System Services Test Procedure

Fast Frequency Response (FFR), Primary, Secondary and Tertiary Reserve (POR, SOR, TOR1, TOR2)

Aggregators

Unit Name

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# Document History

Template Version 3.0, published 12 November 2019

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version** | **Date** | **Comment** | **Name** | **Company** |
| 0.1 | Insert Date | Minor version (v0.1) - First submission for review and approval | Insert Name | Unit Company Name |
| 1.0 | Insert Date | Revised to version 1.0 following approval by EirGrid, SONI. | Insert Name | Unit Company Name |

# Introduction

The User shall submit the latest version of this test procedure as published on the EirGrid website[[1]](#footnote-2). The test procedure shall be submitted to and approved by DSU@eirgrid.com, [generator\_testing@soni.ltd.uk](mailto:generator_testing@soni.ltd.uk) not less than 10 business days in advance of the proposed test date.

The purpose of this document is to detail the data required to apply for a system services contract and to detail the necessary test procedures required to be performed should that data not be available.

All yellow sections shall be filled in before the test procedure will be approved. All grey sections shall be filled in during testing. If any test requirements or steps are unclear, or if there is an issue with meeting any requirements or carrying out any steps, please contact DSU@eirgrid.com / [generator\_testing@soni.ltd.uk](mailto:generator_testing@soni.ltd.uk)

On the day of testing, suitably qualified technical personnel are required on site to assist in undertaking the tests. The personnel shall have the ability to:

1. Set up and disconnect the control system and instrumentation as required;
2. Ability to fully understand the Unit’s function and its relationship to the System;
3. Liaise with the Aggregator control centre and / or NCC, CHCC as required;
4. Mitigate issues arising during the test and report on system incidents.

On the day of the test, NCC, CHCC will determine:

1. If network conditions allow the testing to proceed.
2. Which tests will be carried out.
3. When the tests will be carried out.

The Aggregator shall liaise with the DSO, DNO as appropriate in advance of testing.

Following testing, the following shall be submitted to DSU@eirgrid.com / [generator\_testing@soni.ltd.uk](mailto:generator_testing@soni.ltd.uk)

|  |  |
| --- | --- |
| **Submission** | **Timeline** |
| A scanned copy of the entire test procedure, as completed and signed on site on the day of testing | 1 working day |
| Test data in CSV or Excel format | 1 working day |
| Test report | 10 working days |

# Abbreviations

AGU Aggregated Generating Units

DNO Distribution Network Operator

DSO Distribution System Operator

DSU Demand Side Unit

EDIL Electronic Dispatch Instruction Logger

FFR Fast Frequency Response

IS Individual Site

MPRN Metering Point Registration Number

MVAr Mega VAR

MW Mega watt

NCC, CHCC National Control Centre, Castlereagh House Control Centre

PMU Phasor Monitoring Unit

POR Primary Operating Reserve

SOR Secondary Operating Reserve

TOR Tertiary Operating Reserve

TSO Transmission System Operator

# Operational Data

## Aggregator Unit Data

|  |  |
| --- | --- |
| Aggregator Type | Unit to specify |
| Aggregator Name | Unit to specify |
| Aggregator Test coordinator contact name and number | Unit to specify |
| Aggregator Control Centre Location and main contact Number | Unit to specify |
| Response Type (Static, Dynamic) | Unit to specify |

