

539-Consulting 08-v1.0

**Conformance Test Procedures for Client System  
with IEC 61850-8-1 interface**

**Revision 1.0**

On request of the UCA International Users Group

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Revision	Changes
Rev 0.1	First working draft
Rev 0.2	Second working draft
Rev 0.3	Comments from Siemens, ABB and Test sub committee
Rev 0.4	<ul style="list-style-type: none"> <li>- Harmonized the 61850 Client test procedures with IEC 61400-25-5 (FDIS) "Client test cases", additions are marked as blue, 61850 test cases are grouped according to conformance blocks</li> <li>- All client test cases start with "c"</li> <li>- Sub test cases are identified by a), b), c), d) etc.</li> <li>- GSSE/GOOSE publish and GSSE/GOOSE management are not applicable for client devices and removed</li> <li>- GOOSE subscribe test cases are same as server</li> </ul>
Rev 0.5	Comments from Siemens: Mdl5, AssN5, Srvn2-3-4, Dsn6, Sg2, Rp4, Rp6, RpN3, RpN9, Br4, Br6, Br11, Br13, BrN7, BrN9, BrN12, Ctl3, CtlN1 All test cases start with "c"
Rev 0.6a	Added server simulator modelling, configuration and communication requirements in par 3.1 Added detailed test procedures Removed cRp6 because this is the same as cRpN10 Removed cBr6 because this is the same as cBrN10 Harmonized the order of Does testcases according to Dons Clarified cTmN2
Rev 0.6b	cCnf4 specified the capabilities in more detail cMdl2 specified the control blocks in more detail Added cRpt11 and cBr11 – reporting of data attributes DA, DA.BDA Added cSub1 and cSub2 Merged cSBOs2 and SBOs3 in one test case Merged cSBOes2 and SBOes3 in one test case
Rev 0.7	Added detailed test procedures for dynamic datasets, substitution, buffered reporting and setting group definition Copied GOOSE subscribe test cases from server test procedures Adjusted the file transfer test procedures Changed the title Removed cMdl5 Added SBOs and SBOes test cases + test procedures for Cancel Specified mandatory and optional test cases in table A4.2
Rev 0.8	Updated according the comments agreed upon during teleconference November 26 Editor: removed cCnf3 and cCnf4 and moved cMdl4 to cCnf3
Rev 1.0	Updated according the comments agreed upon during teleconference March 3

Remark: the detailed change history is not part of this report but is archived by KEMA.

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## 1 INTRODUCTION

### 1.1 Identifications

The following table gives the exact identification of Client system and test environment used for this conformance test of a IEC 61850 CLIENT system.

<i>SUT</i>	<complete description of the client System Under Test, type, hardware / software version>
<i>MANUFACTURER</i>	<name, location of the manufacturer of the SUT>
<i>PICS</i>	<complete reference description of the PICS>
<i>MICS</i>	<complete reference description of the MICS>
<i>TICS</i>	<complete reference description of the TICS>
<i>PIXIT</i>	<complete reference description of the PIXIT>
<i>SCD</i>	<complete reference description of the SCD configuration file>
<i>TEST INITIATOR</i>	<the initiator of the test, name, address, contact person>
<i>TEST FACILITY</i>	<test facility name> <accredited/recognized to issue Level A/B/C Certificates>
<i>TEST ENGINEER</i>	<name and e-mail address of test engineer>
<i>TEST SESSION</i>	<date and location(s) of the test session>
<i>SERVER SIMULATOR</i>	<name and type conformance test simulator version X.Y with reference test suite, version X.Y and Test parameters file>
<i>ANALYSER</i>	<name and type analyzer, version X.Y>
<i>HMI</i>	<name and type equipment simulator>
<i>TIME SERVER</i>	<name and type of time master>

<the TEST INITIATOR may provide the documents in digital or printed format>

## 1.2 **Background**

<OPTIONAL, short description on the environment where the *SUT* will be used>

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

*“Does the protocol implementation of the SUT, conform to 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 *SUT*. This test has been performed according to procedures and conditions set forth in IEC 61850 part 10 and UCA IUG Quality Assurance Program. *TEST FACILITY* is accredited/recognized by the UCA IUG to perform formal IEC 61850 conformance tests and issue the Level A/B 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 implementation in the *SUT*.

The test procedures verify the client system under test against conformant servers.

The test results are the basis of the conformance statement.

## 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 *SUT*. 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, the conclusion(s) and recommendations.

Appendix A specifies the detailed test procedures and their outcome, appendix B contains detailed comments on test results, for instance when a defect is detected, including the actual message flow if appropriate.

## 1.5 Glossary

SUT	System Under Test
HMI	Human machine interface
ICD	IED configuration description in SCL-format
MICS	Model Implementation Conformance Statement
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
SCD	Substation configuration description in SCL-format
SCL	Substation Configuration Language
SNTP	Simple Network Time Protocol
TICS	TISSUES Implementation Conformance Statement
TISSUE	Technical issue
UCA IUG	UCA International Users Group

## 2 REFERENCES

### 2.1 Normative

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

IEC/TR 61850-1, *Communication networks and systems in substations – Part 1: Introduction and overview; First edition 2003-04*

IEC/TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary; First edition 2003-08*

IEC 61850-3, *Communication networks and systems in substations – Part 3: General requirements; First edition 2003-01.*

IEC 61850-4, *Communication networks and systems in substations – Part 4: System and project management; First edition 2003-01*

IEC 61850-5, *Communication networks and systems in substations – Part 5: Communication requirements for functions and device models; First edition 2003-07*

IEC 61850-6, *Communication networks and systems in substations – Part 6: Substation Automation System configuration language; First edition 2004-03*

IEC 61850-7-1, *Communication networks and systems in substations – Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models; First edition 2003-07*

IEC 61850-7-2, *Communication networks and systems in substations – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI); First edition 2003-05*

IEC 61850-7-3, *Communication networks and systems in substations – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes and attributes; First edition 2003-05*

IEC 61850-7-4, *Communication networks and systems in substations – Part 7-4: Basic communication structure for substation and feeder equipment – Compatible logical node and data object addressing; First edition 2003-05*

IEC 61850-8-1, *Communication networks and systems in substations – 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; First edition 2004-05*

IEC 61850-10, *Communication networks and systems in substations – Part 10: Conformance testing; First edition 2005-05*

## 2.2 **Other**

ISO/IEC 9646-1:1994 OSI-Conformance testing methodology and framework, Part 1: General Concepts

UCA IUG: Quality Assurance Program for IEC Device Implementation Testing and Test System Accreditation and Recognition, Version 2.6, March 8, 2007

UCA IUG: Quality Assurance Program Addendum for IEC 61850 Specific Product Testing, Version 1.0, March 8, 2007



UCA IUG: Test Center Accreditation and Recognition Procedure  
For IEC 61850 Device Testing, V1.1, August, 2006

TISSUES: <http://www.tissues.iec61850.com>

### 3 THE CONFORMANCE TEST

#### 3.1 Components in the test environment

The test environment consists of the following components:

- SUT
- SERVER SIMULATOR 1..N
- ANALYSER
- Ethernet HUB
- TIME SERVER

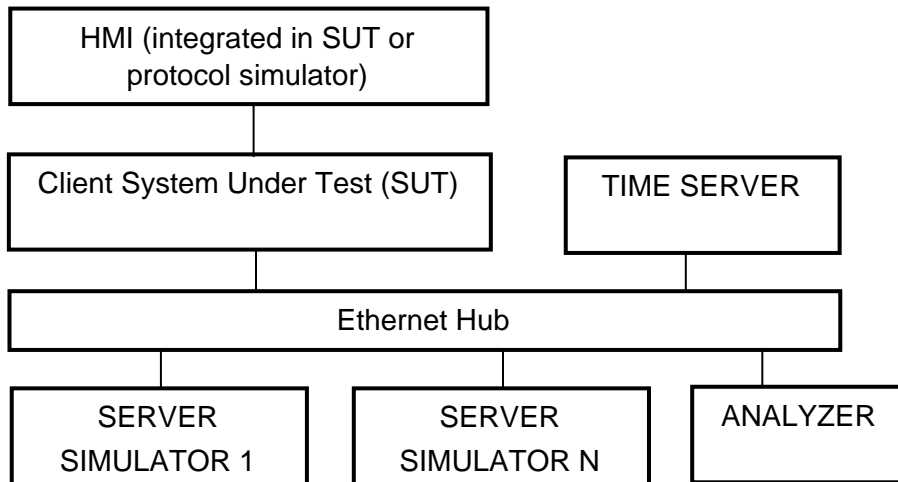


Figure 3.1 The test environment

The HMI can be integrated into the SUT (typically a substation control system) or in case the SUT is a protocol gateway the HMI is a protocol simulator with a HMI.

The server [simulator] requirements are:

- Modelling:
  - o contain all common data classes supported by the SUT
  - o contain several new data objects within a standard logical node
  - o contain several new data attributes within a standard data object (common data class)
  - o contain several new enum types and enum values
- Configuration:
  - o one or more servers with preconfigured datasets with data objects
  - o one or more servers with dynamic datasets (when supported by SUT)
  - o one or more servers with report control block indexing
  - o one or more servers without report control block indexing
- Communication:
  - o support all conformance blocks supported by the SUT in one or more servers
  - o support all ACSI services supported by the SUT
  - o one or more servers with all supported control models

### 3.2 Overview of the test suite

The abstract test cases and detailed test procedures 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)
  - o Application Association
  - o Server & Logical Device & Logical Node & Data
  - o Data Set
  - o Substitution
  - o Setting Group Control
  - o Unbuffered and Buffered Reporting
  - o Logging
  - o Generic Substation Events
  - o Control
  - o Time Synchronization
  - o File Transfer
  - o Combinations

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

In general if a problem occurs on a connection to one server this may have no impact on the connections to other servers.

## 4 TEST RESULTS

Table 4.1 in this Chapter describes the summary of the conformance test results. References shown in the table columns refer to references of individual test procedures in appendix A.

The **Passed** column indicates the test cases with test result Passed, the **Failed** column with test result Failed and the **Inconclusive** column for test result Inconclusive. For details refer to the applicable test procedure in Appendix A.

When all mandatory testcases within a conformance block are Passed or Inconclusive the SUT has passed the test for that conformance block.

Table 4.1 Summary of test results for *SUT*

Test Group	Passed	Failed (*)	Inconclusive(*)
Documentation			
Configuration			
Data model			
1: Basic Exchange			
2: Data Set			
2+: Data Set Definition			
3: Substitution			
4: Setting Group Selection			
4+: Setting Group Definition			
5: Unbuffered Reporting			
6: Buffered Reporting			
7: Logging			
9b: GOOSE subscribe			
12a: Direct control			
12b: SBO control			
12c: Enhanced Direct			

<b>Test Group</b>	<b>Passed</b>	<b>Failed (*)</b>	<b>Inconclusive(*)</b>
Control			
12d: Enhanced SBO control			
13: Time Sync			
14a: Get File Transfer			
14b: Set File Transfer			
<b>TOTALS</b>			

(\*) column only when applicable

## 5 CONCLUSION AND RECOMMENDATIONS

When all mandatory testcases within a conformance block are Passed or Inconclusive the SUT has passed the test for that conformance block.

Based on the test results described in this report, *TEST FACILITY* declares the tested IEC 61850 implementation in the *SUT* has **shown/not shown to be non-conforming** to IEC 61850, *PICS*, *MICS*, *PIXIT* and *SCD* configuration.

### 5.1 Recommendations following from the test

The following comments and recommendations apply for the *SUT*:

<Comments and Recommendations from *TEST FACILITY*>

**ANNEX A Detailed Test procedures and results**

**A1 Documentation and version control (IEC 61850-4)**

Id	Test procedure	Verdict
cDoc1	Check if the manufacturer PICS documentation and software version of the SUT does match (IEC61850-4).	
cDoc2	Check if the manufacturer PIXIT documentation and software version of the SUT does match (IEC61850-4).  PIXIT shall indicate the required information as requested in the test cases in this document	
cDoc3	Check if the manufacturer TICS documentation and software version of the SUT does match (IEC65180-4).  TICS shall indicate if the SUT supports servers that implemented or not implemented the TISSUE	
cDoc4	Check if the manufacturer MICS documentation and software version of the SUT does match (IEC61850-4).  MICS shall indicate which CDC's and/or CDC parts are supported by the SUT	

**A2 Configuration file (IEC 61850-6)**

Id	Test procedure	Verdict
cCnf1	Check if the SUT process the data names, data types as configured in the SCL configuration file.	
cCnf2	Change at least 5 end-user configurable parameters that are displayed by the SUT in the SCL configuration file, configure the SUT using the SCL configuration file (using the supplied configuration tool) and check the updated configuration. Restore the original SCL file and re-configure the SUT to its original state.	
cCnf3	Verify that client can handle the ConfigRev management in SCL and exposed by the server in LLN0.NamPlt.configRev. On a mismatch the SUT shall behave as described In the PIXIT.	

