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

Revision 1.1

On request of the UCA International Users Group

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Revision	Changes
Rev 1.0	Updated according the comments agreed upon during teleconference March 3
Rev 1.05	Updated test procedures according to comments from testing sub committee and pilot test results: - Separate combined test procedures and clarify test procedures - Updated table A4.1 and A4.2 - Comments received from testsub are marked as blue
Rev 1.09	Updated Rev 1.05 testprocedures according to the UCA approved comments from 24 September 2009.
Rev 1.1	Approved by the UCAIUG test sub committee

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 the test environment used for this conformance test of a IEC 61850 CLIENT system.

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

Test Procedures Change List (TPCL) for IEC 61850 client test procedures revision 1.1 Version 1.0 (when available)

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

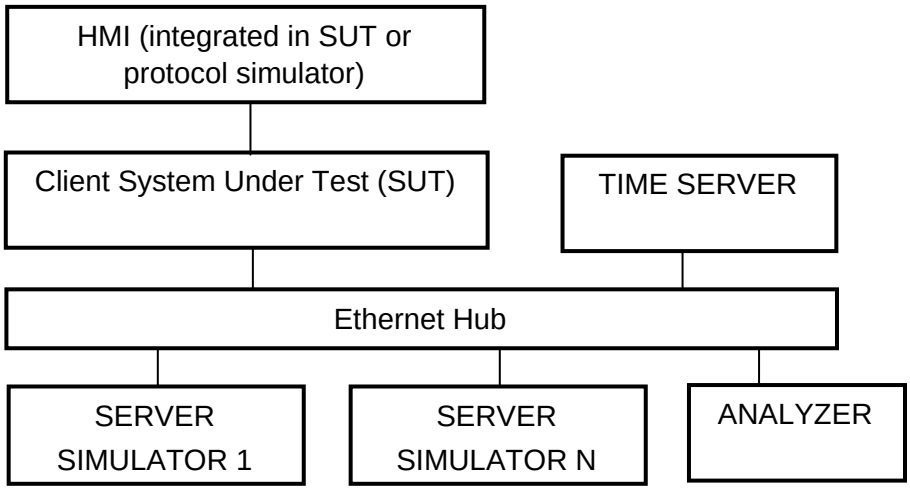

Figure 3.1 The test environment

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:

- Modeling:
  - contain all common data classes supported by the SUT
  - contain several new data objects within a standard logical node
  - contain several new data attributes within a standard data object (common data class)
  - contain several new enum types and enum values
- Configuration:
  - one or more servers with preconfigured datasets with data objects
  - one or more servers with dynamic datasets (when supported by SUT)
  - one or more servers with report control block indexing
  - one or more servers without report control block indexing
- Communication:
  - support all conformance blocks supported by the SUT in one or more servers
  - support all ASCI services supported by the SUT
  - 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)
  - Application Association
  - Server & Logical Device & Logical Node & Data
  - Data Set
  - Substitution
  - Setting Group Control
  - Unbuffered and Buffered Reporting
  - Logging
  - Generic Substation Events
  - Control
  - Time Synchronization
  - File Transfer

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 shall 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			
Conformance block			
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			

Test Group	Passed	Failed (*)	Inconclusive(*)
12c: Enhanced Direct Control			
12d: Enhanced SBO control			
13: Time Sync			
14: File Transfer			
TOTALS			

(*) column only when applicable

5 CONCLUSION AND RECOMMENDATIONS

When all applicable 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 the IEC 61850 standard, *PICS, MICS, TICS, PIXIT* documents 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 Test procedures and results

A1 Documentation and version control (IEC 61850-4)

Id	Test procedure	Verdict
cDoc1	Check if the major/minor software version in the PICS documentation and the SUT do match (IEC61850-4)	
cDoc2	Check if the major/minor software version 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 major/minor software version in 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 major/minor software version 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, for example arrays	

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 as described in the PIXIT. On a mismatch the SUT shall behave as described In the PIXIT (note that, if the PIXIT describes that the SUT does not check such a mismatch, no action is required by the SUT)	

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

Id	Test procedure	Verdict
cMdl1	Verify that the client can handle the maximum name length and expands objects like SDOs correctly (PIXIT)	
cMdl2	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	
cMdl3	Verify that SUT can read and process 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/conditional 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**	**Conditional**
1: Basic Exchange	Associate Abort and/or Release GetDataValues	GetAllDataValues SetDataValues GetServerDirectory GetLogicalDeviceDirectory GetLogicalNodeDirectory (DATA) GetDataDirectory GetDataDefinition
2: Data Set	GetLogicalNodeDirectory (DATA-SET) GetDataSetDirectory	GetDataSetValues SetDataSetValues
2+: Data Set Definition	CreateDataSet DeleteDataSet	
3: Substitution	SetDataValues	GetLogicalNodeDirectory (SGCB)
4: Setting Group Selection	SelectActiveSG GetSGCBValues	
4+: Setting Group Definition	SelectEditSG, GetSGValues SetSGValues ConfirmEditSGValues	
5: Unbuffered Reporting	**Receive** Report GetURCBValues SetURCBValues	GetLogicalNodeDirectory (URCB)
6: Buffered Reporting	**Receive** Report GetBRCBValues SetBRCBValues	GetLogicalNodeDirectory (BRCB)
7: Logging	GetLCBValues GetLogicalNodeDirectory (LOG) QueryLogByTime or QueryLogAfter GetLogStatusValues	GetLogicalNodeDirectory (LCB) SetLCBValues
12a: Direct control	Operate	TimeActivatedOperate
12b: SBO control	Select, Operate	Cancel, TimeActivatedOperate
12c: Enhanced Direct Control	Operate **Receive** CommandTermination	TimeActivatedOperate
12d: Enhanced SBO control	SelectWithValue, Operate **Receive** CommandTermination	Cancel, TimeActivatedOperate

Conformance Block	Mandatory	Conditional
13: Time sync	TimeSynchronization	
14: File transfer	GetServerDirectory(FILE) GetFileAttributeValues GetFile	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, cAssN4, cAssN5, cAssN6, cSrv5, cSrvN3	Automatic startup: cAssN7 GetXxxDirectory[1]: cSrv1, cSrv2, cSrv3, cSrv4, cSrvN1 SetDataValues: cSrv6, cSrvN4 GetAllDataValues: cSrv7, cSrvN2 Quality: cSrvN5 TimeQuality: cSrvN6
2: Data Sets	cDs1, cDs2, cDs5, 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	GetLogicalNodeDirectory(SGCB): cSg1 GetSettingGroupValues: Sg3
4+: Setting Group Definition	cSg3, cSg4	
5: Unbuffered Reporting	cRp2, cRp3, cRp4, cRp5, cRp8, cRp9, cRp10 cRpN2, cRpN3, cRpN7, cRpN8	GetLogicalNodeDirectory(URCB): cRp1, cRpN1 Buffer time: cRp6 General interrogation: cRp7 Reserved: cRpN4 Unsupported optflds: cRpN5 Unsupported trigger: cRpN6

[1] GetXxxDirectory = GetServerDirectory, GetLogicalDeviceDirectory, GetLogicalNodeDirectory(DATA), GetDataDirectory and GetDataDefinition

Conformance Block	Mandatory	Conditional
6: Buffered Reporting	cBr2, cBr3, cBr4, cRp5, cBr8, cBr9, cBr10, cBr11, cBr12, cBrN2, cBrN3, cBrN7, cBrN8, cBrN9	GetLogicalNodeDirectory(BRCB): cBr1, cBrN1 Buffer time: cBr6 General interrogation: cBr7 Purge buffer: cBr13 Reserved: cBrN4 Unsupported optflds: cBrN5 Unsupported trigger: cBrN6
12a: Direct control	cCtl4, cCtlN1, cDOns1, cDOns2	Test: cCtl1 Check: cCtl2 Change control model: cCtl3
12b: SBO control	cCtl4, cCtlN1, cSBOns1, cSBOns2, cSBOns3	Test: cCtl1 Check: cCtl2 Change control model: cCtl3 Cancel: cSBOns4
12c: Enhanced Direct Control	cCtl4, cCtlN1, cDOes1, cDOes2	Test: cCtl1 Check: cCtl2 Change control model: cCtl3
12d: Enhanced SBO control	cCtl4, cCtlN1,cSBOes1, cSBOes2, cSBOes3	Test: cCtl1 Check: cCtl2 Change control model: cCtl3 Cancel: cSBOes4
13: Time sync	cTm1	Optional: cTm2 TimeQuality: cTmN2 ClockNotsynchronized: cTmN1
14: File transfer	cFt1, cFt2, cFt3, cFtN1, cFtN2	SetFile: cFt4, cFtN3 DeleteFile: cFt5

Note1: cAssN2 and cAssN3 are not applicable for part 8-1
Note2: Time activated control and logging test procedures are not available yet
Note3: cCtlN2 is out of scope for IEC 61850 conformance testing

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 (IEC 61850-7-2 7.4, 8-1 10.2)
cAss2	Force the client to associate with maximum number of servers simultaneously (PIXIT).
cAss3	Verify that losing and restoring the TPAA between SUT and server has no effect on existing TPAA between SUT and other servers.
cAss4	Verify the client can handle servers with small (4k) and large (64k) MMS PDU size, the client should keep on proposing it's original MMS PDU size

Note1: The client is always considered to be the calling node

Test case	Test case description
cAssN1	Associate and server responds with negative response due to AccessPoint mismatch.
cAssN2	Associate and server responds with negative response due to AuthenticationParameter mismatch.
cAssN3	Associate and server releases TPAA (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 (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 (IEC 61850-7-2 7.4). SUT should try to re-establish the association after the configured period (PIXIT).
cAssN6	Disconnect the communication interface, the SUT should detect link lost within a specified period.
cAssN7	Interrupt and restore the power supply, the SUT shall automatically establish the configured associations when ready (PIXIT).

