

Test Report

Report Number:

F220520E1

Equipment under Test (EUT):

MGB-L2B-PNA-R-161481

Applicant:

EUCHNER GmbH + Co. KG

Manufacturer:

EUCHNER GmbH + Co. KG



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

References

- [1] **ANSI C63.10: 2013** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- [2] **FCC CFR 47 Part 15** Radio Frequency Devices
- [3] **RSS-210 Issue 10 (December 2019)**
License-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen Issue 5 (March 2019) Amendment 1**
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 clause 1.3 of ANSI C63.10 (2013). However, the measurement uncertainty is calculated and shown in this test report.

Tested and
written by:

Signature

Reviewed and
approved by:

Signature

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

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1 Identification

1.1 Applicant

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Country:	Germany
Name for contact purposes:	Mr. Tobias LEHMANN
Phone:	+49 (0) 711-7597-145
eMail address:	tobias.lehmann@euchner.de
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	EUCHNER GmbH + Co. KG
Address:	Kohlhammerstr. 16, 70771 Leinfelden-Echterdingen
Country:	Germany
Name for contact purposes:	Mr. Tobias LEHMANN
Phone:	+49 (0) 711-7597-145
eMail address:	tobias.lehmann@euchner.de
Manufacturer represented during the test by the following person:	None

1.3 Test Laboratory

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

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

1.4 EUT (Equipment under Test)

Test object: *	MGB-L2B-PNA-R-161481
Model name: *	MGB-L2B-PNA-R-161481
Model number: *	161481
Order number: *	161481
FCC ID: *	2AJ58-19
IC certification number: *	22052-19
PMN: *	MGB-L0-PN Series MGB-L1-PN Series MGB-L2-PN Series
HVIN: *	19
FVIN: *	N/A

* Declared by the applicant



One EUT was used for all tests.

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

1.5 Technical Data of Equipment

General			
Power supply EUT: *	DC		
Supply voltage EUT: *	$U_{nom} = 24 \text{ V}$	$U_{nom} = 20.4 \text{ V}$	$U_{nom} = 27.6 \text{ V}$
Temperature range: *	-25 °C to +55 °C		
Lowest / highest internal frequency: *	125 kHz / 150 MHz		

* Declared by the applicant

RFID part	
Operating frequency: *	125 kHz
Number of channels: *	1
Type of modulation: *	AM
Data rate: *	4 bits / ms, Manchester coded
Duty cycle: *	50 %
Antenna type: *	Ring
Antenna connector: *	None

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
X1 DC supply	7/8" 5 Pin Socket male	7/8" 5 Pin Plug female	3 m	No
X2 DC supply	7/8" 5 Pin Socket female	Left open	-	-
X3 PN 2 (SPS)	M12 4 Pin Socket female	Left open	-	-
X4 PN 1 (SPS)	M12 4 Pin Socket female	M12 4 Pin Socket male	5 m	No

Equipment used for testing		
TAG* ¹ (Handel-Module)		
Bus module * ¹		

*¹ Provided by the applicant

*² Provided by the laboratory

Ancillary equipment	
SPS	Siemens SIMATIC S7-1200

*1 Provided by the applicant

*2 Provided by the laboratory

1.6 Dates

Date of receipt of test sample:	18.07.2022
Start of test:	09.08.2022
End of test:	26.06.2023

2 Operational States

Description of function of the EUT:

The EUT is a 125 kHz RFID system used as an authorization system or lockout system.

The following states were defined as the operating conditions:

