VERIFICATION REPORT

IEC 61850 Edition 2 Amd1 client conformance test in RTU32M

STRATON AUTOMATION

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Task and objective:

Does the client protocol implementation of the DUT, conform to the IEC 61850 Edition 2 with Amendment 1 standard and the PICS, MICS, TICS, PIXIT documents as configured with SCD?

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This document replaces the previous revision(s). Previous revision(s) are no longer valid.

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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 an IEC 61850 CLIENT system.

CONFORMANCE	IEC 61850 Edition 2 with Amendment 1 – Client System
*DUT**	Brodersen RTU32M with module MP32A and PS24A IEC 61850 firmware: straton runtime version 1601.51104
MANUFACTURER	Broderson
*PICS**	Protocol Implementation Conformance Statement for the IEC 61850 interface in RTU32M straton runtime version 16 date 11/11/2025
*MICS**	Model Implementation Conformance Statement for Ed1 + Ed2 + Ed2Amd1 for the IEC 61850 Client Interface in RTUE32M running with straton runtime version 16, date: 11.11.2025, version 16
*TICS**	Tissues Implementation Conformance statement (TICS) for the IEC 61850 Client interface in RTU 32M straton runtime IEC61850 stack, date: November 11, 2025
*PIXIT**	Protocol Implementation eXtra Information for Testing (PIXIT) for the IEC 61850 Client interface in RTU32M using straton runtime IEC 61850 stack; date: November 11, 2025
*SICS**	<complete reference description of the SICS>
SCD	Ed2Amd1_Reference_Rev7.scd, version=”10”
TEST INITIATOR	STRATON AUTOMATION Anthony Burille, Nasreddine Moussa
TEST FACILITY	DNV Netherlands B.V. Protocol Competence & Test Center Utrechtseweg 310-B50, Arnhem, The Netherlands Accredited as independent Level A test lab by the UCAIug
TEST ENGINEER	Marianne Plouvier, marianne.plouvier@dnv.com
TEST SESSION	Arnhem Netherlands, November 2025
SERVER SIMULATOR	UniGrid SA Simulator version 4.1.0
SCT SIMULATOR	straton Editor
HMI	straton Editor
ANALYSER	UniCA 61850 Analyzer, version 6.46.03
TIME SERVER	DNV_SNTP.exe

*Provided by customer

1.2 Background

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

“Does the client protocol implementation of the DUT, conform to the IEC 61850 Edition 2 with Amendment 1 standard and the PICS, MICS, TICS, PIXIT documents as configured with SCD?”

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

TEST FACILITY is accredited by the UCAIug to perform formal IEC 61850 conformance tests and issue the Level A UCAIug certificate.

1.3 Purpose of this document

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

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

The described procedures and results are the basis of this verification report, the DNV Attestation of Conformity and the UCAIug Level A certificate/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 DUT. This chapter also gives an overview and introduction to the various test groups that together constitute the conformance test.

Chapter 4 and 5 give an overview and summary of the test results, 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

DUT	Device Under Test
HMI	Human machine interface
ICD	IED Capability Description
MICS	Model Implementation Conformance Statement
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
PTP	Precision Time Protocol
SCD	Substation configuration description in SCL-format
SCL	Substation Configuration Language
SICS	SCL tool Implementation Conformance Statement
SNTP	Simple Network Time Protocol
TICS	TISSUES Implementation Conformance Statement
TISSUE	Technical issue
UCAIug	UCA International Users Group.

2 REFERENCES

2.1 Normative

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

IEC 61850-4, *Communication networks and systems for power utility automation – Part 4: System and project management; Edition 2.0; 2011-04 and Amendment 1; 2020-11*

IEC 61850-6, *Communication networks and systems for power utility automation – Part 6: Configuration description language for communication in electrical substations related to IEDs; Edition 2.0; 2009-12 and Amendment 1; 2018-06*

IEC 61850-7-1, *Communication networks and systems for power utility automation – Part 7-1: Basic communication structure for substation and feeder equipment – Principles and models; Edition 2.0; 2011-07 and Amendment 1; 2020-08*

IEC 61850-7-2, Communication networks and systems for power utility automation – Part 7-2: Basic communication structure for substation and feeder equipment – Abstract communication service interface (ACSI); Edition 2.0; 2010-08 and Amendment 1; 2020-02

IEC 61850-7-3, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure for substation and feeder equipment – Common data classes; Edition 2.0; 2010-12 and Amendment 1; 2020-02*

IEC 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes; Edition 2.0; 2010-03 and Amendment 1; 2020-02*

IEC 61850-8-1, *Communication networks and systems for power utility automation – Part 8-1: Specific communication service mapping (SCSM) – Mappings to MMS (ISO/IEC 9506-1 and ISO/IEC 9506-2) and to ISO/IEC 8802-3; Edition 2.0; 2011-06 and Amendment 1; 2020-02*

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

Unless stated otherwise, references to IEC 61850 standards always refer to the above specified version of the standard.

2.2 Other

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

UCA International User Group: Quality Assurance Program for IEC Device Implementation Testing and Test System Accreditation and Recognition; Version 2.6, 2007-03.

UCA International User Group: Quality Assurance Program Addendum for IEC 61850 Specific Product Testing; Version 1.0, 2007-03.

UCA International User Group: Test Center Accreditation and Recognition Procedure.For IEC 61850 Device Testing; V1.1, 2006-08.

UCA International User Group: Conformance Test Procedures for Client System with IEC 61850-8-1 Edition 2 Amendment 1 interface; Version 1.0, January 26, 2022.

http://www.tissues.iec61850.com.

3 THE CONFORMANCE TEST

3.1 Components in the test environment

The test environment consists of the following components:

- DUT
- SERVER SIMULATOR 1..N
- ANALYSER
- Ethernet switch
- TIME SERVER

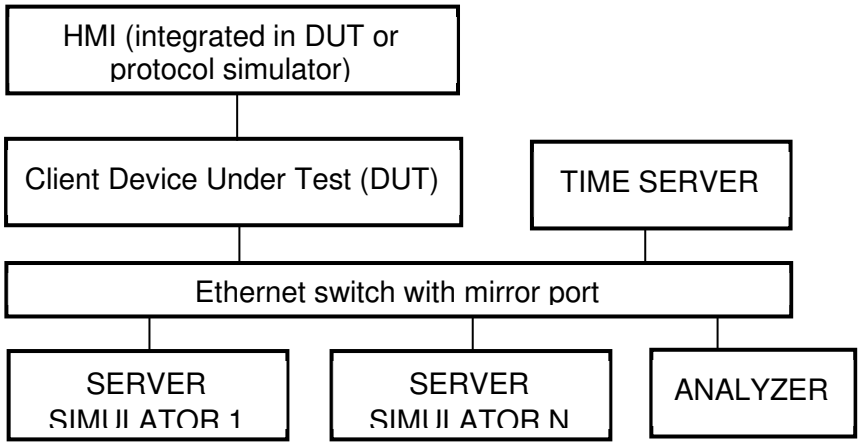


Figure 3.1 The test environment

The HMI can be integrated into the DUT (typically a substation control system) or in case the DUT 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 DUT
  - 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 DUT)
  - one or more servers with report control block indexing
  - one or more servers without report control block indexing
  - one or more servers with pre-assigned report control blocks
- Communication:
  - support all conformance blocks supported by the DUT in one or more servers
  - support all ACSI services supported by the DUT
  - one or more servers with all supported control models.
- Editions:
  - support Edition 2 Amendment 1
  - support Edition 1 and 2 behavior for backward compatibility tests
  - support Future edition for forward compatibility tests

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
- Service Tracking.

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 and 4.2 in this Chapter give an overview of the conformance test results. References shown in the table columns refer to references of individual test procedures in appendix A. The Mandatory column indicates the mandatory test cases and the Conditional column indicates the same for the conditional test cases. The Inconclusive column indicates those test cases that did not pass nor fail.

Table 4.1 Summary of test results for *DUT*

Conformance Block	Mandatory	Conditional
1a: Basic Exchange	cAss1, cAss2, cAss3, cAssN1, cAssN4, cAssN5, cAssN6, cAssN8	cAssN7, cSrv1, cSrv4, cSrv5, cSrv6, cSrv7, cSrv9, cSrv10 cSrvN1, cSrvN3, cSrvN4, cSrvN5, cSrvN6, cSrvN7, cSrvN8, cSrvN9
2: Data Sets		cDs1, cDs2, cDs5, cDs6 cDsN1a, cDsN1b
2+: Data Set Definition		cDs10, cDs11, cDs12, cDs13, cDs14, cDsN10a, CdsN10b, cDsN11
3: Substitution	cSub1, cSub3	cSub2
4: Setting Group Selection	cSg2, cSg46, cSgN1	
4+: Setting Group Definition	cSg11, cSg14	cSg10, cSg12, cSg13
5: Unbuffered Reporting	cRp3, cRp4, cRp5, cRp8, cRp9, cRp10, cRp11, cRp13a, cRp14, cRp15, cRp18, cRp19, cRp20, cRp21, cRp22, cRp40, cRp41, cRp42, cRp43, cRp44, cRp45, cRp46, cRpN2, cRpN5, cRpN6	cRp2, cRp6, cRp7, cRp16, cRp17
6: Buffered Reporting	cBr3, cBr4, cBr5, cBr8, cBr9, cBr10, cBr11, cBr13a, cBr14, cBr15, cBr18, cBr19, cBr20, cBr21, cBr22, cBr30, cBr31, cBr46, cBrN2, cBrN5, cBrN6	cBr2, cBr6, cBr7, cBr16, cBr17, cBr32, cBr33
9: GOOSE control block		cGcb1, cGcb2, cGcb46
12a: Direct Control Direct control	cCtl4, cCtl5, cDOns1, cDOns2	cCtl1, cCtl2, cCtl3
12b: SBO Control SBO control	cCtl4, cCtl5, cSBOns1, cSBOns2, cSBOns3, cSBOns10	cCtl1, cCtl2, cCtl3, cSBOns4
12c: Enhanced Direct Control	cCtl4, cCtl5, cDOes1, cDOes2	cCtl1, cCtl2, cCtl3
12d: Enhanced SBO Control Enhanced SBO control	cCtl4, cCtl5, cSBOes1, cSBOes2, cSBOes3	cCtl1, cCtl2, cCtl3, cSBOes4
13a: Time sync SNTP Time sync	cTm1, cTmN1	cTmN2

Conformance Block	Mandatory	Conditional
14: File transfer	cFt1, cFt3, cFt6, cFtN1	cFt2, cFt5, cFtN2
15: Service Tracking		cTrk1, cTrk2, cTrk4, cTrk7, cTrk8, cTrk9, cTrk10, cTrk11, cTrk12, cTrk13, cTrk14, cTrk15, cTrk16

Test case	Limitations or Comments
Service Tracking	Test case numbering updated according to redmine #6654
cTrk3, cTrk5, cTrk6, cTrk17	Test tool limitation, can not be tested

5 CONCLUSION

When all applicable test cases within a conformance block are Passed or Inconclusive the DUT has passed the test for that conformance block.

Based on the test results described in this verification report, *TEST FACILITY* declares the tested IEC 61850 client interface in the *DUT* has **not been shown to be non-conforming** to the IEC 61850 standard, *PICS, MICS, TICS, PIXIT* documents and *SCD* configuration.

5.1 Comments

The following comments apply for the *DUT*:

None

APPENDIX A: DETAILED 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 DUT do match (IEC61850-4) PICS shall include the ACSI conformance statement from IEC 61850-7-2 Annex A with applicable extensions from IEC 61850-9-3 when this is supported	☒ Passed ☐ Failed ☐ Inconclusive
cDoc2	Check if the major/minor software version in the PIXIT documentation and software version of the DUT does match (IEC61850-4). PIXIT shall indicate the applicable extra information for testing as requested in the test cases in this document	☒ Passed ☐ Failed ☐ Inconclusive
cDoc3	Check if the major/minor software version in the MICS documentation and software version of the DUT does match (IEC65180-4). MICS shall indicate which CDC's and/or CDC parts are supported by the DUT, for example arrays	☒ Passed ☐ Failed ☐ Inconclusive
cDoc4	Check if the major/minor software version in the TICS documentation and software version of the DUT does match (IEC61850-4). TICS shall indicate that the mandatory applicable technical issues are supported.	☒ Passed ☐ Failed ☐ Inconclusive
cDoc5	Check the ICD if the capabilities in the IED "services" section do correspond with services in the PICS: ClientServices supportsLdName ="true" ClientServices bufReport matches PICS S24 ClientServices unbufReport matches PICS S27 ClientServices maxAttributes="<value>" (optional) ClientServices maxReports="<value>" (when PICS S24 or S27 is supported) ClientServices readLog="<value>" (when PICS S32 or S33 is supported) ClientServices TimeSynchProt sntp="true" or absent ClientServices TimeSynchProt iec61850_9_3 matches PICS 61850-9-3	☒ Passed ☐ Failed ☐ Inconclusive
cDoc6	Check if the major/minor software version in the SICS documentation and software version of the DUT does match (IEC 61850-4). SICS shall indicate that the mandatory applicable entries are supported	☒ Passed ☐ Failed ☐ Inconclusive

A2 Configuration file (IEC 61850-6)

ICD export test procedures

Test case	Test procedure	Verdict
cCnf1 AtLeastOne(1)	The client system ICD file is fixed (when SICS I11 is supported)	☐ Passed ☐ Failed ☐ Inconclusive ☒ Not applicable
cCnf2 AtLeastOne(1)	Use the ICT tool to export an ICD file (when SICS I12 is supported)	☒ Passed ☐ Failed ☐ Inconclusive ☐ Not applicable

cCnf3	The client system ICD file shall have (SICS I16) • SCL version="2007" revision="B" release="4" • SCL IED originalSclVersion="2007" originalSclRevision="B" originalSclRelease="4"	☒ Passed ☐ Failed ☐ Inconclusive
cCnf4	The client system ICD file has communication section with default address (when SICS I110 is supported)	☒ Passed ☐ Failed ☐ Inconclusive ☐ Not applicable
cCnf5	The client system ICD file shall be UTF-8 encoded (SICS I114) and valid against SCL schema 2007B4	☒ Passed ☐ Failed ☐ Inconclusive
cCnf6	Verify the ICD has exactly one IED element and that the attribute "name" of the element is "TEMPLATE"	☒ Passed ☐ Failed ☐ Inconclusive

SCD import test procedures

Test case	Test procedure	Verdict
cCnf10	Check if the DUT identifies the client IED to be configured in the SCD file by client IED name (SICS I21, I214) The valid SCD file has at least 2 instances of the same client ICD with different name and the DUT ICT should select one	☒ Passed ☐ Failed ☐ Inconclusive
cCnf11	Check if the DUT determines the communication address of the IEDs in the SCD (SICS I23)	☒ Passed ☐ Failed ☐ Inconclusive
cCnf12	Check if the DUT determines the clock communication address from the SCD (when SICS I24 is supported)	☐ Passed ☐ Failed ☐ Inconclusive ☒ Not applicable
cCnf13	Check if the DUT interprets client references in control blocks of other IEDs to find the control block instances allocated to the IED, and data sent to this IED (SICS I29) It shall not be possible to select an RCB instance assigned to another client	☒ Passed ☐ Failed ☐ Inconclusive
cCnf14	Check if the DUT supports ldName on server IEDs (SICS I212)	☒ Passed ☐ Failed ☐ Inconclusive
cCnf15	Check if the DUT process the server IED data names, data types as configured in the SCD configuration file.	☒ Passed ☐ Failed ☐ Inconclusive
cCnf16	Change at least 5 end-user configurable parameters that are processed by the DUT in the SCL configuration file, configure the DUT using the SCL configuration file (using the supplied configuration tool) and check the updated configuration. Restore the original SCL file and re-configure the DUT to its original state.	☒ Passed ☐ Failed ☐ Inconclusive
cCnf17	Verify that client can handle the ConfigRev management in SCL and exposed by the server in LLN0.NamPlt.configRev as described in *PIXIT Cf1*. On a mismatch the DUT shall behave as described in the PIXIT (note that, if the PIXIT describes that the DUT does not check such a mismatch, no action is required by the DUT)	☒ Passed ☐ Failed ☐ Inconclusive

There are no IID export test procedures.

Tool Functionality test procedures

Test case	Test procedure	Verdict
cCnf31	Check if the DUT supports the Must Understand concept (SICS I41)	See detail
cCnf32	Check if the DUT bind incoming signals to IED internal (input signals) based upon Inputs ExtRef with serviceType=Report/Poll. (when I42 is supported)	☐ Passed ☐ Failed ☐ Inconclusive ☒ Not applicable
cCnf33	Check if the DUT can change IED input section for binding incoming (external signals) to internal signals to document this binding (when I43 is supported)	☐ Passed ☐ Failed ☐ Inconclusive ☒ Not applicable
cCnf34	Check if DUT can create CID file (when SICS I44 is supported)	☒ Passed ☐ Failed ☐ Inconclusive ☐ Not applicable

cCnf31	**Support MustUnderstand concept (I41)**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-6 clause 8.2.1 SICS I41		
Expected result 2. The RCB with the mustUnderstand shall be ignored and impossible to select		
Test description 1. Use the SCT simulator to create an SCD with a future edition IED that has a MustUnderstand element in a report control block 2. Use the ICT tool to configure the report control blocks from the future device. The RCB with MustUnderstand shall be ignored (impossible to select)		
Comment For example in the IED section of the future version IED: <ReportControl name"willNotBeUnderstood"> <RptEnabled> <ClientLN/> </RptEnabled> <Elephant mustUnderstand="true">African</Elephant> </ReportControl> The SCL version of the SCD shall be a future edition as well.		

