

VERIFICATION REPORT

# **IEC 61850 Edition 2 server conformance test of MVI56E- 61850C**

ProSoft Technology, Inc

**Report no.:** 21-3346, Rev. 2

**Date:** 2021-10-27

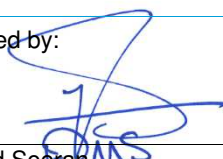


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Report title:	IEC 61850 Edition 2 server conformance test of MVI56E-61850C	DNV Netherlands B.V. Utrechtseweg 310-B50 6812 AR ARNHEM The Netherlands
Customer:	ProSoft Technology, Inc , 9201 Camino Media, Suite 200 Bakersfield, CA 93311 USA	Tel.: +31 26 356 9111 Registered Arnhem 09006404
Customer contact:	Marcio Rodrigues	
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#### Objective:

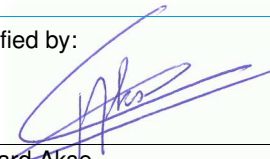
*Does the protocol implementation of the DUT, conform to the IEC 61850 standard and the PICS, MICS, PIXIT and ICD specifications as configured with SCD?*

Prepared by:



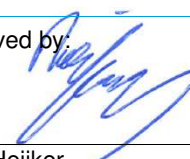
Davood Sooran  
Consultant

Verified by:



Gerard Akse  
Consultant

Approved by:



N. A. Heijker  
Business Leader Interoperability of  
smart power systems

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#### Keywords:

IEC 61850, Conformance, Test,  
Server

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## INTRODUCTION

### 1.1 Identifications

The following table gives the exact identification of tested equipment and test environment used for this conformance test.

<i>DUT (fully tested)</i>	MVI56E-61850C IEC 61850 Client Communication Module with Allen-Bradley ControlLogix 1756-L85E controller			
	<b>Manufacturer</b>	<b>Module</b>	<b>Serial Number</b>	<b>SW version</b>
	ProSoft	MVI56E-61850C	0001A7CA	1.01.022
	Allen-Bradley	ControlLogix 1756-L85E Controller	74457183	33.011
<i>MANUFACTURER</i>	ProSoft Technology, Inc 9201 Camino Media, Suite 200 Bakersfield, CA 93311 USA			
<i>PICS</i>	Protocol Implementation Conformance Statement for the IEC 61850 interface in MVI56E-61850C, Revision 1.01, dated 10/04/2021			
<i>MICS</i>	Model Implementation Conformance Statement for the IEC 61850 interface in MVI56E-61850C, Revision 1.01, dated 09/30/2021			
<i>TICS</i>	TISSUES Implementation Conformance Statement (TICS) for the IEC 61850 Edition 2 Client and Server interface in MVI56E-61850C, Revision 1.01, dated 10/05/2021			
<i>PIXIT</i>	Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 Edition 2 server interface in MVI56E-61850C, Revision 1.01, dated 08/04/2021			
<i>ICD</i>	MVI56E-61850C_2021-09-21_v1.icd, version="1.0"			
<i>SCD</i>	sMdl_v4B.cid, version="1.0" sMdl19_v4B.cid, version="1.0"			
<i>TEST INITIATOR</i>	<i>MANUFACTURER</i>			
<i>TEST FACILITY</i>	DNV Netherlands B.V. Protocol Competence & Test Center Utrechtseweg 310-B50, Arnhem, The Netherlands Accredited as independent Level A test lab by the UCAIug			
<i>TEST ENGINEER</i>	Davood Sooran, davood.sooran@dnv.com			
<i>TEST SESSION</i>	September 27 to September 28, 2021 - Arnhem, The Netherlands			
<i>CLIENT SIMULATOR</i>	UniGrid SA Simulator 1.7.1.0 with test suite 20210701.3			
<i>ANALYSER</i>	UniCA 61850 Analyzer 6.40.01			
<i>EQUIPMENT SIMULATOR</i>	Omicron ISIO-200			
<i>TIME MASTER</i>	DNV_Sntp.exe			

## 1.2 Background

The *TEST FACILITY*'s assignment was to answer the following question:

*"Does the protocol implementation of the DUT conform to the Edition 2 of the IEC 61850 standard and the PICS, MICS, PIXIT and ICD specifications as configured with SCD?"*

To answer this question, *TEST FACILITY* has performed a **conformance test** of the IEC 61850 implementation in the *DUT*. This test has been performed according procedures and conditions set forth in IEC 61850 part 10 and UCAIug Quality Assurance Program.

*TEST FACILITY* is accredited/recognized by the UCAIug to perform formal conformance tests and issue the Level A UCAIug certificate.

## 1.3 Purpose of this document

The purpose of this document is to describe the conformance test procedure and results of the *TEST SESSION* concerning the IEC 61850-8-1 server implementation in the *DUT*.

The described procedures and test results are the basis for the DNV Attestation of Conformity and the UCAIug Level A certificate.

## 1.4 Contents of this document

Chapter 2 shows the list of relevant normative and other references, used to provide input for the conformance test.

Chapter 3 describes the various relevant components for the conformance test and their configuration as used in the conformance test, including the *DUT*. This chapter also gives an overview and introduction to the various test groups that together constitute the conformance test.

Chapter 4 and 5 give an overview and summary of the test results and the conclusion(s).

Annex A specifies the detailed test procedures and their outcome.

## 1.5 Glossary

DUT	Device Under Test
ICD	IED configuration description in SCL-format
MICS	Model Implementation Conformance Statement
PICS	Protocol Implementation Conformance Statement
TICS	Technical Issues Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
SCD	System configuration description in SCL-format
SCL	System Configuration Language
SNTP	Simple Network Time Protocol
TISSUE	Technical issue
UCAIug	UCA International Users Group.

## REFERENCES

### 1.6 Normative

The tests defined in this document are based on the following IEC 61850 documents.

IEC 61850-4, *Communication networks and systems for power utility automation – Part 4: System and project management; Edition 2.0; 2011-04.*

IEC 61850-6, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs; Edition 2.0; 2009-12.*

IEC 61850-7-1, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure – Principles and models; Edition 2.0; 2011-07.*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI); Edition 2.0; 2010-08.*

IEC 61850-7-3, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes; Edition 2.0; 2010-12.*

IEC 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes; Edition 2.0; 2010-03.*

IEC 61850-8-1, *Communication networks and systems for power utility automation – Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO/IEC 9506-1 and ISO/IEC 9506-2) and to ISO/IEC 8802-3; Edition 2.0; 2011-06.*

IEC 61850-10, *Communication networks and systems for power utility automation – Part 10: Conformance testing; Edition 2.0; 2012-12.*

### 1.7 Other

IS 9646 – OSI – Conformance testing methodology and framework.

UCA International User Group: Conformance Test Procedures for Server Devices with IEC 61850-8-1 Edition 2 Interface Revision 2.0.4, December 2020.

UCA International User Group: Quality Assurance Program for IEC Device Implementation Testing and Test System Accreditation and Recognition, Version 2.0, 17 June, 2006.

UCA International User Group: Quality Assurance Program Addendum for IEC 61850 Specific Product Testing, Version 1.0, March 8, 2006.

<http://iec61850.tissue-db.com/>

Name space definition (nsd) code components related to IEC 61850 7-2, 7-3, 7-4 and 8-1 version 2007A3 and the SCL schema 2009 as published on <http://www.iec.ch/tc57/supportdocuments>

## THE CONFORMANCE TEST

### 1.8 Components in the test environment

The test environment consists of the following components:

- DUT
- CLIENT SIMULATOR
- ANALYSER
- EQUIPMENT SIMULATOR
- Ethernet switch
- Time master

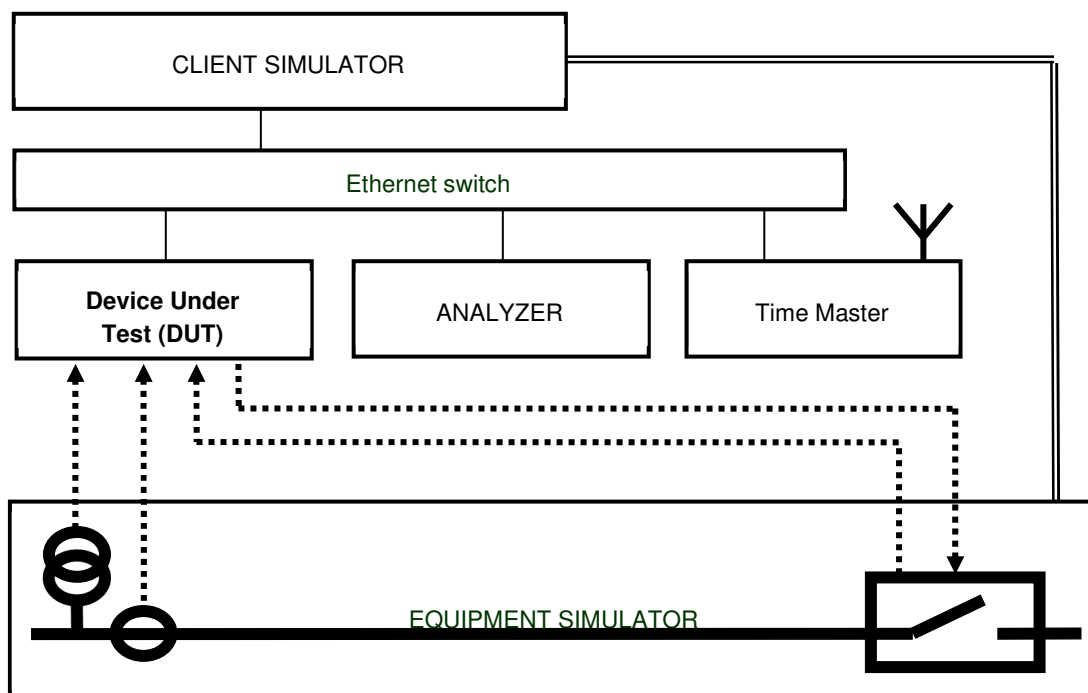


Figure 3.1 The server test environment

### 1.9 Overview of the test suite

The server test cases are structured as follows:

- Documentation and version control (IEC 61850-4)
- Configuration file (IEC 61850-6)
- Data model (IEC 61850-7-3 and IEC 61850-7-4)
- Mapping of ACSI models and services (IEC 61850-7-2 and IEC 61850-8-1)
  - Application association
  - Server & Logical Device & Logical Node & Data
  - Data set
  - Service tracking
  - Substitution
  - Setting group
  - Reporting
  - Logging
  - Generic object oriented substation events
  - Control



- Time and time synchronization
- File transfer.

