EIRGRID_2015 Functional Document Template (21

Battery ESPS Frequency Response

Test Procedure

[Insert ESPS PPM Name]

Version 0.1

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# Document Version History

EirGrid test procedure template version published January 2022.

|  |  |  |
| --- | --- | --- |
| **Document Version History** | | |
| **Version** | **Date** | **Comment** |
| 0.1 | dd/mm/yyyy | First submission for review/approval |
| 1.0 |  |  |
|  |  |  |

# Introduction

|  |  |
| --- | --- |
| ESPS Name | ESPS to Specify  (name per connection agreement) |
| ESPS Test Coordinator and contact number: | ESPS to Specify |
| Associated 110 kV Station | ESPS to Specify |
| ESPS connection point | ESPS to Specify  (*i.e.* T121 in XXX Distribution or Transmission Station) |
| ESPS connection voltage | ESPS to Specify |
| ESPS Connection Type | ESPS to Specify  (TSO, DSO Topology 1, DSO Topology 2 etc.) |
| Installed module type, MW size and quantity | ESPS to Specify |
| Contracted MEC | ESPS to Specify |
| Contracted MIC | ESPS to Specify |
| Registered Capacity | ESPS to Specify |
| Energy Storage Capacity (MWHr) | ESPS to Specify |
| % Charge maintained in normal operation | ESPS to Specify |
| Limiter applied to Exported MW | ESPS to Specify |
| Limiter applied to AAP | ESPS to Specify |
| RoCoF Capability | ESPS to Specify |

## Test Execution

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

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

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).

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

The ESPS representative shall coordinate testing. On the day of testing, suitably qualified technical personnel may be needed at the ESPS to assist in undertaking the tests. Such personnel shall have the ability to fully understand the function of the ESPS and its relationship to the network to which the ESPS is connected. Furthermore, such personnel shall have the ability to set up the control system of the ESPS 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.

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

All battery modules shall be available. If on the day of the testing all battery modules are not available, then the test may proceed where the unavailable modules make up <20% of Registered Capacity. All test results shall be based on tested performance only and shall not be extrapolated in the case of reduced availability. Resource conditions need to be sufficient in order adequately perform the test. The ESPS should, where possible, ensure the unit has sufficient state of charge in advance of commencing testing each day. Before each test section, the state of charge of the ESPS should be checked and adjusted if required, following approval by NCC.

For all 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 PPM may be required to wait for longer than this before carrying out a frequency injection *e.g.* in steps marked “ESPS requests permission from NCC ”. During the test, if the PPM output is fluctuating or has not stabilised at the “Target MW”, the injection period shall be extended as appropriate. PPM shall adjust the timing of the steps as required in order to align with this requirement.

Throughout the test procedure, for instances where APC is OFF the TSO accepts that there may be some level of import required to manage house load in this scenario. The battery should not be discharging or charging while APC is OFF, but may import due to house load.

## Notes

If Automated Test Scripts are being used, Automated Test Scripts generated by the ESPS 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
* The MW Test Profile must account for timing of each step (note 1 minute is not appropriate for all steps).

This test procedure involves injecting simulated reference frequencies at different MW export and import levels and analysing the responses of the unit to those injections

|  |  |
| --- | --- |
|  |  |
| 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 |

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

|  |  |
| --- | --- |
| **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 |

## Site Safety requirements

The following is required for the EirGrid witness to attend 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  (If Yes, PPM to specify how and when the induction shall be carried out) |
| Any further information | PPM to specify |

# Abbreviations

AAP Available Active Power

APC Active Power Control

DMOL Designed Minimum Operating Level

ESPS Energy Storage Power Station

HV High Voltage

MEC Maximum Export Capacity

MIC Maximum Import Capacity

MW Mega Watt

NCC National Control Centre

PN Physical Notification

PPM Power Park Module

SLD Single Line Diagram

TSO Transmission System Operator

# Grid Code References

|  |  |
| --- | --- |
| Grid Code Version: | ESPS to specify |
| Please also refer to the published Battery ESPS Grid Code Implementation Note[[2]](#footnote-3) for guidance on technical requirements for Battery ESPS and applicability of specific PPM clauses within the Grid Code. |  |

# Test desciption and pre conditions

## Purpose of the Test

The purpose of this test is to confirm the ability of the ESPS to respond to changes in system frequency. The ESPS shall be capable of operating with a “MW/Hz” slope – e.g. able to continuously adjust its active power output in response to changes in frequency. As the grid frequency cannot be changed at will, the test will require frequency to be simulated by means of injection of a frequency signal into the ESPS control system.

