



Enabler Test Specification for Lightweight M2M

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Open Mobile Alliance

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1. Scope

This document describes in detail available test cases for LightweightM2M as specified in OMA-TS-LightweightM2M-V1_0.

The test cases are split in two categories, conformance and interoperability test cases.

The conformance test cases are aimed to verify the adherence to normative requirements described in the technical specifications.

The interoperability test cases are aimed to verify that implementations of the specifications work satisfactory.

If either conformance or interoperability tests do not exist at the creation of the test specification this part should be marked not available.

2. References

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2.2 Informative References

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3. Terminology and Conventions

3.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “Scope”, are normative, unless they are explicitly indicated to be informative.

The following numbering scheme is used:

xxx-y.z-con-number where:

xxx	Name of enabler, e.g. MMS or Browsing
y.z	Version of enabler release, e.g. 1.2 or 1.2.1
'con'	Indicating this test is a conformance test case
number	Leap number for the test case

Or

xxx-y.z-int-number where:

xxx	Name of enabler, e.g. MMS or Browsing
y.z	Version of enabler release, e.g. 1.2 or 1.2.1
'int'	Indicating this test is a interoperability test case
number	Leap number for the test case

3.2 Definitions

Application	1) The customer's realisation of a service through M2M - e.g. satnav, smart metering 2) Individual software components that run on top of the device's operating system. Access Point Name
Device	The hardware that is realising a function for the customer e.g. a smart meter.
Module	A modular component of a device e.g. the radio module housing the SIM

3.3 Abbreviations

API	Application Programming Interface
APN	Access Point Name
CoAP	Constrained Application Protocol
CON	Conformance
DM	Device Management
GDSP	Global Data Service Platform
GUI	Graphical User Interface
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IOP	Interoperability
LWM2M	Lightweight Machine to Machine (refers to this OMA enabler)
M2M	Machine to Machine
MSISDN	Mobile Station International Subscriber Directory Number
OMA	Open Mobile Alliance
OpCo	Operating Company
OS	Operating System
SIM	Subscriber Interface Module
UI	User Interface

4. Introduction

The purpose of this document is to provide test cases for LightweightM2M Enabler Release V1.0.

The implementation of some features is optional for the Clients and/or the Servers in the LightweightM2M Enabler. The tests associated with these optional features are marked as "(Includes Optional Features)" in the test specification.

The following items on an overall level are needed to adequately test the LWM2M enabler:

- A LWM2M server
- A LWM2M client e.g. embedded in a M2M device or module connected via UDP and SMS with the LWM2M server

The LWM2M enabler tests are carried out using the LWM2M protocol and objects, and using the underlying protocols such as [CoAP].

5. LightweightM2M Conformance Test Cases

None.

6. LightweightM2M Interoperability Test Cases

6.1 LWM2M Core Specification Test cases [0-999]

6.1.1 Bootstrap Interface: [0-99]

<Test Cases to fill-up>

6.1.2 Registration Interface [100-199]

6.1.2.1 LightweightM2M-1.0-int-101 – Initial Registration

Test Case Id	LightweightM2M-1.0-int-101
Test Object	Client and Server
Test Case Description	Test that the Client registers with the Server.
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is turned on ○ The bootstrap procedure has been completed or the required bootstrap information is available to the client ○ The client contains the following mandatory LWM2M 1.0 objects instances. <ul style="list-style-type: none"> – LWM2M Server Object (ID=1) Instance 0 with mandatory resources and Short Server ID=1 – LWM2M Security Object (ID = 0) Instance 0 with mandatory resources and Bootstrap Server =False – LWM2M Device Object (ID=3) Instance 0 with mandatory resources.
Test Procedure	<ol style="list-style-type: none"> 1. Device is switched on and bootstrap information is available to the device. 2. The device automatically registers at the server, once this information is available. <p>Normal flow:</p> <ol style="list-style-type: none"> a. Registration message (COAP POST) is sent from client to server. b. Client receives Success message (2.01 Created) from the server.
Pass-Criteria	<ol style="list-style-type: none"> 1. Server has received REGISTER operation 2. Server knows the following <ul style="list-style-type: none"> • Endpoint Client Name • registration lifetime (optional) • LWM2M version (optional) • binding mode (optional) • SMS number (optional) • Objects and Object Instances (mandatory and optional objects / object instances) 3. Client has received “Success” message from server

6.1.2.2 LightweightM2M-1.0-int-102 – Registration Update

Test Case Id	LightweightM2M-1.0-int-102
Test Object	Client and Server
Test Case Description	Test that the client updates the registration information on the server.
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Need exists to re-register, e.g. previous registration has expired.
Test Procedure	<ol style="list-style-type: none"> 1. Switch on device and try to Re-Register <p>Normal flow:</p> <ol style="list-style-type: none"> a. Re-Registration message (COAP PUT) is sent from client to server. b. Client receives Success message (2.04 Changed) from the server.
Pass-Criteria	<ol style="list-style-type: none"> 1. Server has received REGISTER operation 2. Server knows the following <ul style="list-style-type: none"> • Endpoint Client Name • registration lifetime (optional) • LWM2M version (optional) • binding mode (optional) • SMS number (optional) • Objects and Object Instances (optional) 3. Client has received “Success” message from server

6.1.2.3 LightweightM2M-1.0-int-103 – Deregistration

Test Case Id	LightweightM2M-1.0-int-103
Test Object	Client and Server
Test Case Description	Test that the client is able to deregister at the server.
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Client is registered
Test Procedure	<ol style="list-style-type: none"> 1. Client will no longer be available, thus, it should de-register <p>Normal flow:</p> <ol style="list-style-type: none"> a. Deregistration message (COAP DELETE) is sent from client to server. b. Client receives Success message (2.02 Deleted) from the server.
Pass-Criteria	<ol style="list-style-type: none"> 1. Client is removed from the servers registration database

6.1.2.4 LightweightM2M-1.0-int-104 – Registration Update Trigger

Test Case Id	LightweightM2M-1.0-int-104
Test Object	Client and Server
Test Case Description	Test that the Client registers with the Server when triggered with the Registration Update Trigger (see LWM2M server object)
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is turned on ○ The bootstrap procedure has been completed or the required bootstrap information is available to the client ○ The client has a LWM2M Server Object Instance. ○ The device is registered with the server.
Test Procedure	<ol style="list-style-type: none"> 1. Binding is set to U (as in TS section 5.2.1.1) 2. De-registration is performed, or, alternatively registration expires 3. Server sends Registration Update Trigger via SMS <p>Normal flow:</p> <ol style="list-style-type: none"> a. Binding is set by sending COAP PUT 1/7 with string content “U” from server to device b. Server receives Success message (2.04 Changed) from the device c. Device registration expires on the server (for test purposes a short registration lifetime could be chosen) d. Registration Update Trigger message COAP POST 1/8 is sent from server to client via SMS e. Re-Registration message (COAP PUT) is sent from client to server via UDP f. Client receives Success message (2.04 Changed) from the server.