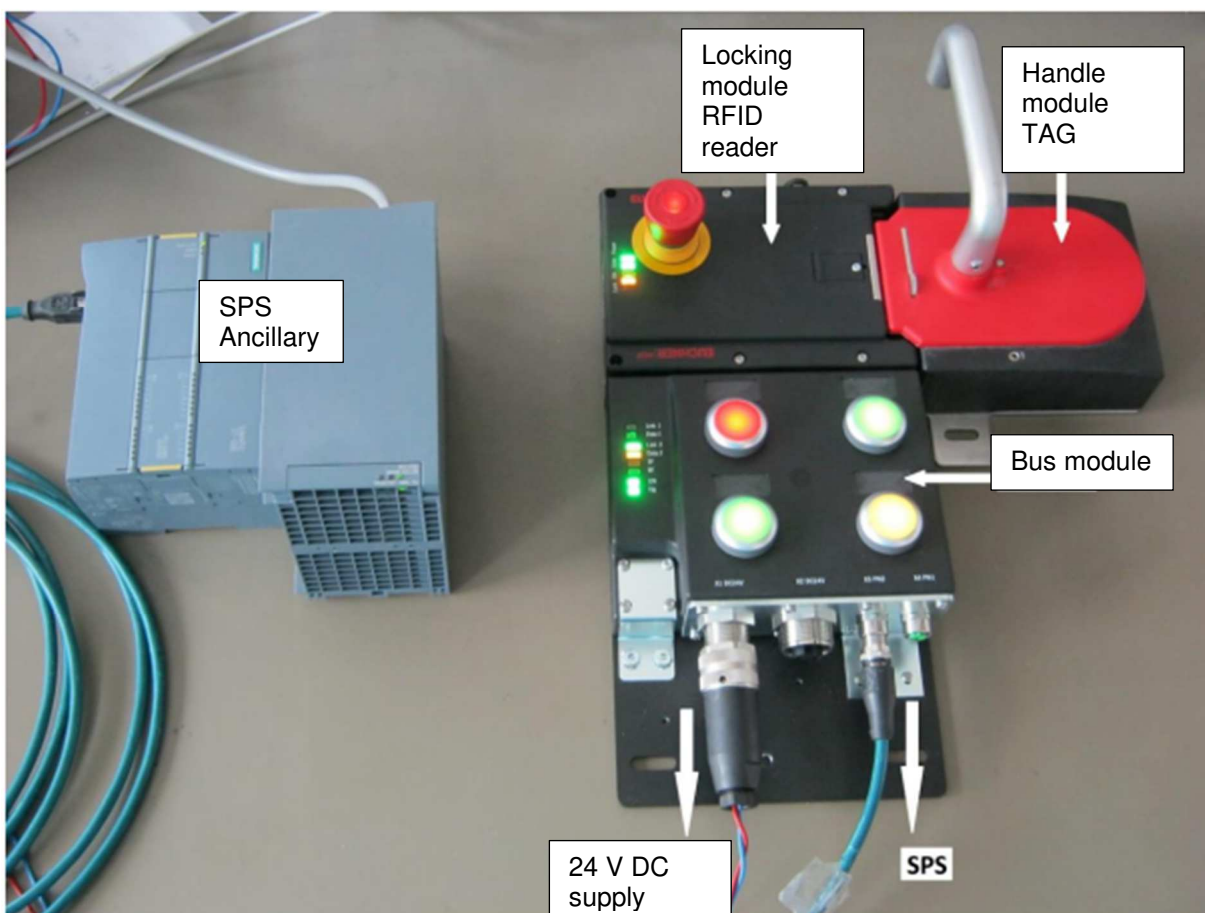
The EUT was supplied by the AC/DC power adaptor bel HC24-2.4-AG provided by the test laboratory. The power adapter itself was supplied by 120V_{AC} 60Hz.

Two states have been defined for the tests:

1. Reading a TAG
2. Continuous search for a TAG.

The worst-case results were measured while the EUT was reading a TAG.

The system was setup as follows:



3 Additional Information

The EUT was labeled as required by FCC / IC.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-Gen, Issue 5 [4] and RSS-210, Issue 10 [3]	Tested EUT	Status
Conducted emissions on supply line	0.15 – 30	15.207 (a)	8.8 [4]	1	Passed
Radiated emissions	0.009 – 2 GHz **	15.205 (a) 15.209 (a)	8.9 and 8.10 [4] 7.1 and 7.3 [3]	1	Passed
99 % bandwidth	0.125	-	6.7 [4]	1	Passed
Antenna requirement	-	15.203 [2]	6.8 [4]	1	Passed *

*: Integrated antenna only, requirement fulfilled.

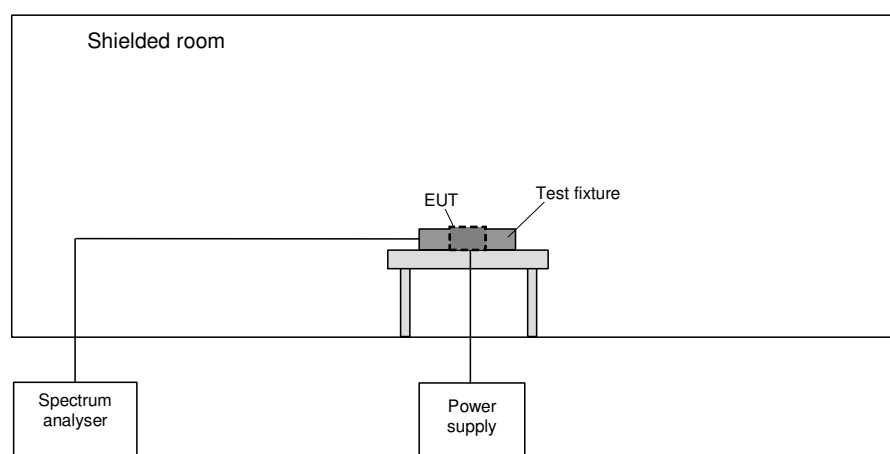
**:
As declared by the applicant the highest radio clock frequency is 150 MHz.
Therefore the radiated emission measurement must be carried out up to 10th of the highest radio clock frequency in this case 2 GHz.

5 Results

5.1 Test setups

5.1.1 Radiated: Test fixture

The test is carried out in a shielded chamber. Table-top devices are set up on a table and the spectrum analyser is connected to a test fixture / loop antenna, which is placed around / on top of the EUT.



