

Report on the FCC and IC Testing of the
GWF MessSysteme AG
Radio transceiver for water-/gas-meter
Model: RCM-H200
In accordance with FCC 47 CFR Parts 1
and 15 and ISED RSS-102 and RSS-
GEN



Product Service

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Prepared for: GWF MessSysteme AG
Obergrundstrasse 119
CH-6002 Lucerne
Switzerland

FCC ID: 2A4F7-RCMH200
IC: 28165-RCMH200

COMMERCIAL-IN-CONFIDENCE

Date: 2022-05-06

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
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Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service document control rules.

Engineering Statement:

This measurement shown in this report were made in accordance with the procedures described on test pages.

All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15 C and ISED RSS-247 and RSS-GEN.

The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Martin Steindl	2022-05-06	 SIGN-ID 647084

Laboratory Accreditation
Dakks Reg. No. D-PL-11321-11-02
Dakks Reg. No. D-PL-11321-11-03

Laboratory recognition
Registration No. BNetzA-CAB-16/21-15

Industry Canada test site registration
3050A-2

Executive Statement:

A sample of this product was tested and found to be compliant with FCC 47 CFR Parts 1 and 15 C:2021 and ISED RSS-102:2017, ISED RSS-102:2021 and RSS-GEN:2021

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1 Report Summary

1.1 Modification Report

Alternations and additions of this report will be issued to the holders of each copy in the form of a complete document.

Revision	Description of changes	Date of Issue
0	First Issue	2022-05-04
1	Calculation for ISED results added	2022-05-06

Table 1: Report of Modifications

1.2 Introduction

Applicant	GWF MessSysteme AG Obergrundstrasse 119 CH-6002 Lucerne Switzerland
Manufacturer	ESCATEC Mechatronics Sd. Bhd. 8 Jalan Firma 1/2 Kawasan Perindustrian Tebrau 1 81100 Johor Bahru Johor Malaysia
Model Number(s)	RCM-H200
Serial Number(s)	94
Hardware Version(s)	HW V11
Software Version(s)	FW V1.0
Number of Samples Tested	1
Test Specification(s) /	47 CFR Part 1: 2021
Issue / Date	47 CFR Part 15: 2021 ISED RSS-247, Issue 2 : March 2017 ISED RSS-102:2015, Amd. 1: February 2021 ISED RSS-GEN, Issue 5, Amd. 1, Amd. 2 : February 2021
Test Plan/Issue/Date	N/A
Order Number	PO- 000003448-2
Date	2021-12-17
Date of Receipt of EUT	2022-04-19
Start of Test	2022-04-19
Finish of Test	2022-04-21
Name of Engineer(s)	M. Steindl



1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Parts 1 and 15, ISED RSS-102 is shown below.

Section	Specification Clause	Test Description	Result
2.1	15.247(i) , 1.1307(b)(3)(B)	RF Exposure	Pass

Table 2: Results according to FCC 47 CFR Parts 1 and 15

Section	Specification Clause	Test Description	Result
2.1	3.4	RF Exposure	Pass

Table 3: Results according to RSS-Gen



1.4 Product Information

1.4.1 Technical Description

The RCM-H200 is an external LoRaWAN radio module for water and gas meters.

<i>Frequency Band</i>	902 – 928 MHz
<i>Frequency range</i>	902.3 MHz to 914.9 MHz
<i>Number of frequency channels:</i>	64
<i>Emission designator:</i>	230KF1D
<i>Power supply:</i>	Lithium Ion Battery
<i>Supply Voltage:</i>	3 V
<i>Supply Frequency:</i>	0 Hz

1.4.2 EUT Ports / Cables identification

Port	Usage	Cable length	Screened
Meter interface	Signal/Control Port	1.2 m	Shielded

Table 4 Ports and Cables identification

1.5 Test Configuration

The EUT was configured as stand alone device

1.6 Modes of Operation

The EUT was operated on lowest, middle and highest frequency



1.7 EUT Modifications Record

The table below details modifications made to the EUT during the test programme.
The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
0	As supplied by the customer	Not Applicable	Not Applicable

Table 5

1.8 Test Location

TÜV SÜD Product Service conducted the following tests at our Straubing test laboratory:

<i>Test Name</i>	<i>Name of Engineer(s)</i>
RF Exposure	M. Steindl

Office Address:

Äußere Frühlingstraße 45
94315 Straubing
Germany



2 Test Details

2.1 RF Exposure

2.1.1 Specification Reference

47 CFR, Part 1, § 1.1307(b)(3)(B)
47 CFR Part 15 C, Clause 15.247(i)
ISED RSS-Gen, Clause 3.4
ISED RSS-102, Clauses 2.5 and 4

2.1.2 Equipment under Test and Modification State

RCM_H200; S/N 94; Modification State 0

2.1.3 Date of Test

2022-04-19

2.1.4 Environmental Conditions

Ambient Temperature	21 °C
Relative Humidity	31 %

2.1.5 Test Method

Estimation is based on output power test.
For details please refer to section 2.6 of of this test report TR-713237652-03.

