Paper n. 300

ICREPQ'20

GRANADA
2-4 SEPTEMBER
2020

INTERNATIONAL CONFERENCE ON RENEWABLE ENERGIES AND POWER QUALITY

UNIVERSITÀ DEGLI STUDI DELL'AQUILA

IMPROVING THE POWER SYSTEM SAFETY IN HOSPITALS BY MEANS OF PERIODICAL SFRA TESTS ON MEDICAL ISOLATION TRANSFORMERS

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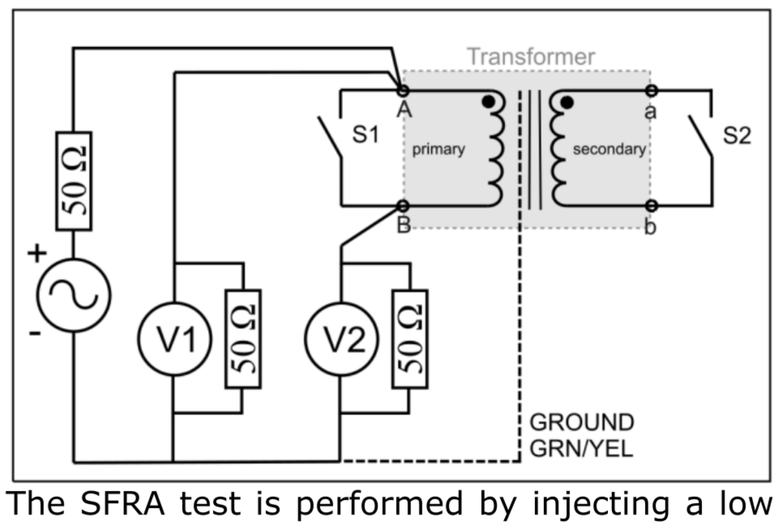
The research has the main aim of demonstrating a possible use of the well consolidated monitoring SFRA (Sweep Frequency Response Analysis) technique for preventive maintenance procedure applied to isolation medical transformers operating in hospitals' group 2 medical locations. a novel testing platform has been implemented that can perform the monitoring test on IT-M during normal periodical verification provided by specific standard.

A SFRA test can be applied to transformers in order to assess winding conditions without the need to open the transformer for inspection. The test is capable of identifying either core or windings movement, winding short circuit, junctions loosening and any other internal fault.



The SFRA test is performed by injecting a low voltage sinusoidal signal at one end of the transformer winding and measuring the voltage at the other end of the transformer winding itself. The ratio between the input and output voltage is then displayed in the frequency domain in dB. The impedance of the transformer under test attenuates and breaks the injected signal.

The SFRA technique could help hospital maintenance personnel identify tempestively even slightly damaged isolation transformers, allowing to replace the faulted IT-M before severe failure and subsequent power outage occur.

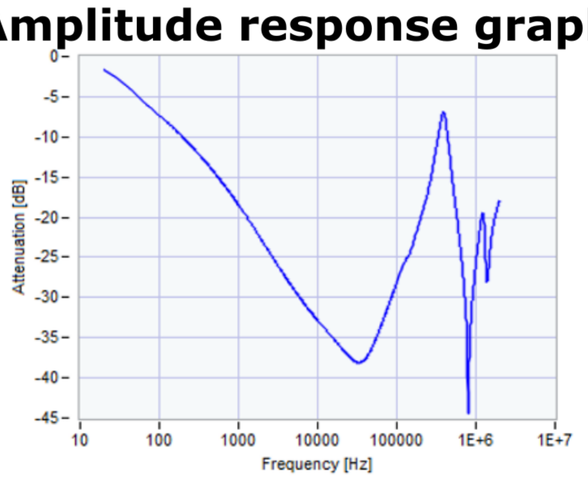
$$TF = 20\log_{10}\frac{V_2}{V_1}$$

The SFRA test is a comparative test where the TF obtained on the new or newly assembled transformer is compared with the TF after the failure or after a certain time period

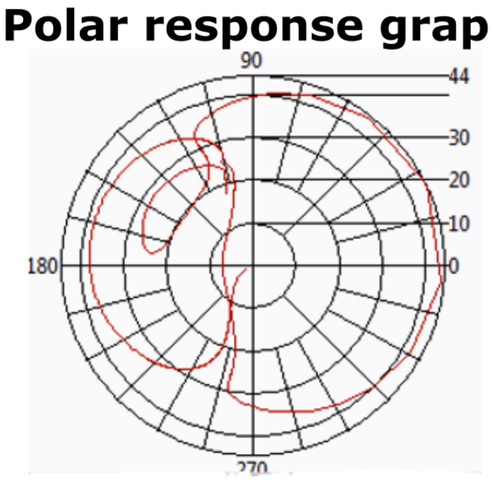
Several repetitive measures must be made before commissioning and during normal operation at regular intervals, to detect the fault and to intervene before further effects.

