

Procedure

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# Inverter OEM Validation Test

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## Document Approval

	Position Title	Name	Date
Reviewer	Future Network Team Leader	Tan Bui	27/03/2024
Approver	Future Network and Planning Manager	Theodora Karastergiou	27/03/2024

## Document History

Revision	Author	Description of Changes
V1.0	Kevin Combe and Julien Fournier	First release
V1.1	Tan Bui	Added three validation activities within this procedure
V1.2	Tan Bui	Added testers and approver in Appendix A
V1.3	Tan Bui	Added two control commands overlapping test in Appendix A
V1.4	Tan Bui, Julien Fournier, Kevin Combe	Added additional active control test at system node and independent node

## Owning Functional Group & Department / Team

Assets and Operations Electricity – Future Network and Planning Team

## Review Details

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## 1. Purpose

The purposes of this document are:

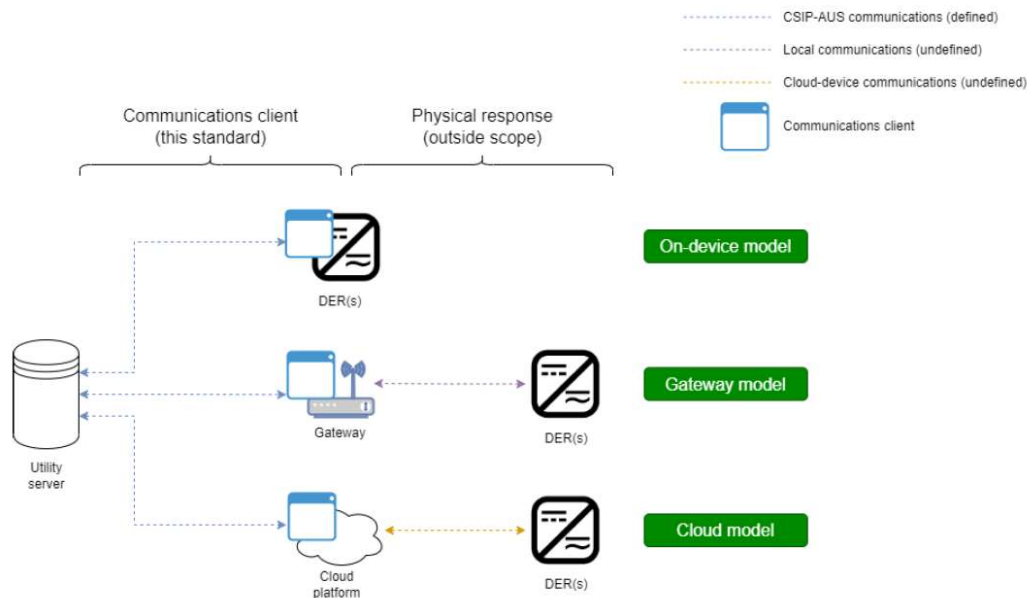
- to ensure there is a consistent procedure for the inverter Original Equipment Manufacturer (OEM) to test their CSIP-AUS communication software clients; and
- to validate successful interoperability between Jemena Utility Server and inverter OEM CSIP-AUS communication software clients for inverters listed under CEC website: [Inverters-with-SCC-240223.pdf \(cleanenergycouncil.org.au\)](https://www.cleanenergycouncil.org.au/inverters-with-SCC-240223.pdf).

This document serves as a supplementary document alongside IEEE 2030.5:2018, SA HB-218:2023, CSIP and CSIP-AUS communications client test procedures v1.0 to assist with interfacing with the Utility Server.

This document will be reviewed regularly and amended as required to reflect changes in standards, the application of new technologies, changes to procedures and field experience, among other things.

## 2. Scope

The scope of this document is limited to the testing of CEC listed inverters with communication software clients that are compliant to IEEE 2030.5 CSIP-Aus, either hosted locally on the inverter or a gateway device or via a certified cloud connection to Jemena's Utility Server.



