



**Activity**  
Connecting with intelligence

# InteropEngine – User Guide

*INTEROP ENGINE GUI REVISION 1.2.0*

*USER GUIDE REVISION 1.3.0*

*DATE: 2018/06/29*

## REVISION HISTORY

Version	Date	Author	
1.0.0	2017/03/28	RG	Initial Version
1.0.1	2017/05/22	RG	Update and minor improvements
1.0.2	2017/09/05	RG	Update to new GUI
1.2.0	2018/02/13	GDG	Remove Routing profile configuration
1.3.0	2018/06/29	GDG	Update to new GUI version 1.2.1



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## OVERVIEW

This document aims at explaining the user interface of the InteropEngine.

This document targets LoRaWAN device developers and testers.

This document does not contain explanations on each Test Plan (TPIT thereafter) as it is the aim of another document, “ThingPark Wireless Interoperability Test plan”, nor is it a description of the LoRaWAN specifications.

## DEFINITIONS AND ABBREVIATIONS

Term	Definition
<b>ADR</b>	Adaptive Data Rate
<b>AppKey</b>	Device root key used to derive AppSKey and NwkSKey during OTA procedure
<b>AppSKey</b>	Application Session Key
<b>DevEUI</b>	Device EUI, globally unique 64 bit identifier assigned according to the IEEE EUI-64 guidelines
<b>DUT</b>	Device Under Test
<b>Interop</b>	A test campaign to test interoperability between a device and Actility's core network
<b>InteropEngine</b>	The engine developed by Actility to perform an interop
<b>LoRa</b>	Long range and low energy radio RF technology developed by Semtech
<b>LoRaWAN</b>	Open Source network topology layer sitting on top of LoRa
<b>LC</b>	Logical Channel
<b>LRC</b>	Long Range Concentrator : LoRa network server
<b>LRR</b>	Long Range Relay: LoRa Basestation
<b>NwkSKey</b>	Network Session Key
<b>RSSI</b>	Received Signal Strength Indicator
<b>SF</b>	Spreading Factor
<b>SNR</b>	Signal to Noise Ratio



## REFERENCE DOCUMENTS

Document	Description
LoRaWAN Specification 1R0	LoRaWAN Specification 1.0
LoRaWAN1.0.1final05Apr2016_1099_1	LoRaWAN Specification 1.0.1
LoRaWAN102-20161012_1398_1	LoRaWAN Specification 1.0.2
LoRaEndDeviceCertificationEU 1.0	LoRa-Alliance End Device Test Software EU
LoRaEndDeviceCertificationNAV	LoRa-Alliance End Device Test Software US
ThingPark Wireless Interoperability Test Plan - V1.5.1	Actility's test plan for LoRaWAN end device

## INTRODUCTION

The InteropEngine is a test tool to validate interoperability of LoRaWAN devices on Actility's networks. This tool gives the list of all the tests that should be run on the device to test against a specific LoRaWAN specification (1.0, 1.0.1 or 1.0.2) for a specific class (A, B or C) and for a specific region (EU, US or APAC).

Currently this tool can only be used on Actility's private development platform. To use this platform, Actility's partner portal ([partners.thingpark.com](https://partners.thingpark.com)) can be used to register with a free account is required and then use the Device Manager to start provisioning the devices. Please refer to the current policies and documentations on the portal for more information on this subject.

The front end of the InteropEngine is available here:

<https://ecosystem.actility.com/interop>

## SUBSCRIBERS VS USERS

The InteropEngine uses ThingPark user and subscriber's IDs to ensure security and right management. For a user to use the InteropEngine properly, it is essential to understand the differences between Subscribers and Users:

- A Subscriber is an entity (person, company ...) that subscribed to a specific data plan. The default plan for Actility's development platform is to allow 5 devices and 1 gateway with no limits (except regulatory) on the bandwidth usage.
- A user is a person that is linked to a subscriber to use this specific data plan.

As such, a user does not register a device or gateway on its own account, but on the subscriber's account. This allow a user to access any devices' information from the same subscribers.

