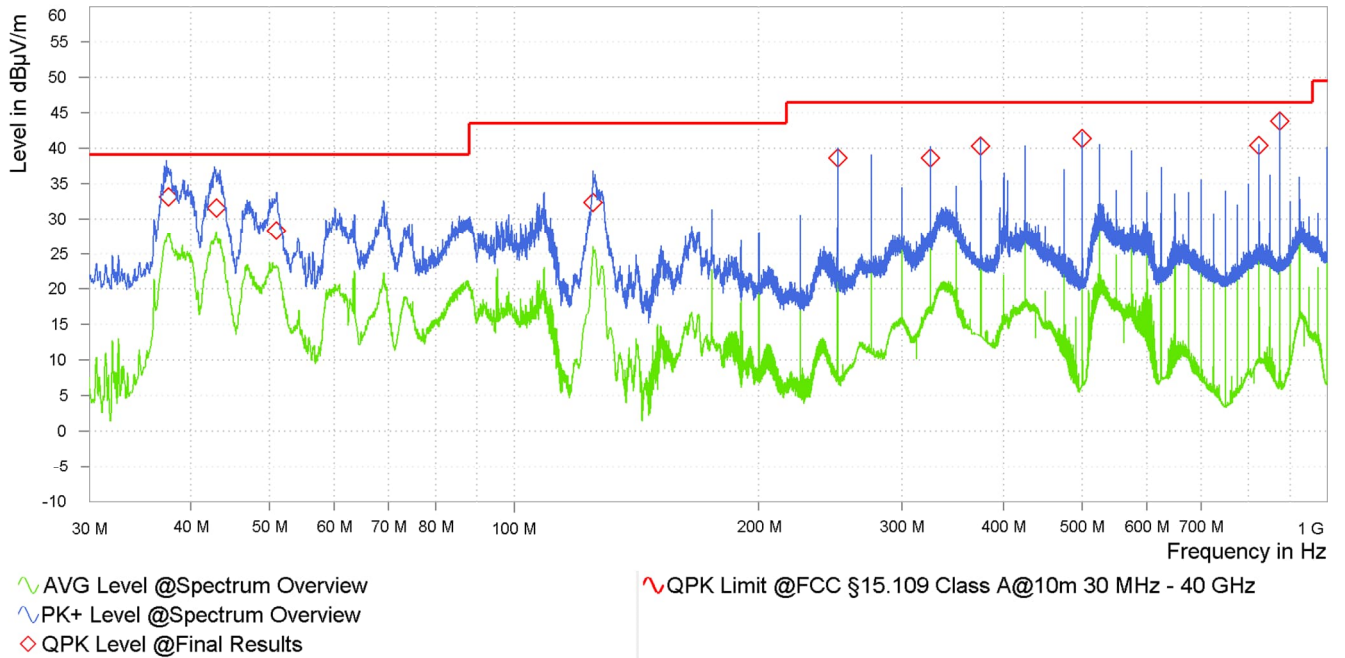
Margin [dB] = Limit [dBμV/m] - Result [dBμV/m]

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 pages.

Spurious emissions from 30 MHz to 1 GHz according to FCC 47 CFR Part 15 section 15.109 (a), (b) [3]:

Worst case plot (EUT 1, position 3):



Result tables:

EUT 1, position 1:

Frequency [MHz]	Result (QP) [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
38.37	29.0	39.1	10.1	10.9	V	133	1.02
42.48	29.2	39.1	9.9	8.2	V	138	1.07
46.26	25.5	39.1	13.6	5.5	V	176	1.34
50.46	27.5	39.1	11.6	3.1	V	308	1.04
249.99	38.7	46.4	7.8	6.7	H	220	1.25
275.01	37.8	46.4	8.6	7.7	H	251	1.01
375.03	37.7	46.4	8.8	10.5	H	238	1.00
425.01	41.5	46.4	4.9	11.6	V	184	1.05
500.01	41.6	46.4	4.8	13.7	H	124	1.44
825.03	39.2	46.4	7.2	18.4	H	68	1.06
875.04	42.0	46.4	4.4	18.7	H	327	1.00

