Public

Static Firm Frequency Response Guidance

NESO
National Energy System Operator

Contents

Testing Guidance

All assets seeking to pre-qualify as Eligible Assets will be required to pass testing prior to pre-qualification except as provided in the Registration and Pre-Qualification Procedure of the Procurement Rules.

Testing will be the responsibility of the Registered Static FFR Participant and subject as provided below should be undertaken/verified by an Independent Technical Expert (ITE). Testing is required at 1Hz.

NESO will require an ITE approval report as part of any submission of an Eligible Asset (or collection of Eligible Assets as the case may be) for pre-qualification. The report shall be deemed accepted by NESO once submitted. However, should any queries be raised, the Eligible Asset (or collection of Eligible Assets) shall not be capable of being allocated to a Static FFR Unit for participation in the daily auctions until any queries have been satisfied.

Testing shall also be required before the Registered Quantity of an existing Eligible Asset (or collection of Eligible Assets) can be increased.

All example graphs in this document are for illustrative purposes only.

Static FFR Test Requirements

The non-dynamic low frequency test is designed to assess the capability of the Registered Static FFR Participant to deliver Static FFR from the relevant Eligible Asset (or collection of Eligible Assets) as described above.

The frequency profile can be injected either at site or remotely to the device that will be measuring frequency to trigger a response. The minimum sample rate for the Test is 1Hz.

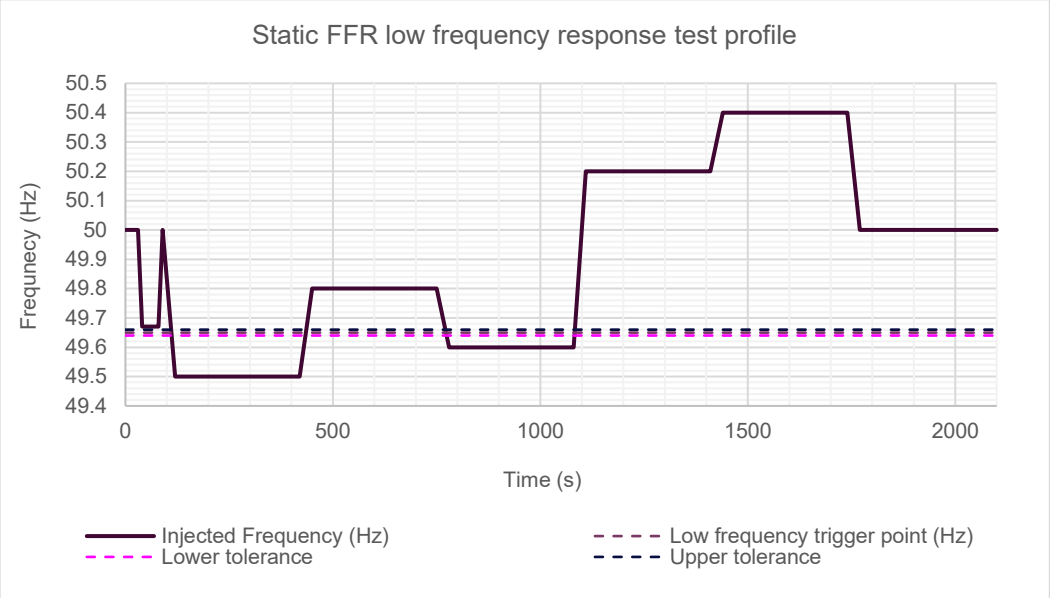
The limits of error and minimum sample rates for testing are shown below for Static FFR. All success criteria are subject to the stated limit of error/accuracy threshold.

Limits of error and minimum sample rates for Static FFR Testing

	Limit of error/ Accuracy threshold	Minimum Sample rate
Frequency (Hz)	±0.01 Hz	1Hz
Active Power (MW)	Please see pass criteria	1Hz

The injected frequency profile used in testing is shown below and where the trigger frequency is 49.65Hz. Testing is to be completed at the prevailing trigger level (as detailed in the Procurement Rules defined terms) at the time of registration. The trigger level may be updated by NESO from time to time, meaning assets must have the capability to alter the trigger frequency on each eligible asset.

