

Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard is adopted by the NERC Board of Trustees (Board).

Description of Current Draft

45-day formal comment period with ballot.

Completed Actions	Date
Standards Committee approved Standard Authorization Request (SAR) for posting (SAR submitted by NERC RS)	June 14, 2017
Standards Committee approved Standard Authorization Request (SAR) for posting (SAR submitted by NWPP FRSG)	October 18, 2017
SAR posted for comment (SAR submitted by NERC RS)	June 16, 2017 – July 18, 2017
SAR posted for comment (SAR submitted by NWPP FRSG)	November 2, 2017 – December 1, 2017
Reliability Standard BAL-003-2	November 5, 2019

Anticipated Actions	Date
45-day formal comment period with ballot	July 25, 2022
45-day formal comment period with additional ballot	April 18, 2023
10-day final ballot	TBD
Board adoption	TBD

New or Modified Term(s) Used in NERC Reliability Standards

This section includes all new or modified terms used in the proposed standard that will be included in the *Glossary of Terms Used in NERC Reliability Standards* upon applicable regulatory approval. Terms used in the proposed standard that are already defined and are not being modified can be found in the *Glossary of Terms Used in NERC Reliability Standards*. The new or revised terms listed below will be presented for approval with the proposed standard. Upon Board adoption, this section will be removed.

Term(s):

The BAL-003-3 Standard Drafting Team (SDT) proposes that the currently-approved Texas RE Regional definition of **Governor** to be made part of the NERC Glossary of Terms generally:

Governor – The electronic, digital, or mechanical device that implements Primary Frequency Response of generating units/generating facilities or other system elements.

The BAL-003-3 SDT proposes that the currently-approved Texas RE Regional definition of **Primary Frequency Response** to be made part of the NERC Glossary of Terms generally:

Primary Frequency Response – The immediate proportional increase or decrease in real power output provided by generating units/generating facilities and the natural real power dampening response provided by Load in response to system Frequency Deviations. This response is in the direction that stabilizes frequency.

These terms are also used in other standards, as indicated below. The BAL-003-3 SDT is obligated to review other standards in which these terms are used to determine if reliability gaps or redundancies are created by the proposed revision to the defined terms. The BAL-003-3 SDT has determined that the proposed definitions do not change the reliability intent of other requirements or definitions. The following is the standard using the terms Governor and Primary Frequency Response:

BAL-001-TRE – Primary Frequency Response in the ERCOT Region: The BAL-003 SDT determined that the proposed definition revision will not create any redundancies or gaps in reliability.

A. Introduction

1. **Title:** Frequency Response and Frequency Bias Setting
2. **Number:** BAL-003-3
3. **Purpose:** To ensure sufficient Frequency Response within the Interconnection to maintain Interconnection Frequency within predefined bounds by arresting frequency deviations and supporting frequency until the frequency is restored to its scheduled value. To provide consistent methods for measuring Frequency Response and determining the Frequency Bias Setting.
4. **Applicability:**
 - 4.1. **Functional Entities:**
 - 4.1.1. Responsible Entity
 - 4.1.1.1. Balancing Authority
 - 4.1.1.1.1. Balancing Authority is the responsible entity unless the Balancing Authority is a member of a Frequency Response Sharing Group, in which case the Frequency Response Sharing Group becomes the responsible entity.
 - 4.1.1.2. Frequency Response Sharing Group
 - 4.1.2. Generator Operator
5. **Effective Date:** See Implementation Plan for BAL-003-3.

B. Requirements and Measures

- R1.** Each Responsible Entity shall achieve an annual Frequency Response Compliance Measure (FRCM) (as calculated and reported in accordance with Attachment A) that is greater than or equal to one to ensure that sufficient Frequency Response is provided by each Responsible Entity to maintain Interconnection Frequency Response equal to or more negative than the Interconnection Frequency Response Obligation. *[Violation Risk Factor: High] [Time Horizon: Real-time Operations]*
- M1.** Each Responsible Entity shall have evidence such as dated data plus documented formula in either hardcopy or electronic format that it achieved an annual FRCM (in accordance with the methods and data specified by the ERO in Attachment A) that is greater than or equal to one to demonstrate compliance with Requirement R1.
- R2.** Each Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting shall implement the Frequency Bias Setting determined in accordance with Attachment A, as validated by the ERO, into its Reporting ACE

calculation during the implementation period specified by the ERO and shall use this Frequency Bias Setting until directed by the ERO to change. *[Violation Risk Factor: Medium] [Time Horizon: Operations Planning]*