## 3. Responsibilities

Role	Responsibility
Jemena	<ul style="list-style-type: none"> <li>• Provides test Utility Server for OEM</li> <li>• Provides testing requirements and criteria (this document)</li> <li>• Witness and record test outcomes</li> <li>• Administer communication software clients and inverters that passes or fails the test</li> <li>• Technical support and resolve dispute</li> </ul>
OEM	<ul style="list-style-type: none"> <li>• Sets up any bench testing and equipment required at the OEM's laboratory to perform the validation test as documented in this document</li> <li>• Ensure connectivity with Utility Server established prior to execution of the tests with Jemena</li> <li>• Conduct test with Jemena's representative to witness and record test outcomes</li> <li>• Document outcomes of test for Jemena to sign off</li> </ul>

## 4. Process

The following steps are used for the testing.

Step 1: OEM to set up test lab as required, refer to Section 2.2 within the CSIP and CSIP-AUS communications client test procedures v1.0 document ([CSIP-AUS-Comms-Client-Test-Procedures-v1.0-final.pdf \(bsgip.com\)](#)).

Step 2: Jemena's Utility Server connection details for testing purposes

- CoE's URL: <https://utilityserver-coe.itron.com:8443/sep2/dcap>
- CA/ Device Certificate/ Device Key/ LFDI/NMI/ PIN are: TBA

Step 3: Conduct the following tests with Jemena representative to witness and record outcomes of each test

Test	Test Description	CSIP-AUS Mapping
Discovery – Monitoring Capability	This test is intended to validate the client's ability to perform discovery against the Utility Server and to establish basic IEEE 2030.5- based communications. It includes monitoring, connection status, operational mode and device capability	The following telemetry readings through the Metering Mirror function set:  Site Real Power (kW) Site Reactive Power (kVAr) Site Voltage (V) Gross Inverter Real Power (kW) Gross Inverter Reactive Power (kVAr) Inverter Voltage (V)  The Status Information will capture attributes under: DERCapability DERSettings DERStatus DERAvailability
Export Limit	This test is intended to validate default export limit and active control export limit functions. <ul style="list-style-type: none"> <li>• Set the default OpModExpLimW = 0.5kW Confirm site active power and generation are correct</li> <li>• Set an active OpModExpLimW = 0kW Confirm site active power limit reduces to 0kW</li> <li>• Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW</li> <li>• Set an active OpModExpLimW = 5kW Confirm site active power limit increases to 5kW</li> <li>• Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW</li> </ul> <p>Note: Depending on pollRate and postRate, the scheduled control time shall be set to at least 4 times to demonstrate each test. E.g. if the pollRate and postRate is set to 1 minute, then the scheduled control time shall be set to a duration of 4 minutes.</p>	DefaultDERControl: OpModExpLimW DERControl: OpModExpLimW
Generation Limit	This test is intended to validate active control generation limit function. <ul style="list-style-type: none"> <li>• Set the default OpModExpLimW = 0.5kW Confirm site active power and generation are correct</li> </ul>	DERControl: OpModGenLimW

Test	Test Description	CSIP-AUS Mapping
	<ul style="list-style-type: none"> <li>Set an active OpModGenLimW = 0kW Confirm inverter active power limit reduces to 0kW</li> <li>Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW</li> <li>Set an active OpModGenLimW = 5kW Confirm inverter active power limit increases to 5kW</li> <li>Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW</li> </ul> <p>Note: Depending on pollRate and postRate, the scheduled control time shall be set to at least 4 times to demonstrate each test. E.g. if the pollRate and postRate is set to 1 minute, then the scheduled control time shall be set to a duration of 4 minutes.</p>	
Energize	<p>Confirm connection status of device Send OpModEnergize = True Confirm connection status Send OpModEnergize = False Confirm connection status</p> <p>At this point in time both cease to energize and disconnection are acceptable to pass this test.</p>	DERControl: opModEnergize
Subscription/ Notification	For aggregator-based systems, repeat above tests.	

#### 4.1 Criteria used to determine pass or fails

The following criteria shall be used to determine pass or fail.

