Redmine (5154 and 5293 and) 5308 proposed updates to Ed2.1 Server test procedures

A4.11a Sampled Value Publish:

Add definitions:

“*Maximum variant of a preferred variant*”: for the symbols **X** and **Y** and a dataset size maximum of **Z** where NamVariant is F????S?I?-**X**U?-**Y**, the max variant is defined as:

F????S?I**X**U**Y** if **X**+**Y** <= **Z**

Otherwise let X be **X** and Y be **Y**, decrement both and Y together until X+Y <= **Z**.  
If either X or Y becomes zero then decrement the other variable by 2 instead

If X+Y < **Z** then increment X by 1. Resultant F????S?IXUY is the maximum variant.

Note that this will often generate a variant of half current and half voltage channels.

Examples:

F4800S2I0-24U0-24 with max channels=32 will generate F4800S2I16U16

F4800S2I0-16U0-4 with max channels=16 will generate F4800S2I14U2

F4800S2I0-16U0-4 with max channels =20 will generate F4800S2I16U4

Add definition: “*Maximum preferred variant of all preferred variants*” is the last of the variants with the largest X+Y of the maximum variants in the order F4800S2 then F14400S6 then F96000S1

Add note: vendor claims of any legacy variants other than I4U4 are NOT verified by these test procedures.

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| **sSvp1** | **Verify that the maximum delay time from taking the sample to sending the corresponding message is within the limit** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Table 901, 6.903.2  PIXIT Svp1 | | |
| Expected result  2. DUT samples the signals as configured  3. DUT sends sampled value messages. The computed delay time shall be less than specified for the application class ms (+0%, -100%). The computed delay time is defined as the fraction of second of the capture time of the message with SmpCnt=0 (when SmpCnt is the first, oldest sample in the message, otherwise add sample time for each additional sample in the message).  The maximum delay does not exceed value specified in LPHD.NamMaxDlRtg and also LPHD.MaxDl | | |
| Test description  Configure the DUT to publish the *Maximum preferred variant of all preferred variants* (or if the *Maximum preferred variant of all preferred variants* contains less than 8 dataset entries then the first declared legacy variant .  When PTP is supported  1. Configure the DUT with PTP and wait till DUT is synchronized  2. Generate current and/or voltage signals  3. Capture the sampled values messages for 1 minute  4. Repeat step 2 to 3 five times using PTP  When PTP is not supported  5. Configure the DUT with PPS and wait till DUT is synchronized  6. Repeat step 2 to 3 five times using PPS | | |
| Comment  The maximum measured delay is:  - PTP/PPS Configuration X = <max delay> | | |

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| **sSvp2** | **Verify the format of the link layer** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61850-9-2 | | |
| Expected result  3. DUT sends sampled value messages with the following format of the link layer:  - destination MAC address = 01-0C-CD-04-xx-xx, as configured  - TPID = 0x8100  - VLAN priority as configured (default = 4)  - VLAN ID as configured  - Ethertype = 0x88BA  - APPID = 0x4000 for MSVCB01 and MSVCB02, otherwise as configured  - reserved 1 = 0x0000  - reserved 2 = 0x0000 | | |
| Test description  1. Configure the with the same configuration as sSvp1, VLAN ID = 0x100 and APPID <> 0x4000 in case of a preferred configuration  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second | | |
| Comment  Tested with configuration: X | | |

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| **sSvp3** | **Verify optional fields, confRev and nofAsdu** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.903.11  Tissue #1692 | | |
| Expected result  3. DUT sends sampled value messages with  - MSVCB01 has only optional field sampleSynchronized, confRev=1 and nofAsdu=1  - MSVCB02 has only optional fields sampleSynchronized, confRev=1 and nofAsdu=8  - Other MSVCB has optional field sampleSynchronized; optional fields: refreshTime, sampleRate, dataSet and security shall be false; Optional field synchSourceId and confRev as configured in SCL  4. The frame contains the synchSourceId service parameter.  5. The frame does not contain the synchSourceId service parameter. | | |
| Test description  1. Configure the DUT with configuration same as sSvp1  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second  4. If PTP is supported, configure synchSourceId to TRUE.  5. If PTP is supported, configure synchSourceId to FALSE.  6. Repeat the test for a backwards compatible configuration | | |
| Comment  Note: confRev=1 is specified in 9-2LE  Tested with configuration: X and Y | | |

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| **sSvp4** | **Verify the format of the ASDU matches the SCL configuration** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61850-9-2 Clause 8.5, Table 14  PIIXT Svp14 (maximum number of channels)  ICD : value of LPHD.NamVariant.val | | |
| Expected result  3,4. DUT sends sampled value messages as configured in SCL | | |
| Test description  For each variant specified in ICD file NamVariant entries (combination of “F” and “S” values  1. Configure the DUT with a dataset containing maximum number of current channel and voltage channels to fill remainder of maximum specified in PIXIT  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second  4. Repeat step 1-3 reversing role of voltage and current channels if this results in a different dataset | | |
| Comment  Tested with variants: X (and Y if needed) | | |

