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

System Services Test Procedure

WFPS

Unit Name

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# Document Revision History

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

# Introduction

## WFPS Submissions

If test data is already available and no testing is required, the accompanying test report shall be completed and submitted along with all supporting documentation.

**WFPS shall highlight any changes made to this document or approval will be void.**

The WFPS shall submit the latest version of this test procedure template as published on the EirGrid, SONI website[[1]](#footnote-2).

If the test data has **not** been collected or is not available then this test procedure shall be followed and completed in full for all the services that are being applied for. Then the accompanying test report shall be completed, using the data collected, and submitted to [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com) or [generator\_testing@soni.ltd.uk](mailto:generator_testing@soni.ltd.uk)

All yellow sections shall be filled in before the test procedure shall 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 [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com) or [generator\_testing@soni.ltd.uk](mailto:generator_testing@soni.ltd.uk)

Where a site consists of two separate controllable WFPS with a single connection point, this may impact on the test procedure outlined below.

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

|  |  |
| --- | --- |
| **Submission** | **Timeline** |
| A scanned copy of the 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 |

## Test Execution

The availability of personnel at NCC, CHCC will be necessary in order to initiate the necessary instructions for the test. NCC, CHCC shall determine if network conditions allow the testing to proceed.

The WFPS representative shall coordinate testing. On the day of testing, suitably qualified technical personnel may be needed at the wind farm to assist in undertaking the tests. Such personnel shall have the ability to fully understand the function of the wind farm and its relationship to the network to which the wind farm is connected. Furthermore, such personnel shall have the ability to set up the control system of the wind farm so as to enable Grid Code compliance test to be correctly undertaken. In addition, the function of the technical personnel is to liaise with NCC, CHCC.

All wind turbines shall be available. If on the day of the testing all wind turbines are not available, then the test may proceed where one wind turbine is unavailable for a wind farm of registered capacity of up to 75 MW, if that turbine makes up <20% of Registered Capacity, or two wind turbines are unavailable for a wind farm of registered capacity in excess of 75 MW. Wind conditions need to be sufficient and at a relatively constant level in order adequately perform the test. The required wind capacity for this test is detailed in section 7.4.

**Witnessing**

The TSO retains the right to witness all System Services tests. Subject to agreement by the TSO, it may be possible for a providing unit to carry out a test as an internal test.

The test date booking process remains the same and requirements around meeting this test date still apply. Generator Testing shall endeavour to accommodate rescheduling of test dates providing there is sufficient availability before the testing deadline. It should be noted that the ability to accommodate late changes between the tender submission deadline and the testing deadline is very much dependant on the volume of tests being sought. It cannot be guaranteed that a second date will be secured.

Test procedures must be approved in advance of test date, the providing unit must submit test procedures with sufficient time for review and approval in advance of test date

If it is agreed to allow the testing to proceed unwitnessed, the unit must submit a load profile by 10am 2 business days in advance through existing internal testing process (through submission of a Wind Farm Outage Notification for WFPS connected in Northern Ireland, or a PPM Load Profile Request Form for WFPS connected in Ireland)

The WFPS must remain in close contact with NCC/CHCC before, during and after the test.

Scanned test procedures and test data shall be submitted within one business day of test date (as per existing process)

## Timing of Test Steps

For all of test steps, if the change in Target MW is <15 MW, the wait time shall be 1 minute. If the change in Target MW is > 15 MW, the wait time shall be at least 2 minutes. As these larger changes in MW will have bigger impact on the transmission system, the WFPS may be required to wait for longer than this before carrying out a frequency injection *e.g.* in steps marked “**In coordination with NCC, CHCC\***”. During the test, if the WFPS output is fluctuating or has not stabilised at the “Target MW”, the injection period shall be extended as appropriate.

## Notes

Graphs of expected responses may be included within the test sections for visual aid purposes only. This is to assist with the efficient execution of the test with NCC. Graphs may include active power, active power control set-point and frequency, developed assuming full available active power. For the avoidance of doubt, these graphs are not assessed for system service provision.