- M2.** The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service shall have evidence such as a dated document in hard copy or electronic format showing the ERO validated Frequency Bias Setting was implemented into its Reporting ACE calculation within the implementation period specified or other evidence to demonstrate compliance with Requirement R2.
- R3.** Each Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service and is utilizing a variable Frequency Bias Setting shall maintain a Frequency Bias Setting that is: *[Violation Risk Factor: Medium][Time Horizon: Operations Planning]*
- 3.1.** Less than zero at all times, and
 - 3.2.** Equal to or more negative than its Frequency Response Obligation when Frequency varies from 60 Hz by more than +/- 0.036 Hz.
- M3.** The Balancing Authority that is a member of a multiple Balancing Authority Interconnection, is not receiving Overlap Regulation Service and is utilizing variable Frequency Bias shall have evidence such as a dated report in hard copy or electronic format showing the average clock-minute average Frequency Bias Setting was less than zero and during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was equal to or more negative than its Frequency Response Obligation to demonstrate compliance with Requirement R3.
- R4.** Each Balancing Authority that is performing Overlap Regulation Service shall modify its Frequency Bias Setting in its Reporting ACE calculation, in order to represent the Frequency Bias Setting for the combined Balancing Authority Area, to be equivalent to either: *[Violation Risk Factor: Medium][Time Horizon: Operations Planning]*
- The sum of the Frequency Bias Settings as validated by the ERO for the participating Balancing Authorities, or
 - The Frequency Bias Setting as validated by the ERO for the entirety of the participating Balancing Authorities' Areas.
- M4.** The Balancing Authority shall have evidence such as a dated operating log, database or list in hard copy or electronic format showing that when it performed Overlap Regulation Service, it modified its Frequency Bias Setting in its Reporting ACE calculation as specified in Requirement R4 to demonstrate compliance with Requirement R4.

- R5.** Each Generator Operator shall operate each generating unit/generating facility connected to an Interconnection with its Governor in speed or frequency control mode unless: *[Violation Risk Factor = Medium] [Time Horizon = Real-time Operations]*
- The generating unit/generating facility is not equipped with a Governor;
 - System operating conditions are incompatible with the generating unit/generating facility operating the Governor in speed or frequency control mode as determined by the Balancing Authority; or
 - The generating unit/generating facility is being operated in start-up, shut-down, experiences a component failure, or other temporary mode that requires the Governor speed or frequency control mode to be temporarily disabled.
- 5.1.** Other control modes, such as outer loop control, shall not override the Primary Frequency Response of the Governor.
- M5.** The Generator Operator shall have evidence to show that it operated each generating unit/generating facility connected to an Interconnection with its Governor in speed or frequency control mode as specified in Requirement R5, Part R5.1, unless it meets one of the bulleted exceptions. Examples of suitable evidence may include, but is not limited to, performance testing, records showing Primary Frequency Response of a unit to frequency disturbances, appropriate documentation and/or control system settings that show the Governor is enabled (droop, deadband, control mode enable/disable, etc., as applicable). Requirement R5 does not require a Generator to operate with headroom, as stated in FERC Order No. 842, P109.

C. Compliance

1. Compliance Monitoring Process

- 1.1. Compliance Enforcement Authority:** “Compliance Enforcement Authority” means NERC or the Regional Entity, or any entity as otherwise designated by an Applicable Governmental Authority, in their respective roles of monitoring and/or enforcing compliance with mandatory and enforceable Reliability Standards in their respective jurisdictions.
- 1.2. Evidence Retention:** The following evidence retention period(s) identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full-time period since the last audit.

The applicable entity shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

- The Balancing Authority shall retain data or evidence to show compliance with Requirements R1, R2, R3, and R4, Measures M1, M2, M3, and M4 for the current year plus the previous three calendar years unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.
 - The Frequency Response Sharing Group shall retain data or evidence to show compliance with Requirement R1 and Measure M1 for the current year plus the previous three calendar years unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.
 - The Generator Operator shall retain evidence of notifications made to the Balancing Authority for the current year and the previous five (5) calendar years for Requirement R5 and Measure M5.
 - If a Balancing Authority or Frequency Response Sharing Group is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the time period specified above, whichever is longer.
 - The Compliance Enforcement Authority shall keep the last audit records and all subsequent requested and submitted records.
- 1.3. Compliance Monitoring and Enforcement Program:** As defined in the NERC Rules of Procedure, “Compliance Monitoring and Enforcement Program” refers to the identification of the processes that will be used to evaluate data or

information for the purpose of assessing performance or outcomes with the associated Reliability Standard.

