

Test Report

Report Number:

F241826E6

Equipment under Test (EUT):

cVEND touch

Applicant:

Feig Electronic GmbH

Manufacturer:

Feig Electronic GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-00

References

- [1] **ANSI C63.10: 2020** 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 11 (June 2024)**
Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen, Issue 5 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 clause 1.4 of ANSI C63.10 (2020). 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

Name:	Feig Electronic GmbH
Address:	Industriestraße 1a, 35781 Weilburg
Country:	Germany
Name for contact purposes:	Mr. Johannes KLEIN
Phone:	06471-3109-0
eMail address:	info@feig.de
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	Feig Electronic GmbH
Address:	Industriestraße 1a, 35781 Weilburg
Country:	Germany
Name for contact purposes:	Mr. Johannes KLEIN
Phone:	06471-3109-0
eMail address:	info@feig.de
Manufacturer represented during the test by the following person:	-

1.3 Test Laboratory

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

accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) according to DIN EN ISO/IEC 17025:2018. The accreditation is only valid for the scope of accreditation listed in the annex of the certificate D-PL-17186-01-00. FCC Test Firm Designation Number DE0004, FCC Test Firm Registration Number 469623, CAB Identifier DE0003 and ISED# 3469A.

1.4 EUT (Equipment under Test)

Test object: *	Contactless payment terminal
Model name: *	cVEND touch
Model number: *	-
Order number: *	-
FCC ID: *	PJMCVT
IC certification number: *	6633A-CVT
PMN: *	cVEND touch
HVIN: *	cVEND touch
FVIN: *	feclr 03.02.00

	EUT number		
	1	2	3
Serial number: *	1817F481	-	-
PCB identifier: *	FE1182 / FE1183 / FE1188	-	-
Hardware version: *	1.0	-	-
Software version: *	tD03.03.00-00.05-2-2	-	-

* 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 by external power supply		
Supply voltage EUT: *	$U_{nom} = 24 \text{ V}_{DC}$	$U_{min} = 12 \text{ V}_{DC}$	$U_{max} = 42 \text{ V}_{DC}$
Temperature range: *	-30 °C to +70 °C		
Lowest / highest internal frequency: *	32.768 kHz / 50 MHz		

* Declared by the applicant

RFID part	
Operating frequency: *	13.56 MHz
Number of channels: *	1
Type of modulation: *	ASK
Data rate: *	106 kBit/s
Duty cycle: *	~100%
Antenna type: *	Integrated loop antenna
Antenna connector: *	/

* Declared by the applicant

Ports / Connectors				
Identification	Connector		Length during test	Shielding (Yes / No)
	EUT	Ancillary		
LAN 1	RJ45	RJ45	2 m	Yes
LAN 2	RJ45	RJ45	2 m	Yes
Power / MDB	Molex Mini Fit 39-28-1063	Molex Mini Fit 39-01-2060	Power >3 m MDB ≤3 m	No
SCR	JST ZH B6B-ZR	JST ZH ZHR-6	≤3 m	No
COM 0	Molex Micro Fit 43045-0412	Molex Micro Fit 43025-0400	≤3 m	No
USB OTG	Molex Micro Fit 43045-0612	Molex Micro Fit 43025-0600	≤3 m	Yes
AUX	Molex Micro Fit 43650-0615	Molex Micro Fit 43645-0600	≤3 m	No

Equipment used for testing	
Laptop PC *2	Lenovo Think Pad 200t
NFC Card *1	ISO 14443A Mifare DESFire ID-1
-	-

*1 Provided by the applicant

*2 Provided by the laboratory

Ancillary equipment	
cVEND EXT.LTE-A * ¹	LTE Modem Extension Board
cVEND SHCR-A * ¹	Secure Hybrid Card Reader
-	-

*¹ Provided by the applicant

1.6 Dates

Date of receipt of test sample:	03.03.2025
Start of test:	07.03.2025
End of test:	27.03.2025

2 Operational States

Description of function of the EUT:

The EUT is a contactless payment terminal with pin entry. The near field communication between the EUT and the contactless card is operating at 13.56 MHz. All tests were carried out with an unmodified test sample.

The following states were defined as the operating conditions:

The EUT was supplied by 24 V DC during all tests, if not otherwise stated.

To set the EUT in operating mode, the EUT is connected via Ethernet to a test PC. Via a terminal app the RFID function of the EUT can be set to operate. For the “unwanted emissions” test cases only the 13.56 MHz carrier is set up to operate without card polling and modulation. During this test no transponder is used.

All other test cases are carried out with a transponder in front of the NFC reader and the reader operates in the RFID mode with modulation.

The system was setup as follows:



3 Additional Information

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

To fulfil the conducted emission test, a dummy load as described below was used, according to KDB 174176 (06/2015):

The following components were used / changed by the applicant to create suitable dummy load in lieu of the antenna:

The antenna is disconnected and resistors instead of the capacitive matching network of the NFC fronted are used, to create an equivalent "correct nominal impedance".

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-Gen, Issue 5 [4] and RSS-210, Issue 11 [3]	Tested EUT	Status
Spectrum mask	13.110 to 14.110	15.225 (a) – (d)	B.6 [3]	1	Passed
20 dB bandwidth	13.56	15.215 (c)	-	1	Passed
99 % bandwidth	13.56	-	6.7 [4]	1	Passed
Frequency tolerance	13.560	15.225 (e)	B.6 [3] 6.11 [4]	1	Passed
Conducted emissions on supply line	0.15 – 30	15.207 (a)	8.8 [4]	1	Passed
Radiated emissions	0.009 – 1000***	15.205 (a) 15.209 (a)	8.9 and 8.10 [4] 8.1 and 8.3 [3]	1	Passed
Radiated emissions (receiver)	30 – 5.000	15.109 (a)	6.1 [4]	-	N/A **
Antenna requirement	-	15.203 [2]	6.8 [4]	1	Passed *

*: Integrated antenna only, requirement fulfilled.