Automated Test Scripts generated by the WFPS shall meet the following requirements:

* It must be possible to pause the script at any point.
* The MW Test Profile has been submitted and agreed in advance (assuming 100% AAP)

# Abbreviations

AAP Available Active Power

APC Active Power Control

DMOL Design Minimum Operating Level

HV High Voltage

MEC Maximum Export Capacity

MW Mega Watt

NCC National Control Centre

CHCC Castlereagh House Control Centre

TSO Transmission System Operator

WFCS Wind Farm Control System

WFPS Wind Farm Power Station

WTG Wind Turbine Generator

FFR Fast Frequency Response

POR Primary Operating Reserve

SOR Secondary Operating Reserve

TOR Tertiary Operating Reserve

# WFPS Data

|  |  |
| --- | --- |
| WFPS Name | WFPS shall specify |
| WFPS Test Coordinator and contact number: | WFPS shall specify |
| WFPS Location | WFPS shall specify |
| WFPS connection point | HV Bushings of T101 in XX 110kV station |
| WFPS connection voltage | WFPS shall specify |
| Installed Turbine type, MW size and quantity | WFPS shall specify |
| Contracted MEC | WFPS shall specify |
| Registered Capacity | WFPS shall specify |
| Limiter applied to Exported MW | WFPS shall specify and confirm if applicable for Emulated Inertia Mode ON. |
| Limiter applied to AAP | WFPS shall specify and confirm if applicable for Emulated Inertia Mode ON. |
| DMOL | WFPS shall specify |

# 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)

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 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.



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

## 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 provided in Section 7.4 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

### 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 must 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.

## Inertial Emulation

Emulated Inertia means the ability of some Controllable WFPS technologies to provide additional increase in MW Output following a Performance Incident at times.

The response through emulated inertia shall be in addition to the MW provided through frequency response without emulated inertia.

# Site Safety

The following is required for the EirGrid, SONI witness to attend site:

|  |  |
| --- | --- |
| Personal Protective Equipment 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  (If Yes, WFPS shall specify how and when the induction shall be carried out) |
| Any further information | WFPS shall specify |

# Test Description and Pre Conditions

## Purpose of the test

This purpose of this test is to establish:

For FFR:

1. The level of provision of FFR and FFR response time.
2. The amount of energy provided by the unit in the timeframe between the FFR response time and 10 seconds,
3. The unit does not draw in more energy in the 10 - 20 second timeframe after the event.

For POR, SOR and TOR1

1. The levels of Primary, Secondary and Tertiary Operating Reserves provided by the unit.

This is achieved by injecting a simulated -200mHz frequency step into the Wind Farm Control system.

|  |  |
| --- | --- |
| **Description** | **Comment** |
| Is the frequency injected using software or external hardware? | WFPS shall specify |
| Can the frequency be injected as a ramp or as a step? | WFPS shall specify |
| Frequency injected as an offset to the system frequency or is the governor/control system isolated from the system frequency? | WFPS shall specify |
| Can the WFPS provide at least 1MW of response? (If No, the WFPS will not be eligible for services). | Yes / No |

## Emulated Inertia Details

The following information shall be provided if a WFPS is providing Emulated Inertia services. (Remove this section if it is not applicable)

|  |  |  |
| --- | --- | --- |
| **No.** | **Description** | **Comment** |
| 1 | Is emulated inertia to be included within testing Programme (if No, remove Section 7.2 and Section 8.4) | Yes / No |
| 2 | Can the WFPS provide at least 1MW or more of emulated inertia? (If No, the WFPS will not be eligible for services). | Yes / No |
| 3 | Emulated Inertia Range of Operation (0% - 100% Registered Capacity) | \_\_\_\_\_\_MW to \_\_\_\_\_MW |
| 4 | Emulated Inertia SCADA signals commissioned[[2]](#footnote-3) | Yes / No |
| 5 | Confirmation that a limiter is in place to ensure MEC is not exceeded for emulated inertia response? | Yes / No |

## Instrumentation and Onsite Data Trending

All of the following trends shall be recorded by the WFPS during the test. Failure to provide any of these trends will result in test cancellation.

|  |  |  |  |
| --- | --- | --- | --- |
| **No.** | **Data Trending and Recording** | **Resolution** | **Check On Day Of Test** |
| 1 | Available active power from the prevailing wind in MW, derived by algorithm in the WFCS\* | WFPS shall specify (≥ 10 Hz) | Yes / No |
| 2 | Actual active power from the WFPS in MW \* | WFPS shall specify (≥ 50 Hz) | Yes / No |
| 3 | APC/Emergency Action ON/OFF | WFPS shall specify (≥ 10 Hz) | Yes / No |
| 4 | APC/Emergency Action set-point from NCC, CHCC | WFPS shall specify (≥10 Hz) | Yes / No |
| 5 | Frequency Response ON/OFF | WFPS shall specify (≥10 Hz) | Yes / No |
| 6 | Frequency Response Curve1/Curve2 | WFPS shall specify (≥10 Hz) | Yes / No |
| 7 | Frequency Droop Setting | WFPS shall specify (≥10 Hz) | Yes / No |
| 8 | Simulated Test Frequency | WFPS shall specify (≥50 Hz) | Yes / No |
| 9 | Grid Frequency | WFPS shall specify (≥50 Hz) | Yes / No |
| 10 | Number of turbines online | WFPS shall specify (≥10 Hz) | Yes / No |
| 11 | Wind Farm Availability % | WFPS shall specify (≥10 Hz) | Yes / No |
| 12 | Emulated Inertia Status ON/OFF | WFPS shall specify (≥10Hz) | Yes / No |
| 13 | Emulated Inertia FFR Availability (MW) | WFPS shall specify (≥10 Hz) | Yes / No |
| 14 | Emulated Inertia POR Availability (MW) | WFPS shall specify (≥10 Hz) | Yes / No |
|  | Additional signals for system services as agreed with the TSO | TSO to Specify | Yes / No |
|  | \* Data can be collected from point Y – Point Z if available. Please note that this may change in the future to point Z data **only** |  |  |

