



## RF - TEST REPORT

- FCC Part 15B -

**Type / Model Name** : smaXtec climate sensor SX.2.1

**Product Description** : Climate sensor

**Applicant** : smaXtec animal care GmbH

Address : Sandgasse 36/2

8010 GRAZ, AUSTRIA

**Manufacturer** : smaXtec animal care GmbH

Address : Sandgasse 36/2

8010 GRAZ, AUSTRIA

**Test Result** according to the standards listed in clause 1 test standards:

**POSITIVE**

**Test Report No. :**

**80164398-01 Rev\_0**

27. June 2023

Date of issue



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## 1 TEST STANDARDS

The tests were performed according to following standards:

### FCC Rules and Regulations Part 15 Subpart B - Unintentional Radiators (**June 2023**)

Part 15, Subpart B, Section 15.107

AC Line conducted emission

Class A device

Class B device

Part 15, Subpart B, Section 15.109

Radiated emission, general requirements

Class A device

Class B device

ANSI C63.4: 2014

Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

CISPR 16-4-2: 2011 + A1: 2014  
EN 55016-4-2: 2011

Uncertainty in EMC measurement

### ISED Canada Rules and Regulations - Information Technology Equipment (Including Digital Apparatus)

ICES-003, Issue 7, October 15, 2020

AC Power Line Conducted Emissions

Class A device

Class B device

ICES-003, Issue 7, October 15, 2020

Radiated emission

Class A device

Class B device

ANSI C63.4: 2014

Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

## 2 TEST RESULT SUMMARY

FCC Rule Part	ISED Standard	Description
15.107	ICES-003/RSS-Gen	AC power line conducted emissions
15.109	ICES-003/RSS-Gen	Radiated Emissions

Type of test	Test result
Emission:	
A4 Conducted emission (AC mains power / DC power)	not applicable
A5 Radiated emission (< 1 GHz)	passed
SER 3 Radiated emission (> 1 GHz)	passed

A4 not applicable because the EuT is battery powered.

### 2.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80164398-01	0	22 June 2023	Initial test report

The test report with the highest revision number replaces the previous test reports.

### 2.2 Final assessment

The equipment under test fulfills the requirements cited in clause 1 test standards.

Date of receipt of test sample : acc. to storage records

Testing commenced on : 29 May 2023

Testing concluded on : 07 June 2023

Checked by:

Tested by:

Klaus Gegenfurtner  
Teamleader Radio

Laurin Roth  
Radio Team

### **3 EQUIPMENT UNDER TEST**

#### **3.1 Information provided by the Client**

Please note, we do not take any responsibility for information provided by the client or his representative which may have an influence on the validity of the test results.

#### **3.2 Sampling**

The customer is responsible for the choice of sample. Sample configuration, start-up and operation is carried out by the customer or according his/her instructions.

#### **3.3 Photo documentation of the EUT – Detailed photos see ATTACHMENT A**

#### **3.4 General remarks**

None.

#### **3.5 Power supply system utilised**

Power supply voltage : 3.0V (2x AA 1.5V Battery)

#### **3.6 Highest internal frequency**

Highest internal frequency : 915 MHz

#### **3.7 Short description of the Equipment under Test (EUT)**

The EUT is a Climate Sensor with RF interface. The climate sensor is an electronic device which provides real time data about ambient temperature, humidity and air pressure.

Number of tested samples: 1

Radiated Sample:

Serial number: 0C10000007

Firmware version: 19

#### **3.8 EUT operation mode**

The equipment under test was operated during the measurement under the following conditions:

- RX continuous

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#### **3.9 EUT configuration**

(The CDF filled by the applicant can be viewed at the test laboratory.)

The following peripheral devices and interface cables were connected during the measurements:

-Power supply

Model : -Hameg HM8143

**Modifications during the EMC test:**

**None**

## 4 TEST ENVIRONMENT

### 4.1 Address of the test laboratory

**CSA Group Bayern GmbH**  
Ohmstrasse 1-4  
94342 STRASSKIRCHEN  
GERMANY

### 4.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15 - 35 °C

Humidity: 30 - 60 %

Atmospheric pressure: 86 - 106 kPa

### 4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. It is noted that the expanded measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor  $k = 2$ . The true value is located in the corresponding interval with a probability of 95 %. The measurement uncertainty was calculated for all measurements listed in this test report on basis of the ETSI Technical Report TR 100 028 Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1 and Part 2. The results are documented in the quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

### 4.4 Conformity Decision Rule

The applied conformity decision rule is based on ILAC G8:09/2019 clause 4.2.1 Binary Statement for Simple Acceptance Rule ( $w = 0$ ).

