Public

Onsite Tests Results Submission Requirements for Power Park Modules – V4

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Summary

The purpose of this document is to set up the general formatting of the test results submitted to NESO for compliance purposes, section ECP.A.4 in the grid code outlines the signals to be submitted. It is also worth highlighting the key points as below:

1. Follow GC requirements (sampling rates & signals required).
2. Log sheet indicates the instants of each test starting and ending.
3. Time format “DD-MM-YYYY HH:MM:SS.000” only.
4. Proper measuring units preferably “MW, MVAr, KV”.
5. Proper titles of the measured quantities.
6. Proper files format.

Test results assessment automation:

1. Analysing test results is a time-consuming process that could demand even more time in the future. However, this task can be simplified with the use of technology.
2. Instead of performing repetitive tasks manually, automation tools can be developed to handle these tasks effortlessly.
3. Automation tools can provide significant benefits such as:
    a) Saving time and effort,
    b) Minimise repeated tasks.
    c) Ensuring consistent assessment, and
    d) Delivering accurate results.
4. For this approach being effective, it is crucial to ensure that test results are submitted in a consistent standardised format.

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Sampling rates

Clauses ECC.6.6.3.1 and ECC.6.6.3.2 specify the required sampling rates for signals that must be provided by the User to the Company for onsite monitoring. These signals must adhere to the specified resolution unless an **alternative agreement** is made with the Company.

(i) 1 Hz for reactive range tests

(ii) 10 Hz for frequency control tests

(iii) 100 Hz for voltage control tests

(iv) 1 kHz for Grid Forming Plant signals including fast fault current measurements.

(v) 100Hz for the other Grid Forming Plant tests carried out in accordance with ECC.6.6.1.9

The signals to be recorded during onshore PPM voltage control & reactive capability tests:

Section **ECP.A.4.3.7** and subsections **ECP.A.4.3.7.3.1-3** list the quantities to be recorded during different types of tests and should be submitted to the company in spreadsheet format.

ECP.A.4.3.7.3.1 lists the signals to be recorded during onshore PPM Voltage Control & Reactive Capability tests; users are encouraged to provide the full list of signals.

For Voltage Control tests, the items below are mandatory for the test assessment:

1. Time
2. Active Power
3. Reactive Power measurement
4. Reactive power setpoint (if any)
5. Connection Point Voltage
6. Voltage Setpoint
7. STATCOM or Windfarm Reactive Power (if any)
8. Power Available / state of charge

For Reactive Capability tests, the items below are mandatory for the test assessment:

1. Time
2. Active Power
3. Reactive Power measurement
4. STATCOM or Windfarm Reactive Power (if any)
5. Power Available / state of charge

The signals to be recorded during offshore PPM voltage control & reactive capability tests:

ECP.A.4.3.7.3.2 lists the signals to be recorded during offshore PPM Voltage Control & Reactive Capability tests, users are always encouraged to provide the full list of signals.

For Voltage Control tests, the items below are mandatory for the test assessment:

1. Time
2. Onshore Interface Point Active Power
3. Onshore Interface Point Reactive Power
4. Reactive power setpoint (if any)
5. Onshore Interface Point Voltage
6. Voltage Setpoint
7. STATCOM or Windfarm Reactive Power
8. Power Available / state of charge

For Reactive Capability tests, the items below are mandatory for the test assessment:

1. Time
2. Onshore Interface Point Active Power
3. Onshore Interface Point Reactive Power
4. STATCOM or Windfarm Reactive Power
5. Power Available / state of charge

The signals to be recorded during PPM frequency control tests:

ECP.A.4.3.7.3.3 lists the signals to be recorded during PPM Frequency Control tests, users are always encouraged to provide the full list of signals listed in ECP.A.4.3.7.3.3 however as a minimum, the items below are mandatory for tests assessment:

1. Time
2. GEP Active Power
3. Speed /Frequency
4. Freq Injection
5. Power Available / state of charge

Information to be provided at the beginning of each test (Log sheet):

ECP.A.4.3.8.1 lists the items to be included in the log sheet, users are always encouraged to provide the full list of signals listed in ECP.A.4.3.8.1 however as a minimum, the items below are mandatory for tests assessment:

1. Time and Date of the test.
2. Name of Power Station and PGM if applicable.
3. Type of testing being undertaken e.g. Voltage Control.
4. Number of Power Park Units in service in each PPM
5. Site registered capacity.
6. Controller settings, e.g. voltage slope, frequency droop, voltage setpoint, UEL & OEL settings

The signals to be provided at the beginning of each test (Log sheet):