Detailed test procedures for Application Association

cAss1	Associate and force client to release a TPAA (IEC 61850-7-2, 7.4)	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 1. SUT accepts Associate.response+ from server 2. SUT returns to “state” where it is able to start a new TPAA with the same server		
Test description 1. Set-up a TPAA with one server 2. Force SUT to release or abort TPAA 3. Repeat step 1 and 2, 10 times		
Comment		

cAss2	Associate to maximum servers	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 1. SUT accepts Associate.response+ from all servers 2. SUT returns to “state” where it is able to start new TPAAs with the same servers		
Test description 1. Set-up a TPAA with the maximum number of servers as specified in the PIXIT 2. Force SUT to release or abort all open TPAAs 3. Repeat step 1 and 2, 10 times		
Comment Tested with X servers		

cAss3	Restore lost association	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4, figure 7 and 8 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 1. SUT accepts Associate.response+ from all servers 2. SUT detects connection loss and tries to reconnect to the server. All other TPAAs shall remain active. 3. SUT successfully restores the connection to the server 4. SUT receives and accepts the Release.response+ from all servers or receives and accepts the abort response+ from all servers		
Test description 1. Set-up a TPAA with at least two servers 2. Force a TPAA disconnect for one server 3. Restore the situation where the disconnected server is able to accept a new TPAA 4. Force SUT to release or abort all TPAAs		
Comment		

cAss4	Verify that the client can handle servers with small and large MMS PDU size	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 1. Client accepts Associate.response+ from all servers 2. SUT receives and accepts the Release.response+ from all servers or receives and accepts the abort response+ from all servers		
Test description 1. Set-up a TPAA with at least two servers where one server has a small PDU size (4k), and the other server has a large PDU size (64k). 2. Force SUT to release or abort all open TPAAs		
Comment Tested with X servers		

cAssN1	Access point mismatch	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-8-1 clause 10.2, 25 and table 111 PIXIT		
Expected result 2. The TPAA fails 4. The TPAA fails 6. The TPAA fails		
Test description 1. Set-up the SUT and one server to have a mismatching Transport Selector 2. Set-up a TPAA between the SUT and the server 3. Set-up the SUT and one server to have a mismatching Presentation Selector 4. Set-up a TPAA between the SUT and the server 5. Set-up the SUT and one server to have a mismatching Session Selector 6. Set-up a TPAA between the SUT and the server		
Comment		

cAssN2	AuthenticationParameter mismatch.	Out of scope
PIXIT		
Expected result		
Test description		
Comment This testcase is not applicable for edition 1 of IEC 61850.		

cAssN3	Server release	Out of scope
Expected result		
Test description		
Comment This testcase is out of scope for the IEC 61850 Client conformance test.		

cAssN4	Server abort	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 1. SUT accepts Associate.response+ from server 2. SUT receives and responds correctly to the abort request from the server		
Test description 1. Set-up a TPAA with one server 2. Force server to abort TPAA 3. Repeat step 1 and 2, 10 times		
Comment		

cAssN5	Server deny	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 2. SUT detects the Association failure and responds as specified in the PIXIT.		
Test description 1. Set-up test configuration with at least two servers 2. Force the SUT to perform an Associate request for all servers which is denied (response-) by one server caused by a mismatching session or presentation selector 3. Repeat step 1 and 2, 10 times		
Comment		

cAssN6	Detection of lost link	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 3. SUT shall detect the lost link and shall try to reconnect to the server 4. SUT shall set-up a TPAA with the server		
Test description 1. Connect the SUT and one server to a hub 2. Set-up a TPAA with the server 3. Disconnect the physical link, between the hub and the server, some seconds longer than the timeout specified in the PIXIT 4. Reconnect the Ethernet cable		
Comment		

cAssN7	Power supply interrupt	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.4 IEC 61850-8-1 clause 10.2 PIXIT		
Expected result 3. SUT behaves as specified in the PIXIT.		
Test description 1. Set-up a TPAA between SUT and all servers as configured in SCL 2. Interrupt the power supply to SUT 3. Restore the power supply to SUT		
Comment		

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

Test case	Test case description
cSrv1	Check the SUT is able to request a GetServerDirectory(LOGICAL-DEVICE) for all the logical devices of the configured servers (See Note 2).
cSrv2	For each GetServerDirectory(LOGICAL-DEVICE) response check the client issues a GetLogicalDeviceDirectory request.
cSrv3	Force SUT to send a GetLogicalNodeDirectory(DATA) request for each responded Logical Node from cSrv2.
cSrv4	Force SUT to send the following requests for a subset of the GetLogicalNodeDirectory(DATA): 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 start-up 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 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	Check that the SUT 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 SUT is able to communicate with other connected servers after a request for GetAllDataValues fails in the following circumstances: a) The response is negative. b) The response comes with mismatching data objects.
cSrvN3	Check that the SUT is able to communicate with other connected servers after a request for GetDataValues fails in the following circuimstances: 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 SUT is able to communicate with other connected servers after a request for SetDataValues fails in the following circumstances: a) The response is negative. b) One of the data values is read-only

Test case	Test case description
cSrvN5	If SUT detects/notify changes in the “Quality” attribute, force a server to change the values in the Quality of the measured/status values monitored by the SUT and check the behaviour described in the PIXIT.
cSrvN6	If SUT detects/notify changes in the timeStamp’s “TimeQuality” attribute, force a server to change the values in the TimeQuality of the measured/status values monitored by the SUT and check the behaviour described in the PIXIT.

NOTE 2 “Client reports an error” can be anything to notify the end-user some error has happened

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

cSrv1	GetServerDirectory(LOGICAL-DEVICE)	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8, 9, 10 IEC 61850-8-1 clause 11, 12, 13		
Expected result 2. SUT accepts a GetServerDirectory.Response+ from the server		
Test description 1. Set-up a TPAA with at least two servers 2. SUT request for each server a GetServerDirectory(LOGICAL-DEVICE) 3. Continue with cSrv2		
Comment		

cSrv2	GetLogicalDeviceDirectory	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8, 9, 10 IEC 61850-8-1 clause 11, 12, 13		
Expected result 1. SUT accepts a GetLogicalDeviceDirectory.Response+ from the server		
Test description 1. SUT request for each responded LogicalDevice a GetLogicalDeviceDirectory 2. Continue with cSrv3		
Comment		

cSrv3	GetLogicalNodeDirectory	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8, 9, 10 IEC 61850-8-1 clause 11, 12, 13		
Expected result 1. SUT accepts a GetLogicalNodeDirectory(DATA).Response+ from the server		
Test description 1. SUT request for each responded LogicalNode a GetLogicalNodeDirectory(DATA) 2. Continue with cSrv4		
Comment		

cSrv4	GetDataDirectory / GetDataDefinition	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8, 9, 10 IEC 61850-8-1 clause 11, 12, 13		
Expected result 1. SUT accepts a GetDataDirectory/GetDataDefinition.Response+ from the server		
Test description 1. SUT request for responded dataobjects a GetDataDirectory/GetDataDefinition 2. Release the TPAA with all servers		
Comment - GetDataDirectory and GetDataDefinition are mapped to the MMS GetVariableAccessAttributes service		

cSrv5	GetDataValues	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.3, 10.4.2 IEC 61850-8-1 clause 12.3.2, 13.2.1 PIXIT		
Expected result 2-3.SUT accepts a GetDataValues.Response+ from server		
Test description 1. Set-up a TPAA with one server 2. SUT request GetDataValues of at least two data attributes 3. SUT request GetDataValues of at least two data objects		
Comment		

cSrv6	SetDataValues	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.4.3 IEC 61850-8-1 clause 13.2.2 PIXIT		
Expected result 2. SUT accepts a SetDataValues.Response+ from server		
Test description 1. Set-up a TPAA with one server 2. SUT request SetDataValues on a writable data attribute with FC = CF, DC, SP or on a non-standard EX with one of the basic type: boolean, integer, float, bitstring or enumerated.		
Comment		

cSrv7	GetAllDataValues	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.3, 10.4.2 IEC 61850-8-1 clause 12.3.2, 13.2.1 PIXIT		
Expected result 2. SUT accepts a GetAllDataValues.Response+ from server		
Test description 1. Set-up a TPAA with one server 2. SUT request GetAllDataValues of at least two Functional Constraints		
Comment		

cSrvN1	GetLogicalDeviceDirectory & GetDataDefinition negative	☐ Passed ☐ Failed ☐ Inconclusive

IEC 61850-7-2 clause 8.2.1, 10.4
IEC 61850-8-1 clause 11, 12, 13
PIXIT

Expected result

1,3,5,7,9,11.	SUT associates with the server and responds as specified in PIXIT. SUT shall continue with the other servers
2,4.	SUT accepts a GetLogicalDeviceDirectory.Response- from the server and continues as specified in PIXIT
6,8.	SUT accepts a GetDataDefinition.Response- from the server and continues as specified in PIXIT
10,12.	SUT receives a GetDataDefinition response and continues as specified in PIXIT