Frequency Injection Profile for Low Frequency Static FFR Testing



Time (s)	Injected Frequency (Hz)
0	50
30	50
40	49.67
80	49.67
90	50
120	49.5
420	49.5
450	49.8
750	49.8
780	49.6
1080	49.6
1110	50.2
1410	50.2
1440	50.4
1740	50.4
1770	50
2010	50
2100	50

The initial frequency dip to 49.67Hz aims to prove that the relay will not activate (hence no response) if the frequency drops to just above 49.65Hz. During the sweep from 50Hz to 49.5Hz, the Relay should trigger at 49.65Hz (±0.01Hz). Once the Relay has triggered, full response should be reached within 30 seconds and be sustained for a further 1770 seconds (30 minutes after relay trigger) regardless of the varying frequency injection.

Pass Criteria for Static FFR Test

- An acceptable frequency injection profile is used (See above).
- The Relay (or equivalent) activates at the correct contracted trigger frequency and within the permitted tolerance (±0.01Hz).
- Sustain the response for the 30 minutes. Response volume is assessed as the minimum response observed from 30 seconds to 30 minutes following relay trigger.

- The standard deviation of active power error over a 30-minute period must not exceed 2.5% of the contracted active power change. (Standard deviation is calculated from 30 seconds to 30 minutes following relay trigger).

Aggregation

The options for the live test are as follows.

1. A single asset capable of meeting the Static FFR service specification on its own.
2. A collection of 'new' assets capable of meeting the Static FFR service specification can be tested simultaneously. These could then contract as a standalone Response Unit or be added to an existing Response Unit.

Where the Eligible Asset being tested is made up of more than one item of Plant and Apparatus, the test described above can be carried out as follows.

1. Each item of Plant and Apparatus is asset tested and assessed separately with the minimum test volume being added to the Eligible Asset. This approach can also be used when adding new items of Plant and Apparatus to an existing Eligible Asset.
2. Test carried out on each item of Plant and Apparatus is time stamped then results aggregated for assessment.
3. Test all item of Plant and Apparatus within the Eligible Asset simultaneously.

Independent Technical Expert: Definitions

Test results for Static FFR will be assessed by an Independent Technical Expert (ITE) who will prepare a Test Certificate (Test Certificate template can be found in Appendix 1).

The following definitions shall apply:

Group means, for any person, another person who is the direct or indirect Holding Company of that person and any Subsidiary of that Holding Company.

Holding Company means, in relation to a company, any other company in respect of which it is a Subsidiary.

Independent Technical Expert means an experienced technical expert with expertise in the operation of demand side Static FFR (DSR) or generating units or electricity interconnectors (as the case may be), Independent of the prospective Service Provider, engaged by the prospective Service Provider at its expense to carry out a technical assessment and prepare a Test Certificate.

Independent means, for any technical expert and the applicable prospective Service Provider, that the technical expert is:

(a) not in the same Group as the prospective Service Provider; and

(b) neither engaged on terms, nor party to any other arrangements, which could allow the prospective Service Provider or any member of its Group to exercise undue influence on any assessment of the Test Certificate prepared by that technical expert or otherwise compromise the objectivity of any such assessment and test certificate to the Required Technical Standard.

Required Technical Standard means, with respect to any assessment and Test Certificate prepared by an Independent Technical Expert that:

(a) to the best of the Independent Technical Expert's knowledge and belief all information provided in it is accurate, complete and not misleading; and

(b) any opinions or forecasts in the assessment have been conservatively prepared on assumptions which it considers to be fair and reasonable.

Subsidiary means a subsidiary within the meaning of section 1159 of the Companies Act 2006 (but relation to an Interconnector, or shareholder in such provider, subsection (1)(a) of that section shall apply as if a "majority of the voting rights" included 50% only of those rights)

Test Certificate means a certificate in the relevant form set out in Appendix 1 prepared by an Independent Technical Expert.

Declaration of availability/unavailability

1. As soon as feasibly possible after becoming aware of inability to deliver the Static FFR service (in whole or in part), the service provider should notify the ENCC via telephone call to ensure they are aware of unavailability and necessary actions can be taken to procure additional response where needed. Following the telephone call with ENCC this declaration should be followed up with an email to commercial.operation@neso.energy
2. As prescribed in the Service Terms should a provider wish to transfer this obligation to another eligible asset due to unavailability, the provider should discuss this with their account manager. The account manager will be able to communicate to the provider whether the request to transfer the obligation to another eligible asset has been approved or rejected.