Details can be found in the procedure CSA\_B\_V50\_29.

### 4.5 Measurement protocol for FCC and ISED

#### 4.5.1 General information

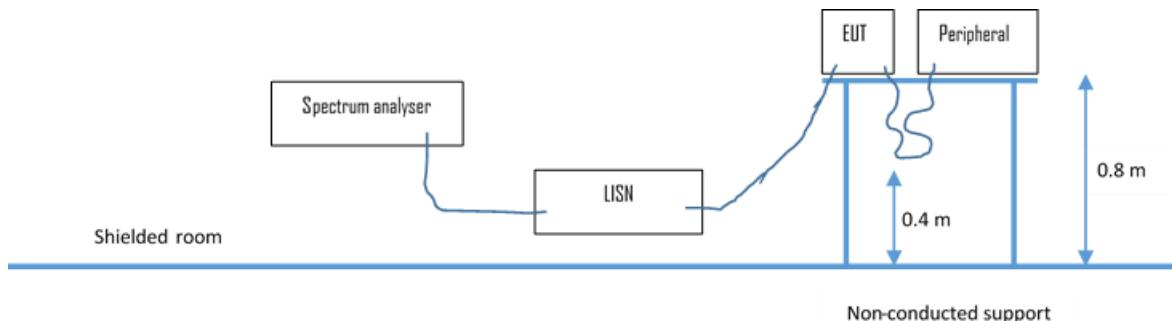
CSA Group Bayern GmbH is recognized as wireless testing laboratory under the CAB identifier:

**FCC: DE 0011**  
**ISED: DE0009**

## 4.5.2 Details of test procedures

### 4.5.2.1 Conducted emission

Test setup according ANSI C63.4



### Description of measurement

The final level, expressed in  $\text{dB}\mu\text{V}$ , is arrived at by taking the reading directly from the Spectrum analyser. This level is compared to the limit.

To convert between  $\text{dB}\mu\text{V}$  and  $\mu\text{V}$ , the following conversions apply:

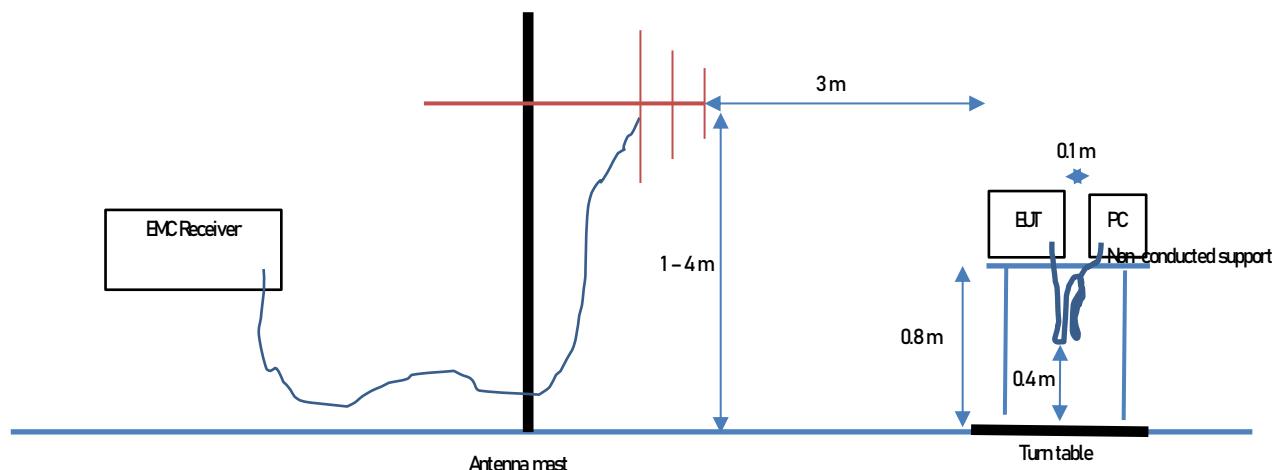
$$\begin{aligned}\text{dB}\mu\text{V} &= 20(\log \mu\text{V}) \\ \mu\text{V} &= \text{Inverse log}(\text{dB}\mu\text{V}/20)\end{aligned}$$

Conducted emissions on the 50 Hz and/or 60 Hz power interface of the EUT are measured in the frequency range of 150 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection and a Line Impedance Stabilization Network (LISN) with  $50 \Omega / 50 \mu\text{H}$  (CISPR 16) characteristics. The receiver is protected by means of an impedance matched pulse limiter connected directly to the RF input. Table top equipment is placed on a non-conducting table 80 centimetres above the floor and is positioned 40 centimetres from the vertical ground plane (wall) of the screen room. If the minimum limit margin appears to be less than 20 dB with a peak mode measurement, the emission is re-measured using a tuned receiver with quasi-peak and average detection and recorded on the data sheets.