## Individual site details

*Copy and paste this table depending of number of IS being tested and complete accordingly*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Descriptor** | **Site No.1** | **Site No.2** | **Site No. \_\_** | **Site No. \_\_** |
| Individual Demand Site Name | Unit to specify | Unit to specify | Unit to specify | Unit to specify |
| MPRN | Unit to specify | Unit to specify | Unit to specify | Unit to specify |
| Bulk Supply Point or Connection Point | Unit to specify | Unit to specify | Unit to specify | Unit to specify |
| Irish Grid Co-ordinates | Eastings | Eastings | Eastings | Eastings |
| Northing | Northing | Northing | Northing |
| Site Address | Unit to specify | Unit to specify | Unit to specify | Unit to specify |
| Special Operating Limits or Network Limitations | Unit to specify | Unit to specify | Unit to specify | Unit to specify |
| MW Capacity (expected) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| Demand Reduction Capability - Avoided Consumption | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| Demand Reduction Capability - On Site Generation (Continuous Parallel Mode or Shaving Mode) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| Maximum Import Capacity | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| Maximum Export Capacity | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| Performance Measurement Device Standards for Fast Acting Services installed in agreement with TSO. | Unit to specify | Unit to specify | Unit to specify | Unit to specify |
| The Trigger Point that the IDS is expected to start responding at (F Trigger On)  Or the trigger point range if using a dynamic system to issue trigger points | \_\_\_\_\_\_\_\_Hz or  \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz or  \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz or  \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz or  \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz |
| The frequency range over which the IDS will go from minimum to maximum declared response. (F Trigger Range) | \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz to \_\_\_\_\_\_\_\_Hz |
| The frequency at which the IDS will begin to cease responding at. (F Trigger Off) | \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz | \_\_\_\_\_\_\_\_Hz |
| Time delay to the F Trigger Off characteristic that the IDS will continue to respond for thereafter. (T loiter) | \_\_\_\_\_sec | \_\_\_\_\_sec | \_\_\_\_\_sec | \_\_\_\_\_sec |
| Minimum time duration following a response before the IDS will become available to respond again. (T Min Interval) | \_\_\_\_\_sec | \_\_\_\_\_sec | \_\_\_\_\_sec | \_\_\_\_\_sec |
| FFR Capacity (MW) (expected) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| POR Capacity (MW) (expected) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| SOR Capacity (MW) (expected) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| TOR1 Capacity (MW) (expected) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |
| TOR2 Capacity (MW) (expected) | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW | \_\_\_\_\_\_\_\_MW |

# System Services Definitions

The definitions referenced in this document are for indicative purposes only. In the event of inconsistency between the definitions in this document and those in the DS3 System Services Agreement, the definitions in the DS3 System Services Agreement shall prevail.

## Fast Frequency Response

FFR is defined as the additional increase in MW output from a unit or a reduction in demand following a frequency event that is available within two seconds of the start of the event and sustainable for at least eight seconds afterwards.

The extra energy provided by the MW increase, in the timeframe from T0 + the FFR response time to 10 seconds **shall be greater** than any loss of energy in the ten-to-twenty second timeframe afterwards due to a reduction in MW output. The energy provided and drawn should be compared to the pre-event output.

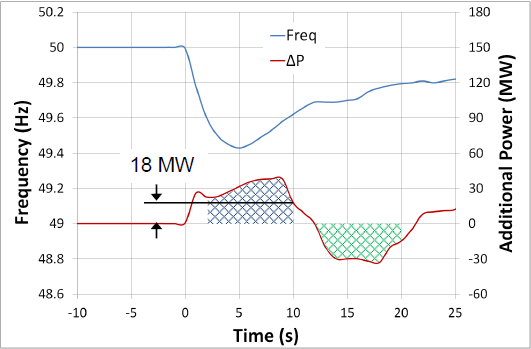


Figure : FFR being delivered after a frequency event

As shown in the diagram above, in order to be eligible for FFR the amount indicated by the blue hatched area (Power provided) shall be greater than the green hatched area (Power drawn).

Please note there are performance monitoring standards that apply for DS3 System Services and specific requirements for FFR. Further detail is available in the DS3 Performance Measurement Device Standards for Fast Acting Services document.

## FFR Response Time

A Providing Unit’s contracted FFR Response Time is the time from when the frequency falls through its contracted Reserve Trigger (T=0) to the time at which the Providing Unit must have achieved its contracted FFR volume, as dictated by its contracted FFR response curve.

The FFR response time shall be based on test data.

Please note that the FFR Response Time, as recorded on the Providing Unit’s installed performance measurement equipment, will be evaluated as part of the FFR performance monitoring process.