In the case of the InteropEngine, this can be used to allow a team of testers to access any devices provisioned on the same subscriber's account. For example: a subscriber (NewDevice



Corp.) is developing a new LoRaWAN device. The main engineer in charge (Person A) is developing on Activity's development network. Once the device is feature complete, it can now go through an internal validation phase and this is done by a tester (Person B). Since both have user accounts under NewDevice Corp. subscriber, both can access the same device and the tester simply must select the right device in the InteropEngine to start testing it.

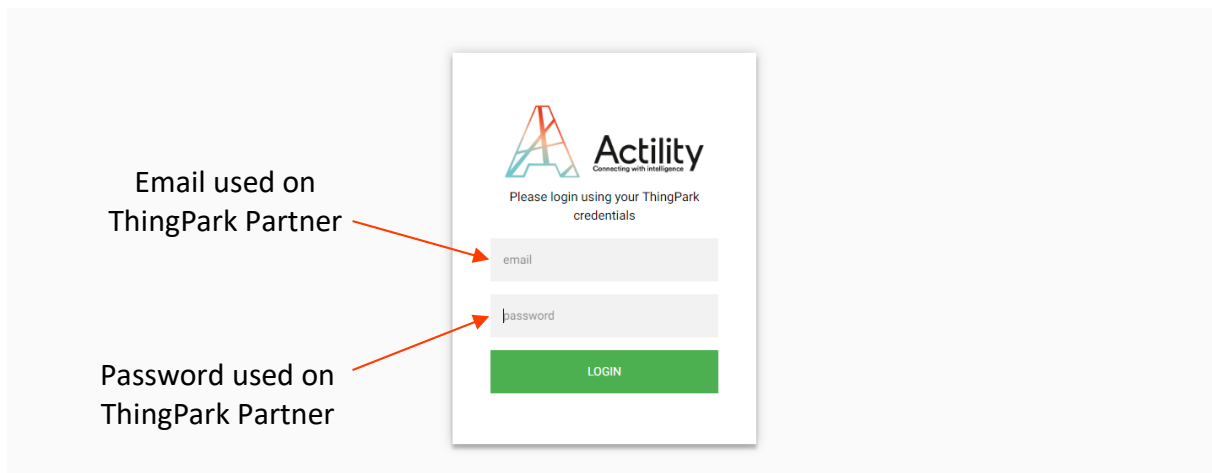
## SETTING UP THE DEVICE

The device must be already provisioned on the ThingPark Wireless interface and that the tester already has an account on ThingPark Wireless platform, this includes accounts created from the Partner portal (<https://partners.thingpark.com>).

Since InteropEngine V1.2, it is no more required to configure an Application Server routing profile to push your packets to the interopEngine

1. Log into the DeviceManager (<https://dev1.thingpark.com/deviceManager/>) using Activity's development platform credentials.
2. Create your device
3. Go to the InteropEngine tool

## HOW TO LOGIN/LOGOUT



---

**Note:** An account on Activity's partner portal (<https://partners.thingpark.com>) or on ThingPark Wireless Development platform is required to log in the InteropEngine.

---



Once logged in, the default 'Interop' page should be visible:

There are currently 13 device(s) registered for interop.

Create new test campaign

Status	DevEUI	Name
▶ ⚙️	0018B200000022C	Adress: 12345678901234567890
▶ ⚙️	0018B2000000329	Adress: 12345678901234567890
▶ ⚙️	F03D291000001D0F	Adress: 12345678901234567890
▶ ⚙️	0018B2000000C09	Adress: 12345678901234567890
▶ ⚙️	0018B2000000B2A	Adress: 12345678901234567890
▶ ✓	0018B200000099E	Adress: 12345678901234567890
▶ ✓	0004A30B061013EC	Adress: 12345678901234567890
▶ ⚠️	4883C7DF3001119C	Adress: 12345678901234567890
▶ ❌	F03D2900000125B4	Adress: 12345678901234567890
▶ ⚠️	000DB531137D3565	Adress: 12345678901234567890
▶ ⚠️	0004A30B001B0512	Adress: 12345678901234567890
▶ ⚠️	000000001FEBB32	Adress: 12345678901234567890
▶ ⚠️	343137326536650D	Adress: 12345678901234567890

**Note:** Only already registered devices are displayed in the list. If a device has never been registered, it needs to be added prior to be visible there.