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 according to IEC 61850-7-2 Subclause 22.2 and SCSM and expands objects like SDOs correctly (*PIXIT Sr1*)	Note: will be verified by the applicable communication test procedures
cMdl2	Verify that DUT 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 block – indexed d buffered report control block – not indexed e setting group control block f GOOSE control block g Log control block	☒ Passed ☐ Failed ☐ Inconclusive
cMdl3	Verify that DUT can read and process the mandatory & optional attributes from the CDCs in part 7-3 unless stated otherwise in the MICS	See detailed test procedure

Compare detailed test procedures

cMdl3 - settings	**Support of CDC: settings**	☒ Passed ☐ Failed ☐ Inconclusive

MICS

Expected result

2. DUT sends correct SelectEditSGValues requests for the supported CDC's (MICS)
3. DUT sends correct SetDataValue requests for the supported CDC's (MICS)

Test description

1. Configure the DUT and server simulator(s) with the following setting group CDC's: SPG, ING, ENG, ORG, TSG, CUG, VSG, ASG, CURVE, CSG with FC=SG/SE and FC=SP
2. Start SERVER SIMULATOR

   When setting group editing is supported
3. Force the DUT to edit setting group values, FC=SE

   When setting group editing is not supported
4. Force the DUT to change setting group values, FC=SP

Comment

What	Supported	Address	Used values
SPG	Y	LTIM.TmUseDT	False, true
ING	Y	PTOV.OpDlTmms	0,5,1000
ENG	Y	PTRC.TrMod	2, 3, 4
ORG	Y	PSCH.RxSrc	straton
TSG	Y	LTIM.TmChgST.setCal.day	3, 0
CUG	Y	privateGGIO.MySECUG	E282ac €
VSG	Y	LCCH.ApNam	Test_straton_automation for LTMS1
ASG	Y	PDOP.StrVal	3.56
CURVE	Y	PTTR.TmTmpCrv.setParA	6.56
CSG	Y	PDIF.TmAChr33.numPts	5624

All supported setpoints were tested with FC=SE

cMdl3 - status	**Support of CDC: status information**	☒ Passed ☐ Failed ☐ Inconclusive

MICS

Expected result

3. DUT processes the values from GI and/or integrity reports of the supported CDC's (MICS)
4. DUT sends GetDataValues request and processes the returned values

Test description

When reporting is supported

1. Configure the DUT and server simulator(s) with datasets and report control blocks with status information from the following CDC's: SPS, DPS, INS, ENS, ACT, ACD, SEC, BCR, HST, VSS, TCS, ORS
2. Start SERVER SIMULATOR
3. Force the DUT to enable the report control blocks and send GI or wait for integrity reports

When DUT does not support reporting

4. the DUT reads status information

Comment:

What	Supported	Address
SPS	Y	LLN0.Loc
DPS	Y	CSWI.Pos
INS	Y	CSWI.OpCntRs
ENS	Y	CSWI.Mod
ACT	Y	PIOC.Op
ACD	Y	PIOC.Str
SEC	Y	GSAL.Authfail
BCR	Y	MMTR.Supwh
HST	Y	MFLK.PPPcbLs
VSS	Y	LTMS.ST.Src
TCS	Y	privateDNVG.MyTCS
ORS	Y	privateDNVG.MyORS

cMdl3 - measurements	**Support of CDC: measurement information**	☒ Passed ☐ Failed ☐ Inconclusive
MICS		
Expected result 3. DUT processes the data from GI and/or integrity reports of the supported CDC's (MICS) 4. DUT sends GetDataValues request and processes the returned values		
Test description When reporting is supported 1. Configure the DUT and server simulator(s) with datasets and report control blocks with measurement information from the following CDC's: MV, CMV, WYE, DEL, SEQ, SAV, HMV, HWYE, HDEL 2. Start SERVER SIMULATOR 3. Force the DUT to enable the report control blocks and send GI or wait for integrity reports When DUT does not support reporting 4. the DUT reads measurement information		
Comment		

What	Supported	Address	Values
MV	Y	MMXU.Hz	111222333
CMV	Y	YEFN.Neutvol	22, 33, 44, 55
WYE	Y	MMXU.A	All mapped
DEL	Y	MMXU.PPV	All mapped
SEQ	Y	MSQI.SeqA	All mapped
SAV	Y	RMXU.AmpLocPhsA	All mapped
HMV	Y	MHAN.HaVol	All array mapped
HWYE	Y	MFLK.PhPdmWav.phsBHar	All array mapped
HDEL	Y	MFLK.PPPdmWav	All array mapped

cMdl3 – Ed1 measurements	**Support of CDC: Ed1 measurement information**	☒ Passed ☐ Failed ☐ Inconclusive
MICS		

Expected result

3. DUT processes the data from GI and/or integrity reports of the supported CDC's (MICS)

4. DUT sends GetDataValues request and processes the returned values

Test description

When reporting is supported

1. Configure the DUT and Ed1 server simulator(s) with datasets and report control blocks with measurement information from the following Edition 1 CDC's: HMV, HWYE, HDEL

2. Start Edition 1 SERVER SIMULATOR

3. Force the DUT to enable the report control blocks and send GI or wait for integrity reports

When DUT does not support reporting

4. the DUT reads measurement information

Comment

What	Supported	Address	Values
HMV	Y	MHAI.DNVHMV	All array mapped
HWYE	Y	MFLK.PhPdmWav.phsBHar	All array mapped
HDEL	Y	MFLK.PPPdmWav	All array mapped

cMdl3 - control	Support of CDC: control	☒ Passed ☐ Failed ☐ Inconclusive

MICS

Expected result

4. DUT sends correct control requests (Select, SelectWithValue, Operate) for the supported CDC's and (MICS), DUT processes the status values from the GI and data-change reports of the supported CDC's

Test description

1. Configure the DUT and server simulator(s) with the following controllable CDC's: SPC, DPC, INC, ENC, BSC, ISC, APC, BAC
2. Configure the DUT and server simulator(s) with datasets and report control blocks with status information from the specified control CDC's
3. Start SERVER SIMULATOR
4. Force the DUT to control requests (Select, SelectWithValue, Operate) to the supported control CDC's and the SERVER SIMILATOR to change the status value according to the control value
5. Repeat step 4 for all supported combinations of control models and CDC's0

Comment

What	Sup	Address	DOns	SBOns	DOes	SBOes	Cancel	Control value
SPC	Y	CSWI.LocSta	ok	ok	ok	ok	ok	false and true
DPC	Y	CSWI.Pos	ok	ok	ok	ok	ok	false and true
INC	Y	CSWI.OpCntRs	ok	ok	ok	ok	ok	-2147483648 and 2147483647
ENC	Y	CSWI.Mod	ok	ok	ok	ok	ok	1, 3 and 5
BSC	Y	ATCC.TapChg	ok	ok	ok	ok	ok	lower, higher, stop, reserved
ISC	Y	ATCC.TapPos	ok	ok	ok	ok	ok	-64, 1, 63
APC	Y	ATCC.SptVal	ok	ok	ok	ok	ok	analogue min + max -11111.5555 and 99999.555444
BAC	Y	ATCC.BndCtrChg	ok	ok	ok	ok	ok	lower, higher

cMdl3 – descriptions	Support of CDC: descriptive information	☒ Passed ☐ Failed ☐ Inconclusive

MICS

Expected result 3. DUT sends correct GetDataValues requests and processes the returned values
Test description 1. Configure the DUT and server simulator(s) with the following descriptive information CDC's: DPL, LPL, CSD, VSD 2. Start SERVER SIMULATOR 3. Force the DUT to read the descriptive information
Comment DPL: LPHD.PhyNam LPL: LLN0.NamPlt CSD: PDIF.TmASt VSD: privateDNVG.MyVSD

cMdl3 – tracking	**Support of CDC: tracking information**	☒ Passed ☐ Failed ☐ Inconclusive

MICS

Expected result

3. DUT processes the data from data update reports of the supported CDC's (MICS)

Test description

1. Configure the DUT and server simulator(s) with dataset(s) and report control block(s) with tracking information from the following CDC's: CST, BTS, CTS, GTS, LTS, MTS, NTS, OTS, STS, UTS
2. Start SERVER SIMULATOR
3. Force the DUT to enable the report control block(s) and to trigger tracking updates

Comment

What	how	Tracked values
CST	Not supported by test tool	
BTS	Good, data changes	See cTrk1
CTS	Good, control report is shown	See cTrk8
GTS	Good, data changes	See cTrk4
LTS	Not supported by test tool	
MTS		
NTS		
OTS		
STS	Good, data changes	See cTrk7
UTS	Good, data changes	See cTrk2

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
1a: Basic Exchange	Associate_Request Abort and/or Release_Request	Associate_Response Release_Response GetAllDataValues SetDataValues GetServerDirectory GetLogicalDeviceDirectory(LD) GetLogicalNodeDirectory(DATA) GetDataDirectory GetDataDefinition GetDataValues
1b: Associate IPv6	Associate_Request Abort and/or Release_Request	Associate_Response Release_Response
2: Data Set		GetDataSetValues SetDataSetValues GetLogicalNodeDirectory(DATA-SET) GetDataSetDirectory
2+: Data Set Definition	CreateDataSet DeleteDataSet	
3: Substitution	SetDataValues	GetLogicalNodeDirectory(SGCB)
4: Setting Group Selection	SelectActiveSG	GetSGCBValues
4+: Setting Group Definition	SelectEditSG SetEditSGValue ConfirmEditSGValues	GetEditSGValue
5: Unbuffered Reporting	Receive Report GetURCBValues SetURCBValues	GetLogicalNodeDirectory(URCB)
6: Buffered Reporting	Receive Report GetBRCBValues SetBRCBValues	GetLogicalNodeDirectory(BRCB)
7: Logging	GetLCBValues QueryLogByTime and/or QueryLogAfter GetLogStatusValues	GetLogicalNodeDirectory(LCB) GetLogicalNodeDirectory (LOG) SetLCBValues
9: GOOSE Control Block		GetLogicalNodeDirectory(GOCB) GetGoCBValues SetGoCBValues
11: Sampled Value Control Block		GetMSVCBValues SetMSVCBValues
12a: Direct Control	Operate	TimeActivatedOperate
12b: SBO Control	Select, Operate	Cancel, TimeActivatedOperate

Conformance Block	Mandatory	Conditional
12c: Enhanced Direct Control	Operate Receive CommandTermination	TimeActivatedOperate
12d: Enhanced SBO Control	SelectWithValue, Operate Receive CommandTermination	Cancel, TimeActivatedOperate
13a: Time Sync SNTP	TimeSynchronization	
13b: Time Sync PTP	TimeSynchronization	
14: File Transfer	GetServerDirectory(FILE) GetFile	GetFileAttributeValues SetFile DeleteFile
15: Service Tracking	Receive Report	

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
1a: Basic Exchange	cAss1, cAss2, cAss3, cAssN1, cAssN4, cAssN5, cAssN6, cAssN8	PICS-Associate by server: cAss10, cAssN10 PIXIT - Automatic startup: cAssN7 PICS-GetServerDirectory: cSrv1 PICS-GetLogicalDeviceDirectory: cSrv2, cSrvN1, cSrvN10 PICS-GetLogicalNodeDirectory: cSrv3, cSrvN1 PICS-GetDataDirectory/GetDataDefinition: cSrv4, cSrvN1, cSrvN9 PICS-GetDataValues: cSrv5, cSrv7, cSrvN3, cSrvN7 PICS-SetDataValues: cSrv6, cSrvN4, cSrvN8 PICS-GetAllDataValues: cSrv8, cSrvN2 PIXIT - Support setting blkEna: cSrv9 SCL - SupportsLdName: cSrv10 PIXIT - Quality: cSrvN5 PIXIT - TimeQuality: cSrvN6
1b: Associate with IPv6	cAss61, cAss62, cAss63, cAss64, cAss6N1, cAss6N4, cAss6N5	PICS-Associate by server: cAss65 PIXIT – Automatic startup: cAss6N7
2: Data Sets		PICS-GetLogicalNodeDirectory(DATA-SET): cDs1, cDsN1a PICS-GetDataSetDirectory: cDs2, cDs5, cDs6, cDsN1b PICS-GetDataSetValues: cDs3, cDsN1c PICS-SetDataSetValues: cDs4, cDsN2
2+: Data Set Definition		PICS-DeleteDataSet: cDs12, cDsN11 PIXIT-Support persistent datasets: cDs10, cDs13, cDsN10a PIXIT-Support non-persistent datasets: cDs11, cDs14, cDsN10b
3: Substitution	cSub1, cSub3	PIXIT-Source “substituted”: cSub2
4: Setting Group Selection	cSg2, cSg46, cSgN1	PICS-GetLogicalNodeDirectory(SGCB): cSg1
4+: Setting Group Definition	cSg11, cSg14	PICS-GetDataValues(FC=SG): cSg10 Cancel SG: cSg12 PIXIT-Read SGCB-ResvTms: cSg13

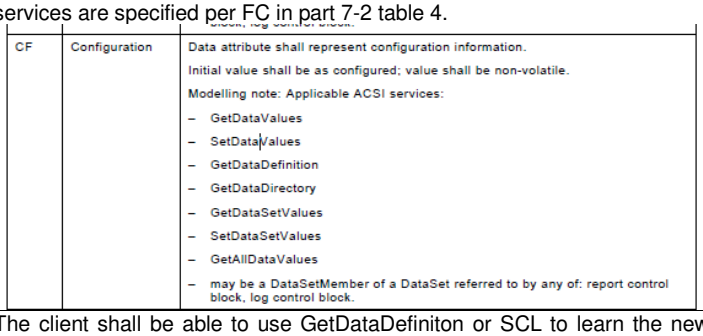
Conformance Block	Mandatory	Conditional
5: Unbuffered Reporting	cRp3, cRp4, cRp5, cRp8, cRp9, cRp10, cRp11, cRp13a, cRp14, cRp15, cRp18, cRp19, cRp20, cRp21, cRp22, cRp40, cRp41, cRp42, cRp43, cRp44, cRp45, cRp46, cRpN2, cRpN5, cRpN6	PICS-GetLogicalNodeDirectory(URCB): cRp1, cRpN1 PICS-SetURCBValues(trgops, optflds): cRp2 PICS-Buffer time: cRp6 PICS-General interrogation: cRp7 PIXIT-Rp2 Dataset=y and PIXIT-Ds11 dataset creation supported: cRp12, cRp13b PIXIT-Non test equipment: cRp16 PIXIT-Owner: cRp17
6: Buffered Reporting	cBr3, cBr4, cBr5, cBr8, cBr9, cBr10, cBr11, cBr13a, cBr14, cBr15, cBr18, cBr19, cBr20, cBr21, cBr22, cBr30, cBr31, cBr46, cBrN2, cBrN5, cBrN6	PICS-GetLogicalNodeDirectory(BRCB): cBr1, cBrN1 PICS-SetBRCBValues(trgops, optflds): cBr2 PICS-Buffer time: cBr6 PICS-General interrogation: cBr7 PIXIT-Rp2 Dataset=y and PIXIT-Ds11 dataset creation supported: cBr12, cBr13b PIXIT-Non test equipment: cBr16 PIXIT-Owner: cBr17 PIXIT-Purge buffer: cBr32
7: Logging	cLog4, cLog6, cLog7, cLog8, cLog46, cLogN3, cLogN4, cLogN5	PICS-GetLogicalNodeDirectory(LOG): cLog1, cLogN1 PICS-GetLogicalNodeDirectory(LCB): cLog2, cLogN2 PICS-SetLCBValues: cLog5 PICS-SetDataValues(GLOG): cLog9
9: GOOSE Control Block		PICS-GetGoCBValues: cGcb1, cGcb46 PICS-SetGoCBValues: cGcb2
11: Sampled Value Control Block		PICS-GetMsvCBValues: cMsvcb1, cMsvcb46 PICS-SetMsvCBValues: cMsvcb2
12a: Direct Control	cCtl4, cCtl5, cDOns1, cDOns2	PIXIT-Test: cCtl1 PIXIT-Check: cCtl2 PIXIT-Change control model: cCtl3 PICS-TimeActivatedOperate: cDOns3, cDOns4
12b: SBO Control	cCtl4, cCtl5, cSBOns1, cSBOns2, cSBOns3, cSBOns10	PIXIT-Test: cCtl1 PIXIT-Check: cCtl2 PIXIT-Change control model: cCtl3 PICS-Cancel: cSBOns4 PICS-TimeActivatedOperate: cSBOns5, cSBOns6
12c: Enhanced Direct Control	cCtl4, cCtl5, cDOes1, cDOes2	PIXIT-Test: cCtl1 PIXIT-Check: cCtl2 PIXIT-Change control model: cCtl3 PICS-TimeActivatedOperate: cDOes3, cDOes4
12d: Enhanced SBO Control	cCtl4, cCtl5, cSBOes1, cSBOes2, cSBOes3	PIXIT-Test: cCtl1 PIXIT-Check: cCtl2 PIXIT-Change control model: cCtl3 PICS-Cancel: cSBOes4 PICS-TimeActivatedOperate: cSBOes5, cSBOes6
13a: Time Sync SNTP	cTm1, cTmN1	PICS-Time accuracy: cTm2 PIXIT-ClockFailure: cTmN2
13b: Time Sync PTP	cTmP1, cTmPN1	PICS-Time accuracy: cTmP2 PIXIT-ClockFailure: cTmPN2

Conformance Block	Mandatory	Conditional
14: File Transfer	cFt1, cFt3, cFt6, cFtN1	PICS-GetFileAttributeValues: cFt2, cFtN2 PICS-SetFile: cFt4, cFtN3 PICS-DeleteFile: cFt5
15: Services Tracking		PIXIT-Buffered Reporting: cTrk1 PIXIT-Unbuffered Reporting: cTrk2 PIXIT-Logging: cTrk3 PIXIT-GOOSE control block: cTrk4 PIXIT-SMV: cTrk5 PIXIT-Setting Group: cTrk7 PIXIT-Control: cTrk8 (SPC), cTrk9 (DPC), cTrk10 (INC), cTrk11 (ENC), cTrk12 (APCf), cTrk13 (APCi), cTrk14 (BSC), cTrk15 (ISC), cTrk16 (BAC) PIXIT-General: cTrk17

Note1: cAssN2 and cAssN3 are not applicable for part 8-1; Note2: cCtl6 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.

