

# Low Frequency Oscillations Generated Due to Interaction of Shunt Reactors with a Long Transmission Line

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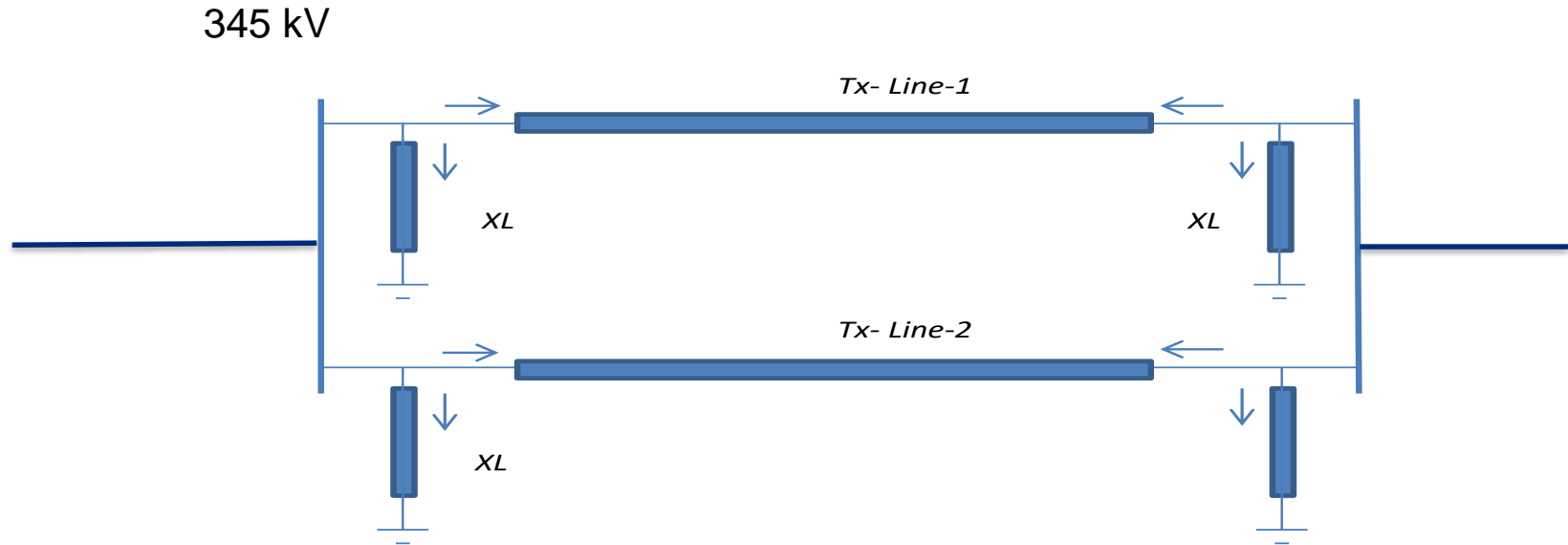
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# Outline

- Application Case- Simplified SLD
- Event Captured by the Relay
- Event Analysis
- Findings

