Dynamic Moderation Testing Analysis Tool
User guide v1.0

Date: 10/12/2021

Introduction

This user guide describes how to use the 'Dynamic Moderation Testing Analysis Tool' to assess pre-qualification test results as specified in the Testing Guidelines for providers wishing to enter into a contract to provide Dynamic Moderation Frequency Response. The following sections are included:

- Prepare Test Data
- Populate Excel Analysis Tool
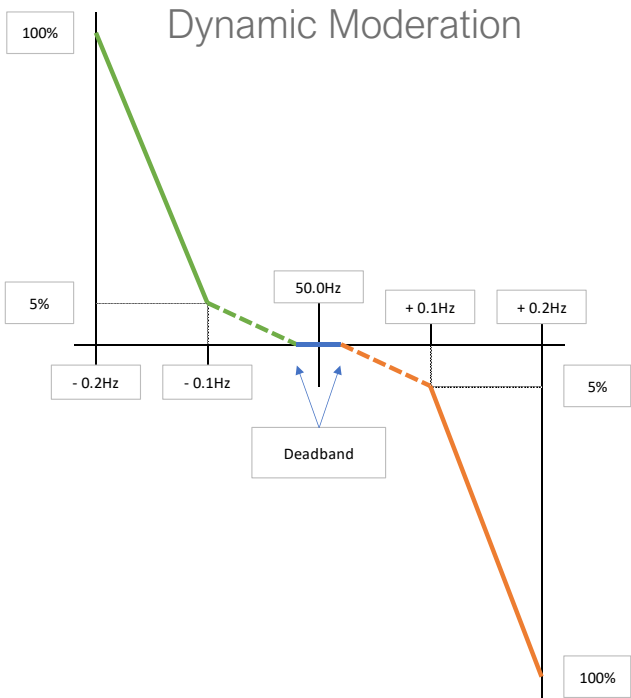- Analyse Results against pass criteria
- Test Report

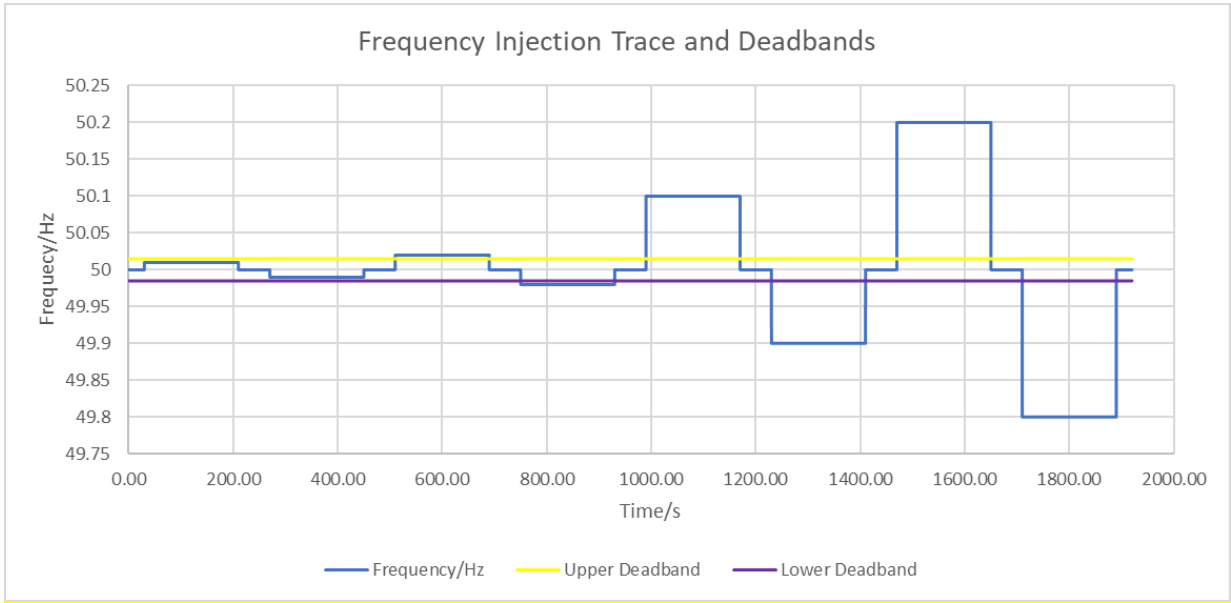| Step	Action	Description	Examples
Prepare Test Data			
1	Format test data to be pasted into Tool.	It is advised to use the tool with values of every 0.05s. Tool has been designed to work for both low and high frequency and the sample tests show it working for both at the same time.	<table><tr><th>Time/s</th><th>Frequency/Hz</th><th>Active Power/MW</th></tr><tr><td>0</td><td>50</td><td>0</td></tr><tr><td>0.05</td><td>50</td><td>0</td></tr><tr><td>0.1</td><td>50</td><td>0</td></tr></table>
2	Overall response values should be copied into the Tool.	The Tool assumes that the response looks like generation i.e. Low frequency = generation increase. High frequency = generation decrease Check response values are +ve or -ve accordingly.	