IEC 61850-7-1 Annex K specifies requirements regarding compatibility issues between different versions of IEC 61850. These requirements are identified in below table together with the corresponding test cases.

Use case	Impact	Test case
K2.1 new type	The client shall be able to ignore elements of unknown type	cRp40
K2.2 add new FC	The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC and ignore DAs with unknow FC	cRp41
K2.3 extend CDC with existing types	The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC	cRp42
K2.4 new DO new CDC	The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC and the FC to understand what services can be applied In Ed2 the services are specified per CDC and not per FC; In Ed2.1 the services are specified per FC in part 7-2 table 4. 	cRp43
K2.7 rename DA, subDO	The client shall be able to use GetDataDefiniton or SCL to learn the new structure of the CDC and the FC to understand what services can be applied	cRp44
K2.10 remove DA	Achievable when DA was (not) mandatory. The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC and the FC to understand how to ignore the unexpected/missing DA	similar to rename DA
K2.17 extend packed list	Guaranteed, unknown bits shall be ignored	cRp45 extend quality
K3.3 Filename delimiter	File name delimiter character	cFt3, cFt4
K3.4 extend control block	Client shall ignore new control block attributes	cRp46 URCB cBr46 BRCB cGcb46 GoCB cLog46 LCB cSg46 SGCB cMsvcb46 MsvCB

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

A4.1 Block 1a: Basic Services

Abstract test cases for Application Association

Test case	Test case description
cAss1	Associate and force the DUT to release or abort a TPAA (IEC 61850-7-2 8.3, 8-1 10.2)
cAss2	Force the DUT to associate with maximum number of servers simultaneously (*PIXIT As1*).
cAss3	Verify the DUT can handle servers with small and large MMS PDU size, the DUT should keep on proposing its original MMS PDU size.
cAss10	Server requests correct associate, release, abort request to DUT

Note1: The client is always considered to be the calling node unless specified otherwise.

Test case	Test case description
cAssN1	Associate and server responds with negative response due to AccessPointReference.
cAssN2	Associate and server responds with negative response due to AuthenticationParameter
cAssN3	Associate and server releases TPAA (IEC 61850-7-2 8.3). DUT should try to re-establish the association after the configured period (*PIXIT As3*).
cAssN4	Associate and server-abort TPAA (IEC 61850-7-2 8.3). DUT should try to re-establish the association after the configured period (*PIXIT As3*).
cAssN5	Associate and server denies TPAA (IEC 61850-7-2 8.3). DUT should try to re-establish the association after the configured period (*PIXIT As3*).
cAssN6	Disconnect the communication interface, the DUT should detect link lost within a specified period (*PIXIT As2*).
cAssN7	Interrupt and restore the power supply, the DUT shall automatically establish the configured associations when ready (*PIXIT As6*).
cAssN8	Associate and release to an Ed1 server
cAssN10	Server requests incorrect associate request to DUT

Note1: cAssN2 and cAssN3 are not applicable for part 8-1

Detailed test procedures for Application Association

cAss1	**Associate and force client to release or abort**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8.3 IEC 61850-8-1 clause 10.2, table 124 *PIXIT As7*		
Expected result 1. DUT sends correct Associate request with association parameters according to the settings in SCL. proposedVersionNumber shall be 1, proposedParameterCBBs = see Note 1 and ServiceSupportCalling = see Note 2. DUT accepts Associate response+ from server 2. DUT sends correct release request. 3. DUT returns to "state" where it is able to start a new TPAA with the same server 4. DUT sends correct Associate request with association parameters according to the settings in SCL. DUT accepts Associate response+ from server 5. DUT sends correct abort request. 6. DUT returns to "state" where it is able to start a new TPAA with the same server		
Test description If DUT supports release: 1. Set-up a TPAA with one server 2. Force DUT to release TPAA 3. Repeat step 1 and 2, 10 times If DUT supports abort: 4. Set-up a TPAA with one server 5. Force DUT to abort TPAA 6. Repeat step 4 and 5, 10 times		
Comment Note: at least release or abort shall be implemented Association parameters to check: TSelector, SSelector, PSelector, AEQualifier and APTitle. Note 1: proposedParameterCBBs=(str1, str2, vnam, valt, vlis) str1 is required if the client does support arrays str2 and valt are required if PICS S8 (GetDataValues) is declared vnam is required if PICS S6 (GetLogicalNodeDirectory) or S8 (GetDataValues) is declared vlis is required if PICS S16 (GetDataSetDirectory) is declared Note 2: ServiceSupportCalling=(fileOpen, fileRead, fileClose, informationReport, conclude) fileOpen, fileRead and fileClose are required if PICS S58 (SetFile) is declared) informationReport is required if PICS S24 or S27 (Report) is declared)		

cAss2	Associate to maximum number of servers	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As1*		
Expected result 1. DUT accepts Associate response+ from all servers 2. DUT returns to “state” where it is able to start new TPAAs with the same servers		
Test description 1. Set-up a TPAA with maximum number of servers 2. Force DUT to release or abort TPAA 3. Repeat step 1 and 2, 10 times		
Comment Tested with 240 servers		

cAss3	Verify that the client can handle servers with small and large MMS PDU size	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As5*		
Expected result 1. Client accepts Associate response+ from all servers 2. DUT 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 (about 4k), and the other server has a large PDU size (about 64k). 2. Force DUT to release or abort all open TPAAs		
Comment Tested with 2 servers		

cAssN1	Access point mismatch	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-8-1 clause 10.2, 25.3.1 and table 132 PIXIT As3		
Expected result 2. DUT detects the Association failure and behaves as specified in the PIXIT 4. DUT detects the Association failure and behaves as specified in the PIXIT 6. DUT detects the Association failure and behaves as specified in the PIXIT 8. DUT detects the Association failure and behaves as specified in the PIXIT 10. DUT detects the Association failure and behaves as specified in the PIXIT		
Test description 1. Set-up the DUT and one server to have a mismatching Transport Selector 2. Set-up a TPAA between the DUT and the server 3. Set-up the DUT and one server to have a mismatching Presentation Selector 4. Set-up a TPAA between the DUT and the server 5. Set-up the DUT and one server to have a mismatching Session Selector 6. Set-up a TPAA between the DUT and the server 7. Set-up the DUT and one server to have a mismatching AP-title 8. Set-up a TPAA between the DUT and the server 9. Set-up the DUT and one server to have a mismatching AE-qualifier 10. Set-up a TPAA between the DUT and the server		
Comment		

cAssN4	Server abort	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As3*		
Expected result 1. DUT accepts Associate response+ from server 2. DUT accepts abort request from the server and behaves as specified in the PIXIT		
Test description 1. Set-up a TPAA with one server 2. Force SERVER SIMULATOR to abort TPAA 3. Repeat step 1 and 2, 10 times		
Comment		

cAssN5	Server deny	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As3*		
Expected result 2. DUT detects the Association failure and behaves as specified in the PIXIT.		
Test description 1. Set-up test configuration with at least two servers 2. Force the DUT to perform an Associate request for all servers, The SERVER SIMULATOR denies the association for one server caused by a mismatching transport, 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 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As2, As3*		
Expected result 3. DUT shall detect the lost link and shall try to reconnect to the server 4. DUT shall set-up a TPAA with the server		
Test description 1. Connect the DUT and one server to a hub 2. Set-up a TPAA with the server 3. Disconnect the physical link, between the two switches/hubs, 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 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As6*		
Expected result 3. DUT behaves as specified in the PIXIT.		
Test description 1. Set-up a TPAA between DUT and all servers as configured in SCL 2. Interrupt the power supply to DUT 3. Restore the power supply to DUT		
Comment		

cAssN8	Ed1 server denies associate	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 8.3 IEC 61850-8-1 clause 10.2 *PIXIT As1, As3*		
Expected result 1. DUT detects the Association failure and behaves as specified in the PIXIT.		
Test description 1. Force the DUT to perform an Associate request to an Ed1 server, the SERVER SIMULATOR denies the association with a non-Ed2 error code.		
Comment		

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

Test case	Test case description
cSrv1	If the DUT implements Autodescription, (See Note 1) force the DUT to start the autodescription and check the DUT requests a GetServerDirectory(LOGICAL-DEVICE) to all the logical devices of the configured servers (see Note 2) (IEC 61850-7-2 Subclause 7.2.2)
cSrv2	If the DUT implements Autodescription, for each GetServerDirectory(LOGICAL-DEVICE) response check the DUT issues a GetLogicalDeviceDirectory request (IEC 61850-7-2 Subclause 9.2.1)
cSrv3	If the DUT "implements Autodescription", for each GetLogicalDeviceDirectory response check the DUT issues a GetLogicalNodeDirectory(DATA) request (IEC 61850-7-2 Subclause 10.2.2)
cSrv4	If the DUT "implements Autodescription", for a subset of the GetLogicalNodeDirectory(DATA) response check the DUT issues at least one of the following services: a GetDataDirectory request and check response (IEC 61850-7-2 Subclause 11.4.4) b GetDataDefinition request and check response (IEC 61850-7-2 Subclause 11.4.5)
cSrv5	Verify that after start-up the DUT 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 (IEC 61850-7-2 Subclause 11.4.3)
cSrv7	Request GetDataValues and check if the DUT updates its model (IEC 61850-7-2 Subclause 11.4.2)

cSrv8	Request GetAllDataValues for the required functional constraints and check if the DUT updates its model (IEC 61850-7-2, 9.2.3)
cSrv9	Verify that the client is able to set/reset blkEna (IEC 61850-7-3 Subclause 6.2.6)
cSrv10	Verify that the client is able to support a server with ldName

NOTE 1 Implement Autodescription means that there is a way to configure the DUT to update the image of the model of one of the servers it has to communicate with using the ACSI services.
NOTE 2 Configured servers means the servers the client DUT is configured to communicated with. The client DUT at least needs to know the parameters to establish an association with them.

Test case	Test case description
cSrvN1	If the DUT implements autodescription, force the DUT to start the autodescription and check the DUT 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 DUT 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 DUT is able to communicate with other connected servers after a request for GetDataValues fails in the following circumstances: 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 DUT is able to communicate with other connected servers after a request for SetDataValues fails in the following circumstances: The response is negative. One of the data values is read-only
cSrvN5	If DUT detects/notify changes in the “Quality” attribute, force the SERVER SIMULATOR to change the values in the Quality of the measured/status values monitored by the DUT and check the behaviour described in the PIXIT.
cSrvN6	If DUT 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 DUT and check the behaviour described in the PIXIT.
cSrvN7	Verify GetDataValues response negative for Ed1 server
cSrvN8	Verify SetDataValues response negative for Ed1 server
cSrvN9	Verify GetDataDirectory response negative for Ed1 server
cSrvN10	Verify GetLogicalDeviceDirectory response negative for Ed1 server

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

cSrv1	**GetServerDirectory(LOGICAL-DEVICE)**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 Subclause 7.2.2 IEC 61850-8-1 Subclause 9.3 *PIXIT Sr2*		
Expected result 1. DUT accepts a GetServerDirectory response+ from the server		
Test description 1. Force DUT to request GetServerDirectory(LOGICAL-DEVICE)		
Comment		

cSrv4	GetDataDirectory / GetDataDefinition	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 Subclause 11.4.4 and 11.4.5 IEC 61850-8-1 Subclause 13.3.3 and 13.3.4 *PIXIT Sr2*		
Expected result 1. DUT accepts a GetDataDirectory/GetDataDefinition response+ from the server		
Test description 1. Force DUT to request GetDataDirectory/GetDataDefinition		
Comment		

cSrv5	Update of process values	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.3, 17.2.5, 17.3.5 IEC 61850-8-1 clause 17.2.1, 17.3.4 *PIXIT Sr3*		
Expected result 2-5. DUT receives the process values either by Reporting or by GetDataValues+ response and handles the values as stated in the PIXIT.		
Test description 1. Set-up a TPAA with one server 2. DUT request either GetDataValues of at least two standard data attributes or data objects 3. Repeat step 2 for extended data objects OR if reporting is supported: 4. DUT receives a Report of at least two standard data attributes or data objects 5. DUT receives a Report of at least two extended data objects		
Comment		

cSrv6	SetDataValues	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.3 IEC 61850-8-1 clause 13.4.2 *PIXIT Sr7*		
Expected result 2. DUT accepts a SetDataValues response+ from server		
Test description 1. Set-up a TPAA with one server 2. DUT request SetDataValues on a writable data attribute with FC = CF, DC, SP with one of the basic type: boolean, integer, float, bitstring or enumerated.		
Comment		

cSrv7	**GetDataValues**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr8*		
Expected result 2-3. DUT accepts a GetDataValues response+ from server		
Test description 1. Set-up a TPAA with one server 2. DUT request GetDataValues of at least two data attributes 3. DUT request GetDataValues of at least two data objects		
Comment Tested with data attributes and data objects		

cSrv9	**Set / reset blkEna**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-3 clause 6.2.6 *PIXIT Sr10*		
Expected result DUT accepts the SetDataValues response+ from server		
Test description 1. Set-up a TPAA with one server 2. DUT request SetDataValues of blkEna to TRUE 3. DUT request SetDataValues of blkEna to FALSE		
Comment		

cSrv10	**ldName**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-6 clause 8.5.3		
Expected result 2. DUT request services with data object references with the ldName value		
Test description 1. Set-up a TPAA with one server with ldName 2. DUT request all supported ACSI services on data objects identified by ldName		
Comment Tested with the following ACSI services: GetDataDefinition getLogicalNodeDirectory (dataset) GetDataSetDirectory ReceiveReport GetRCBValues SetRCBValues GetDataValues Select SelectWithValue Operate Cancel		

cSrvN1	GetLogicalDeviceDirectory & GetDataDefinition negative	☒ Passed ☐ Failed ☐ Inconclusive

IEC 61850-7-2 clause 9.2.1, 11.4.5

IEC 61850-8-1 clause 11, 12, 13

PIXIT Sr2, Sr11

Expected result

1,3,4,5,7,9,11.	DUT associates with the server and responds as specified in PIXIT. DUT shall continue with the other servers
2.	DUT uses autodescription to prevent sending the request or DUT accepts a GetLogicalDeviceDirectory response- from the server and continues as specified in PIXIT
6., 8.	DUT uses autodescription to prevent sending the request or DUT accepts a GetDataDefinition response- from the server and continues as specified in PIXIT
10., 12.	DUT receives a GetDataDefinition response and continues as specified in PIXIT

Test description

If DUT supports GetLogicalNodeDirectory/GetLogicalDeviceDirectory:

1. Reconfigure/rename the LogicalDevice for one server only and restart the server
2. DUT 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. DUT requests GetLogicalDeviceDirectory of the previously known logical node

If DUT supports GetDataDirectory/GetDataDefinition:

5. Reconfigure/rename a data object (in a valid existing logical node) for one server only and restart the server
6. DUT 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. DUT 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. DUT 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. DUT requests GetDataDefinition of a known data object with less attributes then expected