5.1.2 Radiated: 9 kHz to 30 MHz

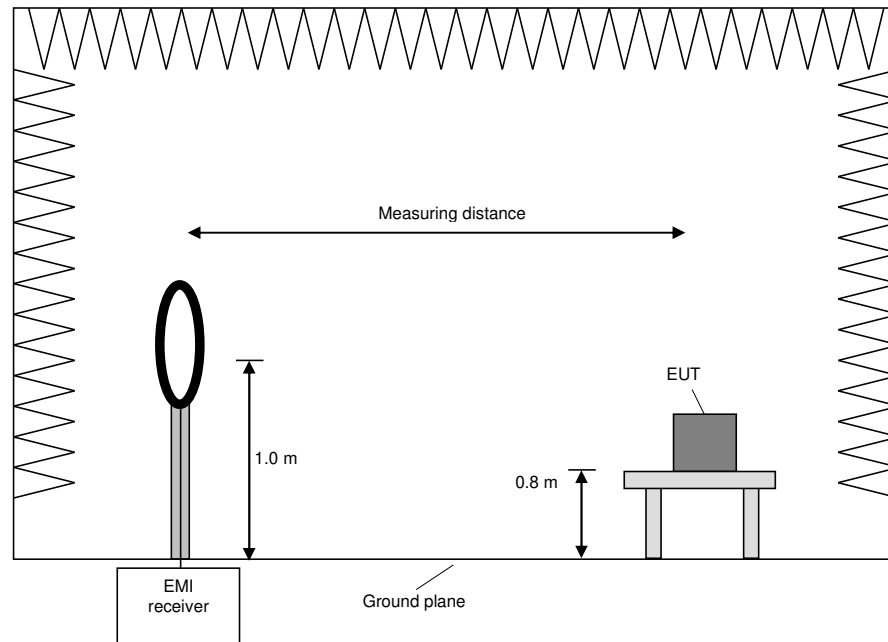
5.1.2.1 Preliminary measurement 9 kHz to 30 MHz

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.

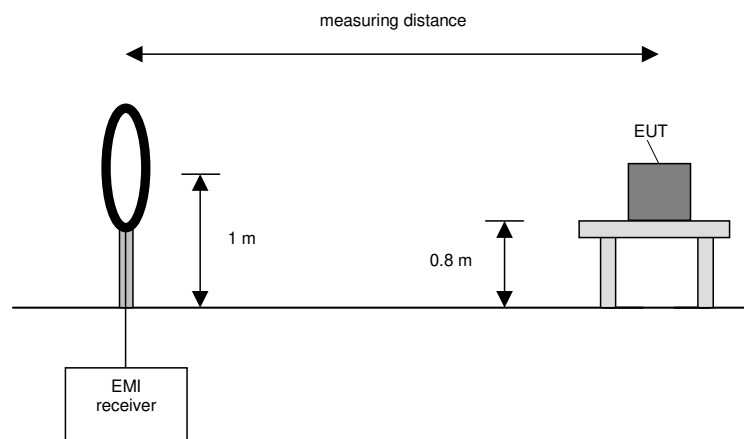
5.1.2.2 Final measurement 9 kHz to 30 MHz

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 to 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.

5.1.3 Radiated: 30 MHz to 1 GHz

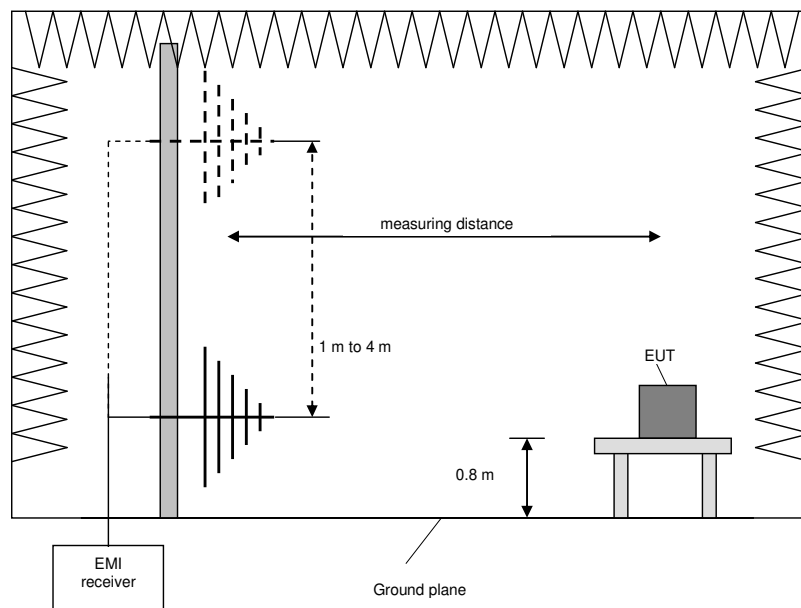
5.1.3.1 Preliminary and final measurement 30 MHz to 1 GHz

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:

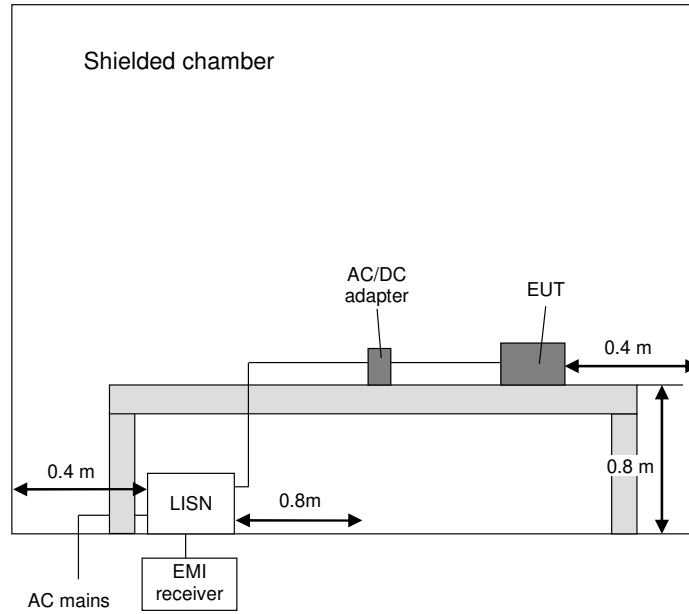
- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case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

5.1.4 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].