Violation Severity Levels

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
R1.	The Responsible Entity's, FRCM was less than 100% by at most 15%.	The Responsible Entity's, FRCM was less than 100% by more than 15% but by at most 30%.	The Responsible Entity's, FRCM was less than 100% by more than 30% but by at most 45%.	The Responsible Entity's, FRCM was less than 100% by more than 45%.
R2.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting failed to implement the validated Frequency Bias Setting value into its Reporting ACE calculation within the implementation period specified but did so within 5 calendar days from the implementation period specified by the ERO.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting implemented the validated Frequency Bias Setting value into its Reporting ACE calculation in more than 5 calendar days but less than or equal to 15 calendar days from the implementation period specified by the ERO.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting implemented the validated Frequency Bias Setting value into its Reporting ACE calculation in more than 15 calendar days but less than or equal to 25 calendar days from the implementation period specified by the ERO.	The Balancing Authority in a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a fixed Frequency Bias Setting did not implement the validated Frequency Bias Setting value into its Reporting ACE calculation in more than 25 calendar days from the implementation period specified by the ERO.
R3.	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and is not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency Bias	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency Bias	The Balancing Authority that is a member of a multiple Balancing Authority Interconnection and not receiving Overlap Regulation Service and uses a variable Frequency Bias Setting average Frequency

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
	Bias Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response Obligation by more than 1% but by at most 10%.	Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response Obligation by more than 10% but by at most 20%.	Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response Obligation by more than 20% but by at most 30%.	Bias Setting during periods when the clock-minute average frequency was outside of the range 59.964 Hz to 60.036 Hz was less negative than its Frequency Response obligation by more than 30%.
R4.	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its Reporting ACE calculation when providing Overlap Regulation Services with combined footprint setting- error less than or equal to 10% of the validated or calculated value.	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its Reporting ACE calculation when providing Overlap Regulation Services with combined footprint setting- error more than 10% but less than or equal to 20% of the validated or calculated value.	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its Reporting ACE calculation when providing Overlap Regulation Services with combined footprint setting- error more than 20% but less than or equal to 30% of the validated or calculated value.	The Balancing Authority incorrectly changed the Frequency Bias Setting value used in its Reporting ACE calculation when providing Overlap Regulation Services with combined footprint setting- error more than 30% of the validated or calculated value. OR The Balancing Authority failed to change the Frequency Bias Setting value used in its Reporting ACE calculation when providing Overlap Regulation Services.
R5.	N/A	N/A	N/A	The Generator Operator did not operate with the Governor

R #	Violation Severity Levels			
	Lower VSL	Moderate VSL	High VSL	Severe VSL
				in service and did not meet any of the exemption criteria. OR Generator is operating in a control mode that overrides the Governor response.

D. Regional Variances

None.

E. Associated Documents

[Implementation Plan](#)

Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard

Version History

Version	Date	Action	Change Tracking
0	April 1, 2005	Effective Date.	New
0	August 8, 2005	Removed "Proposed" from Effective Date.	Errata
0	March 16, 2007	FERC Approval — Order 693.	New
0a	December 19, 2007	Added Appendix 1 ☐ Interpretation of R3 approved by BOT on October 23, 2007.	Addition
0a	July 21, 2008	FERC Approval of Interpretation of R3.	Addition
0b	February 12, 2008	Added Appendix 2 ☐ Interpretation of R2, R2.2, R5, and R5.1 approved by BOT on February 12, 2008.	Addition
0.1b	January 16, 2008	Section F: added "1."; changed hyphen to "en dash." Changed font style for "Appendix 1" to Arial; updated version number to "0.1b"	Errata
0.1b	October 29, 2008	BOT approved errata changes.	Errata
0.1a	May 13, 2009	FERC Approved errata changes – version changed to 0.1a (Interpretation of R2, R2.2, R5, and R5.1 not yet approved).	Errata
0.1b	May 21, 2009	FERC Approved Interpretation of R2, R2.2, R5, and R5.1.	Addition
1	February 7, 2013	Adopted by NERC Board of Trustees.	Complete Revision under Project 2007-12
1	January 16, 2014	FERC Order issued approving BAL-003-1. (Order becomes effective for R2, R3, and R4 April 1, 2015. R1 becomes effective April 1, 2016.)	
1	May 7, 2014	NERC Board of Trustees adopted revisions to VRF and VSLs in Requirement R1.	
1	November 26, 2014	FERC issued a letter order approved VRF and VSL revisions to Requirement R1.	