2.1.6 Specification Limits

CFR 47, Part 1, § 1.1307(b)(3)

(i) For single RF sources (i.e. any single fixed RF source, mobile device, or portable device, as defined in paragraph(b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiate power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall be only be used at separation distances (cm) from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by

$$P_{th}(\text{mW}) = \begin{cases} \text{ERP}_{20\text{cm}} \left(\frac{d}{20 \text{ cm}} \right), & d \leq 20 \text{ cm}; \\ \text{ERP}_{20\text{cm}}, & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

where

$$x = -\log_{10} \left(\frac{60}{\text{ERP}_{20\text{cm}} \sqrt{f}} \right); f \text{ in GHz}$$

and

$$\text{ERP}_{20\text{cm}}(\text{mW}) = \begin{cases} 2040 f, & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060, & 1.5 \text{ GHz} \leq f \leq 1.5 \text{ GHz} \end{cases}$$

d = the test separation distance (cm);

(C) Or using the table below and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value described for that frequency. For the exemption in the table to apply, R must be at least $\lambda/2\pi$ where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

RF source frequency (MHz)	Threshold ERP (Watts)
0.3 – 1.34	$1920 R^2$
1.34 – 30	$3450 R^2 / f^2$
30 – 300	$3.83 R^2$
300 – 1500	$0.0128 R^2 f^2$
1500 – 100000	$19.2 R^2$

(ii) For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of 2 cm between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(i)(A).

(B) In case of fixed RF sources operating in the same time-averaging period, or of multiple or portable RF sources within a device in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation:

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{\text{ERP}_j}{\text{ERP}_{th,j}} + \sum_{k=1}^c \frac{\text{Evaluated}_k}{\text{ExposureLimit}_k} \leq 1$$

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 the table.

For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.:.

Frequency (MHz)	Exemption limits (mW) ¹ at separation distance of									
	≤5 mm	10 mm	15 mm	20 mm	25 mm	30 mm	35 mm	40 mm	45 mm	≥50 mm
≤300 ²	71	101	132	162	193	223	254	284	315	345
450	52	70	88	106	123	141	159	177	195	213
835	17	30	42	55	67	80	92	105	117	130
1900	7	10	18	34	60	99	153	225	316	431
2450	4	7	15	30	52	83	123	173	235	309
3500	2	6	16	32	55	86	124	170	225	290
5800	1	6	15	27	41	56	71	85	97	106

ISED RSS-102, Clause 2.5.1, Table 1

¹ The exemption limit in the table are based on measurements and simulations on 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.

² Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.



ISED RSS-102, Clause 4

Table 3:

Body Region	Average SAR (W/kg)	Averaging Time (min)	Mass Average (g)
Whole Body	0.08	6	Whole Body
Localized Head, Neck and Trunk	1.6	6	1
Localized Limbs	4	6	10

Table 4:

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (min)
0.003 – 10	83	90	---	Instantaneous
0.1 – 10	---	0.73 / f	---	6
1.1 – 10	87 / f ^{0.5}	---	---	6
10 – 20	27.46	0.0728	2	6
20 – 48	58.07 / f ^{0.25}	0.1540 / f ^{0.25}	8.944 / f ^{0.5}	6
48 – 300	22.06	0.05852	1.291	6
300 – 6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000 – 15000	61.4	0.163	10	6
15000 – 150000	61.4	0.163	10	616000 f ^{1.2}
150000 – 300000	0.158 f ^{0.5}	4.21 × 10 ⁻⁴ f ^{0.5}	6.67 × 10 ⁻⁵ f	616000 f ^{1.2}



2.1.7 Test Results

Output power was calculated using equation (22) in ANSI C63.10, clause 9.5:

$$EIRP = E_{Meas} + 20 \log(d_{Meas}) - 104.7 \text{ dB}$$

$EIRP$ is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dB μ V/m

d_{Meas} is the measurement distance, in m

Frequency Channel	3 m Fieldstrength	EIRP
902.3 MHz	115.85 dB μ V/m	20.69 dBm
908.5 MHz	117.36 dB μ V/m	22.20 dBm
914.9 MHz	113.95 dB μ V/m	18.79 dBm

Table 6: Output Power

Minimum test separation distance was defined as 20 cm by the applicant.