The *PICS* is used to select the applicable test procedures to be included in the test.



## TEST RESULTS

Table 4.1 in this Chapter give an overview of the conformance test results. References shown in the table columns refer to the individual test procedures in Annex A. The Mandatory column indicates the mandatory test cases and the Conditional column indicates the same for the conditional test cases. The Inconclusive column indicates those test cases that did not pass nor fail.

**Table 4.1 Overview of applicable test cases passed for *DUT***

Conformance Block	Mandatory	Conditional
9a: GOOSE publish	sGop2a, sGop3, sGop4, sGop9, sGop10, sGop11, sGop12	
9b: GOOSE subscribe	sGos1, sGos2, sGos3, sGos5, sGos6a, sGos7, sGos8, sGos9, sGos10, sGos11, sGos12, sGosN1, sGosN2, sGosN3, sGosN4, sGosN5, sGosN6	sGos13
13 Time sync	sTm1, sTm2, sTmN1	

## CONCLUSIONS

Based on the test results described in this verification report, *TEST FACILITY* declares the tested IEC 61850 Edition 2 implementation in the *DUT* has **not been shown to be non-conforming** to IEC 61850 Edition 2 part 6, 7-1, 7-2, 7-3, 7-4 and 8-1 as specified in the PICS, MICS, PIXIT, TICS and ICD and configured according to the provided SCD.

### 1.10 Comments following from the test

The following comments apply for the *DUT*:

*None*

## APPENDIX A

### Detailed test procedures and results

#### A1 Documentation (IEC 61850-4)

Test case	Test case description	Verdict																																																																										
sDoc1	Check if the major/minor software version in the PICS documentation and the DUT do match (IEC61850-4). PICS shall contain the ACSI conformance statement according to IEC 61850-7-2 Annex A	<div><input checked="" type="checkbox"/> Passed</div> <div><input type="checkbox"/> Failed</div> <div><input type="checkbox"/> Inconclusive</div>																																																																										
sDoc2	Check if the major/minor software version in the PIXIT documentation and software version of the DUT does match (IEC61850-4).  PIXIT shall indicate the required information as requested in the applicable test cases  PIXIT shall keep the entry identifiers from the PIXIT template	<div><input checked="" type="checkbox"/> Passed</div> <div><input type="checkbox"/> Failed</div> <div><input type="checkbox"/> Inconclusive</div>																																																																										
sDoc3	Check if the major/minor software version in the MICS documentation and software version of the DUT does match (IEC61850-4). MICS shall indicate the semantics of all non-standard Logical Nodes, Data Objects and enumerations	<div><input checked="" type="checkbox"/> Passed</div> <div><input type="checkbox"/> Failed</div> <div><input type="checkbox"/> Inconclusive</div>																																																																										
sDoc4	Check if the major/minor software version in the TICS documentation and software version of the DUT does match (IEC61850-4). TICS shall indicate that the mandatory and applicable technical issues are implemented	<div><input checked="" type="checkbox"/> Passed</div> <div><input type="checkbox"/> Failed</div> <div><input type="checkbox"/> Inconclusive</div>																																																																										
sDoc5	<div>Check the ICD if the server capabilities in the IED “services” section(s) do correspond with the ACSI services specified in the PICS (compare TISSUE #901)</div> <table><thead><tr><th><u>SCL Services</u></th><th><u>PICS</u></th></tr></thead><tbody><tr><td>DynAssociation max</td><td>S2</td></tr><tr><td>SettingGroups</td><td>S18    S23</td></tr><tr><td>SettingGroups/SGEdit</td><td>S19    S20    S21    S22</td></tr><tr><td>SettingGroups/ConfSG</td><td>No condition in PICS</td></tr><tr><td>GetDirectory</td><td>S1    S5    S6</td></tr><tr><td>GetDataObjectDefinition</td><td>S11</td></tr><tr><td>DataObjectDirectory</td><td>S10</td></tr><tr><td>GetDataSetValue</td><td>S12</td></tr><tr><td>SetDataSetValues</td><td>S13</td></tr><tr><td>DataSetDirectory</td><td>S16</td></tr><tr><td>ConfDataSet max</td><td>S12</td></tr><tr><td>DynDataSet max</td><td>S14    S15</td></tr><tr><td>ReadWrite</td><td>S8    S9    S17    S54</td></tr><tr><td>TimerActivatedControl</td><td>S56</td></tr><tr><td>GetCBValues</td><td>S23    S25    S28    S30    S38    S46    S49</td></tr><tr><td>ConfReportControl</td><td>S25    S28</td></tr><tr><td>ReportSettings</td><td>S26    S29</td></tr><tr><td>ConfLogControl</td><td>S30</td></tr><tr><td>LogSettings</td><td>S31</td></tr><tr><td>GOOSE</td><td>S35 Publisher</td></tr><tr><td>GSESettings</td><td>S39    S44</td></tr><tr><td>GSEDir</td><td>S36    S37</td></tr><tr><td>SMVsc</td><td>S45    S48</td></tr><tr><td>SMVSettings</td><td>S47    S50</td></tr><tr><td>FileHandling</td><td>S57, S60, S61</td></tr><tr><td>ConfLNs</td><td>No condition in PICS</td></tr><tr><td>ClientServices goose</td><td>S35 subscriber</td></tr><tr><td>ClientServices supportsLdName</td><td>S35 subscriber</td></tr><tr><td>ClientServices sv</td><td>S45 subscriber</td></tr><tr><td>ClientServices TimeSyncProt</td><td>T1, T2, T3</td></tr><tr><td>ConfLdName</td><td>no condition in PICS</td></tr><tr><td>SupSubscription</td><td>no condition in PICS</td></tr><tr><td>ConfSigRef</td><td>no condition in PICS</td></tr><tr><td>ValueHandling</td><td>no condition in PICS</td></tr><tr><td>RedProt</td><td>no condition in PICS</td></tr><tr><td>CommProt</td><td>no condition in PICS</td></tr></tbody></table>	<u>SCL Services</u>	<u>PICS</u>	DynAssociation max	S2	SettingGroups	S18    S23	SettingGroups/SGEdit	S19    S20    S21    S22	SettingGroups/ConfSG	No condition in PICS	GetDirectory	S1    S5    S6	GetDataObjectDefinition	S11	DataObjectDirectory	S10	GetDataSetValue	S12	SetDataSetValues	S13	DataSetDirectory	S16	ConfDataSet max	S12	DynDataSet max	S14    S15	ReadWrite	S8    S9    S17    S54	TimerActivatedControl	S56	GetCBValues	S23    S25    S28    S30    S38    S46    S49	ConfReportControl	S25    S28	ReportSettings	S26    S29	ConfLogControl	S30	LogSettings	S31	GOOSE	S35 Publisher	GSESettings	S39    S44	GSEDir	S36    S37	SMVsc	S45    S48	SMVSettings	S47    S50	FileHandling	S57, S60, S61	ConfLNs	No condition in PICS	ClientServices goose	S35 subscriber	ClientServices supportsLdName	S35 subscriber	ClientServices sv	S45 subscriber	ClientServices TimeSyncProt	T1, T2, T3	ConfLdName	no condition in PICS	SupSubscription	no condition in PICS	ConfSigRef	no condition in PICS	ValueHandling	no condition in PICS	RedProt	no condition in PICS	CommProt	no condition in PICS	<div><input checked="" type="checkbox"/> Passed</div> <div><input type="checkbox"/> Failed</div> <div><input type="checkbox"/> Inconclusive</div>
<u>SCL Services</u>	<u>PICS</u>																																																																											
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SettingGroups	S18    S23																																																																											
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SettingGroups/ConfSG	No condition in PICS																																																																											
GetDirectory	S1    S5    S6																																																																											
GetDataObjectDefinition	S11																																																																											
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ConfReportControl	S25    S28																																																																											
ReportSettings	S26    S29																																																																											
ConfLogControl	S30																																																																											
LogSettings	S31																																																																											
GOOSE	S35 Publisher																																																																											
GSESettings	S39    S44																																																																											
GSEDir	S36    S37																																																																											
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CommProt	no condition in PICS																																																																											

## A2 Configuration file (IEC 61850-6)

IEC 61850-6 clause 7 states: “ An IED which is claimed to implement a server or client according to the IEC 61850 standard shall be accompanied by an ICD file, respectively by a tool capable of generating an ICD file, or a project specific IID file, respectively a tool capable of generating project specific IID file for this IED, and shall be able to consume an SCD file or be accompanied by a tool which can consume the SCD file to configure the communication part of the IED from theis SCD file, within the limits declared in the ICD file or the IID file produced previously by the IED tool”.

The configuration file test cases are performed on both the ICD and the SCD as specified in clause 1.1. unless the test case explicitly specifies otherwise. In case the ICD and/or IID are generated by the IED tool it is not allowed to change these SCL files using for example a general XML editor.