In the first test phase, the 10kVA Thytronic medical isolation transformer that fed the eyes operating room was analyzed by SFRA technique. The transformer was measured by placing the terminals on the primary circuit and leaving the secondary open

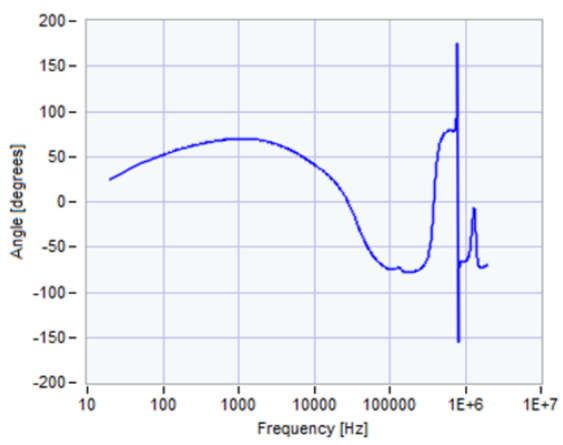
Amplitude response graph



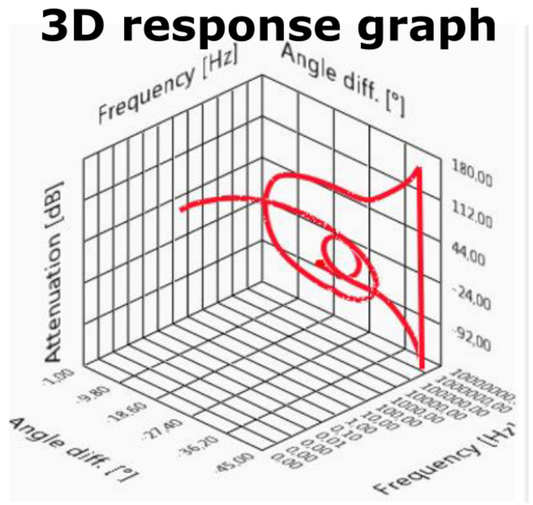
Polar response graph



Angle response graph

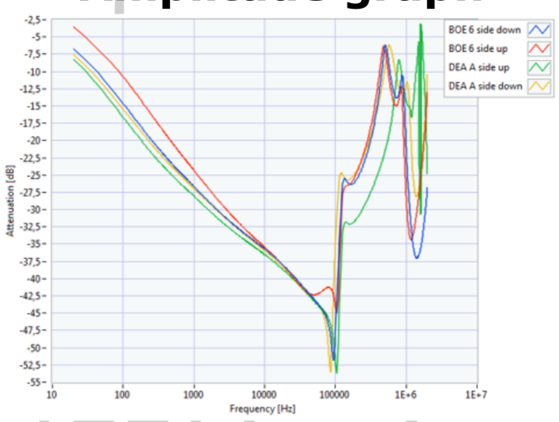


3D response graph

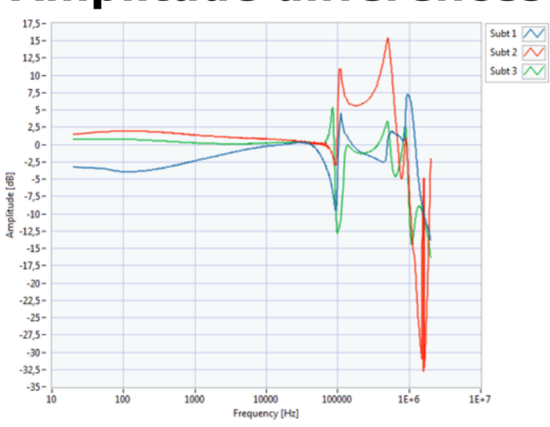


In the second test phase, 4 Siemens 4kVA isolation transformers were analyzed. These transformers fed the group 2 electric sockets of the operating rooms 6 of the BOE (emergency operating section) and A of the DEA (emergency and acceptance department).

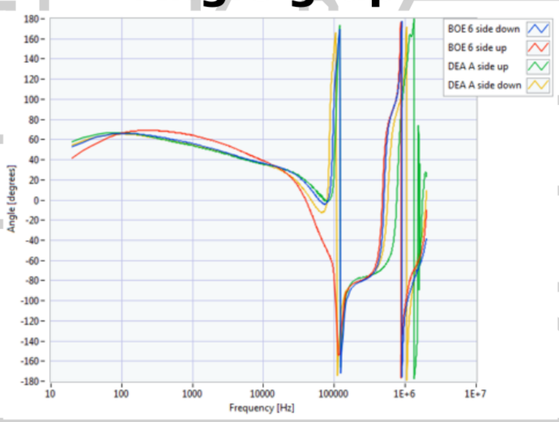
Amplitude graph



Amplitude differences



Angle graph



Angle differences