The product scalar for faster response of FFR will be based on the FFR response time of the Providing Unit.

## POR, SOR, TOR1 & TOR2[[2]](#footnote-3)

### Operating Reserve

Operating Reserve is defined as the additional MW output provided from Generation plant, reduction of Active power transfer to an external system or increase of Active power transfer to the Transmission system by interconnectors, or reduction in Customer demand, which shall be realisable in real time operation to contain and correct any potential Transmission system deviation to an acceptable level.

### Primary Operating Reserve (POR)

Primary Operating Reserve (POR) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) where the nadir occurs between 5 and 15 seconds after an Event.

### Secondary Operating Reserve (SOR)

Secondary Operating Reserve (SOR) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 15 to 90 seconds following an event.

### Tertiary Operating Reserve band 1 (TOR1)

Tertiary Operating Reserve (TOR1) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 90 seconds to 5 minutes following an event.

### Tertiary Operating Reserve band 2 (TOR2)

Tertiary Operating Reserve (TOR2) is the additional MW output (and/or reduction in Demand) required at the frequency nadir (minimum), compared to the pre-incident output (or Demand) which is fully available and sustainable over the period from 5 minutes to 20 minutes following an event.

Note: While it is envisaged that aggregators will provide TOR2 as a dispatch based service and test accordingly, the TSO acknowledge that some providers may wish to demonstrate and provide the TOR2 service as an extension of the other reserve services provided automatically in response to frequency events. The TSO will therefore facilitate TOR2 testing for such units through extended duration of reserve testing; however the TSO reserve the right to assess the appropriateness of this provision on a case by case basis.

# Site Safety requirements

The following is required for the EirGrid, SONI witness to attend the individual demand site.

|  |  |
| --- | --- |
| Personnel Protection Gear Requirements   1. Site Safety boots 2. Hard Hat with chin strap 3. Hi Vis 4. Arc Resistive clothing 5. Safety Glasses 6. Gloves 7. Safe Pass | 1. Yes / No 2. Yes / No 3. Yes / No 4. Yes / No 5. Yes / No 6. Yes / No 7. Yes / No |
| Site Induction requirements | Yes / No |
| Any further information | Unit to specify |

# Test Description and Pre Conditions

## Purpose of the Test

The purpose of this test is to verify:

1. The level of provision of FFR and FFR response time. (**For FFR only**)
2. The unit does not draw in more energy in the ten second timeframe after the control system decrement rate is correctly implemented. (**For FFR only**)
3. The levels of Primary, Secondary and Tertiary Operating Reserves provided by the unit.
4. Verify that the dynamic response meets the conditions for a valid dynamic response (**For dynamic response only**)
5. Verify the trigger point frequency of the IS, Aggregator.
6. Verify the response time of the IS, Aggregator.
7. Aggregators must have the capability to remotely enable/disable frequency response services (switch frequency response mode on/off) at all Individual Demand Sites (IDSs).
8. The Aggregator shall stagger load reconnection on IDSs to ensure inrush currents do not cause a spike over the pre event load.
9. The Aggregator shall not declare down its availability in real-time during a Frequency Event, or if it does, the availability shall reflect the MW response provided.

This is achieved by injecting a frequency profile at a range of different frequencies and periods of time.

|  |  |
| --- | --- |
| Is the frequency injected using software or external hardware? | Unit to specify |
| Can the frequency be injected as a ramp or as a step? | Unit to specify |
| Frequency injected as an offset to the system frequency or is the governor/control system isolated from the system frequency? | Unit to specify |

## Frequency Injection Profile

The following frequency profile shall be used for the testing. It will test the units’ capability for all reserve services and the units Dynamic or Static response.