Test	Expected Result	Failure Criteria	Implementation notes
Discovery – Monitoring Capability	<p>Client communications with the Utility Server are initialised as appropriate by the client.</p> <p>Utility Server captures EndDevice information.</p> <p>Utility Server captures monitoring as per CSIP-Aus mapping through the Metering Mirror Function.</p> <p>Utility Server captures Status Information:</p> <ul style="list-style-type: none"> <li>Ratings (DERCapability)</li> <li>Settings (DERSettings)</li> <li>Operational Status (DERStatus)</li> </ul>	<p>Client does not perform discovery against the Utility Server.</p> <p>Client does not access the necessary function set or device capability.</p> <p>Client becomes unsynchronised with the Utility Server.</p>	<p>Required monitoring data shall be 5-minute average and the inverter must be capable of ending this every 5-minutes.</p> <p>Arbitrary monitoring PostRates shall be supported to a minimum interval of 60s in alignment with the CSIPAUS. This functionality may be utilised by the Utility Server during testing and the capability test.</p> <p>Where a client manages multiple DER under a single device, for the Meter Mirror Function the posted values shall be an aggregation of the DER under a device.</p> <p>Where a client manages multiple DER under a single device, for DERCapability, the posted values shall be a summation of the total controllable capacities of the DER under a device.</p> <p>Where a client manages multiple DER under a single device, for DERSettings, the posted values shall be a summation of the total</p>

Test	Expected Result	Failure Criteria	Implementation notes
	<ul style="list-style-type: none"> <li>- Availability (DERAvailability)</li> <li>- Alarms (DERStatus)</li> </ul> <p>The Client is time synced with the Utility Server.</p>		controllable capacities of the DER under a device.
Export Limit	<p>The utility server configures an active DERControl: OpModExpLimW.</p> <p>On the next poll of the Utility Server, the client receives and starts the updated active DERControl: OpModExpLimW.</p> <p>Following the completion of the active DERControl, the device reverts back to the DefaultDERControl: OpModExpLimW.</p>	<p>The device does not change export power to the scheduled active DERControl.</p> <p>The device does not revert to the DefaultDERControl once the schedules active DERControl is complete.</p>	Where a client manages multiple DER under a single device, the export limit control is the total site export, and the client shall portion this across the DER downstream of the controllable device to comply with the control.
Generation Limit	<p>The utility server configures an active DERControl: OpModGenLimW.</p> <p>On the next poll of the Utility Server, the client receives and starts the updated active DERControl: OpModGenLimW.</p> <p>Following the completion of the active DERControl, the device reverts back to the DefaultDERControl: OpModExpLimW.</p>	<p>The device does not change the generator power to the scheduled active DERControl.</p> <p>The device does not revert to the DefaultDERControl once the schedules active DERControl is complete.</p>	Where a client manages multiple DER under a single device, the generation limit control is the aggregated generation, and the client shall portion this across the DER downstream of the controllable device.
Energize	<p>The utility sever configures an active DERControl: opModEnergize.</p> <p>On the next poll of the Utility Server, the client receives and starts the updated active DERControl: opModEnergize and updates DERStatus to confirm the status of the device.</p> <p>Following the completion of the active DERControl the</p>	<p>The device does not de-energise and re-energise the device.</p> <p>The device status is not updated.</p> <p>At this point in time both cease to energize and disconnection are acceptable to pass this test.</p>	Where a client manages multiple DER under a single device, all managed DER are expected to energise / re-energise when instructed.

Test	Expected Result	Failure Criteria	Implementation notes
	device updates the DERStatus to confirm the status of the device.		
Subscription/ Notification	The Utility Server configures an active control (all tests above) that is 5 minutes in the future and notifies the client of this control.  The client receives and commences the active control.	The device does not commence the active control.	

## 4.2 Multiple inverter support

This subsection outlines tests for communications software clients that intend to manage multiple downstream inverters.