BAL-003-3 – Frequency Response and Frequency Bias Setting

1.1	August 25, 2015	Added numbering to Introduction section, corrected parts numbering. For R3, and adjusted font within section M4.	Errata
1.1	November 13, 2015	FERC Letter Order approved errata to BAL-003-1.1. Docket RD15-6-000.	Errata
2	November 5, 2019	NERC Board of Trustees adopted BAL-003-2.	New
2	July 15, 2020	FERC Letter Order approved errata to BAL-003-2. Docket RD20-9-000.	
3	November 5, 2019	NERC Board of Trustees adopted BAL-003-2.	Complete Revision under Project 2017-01 Phase II
3	July 15, 2020	FERC Order issued approving BAL-003-2.	

Standard Attachments

Attachment A

BAL-003-3 Frequency Response and Frequency Bias Setting Standard

Supporting Document

Overview of IFRO, FRO, SEFRD, FRM, FRCM, and FBS Calculations

There are several calculations needed to implement the Frequency Response and Frequency Bias Setting Standard. The Interconnection Frequency Response Obligation (IFRO) and Frequency Response Obligation (FRO) calculations are performed by the ERO annually. The Single Event Frequency Response Data (SEFRD), Frequency Response Measure (FRM), Frequency Response Compliance Measure (FRCM), and Frequency Bias Setting (FBS) calculations are performed by the individual BAs and/or FRSGs. The FBS, Most Severe Single Contingencies (MSSCs), and annual load and resource data are submitted by the BAs and evaluated by the ERO. These values are determinants in ERO calculations of IFRO for each interconnection and determination of FRO and minimum FBS for each Balancing Authority.

These calculations are performed at differing points in the annual Operating Year (OY) cycle. The chronology of the determination and use of these calculations is as follows: determination of the IFRO, determination of the individual Balancing Authority FROs and minimum FBSs, publication of frequency events through the OY, determination of SEFRDs, determination of FRM and FRCM, and determination of FBS.

Interconnection Frequency Response Obligation

The ERO, in consultation with regional representatives, has established a target reliability criterion for each Interconnection called the IFRO. Illustrative values for OY 2023 are provided below. Certain values are assessed annually according to the methodology which is detailed in the *Procedure for ERO Support of Frequency Response and Frequency Bias Setting Standard*.

Interconnection	Eastern	Western	Texas	Quebec	Units
Max. Delta Frequency (MDF) ¹	0.420	0.280	0.405	0.947	
Resource Loss Protection Criteria (RLPC) ¹	3,740	3,069	2,805	2,000	MW
Credit for Load Resources (CLR) ¹			931		MW
Current IFRO (OY 2023)	-890	-1,096	- 463	-211	MW/0.1 Hz

Table 1: Interconnection Frequency Response Obligations (base year 2023)

$$\text{IFRO} = -(\text{RLPC} - \text{CLR})/\text{MDF}/10$$

1. *These values are evaluated annually for changes in each Interconnection.*

CLR: A load reduction program that meets all of the following requirements shall be utilized by an Interconnection to reduce the IFRO:

- 1.1.** *Is requisite to prevent activation of first stage of an Interconnection's under frequency load shedding (UFLS) program for any resource loss less than or equal to the Interconnection's Resource Loss Protection Criteria (RLPC);*
- 1.2.** *Is non-proportional and automatically activated;*
- 1.3.** *Activates within 1 (one) second of the trigger frequency being reached;*
- 1.4.** *Exclusively reserved for Frequency Response during normal operations and does not participate in UFLS, Undervoltage Load Shedding Program (UVLS Program), or any other Ancillary Service, such as Contingency Reserve, and is not used for any other operator-initiated normal operations; and*
- 1.5.** *Available at least 95% of the time and is reviewed as part of the ERO analysis that determines the IFRO.*

An annual reduction in absolute value of an Interconnection's IFRO due to a change to the RLPC, CLR, and/or the MDF will be limited to no greater than 10 percent of the existing Interconnection's IFRO or -100 MW/.10 Hz, whichever is less negative. Multiple year reductions may be necessary to meet the final target IFRO. If during the step-down process the Interconnection's FRM as calculated by the ERO declines by more than 10 percent, the ERO will delay subsequent reduction in IFRO until such time that a determination can be made as to the cause of the disproportionate performance.