## Pass Criteria

The following is the pass criteria for the test. Any subsequent report for this test will be assessed against each of these criteria.

| **Criteria** |
| --- |
| Frequency response mode settings have been implemented as per unit specific signal list |
| The selected Frequency Response Mode (and feedback) shall not be affected by the Frequency Response status (ON / OFF) i.e. the Frequency Response Mode does not change, nor should the feedback signal go suspect.  If Frequency Response is OFF, the mode should not change. |
| Battery ESPS is capable of operating with parameters set anywhere in the following ranges:   * Under frequency Trigger F1: 49.5Hz – 50Hz * Under frequency Trajectory F1-F2: 1Hz – 5Hz * Maximum Under frequency Response: 0MW – Operating Range * Over frequency Trigger F3: 50Hz – 50.5Hz * Over frequency Trajectory F3-F4: 1Hz – 5Hz * Maximum Over frequency Response: 0MW – Operating Range   *Note: A number of settings will be demonstrated as per existing mode settings during this Frequency Response test.  A statement confirming the max and min ranges that can be applied for each parameter is to be provided by the customer in the test report to further support this criteria.* |
| When Frequency Response is OFF, no response shall be provided. |
| For frequency ≥ F1 and ≤ F3, no response shall be provided |
| For frequency between F1 and F2, and F3 and F4 MW output is based on a MW/Hz slope, which is defined only by the Maximum Response setting and the trajectory, as defined for each Mode. |
| Over frequency Response (∆P) will be limited by the lesser of availability, Maximum Over frequency Response setting, maximum capacity (accounting for MIC), and application of the Capacity Limited Ramp Rate. |
| Under frequency Response (∆P) will be limited by the lesser of availability, Maximum Under frequency Response setting, maximum capacity (accounting for MEC), and application of the Capacity Limited Ramp Rate. |
| ESPS provides ≥60% of its expected response within 5 seconds and 100% of its expected response within 15 seconds. |
| Frequency response is achieved by altering the output of all modules as opposed to switching modules on or off, insofar as possible. |
| ESPS regulates its active power output to within the greater of (±0.5 MW or ±3% of Registered Capacity) of the Active Power Control Set-point adjusted for frequency response. |
| The PPM controller continuously recalculates its expected response during the frequency excursion. |
| **Ramp Rates** |
| Demonstration that the Capacity Limited Ramp Rate and Active Power Control Set-point Ramp Rate can each be set independently over a range between 1% and 100% of Registered Capacity per minute  *Note: APC ramp rate setting is varied in the APC Test Procedure* |
| Ramp rate priority is applied as per Implementation Note and signal list settings |
| **Signals** |
| FFR-TOR Availability signals behave correctly under APC set-point or EDIL dispatch |
| Available active power export and import signals behave correctly when the unit is issued an APC set-point or is providing a frequency response |

## Instrumentation and Onsite Data Trending

All of the following trends shall be recorded by the ESPS during the test. The ESPS may capture any other signals as necessary to demonstrate compliance.

The ESPS shall specify the resolution of these signal recordings. As a minimum the resolution should be as specified in the table below. For some signals used to demonstrate operating reserve and FFR response time, these may be required at 20ms resolution.

| **No.** | **Data Trending and Recording** | **Resolution** | **Check On Day Of Test** |
| --- | --- | --- | --- |
| 1 | Available active power export (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 2 | Available active power import (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 3 | Actual active power (MW) | PPM to specify, ≥ 10 Hz or as agreed with TSO (20ms for FFR scalar product) | Yes / No |
| 4 | APC (ON/OFF) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 5 | APC set-point from NCC (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 6 | ESPS Frequency Response (ON/OFF) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 7 | ESPS Reserve Response Mode (1 - 5) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 8 | ESPS Active Under Frequency Trigger Setting (Hz) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 9 | ESPS Active Under Frequency Trajectory Setting (Hz) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 10 | ESPS Active Over Frequency Trigger Setting (Hz) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 11 | ESPS Active Over Frequency Trajectory Setting (Hz) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 12 | ESPS Active Maximum under frequency response setting (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 13 | ESPS Active Maximum over frequency response setting (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 14 | Simulated Test Frequency (Hz) | PPM to specify, ≥ 10 Hz or as agreed with TSO (20ms for FFR scalar product) | Yes / No |
| 15 | Grid Frequency (Hz) | PPM to Specify (≥ 10 Hz) | Yes / No |
| 16 | ESPS Local/Manual Control (ON/OFF) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 17 | ESPS Grid/TSO Control (ON/OFF) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 18 | ESPS Useable Energy Remaining (MWh) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 19 | ESPS Total Useable Storage Capacity (MWh) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 20 | FFR Availability (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 21 | POR Availability (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 22 | SOR Availability (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 23 | TOR1 Availability (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
| 24 | TOR2 Availability (MW) | PPM to Specify (≥ 1 Hz) | Yes / No |
|  | | | |

## Frequency and Ramp Rate Settings to be implemented in ESPS Control System

Please refer to the published Battery ESPS Grid Code Implementation Note[[3]](#footnote-4) for guidance on technical requirements for Battery ESPS and applicability of specific PPM clauses within the Grid Code.

