electricity north west

Bringing energy to your door

Configuration of NMS and installation/ commissioning of Fault Level Assessment Tool software

30 September 2016

RESPOND

CONTENTS

VERSION HISTORY

Version	Date	Author	Status	Comments
V1.0	27 September 2016	K. Bailey	Final	

APPROVAL

Name	Role	Date
Kieran Bailey (Author)	Future Networks Engineer	27/09/16
Steve Stott (Reviewer)	Lead Innovation Delivery Engineer	28/09/16
Paul Marshall (Reviewer)	Innovation Project Delivery Manager	28/09/16
Paul Turner (Approver)	Innovation Delivery Manager	 29/09/16

GLOSSARY OF TERMS

Abbreviation	Description
ADMS	Advanced Distribution Management System
AP	Adaptive Protection
CB	Circuit Breaker
CFS	Core Function Service
CRMS	Control Room Monitoring System
DMD	Dynamic Mimic Diagram
DMS	Distribution Management System
DNO	Distribution Network Operator
FAT	Factory Acceptance Testing
FCLS	Fault Current Limiting Service
FLAT	Fault Level Assessment Tool
FSA	Functional Spares Assembly
ICCP	Inter Control Communications Protocol
LCNF	Low Carbon Network Fund
NDS	Network Dynamic Service
MTS	Model Topology Service
NMS	Network Management System
NMS	Network Management System
Ofgem	Office of Gas and Electricity Markets
RTU	Remote Terminal Unit
SAT	Site Acceptance Testing
SDRC	Successful Delivery Reward Criteria
UI	User Interface

1 EXECUTIVE SUMMARY

The Ofgem project direction outlines certain successful delivery reward criteria (SDRC), against which the success of the Respond project will be assessed. For each criterion, the project direction defines the evidence that is required to demonstrate successful delivery.

There are five discrete SDRC evidence required for the technology build workstream of the Respond project (as listed below):

- Brief and train Electricity North West operational teams, including planning engineers, on fault level mitigation management protocols by April 2016
- Publish equipment specifications and installation reports for the Adaptive Protection and the I_S-limiter by September 2016 and the FCL service by April 2018
- ***Publish NMS interface and configuration specifications and commissioning reports by September 2016***
- Publish report on validation of the Fault Level Assessment Tool by November 2016
- Publish updated fault level management, planning, design, protection settings and operation and maintenance policies by June 2018.

This report describes the methodology for the commissioning of the network management system (NMS) Fault Level Assessment Tool (FLAT).

2 INTRODUCTION

The Respond project is funded via Ofgem's Second Tier Low Carbon Networks Fund (LCN Fund). Electricity North West received confirmation that the application for funding was successful on the 24 November 2014. The project is due to be completed by 31 October 2018.

Respond aims to demonstrate the use of near real time fault level assessment and adaptive mitigation techniques to overcome the fault level challenges faced by all DNOs at much lower cost and offering much quicker installation timescales. Our approach is to take advantage of the normal fault level fluctuations coupled with targeted fault level mitigation equipment

As this approach could maximise the use of existing assets and minimise the need for capital investment, Respond has the potential to realise significant cost savings to customers and increase the connection of generation to the network. There are four key elements to Respond:

- **Fault Level Assessment Tool (FLAT):** This intelligent software is deployed alongside the network management system (NMS) and uses data from it to estimate the network's fault level in near real time. When the fault level increases beyond a set threshold it will initiate one of three mitigation techniques:
- **Adaptive Protection:** This technique re-sequences the operation of circuit breakers (CBs) and is retro-fitted into existing substation equipment
- **Fault Current Limiting (FCL) service:** This will identify customers who operate equipment that contributes to fault current (eg large motors and generators) and are willing to help develop and ultimately enter into a managed commercial service backed by new technical interfaces with their equipment
- **I_S-limiters:** These devices are widely used across the world to limit fault current, but are not used on GB DNO networks due to compliance issues with GB regulations. Two devices are installed, along with a further five installations of sensing-only equipment.

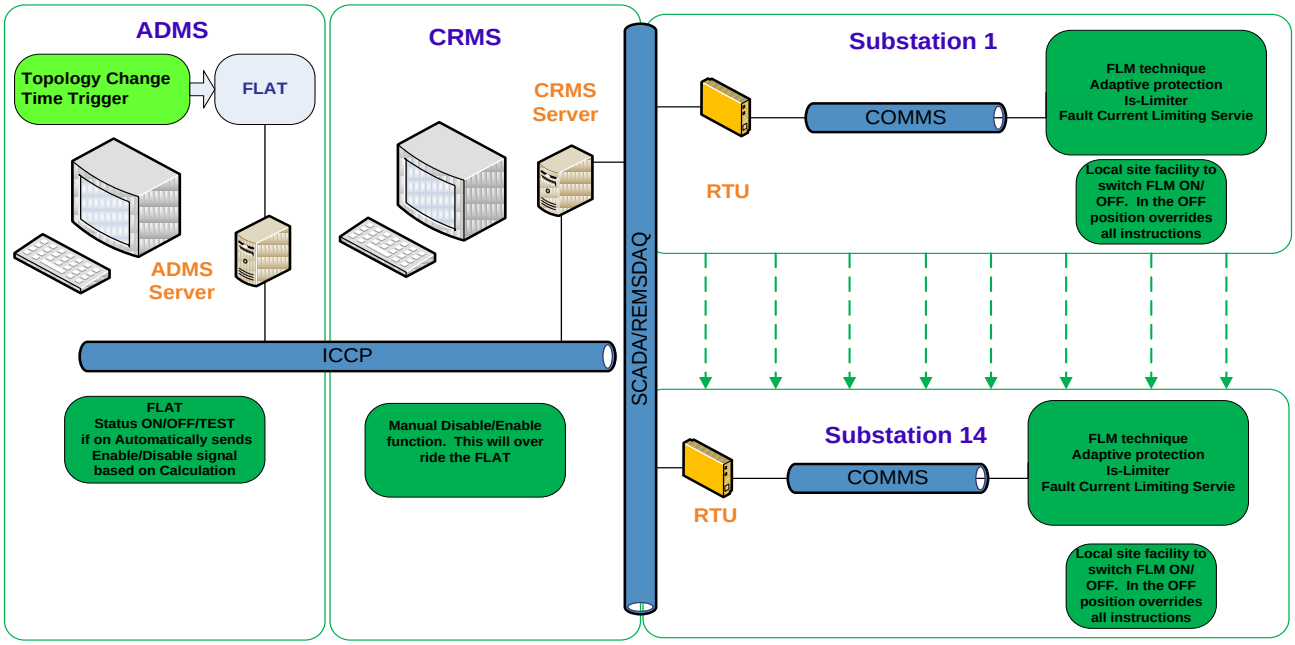
This report describes the overall system functionality and provides the full factory acceptance testing (FAT) and site acceptance testing (SAT) schedules that were carried out to commission and configure the FLAT. This report does not include the onsite hardware commissioning of the respective Adaptive Protection relays and I_S-limiters.

3 SYSTEM OVERVIEW

Respond uses the FLAT, an intelligent software application developed within the Schneider advanced distribution management system (ADMS) to provide real time fault level assessment and initiate enabling of the respective fault level mitigation techniques via the existing control room management system (CRMS).

FLAT is used to check capacity of circuit breakers against fault conditions for actual network topology state and to propose enabling or disabling of fault level mitigation techniques according to calculated fault levels. In order to detect fault level issues the FLAT assesses the fault current value after any topology changes or after predefined period of time. Where the calculated fault current exceeds pre-defined fault level rating, the application will send a signal to CRMS to enable one of the three fault level mitigation techniques to overcome the fault level challenge. Figure 1 below shows an overview of the system connectivity.

Figure 1 System connectivity



3.1 ADMS – FLAT

Automatic Distribution Management System (ADMS). This is the new Schneider Electric network management system (NMS) which will replace the Electricity North West existing CRMS as part of a business as usual change.

FLAT uses the breaker capacity application to calculate fault levels in real time for actual network configuration and checks if calculated fault level exceeds switchgear fault level rating. Based on the breaker capacity results, the FLAT sends enabling or disabling signal to CRMS to activate fault level mitigation techniques when the fault level approaches or rises above switchgear rating.

- The FLAT application can be triggered automatically in real time after topology changes or after pre-specified period of time

- If some topology changes appear during the execution of application, the application will be re-triggered.

Electricity North West's CRMS, interfaces with the ADMS, using an inter control communications protocol (ICCP) link which has been developed specifically for Respond. ADMS FLAT signals are sent to CRMS to enable/disable fault level mitigation technique on the basis of the calculation results.

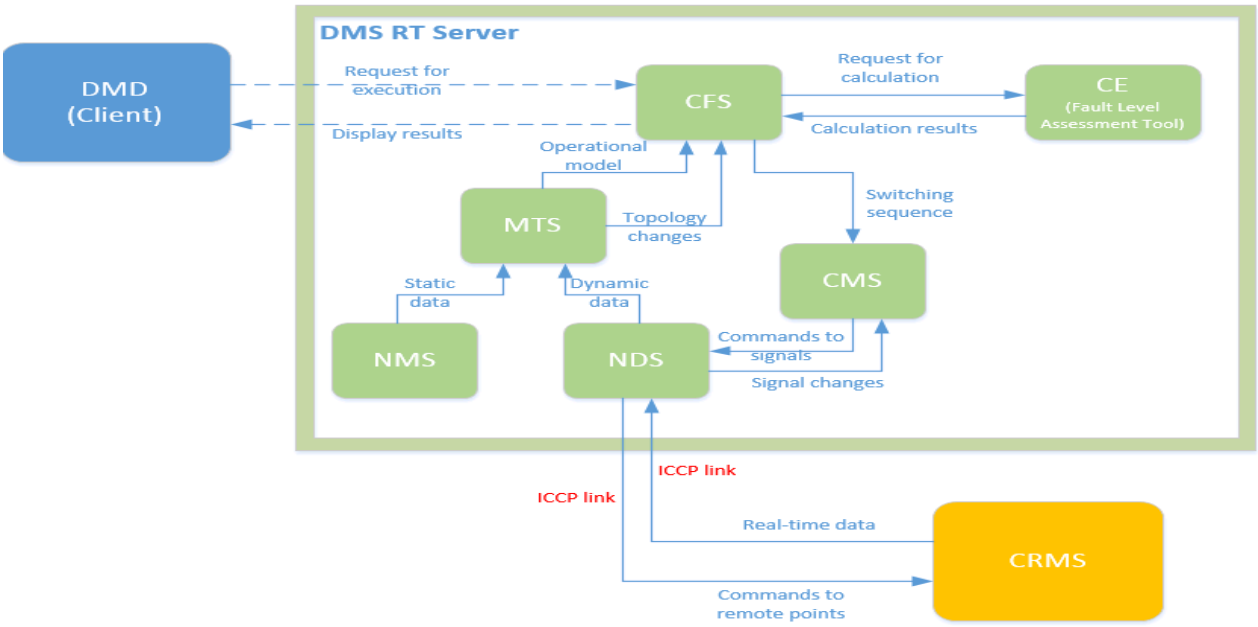
3.2 ADMS architectural design - components and data flows

FLAT closed loop functionality is developed on several components, where the following modules are introduced:

- FLAT closed loop at UI (User Interface) side which includes management and reports
- FLAT closed loop at server side which includes closed loop engine and results data storage
- FLAT as DMS (distribution management system) application which includes the appropriate algorithm, execution and calculation.

Main data flows within the DMS and with external components are presented in Figure 2. The DMS network model is hosted in the network model service (NMS), and it dispatches it to other DMS components. The existing Electricity North West CRMS receives its control points from distribution feeder RTUs (remote terminal unit), and sends them to the network dynamics service (NDS) through the ICCP link, which hosts the dynamics model. The dynamics model also contains the manual points, maintained only in the DMS.

Figure 2: DMS components and main data flows



The model topology service (MTS) receives the network model from the network model service once (during its initialisation), and subsequently only its updates (eg if some elements are added or deleted from the network). From the network model and normal device statuses therein, it creates the operational model, which is suitable for use by DMS applications. The operational model is dynamically updated on the basis of switch statuses from the dynamics model.