Pass-Criteria	<ol style="list-style-type: none"> 1. Server has received REGISTER operation via UDP 2. Server knows the following <ul style="list-style-type: none"> • Endpoint Client Name • registration lifetime (optional) • LWM2M version (optional) • binding mode (optional) • SMS number (optional) • Objects and Object Instances (optional) 3. Client has received “Success” message from server
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6.1.2.5 LightweightM2M-1.0-int-105 – Initial Registration to Bootstrap Server

Test Case Id	LightweightM2M-1.0-int-105
Test Object	Client and Server
Test Case Description	Test that the Client registers with the Bootstrap Server.
Preconditions	<ul style="list-style-type: none"> ○ Device is turned on ○ The required Bootstrap Server Bootstrap information is available to the Client ○ The client contains the following mandatory LWM2M 1.0 objects instances <ul style="list-style-type: none"> – LWM2M Server Object (ID=1) Instance 0 with mandatory resources and Short Server ID=1 – LWM2M Security Object (ID = 0) Instance 0 with mandatory resources and Bootstrap Server =True – LWM2M Device Object (ID=3) Instance 0 with mandatory resources
Test Procedure	<ol style="list-style-type: none"> 1. Device is switched on and Bootstrap Server Bootstrap information is available to the device. 2. The device automatically registers at the Bootstrap Server, once this information is available. <p>Normal flow:</p> <ol style="list-style-type: none"> a. Registration message (COAP POST) is sent from client to Bootstrap Server. b. Client receives Success message (2.01 Created) from the Bootstrap Server.
Pass-Criteria	<ol style="list-style-type: none"> 1. Bootstrap Server has received REGISTER operation 2. Bootstrap Server knows the following <ul style="list-style-type: none"> • Endpoint Client Name • registration lifetime (optional) • LWM2M version (optional) • binding mode (optional) • SMS number (optional) • Objects and Object Instances (mandatory object Instances only) 3. Client has received “Success” message from Bootstrap Server

6.1.3 Device management & Service Enablement Interface [200-299]

6.1.3.1 LightweightM2M-1.0-int-201 – Querying basic information in Plain Text format

Test Case Id	LightweightM2M-1.0-int-201
Test Object	Client and Server
Test Case Description	<p>Querying the following data on the client (Device Object: ID 3):</p> <ul style="list-style-type: none"> • Manufacturer • Model number • Serial number
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> o Device is registered at the LWM2M server
Test Procedure	<p>1. A READ operation from server on these resources has been received by the client.</p> <p>Normal flow:</p> <ol style="list-style-type: none"> a. READ (COAP GET) on device object resources, with the CoAP Accept option to indicate the requested content format: Plain Text b. Server receives success message (2.05 Content) and the requested values in the requested format.
Pass-Criteria	<p>1. Server has received the requested information and display of the following data to the user is possible:</p> <ul style="list-style-type: none"> • Manufacturer • Model number • Serial number

6.1.3.2 LightweightM2M-1.0-int-202 – Querying basic information in Opaque format

<Test Cases to fill-up>

6.1.3.3 LightweightM2M-1.0-int-203 – Querying basic information in TLV format

Test Case Id	LightweightM2M-1.0-int-203
Test Object	Client and Server
Test Case Description	<p>Querying the following data on the client (Device Object: ID 3):</p> <ul style="list-style-type: none"> • Manufacturer • Model number • Serial number
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> o Device is registered at the LWM2M server
Test Procedure	<p>a. A READ operation from server on these resources has been received by the client.</p> <p>Normal flow:</p> <p>b. READ (COAP GET) on device object resources, with the CoAP Accept option to indicate the requested content format: TLV</p> <ul style="list-style-type: none"> i. Bits 7-6=00= Object Instance in which case the Value contains one or more Resource TLVs ii. Bits 7-6=11= Resource with Value <p>c. Server receives success message (2.05 Content) and the requested values in the requested format.</p>
Pass-Criteria	<p>1. Server has received the requested information and display of the following data to the user is possible:</p> <ul style="list-style-type: none"> • Manufacturer • Model number • Serial number

6.1.3.4 LightweightM2M-1.0-int-204 – Querying basic information in JSON format

Test Case Id	LightweightM2M-1.0-int-204
Test Object	Client and Server
Test Case Description	<p>Querying the following data on the client (Device Object: ID 3):</p> <ul style="list-style-type: none"> • Manufacturer • Model number • Serial number
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server
Test Procedure	<ol style="list-style-type: none"> 1. A READ operation from server on these resources has been received by the client. <p>Normal flow:</p> <ol style="list-style-type: none"> a. READ (COAP GET) on device object resources, with the CoAP Accept option to indicate the requested content format: JSON b. Server receives success message (2.05 Content) and the requested values in the corresponding format.
Pass-Criteria	<ol style="list-style-type: none"> 1. Server has received the requested information and display of the following data to the user is possible: <ul style="list-style-type: none"> • Manufacturer • Model number • Serial number

6.1.3.5 LightweightM2M-1.0-int-205 – Setting basic information in Plain Text format

Test Case Id	LightweightM2M-1.0-int-205
Test Object	Client and Server
Test Case Description	Setting the writable resources of object 1 (Server Object: ID 1):
Preconditions	<ul style="list-style-type: none"> o Device is registered with the Server
Test Procedure	<p>A WRITE operation from server on the resource has been received by the client. This test has to be run for the following resources:</p> <ol style="list-style-type: none"> a) Lifetime b) Default minimum period c) Default maximum period d) Disable timeout e) Notification storing when disabled or offline f) Binding <p>Normal flow:</p> <ol style="list-style-type: none"> 1. WRITE (CoAP PUT/POST) on the resource with a value admissible with regards to LWM2M technical specification 2. Server receives success message (2.04 Changed) 3. The server READs the result of the WRITE operation by querying the resource.
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.04” 2. The resource value has changed according to WRITE request

6.1.3.6 LightweightM2M-1.0-int-210 – Setting basic information in Opaque format

<Test Cases to fill-up>

6.1.3.7 LightweightM2M-1.0-int-215 – Setting basic information in TLV format

<Test Cases to fill-up>

6.1.3.8 LightweightM2M-1.0-int-220 – Setting basic information in JSON format

<Test Cases to fill-up>

6.1.3.9 LightweightM2M-1.0-int-241 – Executable Resource: Rebooting the device

Test Case Id	LightweightM2M-1.0-int-241
Test Object	Client and Server
Test Case Description	Test that rebooting of the device remotely through the server is possible (Device Object: ID 3).
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is switched on and registered with the server. (Device might be in a state that requires a reboot)
Test Procedure	<ol style="list-style-type: none"> 1. An EXECUTE operation from server on the resource object/reboot has been received by the client. <p>Normal flow:</p> <ol style="list-style-type: none"> a. Server performs Execute (COAP POST) on device/reboot resource b. Server receives success message (2.04 Changed) from client
Pass-Criteria	<ol style="list-style-type: none"> 1. Device reboots successfully and re-registers at the server again

6.1.3.10 LightweightM2M-1.0-int-260 – Discover Command

<Test Cases to fill-up>

6.1.3.11 LightweightM2M-1.0-int-270 – Create Object Instance

<Test Cases to fill-up>

6.1.3.12 LightweightM2M-1.0-int-271 – Create Multiple Resource Instance

<Test Cases to fill-up>

6.1.3.13 LightweightM2M-1.0-int-290 – Delete Object Instance

<Test Cases to fill-up>

6.1.4 Information Reporting Interface [300-399]

6.1.4.1 LightweightM2M-1.0-int-301 – Observation and Notification of parameter values

Test Case Id	LightweightM2M-1.0-int-301
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device.
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational.
Test Procedure	<ol style="list-style-type: none"> 1. The Server establishes an Observation relationship with the Client to acquire conditional notifications about: <ul style="list-style-type: none"> • Line Voltage • Signal Strength <p>Normal flow:</p> <ol style="list-style-type: none"> a. Server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (COAP PUT) operation b. Server sends OBSERVE (COAP Observe Option) message to activate reporting c. Client reports requested information with a NOTIFY message (COAP responses)
Pass-Criteria	<ol style="list-style-type: none"> 1. The server has received the requested information and display of “Line Voltage” and “Signal Strength” to the user is possible.