## 4.5.2.2 Radiated emission

### 4.5.2.2.1 OATS1 test site (30 MHz - 1 GHz)

Test setup according ANSI C63.4



#### Description of measurement

Spurious emission from the EUT is measured in the frequency range of 30 MHz to 1000 MHz using a tuned receiver and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection. Table top equipment is placed on a 1.0 X 1.5 metre non-conducting table 80 centimetres above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. The setup of the equipment under test is established in accordance with ANSI C63.4. The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion so that they are at least 40 centimetres from the ground plane. Cables to simulators/testers (if used in this test) are routed through the centre of the table and to a screened room located outside the test area.

The antenna is positioned 3 or 10 metres horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 metres, measurement scans are made with both horizontal and vertical antenna polarization planes and the EUT is rotated 360 degrees.

The final level is calculated in a calculation sheet by taking the reading from the EMI receiver (Level dB $\mu$ V) and adding the correction factors and cable loss factor (Factor dB) on to it. The limit is subtracted from this result in order to provide the limit margin listed in the measurement protocols.

Example:

Frequency (MHz)	Reading (dB $\mu$ V)	+	Correction* (dB/m)	=	Level (dB $\mu$ V/m)	-	Limit (dB $\mu$ V/m)	=	Dlimit (dB)
719.0	75.0	+	32.6	=	107.6	-	110.0	=	-2.4

\*Correction Factor = Antenna Factor + Cable Attenuation = 30 dB/m + 2.6 dB = 32.6 dB/m

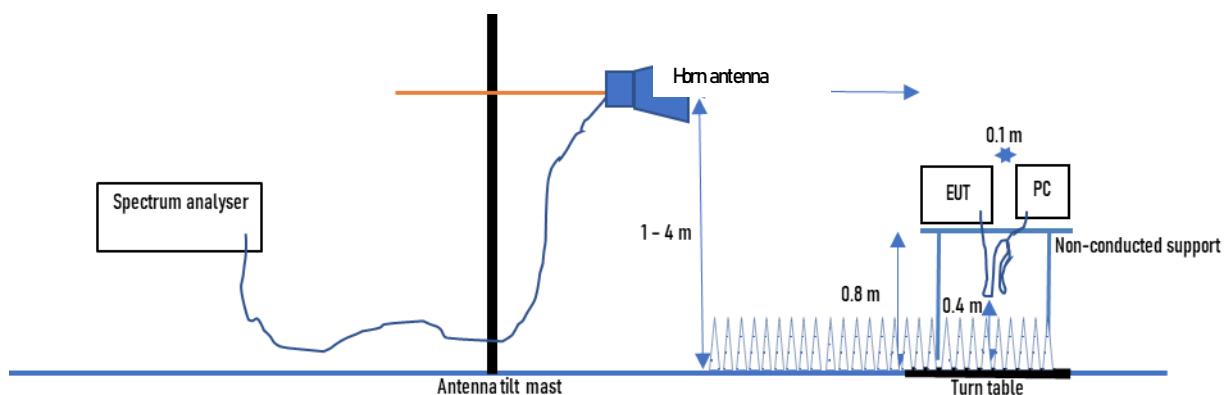
The resolution bandwidth during the measurement is as follows:

30 MHz – 1000 MHz:

RBW: 120 kHz

#### 4.5.2.2.2 Anechoic chamber 1, 1000 MHz – 18000 MHz

Test setup according ANSI C63.4

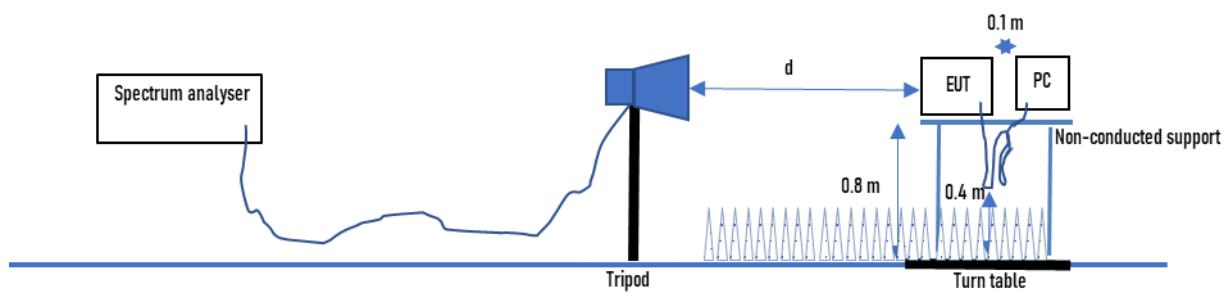


#### Description of measurement

Radiated emission from the EUT are measured in the frequency range of 1 GHz to the maximum frequency as specified in 47 CFR Part 15 Subpart A section 15.33, using a tuned receiver (spectrum analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 0.65 X 1.0 metre non-conducting table 80 centimetres above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12). The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion, so they are at least 40 centimetres from the ground plane. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to a peak detector function and a RBW= 1 MHz and VBW = 3 MHz. All tests are performed at a test distance of 3 metres. Hand-held or body-worn devices are rotated around three orthogonal axes in order to determine the position, angle and configuration having the maximum emission. The antenna height is then adjusted from 1 m to 4 m maximizing the measured value. The antenna is mounted to a boresight axis, so the antenna centre always points to the EUT. The turntable is rotated 360° until the spectrum analyser displays the maximum level at the observed frequency. The antenna height is then adjusted from 1 m to 4 m maximizing the measured value. The turntable is re-adjusted to re-affirm the maximum emission value which is then recorded. This procedure is repeated for all frequencies of interest.

#### 4.5.2.2.3 Anechoic chamber 1, 18 GHz – 40 GHz

Test setup according ANSI C63.4



#### Description of measurement

Radiated emission from the EUT are measured in the frequency range of 1 GHz to the maximum frequency as specified in 47 CFR Part 15 Subpart A section 15.33, using a tuned receiver (spectrum analyser) and appropriate linearly polarized antennas. Table top equipment is placed on a 0.65 X 1.0 metre non-conducting table 80 centimetres above the ground plane. The turntable is fully covered with the appropriate absorber (Type VHP-12).

The interface cables that are closer than 40 centimetres to the ground plane are bundled in the centre in a serpentine fashion, so they are at least 40 centimetres from the ground plane. Measurements are made in both the horizontal and vertical polarization planes in a fully anechoic room using a spectrum analyser set to a peak detector function and an RBW= 1 MHz and VBW = 3 MHz. All tests are performed at a test distance of 3 metres. Hand-held or body-worn devices are rotated around three orthogonal axes in order to determine the position, angle and configuration having the maximum emission. The turntable is rotated 360° until the spectrum analyser displays the maximum level at the observed frequency, the maximum emission value is then recorded. This procedure is repeated for all frequencies of interest.

Where appropriate in frequency range 18 GHz - 40 GHz, the test distance may be reduced to 1 m in order to reduce the noise level to hold a minimum distance between noise level and limit. The limit will be adopted to the measurement distance.

## **5 TEST CONDITIONS AND RESULTS**

### **5.1 Conducted emission**

For test instruments and accessories used see section 6 Part A 4.

#### **5.1.1 Description of the test location**

Test location:                   **NONE**

**Remarks:**                   Not applicable because the EuT is battery powered.

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## 5.2 Radiated emission < 1 GHz (electric field)

For test instruments and accessories used see section 6 Part A 5.

### 5.2.1 Description of the test location

Test location: OATS 1  
Test distance: 3 m

### 5.2.2 Photo documentation of the test setup



### 5.2.3 Test result

Frequency range: 30 MHz - 1000 MHz  
Min. limit margin -20.3 dB at 900 MHz

The requirements are **FULFILLED**.