**: No measurement of the receiver spurious emissions was performed, because of a continuously operating co-located transmitter.

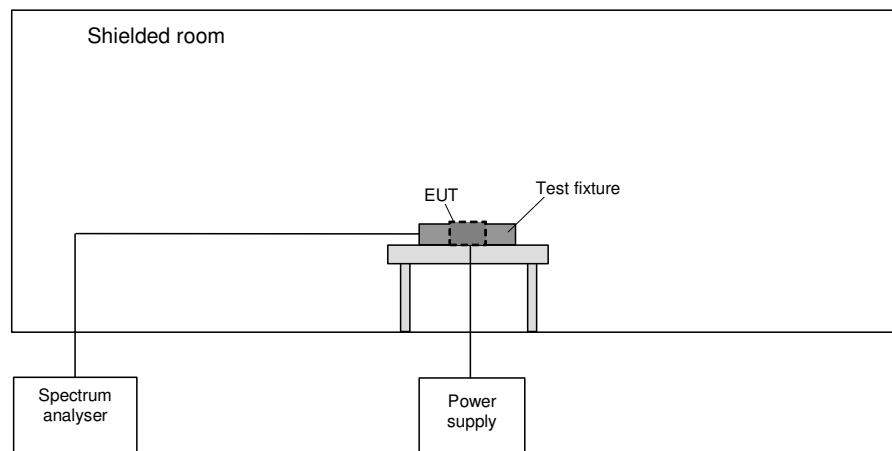
***: As declared by the applicant the highest radio clock frequency of the RFID part is 13.56 MHz. Therefore the radiated emission measurement must be carried out up to 10th of the highest radio clock frequency, but was extended in this case to 1 GHz.

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.



Alternatively, the EUT and test fixture are placed on a non-conductive table inside a temperature chamber if measurements at extreme temperatures are performed.

5.1.2 Radiated: 9 kHz to 30 MHz

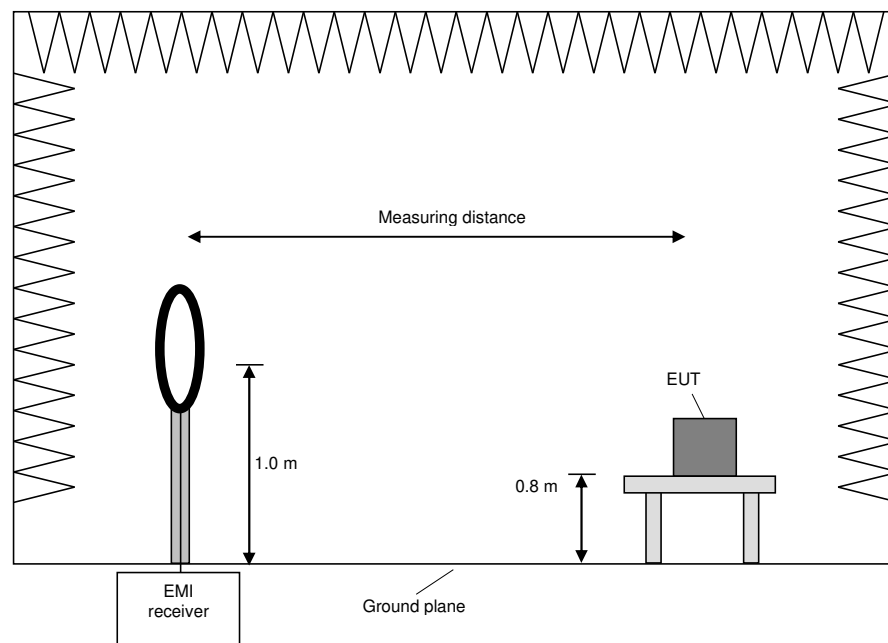
5.1.2.1 Preliminary measurement 9 kHz to 30 MHz

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.

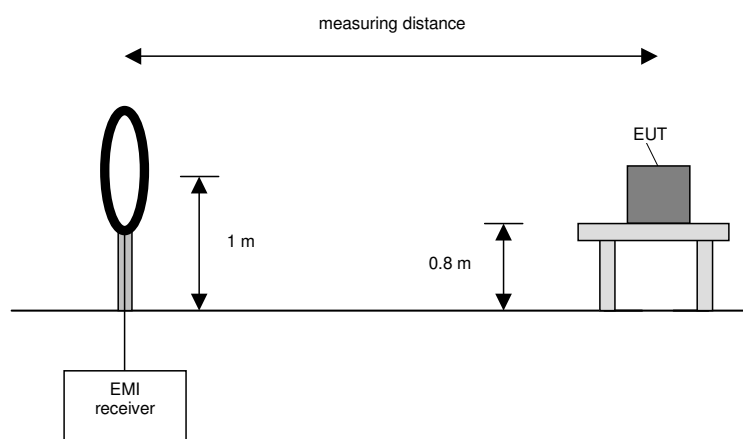
5.1.2.2 Final measurement 9 kHz to 30 MHz

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 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