# Application case: SSO Monitoring

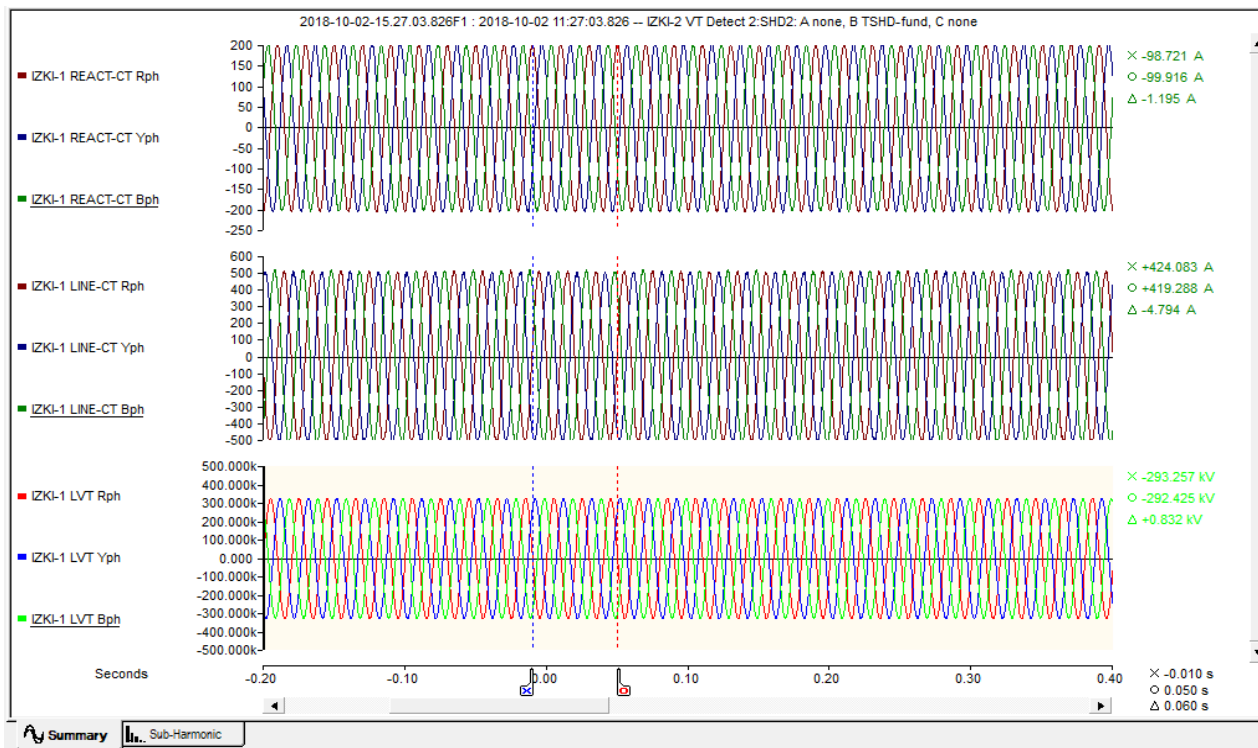
- Simplified SLD



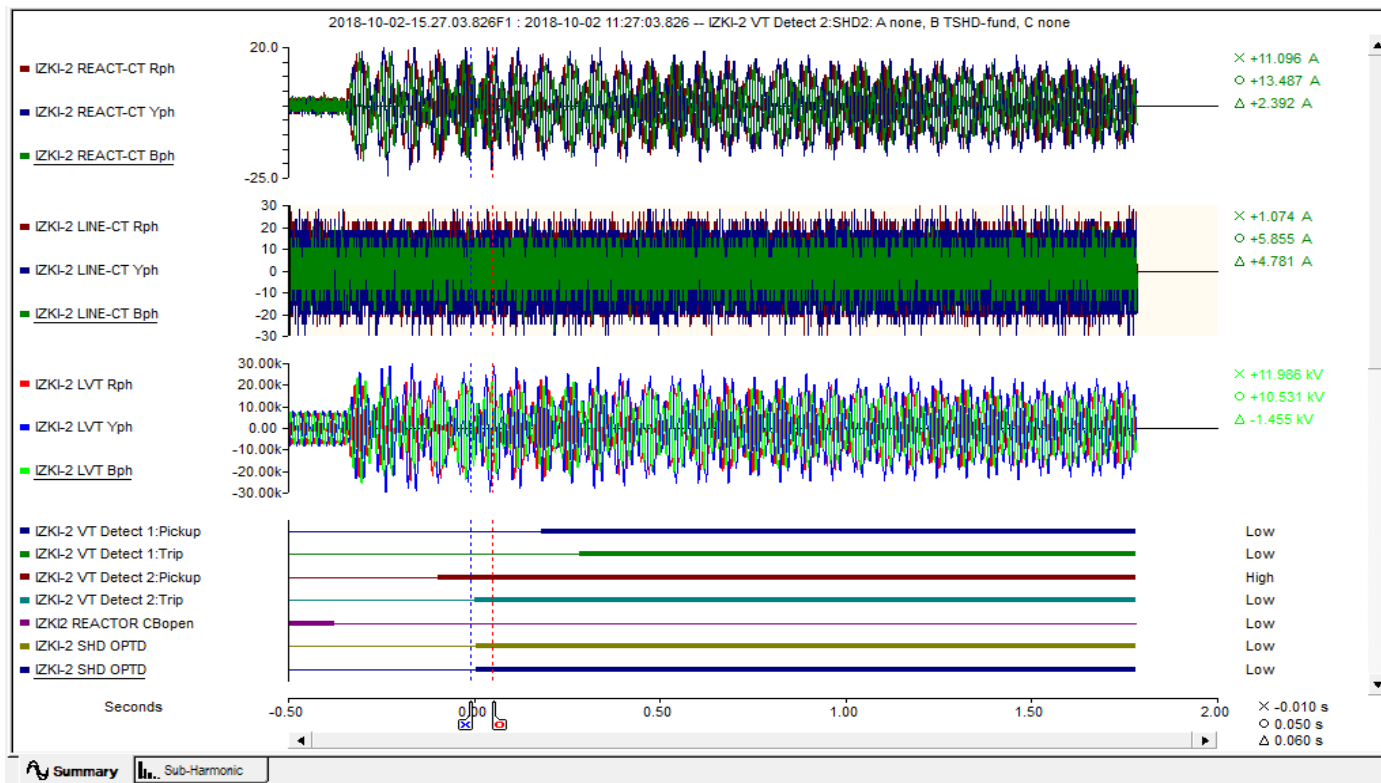
# Event-1

- Summary:
  - Line-1 in-service
  - Reactor-1 in-service
  - Line-2 out of service
  - Reactor-2 closing