To log out, the user simply needs to hover on the user name on the top right corner of the page, then on 'LogOut'

There are currently 13 device(s) registered for interop.

Create new test campaign

Log Out

## THE INTEROP ENGINE MAIN PAGE

Please find the documentation for [Activity's Inter Operability Self Test tool](#)

In this documentation can be found all the necessary information to set up the Application Server Route to allow the Device Under Test to be accessed through the InteropEngine.

The InteropEngine can be used as a Self Test tool in the case of the ThinkPark Connected program. Please refer to [ThinkPark Partner website](#) for more information about this.

The main page of the InteropEngine can be accessed simply by clicking in the Activity's icon on the top left corner.



This page contains documentation and other relevant links and information about the InteropEngine and the ThingPark Connected journey. It will be updated from time to time so please make sure to check for updated documentation.

### THE INTEROP ENGINE STATUS BAR

The Status Bar can be found at the bottom of the page of the InteropEngine. It contains various information about the current state of the InteropEngine.

[UL]: 8 278 175 packets / 87.773 MB

[DL]: 1 340 081 packets / 201.023 KB

Back-end: 1.2.1.3 - Front-end: 1.2.1.3 - LRC: 1.10.40

On the left, some statistics about the uplink/downlink count the InteropEngine has received. This is not for this specific user but for all users.

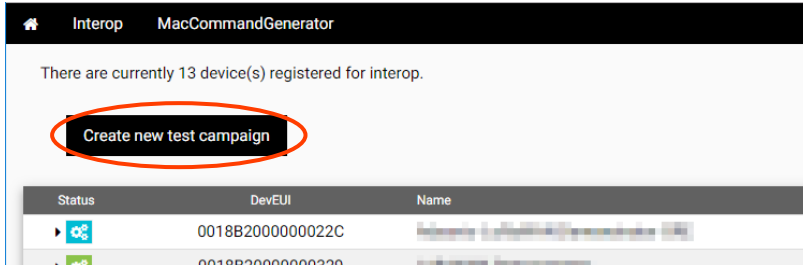
On the right, the current versions the InteropEngine is running at, for the Backend and for the GUI. This is important should you send us a report about a problem to specify these versions.





## HOW TO CREATE A NEW TEST CAMPAGNE

1. From the Interop page, click on the 'Create new test campaign' button.



2. A list of available devices already registered into your subscriber's account will be displayed. Only the devices NOT currently running test campaign and rightly provisioned will have possible actions:  
Click on 'Register' for the device to do interop testing on.

The screenshot shows a table of devices with columns: Device Name, devEUI, Region, Class, Specs, and Action. The Action column contains 'Register' (green), 'On Going' (blue), and 'Missing Connectivity Plan please check the device provisioning' (red). Annotations on the right side of the table explain the status of each action:

- 'Available for interop testing' points to a 'Register' action.
- 'Already running a test campaign' points to an 'On Going' action.
- 'Device not rightly provisioned' points to a red 'Missing Connectivity Plan' action.

Device Name	devEUI	Region	Class	Specs	Action
4883C7DF3001119C	EU863-870	A	LoRaWAN 1.0.1	Register	
0018B200000004A2	EU863-870	A	LoRaWAN 1.0.1	On Going	
000DB531137D3565	AS923	A	LoRaWAN 1.0.2	On Going	
0018B20000000D43	EU863-870	A	LoRaWAN 1.0.1	On Going	
000000000000000F	EU863-870	A	LoRaWAN 1.0.1	On Going	
0000000001AB8E46	EU863-870	A	LoRaWAN 1.0.2	Register	
00000000008639FA	US902-928	A	LoRaWAN 1.0.1	On Going	
343737397533830B	N/A	N/A	N/A	On Going	
3437373967336509	N/A	N/A	N/A	Register	
70B3D53260001A6B	EU863-870	A	LoRaWAN 1.0.1	On Going	
0018B200000000C4	N/A	N/A	N/A	Register	
1122334455667788	EU863-870	A	LoRaWAN 1.0.1	Register	
F03D291000001D01	EU863-870	A	LoRaWAN 1.0.2	Register	
3437373955338607	US902-928	A	LoRaWAN 1.0.1	On Going	
F03D291000001D00	N/A	N/A	N/A	Missing Connectivity Plan please check the device provisioning	