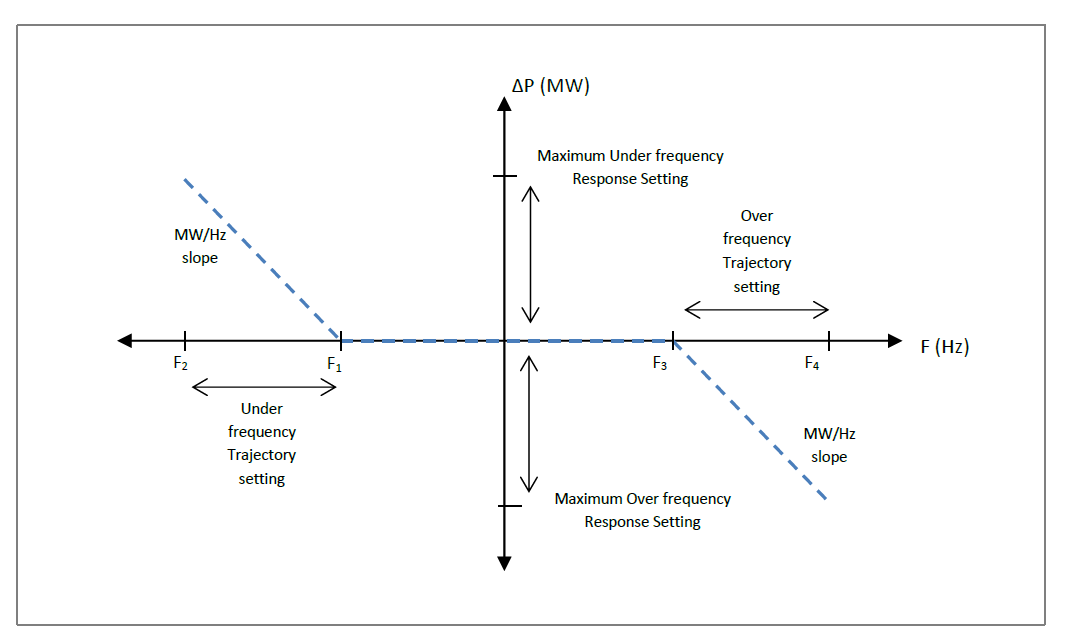


Figure Battery ESPS Frequency Response Characteristics & Parameters

**Frequency Mode Settings**

ESPS to update table below with Mode settings implemented as per unit specific signal list.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *Active under frequency trigger setting (Hz)* | *Active under frequency trajectory setting (Hz)* | *Active Maximum under frequency response setting (MW)* | *Active over frequency trigger setting (Hz)* | *Active over frequency trajectory setting (Hz)* | *Active Maximum over frequency response setting (MW)* |
| ***Mode 1*** | 49.8 | 0.3 | Operating range | 50.2 | 0.3 | Operating range |
| ***Mode 2*** | TBC | TBC | Operating range | TBC | TBC | Operating range |
| ***Mode 3*** | 49.8 | 0.5 | Operating range | 50.2 | 0.5 | Operating range |
| ***Mode 4*** | 49.9 | 2 | Operating range | 50.1 | 2 | Operating range |
| ***Mode 5*** | 49.8 | 0.5 | 50% Operating range | 50.2 | 0.5 | 50% Operating range |

**Ramp Rates**

|  |  |  |
| --- | --- | --- |
| **Mode** | **Rate** | **Priority** |
| Capacity Limited | 1-100% of Registered Capacity per Minute (Note: Setting as per unit specific signal list XX %) | 1 |
| 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. | 2 |
| Active Power Dispatch | 1- 100% of Registered Capacity per Minute (Note: Setting as per unit specific signal list XX %) | 3 |

## Initial Conditions

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

| **Conditions** | **Check on day of test** |
| --- | --- |
| All battery modules are available  (or as outlined in Section 2.1 above) | # modules installed: \_\_\_\_  # modules available: \_\_\_\_ |
| State of charge | \_\_\_\_\_ % |
| Where NCC has control of the reactive power, ensure PPM is exporting close to 0 MVAr at the connection point by bringing kV set-point = system voltage in 1 kV steps | Yes / No |
| MW Profile has been submitted if Test Script is automated | Yes / No / N/A |
| Automated Test Script can be paused. | Yes / No / N/A |
| Test PNs have been submitted  Note this will not be applicable if the unit is not registered in the market | Yes / No / N/A |