6.1.4.2 LightweightM2M-1.0-int-302 – Cancel Observations using Reset Operation

Test Case Id	LightweightM2M-1.0-int-302
Test Object	Client and Server
Test Case Description	Cancel the Observation relationship by sending “Cancel Observation” operation.
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational. ○ Server established Observation relationship with the Client.
Test Procedure	<ol style="list-style-type: none"> 1. The Server removes a pre-established Observation relationship by sending “Cancel Observation”. The Client removes conditional notifications about: <ul style="list-style-type: none"> • Power Source Voltage • Signal Strength <p>Normal flow:</p> <ol style="list-style-type: none"> a. Client reports requested information with a NOTIFY message (COAP responses) b. Server sends Cancel Observe (COAP RESET message) to cancel the Observation relationship. c. Client stops reporting requested information and removes associated entries from the list of observers.
Pass-Criteria	<ol style="list-style-type: none"> 1. The server stops receiving information on “Line Voltage” and “Signal Strength” and associated entries from the list of observers are removed.

6.1.4.3 LightweightM2M-1.0-int-303 – Cancel observations using Observe with Cancel parameter (to be updated)

Test Case Id	LightweightM2M-1.0-int-303
Test Object	Client and Server
Test Case Description	
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational. ○ Server established Observation relationship with the Client.
Test Procedure	
Pass-Criteria	<ol style="list-style-type: none"> 1. The server stops receiving information on “Line Voltage” and “Signal Strength” and associated entries from the list of observers are removed.

6.1.5 Security [400-499]

6.1.5.1 LightweightM2M-1.0-int-401 – UDP Channel Security – Pre-shared Key Mode

Test Case Id	LightweightM2M-1.0-int-401
Test Object	Client and Server
Test Case Description	Establishing DTLS session using UDP pre-shared key mode
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ The bootstrap procedure has been completed or the required bootstrap information is available to the client. ○ The bootstrap information includes the Security Mode resource of the object LWM2M Security set to 0: Pre-Shared Key mode ○ The client has a LWM2M Server Object Instance.
Test Procedure	<ol style="list-style-type: none"> 1. Device is switched on and bootstrap information is available to the device. 2. The device automatically registers at the server, once this information is available and a DTLS session is established between client and server. 3. Using this DTLS session, GET commands are sent from the server to the client, and the client sends back the requested resource values. <p>Normal flow:</p> <ol style="list-style-type: none"> a. Registration message (COAP POST) is sent from client to server. b. Client receives Success message (2.01 Created) from the server. c. READ (COAP GET) on e.g. ACL object resources d. Server receives success message (2.05 Content) and the requested values (encrypted)
Pass-Criteria	<ul style="list-style-type: none"> • Registration and READ commands work successfully over DTLS session.

6.1.6 Core Specific Objects Test cases [500-999]

6.1.6.1 Security Object (ID 0) [500-549]

6.1.6.2 Server Object (ID 1) [550-599]

6.1.6.2.1 LightweightM2M-1.0-int-551 – Querying the readable resources of object

Test Case Id	LightweightM2M-1.0-int-551
Test Object	Client and Server
Test Case Description	Querying the readable resources of object 1
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<p>A READ operation from server on the resource has been received by the client. This test has to be run on the following resources:</p> <ul style="list-style-type: none"> a) Short server ID b) Lifetime c) Default minimum period d) Default maximum period e) Disable timeout f) Notification storing when disabled or offline g) Binding <p>Normal flow:</p> <ol style="list-style-type: none"> 1. READ (CoAP GET) on the resource, with the CoAP Accept option value “0” to indicate the “text/plain” content format 2. The server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.05” for READ success 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The server receives the requested information and displays the resource value to the user

6.1.6.2.2 LightweightM2M-1.0-int-555 – Setting the writable resources

Test Case Id	LightweightM2M-1.0-int-555
Test Object	Client and Server
Test Case Description	Setting the writable resources of object 1
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<p>A WRITE operation from server on the resource has been received by the client. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) Lifetime b) Default minimum period c) Default maximum period d) Disable timeout e) Notification storing when disabled or offline f) Binding <p>Normal flow:</p> <ol style="list-style-type: none"> 1. WRITE (CoAP PUT/POST) on the resource with a value admissible with regards to LWM2M technical specification 2. Server receives success message (2.04 Changed) 3. The server READs the result of the WRITE operation by querying the resource.
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.04” 2. The resource value has changed according to WRITE request

6.1.6.2.3 LightweightM2M-1.0-int-560 – Observation and notification of observable resources

Test Case Id	LightweightM2M-1.0-int-560
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device for resources of object 1
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational
Test Procedure	<p>The Server establishes an Observation relationship with the Client to acquire condition notifications about observable resources. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) Short server ID b) Lifetime c) Default minimum period d) Default maximum period e) Disable timeout f) Notification storing when disabled or offline g) Binding <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (CoAP PUT) operation 2. The server sends OBSERVE (CoAP Observe Option) message to activate reporting 3. The client reports requested information with a NOTIFY message (CoAP response)
Pass-Criteria	<ol style="list-style-type: none"> 1. The server has received the requested information and displays the resource value to the user 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The values returned by the client in each Notify are relevant with regards to the threshold value, the min/max period and the step

6.1.6.3 Access Control Object (ID 2) [600-649]

6.1.6.4 LWM2M Server (ID 3) [650-699]

6.1.6.4.1 LightweightM2M-1.0-int-651 – Querying the readable resources of object

Test Case Id	LightweightM2M-1.0-int-651
Test Object	Client and Server
Test Case Description	Querying the readable resources of object 3
Preconditions	<ul style="list-style-type: none"> o Device is registered with the Server
Test Procedure	<p>A READ operation from server on the resource has been received by the client. This test has to be run on the following resources:</p> <ul style="list-style-type: none"> a) Manufacturer b) Device type c) Model number d) Serial number e) Hardware version f) Firmware version g) Software version h) Available power sources i) Power source voltage j) Power source current k) Battery level l) Battery status m) Memory free n) Memory total o) Error code p) Current time q) UTC offset r) Timezone s) Supported binding and modes <p>Normal flow:</p> <ol style="list-style-type: none"> 1. READ (CoAP GET) on the resource, with the CoAP Accept option value “0” to indicate the “text/plain” content format 2. The server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.05” for READ success 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The server receives the requested information and displays the resource value to the user