### A2.1 SCL Header section

Test case	Test case description	Verdict
sCnf1	Verify the SCL version = “2007”, revision = “B”	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf2	Verify the XML encoding is UTF-8 or utf-8; <?xml version="1.0" encoding="UTF-8"?>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf3	Verify that the ICD validates according to SCL schema: version 2007, revision B	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive

### 2.2 SCL Substation section

Test case	Test case description	Verdict
sCnf10	Verify the ICD has at most one Substation or Line or Process exists at SCL level and the attribute “name” is “TEMPLATE”. If voltagelevel and bay element are present, their name is “TEMPLATE”  Condition: when substation section is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf11	Verify the ICD has none of the LNode bound to an IED different from “TEMPLATE”  Condition: when substation section is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable

## A2.3 SCL Communication section

Test case	Test case description	Verdict
sCnf20	Verify that the "Communication" element exists: <ul style="list-style-type: none"> <li>• IED/Services/DynAssociation or IED/AccessPoint/Services/DynAssociation is declared) and IED/AccessPoint/ Server is declared or</li> <li>• LN0/GSEControl element exist or</li> <li>• LN0/SampledValueControl element exist</li> </ul>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf21	<p>If IED/Services/DynAssociation is declared, for each ConnectedAP/Address element:</p> <p>Verify that exactly one "P" element with attribute type="OSI-PSEL" with a valid value (non-empty, even number of characters, maximum 16 characters 0-9,A-F)</p> <p>Verify that exactly one "P" element with attribute type="OSI-SSEL" with a valid value (non-empty, even number of characters, maximum 16 characters 0-9,A-F)</p> <p>Verify that exactly one "P" element with attribute type="OSI-TSEL" with a valid value (non-empty, even number of characters, maximum 8 characters 0-9,A-F) (Note that if xsi:type mechanism is used then schema validator can automatically verify the type)</p> <p>The DUT only supports GOOSE Publish and GOOSE Subscribe. So, this test case is not applicable.</p>	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf22	<p>Verify that for each accesspoint no more than one "P" element with attribute type="OSI-AP-Title" and "OSI-AE-Qualifier and "IP" and "IP-SUBNET", "IP-GATEWAY", OSI-NSAP, OSI-AP-Invoke, and OSI-AE-Invoke exists. For each of these that exist:</p> <p>Verify OSI-AP-Title value contains only decimal digits and non-repeating commas</p> <p>Verify OSI-AE-Qualifier value is decimal representation from 0-65535</p> <p>Verify IP and IP-SUBNET and IP-GATEWAY contain a "standard dotted-decimal" for Ipv4 (TISSUE #1208 forbids Ipv6 in Ed2)</p> <p>Verify OSI-AP-Invoke and OSI-AE-Invoke are between 0 and 65535.</p> <p>The DUT only supports GOOSE Publish and GOOSE Subscribe. So, this test case is not applicable.</p>	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf23	<p>For each GSE element:</p> <p>Address/P[type=MAC-Address] right digit of first octet is odd (1,3,5,7,9,B,D,F) (multicast).</p> <p>Addresss/P[type=VLAN-ID] present</p> <p>Addresss/P[type=PRIORITY] present</p> <p>Addresss/P[type=APPID] = 0000-3FFF or 8000-BFFF</p> <p>Condition: when GSE element is present</p>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input type="checkbox"/> Not applicable
sCnf24	<p>For each SMV element referencing a SampledValueControl whose attribute multicast=true or missing, verify Address/P[type=MAC-Address] right digit of first octet is odd (1,3,5,7,9,B,D,F) (multicast)</p> <p>For each SMV element referencing a SampledValueControl whose attribute multicast=false, verify Address/P[type=MAC-Address] right digit of first octet is even (0,2,4,6,8,A,C,E) (unicast)</p> <p>For each SMV element in the ICD:</p> <p>Addresss/P[type=VLAN-ID] present</p> <p>Addresss/P[type=PRIORITY] present</p> <p>Addresss/P[type=APPID] = 4000-7FFF</p> <p>Condition: when SMV element is present</p>	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf25	Verify the ICD that each Subnetwork/ConnectedAP@iedName is "TEMPLATE"	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive

sCnf26	Verify each Subnetwork/ConnectedAP@apName matches one of IED/AccessPoint@name	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf27	Verify for each GSE element, the GSE@cbName points to a GSEControl within the AccessPoint pointed to by GSE//@apName and GSE@ldInst.  Condition: when GSE element is present	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input type="checkbox"/> Not applicable
sCnf28	Verify for each SMV element, the SMV@cbName points to a SampledValueControl within the AccessPoint pointed to by SMV//@apName and SMV@ldInst.  Condition: when SMV element is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable

## A2.4 SCL IED section

Test case	Test case description	Verdict
sCnf40	Verify the ICD has exactly one IED element and that the attribute "name" of the element is "TEMPLATE"	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf41	Verify all FCDA elements reference existing data and that doName and (optional) daName contain correct references. (ref 61850-6 §9.3.7 Table 22). <ul style="list-style-type: none"> <li>Verify attributes ldInst, lnClass, doName, and fc are declared.</li> <li>Verify attribute lnInst is declared if lnClass is not "LLN0".</li> <li>Verify first component of doName references a DO@name and second component (if any) references a SDO@name within DO referenced by first component</li> <li>Verify first component of daName (if present) references a DA@name and other component (if any) references a BDA@name within structure hierarchy of the DA referenced by first component</li> <li>Verify that at most one component of doName/daName contains an index and that ix attribute is identical to this index (see 61850-6 Table 22). Valid example: &lt;FCDA ldInst="LD0" lnClass="MHAI" lnInst="1" fc="MX" doName="HA.phsAHar(0)" daName="cVal.mag.f" ix="0" /&gt;</li> </ul>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf42	Verify DOI/SDI/DAI structures match DataTypeTemplates (DOI@name is valid DO in LD/LN and DAI@name is a leaf within that DO and SDI@name form hierarchy between DOI and DAI)	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf43	Verify that the ICD has none of the ExtRef references IEDs different from TEMPLATE or "@"  Condition: when ExtRef iedName attribute is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf44	Verify that the ICD has no ClientLN elements exist within ReportControl and no IEDName elements within GSEControl and SampledValueControl	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf45	Verify all GSEControl/SampledValueControl/ReportControl have confRev>0 when datSet is not empty	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf46	Verify IED@originalSclVersion and IED@originalSclRevision attributes match corresponding attributes of SCL element (SCL@version and SCL@revision)	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive

sCnf47	Verify multiple identically named DOI/SDI/DAI elements at the same level differ by "ix" attribute (either different "ix" or "ix" attribute not present). See 61850-6 page 173. Condition: when DOI/SDI/DAI ix attribute is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf48	Verify multiple LLN0.SGCB do not appear in the same logical device hierarchy (defined by LLN0.GrRef which references the parent logical device) Condition: when multiple SGCB are present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf49	Verify element "Log" exists only in LLN0 Condition: when Log is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf50	Verify that the name length of IED, Logical Devices, Logical Nodes, data objects, data attributes, data sets and control blocks do not exceed the maximum length as specified in IEC 61850-7-2 clause 22.2 and SCSM	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf51	Verify that logical node LPHD is present in each root logical device (IEC 61850-7-1 clause 8.2.5)	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf52	Verify that GSEControl can be added to any LN0 Add one GSEControl to first and last LN0 in the configuration of the device Condition: Services/GSESettings attribute cbName is not "fix" or absent and multiple Logical Devices exist and GOOSE max > 1	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable

## A2.5 SCL IED Services section

Test case	Test case description	Verdict
sCnf60	Verify that the attribute nameLength="64" exists in the IED/Services element	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf61	Verify that the Services section must not contradict existing control block and data sets; <ul style="list-style-type: none"> <li>Nr of DataSet elements &lt;= ConfDataSet.max (if provided).</li> <li>Nr of ReportControl instances &lt;= ConfReportControl.max (if provided)</li> <li>Nr of GSEControl &lt;= GOOSE.max (if provided)</li> <li>Nr of SMVControl &lt;= SMVsc.max (if provided)</li> <li>Nr of LogControl &lt;= ConfLogControl.max (if provided)</li> <li>Nr of LGOS instances &lt;= SupSubscription.maxGo (if provided)</li> <li>Nr of LSVS instances &lt;= SupSubscription.maxSv (if provided)</li> </ul>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf62	Verify the AccessPoint/Services element does not contain the attribute nameLength Condition: when AccessPoint Services element is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf63	Verify AccessPoint/Services element does not contain any of the elements ConfLNs, and ConfLdName Condition: when AccessPoint Services element is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf64	Verify that in case SupSubscription is claimed to be supported at least one instance of LGOS or LSVS must be in the ICD. Condition: when SupSubscription element is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sCnf65	Verify that if serviceType=GOOSE is specified for ExtRef the ClientServices.goose=true. For serviceType=SMV the ClientServices.sv=true Condition: when serviceType=GOOSE or serviceType=SMV is present	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input type="checkbox"/> Not applicable

## A2.6 SCL DataTypeTemplate section

Test case	Test case description	Verdict
sCnf70	Verify for each DAType/BDA or DOType/DA with attribute "bType"=Struct has attribute "type" whose value matches DAType@id; does not declare valKind (TISSUE #823); does not contain a <Val> element	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf71	Verify for each DAType/BDA or DOType/DA with attribute "bType"=Enum has attribute "type" whose value matches EnumType@id	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf72	Verify type names do not exceed 255 characters, contain no "whitespace" characters and contain only characters from Basic-Latin and Latin-1-Supplement	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf73	Verify that each DOType element contains at least one SDO or DA element	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf74	Verify for each DA with FC="CO" (except "SBO") that the associated DAType contains the element <ProtNs type="8-MMS">IEC 61850-8-1:2003</ProtNs> Verify for each DA name="SBO" (FC="CO") contains the ProtNS element	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf75	Verify for each (instance of) DOType/DA[name=ctlModel] whose associated EnumType contains direct-with-normal-security has in the DOType a DA named "Oper". If ctlModel has valKind=RO and valImport=missing/false then use the configured ctlModel value instead of EnumType.  Similar for sbo-with-normal-security, Oper, Cancel and SBO  Similar for direct-with-enhanced-security, Oper Similar for sbo-with-enhanced-security, Oper, Cancel and SBOw	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf76	Verify for each DA element which does not contain the attribute "type" that a maximum of one of dchg/qchg/dupd attributes is true	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input checked="" type="checkbox"/> Inconclusive