The example below has the following:

|  |  |  |  |
| --- | --- | --- | --- |
| Minimum Setpoint | 49.5 Hz | Maximum Step Size | 5MW |
| Minimum Step Size | 1MW | Maximum Capacity | 5MW |

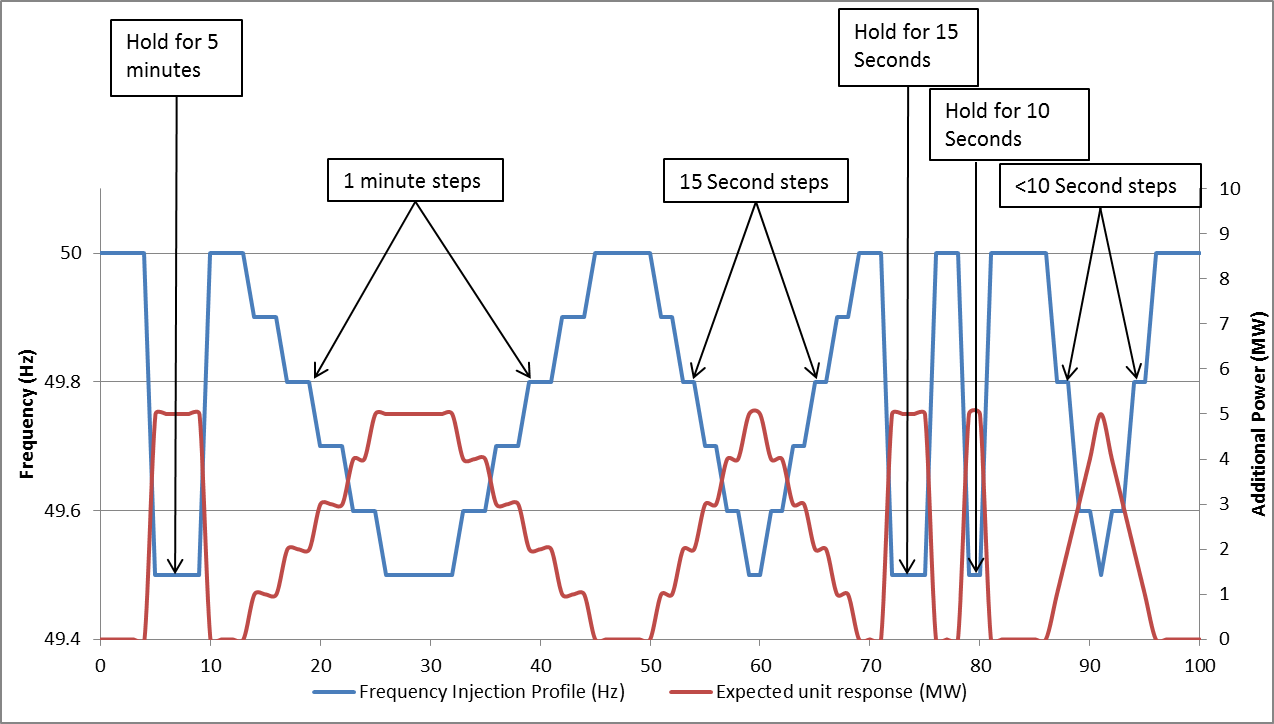


Figure : Example injection profile and unit response for a unit with a minimum setpoint of 49.5Hz