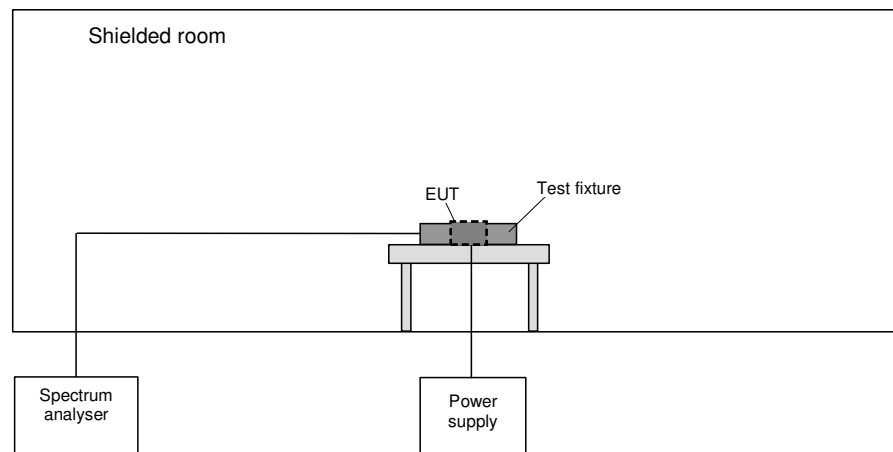
The frequency range 150 kHz to 30 MHz is measured with an EMI receiver set to MAX hold mode with Peak and Average detectors and a resolution bandwidth of 9 kHz. A scan is carried out on the phase and neutral line of the AC mains network. If emissions less than 10 dB below the appropriate limit are detected,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



5.1.5 Method 99% bandwidth

The test is carried out in a shielded chamber. Table-top devices are set up on a table and the spectrum analyser is connected to a test fixture / loop antenna, which is placed around / on top of the EUT.



The following procedure will be used for the occupied bandwidth measurement according to [1]:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- Step a) through step c) might require iteration to adjust within the specified range.

5.2 99 % bandwidth

5.2.1 Test setup (99 % bandwidth)

Test setup (99 % bandwidth)			
Used	Setup	See sub-clause	Comment
<input checked="" type="checkbox"/>	Radiated: Test fixture	5.1.1	-
<input type="checkbox"/>	Test setup (antenna port conducted)	-	-

5.2.2 Test method (99 % bandwidth)

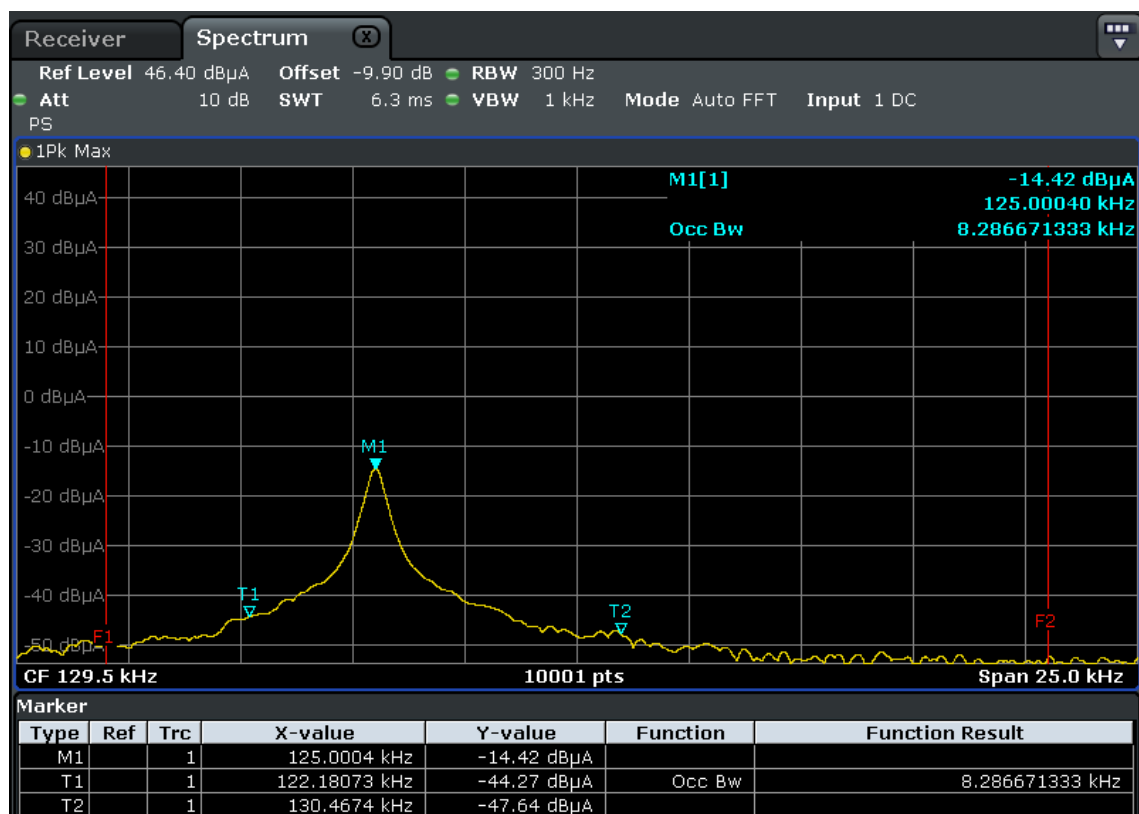
Test method (99 % bandwidth)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
<input checked="" type="checkbox"/>	6.9.3	Occupied bandwidth – power bandwidth (99%) measurement procedure	-	-