A3 Data model (IEC 61850-7-3 and IEC 61850-7-4)

Id	Test procedure	Verdict
C_Mdl1	Verify that the client can handle the maximum name length and expands objects like SDOs correctly (PIXIT)	
C_Mdl2	Verify that SUT supports the following naming conventions for the supported control blocks  a) unbuffered report control block – not indexed  b) unbuffered report control block – indexed  c) buffered report control blocks  d) setting group control block  e) GOOSE control block  f) Log control block	
C_Mdl3	Verify that SUT can import the mandatory & optional attributes from the CDCs in part 7-3 unless stated otherwise in the MICS	

A4 Mapping on MMS (IEC 61850-7-2 and IEC 61850-8-1)

The test procedures are structured according to conformance blocks. The following table specifies which ACSI services, mapped on MMS, are mandatory/optional for each conformance block for IEC 61850-8-1 Client systems.

**Table A.4.1:** ACSI services per conformance block for IEC 61850-8-1 Client systems

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



Conformance Block	Mandatory	Optional
13: Time sync	TimeSynchronization	
14a: Get File transfer	GetServerDirectory(FILE) GetFileAttributeValues GetFile	DeleteFile
14b: Set File transfer	SetFile	DeleteFile

The following table specifies which test procedures are mandatory/conditional for each conformance block. Conditions refer to the SCL - IED - Services section, the PICS or PIXIT.

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

Conformance Block	Mandatory	Conditional
1: Basic Exchange	cAss1, cAss2, cAss3, cAss4, cAssN1, cAssN6 cSrv5, cSrvN3	cAssN3, cAssN4, cAssN5, cAssN7 Autodescription: cSrv1, cSrv2, cSrv3, cSrv4, cSrvN1 SetDataValues: cSrv6, cSrvN4 GetAllDataValues: cSrv7, cSrvN2 Quality: cSrvN5 TimeQuality: cSrvN6
2: Data Sets	cDs5	Autodescription: cDs1, cDs2, cDsN1 GetDataSetValues: cDs3, cDsN2 SetDataSetValues: cDs4, cDsN3
2+: Data Set Definition	cDs6, cDsN4	DeleteDataSet: cDs7, cDsN5
3: Substitution	cSub1	cSub2, cSub3
4: Setting Group Selection	cSg2, cSgN1	Autodescription: cSg1 GetSettingGroupValues: Sg3
4+: Setting Group Definition	cSg3, cSg4	
5: Unbuffered Reporting	cRp2, cRp3, cRp4, cRp5, cRp8, cRp9, cRp10 cRpN2, cRpN3, cRpN7, cRpN8	Autodescription: cRp1, cRpN1 Buffer time: cRp6 General interrogation: cRp7 Reserved: cRpN4 Unsupported optflds: cRpN5 Unsupported trigger: cRpN6
6: Buffered Reporting	cBr2, cBr3, cBr4, cRp5, cBr8, cBr9, cBr10, cBr11, cBr12, cBrN2, cBrN3, cBrN7, cBrN8, cBrN9	Autodescription: cBr1, cBrN1 Buffer time: cBr6 General interrogation: cBr7 Purge buffer: cBr13 Reserved: cBrN4 Unsupported optflds: cBrN5 Unsupported trigger: cBrN6
7: Logging	cLog6, cLog7, cLogN2	Autodescription: cLog1, cLog2,

Conformance Block	Mandatory	Conditional
		cLog3, cLog4, cLogN1 Dynamic configuration: cLog5, cLogN3
9b: GOOSE subscribe	cGos1, cGos2_cGos3, cGosN1, cGosN2, cGosN3, cGosN4, cGosN5, cGosN6	
12a: Direct control	cCtl4, cCtlN1, cCtlN2 cDOs1, cDOs2	Test: cCtl1 Check: cCtl2 Dynamic control model: cCtl3 Time Activated Control: cDOs3 and cDOs4, cDOs5
12b: SBO control	cCtl4, cCtlN1, cCtlN2 cSBOs1, cSBOs2, cSBOs3	Test: cCtl1 Check: cCtl2 Dynamic control model: cCtl3 Cancel: cSBOs4 Time Activated Control: cSBOs5 and cSBOs6
12c: Enhanced Direct Control	cCtl4, cCtlN1, cCtlN2 cDOes1, cDOes2, cDOesN3	Test: cCtl1 Check: cCtl2 Dynamic control model: cCtl3 Time Activated Control: cDOes3 and cDOes4 and cDOesN4
12d: Enhanced SBO control	cCtl4, cCtlN1, cCtlN2 cSBOes1, cSBOes2, cSBOes3, cSBOesN4	Test: cCtl1 Check: cCtl2 Dynamic control model: cCtl3 Cancel: cSBOes4 Time Activated Control: cSBOes5 and cSBOes6 and cSBOesN3 and cSBOes5
13: Time sync	cTm1, cTm2, cTmN1	TimeQuality: cTmN2
14a: Get File transfer	cFt1, cFt2, cFt3, cFtN1, cFtN2	DeleteFile: cFt5
14b: Set File transfer	cFt4, cFtN2, cFtN3	DeleteFile: cFt5

Note: cAssN2 is not applicable for part 8-1

The focus of the conformance test is the application layer. For IEC 61850-8-1 the communication services are mapped on the reliable TCP transport layer. As such the testing of transport related errors like “no response” and “delayed response” are out-of-scope. These are implicitly tested by disconnecting the ethernet cable between the server and the switch.

In general if a problem occurs on a connection to one server this may have no impact on the connections to other servers.

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

#### A4.1 Block 1: Basic services

Abstract test cases for Application Association

Test case	Test case description
cAss1	Associate and force client to release a TPAA association (IEC 61850-7-2, 7.4)
cAss2	Force the client to associate with maximum number of servers simultaneously (PIXIT).
cAss3	Verify that the client restores the association after the association of one server is lost and that this has no effect on the other active associations of the other servers
cAss4	Verify the client can handle servers with small and large MMS PDU size, the client should keep on proposing it's original MMS PDU size

Test case	Test case description
cAssN1	Associate and server responds with negative answer due to AccessPointReference.
cAssN2	Associate and server responds with negative answer due to AuthenticationParameter.
cAssN3	Associate and server releases TPAA association (IEC 61850-7-2, 7.4). SUT should try to re-establish the association after the configured period (PIXIT).
cAssN4	Associate and server-abort TPAA association (IEC 61850-7-2, 7.4). SUT should try to re-establish the association after the configured period (PIXIT).
cAssN5	Associate and server denies TPAA association (IEC 61850-7-2, 7.4). SUT should try to re-establish the association after the configured period (PIXIT).
cAssN6	Disconnect the communication interface between server and the HUB such that the link between SUT and the HUB stays active. The SUT shall detect link lost within a specified period. Once the link is re-established the SUT should try to establish the association again.
cAssN7	Interrupt and restore the power supply, the SUT shall establish the configured associations when ready (PIXIT).

Abstract test cases for server, logical device, logical node and data

Test case	Test case description
cSrv1	If client implements Autodescription, (See Note 1) force the client to start the autodescription and check the client requests a GetServerDirectory(LOGICAL-DEVICE) to all the logical devices of the configured servers (See Note 2).
cSrv2	If client implements Autodescription, for each GetServerDirectory(LOGICAL-DEVICE) response check the client issues a GetLogicalDeviceDirectory request.
cSrv3	If client "implements Autodescription", for each GetLogicalDeviceDirectory response check the client issues a GetLogicalNodeDirectory(DATA) request.
cSrv4	If client "implements Autodescription", for a subset of the GetLogicalNodeDirectory(DATA) response check the client issues at least one of the following services: a) GetDataDirectory request and check response (IEC 61850-7-2, 10.4.4) b) GetDataDefinition request and check response (IEC 61850-7-2, 10.4.5)
cSrv5	Verify that after startup the client is able to update the process values of the configured servers.
cSrv6	Request a SetDataValues of the different basic types (with for example FC=CF) and check the services.
cSrv7	Request GetAllDataValues for the required functional constraints and check if the SUT updates its model (IEC 61850-7-2, 9.2.3)

NOTE 1 Implement Autodescription means that there is a way to configure the client to update the image of the model of one of the servers it has to communicate with using the ACSI services.

NOTE 2 Configured servers means the servers the client is configured to communicated with. The client at least needs to know the parameters to establish an association with them.

Test case	Test case description
cSrvN1	If client implements Autodescription, force the client to start the autodescription and check the client still communicates with other servers when it requests the following services with negative response: a) GetServerDirectory(LOGICAL-DEVICE), b) GetLogicalDeviceDirectory, c) GetLogicalNodeDirectory(DATA), d) GetDataDirectory, e) GetDataDefinition.
cSrvN2	Check that the client is able to communicate with other connected servers after a request for GetAllDataValues fails in the following circuiumstances: a) The response is negative. b) The response comes with mismatching data objects.
cSrvN3	Check that the client is able to communicate with other connected servers after a request for GetDataValues fails in the following circuiumstances: a) The response is negative. b) The response comes with mismatching data objects. c) The value is out of the valid range for this data.
cSrvN4	Check that the client is able to communicate with other connected servers after a request for SetDataValues fails in the following circuiumstances:

Test case	Test case description
	a) The response is negative. b) One of the data values is read-only
cSrvN5	If client detects/notify changes in the "Quality" attribute, use the SERVER SIMULATOR to force different values in the Quality of the measured/status values monitored by the client and check the behaviour described in the PIXIT.
cSrvN6	If client detects/notify changes in the timeStamp's "TimeQuality" attribute, use the SERVER SIMULATOR to force different values in the TimeQuality of the measured/status values monitored by the client and check the behaviour described in the PIXIT.

NOTE 3 "Client reports an error" can be anything to notify the end-user some error has happened

Detailed test procedures for Application Association

cAss1 cAss2 cAss3 cAss4	Associate and release to a server Associate to maximum servers Restore lost association Large and small PDU size	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 3. SUT set-up associations to all servers 4. SUT releases or abort associations to all servers 5. SUT reconnects to all servers 6. SUT releases or abort associations to one server 7. SUT reconnects to server		
<u>Test description</u> 1. Set-up test configuration as specified in par 3.1 with maximum number of servers (as specified in the PIXIT) and configure one server with maximum and one server with minimum MMS PDU size 2. Start SUT 3. Start all servers 4. Stop SUT 5. Start SUT 6. SUT stops the association to one server 7. SUT starts the association to the stopped server		
<u>Comment</u> Tested with X servers		

cAssN1	Access point mismatch	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 2. SUT tries to reconnect to server on regular basis but association fails 4. SUT tries to reconnect to server on regular basis but association fails 6. When association fails the SUT tries to reconnect to server on regular basis		
<u>Test description</u> 1. Stop a server and reconfigure it to force mismatching Transport selector 2. Start the server 3. Stop a server and reconfigure it to force mismatching Session selector 4. Start the server 5. Stop a server and reconfigure it to force mismatching Presentation selector 6. Start the server		
<u>Comment</u>		

cAssN3	Server release	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 4. Client responds with Release Response+"		
<u>Test description</u> 1. Set-up test configuration as specified in par. 3.1 with one server 2. Client requests Associate (MMS Initiate) 3. Server accepts association 4. After about 10 seconds, one server issues Release (MMS Conclude) 5. Client responds with Release Response+ (expected behavior). 6. Server issues a Transport close. 7. Repeat step 2...6 250 times		
<u>Comment</u>		

cAssN4	Server abort	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 4. Client detects the Association abort and retries associate.		
<u>Test description</u> 1. Set-up test configuration with at least two servers 2. Client requests Associate (MMS Initiate) 3. Server accept the association 4. After about 10 seconds one server aborts the association 5. Repeat step 2...4 250 times		
<u>Comment</u>		

cAssN5	Server deny	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 3. Client detects the Association failure and retries associate. Additionally, no attempted associations shall be indicated as "Associated".		
<u>Test description</u> 1. Set-up test configuration with at least two servers 2. Client requests Associate 3. One server denies association (respond-) 4. Repeat step 2 and 3 250 times		
<u>Comment</u>		

cAssN6	Communication interrupt	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 4. SUT tries to reconnect to the server on regular basis 5. SUT reconnects to server		
<u>Test description</u> 1. Set-up test configuration with at least two servers 2. Client requests Associate (MMS Initiate) 3. Server accept the association 4. After 10 seconds disconnect the ethernet cable between the server and the switch 5. When the SUT detected the association loss, reconnect the ethernet cable		
<u>Comment</u>		



cAssN7	Power-supply interrupt	
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
<u>Expected result</u> 3. SUT set-up associations to all servers		
<u>Test description</u> 1. Set-up test configuration with at least two servers 2. Disconnect the power-supply to SUT 3. Connect the power supply to SUT		
<u>Comment</u>		