## Instrumentation and Onsite Data Trending

All of the following trends shall be recorded by the Aggregator during the test. Failure to provide any of these trends will result in test cancellation unless otherwise agreed with the TSO.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Data Trending and Recording** | **Resolution** | **Accuracy** | **Check On Day Of Test** |
| 1 | Total MW Reduction achieved from Generation (Aggregated MW Gen Signal) | Unit to specify | Unit to specify | Yes / No |
| 2 | Total MW Reduction achieved from Demand Reduction (Aggregated MW Demand Signal) | Unit to specify | Unit to specify | Yes / No |
| 3 | FFR Availability | Unit to specify (≥1Hz) | Unit to specify | Yes / No |
| 4 | POR Availability | Unit to specify (≥1Hz) | Unit to specify | Yes / No |
| 5 | SOR Availability | Unit to specify (≥1Hz) | Unit to specify | Yes / No |
| 6 | TOR1 Availability | Unit to specify (≥1Hz) | Unit to specify | Yes / No |
| 7 | TOR2 Availability (via EDIL) | N/A | Unit to specify | Yes / No |
| 8 | Frequency Response Provided | Unit to specify (≥1Hz) | Unit to specify | Yes / No |
| 9 | Aggregated Incomer Load for all Sites Providing Frequency Response | Unit to specify (≥1Hz) | Unit to specify | Yes / No |
| 10 | Reserve Response mode | Unit to specify | Unit to specify | Yes / No |
|  | Onsite Generation MW, AAAAA Generator #1 | Unit to specify | Unit to specify | Yes / No |
|  | Demand Reduction from site MW, DDDDDD #1 | Unit to specify | Unit to specify | Yes / No |
|  | Other signals as required by the unit or by [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com) or [generator\_testing@soni.ltd.uk](mailto:generator_testing@soni.ltd.uk). | Unit to confirm with TSO | Unit to confirm with TSO | Yes / No |

## Pre Test Conditions

Should “No” be answered by the Unit to any of the following conditions, the test will not proceed.

|  |  |  |
| --- | --- | --- |
| **No.** | **Conditions** | **Check on day of test** |
| 1 | Signals wiring completion certificate and pre-test check have been completed with the appropriate signoff sheet as per the signal list scanned, and submitted to [generator\_testing@eirgrid.com](file:///C:\Users\buzek_v\Downloads\DSU\DRAI\generator_testing@eirgrid.com) / [generator\_testing@soni.ltd.uk](file:///C:\Users\buzek_v\Downloads\DSU\DRAI\generator_testing@soni.ltd.uk). | Yes / No |
| 2 | Performance Measurement Device Standards for Fast Acting Services[[3]](#footnote-4) installed in agreement with TSO. | Yes / No |
| 3 | Test Profiles[[4]](#footnote-5) have been submitted and approved by [neartime@eirgrid.com](mailto:neartime@eirgrid.com) or [neartime@soni.ltd.uk](mailto:neartime@soni.ltd.uk). | Yes / No |
| 4 | EDIL Instruction with Test Flag is in place | Yes / No |
| 5 | PN changes had been submitted via MPI (with Test Flag), NCC contacted and changes approved. | Yes / No |

## Pre Test Checks

Confirm the following prior to commencing the test.

|  |  |  |
| --- | --- | --- |
| **No.** | **Conditions** | **Check on day of test** |
| 1 | Confirm nature of response (physical nature, expected ramping, short term parallel, etc.) | Demand / Generation |
| 2 | Test Start position as agreed with in advance with NCC, CHCC (e.g. 10 MW) | \_\_\_\_\_\_\_\_\_\_MW |
| 3 | Size of MW step changes as agreed with in advance with NCC, CHCC (e.g. 0.5Hz) | \_\_\_\_\_\_\_\_\_\_Hz |
| 4 | Confirm expected level and type of Demand Response   1. Generation 2. Demand Reduction 3. FFR Capacity 4. POR Capacity 5. SOR Capacity 6. TOR1 Capacity 7. TOR2 Capability | 1. \_\_\_\_\_MW 2. \_\_\_\_\_MW 3. \_\_\_\_\_MW 4. \_\_\_\_\_MW 5. \_\_\_\_\_MW 6. \_\_\_\_\_MW 7. \_\_\_\_\_MW |
| 5 | Can frequency response mode be switched on/off? | Yes / No |