5.2.3 Test results (99 % bandwidth)

Ambient temperature:	22 °C
Relative humidity:	58 %

Date:	13.09.2022
Tested by:	M. DINTER

operation mode 1



F_L	F_U	BW ($F_U - F_L$)
122.18073 kHz	130.4674 kHz	8.28667 kHz

Test result: Passed

Test equipment (please refer to chapter 7 for details)
17, 18

5.3 Radiated emissions

5.3.1 Test setup (Maximum unwanted emissions)

Test setup (Maximum unwanted emissions)			
Used	Setup	See sub-clause	Comment
<input checked="" type="checkbox"/>	Radiated: 9 kHz to 30 MHz / 30 MHz to 1 GHz / 1 GHz to 40 GHz	5.1.2 / 5.1.3 / 5.1.4	-

5.3.2 Test method (Maximum unwanted emissions)

☒ Test method (radiated) see sub-clause 5.1.2 / 5.1.3 / 5.1.4 as described herein

5.3.3 Test results (Maximum unwanted emissions)

5.3.3.1 Test results preliminary measurement 9 kHz to 30 MHz

Ambient temperature:	23 °C	Date:	09.08.2022
Relative humidity:	50 %	Tested by:	M.DINTER

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

Test record: The measurement value is 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: The EUT was tested in normal installation position.

Calculations:

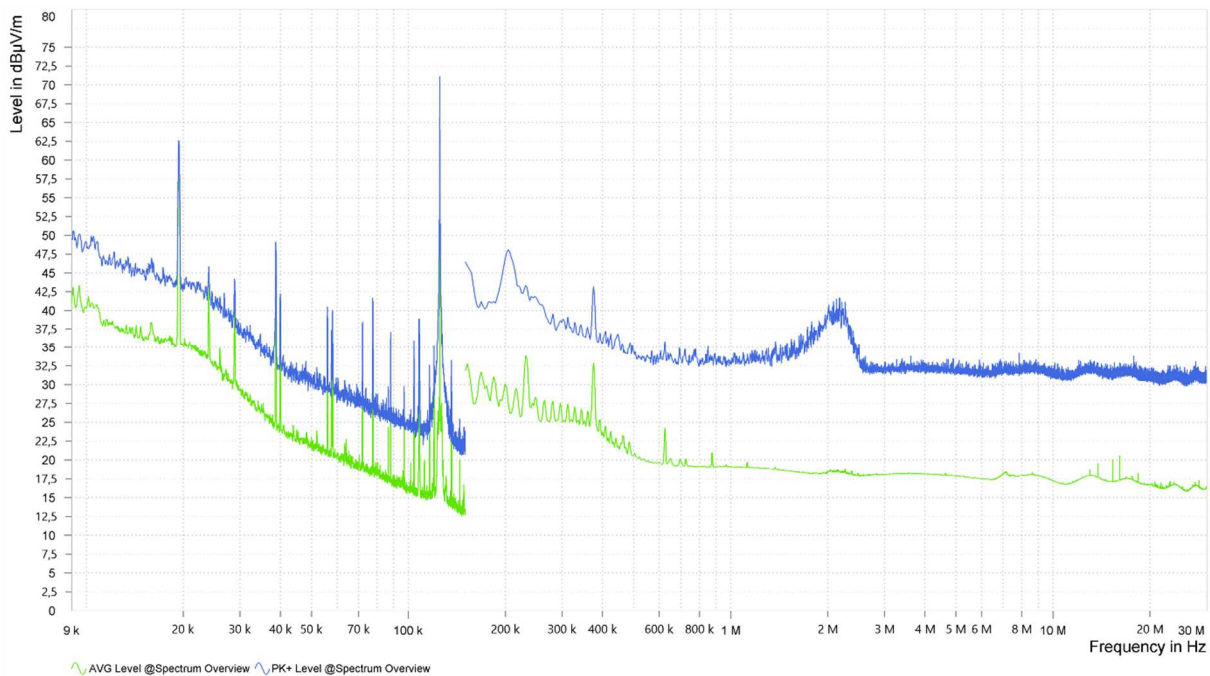
Result @ norm. dist. [dBμV/m] = Reading [dBμV] + AF [dB/m] + Distance corr. fact. [dBμV/m]

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]

Worst case plot:

Spurious emissions from 9 kHz to 30 MHz (operation mode 1):



Only the fundamental of the transmitter (125 kHz) was found.

