

GCDF – FREQUENCY COMPLIANCE TEST

95% WTG availability test requirement vs. 70% compliance test

Compliance Tests for Offshore Wind Farm for FON issue

- 20% compliance test
 - Unwitnessed tests to assess dynamic voltage control capability of the wind farm + OTSDUW assets with less than 20% of wind turbine connected
- 70% compliance test
 - Unwitnessed tests to assess dynamic frequency response of the wind farm with less than 70% of wind turbine connected
- 100% compliance test
 - Mix of witnessed and unwitnessed tests
 - Voltage control scenarios plus frequency response cases plus PQ capability are among the required tests
 - At least 95% of the WTGs must be in service with 65% of active power generated

Pre-100% test frequency response tests

OC5.A.3.6.4

Prior to conducting the full set of tests as per OC5.A.3.6.6, Generators are required to conduct the preliminary set of tests below to confirm the frequency injection method is correct and the plant control performance is within expectation. The test numbers refer to Figure 1 below. The test should be conducted when sufficient MW resource is forecasted in order to generate at least 65% of Registered Capacity of the Power Park Module. The following frequency injections shall be applied when operating at module load point 4.

However, clause OC5.A.3.6.1 add a further requirement to section OC5.A.3.6.4

*This section describes the procedure for performing frequency response testing on an Power Park Module. These tests should be scheduled at a time where there are **at least 95% of the Power Park Units** within the Power Park Module in service. There should be sufficient MW resource forecasted in order to generate at least 65% of Registered Capacity of the Power Park Module.*

Test No (Figure 1)	Frequency Injection	Notes
8	<ul style="list-style-type: none">Inject - 0.5Hz frequency fall over 10 secHold until conditions stabiliseRemove the injected signal	
14	<ul style="list-style-type: none">Inject +0.5Hz frequency rise over 10 secHold until conditions stabiliseRemove the injected signal	
13	<ul style="list-style-type: none">Inject -0.5Hz frequency fall over 10 secHold for a further 20 secAt 30 sec from the start of the test, Inject a +0.3Hz frequency rise over 30 sec.Hold until conditions stabiliseRemove the injected signal	

Purpose of the frequency response pre-test

Based on DONG Energy discussion with NGET about these pre-test, the following objectives are sought with the requirement for this pre-tests

- Ensure the system is fit-for-purpose and the frequency response system of the wind farm can operate correctly*
- As the pre-test is unwitnessed, a positive outcome of the test will show that the system is ready to perform the 100% tests
- Avoid to arrange the further witnessed 100% tests with a system not operating correctly and so avoid NGET to be onsite for a system not ready to be tested

* DE Note: This must refer to its functionality, as the overall 100% tests cover the full compliance capability

DONG Energy experience and concerns

- In previous case, DONG Energy has performed this pre-test as part of the 70% tests (Frequency response tests) and this has never caused any issue, as the functionality was tested and nothing changed between having less than 70% of the WTGs in service or more than 95% of them
- DONG Energy do not see any advantage in waiting for 95% of WTGs in service to perform this test, as the functionality of the frequency response does not change between 70% and 100% of installed WTGs. Only the amount of MW that can be provided, but this is the objective of the 100% to test
- Achieving 95% of the WTGs in service is not so straightforward in the first year after commissioning, so it is DONG Energy preference to use the first opportunity with 95% wind (and assuming the generation is above 65%) to perform the 100% tests to avoid delays in the issue of the FON
- DONG Energy do not understand if this clause is a legacy from compliance testing of onshore generators, but believe that having these tests as part of the 70% should provide sufficient confidence to NGET and avoid adding an extra layer of complexity to the overall compliance tests