EUT 1, position 2:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
37.89	29.7	39.1	9.4	11.2	V	117	1.08
39.06	30.6	39.1	8.5	10.5	V	114	1.01
42.78	29.6	39.1	9.5	7.9	H	147	1.44
50.01	32.1	39.1	7.0	3.3	H	298	1.47
128.07	24.0	43.5	19.5	6.5	H	218	1.31
225.00	33.6	46.4	12.8	5.7	H	48	1.54
249.99	35.8	46.4	10.6	6.7	H	28	1.40
375.03	36.3	46.4	10.1	10.5	V	212	1.38
425.01	37.3	46.4	9.1	11.6	H	177	1.00
500.01	41.2	46.4	5.2	13.7	H	126	1.38
525.03	37.6	46.4	8.8	14.1	H	297	1.50
825.03	34.8	46.4	11.6	18.4	H	328	1.07
875.04	42.6	46.4	3.8	18.7	V	357	1.87

EUT 1, position 3:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
37.53	33.1	39.1	6.0	11.5	V	144	1.00
43.02	31.6	39.1	7.5	7.8	V	132	1.03
50.97	28.3	39.1	10.8	2.8	V	276	1.03
125.01	32.3	43.5	11.3	6.7	V	221	1.01
249.99	38.6	46.4	7.8	6.7	H	237	1.08
325.02	38.6	46.4	7.9	9.2	H	267	1.02
375.03	40.3	46.4	6.1	10.5	H	164	1.04
500.01	41.3	46.4	5.1	13.7	H	109	1.46
825.03	40.4	46.4	6.1	18.4	V	347	1.15
875.04	43.8	46.4	2.7	18.7	H	68	1.00

EUT 2, position 1:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
36.06	33.5	39.1	5.6	12.4	V	355	1.29
60.96	32.2	39.1	6.9	2.0	V	124	1.80
74.58	23.2	39.1	15.9	5.0	V	268	1.20
125.67	32.5	43.5	11.0	6.6	V	228	1.23
132.48	34.1	43.5	9.4	6.0	V	254	1.05
249.99	36.9	46.4	9.5	6.7	H	244	1.27
375.00	32.7	46.4	13.7	10.5	H	176	1.01
500.01	41.6	46.4	4.8	13.7	H	98	1.55
874.98	36.7	46.4	9.7	18.7	H	312	1.03

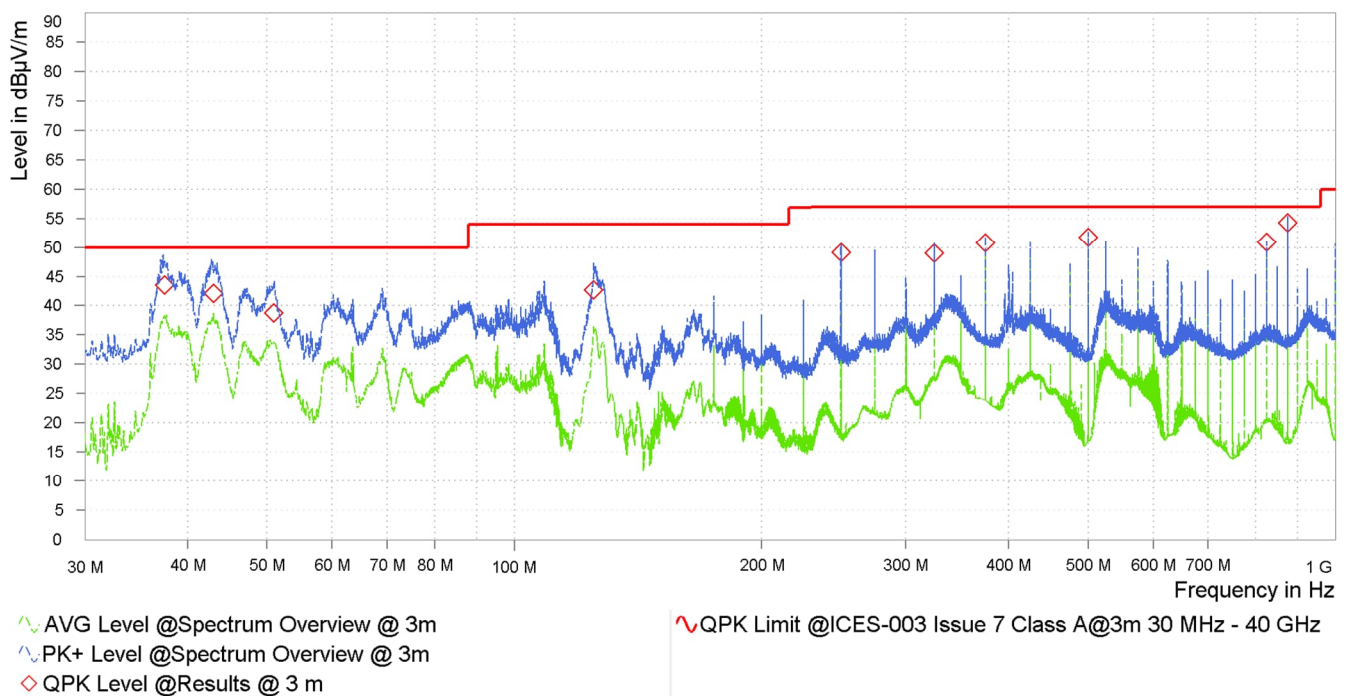
EUT 2, position 2:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
36.06	24.7	39.1	14.4	12.4	V	250	1.18
46.26	23.2	39.1	15.9	5.5	V	130	1.07
60.96	32.1	39.1	7.0	2.0	V	132	1.59
125.76	34.6	43.5	8.9	6.6	V	206	1.05
249.99	37.3	46.4	9.1	6.7	H	166	1.37
324.99	31.3	46.4	15.1	9.2	H	55	1.01
500.01	42.2	46.4	4.2	13.7	H	94	1.60
874.98	37.6	46.4	8.8	18.7	H	310	1.04