3. On the new dialog, fill all the required information:

4883C7DF3001119C

Device Name  prefilled name (can be changed)

LoRaWAN

LoRaWAN specification

LoRaWAN region

LoRaWAN class

Activation Type

Register

**Note:** The information given in red needs to be checked prior to adding the device. They are dependent on the device specifications and region of operation. The dialog is prefilled with default values that can be out of bound depending for this specific device.

4. Once all fields have been properly filled, click on the 'Register' button to create the new test campaign for this device. This will open the newly created test campaign.

**Note:** Some tests are added by default upon test campaign creation. These tests do not change any configuration on the device and as such are non-intrusive.



## HOW TO VISUALIZE A SPECIFIC TEST CAMPAIGN

1. From the Interop page, click on the device which is linked to the test campaign to be displayed in detail.
2. A list of test campaigns for this specific device should be displayed underneath the selected device, click on the line of the desired test campaign to open it.

Status	DevEUI	Name
	4883C7DF3001119C	Interop - Status - FARM
	343737397533830B	LoRaWAN 1
	0018B20000000043	Interop - Status - FARM
	000DB531137D3565	Interop (TP) Testes (TP) (TP) (TP)
	3437373955338607	LoRaWAN 1
	0018B2000000004A2	Interop (Status)
	0000000008639FA	Interop (Status)
	70B3D53260001A6B	Interop
	02000203-00000474	2018-03-20 09:28:51 Nemeus LoRaWAN 1.0.1 A EU863-870 OTAA
	000000000000000F	Interop
	000000001AB8E46	LoRaWAN 1
	F03D29100001D01	Interop (Status)
	3437373967336509	LoRaWAN 1.1
	1122334455667788	LoRa
	0018B200000000C4	Interop (Status)

3. The interop detail page is displayed.  
On left side, can be found the information given during the registration procedure and the closing test campaign button.  
Below can be found a list of tests that needs to be executed during a full interop process (aka 'ThingPark Connected' process).

The screenshot shows the 'MacCommandGenerator' interface for a specific interop campaign. On the left, there is a sidebar with campaign details: DevEUI (4883C7DF3001119C), InteropID (02000203-000004A6), Owner (100000718), Creation Date (29/06/2018, 12:03:09), Closing Date (On Going), LoRaWAN (LoRaWAN 1.0.1), Class (A), Region (EU863-870), and Identification (OTAA). The main area displays a list of tests with their IDs and status indicators (Created or None). The 'Created' tests are highlighted in blue.