Step	Action	Description	Examples
Populate Excel Analysis Tool			
3	General	Green cells can be edited. Timings/ranges may need to be altered depending on the injection profile used.	
4	Clear previous test data	In the Test 1 Main, Test 2.1, 2.2, 3.1, 3.2 and Test 4 data tabs, delete the previous data from 'Frequency' and 'Active Power' columns.	
5	**'Test 1 Main'** Input the Contracted response in the green cell under Maximum Contracted Response Check expected response values in the table are as required for the contracted response Input the data for Test 1	Units in this table should be the same as those in the measured test data. Note: High Frequency response values should be negative. 'Actual' response and tolerance values will be automatically populated from Test 1 Results. If testing for only HF/LF then set the other value to 0MW	(see tables below)

Maximum Contracted Response/MW	
High Frequency	100
Low Frequency	100

Time/s	Frequency/Hz	Active Power/MW
0.05	50	0
0.1	50	0
0.15	50	0
0.2	50	0

Step	Action	Description	Examples
6	Check the Frequency Injection looks as expected on the 'frequency injection trace and deadbands graph'		
8	**Test 1.1 – Test 1.12 tabs** Check time used for each test aligns with test data	If the frequency changes occur at times different than the example trace given in the guidance input, this value can be changed under 'when does the frequency step occur' on the tab for each test.	
9	**Test 2.1 and 2.2**	Maximum Contracted response value should have been	

For step 8:

When does the frequency step occur?
2190

For step 9:

Time/s	Frequency/Hz	Active Power/MW
0.05	50	0
0.1	50	0

Step	Action	Description	Examples		
	Enter data in the same way as for Test 1.	carried over from Test 1	0.15	50	0
			0.2	50	0

10	Check the frequency trace graphs appears as expected

Frequency/Hz

11	**Test 3.1 and 3.2** Enter data again for these tests		Time/s	Frequency/Hz	Active Power/MW
			0.05	50	0
			0.1	50	0
			0.15	50	0

	Also input the time when the change in frequency is supposed to occur	When does the frequency step occur?
		30

12	**Test 4** Input data on the	Time/s	Frequency/Hz	Active Power/MW
		0	50.037	-1.294117647

Step	Action	Description	Examples		
	appropriate tab		0.05	50.037	-1.294117647
			0.1	50.035	-1.176470588
			0.15	50.035	-1.176470588
			0.2	50.035	-1.176470588

Analyse Results against pass criteria.

13	**Test 1** Check the active power fall within limits	Orange line should remain within the black and light blue lines at the peaks and troughs.	

