high frequency diagnostics
High Frequency Diagnostics and Engineering Ltd

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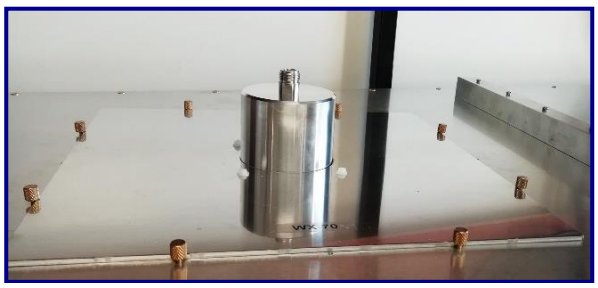
Calibration System for UHF Partial Discharge Sensors

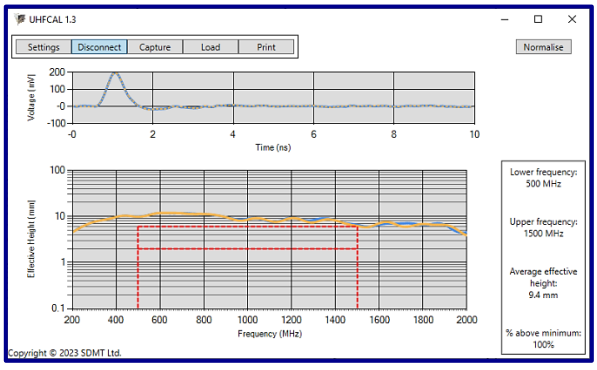
High Frequency Diagnostics offers design and consultancy services to clients wishing to establish their own calibration facilities that will streamline the development of UHF sensors for partial discharge (PD) detection in high voltage plant including GIS, transformers and switchgear. The calibration system is also valuable for quality control and certification of performance during production since the calibration of each PD sensor takes only a few minutes. Based on the award-winning system developed by the founder of High Frequency Diagnostics, Dr Martin Judd, in 1996, the system uses a GTEM cell to measure *effective height* of the sensor. This procedure has been used for nearly 30 years to verify and calibrate the sensitivity of thousands of UHF PD sensors.

GTEM transient test cell (nominal size 3.2 m long, 1. 1 m wide, 1.2 m high)

UHF sensors to be tested are mounted on plates that replicate the sensor mounting arrangement on the HV equipment to which the sensor will be fitted. Examples include GIS windows, insulating gas barrier edges, or transformer drain valves. Suitable plates can be supplied by HFDE or fabricated by users according to requirements.



Operating software can be customised to user requirements (logos, test frequency ranges). Alternatively, clients may wish to develop their own calibration software that will interface directly with the digital sampling oscilloscope.

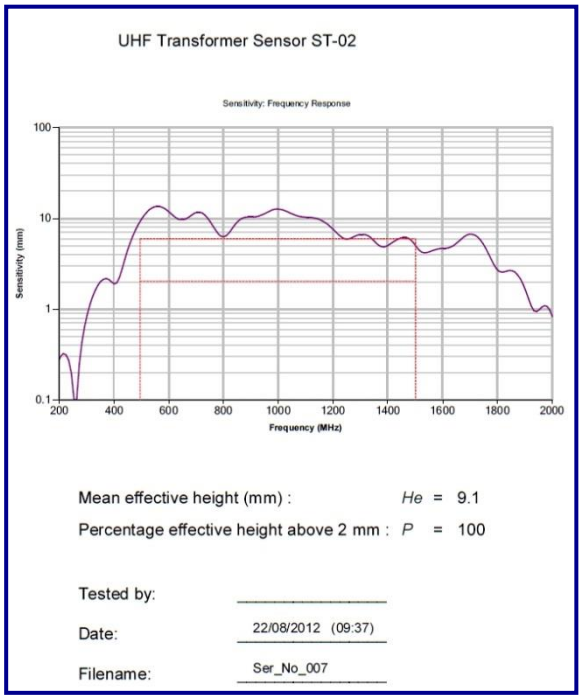


Operating Requirements

- The system requires as its input a repetitive step voltage signal with a sub-nanosecond risetime (typically > 5 V amplitude, < 200 ps risetime measured at 10% - 90%).
- Also required is a digital sampling oscilloscope with an analogue bandwidth of at least 1.0 GHz and a sampling rate of 10 GSa/s.
- UHF PD sensors are calibrated in terms of their sensitivity (*effective height*) as a function of frequency over the range 200 MHz – 2000 MHz or any sub-band within this range.

Measurement Outputs

- Operating software provides a 'real-time' display of the sensor frequency response while the device is under test so that the sensitivity can be conveniently optimised.
- Frequency response data can be exported for analysis or re-plotting using standard spreadsheet software.
- The system can be configured to print custom test certificates, such as the example below.



Accessories and Support

- Monopole reference probes (25 mm, SMA connector) for normalising the system response to ensure calibration accuracy.
- Custom UHF sensor mounting plates to suit user requirements.
- User Manual for system configuration and operation.
- Support for operating software development (design for different software environments or for languages other than English).
- Guidance on the selection of a compatible digital oscilloscope.
- On-site commissioning and training.

Related Scientific Literature

- National Grid Company plc, *Capacitive couplers for UHF partial discharge monitoring*, Technical Guidance Note: TGN(T)121, Issue 1, January 1997
- M Judd, O Farish, P Coventry, *UHF couplers for GIS - sensitivity and specification*, Proc. 10th Int. Symp. on High Voltage Engineering (Montreal), Vol. 6, August 1997
- M Judd, J Pearson, O Farish, *UHF couplers for gas insulated substations - a calibration technique*, IEE Proc. Science, Measurement and Technology, Vol. 144, No. 3, pp. 117-122, May 1997
- M Judd, O Farish, *A pulsed GTEM system for UHF sensor calibration*, IEEE Trans. Instrumentation and Measurement, Vol. 47, No. 4, pp. 875-880, August 1998
- M Judd, *Transient calibration of electric field sensors*, IEE Proc. Science, Measurement and Technology, Vol. 146, No. 3, pp. 113-116, May 1999
- M Siegel, S Coenen, M Judd, *UHF PD Sensor Characterisation using GTEM Cells*, Proc. VDE High Voltage Technology ETG-Symposium (Berlin), November 2018
- *Improvements to PD measurements for factory and site acceptance tests of power transformers*, CIGRE Technical Brochure 861, February 2022

Further Information

To discuss technical requirements and costs for developing a calibration system, please email Martin Judd:

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