## A2.7 SCL Common IED and DataTypeTemplate section

Test case	Test case description	Verdict
sCnf80	Verify that <Val> element values actually match a value in the corresponding EnumType, "ord" shall not be used, only EnumVal element values. Ref IEC 61850-6 Table 45.	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf81	Verify that <Val> elements values match IEC 61850-6 Table "Data type mapping" (if no table rows then Val element is not allowed at all)	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf82	Verify for each LD/LLN0.NamPlt.IdNs, a <Val> element exists with a valid namespace referring to Edition 2: IEC 61850-7-4:2007 or IEC 61850-7-4:2007A	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf83	Verify each ctlModel has an associated <Val> element	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sCnf84	Verify CDC=ORG references use the ACSI format (with ".", no "\$" and no functional constraint, TISSUE 1223) and that the reference does exist  Condition: when a data object with CDC=ORG is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable



sCnf85	<p>Verify for each Logical Device whose LLN0 does not contain GrRef, the existence of Data Object LLN0.NamPIt</p> <p>Verify for each LLN0 which contains the DO NamPIt, the existence and non-null value for Data Attribute LLN0.NamPIt.configRev</p>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
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### A3 Data model (IEC 61850-7-3 and IEC 61850-7-4)

Test case	Test case description	Verdict
sMdl1	Verify presence of mandatory data objects for each LN type and data attributes for each DO type. Passed when all objects/attributes are present	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl2	Verify presence of conditional presence true data objects for each LN type and data attributes for each DO type. Passed when all objects/attributes are present	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl3	Verify non-presence of conditional presence false data objects for each LN type and data attributes for each DO type. Passed when these objects/attributes are not present	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl4	Verify data model mapping according to applicable SCSM concerning name length and object expansion. Passed when mapping is according to applicable SCSM	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl5	Verify data model mapping according to applicable SCSM concerning organisation of functional components.	Deprecated
sMdl6	Verify data model mapping according to applicable SCSM concerning naming of control blocks and logs. Passed when mapping is according to applicable SCSM.	See detail
sMdl7	Verify type of all data objects for each LN type and all data attributes for each DO type. Passed when type of all objects/attributes do match with the IEC 61850-7-3, IEC 61850-7-4 and the applicable SCSM	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl8	Verify that the enum types and values from the SCL and in the device are in specified range. Passed when all enum types and values match the 2007A.nsd.	See detail
sMdl9	Check if manufacturer specific data model extensions are implemented according to the extension rules in IEC 61850-7-1 clause 14.	See detail
sMdl10	Check if the order of the data attributes with the same functional constraint of the DO type match with IEC 61850-7-3. Passed when all attributes are in matching order	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl11	Moved to sCnf50	-
sMdl12	Check that the rules for multiple data object instantiation are kept (IEC 61850-7-1 clause 14.6, IEC 61850-7-4).	See detail
sMdl13	Moved to sCnf82	-
sMdl14	<p>Check the correct use of name spaces for non-substation power utility applications like for example Hydro and DER.</p> <p>Condition: when non-substation name space is used</p>	Not applicable
sMdl15	Check if the SCL configuration file used to configure the DUT corresponds with the actual data object references, data types, data sets and pre-configured data values (settings) exposed by the DUT on the network.	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl16	<p>Change one parameter/setting of each configurable data type and FC (FC can be DC, CF or SP) using the supplied configuration tool and check the updated online parameter/setting values correspond with the configured values in the SCL. The tested parameters are specified in the detailed test procedure.</p> <p>Condition when a parameter/setting is configurable</p>	Not applicable

sMdl17	Check the "ldName" naming structure when supported. All online object references (including data sets, control block references and object references – CDC ORG) shall start with the "LDevice ldName" value instead of the "IED name" + "LDevice inst"  Condition when Services ConfLdName is present	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable
sMdl18	Verify that the indicated trigger option: <DA dchg, qchg, dupd > is conformant with the IEC 61850-7-3 standardized Trigger Option.	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input type="checkbox"/> Not applicable
sMdl19	Configure IED attribute name in server resulting in a 64-character MMS domain name for the longest ldInst and verify online domain name agrees with configuration.	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
sMdl20	If ICD/IID contains any valKind=Conf: Verify that online data model does not contain empty data structures as a result of all contained attributes being valKind=conf	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive <input checked="" type="checkbox"/> Not applicable

#### Detailed data modelling test procedures

sMdl6	Naming of control blocks and logs	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive																																								
IEC 61850-6 Subclause 9.3.8																																										
<u>Expected result</u> <ul style="list-style-type: none"><li>Report control blocks may be indexed. The indexing of report control blocks depends on the presence and value of the SCL elements: RptEnabled, max and indexed. According to the SCL schema the default value of indexed=TRUE and max = 1, max = 0 is not allowed. The indexing shall be according to the following table, SCL name="rcbA"</li></ul> <table><tr><th>RCBName (IED)</th><th>RptEnabled</th><th>max=</th><th>indexed</th></tr><tr><td>rcbA01</td><td></td><td></td><td></td></tr><tr><td>rcbA01</td><td></td><td></td><td>TRUE</td></tr><tr><td>rcbA</td><td></td><td></td><td>FALSE</td></tr><tr><td>rcbA01</td><td>y</td><td>1</td><td></td></tr><tr><td>rcbA01</td><td>y</td><td>1</td><td>TRUE</td></tr><tr><td>rcbA</td><td>y</td><td>1</td><td>FALSE</td></tr><tr><td>rcbA01, rcbA02</td><td>y</td><td>2</td><td></td></tr><tr><td>rcbA01, rcbA02</td><td>y</td><td>2</td><td>TRUE</td></tr><tr><td>rcbA (only unbuffered)</td><td>y</td><td>2</td><td>FALSE</td></tr></table> <ul style="list-style-type: none"><li>The report control block attributes owner and resvTms do match with the SCL IED Services element owner and resvTms</li><li>The setting group control block attribute resvTms does match with the SCL IED Services element SGEdit resvTms</li><li>The presence of the optional GOOSE control block attributes minTime, maxTime, fixedOffs have no SCL IED Services elements</li></ul>			RCBName (IED)	RptEnabled	max=	indexed	rcbA01				rcbA01			TRUE	rcbA			FALSE	rcbA01	y	1		rcbA01	y	1	TRUE	rcbA	y	1	FALSE	rcbA01, rcbA02	y	2		rcbA01, rcbA02	y	2	TRUE	rcbA (only unbuffered)	y	2	FALSE
RCBName (IED)	RptEnabled	max=	indexed																																							
rcbA01																																										
rcbA01			TRUE																																							
rcbA			FALSE																																							
rcbA01	y	1																																								
rcbA01	y	1	TRUE																																							
rcbA	y	1	FALSE																																							
rcbA01, rcbA02	y	2																																								
rcbA01, rcbA02	y	2	TRUE																																							
rcbA (only unbuffered)	y	2	FALSE																																							
<u>Test description</u> <p>Verify the naming and attributes of all control blocks and logs in the DUT.</p>																																										
<u>Comment</u> <p>DUT only supports GOOSE Subscribe and GOOSE Publish</p>																																										

sMdl8	Enumerated Data attribute values	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-6 Subclause 9.5.6 IEC 61850-7-3 Annex D IEC 61850-7-4 Annex H TISSUE #686		
<u>Expected result</u> 1. All ENC enumeration types are correctly defined. Not supported enum values are removed for controllable data objects with common data class ENC. 2. All values are in range, when failed attach a list		
<u>Test description</u> 1. Verify that the enumeration types are defined according IEC 61850-7-3 Annex D, IEC 61850-7-4 Annex H and TISSUE #686. Not supported enum values shall not be included in the ICD file for controllable data objects with common data class ENC 2. Verify that preconfigured enumerated data attribute values from the device and SCL are in specified range.		
<u>Comment</u>		

sMdl9	Data model extensions	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-1 Subclause 13.4.5, 14 TISSUE #828, #1468		
<u>Expected result</u> <ul style="list-style-type: none"> <li>Private LN shall have lNs referring to a non-standard name space</li> <li>Private DO (not defined in the LN) in a standardized LN shall have a dataNs referring to a non-standard name space</li> <li>Standardized LN may re-use DO's from another standard LN. The DO may have a dataNs = IEC 61850-7-4:2007[A] or IEC 61850-7-4:2003 or private or absent</li> <li>Private DO in a private LN may have a dataNs referring to a non-standard name space</li> <li>Standardized DO in a private LN <u>may</u> have a dataNs = IEC 61850-7-4:2007[A] or IEC 61850-7-4:2003</li> <li>Private CDC are not allowed, private extensions in existing CDC are not allowed</li> <li>Private data attributes are not allowed</li> <li>Private ENUM values in a standardized ENUM type shall have a negative ord value</li> <li>Private ENUM types are only allowed for private DO</li> <li>Extensions to control blocks are not allowed</li> <li>Only standardized data types are allowed</li> </ul>		
<u>Test description</u> Scan SCL file for extensions: private LN, private DO, private DA and private ENUMs. Browse DUT for extensions: control blocks		
<u>Comment</u>		

<b>sMdl12</b>	<b>Check that the rules for multiple data object instantiation are kept</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
Data objects as specified in name space definition 2007A2 IEC 61850-7-1 Subclause 14.6, TISSUE #742, #1498, #1511		
<u>Expected result</u> <ul style="list-style-type: none"> <li>Standardized DO's ending with a number do have presCond="Omulti" in the 2007A.nsd (example GGIO.Ind4 is derived from GGIO.Ind with presCond="Omulti"; PSCH.RxPrm29 is derived from PSCH.RxPrm1) and are not member of the exception white list below</li> <li>Private DO's may end with a number</li> <li>Derived instances from TmAChr, TmVChr, TmTmpChr, VChr, VHzChr have instance number range between 33 and 48 (presCond="OmultiRange" presCondArgs="33, 48" in the 2007A.nsd)</li> <li>Standardized DO's ending without a number don't have the presCond="Omulti" in the 2007A.nsd (example Mod)</li> </ul>		
<u>Test description</u> Scan SCL file for DO names		
<u>Comment</u>		

<b>sMdl16</b>	<b>Change configurable parameters/settings in the SCL and check the online data model has been updated accordingly</b>	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input checked="" type="checkbox"/> Inconclusive
Tested parameters/settings:  DUT only support GOOSE Subscribe, and GOOSE Publish. It is not possible to see DC/CF/SP values as the DUT only supports GOOSE. The valKind is not important in this case, because there is no MMS interface.		