Test description

1. Reconfigure/rename the LogicalDevice for one server only and restart the server
2. SUT requests GetLogicalDeviceDirectory of the previously known logical device
3. Reconfigure/rename the LogicalNode (in a valid existing logical device) for one server only and restart the server
4. SUT requests GetLogicalDeviceDirectory of the previously known logical node
5. Reconfigure/rename a data object (in a valid existing logical node) for one server only and restart the server
6. SUT requests GetDataDefinition of the previously known data object
7. Reconfigure/rename a data attribute (in a valid existing data object) for one server only and restart the server
8. SUT requests GetDataDefinition of the previously known data attribute
9. Reconfigure CDC type of a data object (more data attributes then expected) for one server only and restart the server
10. SUT requests GetDataDefinition of a known data object with more data attributes then expected
11. Reconfigure CDC type of a data object (less attributes then expected) for one server only and restart the server
12. SUT requests GetDataDefinition of a known data object with less attributes then expected

Comment
See IEC 61850-7-4 for valid LogicalNode Names. For IEC 61850-8-1: - GetLogicalNodeDirectory(DATA) and GetLogicalDeviceDirectory are mapped to the MMS GetNamedList service - GetDataDirectory and GetDataDefinition are mapped to the MMS GetVariableAccessAttributes service

cSrvN2	GetAllDataValues negative	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.3 IEC 61850-8-1 clause 12.3.2 PIXIT		
Expected result 1,3,5,7. SUT associates with the server and responds as specified in PIXIT. SUT shall continue with the other servers 2,4. SUT accepts a GetAllDataValues.Response- from the server and continues as specified in PIXIT 6,8. SUT receives a GetAllDataValues response and continues as specified in PIXIT		
Test description 1. Reconfigure/rename the LogicalDevice for one server only and restart the server 2. SUT requests GetAllDataValues of the previously known logical device 3. Reconfigure/rename the LogicalNode (in a valid existing logical device) for one server only and restart the server 4. SUT requests GetAllDataValues of the previously known logical node 5. Reconfigure CDC type of a data object (more data attributes then expected) for one server only and restart the server 6. SUT requests GetAllDataValues of a known data object with more data attributes then expected 7. Reconfigure CDC type of a data object (less attributes then expected) for one server only and restart the server 8. SUT requests GetAllDataValues of a known data object with less attributes then expected		
Comment See IEC 61850-7-4 for valid LogicalNode Names.		

cSrvN3	GetDataValues negative	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.4.2 IEC 61850-8-1 clause 13.2.1 PIXIT		
Expected result 1,3,5,7,9,11.SUT associates with the server and responds as specified in PIXIT. SUT shall continue with the other servers 2,4,6,8. SUT accepts a GetDataValues.Response- from the server and continues as specified in PIXIT 10,12. SUT receives a GetDataValues response and continues as specified in PIXIT		
Test description 1. Reconfigure/rename the LogicalDevice for one server only and restart the server 2. SUT requests GetDataValues of the previously known logical device 3. Reconfigure/rename the LogicalNode (in a valid existing logical device) for one server only and restart the server 4. SUT requests GetDataValues of the previously known logical node 5. Reconfigure/rename a data object (in a valid existing logical node) for one server only and restart the server 6. SUT requests GetDataValues of the previously known data object 7. Reconfigure/rename a data attribute (in a valid existing data object) for one server only and restart the server 8. SUT requests GetDataValues of the previously known data attribute 9. Reconfigure CDC type of a data object (more data attributes then expected) for one server only and restart the server 10.SUT requests GetDataValues of a known data object with more data attributes then expected 11.Reconfigure CDC type of a data object (less attributes then expected) for one server only and restart the server 12.SUT requests GetDataValues of a known data object with less attributes then expected		
Comment		

cSrvN4	SetDataValues negative	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.4.3 IEC 61850-8-1 clause 13.2.2 PIXIT		
Expected result 1,3,5,7,9,11.SUT associates with the server and responds as specified in PIXIT. SUT shall continue with the other servers 2,4,6,8,13. SUT accepts a SetDataValues.Response- from the server and continues as specified in PIXIT 10,12. SUT receives a SetDataValues response and continues as specified in PIXIT		
Test description 1. Reconfigure/rename the LogicalDevice for one server only and restart the server 2. SUT requests SetDataValues of the previously known logical device 3. Reconfigure/rename the LogicalNode (in a valid existing logical device) for one server only and restart the server 4. SUT requests SetDataValues of the previously known logical node 5. Reconfigure/rename a data object (in a valid existing logical node) for one server only and restart the server 6. SUT requests SetDataValues of the previously known data object 7. Reconfigure/rename a data attribute (in a valid existing data object) for one server only and restart the server 8. SUT requests SetDataValues of the previously known data attribute 9. Reconfigure CDC type of a data object (more data attributes then expected) for one server only and restart the server 10.SUT requests SetDataValues of a known data object with more data attributes then expected 11.Reconfigure CDC type of a data object (less attributes then expected) for one server only and restart the server 12.SUT requests SetDataValues of a known data object with less attributes then expected 13.SUT requests SetDataValues of an existing read-only data attribute		
Comment		

cSrvN5	Quality values	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.4.2 IEC 61850-8-1 clause 13.2.1 PIXIT		
Expected result 1. SUT processes the quality as specified in the PIXIT.		
Test description 1. Change the value of attribute q of a data object of one server to: - Validity: Invalid - Validity: Questionable – Failure = true - Validity: Questionable – OldData = true - Source = Substituted (by another client) - Test = true - OperatorBlocked = true		
Comment		

cSrvN6	Time Quality values	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.4.2 IEC 61850-8-1 clause 13.2.1 PIXIT		
Expected result 1-3.SUT processes the time quality as specified in the PIXIT.		
Test description 1. Force server to respond with data object with time quality “clock failure” 2. Force server to respond with data object with time quality “clock not synchronised” 3. Force server to respond with data object with time quality “leap seconds known”		
Comment		

A4.2 Block 2: Data set

Test case	Test case description
cDs1	Force SUT to request a GetLogicalNodeDirectory(DATASET) of the Logical Nodes of the configured servers.
cDs2	Check that the SUT can perform a GetDataSetDirectory request for all the DataSets of the server.
cDs3	Check that the SUT can send a GetDataSetValues request and handle the response
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	Check that the SUT still communicates with other servers when the following requests return a negative response: a) GetLogicalNodeDirectory (DATASET) b) GetDataSetDirectory
cDsN2	Check that the SUT still communicates with other servers properly when it performs a GetDataSetValues request on one server and one of the following situations happens: a) The response is negative. b) The response contains more/less members than expected c) The response contains reordered members of different types d) The response contains reordered members of the same type
cDsN3	Check that the SUT still communicates with other servers properly when it performs a SetDataSetValues request on one server and the response is negative.

Detailed test procedures for Data Set

cDs1	GetLogicalNodeDirectory(DATASET)	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1		
Expected result 1. SUT accepts the respond.		
Test description 1. Force SUT to perform a GetLogicalNodeDirectory(DATASET) request for each server and logical device		
Comment For IEC 61850-8-1 the GetLogicalNodeDirectory(DATASET) is mapped on a GetNameList and a logical device as parameter		

cDs2	GetDataSetDirectory	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.6 IEC 61850-8-1 clause 14.3.5		
Expected result 1. SUT accepts the respond.		
Test description 1. Force SUT to perform a GetDataSetDirectory request for the data sets used by the SUT		
Comment		

cDs3	GetDataSetValues	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.2 IEC 61850-8-1 clause 14.3.1 PIXIT		
Expected result 1. SUT accepts the respond.		
Test description 1. Force SUT to perform a GetDataSetValues request		
Comment		

cDs4	SetDataSetValues	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.3 IEC 61850-8-1 clause 14.3.2 PIXIT		
Expected result 1. SUT accepts the respond.		
Test description 1. Force SUT to perform a SetDataSetValues request		
Comment		

cDs5	Pre-configured dataset deviations	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3 IEC 61850-8-1 clause 14.3 PIXIT		
Expected result 3. SUT responds as specified in PIXIT on the reconfigured datasets.		
Test description 1. Stop one server 2. Reconfigure the server to force the following mismatches in different datasets: - Insert a new dataset element in the middle of a dataset - Delete a dataset element in the middle of a dataset - Reorder 2 dataset members in a dataset of a different data type - Reorder 2 dataset members in a dataset of the same data type 3. Start the server and force the SUT to perform a GetDataSetDirectory request on all the datasets used by the SUT		
Comment		

cDsN1	GetLogicalNodeDirectory(DATASET).response- and GetDataSetDirectory.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 11.3.6 IEC 61850-8-1 clause 12.3.1, 14.3.5 PIXIT		
Expected result 4. The SUT processes the negative response and continues as specified in PIXIT 5. The SUT processes the response as specified in the PIXIT 6. The SUT does not send the request or behaves as specified in PIXIT		
Test description 1. Stop one server 2. Reconfigure the server in the following way: o Rename a dataset in one logical device o Add a dataset in another logical device o Rename another logical device 3. Start the server 4. Force the SUT to perform a GetLogicalNodeDirectory(DATA-SET) request for the previously known logical device 5. Force the SUT to perform a GetLogicalNodeDirectory(DATA-SET) request for the logical device which contains the dataset that was newly added 6. Force the SUT to perform a GetDataSetDirectory request for the previously known dataset		
Comment		

cDsN2	GetDataSetValues response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.2 IEC 61850-8-1 clause 14.3.1 PIXIT		
Expected result 3. The SUT responds as specified in PIXIT.		
Test description 1. Stop one server 2. Configure the server SCL file in the following way (one change per dataset): a) Delete a dataset b) The number of members is more/less then expected: 1. add a dataset element in the middle of a dataset 2. remove a dataset element from the middle of the dataset c) change the order of dataset members, hereby changing the order of the datatypes d) change the order of dataset members, without changing the order of the datatypes 3. Start the server and force the SUT to perform a GetDataSetValues request on the removed/altered dataset		
Comment		

cDsN3	SetDataSetValues response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.3 IEC 61850-8-1 clause 14.3.2 PIXIT		
Expected result 1. The SUT processes the response as specified in the PIXT		
Test description 1. Force the SUT to perform a SetDataSetValues request on a dataset that does not exist in the server		
Comment		