Detailed test procedures for server, logical device, logical node and data

cSrv1	GetServerDirectory(LOGICAL-DEVICE)	
cSrv2	GetLogicalDeviceDirectory	
cSrv3	GetLogicalNodeDirectory(DATA)	
cSrv4	GetDataDirectory/GetDataDefinition	
IEC 61850-7-2 clause 8, 9, 10 IEC 61850-8-1 clause 11, 12, 13		
<p><u>Expected result</u></p> <p>2. SUT requests for each server a GetServerDirectory(LOGICAL-DEVICE). And for each responded logical device SUT requests a GetLogicalDeviceDirectory / GetLogicalNodeDirectory(DATA). For a subset of the responded data objects SUT request GetDataDirectory/GetDataDefinition.</p>		
<p><u>Test description</u></p> <p>1. Stop SUT 2. Start SUT</p>		
<p><u>Comment</u></p>		

cSrv5	View server process values	
IEC 61850-7-2 clause 8, 9, 10 IEC 61850-8-1 clause 11, 12, 13		
<p><u>Expected result</u></p> <p>2. The SUT can show a subset of an entire server data model (object reference, type, and value) of each server.</p>		
<p><u>Test description</u></p> <p>1. Stop SUT 2. Start SUT</p>		
<p><u>Comment</u></p>		

cSrv6	Set data values	
IEC 61850-7-2 clause 10.4.3 IEC 61850-8-1 clause 13.2.2 PIXIT		
<u>Expected result</u> 1. SUT sends a correct request and can process the responded result		
<u>Test description</u> 1. SUT request SetDataValue of a data attributes FC=CF with one of the following basic type: boolean, integer, float, bitstring, enumerated		
<u>Comment</u>		

cSrv7	Get (All) data values	
IEC 61850-7-2 clause 9.2.3, 10.4.2 IEC 61850-8-1 clause 12.3.2, 13.2.1 PIXIT		
<u>Expected result</u> 1. SUT sends a correct request and can show the respond result		
<u>Test description</u> 1. SUT request Get(All)DataValue of several data attributes, data objects and, LN+FC's		
<u>Comment</u>		

cSrvN1	Autodescription negative: GetLogicalDeviceDirectory & GetDataDefinition	
IEC 61850-7-2 clause 8.2.1, 10.4 IEC 61850-8-1 clause 11, 12, 13 PIXIT		
<u>Expected result</u> 3. SUT associates with server and responds as specified in PIXIT. SUT should continue with the other servers 4. SUT processes negative respond and continues as specified in PIXIT 5. SUT processes negative respond and continues as specified in PIXIT 6. SUT processes negative respond and continues as specified in PIXIT 7. SUT receives a GetDataDefinition response and continues as specified in PIXIT 8. SUT receives a GetDataDefinition response and continues as specified in PIXIT		
<u>Test description</u> 1. Stop one server 2. Reconfigure the server to force the following mismatches: - rename a logical device - rename a logical node (in a valid logical device) - rename a data object (in a valid logical node) - rename a data attribute (in a valid data object) - change the CDC type of an data object -> more data attributes then expected - change the CDC type of an data object -> less data attributes then expected 3. Start the server - 4. SUT requests GetLogicalDeviceDirectory of the previously known logical device - 5. SUT requests GetLogicalDeviceDirectory of a logical device with the previously known logical node - 6. SUT requests GetDataDefinition of the previously known data object 7. SUT requests GetDataDefinition of known data object with more data attributes then expected 8. SUT requests GetDataDefinition of known data object with less data attributes then expected		

Comment

For IEC 61850-8-1:

- GetServerDirectory(LOGICAL-DEVICE) has no parameters and as such a negative respond is almost impossible to happen in real implementations
- GetLogicalNodeDirectory(DATA) and GetLogicalDeviceDirectory are mapped to the same MMS service
- GetDataDirectory and GetDataDefinition are mapped to the same MMS service

cSrvN2	GetAllDataValues respond-	
IEC 61850-7-2 clause 9.2.3 IEC 61850-8-1 clause 12.3.2 PIXIT		
<u>Expected result</u> 3. SUT associates with server and responds as specified in PIXIT. SUT should continue with the other servers 4. SUT processes negative respond and continues as specified in PIXIT 5. SUT processes negative respond and continues as specified in PIXIT 6. SUT receives a GetAllDataValues response and continues as specified in PIXIT 7. SUT receives a GetAllDataValues response and continues as specified in PIXIT 8. SUT receives a GetAllDataValues response and continues as specified in PIXIT		

Test description

1. Stop one server
2. Reconfigure the server to force the following mismatches:
  - rename a logical device
  - rename a logical node (in a valid logical device)
  - rename a data object (in a valid logical node)
  - rename a data attribute (in a valid data object)
  - change the CDC type of an data object -> more data attributes then expected
  - change the CDC type of an data object -> less data attributes then expected
  - change the data type of an data attribute
3. Start the server
4. SUT requests GetAllDataValues of the previously known logical device
5. SUT requests GetAllDataValues of a logical device with the previously known logical node
6. SUT requests GetAllDataValues of a logical device and logical node with a data object with more data attributes then expected
7. SUT requests GetAllDataValues of a logical device and logical node with a data object with less data attributes then expected
8. SUT requests GetAllDataValues of a logical device and logical node with a data object with different data type then expected

Comment

cSrvN3	GetDataValues respond-	
<p>IEC 61850-7-2 clause 10.4.2 IEC 61850-8-1 clause 13.2.1 PIXIT</p>		
<p><u>Expected result</u></p> <ol style="list-style-type: none"> <li>3. SUT associates with server and responds as specified in PIXIT. SUT should continue with the other servers</li> <li>4. SUT processes negative respond and continues as specified in PIXIT</li> <li>5. SUT processes negative respond and continues as specified in PIXIT</li> <li>6. SUT processes negative respond and continues as specified in PIXIT</li> <li>7. SUT receives GetDataValues response and continues as specified in PIXIT</li> <li>8. SUT receives GetDataValues response and continues as specified in PIXIT</li> <li>9. SUT receives GetDataValues response and continues as specified in PIXIT</li> <li>10. SUT processes negative respond and continues as specified in PIXIT</li> </ol>		
<p><u>Test description</u></p> <ol style="list-style-type: none"> <li>1. Stop one server</li> <li>2. Reconfigure the server to force the following mismatches: <ul style="list-style-type: none"> <li>- rename a logical device</li> <li>- rename a logical node (in a valid logical device)</li> <li>- rename a data object (in a valid logical node)</li> <li>- rename a data attribute (in a valid data object)</li> <li>- change the CDC type of an data object -&gt; more data attributes then expected</li> <li>- change the CDC type of an data object -&gt; less data attributes then expected</li> <li>- change the data type of an data attribute</li> </ul> </li> <li>3. Start the server</li> <li>4. SUT requests request GetDataValues of a data object in the previously known logical device</li> <li>5. SUT requests GetDataValues of a data object in the previously known logical node</li> <li>6. SUT requests GetDataValues of the previously known data object</li> <li>7. SUT requests GetDataValues of a data object with more data attributes then expected</li> <li>8. SUT requests GetDataValues of a data object with less data attributes then expected</li> <li>9. SUT requests GetDataValues of data object with different data type then expected</li> <li>10. SUT requests GetDataValues of FCDA of previously known attribute</li> </ol>		
<p><u>Comment</u></p>		

cSrvN4	SetDataValues respond-	
<p>IEC 61850-7-2 clause 10.4.3 IEC 61850-8-1 clause 13.2.2 PIXIT</p>		
<p><u>Expected result</u></p> <ol style="list-style-type: none"> <li>3. SUT associates with server and responds as specified in PIXIT. SUT should continue with the other servers</li> <li>4. SUT processes negative respond and continues as specified in PIXIT</li> <li>5. SUT processes negative respond and continues as specified in PIXIT</li> <li>6. SUT processes negative respond and continues as specified in PIXIT</li> <li>7. SUT processes negative respond and continues as specified in PIXIT</li> <li>8. SUT processes negative respond and continues as specified in PIXIT</li> <li>9. SUT processes negative respond and continues as specified in PIXIT</li> <li>10. SUT processes negative respond and continues as specified in PIXIT</li> </ol>		
<p><u>Test description</u></p> <ol style="list-style-type: none"> <li>1. Stop one server</li> <li>2. Reconfigure the server to force the following mismatches: <ul style="list-style-type: none"> <li>- rename a logical device</li> <li>- rename a logical node (in a valid logical device)</li> <li>- rename a data object (in a valid logical node)</li> <li>- rename a data attribute (in a valid data object)</li> <li>- change the CDC type of an data object -&gt; more data attributes then expected</li> <li>- change the CDC type of an data object -&gt; less data attributes then expected</li> <li>- change the data type of an data attribute</li> </ul> </li> <li>3. Start the server</li> <li>4. SUT requests SetDataValues of a data object in the previously known logical device</li> <li>5. SUT requests SetDataValues of a data object in the previously known logical node</li> <li>6. SUT requests SetDataValues of the previously known data object</li> <li>7. SUT requests SetDataValues of a data object with more data attributes then expected</li> <li>8. SUT requests SetDataValues of a data object with less data attributes then expected</li> <li>9. SUT requests SetDataValues of data object with different data type then expected</li> <li>10. SUT requests SetDataValues of FCDA of previously known attribute</li> </ol>		
<p><u>Comment</u></p>		



cSrvN5	Quality values	
IEC 61850-7-2 clause 10.4.2 IEC 61850-8-1 clause 13.2.1 PIXIT		
<u>Expected result</u> 2. SUT shows/stores the quality value		
<u>Test description</u> 1. Change the status value quality of a data object of one server to: <ul style="list-style-type: none"> <li>- Validity: Invalid</li> <li>- Validity: Questionable – Failure = true</li> <li>- Validity: Questionable – OldData = true</li> <li>- Source = Substituted (by another client)</li> <li>- Test = true</li> <li>- OperatorBlocked = true</li> </ul> 2. SUT request GetDataValues of the data object		
<u>Comment</u>		

cSrvN6	Time Quality values	
IEC 61850-7-2 clause 10.4.2 IEC 61850-8-1 clause 13.2.1 PIXIT		
<u>Expected result</u> 1. SUT shows/stores process values with time stamp quality “invalid”		
<u>Test description</u> 1. Force server to respond with data object with time quality “invalid”		
<u>Comment</u>		

## A4.2 Block 2: Data set

Test case	Test case description
cDs1	If client implements Autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(DATASET) of the Logical Nodes of the configured servers.
cDs2	If client implements Autodescription, force it to start autodescription and check it requests a GetDataSetDirectory of all the DataSets of the server.
cDs3	Check SUT can request a GetDataSetValues and handle the respond
cDs4	Check SUT can request a SetDataSetValues and handle the respond
cDs5	Verify that the client checks the pre-configured datasets in the SCD file. If any deviation is detected the SUT behaves as specified in the PIXIT

Test case	Test case description
cDsN1	If client implements Autodescription, force the client to start the autodescription and check the client still communicates with other servers when it request the following services with negative response: <ul style="list-style-type: none"> <li>a) GetLogicalNodeDirectory (DATASET)</li> <li>b) GetDataSetDirectory</li> </ul>
cDsN2	Check that the client still communicates with other servers properly when it requests a GetDataSetValue to one of them and the following situations happen: <ul style="list-style-type: none"> <li>a) The response is negative.</li> <li>b) The response comes with more/less elements than expected</li> <li>c) The response comes with reordered elements of different types</li> <li>d) The response comes with reordered elements of the same type</li> </ul>
cDsN3	Check that the client still communicates with other servers properly when it requests a SetDataSetValue to one of them and the response is negative.

