RF – TEST REPORT

- Human Exposure -

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. : 80164398-02 Rev_0	05. December 2023 Date of issue

Deutsche Akkreditierungsstelle
D-PL-12030-01-03
D-PL-12030-01-04

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FCC ID: OHCSXPAMP1 IC: 10671A-SXPAMP1

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1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules and Regulations Part 1, Subpart I - Procedures Implementing the National Environmental Policy Act of 1969

Part 1, Subpart I, Section 1.1310	Radiofrequency radiation exposure limits
Part 1, Subpart 2, Section 2.1091	Radiofrequency radiation exposure evaluation: **mobile devices**.
Part 1, Subpart 2, Section 2.1093	Radiofrequency radiation exposure evaluation: **portable devices**.
KDB 447498 D01	RF Exposure procedures and equipment authorisation policies for mobile and portable devices, April 20, 2021.
ANSI C95.1: 2005	IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
ETSI TR 100 028 V1.3.1: 2001-03,	Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Uncertainties in the Measurement of Mobile Radio Equipment Characteristics—Part 1 and Part 2

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2 EQUIPMENT UNDER TEST

2.1 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.

2.2 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.

2.3 Photo documentation of the EUT – See ATTACHMENT A

2.4 Equipment type, category

LoRa device, mobile equipment.

2.5 Short description of the equipment under test (EUT)

Number of tested samples: 1
Conducted Sample
Serial number: 0C10000008
Firmware version: 19

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

2.6 Variants of the EUT

None.

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2.7 Operation frequency and channel plan

The operating frequency is 902,3 MHz to 927,8 MHz.

US:

Upstream LoRa 125 kHz BW, DR0-DR3

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	902,3	16	905,5	32	908,7	48	911,9
1	902,5	17	905,7	33	908,9	49	912,1
2	902,7	18	905,9	34	909,1	50	912,3
3	902,9	19	906,1	35	909,3	51	912,5
4	903,1	20	906,3	36	909,5	52	912,7
5	903,3	21	906,5	37	909,7	53	912,9
6	903,5	22	906,7	38	909,9	54	913,1
7	903,7	23	906,9	39	910,1	55	913,3
8	903,9	24	907,1	40	910,3	56	913,5
9	904,1	25	907,3	41	910,5	57	913,7
10	904,3	26	907,5	42	910,7	58	913,9
11	904,5	27	907,7	43	910,9	59	914,1
12	904,7	28	907,9	44	911,1	60	914,3
13	904,9	29	908,1	45	911,3	61	914,5
14	905,1	30	908,3	46	911,5	62	914,7
15	905,3	31	908,5	47	911,7	63	914,9

AU:

Upstream LoRa 125 kHz BW, DR0-DR5

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	915,2	16	918,4	32	921,6	48	924,8
1	915,4	17	918,6	33	921,8	49	925,0
2	915,6	18	918,8	34	922,0	50	925,2
3	915,8	19	919,0	35	922,2	51	925,4
4	916,0	20	919,2	36	922,4	52	925,6
5	916,2	21	919,4	37	922,6	53	925,8
6	916,4	22	919,6	38	922,8	54	926,0
7	916,6	23	919,8	39	923,0	55	926,2
8	916,8	24	920,0	40	923,2	56	926,4
9	917,0	25	920,2	41	923,4	57	926,6
10	917,2	26	920,4	42	923,6	58	926,8
11	917,4	27	920,6	43	923,8	59	927,0
12	917,6	28	920,8	44	924,0	60	927,2
13	917,8	29	921,0	45	924,2	61	927,4
14	918,0	30	921,2	46	924,4	62	927,6
15	918,2	31	921,4	47	924,6	63	927,8

Upstream LoRa 500 kHz BW, DR6

Channel	Frequency (MHz)
64	915,9
65	917,5
66	919,1
67	920,7
68	922,3
69	923,9
70	925,5
71	927,1

Note: the marked frequencies are determined for final testing.

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2.8 Transmit operating modes

DataRate	Configuration	Indicative physical bit rate (bit/sec)
0	LoRa: SF10 / 125 kHz	250
1	LoRa: SF9 / 125 kHz	1760
2	LoRa: SF8 / 125 kHz	3125
3	LoRa: SF7 / 125 kHz	5470
5:7	RFU	

2.9 Antennas

The following antenna shall be used with the EUT:

Number	Characteristic	Model number	Plug	Frequency range (MHz)	Gain (dBi)	Cable loss (dB)	Effective gain (dBi)
1	Omni	PCB	-	902 -928	-25.1	0	-25.1

2.10 Power supply system utilised

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

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3 TEST RESULT SUMMARY

WLAN device using digital modulation:

Operating in the 2400 MHz – 2483.5 MHz and 5725 MHz – 5850 MHz band:

FCC Rule Part	RSS Rule Part	Description	Result
KDB 447498, 7.1	RSS 102, 2.5.2	MPE	passed
KDB 447498, 4.3.1	RSS 102, 2.5.1	SAR exclusion consideration	not applicable
KDB 447498, 7.2	RSS102, 3.2	Co-location, Co-transmission	not applicable

The mentioned RSS Rule Parts in the above table are related to:
RSS 102, Issue 5, March 2015

3.1 Revision history of test report

Test report No	Rev.	Issue Date	Changes
80164398-02	0	05 December 2023	Initial test report

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

3.2 Final assessment

Select final Assessment

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

Testing commenced on : 21 June 2023

Testing concluded on : 22 June 2023

Checked by:

Klaus Gegenfurtner
2023.12.05 14:31:17
+01'00'

Klaus Gegenfurtner
Teamleader Radio

Tested by:

Laurin Roth
2023.12.05 13:50:09
+01'00'

Laurin Roth
Radio Team

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.