6.1.6.4.2 LightweightM2M-1.0-int-652 – Querying the firmware version from the client

Test Case Id	LightweightM2M-1.0-int-652
Test Object	Client and Server
Test Case Description	Querying the firmware version of the firmware on the managed device
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<ol style="list-style-type: none"> 1. A READ operation from server on the resource has been received by the client. <p>Normal flow:</p> <ol style="list-style-type: none"> a. READ (COAP GET) on device object resource “firmware version”, with the CoAP Accept option value “0” to indicate the “text/plain” content format; b. Server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format.
IPass-Criteria	<ol style="list-style-type: none"> 1. Server has received the requested information and displays to the user the following information: <ul style="list-style-type: none"> • Firmware version

6.1.6.4.3 LightweightM2M-1.0-int-655 – Setting the writable resources

Test Case Id	LightweightM2M-1.0-int-655
Test Object	Client and Server
Test Case Description	Setting the writable resources of object 3
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<p>A WRITE operation from server on the resource has been received by the client. This test has to be run for the following resources:</p> <ol style="list-style-type: none"> a) Current time b) UTC offset c) Timezone <p>Normal flow:</p> <ol style="list-style-type: none"> 1. WRITE (CoAP PUT/POST) on the resource with a value admissible with regards to LWM2M technical specification 2. Server receives success message (2.04 Changed) 3. The server READs the result of the WRITE operation by querying the resource.
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.04” 2. The resource value has changed according to WRITE request

6.1.6.4.4 LightweightM2M-1.0-int-660 – Observation and notification of observable resources

Test Case Id	LightweightM2M-1.0-int-660
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device for resources of object 3
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational
Test Procedure	<p>The Server establishes an Observation relationship with the Client to acquire condition notifications about observable resources. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) Manufacturer b) Device type c) Model number d) Serial number e) Hardware version f) Firmware version g) Software version h) Available power sources i) Power source voltage j) Power source current k) Battery level l) Battery status m) Memory free n) Memory total o) Error code p) Current time q) UTC offset r) Timezone s) Supported binding and modes <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (CoAP PUT) operation 2. The server sends OBSERVE (CoAP Observe Option) message to activate reporting 3. The client reports requested information with a NOTIFY message (CoAP response)
Pass-Criteria	<ol style="list-style-type: none"> 1. The server has received the requested information and displays the resource value to the user 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The values returned by the client in each Notify are relevant with regards to the threshold value, the min/max period and the step

6.1.6.5 LWM2M Connectivity Monitoring (ID 4) [700-749]

6.1.6.5.1 LightweightM2M-1.0-int-701 – Querying the readable resources of object

Test Case Id	LightweightM2M-1.0-int-701
Test Object	Client and Server
Test Case Description	Querying the readable resources of object 4
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<p>A READ operation from server on the resource has been received by the client. This test has to be run on the following resources:</p> <ol style="list-style-type: none"> a) Network bearer b) Available network bearer c) Radio signal strength d) Link quality e) IP addresses f) Router IP addresses g) Link utilization h) APN i) Cell ID j) SMNC k) SMCC <p>Normal flow:</p> <ol style="list-style-type: none"> 1. READ (CoAP GET) on the resource, with the CoAP Accept option value “0” to indicate the “text/plain” content format 2. The server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.05” for READ success 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The server receives the requested information and displays the resource value to the user

6.1.6.5.2 LightweightM2M-1.0-int-705 – Setting the writable resources

There is no writable resources for this object.

6.1.6.5.3 LightweightM2M-1.0-int-710 – Observation and notification of observable resources

Test Case Id	LightweightM2M-1.0-int-710
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device for resources of object 4
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational
Test Procedure	<p>The Server establishes an Observation relationship with the Client to acquire condition notifications about observable resources. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) Network bearer b) Available network bearer c) Radio signal strength d) Link quality e) IP addresses f) Router IP address g) Link utilization h) APN i) Cell ID j) SMNC k) SMCC <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (CoAP PUT) operation 2. The server sends OBSERVE (CoAP Observe Option) message to activate reporting 3. The client reports requested information with a NOTIFY message (CoAP response)
Pass-Criteria	<ol style="list-style-type: none"> 1. The server has received the requested information and displays the resource value to the user 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The values returned by the client in each Notify are relevant with regards to the threshold value, the min/max period and the step

6.1.6.6 Firmware Update Object (ID 5) [750-799]

6.1.6.6.1 LightweightM2M-1.0-int-751 – Querying the readable resources

Test Case Id	LightweightM2M-1.0-int-751
Test Object	Client and Server
Test Case Description	Querying the readable resources of Firmware Update Object
Preconditions	<ul style="list-style-type: none"> o Device is registered with the Server
Test Procedure	<p>A READ operation from server on the resource has been received by the client. This test has to be run on the following resources:</p> <ul style="list-style-type: none"> a) State b) Update supported objects c) Update result d) Pkgname e) Pkgversion <p>Normal flow:</p> <ol style="list-style-type: none"> 1. READ (CoAP GET) on the resource, with the CoAP Accept option value “0” to indicate the “text/plain” content format 2. The server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.05” for READ success 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The server receives the requested information and displays the resource value to the user

6.1.6.6.2 LightweightM2M-1.0-int-755 – Setting the writable resources

Test Case Id	LightweightM2M-1.0-int-755
Test Object	Client and Server
Test Case Description	Setting the writable resources of Firmware Update Object
Preconditions	<ul style="list-style-type: none"> o Device is registered with the Server
Test Procedure	<p>A WRITE operation from server on the resource has been received by the client. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) Package b) Package URI c) Update supported objects <p>Normal flow:</p> <ol style="list-style-type: none"> 1. WRITE (CoAP PUT/POST) on the resource with a value admissible with regards to LWM2M technical specification 2. Server receives success message (2.04 Changed) 3. The server READs the result of the WRITE operation by querying the resource.
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.04” 2. The resource value has changed according to WRITE request

6.1.6.6.3 LightweightM2M-1.0-int-760 – Observation and notification of observable resources

Test Case Id	LightweightM2M-1.0-int-760
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device for resources of Firmware Update Object
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational
Test Procedure	<p>The Server establishes an Observation relationship with the Client to acquire condition notifications about observable resources. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) State b) Update supported objects c) Update result d) Pkgname e) Pkgversion <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (CoAP PUT) operation 2. The server sends OBSERVE (CoAP Observe Option) message to activate reporting 3. The client reports requested information with a NOTIFY message (CoAP response)
Pass-Criteria	<ol style="list-style-type: none"> 1. The server has received the requested information and displays the resource value to the user 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The values returned by the client in each Notify are relevant with regards to the threshold value, the min/max period and the step

6.1.6.6.4 LightweightM2M-1.0-int-770 – Successful Firmware update (via COAP)

Test Case Id	LightweightM2M-1.0-int-770
Test Object	Client and Server
Test Case Description	Perform a device firmware update remotely triggered by the LWM2M server in using Package Resource (CoAP mechanisms)
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is to “0” (Idle) or “1” (Downloaded)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) is received by the client</p> <p>Normal flow:</p>

