

Synchronized Measurement Working Group

Oscillation Report Document

Purpose

The NERC SMWG Oscillation Report Document provides a way for the industry to record and share information about oscillations in the North American power grids. Whether they are at ultra-low frequency, low frequency, subsynchronous frequencies, or supersynchronous frequencies, sizable oscillations are always threats to the reliability of daily grid operations.

Traditionally, both low-frequency oscillations, caused by long-distance-heavy-transfer scenarios, and subsynchronous oscillations, caused by series capacitor induced resonance conditions, are studied in the planning stage and mitigated using preventive measures. However, as PMUs are being installed across the grid, more and more oscillations have been discovered after the fact and most of them are caused by either equipment malfunction or unforeseen control interactions. Therefore, it has become more important to actively monitor, locate, and mitigate oscillations in real-time rather than rely on off-line studies.

The purpose of this document is to record notable oscillations and share useful insights, in the hope that the grid operators can learn from these events. This document provides a template for you to enter and document information about this event. Each field is explained and preset choices are given for certain fields to maintain consistency. All information entered here is for public view, please redact any confidential or market-sensitive information from the provided material. The report is also subject to approval from the SMWG Oscillation Report Committee before publishing, to not only ensure the quality of the report but also reduce repeated reports of the same type.

Reporting Criteria

Please use the following checklist to determine whether an oscillation event is reportable. A reportable oscillation event should tick at least two of the criteria below:

- Duration and Magnitude

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- multiple Transmission Operators
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Unique Phenomena

- Unique oscillation causes or effects that may be informative to the industry

Parameters

1. **Oscillation Type:** Fundamental characteristic of oscillation.

(Please choose one):

(Click or tap drop down arrow to activate drop down box)

2. **Duration:** The time-period for the reported oscillations.

Start (UTC Only):

Stop (UTC Only):

Duration:

3. **Repeated:** Observed several times?

Yes: ☐ No: ☐

- a. If Yes: How often?

(Click or tap drop down arrow to activate drop down box)

- b. If Conditional, please specify:

4. **Oscillation Frequency:** List dominant fundamental and harmonic (if any) frequency component(s) in observable PMU waveforms during oscillation.

5. **Amplitude:** Overall maximum pk-pk amplitude in observable PMU active power, reactive power and voltage magnitude during oscillation.

6. **Oscillation frequency close to known mode(s):** Whether a fundamental or harmonic frequency is close to a known system mode to excite potential resonance conditions.

Yes: ☐ No: ☐

- a. If Yes: Name the excited mode

Interconnection:

Mode:

(Click or tap drop down arrow to activate drop down box)

- b. If "Other" please list here (include interconnection):

7. Damping Ratio of Excited System Mode:

- a. If the oscillation is type of forced-no-resonance, fill N/A below

- b. If oscillation is growing due to negative damping ratio, provide value of negative damping ratio of mode (e.g. Aug 10, 1996 event)

- c. If oscillation is a forced-resonance (e.g. Jan 11, 2019 event), provide damping ratio of excited mode before and after the oscillation.

- 8. Observable Oscillation/Mode Shape:** Polar chart (or equivalent) describing the relationship of observed signal magnitudes and their relative phases to one another at the fundamental or harmonic (if any) frequency of the oscillation. For a given signal type set, the signal with the largest magnitude is usually chosen as the reference.

- a. Signal Type:

(Click or tap drop down arrow to activate drop down box)

- b. Paste picture(s) of observed oscillation shape(s):

(Click or tap inside box below to upload image, click or tap again to clear image)

Background/Observed

1. **Origin RC/TO:** The identified source of the oscillation.
 - a. Exact Location? (specify:)
2. **Generation and load impacted:** Either the generation/load that seen the oscillation in a certain amplitude, or the generation/load that were taken offline in mitigating the oscillation.

3. **Tools utilized to identify oscillation:** software used to calculate oscillation results.

- a. Offline: if the oscillation was discovered ad hoc.

- b. Real-time: if the oscillation was discovered in real-time.

4. **Root Cause:** Reason for the oscillation.

Actions Taken

1. **Mitigations:** actions taken to mitigate the oscillation.

2. **Responsible Entity:** entity that performed action(s).

3. **Coordination Utilized (RCIS, Hotline, etc.):** processes or mechanisms used to communicate event.

4. **Lessons Learned:** valuable takeaways that will improve understanding, mitigation, or prevention of power system oscillations.

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