Comment

cSrvN3	**GetDataValues negative**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr2, Sr11*		
Expected result 1,3,5,7,9,11. DUT associates with the server and responds as specified in PIXIT. DUT shall continue with the other servers 2,4,6,8. DUT uses autodescription to prevent sending the request or DUT accepts a GetDataValues response- from the server and continues as specified in PIXIT 10,12. DUT 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. DUT requests GetDataValues of a data object in 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. DUT requests GetDataValues of a data object in 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. DUT 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. DUT 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. DUT 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. DUT requests GetDataValues of a known data object with less attributes then expected		
Comment		

cSrvN4	SetDataValues negative	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.3 IEC 61850-8-1 clause 13.4.2 *PIXIT Sr2, Sr11*		
Expected result 1,3,5,7. DUT associates with the server and responds as specified in PIXIT. DUT shall continue with the other servers 2,4,6,8,9. DUT uses autodescription to prevent sending the request or DUT accepts a SetDataValues response- from the server and continues as specified in PIXIT		
Test description 1. Reconfigure/rename the LogicalDevice for one server only and restart the server 2. DUT 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. DUT requests SetDataValues of a data attribute in 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. DUT requests SetDataValues of a data attribute in 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. DUT requests SetDataValues of the previously known data attribute 9. DUT requests SetDataValues of an existing previously writable but now read-only data attribute		
Comment		

cSrvN5	Quality values	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-7-3 table 3 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr4, Sr5, Sr6*		
Expected result 1. DUT 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 – overflow – Validity: Invalid – out of range – Validity: Invalid – badReference – Validity: Invalid – oscillatory – Validity: Invalid – failure – Validity: Questionable – oldData – Validity: Questionable – inconsistent – Validity: Questionable – inaccurate – Source = Substituted (by another client) – Test = true – OperatorBlocked = true		
Comment		

cSrvN6	Time Quality values	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr12, Sr13*		
Expected result 1-5. DUT processes the time quality as specified in the PIXIT		
Test description Force server to respond with data object with time accuracy = 10 bits and time quality 1. "clock failure=T" 2. "clock not synchronised=T" and "leap seconds known=F" (normal not-synched) 3. "clock not synchronised=T" and "leap seconds known=T" (Ed1) 4. "clock not synchronised=F" and "leap seconds known=F" (Ed1) 4. "clock not synchronised=T" and "leap seconds known=T" (normal synched)		
Comment		

cSrvN7	GetDataValues negative for Ed1 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr2, Sr11*		
Expected result 2. DUT queries the data model to prevent sending the request or DUT accepts a GetDataValues response- from the server and continues as specified in PIXIT		
Test description 1. Reconfigure/rename a Logical Node or Data Object in an Ed1 server and restart the server 2. DUT requests GetDataValues of a data object/attribute and SERVER SIMULATOR forces a non-Ed2 error code		
Comment		

cSrvN8	SetDataValue negative for Ed1 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr2, Sr11*		
Expected result 2. DUT queries the data model to prevent sending the request or DUT accepts a SetDataValues response- from the server and continues as specified in PIXIT		
Test description 1. Reconfigure/rename a Logical Node or Data Object in an Ed1 server and restart the server 2. DUT requests SetDataValues of a data object/attribute and SERVER SIMULATOR forces a non-Ed2 error code		
Comment		

cSrvN9	**GetDataDirectory negative for Ed1 server**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 11.4.2 IEC 61850-8-1 clause 13.4.1 *PIXIT Sr2, Sr11*		
Expected result 2. DUT queries the data model to prevent sending the request or DUT accepts a GetDataDirectory response- from the server and continues as specified in PIXIT		
Test description 1. Reconfigure/rename a Logical Node or Data Object in an Ed1 server and restart the server 2. DUT requests GetDataDirectory (MMS GetVarAccessAttributes) of a data object and SERVER SIMULATOR responds a non-Ed2 error code		
Comment		

A4.2 Block 2: Data Set

Test case	Test case description
cDs1	If the DUT implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(DATA-SET) of the Logical Nodes of the configured servers (IEC 61850-7-2 Subclause 10.2.2)
cDs2	If the DUT implements autodescription, force it to start autodescription and check it requests a GetDataSetDirectory of all the DataSets of the server used by the client (IEC 61850-7-2 Subclause 13.3.6)
cDs3	Check the DUT can request a GetDataSetValues and handle the response (IEC 61850-7-2 Subclause 13.3.2)
cDs4	Check the DUT can request a SetDataSetValues and handle the response (IEC 61850-7-2 Subclause 13.3.3)
cDs5	Verify that the DUT checks the pre-configured datasets in the SCD file. If any deviation is detected the DUT behaves as specified in the PIXIT
cDs6	Verify that the DUT can handle a pre-configured data set with the maximum name length for data set and a data set member (IEC 61850-7-2 Subclause 22.2)

Test case	Test case description
cDsN1	If the DUT implements autodescription, force the DUT to start the autodescription and check the DUT still communicates with other servers when it requests the following services with negative response: a GetLogicalNodeDirectory (DATA-SET) b GetDataSetDirectory c GetDataSetValues
cDsN2	Check that the DUT still communicates with other servers properly when it requests a SetDataSetValues to one of them and the response is negative.

Detailed test procedures for Data Set

cDs1	**GetLogicalNodeDirectory(DATA-SET)**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.2.2 IEC 61850-8-1 clause 12.3.1		
Expected result 1. DUT accepts the response		
Test description 1. Force DUT to perform a GetLogicalNodeDirectory(DATA-SET) request for each server and logical device		
Comment		

cDs2	GetDataSetDirectory	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 13.3.6 IEC 61850-8-1 clause 14.3.5		
Expected result 1. DUT accepts the response		
Test description 1. Force DUT to perform a GetDataSetDirectory request for the data sets used by the DUT		
Comment		

cDs5	Pre-configured dataset element deviations	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 13.3 IEC 61850-8-1 clause 14.3 *PIXIT Ds4*		
Expected result 3. DUT 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 DUT to perform a GetDataSetDirectory request on all the datasets used by the DUT		
Comment		

cDs6	Pre-configured dataset name length	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 13.3 IEC 61850-8-1 clause 14.3		
Expected result 2. DUT can handle the response and updates the dataset member with the maximum name length correctly		
Test description 1. Configure the server having a dataset: – With maximum name length for the dataset name <64/16$32> – With maximum name length for one of the dataset members <64/61+3> 2. Start the server and force the DUT to perform a GetDataSetDirectory for this dataset		
Comment		

cDsN1	**GetLogicalNodeDirectory(DATA-SET) response- and GetDataSetDirectory response- and GetDataSetValues response-**	☒ Passed ☐ Failed ☐ Inconclusive

IEC 61850-7-2 clause 10.2.2, 13.3.6, 13.3.2

IEC 61850-8-1 clause 12.3.1, 14.3.5, 14.3.1

PIXIT Sr2, Ds5

Expected result

4. DUT uses autodescription to prevent sending the request or DUT processes the negative response and continues as specified in PIXIT

5. The DUT processes the response as specified in the PIXIT

6,7. DUT uses autodescription to prevent sending the request or DUT processes the negative response and continues as specified in PIXIT

8,9. DUT uses autodescription to prevent sending the request or DUT processes the negative response and continues as specified in PIXIT

Test description

1. Stop all servers
2. Reconfigure Amd1 server and an Ed1 server in the following way:
   - Rename a dataset in logical device1
   - Add a dataset in logical device2
   - Rename logical device3

a)

3. Start the Amd1 server
4. Force the DUT to perform a GetLogicalNodeDirectory(DATA-SET) request for the previously known logical device
5. Force the DUT to perform a GetLogicalNodeDirectory(DATA-SET) request for the logical device which contains the dataset that was newly added

b)

6. Force the DUT to perform a GetDataSetDirectory request for the previously known dataset
7. Force the DUT to perform a GetDataSetDirectory request for the previously known dataset and Ed1 SERVER SIMULATOR to respond with a non-Ed2 error code

c)

8. Force the DUT to perform a GetDataSetValues request for the previously known dataset
9. Force the DUT to perform a GetDataSetValues request for the previously known dataset and Ed1 SERVER SIMULATOR to respond with a non-Ed2 error code

Comment

Only parts a) and b) are performed as GetDataSetValues is not supported by DUT

A4.3 Block 3: Substitution

cSub1	Verify DUT can enable substitution, enter a substituted value and disable substitution
cSub2	Verify DUT can process the source “substituted” for substituted values
cSub3	Verify that the DUT can handle the maximum name length for substitution values (IEC 61850-7-2 Subclause 22.2)

Detailed test procedures for Substitution

cSub1	**Substitute a value**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-3 clause 7 IEC 61850-8-1 clause 13 *PIXIT Sub1*		
Expected result 1. DUT sends successful SetDataValues requests for the values with functional constraint SV 2. DUT successfully enables substitution 3. DUT successfully disables substitution		
Test description 1. DUT substitutes the values of data objects in one server by another valid value of the following supported type: – single point status – double point status – enumerated status – integer measurand – floating point measurand – quality 2. DUT enables substitution 3. DUT disables substitution		
Comment		

cSub2	**Verify that DUT can process the source "substituted" for substituted value**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-3 clause 7 IEC 61850-8-1 clause 13		
Expected result 2. DUT successfully enables substitution 3. DUT processes the new substituted value and quality with source “substituted” when transmitted by the Report or GetDataValues response 4. DUT successfully disables substitution 5. DUT processes the original process value and quality with source “process” when transmitted by the Report or GetDataValues response		
Test description 1. DUT substitutes the values of data objects in one server by another valid value of the following supported type: – single point status – double point status – enumerated status – integer measurand – floating point measurand – quality 2. DUT enables substitution 3. Force the DUT to perform a Report or GetDataValues request on the substituted data 4. DUT disables substitution 5. Force the DUT to perform a Report or GetDataValues request on the data that is no longer substituted		
Comment		

cSub3	**Substitute a value with maximum name length**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-3 clause 7 IEC 61850-8-1 clause 13		
Expected result 1. DUT sends successful SetDataValues requests for the values with functional constraint SV 2. DUT successfully enables substitution 3. DUT successfully disables substitution		
Test description 1. DUT substitutes the value of a data object in one server, the substituted FCDA shall have the longest available name length in the SERVER SIMULATOR (IEC 61850-7-2 Subclause 22.2) 2. DUT enables substitution 3. DUT disables substitution		
Comment		

A4.4 Block 4: Setting Group Selection

cSg1	If the DUT implements autodescription, force it to start autodescription and check if it requests GetLogicalNodeDirectory(SGCB) and check response+
cSg2	Verify the DUT can select a setting group (IEC 61850-7-2 clause 16 figure 22). – SelectActiveSG of the first setting group (IEC 61850-7-2 Clause 16.3.2) – GetSGCBValues to verify active setting group (IEC 61850-7-2 Clause 16.3.7) – Repeat for another setting group
cSg46	Extended SGCB

cSgN1	Force SERVER SIMULATOR to return response- for the following services and verify the DUT continues as before: - SelectActiveSG (IEC 61850-7-2 Subclause 16.3.2) - GetSGCBValues (IEC 61850-7-2 Subclause 16.3.7)

Detailed test procedures for Setting group selection

cSg2	**SelectActiveSG and GetSGCBValues**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 16.3.2, 16.3.7 IEC 61850-8-1 clause 16.2.1, 16.2.6 *PIXIT Sg2*		
Expected result 1. The DUT sends a correct SelectActiveSG request 2. The DUT sends a correct GetSGCBValues request and processes the response		
Test description 1. Force the DUT to perform a SelectActiveSG request to select first setting group of a SGCB 2. When supported, force the DUT 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		

cSg46	**Verify the DUT can handle SGCB with new control block attributes (K.3.4)**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K3.4 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT reads and enables/disables the SGCB		
Test description 1. Configure future edition server SGCB with an additional attribute 2. Start the DUT and force it to read/change the SGCB from step 1.		
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 Sg5*		
Expected result 1. DUT uses autodescription to prevent sending the request or DUT responds as specified in PIXIT to the negative responses from the server		
Test description 1. Force the DUT to send the following request and the SERVER SIMULATOR to return a negative respond for: – SelectActiveSG – GetSGCBValues (when supported)		
Comment		

A4.4+ Block 4+: Setting Group Definition

cSg10	Verify the DUT can get setting group values [FC=SG] (IEC 61850-7-2 Clause 16, Figure 22); a) SelectActiveSG of the first setting group b) Use GetDataValues [FC=SG] to verify the values of the first setting group c) Repeat for another setting group
cSg11	Verify the DUT can edit setting group values a) SelectEditSG of the first setting group b) Request GetEditSGValue to read the edit value (IEC 61850-7-2 Clause 16.3.6) c) Use SetEditSGValue to change the edit value (IEC 61850-7-2 Clause 16.3.4) d) Use ConfirmEditSGValues to confirm the changes (IEC 61850-7-2 Clause 16.3.5)
cSg12	Verify the device can cancel the edit procedure a) SelectEditSG of the first setting group b) Cancel processing with SelectEditSG where SettingGroupNumber is 0 (zero)
cSg13	If the device is able to read the optional ResvTms, verify the DUT does not request SelectEditSG if ResvTms >0 (IEC 61850-7-2 Clause 16.2.2.8)
cSg14	If the device is able to read the EditSG, verify the DUT does not request SelectEditSG if SettingGroupNumber >0 (IEC 61850-7-2 Clause 16.2.2.5)

Detailed test procedures for setting group definition

cSg10	**Get setting group values**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 16.3.2 IEC 61850-8-1 clause 16.2.1 *PIXIT Sg2, Sg3*		
Expected result 1. DUT requests SelectActiveSG 2. DUT requests GetDataValues [FC=SG] and processes the response		
Test description 1. Request SelectActiveSG to Select first setting group of a server 2. Request GetDataValues [FC=SG] to verify setting group values 3. Repeat for another setting group		
Comment		

cSg11	Edit setting group values	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 16.3 IEC 61850-8-1 clause 16.2 *PIXIT Sg4*		
Expected result 1. DUT requests SelectEditSG 2. DUT requests GetEditSGValue[FC=SE] 3. DUT requests SetEditSGValue[FC=SE] 4. DUT requests ConfirmEditSGValues		
Test description 1. Request SelectEditSG to select first setting group of a server 2. When supported, request GetEditSGValue[FC=SE] to get the current setting group values (one for each type) 3. Request SetEditSGValue[FC=SE] to set the new setting group values (one for each type) 4. Request ConfirmEditSGValues		
Comment		

cSg12	Cancel Edit Procedure	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 16.3.3 IEC 61850-8-1 clause 16.2.2 *PIXIT Sg4*		
Expected result 1. DUT requests SelectEditSG 2. DUT requests SelectEditSG(SettingGroupNumber=0)		
Test description 1. Request SelectEditSG to select first setting group of a server 2. Cancel processing with SelectEditSG(SettingGroupNumber=0)		
Comment		

cSg13	Setting group in use by other client: ResvTms > 0	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 16.3.3 IEC 61850-8-1 clause 16.2.2 *PIXIT Sg5, Sg6*		
Expected result 2. Verify DUT does read the optional ResvTms and does not request SelectEditSG		
Test description 1. Connect another client to the server and set EditSG > 0 and ResvTms > 0 2. Try to edit the setting group values using the DUT		
Comment		

cSg14	Setting group in use by other client: EditSG > 0	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 16.3.3 IEC 61850-8-1 clause 16.2.2 *PIXIT Sg5, Sg6*		
Expected result 2. Verify DUT does not request SelectEditSG or DUT processes the negative response and continues as specified in the PIXIT		
Test description 1. Connect another client to the server and set EditSG > 0 2. Try to edit the setting group values using the DUT		
Comment		