A subset of the test procedure must be repeated with a multiple inverter test setup to validate a communication software client's capability to support multiple downstream devices.

Compliance to these tests will be validated with a Jemena representative to witness and record outcomes of each test.

Communication clients that intend to support management of multiple DER simultaneously shall be tested controlling at least two DER.

The following tests must be repeated with multiple inverters present to achieve certification for multiple inverter support:

- Discovery
- Export Limit (DefaultDERControl & DERControl)
- Generation Limit (DERControl)

## 4.3 Validation Activities

The following activities are required to be completed within this Validation Test prior to Jemena signing off successful completion of this verification. Each test step shall be recorded and filed using the form in Appendix A.

Test Activity	Description	Responsible teams	CSIP-AUS Test
Test Environment Connectivity/Discovery	Connectivity testing is to ensure there is a connectivity established between OEM's inverter within its test laboratory and Jemena's Utility Server in the test environment	Jemena Business SMEs Itron/ Kitu Business SMEs	Discovery – connectivity and monitoring capability
Test Environment Functional Testing	Functional testing is to perform various CSIP-AUS functional tests as documented in Step 3 above and Appendix A.	Jemena Business SMEs Jemena Testers Itron/ Kitu Business SMEs	Discovery – Monitoring Capacity Export Limit Generation Limit Energize
Production Environment Verification (Connectivity/Discovery test)	Production verification testing is non-destructive testing in the production environment and will validate the deployment correctness and recommend operational readiness. .	Jemena Business SMEs Itron/ Kitu Business SMEs	Discovery – connectivity and monitoring capability



## 5. Definitions

The terms used within this manual are defined as follows:

Term	Definition
CSIP-AUS	The Common Smart Inverter Profile for Australia, an implementation guide for IEEE 2030.5 applicable to Australia. The CSIP-AUS can be downloaded from the <a href="#">ARENA DEIP interoperability steering committee website</a> .

## 6. Related / Reference Documents

### 6.1 Internal References

Document No.	Document Title

### 6.2 External References / Standards

1. Government of South Australia, Technical Regulator Guideline. Link: [2022D066388-Technical-Regulator-Guidelines-Distributed-Energy-Resources-Version-1.5-1.pdf \(energymining.sa.gov.au\)](#)
2. DEIP Interoperability Steering Committee Common Smart Inverter Profile – Australia - Test Procedures v1.0. Link: [https://bsgip.com/wp-content/uploads/2023/09/CSIP-AUS-Comms-Client-Test-Procedures-v1.0-final.pdf](#)
3. [IEEE 2030.5:2018](#)
4. [SA HB-218:2023](#)

**Appendix A – Jemena’s record of Validation Test outcomes**

Date/ Time: \_\_\_\_\_  
 Test Activity: \_\_\_\_\_  
 Inverter OEM: \_\_\_\_\_  
 Inverter Communication Software Client version: \_\_\_\_\_  
 How many inverters are included in the test? \_\_\_\_\_  
 Inverter PollRate: \_\_\_\_\_  
 Inverter PostRate: \_\_\_\_\_  
 Overall assessment: Pass or Fail  
 Overall comment: \_\_\_\_\_  
 \_\_\_\_\_

Jemena Tester            Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Itron Tester             Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 OEM Tester              Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Jemena’s Approver      Name: \_\_\_\_\_ Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Details of individual CSIP-AUS test shall be recorded below.

- 1) This test looks to confirm various functions of the Client capability. The following test shall be conducted at the **Top-Level Topology Node**.