## A4 Mapping of ACSI models and services (IEC 61850-7-2 and applicable SCSM)

The following table specifies which ACSI services are mandatory / optional for each conformance block.

**Table A.4.1:** ACSI services per conformance block

Conformance Block	Mandatory	Optional
1: Basic Exchange	Associate, Abort, Release GetServerDirectory(LD) GetLogicalDeviceDirectory GetLogicalNodeDirectory (DATA) GetDataValues GetDataDirectory/GetDataDefinition	GetAllDataValues SetDataValues
2: Data Set	GetLogicalNodeDirectory (DATA-SET) GetDataSetValues GetDataSetDirectory	SetDataSetValues
2+: Data Set Definition	CreateDataSet DeleteDataSet	
3: Substitution	SetDataValues GetDataValues	
4: Setting Group Selection	SelectActiveSG GetSGCBValues	
4+: Setting Group Definition	SelectEditSG GetEditSGValue SetEditSGValue ConfirmEditSGValues	
5: Unbuffered Reporting	Report GetURCBValues SetURCBValues	
6: Buffered Reporting	Report GetBRCBValues SetBRCBValues	
7: Logging	GetLCBValues GetLogicalNodeDirectory (LOG) QueryLogByTime or QueryLogAfter GetLogStatusValues	SetLCBValues
9a: GOOSE publish	SendGOOSEMessage (publish)	GetGoCBValues SetGoCBValues
9b: GOOSE subscribe	SendGOOSEMessage (subscribe)	
9c: GOOSE management	GetGoReference GetGOOSEElementNumber	
12a: Direct control	Operate	TimeActivatedOperate
12b: SBO control	Select, Cancel, Operate	TimeActivatedOperate
12c: Enhanced Direct Control	Operate CommandTermination	TimeActivatedOperate
12d: Enhanced SBO control	SelectWithValue, Cancel, Operate CommandTermination	TimeActivatedOperate

13: Time sync	TimeSynchronization	
14: File transfer	GetServerDirectory(FILE) GetFile GetFileAttributeValues	SetFile DeleteFile
15: Service Tracking	<no specific services>	<no specific services>

The following table specifies which test procedures are mandatory/conditional for each conformance block (defined in Quality Assurance Plan Addendum for IEC 61850). Conditions refer to the SCL, PICS, MICS or PIXIT.

**Table A.4.2:** Test procedures per conformance block

Conformance Block	Mandatory	Conditional
1: Basic Exchange	sAss1, sAss2, sAss3, sAss4, sAssN2, sAssN3, sAssN4, sAssN5  sSrv1, sSrv2, sSrv3, sSrv4, sSrv5, sSrv8, sSrvN1abcd, sSrvN4	SCL-DynAssociation max > 1: sAssN6 PIXIT Sr1 declares more bits than validity: sSrv9 PIXIT Sr2 declares more bits than validity: sSrv10 PICS-SetDataValues: sSrv6, sSrvN1e, sSrvN3 SCL-Enum with FC=CF/DC/SP and valKind=Set: sSrvN2 SCL-blkEna: sSrv11 SCL-Mode off/blocked/test: sSrv12 SCL-GrRef: sSrv13 SCL-blkEna: sSrv14
2: Data Sets	sDs1, sDs10a, sDsN1ae	PICS-SetDataSetValues: sDs10b, sDsN1b, sDsN13 SCL-configurable datasets: sDs15
2+: Data Set Definition	sDs2, sDs3, sDs4, sDs5, sDs6, sDs7, sDs8, sDs9, sDs13, sDs14, sDsN1cd sDsN2, sDsN3, sDsN4, sDsN5 sDsN6, sDsN7, sDsN8, sDsN8, sDsN9, sDsN10,	SCL-Report.DatSet=dyn: sDsN11, sDsN12 SCL-maxAttributes: sDs11, sDs12
3: Substitution	sSub1, sSub2, sSub3	
4: Setting Group Selection	sSg1, sSg3, sSgN1	SCL-NumOfSg>1 or PICS-SgEditing: sSg11
4+: Setting Group Definition	sSg2, sSg4, sSg6, sSg7, sSg8, sSg10, sSgN2, sSgN3, sSgN4, sSgN5	SCL-ResvTms: sSg5 SCL-NumOfSg>1: sSg9
5: Unbuffered Reporting	sRp1, sRp2, sRp3, sRp4, sRp5, sRp9, sRp14, sRp16, sRpN1, sRpN2, sRpN3, sRpN4, sRpN8	SCL-DatSet=dyn: sRp6, sRp7 SCL-DatSet=conf/dyn: sRp10, sRp15 SCL-BufTm=conf/dyn: sRp8, sRp11, sRp12 SCL-Owner: sRp13 PIXIT-Rp15 db=0: sRp17 SCL-URCB visible to all clients: sRpN5
6: Buffered Reporting	sBr1, sBr2, sBr3, sBr4, sBr5, sBr9, sBr14, sBr16, sBr20, sBr21, sBr22, sBr25, sBr26, sBr27, sBr28, sBr29 sBrN1, sBrN2, sBrN3, sBrN4, sBrN5, sBrN8	SCL-DatSet=dyn: sBr6, sBr7 SCL-DatSet=conf/dyn: sBr10, sBr15 SCL-BufTm=conf/dyn: sBr8, sBr11, sBr12 SCL-Owner: sBr13 PIXIT-Rp15 db=0: sBr17 SCL-ResvTms: sBr23, sBr24

7: Logging	sLog2, sLog3, sLog4, sLog5, sLog6, sLog7, sLog8, sLog9, sLog11, sLog12, sLog13, sLogN1, sLogN2	SCL-GLOG: sLog10
9a: GOOSE publish	sGop2a, sGop3, sGop4, sGop9, sGop10, sGop11, sGop12	PICS-GetGoCBValues: sGop1 SCL-Fixed offset: sGop2b PIXIT-Simulation: sGop5 PICS-SetGoCBValues: sGop6, sGopN1 PIXIT-Dataset too large: sGopN2
9b: GOOSE subscribe	sGos1, sGos2, sGos3, sGos5, sGos6a, sGos7, sGos8, sGos9, sGos10, sGos11, sGos12, sGosN1, sGosN2, sGosN3, sGosN4, sGosN5, sGosN6	SCL-LGOS: sGos4 PIXIT-Simulation: sGos6b PIXIT-Gs12 No Security: sGos13
9c: GOOSE management	sGom1, sGom2, sGomN1	
12: Control general	sCtl5, sCtl8, sCtl9, sCtl10, sCtl11, sCtl25	SCL-Writable control model: sCtl2 PICS-TimOper: sCtl3 SCL-stSeld: sCtl4 SCL-multiple SBO: sCtl6 SCL-CILO: sCtl7 SCL-Select on DO: sCtl13 SCL-Operate time: sCtl14 PIXIT-Behaviour=off: sCtl15 SCL-Loc: sCtl16 SCL-LocSta: sCtl17 SCL-CmdBlk: sCtl18 PIXIT-AddCause: <ul style="list-style-type: none"> <li>Parameter-change-in-execution: sCtl20</li> <li>Step-limit: sCtl21</li> <li>Ended-with-overshoot: sCtl23</li> <li>Abortion-due-to-deviation: sCtl24</li> <li>Command-already-in-execution and operate time: sCtl26</li> </ul> SCL-SBO and SBOw: sCtl27
12a Direct control	sDOns1, sDOns2	PICS-TimOper: sDOns4, sDOns5
12b SBO control	sSBOs1, sSBOs2, sSBOs6	PICS-TimOper: sSBOs4, sSBOs5 PIXIT-Operate-Many: sSBOs7
12c Enhanced Direct Control	sDOes1, sDOes2	PICS-TimOper: sDOes4, sDOes5
12d Enhanced SBO control	sSBOes1, sSBOes2, sSBOes6, sSBOes8	PICS-TimOper: sSBOes4, sSBOes5 PIXIT-Operate-Many: sSBOes7
13: Time sync	sTm1, sTm2, sTmN1	PIXIT-COMTRADE: sTm3 SCL-LTIM: sTm4 SCL-LTMS: sTm5 PIXIT-ClockFailure: sTmN2
14: File transfer	sFt1, sFt2ab, sFt4, sFt5, sFtN1ab	PICS-SetFile: sFt3 PICS-DeleteFile: sFt2c, sFtN1c

15: Service tracking		SCL-BrcbTrk: sTrk1 SCL-UrcbTrk: sTrk2 SCL-LocbTrk: sTrk3 SCL-GocbTrk: sTrk4 SCL-MsvcbTrk: sTrk5 SCL-UsvcbTrk: sTrk6 SCL-SgcbTrk: sTrk7 SCL-SpcTrk: sTrk8 SCL-DpcTrk: sTrk9 SCL-IncTrk: sTrk10 SCL-EncTrk: sTrk11 SCL-IsctTrk: sTrk12 SCL-BscTrk: sTrk13 SCL-ApcFTrk: sTrk14 SCL-ApcITrk: sTrk15 SCL-BacTrk: sTrk16 SCL-GenTrk: sTrk17
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Note that sAssN1, sSrv7, sCtl12, sCtl22, sRpN6, sRpN7, sBrN6, sBrN7, sLog1, sGop8, sDOns3, sSBOns3, sDOes3 and sSBOes3 are not applicable for IEC 61850-8-1 and not referenced in this table.