	<ol style="list-style-type: none"> 1. Step 1 – Write <ol style="list-style-type: none"> a. The server delivers the firmware to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) b. Update Result is set to “0” (Initial value) c. When the download starts, State is set to “1” (Downloading) d. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. e. When the download is completed, State is set to “2” (Downloaded) 2. Step 2 – Execute <ol style="list-style-type: none"> a. When the download is completed, the server initiates a firmware update by EXECUTE (CoAP POST) /5/0/2 (Update) b. State is set to “3” (Updating) <ul style="list-style-type: none"> If firmware is successfully updated <ul style="list-style-type: none"> b.1 Update Result is set to “1” (Firmware updated successfully) b.2 The device is automatically rebooting. c. The server READs Update Result to know the result of the firmware update procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. Step 1 – Write <ol style="list-style-type: none"> a. The server receives the status code “2.04” for WRITE success b. State is set to “1” (Downloading) during the step and is “2” at the end of the step (Downloaded) c. Update Result is “0” (Initial Value) during the whole step d. New firmware is present on the device 2. Step 2 – Execute <ol style="list-style-type: none"> a. State is “3” (Updating) when EXECUTE has been sent b. The server receives the status code “2.04” for EXECUTE success c. The device is rebooted d. New firmware is updated on the device e. State is “0” (Idle) at the end of the step f. Update Result is “1” at the end of the step (Firmware updated successfully)

6.1.6.6.5 LightweightM2M-1.0-int-771 – Successful Firmware update (via alternative mechanism)

Test Case Id	LightweightM2M-1.0-int-771
Test Object	Client and Server
Test Case Description	Perform a device firmware update remotely triggered by the LWM2M server in using Package URI Resource
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is to “0” (Idle) or “1” (Downloaded)
Test Procedure	<p>A WRITE operation from the server on /5/0/1 (Package URI) is received by the client Normal flow:</p> <ol style="list-style-type: none"> 1. Step 1 – Write <ol style="list-style-type: none"> a. The server delivers the firmware URI to the device through a WRITE (CoAP PUT/POST) operation on /5/0/1 (Package URI) b. Update Result is set to “0” (Initial value) c. The Device downloads the firmware from the URI via an alternative mechanism (not CoAP) d. When the download starts, State is set to “1” (Downloading) e. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. f. When the download is completed, State is set to “2” (Downloaded) 2. Step 2 – Execute <ol style="list-style-type: none"> a. When the download is completed, the server initiates a firmware update by EXECUTE (CoAP POST) /5/0/2 (Update) b. State is set to “3” (Updating) c. Firmware is successfully updated <ol style="list-style-type: none"> c.1 Update Result is set to “1” (Firmware updated successfully) c.2 The device is automatically rebooting. d. The server READs Update Result to know the result of the firmware update procedure.

Pass-Criteria	<ol style="list-style-type: none"> 1. Step 1 – Write <ol style="list-style-type: none"> a. The server receives the status code “2.04” for WRITE success b. State is set to “1” (Downloading) during the step and is “2” at the end of the step (Downloaded) c. Update Result is “0” (Initial Value) during the whole step d. New firmware is present on the device 2. Step 2 – Execute <ol style="list-style-type: none"> a. State is “3” (Updating) when EXECUTE has been sent b. The server receives the status code “2.04” for EXECUTE success c. The device is rebooted d. New firmware is updated on the device e. State is “0” (Idle) at the end of the step f. Update Result is “1” at the end of the step (Firmware updated successfully)
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6.1.6.6.6 LightweightM2M-1.0-int-772 – Error Case: firmware package not downloaded

Test Case Id	LightweightM2M-1.0-int-772
Test Object	Client and Server
Test Case Description	Try to perform a device firmware installation when there is no downloaded firmware package
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State (/5/0/3) is different from “2” (Downloaded)
Test Procedure	<p>An EXECUTE operation from the server on /5/0/2 (Update) is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The client does nothing
Pass-Criteria	<ol style="list-style-type: none"> 1. New firmware is not installed on the device 2. The device is not rebooted 3. State (/5/0/3) does not change 4. Update Result (/5/0/5) is not changed 5. The server receives the status code “4.05” for method not allowed

6.1.6.6.7 LightweightM2M-1.0-int-773 – Error Case: not enough storage

Test Case Id	LightweightM2M-1.0-int-773
Test Object	Client and Server
Test Case Description	Try to perform a device firmware update remotely triggered by the LWM2M Server with a firmware package exceeding the device storage memory capacity.
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State (/5/0/3) is set to “0” (Idle)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) with a firmware package exceeding the device storage memory capacity, is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server delivers the firmware package to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) 2. Update Result is set to “0” (Initial value) 3. When the download starts, State is set to “1” (Downloading) 4. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. 5. Before the end of download, the device runs out of storage and cannot finish the download (State still keeps the value “1”: Downloading). 6. The client removes what was downloaded 7. /5/0/3 (State) is set to “0” (Idle) 8. /5/0/5 (Update Result) is set to “2” (Not enough storage for the new firmware package) 9. The server READs Update Result to know the result of the firmware update procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. New software is not installed on the device 2. New software is not present on the device 3. The device is not rebooted 4. The Server receives the status code "2.04" for WRITE success 5. /5/0/5 (Update Result) is “0” (Initial) during the step and then “1” during download and is “2” (Not enough storage for the new firmware package) at the end of the step 6. /5/0/3 (State) is “1” (Downloading) during the step and is “0” at the end of the step 7. State never reaches the Downloaded value (“3”)

6.1.6.6.8 LightweightM2M-1.0-int-774 – Error Case: out of memory

Test Case Id	LightweightM2M-1.0-int-774
Test Object	Client and Server
Test Case Description	Try to perform a device firmware update remotely triggered by the LWM2M Server while the Device runs out of memory during download
Preconditions	<ul style="list-style-type: none"> ○ Prepare a package with a size big enough to make the Client run out of memory when downloading it ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is set to “0” (Idle)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) is received by the Client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server delivers the firmware to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) 2. Update Result is set to “0” (Initial) 3. When the download starts, State is set to “1” (Downloading) 4. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. 5. Before the end of download, the device runs out of memory and cannot finish the download (State still keeps the value “1” :Downloading) 6. The client removes what was downloaded 7. /5/0/3 (State) is set to “0” (Idle) 8. /5/0/5 (Update Result) is set to “3” (Out of memory during downloading process) 9. The server READs Update Result to know the result of the firmware update procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. New firmware is not installed on the device 2. New firmware is not present on the device 3. The device is not rebooted 4. The server receives the status code “2.04” for WRITE success 5. /5/0/5 (Update Result) is “0” (Initial) during the step and is “3” (Out of memory during downloading process) at the end of the step. 6. /5/0/3 (State) is “1” (Downloading) during the step and is “0” (Idle) at the end of the step 7. State never reaches the Downloaded value (“3”)