## Initial Conditions

If “No” is answered to any of the following, contact NCC, CHCC and agree next steps in advance of making any corrective actions.

| **No.** | **Conditions** | **Check on day of test** |
| --- | --- | --- |
| 1 | All WTGs are available | # turbines installed: \_\_\_\_  # turbines generating: \_\_\_\_ |
| 2 | Generated MW between 20% - 90% of Registered Capacity | Generated MW: \_\_\_\_ |
| 3 | Where NCC, CHCC has control of the reactive power, ensure WFPS is exporting close to 0 Mvar at the connection point by bringing kV set-point = system voltage in 1 kV steps | Yes / No |
| 4 | MW Profile has been submitted if Test Script is automated | Yes / No / N/A |
| 5 | Automated Test Script can be paused. | Yes / No / N/A |
| 6 | High Speed data recorder has been installed in line with the DS3 Performance Measurement Device Standards for Fast Acting Services[[3]](#footnote-4) | Yes / No |

## Response Calculations

|  |  |
| --- | --- |
| **Calculation** | **Value** |
| Theoretical change in MW for frequency decrease of 0.2 Hz with Frequency Droop of 4% (Emulated Inertia Mode OFF) | \_\_\_\_\_\_ MW  (WFPS shall specify calculation and formula used) |
| Theoretical change in MW for frequency decrease of 0.2 Hz with Frequency Droop of 4% (Emulated Inertia Mode ON) | \_\_\_\_\_\_ MW  (WFPS shall specify calculation and formula used, include Emulated Inertia Operating range as applicable) |
| Ramp rate that is applied in frequency response mode | \_\_\_\_\_\_\_ MW/minute |

## Frequency Droop and Ramp Rate Settings

**Frequency Droop**

|  |  |
| --- | --- |
| **Frequency Droop** | **Droop Calculation** |
| 4% of Registered Capacity |  |

**Ramp Rates**

|  |  |  |
| --- | --- | --- |
| **Mode** | **Rate** | **Priority** |
| Frequency Response | As fast as technically possible. 60% of its expected Active Power response within 5 seconds 100% of its expected Active Power response within 15 seconds. | 1 |
| Active Power Dispatch | 20% of Registered Capacity per Minute | 2 |
| Wind Following | 20% of Registered Capacity per Minute | 3 |

# Test Steps

## Functional Check of Signals

## Functional Check

This WFPS demonstrates that the basic functions of switching on and off Emulated Inertia and changing reserve modes are working prior to conducting the frequency response test.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS begins data recording for all trends noted in Section 7.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 1 | WFPS requests permission from NCC to proceed with the Frequency Response functional check and confirms the following with NCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is OFF 4. Frequency Response is ON 5. (IE) Frequency Response is in Curve 1 6. Frequency Droop Setting is 4% 7. Emulated Inertia FFR Availability 8. Emulated Inertia POR Availability 9. Emulated Inertia Status OFF |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. Status \_\_\_\_ 5. (IE) Curve \_\_\_\_ 6. \_\_\_\_% 7. \_\_\_\_MW 8. \_\_\_\_ MW 9. ON/OFF |
| 2 | WFPS requests NCC to select Emulated Inertia ON and manually records the time between the command being issued from NCC and being implemented in the WFCS |  | Status \_\_\_\_  Time delay \_\_\_\_ |
| 3 | WFPS requests NCC to select Emulated Inertia OFF and manually records the time between the command being issued from NCC and being implemented in the WFCS |  | Status \_\_\_\_  Time delay \_\_\_\_ |
| 4 | WFPS requests NCC to select Frequency Response OFF and manually records the time between the command being issued from NCC and being implemented in the WFCS |  | Status \_\_\_\_  Time delay \_\_\_\_ |
| 5 | WFPS requests NCC to select Frequency Response ON and manually records the time between the command being issued from NCC and being implemented in the WFCS |  | Status \_\_\_\_  Time delay \_\_\_\_ |
| 8 | WFPS requests NCC to issue a Frequency Droop Setting of 4% and manually records the Frequency Droop Setting implemented in the WFCS |  | \_\_\_\_% |
| 9 | WFPS informs NCC that the Functional check is complete |  |  |

