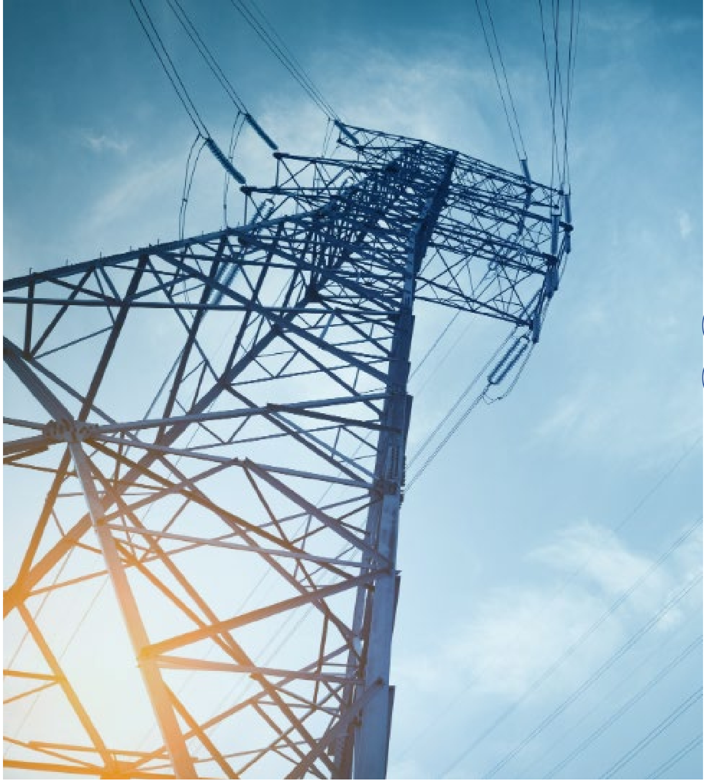

ADMIT

AC & DC High Frequency Instrument Transformers

Characterisation of AC and DC MV instrument transformers in extended frequency range up to 150 kHz (2023 – 2026)

Society's increasing use of switching devices (inverters, bulky power electronic converters, active filters, etc.), both as loads and as part of generators, especially for renewable energy sources, has driven the consequent proliferation of conducted disturbances on grid voltage and current, also at medium voltage level, up to hundreds of kilohertz, due to the harmonics of the components around the switching frequency.

The main objective of this project is to build up the metrological framework to allow the accuracy evaluation of voltage and current transformers for medium voltage grids, up to 36 KV and 2 kA, in a frequency range from DC up to 150 kHz. Suitable reference generation and measurement systems, for voltage and current, will be specifically developed.

To support the European electrical power industry, this three-year project will provide the currently missing solutions for the calibration of voltage and current transformers for medium voltage grids up to 150 kHz. The project will also support IEC TC 38 'Instrument Transformers' in their work on the issue of new standards on the topic, with the goal of fostering accurate voltage and current measurements in medium voltage grids up to 150 kHz.

SCIENTIFIC OBJECTIVES

Accuracy parameters and test methods for MV VTs and CTs up to 150 kHz

Reference voltage generation and measurement system up to 36 kV, 150 kHz

Reference voltage generation and measurement system up to 2 kA, 150 kHz

To provide data, methods, guidelines & recommendations to IEC TC 38 necessary for testing MV VTs and CTs up to 150 kHz.

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METROLOGY PARTNERSHIP | EURAMET