Example of these tests as performed as part of the 70% tests – Test 8

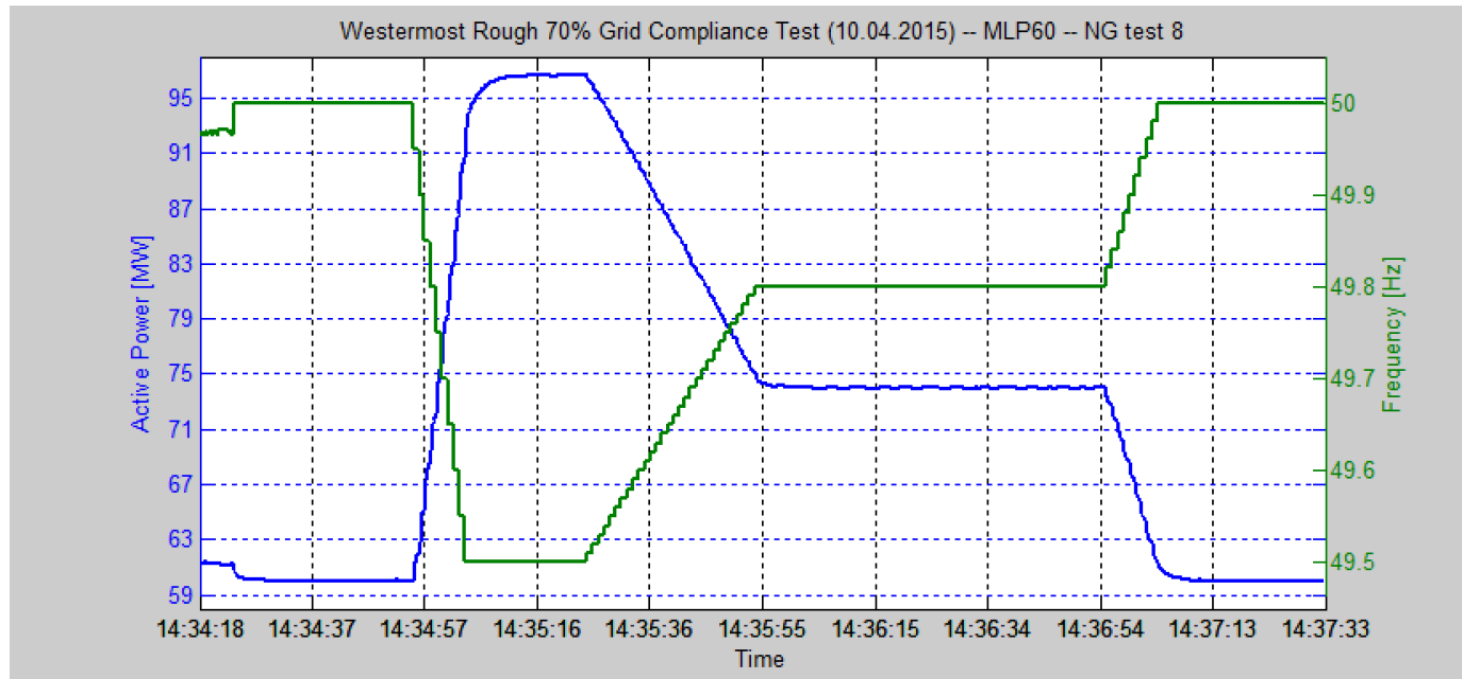


Figure 5 WMR test 8

Example of these tests as performed as part of the 70% tests – Test 13

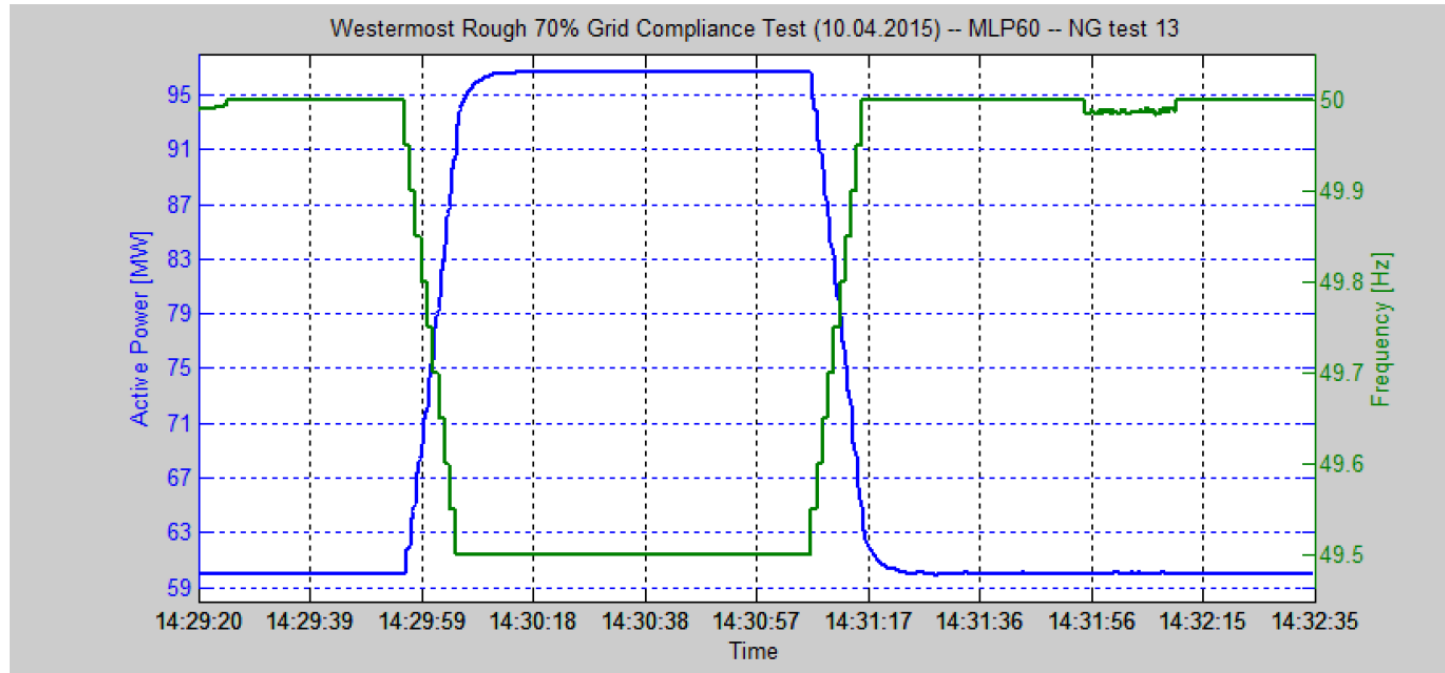


Figure 6 WMR test 13

Example of these tests as performed as part of the 70% tests – Test 14

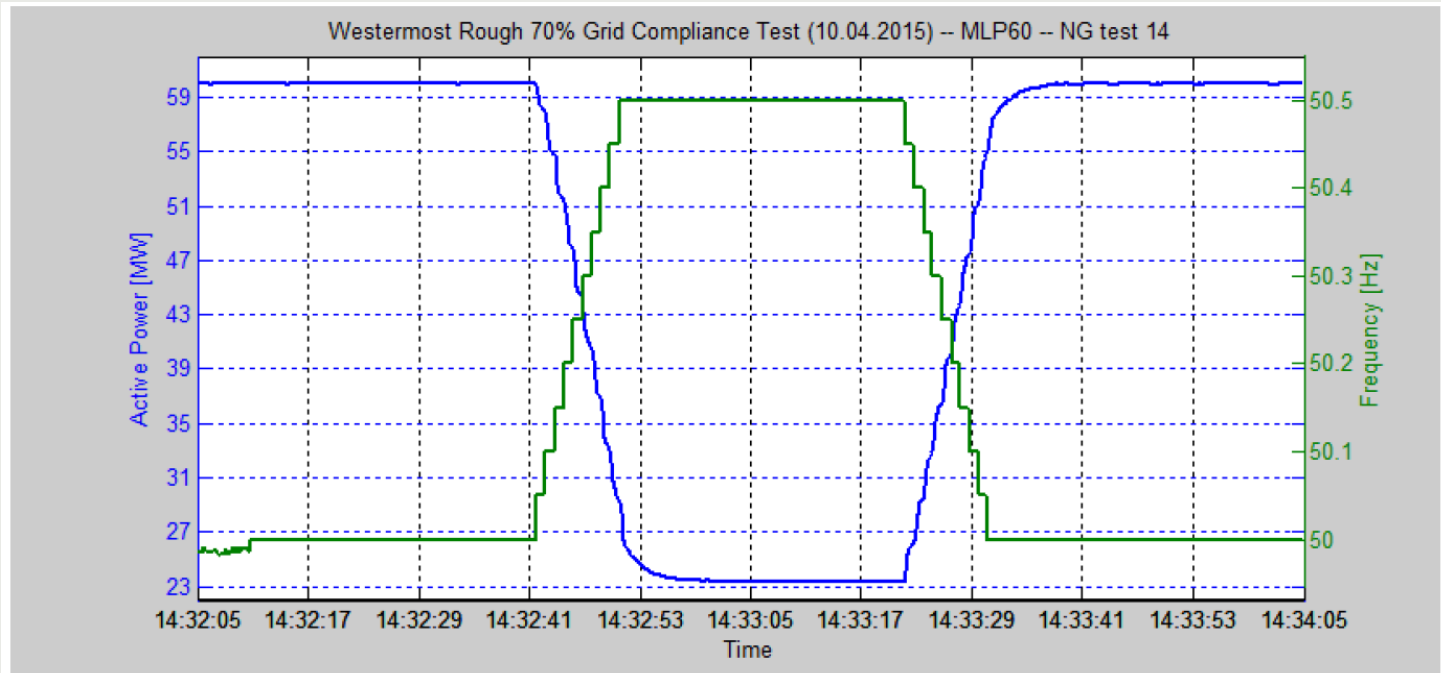
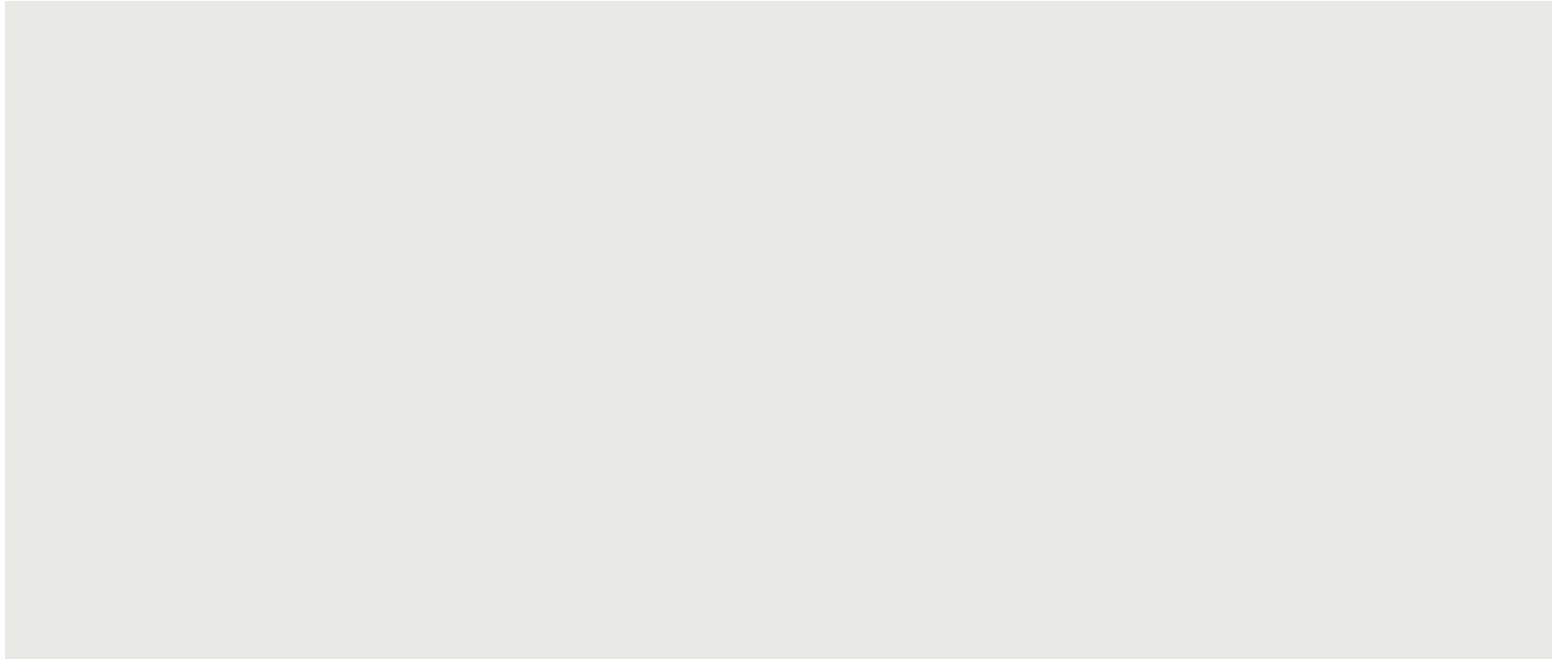


Figure 7 WMR test 14

Backup slides



Backup slides - Test for WMR - Description

4.2 Preliminary frequency test, FSM, MLP – 60MW

The three preliminary test scenarios are required as a prelude to the 100% grid compliance test. The working point of the wind farm is set at 60MW. The FSM dead band is $\pm 0.015\text{Hz}$ around the frequency set point, which is equal to 50Hz. The results of the three tests are shown in Table 4 and further presented in Figure 5, Figure 6, and Figure 7. The calculations are all made for 21 turbines in scope. All the responses correspond to the expected results

Test	Frequency deviation	Calculated response	Calculated result	Expected result	Observed response
60MW – 8	-0.485	36.67	96.67	96.7	96.6
60MW – 8	-0.185	13.99	73.99	74.0	74.0
60MW – 13	-0.485	36.67	96.67	96.7	96.7
60MW – 14	0.485	-36.67	23.33	23.3	23.3

Table 4 “preliminary” test results