Interreg Sudoe
IMPROVEMENT

Dissemination and Awareness Event

Integration of CCHP Microgrids in ZEPB with High PQ and Continuity Requirement, WP2 (UCO)

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1. The IoT Power Quality Sensor developed

Architecture and capabilities

Hardware

- Current and voltage inputs
- Signal conditioning circuits
- Specific purpose IC MCP3909 for energy measurements
- System on chip ESP32

Firmware

Use of the real-time operating system *FreeRTOS* for managing the following task:

- Waveform acquisition
- PQ parameter calculation
- PQ parameter transmission

Vrms, Irms, P, Q, S, tPF and industrial frequency (IEC 61000-4-30)

Detection of both magnitude and duration of voltage disturbances (IEC61000-4-30)

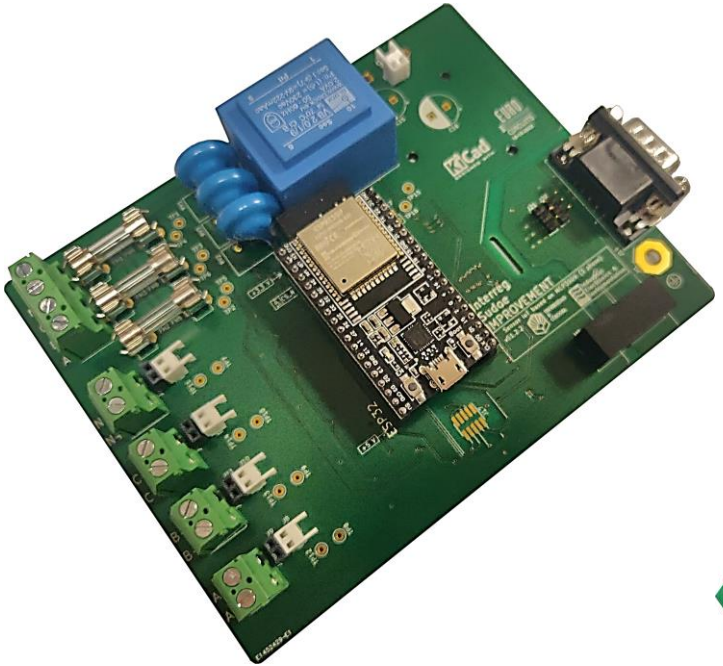
Low power consumption (<3.5 W)

Vh and Ih up to 50th order, THDv and THDi (IEC61000 4-7)

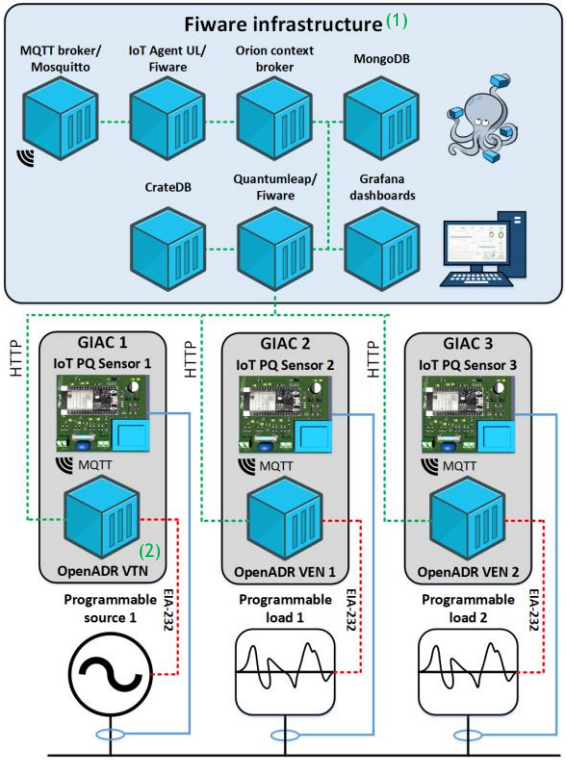
Several communication interfaces: MQTT, HTTP, TCP, UDP…

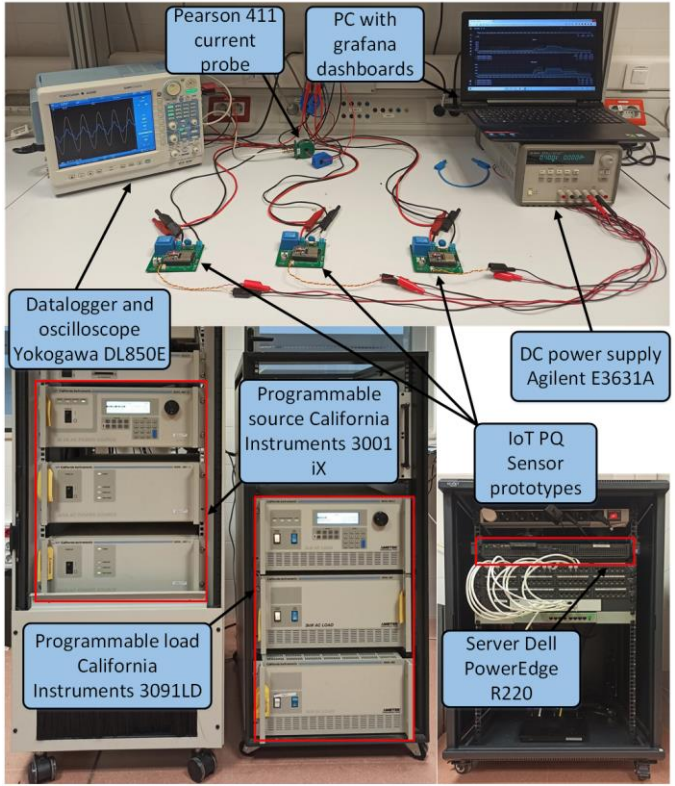
Flexibility over the waveform acquisition layer