The core function service (CFS) manages execution of the ADMS application as well as the FLAT application, which are contained within calculation engine. ADMS FLAT application can be executed automatically or on user's request using DMD UI. CFS generates requests for

automatic execution as appropriate, triggered by topology change and/or by time trigger. To execute FLAT application, CFS fetches an appropriate subset of the operational model from MTS, combines it with appropriate request options (as pre-configured in case of automatic execution, or passed from DMD in case of user-initiated execution), and sends the request to the calculation engine.

The FLAT application receives the subset of the operational model and the request options and upon completion generates its result model containing results about calculated fault levels for switchgear in the affected area, application's messages and a command for enabling/disabling the fault level mitigation techniques which should be passed to CRMS. The result is returned to the CFS, which dispatches it to subscribed clients (DMD) and to CMS to execute commands. During commands execution, CMS issues the commands to the NDS for each considered substation. The NDS in turn communicates with the CRMS system via ICCP interface. The NDS in turn gives updates to the CMS. The CMS uses updates to determine whether the current operation has succeeded, failed or is still in progress.

From the architectural standpoint, the main component responsible for management of the FLAT functionality in the closed loop mode is CFS.

The CFS is the main coordinator for the DMS closed loop functionality. It is responsible for triggering and automation of the proposed command to be executed. Once the triggering conditions are met (time trigger or topology change), CFS gathers the necessary data and initiates the calculations with the calculation engine. Breaker capacity checks the capability of switchgear and it detects critical fault level. It will issue an alarm and command for enabling/disabling of fault level mitigation technique, and appropriate messages. When these calculations are completed, CFS sends the switching list with the proposed command to CRMS via CMS and NDS.

After the application is successfully executed, the results (calculated and rated value of checked switchgear) are stored in CFS cache and ready to be displayed per request in a form of execution report on DMD or saved in historical database to be used for further analysis.

If some topology changes appear during the execution of application, the application will be re-triggered.

3.3 Remote terminal unit (RTU)

The existing substation RTUs are used to collate and process the Respond control and status signals between the fault level mitigation equipment on site, CRMS and ADMS. The RTUs will provide the switch status for all circuit breakers at the 14 Respond sites as well as the upstream network included in the network model. All configured RTUs signals will be passed to the NMS via the ICCP link.

3.4 ICCP

ADMS FLAT tool uses a custom signal for each Respond site which will be sent to CRMS to enable/disable fault level mitigation technique on the basis of the calculation results. The Respond signals are sent through the ICCP interface. The ICCP interface transfers the status and analogue points from the selected Respond primaries from CRMS to ADMS and transfers the Respond controls/commands from ADMS to CRMS.

The Respond signal has two statuses: Closed (1) which means enabling of fault level mitigation techniques and Open (2) which means disabling of fault level mitigation techniques.

4 RESPOND SYSTEM CONTROL

The Respond control and alarm functionality is described below. Figures 3, 4, 5 and 6 show the basic end to end control and alarm functionality for Is-limiter and Adaptive Protection fault limiting techniques.

For system normal operation the FLAT status will be ON (ADMS) and automatic fault level reduction switched IN on site and CRMS

The FLAT is designed to trigger on both topology changes (switch and/or CB status change) or after a specific time. The maximum time between FLAT triggers has been designed to be 5mins. If no FLAT signal is received by the respective fault level mitigation equipment at site after six minutes from the last signal the relay will automatically Enable AP on site.

Figure 3: Status signal

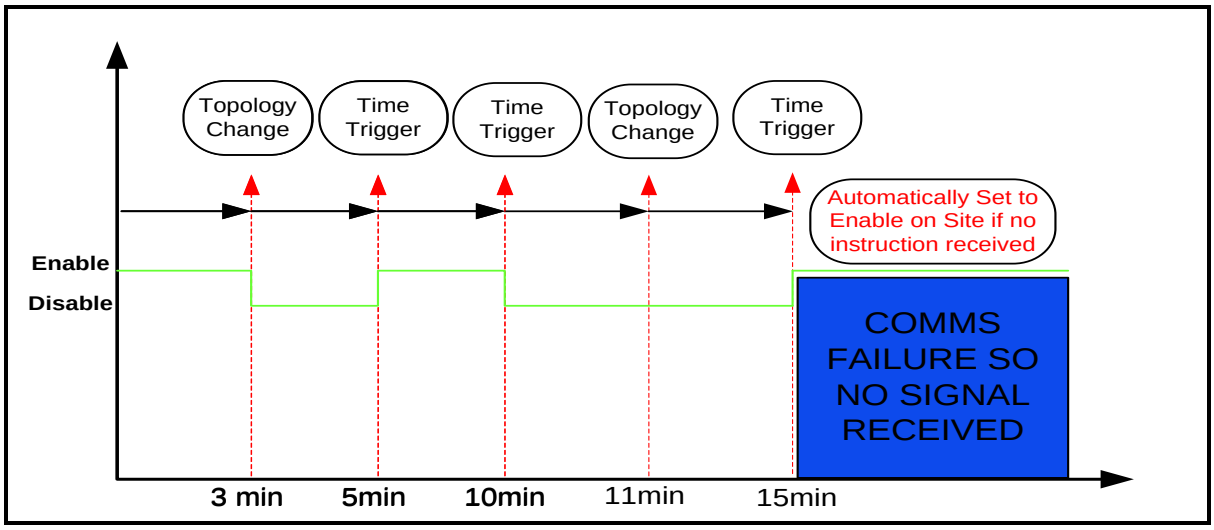


Figure 4: I_S-limiter control system

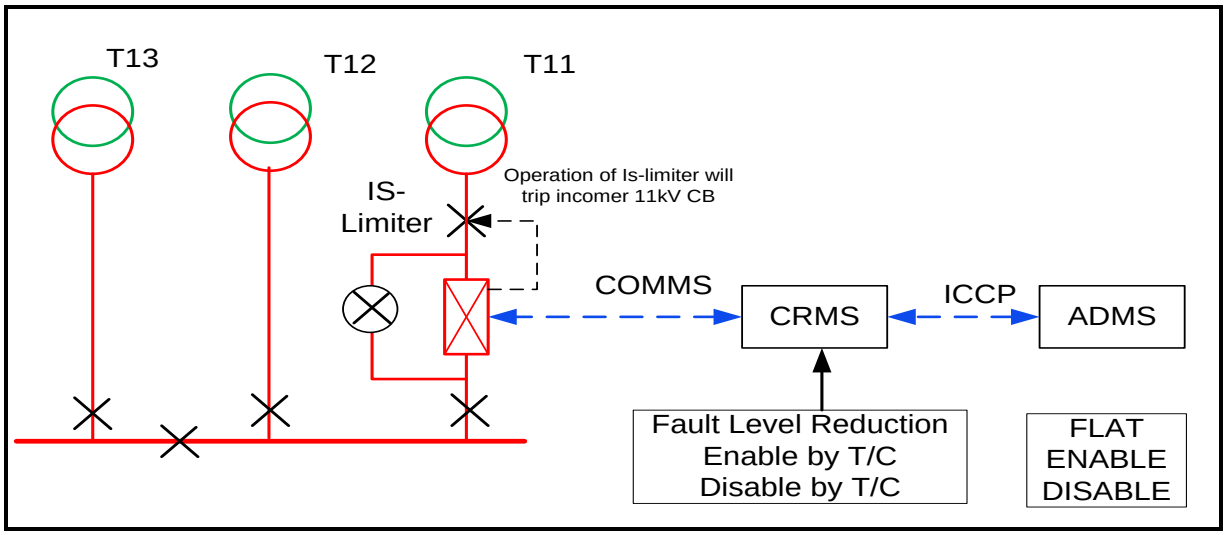


Figure 5: Adaptive Protection control system

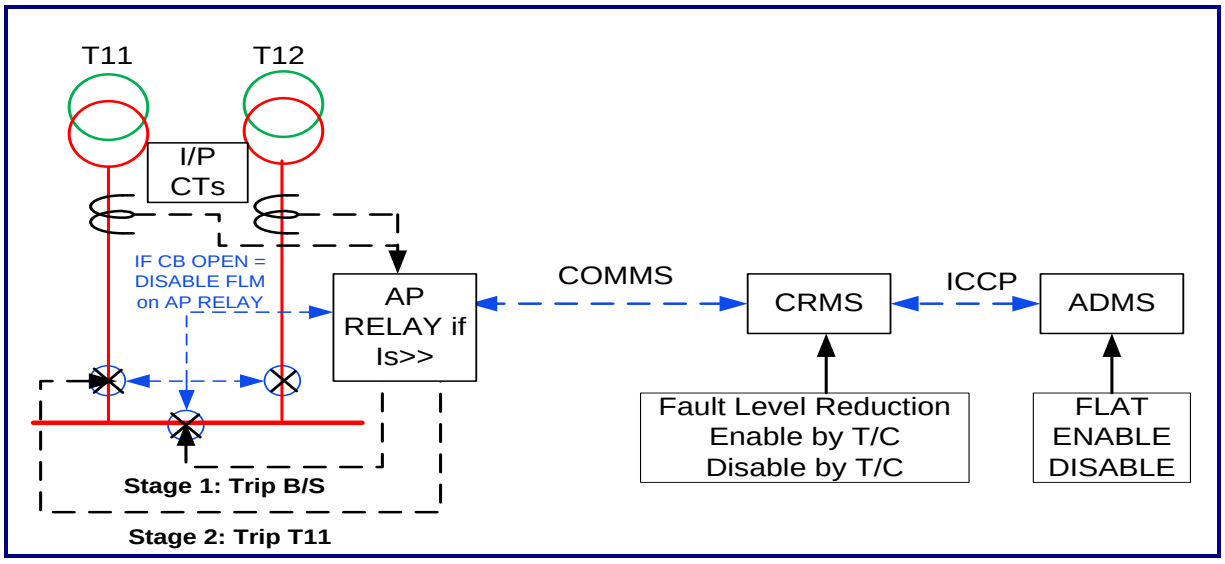
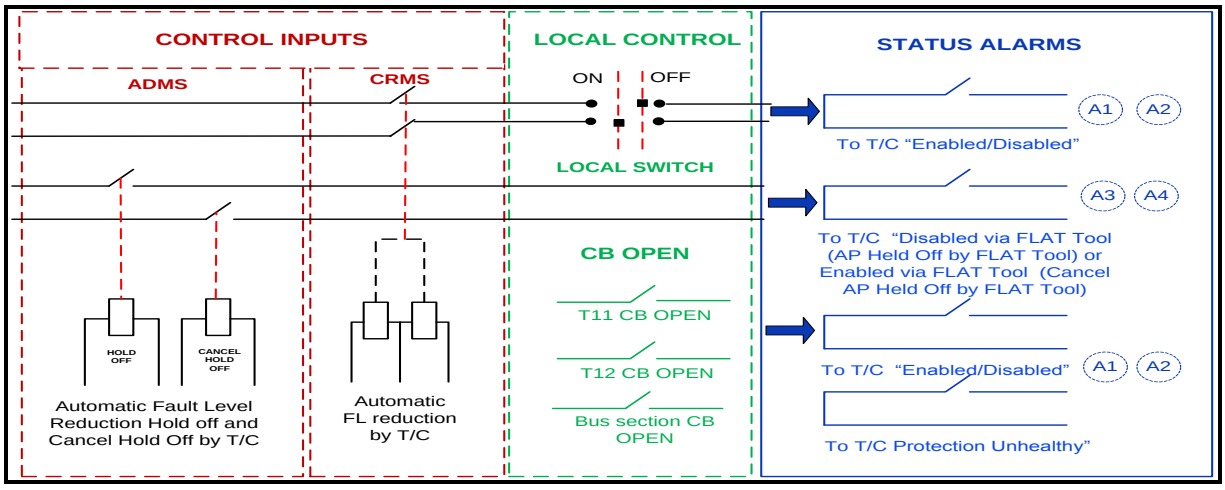


Figure 6: Control and alarm input/outputs



4.1 Control and alarm functionality

This section describes the basic functionality for each control point

4.1.1 CRMS - ENABLED/DISABLED

This allows the control engineer to switch out the respective fault level mitigation (FLM) technique at each of the 14 Respond sites – See appendix C for a full list of Respond sites. This control is activated from CRMS only

CRMS control inputs:

Automatic Fault Level Reduction OUT by T/C

Automatic Fault Level Reduction IN by T/C

- Manual selection only by control engineer
- Normal operation will be Automatic Fault Level Reduction IN by T/C

- When switched to “Auto fault Level Reduction Out by T/C” FLM function will not be operative. This overrides any command from FLAT
- Status alarm will be received to confirm status (A1 or A2)
- No actual FLM status shown on CRMS

4.1.2 ADMS -FLAT ON/OFF/TEST

If FLAT status is OFF, functionality WILL NOT be triggered and no Respond signal command will be sent to CRMS.