# Test Steps

## Functional Check

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

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | ESPS begins data recording for all trends noted in Section 5.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS requests permission from NCC to proceed with the Frequency Response functional check and confirms the following with NCC:   1. MW output of the ESPS 2. APC is OFF 3. Frequency Response is ON 4. Frequency Response Mode 1 is ON 5. Active Under frequency Trajectory setting 6. Active Under frequency Trigger setting 7. Active Maximum under frequency response setting 8. Active Over frequency Trajectory setting 9. Active Over frequency Trigger setting 10. Active Maximum over frequency response setting |  | 1. \_\_\_MW 2. APC status \_\_\_ 3. Frequency Response status \_\_\_\_\_ 4. Mode 1 status \_\_\_ 5. \_\_\_ Hz 6. \_\_\_ Hz 7. \_\_\_ MW 8. \_\_\_ Hz 9. \_\_\_ Hz 10. \_\_\_ MW |
| 3 | ESPS requests NCC to select Reserve Response Mode 2 and manually records the time between the command being issued from NCC and being implemented in the ESPS Control System  NCC to verify trajectory and trigger settings have updated in EMS as per expected Mode 2 settings.   * Trajectory Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Trigger Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Active Maximum under frequency response setting * Active Maximum over frequency response setting |  | Mode \_\_\_\_  Time delay \_\_\_\_  Trajectory Setting \_\_\_\_ Hz  Trigger Setting \_\_\_\_ Hz  Max under frequency response setting \_\_\_ Hz  Max over frequency response setting \_\_\_ Hz |
| 4 | ESPS requests NCC to select Reserve Response Mode 3 and manually records the time between the command being issued from NCC and being implemented in the ESPS Control System  NCC to verify trajectory and trigger settings have updated in EMS as per expected Mode 3 settings.   * Trajectory Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Trigger Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Active Maximum under frequency response setting * Active Maximum over frequency response setting |  | Mode \_\_\_\_  Time delay \_\_\_\_  Trajectory Setting \_\_\_\_ Hz  Trigger Setting \_\_\_\_ Hz  Max under frequency response setting \_\_\_ Hz  Max over frequency response setting \_\_\_ Hz |
| 5 | ESPS requests NCC to select Reserve Response Mode 4 and manually records the time between the command being issued from NCC and being implemented in the ESPS Control System  NCC to verify trajectory and trigger settings have updated in EMS as per expected Mode 4 settings.   * Trajectory Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Trigger Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Active Maximum under frequency response setting * Active Maximum over frequency response setting |  | Mode \_\_\_\_  Time delay \_\_\_\_  Trajectory Setting \_\_\_\_ Hz  Trigger Setting \_\_\_\_ Hz  Max under frequency response setting \_\_\_ Hz  Max over frequency response setting \_\_\_ Hz |
| 6 | ESPS requests NCC to select Frequency Response OFF and manually records the time between the command being issued from NCC and being implemented in the ESPS controller. |  | Status \_\_\_\_  Time delay \_\_\_\_  Note which FR Mode is ON (1-5): \_\_\_\_ |
| 7 | ESPS requests NCC to select Reserve Response Mode 5 and records any change to Frequency Response Mode status |  | (If Frequency Response is OFF, the mode should not change) |
| 8 | ESPS requests NCC to select Frequency Response ON and manually records the time between the command being issued from NCC and being implemented in the ESPS Control system |  | Status \_\_\_\_  Time delay \_\_\_\_  Note which FR Mode is ON (1-5): \_\_\_\_  (The FR Mode does not change, nor should the feedback signal go suspect, when FR is turned ON/OFF.) |
| 9 | ESPS requests NCC to select Reserve Response Mode 5 and manually records the time between the command being issued from NCC and being implemented in the ESPS Control System  NCC to verify trajectory and trigger settings have updated in EMS as per expected Mode 5 settings.   * Trajectory Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Trigger Setting (under/over frequency): \_\_\_ Hz/\_\_\_Hz * Active Maximum under frequency response setting * Active Maximum over frequency response setting |  | Mode \_\_\_\_  Time delay \_\_\_\_  Trajectory Setting \_\_\_\_ Hz  Trigger Setting \_\_\_\_ Hz  Max under frequency response setting \_\_\_ Hz  Max over frequency response setting \_\_\_ Hz |
| 10 | ESPS requests NCC to select Frequency Response Mode 1 |  |  |
| 11 | ESPS informs NCC that the Functional check is complete. If further testing is not being completed, go to Section 6.5 Return to Standard Settings |  |  |
| Note any issues or deviations from test procedure.  For example changes in step size, duration, test operators, parameter changes on site.  Mark as “No Comment” if test proceeded as per procedure. | |  | |

## Frequency Response ON

The ESPS demonstrates that the active power output is correctly altered for simulated frequencies, based on the settings issued by the TSO.