A4.5 Block 5: Unbuffered Reporting

Test case	Test case description
cRp1	If the DUT implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(URCB) of the logical nodes declared in the PIXIT of all configured servers.
cRp2	If the DUT configures the server's Unbuffered ReportControlBlock parameters after startup using SetURCBValues, check that the GetURCBValues/SetURCBValues are sent with the configured values. (IEC 61850-7-2 Subclause 17.2.5.4)
cRp3	Verify the DUT is able to process the reports with different optional fields: Force the DUT to configure/enable a URCB with useful optional fields combinations: sequence-number, configuration-revision, report-time-stamp, reason-for-inclusion, data-set-name and/or data-reference, force/trigger a report and check the DUT is able to process the reports and updates its database. (IEC 61850-7-2 Subclause 17.2.2.8)
cRp4	Verify the DUT is able to process the reports with the following trigger conditions (IEC 61850-7-2 Subclause 17.2.2.11) Configure and enable a URCB with all supported optional fields and check the reports are processed according to the following (supported) trigger conditions: a on integrity b on data update c on data update and integrity d on data change e on data change and quality change f on data change, quality change and integrity
cRp5	Verify the DUT is able to process segmented reports
cRp6	Verify DUT can change the Buffer Time (IEC 61850-7-2 clause 17.2.2.9)
cRp7	Verify DUT can force a General interrogation (IEC 61850-7-2 Subclause 17.2.2.13)
cRp8	Verify that after start up the DUT configures and enables the URCBs as specified in the SCD file. The DUT only may write to the "Dyn" URCB fields in the SCL.
cRp9	Verify that the DUT can process reports with complex structured data (for example WYE and DEL data objects)
cRp10	Verify that the DUT can handle reports with basic data (for example stVal and quality)
cRp11	Verify that the DUT can handle a URCB, RptID and DatSet with maximum name length (IEC 61850-7-2 Subclause 22.2)
cRp12	Verify that the DUT can change the dataset elements of a dynamic dataset previously used in a URCB
cRp13	Verify that the DUT configures another indexed URCB when another client has reserved the indexed URCB before
cRp14	Verify that the DUT supports non-indexed URCB
cRp15	Verify DUT can accept a report with a dataset elements of arrays and service tracking and Unicode strings (even if those types are unsupported)
cRp16	Verify the DUT can handle pre-assigned URCBs
cRp17	Verify the DUT sends a GetURCBValues(owner) requests
cRp18	Verify the DUT can process reports from an URCB and data set in a logical device with ldName
cRp19	Verify the DUT can process reports with private data
cRp20	Verify the DUT can reserve a pre-assigned URCB in Ed2 server
cRp21	Verify the DUT does process a report before RptEna write respond+
cRp22	Verify the DUT can configure a non-indexed URCB in Ed1 server
cRp40	Verify forward compability: new type
cRp41	Verify forward compability: new FC
cRp42	Verify forward compability: extend CDC with existing type
cRp43	Verify forward compability: new CDC
cRp44	Verify forward compability: rename DA
cRp45	Verify forward compability: extended packed list

Test case	Test case description
cRp46	Verify forward compability: URCB extended

Test case	Test case description
cRpN1	If the configured RCB was renamed or deleted, verify that the DUT does not send the GetURCBValues request (prevent) OR when it sends the request it behaves as specified in the PIXIT. In any case verify that the DUT still communicates with other servers.
cRpN2	Check that the DUT still works properly when it performs a SetURCBValues request while the URCB attribute(s) have a dynamic/configurable mismatch: dynamic in the client SCL and configurable in the server SCL
cRpN3	<removed>
cRpN4	<removed>
cRpN5	Mismatching reports: a Report with unknown DataSet. b Report with unknown RptID c Report with incorrect references of the Data. d Report with incorrect types in the Data. Check the behaviour described in the PIXIT.
cRpN6	Verify that the DUT detects a change in the ConfRev attribute (Configuration revision, IEC 61850-7-2, 17.2.2.7) of the Report Control Block. When the DUT does not perform the ConfRev check it should check the dataset elements. The means of detection need to be specified in the PIXIT.

Note: cRpN3 and cRpN4 are not applicable because clients shall support all OptFlds and all TrgOps.

The default server control block configuration for the unbuffered reporting test cases are as follows:
(Any deviation will be mentioned in the detailed test procedure)

<ReportSettings rptID=”Dyn” trgOps=”Dyn” intgPd=”Dyn” optFields=”Dyn” cbName=”Conf” datSet=”Conf” bufTime=”Dyn” resvTms=”false” owner=”false”/>

<ReportControl buffered=”false” name=”urcb01” bufTime=”1000” intgPd=”0” confRev=”1”>
<TrgOps dchg=”true” qchg=”true” dupd=”true” period=”false” gi=”true”/>
<OptFields seqNum=”true” dataSet=”true” reasonCode=”true” dataRef=”true” entryID=”false” configRef=”true” bufOvfl=”false”/>
<RptEnabled max=”3”/>
</ReportControl>

Detailed test procedures for Unbuffered Reporting

cRp2	GetURCBValues and SetURCBValues	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.5.4, Annex E.3 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2*		
Expected result 4. The DUT sends a correct GetURCBValues request 5. The DUT reserves the URCB and then changes the trigger options, optional fields and integrity period and enables the reporting		
Test description 1. Stop DUT 2. Configure at least one report control block in the SCL file, the trigger options, optional fields and integrity period are different in the server then expected by the client 3. The applicable ReportSettings are “Dyn” 4. Start DUT and force DUT to send GetURCBValues request(s) 5. Force DUT to perform SetURCBValues request(s) to reserve, set trigger options and optional fields, integrity period, enable reporting and GI		
Comment		

cRp3	DUT is able to process unbuffered reports with different optional fields	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT Rp5		
Expected result 3. The DUT sets the configured optional fields before enabling the URCB. 4. The DUT is able to process the report. 5. The DUT does not change the optional fields and is able to process the report.		
Test description 1. Stop DUT 2. Configure the minimum optional fields supported by the DUT for a report control block in the DUT SCL file for one server. 3. Start DUT and force DUT to reserve and enable a URCB 4. Generate a report for the configured URCB 5. Repeat step 1 to 4, this time configuring all optional fields in step 2 and change SCL report settings OptFlds=”Conf”		
Comment		

cRp4	DUT is able to process unbuffered reports with different trigger conditions	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 4. DUT is able to process the reports send by the server.		
Test description 1. Stop DUT 2. Configure the following (combination of) trigger conditions by the DUT for several URCBs in the DUT SCL file for one server: a on integrity b on data update c on data update and integrity d on data change e on data change and quality change f on data change, quality change and integrity 3. Start DUT and force DUT to reserve and enable the URCBs. 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	DUT can process segmented unbuffered reports	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp4, Rp6*		
Expected result 2. DUT can process the reported values		
Test description 1. Configure URCB with trigger condition integrity and GI, minimum MMS PDU size and large dataset 2. Force the DUT to send a GI and the SERVER SIMULATOR to send a segmented report or wait for integrity report		
Comment		

cRp6	**Change buffer time**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, Annex E.3 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2, Rp14*		
Expected result 1. DUT first reserves the URCB and then changes the buffer time		
Test description 1. Force the DUT to perform a SetURCBValues request to change the bufTm of an URCB		
Comment		

cRp7	**Verify client can force a General interrogation on an unbuffered report control block**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp4, Rp16*		
Expected result 1. DUT successfully performs a general interrogation request		
Test description 1. Force the DUT to perform a general interrogation request on an URCB		
Comment		

cRp8	SetURCBValues() only on “dyn” fields	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2, Rp17*		
Expected result 1. The DUT configures all URCBs as specified in the SCL The DUT writes only the URCB fields that are marked “Dyn” 2. The DUT writes only the URCB fields that are marked “Dyn”		
Test description 1. Force DUT to reserve and enable a URCB in a server that is configured with the default URCB settings. The default ReportSettings are: <ReportSettings rptID=”Dyn” trgOps=”Dyn” intgPd=”Dyn” optFields=”Dyn” cbName=”Conf” datSet=”Dyn” bufTime=”Dyn“ resvTms=”false” owner=”true”/> 2. Force DUT to reserve and enable a URCB in another server that is configured with non-default URCB settings. The non-default ReportSettings are: <ReportSettings rptID=”Conf” trgOps=”Dyn” intgPd=”Dyn” optFields=”Dyn” cbName=”Conf” datSet=”Conf” bufTime=”Conf“ resvTms=”false” owner=”true”/>		
Comment		

cRp9	Reports with complex structured data	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp8*		
Expected result 1. DUT successfully reserves, configures and enables the report control block 2. DUT processes the report as normal 3.		
Test description 1. Force DUT to reserve, configure and enable an URCB which contains complex structured data (e.g. WYE or DEL). 2. Force the SERVER SIMULATOR to send a report for URCB		
Comment		

cRp10	Reports with basic data	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp8*		
Expected result 1. DUT successfully reserves, configures and enables the report control block 2. The DUT processes the report as normal 3.		
Test description 1. Force the DUT to reserve, configure and enable an URCB which contains basic (unstructured) data (e.g. stVal or q) 2. Force the SERVER SIMULATOR to send a report for the URCB.		
Comment		

cRp11	URCB, RptID and DatSet with maximum name length	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 1. DUT successfully configures and enables the report control block 2. The DUT processes the report as normal		
Test description 1. Force the DUT to reserve, configure and enable an URCB which has: • Maximum possible LD, LN and URCB name length • Maximum possible LD, LN and DataSet name length • Maximum RptID length • Maximum available DatSet ObjectReference length • Maximum available DataRef length 2. Force the SERVER SIMULATOR to send a report for the URCB.		
Comment The maximum length for RCB is 117 (64 / 16 $ RP $ 32) The maximum length for DataSets is 114 (64 / 16 $ 32) The maximum length for RptID is 129 (VisString129) The maximum length for DataSet ObjectReference is 114 (64 / 16 $ 32) The maximum length for Data Reference is 123 (64 / 16 $ 2 $ 12 $ 12 $12)		

cRp13	Indexed URCB usage (static & dynamic reporting)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2, Rp9, Ds11*		
Expected result 1. DUT enables the URCB 3. DUT behaves as specified in PIXIT Rp9 4. DUT enables the URCB 6. DUT behaves as specified in PIXIT Rp9 8. DUT enables the URCB 10. DUT behaves as specified in PIXIT Rp9		
Test description a1) Static reporting with max>1 1. Start the DUT and force it to reserve and enable an indexed URCB 2. Stop the DUT and force another client to configure and enable this URCB 3. Start the DUT a2) Static reporting with max=1 4. Start the DUT and force it to reserve and enable an URCB with max=1 5. Stop the DUT and force another client to configure and enable this URCB 6. Start the DUT b) Dynamic reporting For this test case use default configuration with datset=”dyn” instead of datset=”conf” and DynDatasets specified in Services section. 7. Start the DUT and create a dataset 8. DUT configures and enables a URCB with the dataset from step 7. 9. Stop the DUT and force another client to reserver, configure and enable this URCB 10. Start the DUT		
Comment Only parts a1) and a2) are performed as Dynamic reporting is not supported by DUT		

cRp14	Non Indexed URCB usage	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 3. DUT enables the non-indexed URCB 4. DUT processes the report as normal		
Test description Use default configuration with ReportControl indexed=”false” 1. Configure a non-indexed URCB in SERVER SIMULATOR 2. Load the SCL file with the non-indexed URCB into the DUT configuration tool 3. Start the DUT and force it to reserve and enable the non-indexed URCB 4. Force the SERVER SIMULATOR to send a report		
Comment		

cRp15	Extended DataSet Elements	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-4 clause 5.3.10, 5.10.4 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp4*		
Expected result 2. DUT enables the URCB 3. DUT processes the report and supported CDC as normal		
Test description If applicable use default configuration with integrity period = nonzero if test performed with integrity in step 3. 1. Configure the SERVER SIMULATOR with a DataSet containing supported CDC classes as well as CDCs which may not be supported: – Tracking (all tracking DO CDCs within logical node LTRK: SpcTrk (CTS), UrcbTrk (UTS), BrcbTrk (BTS), LocbTrk (LTS), GocbTrk (GTS), MsvcbTrk (MTS), UsvcbTrk (NTS), SgcbTrk (STS) – Complete arrays (harmonic values with CDC "HDEL") with FC "MX" 2. Configure and start the DUT with a report control using this DataSet 3. Force the SERVER SIMULATOR to send a GI or integrity report		
Comment		

cRp16	Pre-assigned URCBs	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-6 clause 9.3.8 IEC 61850-7-2 clause 17.2, Annex E IEC 61850-8-1 clause 17.1, 17.2		
Expected result 3. DUT does use the URCBs assigned to DUT and does not use the URCBs assigned to another client(s). The DUT reserves the assigned URCB instance before configure/enable.		
Test description 1. Configure firstURCB01 assigned to DUT and firstURCB02 to another client, and secondURCB01 to another client and secondURCB02 to DUT and start the SERVER SIMULATOR 2. Load the SCD in DUT 3. Start the DUT		
Comment		

cRp17	GetURCBValues(owner)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp23*		
Expected result 1. DUT successfully sends the GetURCBValues request and processes the owner value		
Test description Use default configuration with owner="true" 1. Force the DUT to perform a GetURCBValues(owner) request		
Comment		

cRp18	URCB in logical device with ldName	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 1. DUT enables the URCB 2. DUT processes the report as normal		
Test description 1. Start the DUT and force it to enable an URCB in a logical device with ldName 2. Force the SERVER SIMULATOR to send a report		
Comment		

cRp19	Verify the DUT can process reports with private data	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT processes the report as normal		
Test description 1. Configure server URCB with dataset that has members with private logical node and standard data objects and that has members with standard logical node and private data objects. 2. Start the DUT and force it to enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment		

cRp20	Verify the DUT can reserve a pre-assigned URCB in Ed2 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables it's pre-assigned URCB instance 02 3. DUT processes the reported values as normal		
Test description 1. Configure and pre-assign an indexed URCB instance 01 to another client and instance 02 to the DUT. The SERVER SIMULATOR set URCB.Resv=T for the pre-assigned instances 2. Start the DUT and configure it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment		

cRp21	Process a report before and after the enable response	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT Rp8		
Expected result 1. DUT successfully reserves, configures and enables the report control block 2. The DUT processes the report with the new value as normal 1. The DUT processes the report with the new value as normal		
Test description 1. Force the DUT to reserve, configure and enable an URCB which a valid data set 2. Force the SERVER SIMULATOR to send a report 3. SERVER SIMULATOR sends the enable response Force the SERVER SIMULATOR to send another report with a different new data value		
Comment		

cRp22	Process a report from non-indexed Ed1 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT Rp8		
Expected result 1. DUT successfully configures and enables the non-indexed report control block 2. The DUT processes the report with the new value as normal		
Test description Configure an Ed1 server with non-indexed URCB 1. Force the DUT to configure and enable an URCB which a valid data set 2. Force the SERVER SIMULATOR to send a report		
Comment The Ed1 SCL has no SCL indexed in ReportControl		

cRp40	Verify the DUT can handle URCB dataset elements with new type (K.2.1)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K2.2 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT shall process, at the minimum, the Ed2 reported values		
Test description 1. Configure future edition server URCB with a dataset element with new FC. 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator with future edition CDC=SPC Dotype with a new DA=ST.futType with new type and instantiate FutInd1 and FutInd2, add these to a dataset as follows and add this dataset to an URCB - Future SPC: FutInd1.ST.stVal and FutInd1.ST.futType as FCDA - Normal Ed2 SPS: Ind1.ST.stVal and Ind1.ST.q - Future SPC: FutInd2.ST - Normal Ed2 SPS: Ind2.ST K2.1: The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC and may **ignore Das with unknow type**		

cRp41	Verify the DUT can handle URCB dataset elements with new FC (K.2.2)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K2.2 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT shall process, at the minimum, the Ed2 reported values		
Test description 1. Configure future edition server URCB with a dataset element with new FC. 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator with future edition CDC=SPC Dotype with FC=MM and DA=futVal as Boolean and instantiate FutInd1 and FutInd2, add these to a dataset as follows and add this dataset to an URCB - Future SPC: FutInd1.ST.stVal and FutInd1.MM.futVal as FCDA - Normal Ed2 SPS: Ind1.ST.stVal and Ind1.ST.q - Future SPC: FutInd2.ST and FutInd2.MM as FCD - Normal Ed2 SPS: Ind2.ST K2.2: The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC and may **ignore Das with unknow FC**		

cRp42	Verify the DUT can handle URCB dataset elements with extended CDC with existing type (K.2.3)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K2.2 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT shall process, at the minimum, the Ed2 reported values		
Test description 1. Configure future edition server URCB with a dataset element with new FC. 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator with future edition CDC=SPC Dotype with DA=ST.futVal as Boolean and instantiate FutInd1 and FutInd2, add these to a dataset as follows and add this dataset to an URCB - Future SPC: FutInd1.ST.stVal and FutInd1.ST.futVal as FCDA - Normal Ed2 SPS: Ind1.ST.stVal and Ind1.ST.q - Future SPC: FutInd2.ST - Normal Ed2 SPS: Ind2.ST K2.3: The client shall be able to use GetDataDefinition or SCL to learn the new structure of the CDC and may **ignore new DA**		

cRp43	Verify the DUT can handle URCB dataset elements with new CDC with existing FC (K.2.4)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K2.2 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT shall process, at the minimum, the Ed2 reported values		
Test description 1. Configure future edition server URCB with a dataset element with new FC. 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator with future edition CDC=MMM Dotype with DA=ST.stVal as Boolean and instantiate FutInd1 and FutInd2, add these to a dataset as follows and add this dataset to an URCB - Future MMM: FutInd1.ST.stVal and FutInd1.ST.q as FCDA - Normal Ed2 SPS: Ind1.ST.stVal and Ind1.ST.q - Future MMM: FutInd2.ST - Normal Ed2 SPS: Ind2.ST K2.4: The client shall be able to use GetDataDefinition or SCL to learn the new structure of the new CDC and shall be able able to process the new CDC with existing FC		