# Test Steps – Unit Operating Reserve

## Functional Checks

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | Aggregator begins data recording for all trends noted in Section 7.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | Unit requests permission from NCC, CHCC to proceed with the Frequency Response functional check and confirms the following with NCC,CHCC:   1. Total MW reduction Availability of Unit 2. Total MW Reduction achieved from Generation 3. Total MW Reduction achieved from Demand Reduction 4. FFR Availability 5. POR Availability 6. SOR Availability 7. TOR1 Availability 8. Frequency Response Provided 9. Aggregated Incomer Load for all Sites Providing Frequency Response 10. Reserve Response Mode: 1 11. Frequency Response is ON |  | 1. \_\_\_\_\_\_ MW 2. \_\_\_\_\_\_ MW 3. \_\_\_\_\_\_ MW 4. \_\_\_\_\_\_ MW 5. \_\_\_\_\_\_ MW 6. \_\_\_\_\_\_ MW 7. \_\_\_\_\_\_ MW 8. \_\_\_\_\_\_ MW 9. \_\_\_\_\_\_ MW 10. Mode No. \_\_\_\_\_\_ 11. Status \_\_\_\_\_\_ |
| 3 | Aggregator requests NCC, CHCC to select Frequency Response Mode 5 and manually records the time between the command being issued from NCC, CHCC and being implemented in the Unit control system |  | Mode \_\_\_\_\_\_  Time delay \_\_\_\_\_\_ |
| 4 | Aggregator requests NCC, CHCC to select Frequency Response Mode 1 and manually records the time between the command being issued from NCC, CHCC and being implemented in the Unit control system |  | Mode \_\_\_\_\_\_  Time delay \_\_\_\_\_\_ |
| 5 | Aggregator requests NCC, CHCC to select Frequency Response OFF and manually records the time between the command being issued from NCC, CHCC and being implemented in the Unit control system |  | Status \_\_\_\_\_\_  Time delay \_\_\_\_\_\_ |
| 6 | Aggregator requests NCC, CHCC to select Frequency Response ON and manually records the time between the command being issued from NCC, CHCC and being implemented in the Unit control system |  | Status \_\_\_\_\_\_  Time delay \_\_\_\_\_\_ |
| 7 | Aggregator informs NCC, CHCC that the Functional check is complete |  |  |

## Injection Tests

The following test steps are to verify the amount of FFR, POR, SOR, TOR1 and TOR2 available.

