



Good practice guide for sampling power and power quality measurements

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Objectives of the good practice guide

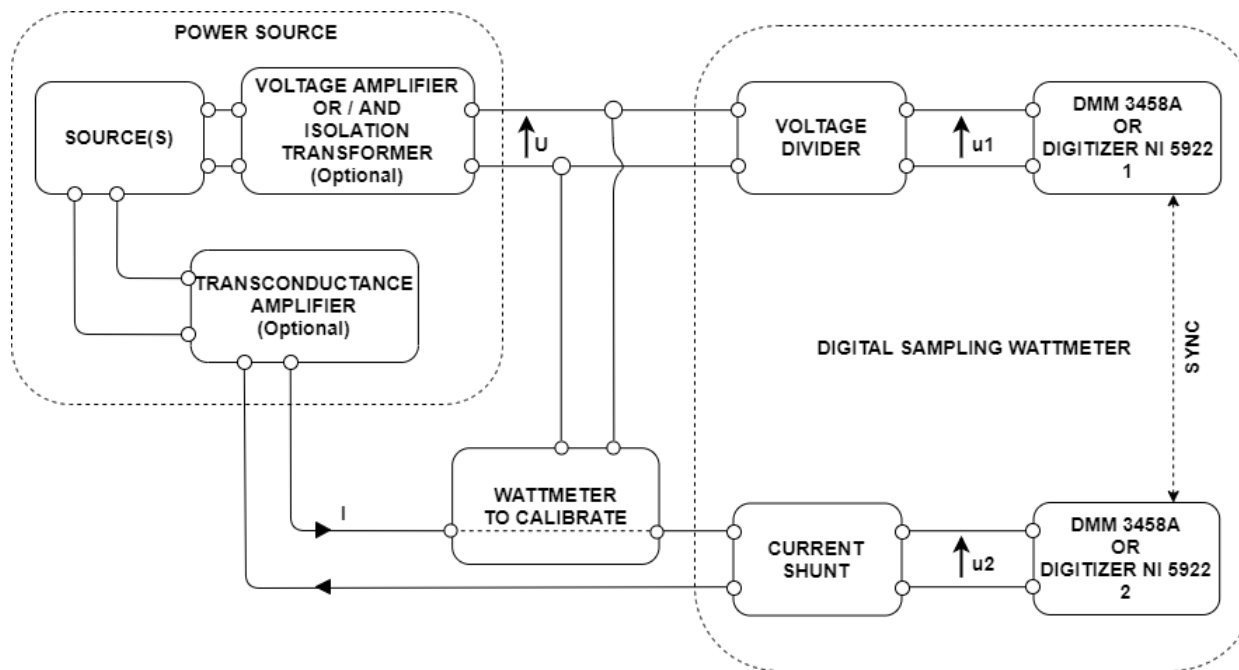
1. Provide a complete **description of the modular power and PQ measurements setups** for LF and HF
2. Include description of **calibration methods** of all the components to establish full traceability to the SI
3. Produce a guide for the developed **open software tool** to assist end-users

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Modular measurements setups

- Ensure both the **lowest possible uncertainties** and the **highest possible bandwidth** using commercially available devices:
 - Setup LF** : up to 10 kHz with **DMM 3458A**
 - Setup HF** : up to 1 MHz with **NI PXI-5922** digitizers



Modular measurements setups

Design of both macro-setups (LF & HF)

- Description of both LF and HF modular power and PQ measurements setups
- proper interference-free connection of the particular components
- focus on cancelling ground loops and elimination of leakage currents.

Modular measurements setups

Selecting relevant components

- ❖ Guidance on selecting suitable system components (power sources, current shunts, voltage dividers, digitizers) for both LF and HF setups
- ❖ Taking into account the availability of the components in most NMIs, calibration laboratories, industry etc.

Achievable Uncertainties

- ❖ Details on typical achievable uncertainties for appropriate power and PQ measurements.

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Calibration methods

The modular measurement setup comprises:

- **Transducers** (current shunts, voltage dividers)
 - **Digitizers** (3858A, 5922).
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- The calibration of individual components performed for all of the parameters relevant to the power and PQ measurements over the appropriate frequency range needed to be traceably measured.

Calibration methods

- Guidance documentation on **methods for calibration of transducers** (current shunts and voltage dividers)
- provided in terms of :
 - ❖ **Amplitude**
 - ❖ **Phase angle error**
 - ❖ **Level dependence**
 - ❖ **Temperature dependence**

Current shunts



Voltage dividers



Calibration methods

- The calibration of the digitizers includes:
 - ❖ calibration of the **amplitude** including **level dependence**,
 - ❖ **phase angle error** between the channels
 - ❖ evaluation of the **stability**.
- Different calibration procedures required and described for DMMs 3458A and wideband ADCs such as NI PXI-5922.

(LF) DMM 3458A



(HF) NI PXI-5922

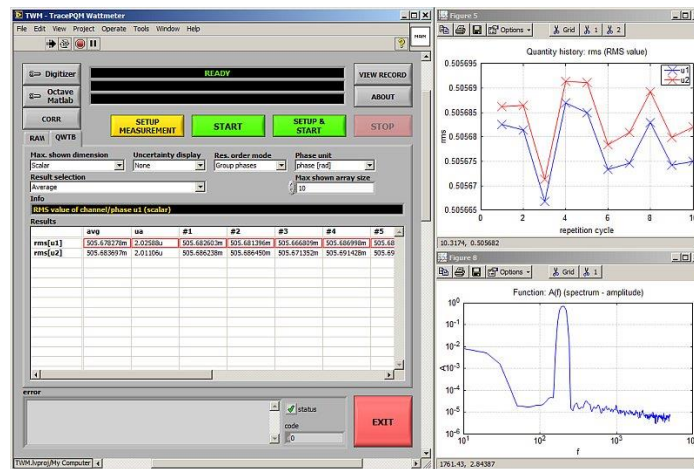


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Open software tool

- **TWM** and **TPQA** software,
- designed to allow **recording of the voltage and current waveforms** using various **digitizers** and **processing measured waveforms** using developed **algorithms**.
- Guidance documentation provided on the **start-up**, including **installation** of the software, and the user interface for both **LabVIEW** and **LabWindows/CVI**.



Open software tool

Control and data acquisition module

- to enable the software tool to operate with different hardware platforms for recording voltage and current waveforms :
 - ❖ DMM 3458A for LF setup
 - ❖ NI PXI-5922 for wideband setup
- Guidance documentation includes details:
 - ❖ methods for **configuring the digitizers**
 - ❖ methods for **configuring corrections** for voltages dividers, current shunts and digitizers

A guidance on **integration of new types of digitizers** to adapt the SW to available HW platforms.

Open software tool

Data processing module

- List of processing algorithms for the calculation of power and PQ parameters from the raw data
- Each individual algorithm :
 - ❖ Description of **calculation methods**
 - ❖ Description of **input parameters** and **output results**
 - ❖ Description of **uncertainty calculations** using Monte Carlo or GUF calculation or a quick semi-analytical estimator
- A guidance provided on **integration of new algorithms** into the open SW tool to easily **modify / extend the capabilities of the TWM / TPQA software** in the future.

Conclusion

- Document with **more than 230 pages**
- Provide information to establish modular sampling setup for power nad PQ traceable measurement
- Status: review of final draft
- **It will be available at project website** at the end of the project (next week) – it will be announced by email.