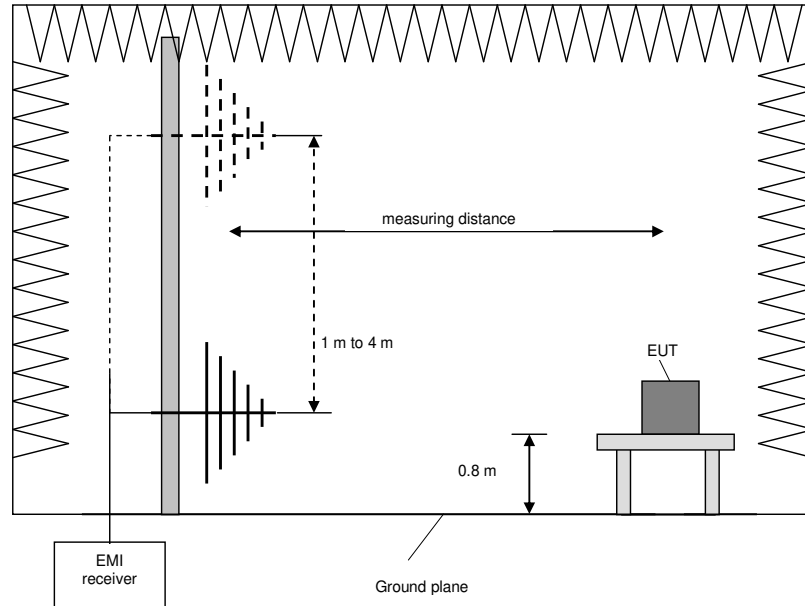
5.1.3.1 Preliminary and final measurement 30 MHz to 1 GHz

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:

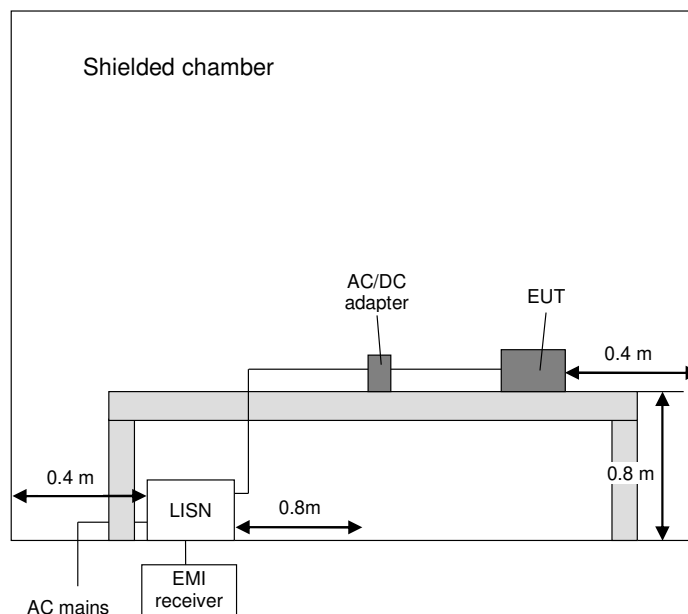
- 1) Select the highest frequency peaks (lowest margin to the limit) for the final measurement.
- 2) The software determines the exact peak frequencies by doing a partial scan with reduced step size of the pre-scan of the selected peaks.
- 3) If the EUT is portable or ceiling mounted, find the worst-case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



5.2 Spectrum mask

5.2.1 Test setup (Spectrum mask)

Test setup (Spectrum mask)			
Used	Setup	See sub-clause	Comment
<input checked="" type="checkbox"/>	Radiated: Test fixture	5.1.1	-

5.2.2 Test method (Spectrum mask)

The following procedure is used for the spectrum mask measurement:

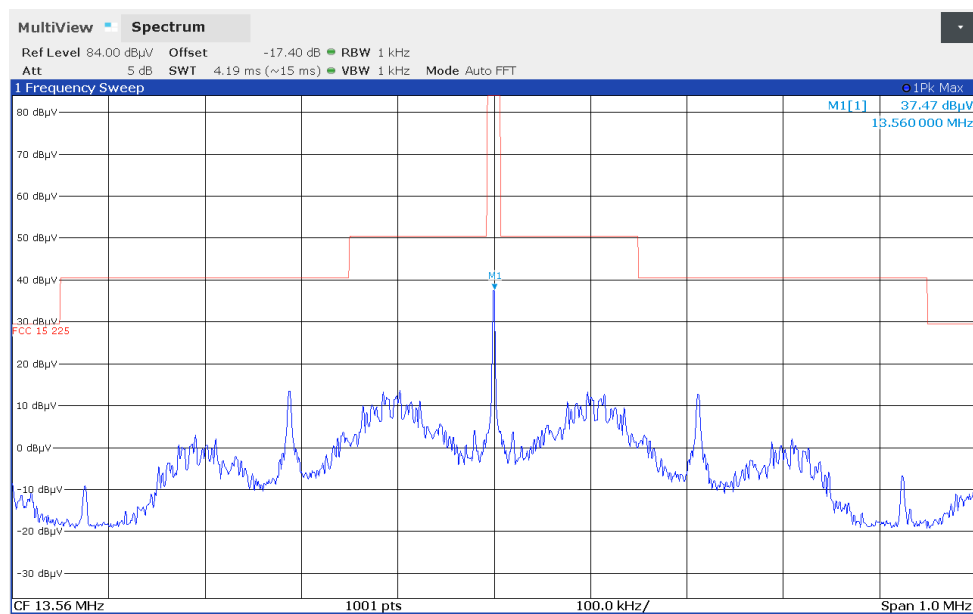
- 1) Place the EUT in the test fixture and switch it on.
- 2) Use the following spectrum analyzer settings:
 - a. RWB = VBW = 1 kHz
 - b. Span = wide enough to capture the whole 13 MHz band including the frequency ranges where the limit [2; 3] applies
 - c. Trace mode = Max hold
 - d. Select the limit line.
 - e. The bandwidth usually has to be 10 kHz for the measurement [1]. Because a measurement with this bandwidth results into an envelope, which is too wide for the 14 kHz spectrum mask, the bandwidth was reduced. The amplitude was determined using the 10 kHz bandwidth.
- 3) After trace stabilization, set the marker to the signal peak.
- 4) The reference level will be calculated by the margin of the wanted signal to its 30 m emission limit plus the marker value.
- 5) The whole signal trace has to be below the limit line.