5 HUMAN EXPOSURE

5.1 Maximum permissible exposure (MPE)

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

5.1.1 Description of the test location

Test location: NONE

5.1.2 Applicable standard

According to FCC Part 15, Section 15.247(i):
Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.
The test methods used comply with ANSI/IEEE C95.1, "IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz".
This test report shows the compliance with the limits for Maximum Permissible Exposure (MPE) specified in FCC Part 1, Section 1.1310 and the criteria to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in FCC Part 1, Section 1.1307(b).

5.1.3 Description of Determination

The maximum rated output power conducted included the tune up tolerance is used to calculate the EIRP. Through the Friis transmission formula, the known maximum gain of the antenna and the maximum power, can be calculated the MPE in a defined distance away from the product.

Friis transmission formula: $$P_d = \frac{P_{out} * G}{4 * \Pi * r^2}$$

Where:
P_d =power density (mW/cm^2)
P_{out} = output power to antenna (mW)
G = gain of antenna (linear scale)
r = distance between antenna and observation point (cm)

According to FCC Rules 47CFR 2.1093(b) the EUT is not a portable device. The EUT is designed to be used that radiating structures are 20 cm outside of the body of the user. (r = 20 cm)

5.1.4 Determination of MPE according FCC

LoRa

Rated output power:	11,903317	dBm	15,5	mW
Tune-up tolerance:	2,00	dB		
Maximum output power:	13,9	dBm	24,6	mW
Antenna gain max:	-25,10	dBi		
Maximum EIRP:	-11,2	dBm	0,1	mW
Minimum distance r:	20,0	cm		

Channel No.	Antgain (dBi)	EIRP (dBm)	EIRP (mW)	G linear	EIRP (W)	S (mW/cm^2)	Limit S_{eq} (mW/cm^2)	Margin (mW/cm^2)	Exposure ratio (%)
0	-25,1	-11,2	0,08	0,00	0,00008	0,0000	0,6	-0,6015	0,003
32	-25,1	-11,2	0,08	0,00	0,00008	0,0000	0,6	-0,6058	0,002
63	-25,1	-11,2	0,08	0,00	0,00008	0,0000	0,6	-0,6099	0,002

Limits for maximum permissible exposure (MPE):

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(B) Limits for General Population / Uncontrolled Exposure				
0.3 – 1.34	614	1.63	100	30
1.34 – 30	824/*f*	2.19/*f*	180/ f^2	30
30 - 300	27.5	0.073	0.2	30
300-1500	---	---	*f*/1500	30
1500-100000	---	---	1.0	30

f = Frequency in MHz

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5.1.5 Determination of MPE according ISED:

Frequency	Antgain	EIRP	Factor	$f^{0.6834}$	Limit	Margin
MHz	(dBi)	(W)		(W)	(W)	(W)
902,3	-25,1	0,00008	0,0131	104,6374	1,371	-1,3707
908,7	-25,1	0,00008	0,0131	105,1440	1,377	-1,3773
914,9	-25,1	0,00008	0,0131	105,6338	1,384	-1,3837

Exemption limits for routine Evaluation – RF exposure evaluation according RSS102, 2.5.2:

At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1.31 x 10-2 f0.6834 W (adjusted for tune-up tolerance), where f is in MHz;

At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

The requirements are **FULFILLED.**

Remarks:
/

5.2 Co-location and Co-transmission

Applicable standard:
OET Bulletin 65, Edition 97-01, Section 2: Multiple-transmitter sites and Complex Environments

The FCC's MPE limits vary with frequency. Therefore, in mixed or broadband RF fields where several sources and frequencies are involved, the fraction of the recommended limit (in terms of power density or square of the electric or magnetic field strength) incurred within each frequency interval should be determined, and the sum of all fractional contributions should not exceed 1.0, or 100 % in terms of percentage.

Remarks: Not applicable, the EuT has only one transmitter.

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5.3 SAR test exclusion considerations

5.3.1 Applicable standard

According to RF exposure guidance:
Systems operating under the provisions of this section shall be operated in a manner that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

The requirements are **FULFILLED.**

Remarks: Not applicable, because the EuT is for mobile used.

5.4 Exemption limits for routine evaluation - SAR evaluation

5.4.1 Applicable standard

According to RSS-102, item 2.5.1:
SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance 4, 5

Frequency (MHz)	**Exemption Limits (mW)**				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	**17 mW**	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

4 The exemption limits in Table 1 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.
5 Transmitters operating between 0.003-10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in Section 4.

The applied exemtion limit is 23.7 mW at 908 MHz at a distance of 7.0mm.

Note: the limit was linearly interpolated from the table above**.**

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5.4.2 Cunclusion according RSS-102.

Rated output power:	10,9	dBm	12,3	mW
Tune-up tolerance:	2,00	dB		
Maximum output power:	12,9	dBm	19,5	mW
Antenna gain max:	-25,10	dBi		
Maximum EIRP:	-12,2	dBm	0,1	mW
Minimum distance r:	7,0	mm		

Maximum EIRP output power, **19,5 mW is < 23,7 mW;**

Conclusion: The power level is much lower than the limit, SAR measurement is NOT necessary.

The requirements are **FULFILLED.**

Remarks: None.

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6 USED TEST EQUIPMENT AND ACCESSORIES

All test instruments used are calibrated and verified regularly. The calibration history is available on request.

Test ID	Model Type	Equipment No.	Next Calib.	Last Calib.	Next Verif.	Last Verif.
-	-	-	-	-	-	-