

Test Suite Specification

Test Suite Specification

Purpose /
Scope

PMU
Features

Test
Equipment

Test Signals

Test Result
Calculations

Test Plans
(procedures)

Test
Result
Calculation

Test
Reporting

Test System
Calibration

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Purpose

Procedures and requirements for test labs participating in IEEE ICAP PMU certification program

In accordance with Smart Grid Interoperability Panel (SGIP) Interoperability Process Reference Manual (IPRM)

Unambiguous test plans

More specific than requirements of PMU performance standard

Scope

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IEEE Std. C37.118.1 - 2011

As amended by PC37.118.1a

Revised as the standard is revised

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Required features

Optional Features

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Required features

Reporting Rates:

50 : 10,25,50

60 : 10,12,15,20,30,60

Performance Class

P or M

Time Sync Sources

GPS or IRIG B or IEEE 1588

Optional Features

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Required features

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50 : 10,25,50

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Performance Class

P or M

Time Sync Sources

GPS or IRIG B or IEEE 1588

Optional Features

Optional reporting rates

Multiple data transmission protocols

Multiple timing sources

Ability to switch or holdover timing

Multifunction devices

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Required capabilities

Components

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Required capabilities

Provide timing reference to PMU

Provide voltage and current input signals to PMU

Receive measurements from PMU

Compare measurements to “true” reference

Calculate TVE, FE, RFE and step test results

Able to determine reporting latency

Provide results documentation and raw data

Components

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Receive measurements from PMU

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Able to determine reporting latency

Provide results documentation and raw data

Components

Signal Sources

Receiver for PMU measurements

Determine the “true reference value

Environmental Conditions

Test Uncertainty Ratio (TUR)

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Nominal Voltage

Nominal Current

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Nominal Voltage

Specified as 70 VRMS or 120 VRMS
As determined by PMU settings

Nominal Current

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Nominal Voltage

Specified as 70 VRMS or 120 VRMS
As determined by PMU settings

Nominal Current

Specified as 5 ARMS or 1 ARMS
As determined by PMU settings

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Steady State Tests

Dynamic Tests

Reporting Latency Test

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Steady State Tests

Frequency range tests
(0.1 Hz increments across the reporting rate bandwidth)

Harmonic distortion tests
(50 Harmonics, individually)

Out of band interfering signals tests
(interharmonics added to nominal and off-nominal frequency fundamentals)

Signal magnitude tests

Dynamic Tests

Reporting Latency Test

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Signal magnitude tests

Dynamic Tests

Measurement bandwidth (modulation) tests
Phase and magnitude modulation

Ramp of system frequency tests
(1 Hz/second positive and negative sweeps)

Step tests
(Positive and negative phase and magnitude steps)

Reporting Latency Test

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Signal magnitude tests

Dynamic Tests

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Phase and magnitude modulation

Ramp of system frequency tests
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Step tests
(Positive and negative phase and magnitude steps)

Reporting Latency Test

Difference between the reported time stamp and the
time the report leaves the PMU

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PMU under test settings

Test results demonstrating
performance

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PMU under test settings

PMU class

PMU reporting rate

Nominal magnitudes

Tracking and filter settings if applicable

Environmental conditions during testing

Test results demonstrating
performance

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Maximum TVE for each test run

Maximum frequency error for each test run

Maximum ROCOF error for each test run

Step test response times

Step test delay times

Step test maximum overshoot/undershoot

Reporting latency in seconds

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Calibration Requirements

Performance Limits

Calibration Methodology

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Calibration Requirements

Analog signal source magnitude and absolute phase shall be traceable to first principles as represented by national standards

“True” (reference) value uncertainty shall be documented and verified

Result calculations shall be verified to be compliant with IEEE Std. C37.118.1-2011

Performance Limits

Calibration Methodology

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Performance Limits

Test Uncertainty Ratio

Test Signal Total Harmonic Distortion

Calibration Methodology

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Performance Limits

Test Uncertainty Ratio

Test Signal Total Harmonic Distortion

Calibration Methodology

Direct Measurement

Transfer Calibration (not appropriate)

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Questions?