cRp44	Verify the DUT can handle URCB dataset elements with renamed DA (K.2.7)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K2.2 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT shall process, at the minimum, the Ed2 reported values		
Test description 1. Configure future edition server URCB with a dataset element with new FC. 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator with future edition CDC=SPC Dotype and rename DA stVal to DA=ST.futVal as Boolean and instantiate FutInd1 and FutInd2, add these to a dataset as follows and add this dataset to an URCB - Future SPC: FutInd1.ST.futVal and FutInd1.ST.q as FCDA - Normal Ed2 SPS: Ind1.ST.stVal and Ind1.ST.q - Future SPC: FutInd2.ST - Normal Ed2 SPS: Ind2.ST K2.7: The client shall be able to use GetDataDefinition or SCL to learn the new structure of the new CDC and shall be able able to process the attributes with known FC		

cRp45	Verify the DUT can handle URCB dataset elements with extended packed list (K.2.17)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K2.2 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT shall process, at the minimum, the Ed2 reported values		
Test description 1. Configure future edition server URCB with a dataset element with new FC. 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator with future edition CDC=SPC Dotype with DA=ST.q extended to 16 bits and instantiate FutInd1 and FutInd2, add these to a dataset as follows and add this dataset to an URCB - Future SPC: FutInd1.ST.stVal and FutInd1.ST.q as FCDA - Normal Ed2 SPS: Ind1.ST.stVal and Ind1.ST.q - Future SPC: FutInd2.ST - Normal Ed2 SPS: Ind2.ST K2.17: The client shall be able to use GetDataDefinition or SCL to learn the new structure of the new CDC and shall be able able to process the known bits from the extended packed list		

cRp46	Verify the DUT can handle URCB with new control block attributes (K.3.4)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K3.4 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the URCB 3. DUT processes the reported values as normal		
Test description 1. Configure future edition server URCB with additional attribute 2. Start the DUT and force it to reserve and enable the URCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment Configure server simulator that has additional attributes in the URCB (for example owner but without the owner=true in SCL) K3.4: Client shall ignore new control block attributes		

cRpN2	SetURCBValues Response-	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2, Rp19*		
Expected result 3. The DUT processes the SetURCBValues response- as specified in the PIXIT		
Test description 1. Stop a SERVER SIMULATOR 2. Change the SERVER SIMULATOR configuration so that one or more of the following configurable URCB elements which were previously writable become read-only: datSet, rptID, optFlds, bufTm, trgOps, intgPd 3. Start SERVER SIMULATOR and force the DUT to perform a SetURCBValues request for one or more of the read-only URCB elements		
Comment		

cRpN5	DUT is able to handle report control blocks with a mismatching dataset configuration	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp12*		
Expected result 4. The DUT behaves as described in the PIXIT.		
Test description 1. Stop a SERVER SIMULATOR 2. Configure several URCBs in the SERVER SIMULATOR SCL file in the following way (one change per URCB) and keep the ConfRev value the same: 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 SIMULATOR SCL file in the following way: – change the order of dataset members, without changing the order of the data types – change the order of dataset members, hereby changing the order of the data types – 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 SIMULATOR containing the URCB) to “Conf” 4. Start the SERVER SIMULATOR and force the DUT to enable the URCB		
Comment		

cRpN6	DUT is able to detect a change in ConfRev	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp13*		
Expected result 3. The DUT behaves as described in the PIXIT. 4. The DUT behaves as described in the PIXIT.		
Test description 1. Stop a SERVER SIMULATOR 2. Increment the value for confRev of a URCB in the SERVER SIMULATOR SCL and remove a member from the referenced dataset 3. Start the SERVER SIMULATOR and force DUT 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	If the DUT implements autodescription, force it to start autodescription and check if it requests a GetLogicalNodeDirectory(BRCB) of the logical nodes declared in the PIXIT of all configured servers.
cBr2	If the DUT configures the server's Buffered ReportControlBlock parameters after startup using SetBRCBValues, check that the GetBRCBValues/SetBRCBValues are sent with the configured values (IEC 61850-7-2 Subclause 17.2.3.4)
cBr3	Verify the DUT is able to process the reports with different optional fields: Force the DUT to configure/enable a BRCB with the useful optional fields combinations: sequence-number, report-time-stamp, reason-for-inclusion, data-set-name, data-reference, buffer-overflow, 57ntryID and configuration-revision , force/trigger a report and check the DUT is able to process the reports and updates its database (IEC 61850-7-2 Subclause 17.2.2.8)
cBr4	Verify the DUT is able to process buffered reports with the following supported trigger conditions (IEC 61850-7-2 Subclause 17.2.2.11). Configure and enable a BRCB with all supported optional fields and check the reports are processed according to the following (supported) trigger conditions: a on integrity b on data update c on data update and integrity d on data change e on data change and quality change f on data change, quality change and integrity
cBr5	Verify the DUT is able to process segmented reports
cBr6	Verify client can change the Buffer Time (IEC 61850-7-2 clause 17.2.2.9)
cBr7	Verify the DUT can force a General interrogation (IEC 61850-7-2 Subclause 17.2.2.13)
cBr8	Verify that the DUT configures and enables the BRCBs as configured in the SCD file. The DUT only may write to the "Dyn" BRCB fields in the SCL.
cBr9	Verify that the DUT can handle reporting of complex structured data (for example WYE and DEL data objects)
cBr10	Verify that the DUT can handle reporting of basic data (for example stVal and quality)
cBr11	Verify that the DUT can handle a BRCB, RptID and DatSet with maximum name length (IEC 61850-7-2 Subclause 22.2)
cBr12	Verify that the DUT can change the dataset elements of a dynamic dataset previously used in a BRCB resulting in a ConfRev increment by the server.
cBr13	Verify that the DUT configures another indexed BRCB when another client has configured the indexed BRCB before
cBr14	Verify that the DUT supports non-indexed BRCB
cBr15	Verify DUT can accept a report with a dataset elements of arrays and service tracking and Unicode strings (even if those types are unsupported).
cBr16	Verify the DUT can handle pre-assigned BRCBs
cBr17	Verify the DUT sends a GetBRCBValues(owner) requests
cBr18	Verify that the DUT can process reports from a BRCB and dataset in a logical device with ldName
cBr19	Verify the DUT can process reports with private data
cBr20	Verify the DUT can use pre-assigned BRCB in Ed2 server with and without ResvTms
cBr21	Verify the DUT does process a report before RptEna write respond+
cBr22	Verify the DUT can configure a non-indexed BRCB in Ed1 server
cBr30	Verify the DUT is able to process reports buffered during a lost association a without buffer overflow (PIXIT) b with buffer overflow
cBr31	Verify the DUT is able to request specific buffered reports after restoring a lost association by setting the EntryID
cBr32	Verify the DUT is able to purge buffered reports
cBr46	Extended BRCB control block

Test case	Test case description
cBrN1	If the configured RCB was renamed or deleted, verify that the DUT does not send the GetBRCBValues request (prevent) OR when it sends the request it behaves as specified in the PIXIT. In any case verify that the DUT still communicates with other servers.
cBrN2	Check that the DUT still works properly when it performs a SetBRCBValues request while the BRCB attribute(s) have a dynamic/configurable mismatch: dynamic in the client SCL and configurable in the server SCL.
cBrN3	Report with not supported OptFlds. Check that the DUT does not collapse if it receives a Report with a non-configured or non-supported OptFlds.
cBrN4	Report with not supported TrgOps. Check that the DUT does not collapse if it receives a Report with a non-configured or non-supported Trigger Option.
cBrN5	Mismatching reports: a Report with a mismatching DataSet. b Report with a mismatching RptID c Report with mismatching references of the Data d Report with incorrect types in the Data. Check the behaviour described in the PIXIT.
cBrN6	Verify that the DUT detects a change in the ConfRev attribute (Configuration revision, IEC 61850-7-2, 17.2.2.7) of the Report Control Block. When the DUT does not perform the ConfRev check it should check the dataset members. The means of detection needs to be specified in the PIXIT.

Note: cBrN3 and cBrN4 are not applicable because clients shall support all OptFlds and all TrgOps.

The default server control block configuration the buffered reporting testcases are as follows:
(Any deviation will be mentioned in the detailed test procedure)

<ReportSettings rptID="Dyn" trgOps="Dyn" intgPd="Dyn" optFields="Dyn" cbName="Conf" datSet="Conf" bufTime="Dyn" resvTms="false" owner="false"/>

<ReportControl buffered="true" name="brcb01" bufTime="1000" intgPd="0" confRev="1">
<TrgOps dchg="true" qchg="true" dupd="true" period="false" "gi=true"/>
<OptFields seqNum="true" timeStamp="true" dataSet="true" reasonCode="true" dataRef="true" entryID="true" configRef="true" bufOvfl="true"/>
<RptEnabled max="3"/>
</ReportControl>

Detailed test procedures for Buffered Reporting

cBr2	GetBRCBValues and SetBRCBValues	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, Annex E.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2*		
Expected result 4. The DUT sends a correct request 5. The DUT first reserves the BRCB and then changes the trigger options, optional fields and integrity period and enables the reporting		
Test description 1. Stop DUT 2. Configure at least one report control block in the SCL file, the trigger options, optional fields and integrity period are different in the server then expected by the client 3. The applicable ReportSettings are “Dyn” 4. Start DUT and force DUT to send GetBRCBValues request(s) 5. Force DUT to perform SetBRCBValues request(s) to reserve, set trigger options, integrity period and optional fields, enable reporting and GI		
Comment		

cBr3	DUT is able to process buffered reports with different optional fields	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp5*		
Expected result 3 The DUT sets the configured optional fields before enabling the BRCB. 4. The DUT is able to process the report. 5. The DUT does not change the optional fields and is able to process the report.		
Test description 1. Stop DUT 2. Configure the minimum optional fields supported by the DUT for a report control block in the DUT SCL file for one server. 3. Start DUT and force DUT to enable a BRCB 4. Generate a report for the configured BRCB 5. Repeat step 1 to 4, this time configuring all optional fields in step 2 and change SCL report settings OptFlds=”Conf		
Comment		

cBr4	DUT is able to process buffered reports with different trigger conditions	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2.2.11 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp4*		
Expected result 4. DUT is able to process the reports sent by the server.		
Test description 1. Stop DUT 2. Configure the following (combination of) trigger conditions by the DUT for several BRCBs in the DUT SCL file for one server: a on integrity b on data update c on data update and integrity d on data change e on data change and quality change f on data change, quality change and integrity 3. Start DUT and force DUT to reserve and enable the BRCBs. 4. Force events related to the trigger conditions configured in step 2, which 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	DUT can process segmented buffered reports	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp4, Rp6*		
Expected result 1. DUT can process the reported value change(s)		
Test description 1. Force to send a GI and the SERVER SIMULATOR to send a segmented report with new values or wait for integrity report		
Comment		

cBr6	Change buffer time	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, Annex E.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT 14*		
Expected result 1. DUT first reserves the BRCB and then changes the buffer time		
Test description 1. Force the DUT to perform a SetBRCBValues request to change the bufTm of a BRCB		
Comment		

cBr7	Verify DUT can force a General interrogation on a buffered report control	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp4, Rp16*		
Expected result 1. DUT successfully performs a general interrogation request		
Test description 1. Force the DUT to perform a general interrogation request on a BRCB		
Comment		

cBr8	SetBRCBValues() only on “dyn” fields	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2, Rp17*		
Expected result 1. The DUT writes only the BRCB fields that are marked “Dyn” 2. The DUT writes only the BRCB fields that are marked “Dyn”.		
Test description 1. Force DUT to reserve and enable BRCB that is configured in the SCL with the default BRCB settings 2. Force DUT to reserve and enable a BRCB that is configured in the SCL with non-default BRCB settings. The report settings are: <ReportSettings rptID="Dyn" trgOps="Dyn" intgPd="Dyn" optFields="Dyn" cbName="Conf" datSet="Dyn" bufTime=" Dyn " resvTms="true" owner="true"/>		
Comment		

cBr9	Reports with complex structured data	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp8*		
Expected result 1. DUT successfully configures and enables the report control block 2. The DUT processes the report as normal		
Test description 1. Force the DUT to configure and enable a BRCB which contains complex structured data (e.g. WYE or DEL). 2. Force the SERVER SIMULATOR to send a report for the BRCB.		
Comment		

cBr10	Reports with basic data	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp8*		
Expected result 1. DUT successfully reserves, configures and enables the report control block 2. The DUT processes the report as normal		
Test description 1. Force the DUT to reserve, configure and enable a BRCB which contains basic (unstructured) data (for example stVal and quality). 2. Force the SERVER SIMULATOR to send a report for the BRCB.		
Comment		

cBr11	BRCB, RptID and DatSet with maximum name length	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2, 22.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 1. DUT successfully configures and enables the report control block 2. The DUT processes the report as normal		
Test description 1. Force the DUT to reserve, configure and enable an BRCB which has: – Maximum possible LD, LN and brcb name length – Maximum possible LD, LN and DataSet name length – Maximum RptID length – Maximum possible DatSet ObjectReference length – Maximum possible DataRef length 2. Force the SERVER SIMULATOR to send a report for the BRCB.		
Comment The maximum length for RCB is 117 (64 / 16 $ BR $ 32) The maximum length for DataSets is 114 (64 / 16 $ 32) The maximum length for RptID is 129 (VisString129) The maximum length for DataSet ObjectReference is 114 (64 / 16 $ 32) The maximum length for Data Reference is 123 (64 / 16 $ 2 $ 12 $ 12 $12)		

cBr13	Indexed BRCB usage(static & dynamic reporting)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp2, Rp10, Ds11*		
Expected result 1. DUT enables the BRCB 3. DUT behaves as specified in PIXIT Rp10 4. DUT enables the BRCB 6. DUT behaves as specified in PIXIT Rp10 8. DUT enables the BRCB 10. DUT behaves as specified in PIXIT Rp10		
Test description a1) Static reporting with max>1 1. Start the DUT and force it to reserve and enable an indexed BRCB 2. Stop the DUT and force another client to configure and enable this BRCB 3. Start the DUT a2) Static reporting with max=1 4. Start the DUT and force it to reserve and enable an BRCB with max=1 5. Stop the DUT and force another client to configure and enable this BRCB 6. Start the DUT b) Dynamic reporting 7. Start the DUT and create a dataset 8. DUT reserves, configures and enables a BRCB with dataset from step 7 9. Stop the DUT and force another client to configure and enable this BRCB 10. Start the DUT		
Comment Only parts a1) and a2) are performed as DUT does not support create a dataset		

cBr14	Non Indexed BRCB usage	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 3. DUT enables the non-indexed BRCB 4. DUT processes the report as normal		
Test description 1. Configure a non-indexed BRCB in SERVER SIMULATOR 2. Load the SCL file with the non-indexed BRCB into the DUT configuration tool 3. Start the DUT and force it to reserve and enable the non-indexed BRCB 4. Force the SERVER SIMULATOR to send a report		
Comment		

cBr15	Extended DataSet Elements	☒ Passed ☐ Failed ☐ Inconclusive

IEC 61850-7-4 clause 5.3.10, 5.10.4

IEC 61850-8-1 clause 17.1, 17.2

PIXIT Rp4

Expected result

2. DUT enables the BRCB
3. DUT processes the report and supported CDC as normal

Test description

If applicable use default configuration with integrity period = nonzero if test performed with integrity in step 3.