Work in progress: Versions



IoT Infrastructure deployed for testing



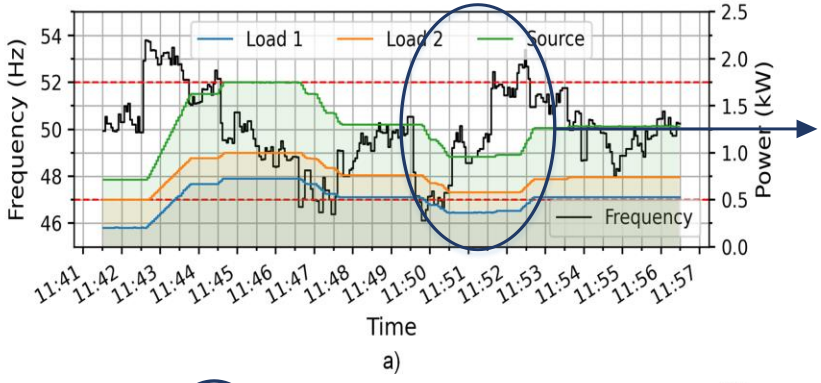


(1) "OPEN-SOURCE SOFTWARE STRATEGY 2020 – 2023, Think Open", European Commission, Tech. Rep, 7149, 21-10-2020.

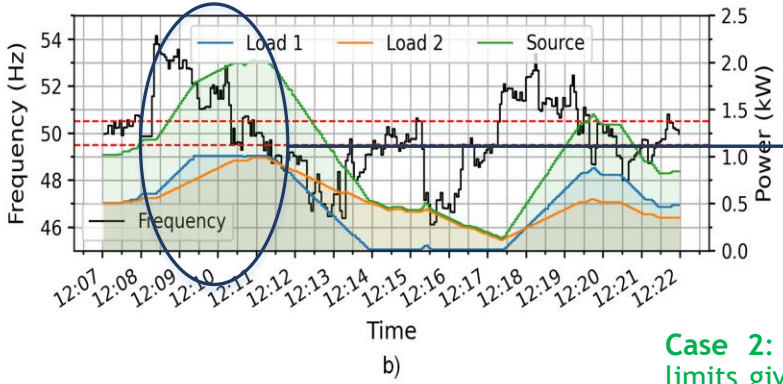
(2) "OpenLEADR — OpenLEADR 0.5.24 documentation." https://openleadr.org/docs/index.html.

2. Protective Functionalities provided by the device

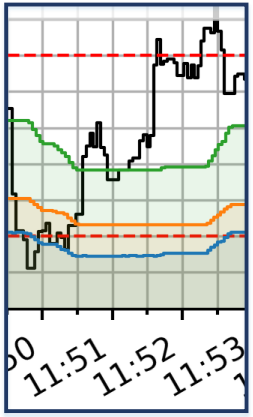
Frequency deviations



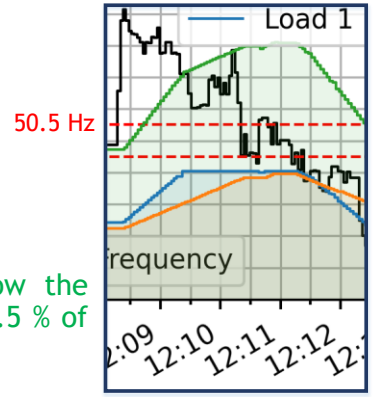
a)



b)



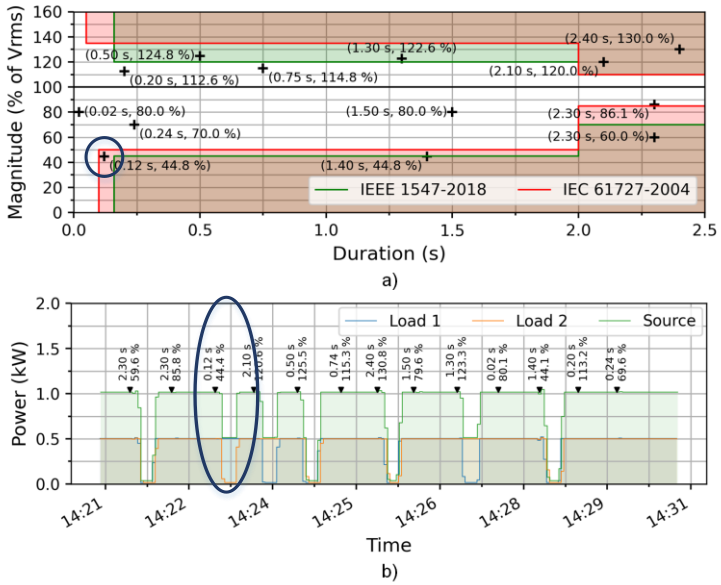
Case 1: Red dashed lines show the limits given by EN 50160 for 100 % of the year: 47 – 52 Hz