- Clause **ECP.A.4.3.8.2** mandates the customer to record a set of items [at the point of compliance] at the starting of each test as relevant to the type of test being undertaken as indicated below:
    - **ECP.A.4.3.8.2.1** lists the items of Voltage Control Tests
    - **ECP.A.4.3.8.2.2** lists the items of Reactive Power Capability Tests
    - **ECP.A.4.3.8.2.3** lists the items of Frequency Response Capability Tests

- **Users are always encouraged to provide the full list of signals, however as a minimum, the items below are mandatory for tests assessment:**

    1. Injection Start time “DD-MM-YYYY HH:MM:SS.000”
    2. Injection End time “DD-MM-YYYY HH:MM:SS.000”

    The preferred time format is “DD-MM-YYYY HH:MM:SS.000”.

Log sheet data for the voltage control tests:

As stated, clause **ECP.A.4.3.8.2.1** list the quantities to be recorded at the **beginning** of each test step and submitted to the company as listed below and as explained later in the templates section.

1. Start time of each test step;
2. Active Power;
3. Reactive Power;
4. Connection voltage;
5. Voltage Control Setpoint, if applicable or changed;
6. Voltage Control Slope, if applicable or changed;
7. Terminal Voltage if applicable;
8. Generator transformer tap position or grid transformer tap position, as applicable;
9. Number of Power Park Units in service in each Power Park Module, if applicable; and
10. For offshore connections Offshore Grid Entry Point voltage.

- **Users are always encouraged to provide the full list of signals, however as a minimum, the items below are mandatory for tests assessment:**

    1. Injection Start time “DD-MM-YYYY HH:MM:SS.000”
    2. Injection End time “DD-MM-YYYY HH:MM:SS.000”

    The preferred time format is “DD-MM-YYYY HH:MM:SS.000”.

Log sheet data for the reactive power capability tests:

As stated, clause **ECP.A.4.3.8.2.2**, list the quantities to be recorded at the **beginning** of each test and submitted to the company as listed below and as explained later in the templates section.

1. Start time of test;
2. Active Power;
3. Reactive Power;
4. Connection Voltage;
5. Terminal Voltage if applicable;
6. Generating Unit transformer tap position or grid transformer tap position as applicable;
7. Number of Power Park Units in service in each Power Park Module, if applicable; and
8. For offshore connections Offshore Grid Entry Point voltage.

- **Users are always encouraged to provide the full list of signals, however as a minimum, the items below are mandatory for tests assessment:**

1. Injection Start time “DD-MM-YYYY HH:MM:SS.000”
2. Injection End time “DD-MM-YYYY HH:MM:SS.000”

The preferred time format is “DD-MM-YYYY HH:MM:SS.000”.

Log sheet data for the Frequency tests:

As stated in clause **ECP.A.4.3.8.2.3**, the following quantities should be recorded **at the starting** of each test step and submitted to the company as shown in the templates section.

1. Start time of test;
2. Active Power;
3. System Frequency;
4. For CCGT Modules, Active Power for the individual units (GT &ST);
5. For boiler plant, HP steam pressure;
6. Droop setting of controller if applicable;
7. Number of Power Park Units in service in each Power Park Module, if applicable; and
8. For offshore connections Offshore Grid Entry Point Active Power for each Power Park Module.

- **Users are always encouraged to provide the full list of signals, however as a minimum, the items below are mandatory for tests assessment:**

1. Injection Start time “DD-MM-YYYY HH:MM:SS.000”
2. Injection End time “DD-MM-YYYY HH:MM:SS.000”

The preferred time format is “DD-MM-YYYY HH:MM:SS.000”.

Loading Points for Frequency Response Tests:

As stated in grid code clause **ECP.A.6.6.6**, the following MW values should be achieved with respect to the corresponding loading point:

Loading Point	Value Calculation
Module Load Point 6 **(Maximum Export Limit)**	100% MEL
Module Load Point 5	90% MEL
Module Load Point 4	80% MEL
Module Load Point 3	MRL+0.6 x (MEL – MRL)
Module Load Point 2 Lower of MRL + 0.3 x (MEL – MRL) or **Minimum Stable Operating Level**	MRL+0.3 X (MEL – MRL) or MSOL
Module Load Point 1 **(Minimum Regulating Level)**	MRL

Format of the raw data files submission:

Raw test data templates:

To benefit both customers and NESO, NESO has created Excel templates for each type of test. These templates are available on the NESO website, where customers can download an editable version and fill in their test results.

