

Introduction

1. **Title:** **Digital Circuits Synchronization**
2. **Number:** COM-001-WECC-CRT-4
3. **Purpose:** To minimize digital circuit timing problems between WECC entities owning or operating digital Time Division Multiplex (TDM) telecommunication networks. Timing circuit problems will be minimized by establishing synchronization requirements for the WECC telecommunication networks.
4. **Applicability:**
 - 4.1. **Functional Entities:**
 - 4.1.1. Transmission Operator that owns or operates TDM telecommunication systems.
 - 4.1.2. Transmission Owner that owns or operates TDM telecommunication systems.
5. **Document Specific Definition**
 - 5.1. **Primary Reference Source**
 - 5.1.1. Primary Reference Source equipment provides a timing signal whose long-term accuracy is maintained at 1×10^{-11} or better with verification to universal time coordinated (UTC). A PRS signal is used as the basis of reference for control of other clocks within a telecommunications network.
6. **Effective Date:** March 7, 2023

Requirements and Measures

- WR1.** Each Transmission Owner and each Transmission Operator shall employ at least one global positioning system (GPS) referenced clock or one autonomous referenced (e.g., cesium beam) primary reference source (PRS) clock, having a long-term accuracy of $+1 \times 10^{-11}$ with a slip rate of 1 slip per 72 days (stratum 1).
- WM1.** Each Transmission Owner and each Transmission Operator will have evidence showing the existence and use of at least one PRS within a telecommunication network as required in WR1.
- WR2.** Each Transmission Owner and each Transmission Operator's telecommunications network shall have built-in timing redundancies such that loss of a PRS reference signal does not result in loss of stratum 1 timing traceability to network elements.
- WM2.** Each Transmission Owner and each Transmission Operator will have evidence that its telecommunication networks have built-in timing redundancies such that loss of a reference signal does not result in a loss in stratum 1 timing traceability to network elements as required in WR2.
- Acceptable evidence of timing redundancies may include, but is not limited to:
- Diagrams or drawings showing how timing signals propagate within the network(s);
 - Screenshots of network management monitoring systems showing network timing signal propagation or routes;
 - Diagrams, drawings, or screenshots of individual equipment configuration indicating capability to use multiple timing signals traceable to stratum 1.
- WR3.** Each Transmission Owner and Transmission Operator's telecommunications network shall have each of the following capabilities in responding to system or clock failures:
- 3.1.** Telecommunication equipment set to automatically reconfigure timing reference sources such that traceability to stratum 1 PRS is maintained.
 - 3.2.** PRS clock failures, including loss of a GPS signal source, alarmed, and monitored.
 - 3.3.** Synchronous optical networking (SONET) elements that indicate loss of stratum 1 traceability due to PRS failures.
- WM3.** Each Transmission Owner and each Transmission Operator will have evidence that its telecommunication networks have each of the capabilities listed in WR3, as required in WR3.

WR4. Each Transmission Owner and each Transmission Operator shall employ synchronization planning to reflect each of the following:

- 4.1.** Timing for each node in a telecom network is traceable to a PRS clock per WR1.
- 4.2.** Clocks with less than stratum 1 accuracy shall not be used except in emergency situations.
- 4.3.** The plan is reviewed and updated every 12 months.

WM4. Each Transmission Owner and each Transmission Operator will have evidence that it employed synchronous planning including each of the elements described in WR4.

Version History

Version	Date	Action	Change Tracking
1	March 3, 2011	Operating Committee Approval	Developed as WECC-0066. Initial Version
1	June 22, 2011	WECC Board of Directors Approved	Final
1	September 5, 2012	WECC Board of Directors changed designation from “CRT” to “RBP.”	Designation change
1	June 25, 2014	WECC Board of Directors changed designation from “RBP” to “CRT.”	Designation change
1	April 1, 2016	No change	Converted to new template
2	December 6, 2016	WECC Standards Committee approved the review and deemed the project complete.	<p>WECC-0112, Version 2 was developed to meet the mandatory five-year review of this WECC Criterion.</p> <p>WECC-0122 confirmed no substantive changes were required.</p> <p>Non-substantive changes were made to the Measures. Lower case was used where a defined term was not warranted.</p>
2.1	June 18, 2019	Errata	<p>Converted to newest template.</p> <p>In Version 2.1: 1) syntax was corrected, 2) “AKA” was deleted (WR3.3.3), 3) “but are not limited to” was corrected to “but is not limited to” (WM2) and, 4) Version History syntax was corrected.</p>
3	June 15, 2021	WECC Standards Committee	Developed as WECC-0143. This document was reviewed as part of a five-year review. No substantive changes were made. The following non-substantive changes were made: 1) “...as required in WR4” was removed from WM4, and 2) the date for Attachment A, WECC TELWG Guideline, Digital Circuits Synchronization was updated from March 2010 to June 2019.
4	March 7, 2023	WECC Standards Committee	<p>On March 7, 2023, the WECC Glossary of Terms Used in WECC Criteria (Glossary) was retired, and all document specific definitions were moved into their associated WECC Criteria. PRS is incorporated at Section 5., Document Specific Definition.</p> <p>TELWG was spelled out in the</p>



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			Attachment/Reference section. Non-Substantive template narrative was removed from the Rationale section.
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Attachments

Attachment A—References

WECC Telecommunications Work Group (TELWG), *Digital Circuits Synchronization*, June 2019.

Rationale

Rationale Boxes were not developed for this project.