Remark: No further emissions close than 20 dB to the limit.

5.3.3.2 Test results final measurement 9 kHz to 30 MHz

Ambient temperature:	25 °C
Relative humidity:	38 %

Date:	31.08.2022
Tested by:	M. DINTER

The results of the standard subsequent measurement on the outdoor test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above-mentioned standard while taking account of the specified requirements for a 300 m measuring distance.

Results 9kHz - 30 MHz										
Frequency	Reading	Result*	Result*	Limit acc. 15.209	Limit acc. RSS-Gen Table 6	Margin**	Detector (acc. to §15.209 (d))	Antenna factor	Measuring Distance	Distance correction factor***
[MHz]	[dBμV]	[dBμV/m]	[dBμA/m]	[dBμV/m]	[dBμA/m]	[dB]		[dB/m]	[m]	[dB]
0.019	62.7	3.6 @ 300m	-48 @ 300m	42.0	-9.5	38.5	AV	20.9	3	80.0
0.039	49.1	-10.4 @ 300m	-61.9 @ 300m	35.8	-15.7	46.2	AV	20.5	3	80.0
0.125	37.1	-1.6 @ 300m	-53.1 @ 300m	25.7	-25.9	27.3	AV	20.4	10	59.1
0.375	43.2	-16.5 @ 300m	-68 @ 300m	16.1	-35.4	32.6	AV	20.3	3	80.0

Note*: Result @ norm dist = Reading + Antenna factor - Distance Extrapolation Factor; Result [dBμA/m] = Result [dBμV/m] - 20*log(377 Ω)

** Margin = Limit [dBμ{V|A}/m] - Result @ norm distance

*** 40dB/decade according Part §15.31 (f) (2)

Remark:

The limits in CFR 47. Part 15. Subpart C. paragraph 15.209 (a). are identical to those in RSS-GEN Section 8.9. Table 6. since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ω.

For example. the measurement frequency X kHz resulted in the level of Y dBμV/m. which is equivalent to Y - 51.5 = Z dBμA/m. which was the same margin. W dB. to the corresponding RSS-GEN Table 6 as it has to the 15.209(a) limit.

Test result: Passed

Test equipment (please refer to chapter 7 for details)
5, 13, 14

5.3.3.3 Test results (30 MHz – 1 GHz)

Ambient temperature:	23 °C
Relative humidity:	50 %

Date:	09.08.2022
Tested by:	M. DINTER

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

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

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

Remark: The EUT was tested in normal installation position.

Calculations:

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

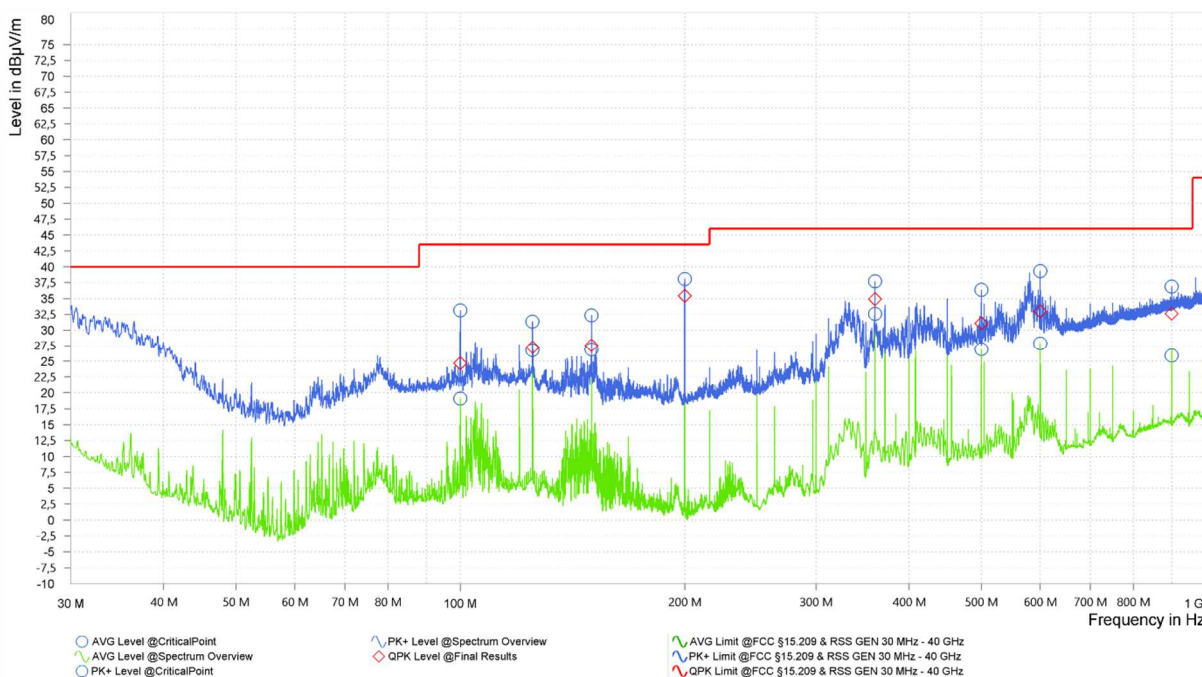
Correction [dBμV/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

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.

