

*Consortium for
Electric
Reliability
Technology
Solutions*

**NERC
Interconnections
Candidate
Frequency Event
Selection Criteria**

FRSDT ACTION ITEM

Define how and when to use 2 years of event data in addition to the 1 year currently in the draft standard

DRAFT

For

NERC – Frequency Response Standard Drafting Team (FRSDT)

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1. Background

Item-2 from the current version of the Frequency Response(FR) standard Procedure document establish:

“The ERO will identify at least 20 frequency excursion events in each Interconnection for calculating the Frequency Bias Setting and the FRM. If the ERO cannot identify in a given evaluation period 20 frequency excursion events satisfying the limits specified in criteria 3 below, then similar acceptable events from the previous evaluation period also satisfying listed criteria will be included with the data set by the ERO for determining FRS compliance.”

The premise is that more than one year of event data should be used for estimating FR metrics performance only if the ERO cannot identify more than 20 events for the current year. For validating the premise, CERTS tabulated the candidate events presented each month to the RS Frequency Working Group for 2011 and for the first six months of 2012. Following are the summary tables categorized by year, month and hour:

2011 Eastern Interconnections Events

2012 Eastern Interconnections Events

| hour | month | | | | | | | | | | | | Sum |
|------|-------|----|---|----|----|----|---|---|----|----|----|----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 |
| 3 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 5 |
| 4 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 7 |
| 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 6 |
| 6 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 6 |
| 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| 8 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 6 |
| 9 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 7 |
| 10 | 0 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 9 |
| 11 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 |
| 12 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 3 |
| 14 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 7 |
| 15 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 2 | 9 |
| 16 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 17 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 7 |
| 18 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 19 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 20 | 0 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 21 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 8 |
| 22 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 0 | 5 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 3 | 3 |
| Sum | 5 | 11 | 5 | 20 | 11 | 10 | 7 | 8 | 12 | 18 | 6 | 10 | 123 |

| hour | month | | | | | | | | | | | | Sum |
|------|-------|---|---|---|---|---|---|---|---|----|----|----|-----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 8 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 12 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 13 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 14 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 15 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 19 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 20 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Sum | 5 | 5 | 5 | 7 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |

2. Recommendation

Experience with the number and distribution of Eastern frequency events for the last 18 months clearly indicates more than 20 candidate events will be identify per year for the Eastern interconnection. CERTS will create similar tabulations for the other 3 interconnections events, but preliminary results show similar tabulation results. It is recommended more than 1 year of data be used only as currently describe in item-2 of the standard procedure document. It is also recommend that the number of events per year be increase from 20 to 25 to make the yearly sample more statistical significant.

The attachment describes the criteria and historical phasor frequency data use for identifying monthly candidate events. The process uses definitions from the FRSDT and follows closely the type frequency-related trigger algorithms use to initiate disturbance recordings by PMUs and other related devices

DESCRIPTION OF THE FREQUENCY EVENT IDENTIFICATION CRITERIA FOR DETECTING AND SELECTING CANDIDATE SIGNIFICANT INTERCONNECTIONS FREQUENCY EVENTS FOR FINAL SELECTION BY NERC RESOURCES SUBCOMMITTEE – Revision: 06.12.12

Objective and Background

Support for NERC Resource Subcommittee (RS) for the implementation of Reliability Standard BAL-3. The following interconnections frequency event identification methodology and criteria were researched, defined and reported by CERTS to RS during 2010 for capturing significant frequency events for all NERC interconnections.

Description of Frequency Events Detection Methodology and Criteria

This methodology uses archived, historical 1-second phasor frequency data to identify and capture approximately 2 to 6 most significant frequency events for each interconnection per month. On a monthly basis, CERTS-EPG and NERC Staff prepare and submit to NERC RS all captured events with require parameters for monthly posting in the RS web-site for BAs to have a “heads up” on events that will be used for current year’s Frequency Response Measurement (FRM) and next year’s Bias Setting.

The event selection process uses a 15-second rolling time window to:

- Identify the Max and Min frequencies for each 15-second rolling window
- Compare the absolute Max-Min frequency difference for each 15-second rolling window against the interconnections’ pre-defined frequency thresholds. The current thresholds for each of the interconnections are as follows: EI – 40 mHz; WI – 70 mHz; ERCOT – 90 mHz; HQ – 300 mHz.
- Mark as candidate significant frequency events those events that the absolute frequency difference is equal to or greater than the frequency threshold
- Identify and archive the following parameters, as define in BAL-3, standard, for all events market as significant:
 - Value A – Average frequency values between T(-16) and T(0)
 - Value B – Average frequency values between T(20) and T(52)
 - Point C – Min/Max Frequency within 8 seconds after T(0)
 - T(0) as the point with the minimum frequency change threshold of 5 mHz within 1-second for all significant candidate events
 - Recovering frequencies for up to 600 seconds after T(0) for each significant event

This frequency event detection methodology has been used for the last 2 years for producing and delivering monthly reports with the most significant events including frequency profile graphs for each of the 4 NERC interconnections. The frequency thresholds are monitored, analyzed and adjusted periodically using interconnections phasor frequency data from the most recent years for capturing recent operational trends.