Test	CSIP-AUS Test Record	Comments
Discovery – Monitoring Capability	The following telemetry readings through the Metering Mirror function set:  Site Real Power (kW) _____  Site Reactive Power (kVAr) _____  Site Voltage (V) _____  Gross Inverter Real Power (kW) _____  Gross Inverter Reactive Power (kVAr) _____  Inverter Voltage (V) _____  The Status Information will capture attributes under: DERCapability _____  DERSettings _____ _____	

Test	CSIP-AUS Test Record	Comments
	<p>DERStatus _____</p> <p>DERAvailability _____</p>	
Export Limit	<p>This test is intended to validate default export limit and active control export limit functions. PollRate applied: _____ PostRate applied: _____ Scheduled control duration: _____</p> <ul style="list-style-type: none"> <li>Set the default OpModExpLimW = 0.5kW Confirm site active power and generation are correct _____ _____</li> <li>Set an active OpModExpLimW = 0kW Confirm site active power limit reduces to 0kW _____ _____</li> </ul> <p>Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW _____ _____</p> <ul style="list-style-type: none"> <li>Set an active OpModExpLimW = 5kW Confirm site active power limit increases to 5kW _____ _____</li> </ul> <p>Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW _____ _____</p> <p>Note: Depending on pollRate and postRate, the scheduled control time shall be set to at least 4 times to demonstrate each test. E.g. if the pollRate and postRate is set to 1 minute, then the scheduled control time shall be set to a duration of 4 minutes.</p> <p><b>Overlap of two control commands test</b> This test is intended to understand whether the first control command will be cancelled when the second control command initiates.</p> <ul style="list-style-type: none"> <li>Set the default OpModExpLimW = 0.5kW</li> <li>Set 1<sup>st</sup> active OpModExpLimW = 0.25kW for Tstart=0 and Tend = 20 minutes</li> <li>Set 2<sup>nd</sup> active OpModExpLimW = 1.0kW for Tstart=14 and Tend = 27 minutes (event needs to be created once 1<sup>st</sup> active control has started)</li> <li>Confirm at end of scheduled control that site export limit returns to 0.5 kW.</li> <li>Record observation below:</li> </ul>	<p>DefaultDERControl: OpModExpLimW DERControl: OpModExpLimW</p>

Test	CSIP-AUS Test Record	Comments
	<p>_____</p> <p>_____</p>	
<p>Generation Limit</p>	<p>PollRate applied: _____</p> <p>PostRate applied: _____</p> <p>Scheduled control duration: _____</p> <p>This test is intended to validate active control generation limit function.</p> <ul style="list-style-type: none"> <li>Set the default OpModExpLimW = 0.5kW Confirm site active power and generation are correct _____ _____</li> <li>Set an active OpModGenLimW = 0kW Confirm inverter active power limit reduces to 0kW _____ _____</li> </ul> <p>Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW _____ _____</p> <ul style="list-style-type: none"> <li>Set an active OpModGenLimW = 5kW Confirm inverter active power limit increases to 5kW _____ _____</li> </ul> <p>Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW _____ _____</p> <p>Note: Depending on pollRate and postRate, the scheduled control time shall be set to at least 4 times to demonstrate each test. E.g. if the pollRate and postRate is set to 1 minute, then the scheduled control time shall be set to a duration of 4 minutes.</p> <p><b>Overlap of two control commands test</b> This test is intended to understand whether the first control command will be cancelled when the second control command initiates.</p> <ul style="list-style-type: none"> <li>Set the default OpModExpLimW = 0.5kW</li> <li>Set 1<sup>st</sup> active OpModGenLimW = 0.25kW for Tstart=0 and Tend = 20 minutes</li> <li>Set 2<sup>nd</sup> active OpModGenLimW = 1.0kW for Tstart=14 and Tend = 27 minutes (event needs to be created once 1<sup>st</sup> active control has started)</li> <li>Confirm at end of scheduled control that site export limit returns to 0.5 kW</li> <li>Record observation below: _____</li> </ul>	<p>DERControl: OpModGenLimW</p>