If FLAT status is ON, functionality will be triggered automatically on topology change or on time trigger and Respond signal command for enabling/disabling of Adaptive Protection (AP) will be sent automatically to remote point (Substation) via CRMS.

If FLAT status is TEST, functionality will be triggered automatically on topology change or on time trigger, but Respond signal command for enabling/disabling of fault level mitigation techniques WILL NOT be sent automatically to CRMS.

If the FLAT calculates fault level in excess of circuit breaker (CB) rating it will send a FLAT enable FLM control signal. The status indication will only change upon confirmation of execution.

FLAT control inputs

Automatic Fault Level Reduction Hold Off (DISABLED)

Automatic Fault Level Reduction Cancel Hold Off (ENABLED)

- The FLAT status will normally be switched ON (manually selected via ADMS FLAT Dashboard)
- If FLAT is OFF then no trigger will be sent and Adaptive Protection will remain enabled (as long as enabled on CRMS)
- Fault level triggered by topology change or time
- Alarm will be received to confirm status (A3 or A4) upon execution
- If Fault Level > threshold “ENABLE via FLAT” command will be sent and executed with corresponding alarm
- If Fault level < threshold “DISABLE Via FLAT” command will be sent and executed with corresponding alarm
- If fault calculation does not converge system will default to safety and send an “ENABLE via FLAT” control
- For loss of communications FLAT will default to safety and remain in enabled Status regardless of calculated fault level
- If FLM Disabled on CRMS or Local Control selected to OFF any FLAT control output will be overridden.

4.1.3 Local FLM selection – ON/OFF

This is a site function and allows FLM to be switched ON/OFF at site. In the OFF position overrides all instructions from ADMS

- Will normally be selected to “ON”
- When switched “ON” should receive “ENABLED” alarm.
- If selected to “OFF” adaptive protection is disabled locally – Hardware lock.
- When switched “OFF” should receive “ DISABALED” alarm
- Does not automatically disable function on CRMS
- Actual Site status could be different to FLAT

- In the OFF position any FLAT status control signal will not be executed and FLAT will default to enabled status

The following trigger diagrams illustrate the respective respond signal status (FLAT and site)

Figure 7: FLM trigger diagram 1

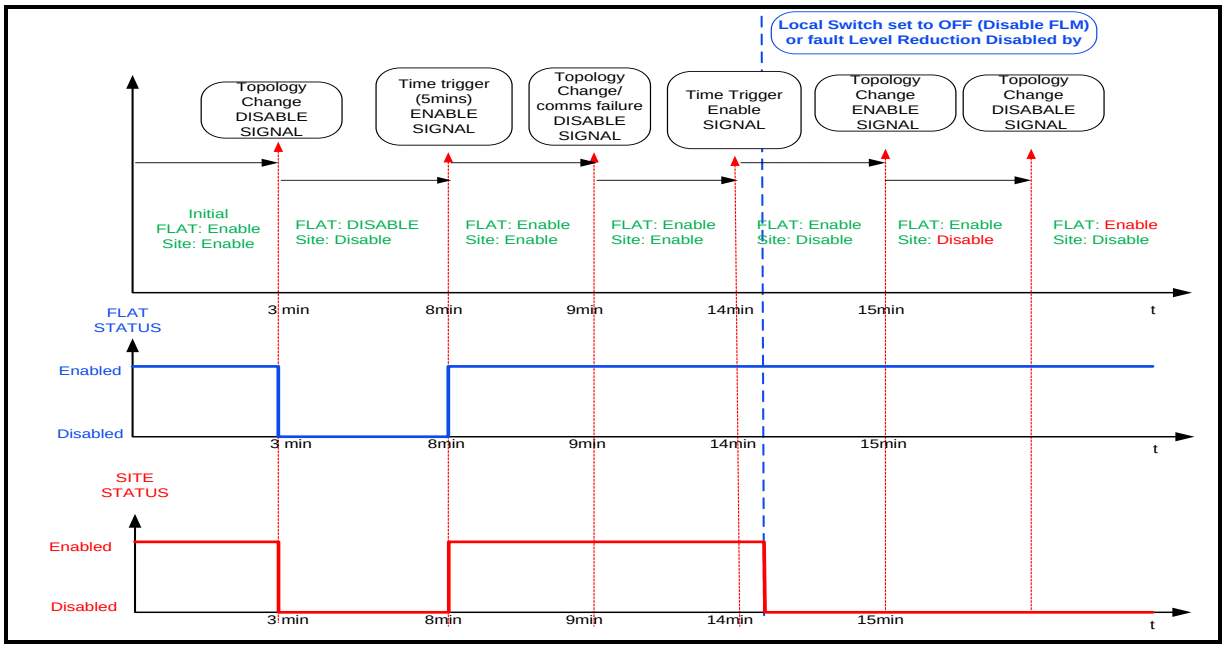
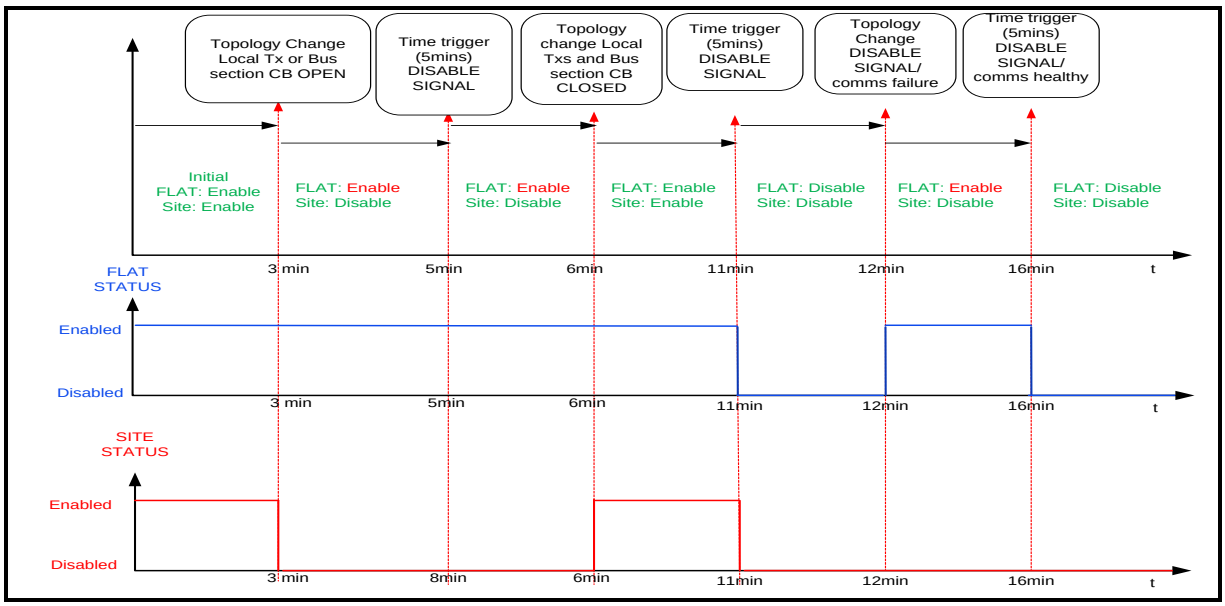


Figure 8: FLM Trigger Diagram 2



5 FLAT SOFTWARE COMMISSIONING

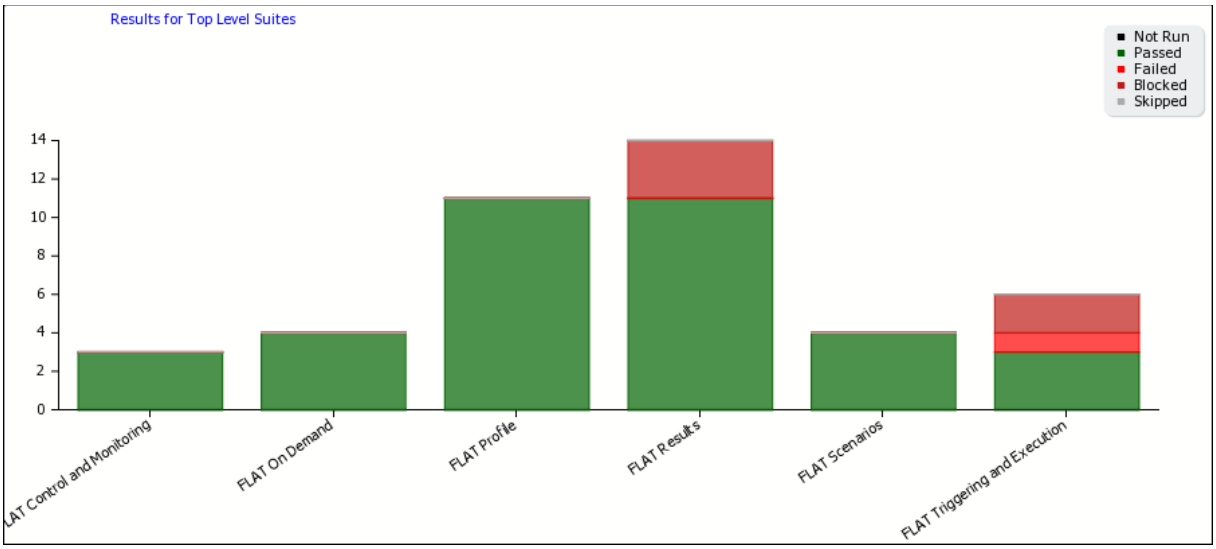
The FLAT commissioning programme was completed over two separate one week periods, FAT (Factory acceptance Test) from 28 April to 1 March and SAT (site acceptance test) from 11 to 15 April.

The FLAT commissioning programme started with FAT (factory acceptance testing) at Schneider Electric Offices in Nova Sad, Serbia. This one week of testing was to prove the overall software functionality and demonstrate the accuracy of the fault level calculations using the Respond electrical model. The system was tested using a set of prescribed tests agreed by Schneider Electric and Electricity North West. For the purpose of testing and reporting of software bugs Schneider Electric use two online applications called Testlink and Bugzilla. The Testlink application allows the used to fail/approve each of the tests and then report any problems via Bugzilla. The full test can be found in Appendix A.

The second and final phase of commissioning, SAT, took place between 11 to 15 April, at Electricity North West's Linley House office, in Manchester. The test plan for SAT was very much the same as the FAT except in this phase the NMS was connected to Electricity North West's Functional Spares Assembly system (FSA) via the ICCP along with two RTUs to test communications. The RTUs were connected to a test box which effectively acts as the remote substation and mimics the alarms, status switch status and Respond FLM plant status. The SAT included tests to demonstrate that the Respond signal was successfully issued/received at the remote end following the correct trigger based on the fault level calculation. The full SAT test plan can be found in Appendix B.

Following the completion of SAT the general test plan Metric was produced to identify the overall success of the commissioning – Figure 9 below. As can be seen there was only one that failed and five that were blocked. These problems were due to the ICCP and the test box signalling.

Figure 9: SAT test plan metric



Following the successful completion of SAT, the Respond system went live in May 2016.

At the time of writing this document there have been three successful operations of the Adaptive Protection fault level mitigation techniques, all of which will be reported on the website in the coming months.