Performance monitoring data

The requirement for performance monitoring data is detailed in 15.8 of the Service Terms. This dictates providers to submit timestamped data for Active Power and Frequency at 1 Hz granularity for each Static FFR unit.

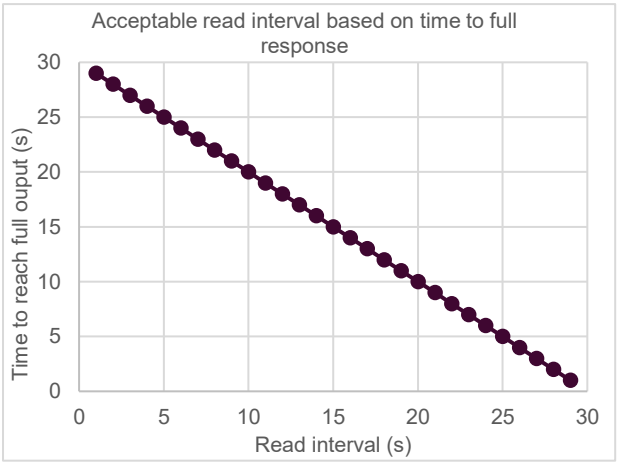
Active power

For units that are wishing to aggregate assets that don't currently meet the minimum unit threshold, providers can utilise sites that they are unable to get measurements at 1Hz granularity if they please.

As the service and testing process require Eligible Assets to respond within 30 seconds of a frequency trigger, measurements from assets must be at a more regular frequency than this. Providers are allowed to use their own discretion around the read frequency that is adequate to show delivery of a service from an eligible asset. This will be driven by how quickly assets are able to achieve full output following a frequency trigger.

Example 1 – If an asset takes up to 15 seconds to achieve full response following a frequency trigger, that asset will have to record measurements at a more regular occurrence than 15 seconds to be considered for an aggregated Static FFR unit

Example 2 – If an asset takes up to 25 seconds to respond to achieve full response following a frequency trigger, that asset will have to record measurements at a more regular occurrence than 5 seconds to take part in the service.



The required measurement frequency is therefore bound by the maximum time an asset could achieve full response following a frequency trigger. This needs to be maintained for all performance metering data, including those submitted for availability checks. It is expected that providers will be aggregating similar asset types that will therefore have comparable asset capacities, response times and measurement intervals. It is also assumed that assets not measuring every second will measure at set time interval that are uniformly distributed across the assets being aggregated e.g. If a unit contains 100 assets, all measuring at 5 second read frequency, NESO expects 20 assets each second to be recording new measurements into the aggregation.

All performance monitoring checks will be conducted on unit level data, which will be provided at 1 Hz granularity. The process for measuring performance remains

unchanged, meaning the onus is on providers to ensure they can prove they have delivered the service through measured data at each site. The service terms provide for NESO to inspect measurement equipment/data on site at an Eligible Asset participating in Static FFR auction, which includes accessing data for each Eligible Asset that was used to create the data for an aggregated Static FFR unit.