Test ID	Test Name	Status
1.0.1	Specify the range of DevEUI allocated for the device part number.	
1.2.1	OTAA AppKey conformity test	
1.2.2	OTAA Join Request / Join Accept (this run TPIT 1.2.2.1 / 1.2.2.2 / 1.2.2.4 / 1.2.2.6 / 3.1.1)	<input type="radio"/> None
1.2.3	Agregated Duty Cycle test	
2.1.1	Uplink Unconfirmed message test	<input checked="" type="checkbox"/> Created
2.1.2	Uplink confirmed message test	<input checked="" type="checkbox"/> Created
2.1.3	Uplink Spreading factor range test	<input type="radio"/> None
2.1.4	Uplink Packet loss rate test	<input type="radio"/> None
2.2.1	Downlink unconfirmed message test	<input type="radio"/> None
2.2.2	Downlink confirmed message test	<input type="radio"/> None
2.2.3	Downlink Spreading factor range test	<input type="radio"/> None
2.2.4	Downlink Packet loss rate test	<input type="radio"/> None
2.2.5	RX2 window test	<input type="radio"/> None
3.1.2	Uplink channel usage test	<input checked="" type="checkbox"/> Created
3.2.1	ADR on unconfirmed uplink	<input type="radio"/> None
3.2.2	ADR on confirmed uplink	<input type="radio"/> None
3.2.3	ADR TxPower change test	<input type="radio"/> None
3.2.4	ADR Unconfirmed Redundancy test	<input type="radio"/> None
3.3.1	ADR Disabling test (for mobile devices)	<input type="radio"/> None
4.1.1.1	MAC RXTimingSetup test	<input type="radio"/> None
4.2.1.1	MAC RXParamSetup test	<input type="radio"/> None
4.3.1	MAC DevStatus test	<input type="radio"/> None
4.4	MAC NewChannelReq add and delete (TPIT 4.4.1 / 4.4.2)	<input type="radio"/> None

**Note:** The two buttons above the list of tests are filters. When they are Green, the category in question is visible. When they are red, the category in question is hidden.



- By clicking on a line of each test, an history and result of all test previously run on this test campaign can be found at the right

The screenshot displays the 'mmandGenerator' interface. On the left, a list of tests is shown with their status: 'Success', 'Created', 'Running', or 'None'. The 'Uplink Spreading factor range test' (2.1.3) is highlighted as 'Running'. On the right, a detailed view of this test is shown, including a progress bar at 33%, parameters (minSF: 7, maxSF: 12, packetTimeout: 3), and a JSON result object: 

```
{ "sf": { "min": "7", "max": "12", "current": "10" }, "packetTimeout": 2 }
```

**Note:** The test history is given in inverse chronological order, with the most recent on top.

## HOW TO START A TEST

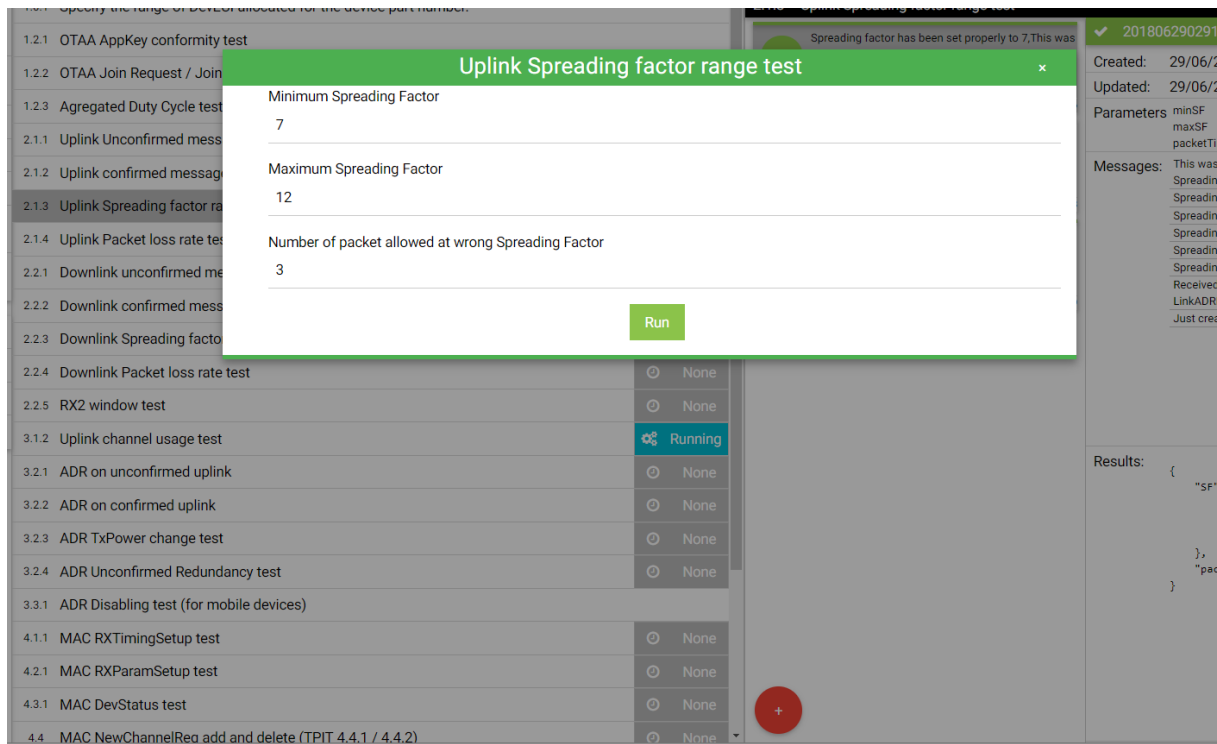
- In the interop detail page, search for the desired test to be run on the device in the list. Tests that can be run through scripts have a red round button with a plus (+) on the bottom side.