The following paragraphs describe the abstract test cases and corresponding detailed test procedures.



## A4.10a GOOSE Publish

### Abstract test cases

Test case	Test case description
sGop1	Request GetLogicalNodeDirectory(GoCB) and request GetGoCBValues (IEC 61850-7-2 Subclause 18.2.2.5 and 10.2.2)
sGop2	GOOSE messages are published with a long (SCL maxtime) cycle time, check the GOOSE data with configured data; (IEC 61850-7-2 Subclause 18.2.3) <ul style="list-style-type: none"> <li>– <u>gocbRef</u> is a valid GoCB reference</li> <li>– <u>timeAllowedtoLive</u> &gt; 0 and the next GOOSE message is transmitted within the specified value of the current GOOSE message</li> <li>– <u>datSet</u> is same as the GoCB and SCL and contains a valid dataset reference</li> <li>– <u>goID</u> is same as the GoCB and SCL, the default value is the GoCB reference</li> <li>– <u>t</u> contains the time of the status increment or start-up</li> <li>– <u>sqNum</u> is incremented, stNum&gt;0 and isn't changed</li> <li>– <u>Simulation</u> is not present or if present with value FALSE</li> <li>– <u>confRev</u> &gt;0 and is same as the GoCB and SCL (IEC 61850-7-2 Subclause 18.2.1.6)</li> <li>– <u>needsCommissioning</u> is not present or if present same as GoCB</li> <li>– <u>numDataSetEntries</u> matches with the number of data entries in allData</li> <li>– <u>allData</u> values match with the datSet element type</li> </ul>
sGop3	Verify that a newly activated device sends the initial GOOSE message with stNum initial value one (1) (IEC 61850-7-2 Subclause 18.1 and 18.2.3)
sGop4	Force a data change of a data value in the GOOSE dataset, DUT shall publish GOOSE messages as specified/configured (SCL mintime), stNum is incremented, sqNum = 0
sGop5	When supported, verify that the DUT publishes GOOSE messages with the simulation flag set (IEC 61850-7-2 Subclause 18.2.3.8)
sGop6	Disable GoCB, verify that changing parameters with SetGoCBValues are active (IEC 61850-7-2 Subclause 18.2.1.3 and 18.2.2) and no GOOSE messages are transmitted anymore
sGop7	Deprecated - Verify that after a restart the device keeps the same Configuration revision value in the GoCB and GOOSE messages (IEC 61850-7-2 Subclause 18.2.1.6)
sGop8	Deprecated - Verify that ConfRev increments every time when the configuration of the data set referenced by DataSet has been changed (IEC 61850-7-2 Subclause 15.2.1.6). Changes that are counted are: <ul style="list-style-type: none"> <li>– deletion of a member of the data-set</li> <li>– re-ordering of members in the data-set</li> <li>– changing the value of the attribute DataSet</li> </ul>
sGop9	Verify that GoCB attribute NdsCom is set when DataSet is not yet configured (is NULL) (IEC 61850-7-2 Subclause 18.2.1.7)
sGop10	Verify the DUT can send GOOSE messages with data attributes and/or data objects
sGop11	Verify that the server can process a GoCB with maximum name length for DataSet, GoCBRef and GoID (IEC 61850-7-2 Subclause 22.2)
sGop12	GOOSE message with sequence number value 128

Note: sGop8 is not applicable for part 8-1

Test case	Test case description
sGopN1	When GoEna=TRUE, no attributes of the GoCB control block can be set except for GoEna. (IEC 61850-7-2 Subclause 18.2.1.3)
sGopN2	Verify that if the number or size of values being conveyed by the elements in the dataset exceeds the SCSM determined maximum number, NdsCom is set to True. (IEC 61850-7-2 Subclause 18.2.1.7)

### Detailed test procedures

sGop2	GOOSE message	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3.6+7 IEC 61850-8-1 Subclause 18.1, A.3 PIXIT: Gp3, Gp4 TISSUE #817		
<u>Expected result</u> a) DUT sends valid GOOSE messages with valid references, time stamp, incrementing sequence number, status number is the same, offset is variable (the GoCB.FixedOffs is false or is not available) b) DUT sends valid GOOSE messages with valid references, time stamp, incrementing sequence number, status number is the same, the GOOSE header and Data values use fixed length encoding according to table A.1 and A.2, the GoCB.FixedOffs is true In both cases the GOOSE messages: <ul style="list-style-type: none"> <li>– gocbRef matches the SCL file</li> <li>– timeAllowedtoLive &gt; 0 and the next GOOSE message is transmitted within the specified value of the current GOOSE message</li> <li>– dataSet matches the SCL file and contains a valid dataset reference</li> <li>– goID matches SCL file appID, the default value is the GoCB reference</li> <li>– t contains the time of the status increment or start-up</li> <li>– sqNum is incremented, stNum&gt;0 and isn't changed</li> <li>– Simulation value FALSE</li> <li>– confRev &gt;0 matches the SCL file (IEC 61850-7-2 Subclause 18.2.1.6)</li> <li>– needsCommissioning is False</li> <li>– numDataSetEntries matches with the number of data entries in allData</li> <li>– allData values match with the dataSet element type</li> <li>– MAC address, APPID, VLAN ID and VLAN-PRIORITY, match the SCL file</li> <li>– Ethertype of Ethernet packet is 0x8100 and VLAN CFI = 0</li> <li>– Ethertype of GOOSE is 0x88B8</li> <li>– The slow retransmission time does not exceed the SCL MaxTime</li> </ul>		
<u>Test description</u> Configure SCD file with MAC-Address, APPID, VLAN-ID, VLAN-PRIORITY different from ICD/IID a) Force no data change. Wait for several variable offset GOOSE messages b) Force no data change. Wait for several fixed offset GOOSE messages		
<u>Comment</u> Part b) is not applicable because fixed offset is not supported		

sGop3	Initial GOOSE message	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.3.2.2 IEC 61850-8-1 Subclause 18.1 IEC 61850-10 Subclause 3.12 PIXIT: Gp7, As9 TISSUE #1238		
<u>Expected result</u> 2. DUT sends initial GOOSE message with stNum=1 and sqNum=0 or 1		
<u>Test description</u> 1. Enable GoCB when necessary 2. Restart the DUT and wait for initial GOOSE. Test equipment may be reconfigured and the GoCB enabled after restart		
<u>Comment</u> DUT sends initial GOOSE message with stNum=1 and sqNum=0		

<b>sGop4</b>	<b>GOOSE on data change</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.3.2.2 IEC 61850-8-1 Subclause 18.1, PIXIT: Gp5		
<u>Expected result</u> DUT sends GOOSE messages according to the configured retransmission strategy, the first retransmission does not exceed the SCL MinTime, stNum is incremented, sqNum = 0 in the first message after data change		
<u>Test description</u> 1. Force a data change of a data value in the GoCB data set 2. Wait for GOOSE messages		
<u>Comment</u>		

<b>sGop9</b>	<b>DatSet not configured</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.1.7 IEC 61850-8-1 Subclause 18.1		
<u>Expected result</u> 1. DUT (including IED tool) either refuses the entire configuration or it ignores parts of the new configuration or it accepts the configuration. 2. DUT sends SetGoCBValues response- 3. DUT sends no GOOSE messages for GoCB with empty datSet 4. If DUT accepts configuration, GoCB.datSet is empty and GoCB.NdsCom is TRUE		
<u>Test description</u> 1. DUT is configured with a GSEControl element without the datSet 2. If supported, client sends SetGoCBValues request to enable this GoCB 3. Wait one minute after reconfiguration is completed 4. If supported, client sends GetGoCBValues request		
<u>Comment</u> DUT does not accept the configuration.		

<b>sGop10</b>	<b>GOOSE with data attributes (FCDA) and data objects (FCD)</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2 IEC 61850-8-1 Subclause 18.1 PIXIT-Gp8		
<u>Expected result</u> 1) DUT sends a GOOSE messages with data attributes 2) DUT sends a GOOSE messages with data objects		
<u>Test description</u> If the DUT supports GOOSE datasets with at least one FCDA (PIXIT): 1) Verify the DUT is able to send GOOSE message with data attributes (FCDA) If the DUT supports GOOSE datasets with at least one FCD (PIXIT): 2) Verify the DUT able to send GOOSE message with data objects (FCD)		
<u>Comment</u> Tested with FCDA and FCD. If datasets are configurable then both steps are applicable.		