Test result: Passed

Spurious emissions from 30 MHz to 1 GHz according to ICES-003 Issue 7 section 3.2.2 [4]:

Worst case plot (EUT 1, position 3):



The result tables are presented on the following pages.

Result tables:

EUT 1, position 1:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
38.37	39.5	50.0	10.5	10.9	V	133	1.02
42.48	39.7	50.0	10.3	8.2	V	138	1.07
46.26	36.0	50.0	14.0	5.5	V	176	1.34
50.46	38.0	50.0	12.0	3.1	V	308	1.04
249.99	49.2	57.0	7.8	6.7	H	220	1.25
275.01	48.3	57.0	8.7	7.7	H	251	1.01
375.03	48.2	57.0	8.8	10.5	H	238	1.00
425.01	52.0	57.0	5.0	11.6	V	184	1.05
500.01	52.1	57.0	4.9	13.7	H	124	1.44
825.03	49.7	57.0	7.3	18.4	H	68	1.06
875.04	52.5	57.0	4.5	18.7	H	327	1.00

EUT 1, position 2:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
37.89	40.2	50.0	9.8	11.2	V	117	1.08
39.06	41.1	50.0	8.9	10.5	V	114	1.01
42.78	40.1	50.0	9.9	7.9	H	147	1.44
50.01	42.6	50.0	7.4	3.3	H	298	1.47
128.07	34.5	54.0	19.5	6.5	H	218	1.31
225.00	44.1	56.9	12.8	5.7	H	48	1.54
249.99	46.3	57.0	10.7	6.7	H	28	1.40
375.03	46.8	57.0	10.2	10.5	V	212	1.38
425.01	47.8	57.0	9.2	11.6	H	177	1.00
500.01	51.7	57.0	5.3	13.7	H	126	1.38
525.03	48.1	57.0	8.9	14.1	H	297	1.50
825.03	45.3	57.0	11.7	18.4	H	328	1.07
875.04	53.1	57.0	3.9	18.7	V	357	1.87

EUT 1, position 3:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
37.53	43.6	50.0	6.4	11.5	V	144	1.00
43.02	42.1	50.0	7.9	7.8	V	132	1.03
50.97	38.8	50.0	11.2	2.8	V	276	1.03
125.01	42.8	54.0	11.2	6.7	V	221	1.01
249.99	49.1	57.0	7.9	6.7	H	237	1.08
325.02	49.1	57.0	7.9	9.2	H	267	1.02
375.03	50.8	57.0	6.2	10.5	H	164	1.04
500.01	51.8	57.0	5.2	13.7	H	109	1.46
825.03	50.9	57.0	6.1	18.4	V	347	1.15
875.04	54.3	57.0	2.7	18.7	H	68	1.00

EUT 2, position 1:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
36.06	44.0	50.0	6.0	12.4	V	355	1.29
60.96	42.7	50.0	7.3	2.0	V	124	1.80
74.58	33.7	50.0	16.3	5.0	V	268	1.20
125.67	43.0	54.0	11.0	6.6	V	228	1.23
132.48	44.6	54.0	9.4	6.0	V	254	1.05
249.99	47.4	57.0	9.6	6.7	H	244	1.27
375.00	43.2	57.0	13.8	10.5	H	176	1.01
500.01	52.1	57.0	4.9	13.7	H	98	1.55
874.98	47.2	57.0	9.8	18.7	H	312	1.03