A4.2+ Block 2+: Data set definition

Test case	Test case description
cDs6	Check if the SUT can send a correct CreateDataSet request for: a) a non-persistent dataset b) a persistent dataset
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	Check if the SUT still communicates with other servers after it receives a CreateDataSet.response-
cDsN5	Check if the SUT still communicates with other servers after it receives a DeleteDataSet.response-

Detailed test procedures for Data Set definition

cDs6	CreateDataSet	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.4 IEC 61850-8-1 clause 14.3.3 PIXIT		
Expected result 1a) The SUT sends a correct CreateDataSet request 1b) The SUT sends a correct CreateDataSet request		
Test description 1. Force SUT to: a) Perform a CreateDataSet request to create a non-persistent dataset b) Perform a CreateDataSet request to create a persistent dataset		
Comment		

cDs7	DeleteDataSet	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.5 IEC 61850-8-1 clause 14.3.4 PIXIT		
Expected result 1a). SUT sends correct DeleteDataset request 1b). SUT sends correct DeleteDataset request		
Test description 1. Force SUT to: a) Perform a DeleteDataSet request on a non-persistent dataset b) Perform a DeleteDataSet request on a persistent dataset		
Comment		

cDsN4	CreateDataSet.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.4 IEC 61850-8-1 clause 14.3.3 PIXIT		
Expected result 1. SUT behaves as specified in the PIXIT		
Test description 1. Force SUT the send a CreateDataSet request that returns a CreateDataSet.response-		
Comment		

cDsN5	DeleteDataSet.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.3.5 IEC 61850-8-1 clause 14.3.4 PIXIT		
Expected result 1. SUT behaves as specified in the PIXIT		
Test description 1. Force SUT to send a DeleteDataSet request that returns a DeleteDataSet.response-		
Comment		

A4.3 Block 3: Substitution

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

Detailed test procedures for Substitution

cSub1	Substitute a value	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 12 IEC 61850-8-1 clause 15		
Expected result 1. SUT sends successful SetDataValues requests for the values with functional constraint SV 2. SUT successfully enables substitution 3. SUT successfully disables substitution		
Test description 1. SUT substitutes the values of data objects in one server by another valid value of the following type: - single point status - double point status - enumerated status - integer measurand - floating point measurand - quality 2. SUT enables substitution 3. SUT disables substitution		
Comment		

cSub2	Verify that SUT can process the source "substituted" for substituted value	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 12 IEC 61850-8-1 clause 15		
Expected result 2. SUT succesfully enables substitution 3. SUT processes the new substituted value and quality with source “substituted” when transmitted by the report or GetDataValues response 4. SUT succesfully disables substitution 5. SUT processes the original process value and quality with source “process” when transmitted by the GetDataValues response		
Test description 1. SUT substitutes the values of data objects in one server by another valid value of the following type: - single point status - double point status - enumerated status - integer measurand - floating point measurand - quality 2. SUT enables substitution 3. Force the SUT to perform a GetDataValues request on the substituted data 4. SUT disables substitution 5. Force the SUT to perform a GetDataValues request on the data that is no longer substituted		
Comment		

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

A4.4 Block 4: Setting group selection

cSg1	Check that the SUT can send a correct GetLogicalNodeDirectory(SGCB) request
cSg2	Verify the SUT can select a setting group (IEC 61850-7-2 clause 13 figure 18). For each setting group: a) SelectActiveSG of the setting group b) GetSGCBValues to verify active setting group

cSgN1	Force the SUT to perform the following requests in a way that makes the server return a response-: a) SelectActiveSG (IEC 61850-7-2 clause 13.3.2) b) GetSGCBValues (IEC 61850-7-2 clause 13.3.7) The SUT should respond to these responses as specified in the PIXIT.

Detailed test procedures for Setting group selection

cSg1	Check that the SUT can send a correct GetLogicalNodeDirectory(SGCB) request	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1 PIXIT		
Expected result 1. The SUT sends a correct GetLogicalNodeDirectory(SGCB) request		
Test description 1. Force the SUT to send a GetLogicalNodeDirectory(SGCB) request for each logical device in each server		
Comment		

cSg2	Select setting group	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 13.3.2 IEC 61850-8-1 clause 16.2.1 PIXIT		
Expected result 1. The SUT sends a correct SelectActiveSG request 2. The SUT sends a correct GetSGCBValues request		
Test description 1. Force the SUT to perform a SelectActiveSG request to select first setting group of a SGCB 2. Force the SUT to perform a GetSGCBValues request to read the active setting group 3. Repeat step 1 and 2 for the other setting groups in the SGCB		
Comment		

cSgN1	Pre-configured setting group deviations	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 13.3.2 IEC 61850-8-1 clause 12.3.1, 16.2.1 PIXIT		
Expected result 1. The SUT responds as specified in PIXIT to the negative responses from the server		
Test description 1. Force the SUT to send the following requests with invalid/non existing parameters: a) SelectActiveSG b) GetSGCBValues		
Comment		

A4.4+ Block 4+: Setting group definition

cSg3	Verify SUT can get setting group values [FC=SG] (IEC 61850-7-2 clause 13 figure 18). For each setting group: a) SelectActiveSG of the first setting group b) Use GetSGValues [FC=SG] to verify the values are of first setting group
cSg4	Verify SUT can edit setting group values

Detailed test procedures for Setting group definition

cSg3	Get setting group values	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 13.3.6 IEC 61850-8-1 clause 16.2.5 PIXIT		
Expected result 1. SUT requests SelectActiveSG 2. SUT requests GetSGValues		
Test description 1. Request SelectActiveSG to Select first setting group of a server 2. Request GetSGValues [FC=SG] to verify setting group values 3. Repeat for another setting group		
Comment		

cSg4	Edit setting group values	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 13.3 IEC 61850-8-1 clause 16.2 PIXIT		
Expected result 1. SUT requests SelectActiveSG 2. SUT requests GetSGValues[FC=SE] 3. SUT requests SetSGValues[FC=SE] 4. SUT requests ConfirmEditSG		
Test description 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		
Comment		

A4.5 Block 5: Unbuffered Reporting

Test case	Test case description
cRp1	Force the SUT to perform a GetLogicalNodeDirectory(URCB) request for the logical nodes declared in the PIXIT.
cRp2	SetURCBValues for RptID and DatSet.Check that the SUT overwrites mismatching RptID and DatSet values in URCBs.
cRp3	Verify the client is able to process the reports with different optional fields.
cRp4	Verify the client is able to process unbuffered reports with the following supported trigger conditions: a) on integrity b) on update (dupd) c) on update with integrity (dupd+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)
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 the SUT configures and enables the URCB's as specified in the SCD file. The SUT is only allowed to write to the "dyn" URCB fields in the SCL.
cRp9	Verify that the SUT can process reports with complex structured data (for example WYE and DEL data objects)
cRp10	Verify that the SUT can handle reports with basic data (for example stVal and quality)

Test case	Test case description
cRpN1	Check that the SUT still communicates with other servers when it performs a GetLogicalNodeDirectory(URCB) request which returns a negative response.
cRpN2	Check that the SUT still works properly when it performs a GetURCBValues request which returns a negative response.
cRpN3	Check that the SUT still works properly when it performs a SetURCBValues request which returns a negative response.
cRpN4	Check that the SUT still works properly when it performs a SetURCBValues request while the URCB is reserved by another client (Resv=TRUE, PIXIT)
cRpN5	Check that the SUT keeps functioning normally if it receives a report that contains OptFlds that the SUT does not support.
cRpN6	Check that the SUT keeps functioning normally if it receives a report that contains Trigger options that the SUT does not support.
cRpN7	Check that the SUT behaves as described in the PIXIT when a URCB in the server has a different configuration then expected.
cRpN8	Verify that the SUT 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 members. The means of detection need to be specified in the PIXIT.