47 CFR Part 1, § 1.1307(b)(3)(i)(B)

f (MHz)	P (mW)	P_{th} (mW)	Rating
902.3	117.22	1840.7	Exempt from standard evaluation
908.5	165.96	1853.3	Exempt from standard evaluation
914.9	75.68	1866.4	Exempt from standard evaluation

ISED RSS-102, Clause 2.5.1

f (MHz)	P (mW)	Exemption Limit (mW)	Rating
902.3	117.22	149.02	Exempt from standard evaluation
908.5	165.96	150.77	Standard evaluation
914.9	75.68	152.58	Exempt from standard evaluation

Exemption Limits were calculated with linear interpolated using values from ISED RSS-102, Clause 2.5.1, table 1 as seen above

ISED RSS-102, Clause 4 – Standard evaluation

f (MHz)	E (V/m)	Limit (V/m)	Rating
908.5	5.96	32.2	Pass



3 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

The measurement uncertainty in the laboratory is less than or equal to the maximum measurement uncertainty according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 (U_{CISPR}). This normative regulation means that the measured value is also the value to be assessed in relation to the limit value.

<i>Radio Interference Emission Testing</i>		<i>kp</i>	<i>Expanded Uncertainty</i>
Test Name			
Conducted Voltage Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	
100 kHz to 200 MHz (50Ω/5µH AMN)	2	± 3.6 dB	
Discontinuous Conducted Emission			
9 kHz to 150 kHz (50Ω/50µH AMN)	2	± 3.8 dB	
150 kHz to 30 MHz (50Ω/50µH AMN)	2	± 3.4 dB	
Conducted Current Emission			
9 kHz to 200 MHz	2	± 3.5 dB	
Magnetic Fieldstrength			
9 kHz to 30 MHz (with loop antenna)	2	± 3.9 dB	
9 kHz to 30 MHz (large-loop antenna 2 m)	2	± 3.5 dB	
Radiated Emission			
30 MHz to 300 MHz	2	± 4.9 dB	
300 MHz to 1 GHz	2	± 5.0 dB	
1 GHz to 6 GHz	2	± 4.6 dB	
Test distance 10 m			
30 MHz to 300 MHz	2	± 4.9 dB	
300 MHz to 1 GHz	2	± 4.9 dB	
The expanded uncertainty reported according to CISPR16-4-2: 2011 + A1 + A2 + Cor1 is based on a standard uncertainty multiplied by a coverage factor of $kp = 2$, providing a level of confidence of $p = 95.45\%$			

Table 7 Measurement uncertainty based on CISPR 16-4-2



Radio Interference Emission Testing		
Test Name	<i>kp</i>	Expanded Uncertainty
Occupied Bandwidth	2	± 5 %
Conducted Power		
9 kHz ≤ f < 30 MHz	2	± 1.0 dB
30 MHz ≤ f < 1 GHz	2	± 1.5 dB
1 GHz ≤ f ≤ 40 GHz	2	± 2.5 dB
1 MS/s power sensor (TS8997)	2	± 1.5 dB
Occupied Bandwidth	2	± 5 %
Power Spectral Density	2	± 3.0 dB
Radiated Power		
9 kHz ≤ f < 26.5 GHz	2	± 6.5 dB
26.5 GHz ≤ f < 60 GHz	2	± 8.0 dB
60 GHz ≤ f < 325 GHz	2	± 10 dB
Conducted Spurious Emissions	2	± 3.0 dB
Radiated Spurious Emissions	2	± 6.0 dB
Voltage		
DC	2	± 1.0 %
AC	2	± 2.0 %
Time (automatic)	2	± 5 %
Frequency	2	± 10 ⁻⁷

The expanded uncertainty reported according to ETSI TR 100 028:2001 is based on a standard uncertainty multiplied by a coverage factor of *kp* = 2, providing a level of confidence of *p* = 95.45%

Table 8 Measurement uncertainty based on ETSI TR 100 028