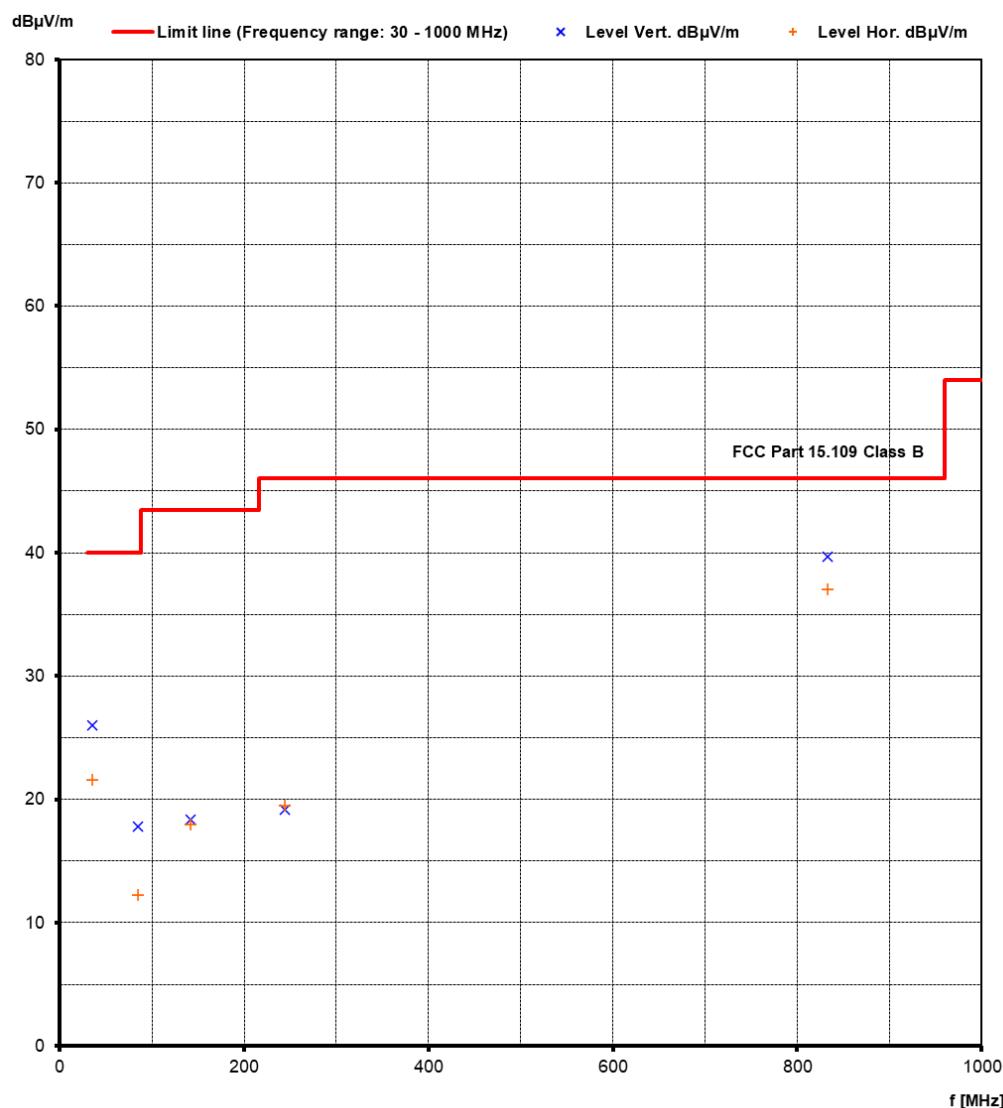
**Remarks:** For detailed results, please see the following page(s).

For description of the measurement see 4.5.2.

#### 5.2.4 Test protocol

Operation mode: RX continuous Result: passed  
 Remarks: only noise was detected.  
 Date: 06.05.2022  
 Tested by: Laurin Roth

Frequency (MHz)	Reading Vert. (dB $\mu$ V)	Reading Hor. (dB $\mu$ V)	Correct. Vert. (dB)	Correct. Hor. (dB)	Level Vert. (dB $\mu$ V/m)	Level Hor. (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Dlimit (dB)
35,10	9,9	4,4	16,1	17,2	26,0	21,6	40,0	-14,0
84,30	4,0	-1,5	13,8	13,7	17,8	12,2	40,0	-22,2
142,00	-1,0	-0,5	19,4	18,5	18,4	18,0	43,5	-25,1
244,10	0,7	1,1	18,5	18,4	19,2	19,5	46,0	-26,5
832,60	7,9	4,8	31,8	32,2	39,7	37,0	46,0	-6,3