2nd Newsletter

ADMIT
AC & DC High Frequency Instrument Transformers

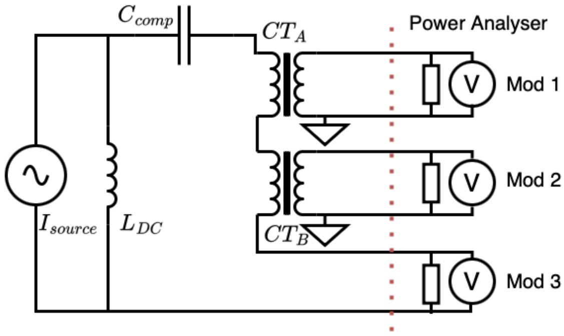
Need

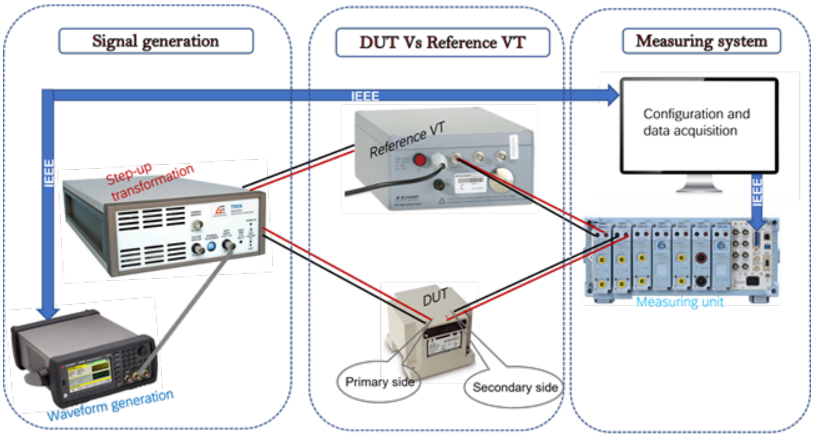
Society's increasing use of switching devices has driven the proliferation of conducted disturbances on grid voltage and current, also at medium voltage level, up to hundreds of kilohertz. Suitable parameters to define the accuracy and the performance requirements of ITs up to 150 kHz are not available, and there is an urgent need to standardise procedures to test ITs up to this range of frequency. Indeed, the standards which are currently in force include requirements only up to 20 kHz and test procedures only for 50/60 Hz.

Progress beyond the state of the art

Measurement System for CT Calibration from 50 Hz to 150 kHz Using a Wideband Power Analyzer

A simplified calibration method for current transformers (CTs) up to 150 kHz has been developed using a broadband high-precision power analyzer for the direct measurement of CT secondary currents. Thorough investigation of the operational parameters and configuration choices affecting the measurement accuracy and repeatability led to an expanded measurement uncertainty of 10 ppm at 10 kHz and 120 ppm at 150 kHz, thus outperforming current state-of-the-art approaches.



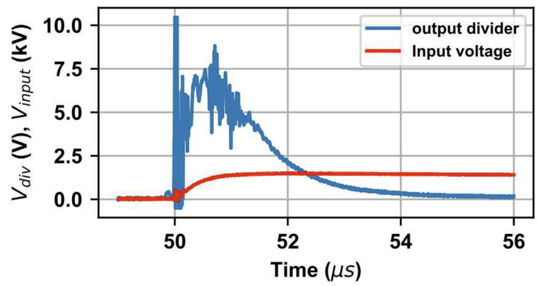


Simplified measurement setup for VT testing for frequency up to 150 kHz

The figure below shows a simplified setup for the characterization of voltage transformers, covering a frequency range from 50 Hz to 150 kHz. Developed within the project, this approach aims to extend characterization capabilities to higher frequencies while providing a more accessible and efficient method for testing and performance validation.

Can Voltage pulses be used for VT frequency characterization?

The identification of a standardized methodology to perform VT frequency characterization is still an open issue. Among the possible approaches discussed in international standards and literature, the use of pulse signals is particularly attractive. The conducted theoretical and experimental studies shown various issues. The waveform is not periodic and so the time window of analysis plays a crucial role. The inherent presence of the DC component cause saturation of inductive VTs. The high slew rates can give rise to resonances with output amplitudes much higher than expected.



Consortium

NMIs: INRiM Istituto Nazionale di Ricerca Metrologica, VSL, VTT, LNE, F²I² Fundación para el Fomento de la Innovación Industrial, RISE, METAS

Others: Università degli Studi della Campania Luigi Vanvitelli, Alma Mater Studiorum A.D. 1088, Università degli Studi di Genova, RSE Ricerca Sistema Energetico, arteche, unareti