<b>sGop11</b>	<b>Max GoCB name length</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 22.2 IEC 61850-8-1 Subclause 18.1 SCL Services GSESettings cbName, datSet and applID		
<u>Expected result</u> 1. DUT sends valid GOOSE messages where GoCBRef, (containing a GoCB of 32), GoID (129) and data set name (32) reflect the configuration 2. DUT sends GetGoCBValues response+ where GoID (129) and Dataset name (32) reflect the configuration		
<u>Test description</u> 1. Configure DUT with GoCB with maximum name length (32, when not fixed), with maximum name length data set name (32, when not fixed) and GoID (129) 2. Client requests GetGoCBValues (when supported)		
<u>Comment</u>		

<b>sGop12</b>	<b>GOOSE message with sequence number value 128</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-6 Subclause 9.4.4 IEC 61850-7-2 Subclause 18.2.3.6+7 IEC 61850-8-1 Subclause 18.1		
<u>Expected result</u> 3. GOOSE message has sqNum = 128		
<u>Test description</u> 1. Configure one GoCB 2. Wait for GOOSE message with sqNum = 127 3. Wait for another GOOSE message		
<u>Comment</u>		

## A4.10b GOOSE Subscribe

### Abstract test cases

Test case	Test case description
sGos1	Send GOOSE messages <u>with/without the VLAN tag</u> with new data and check if the message is received and the data has the new value by e.g. check binary output, event list, logging or MMI
sGos2	Send GOOSE messages with the ndsCom parameter set. Verify that on a status change the values are not used for operational purposes (IEC 61850-7-2 Subclause 18.2.3.8)
sGos3	Proper detection and action roll-over of sqNum with no status change (sqNum=max -> sqNum = 1) and with status change (sqNum=max -> sqNum = 0)
sGos4	Verify the logical node LGOS data object attribute values on receiving valid GOOSE messages, no GOOSE messages and GOOSE messages with mismatching ConfRev
sGos5	Verify that the server can subscribe to GOOSE messages with structured data (FCD)
sGos6	Send subscribed GOOSE messages with the Simulation parameter set (IEC 61850-7-2 Subclause 18.2.3.8). Verify that <ul style="list-style-type: none"> <li>a when the subscriber is not in simulation mode (LPHD.Sim.stVal=false or not present) the simulated values are ignored. The subscriber shall keep on using the "real" GOOSE messages</li> <li>b when the subscriber is in simulation mode (LPHD.Sim.stVal=true) the simulated values are used for operational purposes. The subscriber shall ignore the "real" GOOSE messages <b>after a first simulated one has been received</b>. The corresponding LGOS.SimSt shall be set when the first simulated message is received and cleared when LPHD.Sim.stVal is set to false.</li> </ul>
sGos7	Verify that the server can subscribe GOOSE messages with maximum name length for DataSet, GoCBRef and GoID (IEC 61850-7-2 Subclause 22.2)
sGos8	Subscribe GOOSE message with non-1 boolean "true" value
sGos9	Subscribe GOOSE message with "fixed length" GOOSE
sGos10	Subscribe GOOSE message with IdName
sGos11	Subscribe GOOSE message with private DO
sGos12	Process first GOOSE message after state change
sGos13	Subscribe GOOSE message with security bits and trailer

Test case	Test case description
sGosN1	Check behaviour of DUT as specified in PIXIT on Missing GOOSE message
sGosN2	Check behaviour of DUT as specified in PIXIT on Double GOOSE message
sGosN3	Check behaviour of DUT as specified in PIXIT on Delayed GOOSE message, with and without exceeding timeAllowedToLive
sGosN4	Check behaviour of DUT as specified in PIXIT on Out of order GOOSE message
sGosN5	Check behaviour of DUT as specified in PIXIT on No GOOSE messages
sGosN6	Check behaviour of DUT as specified in PIXIT on invalid GOOSE messages <ul style="list-style-type: none"> <li>- <u>gocbRef</u> different from GoCB and NULL</li> <li>- <u>timeAllowedToLive</u> = 0</li> <li>- <u>datSet</u> different from GoCB and NULL</li> <li>- <u>goID</u> different from GoCB and NULL</li> <li>- <u>t</u> contains the time of a status change minus/plus one hour</li> <li>- <u>confRev</u> different from GoCB and NULL</li> <li>- <u>numDataSetEntries</u> 0, more, less with the number of data entries in the allData</li> <li>- <u>allData</u> values do not match with the dataSet element type</li> </ul>

## Detailed test procedures

To perform the DUT subscribe test procedures the DUT need to be configured as follows:

- a data value that is connected to a subscribed GOOSE member, e.g. GGIO.SPS01
- a data set that contains the value of this data point
- a GoCB that publishes this data set (or a RCB that sends a data change/quality change report)

As such the analyzer trace files contain the proof when the subscribed GOOSE messages are processed.

sGos1	Subscribe GOOSE message	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1: PIXIT: Gs8		
<u>Expected result</u> 1,2,3 DUT updates the value and sends a GOOSE message with changed status value		
<u>Test description</u> Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism) <ol style="list-style-type: none"> <li>1. Publisher sends GOOSE message with new data value with the VLAN tag</li> <li>1. Publisher sends GOOSE message with new data value without the VLAN tag</li> <li>2. Publisher sends GOOSE message with new data with MAC-Address outside the recommended range, for example 03-BB-CC-DD-EE-FF</li> </ol>		
<u>Comment</u>		

sGos2	Subscribe GOOSE with ndsCom set	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1		
<u>Expected result</u> 4. DUT behaves as specified in the PIXIT		
<u>Test description</u> 1. Test engineer configures the DUT as specified (without a "safe position" mechanism) 2. Publisher sends GOOSE message with old data value with NdsCom=F 3. Publisher sends GOOSE message with old data value with NdsCom=T 4. Publisher sends GOOSE message with new data value with NdsCom =T		
<u>Comment</u>		

<b>sGos3</b>	<b>SqNum roll-over with/without status change</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1 PIXIT: Gs4		
<u>Expected result</u> 1. DUT just receives the messages without any action 2. DUT just receives the messages without any action 3. DUT responds to the status change		
<u>Test description</u> 1. Publisher sends GOOSE message with sqNum = max-1, max and 1 without status change 2. Publisher sends GOOSE message with sqNum = max-1, max 3. Publisher forces a status change stNum and sends a GOOSE message with incremented stNum and sqNum=0		
<u>Comment</u>		

<b>sGos5</b>	<b>Subscribe to data set with structured data (FCD)</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1 PIXIT: Gs8		
<u>Expected result</u> 2. DUT responds to the status change		
<u>Test description</u> 1. Publisher sends GOOSE message with structured data 2. Publisher sends GOOSE message with a data change in a data attribute in the structured data		
<u>Comment</u>		

<b>sGos6</b>	<b>Subscribe GOOSE with simulation parameter set</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-1 Subclause 7.8.2 IEC 61850-7-2 Subclause 18.2.3.8 IEC 61850-8-1 Subclause 18.1 PIXIT: Gs9 TISSUE #1151		
<u>Expected result</u> a) LPHD.Sim.stVal = FALSE or not present 2. DUT accepts the normal GOOSE messages, LGOS.St = TRUE, LGOS.SimSt=FALSE 3. DUT ignores the simulated data value change, LGOS.St=TRUE, LGOS.SimSt=FALSE 4. DUT changes LGOS.St.stVal to FALSE (and keeps LGOS.SimSt = FALSE) b) LPHD.Sim.stVal = TRUE 6. DUT accepts the normal GOOSE messages because no simulated GOOSE messages have been received yet, LGOS.St=TRUE, LGOS.SimSt=FALSE state: subscription normal goose as long as no simulated goose received) 7. DUT changes LGOS.SimSt=TRUE (and keeps LGOS.St=TRUE); state: subscription simulated GOOSE 8. DUT accepts the simulated data value change 9. DUT changes LGOS.St to FALSE (and keeps LGOS.SimSt=TRUE); state: wait for simulated GOOSE 10. DUT ignores the normal GOOSE messages 11. DUT keeps LGOS.St=FALSE and LGOS.SimSt=TRUE 12. DUT changes LPHD.Sim.stVal to FALSE and LGOS.SimSt to FALSE (and keeps LGOS.St=FALSE); state: wait for normal GOOSE 13. DUT changes LGOS.St to TRUE (and keeps LGOS.SimSt=FALSE); state: subscription normal goose		
<u>Test description</u> a) LPHD.Sim=FALSE or not present 1. Force the DUT to ignore simulated GOOSE messages when LPHD.Sim is present 2. Publisher1 sends GOOSE message with a new data value with Simulation off 3. Publisher2 sends GOOSE message with a new data value with Simulation set 4. Publisher1 stops GOOSE message b) LPHD.Sim=TRUE 5. Force the DUT to accept simulated GOOSE messages 6. Publisher1 sends GOOSE message with a new data value with Simulation off 7. Then publisher2 starts sending GOOSE message with Simulation set 8. Publisher2 sends GOOSE message with a new data value with Simulation set 9. Publisher2 stops sending GOOSE messages with Simulation set 10. Publisher1 sends GOOSE message with a new data value with Simulation off 11. Publisher1 stops sending GOOSE message with Simulation off 12. Force DUT to accept normal GOOSE messages 13. Publisher1 sends GOOSE message with a new data value with Simulation off		
<u>Comment</u> Only step a) is applicable and tested as LPHD.Sim does not exist.		

<b>sGos7</b>	<b>GOOSE with maximum name length for DatSet, GoCBRef and Gold</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3.8 IEC 61850-8-1 Subclause 18.1		
<u>Expected result</u> 1. The DUT accepts the GOOSE messages and data changes		
<u>Test description</u> 1. Configure the DUT to accept GOOSE messages with maximum name length for DatSet, GoCBRef and Gold		
<u>Comment</u>		



<b>sGos8</b>	<b>Subscribe GOOSE message with non-1 as boolean “true” value</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1		
<u>Expected result</u>		
2. DUT updates the value and sends a GOOSE message with status value true (any value >0)		
<u>Test description</u>		
Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism)		
1. Publisher sends GOOSE message with boolean “false” as value 0		
2. Publisher sends GOOSE message with boolean “true” as value 0x02		
<u>Comment</u>		

<b>sGos9</b>	<b>Subscribe GOOSE message with “fixed length” GOOSE</b>	<input type="checkbox"/> Passed <input type="checkbox"/> Failed <input checked="" type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause A.3		
<u>Expected result</u>		
2. DUT updates the value and sends a GOOSE message with changed integer value		
<u>Test description</u>		
Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism) containing a “Beh.stVal” or an integer value.		
1. Publisher sends “fixed length” GOOSE with initial integer value		
2. Publisher sends “fixed length” GOOSE with other integer value		
<u>Comment</u>		
DUT does not support integers.		