The screenshot displays the 'mmandGenerator' interface. The 'Uplink Spreading factor range test' (2.1.3) is now marked as 'Success'. The detailed view on the right shows a progress bar at 100% and a different JSON result object: 

```
{ "sf": { "min": "7", "max": "12", "current": "7" }, "packetTimeout": "2" }
```



2. Click on the button. A new dialog will pop up. Fill up the form and then click on 'Run' to start the test. If the test requires parameters, they will be asked in this form also.



**Note:** Test parameters are specific to the test itself and to the device specifications. The default values must be checked and updated to ensure the test does not give false positive or fail unexpectedly.

3. If the InteropEngine accepts the test, the interface will automatically be refreshed to display the new test. A pop up with an error message will be displayed if the test is rejected.

**Note:** Except default tests, only one test can be run at a time as they will change the behavior of the network to test the device.

4. You can repeat step 1 and 2 to add multiple tests in queue, then the InteropEngine will execute all tests one by one automatically.

The number display the position in queue.

The hourglass appears when the test is waiting the Network Server availability to start this test.



1.0.1	Specify the range of DevEUI allocated for the device part number.	
1.2.1	OTAA AppKey conformity test	
1.2.2	OTAA Join Request / Join Accept (this run TPIT 1.2.2.1 / 1.2.2.2 / 1.2.2.4 / 1.2.2.6 / 3.1.1)	✓ Success
1.2.3	Agregated Duty Cycle test	
2.1.1	Uplink Unconfirmed message test	✓ Success
2.1.2	Uplink confirmed message test	⌚ Created
2.1.3	Uplink Spreading factor range test	✓ Success
2.1.4	Uplink Packet loss rate test	! Warning
2.2.1	Downlink unconfirmed message test	⌚ Pending
2.2.2	Downlink confirmed message test	⌚ None
2.2.3	Downlink Spreading factor range test	1 ⌚ Queued
2.2.4	Downlink Packet loss rate test	3 ⌚ Queued
2.2.5	RX2 window test	⌚ None
3.1.2	Uplink channel usage test	⚙️ Running
3.2.1	ADR on unconfirmed uplink	⌚ None

**Note:** Some tests require a restart of the device, look the message log.

## HOW TO ABORT A TEST

1. In the interop detail page, search for the desired test to be aborted on the device in the list then click on the orange Abort button.

The screenshot shows the InteropEngine interface. On the left, a list of tests is displayed with their current status. The test '2.2.1 Downlink unconfirmed message test' is highlighted in grey and has a 'Running' status. On the right, a detailed view of this test is shown. The test name is '2.2.1 Downlink unconfirmed message test' and the device ID is '2018062902922'. The test status is 'Running' with a progress bar at 50%. An orange 'Abort' button is visible in the top left corner of the test detail view. The 'Messages' section shows 'Unconfirmed Downlink has been queued' and 'Just created'. The 'Results' section shows 'No results'.

2. If the test is successfully aborted, the page will be updated with the new status. If the test cannot be aborted, a pop-up message will also be displayed.