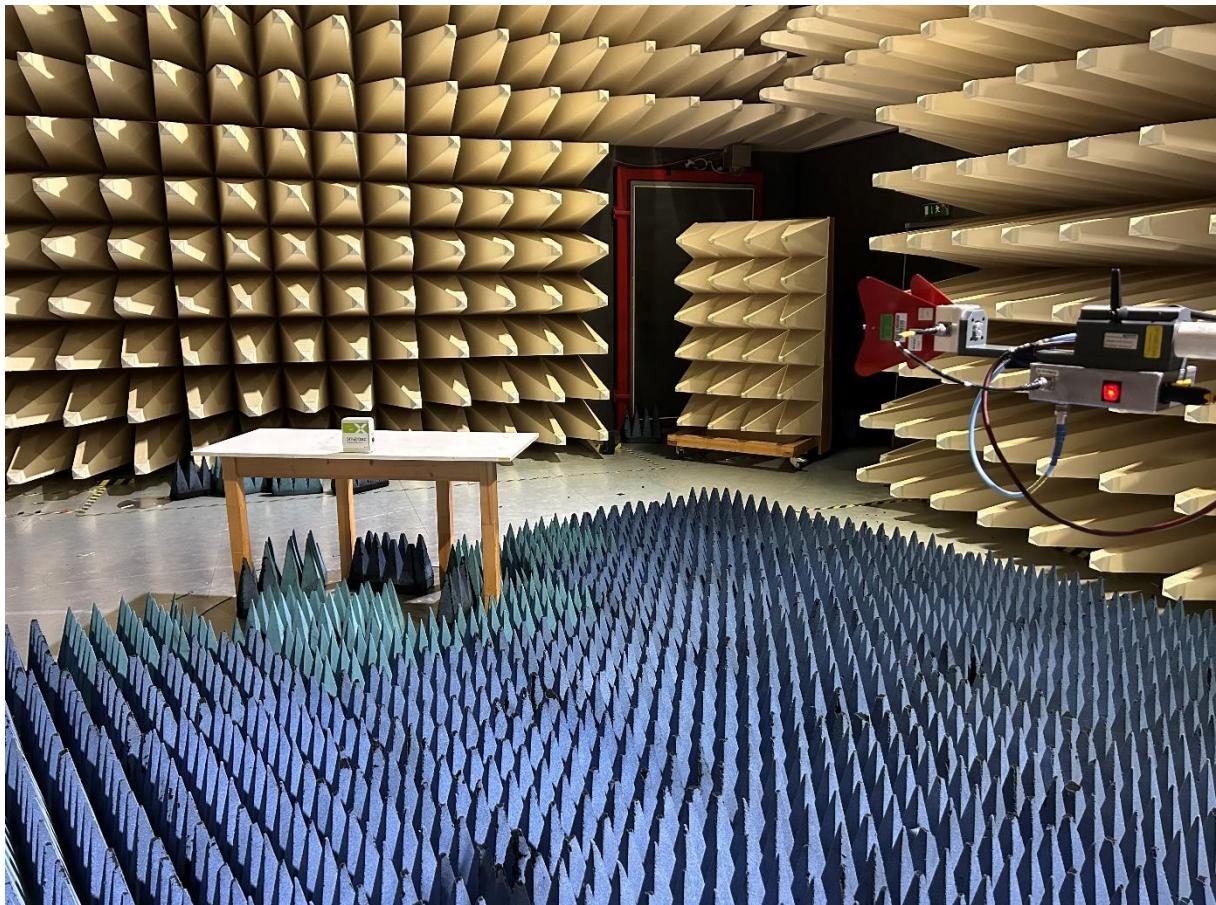
## 5.3 Radiated emission > 1 GHz (electric field)

For test instruments and accessories used see section 6 Part SER 3.