Worst case plot: The worst-case results are for the EUT reading a TAG.

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



Result tables:

(Operation mode 1):

Frequency [MHz]	Result (QP) [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol. (H/V)
99.990	24.67	43.50	18.83	17.32	2.53	81	H
125.010	27.25	43.50	16.25	17.24	1.02	-9	V
150.000	27.54	43.50	15.96	15.33	1	328	V
200.010	35.42	43.50	8.08	15.75	1.02	231	V
360.000	34.92	46.00	11.08	20.86	1.25	95	V
500.010	31.06	46.00	14.94	24.54	1.77	45	H
600.030	32.98	46.00	13.02	26.07	1.39	15	V
900.030	32.60	46.00	13.40	30.02	1.02	15	H

Test result: Passed

5.3.3.4 Test results (radiated 1 to 40 GHz)

Ambient temperature:	24 °C
Relative humidity:	58 %

Date:	26.06.2023
Tested by:	M. DINTER

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

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

Calculation:

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

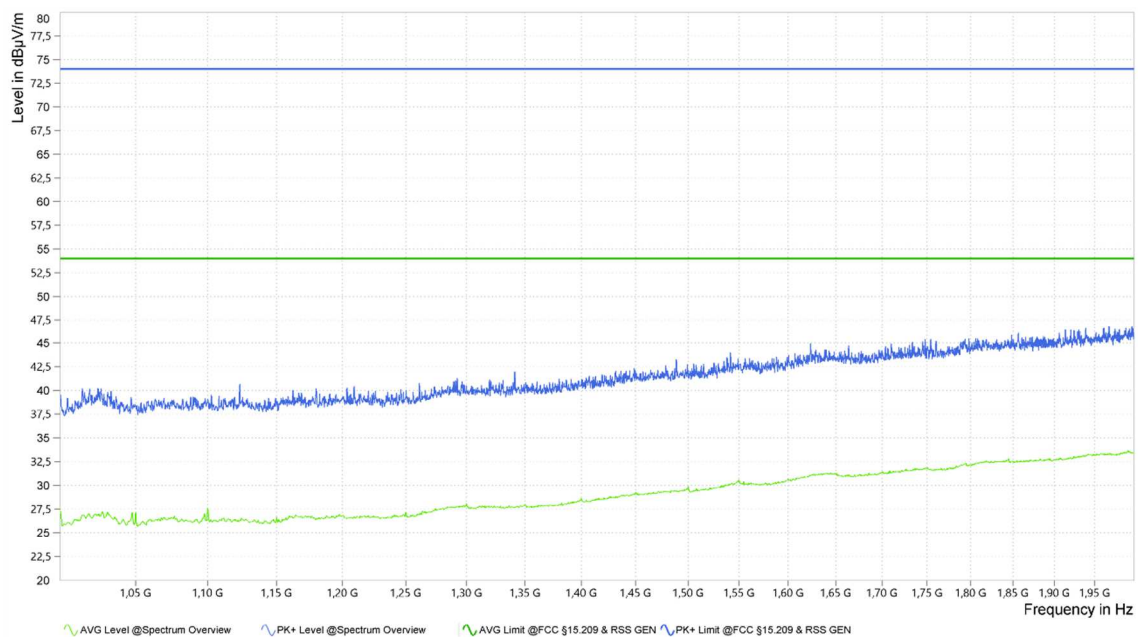
Average [dBμV/m] = Reading [dBμV] + Correction [dBμV/m]

Correction [dBμV/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]

Worst case plot:

Spurious emissions from 1 GHz to 2 GHz (operation mode 1):



Result tables:

Operation mode 1:

Frequency [MHz]	MaxPeak [dB(μV/m)]	Average [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB(μV/m)]	Pol [H/V]	Azimuth [deg]	Elevation [deg]	Corr. [dB]
	No significant emissions were found, therefor no final measurements were carried out.							

Test result: Passed

Test equipment (please refer to chapter 7 for details)
6 – 12, 15, 16, 19 - 20

5.4 AC power-line conducted emissions

5.4.1 Test setup (Conducted emissions on power supply lines)

Test setup (Conducted emissions on power supply lines)			
Used	Setup	See sub-clause	Comment
<input checked="" type="checkbox"/>	Conducted: AC power line	5.1.4	-
<input type="checkbox"/>	Not applicable. because ...	-	-

5.4.2 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
<input checked="" type="checkbox"/>	6.2	Tabletop equipment testing	5.1.4	Provided AC switching power adaptor
<input type="checkbox"/>	6.2	Floor-standing equipment testing	-	-

The AC power adaptor provided by the test laboratory was used for the tests:
bel HC24-2.4-AG