APPENDIX A – RESPOND FAT TEST PLAN

Schneider Electric DMS

ENWL-Respond

Schneider Electric DMS NS

RESPOND_FAT

Test Plan

Scope

FAT Test Plan

Test Suite : FLAT Profile

Test Case ENWL-RES-1: Profile Library: Default FLAT Profile		
Purpose: The main purpose is to introduce FLAT default profile in Profile Library.		
Preconditions: DMS services are started and in HOT state. DMS is started and connected to DMS services. User is a member of Grid Management Engineer job role group.		
#:	Step actions:	Expected Results:
1	Open 'Profile Library' from main menu.	'Profile Library' window is opened.
2	Expand 'Power Applications -> FLAT'.	'Fault Level Assessment (Default)' profile is visible.
3	Right click on 'Fault Level Assessment (Defaul)' profile and select 'Open' from context menu.	Fault Level Assessment profile with default options settings is opened.
4	Verify content in the opened window.	At the top of window are: - 'Profile name' field; - 'Profile description' field; - 'Select switch' button. In 'Fault Level Mitigation Techniques' section is 'Mitigation technique' with checkboxes: - 'Use Is-Limiters' checkbox; - 'Adaptive Protection' checkbox; - 'Fault Current Limiting Service' checkbox. In 'Soft Limit Factor' section are: - 'Lower' value enter field; - 'Upper' value enter field. In 'Triggering settings' section are: - 'Topology change triggering time delay' value enter field; - 'Period of time' value enter field; - 'Triggering type' (with

		checkboxes 'After Topology Change' and 'After Period of Time'). At the bottom of window are 'Apply', 'OK' and 'Cancel' buttons.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-2: Profile Library: Create New FLAT Profile		
Purpose: The main purpose is to demonstrate creation of FLAT profile and defining of available parameters inside it.		
Preconditions: User who is member of DMS Admins job role group exists. DMS services are started and in HOT state		
#:	Step actions:	Expected Results:
1	Open Profile Library .	Profile Library is opened.
2	Expand 'FLAT' folder on Profile Library tree.	'FLAT' folder is expanded.
3	Right click on 'FLAT' folder and from context menu choose 'New profile'.	Profile window is opened. Initial name of new profile is 'New Profile'. Note: Initial settings in new profile are set in 'RTApplicationConfiguration_ENWL' xml for current context. 15/03/2016 Ant - The 'Default' profile is set in xml, does this prevent the user from changing setting on the UI, if not how is the 'Default' profile aligned with the xml settings. What are the default settings that have been agreed?
4	Enter new profile name which contains more than 64 characters.	Profile name is defined.
5	Set available options on desired values.	The following can be set: Triggering setting parameters - type of the trigger (on topology change and/or after period of time) - specify period of time for periodic execution Fault Level Mitigation techniques which can be applied: - Is limiters - Adaptive Protection - Fault Current Limiting Service Soft Limit Factor (lower and upper value). Note: Pre-fault load flow voltage option to made available.
7	and Click on 'Apply' button and then on 'OK' button.	Profile window is closed. New profile with name specifed in step 4 is created.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-3: Profile Library: FLAT Profile Control
Purpose: The main purpose is to verify available control over created FLAT profile.

Preconditions: User who is member of DMS Admins job role group exists. DMS services are started and in HOT state.		
#:	Step actions:	Expected Results:
1	Open Profile Library.	Open Profile Library.
2	Expand 'FLAT' folder on Profile Library tree.	'FLAT' folder is expanded.
3	Right click on a previously created FLAT profile.	Context menu appears with following options: - Open - Delete - Cut - Copy - Rename.
4	From context menu choose 'Open'.	Profile window is opened.
5	Click on 'Cancel' button.	Profile window is closed.
6	Right click on created profile and from context menu choose 'Copy'.	Profile is copied to clipboard.
7	Check context menu of each root power application folders and its sub-folders in Profile Library tree. Note: Right click on folder to show context menu.	Option 'Paste profile' is enabled only for 'FLAT' folder. For all other root power application folders and its sub-folders, option 'Paste profile' is disabled because it is not allowed to mix profiles from various functions in one folder.
8	Right click on 'FLAT' folder and from context menu choose 'Paste profile'.	Profile is pasted in 'FLAT' folder. Pasted profile has default name: '{OriginalProfileName} - Copy'.
9	Right click on a prevously created profile which is not assigned and from context menu choose 'Delete'.	Dialog with question appears: "Are you sure that you want to delete this profile?"
10	Click on 'Yes' button.	Profile is deleted.
11	Right click on a prevously created profile which is not assigned but it is approved and from context menu choose 'Delete'. Note: To approve, open prevously created profile and select option 'Approved'.	Dialog with question appears: "Are you sure that you want to delete this profile?"
12	Click on 'Yes' button.	Profile is deleted.
13	Right click on a prevously created profile which is assigned and from context menu choose 'Delete'. Note: To assign profile, open Profile Assignment Editor.	Dialog with question appears: "Are you sure that you want to delete this profile?"
14	Click on 'Yes' button.	Message appears: "Fail to remove item {profile_name}. Used profile {profile_name} cannot be deleted." After message confirmation profile is not deleted.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-4: Profile Assignment Editor Window		
Purpose: The main purpose of this test to verify opening of "Profile Assignment Editor" window and its content.		
Preconditions: - DMS services started and in HOT state. - User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "Tools -> Profile Assignment Editor".	"Profile Assignment Editor" window is opened.
2	Verify report form.	Report has toolbar with following options: - Export to CSV - Print. There is Network Tree with 'Search' text box which enables viewing circuit hierarchy and selecting circuits for result presentation. Following tabs exist in report: - Control & Monitoring - Profile Assignment.
3	Open "Control & Monitoring" tab.	"Control & Monitoring" tab contains following columns: - Object (This column contains network hierarchy without elements that are below substation level (i.e. Transformer area, Feeder)). - Active Mode (Normal and Storm) - One column per every function included in "Profile Assignment Editor". Among them should be displayed Fault Level Assessment column.
4	Open "Profile Assignment" tab.	"Profile Assignment" tab contains sub-tabs for each application included in "Profile Assignment Editor". Among them should be displayed Fault Level Assessment sub-tab. Fault Level Assessment sub-tab contains "Object" column and "Normal Mode" column ("Storm Mode" column is not available for FLAT profile). "Object" column contains Network hierarchy tree without elements that are below substation level (i.e. Transformer area, Feeder). Toolbar in "Profile Assignment" tab for FLAT function contains following options: - Profile Library - Assign and Remove profile for Normal mode.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-5: Profile Assignment Editor: Assigning Profiles		
Purpose: The main purpose of this test is to verify that profile can be assigned for the selected circuit and for the specified function.		
Preconditions: - DMS services started and in HOT state. - User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "Tools -> Profile Assignment Editor".	"Profile Assignment Editor" window is opened.
2	Expand network tree from left side of form.	Network tree is expanded.
3	Select "Profile Assignment" tab.	"Profile Assignment" tab is opened, there is sub-tab for every function included in "Profile

		Assignment Editor".
4	Select "Fault Level Assessment" sub-tab.	"Fault Level Assessment" sub-tab is opened.
5	In column "Object" select arbitrary substation and on toolbar menu click on "Assign Normal Profile" button.	"Profile Selection" window appears.
6	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	"Profile Selection" window is closed and selected substation has assigned chosen profile.
7	Select "Profile Assignment" tab and then select "Fault Level Assessment" sub-tab.	"Fault Level Assessment" sub-tab is opened.
8	In column "Object" select arbitrary region and on toolbar menu click on "Assign Normal Profile" button.	"Profile Selection" window appears.
9	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	"Profile Selection" window is closed and all substations which belong to selected region have assigned chosen profile.
10	Select "Profile Assignment" tab and then select "Fault Level Assessment" sub-tab.	"Fault Level Assessment" sub-tab is opened.
11	In column "Object" select entire network and on toolbar menu click on "Assign Normal Profile" button.	"Profile Selection" window appears.
12	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	"Profile Selection" window is closed and all substations have assigned chosen profile.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-6: Profile Assignment Editor: Assigning Profile Using Context Menu		
Purpose: The main purpose of this test is to verify that profile can be assigned for the selected circuit and for the specified function using context menu.		
Preconditions: - DMS services started and in HOT state. - User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "Tools -> Profile Assignment Editor".	"Profile Assignment Editor" window is opened.
2	Expand network tree from left side of form.	Network tree is expanded.
3	Select "Profile Assignment" tab.	"Profile Assignment" tab is opened, there is sub-tab for every function included in "Profile Assignment Editor".

4	Select "Fault Level Assessment" sub-tab.	"Fault Level Assessment" tab is opened.
5	In column "Object" right click on arbitrary substation and from context menu choose "Assign Normal Profile".	"Profile Selection" window appears.
6	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	"Profile Selection" window is closed and selected substation has assigned chosen profile.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-7: Profile Assignment Editor: Removing Profiles		
Purpose: The main purpose of this test is to verify that profile can be removed for the circuit and for the specified function.		
Preconditions: - DMS services started and in HOT state. - User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "Tools -> Profile Assignment Editor".	"Profile Assignment Editor" window is opened.
2	Expand network tree from left side of form.	Expand network tree from left side of form.
3	Select "Profile Assignment" tab.	"Profile Assignment" tab is opened, there is sub-tab for every function included in "Profile Assignment Editor".
4	Select "Fault Level Assessment" tab.	"Fault Level Assessment" tab is opened.
5	In column "Object" select arbitrary substation and on toolbar menu click on "Assign Normal Profile" button.	"Profile Selection" window appears.
6	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	Selected substation has assigned chosen profile.
7	On toolbar menu click on "Remove Normal Profile" button. Click on "Yes" button when question "Are you sure you want to remove this profile" appears.	Profile is removed.
8	In column "Object" select arbitrary region and on toolbar menu click on "Assign Normal Profile" button.	"Profile Selection" window appears.
9	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	All substations that belong to the selected region have assigned chosen profile.
10	On toolbar menu click on "Remove Normal Profile" button. Click on "Yes" button when question "Are	All profiles are removed.

	you sure you want to remove this profile" appears.	
11	In column "Object" select entire network and on toolbar menu click on "Assign Normal Profile" button.	"Profile Selection" window appears.
12	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	All substations have assigned chosen profile.
13	On toolbar menu click on "Remove Normal Profile" button. Click on "Yes" button when question "Are you sure you want to remove this profile" appears.	All profiles are removed.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-8: Profile Assignment Editor: Removing Profile Using Context Menu		
Purpose: The main purpose of this test is to verify that profile can be removed for the selected circuit and for the specified function.		
Preconditions: - DMS services started and in HOT state. - User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "Tools -> Profile Assignment Editor".	"Profile Assignment Editor" window is opened.
2	Expand network tree from left side of form.	Network tree is expanded.
3	Select "Profile Assignment" tab.	"Profile Assignment" tab is opened, there is sub-tab for every function included in "Profile Assignment Editor".
4	Select "Fault Level Assessment" tab.	"Fault Level Assessment" tab is opened.
5	In column "Object" right click on arbitrary substation and from context menu choose "Assign Normal Profile".	"Profile Selection" window appears.
6	In "Fault Level Assessment" folder select one of the available profiles and press "OK" button.	"Profile Selection" window is closed and selected substation has assigned chosen profile.
7	Right click on selected substation and from context menu choose "Remove Normal Profile". Click on "Yes" button when question "Are you sure you want to remove this profile" appears.	Profile is removed for selected substation.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-10: Profile Library: Switch Selection in FLAT Profile		
Purpose: The main purpose of this test is to introduce selection of switches in FLAT profile, which statuses should be checked before sending the Respond signal.		
Preconditions: DMS services started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open Profile Library from main menu.	Profile Library is opened.
2	In Profile Library expand FLAT folder.	FLAT folder is expanded. Notice that Fault Level Assessment (Default) profile exists.
3	Double click on a prevously created Fault Level Assessment profile.	Fault Level Assessment profile is opened.
4	Click on "Select switch" button.	"Switch selection" window appears. Window consists of two major parts: - Select switch, - Switch list (list of switches and its expected status). Between these two parts are action buttons for adding/removing the switches to/from the switch list ("Add", "Remove" and "Remove all" buttons). On the left side of 'Select switch' part, two elements can be noticed: - Search field at the top (helps the user to navigate to desired substation) - Network tree (transmission and distribution network; substation is the last in hierarchy)
5	On the left side of "Select switch" window select arbitrary part of network and extend it.	Selected part of network appears on the right side of "Select switch" part.
6	From the right side of "Select switch" part, select arbitrary switches and click on Add button.	Selected switches appear in "Switch list".
7	For each switch in the "Switch list", select combo box and choose one of the available statuses (switch statuses should be in accordance to the given message mapping).	Switches' statuses are selected.
8	Click on OK button to close "Switch selection" window.	"Switch selection" window is closed.
9	Click on OK button to close Fault Level Assessment profile.	Fault Level Assessment profile is closed.
10	Double click on default Fault Level Assessment profile.	Default Fault Level Assessment profile is opened.
11	Click on "Select switch" button.	"Switch selection" window appears.