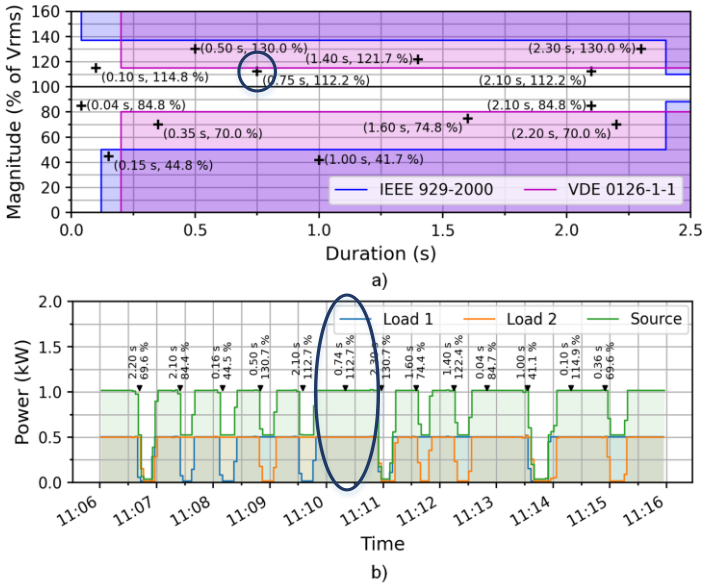
Case 2: Red dashed lines show the limits given by EN 50160 for 99.5 % of the year: 49.5 – 50.5 Hz

Voltage disturbances

Case 1: Standards IEEE 1547-2018 and IEC 61727-2004 have been employed as reference for loads 1 and 2 respectively

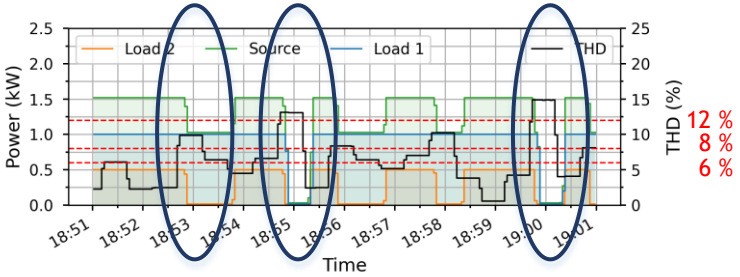


Case 2: Standards IEEE 929-2000 and VDE 0126-1-1 have been employed as reference for loads 1 and 2 respectively

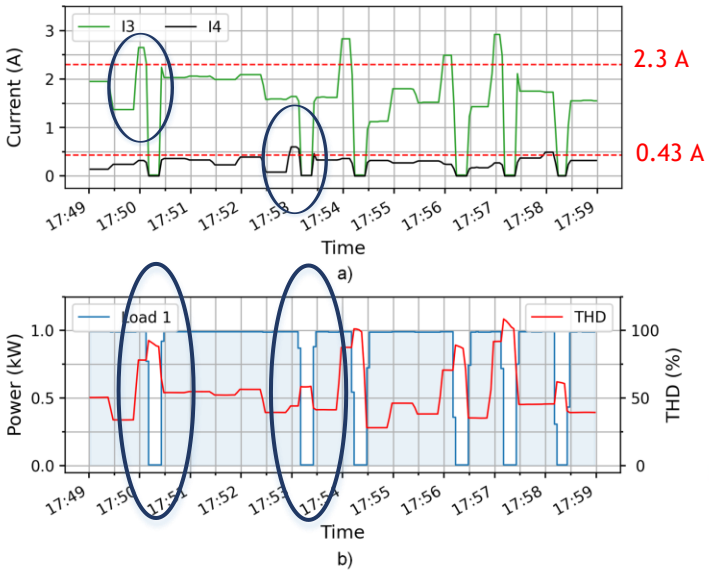


Voltage and current harmonic distortion

Case 1: Standards IEEE 519 and EN 50160 have been employed as reference to limit the voltage THD in loads 1 and 2 respectively (12 and 8 %). The value 6 % is the reconnection criterion.



Case 2: The standard IEC 61000-3-2 has been used as reference to limit the magnitude of individual harmonics. Concretely, 3rd and 4th current harmonics are generated.



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THANK YOU VERY MUCH!

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