**The Unit shall remove the tests, as appropriate, that are not being completed.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Step** | **Action** | | **Event Time** | **Comment** |
| **Static Response with Single Step Test** | | | | |
| 1 | Unit requests NCC, CHCC permission to begin test. | |  |  |
| 2 | Begin data recording of signals listed in Section 7.3 | |  |  |
| 3 | The Unit shall allow the IS to stabilise and record the Active Power output at the connection point | |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 4 | The Unit injects a 50Hz Signal and maintains the injection for one minute.  The Unit records Active Power output at connection time. | |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 5 | The Unit injects a Step injection of [Insert Minimum Frequency set point (2 decimal places] Hz and wait 5 minutes. (20 minutes for units demonstrating TOR2 capability)  Record Active Power Output at connection point. | |  | Minimum Setpoint: \_\_\_\_\_\_\_\_\_Hz  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 7 | The Unit injects a 50Hz Signal and wait 3 minutes.  Record Active Power output at connection point. | |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 8 | Stop data recording | |  |  |
| 9 | Static Response testing completed | |  |  |
| **Static Response with Multiple Steps Test** | | | | |
| 1 | | Unit requests NCC, CHCC permission to begin test. |  |  |
| 2 | | Begin data recording of signals listed in Section 7.3 |  |  |
| 3 | | The Unit shall allow the IS to stabilise and record the Active Power output at the connection point |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 4 | | The Unit injects a 50Hz Signal and maintains the injection for one minute.  The Unit records Active Power output at connection time. |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 5 | | The Unit decreases the simulated frequency in steps, as agreed, until [Insert the units’ Minimum Frequency Setpoint] Hz has been reached.  **Each step shall be held for one minute before continuing.**  [Insert Additional Hz Steps as required] |  | Agreed step size: \_\_\_\_\_\_\_\_\_\_Hz  Step 1: Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 2: Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 3: Active Power at connection point of IDS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Minimum Frequency Setpoint: \_\_\_\_\_\_\_\_\_Hz |
| 6 | | Once [insert the Minimum Frequency Setpoint]Hz has been achieved, the unit shall maintain the injection for five minutes (20 minutes if demonstrating TOR2) |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 7 | | The Unit increase the simulated frequency in steps, as agreed, until the simulated frequency has reached 50Hz again.  **Each step shall be held for one minute before continuing.**  [Insert Additional Hz Steps as required] |  | Agreed step size: \_\_\_\_\_\_\_\_\_\_\_\_Hz  Step1 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 2 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 3 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 8 | | The Unit injects a 50Hz Signal and wait 3 minutes.  Record Active Power output at connection point. |  | Start Time: \_\_\_\_\_\_\_  Active Power at connection point: of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_ |
| 9 | | Stop data recording |  |  |
| 10 | | Stepped Response testing completed. |  |  |
| **Dynamic Response Test** | | | | |
| 1 | | Unit requests NCC, CHCC permission to begin test. |  |  |
| 2 | | Begin data recording of signals listed in Section 7.3 |  |  |
| 3 | | The Unit shall allow the Unit, IS to stabilise and record the Active Power output at the connection point |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW |
| 4 | | The Unit injects a 50Hz Signal and maintains the injection for one minute.  The Unit records Active Power output at connection time. |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW |
| 5 | | The Unit decreases the simulated frequency in steps, as agreed, until [insert the units’ Minimum Frequency Setpoint] Hz has been reached.  **Each step shall be held for fifteen seconds before continuing.**  [Insert Additional Hz Steps as required] |  | Agreed step size: \_\_\_\_\_\_\_\_\_\_Hz  Step 1 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Step 2 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Step 3 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Minimum Frequency Setpoint: \_\_\_\_\_\_\_\_\_Hz |
| 6 | | The Unit holds injection at [insert Minimum Frequency setpoint]Hz for 90 seconds  Record Active Power output at connection point. |  | Start time: \_\_\_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_\_\_ |
| 7 | | The Unit increase the simulated frequency in steps, as agreed, until the simulated frequency has reached 50Hz again.  **Each step shall be held for fifteen seconds before continuing.**  [Insert Additional Hz Steps as required] |  | Agreed step size: \_\_\_\_\_\_\_\_\_\_\_\_Hz  Step 1 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Step 2 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Step 3 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW |
| 8 | | The Unit injects a 50Hz Signal and maintains the injection for [insert stabilising time] minutes. |  | Start time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_ |
| 9 | | The Unit injects a Step injection of [insert the Minimum Frequency setpoint] Hz and maintain injection for at least 15 seconds. |  | Minimum Frequency Setpoint: \_\_\_\_\_\_\_\_\_Hz  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW |
| 10 | | The Unit injects a 50Hz and waits 1 minute and records the output of the unit. |  | Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 11 | | The Unit injects a Step injection of [insert Minimum Frequency setpoint] Hz and maintains for 10 seconds. |  | Minimum Frequency Setpoint: \_\_\_\_\_\_\_\_\_Hz  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW |
| 12 | | The Unit injects a 50Hz Signal and maintains the injection for [insert stabilising time] minutes. |  | Start time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_ |
| 13 | | The Unit decreases the simulated frequency in steps, as agreed, until [insert the units’ Minimum Frequency Setpoint] Hz has been reached.  **Each step shall be held for one second before continuing.**  [Insert Additional Hz Steps as required] |  | Agreed step size: \_\_\_\_\_\_\_\_\_\_Hz  Step 1 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator: \_\_\_\_\_\_\_MW  Step 2 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 3 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Minimum Frequency Setpoint: \_\_\_\_\_\_\_\_\_Hz |
| 14 | | The Unit holds injection at [insert Minimum Frequency setpoint]Hz for 10 seconds  Record Active Power output at connection point. |  | Start time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_ |
| 15 | | The Unit increase the simulated frequency in steps, as agreed, until the simulated frequency has reached 50Hz again.  **Each step shall be held for one second before continuing.**  [Insert Additional Hz Steps as required] |  | Agreed step size: \_\_\_\_\_\_\_\_\_\_\_\_Hz  Step 1 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 2 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Step 3 - Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW |
| 16 | | The Unit injects a 50Hz Signal and maintains the injection for [insert stabilising time] minutes. |  | Start time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_ |
| 17 | | Stop data recording |  |  |
| 18 | | Dynamic Response Test Completed |  |  |