Balancing Authority Frequency Response Obligation

For a multiple Balancing Authority interconnection, the IFRO shown in Table 1 is allocated based on the Balancing Authority annual load and annual generation as measured in MWh. The allocation of IFRO to determine the FRO for each BA is calculated using the following formula:

$$FRO_{BA} = IFRO \times \frac{\text{Annual Gen}_{BA} + \text{Annual Load}_{BA}}{\text{Annual Gen}_{Int} + \text{Annual Load}_{Int}}$$

Where:

- Annual Gen_{BA} is the total annual output of generating plants within the Balancing Authority Area (BAA).
- Annual Load_{BA} is total annual Load within the BAA.
- Annual Gen_{Int} is the sum of all Annual Gen_{BA} values reported in that Interconnection.
- Annual Load_{Int} is the sum of all Annual Load_{BA} values reported in that Interconnection.

Balancing Authorities that form, merge or transfer load or resource must notify the ERO of the change in footprint and corresponding changes in allocation prior to the change such that the net obligation to the Interconnection remains the same and so that FBS and FRO can be adjusted.

Annually, the ERO reviews the load and resource data submitted for all Balancing Authorities for each Interconnection in the format requested by the ERO. After such annual review, the ERO will post the following information for each Balancing Authority for the upcoming year:

- Minimum FBS
- FRO

Balancing Authorities that elect to form a FRSG will calculate a FRSG FRO by adding together the individual Balancing Authority FRO's.

Frequency Event Selections and Postings

The OY annual list of events for each interconnection are selected by the ERO using the Procedure for ERO Support of Frequency Response and FBS Standard. Events that trigger UFLS will not be selected as BAL-003 events. The ERO will publish the annual list for each interconnection in accordance with the timeline below. If the ERO posts the official list of events after the date specified in the timeline below, Balancing Authorities and FRSG(s) will be given 30 days from the date the ERO posts the official list of events to submit the required data.

ERO Posting and Data Submittal Form

The ERO shall alert responsible entities each year of the appropriate method for data submittal.

The ERO publication of the official list of events is included in the form to be used for annual data submittal. The submittal includes data needed for the determination of Interconnection RLPCs and IFROs, as well as calendar year Balancing Authority specific data needed for determination of the respective Balancing Authorities' FROs and minimum bias settings.

Interconnection RLPC and Minimum Bias Data Submittal Data Items:

- Largest potential resource loss within the Balancing Authority Area for the next Operating Year as detailed in the "Procedure for ERO Support of Frequency Response and Frequency Bias Settings Standard"
- Second largest potential resource loss within the Balancing Authority Area for the next Operating Year as detailed in the "Procedure for ERO Support of Frequency Response and Frequency Bias Settings Standard"
- The largest resource loss within the Balancing Authority Area that results from a RAS action initiated by a multiple contingency (N-2) event as detailed in the "Procedure for ERO Support of Frequency Response and Frequency Bias Settings Standard"
- CLR – this value will be used to adjust the Interconnection IFRO
- Balancing Authority Area resource (MWh) for the previous calendar year – this value will be used in the formula described above to determine the BA FRO
- Balancing Authority Area Net Energy for load (MWh) for the previous calendar year – this value will be used in the formula described above to determine the BA FRO
- Balancing Authority Area Integrated Hourly Peak load (MW) for the previous calendar year – this value will be used to determine the minimum (in absolute value) bias setting. The (absolute value) minimum is 0.9% of the annual BA peak load.

Desired FBS - may be set to a value between 100% to 125% of the Balancing Authority FRM if this value is more negative than the minimum Frequency Bias based on Peak Demand. If not more negative, then the Frequency Bias must be the minimum Bias based on Peak Demand.

For Balancing Authorities which supply or receive Overlap Regulation Service, the partnered Balancing Authority and the amount of overlap are to be provided.

The ERO submittal form also is used to collect data for each event as described in the following sections.