1. Configure the SERVER SIMULATOR with a DataSet containing supported CDC classes as well as CDCs which may not be supported:
   - Tracking (all tracking DO CDCs within logical node LTRK:
     SpcTrk (CTS), UrcbTrk (UTS), BrcbTrk (BTS), LocbTrk (LTS), GocbTrk (GTS),
     MsvcbTrk (MTS), UsvcbTrk (NTS), SgcbTrk (STS)
   - Complete arrays (harmonic values with CDC “HDEL”)”) with FC=”MX
2. Configure and start the DUT with a report control using this DataSet
3. Force the SERVER SIMULATOR to send a GI or integrity report

Comment

cBr16	Pre-assigned BRCBs	☒ Passed ☐ Failed ☐ Inconclusive

IEC 61850-6 clause 9.3.8, SICS I29

IEC 61850-7-2 clause 17.2, TISSUE #1276

IEC 61850-8-1 clause 17.1, 17.2

Expected result

3. DUT does use the BRCBs assigned to DUT and does not use the BRCBs assigned to another client(s). The DUT reserves the assigned BRCB instance before configure/ enable

Test description

1. Configure firstBRCB01 assigned to DUT and firstBRCB02 to another client, and secondBRCB01 to another client and secondBRCB02 to DUT and start the SERVER SIMULATOR
2. Load the SCD in the DUT
3. Start the DUT

Comment

cBr17	GetBRCBValues(owner)	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp23*		
Expected result 1. DUT successfully sends the GetBRCBValues request and processes the owner value		
Test description Use default configuration with owner="true" 1. Force the DUT to perform a GetBRCBValues(owner) request		
Comment		

cBr18	BRCB in logical device with ldName	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 1. DUT enables the BRCB 2. DUT processes the report as normal		
Test description 1. Start the DUT and force it to reserve and enable a BRCB in a logical device with ldName 2. Force the SERVER SIMULATOR to send a report		
Comment		

cBr19	Verify the DUT can process reports with private data	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT enables the BRCB 3. DUT processes the report as normal		
Test description 1. Configure server BRCB with dataset that has members with private logical node and standard data objects and that has members with standard logical node and private data objects. 2. Start the DUT and force it to reserve and enable the BRCB from step 1. 3. Force the SERVER SIMULATOR to send a report		
Comment		

cBr20	Verify the DUT can reserve a pre-assigned BRCB in Ed2 server with ResvTms and a free BRCB without ResvTms	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 3. DUT enables it's pre-assigned BRCB instance 02 from step 1 and the free BRCB from step 2 4. DUT processes the reported values as normal		
Test description 1. Configure and pre-assign an indexed BRCB instance 01 to another client and instance 02 to the DUT in an Ed2 server with ResvTms 2. Configure a free BRCB instance to the DUT in another Ed2 server without ResvTms 3. Start the DUT and configure it to reserve and enable the BRCBs from step 1 and step 2. 4. Force the SERVER SIMULATORs to send report for the 2 BRCBs		
Comment Note: in Ed2 the pre-assigned BRCB.ResvTms = -1 and does not accept to write a value to it. The DUT is expected to ignore such error or skip writing ResvTms. The Ed2 server will refuse writing ResvTms and accept the enable.		

cBr21	Process a report before and after the enable response	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT Rp8		
Expected result 3. DUT successfully configures and enables the report control block 4. The DUT processes the report with the new value as normal 4. The DUT processes the report with the new value as normal		
Test description 3. Force the DUT to Configure and enable an BRCB which a valid data set 4. Force the SERVER SIMULATOR to send a report 5. SERVER SIMULATOR sends the enable response 6. Force the SERVER SIMULATOR to send another report with a different new data value		
Comment		

cBr22	Process a report from non-indexed Ed1 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 PIXIT Rp8		
Expected result 1. DUT successfully configures and enables the non-indexed report control block 2. The DUT processes the report with the new value as normal		
Test description Configure an Ed1 server with non-indexed BRCB 1. Force the DUT to configure and enable an BRCB which a valid data set 2. Force the SERVER SIMULATOR to send a report		
Comment The Ed1 SCL has no SCL indexed in ReportControl		

cBr30	**Process buffered reports with and without buffer overflow**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp20, Rp21*		
Expected result 5. The DUT resync's to the last received EntryID and handles the buffered reports or purges the buffer 8. The DUT tries to resync to the last received EntryID and handles the buffer overflow and buffered reports as specified in PIXIT or purges the buffer		
Test description 1. Reserve, 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 or disable a port in the 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 or disable a port in the switch 7. Force many data changes in the server to force buffer overflow 8. Restore the Ethernet connection		
Comment		

cBr31	Set EntryID of buffered reports	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp21*		
Expected result 6. The DUT sends a correct SetBRCBValues request with the last received EntryID 7. The DUT is able to process the buffered reports		
Test description 1. Reserve, 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 or disable a port in the switch 4. Force data/quality changes in the server to force buffered reports 5. Restore the Ethernet connection 6. Force DUT to send a correct SetBRCBValues request with an EntryID that was received before the disconnect 7. DUT enables the reporting		
Comment		

cBr32	Purge buffered reports	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp21*		
Expected result 6. The DUT requests purge buffer		
Test description 1. Reserve, 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 or disable a port in the switch 4. Force data/quality changes in the server to force buffered reports 5. Restore the Ethernet connection 6. Force DUT to purge buffered reports (PIXIT)		
Comment		

cBrN2	SetBRCBValues response-	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 10.2.2, 17.2 IEC 61850-8-1 clause 12.3.1, 17.1, 17.2 *PIXIT Rp2, Rp19*		
Expected result 3. The DUT processes the SetBRCBValues response- as specified in the PIXIT		
Test description 1. Stop a SERVER SIMULATOR 2. Change the SERVER SIMULATOR configuration so that one or more of the following configurable BRCB Elements which were previously writable become read-only: datSet, rptID, optFlds, bufTm, trgOps, intgPd 3. Start SERVER SIMULATOR and force the DUT to perform a SetBRCBValues request for one or more of the read-only BRCB elements		
Comment		

cBrN5	DUT is able to handle report control blocks with a mismatching configuration	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp12*		
Expected result 4. The DUT behaves as described in the PIXIT.		
Test description 1. Stop a SERVER SIMULATOR 2. Configure several BRCBs in the SERVER SIMULATOR SCL file in the following way (one change per BRCB) and keep the ConfRev value the same: 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 SIMULATOR SCL file in the following way: – change the order of dataset members, without changing the order of the data types – change the order of dataset members, hereby changing the order of the data types – 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 SIMULATOR containing the BRCB) to “Conf”. 4. Start the SERVER SIMULATOR and force the DUT to reserve and enable the BRCB		
Comment		

cBrN6	**DUT is able to detect a change in ConfRev**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2 *PIXIT Rp13*		
Expected result 3. The DUT behaves as described in the PIXIT.		
Test description 1. Stop a SERVER SIMULATOR 2. Increment the value for confRev of a BRCB in the SERVER SIMULATOR SCL and remove a member from the referenced dataset 3. Start the SERVER SIMULATOR and force DUT to reserve enable the BRCB 4. Repeat step 1 to 3, this time without changing the referenced dataset in step 2		
Comment		

A4.9 Block 9: GOOSE Control Block

Test case	Test case description
cGcb1	Verify the DUT can send a GetGoCBValues request and handle the response (IEC 61850-7-2 Subclause 18.2.2.5)
cGcb2	Verify the DUT can send a SetGoCBValues request and handle the response (IEC 61850-7-2 Subclause 18.2.6)
cGcb46	Extended GoCB

Detailed test procedures for GOOSE control block:

cGcb1	**GetGoCBValues**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18.2.2.5 IEC 61850-8-1 clause 18.1.2.3		
Expected result 1. The DUT sends a valid GetGoCBValues request and is able to handle the response. 2. The DUT sends a valid GetGoCBValues request and is able to handle the response.		
Test description 1. Force DUT to send a GetGoCBValues request to a server that has no minTime, MaxTime and fixedOffset in the GoCB 2. Force DUT to send a GetGoCBValues request to a server that does have minTime, MaxTime and fixedOffset in the GoCB		
Comment		

cGcb2	**SetGoCBValues**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18.2.2.6 IEC 61850-8-1 clause 18.1.2.4		
Expected result 1. The DUT sends a valid SetGoCBValues request		
Test description 1. Force DUT to send a SetGoCBValues request		
Comment		

cGcb46	**Verify the DUT can handle GoCB with new control block attributes (K.3.4)**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-1 Annex K3.4 IEC 61850-7-2 clause 17.2 IEC 61850-8-1 clause 17.1, 17.2		
Expected result 2. DUT reads and enables/disables the GoCB		
Test description 1. Configure future edition server GoCB with an additional attribute 2. Start the DUT and force it to read and when supported enable/disable the GoCB from step 1.		
Comment K3.4: Client shall ignore new control block attributes		

A4.12 Block 12: Control

Test case	Test case description
cCtl1	Check if the DUT is able to set the TEST field in the SelectWithValue and Operate requests (PIXIT).
cCtl2	Check if the DUT is able to set the CHECK (synchrocheck or interlock-check bits) in the SelectWithValue and Operate requests (PIXIT) for the supported control models.
cCtl3	Check if the DUT is able to change control model using online services (PIXIT).
cCtl4	Verify the values of originator category, origin identification and the control number (PIXIT)
cCtl5	Check if the DUT reacts as described in the PIXIT when it detects a control model mismatch: a Server status-only, DUT expects controllable b Server SBO, DUT expects direct operate c Server direct operate, DUT expects SBO d Server SBO enhanced DUT expects SBO normal
cCtl6	Check if the DUT 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	**Control with Test flag**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.5.2.6 IEC 61850-8-1 clause 20 *PIXIT Ctl1, Ctl4*		
Expected result DO normal/enhanced security: – The DUT sends the Operate request with Test flag = true SBO normal security: – The DUT sends the Operate requests with Test flag = true SBO enhanced security: – The DUT sends the SelectWithValue and Operate requests both with Test flag = true		
Test description DO normal/enhanced security: – Force the DUT to perform an Operate request with the Test flag set SBO normal security: – Force the DUT to perform a Select request followed by an Operate request with the Test flag set SBO enhanced security: – Force the DUT to perform a SelectWithValue request followed by an Operate request, both with the Test flag set		
Comment		

cCtl2	Synchro and/or interlock check	☒ Passed ☐ Failed ☐ Inconclusive

IEC 61850-7-2 clause 20.5.2.7

IEC 61850-8-1 clause 20

PIXIT Ctl1, Ctl5

Expected result

The DUT sends the request(s) with the Check bits as specified in PIXIT.

Test description

DO normal/enhanced security:

1. Force the DUT to send an Operate request with the synchrocheck bit set
2. Force the DUT to send an Operate request with the interlock-check bit set
3. Force the DUT to send an Operate request with the interlock- and synchrocheck bit set

SBO normal security:

1. Force the DUT to perform a Select and Operate request with the synchrocheck bit set
2. Force the DUT to perform a Select and Operate request with the interlock-check bit set
3. Force the DUT to perform a Select and Operate request with the interlock- and synchrocheck bit set

SBO enhanced security:

1. Force the DUT to perform a SelectWithValue and Operate request, both with the synchrocheck bit set
2. Force the DUT to perform a SelectWithValue and Operate request, both with the interlock-check bit set
3. Force the DUT to perform a SelectWithValue and Operate request, both with the interlock- and the synchrocheck bit set

Comment

cCtl3	Change control model	☒ Passed ☐ Failed ☐ Inconclusive

IEC 61850-7-2 clause 20.2, 20.3

IEC 61850-8-1 clause 20

PIXIT Ctl10

Expected result

The DUT sends the SetDataValues request with the corresponding control model

Test description

1. Force the DUT to perform a SetDataValues request to change control model to “Direct control with normal security”
2. Force the DUT to perform a SetDataValues request to change control model to “SBO control with normal security”
3. Force the DUT to perform a SetDataValues request to change control model to “Direct control with enhanced security”
4. Force the DUT 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 20.2, 20.3 IEC 61850-8-1 clause 20 *PIXIT Ctl6, Ctl7*		
Expected result The DUT 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		

cCtl5	Control model mismatch	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2, 20.3 IEC 61850-8-1 clause 20 PIXIT Ctl12		
Expected result 3. The DUT behaves as specified in the PIXIT		
Test description 1. Stop one SERVER SIMULATOR the DUT 2. Configure the server SCL file for the DUT and the SERVER SIMULATOR differently to get a control model mismatch: a DUT expects DOns; SERVER SIMULATOR is SBOns, repeat for DOes, SBOes and status-only b DUT expects SBOns; SERVER SIMULATOR is DOns, repeat for DOes, SBOes and status-only c DUT expects DOes; SERVER SIMULATOR is DOns, repeat for SBOns, SBOes and status-only d DUT expects SBOes; SERVER SIMULATOR is DOns, repeat for SBOns, DOes and status-only 3. Start the DUT and force the DUT to request a Select/SelectWithValue/Operate request for the control object(s) with mismatching control model		
Comment		

A4.12a Block 12a: Direct Control

Test case	Test case description
cDOns1	Operate Request[test ok] resp+ Perform a correct Operate request. Check that the DUT does not generate an error.
cDOns2	Operate Request[test not ok] resp- Client requests Operate resulting in Test not ok. Check that the DUT realizes the operation failed.
cDOns3	TimeActivatedOperate [test not ok] resp- Verify the WaitForActivationTime results in a timer expired 'Test not ok' and that the DUT realizes the operation succeeded.
cDOns4	TimeActivatedOperate [test ok] resp+ Send a TimeActivatedOperate request. Verify the WaitForActivationTime results in a timer expired 'Test ok' and that the DUT realizes the operation succeeded.

Detailed test procedures for Direct Control with normal security (DOns).

cDOns1	**Successful Operate**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.1 IEC 61850-8-1 clause 20.8		
Expected result 1. The DUT sends correct Operate request and processes the response+		
Test description 1. Force the DUT to perform an Operate request on a DOns control object 2. Repeat step 1 for the same CDC with a different control value		
Comment		

cDOns2	**Failed Operate**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.1 IEC 61850-8-1 clause 20.8 *PIXIT Ctl8, Ctl9*		
Expected result 1. The DUT processes the response- as specified in the PIXIT 2. The DUT processes the response- as specified in the PIXIT		
Test description 1. Force the DUT to perform an Operate request on a DOns control object that results in a Operate response- without Last Application Error 2. Force the DUT to perform an Operate request on a DOns control object that results in a Operate response- with the Last Application Error		
Comment		

A4.12b Block 12b: SBO Control

Test case	Test case description
cSBOns1	Select[test not ok] resp-: DUT requests Select resulting in Test not ok. Check that the DUT realizes the select failed (PIXIT).
cSBOns2	Select[test ok] resp+ and Operate[test ok] resp+ Select a controllable object using Select. Perform a correct Operate request. Check that the DUT does not generate an error.
cSBOns3	Select[test ok] resp+ and Operate[test not ok] resp- of selected object. Perform a correct Operate request resulting in Test not ok. Check that the DUT realizes the operation failed.
cSBOns4	Select[test ok] resp+ and Cancel Perform a correct Cancel request.
cSBOns5	Select[test ok] resp+ and TimeActivatedOperate [test ok] resp+ Perform a correct TimeActivatedOperate request. Check that the DUT realizes the operation succeeded after the WaitForActivationTime.
cSBOns6	Select[test ok] resp+ and TimeActivatedOperate [test not ok] resp- Perform a correct TimeActivatedOperate request resulting in test not ok. Check that the DUT realizes the operation failed.
cSBOns10	Select[test ok] resp+ and Operate on a Ed1 server

Detailed test procedures for SBO Control with normal security (SBOns).

cSBOns1	**Failed Select**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2, 20.5.3.2 IEC 61850-8-1 clause 20.5 *PIXIT Ctl9*		
Expected result 1. The DUT handles the Select response- as described in the PIXIT and shall not send the Operate request		
Test description 1. Force the DUT to perform a correct Select request and force the SERVER SIMULATOR to send a Select response-		
Comment		

cSBOns2	Select and successful Operate	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2, 20.5.3.5 IEC 61850-8-1 clause 20.8		
Expected result 1. The DUT sends a correct Select request for the SBOns object 2. The DUT sends a correct Operate request on the selected SBOns object		
Test description 1. Force the DUT to perform a Select request on an SBOns object 2. Force the DUT to perform an Operate request on the selected SBOns object 3. Repeat steps 1 and 2 for the same CDC with a different control value		
Comment		

cSBOns3	Select and failed Operate	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2, 20.5.3.5 IEC 61850-8-1 clause 20.8 *PIXIT Ctl8, Ctl9*		
Expected result 2. DUT indicates Operate failure 4. DUT indicates Operate failure		
Test description 1. Force the DUT to send a correct Select request 2. Force the DUT to perform an Operate request and the SERVER SIMULATOR to send an Operate response-without Last Application Error 3. Force the DUT to send a correct Select request 4. Force the DUT to perform an Operate request and the SERVER SIMULATOR to send an Operate response-with Last Application Error		
Comment		

cSBOns4	Cancel	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2, 20.5.3.4 IEC 61850-8-1 clause 20.7		
Expected result 1. The DUT sends a correct Select request 2. The DUT sends a correct Cancel request		
Test description 1. Force the DUT to perform a Select request for an SBOns object 2. Force the DUT to perform a Cancel request on the selected object 3. Repeat steps 1 and 2 for the same CDC with a different control value		
Comment		

cSBOns10	Select and successful Operate on Ed1 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.2, 20.5.3.5 IEC 61850-8-1 clause 20.8		
Expected result 1. The DUT sends a correct Select request for the SBOns object and accepts the SBO value 2. The DUT sends a correct Operate request on the selected SBOns object		
Test description 1. Force the DUT to perform a Select request on an SBOns object in an Ed1 server, the SERVER SIMULATOR responds with SBO=<operreference> (without “SBO”) 2. Force the DUT to perform an Operate request on the selected SBOns object		
Comment		

A4.12c Block 12c: Enhanced Direct Control

Test case	Test case description
cDOes1	Operate[test ok] resp+: Send a correct Operate request. a Check that the DUT notices the operation ended positively when it receives the CommandTermination+. b Check that the DUT notices the operation ended negatively when it receives the CommandTermination- (PIXIT)
cDOes2	Operate[test not ok] resp-: Send an Operate request, thereby making sure the device will generate a 'test not ok'. Check that the DUT behaves as specified in the PIXIT.
cDOes3	TimeActivatedOperate[test not ok] resp-: Send a TimeActivatedOperate request, thereby making sure the device will generate a 'test not ok'. Check that the DUT realizes the operation failed.
cDOes4	TimeActivatedOperate [test ok] resp+: Send a correct TimeActivatedOperate request. a Check that the DUT realizes the operation request succeeded. b Check that the DUT notice the operation ended positively when it receives the CommandTermination+. c Check that the DUT notice the operation ended negatively when it receives the CommandTermination-.