Detailed test procedures for Data Set

cDs1	GetLogicalNodeDirectory(DATASET)	
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1		
<u>Expected result</u> 2. SUT accepts the respond.		
<u>Test description</u> 1. Stop SUT 2. Start SUT and SUT requests GetLogicalNodeDirectory(DATASET) for each server and logical device		
<u>Comment</u> For IEC 61850-8-1 the GetLogicalNodeDirectory(DATASET) is mapped on a GetNameList and a logical device as parameter		

cDs2	GetDataSetDirectory	
IEC 61850-7-2 clause 11.3.6 IEC 61850-8-1 clause 14.3.5		
<u>Expected result</u> 2. SUT accepts the respond.		
<u>Test description</u> 1. Stop SUT 2. Start SUT and SUT requests GetDataSetDirectory for the used data sets		
<u>Comment</u>		

cDs3	GetDataSetValues	
IEC 61850-7-2 clause 11.3.2 IEC 61850-8-1 clause 14.3.1 PIXIT		
<u>Expected result</u> 1. SUT accepts the respond.		
<u>Test description</u> 1. SUT requests GetDataSetValues (PIXIT)		
<u>Comment</u>		

cDs4	SetDataSetValues	
IEC 61850-7-2 clause 11.3.3 IEC 61850-8-1 clause 14.3.2 PIXIT		
<u>Expected result</u> 1. SUT accepts the respond.		
<u>Test description</u> 1. SUT requests SetDataSetValues (PIXIT)		
<u>Comment</u>		

cDs5 cDsN2bcd	Pre-configured dataset deviations	
IEC 61850-7-2 clause 11.3 IEC 61850-8-1 clause 14.3 PIXIT		
<u>Expected result</u> 3. SUT associates with server and responds as specified in PIXIT on the reconfigured datasets. The SUT should continue with those data sets that are not reconfigured.		
<u>Test description</u> 1. Stop one server 2. Reconfigure the server to force the following mismatches in different datasets: <ul style="list-style-type: none"><li>- Insert a new dataset element in the middle of a dataset</li><li>- Delete a dataset element in the middle of a dataset</li><li>- Reorder 2 dataset elements in a dataset of a different data type</li><li>- Reorder 2 dataset elements in a dataset of the same data type</li></ul> 3. Start the server		
<u>Comment</u>		

cDsN1	GetLogicalNodeDirectory(DATA-SET) respond- and GetDataSetDirectory respond-	
<p>IEC 61850-7-2 clause 9.2.2, 11.3.6 IEC 61850-8-1 clause 12.3.1, 14.3.5 PIXIT</p>		
<p><u>Expected result</u></p> <ol style="list-style-type: none"> <li>3. SUT associates with server and responds as specified in PIXIT. The SUT should continue with the other servers</li> <li>4. SUT processes negative respond and continues as specified in PIXIT</li> <li>5. SUT does not send the request or indicates negative respond and continues as specified in PIXIT</li> </ol>		
<p><u>Test description</u></p> <ol style="list-style-type: none"> <li>1. Stop one server</li> <li>2. Reconfigure the server: <ul style="list-style-type: none"> <li>o Rename a dataset</li> <li>o Add a dataset</li> <li>o Rename a logical device</li> </ul> </li> <li>3. Start the server</li> <li>4. SUT requests GetLogicalNodeDirectory(DATA-SET) of an previously known logical device</li> <li>5. SUT requests GetDataSetDirectory of a previously known dataset (PIXIT)</li> </ol>		
<p><u>Comment</u></p>		

cDsN2a	GetDataSetValues respond-	
IEC 61850-7-2 clause 11.3.2 IEC 61850-8-1 clause 14.3.1 PIXIT		
<u>Expected result</u> 3. SUT associates with server and responds as specified in PIXIT. The SUT should continue with the other servers		
<u>Test description</u> 1. Stop one server 2. Force server simulator to send GetDataSetValues respond- (ServiceError with errorClass access "object-non-existent", Tissue #165) for one dataset 3. Start the server		
<u>Comment</u>		

cDsN3	SetDataSetValues respond-	
IEC 61850-7-2 clause 11.3.3 IEC 61850-8-1 clause 14.3.2 PIXIT		
<u>Expected result</u> 4. SUT reports an error		
<u>Test description</u> 1. Stop one server 2. Force server simulator to send SetDataSetValues respond- (ServiceError with errorClass access "object-non-existent", Tissue #165) for one dataset 3. Start the server 4. SUT request SetDataSetValues		
<u>Comment</u>		

**A4.2+ Block 2+: Data set definition**

Test case	Test case description
cDs6	If the client creates persistent / non-persistent datasets dynamically after starting up check that the client sends the CreateDataSet services according to configuration. PIXIT
cDs7	Request a DeleteDataSet service and check the client sends the request properly and is able to process the response of the server.

Test case	Test case description
cDsN4	If client creates persistent / non-persistent datasets dynamically after starting up check the client still communicates with other servers when it requests a CreateDataSet with negative response
cDsN5	If client configures the datasets dynamically after starting up check the client still communicates with other servers when it requests a DeleteDataSet with negative response

Detailed test procedures for Data Set definition

cDs6	CreateDataSet	
IEC 61850-7-2 clause 11.3.4 IEC 61850-8-1 clause 14.3.3 PIXIT		
<u>Expected result</u> 2. SUT request CreateDataSet to create persistent and/or non-persistent data sets 5. When a dataset already exists SUT behaves as specified in the PIXIT, for example delete the dataset and create it again		
<u>Test description</u> 1. Stop one server supporting non-persistent datasets (to remove previously created non-persistent datasets) 2. Start the server 3. Start SUT a) SUT creates non-persistent datasets b) SUT creates persistent datasets 4. Stop SUT 5. Start SUT (server has previously created persistent datasets)		
<u>Comment</u>		



cDs7	DeleteDataSet	
IEC 61850-7-2 clause 11.3.5 IEC 61850-8-1 clause 14.3.4 PIXIT		
<u>Expected result</u> 2. SUT sends correct delete dataset request		
<u>Test description</u> 1. Stop SUT 2. Start SUT <ul style="list-style-type: none"> <li>a) Cause the SUT to delete a non-persistent dataset</li> <li>b) Cause the SUT to delete a persistent dataset</li> </ul>		
<u>Comment</u>		

cDsN4	Create data set negative	
IEC 61850-7-2 clause 11.3.4 IEC 61850-8-1 clause 14.3.3 PIXIT		
<u>Expected result</u> 2. SUT behaves as specified in the PIXIT		
<u>Test description</u> 1. Stop server and force server simulator to send CreateDataset respond- by removing one dataset element at the server and/or simulating a memory limitation) 2. Start server		
<u>Comment</u>		

cDsN5	Delete Data set negative	
IEC 61850-7-2 clause 11.3.5 IEC 61850-8-1 clause 14.3.4 PIXIT		
<u>Expected result</u> 2. SUT behaves as specified in the PIXIT		
<u>Test description</u> 1. A second client system uses the persistent created dataset by SUT in a report control block 2. Cause SUT to delete this data set		
<u>Comment</u>		

### A4.3 Block 3: Substitution

cSub1	Verify SUT can enable substitution, enter a substituted value and disable substitution
cSub2	Verify SUT can display the source "substituted" for substituted values
cSub3	Verify SUT can display the source "substituted" for values substituted by another client

#### Detailed test procedures for Substitution

cSub1 cSub2	Substitute a value	
IEC 61850-7-2 clause 12 IEC 61850-8-1 clause 15		
<u>Expected result</u>		
<ol style="list-style-type: none"> <li>2. SUT processes the substituted value and quality with source "substituted" when transmitted by the report or GetDataValue response</li> <li>3. SUT processes the new substituted value and quality with source "substituted" when transmitted by the report or GetDataValue response</li> <li>4. SUT processes the original process value and quality with source "process" when transmitted by the report or GetDataValue response</li> </ol>		
<u>Test description</u>		
<ol style="list-style-type: none"> <li>1. SUT substitutes the values of data objects in one server by another valid value of the following type: <ul style="list-style-type: none"> <li>- single point status</li> <li>- double point status</li> <li>- enumerated status</li> <li>- integer measurand</li> <li>- floating point measurand</li> <li>- quality</li> </ul> </li> <li>2. SUT enables substitution</li> <li>3. SUT sets a new substituted value</li> <li>4. SUT disables substitution</li> </ol>		
<u>Comment</u>		

cSub3	Substitute a value by another client	
IEC 61850-7-2 clause 12 IEC 61850-8-1 clause 15		
<u>Expected result</u> 1. SUT displays the substituted value and quality when transmitted by the report or a GetDataValue response		
<u>Test description</u> 1. Use another client to substitute a value and quality of a data object		
<u>Comment</u>		

#### A4.4 Block 4: Setting group selection

C_Sg1	If client implements Autodescription, force it to start autodescription and check if it requests GetLogicalNodeDirectory(SGCB) and check response+
C_Sg2	Verify the client can select a setting group (IEC 61850-7-2 clause 13 figure 18); <ul style="list-style-type: none"> <li>a) SelectActiveSG of the first setting group</li> <li>b) GetSGCBValues to verify active setting group</li> <li>c) Repeat for another setting group</li> </ul>
C_SgN1	Force SERVER SIMULATOR to return response- for the following services and verify the SUT continues as before <ul style="list-style-type: none"> <li>a) SelectActiveSG (IEC 61850-7-2 clause 13.3.2)</li> <li>b) GetSGCBValues (IEC 61850-7-2 clause 13.3.7)</li> </ul>

#### Detailed test procedures for Setting group selection

cSg1	Setting group autodescription	
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1 PIXIT		
<u>Expected result</u> 2. SUT requests a GetLogicalNodeDirectory(SGCB) and GetSGCBValues		
<u>Test description</u> 1. Stop a server with a SGCB 2. Start the server		
<u>Comment</u>		

cSg2	Select setting group	
IEC 61850-7-2 clause 13.3.2 IEC 61850-8-1 clause 16.2.1 PIXIT		
<u>Expected result</u> 1. SUT reads the SGCB values 2. SUT verifies the active setting group		
<u>Test description</u> 1. Request GetSGCBValues to read the active setting group 2. Request SelectActiveSG to select first setting group of a SGCB 3. Repeat for maximum setting group of the same SGCB		
<u>Comment</u>		

cSgN1	Pre-configured setting group deviations	
IEC 61850-7-2 clause 9.2.2, 13.3.2 IEC 61850-8-1 clause 12.3.1, 16.2.1 PIXIT		
<u>Expected result</u> 3. SUT associates with server and responds as specified in PIXIT on the reconfigured setting groups. The SUT should continue with those setting groups that are not reconfigured.		
<u>Test description</u> 1. Stop one server 2. Reconfigure the server to force the following mismatches: <ul style="list-style-type: none"> <li>- Rename the logical device of a setting group or remove the setting group in the server simulator</li> <li>- Change the configured setting group to another valid number</li> </ul> 3. Start the server		
<u>Comment</u>		

### A4.4+ Block 4+: Setting group definition

C_Sg3	Verify SUT can get setting group values [FC=SG] (IEC 61850-7-2 clause 13 figure 18); <ul style="list-style-type: none"> <li>a) SelectActiveSG of the first setting group</li> <li>b) Use GetSGValues [FC=SG] to verify the values are of fist setting group</li> <li>c) Repeat for another setting group</li> </ul>
C_Sg4	Verify SUT can edit setting group values

#### Detailed test procedures for Setting group definition

cSg3	Get setting group values	
IEC 61850-7-2 clause 13.3.6 IEC 61850-8-1 clause 16.2.5 PIXIT		
<u>Expected result</u>		
<ol style="list-style-type: none"> <li>1. SUT requests SelectActiveSG</li> <li>2. SUT requests GetSGValues</li> </ol>		
<u>Test description</u>		
<ol style="list-style-type: none"> <li>1. Request SelectActiveSG to Select first setting group of a server</li> <li>2. Request GetSGValues [FC=SG] to verify setting group values</li> <li>3. Repeat for another setting group</li> </ol>		
<u>Comment</u>		

cSg4	Edit setting group values	
IEC 61850-7-2 clause 13.3 IEC 61850-8-1 clause 16.2 PIXIT		
<u>Expected result</u> 1. SUT requests SelectActiveSG 2. SUT requests GetSGValues[FC=SE] 3. SUT requests SetSGValues[FC=SE] 4. SUT requests ConfirmEditSG		
<u>Test description</u> 1. Request SelectEditSG to select first setting group of a server 2. Request GetSGValues[FC=SE] to get the current setting group values 3. Request SetSGValues[FC=SE] to set the new setting group values 4. Request ConfirmEditSG		
<u>Comment</u>		



**A4.5 Block 5: Unbuffered Reporting**

Test case	Test case description
cRp1	If client implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(URCB) of the logical nodes declared in the PIXIT of all configured servers.
cRp2	If the client configures the server's Unbuffered ReportControlBlock parameters after startup using SetURCBValues, check that the SetURCBValues are sent with the configured values.
cRp3	Verify the client is able to process the reports with different optional fields:  Force the client to configure/enable a URCB with useful optional fields combinations: sequence-number, report-time-stamp, reason-for-inclusion, data-set-name and/or data-reference (IEC 61850-7-2, 14.2.3.2.2.1), force/trigger a report and check the client is able to process the reports and updates its database.
cRp4	Verify the client is able to process the reports with different trigger conditions:  Configure and enable a URCB with all supported optional fields and check the reports are transmitted according to the following (supported) trigger conditions:  a) on integrity b) on update (dupd) c) on update with integrity d) on data change (dchg) e) on data change and quality change (dchg+qchg) f) on data change and quality change with integrity period (dchg+qchg)
cRp5	Verify the client is able to process segmented reports
cRp6	Verify client can change the (pre-)configured Buffer Time (IEC 61850-7-2 clause 14.2.2.9)
cRp7	Verify client can force a General interrogation
cRp8	Verify that after startup the SUT configures and enables the URCB's as specified in the SCD file. The client only may write to the "dyn" URCB fields in the SCL.
cRp9	Verify that the SUT can handle reporting of complex structured data (for example WYE and DEL data objects)
cRp10	Verify that the SUT can handle reporting of basic data (for example stVal and quality)

Test case	Test case description
cRpN1	If client implements Autodescription, force the client to start the autodescription and check that the client still communicates with other servers when it request GetLogicalNodeDirectory (URCB) with negative response.
cRpN2	a) Check that the client still works properly when it request a GetURCBValues when the response is negative.
cRpN3	a) Check that the client still works properly when it request a SetURCBValues when the response is negative.
cRpN4	Check that the SUT still works properly when it request a SetURCBValues and the URCB is reserved (Resv=TRUE, PIXIT)
cRpN5	Report with not supported OptFlds. Check that the client does not collapse if it receives a Report with a non-configured or non-supported OptFlds.
cRpN6	Report with not supported TrgOps. Check that the client does not collapse if it receives a Report with a non-configured or non-supported Trigger Option.
cRpN7	Mismatching reports: <ul style="list-style-type: none"> <li>a) Report with unknown DataSet.</li> <li>b) Report with unknown RptId</li> <li>c) Report with incorrect references of the Data.</li> <li>d) Report with incorrect types in the Data.</li> </ul> Check the behaviour described in the PIXIT.
cRpN8	Verify that the client detects a change in the ConfRev attribute (Configuration revision, IEC 61850-7-2, 14.2.2.7) of the Report Control Block. When the SUT does not perform the ConfRev check it should check the dataset elements. The means of detection needs to be specified in the PIXIT.