EUT 2, position 2:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Correction [dB/m]	Polarization (H/V)	Azimuth [deg]	Antenna height [m]
36.06	35.2	50.0	14.8	12.4	V	250	1.18
46.26	33.7	50.0	16.3	5.5	V	130	1.07
60.96	42.6	50.0	7.4	2.0	V	132	1.59
125.76	45.1	54.0	8.9	6.6	V	206	1.05
249.99	47.8	57.0	9.2	6.7	H	166	1.37
324.99	41.8	57.0	15.2	9.2	H	55	1.01
500.01	52.7	57.0	4.3	13.7	H	94	1.60
874.98	48.1	57.0	8.9	18.7	H	310	1.04

Test result: Passed

Test equipment (please refer to chapter 7 for details)
1 - 9

5.2.3.2 Test results (radiated 1 to 40 GHz)

Ambient temperature:	22 °C
Relative humidity:	30 %

Date:	12.12.2025
Tested by:	M. BASTERT

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 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: All 3 orthogonal planes were tested separately. Only EUT 1 was tested above 1 GHz.

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]

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.

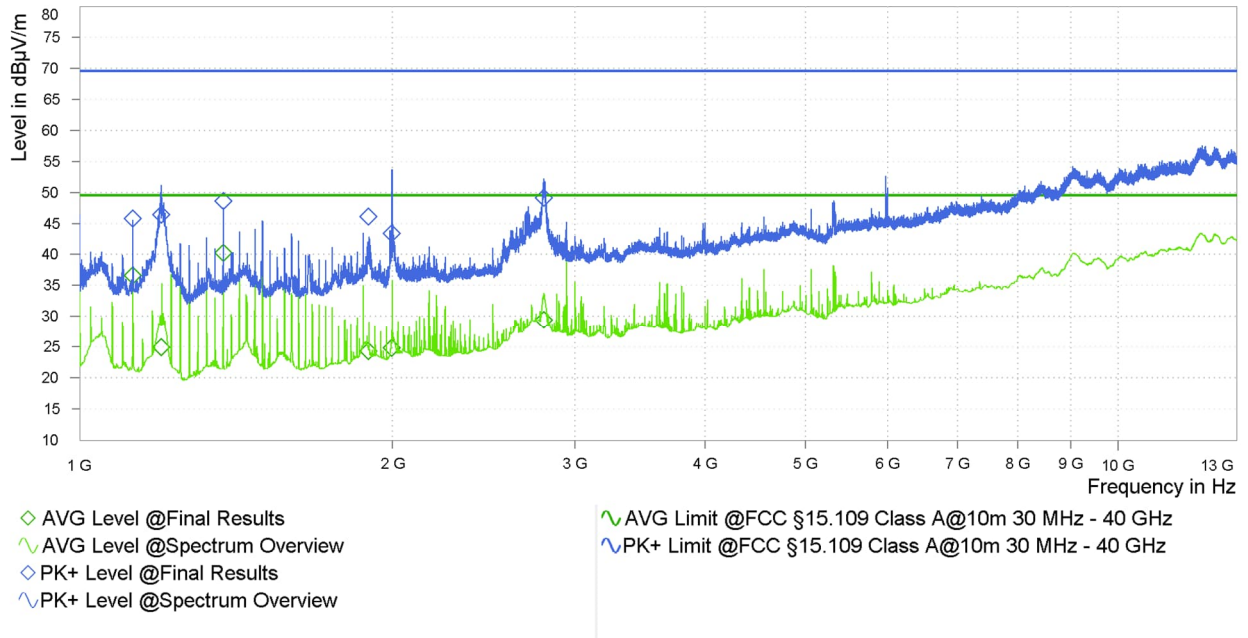
The top measured curve represents the peak measurement. The measured points marked with "◇" are frequency points for the final peak detector measurement. These values are indicated in the following table.

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

The test results are presented on the following pages.