1. Frequency Response Template MLP1
2. Frequency Response Template MLP2
3. Frequency Response Template MLP3
4. Frequency Response Template MLP4 number tests
5. Frequency Response Template MLP4 letter tests
6. Frequency Response Template MLP5
7. Frequency Response Template MLP6
8. Frequency Response Template Test L
9. Frequency Response Template Test N
10. Frequency Response Template Test M
11. Reactive Capability Template.
12. Voltage Control Template.

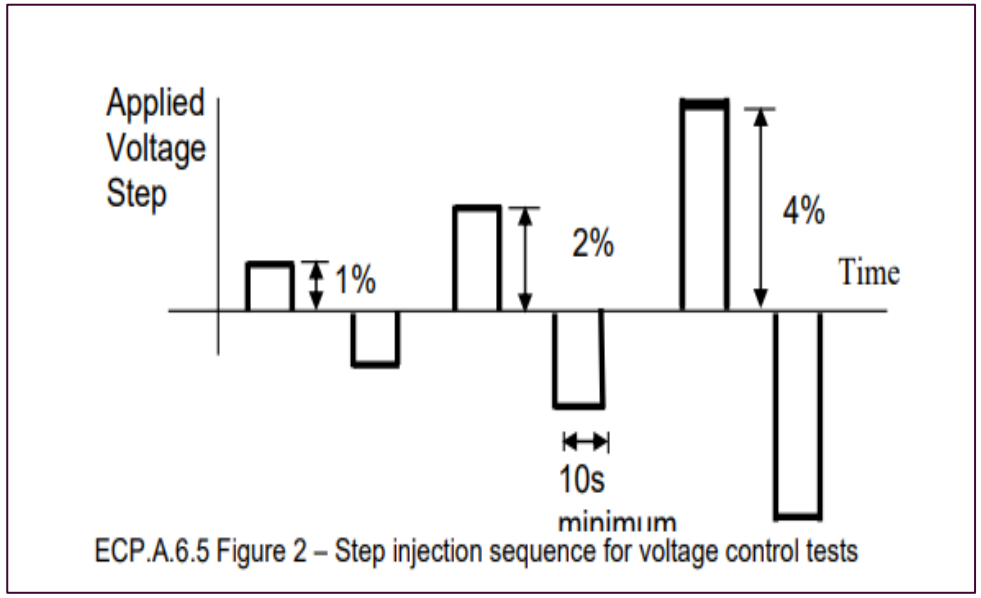
Each template file contains two tabs:

- Raw Test Data Tab: For recording the raw test data and signals captured during the test,
- Log Sheet Tab: For documenting the signals recorded at the start of each individual test,

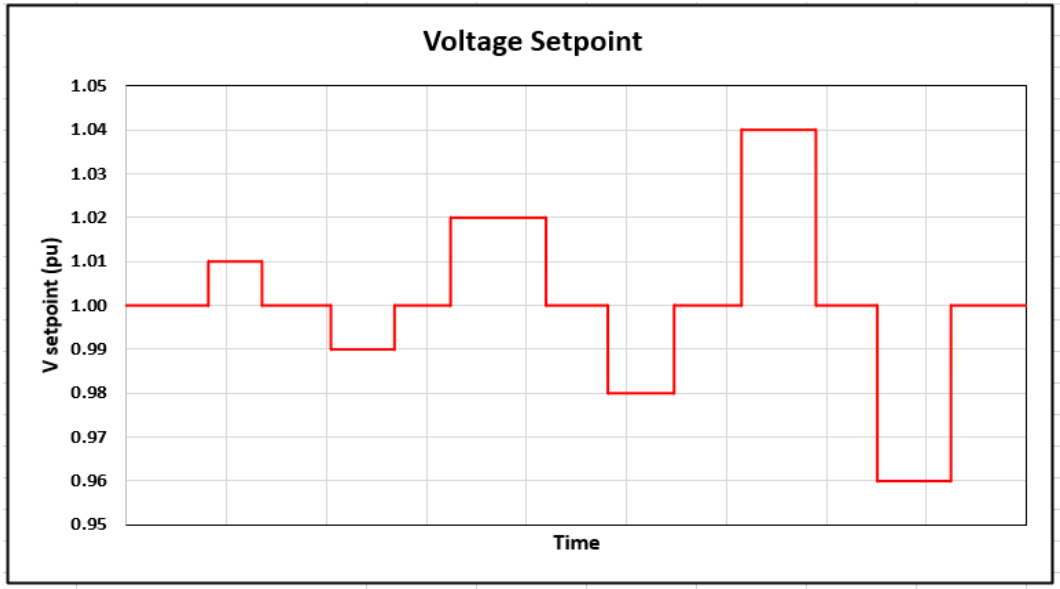
Format of the raw data files submission:

Voltage step tests:

The voltage test results must be submitted in **a single Excel worksheet**, containing all tests in sequence (+1%, -1%, +2%, -2%, +4%, -4%) as shown in the figures below. For BESS, a separate file should be provided for each mode of operation (export, import).