Detailed test procedures for Unbuffered Reporting

cRp1	GetLogicalNodeDirectory(URCB)	
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1 PIXIT		
<u>Expected result</u> 2. SUT requests GetLogicalNodeDirectory(URCB) in the logical nodes specified in PIXIT		
<u>Test description</u> 1. Stop SUT 2. Start SUT, when necessary cause SUT to request GetLogicalNodeDirectory(URCB)		
<u>Comment</u>		

cRp2	SetURCBValues	
cRp3	Optional fields	
cRp4	Trigger conditions	
cRp7	General interrogation	
cRp8	Enable the URCB in SCD	
cRp9	Reporting complex structured data objects	
cRp10	Reporting basic data attributes	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 5. SUT initializes each report control block as configured and as specified in the PIXIT. The dynamic report control block attributes may be overruled by the SUT. The configurable and fixed attributes should not be changed. The Resv attribute shall be set to true. 6. SUT can display the reported values		

<p><u>Test description</u></p> <ol style="list-style-type: none"> <li>1. Stop SUT</li> <li>2. Configure the “Conf” fields on a report control block in the SCD file in one server: <ul style="list-style-type: none"> <li>- minimum optional fields (PIXIT) &amp; all supported optional fields</li> <li>- trigger condition: none, integrity, dchg and qchg and dchg, qchg and integrity</li> <li>- a specific integrity period</li> <li>- report ID</li> </ul>                     and activate the changed configuration to the applicable server(s)                 </li> <li>3. Configure the “Dyn” fields on a report control block in the SCD file in another server: <ul style="list-style-type: none"> <li>- minimum optional fields &amp; all supported optional fields</li> <li>- trigger condition: integrity, dchg and qchg and dchg, qchg and integrity</li> <li>- a specific integrity period</li> <li>- report ID</li> </ul> </li> <li>4. Configure a reported dataset with complex data objects: DO, DO.SDO and another reported dataset with basic data attributes: DA, DA.BDA</li> <li>5. Start SUT, when necessary cause SUT to perform a general interrogation</li> <li>6. Force some data change reports in server simulator</li> </ol>
<p><u>Comment</u></p>

cRp5	Segmented report	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<p><u>Expected result</u></p> <ol style="list-style-type: none"> <li>5. SUT can display the reported values</li> </ol>		
<p><u>Test description</u></p> <ol style="list-style-type: none"> <li>1. Stop a server with a large SCL compliant data set</li> <li>2. Reconfigure the server to minimum MMS PDU size</li> <li>3. Start server</li> <li>4. Cause SUT to perform a general interrogation</li> <li>5. Server simulator sends a segmented report</li> </ol>		
<p><u>Comment</u></p>		

cRp6	Change buffer time	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 3. SUT overwrites the buffer time value		
<u>Test description</u> 1. Stop SUT 2. Configure the dynamic buffer time in the SUT or in the SCD on a different value then stored in the RCB of the server 3. Start SUT		
<u>Comment</u>		

cRpN1	Renamed URCB	
cRpN2	GetURCBValues response-	
cRpN3	SetURCBValues response-	
cRpN5	Not supported OptFlds	
cRpN6	Not supported TrgOps	
cRpN7	Mismatching report ID, dataset, data references	
cRpN8	Mismatching ConfRev	
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
<u>Expected result</u>		
4. SUT initializes the non-renamed report control block as configured. The SUT behaves as specified in the PIXIT for the renamed control block		
<u>Test description</u>		
<ol style="list-style-type: none"> <li>1. Stop a server</li> <li>2. Reconfigure the server (one change per URCB): <ul style="list-style-type: none"> <li>- rename a report control block</li> <li>- rename a report ID</li> <li>- rename a dataset (to force SetURCBValues response-)</li> <li>- increment a ConfRev</li> <li>- unsupported optional fields (if any)</li> <li>- unsupported trigger condition (if any)</li> <li>- change the order of dataset elements (different type)</li> <li>- change the order of dataset elements (same type)</li> <li>- remove a dataset element from the middle of the dataset</li> <li>- add a dataset element in the middle of the dataset</li> </ul> </li> <li>4. Start server</li> </ol>		
<u>Comment</u>		

cRpN4	Report block is already reserved	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 3. The SUT behaves as specified in the PIXIT		
<u>Test description</u> 1. Stop a server 2. Reconfigure the server to force a report control block reserved (set Resv=true), by pre-assigning the URCB to another client or start server and use another client to reserve the URCB prior to SUT 3. Start server		
<u>Comment</u>		

**A4.6 Block 6: Buffered Reporting**

Test case	Test case description
cBr1	If client implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(BRCB) of the logical nodes declared in the PIXIT of all configured servers.
cBr2	If the client configures the server's Buffered ReportControlBlock parameters after startup using SetBRCBValues, check that the GetBRCBValues/SetBRCBValues are sent with the configured values.
cBr3	Verify the client is able to process the reports with different optional fields:  Force the client to configure/enable a BRCB with the useful optional fields combinations: sequence-number, report-time-stamp, reason-for-inclusion, data-set-name, data-reference, and/or entryID (IEC 61850-7-2, 14.2.3.2.2.1), force/trigger a report and check the client is able to process the reports and updates its datamodel.
cBr4	Verify the client is able to process the reports with different trigger conditions:  Configure and enable a BRCB with all useful optional fields: sequence-number, report-time-stamp, reason-for-inclusion, data-set-name, data-reference, and entryID and check the reports are transmitted according to the following (supported) trigger conditions:  a) on integrity b) on update (dupd) c) on update with integrity d) on data change (dchg) e) on data and quality change (dchg+qch) f) on data and quality change with integrity period (dchg+qchg)
cBr5	Verify the client is able to process segmented reports
cBr6	Verify client can change the (pre-)configured Buffer Time (IEC 61850-7-2 clause 14.2.2.9)
cBr7	Verify client can force a General interrogation
cBr8	Verify that after startup the SUT configures and enables the BRCB's as configured in the SCD file (and actually used). The client only may write to the "dyn" BRCB fields in the SCL.
cBr9	Verify that the SUT can handle reporting of complex structured data (for example WYE and DEL data objects)
cBr10	Verify that the SUT can handle reporting of basic data (for example stVal and quality)
cBr11	Verify the SUT is able to process reports buffered during an lost association  a) without bufferoverflow (PIXIT) b) with bufferoverflow
cBr12	Verify the SUT is able to request specific buffered reports after restoring an lost association by setting the EntryId
cBr13	Verify the SUT is able to purge buffered reports



Test case	Test case description
cBrN1	If client implements Autodescription, force the client to start the autodescription and check that the client still communicates with other servers when it request GetLogicalNodeDirectory (BRCB) with negative response.
cBrN2	Check that the client still works properly when it request a GetBRCBValues when the response is negative.
cBrN3	Check that the client still works properly when it request a SetBRCBValues when the response is negative.
cBrN4	Check that the client still works properly when it request a SetBRCBValues and the BRCB is used by or pre-assigned to another client. (PIXIT)
cBrN5	Report with not supported OptFlds. Check that the client does not collapse if it receives a Report with a non-configured or non-supported OptFlds.
cBrN6	Report with not supported TrgOps. Check that the client does not collapse if it receives a Report with a non-configured or non-supported Trigger Option.
cBrN7	Mismatching reports: <ul style="list-style-type: none"> <li>a) Report with unknown DataSet.</li> <li>b) Report with unknown RptID</li> <li>c) Report with incorrect references of the Data (when data references are enabled).</li> <li>d) Report with incorrect types in the Data.</li> </ul> Check the behaviour described in the PIXIT.
cBrN8	Verify that the client detects a change in the ConfRev attribute (Configuration revision, IEC 61850-7-2, 14.2.2.7) of the Report Control Block. When the SUT does not perform the ConfRev check it should check the dataset elements. The means of detection needs to be specified in the PIXIT.
cBrN9	Verify the SUT can handle a severe buffer overflow with SetBRBValues(EntryID) response-

Detailed test procedures for Buffered Reporting

cBr1	GetLogicalNodeDirectory(BRCB)	
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1 PIXIT		
<u>Expected result</u> 2. SUT requests GetLogicalNodeDirectory(BRCB) in the logical nodes specified in PIXIT		
<u>Test description</u> 1. Stop SUT 2. Start SUT, when necessary cause SUT to request GetLogicalNodeDirectory(BRCB)		
<u>Comment</u>		

cBr2	SetURCBValues	
cBr3	Optional fields	
cBr4	Trigger conditions	
cBr7	General interrogation	
cBr8	Enable the BRCBs in SCD	
cBr9	Reporting complex structured data objects	
cBr10	Reporting basic data attributes	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 5. SUT initializes each report control block as configured. The DYN report control fields may be overruled by the SUT 6. SUT can display the reported values 7. SUT can display the reported values		

Test description

1. Stop SUT
2. Configure the “Conf” fields on a report control block in the SCD file:
  - minimum optional fields (PIXIT) & all supported optional fields
  - trigger condition: integrity, dchg and qchg and dchg, qchg and integrity
  - a specific buffer time
  - a specific integrity period
  - report IDand activate the changed configuration to the applicable server(s)
3. Configure the “Dyn” fields on a report control block in the SCD file:
  - minimum optional fields & all supported optional fields
  - trigger condition: integrity, dchg and qchg and dchg, qchg and integrity
  - a specific buffer time
  - a specific integrity period
  - report ID
4. Configure a reported dataset with complex data objects: DO, DO.SDO and another reported dataset with basic data attributes: DA, DA.BDA
5. Start SUT
6. Force some data changes in server simulator