Detailed test procedures for Unbuffered Reporting

cRp1	GetLogicalNodeDirectory(URCB)	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1 PIXIT		
Expected result 1. SUT correctly requests GetLogicalNodeDirectory(URCB)		
Test description 1. Force the SUT to perform a GetLogicalNodeDirectory(URCB)		
Comment		

cRp2	SetURCBValues for RptID and DatSet	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. The SUT configures the new values.		
Test description 1. Stop SUT 2. Configure the “RptID” and the “DatSet” fields for a report control block in the SUT SCL file for one server to be different from the values in the server. 3. Configure RptID and DatSet in the ReportSettings for the server to be “Dyn” 4. Start SUT and force SUT to perform a SetURCBValues request for the mismatching RptID and DatSet		
Comment		

cRp3	SUT is able to process unbuffered reports with different optional fields	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 3. The SUT sets the configured optional fields before enabling the URCB. 4. The SUT is able to process the report.		
Test description 1. Stop SUT 2. Configure the minimum optional fields supported by the SUT for a report control block in the SUT SCL file for one server. 3. Start SUT and force SUT to enable a URCB 4. Generate a report for the configured URCB 5. Repeat step 1 to 4, this time configuring the maximum optional fields supported by the SUT in step 2		
Comment		

cRp4	SUT is able to process unbuffered reports with different trigger conditions	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. SUT is able to process the reports sent by the server.		
Test description 1. Stop SUT 2. Configure the following (combination of) trigger conditions supported by the SUT for a URCB in the SUT SCL file for one server: a) integrity b) data update (dupd) c) data update and integrity (dupd+integrity) d) data change (dchg) e) data change and quality change (dchg+qchg) f) data change, quality change and integrity (dchg+qchg+integrity) 3. Start SUT and force SUT to enable the report URCB. 4. Force events related to the trigger conditions configured in step 2, that are related to members in the dataset of the RCB. If the trigger condition "Integrity" was configured in step 2, wait for the configured integrity period to expire.		
Comment		

cRp5	SUT can process segmented unbuffered reports	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT can process the reported valuechange(s)		
Test description 1. Force a server to send a segmented, unbuffered report with a data- and/or quality-change		
Comment		

cRp6	Change buffer time	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully sends the SetURCBValues request.		
Test description 1. Force the SUT to perform a SetURCBValues request to change the BufTm of a URCB		
Comment		

cRp7	Verify client can force a General interrogation on an unbuffered report control block	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully performs a general interrogation request		
Test description 1. Force the SUT to perform a general interrogation request on a URCB		
Comment		

cRp8	Enable all URCBs specified in SCL	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. The SUT configures all URCBs as specified in the SUT SCL		
Test description 1. Force SUT to enable all URCBs that are configured in the SUT SCL		
Comment		

cRp9	Verify that the SUT can process URCB reports with complex structured data	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully configures and enables the report control block 2. SUT processes the report as normal		
Test description 1. Force SUT to Configure and enable an unbuffered report control block which contains complex structured data (e.g. WYE or DEL). 2. Force the server to send a report for the unbuffered report control block		
Comment		

cRp10	Verify that the SUT can process URCB reports with basic data	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully configures and enables the report control block 2. The SUT processes the report as normal		
Test description 1. Force the SUT to Configure and enable an unbuffered report control block which contains basic (unstructured) data (e.g. stVal or q) 2. Force the server to send a report for the unbuffered report control block.		
Comment		

cRpN1	Renamed URCB	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
Expected result 3. The SUT behaves as specified in the PIXIT		
Test description 1. Stop a server 2. Reconfigure a URCB in the server SCL with a new valid name 3. Start server and force the SUT to perform a GetLogicalNodeDirectory(URCB) request for the LD that contains the URCB		
Comment		

cRpN2	GetURCBValues.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
Expected result 3. SUT is able to communicate to other servers and behaves like stated in PIXIT for the server with the deleted URCB.		
Test description 1. Stop a server 2. Remove a URCB in the server SCL 3. Start server and force the SUT to perform a GetURCBValues request for the non existing URCB		
Comment		

cRpN3	SetURCBValues.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
Expected result 3. The SUT processes the SetURCBValues.response- as specified in the PIXIT		
Test description 1. Stop a server 2. Change the server configuration so that one or more of the following URCB elements which where previously writable become read-only: DatSet, RptID, OptFlds, BufTm, TrgOps, IntgPd 3. Start server and force the SUT to perform a SetURCBValues request for one or more of the read-only URCB elements		
Comment		

cRpN4	Report block is already reserved	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. The SUT processes the SetURCBValues.response- as specified in the PIXIT		
Test description 1. Use another client to reserve a URCB prior to SUT and force SUT to perform a SetURCBValues request on the reserved URCB		
Comment		

cRpN5	SUT is able to handle reports with unsupported optional fields	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. The SUT behaves as described in the PIXIT. 5. The SUT correctly processes the GI report.		
Test description 1. Stop SUT 2. Configure an unbuffered report control block in the SUT SCL and the server SCL file so that it has one or more optional fields configured which are not supported by the SUT. 3. Set OptFlds in the reportsettings (for the IED containing the URCB) to conf. 4. Start SUT and force the SUT to perform a general interrogation on the URCB with unsupported optional fields 5. Force the SUT to perform a general interrogation on a URCB which is correctly configured according to the capabilities of the SUT		
Comment		

cRpN6	SUT is able to handle reports with unsupported trigger conditions	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 5. The SUT behaves as described in the PIXIT. 6. The SUT correctly processes the GI report.		
Test description 1. Stop SUT 2. Configure an unbuffered report control block in the SUT SCL and the server SCL file so that it has one or more trigger conditions configured which are not supported by the SUT. 3. Set TrgOps in the ReportSettings (for the IED containing the URCB) to conf. 4. Start SUT and force the SUT to enable the URCB with unsupported trigger conditions 5. Trigger the event(s) related to the unsupported trigger condition(s) for the server 5. Force the SUT to perform a general interrogation on a URCB which is correctly configured according to the capabilities of the SUT		
Comment		

cRpN7	SUT is able to handle report control blocks with a mismatching configuration	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. The SUT behaves as described in the PIXIT.		
Test description 1. Stop a server 2. Configure a URCB in the server SCL file in the following way: a) Change the referenced dataset into a new valid dataset b) Change the RptID c) Configure the dataset linked to a URCB in the server SCL file in the following way: - change the order of dataset members, without changing the order of the datatypes - change the order of dataset members, hereby changing the order of the datatypes - remove a dataset element from the middle of the dataset - add a dataset element in the middle of a dataset 3. Set DatSet and RptID in the reportsettings (for the server containing the URCB) to conf. 4. Start the server and force the SUT to enable the URCB		
Comment		

cRpN8	SUT is able to detect a change in ConfRev	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 3. The SUT behaves as described in the PIXIT.		
Test description 1. Stop a server 2. Increment the value for confRev of a URCB in the server SCL and remove a member from the referenced dataset 3. Start the server and force SUT to enable the URCB 4. Repeat step 1 to 3, this time without changing the referenced dataset in step 2		
Comment		

A4.6 Block 6: Buffered Reporting

Test case	Test case description
cBr1	Force the SUT to perform a GetLogicalNodeDirectory(BRCB) request for the logical nodes declared in the PIXIT.
cBr2	SetBRCBValues for RptID and DatSet. Check that the SUT overwrites mismatching RptID and DatSet values in all BRCBs..
cBr3	Verify the client is able to process the reports with different optional fields.
cBr4	Verify the client is able to process buffered reports with the following supported trigger conditions: a) on integrity b) on update (dupd) c) on update with integrity (dupd+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 the SUT configures and enables the BRCBs as configured in the SCD file. The SUT is only allowed to 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 a lost association a) without bufferoverflow (PIXIT) b) with bufferoverflow
cBr12	Verify the SUT is able to request specific buffered reports after restoring a lost association by setting the EntryID
cBr13	Verify the SUT is able to purge buffered reports

Test case	Test case description
cBrN1	Check that the SUT still communicates with other servers when it performs a GetLogicalNodeDirectory (BRCB) request which returns a negative response.
cBrN2	Check that the SUT still works properly when it performs a GetBRCBValues request which returns a negative response.
cBrN3	Check that the SUT still works properly when it requests a SetBRCBValues and the response is negative.
cBrN4	Check that the SUT still works properly when it requests a SetBRCBValues and the BRCB is used by or pre-assigned to another client. (PIXIT)
cBrN5	Check that the SUT keeps functioning normally if it receives a Report which contains OptFlds that the SUT does not support.
cBrN6	Check that the SUT keeps functioning normally if it receives a Report which contains Trigger Options that the SUT does not support.
cBrN7	Mismatching reports: a) Report with a mismatching DataSet. b) Report with a mismatching RptID c) Report with mismatching references of the Data (when data references are enabled). Check the behaviour described in the PIXIT.
cBrN8	Verify that the SUT 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 members. 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)	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2 IEC 61850-8-1 clause 12.3.1 PIXIT		
Expected result 1. SUT correctly requests GetLogicalNodeDirectory(BRCB)		
Test description 1. Force the SUT to perform a GetLogicalNodeDirectory(BRCB)		
Comment		

cBr2	SetBRCBValues for RptID and DatSet	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. The SUT configures the new values.		
Test description 1. Stop SUT 2. Configure the “RptID” and the “DatSet” fields for a report control block in the SUT SCL file for one server to be different from the values in the server. 3. Configure RptID and DatSet in the ReportSettings for the server to be “Dyn” 4. Start SUT and force SUT to perform a SetBRCBValues request for the mismatching RptID and DatSet		
Comment		

cBr3	SUT is able to process buffered reports with different optional fields	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 3. The SUT sets the configured optional fields before enabling the BRCB. 4. The SUT is able to process the report.		
Test description 1. Stop SUT 2. Configure the minimum optional fields supported by the SUT for a report control block in the SUT SCL file for one server. 3. Start SUT and force SUT to enable a BRCB 4. Generate a report for the configured BRCB 5. Repeat step 1 to 4, this time configuring the maximum optional fields supported by the SUT in step 2		
Comment		