12	Observe list in "Switch list" part.	Switches that have been selected in step 6 are located in the list, and their statuses are the same as in step 7.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-11: Profile Assignment Editor: Removing FLAT Profiles From Substation Where FLAT Is Active		
Purpose: The main purpose is to demonstrate the preventing of FLAT profile removing for substation where FLAT functionality is enabled (active).		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu select 'FLAT Control and Monitoring'.	'FLAT Control and Monitoring' window is opened.
2	In 'FLAT Control and Monitoring' window, find a substation for which FLAT Status is ON and remember the name of it.	Substation with active (enabled) FLAT functionality has been found.
3	From main menu select 'Tools->Profile Assignment Editor'.	'Profile Assignment Editor' is opened.
4	Expand network tree and find substation found in step 2.	
5	Select 'Profile Assignment' tab.	'Profile Assignment' tab is opened, there is sub-tab for every function included in 'Profile Assignment Editor'.
6	Select 'Fault Level Assessment' tab	'Fault Level Assessment' tab is opened.
7	Right click on selected substation and observe context menu.	Options 'Remove Normal Profile' is disabled for the selected substation since profile cannot be removed for the substation while FLAT functionality is active.
Execution type:	Manual	
Keywords:	FLAT	

Test Suite : FLAT Triggering and Execution

Test Case ENWL-RES-19: FLAT Triggering: Topology Trigger
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will be triggerd on topology change.

Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There is FLAT Profile with checked topology trigger option. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open Profile Assignment Editor and select Profile Assignment -> Fault Level Assessment tab.	Fault Level Assessment tab is opened in Profle Assignment Editor.
2	Find a Respond station in the tree view and right click on it to open context menu.	Context menu of selected Respond station is opened.
3	Select "Assign Normal Profile" in context menu and add FLAT profile with checked topology trigger option for selected Respond station.	FLAT Profile has been assigned to the selected station.
4	Open FLAT Control and Monitoring window and check FLAT status for considered station (from prevoius step).	FLAT status of the station may be ON, OFF or Test.
5	If FLAT Status for the station is different than ON, change it to ON.	FLAT Status of the station has been changed to ON.
6	Locate considered station by double-click on it in FLAT Control and Monitoring window.	Selected station has been located on the schematic/geographic view.
7	Find a closed switching device in the area of considered station and open it.	The switching device is opened.
8	Open FLAT Execution report and find considered station in it.	FLAT Results for the considered station are presented in the right side of the report and "Last successful run" time is about present time.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-21: FLAT Triggering: Topology Trigger When FLAT Status is OFF		
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will not be triggerd on topology change if FLAT is not enabled for station where topology change has been occured.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There is FLAT Profile with checked topology trigger option. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open Profile Assignment Editor and select Profile Assignment->Fault Level Assessment tab.	Fault Level Assessment tab is open in Profle Assignment Editor.
2	Locate a Respond station in the tree view and assign FLAT profile with checked topology trigger to it. Note: In order to assing FLAT profile to selected station, open context menu	FLAT profile has been assigned to the station.

	of the station and select option "Assign Normal Profile". For more details, please see test case "Profile Assignment Editor: Assigning Profiles".	
3	Open FLAT Control and Monitoring window and check FLAT status for considered station (from prevoius step).	FLAT status of the station may be ON, OFF or Test.
4	If FLAT Status for the station is different than OFF, change it to OFF.	FLAT Status of the station has been changed to OFF.
5	Locate considered station by double-click on it in FLAT Control and Monitoring window.	Selected station has been located on the schematic/geographic view.
6	Find a closed switching device in the area of considered station and open it.	The switching device is opened.
7	Open FLAT Execution report and find considered station in it.	There are no FLAT results for considered station.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-20: FLAT Triggering: Topology Trigger When All Triggers Are Inhibit		
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will not be triggerd on topology change if all triggers are inhibit, althought FLAT is enabled for station where topology change has been occured.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There is FLAT Profile with checked topology trigger option. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open Tools->Power Applications Settings and check option "Inhibit all triggers".	Option "Inhibit all triggers" is checked. Note: By checking the option "Inhibit all triggers.", FLAT application (as well as all other real time applications) will not be triggered, regardless selected triggering options in profile.
2	Open Profile Assignment Editor and select Profile Assignment -> Fault Level Assessment tab.	Fault Level Assessment tab is opened in Profle Assignment Editor.
3	Find a Respond station in tree view and assign FLAT profile with checked topology trigger to it. Note: In order to assing FLAT profile to selected station, open context menu of the station and select "Assign Normal Profile". For more details, please see test case "Profile Assignment Editor: Assigning Profiles".	FLAT profile has been assigned to the station.
4	Open FLAT Control and Monitoring window and check FLAT status for considered station (from prevoius step).	FLAT status of the station may be ON, OFF or Test.

5	If FLAT Status for the station is different than ON, change it to ON.	FLAT Status of the station has been changed to ON.
6	Locate considered station by double-click on it in FLAT Control and Monitoring window.	Selected station has been located on the schematic/geographic view.
7	Find a closed switching device in the area of considered station and open it.	The switching device is opened.
8	Open FLAT Execution report and find considered station in it.	There are no FLAT results for considered station.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-22: FLAT Triggering: Topology Trigger When Triggering Options are not checked in FLAT Profile		
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will not be triggerd on topology change or after predefined period of time, althought FLAT is enabled for station where topology change has been occured.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There is FLAT Profile where triggering options are not checked. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open Profile Assignment Editor and select Profile Assignment -> Fault Level Assessment tab.	Fault Level Assessment tab is open in Profle Assignment Editor.
2	Find a Respond station in tree view and assign FLAT profile with checked topology trigger to it. (NN: topology trigger should be unchecked???) Note: In order to assing FLAT profile to selected station, open context menu of the station and select "Assign Normal Profile". For more details, please see test case "Profile Assignment Editor: Assigning Profiles".	Selected FLAT profile has been assigned to the station.
3	Open FLAT Control and Monitoring window and check FLAT status for considered station (from prevoius step).	FLAT status of the station may be ON, OFF or Test.
4	If FLAT Status for the station is different than ON, change it to ON.	FLAT Status of the station has been changed to ON.
5	Locate considered station by double-click on it in FLAT Control and Monitoring window.	Selected station has been located on the schematic/geographic view.
6	Find a closed switching device in the area of considered station and open it.	The switching device is opened.
7	Open FLAT Execution report and find considered station in it.	There are no FLAT results for considered station.
Execution type:	Manual	

Keywords:	FLAT

Test Case ENWL-RES-23: FLAT Triggering: Time Trigger		
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will be triggerd after prespecifed period of time expired.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There is FLAT Profile with checked time trigger with specified period of time and unchecked topology trigger. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open Profile Assignment Editor "from Tools Menu - KB" and select Profile Assignment -> Fault Level Assessment Tool tab.	Fault Level Assessment Tool tab is open in Profle Assignment Editor.
2	Find a Respond station in the tree view and right click on it.	Context menu of selected Respond station is opened.
3	Add FLAT profile with checked time trigger option for selected Respond station.	FLAT Profile has been assigned to the selected station.
4	Open FLAT Control and Monitoring window and check FLAT status for considered station (from prevoius step).	FLAT status of the station may be ON, OFF or Test.
5	If FLAT Status for the station is different than ON, change it to ON.	FLAT Status of the station has been changed to ON.
6	Wait until specified period of time has expired.	Should see a time/date in alst run column
7	Open FLAT Execution report and find considered station in it.	FLAT Results for the considered station are presented in the right side of the report and "Last successful run" time is about present time.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-24: FLAT Triggering: Time Trigger When Topology Change Appears
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will be triggerd after prespecifed period of time expired, regardless if some topology changes have been occured meanwhile.
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. There is FLAT Profile with checked time trigger with specified period of time and topology trigger. User who is member of Grid Management Engineer job role group exists.

#:	Step actions:	Expected Results:
1	Open Profile Assignment Editor and select Profile Assignment -> Fault Level Assessment Tool tab.	Fault Level Assessment Tool tab is open in Profle Assignment Editor.
2	Find a Respond station in tree view and right click on it.	Context menu of selected Respond station is opened.
3	Add FLAT profile with checked time trigger option for selected Respond station.	FLAT Profile has been assigned to the selected station.
4	Open FLAT Control and Monitoring window and check FLAT status for considered station (from prevoius step).	FLAT status of the station may be ON, OFF or Test.
5	If FLAT Status for the station is different than ON, change it to ON and start to count period of time specified in FLAT profile.	FLAT Status of the station has been changed to ON.
6	Locate considered station by double-click on it in FLAT Control and Monitoring window.	Selected station has been located on the view. **17/01/2016 Ant - s/s internal view is located, can this be changed to composite - confirm with Respond project manager**
7	Find a closed switching device and open it before specified period of time in FLAT profile has been expired. Note: Timer continues to count. The timer should restart after a topology change - KB	The switching device has been opened.
8	Wait the rest of time, until specified period of time in FLAT profile has been expired and open FLAT Execution report and find considered station in it.	FLAT Results for the considered station are presented in the right side of the report and "Last successful run" time is about present time. Note: Time trigger will not be reset by topology changes appeared meanwhile.
9	OPEN/CLOSE multiple circuit breaker in the same RESPOND area within the time trigger period (KB)	Confirm last run status in FLAT control and monitoring windows and review execution report. Export report to CSV (KB)
10	OPEN/CLOSE multiple Circuit Breakers across multiple RESPOND areas. Test case to be carried out using different voltage options (KB)	Confirm Last run time for all RESPOND sites where topology changes taken place.Review execution report. Check FL results for the different voltage options (KB)
11	17/03/2016 Ant - Find an open switching device and close it before specified period of time in FLAT profile has been expired. Note: Timer continues to count.	The switching device has been closed.
12	17/03/2016 Ant - Wait the rest of time, until specified period of time in FLAT profile has been expired and open FLAT Execution report and find considered station in it.	17/03/2016 Ant - FLAT Results for the considered station are presented in the right side of the report and "Last successful run" time is about present time. Note: Time trigger will not be reset by topology changes appeared meanwhile.
13		
Execution type:	Manual	

Keywords:	FLAT

Test Suite : FLAT Control and Monitoring

Test Case ENWL-RES-12: FLAT Dashboard: Overview		
Purpose: Verify Control and Monitoring window form overview.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "FLAT Control & Monitoring".	"FLAT Control & Monitoring" is opened.
2	Observe list of substations presented in 'FLAT Control and Monitoring' window.	Only Respond substation are presented in the window. ENW to validate this list and confirm correct.
3	Observe data given for each substation in "FLAT Control & Monitoring" window.	"FLAT Control & Monitoring" consists of data grid with the following columns: - Substation - Region - Sub-region - FLAT Status (presents actual status of FLAT functionality) - Active profile (presents profile currently assigned to the selected substation - Profile assignment editor) - Last run (time stamp (date + time) of the last FLAT execution) - Messages (displayed for the last FLAT execution) - Respond signal status (for every displayed substation this signal status is set on "Enable FL mitigation techniques")
4	Right mouse click on field with data.	Context menu is opened. Following options are available: - Status - Locate - Copy Field - Copy Row - Export to CSV - Open In - Properties - Print
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-13: FLAT Dashboard: Change FLAT Status		
Purpose: The main purpose of this test is to demonstrate opening "Status" window from "FLAT - Control & Monitoring " window.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "FLAT -	"FLAT - Control & Monitoring" window is opened.