Test	CSIP-AUS Test Record	Comments
Energize	<p>Confirm connection status of device Send OpModEnergize = True Confirm connection status</p> <p>_____</p> <p>_____</p> <p>Send OpModEnergize = False Confirm connection status</p> <p>_____</p> <p>_____</p> <p>At this point in time both cease to energize and disconnection are acceptable to pass this test.</p> <p><b>Overlap of two control commands test</b> This test is intended to understand whether the first control command will be cancelled when the second control command initiates.</p> <ul style="list-style-type: none"> <li>• Set 1<sup>st</sup> active OpModEnergize = False for Tstart=0 and Tend = 15 minutes</li> <li>• Set 2<sup>nd</sup> active OpModEnergize = True for Tstart=9 and Tend = 20 minutes (event needs to be created once 1<sup>st</sup> active control has started)</li> <li>• Record observation below:</li> </ul> <p>_____</p> <p>_____</p>	DERControl: opModEnergize

2) This test looks to represent the use case of Ongoing Site Export Control via an Independent Node. Repeat with one Active Export Limit test, with the control set at the **Independent Node** as follows:

- Assign the device to an Independent Node “**Testing Node**” with Primacy set to 127 (i.e., the same as the Top-Level Topology Node)
- Set control time to 2 times the pollRate or postRate (whichever is the longest time)
- Set an active OpModExpLimW = 5kW on Independent Node

Confirm site active power limit increases to 5kW

\_\_\_\_\_

\_\_\_\_\_

Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW

\_\_\_\_\_

\_\_\_\_\_

3) This test looks to represent the use case of Ongoing Generation Limit Control via an Independent Node. Repeat with one Active Generation Limit test, with the control set at the **Independent Node** as follows:

- Assign the device to an Independent Node "**Testing Node**" with Primacy set to 127 (i.e., the same as the Top-Level Topology Node)
- Set control time to 2 times the pollRate or postRate (whichever is the longest time)
- Set an active OpModGenLimW = 0kW on Independent Node  
Confirm inverter active power limit reduces to 0kW

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Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW

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4) This test looks to represent the use case of Ongoing Site Export Control via an Independent Node and Overriding by the MSL event at the Top-Level Topology Node.

- Set the default OpModExpLimW on **Top-Level Topology Node** = 0.5kW  
Set the default OpModGenLimW on **NMI Topology Node** = Max Rating of Device  
Confirm site active power and generation are correct

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- Assign the device to an Independent Node "**Testing Node**" with Primacy set to 127 (i.e., the same as the Top-Level Topology Node).
- Set an **Independent Node** active OpModExpLimW = 5 kW on "**Testing Node**" for 20 Minutes or (4x poll rate)  
Confirm site active power limit increases to 5 kW

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- After 5 minutes or (1x poll rate)  
Set an active OpModGenLimW on **Top-Level Topology Node** = 0 kW for 10 minutes or (2x poll rate)  
Confirm inverter active power limit decreases to 0 kW  
Record whether **Independent Node** active OpModExpLimW control has been aborted?

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Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW

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5) This test looks to represent the use case of Ongoing Site Export Control via an Independent Node (with Primacy set to 127) and Overriding by a Lower Primacy at the NMI Topology Node.

- Set the default OpModExpLimW on **Top-Level Topology Node** = 0.5kW  
Set the default OpModGenLimW on **NMI Topology Node** = Max Rating of Device  
Confirm site active power and generation are correct  
\_\_\_\_\_  
\_\_\_\_\_
- Assign the device to an Independent Node "**Testing Node**" with Primacy set to 127 (i.e., the same as the Top-Level Topology Node).
- Set an **Independent Node** active OpModExpLimW = 5 kW on "**Testing Node**" for 20 Minutes or (4x poll rate)  
Confirm site active power limit increases to 5 kW  
\_\_\_\_\_  
\_\_\_\_\_
- After 5 minutes or (1x poll rate)  
Set an active OpModGenLimW on **NMI Topology Node** = 0 kW for 10 minutes or (2x poll rate)  
Confirm inverter active power limit decreases to 0 kW  
Record whether **Independent Node** active OpModExpLimW control has been aborted?  
\_\_\_\_\_  
\_\_\_\_\_

Confirm at end of scheduled control that site export limit returns to 0.5kW. Observe and record failsafe response time, that is, the duration from end of scheduled control to when the site export limit returns to 0.5kW.  
\_\_\_\_\_  
\_\_\_\_\_