Single Event Frequency Response Data

The Balancing Authority will calculate its FRM and FRCM values from SEFRD, defined as: “the data from an individual event in a Balancing Authority area that is used to calculate its Frequency Response, expressed in MW/0.1Hz.”

The SEFRD needed for evaluation is, at a minimum, the following Balancing Authority’s Energy Management System (EMS) scan rate data items for the period one minute prior through five minutes after the ERO-supplied event time (t0):

- Actual frequency (F_A)
- Actual Net Interchange (NA_i) – for single BA interconnections, this value may be zero (0)
- Net resource or load loss – for single Balancing Authority interconnections, this value is needed for each event; for multiple Balancing Authority interconnections, this value is only to be reported by the Balancing Authority (or pro rata by multiple Balancing Authorities if a jointly owned unit) which sustained the resource loss. Lost load values are to be specified as a negative amount; lost resource values are to be specified as a positive amount.

Balancing Authorities may choose to apply certain adjustments to their calculations to account for factors such as nonconforming loads. For any such adjustments used, the SEFRD shall include the EMS scan rate data for the period one minute prior to through five minutes after the ERO-supplied event time (t0). The types of adjustments that are allowed are:

- non-conforming loads (load values specified as a negative amount),
- pumped hydro operation (load values specified as a negative amount, resource values specified as a positive amount),
- jointly owned unit dynamic schedules (import values specified as a negative amount, export values specified as a positive amount), and
- transferred frequency response (receipt values specified as a negative amount, delivered values specified as a positive amount).

For each of these adjustments, a given adjustment must be made for either all events or none of the events in an evaluation year.

All events provided by the ERO need to be included in the annual evaluation to determine the annual FRCM. A Balancing Authority may exclude an event only if, during any part of the event evaluation period:

- its tie-line data or its Frequency data was corrupt,
- its EMS was unavailable, or
- its Balancing Authority was completely islanded from the remainder of the Interconnection.

Determination of Balancing Authority Event Time (t_0) and Data Alignment

Because a particular BA’s EMS scan can occur anywhere within a two- to six-second window, the ERO specified event time (t_0) may not exactly align with a given BA’s EMS scan. For each event, the Balancing Authority must review its frequency scan data and determine the last frequency scan prior to the frequency deviation (decline for a resource loss, spike for a load loss). The Balancing Authority should set the time of that scan as the Balancing Authority’s event time (t_0) for that event. The time of the Balancing Authority’s event time (t_0) should be within one scan of the frequency deviation.

In addition to the determination of the Balancing Authority’s t_0 , a review of the other data items collected should be made to determine if a time shift is needed for any of these items relative to the times of the frequency scans. These shifts may be needed due to data transfer lags (e.g., dynamic signals transferred between Balancing Authorities via ICCC). If such a shift is needed, data item scans should be shifted to align to the times of the frequency scans.

Determination of the pre-event sample period (commonly known as the A space) and the post-event sample period (commonly known as the B space) shall be measured from the Balancing Authority determined event time (t_0).

Single Event Frequency Response Measure

Pre-event values (A value scans) for each data item used (actual frequency, net actual interchange, contingency loss, non-conforming loads, pumped hydro operation, jointly owned unit dynamic schedules, and/or transferred frequency response) will be the EMS data scans over the 16-second period before the Balancing Authority’s event time (t_0) up to but excluding the Balancing Authority’s event time (t_0).

The A value will be the average of the selected scans for that item. For low frequency events, the pre-event frequency value (frequency A value) will be calculated as the minimum of 60.000 Hz or average actual starting frequency. For high frequency events, the pre-event frequency value (frequency A value) will be calculated as the maximum of 60.000 Hz or average actual frequency.

Post-event (B value scans) for each data item used will be the EMS data scans over 20 to 52 seconds after the Balancing Authority’s event time (t_0). For each item used, the B value for that item will be the average of the selected scans for that item.

The number of scans for each average value in the computation of A and B values will be

dependent on the data scan rate of the Balancing Authority's EMS. Calculation of the A value should contain data from at least three distinct time points and the calculation of the B value should contain data from at least five distinct time points.

The pre-event MW value is the average of the A values (scan values) of all of the data items (except frequency) used. Each of the data items must use the sign convention as noted in the listings above. Similarly, the post-event MW value is the average of the B values (scan values) of all of the data items (except frequency) used, again using the appropriate sign convention for each item.