Comment

cBr5	Segmented report	Server limit
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 4. SUT can display the reported values		
<u>Test description</u> 1. Stop a server with a large data set 2. reconfigure the server to minimum MMS PDU size to force segmented reports 3. Start server 4. Force some data changes in server simulator		
<u>Comment</u>		

cBr6	Change buffer time	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 3. SUT overwrites the buffer time value		
<u>Test description</u> 1. Stop SUT 2. Configure the dynamic buffer time in the SUT or in the SCD on a different value then stored in the RCB of the server 3. Start SUT		
<u>Comment</u>		

cBr11	Process buffered reports with/without buffer overflow	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 4. The SUT handles the buffered reports 7. The SUT handles the buffered reports as specified in PIXIT		
<u>Test description</u> 1. Force data changes in a server to force reports 2. Disconnect the ethernet cable between the server and switch 3. Force data changes in the server to force report buffering 4. Restore the ethernet connection 5. Disconnect the ethernet cable between the server and switch 6. Force many data changes in some servers to force buffer overflow 7. Restore the ethernet connection		
<u>Comment</u>		

cBr12	Set EntryId of buffered reports	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 5. The SUT stores the buffered reports		
<u>Test description</u> 1. Force data changes in a server to force reports 2. Disconnect the ethernet cable between switch and the server 3. Force data changes in the server to force buffered reports 4. Restore the ethernet connection 5. Cause SUT to request a valid EntryID (PIXIT)		
<u>Comment</u>		

cBr13	Purge buffered reports	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 5. The SUT requests purge buffer		
<u>Test description</u> 1. Force data changes in a server to force reports 2. Disconnect the ethernet cable between switch and the server 3. Force data changes in the server to force buffered reports 4. Restore the ethernet connection 5. Cause SUT to purge buffered reports (PIXIT)		
<u>Comment</u>		

cBrN1	Renamed BRCB	
cBrN2	GetBRCBValues response-	
cBrN3	SetBRCBValues response-	
cBrN5	Not supported OptFlds	
cBrN6	Not supported TrgOps	
cBrN7	Mismatching report ID, dataset, data references	
cBrN8	Mismatching ConfRev	
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
<u>Expected result</u>		
4. SUT initializes the non-renamed report control block as configured. The SUT behave as specified in the PIXIT for the renamed control block		
<u>Test description</u>		
<ol style="list-style-type: none"> <li>1. Stop a server</li> <li>2. Reconfigure the server: <ul style="list-style-type: none"> <li>- rename a report control block</li> <li>- rename a report ID</li> <li>- rename a dataset (to force SetBRCBValues response-)</li> <li>- rename a ConfRev</li> <li>- unsupported optional fields (if any)</li> <li>- unsupported trigger condition (if any)</li> <li>- change the order of dataset element (different type)</li> <li>- change the order of dataset element (same type)</li> <li>- remove a dataset element in the middle of the dataset</li> <li>- add a dataset element in the middle of the dataset</li> </ul> </li> <li>4. Start server</li> </ol>		
<u>Comment</u>		

cBrN4	Report block is pre-assigned to another client	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 3. The SUT behaves as specified in the PIXIT		
<u>Test description</u> 1. Stop a server 2. Reconfigure the server to pre-assign a report control block to another client 3. Start server		
<u>Comment</u>		

cBrN9	Set non-existing EntryID	
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
<u>Expected result</u> 5. The SUT will behave as specified in PIXIT		
<u>Test description</u> 1. Force data changes in a server to force reports 2. Disconnect the ethernet cable between the ethernet switch and the server 3. Force many data changes in a server to force severe buffer overflow 6. Restore the ethernet connection 7. SUT will request a SetBRCBValues with a non-existing EntryID		
<u>Comment</u>		



### A4.7 Block 7: Logging

Test case	Test case description
cLog1	If client implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory (LOG) of the logical nodes declared in the PIXIT of all configured servers.
cLog2	If client implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(LCB) of the logical nodes declared in the PIXIT of all configured servers.
cLog3	If client implements autodescription, force it to start autodescription and check if it requests a GetLogStatusValues of the LOGs found with the GetLogicalNodeDirectory(LCB) services
cLog4	If client implements autodescription, force it to start autodescription and check if it requests a GetLCBValues of the LCBs found with the GetLogicalNodeDirectory(LCB) services
cLog5	If the client configures the server's LogControlBlock parameters after startup using SetLCBValues, check that the SetLCBValues are sent with the configured values.
cLog6	Force the client to enable the Logging of at least one LOG of the server and check the client send the request correctly.
cLog7	Force the client to QueryLogByTime or QueryLogByEntry and check the SUT updates its database with the Log entries received.

Test case	Test case description
cLogN1	If client implements Autodescription, force the client to start the autodescription and check that the client still communicates with other servers when it request GetLogicalNodeDirectory (LCB) and GetLogicalNodeDirectory (LOG) with negative response.
cLogN2	Check that the client still works properly when it request a GetLCBValues/GetLogStatusValues when the response is negative.
cLogN3	Check that the client still works properly when it request a SetLCBValues when the response is negative.

The detailed test procedures need to be defined.

**A4.12 Block 12: Control**

<b>Test case</b>	<b>Test case description</b>
cCtl1	Check if the SUT is able to set the TEST field in the commands (PIXIT).
cCtl2	Check if the SUT is able to set the CHECK (Synchro-Check or Interlock-Check bits) in the commands (PIXIT) for the supported control models.
cCtl3	Check if the SUT is able to change control model using online services (PIXIT).
cCtl4	Verify the values of originator category & identification and the control number values (PIXIT)

<b>Test case</b>	<b>Test case description</b>
cCtlN1	Check if the SUT reacts in a proper way when it detects a control model mismatch (PIXIT): a) Server status-only, SUT expects controllable b) Server SBO, SUT expects direct operate c) Server direct operate, SUT expects SBO
cCtlN2	Check if the SUT reacts in a proper way when it detects a control model is not initialized in the SCL file (PIXIT)

The testing of the control model has been divided in the four possible control model that can be implemented:

- Direct control with normal security.
- SBO control with normal security.
- Direct control with enhanced security.
- SBO control with enhanced security.

Detailed test procedures for Control

cCtl1	Test mode	
IEC 61850-7-2 clause 17.5.2.4 IEC 61850-8-1 clause 20, Annex E		
<u>Expected result</u> SUT sends SelectWithValue and Operate request with Test flag = true		
<u>Test description</u> DO normal/enhanced security: SUT request Operate with the Test flag set SBO normal security: SUT request Select followed by Operate with the Test flag set SBO enhanced security: SUT request SelectWithValue followed by Operate both with the Test flag set		
<u>Comment</u>		

cCtl2	Synchro and interlock check	
IEC 61850-7-2 clause 17.5.2.5 IEC 61850-8-1 clause 20, Annex E PIXIT		
<u>Expected result</u> SUT sends requests with applicable Check bits as specified in PIXIT.		

<p><u>Test description</u></p> <p>DO normal/enhanced security:</p> <ol style="list-style-type: none"> <li>1. SUT request Operate with Synchro Check bit set</li> <li>2. SUT request Operate with Interlock Check bit set</li> <li>3. SUT request Operate with Interlock and Synchro Check bit set</li> </ol> <p>SBO normal security:</p> <ol style="list-style-type: none"> <li>4. SUT request Select and Operate with Synchro Check bit set</li> <li>5. SUT request Select and Operate with Interlock Check bit set</li> <li>6. SUT request Select and Operate with Interlock and Synchro Check bit set</li> </ol> <p>SBO enhanced security:</p> <ol style="list-style-type: none"> <li>7. SUT request SelectWithValue and Operate both with Synchro Check bit set</li> <li>8. SUT request SelectWithValue and Operate both with Interlock Check bit set</li> <li>9. SUT request SelectWithValue and Operate both with Interlock and Synchro Check bit set</li> </ol>
<p><u>Comment</u></p>

cCtl3	Change control model	
<p>IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT</p>		
<p><u>Expected result</u> SUT sends SetDataValues with corresponding control model</p>		
<p><u>Test description</u></p> <ol style="list-style-type: none"> <li>1. SUT request SetDataValues to change control model to "Direct control with normal security"</li> <li>2. SUT request SetDataValues to change control model to "SBO control with normal security"</li> <li>3. SUT request SetDataValues to change control model to "Direct control with enhanced security"</li> <li>4. SUT request SetDataValues to change control model to "SBO control with enhanced security"</li> </ol>		
<p><u>Comment</u></p>		

cCtl4	Verify control number and originator	
IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT		
<u>Expected result</u> SUT sets the control number and the originator as specified in PIXIT		
<u>Test description</u> Execute the applicable control model specific testcases		
<u>Comment</u>		

cCtlN1	Control model deviations	
IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT		
<u>Expected result</u> 4. 5. 6.7. SUT reports control error indication when server responds an error		
<u>Test description</u> 1. Stop a server 2. Reconfigure the server: <ul style="list-style-type: none"><li>- Reconfigure one controllable object to status only</li><li>- Reconfigure one SBO object to direct operate</li><li>- Reconfigure one direct object to SBO</li><li>- Reconfigure SBO enhanced security control object to SBO normal security</li></ul> 3. Start server 4. SUT request Select/Operate of the 1st reconfigured control object 5. SUT request Select/SelectWithValue of the 2nd reconfigured control object 6. SUT request Operate of the 3rd reconfigured control object 7. SUT request SelectWithValue of the 4th reconfigured control object		
<u>Comment</u>		

cCtlN2	Control model not configured in SCL	
IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT		
<u>Expected result</u> 4. SUT behaves as specified in PIXIT		
<u>Test description</u> 1. Stop SUT 2. Reconfigure a server: remove control model initialization of one "SBO" controllable object (DAI valKind) and/or the data type template (DA valKind) 1. Start SUT 2. Perform the supported control operation (PIXIT)		
<u>Comment</u>		

**A4.12a Block 12a: Direct Control**

Test case	Test case description
cDOns1	OperReq[test ok] resp+ Perform a correct Operate request. Check that the SUT does not generate an error.
cDOns2	OperReq[test not ok] resp- Client requests Oper resulting in Test not ok. Check that the SUT realizes the operation failed.
cDOns3	TimOperReq[test not ok] resp- Client requests TimOper resulting in Test not ok. Check that the SUT realizes the time operation failed.
cDOns4	TimOperReq[test ok] + TimerExpired[test ok] resp+ Send a TimeActivatedOperate request, thereby making sure the device will generate a 'test Ok'. Verify the WaitForActionTime results in a timer expired 'Test ok' and that the client realizes the operation succeeded.
cDOns5	TimOperReq[test ok] + TimerExpired[test not ok] resp- Send a TimeActivatedOperate request, thereby making sure the device will generate a 'test Ok'. Force situation that the WaitForActionTime results in a timer expired 'Test not ok'. Check that the client realizes the operation failed.

Detailed test procedures for Direct Control with normal security (DOns), excluding TimeActivatedOperate test cases.

cDOns1	Successfull Operate	
IEC 61850-7-2 clause 17.2.1 IEC 61850-8-1 clause 20.7		
<u>Expected result</u> 2. SUT indicates no Operate failure		
<u>Test description</u> 1. SUT requests Operate 2. Server sends Operate respond+		
<u>Comment</u>		



cDOns2	Failed Operate	
IEC 61850-7-2 clause 17.2.1 IEC 61850-8-1 clause 20.7		
<u>Expected result</u> 3. SUT indicates Operate failure		
<u>Test description</u> 1. Force server simulator to send Operate respond- 2. SUT requests Operate 3. Server sends Operate respond-		
<u>Comment</u>		

**A4.12b Block 12b: SBO Control**

<b>Test case</b>	<b>Test case description</b>
cSBOs1	SelectReq[test not ok] resp-: Client requests Select resulting in Test not ok. Check that the SUT realizes the select failed (PIXIT).
cSBOs2	SelectReq[test ok] resp+ and OperReq[test ok] resp+ of selected object Select a controllable object using Select. Perform a correct Operate request. Check that the SUT does not generate an error.
cSBOs3	SelectReq[test ok] resp+ and OperReq[test not ok] resp- of selected object. Perform a correct Operate request resulting in Test not ok. Check that the client realizes the operation failed.
cSBOs4	SelectReq[test ok] resp+ and CancelReq of selected object. Perform a correct cancel request.
cSBOs5	SelectReq[test ok] resp+ and TimOperReq[test ok] resp+ of selected object Perform a correct TimOperate request. Check that the client realizes the operation succeeded after the WaitForActionTime.
cSBOs6	SelectReq[test ok] resp+ and TimOperReq[test not ok] resp- of selected object Perform a correct TimOperate request resulting in test not ok. Check that the client realizes the operation failed.