### 5.3.1 Description of the test location

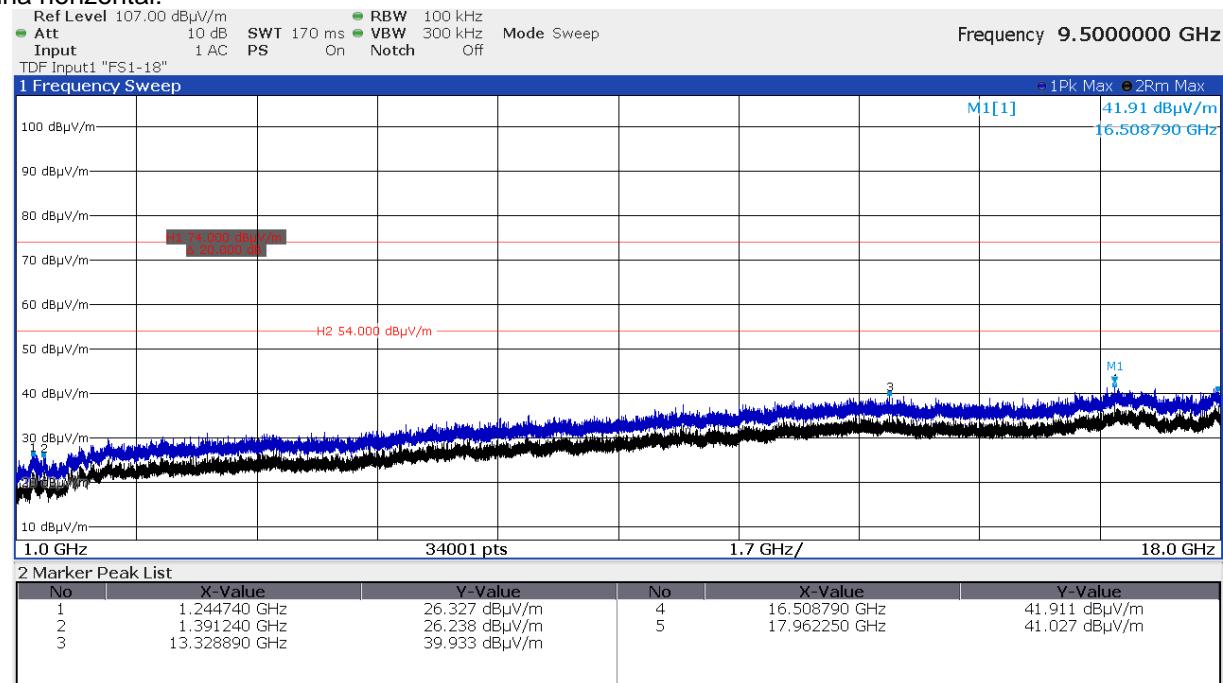
Test location: Anechoic chamber 1  
Test distance: 3 m

### 5.3.2 Photo documentation of the test setup

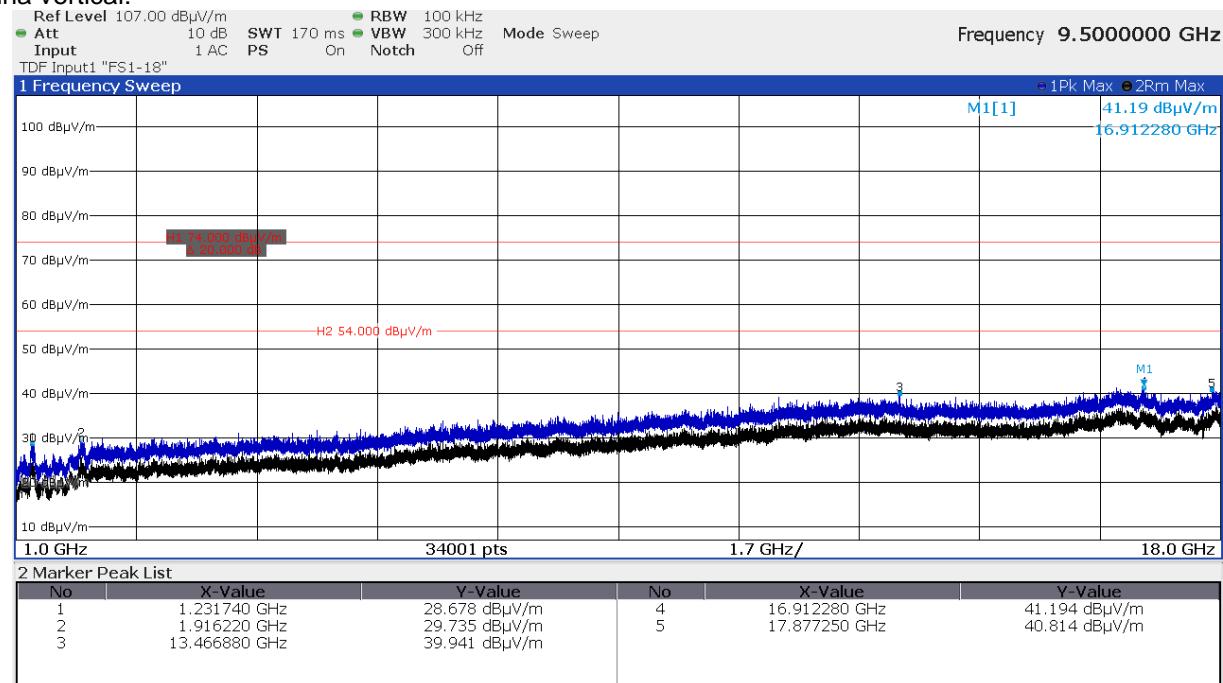


### 5.3.3 Test result

#### Antenna horizontal:



#### Antenna vertical:



The requirements are **FULFILLED**.