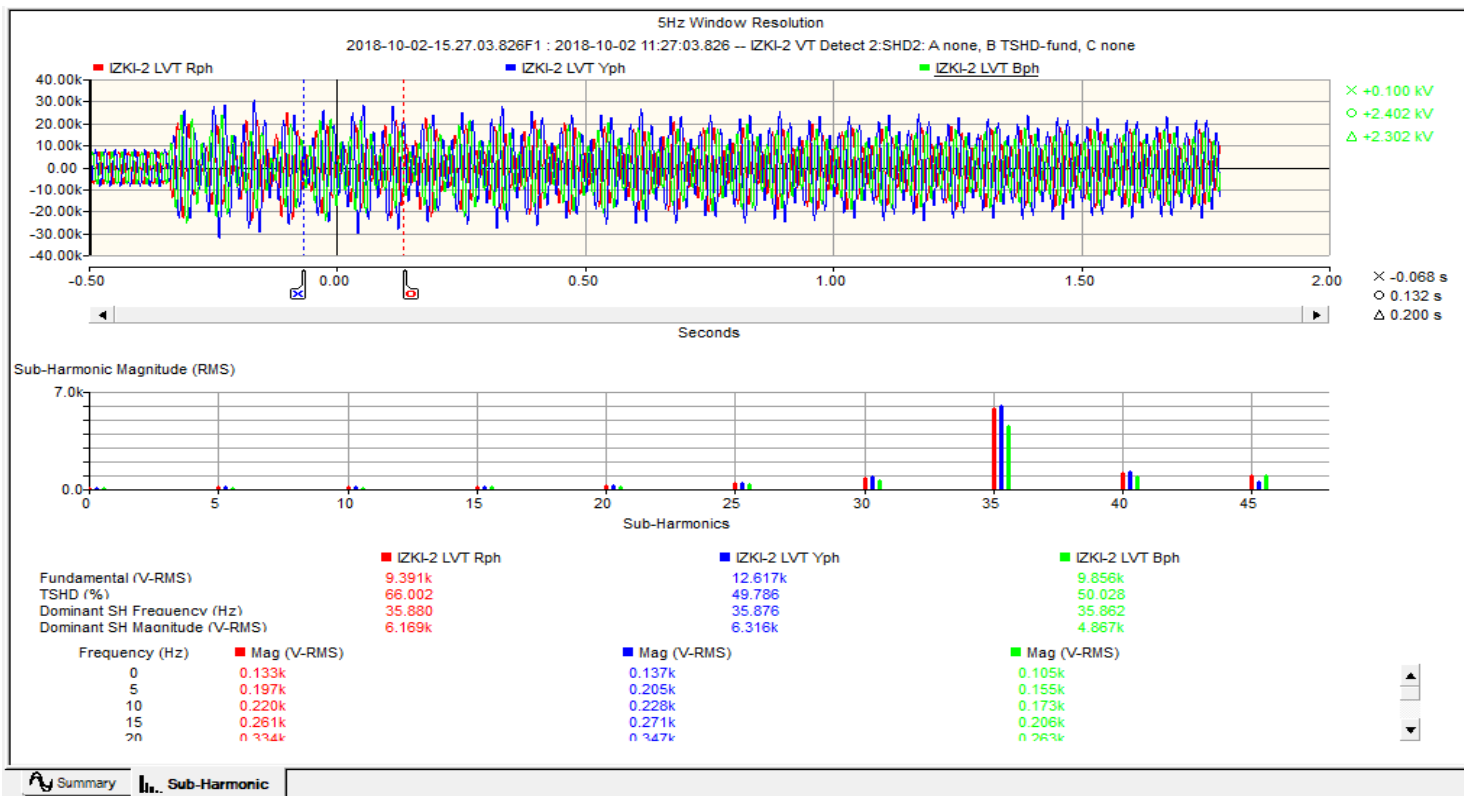
# Measurements on Line-1



# Measurements on Line-2



# Analysis of Line-2 