### Frequency Response ON, Mode 1

This test demonstrates the performance of the Battery ESPS in response to frequency injections at different points in the frequency response curve. The injections are carried out as steps and ramped injections. This test is carried out in Mode 1 for test purposes, it is expected that the unit will be capable of meeting the requirements in all 5 Modes.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | ESPS begins data recording for all trends noted in Section 5.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS requests permission from NCC to proceed with the Frequency Response ON, Mode 1 test and confirms the following with NCC:   1. ESPS Useable Energy Remaining (MWhr) 2. MW set-point is 0MW 3. APC is OFF 4. MW output of the ESPS is 0MW 5. Frequency Response is ON 6. Frequency Response is in Mode 1 7. Active Under frequency Trajectory setting 8. Active Under frequency Trigger setting 9. Active Maximum under frequency response setting 10. Active Over frequency Trajectory setting 11. Active Over frequency Trigger setting 12. Active Maximum over frequency response setting |  | 1. \_\_\_MWhr 2. MW set-point \_\_MW 3. APC status \_\_\_ 4. MW output \_\_\_ MW 5. Frequency Response status \_\_\_\_\_ 6. Mode 1 status \_\_\_ 7. \_\_\_ Hz 8. \_\_\_ Hz 9. \_\_\_ MW 10. \_\_\_ Hz 11. \_\_\_ Hz 12. \_\_\_ MW |
| 3 | ESPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute.  Expected MW Output = [Insert Target MW] |  | AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz inside active under frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | For frequency ≥ F1 and ≤ F3, no response shall be provided  MW Output = \_\_\_\_ MW |
| 5 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz outside active under frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 6 | ESPS requests permission from NCC to inject a simulated frequency step injection of 50Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 7 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 49Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 8 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 9 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz inside active over frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | For frequency ≥ F1 and ≤ F3, no response shall be provided  MW Output = \_\_\_\_ MW |
| 10 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz outside active over frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 11 | ESPS requests permission from NCC to inject a simulated frequency step injection of 50Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 12 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 51Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 13 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 14 | ESPS requests NCC to turn APC ON and issue an APC set-point of [insert 50% MEC] MW and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 15 | ESPS to confirms simulated frequency of 50Hz is in place |  | MW Output = \_\_\_\_ MW |
| 16 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 49Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 17 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 18 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 51Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 19 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 20 | ESPS requests NCC to issue an APC set-point of [insert -50% MIC] MW and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 21 | ESPS to confirms simulated frequency of 50Hz is in place |  | MW Output = \_\_\_\_ MW |
| 22 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 49Hz over 1 second and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 23 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 second and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 24 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 51Hz over 1 second and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 25 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 second and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 26 | ESPS requests NCC to issue an APC set-point of [insert 100% MEC] MW and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 27 | ESPS to confirms simulated frequency of 50Hz is in place |  | MW Output = \_\_\_\_ MW |
| 28 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 49Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 29 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 30 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 51Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 31 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 32 | ESPS requests NCC to issue an APC set-point of [insert -100% MIC] MW and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 33 | ESPS to confirms simulated frequency of 50Hz is in place |  | MW Output = \_\_\_\_ MW |
| 34 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 49Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 35 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 36 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 51Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 37 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 38 | ESPS requests NCC to issue an APC set-point of 0MW MW and turn APC OFF and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 39 | ESPS ends data recording |  |  |
| 40 | ESPS informs NCC that the Frequency Response ON, Mode 1 test is complete. If further testing is not being completed, go to Section 6.5 Return to Standard Settings |  |  |
| Note any issues or deviations from test procedure  For example changes in step size, duration, test operators, parameter changes on site.  Mark as “No Comment” if test proceeded as per procedure. | |  | |

### Frequency Response ON, Mode 2

This test demonstrates the frequency response curve implemented for Mode 2. This test offers the opportunity to gather data for a System Services Operating Reserve Report, and to demonstrate the MWHr capacity of the unit.