cBr4	SUT is able to process buffered reports with different trigger conditions	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. SUT is able to process the reports sent by the server.		
Test description 1. Stop SUT 2. Configure the following (combination of) trigger conditions supported by the SUT for a BRCB in the SUT SCL file for one server: a) integrity b) data update (dupd) c) data update and integrity (dupd+integrity) d) data change (dchg) e) data change and quality change (dchg+qchg) f) data change, quality change and integrity (dchg+qchg+integrity) 3. Start SUT and force SUT to enable the report BRCB. 4. Force events related to the trigger conditions configured in step 2, that are related to members in the dataset of the RCB. If the trigger condition "Integrity" was configured in step 2, wait for the configured integrity period to expire.		
Comment		

cBr5	SUT can process segmented buffered reports	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT can process the reported valuechange(s)		
Test description 1. Force a server to send a segmented, buffered report with a data- and/or quality-change		
Comment		

cBr6	Change buffer time	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully sends the SetBRCBValues request.		
Test description 1. Force the SUT to perform a SetBRCBValues request to change the bufTm of a BRCB		
Comment		

cBr7	Verify client can force a General interrogation on a buffered report control	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully performs a general interrogation request		
Test description 1. Force the SUT to perform a general interrogation request on a BRCB		
Comment		

cBr8	Enable all BRCBs specified in SCL	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. The SUT configures all BRCBs as specified in the server SCL		
Test description 1. Force SUT to enable all BRCBs that are configured in the server SCL		
Comment		

cBr9	Verify that the SUT can process BRCB reports with complex structured data	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully configures and enables the report control block 2. The SUT processes the report as normal		
Test description 1. Force the SUT to Configure and enable a buffered report control block which contains complex structured data. (e.g. WYE or DEL) 2. Force the server to send a report for the buffered report control block		
Comment		

cBr10	Verify that the SUT can process BRCB reports with basic data	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. SUT successfully configures and enables the report control block 2. The SUT processes the report as normal		
Test description 1. Force the SUT to Configure and enable a buffered report control block which contains basic (unstructured) data (e.g. stVal or q) 2. Force the server to send a report for the buffered report control block		
Comment		

cBr11	Process buffered reports with and without buffer overflow	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 5. The SUT handles the buffered reports 8. The SUT handles the buffered reports as specified in PIXIT		
Test description 1. Configure and enable a BRCB with trigger conditions data change and all supported optional fields. 2. Force data changes in a server to force reports 3. Disconnect the Ethernet cable between the server and switch 4. Force data changes in the server to force report buffering 5. Restore the Ethernet connection 6. Disconnect the Ethernet cable between the server and switch 7. Force many data changes in the server to force buffer overflow 8. Restore the Ethernet connection		
Comment		

cBr12	Set EntryId of buffered reports	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 5. The SUT is able to process the buffered reports		
Test description 1. Configure and enable a BRCB with trigger conditions data change and/or quality change, and all supported optional fields. 2. Force data/quality changes in a server to force reports 3. Disconnect the Ethernet cable between switch and the server 4. Force data/quality changes in the server to force buffered reports 5. Restore the Ethernet connection 6. Force SUT to send a correct SetBRCBValues request for the EntryID that was last received by the SUT		
Comment		

cBr13	Purge buffered reports	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 6. The SUT requests purge buffer		
Test description 1. Configure and enable a BRCB with trigger conditions data change and/or quality change, and all supported optional fields. 2. Force data/quality changes in a server to force reports 3. Disconnect the Ethernet cable between switch and the server 4. Force data/quality changes in the server to force buffered reports 5. Restore the Ethernet connection 6. Force SUT to purge buffered reports (PIXIT)		
Comment		

cBrN1	Renamed BRCB	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
Expected result 3. The SUT behaves as specified in the PIXIT		
Test description 1. Stop a server 2. Reconfigure a BRCB in the server SCL with a new valid name 3. Start server and force the SUT to perform a GetLogicalNodeDirectory(BRCB) request for the LD which contains the BRCB		
Comment		

cBrN2	GetBRCBValues.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
Expected result 3. SUT is able to communicate to other servers and behaves like stated in PIXIT for the server with the deleted BRCB.		
Test description 1. Stop a server 2. Remove a BRCB in the server SCL 3. Start server and force the SUT to perform a GetBRCBValues request for the non existing BRCB		
Comment		

cBrN3	SetBRCBValues.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 9.2.2, 14.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 PIXIT		
Expected result 3. The SUT processes the SetBRCBValues.response- as specified in the PIXIT		
Test description 1. Stop a server 2. Change the server configuration so that one or more of the following BRCB elements which where previously writable become read-only: DatSet, RptID, OptFlds, BufTm, TrgOps, IntgPd 3. Start server and force the SUT to perform a SetBRCBValues request for one or more of the read-only BRCB elements		
Comment		

cBrN4	Report block is already reserved	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 1. The SUT behaves as specified in the PIXIT		
Test description 1. Use another client to enable a BRCB prior to SUT and force SUT to perform a SetBRCBValues request on the BRCB		
Comment		

cBrN5	SUT is able to handle reports with unsupported optional fields	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. The SUT behaves as described in the PIXIT. 5. The SUT correctly processes the GI report.		
Test description 1. Stop SUT 2. Configure a buffered report control block in the SUT SCL and the server SCL file so that it has one or more optional fields configured which are not supported by the SUT. 3. Set OptFlds in the reportsettings (for the IED containing the BRCB) to conf. 4. Start SUT and force the SUT to perform a general interrogation on the BRCB with unsupported optional fields 5. Force the SUT to perform a general interrogation on a BRCB which is correctly configured according to the capabilities of the SUT		
Comment		

cBrN6	SUT is able to handle reports with unsupported trigger conditions	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 5. The SUT behaves as described in the PIXIT. 6. The SUT correctly processes the GI report.		
Test description 1. Stop SUT 2. Configure a buffered report control block in the SUT SCL and the server SCL file so that it has one or more trigger conditions configured which are not supported by the SUT. 3. Set TrgOps in the reportsettings (for the IED containing the BRCB) to conf. 4. Start SUT and force the SUT to enable the BRCB with unsupported trigger conditions 5. Trigger the event(s) related to the unsupported trigger condition(s) for the server 5. Force the SUT to perform a general interrogation on a BRCB which is correctly configured according to the capabilities of the SUT		
Comment		

cBrN7	SUT is able to handle report control blocks with a mismatching configuration	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 4. The SUT behaves as described in the PIXIT.		
Test description 1. Stop a server 2. Configure a BRCB in the server SCL file in the following way: a) Change the referenced dataset into a new valid dataset b) Change the RptID c) Configure the dataset linked to a BRCB in the server SCL file in the following way: - change the order of dataset members, without changing the order of the datatypes - change the order of dataset members, hereby changing the order of the datatypes - remove a dataset element from the middle of the dataset - add a dataset element in the middle of a dataset 3. Set DatSet and RptID in the ReportSettings (for the server containing the BRCB) to conf. 4. Start the server and force the SUT to enable the BRCB		
Comment		

cBrN8	SUT is able to detect a change in ConfRev	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 3. The SUT behaves as described in the PIXIT.		
Test description 1. Stop a server 2. Increment the value for confRev of a BRCB in the server SCL and remove a member from the referenced dataset 3. Start the server and force SUT to enable the BRCB 4. Repeat step 1 to 3, this time without changing the referenced dataset in step 2		
Comment		

cBrN9	Set non-existing EntryID	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 14.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT		
Expected result 5. The SUT will behave as specified in PIXIT		
Test description 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 a buffer overflow 4. Restore the Ethernet connection 5. Force SUT to perform a SetBRCBValues request with an EntryID from a discarded report		
Comment		

A4.7 Block 7: Logging

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

Test case	Test case description
cLogN1	Check that the SUT still communicates with other servers when it request GetLogicalNodeDirectory (LCB) and GetLogicalNodeDirectory (LOG) with negative response.
cLogN2	Check that the SUT still works properly when it requests a GetLCBValues/GetLogStatusValues when the response is negative.
cLogN3	Check that the SUT still works properly when it requests a SetLCBValues when the response is negative.

The detailed test procedures need to be defined.

A4.12 Block 12: Control

Test case	Test case description
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 following (combination of) CHECK bits in the commands (PIXIT) for the supported control models: a) Synchro Check b) Interlock Check c) Synchro Check and Interlock Check
cCtl3	Check if the SUT is able to change control model using online services (PIXIT).
cCtl4	Verify the values of originator category, origin identification and the control number (PIXIT)

Test case	Test case description
cCtlN1	Check if the SUT reacts as described in the PIXIT when it detects a control model mismatch: a) Server status-only, SUT expects controllable b) Server SBO, SUT expects direct operate c) Server direct operate, SUT expects SBO d) Server SBO enhanced SUT expects SBO normal
cCtlN2	Check if the SUT reacts as described in the PIXIT when it detects a control model that is not initialized in the SCL file