6.1.6.6.9 LightweightM2M-1.0-int-775 – Error Case: Connection lost during download (package URI)

Test Case Id	LightweightM2M-1.0-int-775
Test Object	Client and Server
Test Case Description	Try to perform a device firmware update remotely triggered by the LWM2M server while connection is lost during download
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is set to “0” (Idle)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server delivers the firmware to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) 2. Update Result is set to “0” (Initial) 3. When the download starts, State is set to “1” (Downloading) 4. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. 5. Before the end of download, the connection is lost and the client cannot finish the download (State still keeps the value “1” :Downloading) 6. The client removes what was downloaded 7. /5/0/3 (State) is set to “0” (Idle) 8. /5/0/5 (Update Result) is set to “4” (Connection lost during downloading process.) 9. The server READs Update Result to know the result of the software installation procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. New firmware is not installed on the device 2. New firmware is not present on the device 3. The device is not rebooted 4. The server receives the status code “2.04” for WRITE success 5. /5/0/5 (Update Result) is “0” during the step and is “4” (Connection lost during downloading process) at the end of the step. 6. /5/0/3 (State) is “1” (Downloading) during the step and is “0” (Idle) at the end of the step 7. State never reaches the Downloaded value (“3”)

6.1.6.6.10 LightweightM2M-1.0-int-776 – Error Case: CRC check fail

Test Case Id	LightweightM2M-1.0-int-776
Test Object	Client and Server
Test Case Description	Try to perform a device firmware update remotely triggered by the LWM2M Server while the downloaded package does not pass the integrity check
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is set to “0” (Idle)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server delivers the firmware to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) 2. Update Result is set to “0” (Initial) 3. When the download starts, State is set to “1” (Downloading) 4. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. 5. The package integrity check fails 6. The client removes what was downloaded 7. /5/0/3 (State) is set to “0” (Initial) 8. /5/0/5 (Update Result) is set to “5” (CRC check failure for new downloaded package) 9. The server READs Update Result to know the result of the firmware update procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. New firmware is not installed on the device 2. New firmware is not present on the device 3. The device is not rebooted 4. The server receives the status code “2.04” for WRITE success 5. /5/0/5 (Update Result) is “0” (Initial) during the step and is “5” (CRC check failure for new downloaded package) at the end of the step 6. /5/0/3 (State) is set to “1” (Downloading) during the step and is “0” (Idle) at the end of the step 7. State never reaches the Downloaded value (“3”)

6.1.6.6.11 LightweightM2M-1.0-int-777 – Error Case: unsupported package type

Test Case Id	LightweightM2M-1.0-int-777
Test Object	Client and Server
Test Case Description	Try to perform a device firmware update remotely triggered by the LWM2M server with an unsupported package type
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is set to “0” (Idle)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) with a package with an unsupported type is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server delivers the firmware package to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) 2. Update Result is set to “0” (Initial) 3. When the download starts, State is set to “1” (Downloading) 4. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the Server. The Server may send repeated READs or OBSERVE the resource to determine when the download is completed. 5. The package type is not supported 6. The client removes what was downloaded 7. /5/0/3 (State) is set to “0” (Idle) 8. /5/0/5 (Update Result) is set to “6” (Unsupported package type) 9. The server READs Update Result to know the result of the firmware update procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. New firmware is not installed on the device 2. New firmware is not present on the device 3. The device is not rebooted 4. The server receives the status code “2.04” for WRITE success 5. Update Result is “0” during the step and is “6” (Unsupported package type) at the end of the step 6. State is set to “1” (Downloading) during the step and is “0” (Idle) at the end of the step

6.1.6.6.12 LightweightM2M-1.0-int-778 – Error Case: invalid URI (package URI)

Test Case Id	LightweightM2M-1.0-int-778
Test Object	Client and Server
Test Case Description	Try to perform a device firmware update remotely triggered by the LWM2M server with an invalid URI
Preconditions	<p>Device is registered at the LWM2M server</p> <p>Device is switched on and operational</p> <p>Firmware Update is available on the Server</p> <p>State is set to “0” (Idle)</p>
Test Procedure	<p>A WRITE operation from the server on /5/0/1 (Package URI) with an invalid URI is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server delivers the invalid firmware URI to the device through a WRITE (CoAP PUT/POST) operation on /5/0/1 (Package URI) 2. /5/0/5 (Update Result) is set to “0” (Initial) 3. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The state should indicate that the download did not start (State = “0”) 4. /5/0/5 (Update Result) is set to “7” (Invalid URI) 5. The server READs /5/0/5 (Update Result) to know the result of the firmware update procedure.
Pass-Criteria	<ol style="list-style-type: none"> 1. New firmware is not installed on the device 2. The device is not rebooted 3. The server receives the status code “2.04” for WRITE success 4. /5/0/5 (Update Result) is set to “0” during the step and is “7” (Invalid URI) at the end of the step 5. /5/0/3 (State) is “0” (Idle) during the whole step 6. State always keeps the Idle (“0”) value.

6.1.6.6.13 LightweightM2M-1.0-int-779 – Error Case: Unsuccessful Firmware Update

Test Case Id	LightweightM2M-1.0-int-779
Test Object	Client and Server
Test Case Description	Perform a device firmware update remotely triggered by the LWM2M server in using Package Resource (CoAP mechanisms) but with installation failure
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational ○ Firmware Update is available on the Server ○ State is to “0” (Idle) or “1” (Downloaded)
Test Procedure	<p>A WRITE operation from the server on /5/0/0 (Package) is received by the client</p> <p>Normal flow:</p> <ol style="list-style-type: none"> 1. Step 1 – Write <ol style="list-style-type: none"> a. The server delivers the firmware to the device through a WRITE (CoAP PUT/POST) operation on /5/0/0 (Package) b. Update Result is set to “0” (Initial value) c. When the download starts, State is set to “1” (Downloading) d. A READ (CoAP GET) on /5/0/3 (State) provides the status of the firmware download to the server. The server may send repeated READs or OBSERVE the resource to determine when the download is completed. e. When the download is completed, State is set to “2” (Downloaded) 2. Step 2 – Execute <ol style="list-style-type: none"> a. When the download is completed, the server initiates a firmware update by EXECUTE (CoAP POST) on /5/0/2 (Update) Resource b. State is set to “3” (Updating) c. Firmware updates fails <ol style="list-style-type: none"> c.1 Update Result is set to “8” (Firmware update failed) c.2 The device is not rebooted c.3 State is set back to “2” (Downloaded) d. The server READs Update Result to know the result of the firmware update procedure.

Pass-Criteria	<ol style="list-style-type: none">1. Step 1 – Write<ol style="list-style-type: none">a. The server receives the status code “2.04” for WRITE successb. /5/0/3 (State) is “1” (Downloading) during the step and is “2” (Downloaded) at the end of the stepc. /5/0/5 (Update Result) is “0” (Initial Value) during the whole stepd. New firmware is present on the device2. Step 2 – Execute<ol style="list-style-type: none">a. /5/0/3 (State) is “3” (Updating) and /5/0/5 (Update Result) is “0” (Initial) when EXECUTE on /5/0/2 (Update) Resource has been sentb. The server receives the status code “2.04” for EXECUTE successc. The device is not rebootedd. New firmware is not updated on the devicee. /5/0/3 (State) is “2” (Downloaded) at the end of the stepf. /5/0/5 (Update Result) is “8” (Firmware update failed) at the end of the step
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6.1.6.7 Location Object (ID 6) [800-849]

6.1.6.7.1 LightweightM2M-1.0-int-801 – Querying the readable resources of object

Test Case Id	LightweightM2M-1.0-int-801
Test Object	Client and Server
Test Case Description	Querying the readable resources of object 6
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<p>A READ operation from server on the resource has been received by the client. This test has to be run on the following resources:</p> <ul style="list-style-type: none"> a) Latitude b) Longitude c) Altitude d) Uncertainty e) Velocity f) Timestamp <p>Normal flow:</p> <ol style="list-style-type: none"> 1. READ (CoAP GET) on the resource, with the CoAP Accept option value “0” to indicate the “text/plain” content format 2. The server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.05” for READ success 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The server receives the requested information and displays the resource value to the user

6.1.6.7.2 LightweightM2M-1.0-int-805 – Setting the writable resources

There are no writable resources for this object.