**Note:** A test can only be aborted by a user. The other states are Success, Failure and Warning. These states can only be set by the test itself, and not by the user.



## TEST DETAILS

1. In the interop detail page, select the proper test line, then select the desired test execution. At the right you will have all the log and test result.

2.1.3 Uplink Spreading factor range test

✓ 2018062902920

Created: 29/06/2018, 14:29:46

Updated: 29/06/2018, 14:31:24 100%

Parameters

minSF	7
maxSF	12
packetTimeout	3

Messages:

- This was the last spreading factor to test
- Spreading factor has been set properly to 7
- Spreading factor has been set properly to 8
- Spreading factor has been set properly to 9
- Spreading factor has been set properly to 10
- Spreading factor has been set properly to 11
- Spreading factor has been set properly to 12
- Received 1st packet with ADR bit set, sending LinkADDRReq.
- Just created

Results:

```
{
  "SF": {
    "min": "7",
    "max": "12",
    "current": "7"
  },
  "packetTimeout": "2"
}
```

Back-end: 1.2.1.3 - Front-end: 1.2.1.3 - LRC: 1.12.15

**Note:** This dialog is refreshed at the same time as the rest of the interface. As such, it can be left open while a test is running to see the new information being updated.

2. To close this dialog, click on the 'cross' on the right top button.



## HOW TO CHANGE THE STATUS OF A TEST CAMPAIGN

1. A campaign could be closed as Abort or Success. Success is available only if all tests were run and succeed or acceptable warning (the orange button will become green).

The screenshot shows the 'MacCommandGenerator' page in the InteropEngine interface. On the left, there is a sidebar with a 'Created' button circled in red. The main area displays a list of test items with their descriptions and status indicators.

1.0.1	Specify the range of DevEUI allocated for the device part number.	
1.2.1	OTAA AppKey conformity test	
1.2.2	OTAA Join Request / Join Accept (this run TPIT 1.2.2.1 / 1.2.2.2 / 1.2.2.4 / 1.2.2.6 / 3.1.1)	
1.2.3	Aggregated Duty Cycle test	
2.1.1	Uplink Unconfirmed message test	
2.1.2	Uplink confirmed message test	

**Note:** Closing a test campaign is irreversible. To keep on testing a device, a new test campaign will have to be created.

2. Click on it to **close** the test campaign. A confirmation pop up will be displayed. Click on OK to confirm.

The screenshot shows a confirmation dialog box with an orange header and a white body. The text inside reads: 'Are you sure?' followed by 'You can be close this campaign to aborted. Do you want to proceed?' and an 'OK' button.

3. A pop-up message should be displayed indicating that the closure was accepted by the InteropEngine.
4. Once the page is reloaded, displaying the new status and closure date.

**Note:** Once a test campaign is closed, it cannot be reopened.

The screenshot shows the 'MacCommandGenerator' page with the test campaign status changed to 'Aborted'. The 'Aborted' button is circled in red. The 'Closing Date' is also circled in red. The test items list shows various results: Success, Aborted, Warning, and None.

1.0.1	Specify the range of DevEUI allocated for the device part number.	
1.2.1	OTAA AppKey conformity test	
1.2.2	OTAA Join Request / Join Accept (this run TPIT 1.2.2.1 / 1.2.2.2 / 1.2.2.4 / 1.2.2.6 / 3.1.1)	✓ Success
1.2.3	Aggregated Duty Cycle test	
2.1.1	Uplink Unconfirmed message test	✓ Success
2.1.2	Uplink confirmed message test	⊗ Aborted
2.1.3	Uplink Spreading factor range test	✓ Success
2.1.4	Uplink Packet loss rate test	⚠ Warning
2.2.1	Downlink unconfirmed message test	✓ Success
2.2.2	Downlink confirmed message test	○ None
2.2.3	Downlink Spreading factor range test	✓ Success
2.2.4	Downlink Packet loss rate test	✓ Success
2.2.5	RX2 window test	○ None
3.1.2	Uplink channel usage test	✓ Success