Reactor Measurements

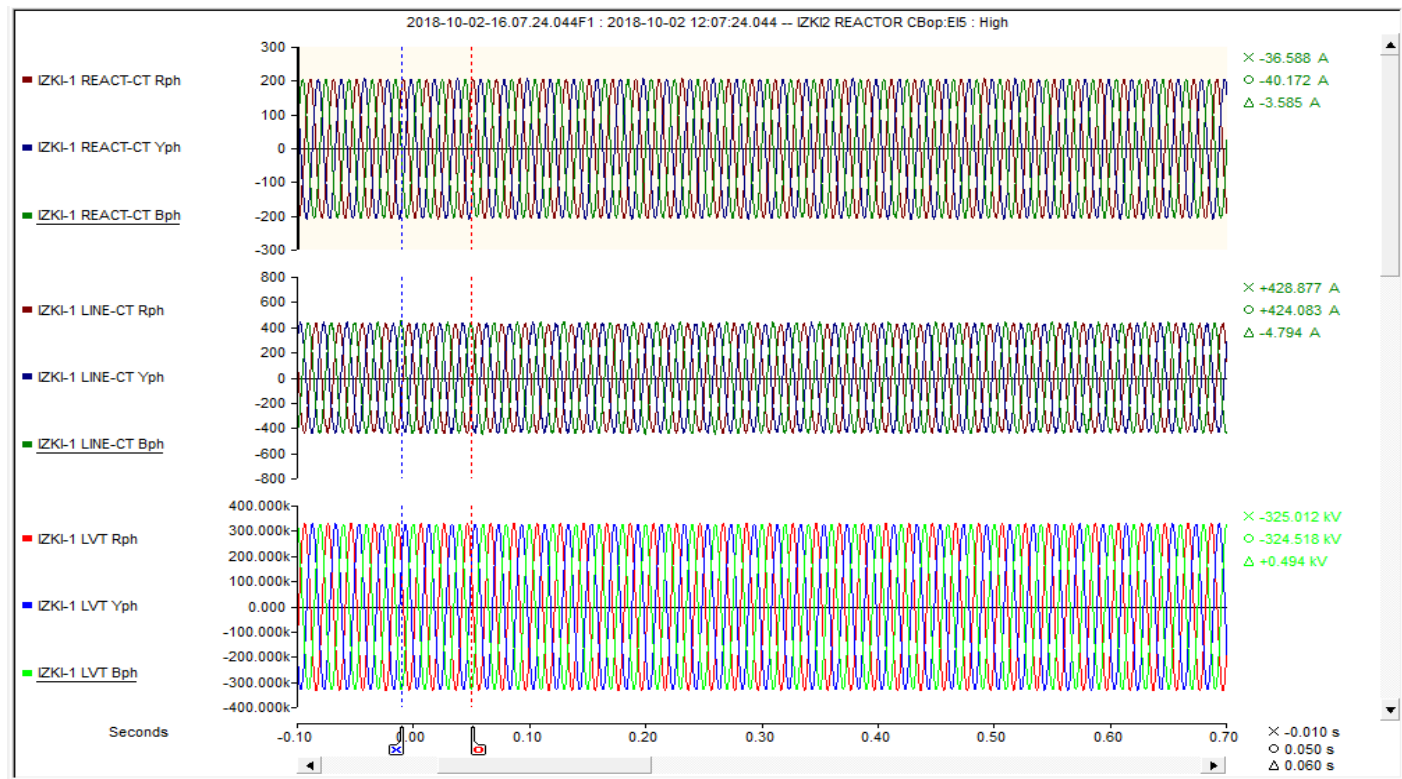


# Event-2

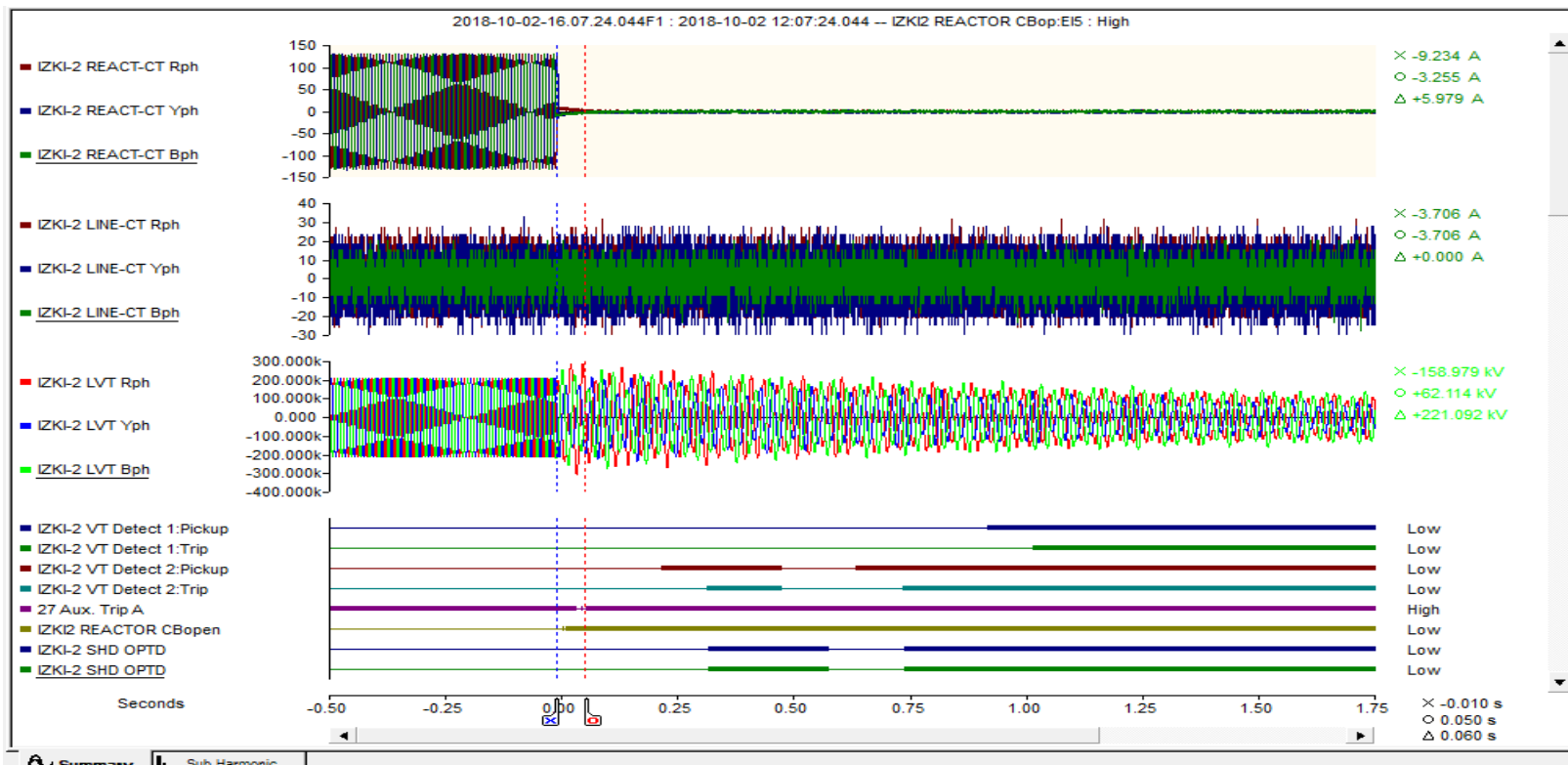
- Summary:
  - Line-1 in-service
  - Reactor-1 in-service
  - Line-2 in-service with remote end open
  - Reactor-2 opening