Active Power and Limits

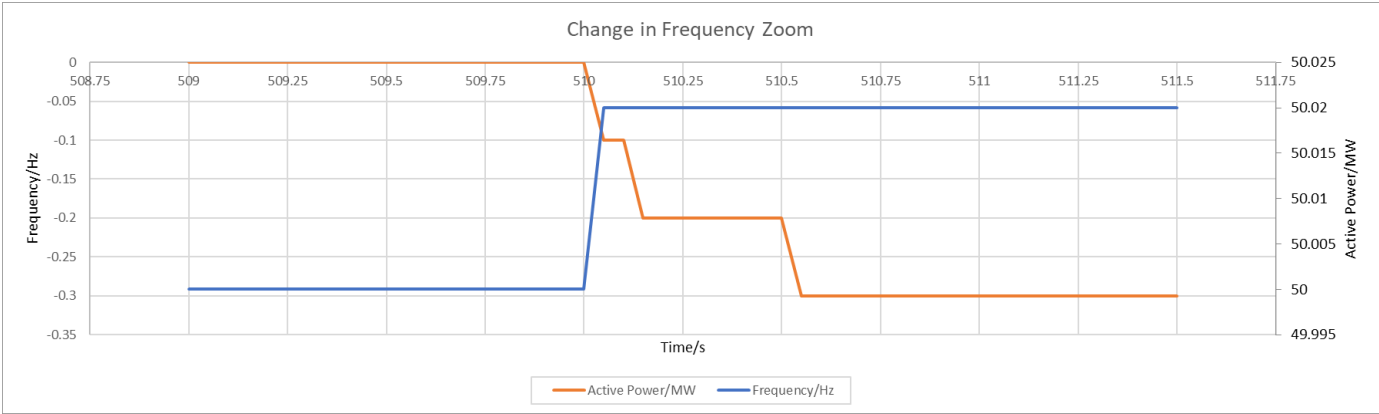Upper active power limit — Lower Active Power Limit — Active Power/MW
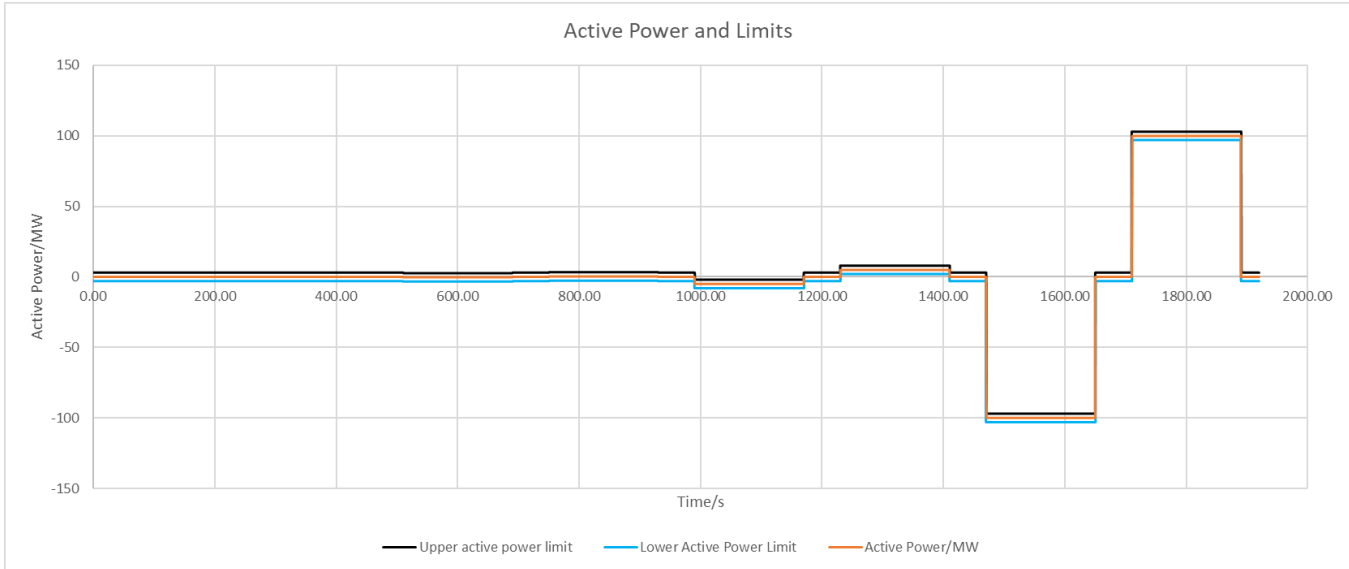
Step	Action	Description	Examples
	For Tests 1.1 & 1.2 where there are any non-zero values these need to be explained by the ITE in the test report using the comments field.		