The standard trigger test is an injection of 0.05Hz above and below the Mode 2 trigger setting. In the case that this would result in large MW step changes, for example for units with small trajectory settings, changes to these test steps should be discussed with Generator Testing.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | ESPS begins data recording for all trends noted in Section 5.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS requests permission from NCC to proceed with the Frequency Response ON, Mode 2 test and confirms the following with NCC:   1. ESPS Useable Energy Remaining (MWhr) 2. MW set-point is 0MW 3. APC is OFF 4. MW output of the ESPS is 0MW 5. Frequency Response is ON 6. Frequency Response is in Mode 2 7. Active Under frequency Trajectory setting 8. Active Under frequency Trigger setting 9. Active Maximum under frequency response setting 10. Active Over frequency Trajectory setting 11. Active Over frequency Trigger setting 12. Active Maximum over frequency response setting |  | 1. \_\_\_MWhr 2. MW set-point \_\_MW 3. APC status \_\_\_ 4. MW output \_\_\_ MW 5. Frequency Response status \_\_\_\_\_ 6. Mode 2 status \_\_\_ 7. \_\_\_ Hz 8. \_\_\_ Hz 9. \_\_\_ MW 10. \_\_\_ Hz 11. \_\_\_ Hz 12. \_\_\_ MW |
| 3 | ESPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute.  Expected MW Output = [Insert Target MW] |  | AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz inside active under frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | For frequency ≥ F1 and ≤ F3, no response shall be provided  MW Output = \_\_\_\_ MW |
| 5 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz outside active under frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 6 | ESPS requests permission from NCC to inject a simulated frequency step injection of 50Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 7 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz inside active over frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | For frequency ≥ F1 and ≤ F3, no response shall be provided  MW Output = \_\_\_\_ MW |
| 8 | ESPS requests permission from NCC to inject a simulated frequency step injection of 0.05Hz outside active over frequency trigger [insert value of injection here \_\_ Hz] and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 9 | ESPS requests permission from NCC to inject a simulated frequency step injection of 50Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 10 | ESPS requests NCC to turn APC ON and issue an APC set-point of [insert 100% MIC] MW and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 11 | ESPS to confirms simulated frequency of 50Hz is in place |  |  |
| 12 | ESPS requests permission from NCC to inject a simulated frequency step injection of under frequency trigger-trajectory [insert value of injection here \_\_ Hz] and waits 20 minutes\*  Expected MW Output = [Insert Target MW]  \*Note this step is intended to be used to demonstrate System Services Operating Reserve response time and volumes, and will also demonstrate the capacity of the battery ESPS. If the battery ESPS has a greater capacity than 20 minutes, the timing for this step can be extended to demonstrate this. |  | MW Output = \_\_\_\_ MW  ESPS shall ramp at frequency response ramp rate.  Unless capacity limited, the ESPS should remain at this output until the frequency is returned towards 50Hz in step 13. |
| 13 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 minute and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 14 | ESPS requests NCC to turn APC ON and issue an APC set-point of [insert 100% MEC] MW and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 15 | ESPS requests permission from NCC to inject a simulated frequency step injection of over frequency trigger+ trajectory [insert value of injection here \_\_ Hz] and waits 1 minute\*  Expected MW Output = [Insert Target MW]  \*Note if Battery ESPS unit has contracted for over-frequency services as part of the Volume Capped arrangements, the timing of this step should be extended |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 16 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 1 second and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 17 | ESPS requests NCC to issue an APC set-point of 0MW MW and turn APC OFF and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 18 | ESPS ends data recording |  |  |
| 19 | ESPS informs NCC that the Frequency Response ON, Mode 2 test is complete. If further testing is not being completed, go to Section 6.5 Return to Standard Settings |  |  |
| Note any issues or deviations from test procedure  For example changes in step size, duration, test operators, parameter changes on site.  Mark as “No Comment” if test proceeded as per procedure. | |  | |

### Frequency Response ON, Mode 5

This test demonstrates that the Battery ESPS frequency response to under frequency and over frequency is limited by the Maximum Under frequency Response setting and the Maximum Over frequency Response setting, respectively.

This test is completed in Mode 5, as there are lesser settings for maximum under frequency and over frequency response settings implemented in this mode.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | ESPS begins data recording for all trends noted in Section 5.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS requests permission from NCC to proceed with the Frequency Response ON, Mode 5 test and confirms the following with NCC:   1. ESPS Useable Energy Remaining (MWhr) 2. MW set-point is 0MW 3. APC is ON 4. MW output of the ESPS is 0MW 5. Frequency Response is ON 6. Frequency Response is in Mode 5 7. Active Under frequency Trajectory setting 8. Active Under frequency Trigger setting 9. Active Maximum under frequency response setting 10. Active Over frequency Trajectory setting 11. Active Over frequency Trigger setting 12. Active Maximum over frequency response setting |  | 1. \_\_\_MWhr 2. MW set-point \_\_MW 3. APC status \_\_\_ 4. MW output \_\_\_ MW 5. Frequency Response status \_\_\_\_\_ 6. Mode 5 status \_\_\_ 7. \_\_\_ Hz 8. \_\_\_ Hz 9. \_\_\_ MW 10. \_\_\_ Hz 11. \_\_\_ Hz 12. \_\_\_ MW |
| 3 | ESPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute.  Expected MW Output = [Insert Target MW] |  | AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 4 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 49Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 5 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 6 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 51Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall ramp at the Frequency response ramp rate  MW Output = \_\_\_\_ MW |
| 7 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 8 | ESPS requests NCC turn APC OFF and waits 1 minute after set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 9 | ESPS ends data recording |  |  |
| 10 | ESPS informs NCC that the Frequency Response ON, Mode 5 test is complete. If further testing is not being completed, go to Section 6.5 Return to Standard Settings |  |  |
| Note any issues or deviations from test procedure  For example changes in step size, duration, test operators, parameter changes on site.  Mark as “No Comment” if test proceeded as per procedure. | |  | |