ECP.A.6.5 Figure 2 – Step injection sequence for voltage control tests



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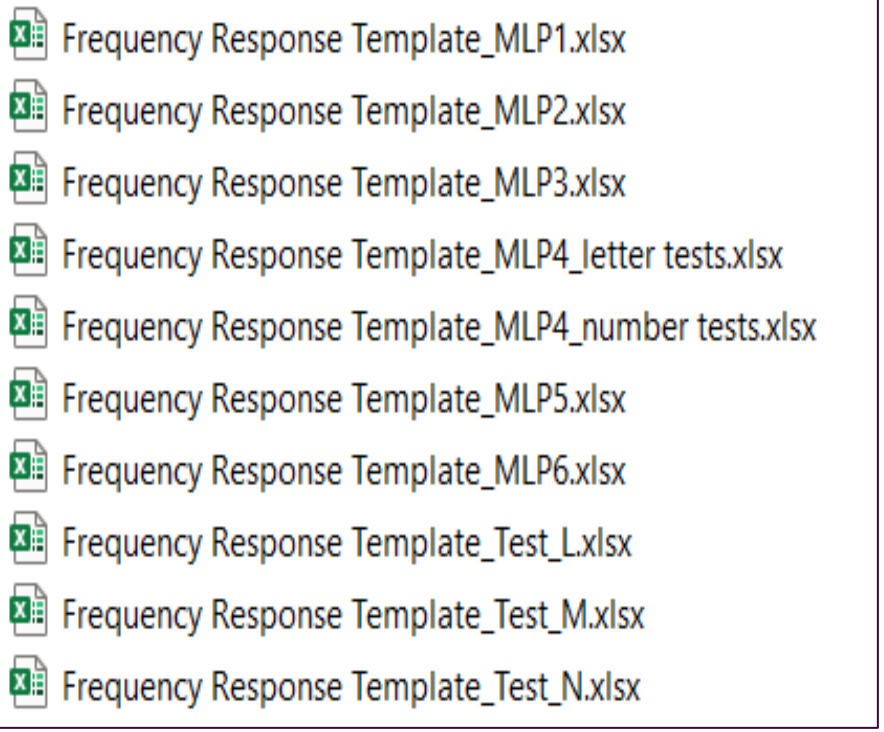
Format of the raw data files submission:

Frequency tests:

The frequency test results must be submitted such that **all tests under the same MLP are submitted in a single Excel worksheet** (except MLP4 and tests L, M, and N):

1. MLP1 tests = separate Excel file
2. MLP2 tests = separate Excel file
3. MLP3 tests = separate Excel file
4. MLP4 letter tests (except tests M and N) = separate Excel file.
5. MLP4 number tests = separate Excel file.
6. MLP5 tests = separate Excel file
7. MLP6 tests (except test L) = separate Excel file
8. Tests L, M, and N must be submitted each in a separate Excel file.

This results in a total of 10 separate files. For BESS, there will be 20 files in total.