<b>sGos10</b>	<b>Subscribe GOOSE message with IdName</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1 TISSUE #1419		
<u>Expected result</u>		
2. DUT updates the value and sends a GOOSE message with changed status value		
<u>Test description</u>		
Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism) from a GoCB with dataset elements from a logical device with a configured IdName.		
1. Publisher sends GOOSE messages with boolean “false” value		
2. Publisher sends GOOSE messages with boolean “true” value		
<u>Comment</u>		

<b>sGos11</b>	<b>Subscribe GOOSE message with private DO</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1		
<u>Expected result</u> 2. DUT updates the value and sends a GOOSE message with changed status value		
<u>Test description</u> Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism) from a GoCB with dataset elements from a private logical node and private DO.  1. Publisher sends GOOSE messages with boolean "false" value 2. Publisher sends GOOSE messages with boolean "true" value		
<u>Comment</u>		

<b>sGos12</b>	<b>Process first GOOSE message after state change</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3.6		
<u>Expected result</u> 2. DUT updates the value and sends a GOOSE message with changed status value within 1 second		
<u>Test description</u> Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism) 1. Publisher sends multiple GOOSE messages with incremented sqNum, timeAllowedToLive=2000 milliseconds 2. Publisher sends one GOOSE message with incremented stNum, sqNum=0, timeAllowedToLive=2000 milliseconds and wait for 2 seconds (the publisher does not re-transmit the GOOSE message in these 2 seconds)		
<u>Comment</u>		

<b>sGos13</b>	<b>Subscribe to "secure" GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1, Annex C PIXIT: Gs12		
<u>Expected result</u> 2. DUT updates the value and sends a GOOSE message with changed status value		
<u>Test description</u> Test engineer configures the DUT with subscribed GOOSE (ping-pong mechanism)  1. Publisher sends GOOSE messages with boolean "false" value with Reserved 1 Security bits not zero, Reserved 2 bits not zero and several trailing non-zero bytes. 2. Publisher sends GOOSE messages with boolean "true" value with the same Reserved bits and trailing bytes		
<u>Comment</u>		

<b>sGosN1</b>	<b>Missing GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1 PIXIT: Gs3		
<u>Expected result</u> 3. DUT accepts GOOSE message as specified in the PIXIT, resulting in a report or published GOOSE message		
<u>Test description</u> 1. Test engineer configures the DUT as specified 2. Publisher sends correct GOOSE message with no value changes (same stNum) 3. Publisher sends GOOSE message with data value change with incremented stNum, starting with sqNum=1 (simulating a missing sqNum=0)		
<u>Comment</u>		

<b>sGosN2</b>	<b>Double GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1 PIXIT: Gs5		
<u>Expected result</u> 2. DUT accepts GOOSE messages 3. DUT accepts first GOOSE message with sqNum=0, resulting in published GOOSE messages and ignores the second message with sqNum=0		
<u>Test description</u> 1. Test engineer configures the DUT as specified 2. Publisher sends correct GOOSE message with no value changes (same stNum) 3. Publisher sends GOOSE message with data value change with incremented stNum, and with sqNum=0 two times (simulating a double sqNum=0)		
<u>Comment</u>		

<b>sGosN3</b>	<b>Delayed GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1 PIXIT: Gs2		
<u>Expected result</u> 3. DUT behaves as specified in the PIXIT		
<u>Test description</u> 1. Test engineer configures the DUT as specified 2. Publisher sends correct GOOSE message with no value changes (same stNum) 3. Publisher sends GOOSE message with data value change with incremented stNum, and with sqNum=0, but outside the TimeAllowedtoLive interval of the previous GOOSE message. The following GOOSE messages with sqNum>0 are transmitted inside the TAL of the previous message.		
<u>Comment</u>		

<b>sGosN4</b>	<b>Out-of-order GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1, PIXIT: Gs4		
<u>Expected result</u> 3. DUT behaves as specified in the PIXIT		
<u>Test description</u> 1. Test engineer configures the DUT as specified 2. Publisher sends correct GOOSE message with no value changes (same stNum) 3. Publisher sends GOOSE message with data value change with incremented stNum, and with sqNum=1, sqNum=0, sqNum=2,3 etc.		
<u>Comment</u>		

<b>sGosN5</b>	<b>No GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.3 IEC 61850-8-1 Subclause 18.1, PIXIT: Gs2		
<u>Expected result</u> 3. DUT indicates that subscribed GOOSE message isn't received (PIXIT) 4. DUT indicates that subscribed GOOSE message is received again (PIXIT) 5. DUT indicates that subscribed GOOSE message isn't received (PIXIT) 6. DUT shall process new state value(s)		
<u>Test description</u> 1. Test engineer configures the DUT as specified 2. Publisher sends correct GOOSE message with no value changes (same stNum) 3. Publisher is disconnected from the network, continues to send GOOSE messages for 30 seconds with no state change (e.g. same stNum as step 2). 4. Publisher is reconnected to the network and continues to send GOOSE messages (same stNum) 5. Publisher is disconnected from the network, continues to send GOOSE messages for 30 seconds with no state change (e.g. same stNum as step 2). 6. Publisher is reconnected to the network and continues sends GOOSE messages indicating a state change (incremented stNum, sqNum other than 0)		
<u>Comment</u>		

<b>sGosN6</b>	<b>Invalid GOOSE message</b>	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 18.2.1, 18.2.3 IEC 61850-8-1 Subclause 18.1, Annex C, PIXIT: Gs1		
<u>Expected result</u> DUT responds as specified in the PIXIT		
<u>Test description</u> Test engineer configures the DUT as specified below and Publisher sends several GOOSE message with data value change with correct status & sequence numbers with: a) GoCB reference = mismatch with SCL, NULL b) timeAllowedtoLive = 0 c) dataSet reference = mismatch with GoCB from SCL, NULL d) goID reference = mismatch with GoCB from SCL, NULL e) timestamp of status change = plus one hour, minus one hour, 0 f) confRev = mismatching with GoCB from SCL g) numDataSetEntries = mismatch with the expected number of DataSet element members from SCL. The confRev remains as , but the numDataSetEntries changes +1 and then -1 and the allData matches the number of numDataSetEntries (+1 add one value at the end and -1 remove last value) h) values of allData entries (same DataSetReference, same expected ConfRev) = data type values out-of-order i) APPID = mismatch from GoCB from SCL and 0		
<u>Comment</u>		

## A4.12 Time synchronization

### Abstract test cases

Test case	Test case description
sTm1	Verify the DUT supports and executes the SCSM time synchronisation as configured in SCL
sTm2	Check report/logging timestamp accuracy and leap seconds known matches the documented timestamp quality of the server
sTm3	Verify that when the device supports time zones and daylight saving the time stamp of events and disturbance records are UTC time
sTm4	Verify the time management settings in logical node LTIM
sTm5	Verify the time master supervision in logical node LTMS

Test case	Test case description
sTmN1	Verify that when time synchronisation communication lost is detected after a specified period
sTmN2	On synchronisation error, deviation beyond time stamp tolerance shall be detected

### Detailed test procedures

sTm1	SCSM time synchronisation (SNTP)	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 21 and 6.1.2.9.3 IEC 61850-8-1 Subclause 21 and 6.4.2 PIXIT: Tm3, Tm8		
<u>Expected result</u> 3. DUT sends the base UTC time value in the report timestamp or GOOSE timestamp or GetDataValues respond data value timestamp. Verify that the timestamp value is accurate +/-10 seconds compared to the time in the time server 5.,7. DUT sends the new UTC time value in the report data value timestamp or GOOSE timestamp or GetDataValues respond data value data value timestamp. Sending reports or GOOSE shall not be delayed by a time change.		
<u>Test description</u> 1. Configure <ul style="list-style-type: none"> <li>One SNTP time master</li> <li>A non-zero UTC offset (when time zone is supported).</li> <li>An URCB or BRCB with all optional fields with trigger option data-change and BufTm = 0 with FCD dataset elements or with FCDA (including the value, q and t) controllable by the EQUIPMENT SIMULATOR</li> <li>Or a GoCB with adataset element controllable by the EQUIPMENT SIMULATOR</li> <li>Or Client requests GetDataValues after each event (when reporting or GOOSE is not supported and when GetDataValues is supported)</li> </ul> 2. Wait until DUT is completely synchronized to SNTP time master 3. Force an event using the EQUIPMENT SIMULATOR and Client requests GetDataValues of the DO (if used) 4. Test engineer changes the time at least +2 minutes in the TIME MASTER and wait till DUT takes over the new time (PIXIT) 5. Force an event using the EQUIPMENT SIMULATOR and Client requests GetDataValues of the DO (if used) 6. Test engineer changes the time at least -2 minutes in the TIME MASTER and wait till DUT takes over the new time (PIXIT) 7. Force an event using the EQUIPMENT SIMULATOR and Client requests GetDataValues of the DO (if used)		
<u>Comment</u>		

sTm2	Time stamp quality	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 21 and 6.1.2.9.3 IEC 61850-8-1 Subclause 21 and 6.4.2, table 32 PIXIT: Tm1		
<u>Expected result</u> 3. The TimeStamp – TimeQuality – TimeAccuracy matches with the documented resolution (PICS-T2), TimeQuality.ClockNotSynchronized is FALSE and the TimeStamp – TimeQuality – LeapSecondsKnown is TRUE		
<u>Test description</u> 1. Synchronize DUT clock using external SNTP server 2. Force an event using the EQUIPMENT SIMULATOR or subscribed GOOSE message 3. Client requests GetDataValues of the event or waits for a Report/GOOSE message with the state change		
<u>Comment</u>		

sTmN1	Lost time synchronisation	<input checked="" type="checkbox"/> Passed <input type="checkbox"/> Failed <input type="checkbox"/> Inconclusive
IEC 61850-7-2 Subclause 21 and 6.1.2.9.3 IEC 61850-8-1 Subclause 21 and 6.4.2 PIXIT: Tm2, Tm5		
<u>Expected result</u> 1. DUT detects the lost time synch 2. DUT updates the event 3. DUT sends GetDataValues response+ or Report/GOOSE with time quality "ClockNotSynchronized"		
<u>Test description</u> 1. Test engineer disconnects all time masters and waits specified period 2. Force an event using the EQUIPMENT SIMULATOR or subscribed GOOSE message 3. Client requests GetDataValues of the event or waits for a Report/GOOSE message with the state change		
<u>Comment</u>		



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