## Frequency Response OFF

The ESPS demonstrates that the active power output is independent of simulated frequency while Frequency Response is OFF.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | ESPS begins data recording for all trends noted in Section 5.3, above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS requests permission from NCC to proceed with the Frequency Response OFF test and confirms the following with NCC:   1. APC OFF 2. MW output of the ESPS is 0MW 3. Frequency Response is OFF 4. Frequency Response is in Mode 4 |  | 1. APC status \_\_\_\_ 2. \_\_\_\_ MW 3. Frequency Response status \_\_\_\_ 4. Mode 4 \_\_\_ |
| 3 | ESPS replaces the system frequency with a simulated frequency of 50 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 4 | ESPS injects a simulated frequency of 49 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall not respond  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 5 | ESPS injects a simulated frequency of 51 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall not respond  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 6 | ESPS requests NCC to turn APC ON and issue an APC set-point of [insert 40% of Registered Capacity] MW and waits until APC set-point has been achieved |  | MW Output = \_\_\_\_ MW |
| 7 | ESPS injects a simulated frequency of 49 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall not respond  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 8 | ESPS injects a simulated frequency of 51 Hz and waits 1 minute  Expected MW Output = [Insert Target MW] |  | ESPS shall not respond  AAP = \_\_\_\_ MW  MW Output = \_\_\_\_ MW |
| 9 | ESPS requests NCC to issue an APC set-point of 0 MW and turn APC OFF, and waits until output reaches 0MW. |  | MW Output = \_\_\_\_ MW |
| 10 | ESPS ends data recording |  |  |
| 11 | ESPS informs NCC that the Frequency Response OFF test is complete. If further testing is not being completed, go to Section 6.5 Return to Standard Settings |  |  |
| Note any issues or deviations from test procedure  For example changes in step size, duration, test operators, parameter changes on site.  Mark as “No Comment” if test proceeded as per procedure. | |  | |