	Control & Monitoring".	
2	Right click on substation that has assigned FLAT profile and choose "Status" option from context menu.	"Status" window is opened for that part of network. There are two group boxes: - Current status (ON or OFF or Test indicator presented) - Status control (ON/OFF/Test radio-buttons presented) - OK and Cancel buttons
3	In "Status Control" field, change status - selection of radio-button (if it was "OFF", choose "ON" or "Test") and click "OK" button.	In "FLAT - Control & Monitoring" window, for chosen substation in "FLAT Status" column, newly changed status is displayed.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-14: FLAT Dashboard: Change FLAT Status When Profile Is Not Assigned		
Purpose: The main purpose of this test is to demonstrate prevention of "FLAT Status" change when FLAT profile is not assigned.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of DMS Admin job role group exists.		
#:	Step actions:	Expected Results:
1	From main menu choose "FLAT - Control & Monitoring".	"FLAT - Control & Monitoring" window is opened.
2	Right click on substation without assigned FLAT profile and choose "Status" option from context menu.	"Status" window is opened for that part of network. There are two group boxes: - Current status (ON or OFF or Test indicator presented) - Status control (ON/OFF/Test radio-buttons presented) - OK and Cancel buttons
3	In "Status Control" field, change status - selection of radio-button (if it was "OFF", choose "ON" or "Test") and click "OK" button.	Message that FLAT status cannot be changed into "ON" or "Test" is issued, since there is no FLAT profile assigned to selected substation.
Execution type:	Manual	
Keywords:	FLAT	

Test Suite : FLAT Results

Test Case ENWL-RES-25: FLAT Execution Report: Report Overview for Entire Network
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for entire network.
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid

Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. **AP 16/03 - Could the report be accessed from the 'FLAT Control & Monitoring' window? it would be nice to access the Profile Editor' from here too?** Recommandation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background.	FLAT Execution Report is opened.
2	Click on the top of the network view and verify the content of the FLAT Execution Report for entire network.	For entire network, FLAT results for all circuit breaker in the network are presented in the part "Circuit breakers": **(AP-Check naming convention)** 1. Peak Current -Rated Current - rated level of peak current **(AP can it be defined in kA?) -Calculated - calculated value of peak current -Quality - quality marker which may be Bad or Good depending on Rated Current and Calculated current ratio. **(AP - Can the term 'Quality' be changed to 'Violation'?) 2. Breaking Current -Rated Current - rated level of breaking current - Calculated - calculated value of breaking current -Quality - quality marker which may be Bad or Good depending on Rated Current and Calculated current ratio. 3.Thermal Current -Rated Current - rated level of thermal current -Calculated - calculated value of thermal current -Quality - quality marker which may be Bad or Good depending on Rated Current and Calculated current ratio. Filter functionality is also available in the Report. **17/03/2016 Ant - How do we search & extract historic reports - Can we demonstrate use cases for this)**
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-26: FLAT Execution Report: Report Overview for Station		
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is	FLAT Execution Report is opened.

	to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background.	
2	Verify the content of the FLAT Execution Report.	Report is based on the network tree view. For selected station on the tree view, data grid is presented. Data grid is divided into four parts: "Current status" with the following data: 1. Status - presents current FLAT status for considered station 2. Current Profile - presents currently assigned FLAT profile. 3. Last successful run - present last successful execution time (without error) "Applied technique" with the following data: 1. Mitigation technique - technique for fault level mitigation which can be applied at the station area, as it is selected in FLAT profile. 2. Issued command - Value of Respond signal issued after FLAT calculation has been finished. 3. Signal status - Current status of Respond signal. "Proposed actions" - switching sequence which will contain the command to Enable/Disable Respond signal. This will be available in "Test" mode only. In case the FLAT status is "On" or "Off", this part of the report will be empty. "Circuit breakers" - list of all circuit breaker which were analysed in the last FLAT execution. For each circuit breaker, the following are given: 1. Peak Current -Rated Current - rated level of peak current -Calculated - calculated value of peak current -Quality - quality marker which may be Bad or Good depending on Rated Current and Calculated current ratio. 2. Breaking Current - Rated Current - rated level of breaking current < -Calculated - calculated value of breaking current -Quality - quality marker which may be Bad or Good depending on Rated Current and Calculated current ratio. 3.Thermal Current - Rated Current - rated level of thermal current - Calculated - calculated value of thermal current - Quality - quality marker which may be Bad or Good depending on Rated Current and Calculated current ratio. (Values should be in kA not A and replace "Quality" for "Violation" - KB) Filter functionality is also available in the Report.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-27: FLAT Execution Report: Enable mitigation technique in case breaking capacity is exceeded		
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations in case there are breakers whose breaking capacity is exceeded.		
Preconditions: DMS services are started and in HOT state. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:

1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Execution Report is opened.
2	Expand the network tree, and select arbitrary substation (substation that is part of the Respond program).	Report is populated with the results for selected substation.
3	Observe the "Circuit breakers" and "Applied technique" parts of the report.	If any of the breakers in the list has a "Bad" or "Questionable" value in "Breaking Violation" column, then "Issued command" within the "Applied technique" part of the report should be "Enabled". (Enabled/Disabled and respond signal should be determined using the Breaking Current ONLY - KB) Note: If there are no breakers whose breaking capacity has been violated, in order to verify this behavior, try lowering the soft limit factors in FLAT Profile.
5	If the actual result is not in line with the expected results from step 3 (there are breakers with violation, but issued command is "Disable"), open the Control and Monitoring window to get more information about the cause for this behavior.	In the FLAT control and monitoiring window Locate the same substation as observed in step 1. Click on the "..." button in the Messages column A message with the following information should appear: "Current status of switch [switchID] is not as expected (defined in selected profile) and Respond signal will be disabled."
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-28: FLAT Execution Report: Disable mitigation technique in case breaking capacity is within limits		
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations in case breaking capacity is within predefined limits.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Execution Report is opened.
2	Expand the network tree, and select arbitrary substation (substation that is part of the Respond program).	Report is populated with the results for selected substation.

3	Observe the "Circuit breakers" and "Applied technique" parts of the report.	If all the breakers in the list have "Good" value in "Overall quality" column, then "Issued command" within the "Applied technique" part of the report should be "Disabled". Enabled/Disabled and respond signal should be determined using the Breaking Current ONLY - KB)
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-29: FLAT Execution Report: No results if FLAT status is OFF		
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report in case when FLAT status is OFF.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	From main menu choose "FLAT - Control & Monitoring".	"FLAT - Control & Monitoring" window is opened.
2	Right click on substation that has assigned FLAT profile and choose "Status" option from context menu.	"Status" window is opened for that part of network.
3	Change the FLAT Status to "Off" state and click on the "OK" button.	FLAT Status column is updated for selected part of the network - it is in the "Off" state.
4	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background.	FLAT Execution Report is opened.
5	Expand the network tree, and select the substation from step 2.	Report should be empty. No results will be displayed since the status of the function is Off.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-30: FLAT Execution Report: Switching sequence in Test mode
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report - Proposed actions part of

the report. In case that FLAT Status is in Test mode, this part of the report will contain switching sequence that can be used for issuing Enable/Disable command for Respond signal manually.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Off".		
#:	Step actions:	Expected Results:
1	From main menu choose "FLAT - Control & Monitoring".	"FLAT - Control & Monitoring" window is opened.
2	Right click on substation that has assigned FLAT profile and choose "Status" option from context menu.	"Status" window is opened for that part of network.
3	Change the FLAT Status to "Test" state and click on the "OK" button.	FLAT Status column is updated for selected part of the network - it is in the "Test" state.
4	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Execution Report is opened.
5	Expand the network tree, and select the substation from step 2.	"Proposed action" part of the report should contain switching sequence with the same command as displayed for "Issued command" in "Applied technique" part of the report.
6	Export the switching sequence to the Switching Plan and execute it.	Respond signal status should be in accordance with the command that has been executed in Switching Plan.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-31: FLAT Execution Report: In the event of function failure Respond signal will be enabled		
Purpose: The main purpose of this test case is to validate that the application will activate the "fail safe" approach in the event of an unexpected function failure. Function will fail in the following cases: 1. Breaker Capacity results are unavailable due to the problem with short circuit calculation. 2. There are no circuit breakers in selected part of the network. 3. Calculation engine crash.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:

1	Locate area of Respond station where FLAT is enabled and place temporary ground on an energized element.	Temporary ground placed and affected part of the network is marked as network with unknown topology. Note: Placing of ground on energized element is not allowed and therefore that part of the network is marked as unknown topology network.
2	Open FLAT Execution Report and observe result for the considered Respond station.	FLAT status is ON. Issued command = Enabled Respond signal status = Enabled. There are no results for circuit breakers presented in the report, since the calculation has not performed due to bad topology.
3	Open FLAT Control and Monitoring window and observe data for the considered Respond station.	FLAT Status is ON. Respond signal value is Enabled. There is a message: Breaker Capacity results are unavailable due to the problem with short circuit current calculation.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-32: FLAT Execution Report: Values presented in Exceeded column		
Purpose: The main purpose of this test case is to validate that soft limit factors are taken into account during the determination of the breakers' quality marker.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Execution Report is opened.
2	Expand the network tree, and select arbitrary substation (substation that is part of the Respond program).	Report is populated with the results for selected substation.
3	Observe the "Circuit breakers" part of the report.	Quality marker can have the following values: - Good - Questionable - Bad *AP 25/03 Is Quality the right term? Can we have 'Exceeded' ? These markers are determined for each criteria (Peak, Breaking, Thermal current). Observe the results and verify that quality markers are determined in accordance to the following rules: - If Calculated is greater or equal than Rated - Quality is Bad, - If Calculated is smaller and equal than (lower soft limit)*Rated -Quality is Good, - If Calculated between (upper soft limit)*Rated and Rated - Quality is Questanable. There is no mention of the Upper soft limit. It was understood that the Upper soft limit would be used to trigger the Enable status (effectively reducing the CB rating). Bad (Which is used to ENABLE): = Upper soft limit* CB

		Break Rating The Bad should only reset once the FL goes below the Lower Soft Level * Rating. Note: All respond ENABLE/DISABLE Triggers should be triggered by Break Rating KB
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-37: FLAT Execution: Enable mitigation techniques in CRMS		
Purpose: The main purpose of this test case is to validate that signal for enabling of fault level mitigation techniques has appropriate value in a case when violation of fault level limits has detected in ADMS.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Execution Report is opened.
2	Expand the network tree, and select arbitrary substation (substation that is part of the Respond program).	Report is populated with the results for selected substation.
3	Observe the "Circuit breakers" and "Applied technique" parts of the report.	If any of the breakers in the list has a "Bad" or "Questionable" value in "Overall quality" column, then "Issued command" within the "Applied technique" part of the report should be "Enabled". Note: If there are no breakers whose breaking capacity has been violated, in order to verify this behavior, try lowering the soft limit factors in FLAT Profile.
4	Check value of appropriate signals (IsLimiter, Adaptive Protection) in CRMS.	They have to be set on Enabled value.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-38: FLAT Execution: Disable mitigation technique in CRMS
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations in case breaking capacity is within predefined limits.
Preconditions:

DMS services are started and in HOT state. DMD is started and connected to DMS services. There are RESPOND FAULT ANALYSIS IN PROGRESS signals assigned to Respond stations. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Execution Report from the main menu. Note: The main menu is configurable so that user is able to add FLAT Execution Report command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Execution Report is opened.
2	Expand the network tree, and select arbitrary substation (substation that is part of the Respond program).	Report is populated with the results for selected substation.
3	Observe the "Circuit breakers" and "Applied technique" parts of the report.	If all the breakers in the list have "Good" value in "Overall quality" column, then "Issued command" within the "Applied technique" part of the report should be "Disabled".
4	Check status of appropriate signals in CRMS.	Is Limiter and/or Adaptive Protection have to be set on Disabled value.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-33: FLAT Event: Change FLAT Status Event		
Purpose: The main purpose of this test case is to verify that information about FLAT status changes appear in Event Summary.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists.		
#:	Step actions:	Expected Results:
1	Open FLAT Control and Monitoring window from main menu.	FLAT Control and Monitoring window is opened.
2	Select a Respond station and open context menu of it by right-click and select option "Status".	Commanding window for FLAT Status selection is opened.
3	Change FLAT Status to be different than current status.	FLAT Status has been changed.
4	Open Summary->Event Summary from main	If FLAT Status has been changed to "ON" or "Test", in the previous step, the message will be: "FLAT functionality is enabled for site {{ID}}.", where {{ID}} is ID of considered station. If FLAT

	menu.	Status has been changed to "OFF", in the previous step, the message will be "FLAT functionality is disabled for site {{ID}}.", where {{ID}} is ID of considered station.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-34: FLAT Event: Respond signal value has been changed		
Purpose: The main purpose of this test case is to verify that information about Respond signal value changes appear in the Event Summary.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Control & Monitoring window from the main menu. Note: The main menu is configurable so that user is able to add FLAT Control and Monitoring command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Control and Monitoring is opened.
2	Find a Respond station with enabled FLAT functionality (FLAT Status is ON) and Disabled value of Respond signal.	Please remember Respond station name with enabled FLAT functionality and its FLAT profile since it will be used later.
3	Go to Tools->Profile Library and expand FLAT in the tree view.	FLAT Profile Library is opened.
4	Find FLAT profile considered in step 2 and open it.	FLAT profile considered in step 2 is opened.
5	Change soft limit to very slow value, e.g. 0.1. Note: The aim is to decrease fault level limit so that calculated fault level is greater than the limit which will require changing Respond signal value to Enabled of fault level mitigation techniques.	Soft limit has been changed (to value of 0.1).
6	Go to schematic view and locate considered station from step 2.	Considered station from step 2 is located on schematic view.
7	Find a closed switching device in the area of considered station and open it. Note: Opening the switching device, network topology in the area of considered station is changed and that will cause triggering of FLAT functionality.	The switching device is opened.
8	Open FLAT Execution Report from the main menu.	FLAT Execution Report is opened.
9	Find considered Respond station in the tree view of FLAT Execution Report and click on it.	FLAT results for selected station are presented.