6.1.6.7.3 LightweightM2M-1.0-int-810 – Observation and notification of observable resources

Test Case Id	LightweightM2M-1.0-int-810
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device for resources of object 6
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational
Test Procedure	<p>The Server establishes an Observation relationship with the Client to acquire condition notifications about observable resources. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) Latitude b) Longitude c) Altitude d) Uncertainty

	<ul style="list-style-type: none"> e) Velocity f) Timestamp <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (CoAP PUT) operation 2. The server sends OBSERVE (CoAP Observe Option) message to activate reporting 3. The client reports requested information with a NOTIFY message (CoAP response)
<p>Pass-Criteria</p>	<ol style="list-style-type: none"> 1. The server has received the requested information and displays the resource value to the user 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The values returned by the client in each Notify are relevant with regards to the threshold value, the min/max period and the step

6.1.6.8 Connectivity Statistics (ID 7) [900-949]

6.1.6.8.1 LightweightM2M-1.0-int-901 – Querying the readable resources of object

Test Case Id	LightweightM2M-1.0-int-901
Test Object	Client and Server
Test Case Description	Querying the readable resources of object 7
Preconditions	<ul style="list-style-type: none"> ○ Device is registered with the Server
Test Procedure	<p>A READ operation from server on the resource has been received by the client. This test has to be run on the following resources:</p> <ul style="list-style-type: none"> a) SMS Tx counter b) SMS Rx counter c) Tx data d) Rx data e) Max message size f) Average message size <p>Normal flow:</p> <ol style="list-style-type: none"> 1. READ (CoAP GET) on the resource, with the CoAP Accept option value “0” to indicate the “text/plain” content format 2. The server receives success message (2.05 Content) and the requested value in the corresponding Plain Text format
Pass-Criteria	<ol style="list-style-type: none"> 1. The server receives the status code “2.05” for READ success 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The server receives the requested information and displays the resource value to the user

6.1.6.8.2 LightweightM2M-1.0-int-905 – Setting the writable resources

There are no writable resources for this object.

6.1.6.8.3 LightweightM2M-1.0-int-910 – Observation and notification of observable resources

Test Case Id	LightweightM2M-1.0-int-910
Test Object	Client and Server
Test Case Description	Sending the observation policy to the device for resources of object 7
Preconditions	<ul style="list-style-type: none"> ○ Device is registered at the LWM2M server ○ Device is switched on and operational
Test Procedure	<p>The Server establishes an Observation relationship with the Client to acquire condition notifications about observable resources. This test has to be run for the following resources:</p> <ul style="list-style-type: none"> a) SMS Tx counter b) SMS Rx counter c) Tx data d) Rx data e) Max message size f) Average message size <p>Normal flow:</p> <ol style="list-style-type: none"> 1. The server communicates to the device min/max period, threshold value and step with a WRITE ATTRIBUTE (CoAP PUT) operation 2. The server sends OBSERVE (CoAP Observe Option) message to activate reporting 3. The client reports requested information with a NOTIFY message (CoAP response)
Pass-Criteria	<ol style="list-style-type: none"> 1. The server has received the requested information and displays the resource value to the user 2. The value returned by the client is admissible with regards of LWM2M technical specification 3. The values returned by the client in each Notify are relevant with regards to the threshold value, the min/max period and the step

6.2 LWM2M Additional Objects Test cases [1000-1999]

6.2.1 Lock and Wipe Object (ID 8) [1000-1099]

<Test Cases to fill-up>

6.2.2 Software Management Object (ID 9) [1100-1199]

<Test Cases to fill-up>

6.2.3 Connectivity Management Objects (ID 10, 11, 12, 13) [1200-1499]

6.2.3.1 LightweightM2M-CONMGMT-1.0-int-1201 – APN configuration

Test Case Id	LightweightM2M-CONMGMT-1.0-int-1201
Test Object	Client and Server
Test Case Description	Creating and enabling a new APN profile
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is switched on and operational ○ Device is registered at the LWM2M server ○ Device has a Cellular Network Connectivity object and one instance of an APN Connection Profile object. Cellular connectivity is established with the parameters given in the APN Connection Profile object instance.
Test Procedure	<p>Normal flow:</p> <ol style="list-style-type: none"> a. CREATE (COAP POST) operation is performed by the server targeting 11/1 to create a 2nd instance of the APN connection profile object with a new APN which is not yet active. b. Server receives success message (2.01 Created) c. Client is triggered to do a REGISTER operation e.g. by power off/on d. REGISTER message (COAP POST) is sent from client to server including information about the supported Objects and Object Instances including the new instance of the APN Connection Profile object e. Client receives 2.01 Created indicating successful completion of register message. f. Server activates the new APN Connection Profile by changing Enable status to True by WRITE 11/1/3 (COAP PUT) g. Server receives success message (2.04 Changed) h. Server reads the list of active APN Connection Profiles by performing READ 10/4000 i. Server receives success message (2.05 Content) indicating the active APN Connection Profiles
Pass-Criteria	<ul style="list-style-type: none"> ● New APN connection profile is active <p>NOTE: In case the device only supports one active APN profile this test is passed when the new APN profile is activated.</p>

6.2.3.2 LightweightM2M-CONMGMT-1.0-int-1202 – Bearer Selection

Test Case Id	LightweightM2M-CONMGMT-1.0-int-1202
Test Object	Client and Server
Test Case Description	Controlling bearers using Bearer Selection Object
Tool	n/a
Test code	n/a
Preconditions	<ul style="list-style-type: none"> ○ Device is switched on and operational ○ Device is registered at the LWM2M server ○ Device has a Cellular Network Connectivity object and one instance of an APN Connection Profile object. Cellular connectivity is established with the parameters given in the APN Connection Profile object instance. Also, Device has a WLAN Connectivity object but WLAN radio is not enabled.
Test Procedure	<p>Normal flow:</p> <ol style="list-style-type: none"> a. CREATE (COAP POST) operation is performed by the server targeting 13/0 to create the instance of the Bearer selection object with Preferred Communication Bearer (13/0/0) as WLAN preferred. b. Server receives success message (2.01 Created) c. Client shall turn on the WLAN radio and use it for connectivity with the Server. Client shall send Update to the Server indicating the update in registration as the Client's IP address (and port) has changed. d. Server checks the status of the WLAN connectivity object by performing a READ on /12/0. The interface shall be enabled and running. The Server shall verify the values of Enable and Status resources for the same. e. Server performs WRITE operation on Preferred Communication Bearer (13/0/0) resource and updates its value to 3GPP PS Preferred. f. Client shall turn on the Cellular network connectivity (if not already enabled) and use it for connectivity with the Server. Client shall send Update to the Server indicating the update in registration as the Client's IP address (and port) has changed. g. Server checks the status of the Cellular Network Connectivity object by performing a READ on /10. The interface shall be enabled and running.
Pass-Criteria	<ul style="list-style-type: none"> • Bearer Selection Object is allowing the Server to control Client interface for communication