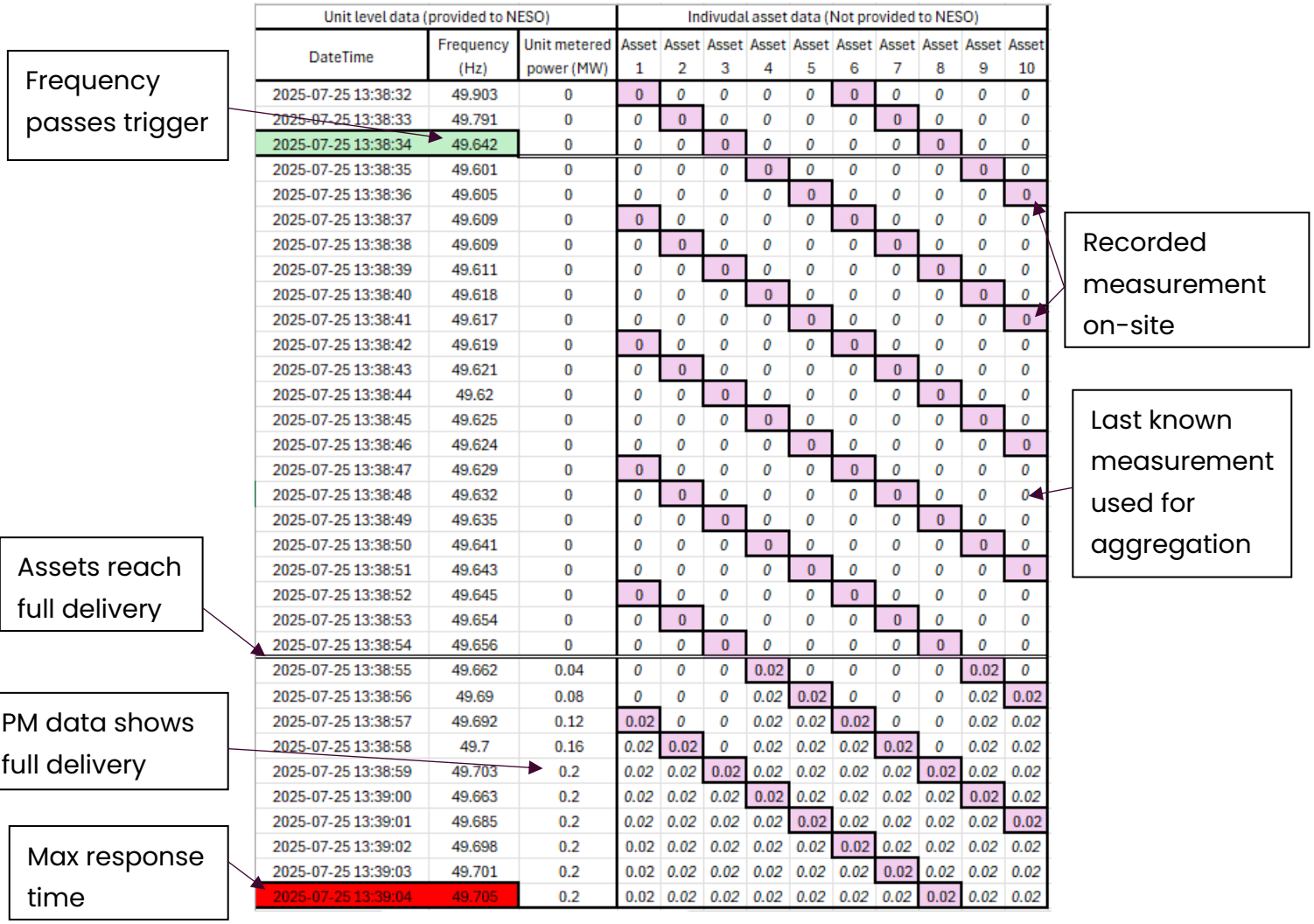
Worked example

Below is an example of how this requirement works in practice.

- Unit size – 200 kW (0.2 MW)
- Asset sizes – 20 kW (0.02 MW)
- Time to full response – 20 seconds
- Measurement interval – 5 seconds

We know from the data above that by 20 seconds after the frequency trigger, the unit will be delivering the full 0.2 MW. However, as the data isn't being recorded each second, this is only confirmed by the performance monitoring data 25 seconds after the trigger.

When aggregating measurements to provide a 1 Hz performance monitoring feed, providers should use the latest measurement taken from a site until a new active measurement is recorded.



Unit level data (provided to NESO)			Indivudal asset data (Not provided to NESO)									
DateTime	Frequency (Hz)	Unit metered power (MW)	Asset 1	Asset 2	Asset 3	Asset 4	Asset 5	Asset 6	Asset 7	Asset 8	Asset 9	Asset 10
2025-07-25 13:38:32	49.903	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:33	49.791	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:34	49.642	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:35	49.601	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:36	49.605	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:37	49.609	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:38	49.609	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:39	49.611	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:40	49.618	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:41	49.617	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:42	49.619	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:43	49.621	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:44	49.62	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:45	49.625	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:46	49.624	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:47	49.629	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:48	49.632	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:49	49.635	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:50	49.641	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:51	49.643	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:52	49.645	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:53	49.654	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:54	49.656	0	0	0	0	0	0	0	0	0	0	0
2025-07-25 13:38:55	49.662	0.04	0	0	0	0.02	0	0	0	0	0.02	0
2025-07-25 13:38:56	49.69	0.08	0	0	0	0.02	0.02	0	0	0	0.02	0.02
2025-07-25 13:38:57	49.692	0.12	0.02	0	0	0.02	0.02	0.02	0	0	0.02	0.02
2025-07-25 13:38:58	49.7	0.16	0.02	0.02	0	0.02	0.02	0.02	0.02	0	0.02	0.02
2025-07-25 13:38:59	49.703	0.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
2025-07-25 13:39:00	49.663	0.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
2025-07-25 13:39:01	49.685	0.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
2025-07-25 13:39:02	49.698	0.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
2025-07-25 13:39:03	49.701	0.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
2025-07-25 13:39:04	49.705	0.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Frequency measurement