The testing of the control model has been divided in the four possible control models 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	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.5.2.4 IEC 61850-8-1 clause 20, Annex E		
Expected result DO normal/enhanced security: 1a. The SUT sends the Operate request with Test flag = true SBO normal security: 1b. The SUT sends the Operate requests with Test flag = true SBO enhanced security: 1c. The SUT sends the SelectWithValue and Operate requests with Test flag = true		
Test description DO normal/enhanced security: 1a. Force the SUT to perform an Operate request with the Test flag set SBO normal security: 1b. Force the SUT to perform a Select request followed by an Operate request with the Test flag set SBO enhanced security: 1c. Force the SUT to perform a SelectWithValue request followed by an Operate request, both with the Test flag set		
Comment		

cCtl2	Synchro and interlock check	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.5.2.5 IEC 61850-8-1 clause 20, Annex E PIXIT		
Expected result The SUT sends the request(s) with the Check bits as specified in PIXIT.		
Test description DO normal/enhanced security: a) Force the SUT to send an Operate request with the Synchro Check bit set b) Force the SUT to send an Operate request with the Interlock Check bit set c) Force the SUT to send an Operate request with the Interlock and Synchro Check bit set SBO normal security: a) Force the SUT to perform a Select and Operate request with the Synchro Check bit set b) Force the SUT to perform a Select and Operate request with the Interlock Check bit set c) Force the SUT to perform a Select and Operate request with the Interlock and Synchro Check bit set SBO enhanced security: a) Force the SUT to perform a SelectWithValue and Operate request, both with the Synchro Check bit set b) Force the SUT to perform a SelectWithValue and Operate request, both with the Interlock Check bit set c) Force the SUT to perform a SelectWithValue and Operate request, both with the Interlock and the Synchro Check bit set		
Comment		

cCtl3	Change control model	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT		
Expected result The SUT sends the SetDataValues request with the corresponding control model		
Test description 1. Force the SUT to perform a SetDataValues request to change control model to “Direct control with normal security” 2. Force the SUT to perform a SetDataValues request to change control model to “SBO control with normal security” 3. Force the SUT to perform a SetDataValues request to change control model to “Direct control with enhanced security” 4. Force the SUT to perform a SetDataValues request to change control model to “SBO control with enhanced security”		
Comment		

cCtl4	Verify control number and originator	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT		
Expected result The SUT sets the control number and the originator as specified in PIXIT		
Test description Execute the applicable control model specific test cases		
Comment this is a continuous effort during the conformance test of the supported control models		

cCtlN1	Control model deviations	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, 17.3 IEC 61850-8-1 clause 20, Annex E PIXIT		
Expected result 4. The SUT responds as specified in the PIXIT		
Test description 1. Stop a server 2. Reconfigure the server: a) Reconfigure one controllable object to status only b) Reconfigure one SBO object to direct operate c) Reconfigure one direct object to SBO d) Reconfigure SBO enhanced security control object to SBO normal security 3. Start server 4. Force the SUT to perform a Select/Operate request for the reconfigured control object		
Comment		

cCtlN2	Control model not configured in SCL	Out of scope
Expected result		
Test description		
Comment Testcase is out of scope for IEC 61850		

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 SUT 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 SUT realizes the operation failed.

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

cDOns1	Successful Operate	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.1 IEC 61850-8-1 clause 20.7		
Expected result 1. The SUT processes the response		
Test description 1. Force the SUT to perform an Operate request on a DOns control object		
Comment		

cDOns2	Failed Operate	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.1 IEC 61850-8-1 clause 20.7		
Expected result 1. The SUT processes the response- as specified in the PIXIT		
Test description 1. Force the SUT to perform an Operate request on a DOns control object that results in a Operate.response- with a Last Application Error (Tissue #246)		
Comment		

A4.12b Block 12b: SBO Control

Test case	Test case description
cSBOns1	SelectReq[test not ok] resp-: Force the SUT to perform a Select request that results in Test not ok. Check that the SUT handles the Select.response- as specified in the PIXIT.
cSBOns2	SelectReq[test ok] resp+ and OperReq[test ok] resp+ of selected object Force the SUT to send a Select request for an SBOns object. Force the SUT to perform a correct Operate request. Check that the SUT sends correct Select and Operate requests.
cSBOns3	SelectReq[test ok] resp+ and OperReq[test not ok] resp- of selected object. Force the SUT to perform a correct Select request, followed by an Operate request that results in Test not ok. Check that the SUT is able to process the Operate.response-
cSBOns4	SelectReq[test ok] resp+ and CancelReq of selected object. Check that the SUT can send a correct Cancel request.
cSBOns5	SelectReq[test ok] resp+ and TimOperReq[test ok] resp+ of selected object Check that the SUT is able to send a correct TimeActivated Operate request and that the SUT is able to process the response.
cSBOns6	SelectReq[test ok] resp+ and TimOperReq[test not ok] resp- of selected object Check that the SUT can process a Operate.response-

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

cSBOns1	Failed Select	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.2, 17.5.3.2 IEC 61850-8-1 clause 20.4 PIXIT		
Expected result 3. The SUT handles the Select.response- as described in the PIXIT		
Test description 1. Force the SUT to perform a correct Select request for which the server sends a response-		
Comment		

cSBOns2	Select and successful Operate	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.2, 17.5.3.5 IEC 61850-8-1 clause 20.7		
Expected result 1. The SUT sends a correct Select request for the SBOns object 2. The SUT sends a correct Operate request on the selected SBOns object		
Test description 1. Force the SUT to perform a Select request on an SBOns object 2. Force the SUT to perform an Operate request on the selected SBOns object		
Comment		

cSBOns3	Select and failed Operate	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.2, 17.5.3.5 IEC 61850-8-1 clause 20.7		
Expected result 5. SUT indicates Operate failure		
Test description 1. Force the SUT to send a correct Select request 2. Force the SUT to perform an Operate request that results in an Operate.response- with a Last Application error (Tissue #246)		
Comment		

cSBOns4	Cancel	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.2, 17.5.3.4 IEC 61850-8-1 clause 20.6		
Expected result 1. The SUT sends a correct Select request 2. The SUT sends a correct Cancel request		
Test description 1. Force the SUT to perform a Select request for an SBOns object 2. Force the SUT to perform a Cancel request on the selected object		
Comment		

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

Test case	Test case description
cDOes1	OperReq[test ok] resp+: Force the SUT to send a correct Operate request that causes the server to send an Operate.response+ and: a) a CommandTermination+. b) a CommandTermination- (PIXIT) Check that the SUT processes the CommandTermination+ and the CommandTermination- as specified in the PIXIT
cDOes2	OperReq[test not ok] resp-: Check that the SUT behaves as specified in the PIXIT when it receives an Operate.response-
cDOes3	TimOperReq[test not ok] resp-: Check that the SUT behaves as described in the PIXIT when it receives a Operate.response-
cDOes4	TimOperReq[test ok] resp+: Force the SUT to send a correct TimeActivated Operate request that causes the server to send a Operate.response+ and: a) a CommandTermination+ b) a CommandTermination- Check that the SUT can process the CommandTermination+ and the CommandTermination-

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

cDOes1	Successful Operate with command termination	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.3.2, 17.5.3.5 IEC 61850-8-1 clause 20.7 and 20.8 PIXIT		
Expected result 1. Check that the SUT processes the Command termination as specified in the PIXIT		
Test description 1. Force the SUT to send a correct Operate request that causes the server to send an Operate.response+ and: a) a CommandTermination+ b) a CommandTermination-		
Comment		

cDOes2	Operate failure	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.3.2, 17.5.3.5 IEC 61850-8-1 clause 20.7 and 20.8 PIXIT		
Expected result 1. The SUT processes the Operate.response- as specified in the PIXIT		
Test description 1. Force the SUT to perform an Operate that results in an Operate.response-		
Comment		

A4.12d Block 12d: Enhanced SBO Control

Test case	Test case description
cSBOes1	SelectWithValue [test not ok] resp-: Force the SUT to perform a SelectWithValue request that results in a test not ok.
cSBOes2	SelectWithValue [test ok] resp+ and OperReq[test ok] resp+ of selected object Force the SUT to send a correct SelectWithValue request, followed by a correct Operate request.
cSBOes3	SelectWithValue [test ok] resp+ and OperReq[test not ok] resp- of selected object. Force the SUT to send a correct SelectWithValue request, followed by an Operate request that results in test not ok. Check that the SUT behaves as described in the PIXIT when it recieves the Operate.response-
cSBOes4	SelectWithValue [test ok] resp+ and CancelReq of selected object. Force the SUT to send a correct SelectWithValue request, followed by a correct Cancel request.
cSBOes5	SelectWithValue [test ok] resp+ and TimOperReq[test ok] resp+ of selected object Force the SUT to perform a correct SelectWithValue request, followed by a correct TimeActivedOperare request. Check that the SUT processes the response as specified in the PIXIT.
cSBOes6	SelectWithValue [test ok] resp+ and TimOperReq[test ok] resp- of selected object Force the SUT to perform a correct SelectWithValue request, followed by a TimeActivedOperate request that results response-..