## APC/Emergency Action ON, Frequency response Mode ON

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS begins data recording for all trends noted in Section 7, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | WFPS requests permission from NCC, CHCC to proceed with the test and confirms the following with NCC, CHCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is ON 4. APC/Emergency Action set-point is [insert 40% of Registered Capacity] MW 5. Frequency Response is ON 6. (IE) Frequency Response is in Curve 1 7. Frequency Droop Setting is 4% 8. Emulated inertia status is OFF (remove if not applicable) 9. Emulated Inertia FFR Availability (MW) 10. Emulated Inertia POR Availability (MW) |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. \_\_\_\_ MW 5. Status \_\_\_\_ 6. (IE) Curve \_\_\_\_ 7. \_\_\_\_% 8. Status \_\_\_\_\_ 9. \_\_\_\_\_MW 10. \_\_\_\_\_MW |
| 3 | WFPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | **In coordination with NCC, CHCC\*** WFPS injects a simulated frequency of 49.8 Hz and waits for 5 minutes  Expected MW Output = [Insert Target MW] |  | Completion time (t+5mins): \_\_\_\_\_\_  @t+5Mins record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 5 | **In coordination with NCC, CHCC\***, remove frequency injection and allow the WFPS to return to pre-injection load under control system action  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 6 | WFPS ends data recording |  |  |
| 7 | WFPS informs NCC, CHCC that the Frequency test is complete |  |  |

## Emulated Inertia Testing

The following additional testing is for WFPS providing additional Emulated Inertia response. The WFPS shall remove these sections if not applicable.

### APC/Emergency Action ON, Frequency Response Mode ON, Emulated Inertia ON,

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS begins data recording for all trends noted in Section 7, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | WFPS requests permission from NCC, CHCC to proceed with the test and confirms the following with NCC, CHCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is ON 4. APC/Emergency Action set-point is [insert 40% of Registered Capacity] MW 5. Frequency Response is ON 6. (IE) Frequency Response is in Curve 1 7. Frequency Droop Setting is 4% 8. Emulated inertia status is ON 9. Emulated Inertia FFR Availability (MW) 10. Emulated Inertia POR Availability (MW) |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. \_\_\_\_ MW 5. Status \_\_\_\_ 6. (IE) Curve \_\_\_\_ 7. \_\_\_\_% 8. Status \_\_\_\_\_ 9. \_\_\_\_\_\_\_MW 10. \_\_\_\_\_\_\_MW |
| 3 | WFPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | **In coordination with NCC, CHCC\*** WFPS injects a simulated frequency of 49.8 Hz and waits for 5 minutes  Expected MW Output = [Insert Target MW] |  | Completion time (t+5mins): \_\_\_\_\_\_  @t+5Mins record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 5 | **In coordination with NCC, CHCC\***, remove frequency injection and allow the WFPS to return to pre-injection load under control system action  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 6 | WFPS ends data recording |  |  |
| 7 | WFPS informs NCC, CHCC that the Frequency test is complete |  |  |

### APC/Emergency Action OFF, Frequency Response Mode OFF, Emulated Inertia ON

If a frequency injection cannot be applied with Frequency Response Mode OFF, the WFPS shall carry out the test with Frequency Response Mode ON (Section 8.4.3)

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS begins data recording for all trends noted in Section 7, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | WFPS requests permission from NCC, CHCC to proceed with the test and confirms the following with NCC, CHCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is OFF 4. Frequency Response is OFF 5. (IE) Frequency Response is in Curve 1 6. Frequency Droop Setting is 4% 7. Emulated inertia status is ON 8. Emulated Inertia FFR Availability (MW) 9. Emulated Inertia POR Availability (MW) |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. Status \_\_\_\_ 5. (IE) Curve \_\_\_\_ 6. \_\_\_\_% 7. Status \_\_\_\_\_ 8. \_\_\_\_\_\_\_MW 9. \_\_\_\_\_\_\_MW |
| 3 | WFPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | **In coordination with NCC, CHCC\*** WFPS injects a simulated frequency of 49.8 Hz and waits for 5 minutes  Expected MW Output = [Insert Target MW] |  | Completion time (t+5mins): \_\_\_\_\_\_  @t+5Mins record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 5 | **In coordination with NCC, CHCC\***, remove frequency injection and allow the WFPS to return to pre-injection load under control system action  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 6 | WFPS ends data recording |  |  |
| 7 | WFPS informs NCC, CHCC that the Frequency test is complete |  |  |