## Unit, IS trigger point testing

|  |  |  |  |
| --- | --- | --- | --- |
| **Step** | **Action** | **Event Time** | **Comment** |
| 1 | Unit requests NCC, CHCC permission to begin test. |  |  |
| 2 | Begin data recording of signals listed in Section 7.3 |  |  |
| 3 | The Unit injects a 50Hz Signal and wait 5 minutes.  Record Active Power output at connection point. |  | Start Time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_ |
| 4 | The Unit injects a **Step change to [insert trigger Frequency + 0.01Hz]**Hzand maintain the frequency injection for a minimum of **5 minutes** and note the completion time |  | Start Time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_Hz (Trigger Frequency + 0.01Hz) |
| 5 | Note how the unit react to this injection  (Unit should not respond) |  |  |
| 6 | Remove the frequency simulation and allow the unit to return its pre injection load under Unit control system action |  |  |
| 7 | The unit injects [insert **Step change to Trigger Frequency]Hz** and maintain the frequency injection for a minimum of **5 minutes** and note the completion time |  | Start Time: \_\_\_\_\_\_\_\_  Active Power at connection point of IS: \_\_\_\_\_\_\_MW.  Total MW reduction Availability of aggregator \_\_\_\_\_\_\_MW  Finish Time: \_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_Hz (Trigger Frequency) |
| 8 | Note how the unit react to this injection  (Unit should not respond) |  |  |
| 9 | The Unit removes the frequency simulation and allow the unit to return its pre injection load under control system action |  |  |
| 10 | The Unit injects [insert **Step change of Trigger Frequency - 0.01Hz)Hz** and maintain the frequency injection for a minimum of **5 minutes** and note the completion time |  | Completion time: \_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_Hz (Trigger Frequency - 0.01Hz) |
| 11 | Note how the unit react to this injection |  |  |
| 12 | The Unit removes the frequency simulation and allow the unit to return its pre injection load under control system action |  |  |
| 13 | Stop Data Recording |  |  |
| 14 | Unit/IS Trigger Point Testing completed |  |  |

## Unit / IS Response time testing

|  |  |  |  |
| --- | --- | --- | --- |
| **Step** | **Action** | **Event Time** | **Comment** |
| 1 | Unit requests NCC, CHCC permission to begin test. |  |  |
| 2 | Confirm data recording of signals as set out in section 7.5 |  |  |
| 3 | The Unit injects [Insert **Step change to Trigger Frequency]Hz** and maintain the frequency injection for a minimum of **5 minutes** and note the completion time |  | Reaction time: \_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_Hz (Trigger Frequency) |
| 4 | Stop Data Recording |  |  |
| 5 | Unit/IS Response time testing completed |  |  |

# Comments & Sign Off

|  |
| --- |
| **Comments:** |
| Aggregator Witness signoff that this test has been carried out according to the test procedure, above.  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date / Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| EirGrid, SONI Witness signoff that this test has been carried out according to the test procedure, above.  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date / Time: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

1. <http://www.eirgridgroup.com/__uuid/b1d14629-fe49-41a9-ac30-c3cb14393c82/index.xml?__toolbar=1> [↑](#footnote-ref-2)
2. Definitions form DS3 System Services Decision Paper SEM-13-098: <https://www.semcommittee.com/news-centre/ds3-system-services-technical-definitions-decision-paper> [↑](#footnote-ref-3)
3. <http://www.eirgridgroup.com/site-files/library/EirGrid/DS3-Performance-Measurement-Device-Standards-for-Fast-Acting-Services.pdf> [↑](#footnote-ref-4)
4. <http://www.eirgridgroup.com/site-files/library/EirGrid/DSUTestProfileTemplate.xlsx> [↑](#footnote-ref-5)