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

cSBOes1	SelectWithValue – test not ok	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.3.3, 17.5.3.3 IEC 61850-8-1 clause 20.5, 20.8		
Expected result 2. SUT indicates SelectWithValue failure		
Test description 1. Force the SUT to perform a SelectWithValue request that results in a SelectWithValue.response-		
Comment		

cSBOes2	SelectWithValue and successfull Operate	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.3.3, 17.5.3.5 IEC 61850-8-1 clause 20.5, 20.7, 20.8		
Expected result 1. The SUT performs a correct SelectWithValue request 2. The SUT performs a correct Operate request		
Test description 1. Force the SUT to perform a SelectWithValue request for an SBOes object 2. Force the SUT to perform an Operate request for the selected object		
Comment		

cSBOes3	SelectWithValue and failed Operate	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.3.3, 17.5.3.5 IEC 61850-8-1 clause 20.5, 20.7, 20.8		
Expected result 1. The SUT performs a correct SelectWithValue request 2. The SUT performs a correct Operate request		
Test description 1. Force the SUT to perform a SelectWithValue request 2. Force the SUT to perform an Operate request that results in an Operate.response-		
Comment		

cSBOes4	Cancel	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.3.3, 17.5.3.4 IEC 61850-8-1 clause 20.6, 20.8		
Expected result 1. The SUT performs a correct SelectWithValue request 2. The SUT performs a correct Cancel request		
Test description 1. Force the SUT to perform a SelectWithValue request 2. Force the SUT to perform a Cancel request		
Comment		

A4.13 Block 13: Time and time synchronization

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

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	Time synchronisation	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21 PIXIT		
Expected result 3. The SUT uses the new timestamp		
Test description 1. SUT exposes the time and time quality as specified in the PIXIT 2. Test engineer changes the time of the time server and waits till SUT has received the new time synch message 3. SUT exposes the time and time quality as specified in the PIXIT		
Comment		

cTm2	Time accuracy	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21 PIXIT		
Expected result 1. SUT timestamp accuracy matches with the documented accuracy 3. SUT uses the new timestamp		
Test description 1. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp 2. Test engineer changes the time of the time server and waits till SUT has received the new time synch message 3. SUT displays the time and time quality (PIXIT) or requests a service including the timestamp		
Comment		

cTmN1	Time synchronisation lost	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21, PIXIT		
Expected result 1. SUT uses the correct timestamp 3. SUT uses the timestamp with “ClockNotsynchronized” 5. SUT uses the correct timestamp		
Test description 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		
Comment		

cTmN2	Time synchronisation with ClockFailure from time server	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21, PIXIT		
Expected result 1. SUT uses the correct timestamp and quality 3. SUT uses the timestamp quality with “ClockFailure”		
Test description 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		
Comment		

A4.14 Block 14: File transfer

cFt1	Verify that the SUT can send a GetServerDirectory(FILE) request with correct parameters and that the SUT is able to process the response (IEC 61850-7-2 clause 6.2.2)
cFt2	Verify that the SUT can send a GetFileAttributeValues request with correct parameters and verify that the SUT is able to process the response (IEC 61850-7-2 clause 20.2.4)
cFt3	Verify that the SUT can send a GetFile request with correct parameters and verify the SUT handles the response (IEC 61850-7-2 clause 20.2.1)
cFt4	Verify that the SUT can perform a SetFile request with correct parameters and handles the response (IEC 61850-7-2 clause 6.2.2)
cFt5	Verify that the SUT can send a DeleteFile request with correct parameters and verify that the SUT can process the response

cFtN1	Verify that the SUT is able to process a GetFile.response-
cFtN2	Verify that the SUT is able to process a GetFileAttributeValues.response-
cFtN3	Force the SUT to perform a SetFile request that results in a SetFile.response-. Check that the SUT processes the response as specified in the PIXIT.

Detailed test procedures for File transfer

cFt1	GetServerDirectory(FILE)	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 6.2.2 IEC 61850-8-1 clause 9.3, 23.2 PIXIT		
Expected result 1. The SUT processes the GetServerDirectory response		
Test description 1. Force the SUT to perform a GetServerDirectory(FILE) request with and without folder name		
Comment GetServerDirectory(FILE) and GetFileAttributeValues are mapped on the same MMS service		

cFt2	GetFileAttributeValues	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 6.2.2 IEC 61850-8-1 clause 9.3, 23.2 PIXIT		
Expected result 1. The SUT processes the GetFileAttributeValues response		
Test description 1. Force the SUT to perform a GetFileAttributeValues request with and without folder name		
Comment GetServerDirectory(FILE) and GetFileAttributeValues are mapped on the same MMS service		

cFt3	GetFile	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.1 IEC 61850-8-1 clause 23.2.1 PIXIT: file size 0		
Expected result 1. The SUT processes the file 2. The SUT processes the file 3. The SUT processes the file		
Test description 1. Force the SUT to perform a GetFile request for a small file of about 1kB 2. Force the SUT to perform a GetFile request for a file with file size 0 (unknown) 3. Force the SUT to perform a GetFile request for a large file of about 1MB		
Comment		

cFt4	SetFile	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2 IEC 61850-8-1 clause 23.2.2 PIXIT		
Expected result 1. The SUT performs a correct SetFile request and sends the file to the server 2. The SUT performs a correct SetFile request and sends the file to the server		
Test description 1. Force the SUT to perform a SetFile request with a small file of about 1kB 2. Force the SUT to perform a SetFile request with a large file of about 1MB		
Comment		

cFt5	DeleteFile	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2 IEC 61850-8-1 clause 23.2.3		
Expected result 1. The SUT sends a correct DeleteFile request		
Test description 1. Force the SUT to perform a DeleteFile request on an existing, deletable file		
Comment		

cFtN1	GetFile.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.1 IEC 61850-8-1 clause 23.2.1 PIXIT		
Expected result 1. The SUT processes the GetFile.response-		
Test description 1. Force the SUT to perform a GetFile request that results in a GetFile.response-		
Comment		

cFtN2	GetFileAttributeValues.response-	☐ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.4 IEC 61850-8-1 clause 23.2.4 PIXIT		
Expected result 1. The SUT processes the GetFileAttributeValues.response-		
Test description 1. Force the SUT to perform a GetFileAttributeValues request that results is a GetFileAttributeValues.response-		
Comment		

cFtN3	SetFile response-	
IEC 61850-7-2 clause 20.2.2 IEC 61850-8-1 clause 23.2.2		
Expected result 1. The SUT processes the SetFile.response-		
Test description 1. Force the SUT to perform a SetFile request that results in a SetFile.response-		
Comment		

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

Conformance Block	**Mandatory**	**Optional**
9b: GOOSE subscribe	SendGOOSEMessage (subscribe)	GetLogicalNodeDirectory (GoCB) GetGoCBValues SetGoCBValues

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

Conformance Block	**Mandatory**	**Conditional**
9b: GOOSE subscribe	cGos1, cGos2, cGos3, cGosN1, cGosN2, cGosN3, cGosN4, cGosN5, cGosN6	

Note: Get/SetGoCBValues test procedures are not available yet

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 with/without the VLAN tag 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 – gocbRef different from GoCB and NULL – timeAllowedtoLive = 0 – DatSet different from GoCB and NULL – goID different from GoCB and NULL – t contains the time of a status change minus/plus one hour – confRev different from GoCB and NULL – numDatSetEntries 0, more, less with the number of data entries in the allData – allData values do not match with the DatSet element type – APPID different from SCL and 0 (IEC 61850-8-1 Annex C)

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
Guaranteed 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	
How does the client behave in case of a lost connection with (one of) the associated servers?	
How does the client behave when a server denies an Association request by the client?	
Does the client automatically reconnect to the configured servers after startup (Automatic statup)?	Y/N
<additional items>	

PIXIT for Server model

Description	Value / Clarification
Maximum object identification length	129 octects: <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/N OldData Y/N Inconsistent Y/N Inaccurate Y/N Process Y/N Substituted Y/N Test

Description	**Value / Clarification**
	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/N OldData 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 members in a dataset of a different data type (4) Reordered dataset members 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 support the creation of: - persistent datasets - non-persistent datasets	 Y/N Y/N
Describe how the client behaves in case of: - CreateDataSetDirectory response- - DeleteDataSet response-	
Describe how the client behaves when it receives a SetDataSetValues.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 IEDs with indexed and non-indexed report control blocks (RCB)	Buffered RCB indexed Y/N Buffered RCB not indexed Y/N 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 supported 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
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 indexed RCBs	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 detects reporting configuration changes (mismatches). Does it check the “configuration revision” attributes and/or does it check the dataset members?	
Describe how to force the client to change the RCB BufTm	
Describe how the client behaves when it receives a report that has the buffer overflow flag set?	
Describe how to force the client to write a (valid) EntryID value.	
Describe how to force the client to purge the report buffer.	
Describe how the client responds when it receives a GetXRCBValues.response-	
Describe how the client responds when it receives a SetXRCBValues.response-	
Describe how the client responds when it tries to use a RCB that is reserved by another client	
Describe how the client behaves when it receives a report that contains optional fields that are not supported by the client	
Describe how the client behaves when it receives a report that was caused by one or more trigger conditions that are not supported by the client	
Describe how the client behaves when it encounters an RCB with a different dataset configuration than expected.	
Describe how the client behaves when it	

encounters an RCB with a different confRev value than expected	
Describe how the client responds when it sets an EntryID value that is not recognized by the server.	
Is there a maximum number of report control blocks that the client can enable?	No, there is no known maximum / Yes, the maximum number of report control blocks that can be enabled per server by the client is …
<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? Ignored = element value is not checked, message will be accepted SCL match = element value should match with the configuration, otherwise the GOOSE message will be ignored	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
	Y/N	DatSet	= SCL match
	Y/N	goID	= SCL match
	N	t	= ignored
	Y/N	stNum	= <describe>
	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
For the checked GOOSE header elements describe the checking conditions in more detail when necessary			
What is the behavior when one subscribed 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 do when it receives a LastApplicationError and describes how to view the additional cause?	For example display / store the AddCause
What does the client do when it 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 do when the ctlModel is not initialized in the SCL?	
Describe how the client responds when it receives a positive Command Termination	
Describe how the client responds when it receives a negative Command Termination	
Describe how the client responds when it receives a negative Operate response	
<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 "ClockFailure" set?	
When is the quality bit "ClockNotSynchronised” 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
Does the client support IEDs 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 IEDs that use the file separator	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 / Not case sensitive
Maximum file size	
Describe how the client behaves in case of: - GetFileAttributes response-	
<additional items>	