Detailed test procedures for SBO Control with normal security (SBOs), excluding TimeActivatedOperate test cases).

cSBOs1	Failed Select	
IEC 61850-7-2 clause 17.2.2, 17.5.3.2 IEC 61850-8-1 clause 20.4 PIXIT		
<u>Expected result</u> 3. SUT indicates Select failure		
<u>Test description</u> 1. Force server simulator to send Select respond- (PIXIT) 2. SUT requests Select 3. Server sends Select respond-		
<u>Comment</u>		

cSBOs2	Select and successfull Operate	
IEC 61850-7-2 clause 17.2.2, 17.5.3.5 IEC 61850-8-1 clause 20.7		
<u>Expected result</u> 4. SUT indicates no Operate failure		
<u>Test description</u> 1. SUT requests Select 2. Server sends Select respond+ 3. SUT requests Operate 4. Server sends Operate respond+		
<u>Comment</u>		

cSBOs3	Select and failed Operate	
IEC 61850-7-2 clause 17.2.2, 17.5.3.5 IEC 61850-8-1 clause 20.7		
<u>Expected result</u> 5. SUT indicates Operate failure		
<u>Test description</u> 1. Force server simulator to send Operate respond- 2. SUT requests Select 3. Server sends Select respond+ 4. SUT requests Operate 5. Server sends Operate respond-		
<u>Comment</u>		

cSBOs4	Cancel	
IEC 61850-7-2 clause 17.2.2, 17.5.3.4 IEC 61850-8-1 clause 20.6		
<u>Expected result</u> 4. SUT indicates no error		
<u>Test description</u> 1. SUT requests Select 2. Server sends Select respond+ 3. SUT requests Cancel 4. Server sends Cancel respond+		
<u>Comment</u>		

**A4.12c Block 12c: Direct Control with Enhanced Security**

Test case	Test case description
cDOes1	OperReq[test ok] resp+: Send a correct Operate request. <ul style="list-style-type: none"> <li>a) Check that the client notice the operation ended positively when it receives the CommandTermination+.</li> <li>b) Check that the client notice the operation ended negatively when it receives the CommandTermination- (PIXIT)</li> </ul>
cDOes2	OperReq[test not ok] resp-: Send an Operate request, thereby making sure the device will generate a 'test not OK'. Check that the client realizes the operation failed (PIXIT)
cDOes3	TimOperReq[test not ok] resp-: Send a TimeActivated Operate request, thereby making sure the device will generate a 'test not Ok'. Check that the client realizes the operation failed.
cDOes4	TimOperReq[test ok] resp+: Send a correct TimeActivated Operate request. <ul style="list-style-type: none"> <li>a) Check that the client realizes the operation request succeeded.</li> <li>b) Check that the client notice the operation ended positively when it receives the CommandTermination+.</li> <li>c) Check that the client notice the operation ended negatively when it receives the CommandTermination-.</li> </ul>

Detailed test procedures for Direct Control with enhanced security (DOes), excluding TimeActivatedOperate.

cDOes1	Successfull Operate with command termination	
IEC 61850-7-2 clause 17.3.2, 17.5.3.5 IEC 61850-8-1 clause 20.7 and 20.8 PIXIT		
<u>Expected result</u> a. SUT indicates Operate or Command termination success b. SUT indicates Operate or Command termination failure (PIXIT)		
<u>Test description</u> a. SUT requests Operate, server simulator sends Operate respond+ and CommandTermination+ b. SUT requests Operate and force server simulator to send Operate respond+ and CommandTermination-		
<u>Comment</u>		

cDOes2	Operate failure	
IEC 61850-7-2 clause 17.3.2, 17.5.3.5 IEC 61850-8-1 clause 20.7 and 20.8 PIXIT		
<u>Expected result</u> 3. SUT indicates Operate failure (PIXIT)		
<u>Test description</u> 1. Force server simulator to send Operate respond- 2. SUT requests Operate 3. Server sends Operate respond- followed by a information report with LastApplicationError		
<u>Comment</u>		

**A4.12d Block 12d: Enhanced SBO Control**

Test case	Test case description
cSBOes1	SelectWithValue [test not ok] resp-: Select device using SelectWithValue resulting in test not ok. Check the client indicates an error.
cSBOes2	SelectWithValue [test ok] resp+ and OperReq[test ok] resp+ of selected object Select device using correct SelectWithValue. Perform a correct Operate request. Check the client indicates no error after receiving the command termination+
cSBOes3	SelectWithValue [test ok] resp+ and OperReq[test not ok] resp- of selected object. Perform a SelectWithValues and Operate request. The Operate results in test not ok. Check that the client realizes the operation failed.
cSBOes4	SelectWithValue [test ok] resp+ and CancelReq of selected object. Perform a correct Cancel request. Check the client indicates no error.
cSBOes5	SelectWithValue [test ok] resp+ and TimOperReq[test ok] resp+ of selected object Perform a correct TimOperate request. Check that the client realizes the operation succeeded after the WaitForActionTime and detects the CommandTermination with the result of the order.
cSBOes6	SelectWithValue [test ok] resp+ and TimOperReq[test ok] resp- of selected object Perform a SelectWithValue and TimOperate request. The TimeOperate results in test not ok. Check that the client realizes the operation failed.

Detailed test procedures for SBO Control with enhanced security (SBOes), excluding TimeActivatedOperate.

cSBOes1	SelectWithValue – test not ok	
IEC 61850-7-2 clause 17.3.3, 17.5.3.3 IEC 61850-8-1 clause 20.5, 20.8		
<u>Expected result</u>		
2. SUT indicates SelectWithValue failure		
<u>Test description</u>		
1. SUT requests SelectWithValue 2. Server sends SelectWithValue respond- and information report with lastApplicationError		
<u>Comment</u>		

cSBOes2	SelectWithValue and successfull Operate	
IEC 61850-7-2 clause 17.3.3, 17.5.3.5 IEC 61850-8-1 clause 20.5, 20.7, 20.8		
<u>Expected result</u> 4. SUT indicates no Operate failure		
<u>Test description</u> 1. SUT request SelectWithValue 2. Server sends SelectWithValue respond+ 3. SUT requests Operate 4. Server sends Operate respond+ and CommandTermination+		
<u>Comment</u>		

cSBOes3	SelectWithValue and failed Operate	
IEC 61850-7-2 clause 17.3.3, 17.5.3.5 IEC 61850-8-1 clause 20.5, 20.7, 20.8		
<u>Expected result</u> 4. SUT indicates Operate failure		
<u>Test description</u> 1. SUT request SelectWithValue 2. Server sends SelectWithValue respond+ 3. SUT requests Operate 4. Server sends Operate respond+ and CommandTermination- with lastApplicationError		
<u>Comment</u>		



cSBOes4	Cancel	
IEC 61850-7-2 clause 17.3.3, 17.5.3.4 IEC 61850-8-1 clause 20.6, 20.8		
<u>Expected result</u> 4. SUT indicates no failure		
<u>Test description</u> 1. SUT request SelectWithValue 2. Server sends SelectWithValue respond+ 3. SUT requests Cancel 4. Server sends Cancel respond+ and information report with lastApplicationError		
<u>Comment</u>		

**A4.13 Block 13: Time and time synchronization**

cTm1	Verify the SUT supports the SCSM time synchronisation, Change the time in the time server and verify the SUT uses the new time
cTm2	Check the SUT timestamp accuracy matches the documented timestamp quality

cTmN1	Verify that a lost time synchronisation is detected after a specified period and the timestamp quality invalid is set
cTmN2	Verify the SUT handles the time stamp quality coming from the time server

Detailed test procedures for Time and time synchronization

cTm1 cTm2	Time synchronisation	
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21 PIXIT		
<u>Expected result</u>		
<ol style="list-style-type: none"> <li>1. SUT timestamp accuracy matches with the documented accuracy</li> <li>3. SUT uses the new timestamp</li> </ol>		
<u>Test description</u>		
<ol style="list-style-type: none"> <li>1. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp</li> <li>2. Test engineer changes the time of the time server and waits till SUT has received the new time synch message</li> <li>3. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp</li> </ol>		
<u>Comment</u>		

cTmN1	Time synchronisation lost	
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21, PIXIT		
<u>Expected result</u> 1. SUT uses the correct timestamp 3. SUT uses the timestamp with “time synch lost” 5. SUT uses the correct timestamp		
<u>Test description</u> 1. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp 2. Test engineer stops or disconnects the time server and waits for the SUT to detect the time server is lost 3. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp 4. Test engineer restarts or reconnects the time server and waits till SUT has received the time synch message 5. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp		
<u>Comment</u>		

cTmN2	Time synchronisation with ClockFailure from time server	
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21, PIXIT		
<u>Expected result</u> 1. SUT uses the correct timestamp and quality 3. SUT uses the timestamp quality with “ClockFailure”		
<u>Test description</u> 1. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp 2. Test engineer forces “ClockFailure” in SNTP time server 3. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp		
<u>Comment</u>		

**A4.14 Block 14: File transfer**

cFt1	Verify that the client requests a GetServerDirectory(FILE) with correct parameters and handles the response (IEC 61850-7-2 clause 6.2.2)
cFt2	Verify that the client requests a GetFileAttributeValues with correct parameters and verify the SUT handles the response (IEC 61850-7-2 clause 20.2.4)
cFt3	Verify that the client requests a GetFile with correct parameters and verify the SUT handles the response (IEC 61850-7-2 clause 20.2.1)
cFt4	The client requests a SetFile service with a small and large file and verify the client sends the resulting file(s)
cFt5	Verify the client requests a DeleteFile with correct parameters and verify the SUT handles the response

cFtN1	Force SERVER SIMULATOR to respond– on GetFile request, and verify the client reports an error
cFtN2	Force SERVER SIMULATOR to respond– on GetFileAttributeValues request, and verify the client reports an error
cFtN3	Force SERVER SIMULATOR to respond– on SetFile request, and verify the client reports an error

Detailed test procedures for File transfer

cFt1 cFt2	GetServerDirectory(FILE) GetFileAttributeValues	
IEC 61850-7-2 clause 6.2.2 IEC 61850-8-1 clause 9.3, 23.2 PIXIT		
<u>Expected result</u> 1. SUT displays or stores the GetServerDirectory response		
<u>Test description</u> 1. SUT requests GetServerDirectory(FILE) with and without folder name 2. Server sends MMS fileDirectory respond with file names (with/without path) and file size		
<u>Comment</u> GetServerDirectory(FILE) and GetFileAttributeValues are mapped on the same MMS service		

cFt3	GetFile	
IEC 61850-7-2 clause 20.2.1 IEC 61850-8-1 clause 23.2.1 PIXIT: file size 0		
<u>Expected result</u> 2. SUT stores the file 4. SUT stores the file 6. SUT stores the file		
<u>Test description</u> 1. SUT requests GetFile of a small file of about 1kB 2. Server sends GetFile respond+ 3. SUT requests GetFile of a file with file size 0 (unknown) 4. Server sends GetFile respond+ 5. SUT requests GetFile of a large file of about 1MB 6. Server sends GetFile respond+		
<u>Comment</u>		

cFt4	SetFile	
IEC 61850-7-2 clause 20.2.2 IEC 61850-8-1 clause 23.2.2 PIXIT		
<u>Expected result</u> 2. SUT sends the file to the server 4. SUT sends the file to the server		
<u>Test description</u> 1. SUT request SetFile of a small file of about 1kB 2. Server sends SetFile respond+ 3. SUT request SetFile of a large file of about 1MB 4. Server sends SetFile respond+		
<u>Comment</u>		

cFt5	DeleteFile	
IEC 61850-7-2 clause 20.2.2 IEC 61850-8-1 clause 23.2.3		
<u>Expected result</u> 2. SUT indicates no error		
<u>Test description</u> 1. SUT request DeleteFile 2. Server sends DeleteFile respond+		
<u>Comment</u>		

cFtN1	GetFile negative	
IEC 61850-7-2 clause 20.2.1 IEC 61850-8-1 clause 23.2.1 PIXIT		
<u>Expected result</u> 2. SUT reports an error		
<u>Test description</u> Test engineer forces server simulator to respond with GetFile respond- 1. SUT requests GetFile 2. Server sends GetFile respond-		
<u>Comment</u>		

cFtN2	GetFileAttributeValues negative	
IEC 61850-7-2 clause 20.2.4 IEC 61850-8-1 clause 23.2.4 PIXIT		
<u>Expected result</u> 2. SUT reports an error		
<u>Test description</u> Test engineer forces server simulator to respond with GetFileAttributeValues respond- 1. SUT requests GetFileAttributeValues 2. Server sends GetFileAttributeValues respond-		
<u>Comment</u>		

cFtN3	SetFile response-	
IEC 61850-7-2 clause 20.2.2 IEC 61850-8-1 clause 23.2.2		
<u>Expected result</u> 2. SUT reports an error		
<u>Test description</u> Test engineer forces server simulator to respond negative on the next SetFile request 1. SUT requests SetFile 2. Server simulator sends SetFile response-		
<u>Comment</u>		

A5 Mapping on GOOSE (IEC 61850-7-2 and IEC 61850-8-1)

The test procedures are structured according to conformance blocks. The following table specifies which ACSI services, mapped on GOOSE, are mandatory/optional for IEC 61850-8-1 Client systems.

**Table A.5.1:** ACSI services per conformance block for IEC 61850-8-1 Client systems

<b>Conformance Block</b>	<b>Mandatory</b>	<b>Optional</b>
9b: GOOSE subscribe	SendGOOSEMessage (subscribe)	

The following table specifies which test procedures are mandatory/conditional for each conformance block. Conditions refer to the SCL - IED - Services section, the PICS or PIXIT.

