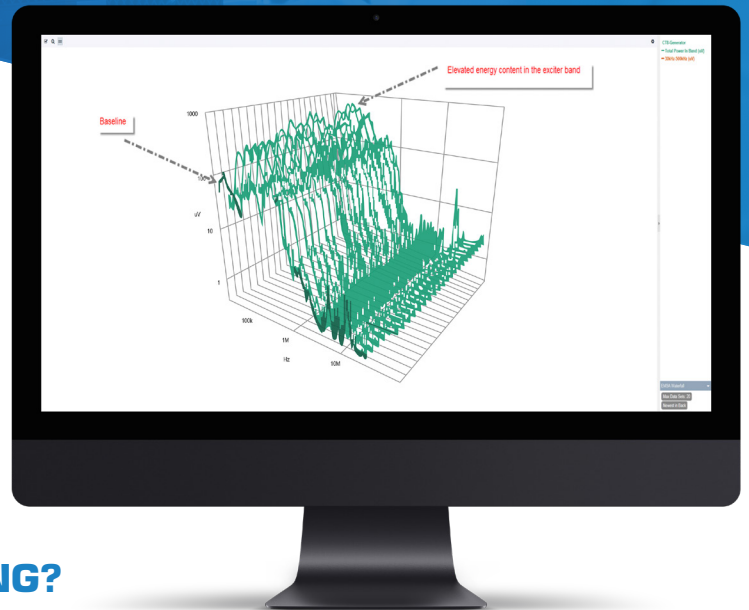


CUTSFORTH ELECTRO-MAGNETIC INTERFERENCE MONITORING

This paper may be used in conjunction with Cutsforth™
Electro - Magnetic Interference Monitoring Professional
Development Webinar from May 1st, 2020.
You can find the recording at [Cutsforth.com/EMI](https://cutsforth.com/EMI)

⚡ SYNOPSIS

This paper is intended for power generation facilities that have ever wondered if the insulation in a generator's stator is in tact, about the condition of the transformers, or even the isophase bus. This paper will provide a brief overview on how the Cutsforth™ Electro-Magnetic Interference (EMI) Monitoring can detect signals associated with a variety of defects.



⚡ WHAT IS EMI AND EMSA MONITORING?

Electro-Magnetic Interference (EMI):

Current flow from arcing emits radio electromagnetic waves that can be detected by radio frequency analyzers.. If this energy flow is controlled, it can be useful for transmission (i.e. a radio). However if uncontrolled, the electro-magnetic wave can interfere with the transmission of information creating an interference pattern that can be analyzed.

Electro-Magnetic Signature Analysis (EMSA):

EMSA captures and analyzes electromagnetic emissions from generators. Plants can then use these signatures to determine the electrical health of a piece of equipment. EMSA is a non-intrusive, online surveillance system monitoring abnormalities from energized, high voltage assets.

⚡ WHAT DOES EMI MONITORING DETECT?

Potential Failures to Detect:

EMI monitoring detects insulation failure when current flows from conductor to ground and creates a discharge that, in turn, emits an electro-magnetic signal that the Cutsforth™ system detects and measures. This failure usually manifests itself in some form of arcing. Below are some other defects easily detected by EMI:

Generator Defects:

- Slot discharge
- Loose end-windings (broken ties)
- Loose stator bars (loose wedging)
- Loose phase rings (circuit rings)
- Contamination on windings

Iso-phase/Aux Bus/Substation Defects:

- Insulation breakdown and water intrusion
- Broken support insulators
- Loose isolated phase bus hardware
- Contaminated insulators
- Defective isolated phase bus enclosure insulation



⚡ DATA ACQUISITION

Without continuous monitoring of EMI, plants spent a lot of money engaging a subject matter expert to visit their site once a year, collect the data, write a report, and store the report for future reference. Now, data can be continuously captured and trended using NI's Insight CM. The system creates a power spectrum from thousands of frequencies by utilizing a square root sum of squares technique. This allows the system to alarm within different subsets of the total spectrum. The information is stored and archived within InsightCM, and can easily be used for comparison in analysis. EMI Monitoring also provides time domain waveforms that can be used to identify several faults including:

- Arcing
- Partial Discharge
- Gap Discharge
- Corona
- Random Noise
- Micro - Sparking (rapid gap discharge)

⚡ CASE STUDIES AND ANALYSIS

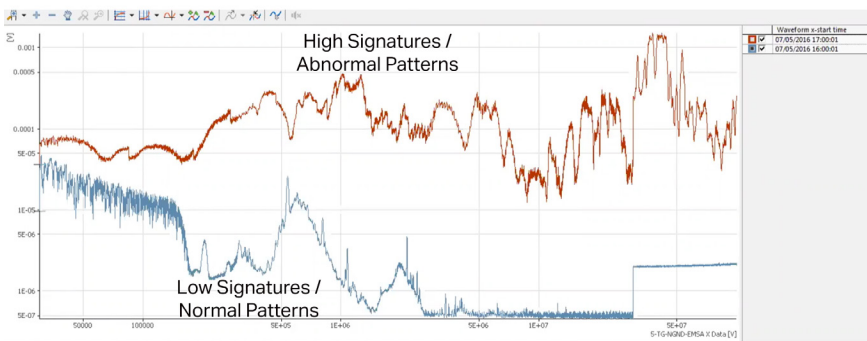


Figure 1, A Tale of 2 Generators: The orange line has Isophase Bus issues (specifically relay actuation); the grey line is normal. With EMI, plants can track generators side by side as another method to determine when a fault is occurring, and take appropriate action.

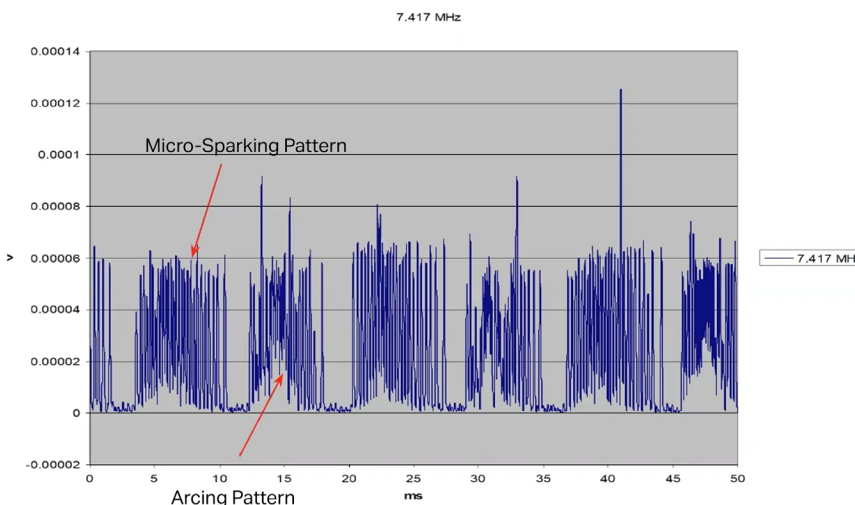


Figure 2, A Tale of 2 Failure Modes: In this example, this particular generator is showing micro - sparking and arcing patterns. The plant was able to track and trend the generator, and was able to plan for and repair these defaults in an upcoming outage.

⚡ CONCLUSION

Plants are now able to monitor and trend electromagnetic emissions from generators. The EMI system provides a broad based condition monitoring solution for the generator train out to the step-up transformer. Early detection of faults within the generator core, the excitation systems, isolated phase bus, or even transformers may reduce the risk of unplanned outages.

For information on Electro-Magnetic Interference Monitoring or any of our other systems visit Cutsforth.com.