## Ramp Rate Priority

This test demonstrates that the three ramp rates are prioritised in correct manner.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | ESPS begins data recording for all trends noted in Section 5.3 above |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS requests permission from NCC to proceed with the test and confirms the following with NCC:   1. APC is OFF 2. MW output of the ESPS 3. Frequency Response is ON 4. Mode 1 is ON 5. ESPS Useable Energy Remaining (MWhr) 6. ESPS Total Useable Storage Capacity (MWhr) |  | 1. APC status \_\_\_ 2. MW output \_\_\_\_ 3. Frequency Response status \_\_\_ 4. Mode 1 \_\_\_ 5. \_\_\_MWhr 6. \_\_\_MWhr |
|  | **Under Frequency injection during APC ramp**  **APC turned OFF during under frequency event** |  |  |
| 3 | ESPS requests NCC to turn APC ON and issue a set-point of [insert 50% of Registered Capacity] MW.  While ramping to the APC set-point, ESPS requests permission from NCC to inject a simulated frequency step injection of [insert under-frequency value] Hz and waits until ESPS finishes ramping.  *(Note: size of under-frequency injection to be such that the required delta MW is approx. 10-20% Operating Range)*  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 4 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits until output settles  Expected MW Output = [Insert Target MW] |  | APC set-point |
| 5 | ESPS requests permission from NCC to inject a simulated frequency step injection of [insert under-frequency value] Hz and waits until ESPS finishes ramping. |  | APC set-point \_+ delta |
| 6 | ESPS requests NCC to turn APC OFF and waits until unit output settles  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 7 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits until output reaches 0MW  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
|  | **Over Frequency injection during APC ramp**  **APC turned OFF during over frequency event** |  |  |
| 8 | ESPS requests NCC to turn APC ON and to issue a set-point of [insert 15% of Registered Capacity] MW.  While ramping to the APC set-point, ESPS requests permission from NCC to inject a simulated frequency step injection of [insert over-frequency value] Hz and waits until ESPS finishes ramping.  *(Note: size of over-frequency injection to be such that the required delta MW is approx. 20-30% Operating Range)*    Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 9 | ESPS requests NCC to turn APC OFF and waits until unit output settles  Expected MW Output = [Insert Target MW] |  | Expected MW output should be 0MW – delta MW |
| 10 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits until output settles  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
|  | **Over Frequency injection during APC ramp**  **Returning to APC set-point on frequency recovery** |  |  |
| 11 | ESPS requests NCC to turn APC ON and issue a set-point of [insert 20% of Registered Capacity] MW.  While ramping to the APC set-point, ESPS requests permission from NCC to inject a simulated frequency step injection of [insert over-frequency value] Hz and waits until ESPS finishes ramping.  *(Note: size of over-frequency injection to be such that the required delta MW is approx. 20-30% Operating Range)*    Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
| 12 | ESPS requests permission from NCC to inject a simulated frequency ramp injection of 50Hz over 10 seconds and waits until output settles  Expected MW Output = [Insert Target MW] |  | MW Output = \_\_\_\_ MW |
|  | **Frequency injections during Capacity Limited Ramp Down** |  |  |
| 13 | ESPS sets the Capacity Limited Ramp Rate to XX% of Registered Capacity per minute confirms the following to NCC:   1. Capacity Limited Ramp Rate is now XX% of Registered Capacity per minute   *(Note: The capacity limited ramp rate to be set to different value than the current APC ramp rate setting. This setting should be such that Steps 16 & 17 can be carried out while the unit is ramping down from a 60% registered capacity set-point (Step 14). E.g. 10% Registered Capacity/minute would give 6 minutes of a ramp down to allow Step16 & 17 to be completed.)* |  | \_\_\_\_ MW/min |
| 14 | ESPS requests NCC to turn APC ON and issue a set-point of [insert 60% of Registered Capacity] MW |  | MW Output =\_\_\_\_ MW  ESPS Useable Energy Remaining = \_\_\_\_MWhr |
| 15 | ESPS output to be held until the unit starts ramping at Capacity Limited Ramp Rate  *(Note: State of charge should be low enough so that this wait time is reasonable)* |  |  |
| 16 | ESPS requests permission from NCC to inject a simulated frequency step injection of 49.5 Hz (Under frequency injection)  Expected MW Output = [Insert Target MW] |  | AAP =\_\_\_\_ MW  MW Output =\_\_\_\_ MW |
| 17 | ESPS requests permission from NCC to inject a simulated frequency step injection of XXHz (Over frequency injection).  *(Note: size of over-frequency injection to be such that the required delta MW is approx. 10-20% Operating Range)*  If the unit is still exporting as a result of this injection, this simulated frequency injection is held until output settles and/or capacity limited ramp rate is completed.  If the unit has started importing as a result of this injection, this simulated frequency injection should be held for 1 minute.  Expected MW Output = [Insert Target MW] |  | AAP =\_\_\_\_ MW  MW Output =\_\_\_\_ MW  ESPS Useable Energy Remaining = \_\_\_\_MWhr |
| 18 | ESPS requests permission from NCC to inject a simulated frequency step injection of 50Hz and waits 1 minute. Expected MW Output = [Insert Target MW] |  | MW Output =\_\_\_\_ MW |
| 19 | ESPS sets the Capacity Limited Ramp Rate to XX% of Registered Capacity per minute, as per Table in Section 5 above, confirms the following to NCC:   1. Capacity Limited Ramp Rate is now XX% of Registered Capacity per minute |  | \_\_\_\_ MW/min  ESPS returns the capacity limited ramp rate setting to setting as per signal list |
| 20 | ESPS requests NCC to issue a set-point of 0MW then turn APC OFF and waits the MW output has reached 0 MW |  | AAP =\_\_\_\_ MW  MW Output =\_\_\_\_ MW |
| 21 | ESPS ends data recording |  |  |
| 22 | ESPS informs NCC that the Ramp Rate Priority test is complete. If further testing is not being completed, go to Section 6.5 Return to Standard Settings |  |  |
| Note any issues or deviations from test procedure  For example changes in step size, duration, test operators, parameter changes on site  Mark as “No Comment” if test proceeded as per procedure. | |  | |

## Return to Standard Settings

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

|  |  |  |  |
| --- | --- | --- | --- |
| **Step No.** | **Action** | **Time** | **Comments** |
| 1 | ESPS removes the simulated frequency, returning the ESPS reference to system frequency |  | Operator Name \_\_\_\_\_\_\_\_\_\_\_\_  Date \_\_\_\_\_\_\_\_\_\_\_\_ |
| 2 | ESPS confirms the following with NCC:   1. APC Set-point = 0MW 2. APC is OFF 3. MW output of the ESPS 4. Frequency Response is ON 5. Frequency Response is in Mode 1 (or as agreed with NCC) 6. ESPS Control System frequency reference is system frequency |  | 1. \_\_\_\_ MW 2. Status \_\_\_\_ 3. \_\_\_\_ MW 4. Status \_\_\_\_ 5. Mode \_\_\_\_ 6. Frequency Reference \_\_\_\_\_\_\_\_\_\_ |
| 3 | ESPS informs NCC that Frequency Response testing is complete |  |  |

## Comments & Signatures

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

1. <http://www.eirgridgroup.com/library> [↑](#footnote-ref-2)
2. <http://www.eirgridgroup.com/site-files/library/EirGrid/Integration-of-Batteries-Implementation-Note.pdf> [↑](#footnote-ref-3)
3. <http://www.eirgridgroup.com/site-files/library/EirGrid/Integration-of-Batteries-Implementation-Note.pdf> [↑](#footnote-ref-4)