**Table A.5.2:** Test procedures per conformance block

<b>Conformance Block</b>	<b>Mandatory</b>	<b>Conditional</b>
9b: GOOSE subscribe	cGos1, cGos2_cGos3, cGosN1, cGosN2, cGosN3, cGosN4, cGosN5, cGosN6	

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



### A5.9b Block 9b: GOOSE subscribe

Both the IEC 61850 client and server can behave as a GOOSE subscriber. The abstract GOOSE subscribe test cases defined for the server are copied for the client. The detailed test procedures will be different.

cGos1	Send single GOOSE message <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
cGos2	Send single GOOSE message with the Test or ndsCom parameter set. Verify that on a status change the values are not used for operational purposes (IEC 61850-7-2 clause 15.2.3.8)
cGos3	Proper detection and action roll-over of sqNum with no status change (sqNum=max -> sqNum = 1) and with status change (sqNum=max -> sqNum = 0)

cGosN1	Check behaviour of SUT as specified in PIXIT on Missing GOOSE message
cGosN2	Check behaviour of SUT as specified in PIXIT on Double GOOSE message
cGosN3	Check behaviour of SUT as specified in PIXIT on Delayed GOOSE message, with and without exceeding timeAllowedToLive
cGosN4	Check behaviour of SUT as specified in PIXIT on Out of order GOOSE message
cGosN5	Check behaviour of SUT as specified in PIXIT on No GOOSE messages
cGosN6	Check behaviour of SUT 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>numDatSetEntries</u> 0, more, less with the number of data entries in the allData</li> <li>- <u>allData</u> values do not match with the datSet element type</li> <li>- APPID different from SCL and 0 (IEC 61850-8-1 Annex C)</li> </ul>

The detailed test procedures need to be defined.

## A6 Free form testing

For free form testing a test lab can add extra test cases/procedures and propose these to the UCA IUG. The UCA IUG decides if and how to include the test case in the next revision.

## **ANNEX B – Detailed description of test results**

This appendix contains detailed comments on test results, for instance when a defect is detected or to explain an inconclusive test result, including the actual message flow if appropriate.

<Test procedure identifier X>

<Additional extra information, e.g. a trace dump>

## ANNEX C – PIXIT Template for Client

### Introduction

This document specifies the protocol implementation extra information for testing (PIXIT) of the IEC 61850 interface in the client system: “<product>” with version “<version>”, further referred to as “client”.

Together with the PICS and the MICS the PIXIT forms the basis for a conformance test according to IEC 61850-10.

The following chapters specify the PIXIT for each applicable ACSI service model as structured in IEC 61850-10 and the “Conformance Test Procedures for Client System with IEC 61850-8-1 interface”.

### PIXIT for Configuration

Description	Value / Clarification
Describe how the client handles nameplate configuration revision mismatches	
Describe how the client handles report control block configuration revision mismatches	
<additional items>	

### PIXIT for Association model

Description	Value / Clarification
Garanteed number of servers that can set-up an association simultaneously (one association per server)	
Lost connection detection time range (default range of TCP_KEEPALIVE is 1 – 20 seconds)	... seconds
Lost (abort) connection retry time	... seconds
Is authentication supported	Y/N

Description	Value / Clarification
What is the maximum and minimum MMS PDU size	Max MMS PDU size Min MMS PDU size
What is the typical startup time after a power supply interrupt	
<additional items>	

**PIXIT for Server model**

Description	Value / Clarification
Maximum object identification length	129 octets: <64>/<64>
Does client support autodescription	<describe the autodescription procedure>
What analogue value (MX) quality bits are used in the client	Y/N Good, Y/N Invalid, Y/N Reserved, Y/N Questionable Y/N Overflow Y/N OutofRange Y/N BadReference Y/N Oscillatory Y/N Failure Y/NOldData Y/N Inconsistent Y/N Inaccurate Y/N Process Y/N Substituted Y/N Test Y/N OperatorBlocked
Which status value (ST) quality bits are used in the client	Y/N Good, Y/N Invalid, Y/N Reserved, Y/N Questionable Y/N BadReference Y/N Oscillatory Y/N Failure Y/NOldData

Description	Value / Clarification
	Y/N Inconsistent Y/N Inaccurate Y/N Process Y/N Substituted Y/N Test Y/N OperatorBlocked
Describe how to view/display quality values	
Describe how to force a SetDataValues request	
Describe how to force a GetAllDataValues request	
Describe how the client behaves in case of: - GetDataDefinition response- - GetLogicalDeviceDirectory response- - GetAllDataValues response- - GetDataValues response- - SetDataValues response-	

**PIXIT for Data set model**

Description	Value / Clarification
Describe how to force a GetDataSetValues request	
Describe how to force a SetDataSetValues request	
Describe how to force a DeletaDataSet request	
Describe how the client handles following dataset mismatches between the SCL and the data sets exposed via MMS: (1) new dataset element (2) missing dataset element (3) Reordered dataset elements in a dataset of a different data type (4) Reordered dataset elements in a dataset of the same data type	
Describe how the client behaves in case of: - GetLogicalNodeDirectory(DATA-SET) response- - GetDataSetDirectory response-	
Does the client create: - persistent datasets - non-persisten datasets	Y/N Y/N
Describe how the client behaves in case of: - CreateDataSetDirectory response- - DeleteDataSet response-	
<additional items>	

**PIXIT for Substitution model**

Description	Value / Clarification
Describe how to substitute a value	
<additional items>	

**PIXIT for Setting group control model**

Description	Value / Clarification
Describe how to change the active setting group	
Describe how to get the actual setting group values	
Describe how to edit setting group values	
Describe how the client behaves in case of: - GetSGCBValues response- - The configured SG is different then the actual setting group	
<additional items>	

**PIXIT for Reporting model**

Description	Value / Clarification
Does the client search for RCB in all logical nodes? when not specify the logical nodes	All logical nodes or The following logical nodes:
Which dynamic RCB attributes are/can be configured by the client	RptID                    Y/N DataSet                Y/N Optional fields        Y/N Trigger conditions    Y/N Buffer time            Y/N Integrity period       Y/N
Does the client supports IED's with indexed and non-indexed report control	Buffered RCB indexed    Y/N Buffered RCB not indexed Y/N



blocks (RCB)	Unbuffered RCB indexed Y/N Unbuffered RCB not indexed Y/N
The supported trigger conditions are	integrity Y/N data change Y/N quality change Y/N data update Y/N general interrogation Y/N
The minimum required optional fields are	sequence-number Y/N report-time-stamp Y/N reason-for-inclusion Y/N data-set-name Y/N data-reference Y/N buffer-overflow Y/N entryID Y/N conf-rev Y/N
Does the client support segmented reports	Y/N
Does the client support pre-assigned RCB	Y/N
Does the client support reported data set containing structured data objects or data attributes?	reporting of data objects Y/N reporting of data attributes Y/N
Describe how the client does respond when an URCB is already reserved	
Describe how the client does respond when a BRCB is already reserved	
Describe how the client does respond on a SetBRCBValues(EntryID) respond-	
Describe how the client does respond when a report has an unknown: dataset, RptId, unexpected number of dataset entries, and/or unexpected data type format entries	
Describe how the client detect reporting configuration changes (mismatches). Does it check the "configuration revision" attributes and/or does it check the dataset elements?	
Describe how to force the client to change	

the RCB buffertime	
<additional items>	

**PIXIT for Logging model**

Description	Value / Clarification
Does the client search for LCB in all logical nodes? when not specify the logical nodes	All logical nodes or The following logical nodes:
Describe how to change LOG and LCB attributes	
<additional items>	

**PIXIT for Generic substation events model**

Description	Value / Clarification																					
What elements of a subscribed GOOSE header are checked to decide the message is valid and the allData values are accepted?	<table border="0"> <tr> <td>N</td> <td>source MAC address</td> <td>= ignored</td> </tr> <tr> <td>Y</td> <td>dest. MAC address</td> <td>= SCL match</td> </tr> <tr> <td>N</td> <td>VLAN id</td> <td>= ignored</td> </tr> <tr> <td>N</td> <td>VLAN priority</td> <td>= ignored</td> </tr> <tr> <td>Y</td> <td>Ethertype</td> <td>= 0x88B8</td> </tr> <tr> <td>Y/N</td> <td>gocbRef</td> <td>= SCL match</td> </tr> <tr> <td>Y/N</td> <td>timeAllowedtoLive</td> <td>= see below</td> </tr> </table>	N	source MAC address	= ignored	Y	dest. MAC address	= SCL match	N	VLAN id	= ignored	N	VLAN priority	= ignored	Y	Ethertype	= 0x88B8	Y/N	gocbRef	= SCL match	Y/N	timeAllowedtoLive	= see below
N	source MAC address	= ignored																				
Y	dest. MAC address	= SCL match																				
N	VLAN id	= ignored																				
N	VLAN priority	= ignored																				
Y	Ethertype	= 0x88B8																				
Y/N	gocbRef	= SCL match																				
Y/N	timeAllowedtoLive	= see below																				
Ignored = element value is not checked, message will be accepted	<table border="0"> <tr> <td>Y/N</td> <td>datSet</td> <td>= SCL match</td> </tr> <tr> <td>Y/N</td> <td>gold</td> <td>= SCL match</td> </tr> <tr> <td>N</td> <td>t</td> <td>= ignored</td> </tr> <tr> <td>Y/N</td> <td>stNum</td> <td>= &lt;describe&gt;</td> </tr> </table>	Y/N	datSet	= SCL match	Y/N	gold	= SCL match	N	t	= ignored	Y/N	stNum	= <describe>									
Y/N	datSet	= SCL match																				
Y/N	gold	= SCL match																				
N	t	= ignored																				
Y/N	stNum	= <describe>																				
SCL match = element value should match with the configuration, otherwise the GOOSE message will be ignored	<table border="0"> <tr> <td>Y/N</td> <td>sqNum</td> <td>= see below</td> </tr> <tr> <td>Y/N</td> <td>test</td> <td>= false (true will be ignored)</td> </tr> <tr> <td>Y/N</td> <td>confRev</td> <td>= SCL match</td> </tr> <tr> <td>Y/N</td> <td>ndsCom</td> <td>= false (true will be ignored)</td> </tr> <tr> <td>Y/N</td> <td>numDatSetEntries</td> <td>= SCL match</td> </tr> </table>	Y/N	sqNum	= see below	Y/N	test	= false (true will be ignored)	Y/N	confRev	= SCL match	Y/N	ndsCom	= false (true will be ignored)	Y/N	numDatSetEntries	= SCL match						
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Y/N	confRev	= SCL match																				
Y/N	ndsCom	= false (true will be ignored)																				
Y/N	numDatSetEntries	= SCL match																				
For the checked GOOSE header elements describe the checking conditions in more detail when necessary																						
What is the behavior when one subscribed																						

Description	Value / Clarification
GOOSE message isn't received or syntactically incorrect (missing GOOSE)	
What is the behavior when one subscribed GOOSE message exceeds the previous time Allowed to Live (TAL)	
What is the behavior when a subscribed GOOSE message is out-of-order	
What is the behavior when a subscribed GOOSE message is duplicated	
May the GOOSE data set contain structured data objects?	Y/N
<additional items>	

**PIXIT for Control model**

Description	Value / Clarification
What control modes are supported	Y/N status-only Y/N direct-with-normal-security Y/N sbo-with-normal-security Y/N direct-with-enhanced-security Y/N sbo-with-enhanced-security
Is Time activated operate (operTm) supported	Y/N
Is "operate-many" supported	Y/N
Can the client set the test flag?	Y/N
What check conditions can be set	Y/N synchrocheck Y/N interlock-check
Which originator categories are supported and what is the originator identification?	
Describe if and how the client sets/increments the ctlNum	
What does the client when its receives a LastApplicationError and describe how to view the additional cause?	For example display / store the AddCause

Description	Value / Clarification
What does the client when its receives a Select, SelectWithValue or Operate respond negative ?	For example display error
Can the client change the control model via online services?	
What does the client when the ctlModel is not initialized in the SCL?	
<additional items>	

**PIXIT for Time and time synchronisation model**

Description	Value / Clarification
Described how to view the internal time & quality or how to expose the timestamp and timestamp quality via the IEC 61850 interface	View: Expose: for example in Operate request
What time quality bits are supported	Y/N LeapSecondsKnown Y/N ClockFailure Y/N ClockNotSynchronized
What is the behavior when the time synchronization signal/messages are lost	
When is the quality bit "Clock failure" set?	
When is the quality bit "Clock not synchronised" set?	
<additional items>	

**PIXIT for File transfer model**

Description	Value / Clarification
Describe when or how to force the client to request GetServerDirectory(FILE) and what it does with the responded filenames	
Does the client uses a wildcard in the GetServerDirectory(FILE) request	Yes, wildcard = "*" or "*.*" No

Description	Value / Clarification
Does the client support IED's that include the path in the file name in the GetServerDirectory(FILE) respond?	Y/N path included Y/N path not included
Does the client support IED's that use the fileseparator	Y/N "/" Y/N "\"
What is the maximum file name size including path	
Can the client read a file with size 0	Y/N
Are directory/file name case sensitive	Case sensitive
Maximum file size	
Describe how the client behaves in case of: - GetFileAttributes response-	
<additional items>	