5.2.3 Test results (spectrum mask)

Ambient temperature:	23 °C
Relative humidity:	26 %

Date:	27.03.2025
Tested by:	S. KREHS

Operation mode of transmitter: Continuously reading a TAG.



Test result: Passed

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

5.3 20 dB bandwidth

5.3.1 Test setup (20 dB bandwidth)

Test setup (20 dB bandwidth)			
Used	Setup	See sub-clause	Comment
<input checked="" type="checkbox"/>	Radiated: Test fixture	5.1.1	-

5.3.2 Test method (20 dB bandwidth)

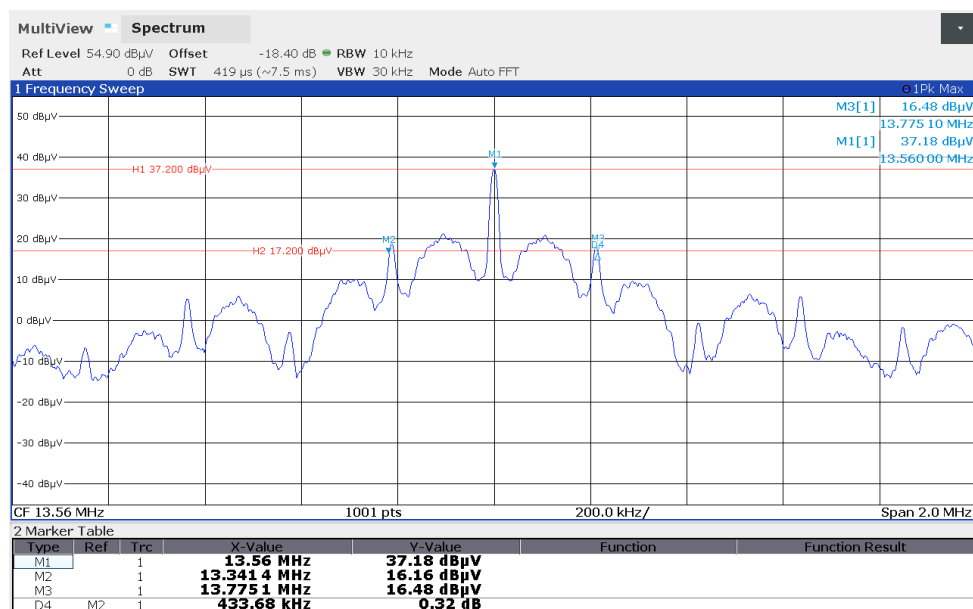
Test method (20 dB bandwidth)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
<input checked="" type="checkbox"/>	6.9.2	Occupied bandwidth – relative measurement procedure	-	-

5.3.3 Test results (20 dB bandwidth)

Ambient temperature:	23 °C
Relative humidity:	26 %

Date:	27.03.2025
Tested by:	S. KREHS

Operation mode of transmitter: Continuously reading a TAG.



F_L	F_U	$BW (F_U - F_L)$
13.341400 MHz	13.775100 MHz	433.680 kHz

Test result: Passed

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

5.4 99 % bandwidth

5.4.1 Test setup (99 % bandwidth)

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

5.4.2 Test method (99 % bandwidth)

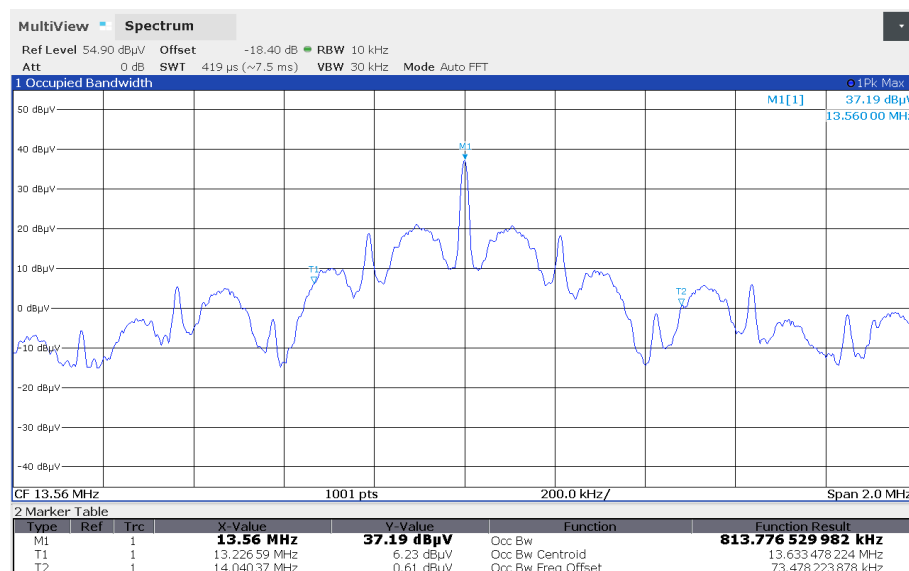
Test method (99 % bandwidth)				
Used	Sub-Clause [1]	Name of method	Applicability	Comment
<input checked="" type="checkbox"/>	6.9.3	Occupied bandwidth – power bandwidth (99%) measurement procedure	-	-

5.4.3 Test results (99 % bandwidth)

Ambient temperature:	23 °C
Relative humidity:	26 %

Date:	27.03.2025
Tested by:	S. KREHS

Operation mode of transmitter: Continuously reading a TAG.