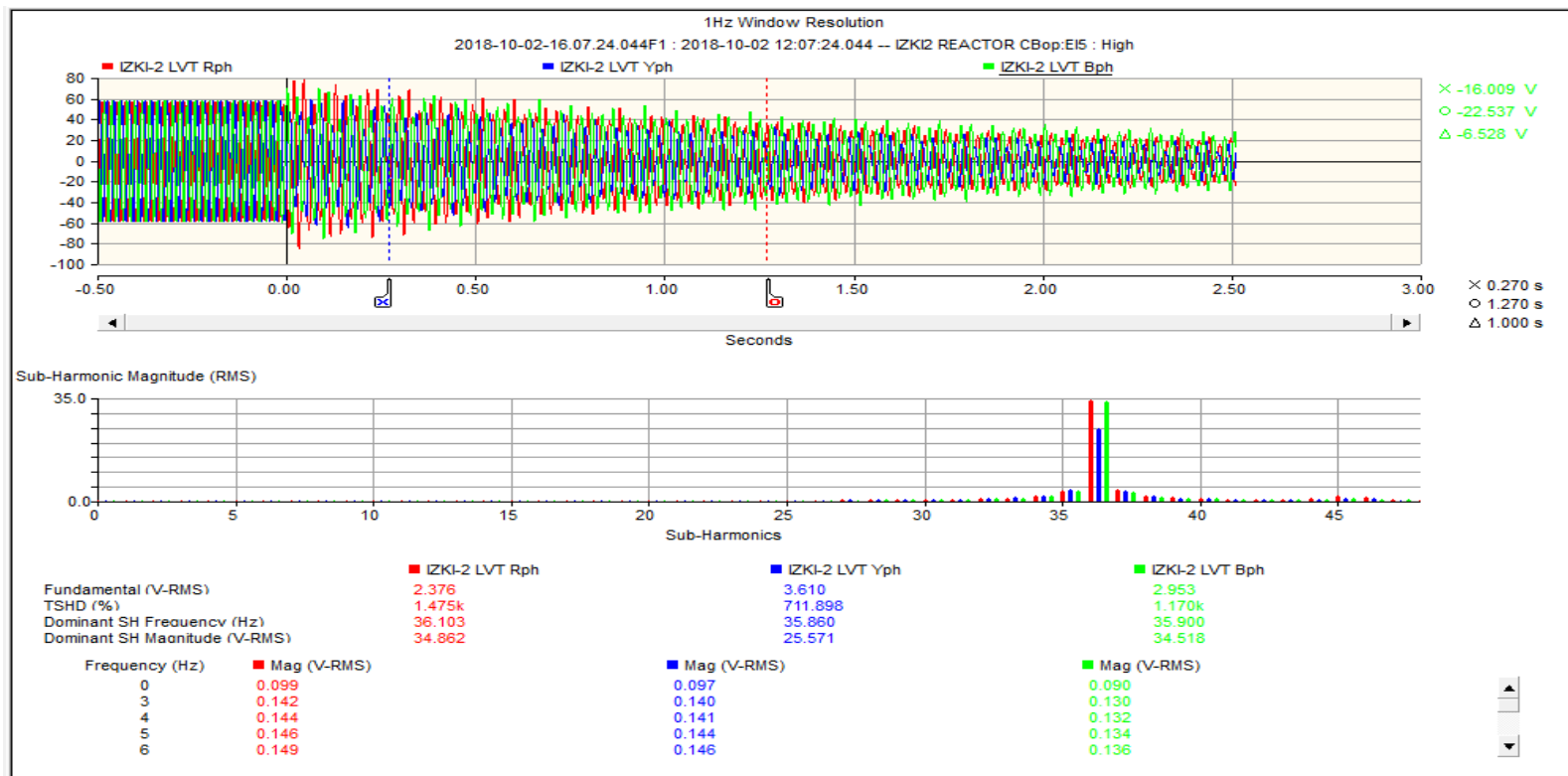
# Measurements on Line-1



# Measurement on Line-2



# Analysis on Line-2 Reactor Measurements



# Summary

- Operation of a subharmonic protection relay during a switching of a double circuit transmission line with reactors was analyzed.
- Review of the events captured by the relays indicates that low magnitude sub harmonics are observed during the switching conditions.
- System is under continuous monitoring for possible high magnitude sub harmonic conditions.
  - Possible damages to reactors
  - Possible mis-operations of other protection relays during simultaneous events