The Testcenter facility 'LoRa® Test Lab' within IMST GmbH is recognized by the LoRa® Alliance for testing in accordance to the LoRaWAN® Specification V1.0.4

Report for Test of Conformance to LoRaWAN® V1.0.4 EU868 (Temporary Class C)

for the Device

"Smart Waste Sensor Unit"

for the Customer

"**Hailo Digital Hub GmbH & Co.KG**"

Jens Lerner
Yavuz Turan

31st March, 2023

Administrative Summary

Location: IMST GmbH, Test Centre, Kamp-Lintfort, Germany
Responsible Test Engineer: Yavuz Turan, Jens Lerner

Subject: Test of Conformance to LoRaWAN® Specification V1.0.4 (Class C for EU868)

Company and Contact Information:
Hailo Digital Hub GmbH & Co.KG
Dr. Josef Stoll
Aulweg 45
35392 Gießen
Germany
Tested Device: Smart Waste Sensor Unit
Hardware Version: 3.7
Software Version: N/A
Firmware Version: 2.0.0
End-device identifier: 0080e11505004a31
LoRa Device Class: Temporary Class C
LoRaWAN Specification Version: V1.0.4
LoRaWAN Regional Parameters Version: RP02-1.0.3
Certification requirements:
LW1.0.4 End Device Certification V1.6 and LW1.0.4 Device Class C Certification Tests v1.0.1
Frequency band(s) tested: 868MHz
Test Equipment: LCTT v3.9.0_R1
2x IMST LGW (iC880A + Raspberry Pi): Gateway software version 5.0.1
Packet forwarder software version 4.0.1

Test Result: PASS

Quality Engineer: Jens Lerner

Date: March 31st, 2023

The Test Report, No. 6230070 has the following conclusion:

The device has PASSED the tests hereunder.

Responsibility: Approved:

Yavuz Turan	Jens Lerner
Test Engineer	Quality Engineer

1 Description of the Device Under Test (DUT)

1.1 General

Item	Value
Product name	Smart Waste Sensor Unit
Product Vertical(s)	Buildings, Cities
Series (if any)	N/A
Hardware Version	3.7
Software Version	N/A
Firmware Version	2.0.0
Type of DUT	☐ Module ☒ End Device/Sensor ☐ others
Geographical area of operation	☒ Europe ☐ USA ☐ Australia
Operating frequency	☐ 433 MHz ☒ 868 MHz ☐ 915 MHz
Adaptive Data Rate (ADR) supported?	☒ Yes ☐ No
Optional data rates supported?	☐ DR6 ☐ DR7
Activation possibilities	☒ Over the air ☐ by personalization ☐ both
Test According LoRaWAN® Spec	☐ V1.0.1 ☐ V1.0.2 ☒ V1.0.4
Output Power	N/A
Number / Type of Antenna(s)	1x MIFA
Antenna Gain	~1 dBm

Table 1 Device Information

1.2 DUT Modes of Operation

During the tests the device operated in the following modes:

- Test mode according to document “TS009-1.1.0 LoRaWAN Certification Protocol” Chapter 2.

1.3 DUT Setup

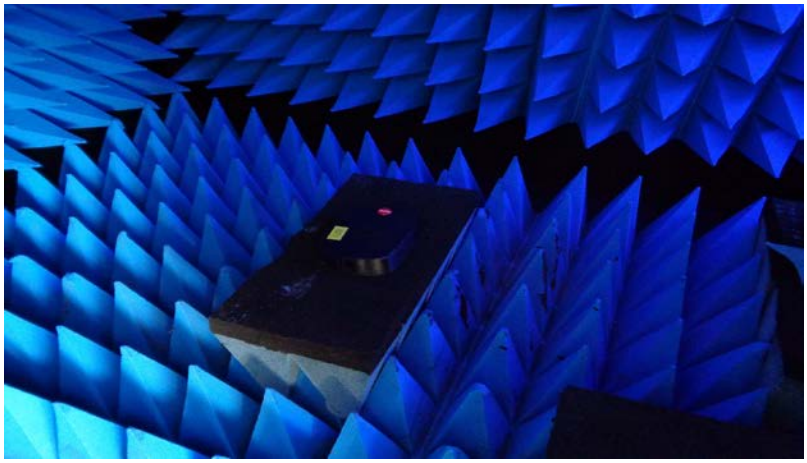

Figure 1 DUT Setup

Applied Methods of Measurement

1.4 Protocol Testing according to LoRaWAN® specification V1.0.4 (EU868)

Detailed Test Results Class A:

Test Mode Activation: **PASS**
Over the Air Activation: **PASS**
Cryptography: **PASS**
Downlink Sequence Number: **PASS**
Confirmed Frames: **PASS**
Device Status Request: **PASS**
New Channel Request**: PASS**
Di Channel Request Mac Command: **PASS**
RX Parameter Setup Request: **PASS**
RX Timing Setup Request: **PASS**
TX Parameter Setup Request: **PASS**
Link Check Request: **PASS**
Link ADR Request: **PASS**
Duty Cycle Request: **PASS**
Device Time Request: **PASS**
RX1 Window Test: **PASS**
RX2 Window Test: **PASS**
RX1 and RX2 Simultaneous Frames: **PASS**
RX Oversized Payload: **PASS**
Maximum Allowed Payload: **PASS**
Mac Commands: **PASS**
Multiple MAC Commands Prioritization: **PASS**
Device Deactivation: **PASS**

Detailed Test Results Class C:

Device Activation: **PASS**
DUT Pre-condition Settings: **PASS**
Activate Class C on DUT: **PASS**
Downlinks on Different RXC Reception Slots: **PASS**
Downlinks of Unconfirmed Frames on RXC (1), RX1 and RXC (2-3) Windows: **PASS**
Downlinks of Unconfirmed Frames on RXC (1), RXC (2), RX2 and RXC (3) Windows: **PASS**
Downlinks of an Unconfirmed Frame on RX1 and a Confirmed Frame on RXC (2-3) Window: **PASS**
Downlinks on RXC (1) just before it is due to open RX1 and on RXC (2) just before RX2: **PASS**
Error Rate Test - Lowest DR: **PASS**
Error Rate Test - Highest DR: **PASS**
Confirmed Uplinks: **PASS**
Switch Class A and Verify: **PASS**

Supported Optional Features:

Adaptive Data Rate (ADR):	Yes
SF7BW250 (DR6)	No
FSK50 (DR7)	No
Permanent Class C	No

Remarks: None

Result: The device passed the test without limitations.