6.2.4 Device Capability Management Object (ID 15) [1500-1599]

<Test Cases too fill-up>

Appendix A. Change History

(Informative)

A.1 Approved Version History

Reference	Date	Description
n/a	n/a	No prior version

A.2 Draft/Candidate Version 1.0 History

Document Identifier	Date	Sections	Description
Draft Versions OMA-ETS-LightweightM2M-V1_0	18 Jun 2013	All	First Draft as agreed in OMA-IOP-MEC-2013-0083-INP_ETS_for_LWM2M
	17 Oct 2013	All	Cleaned up Version for the LWM2M Testfest in Las Vegas as agreed in OMA-IOP-MEC-2013-0103-CR_Clean_up_of_LWM2M_ETS
	20 Dec 2013	1, 2.1, 3.3, 5, 6.1.3, 6.2, 6.3, 6.4, 6.5	Incorporated CR: OMA-IOP-MEC-2013-0115-CR_LWM2M_ETS_Update Editorial changes
	19 Feb 2014	2.1, 6.1.4, 6.2.1, 6.2.2, 6.2.3, 6.4.1, 6.5, 6.6	Incorporated CR: OMA-IOP-MEC-2014-0005R01-CR_LWM2M_ETS_new_test_cases Editorial changes
Candidate Version OMA-ETS-LightweightM2M-V1_0	26 Feb 2014	n/a	Status changed to Candidate by TP TP Ref # OMA-TP-2014-0047-INP_LightweightM2M_V1_0_ETS_for_Candidate_approval
Draft Version OMA-ETS-LightweightM2M-V1_0	22 Jan 2015	6.7, 6.8	Incorporated CRs: OMA-IOP-MEC-2015-0001R01-CR_LWM2M_ETS_CONMGMT_test_case_for_APN_configuration OMA-IOP-MEC-2015-0002-CR_LWM2M_ETS_Location_Object_Test_Case OMA-IOP-MEC-2015-0003-CR_LWM2M_ETS_CONMGMT_test_case_for_Bearer_Selection Editorial changes
Candidate Version OMA-ETS-LightweightM2M-V1_0	03 Feb 2015	n/a	Status changed to Candidate by TP TP Ref # OMA-TP-2015-0042-INP_LightweightM2M_V1_0_ETS_for_Candidate_re_approval
Draft Versions OMA-ETS-LightweightM2M-V1_0	11 Aug 2015	6	Incorporated CR: OMA-IOP-MEC-2015-0007R01-CR_LWM2M_Tests_Cases_New_Structure_ Editorial changes
	03 Sep 2015	6.1.3.5, 6.1.6.2, 6.1.6.4, 6.1.6.6, 6.1.6.9.1, 6.1.6.9.2, 6.1.6.9.3, 6.1.6.11	Incorporated CRs: OMA-IOP-2015-0154R01-CR_LWM2M_ETS_SettingValues_int205 OMA-IOP-2015-0156R01-CR_LWM2M_ETS_Obj_1 OMA-IOP-2015-0157R01-CR_LWM2M_ETS_Obj_3 OMA-IOP-2015-0164R01-CR_LWM2M_ETS_Obj_4 OMA-IOP-2015-0165R01-CR_LWM2M_ETS_Obj_6 OMA-IOP-2015-0166R01-CR_LWM2M_ETS_Obj_7 Editorial changes
	16 Sep 2015	6.1.2.5, 6.1.6.8.1, 6.1.6.8.2, 6.1.6.8.5-6.1.6.8.15	Incorporated CRs: OMA-IOP-2015-0155R01-CR_LWM2M_ETS_BootStrapServer_int105 OMA-IOP-2015-0158R02-CR_LWM2M_ETS_FirmwareUpdate_Obj_5 Editorial changes
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Appendix B. Additional Information

B.1 Example of Test Configuration and Setup

The following hardware components were part of a test setup.

- M2M device equipped with LWM2M client
- Computer that runs the browser interface to the LWM2M server component
- Server that runs the LWM2M server software
- USIM provisioned for use on the network.
- External appliance which is connected directly to M2M device (e.g. light, temperature sensor, motor).

In addition the demonstration setup shall include the following software components:

- Measurement software which enables to see e.g. LWM2M messages and CoAP messages.
 - The software shall enable
 - GUI to trigger the chosen test cases
 - To see the flow of information between client and server, e.g. on LWM2M protocol level and on CoAP transport level.

Appendix C. Enabler Validation Plan

The validation of this enabler will be made based on the successful execution of test cases defined in the [LWM2M-ETS].

A summary of test results will be the evidence that those test cases were executed. The lack of open Problem Reports will be the evidence the test cases were successful executed and that any issue found whether on test specifications, technical specifications or other was correctly addressed.

C.1 Entry Criteria for TestFest

The following tests need to be performed and passed by implementations by members wishing to participate in the TestFest. This ensures minimal requisite capability of the implementations. The tests are defined in the ETS [LWM2M-ETS] and any special comments are noted.

Test Case Id	Special Conditions
LightweightM2M-1.0-int-101	
LightweightM2M-1.0-int-102	
LightweightM2M-1.0-int-201	
LightweightM2M-1.0-int-204	

Table 1: Listing of Tests for Entry Criteria for TestFest

C.2 Enabler Validation Test Cases

The following table should list the set of tests that are used for enabler validation.

Test Case Id	ETR Requirement Id/Feature Key	ETR Status	Notes
LightweightM2M-1.0-int-101	BT-MODE-C, BT-MODE-S	M	
LightweightM2M-1.0-int-102	IF-CR-C, IF-CR-S	M	
LightweightM2M-1.0-int-103	IF-CR-C, IF-CR-S	M	
LightweightM2M-1.0-int-201	DT-PT-C, DT-PT-S	M	
	OB-DEVICE-C, OB-DEVICE-S	M	
	DT-TLV-C, DT-TLV-S	M	
	DT-JSON-S	M	
	DT-JSON-C	O	
LightweightM2M-1.0-int-202	IF-DMSE-C, IF-DMSE-S	M	
LightweightM2M-1.0-int-203	IF-DMSE-C, IF-DMSE-S	M	
LightweightM2M-1.0-int-204	IF-DMSE-C, IF-DMSE-S	M	
LightweightM2M-1.0-int-301	OB-FU-C, OB-FU-S	O	
LightweightM2M-1.0-int-401	OB-SERVER-C, OB-SERVER-S	M	
	OB-CON-C, OB-CON-S	O	
LightweightM2M-1.0-int-501	IF-IR-C; IF-IR-S	M	
LightweightM2M-1.0-int-601	SEC-C, SEC-S, TRANS-C, TRANS-S	M	

Table 2: Enabler Validation Test Cases

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