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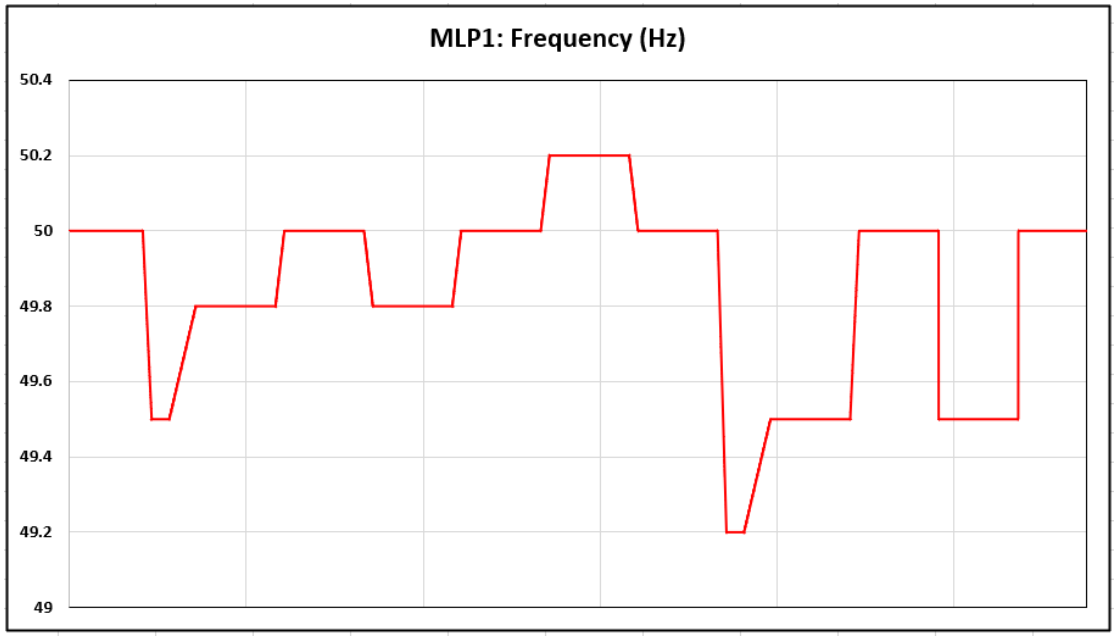
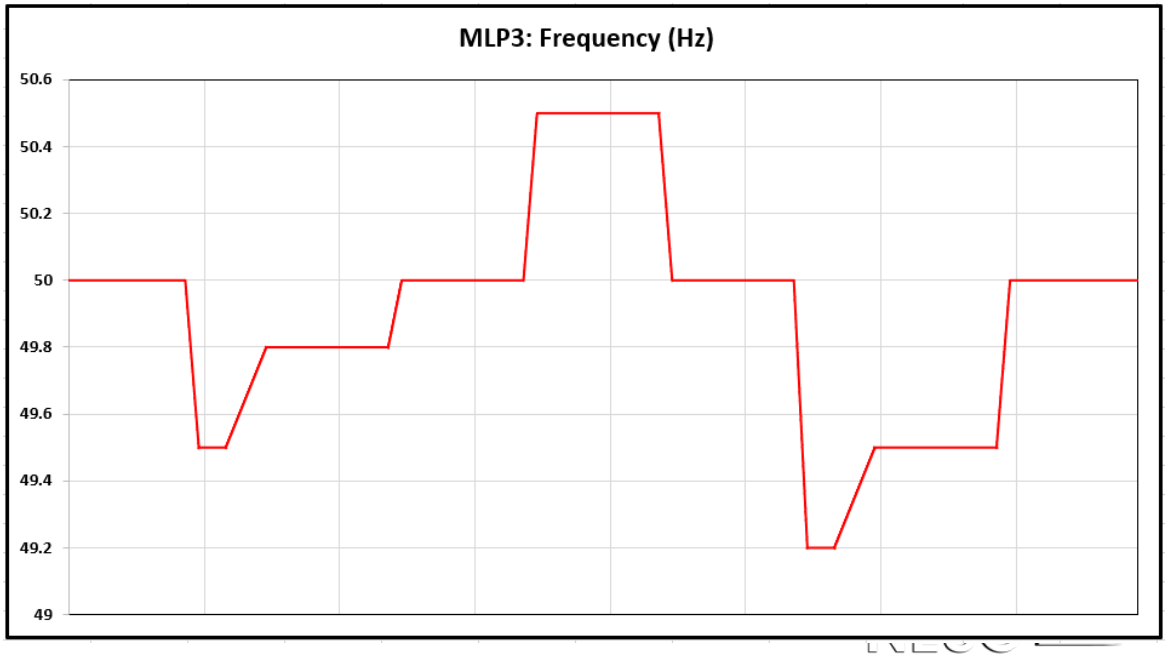
Format of the raw data files submission:

Frequency tests:

Each file must include all tests under the same MLP in sequence, as illustrated in the pictures below:

- The file for MLP1 should contain tests (23-24-25-26-K) in sequence.
- The file for MLP3 should include tests (15-16-17) in sequence.





Format of the raw data files submission:

Reactive Capability tests:

All the reactive capability test results must be submitted **in a single Excel worksheet**, containing all tests in sequence and with the same order described in **ECP.A.6.4.5** even for electricity storage modules.

De-load function tests:

The de-load function test results must be submitted **each in a separate Excel file** as follows:

1. Test 1: 49Hz, 100% import = separate file.
2. Test 2: 49Hz, 40% import = separate file.
3. Test 3: 48.8Hz, 100% import = separate file.
4. Test 4: 48.8Hz, 40% import = separate file.