**Remarks:** For detailed results, please see the following page(s).

For description of the measurement see 4.5.2.

## **6 USED TEST EQUIPMENT AND ACCESSORIES**

All test instruments used, in addition to the test accessories, are calibrated and verified regularly.

<b>Test ID</b>	<b>Model Type</b>	<b>Equipment No.</b>	<b>Next Calib.</b>	<b>Last Calib.</b>	<b>Next Verif.</b>	<b>Last Verif.</b>
A 5	ESVS 30	02-02/03-05-006	27/07/2023	27/07/2022		
	VULB 9168	02-02/24-05-005	20/04/2024	20/04/2023	03/07/2023	03/07/2022
	NW-2000-NB	02-02/50-05-113				
	KK-EF393/U-16N-21N20 m	02-02/50-12-018				
	KK-SD_7/8-2X21N-33,0M	02-02/50-15-028				
SER 3	50F-003 N 3 dB	02-02/50-21-010				
	FSW43	02-02/11-15-001	04/05/2024	04/05/2023		
	AMF-6D-01002000-22-10P	02-02/17-15-004				
	3117	02-02/24-05-009	23/06/2023	23/06/2022		
	BAM 4.5-P	02-02/50-17-024				
	NCD	02-02/50-17-025				
	KK-SF106-2X11N-6,5M	02-02/50-18-016				
	BAT-EMC 2022.0.23.0	02-02/68-13-001				

## 7 Detailed measurement uncertainty

### 7.1 Overview

Measurement instrumentation uncertainty shall be taken into account when determining compliance or non-compliance with a disturbance limit.

The measurement instrumentation uncertainty for a test laboratory shall be evaluated. The standard uncertainty  $u(x_i)$  in decibels and the sensitivity coefficient  $c_i$  shall be evaluated for the estimate  $x_i$  of each quantity. The combined standard uncertainty  $u_c(y)$  of the estimate  $y$  of the measurand shall be calculated as

$$u_c(y) = \sqrt{\sum_i c_i^2 u^2(x_i)}$$

The expanded measurement instrumentation uncertainty  $U_{lab}$  for a test laboratory shall be calculated as  $U_{lab} = 2 u_c(y)$

$$U_{lab} = 2 u_c(y)$$

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If  $U_{lab}$  is less than or equal to  $U_{cispr}$  in the table below, then:

- compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

If  $U_{lab}$  is greater than  $U_{cispr}$  in the table below, then:

- compliance is deemed to occur if no measured disturbance, increased by  $(U_{lab} - U_{cispr})$ , exceeds the disturbance limit.
- non-compliance is deemed to occur if any measured disturbance, increased by  $(U_{lab} - U_{cispr})$ , exceeds the disturbance limit.

### 7.2 Definitions and symbols

$X_i$	Input quantity
$x_i$	estimate of $X_i$
$u(x_i)$	standard uncertainty of $x_i$
$c_i$	sensitivity coefficient
$u_c(y)$	(combined) standard uncertainty of $y$
$Y$	result of a measurement, (the estimate of the measured), corrected for all recognised significant systematic effects
$U$	expanded uncertainty of $y$

### 7.3 Measurement uncertainty

Measurement	$U_{lab}$ [dB]
<b>Conducted disturbance</b>	+ 2.53 / - 2.77
<b>Radiated disturbance (electric field)</b>	
- 10 m test distance	+ 3.16 / - 3.22
- 3 m test distance	+ 3.16 / - 3.22
- Frequency range: 30 MHz – 200 MHz	
<b>Radiated disturbance (electric field)</b>	
- 10 m test distance	+ 4.51 / - 4.51
- 3 m test distance	+ 4.51 / - 4.51
- Frequency range: 200 MHz – 1000 MHz	
<b>Radiated disturbance (electric field)</b>	
- 3 m test distance	+ 5.07 / - 3.70
- Frequency range: 1 GHz – 30 GHz	