FL	FU	BW (FU - FL)
13.226590 MHz	14.040370 MHz	813.780 kHz

Test result: Passed

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

5.5 Frequency tolerance

5.5.1 Test setup (frequency tolerance)

Test setup (frequency tolerance)			
Used	Setup	See sub-clause	Comment
<input checked="" type="checkbox"/>	Radiated: Test fixture	5.1.1	-

5.5.2 Test method (frequency tolerance)

The following procedure is used for the spectrum mask measurement:

- 6) Place the EUT in the test fixture and switch it on.
- 7) Use the following spectrum analyzer settings:
 - a. RWB = VBW = 1 kHz
 - b. Span = wide enough to capture the whole 13 MHz band including the frequency ranges where the limit [2; 3] applies
 - c. Trace mode = Max hold
 - d. Select the limit line.
 - e. The bandwidth usually has to be 10 kHz for the measurement [1]. Because a measurement with this bandwidth results into an envelope, which is too wide for the 14 kHz spectrum mask, the bandwidth was reduced. The amplitude was determined using the 10 kHz bandwidth.
- 8) After trace stabilization, set the marker to the signal peak.
- 9) The reference level will be calculated by the margin of the wanted signal to its 30 m emission limit plus the marker value.
- 10) The whole signal trace has to be below the limit line.

5.5.3 Test results

Ambient temperature:	23 °C
Relative humidity:	26 %

Date:	27/28.03.2025
Tested by:	S. KREHS

Operation mode of transmitter: Continuously reading a TAG.

Temperature	Voltage	Minutes after switch-on	Frequency	Allowed tolerance	Measured tolerance	Result
+70 °C	24 V DC	0	13.559490 MHz	±1.356kHz	5 Hz	Passed
		2	13.559505 MHz	±1.356kHz	10 Hz	Passed
		5	13.559520 MHz	±1.356kHz	25 Hz	Passed
		10	13.559535 MHz	±1.356kHz	40 Hz	Passed
+60 °C	24 V DC	0	13.559480 MHz	±1.356kHz	15 Hz	Passed
		2	13.559490 MHz	±1.356kHz	5 Hz	Passed
		5	13.559495 MHz	±1.356kHz	0 Hz	Passed
		10	13.559510 MHz	±1.356kHz	15 Hz	Passed
+50 °C	24 V DC	0	13.559480 MHz	±1.356kHz	15 Hz	Passed
		2	13.559480 MHz	±1.356kHz	15 Hz	Passed
		5	13.559480 MHz	±1.356kHz	15 Hz	Passed
		10	13.559485 MHz	±1.356kHz	10Hz	Passed
+40 °C	24 V DC	0	13.559500 MHz	±1.356kHz	5 Hz	Passed
		2	13.559495 MHz	±1.356kHz	0 Hz	Passed
		5	13.559485 MHz	±1.356kHz	10 Hz	Passed
		10	13.559485 MHz	±1.356kHz	10 Hz	Passed
+30 °C	24 V DC	0	13.559520 MHz	±1.356kHz	25 Hz	Passed
		2	13.559515 MHz	±1.356kHz	20 Hz	Passed
		5	13.559510 MHz	±1.356kHz	15 Hz	Passed
		10	13.559500MHz	±1.356kHz	5 Hz	Passed
+20 °C	12 V DC	0	13.559495 MHz	±1.356kHz	0 Hz	Passed
	24 V DC		13.559495 MHz	-	-	Passed
	42 V DC		13.559495 MHz	±1.356kHz	0 Hz	Passed
+10 °C	24 V DC	0	13.559585 MHz	±1.356kHz	90 Hz	Passed
		2	13.559580 MHz	±1.356kHz	85 Hz	Passed
		5	13.559575 MHz	±1.356kHz	80 Hz	Passed
		10	13.559565 MHz	±1.356kHz	70 Hz	Passed
0 °C	24 V DC	0	13.559600 MHz	±1.356kHz	105 Hz	Passed
		2	13.559600 MHz	±1.356kHz	105 Hz	Passed
		5	13.559590 MHz	±1.356kHz	95 Hz	Passed
		10	13.559590 MHz	±1.356kHz	95 Hz	Passed
-10 °C	24 V DC	0	13.559590 MHz	±1.356kHz	95 Hz	Passed
		2	13.559595 MHz	±1.356kHz	100 Hz	Passed
		5	13.559590 MHz	±1.356kHz	95 Hz	Passed
		10	13.559600 MHz	±1.356kHz	105 Hz	Passed
-20 °C	24 V DC	0	13.559550 MHz	±1.356kHz	55 Hz	Passed
		2	13.559565 MHz	±1.356kHz	70 Hz	Passed
		5	13.559575 MHz	±1.356kHz	80 Hz	Passed
		10	13.559585 MHz	±1.356kHz	90 Hz	Passed
-30 °C	24 V DC	0	13.559480 MHz	±1.356kHz	15 Hz	Passed
		2	13.559510 MHz	±1.356kHz	15 Hz	Passed
		5	13.559530 MHz	±1.356kHz	35 Hz	Passed
		10	13.559545 MHz	±1.356kHz	50 Hz	Passed

Test result: Passed

Test equipment (please refer to chapter 7 for details)
1 - 5

5.6 Radiated emissions

5.6.1 Test setup (Radiated 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	5.1.2 / 5.1.3	-

5.6.2 Test method (Radiated emissions)

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

5.6.3 Test results (Radiated emissions)

5.6.3.1 Test results preliminary measurement 9 kHz to 30 MHz

Ambient temperature:	22 °C	Date:	11.03.2025
Relative humidity:	19 %	Tested by:	M. DINTER

Position of EUT: For tests in the frequency range 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. The EUT was measured in its normal installation orientation.

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 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: All 3 orthogonal planes were tested separately
Operation mode of transmitter: Continuously transmit without a transponder.