The total MW change is determined by subtracting the average post-event MW value from the average pre-event MW value. Similarly, the frequency change is determined by subtracting the average post-event frequency value (frequency B value) from the average pre-event frequency value (frequency A value).

The Single Event Frequency Response Measure (event FRM) is determined by dividing the total MW change by the total frequency change.

If a Balancing Authority uses the transferred frequency response adjustment, an additional calculation will be needed. BAs will need to calculate the event FRMs without incorporating transferred frequency response adjustments. This "FRM w/o Trfr" value is needed to calculate the Balancing Authority's Bias Setting, but it is not used to calculate the Balancing Authority's event FRCMs. The event FRMs including transferred frequency response are the values used to calculate event FRCMs.

Single Event Frequency Response Compliance Measure

The FRCM for each event is the ratio of FRM to FRO (FRM divided by FRO).

For FRSGs, the FRSG FRM for each event is calculated by dividing the sum the active Balancing Authorities' FRMs by the sum of the active Balancing Authorities' FROs. If a Balancing Authority is an FRSG participant and meets the requirements for excluding an event, e.g. loss of telemetry during event, the FRSG shall exclude the Balancing Authority's FRO and FRM from the FRSG's calculation of FRCM for the excluded event. For any event in which more than 50% of the Balancing Authority participants' data is excluded, the FRSG shall exclude that event for the FRSG.

Annual (OY) Frequency Response Measure and Frequency Response Compliance Measure

The Balancing Authority's FRM for the OY is determined by taking the median of the individual event FRM values.

The Balancing Authority's FRCM for the OY is determined by taking the median of the individual event FRCM values. An FRSG or a Balancing Authority providing Overlap Regulation Service will provide individual event FRCMs for the aggregate of its active participants.

Balancing Authority Fixed Frequency Bias Setting

A Balancing Authority in an Interconnection with multiple Balancing Authorities using a fixed FBS sets its FBS to the more negative value than:

- Any number the Balancing Authority chooses between 100 percent and 125 percent of its Frequency Response Measure
- Balancing Authority Minimum Frequency Bias Setting as determined by the ERO

Balancing Authority Variable Frequency Bias Setting

A Balancing Authority in an Interconnection with multiple Balancing Authorities using a variable FBS sets its FBS such that it is:

- Less than zero at all times, and
- Equal to or more negative than its Frequency Response Obligation when Frequency varies from 60 Hz by more than +/- 0.036 Hz

Balancing Authority and Frequency Response Group Reporting

Each Balancing Authority reports its previous year’s FRM (both with and without transferred frequency response adjustment), FRCM Frequency Bias Setting and Frequency Bias type (fixed or variable) to the ERO each year to allow the ERO to validate the revised FBS. In addition, each Balancing Authority will report its two largest potential resource losses and any applicable N-2 RAS events in the format specified by the ERO.

Once the data listed above is fully posted, the ERO will announce the implementation period for changing the FBS.

Timeline for Balancing Authority Frequency Response and Frequency Bias Setting Activities

Described below is the timeline for the exchange of information between the ERO and Balancing Authorities to:

- Facilitate the assignment of Balancing Authority FRO
- Calculate Balancing Authority FRCM
- Determine Balancing Authority FBS

BAL-003-3 – Frequency Response and Frequency Bias Setting

Target Business Date	Activity
March 1	Events for evaluation of FRM and FRCM are posted by the ERO* with all selected events for the operating year for BA usage.
April 1	BAs and FRSGs complete their frequency response calculations for all four quarters, including the BAs' FBS calculations, returning the results to the ERO in a format specified by the ERO.
May 1	The ERO validates FBS values, computes the sum of all FBS values for each Interconnection and determines the implementation schedule for changes to BAs FBS.
May 15	Balancing Authorities and FRSGs provide data needed by NERC to calculate the IFRO and the IFRO allocation to each BA in the format specified by the ERO.**
June 1	Balancing Authorities implement changes to their FBS.
November 1	The ERO assigns FRO values and Minimum FBS for the upcoming year to the BAs.

* If the 4th quarter posting of events for evaluation of FRM and FRCM is delayed, the ERO may adjust the other timelines in this table.

** Data specification will be maintained on the ERO website; for example, Procedure for ERO Support of Frequency Response and FBS Standard or its successor.