Spurious emissions from 1 GHz to 13 GHz according to FCC 47 CFR Part 15 section 15.109 (a), (b) [3]:

Worst case plot (EUT 1, position 1):



Result tables:

EUT 1, position 1:

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]	Azimuth [deg]	Height [m]
1125.00	45.83	69.54	23.71	36.55	49.54	12.99	-10.56	V	21	2.92
1197.50	46.38	69.54	23.16	24.97	49.54	24.57	-9.56	V	271	2.81
1375.00	48.56	69.54	20.98	40.30	49.54	9.24	-8.20	V	33	3.19
1895.50	46.07	69.54	23.47	24.27	49.54	25.27	-4.70	H	19	3.28
1998.75	43.38	69.54	26.16	24.86	49.54	24.68	-4.03	H	41	2.88
2799.00	49.09	69.54	20.45	29.44	49.54	20.10	1.43	V	159	2.78

EUT 1, position 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]	Azimuth [deg]	Height [m]
1125.00	47.05	69.54	22.49	38.89	49.54	10.65	-10.56	V	13	2.95
1206.00	45.14	69.54	24.40	25.39	49.54	24.15	-9.44	H	163	1.52
1375.00	46.89	69.54	22.65	38.84	49.54	10.70	-8.20	H	155	1.00
1990.50	37.33	69.54	32.21	22.32	49.54	27.22	-4.10	H	53	1.18
2790.50	50.60	69.54	18.94	31.99	49.54	17.55	1.52	H	155	1.72
4559.75	45.54	69.54	24.00	35.34	49.54	14.20	7.53	V	147	2.75

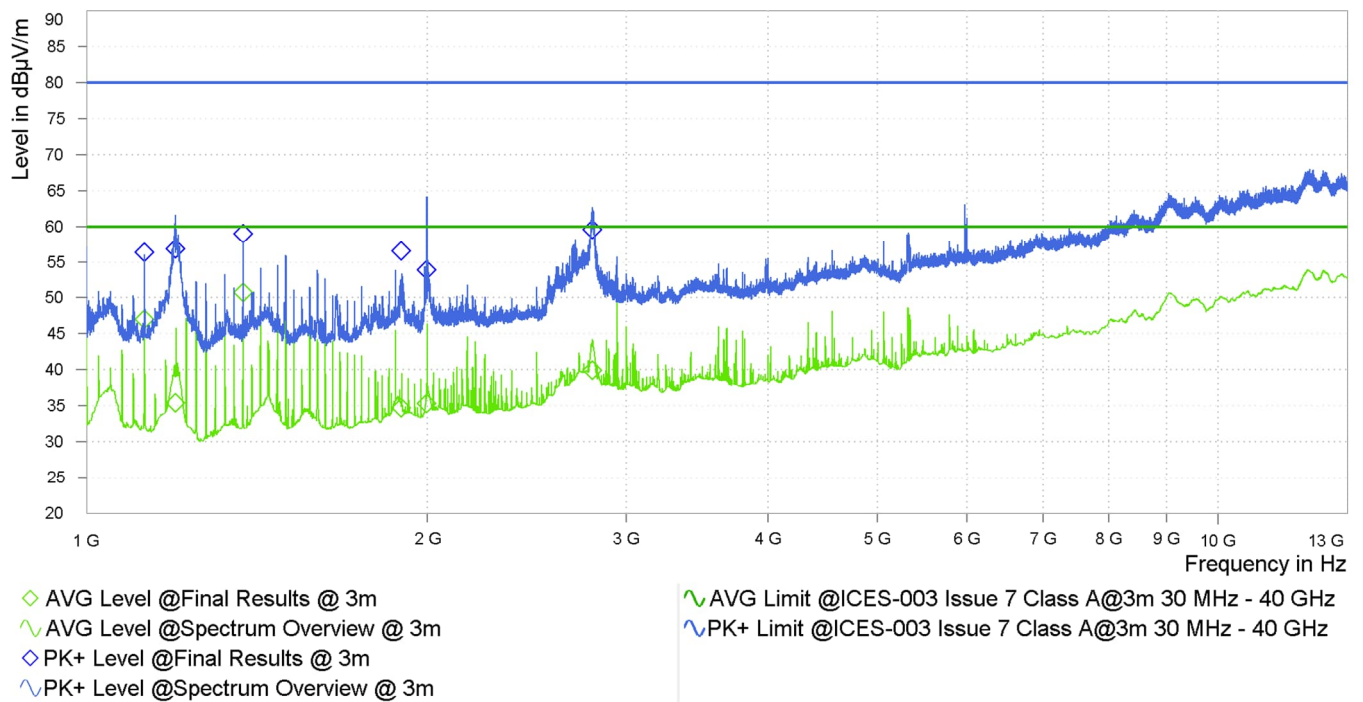
EUT 1, position 3:

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]	Azimuth [deg]	Height [m]
1125.00	46.31	69.54	23.23	38.33	49.54	11.21	-10.56	H	171	1.05
1204.00	47.55	69.54	21.99	28.04	49.54	21.50	-9.46	H	65	3.31
1375.00	46.96	69.54	22.58	39.74	49.54	9.80	-8.20	V	35	2.82
1991.50	39.66	69.54	29.88	23.56	49.54	25.98	-4.09	H	24	2.95
2794.75	49.98	69.54	19.56	31.49	49.54	18.05	1.48	H	153	1.08
4554.00	42.15	69.54	27.39	29.14	49.54	20.40	7.53	V	113	1.48

Test result: Passed

Spurious emissions from 1 GHz to 13 GHz according to ICES-003 Issue 7 section 3.2.2 [4]:

Worst case plot (EUT 1, position 1):



The result tables are presented on the following page.

Result tables:

EUT 1, position 1:

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]	Azimuth [deg]	Height [m]
1125.00	56.29	80.0	23.71	47.01	60.0	12.99	-10.56	V	21	2.92
1197.50	56.84	80.0	23.16	35.43	60.0	24.57	-9.56	V	271	2.81
1375.00	59.02	80.0	20.98	50.76	60.0	9.24	-8.20	V	33	3.19
1895.50	56.53	80.0	23.47	34.73	60.0	25.27	-4.70	H	19	3.28
1998.75	53.84	80.0	26.16	35.32	60.0	24.68	-4.03	H	41	2.88
2799.00	59.55	80.0	20.45	39.90	60.0	20.10	1.43	V	159	2.78

EUT 1, position 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]	Azimuth [deg]	Height [m]
1125.00	57.51	80.0	22.49	49.35	60.0	10.65	-10.56	V	13	2.95
1206.00	55.60	80.0	24.40	35.85	60.0	24.15	-9.44	H	163	1.52
1375.00	57.35	80.0	22.65	49.30	60.0	10.70	-8.20	H	155	1.00
1990.50	47.79	80.0	32.21	32.78	60.0	27.22	-4.10	H	53	1.18
2790.50	61.06	80.0	18.94	42.45	60.0	17.55	1.52	H	155	1.72
4559.75	56.00	80.0	24.00	45.80	60.0	14.20	7.53	V	147	2.75

EUT 1, position 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]	Azimuth [deg]	Height [m]
1125.00	56.77	80.0	23.23	48.79	60.0	11.21	-10.56	H	171	1.05
1204.00	58.01	80.0	21.99	38.50	60.0	21.50	-9.46	H	65	3.31
1375.00	57.42	80.0	22.58	50.20	60.0	9.80	-8.20	V	35	2.82
1991.50	50.12	80.0	29.88	34.02	60.0	25.98	-4.09	H	24	2.95
2794.75	60.44	80.0	19.56	41.95	60.0	18.05	1.48	H	153	1.08
4554.00	52.61	80.0	27.39	39.60	60.0	20.40	7.53	V	113	1.48

Test result: Passed

Test equipment (please refer to chapter 7 for details)
3 - 11

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	-
☐	7.3; 11.6; 11.8	Floor-standing equipment testing	-	-

The AC power adapter as shown in clause 1.5 of this test report was used for the test.
The power adapter was supplied by 120 V_{AC} 60Hz.