Calculations:

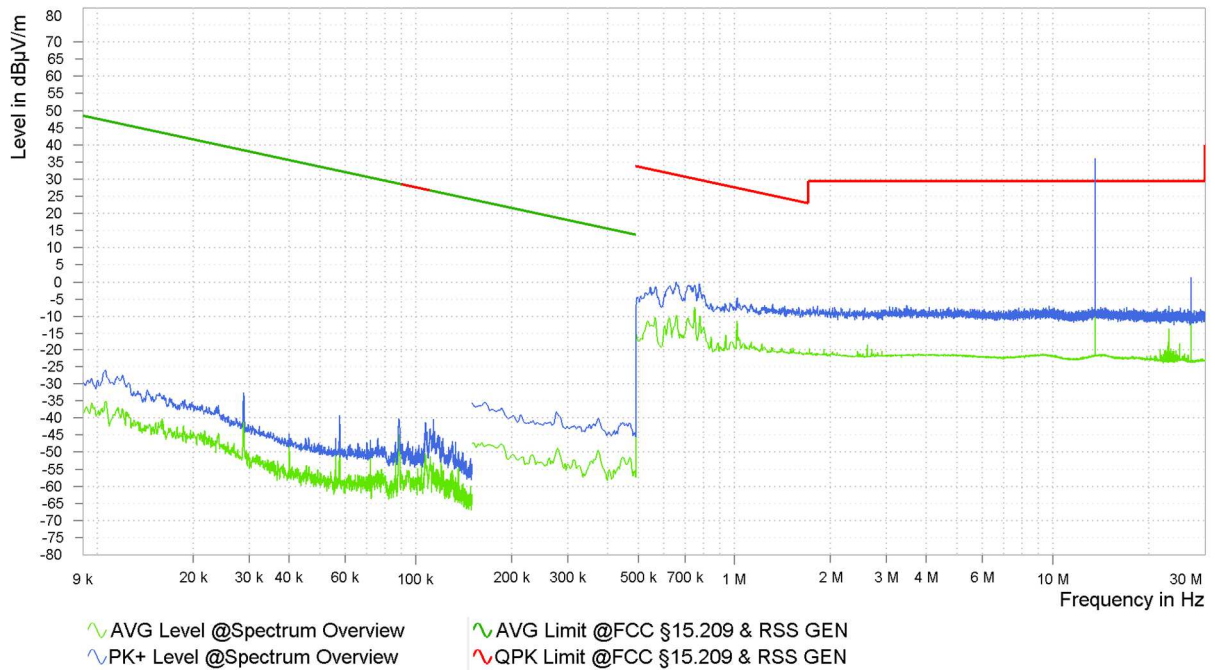
Result @ norm. dist. [dBμV/m] = Reading [dBμV] + AF [dB/m] - Distance corr. fact. [dBμV/m]

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:



The following frequencies were found in the frequency range 30 MHz to 960 MHz:
13.56 MHz and 27.12 MHz

Test equipment (please refer to chapter 7 for details)
2, 4, 6 - 12

5.6.3.2 Test results final measurement 9 kHz to 30 MHz

Ambient temperature:	13 °C
Relative humidity:	47 %

Date:	20.03.2025
Tested by:	S. KREHS

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 30 m measuring distance.

Results 9 kHz - 30 MHz											
Frequency [MHz]	Reading @ measuring distance [dB(μV)]	Result @ norm. distance [dB(μV/m)]	Result @ norm. distance [dB(μA/m)]	Limit acc. 15.225 [dB(μV/m)]	Limit acc. RSS-210 [dB(μA/m)]	Margin [dB]	Detector	Antenna factor [dB/m]	Measuring distance [m]	Normative distance [m]	Distance correction factor [dB]
13.560000	36.7	37.4	-14.1	84.0	32.5	46.6	QP	19.8	10	30	19.1
27.123000*	11.2	-8.3	-59.8	29.5	-22.0	37.8	QP	20.5	3	30	40.0

* Remark: At 10 m measuring distance the signal of the EUT was below the sensitivity of the measuring system.

Test result: Passed

Test equipment (please refer to chapter 7 for details)
13 - 15

5.6.3.3 Test results (30 MHz – 1 GHz)

Ambient temperature:	22 °C
Relative humidity:	24 %

Date:	10.03.2025
Tested by:	M. DINTER

Position of EUT: For tests in the frequency range 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. The EUT was measured in its normal installation orientation.

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: Operation mode of transmitter: Continuously transmit without a transponder.

Calculations:

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

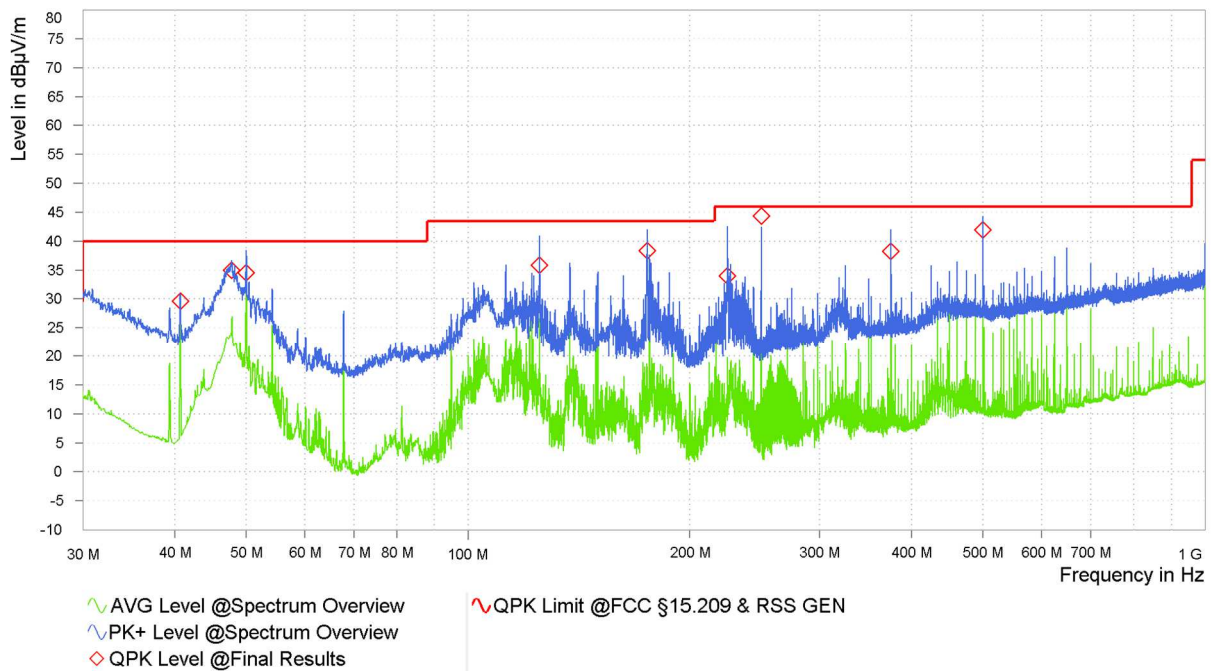
Correction [dBμV/m] = AF [dB/m] + Cable attenuation [dB] + optional preamp gain [dB]