10	Odserve "Issued command" and "Respond signal value" in Current Status panel.	"Issued command" is "Enabled" and "Respond signal value" is Enabled.
11	Open Event Summary and find message with information that Respond signal value has been changed.	There is a message: "Respond signal for site {{ID}} changed value to {{Respond signal value}}.", where ID is ID of considered station.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-36: FLAT Event: Respond signal command fails to execute		
Purpose: The main purpose of this test case is to verify that information about failure of Respond signal command execution appear in the Event Summary.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Control & Monitoring window from the main menu. Note: The main menu is configurable so that user is able to add FLAT Control and Monitoring command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Control and Monitoring is opened.
2	Find a Respond station with enabled FLAT functionality (FLAT Status is ON) and Disabled value of Respond signal.	Please remember Respond station name with enabled FLAT functionality and its FLAT profile since it will be used later.
3	Go to Tools->Profile Library and expand FLAT in the tree view.	FLAT Profile Library is opened.
4	Find FLAT profile considered in step 2 and open it.	FLAT profile considered in step 2 is opened.
5	Change soft limit to very slow value, e.g. 0.1. Note: The aim is to decrease fault level limit so that calculated fault level is greater than the limit which will require changing Respond signal value to Enabled of fault level mitigation techniques.	Soft limit has been changed (to value of 0.1).
6	Go to schematic view and locate considered station from step 2.	Considered station from step 2 is located on schematic view.
7	Open context menu of the station and select "Signals" options	List of all specifed signals in considered station is opened.
8	Find Respond signal and open its Commanding window by double-click on it.	Commanding window of Respond signal is opened.

9	Place "Communication loss" tag on Respond signal.	Tag "Communication loss" has beed assigned to the Respond signal.
10	Find a closed switching device in the area of considered station and open it. Note: Opening the switching device, network topology in the area of considered station is changed and that will cause triggering of FLAT functionality.	The switching device is opened.
11	Open FLAT Execution Report from the main menu.	FLAT Execution Report is opened.
12	Find considered Respond station in the tree view of FLAT Execution Report and click on it.	FLAT results for selected station are presented.
13	Odserve "Issued command" and "Respond signal value" in Current Status panel.	"Issued command" is "Enabled" and "Respond signal value" is Disabled.
14	Open Event Summary and find message with information that Respond signal command has failed to execute. **AP 25/03 - How is the operator made aware, is the an ALARM that has to be acknowledged?**	There is a message: "Respond command fails to execute for site {{ID}}.", where ID is ID of considered station.
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-35: FLAT Alarm: Alarm is issued for critical circuit breakers		
Purpose: The main purpose of this test case is to verify that alarm is arised in a case when fault level limit has been violated for considered circuit breakers.		
Preconditions: DMS services are started and in HOT state. DMD is started and connected to DMS services. User who is member of Grid Management Engineer job role group exists. Topology change trigger (or time trigger) is enabled in FLAT Profile. Substation has a Profile assigned to it. FLAT Status is either "On" or "Test".		
#:	Step actions:	Expected Results:
1	Open FLAT Control & Monitoring window from the main menu. Note: The main menu is configurable so that user is able to add FLAT Control and Monitoring command in any available menu list. Recommendation is to add FLAT Execution Report in Core Apps menu, since it is real-time application runs in background	FLAT Control and Monitoring is opened.
2	Find a Respond station with enabled FLAT functionality (FLAT Status is ON) and Disabled value of Respond signal.	Please remember Respond station name with enabled FLAT functionality and its FLAT profile since it will be used later.
3	Go to Tools->Profile Library and expand FLAT in the tree view.	FLAT Profile Library is opened.
4	Find FLAT profile considered in step 2	FLAT profile considered in step 2 is opened.

	and open it.	
5	Change soft limit to very slow value, e.g. 0.1. Note: The aim is to decrease fault level limit so that calculated fault level is greater than the limit which will lead to violation of fault level limit for considered circuit breakers.	Soft limit has been changed (to value of 0.1).
6	Go to schematic view and locate considered station from step 2.	Considered station from step 2 is located on schematic view.
7	Find a closed switching device in the area of considered station and open it. Note: Opening the switching device, network topology in the area of considered station is changed and that will cause triggering of FLAT functionality.	The switching device is opened.
8	Open FLAT Execution Report from the main menu.	FLAT Execution Report is opened.
9	Find considered Respond station in the tree view of FLAT Execution Report and click on it.	FLAT results for selected station are presented.
10	Odserve results given in "Circuit breakers" panel.	There are circuit breakers with "Bad" or "Suspicious" quality marker for one or more criteria (Peak Current, Breaking Current, Thermal Current).
11	Find one of critical circuit breakers (circuit breaker with "Bad" or "Suspicious" quiality marker) from the FLAT Execution report.	Remember ID of critical circuit breaker.
12	Open Alarm Summary.	One or more of the following messages appear in the Alarm summary for considered circuit breaker depending on criterion which has been violated: 1. "Peak current value limit is violated for circuit breaker {{circuit breaker ID}}." 2. "Breaking current value limit is violated for circuit breaker {{circuit breaker ID}}." 3. "Thermal current value limit is violated for circuit breaker {{circuit breaker ID}}." If more than one criteria have been violated, there will be as many messages as violated criteria for considered circuit breaker. **AP 25/03 - Are all breakers considered for each sub-station, we could have ALARM overload if all devices report a violation simulataneously, would it be better to create EVENTS and a single substation ALARM to inform the operator that FL mitigation is required**
Execution type:	Manual	
Keywords:	FLAT	

Test Suite : FLAT On Demand

Test Case ENWL-RES-15: FLAT On Demand Options		
Purpose: Observe available Fault Level Assessment options when the application is executed on demand.		
Preconditions: User who is member of Grid Management Engineers job role group logged in. DMS services started and in HOT state. DMD is started and connected to DMS services.		
#:	Step actions:	Expected Results:
1	Select Fault Level Assessment function from main menu.	Fault Level Assessment function appears in Function Execution Manager.
2	Click on Options button from toolbar in Function Execution Manager.	Fault Level Assessment Options window is opened.
3	Observe content of Fault Level Assessment Options window.	There are five sections in Fault Level Assessment Options window: - Standard (with 'IEEE\ANSI' and 'IEC' circle checkboxes) - Switching action options (with switch type checkboxes: 'Breaker', 'Disconnector', 'Fuse', 'Load break device' and 'All') - Calculation criteria (with checkboxes: 'Momentary (Peak) current', 'Breaking current', 'Thermal current' and 'Inrush current') - Limit factors (with sliders for 'Upper soft limit factor' and 'Lower soft limit factor') - Advanced options (contains two drop-down selections: 'Power of transmission network' (Maximum, Minimum and Actual) and 'Pre-fault voltage' (Maximum, Rated and Minimum), and two checkboxes: 'Line resistance growth' and 'Adjust Petersen coil').
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-39: FLAT On Demand Execution		
Purpose: The main purpose of this test is to demonstrate execution of FLAT functionality on demand.		
Preconditions: User who is member of Grid Management Engineers job role group logged in. DMS services started and in HOT state. DMD is started and connected to DMS services.		
#:	Step actions:	Expected Results:
1	Select Fault Level Assessment function from main menu.	Fault Level Assessment function appears in Function Execution Manager.
2	Click on Options button from toolbar in Function Execution Manager.	Fault Level Assessment Options window is opened.
3	Select FLAT options.	The following FLAT options are set: - Standard - Switching action options - Calculation criteria - Limit factors - Advanced options ('Power of transmission network' (Maximum, Minimum and Actual) and 'Pre-fault voltage'

		(Maximum, Rated and Minimum), and two checkboxes: ‘Line resistance growth’ and ‘Adjust Petersen coil’).
4	Click on "Execute" button on Function Execution Manager toolbar. (NN: need to drag and drop device in the selected ckt box prior to this step)	Fault Level Assessment application starts to execute.
5	Wait until execution finishes and observe status of Fault Level Assessment given in Function Execution Manager.	Status of Fault Level Assessment application can be: Completed - the application has been executed successfully Completed with Warning - the application has been executed successfully with Warning messages Completed with Errors - the application has been executed successfully with Error messages Failed - the application failed to execute.
6	If the application finished with Warning messages, check text of the messages in the bottom of Function Execution Manager.	The following Warning messages can be issued: - Breaker Capacity results are unavailable due to the problem with short circuit calculation - if the application did not finish calculation due to the problem in determination of short circuit value. - There are no circuit breakers in selected part of the network - if there are no circuit breaker devices in area of interest
Execution type:	Manual	
Keywords:	FLAT	

Test Case ENWL-RES-40: FLAT On Demand Report		
Purpose: The main purpose of this test is to verify content of FLAT Report when the application has been triggered on demand.		
Preconditions: User who is member of Grid Management Engineers job role group logged in. DMS services started and in HOT state. DMD is started and connected to DMS services.		
#:	Step actions:	Expected Results:
1	Select Fault Level Assessment function from main menu.	Fault Level Assessment function appears in Function Execution Manager.
2	Click on Options button from toolbar in Function Execution Manager.	Fault Level Assessment Options window is opened.
3	Select FLAT options.	The following FLAT options are set: - Standard - Switching action options - Calculation criteria - Limit factors - Advanced options (‘Power of transmission network’ (Maximum, Minimum and Actual) and ‘Pre-fault voltage’ (Maximum, Rated and Minimum), and two checkboxes: ‘Line resistance growth’ and ‘Adjust Petersen coil’).
4	Click on "Execute" button on Function Execution Manager	Fault Level Assessment application starts to execute.

	toolbar.	
5	Wait until execution finishes.	Status of Fault Level Assessment is Completed.
6	Open Report from Function Execution Manager.	Fault Level Assessment Report is based on tree network view. Results are grouped in tabs per types of switching devices selected in Options for which the analysis has been done. Each tab containts results for particular type of switching devices. For each selected criteria in Options the following results are given: - Calculated value - calculated value of criterion - Rated value - considered limit of the criterion - Quality value - Bad, Qood or Questanable.
7	Verify Quality value.	**AP 25/03 Need to reference upper soft limit**If Calculated is greater and equal than Rated - Quality is Bad, If Calculated is smaller and equal than (lower soft limit)*Rated -Quality is Good, if Calculated between (lower soft limit)*Rated and Rated - Quality is Questanable
Execution type:	Manual	
Keywords:	FLAT	

Test Suite : Inspection

Test Case ENWL-RES-41: Inspection for 3.14-151:ADMS FLAT	
Purpose: Purpose of this test is requirement inspection for Req 3.14-151:ADMS FLAT	
Execution type:	Manual
Keywords:	FLAT

Test Case ENWL-RES-42: Inspection for 3.14-157:Communication with EHV and HV distribution network	
Purpose: Purpose of this test is inspection for Req 3.14-157:Communication with EHV and HV distribution network	
Execution type:	Manual
Keywords:	FLAT

Test Case ENWL-RES-43: Inspection for 3.14-158:Availability of the fault level analysis tool	
Purpose: Purpose of this test is inspection for Req 3.14-158:Availability of the fault level analysis tool	
Execution type:	Manual
Keywords:	FLAT

Test Case ENWL-RES-44: Inspection for 3.14-163:SCADA Communication infrastructure	
Purpose: Purpose of this test is requirement inspection for req 3.14-163:SCADA Communication infrastructure	
Execution type:	Manual
Keywords:	FLAT