For units that are wishing to aggregate assets that don't currently meet the minimum unit threshold, it is acceptable for an eligible asset which is providing static FFR to be triggered remotely, using a frequency transducer located at some central location to detect frequency deviations in real time and incite a response from the site. Measurement points should be located on or as close to asset locations where possible.

Providers must notify NESO if they are taking this approach and provide the location of their frequency measurement. NESO will be actively monitoring this approach and may take the decision to require on-site frequency measurements and relays should there be any reason to believe delivery is detrimental to system frequency. Providers should

consider any delay introduced in time to get to full delivery if using a centralised approach.

The intention is for the service to transition to locational aggregation, meaning frequency measurement data triggering a response will need to be within the same aggregation zone.

Additional clarifications

3. **Transition periods** – If a unit is transitioning to a Dx response contract, that unit should adhere to any Continuous Transition Period requirements for that new contract. A unit providing Static FFR is required to continue with service delivery into the next EFA block if triggered in the last 30 minutes of their contracted EFA. Providers should adhere to guidance around what their performance baseline should reflect if any delivery of a service impacts the baseline in the next service window.
4. **State of energy** – It is the sole responsibility of providers managing energy limited assets to ensure they can always deliver their contracted capacity during a contracted EFA period.

Appendix 1 – Static FFR Test Certificate Template

Please use this Test Certificate format and submit to NESO, along with the test data and CV of the ITE employed by the prospective response provider.

Prospective Response Provider Company Details

Contracted company name	
Primary contact name	
Contact number/s	
Email address	

Contract Details

Contract ID	
Service type	
Asset type, e.g. diesel generator, battery etc	
Unit make up, e.g. single or aggregated	
Aggregation methodology (if appropriate)	
Unit location / ID	
Test date	

Static Service Details

Contracted MW	
Contracted Response Time	30 seconds
Contracted Duration	30 minutes
Trigger Frequency Setting	

Test Results

Pass Criteria	Pass/Fail	Comment
An acceptable frequency injection profile is used	Pass/fail	

The relay operating point of the plant/unit(s) occurs at the correct contracted trigger frequency and within the permitted tolerance (±0.01 Hz)	Pass/fail	See figure 1 for sample showing close up of the frequency at which relay operates
The response is sustained for 30 minutes	Pass/fail	
The standard deviation of active power error over a 30 minute period does not exceed 2.5% of the contracted active power change	Pass/fail	Insert test SD value here
Response volume is assessed as the minimum response observed from 30 second to 30 minutes following relay trigger	Pass/fail	Can be shown in figure 2 below
Overall Test Result	**Pass/fail**	**Confirm volume validated by test**

Figure 1: Relay Operation (sample, to be replaced with test data. NOTE – example sample below taken from site with a trigger frequency of 49.7Hz)