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:

Spurious emissions from 30 MHz to 1 GHz:



Result tables:

Frequency [MHz]	Result (QP) [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Readings [dBμV]	Correction [dB/m]	Height [cm]	Azimuth [deg]	Pol. (H/V)
40.680	29.58	40.00	10.42	19.85	40.680	102	296	V
47.790	34.95	40.00	5.05	15.03	47.790	102	26	V
50.010	34.50	40.00	5.50	13.75	50.010	103	347	V
125.010	35.83	43.50	7.67	17.11	125.010	165	100	H
174.990	38.33	43.50	5.17	16.38	174.990	126	117	V
224.880	33.99	46.00	12.01	16.16	224.880	126	117	V
249.990	44.28	46.00	1.72	17.15	249.990	109	259	H
375.000	38.18	46.00	7.82	20.94	375.000	102	224	H
499.980	41.95	46.00	4.05	24.19	499.980	100	35	H

Test result: Passed

Test equipment (please refer to chapter 7 for details)
2, 4, 7 – 12, 16 - 18

5.7 AC power-line conducted emissions

5.7.1 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 ...	-	-

5.7.2 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	The EUT is DC supplied, therefore an AC / DC adaptor has to be used.
<input type="checkbox"/>	6.2	Floor-standing equipment testing	-	-

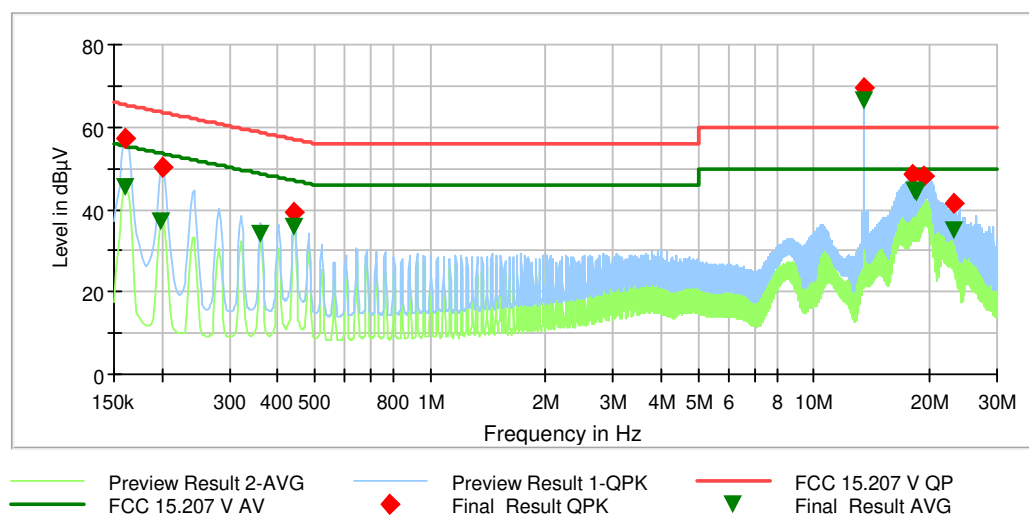
During the measurement the EUT was supplied with 24.0 V_{DC} by an AC/DC adaptor MINI-PS-100-240AC/24DC/1.3. The power adaptor itself was supplied by 120V_{AC} 60Hz.

5.7.3 Test results (Conducted emissions on power supply lines)

Ambient temperature:	22 °C
Relative humidity:	43 %

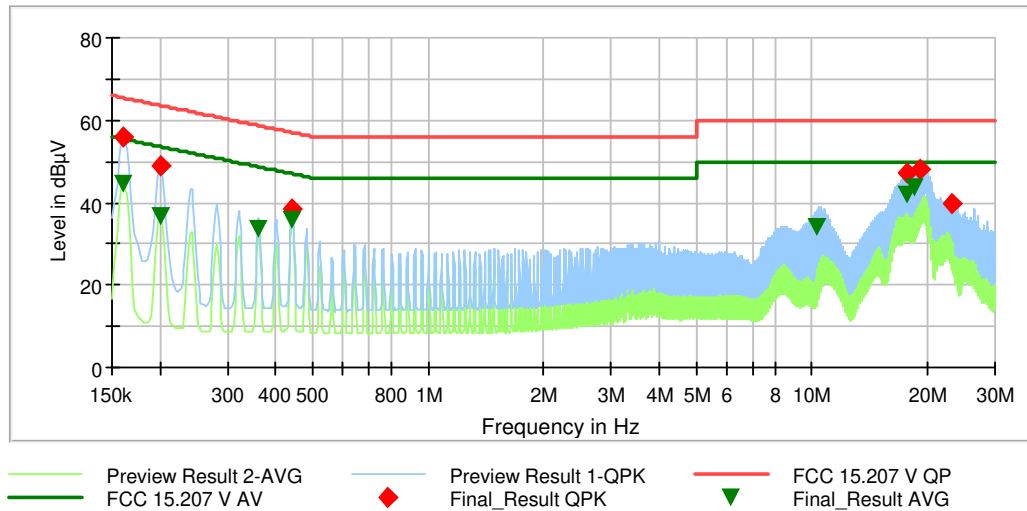
Date:	24.03.2025
Tested by:	M. DINTER

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 ▼.