APPENDIX B – RESPOND SAT TEST PLAN

Schneider Electric DMS

ENWL-Respond

Schneider Electric DMS NS

RESPOND_SAT

Scope

SAT Plan

Test Suite : FLAT Profile

Test Case ENWL-RES-1: Profile Library: Default FLAT Profile	
Author:	izabela.stefani
Purpose: The main purpose is to introduce FLAT default profile in Profile Library.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-2: Profile Library: Create New FLAT Profile	
Author:	izabela.stefani
Purpose: The main purpose is to demonstrate creation of FLAT profile and defining of available parameters inside it.	
Execution type:	Manual
Requirements	3.14-161: Calculation of fault level for ten EHV & HV networks

Test Case ENWL-RES-3: Profile Library: FLAT Profile Control	
Author:	izabela.stefani
Last edit by:	Anthony.Pointon

Purpose: The main purpose is to verify available control over created FLAT profile.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-4: Profile Assignment Editor Window	
Author:	izabela.stefani
Last edit by:	Anthony.Pointon
Purpose: The main purpose of this test to verify opening of "Profile Assignment Editor" window and its content.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-5: Profile Assignment Editor: Assigning Profiles	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify that profile can be assigned for the selected circuit and for the specified function.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-6: Profile Assignment Editor: Assigning Profile Using Context Menu	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify that profile can be assigned for the selected circuit and for the specified function using context menu.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-7: Profile Assignment Editor: Removing Profiles	
Author:	izabela.stefani
Purpose:	

The main purpose of this test is to verify that profile can be removed for the circuit and for the specified function.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-8: Profile Assignment Editor: Removing Profile Using Context Menu	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify that profile can be removed for the selected circuit and for the specified function.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-10: Profile Library: Switch Selection in FLAT Profile	
Author:	izabela.stefani
Purpose: The main purpose of this test is to introduce selection of switches in FLAT profile, which statuses should be checked before sending the Respond signal.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-11: Profile Assignment Editor: Removing FLAT Profiles From Substation Where FLAT Is Active	
Author:	izabela.stefani
Purpose: The main purpose is to demonstrate the preventing of FLAT profile removing for substation where FLAT functionality is enabled (active).	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-46: Profile Assignment Editor: Reassigning FLAT Profiles From Substation Where FLAT Is Active	
Author:	izabela.stefani
Purpose:	

The main purpose is to demonstrate the preventing of FLAT profile reassigning for substation where FLAT functionality is enabled (active).	
Execution type:	Manual
Requirements	None

Test Suite : FLAT Triggering and Execution

Test Case ENWL-RES-19: FLAT Triggering: Topology Trigger	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will be triggerd on topology change.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-21: FLAT Triggering: Topology Trigger When FLAT Status is OFF	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will not be triggerd on topology change if FLAT is not enabled for station where topology change has been occured.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-20: FLAT Triggering: Topology Trigger When All Triggers Are Inhibit	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will not be triggerd on topology change if all triggers are inhibit, althought FLAT is enabled for station where topology change has been occured.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-22: FLAT Triggering: Topology Trigger When Triggering Options are not checked in FLAT Profile	
Author:	izabela.stefani

Purpose: The main purpose of this test is to demonstrate that FLAT functionality will not be triggerd on topology change or after predefined period of time, althought FLAT is enabled for station where topology change has been occured.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-23: FLAT Triggering: Time Trigger	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will be triggerd after prespecifed period of time expired.	
Execution type:	Manual
Requirements	3.14-152: FLAT Periodic Calculation

Test Case ENWL-RES-24: FLAT Triggering: Time Trigger When Topology Change Appears	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate that FLAT functionality will be triggerd after prespecifed period of time expired, regardless if some topology changes have been occured meanwhile.	
Execution type:	Manual
Requirements	3.14-152: FLAT Periodic Calculation

Test Suite : FLAT Control and Monitoring

Test Case ENWL-RES-12: FLAT Dashboard: Overview	
Author:	izabela.stefani
Purpose: Verify content of FLAT Dashboard window.	
Execution type:	Manual
Requirements	3.14-160: Initial proposal for ten EHV &HV distribution networks

Test Case ENWL-RES-13: FLAT Dashboard: Change FLAT Status	
Author:	izabela.stefani

Purpose: The main purpose of this test is to demonstrate opening "Status" window from "FLAT Dashboard " window.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-14: FLAT Dashboard: Change FLAT Status When Profile Is Not Assigned	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate prevention of "FLAT Status" change when FLAT profile is not assigned.	
Execution type:	Manual
Requirements	None

Test Suite : FLAT Results

Test Case ENWL-RES-25: FLAT Execution Report: Report Overview for Entire Network	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for entire network.	
Execution type:	Manual
Requirements	3.14-154: Circuit Breaker in affected area

Test Case ENWL-RES-26: FLAT Execution Report: Report Overview for Station	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations.	
Execution type:	Manual
Requirements	3.14-154: Circuit Breaker in affected area

Test Case ENWL-RES-27: FLAT Execution Report: Enable mitigation technique in case breaking capacity is exceeded	
Author:	izabela.stefani
Purpose:	

The main purpose of this test case is to validate contents of the FLAT Execution Report for stations in case there are breakers whose breaking capacity is exceeded.	
Execution type:	Manual
Requirements	3.14-153: CRMS request 3.14-162: 'ARM' Command

Test Case ENWL-RES-28: FLAT Execution Report: Disable mitigation technique in case breaking capacity is within limits	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations in case breaking capacity is within predefined limits.	
Execution type:	Manual
Requirements	3.14-153: CRMS request 3.14-162: 'ARM' Command

Test Case ENWL-RES-29: FLAT Execution Report: No results if FLAT status is OFF	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report in case when FLAT status is OFF.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-30: FLAT Execution Report: Switching sequence in Test mode	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report - Proposed actions part of the report. In case that FLAT Status is in Test mode, this part of the report will contain switching sequence that can be used for issuing Enable/Disable command for Respond signal manually.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-31: FLAT Execution Report: In the event of function failure Respond signal will be enabled

Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate that the application will activate the "fail safe" approach in the event when the application does not provide results. THe application will not provide results in the following cases: 1. Breaker Capacity results are unavailable due to the problem with short circuit calculation. 2. There are no circuit breakers in selected part of the network. 3. Calculation engine crash. 4. If calculation is triggered for part of the network with unknown topology.	
Execution type:	Manual
Requirements	3.14-153: CRMS request 3.14-162: 'ARM' Command

Test Case ENWL-RES-32: FLAT Execution Report: Values presented in Exceeded column	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate that Exceeded column are populated in accordance to selected upper/lower soft limit and calculated values of criteria.	
Execution type:	Manual
Requirements	3.14-154: Circuit Breaker in affected area

Test Case ENWL-RES-37: FLAT Execution: Enable mitigation techniques in CRMS	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate that signal for enabling of fault level mitigation techniques has appropriate value in a case when violation of fault level limits has detected in ADMS.	
Execution type:	Manual
Requirements	3.14-155: FLAT link into CRMS via ICCP 3.14-156: Fault level analysis tool

Test Case ENWL-RES-38: FLAT Execution: Disable mitigation technique in CRMS	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to validate contents of the FLAT Execution Report for stations in case breaking capacity is within predefined limits.	
Execution type:	Manual
Requirements	3.14-155: FLAT link into CRMS via ICCP 3.14-156: Fault level analysis tool

Test Case ENWL-RES-33: FLAT Event: Change FLAT Status Event	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to verify that information about FLAT status changes appear in Event Summary.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-34: FLAT Event: Respond signal value has been changed	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to verify that information about Respond signal value changes appear in the Event Summary.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-36: FLAT Event: Respond signal command fails to execute	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to verify that information about failure of Respond signal command execution appear in the Event Summary.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-35: FLAT Alarm: Alarm is issued for critical circuit breakers	
Author:	izabela.stefani
Purpose: The main purpose of this test case is to verify that alarm is arised in a case when fault level limit has been violated for considered circuit breakers.	
Execution type:	Manual
Requirements	None

Test Suite : FLAT On Demand

Test Case ENWL-RES-15: FLAT On Demand Options	
Author:	izabela.stefani
Purpose: Observe available Fault Level Assessment options when the application is executed on demand.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-39: FLAT On Demand Execution	
Author:	izabela.stefani
Purpose: The main purpose of this test is to demonstrate execution of FLAT functionality on demand.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-40: FLAT On Demand Report	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify content of FLAT Report when the application has been triggered on demand.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-50: FLAT On Demand Flags on schematic view	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify presentation of flags with results for each considered circuit breaker when the application has been triggered on demand.	
Execution type:	Manual
Requirements	None

Test Suite : FLAT Scenarios

Test Case ENWL-RES-45: Respond signal status in the case of RTU scan off	
Author:	izabela.stefani
Purpose: The purpose of this test case is to verify Respond signal status in the case when RTU is in scan off state.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-47: Selected switch in FLAT Profile is in Error state in CRMS	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify that the FLAT will consider last known state in a case when one of selected switches in FLAT profile is in Error state in CRMS.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-48: More fault level mitigation techniques are selected in FLAT profile	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify that all selected mitigation techniques in FLAT profile will be also presented in the FLAT report for corresponding station.	
Execution type:	Manual
Requirements	None

Test Case ENWL-RES-49: No fault level mitigation technique is selected in FLAT profile	
Author:	izabela.stefani
Purpose: The main purpose of this test is to verify that nothing will be presented in the FLAT report if no mitigation technique is not selected in the assigned profile.	
Execution type:	Manual
Requirements	None

APPENDIX C – FINAL INSTALLATION LIST

Substation	Substation Number	Voltage at Site	Protection at Site	Installation year of equipment	Worst Performer Feeder Ranking	Number of faults in 2012/2013	Faults outside fault level	Technology to be Deployed	Fault Level Reason
Bamber Bridge	400201	11kV	Numerical / Microprocessor	2006	315	7	2	HV Is Limiter - bus section - 1	Existing arrangements at site
Broadheath	100134	11kV	Electromechanical		401	10	3	HV Is Limiter - Incomer - 2	RMU on outgoing feeder
Athletic ST	400052	6.6kV, 33kV	6.6kV - Electromechanical 33kV - Electromechanical	1964	294	28	8	EHV Is sensing equipment - 1	RMU on outgoing feeder
Wigan BSP (Gidlow CCT No 1)	200421	6.6kV, 33kV	6.6kV - Electromechanical 33kV - Electromechanical	1993	145	20	6	EHV Is sensing equipment - 2	RMU on outgoing feeder
Longridge	400416	6.6kV	Mixture	1967	135	36	11	HV Is sensing equipment - 1	RMU on outgoing feeder
Hareholme	400092	6.6kV	Static Electronic	1994	257	20	6	HV Is sensing equipment - 2	RMU on outgoing feeder
Nelson	400044	6.6kV	Electromechanical	1965	131	17	5	HV Is sensing equipment - 3	RMU on outgoing feeder
Mount St	100622	6.6kV, 33kV	6.6kV - Electromechanical 33kV - Electromechanical	1966	223	10	3	EHV adaptive protection - 1	RMU on outgoing feeder
Offerton	302872	6.6kV, 33kV	6.6kV - Electromechanical 33kV - Electromechanical	1966	719	0	0	EHV adaptive protection - 2	Can run in // with 3x BSPs
Atherton TC	205318	11kV	Static Electronic	1994	7	29	9	HV adaptive protection - 1	Substation equipment

Substation	Substation Number	Voltage at Site	Protection at Site	Installation year of equipment	Worst Performer Feeder Ranking	Number of faults in 2012/2013	Faults outside fault level	Technology to be Deployed	Fault Level Reason
Denton West	100111	6.6kV, 33kV	6.6kV - Electromechanical 33kV - Electromechanical	1963 / 2005	1047	0	0	HV adaptive protection - 2	Substation equipment
Blackbull	400403	6.6kV	Numerical / Microprocessor	2007	303	17	5	HV adaptive protection - 3	RMU on outgoing feeder
Irlam	100615	6.6kV	Static Electronic	1989	275	7	2	HV adaptive protection - 4	RMU on outgoing feeder
Littleborough	304884	6.6kV	Electromechanical	1966	336	13	4	HV adpative protection - 5	RMU on outgoing feeder