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

cDOes1	**Successful Operate with command termination**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.3.2, 20.5.3.5 IEC 61850-8-1 clause 20.8 and 20.9 *PIXIT Ctl13*		
Expected result 1. Check that the DUT processes the CommandTermination+ as specified in the PIXIT 2. Check that the DUT processes the CommandTermination- as specified in the PIXIT		
Test description 1. Force the DUT to send a correct Operate request that causes the server to send an Operate response+ and a CommandTermination.request+ 2. Force the DUT to send a correct Operate request that causes the server to send an Operate response+ and a CommandTermination.request- 3. Repeat step 1 for the same CDC with a different control value		
Comment		

cDOes2	**Operate failure**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.3.2, 20.5.3.5 IEC 61850-8-1 clause 20.8 and 20.9 *PIXIT Ctl8, Ctl9*		
Expected result 1. The DUT processes the Operate response- as specified in the PIXIT		
Test description 1. Force the DUT to perform an Operate and the SERVER SIMULATOR to send Operate response- with LastApplicationError		
Comment		

A4.12d Block 12d: Enhanced SBO Control

Test case	Test case description
cSBOes1	SelectWithValue [test not ok] resp-: Select device using SelectWithValue resulting in test not ok. Check the DUT indicates an error.
cSBOes2	SelectWithValue [test ok] resp+ and Operate[test ok] resp+ Select device using correct SelectWithValue. Perform a correct Operate request. Check the DUT indicates no error after receiving the command termination+ and an error after receiving command termination – (PIXIT)
cSBOes3	SelectWithValue [test ok] resp+ and Operate[test not ok] resp- Perform a SelectWithValue and Operate request. The Operate results in test not ok. Check that the DUT realizes the operation failed.
cSBOes4	SelectWithValue [test ok] resp+ and Cancel Perform a correct Cancel request. Check the DUT indicates no error.
cSBOes5	SelectWithValue [test ok] resp+ and TimeActivatedOperate [test ok] resp Perform a correct TimeActivatedOperate request. Check that the DUT realizes the operation succeeded after the WaitForActivationTime and detects the CommandTermination with the result of the order.
cSBOes6	SelectWithValue [test ok] resp+ and TimeActivatedOperate [test not ok] resp- Perform a SelectWithValue and TimeActivatedOperate request. The TimeActivatedOperate results in test not ok. Check that the DUT realizes the operation failed.

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

cSBOes1	**SelectWithValue [test not ok]**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.3.3, 20.5.3.3 IEC 61850-8-1 clause 20.6, 20.9 PIXIT Ctl9		
Expected result 1. DUT indicates SelectWithValue failure and shall not send an Operate request		
Test description 1. Force the DUT to perform a SelectWithValue request and force the SERVER SIMULATOR to send a SelectWithValue response- with LastApplicationError		
Comment		

cSBOes2	SelectWithValue and successful Operate with command termination	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.3.3, 20.5.3.5 IEC 61850-8-1 clause 20.6, 20.8, 20.9		
Expected result 1. The DUT performs a correct SelectWithValue request 2. The DUT performs a correct Operate request 3. The DUT performs a correct SelectWithValue request 4. The DUT performs a correct Operate request and handles the CommandTermination- as specified in the PIXIT		
Test description 1. Force the DUT to perform a SelectWithValue request for an SBOes object 2. Force the DUT to perform an Operate request for the selected object and server simulator to send Operate response+ and CommandTermination+ 3. Force the DUT to perform a SelectWithValue request for an SBOes object 4. Force the DUT to perform an Operate request for the selected object and server simulator to send Operate response+ and CommandTermination- 5. Repeat steps 1 and 2 for the same CDC with a different control value		
Comment		

cSBOes3	SelectWithValue and failed Operate	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.3.3, 20.5.3.5 IEC 61850-8-1 clause 20.6, 20.8, 20.9 PIXIT Ctl9		
Expected result 1. The DUT performs a correct SelectWithValue request 2. The DUT performs a correct Operate request and indicates the failed operate as described in PIXIT.		
Test description 1. Force the DUT to perform a SelectWithValue request 2. Force the DUT to perform an Operate request force the SERVER SIMULATOR to send an Operate response- with LastApplicationError		
Comment		

cSBOes4	**Cancel**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.3.3, 20.5.3.4 IEC 61850-8-1 clause 20.7, 20.9		
Expected result 1. The DUT performs a correct SelectWithValue request 2. The DUT performs a correct Cancel request		
Test description 1. Force the DUT to perform a SelectWithValue request 2. Force the DUT to perform a Cancel request 3. Repeat steps 1 and 2 for the same CDC with a different control value		
Comment		

A4.13a Block 13a: Time Synchronization SNTP

cTm1	Verify that the DUT supports the SCSM time synchronisation, Change the time in the time server and verify the DUT uses the new time
cTm2	Check that the timestamp quality of the DUT 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 DUT can set the time stamp quality “ClockFailure” (PIXIT)

Detailed test procedures for Time and time synchronization

cTm1	**Time synchronisation**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 21 and 6.1.2.9.3.3 IEC 61850-8-1 clause 21 *PIXIT Sr13, Tm1, Tm6*		
Expected result 1. The DUT uses the original timestamp and time quality (PIXIT) 3. The DUT uses the new timestamp and time quality (PIXIT)		
Test description 1. DUT exposes the time and time quality as specified in the PIXIT 2. Test engineer changes the time of the time server and waits till DUT has received the new time synch message 3. DUT exposes the time and time quality as specified in the PIXIT		
Comment		

cTmN1	Time synchronisation lost	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 21 and 6.1.2.9.3.3 IEC 61850-8-1 clause 21, *PIXIT Tm1, Tm7*		
Expected result 1. DUT uses the correct timestamp 3. DUT uses the timestamp with “ClockNotSynchronized” and without “LeapSecondsKnown” 5. DUT uses the correct timestamp		
Test description 1. DUT 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 DUT to detect the time server is lost (when reasonable <1 hour) 3. DUT 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 DUT has received the time synch message 5. DUT displays the time and time quality (PIXIT) or requests a service including the timestamp		
Comment		

cTmN2	Timestamp with ClockFailure	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 18 and 5.5.3.7.3.3 IEC 61850-8-1 clause 21 PIXIT Tm2, Tm4		
Expected result 2. DUT uses the timestamp quality with “ClockFailure”		
Test description 1. Test engineer forces “ClockFailure” in the DUT (PIXIT) 2. DUT displays the time and time quality (PIXIT) or requests an ACSI service including the timestamp		
Comment		

A4.14 Block 14: File Transfer

cFt1	Verify that the DUT can send a GetServerDirectory(FILE) request with correct parameters and that the DUT is able to process the response (IEC 61850-7-2 clause 7.2.2)
cFt2	Verify that the DUT can send a GetFileAttributeValues request with correct parameters and verify that the DUT is able to process the response (IEC 61850-7-2 clause 23.2.4)
cFt3	Verify that the DUT can send a GetFile request with correct parameters and verify the DUT handles the response (IEC 61850-7-2 clause 23.2.1)
cFt4	The DUT requests a SetFile service with a small and large file and verify the DUT sends the resulting file(s).
cFt5	Verify that the DUT can send a DeleteFile request with correct parameters and verify that the DUT can handle the response
cFt6	Verify that the DUT can request a GetServerDirectory(FILE) and GetFile on Ed1 server

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

Detailed test procedures for File transfer

cFt1	**GetServerDirectory(FILE)**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.2.2 IEC 61850-8-1 clause 9.3, 23.2 *PIXIT Ft1, Ft2, Ft3*		
Expected result 1. The DUT sends the GetServerDirectory(FILE) request without a file name specification or with wildcard and processes the GetServerDirectory response		
Test description 1. Force the DUT to perform a GetServerDirectory(FILE) request; the SERVER SIMULATOR will return filenames with 3 and 4 char suffixes		
Comment		

cFt2	**GetFileAttributeValues**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.2.2 IEC 61850-8-1 clause 9.3, 23.2		
Expected result 1. The DUT processes the GetFileAttributeValues response		
Test description 1. Force the DUT to perform a GetFileAttributeValues request with a complete filename		
Comment		

cFt3	GetFile	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 23.2.1 IEC 61850-8-1 clause 23.2.1 *PIXIT Ft6, Ft8*		
Expected result 1-5. The DUT processes the file		
Test description 1. Force the DUT to perform a GetFile request for a small file of about 1kB 2. Force the DUT to perform a GetFile request for a non-empty file with file size 0 (unknown) 3. Force the DUT to perform a GetFile request for a large file of about 1MB 4. Force the DUT to perform a GetFile request for a file with the maximum file name length (255char) 5. Force the DUT to perform a GetFile request for a file with "/"and an Ed2 server for a file with "\" as separator as returned by the GetServerDirectory(FILE)		
Comment		

cFt5	DeleteFile	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.2.3 IEC 61850-8-1 clause 23.2.3		
Expected result 1. The DUT sends a correct DeleteFile request 2. The DUT sends a correct DeleteFile request		
Test description 1. Force the DUT to perform a DeleteFile request on an existing, deletable file 2. Force the DUT to perform a DeleteFile request on an existing, deletable file in an Ed1 Server using "\" as hierarchical delimiter in the fileSpecification		
Comment		

cFt6	GetServerDirectory(FILE) and GetFile on Ed1 server	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 7.2.2 IEC 61850-8-1 clause 9.3, 23.2 *PIXIT Ft1, Ft2, Ft3*		
Expected result 1. The DUT sends the GetServerDirectory(FILE) request without a file name specification (to get the folders in the root) and/or with a file name specification, does not use the wildcard and processes the GetServerDirectory response 2. The DUT processes the file		
Test description 1. Force the DUT to request a GetServerDirectory(FILE) on an Ed1 server that just responds with files and folders in the specified folder (a non flat file system) 2. Force the DUT to request a GetFile on a file in a folder		
Comment Note: e.g. the server responds a folder name “COMTRADE\” then the client requests GetServerDirectory(“COMTRADE\”) and the server responds with “myfile.dat”. The client requests GetFile(“COMTRADE\myfile.dat”)		

cFtN1	GetFile response-	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 23.2.1 IEC 61850-8-1 clause 23.2.1 *PIXIT Ft9*		
Expected result 1,2. The DUT processes the GetFile response-		
Test description 1. Force the DUT to perform a GetFile request and the SERVER SIMULATOR to send a GetFile response- (e.g. by limiting the file access rights) 2. Force the DUT to perform a GetFile request and the Ed1 SERVER SIMULATOR to send a GetFile response- with a non-Ed2 error code.		
Comment		

cFtN2	**GetFileAttributeValues response-**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 23.2.4 IEC 61850-8-1 clause 23.2.4 *PIXIT Ft9*		
Expected result 1,2. The DUT processes the GetFileAttributeValues response-		
Test description 1. Force the DUT to perform a GetFileAttributeValues request and the SERVER SIMULATOR to send a GetFileAttributeValues response- 2. Force the DUT to perform a GetFileAttributeValues request and the Ed1 SERVER SIMULATOR to send a GetFileAttributeValues response- with a non-Ed2 error code		
Comment		

A4.15 Block 15: Service Tracking

cTrk1	Verify that the DUT can process tracking of control block services: Buffered reporting, LTRK.BrcbTrk
cTrk2	Verify that the DUT can process tracking of control block services: Unbuffered reporting, LTRK.UrcbTrk
cTrk3	Verify that the DUT can process tracking of control block services: Log control block, LTRK.LocbTrk
cTrk4	Verify that the DUT can process tracking of control block services: GOOSE control block, LTRK.GocbTrk
cTrk5	Verify that the DUT can process tracking of control block services: Multicast sampled values control block, LTRK.MsvcbTrk
cTrk6	Verify that the DUT can process tracking of control block services: Unicast sampled values control block, LTRK.UsvcbTrk
cTrk7	Verify that the DUT can process tracking of control block services: Setting group control block, LTRK.SgcbTrk
cTrk8	Verify that the DUT can process tracking of control services: Single point control, LTRK.SpcTrk
cTrk9	Verify that the DUT can process tracking of control services: Double point control, LTRK.DpcTrk
cTrk10	Verify that the DUT can process tracking of control services: Integer control, LTRK.IncTrk
cTrk11	Verify that the DUT can process tracking of control services: Enumerated control, LTRK.EncTrk
cTrk12	Verify that the DUT can process tracking of control services: Analogue process value control with float command, LTRK.ApcFTrk
cTrk13	Verify that the DUT can process tracking of control services: Analogue process value control with integer command, LTRK.ApcIntTrk
cTrk14	Verify that the DUT can process tracking of control services: Binary step control, LTRK.BscTrk
cTrk15	Verify that the DUT can process tracking of control services: Integer step control, LTRK.IscTrk
cTrk16	Verify that the DUT can process tracking of control services: Binary analogue process value control, LTRK.BacTrk
cTrk17	Verify that the DUT can process tracking of other supported common services, LTRK.GenTrk

Detailed test procedures for Service Tracking Model

cTrk1	**Buffered Reporting, BTS, LTRK.BrcbTrk**	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 15.3.2.2 IEC 61850-8-1 clause 15.3 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed BRCB attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a first DataSet and a first BRCB which has to be tracked. 2. SERVER SIMULATOR: Configure a second DataSet referencing the LTRK.BrcbTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a second RCB with the second DataSet 4. Start the DUT 5. DUT enables the second RCB 6. Force another client to change one or more attributes of the first BRCB (for example LTRK.BrcbTrk.rptEna)		
Comment		

cTrk2	Unbuffered Reporting, UTS, LTRK.UrcbTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 15.3.2.3 IEC 61850-8-1 clause 15.3 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed URCB attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a first DataSet and a first URCB which has to be tracked. 2. SERVER SIMULATOR: Configure a second DataSet referencing the LTRK.UrcbTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a second RCB with the second DataSet 4. Start the DUT 5. DUT enables the second RCB 6. Force another client to change one or more attributes of the first URCB (for example LTRK.UrcbTrk.rptEna)		
Comment		

cTrk4	GOOSE, GTS, LTRK.GocbTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 15.3.2.6 IEC 61850-8-1 clause 15.7 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed GoCB attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a first DataSet and a GoCB which has to be tracked. 2. SERVER SIMULATOR: Configure a second DataSet referencing the LTRK.GocbTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the second DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the GoCB (for example LTRK.GocbTrk.goEna)		
Comment		

cTrk7	Setting Group, STS, LTRK.SgcbTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 15.3.2.9 IEC 61850-8-1 clause 15.8 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed SGCB attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a SGCB which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.SgcbTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the SGCB (for example by changing the active setting group)		
Comment		

cTrk8	SPC Tracking, CTS, LTRK.SpcTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed SPC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a SPC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.SpcTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the SPC (for example by changing ctlVal)		
Comment		

cTrk9	DPC Tracking, CTS, LTRK.DpcTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed DPC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a DPC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.DpcTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the DPC (for example by changing ctlVal)		
Comment		

cTrk10	INC Tracking, CTS, LTRK.IncTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed INC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a INC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.IncTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the INC (for example by changing ctlVal)		
Comment		

cTrk11	ENC Tracking, CTS, LTRK.EncTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed ENC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a ENC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.EncTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the ENC (for example by changing ctlVal)		
Comment		

cTrk12	APC Float Tracking, CTS, LTRK.ApcFTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed APC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a APC float which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.ApcFTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the APC (for example by changing ctlVal)		
Comment		

cTrk13	APC Integer Tracking, CTS, LTRK.ApcIntTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed APC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure an APC integer which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.ApcIntTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the APC (for example by changing ctlVal)		
Comment		

cTrk14	BSC Tracking, CTS, LTRK.BscTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed BSC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a BSC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.BscTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the BSC (for example by changing ctlVal)		
Comment		

cTrk15	ISC Tracking, CTS, LTRK.IscTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed ISC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a ISC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.IscTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the ISC (for example by changing ctlVal)		
Comment		

cTrk16	BAC Tracking, CTS, LTRK.BacTrk	☒ Passed ☐ Failed ☐ Inconclusive
IEC 61850-7-2 clause 20.6.2 IEC 61850-8-1 clause 15.2 *PIXIT Tr1, Tr2*		
Expected result 6. The DUT processes the report containing the changed BAC attributes as stated in PIXIT		
Test description 1. SERVER SIMULATOR: Configure a BAC which has to be tracked. 2. SERVER SIMULATOR: Configure a DataSet referencing the LTRK.BacTrk [SR] FCD. 3. SERVER SIMULATOR and DUT: Configure a RCB with the DataSet 4. Start the DUT 5. DUT enables the RCB 6. Force another client to change one or more attributes of the BAC (for example by changing ctlVal)		
Comment		

About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.