15	For Test 1.3-1.4, check there is a noticeable change in power in the correct direction		
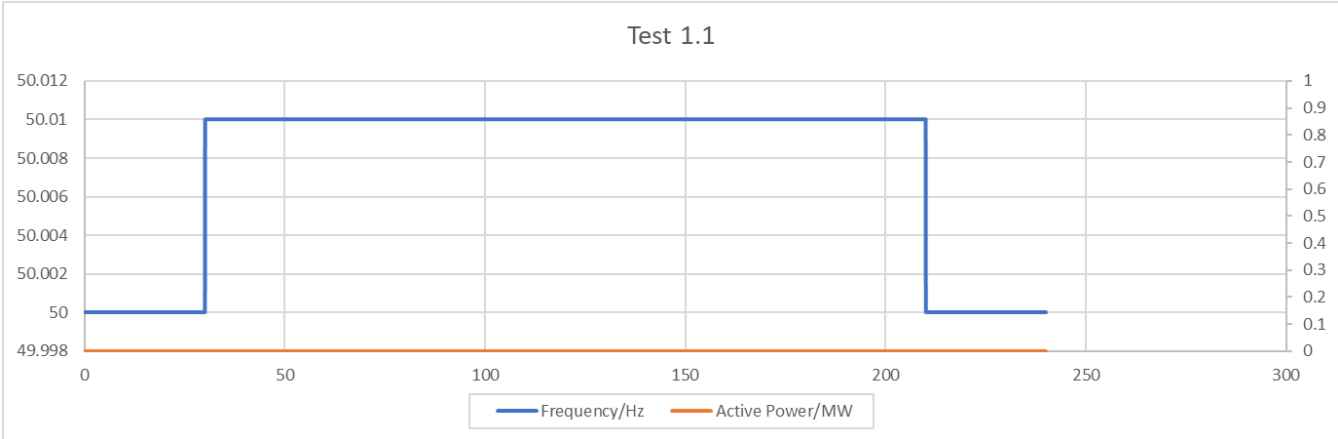
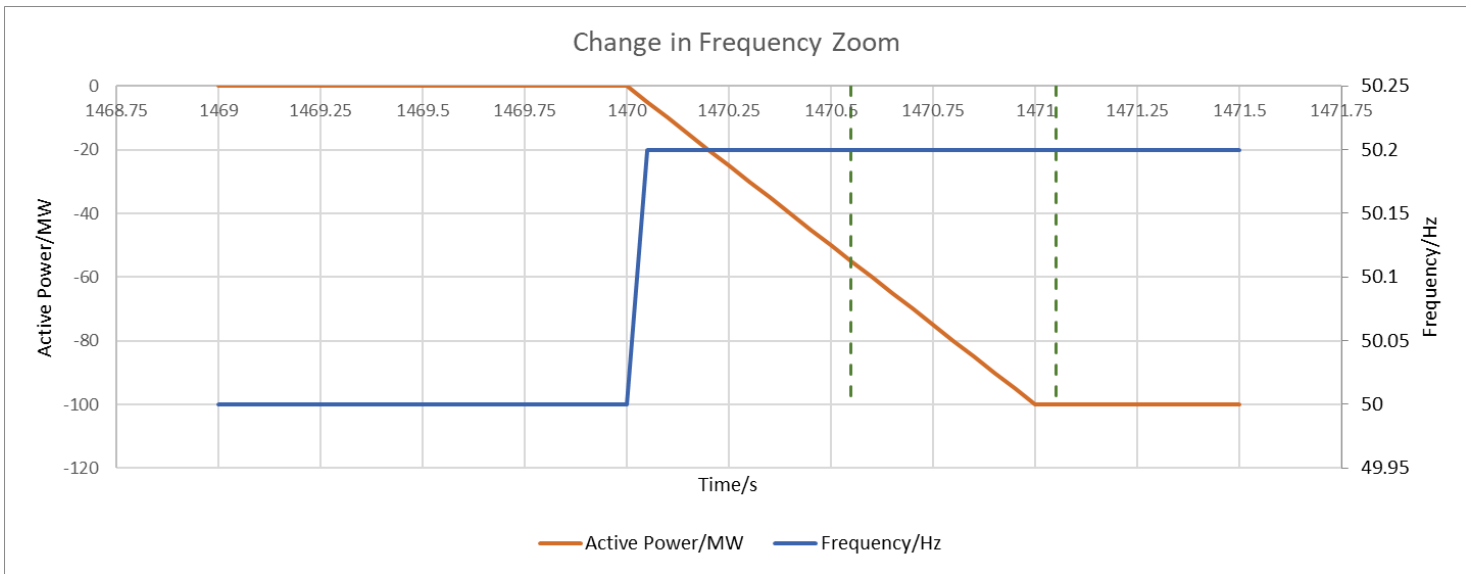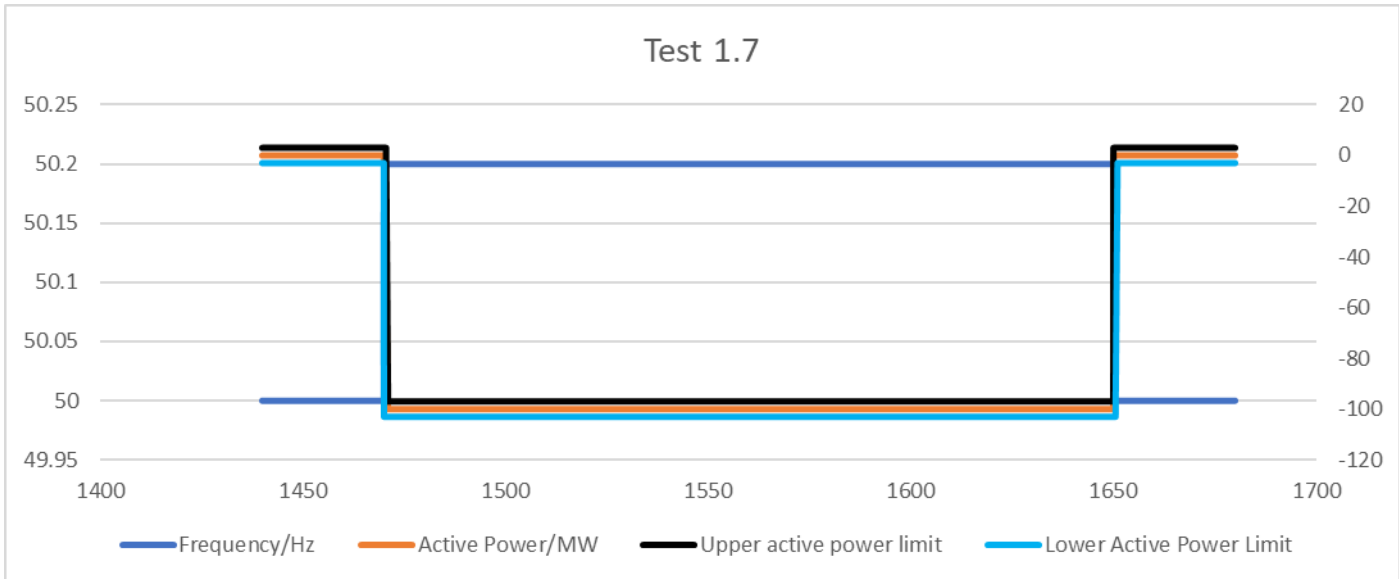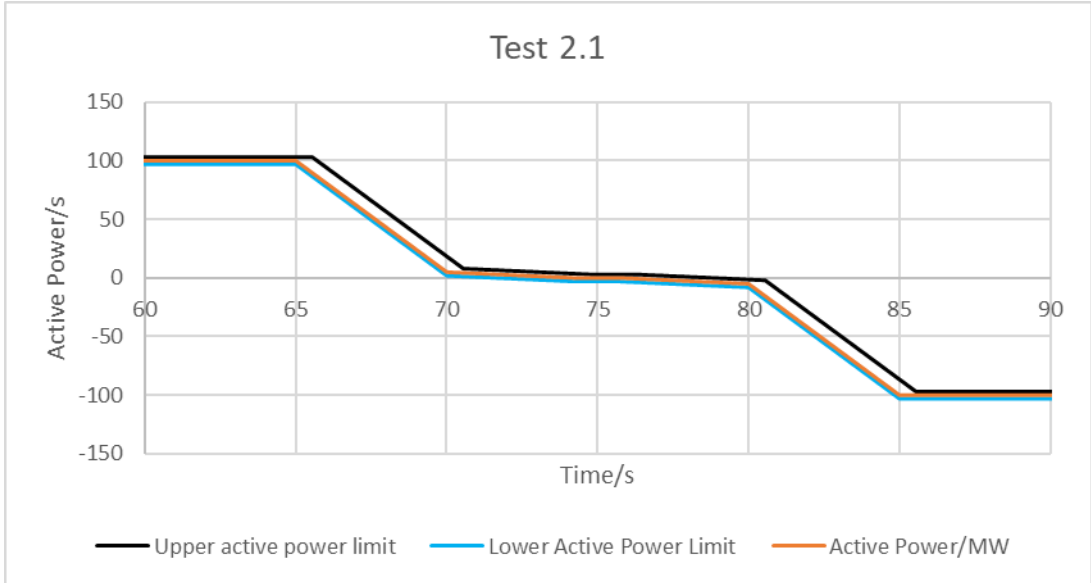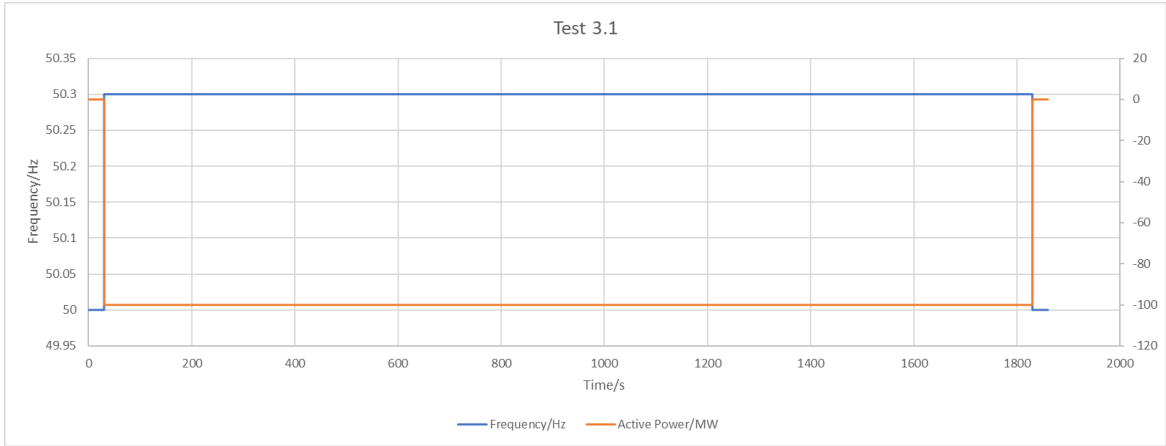| Step	Action	Description	Examples
16	By going through Tabs for Test 1.5-1.8, check the active power response is within the tolerance for each step graphically Check that for each of Test 1.5-1.8 a response to a change in frequency occurs before t=0.55s and the maximum response for each step is reached in the required timescale. Check that this response monotonically progresses	Where there is an initial overshoot outside the tolerance, then the ITE can address this in the report. Dotted green lines are added automatically at t=0.55 and at the required timescale for each step. A change in frequency should start to occur before the first green dotted line and should reach the required Active Power Response by the second line .	