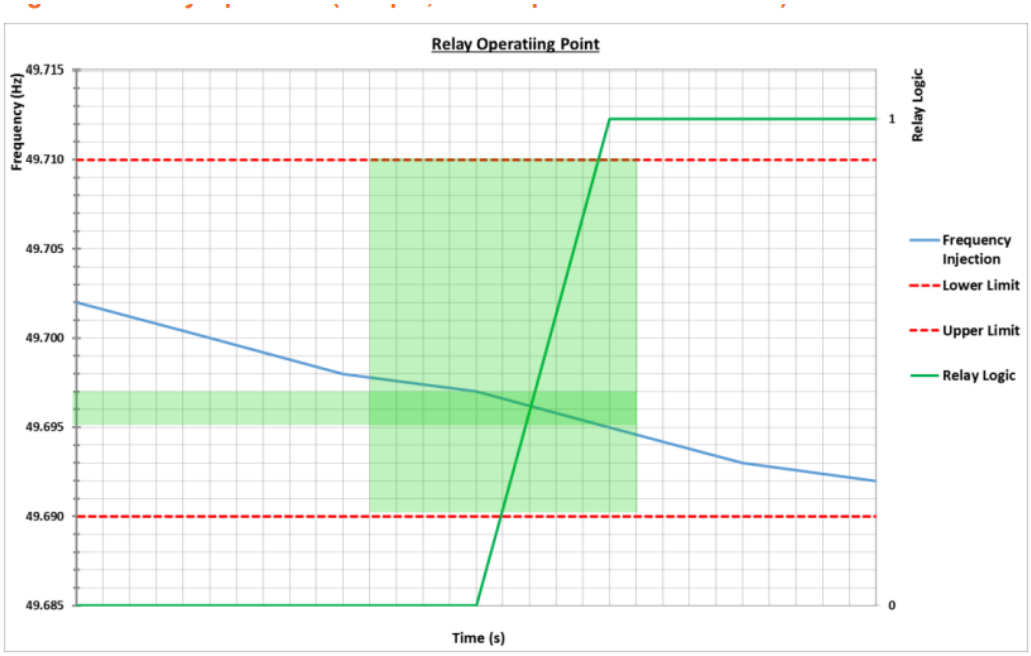
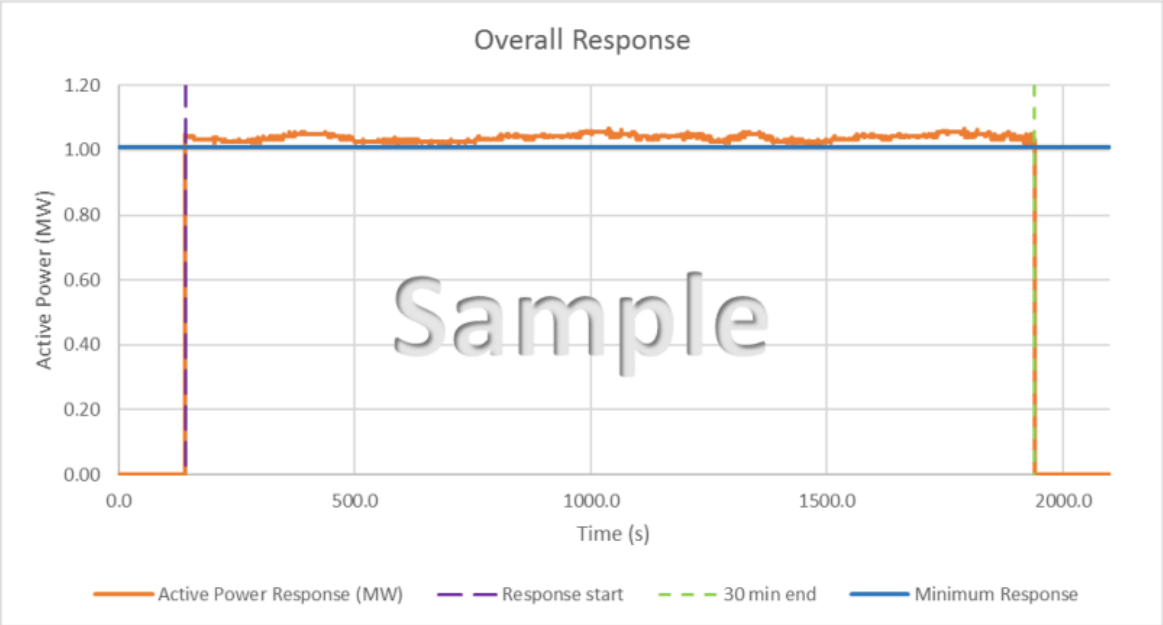


Figure 2: Overall Response (sample, to be replaced with test data)



Independent Technical Expert (ITE) Details

Company Name	
Primary Contact Name	
Contact Number(s)	
Email Address	
I / We confirm that I / We the following: **a. I/We am a/are Independent Technical Expert(s) (as defined in this SFFR Guidance;** **b. I/We have carried out an assessment of the [asset] described above in accordance with the Testing Rules contained this SFFR Guidance ;** **c. the above details are, to my/our best knowledge and belief, true, accurate, complete and not misleading; and** **d. the CV attached of my/our experience is to my/our best knowledge and belief, true, accurate, complete and not misleading.**	
Signed: Date:	