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

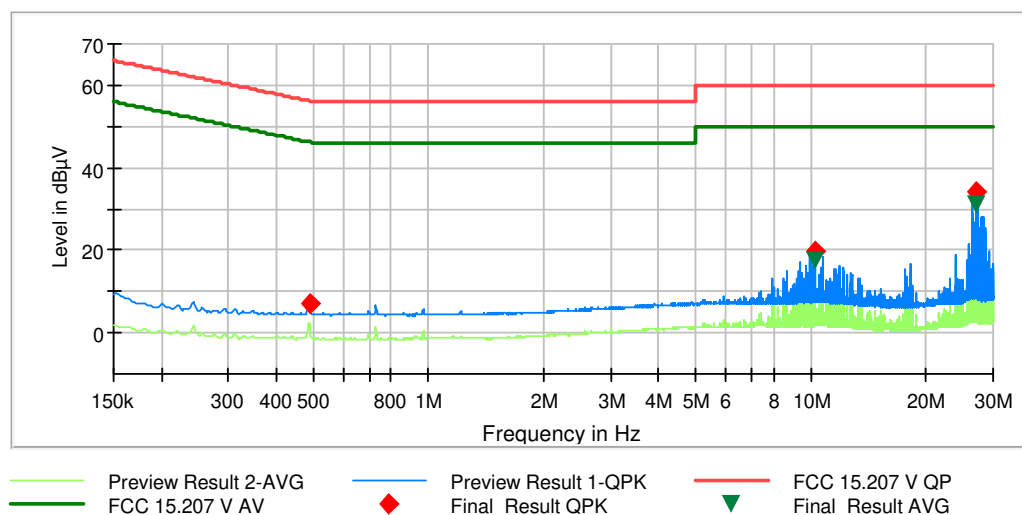
The worst-case results are for the EUT reading a TAG.

5.4.3 Test results (Conducted emissions on power supply lines)

Ambient temperature:	22 °C
Relative humidity:	38 %

Date:	02.09.2022
Tested by:	M. DINTER

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	Corr. [dB]
0.487500	7.20	---	56.21	49.01	15000.0	9.000	L1
10.243500	---	17.43	50.00	32.57	15000.0	9.000	L1
10.243500	19.59	---	60.00	40.41	15000.0	9.000	L1
27.159000	---	30.89	50.00	19.11	15000.0	9.000	N
27.159000	33.97	---	60.00	26.03	15000.0	9.000	N

Test result: Passed

Test equipment (please refer to chapter 7 for details)
1-4

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 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 18 – 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 18 – 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	LISN	NSLK8128RC	Rohde & Schwarz	0412	483186	Calibration not necessary	
2	Shielded chamber M155	SK3	Albatross Projects	-	482786	Calibration not necessary	
3	Software	EMC32	Rohde & Schwarz	100619	483182	Calibration not necessary	
4	EMI receiver	ESR7	Rohde & Schwarz	101939	482558	15.02.2022	02.2024
5	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	22.02.2022	02.2024
6	Software	EMC32	Rohde & Schwarz	100970	482972	Calibration not necessary	
7	RF switch matrix	OSP220	Rohde & Schwarz		482976	Calibration not necessary	
8	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	Calibration not necessary	
9	Antenna support	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
10	Controller	NCD	Maturo	474/2612.01	483226	Calibration not necessary	
11	Semi-anechoic chamber M276	SAC5-2	Albatross Projects	C62128-A540-A138-10-0006	483227	Calibration not necessary	
12	EMI receiver	ESW44	Rohde & Schwarz	101819	483149	18.02.2022	02.2024
13	Outdoor test site	-	PHOENIX TESTLAB	-	480293	Calibration not necessary	
14	EMI receiver	ESI 40	Rohde & Schwarz	100064/040	480355	18.02.2022	02.2023
15	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
16	Ultra-log. antenna	HL562E	Rohde & Schwarz	101079	482978	18.03.2021	03.2024
17	Loop antenna	22.5 cm	PHOENIX TESTLAB	-	410085	Calibration not necessary	
18	Spectrum analyzer	FSW43	Rohde & Schwarz	100586 & 100926	481720	30.03.2021	03.2023
19	Low Noise Amplifier 100 MHz - 18 GHz	LNA-30-00101800-25-10P	Narda-Miteq	2110917	482967	18.02.2022	02.2024
20	Log.-Per. antenna	HL050	Rohde & Schwarz	100908	482977	22.09.2022	09.2025

8 Test site Verification

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
Shielded chamber M155	482784	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	25.09.2020	24.09.2022
OATS Outdoor	480293	9 kHz – 30 MHz	-	ANSI C63.4-2014	-	-
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA/RSM	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	03.03.2021	02.03.2023
Semi anechoic chamber M276	483227	1 -18 GHz	SVSWR	CISPR 16-1-4 + Cor1:2010 + A1:2012 +A2:2017	28.02.2023	27.02.2026

9 Report History

Report Number	Date	Comment
F220520E1	30.08.2023	Initial Test Report
-	-	-
-	-	-

10 List of Annexes

Annex A	Test Setup Photos	7 pages
Annex B	EUT External Photos	12 pages
Annex C	EUT Internal Photos	16 pages