Test plot for AC mains conducted emissions with antenna

Frequency [MHz]	QuasiPeak [dB(μV)]	Average [dB(μV)]	Limit [dB(μV)]	Margin [dB]	Line	PE	Corr. [dB]
0.161250	---	45.33	55.40	10.07	L1	GND	19.9
0.161250	57.16	---	65.40	8.24	L1	GND	19.9
0.199500	---	37.11	53.63	16.52	L1	GND	19.8
0.201750	50.35	---	63.54	13.19	L1	GND	19.8
0.361500	---	33.89	48.69	14.80	N	GND	19.7
0.442500	---	35.94	47.01	11.08	L1	GND	19.7
0.442500	39.15	---	57.01	17.87	L1	FLO	19.7
13.560000	69.51	---	60.00	-9.51	L1	GND	20.3
13.560000	---	66.44	50.00	-16.44	L1	GND	20.3
18.181500	48.56	---	60.00	11.45	L1	GND	20.3
18.300750	---	44.42	50.00	5.58	L1	GND	20.3
18.541500	---	44.35	50.00	5.65	L1	GND	20.3
19.347000	48.25	---	60.00	11.75	L1	GND	20.4
23.129250	---	34.96	50.00	15.04	L1	GND	20.3
23.129250	41.51	---	60.00	18.49	L1	GND	20.3



Test plot for AC mains conducted emissions with dummy load

Frequency [MHz]	QuasiPeak [dB(μ V)]	Average [dB(μ V)]	Limit [dB(μ V)]	Margin [dB]	Line	PE	Corr. [dB]
0.161250	---	44.43	55.40	10.96	L1	GND	19.9
0.161250	55.97	---	65.40	9.43	L1	GND	19.9
0.201750	49.10	---	63.54	14.44	L1	GND	19.8
0.201750	---	36.83	53.54	16.70	L1	GND	19.8
0.361500	---	33.51	48.69	15.19	N	FLO	19.7
0.442500	38.68	---	57.01	18.34	N	GND	19.7
0.442500	---	35.70	47.01	11.32	L1	FLO	19.7
10.248000	---	34.22	50.00	15.78	N	FLO	20.3
17.643750	---	42.11	50.00	7.89	L1	FLO	20.3
17.646000	47.03	---	60.00	12.97	L1	GND	20.3
18.487500	---	43.52	50.00	6.48	L1	FLO	20.3
19.209750	48.04	---	60.00	11.96	L1	GND	20.3
23.070750	39.81	---	60.00	20.19	L1	GND	20.3

Test result: Passed

Test equipment (please refer to chapter 7 for details)
19 - 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 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	Loop antenna	11 cm	PHOENIX TESTLAB GmbH	-	410084	Calibration not necessary	
2	Multimeter	971A	Hewlett Packard	JP40010640	480724	02.04.2024	04.2026
3	Signal & spectrum analyser	FSW43	Rohde & Schwarz	102954	483957	10.07.2024	07.2026
4	Power Supply	TOE8852	Toellner Electronic Inst.	51704	480591	Calibration not necessary	
5	Dynamic temperature chamber	MK 240	WTB Binder Labortechnik GmbH	05-79022	480462	21.11.2024	11.2025
6	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	21.02.2024	02.2026
7	EMC test software	Elektra V5.10.00	Rohde&Schwarz		483755	Calibration not necessary	
8	RF Switch Matrix	OSP220	Rohde & Schwarz	101391	482976	Calibration not necessary	
9	Turntable	TT3.0-3t	Maturo	825/2612/.01	483224	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 / Spectrum analyser	ESW44	Rohde & Schwarz	101828	482979	21.02.2024	02.2026
13	Loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	21.02.2024	02.2026
14	Outdoor test site	-	PHOENIX TESTLAB GmbH	-	480293	Calibration not necessary	
15	EMI receiver / Spectrum analyser	ESI 40	Rohde & Schwarz	100064/040	480355	20.02.2024	03.2026
16	Attenuator 6 dB	WA2-6	Weinschel	8254	410119	Calibration not necessary	
17	Ultralog antenna	HL562E	Rohde & Schwarz	101079	482978	24.04.2024	04.2027
18	Antennasupport	BAM 4.5-P-10kg	Maturo	222/2612.01	483225	Calibration not necessary	
19	V-LISN	NSLK8128RC	Schwarzbeck	0412	483186	28.02.2024	02.2026
20	Shielded chamber M155	SK3	Albatross Projects		482786	Calibration not necessary	
21	Software	EMC32 Ver. 10.60.20	Rohde & Schwarz	100619	483182	Calibration not necessary	
22	EMI receiver / Spectrum analyser	ESR7	Rohde & Schwarz	101939	482558	21.02.2024	02.2026

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	14.11.2022	13.11.2025
OATS Outdoor	480293	9 kHz – 30 MHz	-	ANSI C63.4-2014	-	-
Semi anechoic chamber M276	483227	30 – 1000 MHz	NSA	ANSI C63.4-2014 ANSI C63.4a-2017	01.03.2023	28.02.2026

9 Report History

Report Number	Date	Comment
F241826E6	29.04.2025	Initial Test Report
-	-	-
-	-	-

10 List of Annexes

Annex A	Test Setup Photos	4 pages
Annex B	EUT External Photos	5 pages
Annex C	EUT Internal Photos	7 pages

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