### APC/Emergency Action OFF, Frequency Response Mode ON, Emulated Inertia ON

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS begins data recording for all trends noted in Section 7, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | WFPS requests permission from NCC, CHCC to proceed with the test and confirms the following with NCC, CHCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is OFF 4. Frequency Response is ON 5. (IE) Frequency Response is in Curve 1 6. Frequency Droop Setting is 4% 7. Emulated inertia status is ON 8. Emulated Inertia FFR Availability (MW) 9. Emulated Inertia POR Availability (MW) |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. Status \_\_\_\_ 5. (IE) Curve \_\_\_\_ 6. \_\_\_\_% 7. Status \_\_\_\_\_ 8. \_\_\_\_\_\_\_MW 9. \_\_\_\_\_\_\_MW |
| 3 | WFPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | **In coordination with NCC, CHCC\*** WFPS injects a simulated frequency of 49.8 Hz and waits for 5 minutes  Expected MW Output = [Insert Target MW] |  | Completion time (t+5mins): \_\_\_\_\_\_  @t+5Mins record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 5 | **In coordination with NCC, CHCC\***, remove frequency injection and allow the WFPS to return to pre-injection load under control system action  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 6 | WFPS ends data recording |  |  |
| 7 | WFPS informs NCC, CHCC that the Frequency test is complete |  |  |

### APC/Emergency Action ON, Frequency Response Mode OFF, Emulated Inertia ON,

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS begins data recording for all trends noted in Section 7, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | WFPS requests permission from NCC, CHCC to proceed with the test and confirms the following with NCC, CHCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is ON 4. APC/Emergency Action set-point is [insert 40% of Registered Capacity] MW 5. Frequency Response is OFF 6. (IE) Frequency Response is in Curve 1 7. Frequency Droop Setting is 4% 8. Emulated inertia status is ON 9. Emulated Inertia FFR Availability (MW) 10. Emulated Inertia POR Availability (MW) |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. \_\_\_\_ MW 5. Status \_\_\_\_ 6. (IE) Curve \_\_\_\_ 7. \_\_\_\_% 8. Status \_\_\_\_\_ 9. \_\_\_\_\_\_\_MW 10. \_\_\_\_\_\_\_MW |
| 3 | WFPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | **In coordination with NCC, CHCC\*** WFPS injects a simulated frequency of 49.8 Hz and waits for 5 minutes  Expected MW Output = [Insert Target MW] |  | Completion time (t+5mins): \_\_\_\_\_\_  @t+5Mins record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 5 | **In coordination with NCC, CHCC\***, remove frequency injection and allow the WFPS to return to pre-injection load under control system action  Expected MW Output = [Insert Target MW] |  | @t+30s record the following:  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 6 | WFPS ends data recording |  |  |
| 7 | WFPS informs NCC, CHCC that the Frequency test is complete |  |  |

## Return to Standard Settings

The WFPS settings are returned to standard following completion of the Frequency Response Test.

|  |  |  |  |
| --- | --- | --- | --- |
| **Step No.** | **Action** | **Time** | **Comments** |
| 1 | WFPS removes the simulated frequency, returning the WFCS reference to system frequency |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | WFPS confirms the following with NCC, CHCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. APC/Emergency Action is OFF 4. APC/Emergency Action Set-point = [insert 100% of Registered Capacity] MW 5. Frequency Response is ON 6. (IE) Frequency Response is in Curve 1 7. Frequency Droop Setting is 4% 8. Emulated Inertia status is ON 9. Emulated Inertia FFR Availability (MW) 10. Emulated Inertia POR Availability (MW) 11. WFCS frequency reference is system frequency |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. Status \_\_\_\_ 4. \_\_\_\_ MW 5. Status \_\_\_\_ 6. (IE) Curve \_\_\_\_ 7. \_\_\_\_% 8. Status \_\_\_\_\_\_ 9. \_\_\_\_\_\_MW 10. \_\_\_\_\_\_MW 11. Frequency Reference \_\_\_\_\_\_\_\_\_\_ |
| 3 | WFPS informs NCC, CHCC that the Frequency test is complete |  |  |

# Comments and sign off

|  |
| --- |
| **Comments:** |
| WFPS 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/library> [↑](#footnote-ref-2)
2. Wiring completion Certificate and commissioning certificates required (Pre and Post signals and controls check). [↑](#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)