5.3.3 Test results (Conducted emissions on power supply lines)

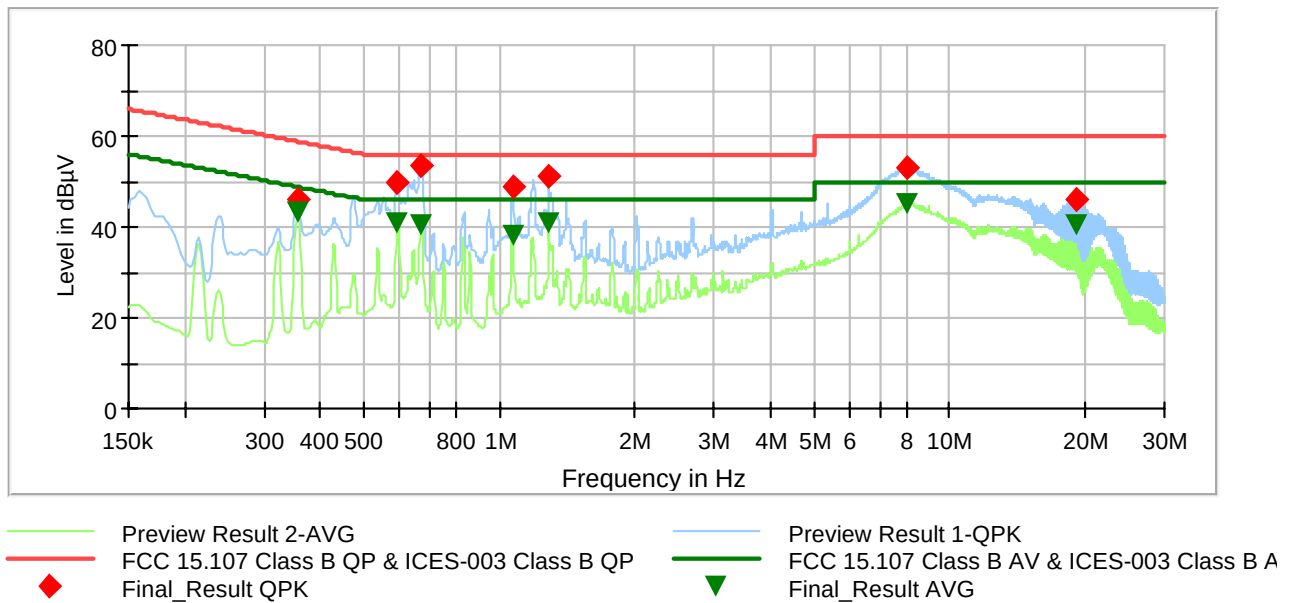
Ambient temperature:	22 °C
Relative humidity:	32 %

Date:	05.03.2026
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 ▼.

The test results are presented on the next pages.

Measurement plot EUT 1:

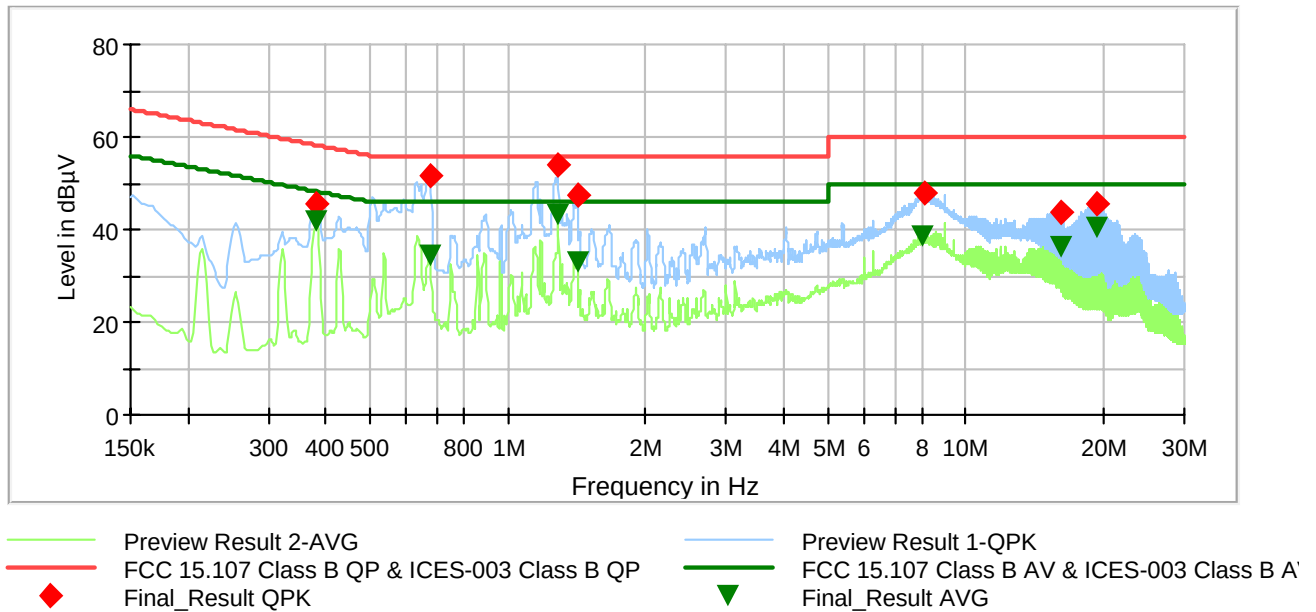


Result table EUT 1:

Frequency [MHz]	QuasiPeak [dB(μ V)]	Average [dB(μ V)]	Limit [dB(μ V)]	Margin [dB]	Line	PE	Corr. [dB]
0.35475	45.92	-	58.85	12.93	L1	FLO	19.8
0.35700	-	43.43	48.80	5.37	L1	FLO	19.8
0.59325	49.70	-	56.00	6.30	L1	FLO	19.7
0.59325	-	40.71	46.00	5.29	L1	FLO	19.7
0.67200	53.52	-	56.00	2.48	L1	FLO	19.7
0.67200	-	40.33	46.00	5.67	L1	FLO	19.7
1.07250	48.88	-	56.00	7.12	L1	FLO	19.7
1.07250	-	37.93	46.00	8.07	L1	FLO	19.7
1.28625	51.08	-	56.00	4.92	N	FLO	19.8
1.28850	-	40.96	46.00	5.04	L1	GND	19.8
8.07450	53.11	-	60.00	6.89	L1	GND	20.2
8.08125	-	45.10	50.00	4.90	L1	GND	20.2
19.11750	46.16	-	60.00	13.84	N	GND	20.3
19.11750	-	40.51	50.00	9.49	N	GND	20.3

Test result: Passed

Measurement plot EUT 2:



Result table EUT 2:

Frequency [MHz]	QuasiPeak [dB(μV)]	Average [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Line	PE	Corr. [dB]
0.37950	45.53	-	58.29	12.76	L1	FLO	19.7
0.38175	-	41.67	48.24	6.57	L1	FLO	19.7
0.67425	51.81	-	56.00	4.19	L1	FLO	19.7
0.67425	-	34.34	46.00	11.66	L1	FLO	19.7
1.28850	54.13	-	56.00	1.87	N	FLO	19.8
1.28850	-	43.17	46.00	2.83	L1	GND	19.8
1.41675	47.55	-	56.00	8.45	L1	GND	19.8
1.41675	-	33.09	46.00	12.91	N	FLO	19.8
8.05425	-	38.53	50.00	11.47	N	GND	20.2
8.09700	47.80	-	60.00	12.20	L1	GND	20.2
16.10700	43.87	-	60.00	16.13	N	GND	20.3
16.11150	-	36.05	50.00	13.95	N	GND	20.3
19.32900	45.59	-	60.00	14.41	N	GND	20.4
19.32900	-	40.69	50.00	9.31	N	GND	20.4

Test result: Passed

Test equipment (please refer to chapter 7 for details)
12 - 15

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	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
2	Ultralog antenna 30 MHz - 6 GHz	HL562E	Rohde & Schwarz	101079	482978	24.04.2024	04.2027
3	EMC test software	Elektra V5.21	Rohde & Schwarz	-	483755	Calibration not necessary	
4	RF switch matrix	OSP220	Rohde & Schwarz	101391	482976	Calibration not necessary	
5	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
6	Antenna support tilt mast	BAM 4.5-P- 10kg	Maturo	222/2612.01	483225	Calibration not necessary	
7	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
8	Semi anechoic chamber M276	SAC5-2	Albatross Projects	C62128-A540- A138-10-0006	483227	Calibration not necessary	
9	EMI receiver / Spectrum analyser	ESW44	Rohde & Schwarz	101828	482979	21.02.2024 06.02.2026	02.2026 02.2028
10	Low noise amplifier 10 MHz - 18 GHz	LNA-30- 00101800-25- 10P	Narda-Miteq	2110917	482967	20.02.2024 04.02.2026	02.2026 02.2028
11	Log.-Per. Antenna 850 MHz - 26.5 GHz	HL050	Rohde & Schwarz	100908	482977	22.09.2022 10.10.2025	09.2025 10.2028
12	V-LISN	NSLK8128RC	Schwarzbeck	0412	483186	28.02.2024 09.02.2026	02.2026 02.2028
13	Shielded chamber M155	SK3	Albatross Projects	-	482786	Calibration not necessary	
14	Software	EMC32 Ver. 10.60.20	Rohde & Schwarz	100619	483182	Calibration not necessary	
15	EMI receiver / Spectrum analyser	ESR7	Rohde & Schwarz	101939	482558	21.02.2024 11.02.2026	02.2026 02.2028

8 Test site Verification

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Shielded chamber M155	482786	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	14.11.2022 14.11.2025	11.2025 11.2028
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4-2014 ANSI C63.4a-2017	05.06.2025	06.2028
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	28.02.2023 29.01.2026	02.2026 01.2029

9 Report History

Report Number	Date	Comment
F250250E2	16.06.2026	Initial test report
-	-	-
-	-	-

10 List of Annexes

Annex A Test setup photos

11 pages

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