Step	Action	Description	Examples
17	**Test 2.1 and Test 2.2** Check the active power response stays within limits during the test and reaches the maximum response where required.	Orange line should remain within black and light blue lines.	Test 2.1 graph Active Power/s vs Time/s Legend: Upper active power limit, Lower Active Power Limit, Active Power/MW
19	**Test 3.1 and 3.2** Check on graphs that response is sustained for 15 minutes (900 seconds)		Test 3.1 graph Frequency/Hz vs Time/s Legend: Frequency/Hz, Active Power/MW
20	Check the standard deviation is <2.5% of the		Standard Deviation 0

Step	Action	Description	Examples
		expected active power	
21	**Test 4**	Check the active power response is consistent with the expected active power.	
		In most cases, the frequency will remain within the range 49.9Hz-50.1Hz for Test 4. In the second Test 4 graph, the frequency axis is set to this range and reversed.	
		The Active Power axis should be adjusted to ±5% of contracted power. This should 'overlay' frequency and active power as shown so that any inconsistencies can be easily observed.	

Test Report
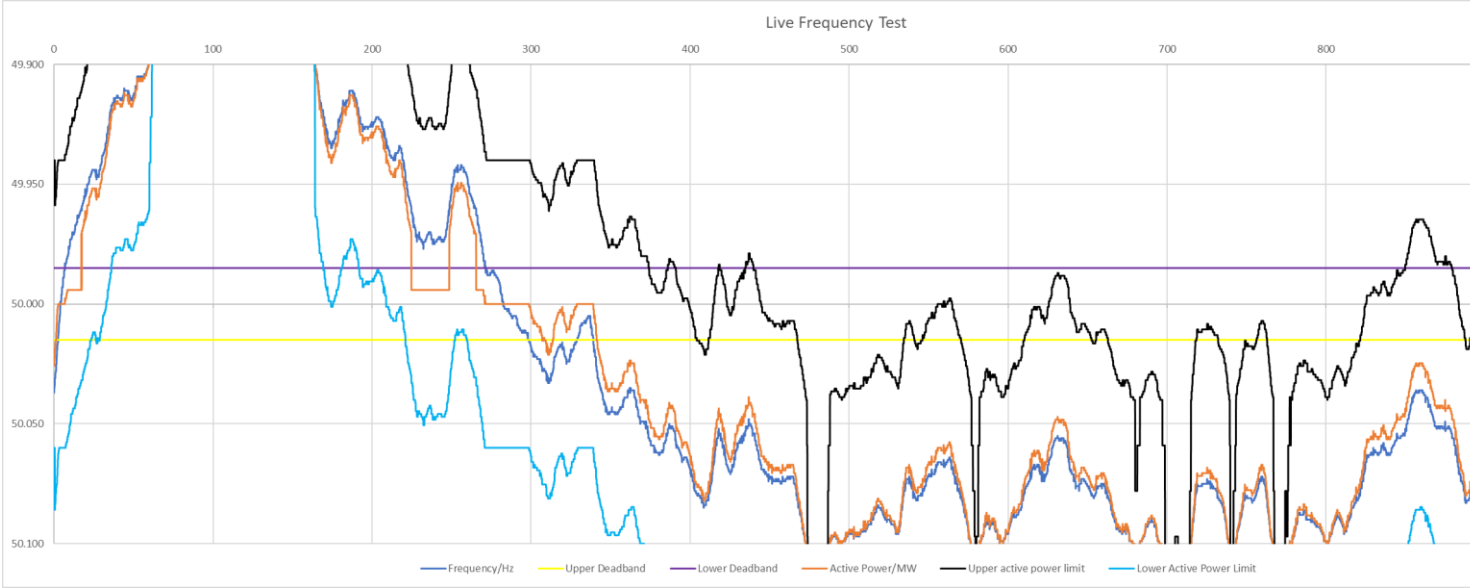
Step	Action	Description	Examples
22	Write report giving feedback on test results.	See report template	Testing Guidance Appendix E