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| **sSvp5** | **Verify the ASDU dataset elements** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.903.10  PIXIT Svp4 | | |
| Expected result  3. DUT sends sampled value messages with the correct data set elements matching the variant code under test   * MSVCB01 has data set PhsMeas1 and elements * MSVCB02 has data set PhsMeas1 and elements * Other MSVCB have dataset as configured in the SCL, Current values shall precede any voltage values, phase order shall be A-AB-B-BC-C-CA-N, shall not exceed the maximum number of elements | | |
| Test description  1. Configure the DUT with configuration same as sSvp1  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second  4. Repeat the test for a backwards compatible configuration | | |
| Comment  Tested with configuration: X and Y | | |

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| **sSvp6** | **Verify the sample rate** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.903.11 | | |
| Expected result  2. DUT samples the signals as configured  3. In one minute DUT sends 60 x samples per seconds / numAsdu ±1 sampled value messages   * MSVCB01 samples are transmitted with 80 messages per cycle * MSVCB02 samples are transmitted with 32 (256/8) messages per cycle * Other MSVCBxx samples are transmitted with the configured sample and message rate | | |
| Test description  1. Configure the DUT with the first specified backwards compatible variant and the applicable 50 or 60 Hz nominal frequency  2. Generate current and/or voltage signals  3. Capture the sampled values messages for 1 minute  4. Repeat step 1 to 3 five times  5. Repeat steps 1-4 for each other declared backwards compatible variants  6. Repeat steps 1-4 for each unique declared preferred variant sampling frequency and same dataset used for backward compatible variant. Apply 50 or 60 Hz signal inputs. Record the signal frequency used. | | |
| Comment  Note:   * F4000S1I4U4 and F12800S8I4U4 = 50Hz only, F4800S1I4U4 and F5760S1I4U4 and F15360S8I4U4 = 60Hz only * For the preferred variants the sample rate shall be independent from the nominal frequency.   Tested with configuration: X Preferred variants tested at frequency: 50 or 60 | | |

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| **sSvp7** | **Verify that the size for encoding the Length field (TLV) of the variable size elements shall always use minimum length encoding** | **Passed**  **Failed**  **Inconclusive** |
| Tissue #1720 | | |
| Expected result  2. DUT sends sampled value messages with following length encoding for SV message length, ASDU length, MsvID length and Dataset length:   * Length <128: <Type> <Length one byte> <Value> * Length 128..255: <Type> 0x81 <Length one byte> <Value> * Length >255: <Type> 0x82 <Length 2 bytes> <Value> | | |
| Test description  1. Configure the DUT with the lowest frequency backward compatible variant.  2. Capture the sampled values messages for at least 1 second  3. Repeat steps 1-2 with configuration same as sSvp1 | | |
| Comment  Tested with configuration: X and Y | | |

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| **sSvp8** | **Verify plausibility that the sampled values match with the analogue signals and quality** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.903.9  PIXIT: Svp5, Svp12 | | |
| Expected result  3. Voltages   * If VN is calculated, check that VN is equal to the magnitude of VA, VB, VC when applying 1 phase voltage and near zero when no signal is applied. * For measured channels, verify match with signal source       Currents   * If IN is calculated, check that IN is equal to the magnitude of IA, IB, IC (ignoring the sign) when applying 1 phase current and near zero when no signal is applied. * For measured channels, verify match with signal source   Quality   * The validity is good when the signal is measured or calculated * The overflow, badReference, oscillatory, oldData, inconsistent and operatorBlocked flags shall be set to false * The source shall be process * For backward compatible MSVCB it is permissible to set the “derived” bit (bit 13) when the value is calculated | | |
| Test description  1.  Configure the DUT with the highest frequency backwards compatible variant and the correct parameters and frequency  2.  Apply current and/or voltage signals to each phase 1 at-a-time for at least 5 seconds each then apply no signal for 10 seconds  3.  Capture the sampled values messages | | |
| Comment  This is a plausibility check not an accuracy test.  Tested with configuration: X | | |

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| **sSvp9** | **Verify that the DUT is synchronized with PTP time source** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.904, 6.904.7  IEC 61850-9-2 Ed2 Amd1 Clause 9  PIXIT Svp6, Svp7 | | |
| Expected result  3. When PTP is connected DUT sends sampled value messages with SmpSynch = 2 within 30 seconds  4. DUT sends sampled value messages with SmpSynch = 1. The maximum processing delay does not change by more than ±100 μs from the value measured during the 1 min synchronized state test (sSvp1).  5. Within the maximum resynch time (PIXIT Svp7) the SmpSynch = 2  6. When DUT has left the hold-over mode it sends messages with SmpSynch = 0.  SmpCnt shall wrap as if a PTP master would be present.  The maximum processing delay does not change by more than ±100 μs from the value measured during the 1 min synchronized state test  7. Within the maximum resynch time (PIXIT Svp7) the SmpSynch = 2. The values of SmpCnt and SmpSynch shall in all cases correspond to the time scale and source used for the samples in that ASDU. The sample following a jump have the adjusted values of both SmpCnt and SmpSynch | | |
| Test description  1. Configure the DUT with configuration same as sSvp1 and connect PTP grand master  2. Generate current and/or voltage signals  3. Capture the sampled values messages  4. Force the global PTP master to local (clockClass not 6 and not 7), then wait 30 seconds, by for example disconnecting the GPS antenna  5. Restore the PTP grand master from local to global, by for example connecting the GPS antenna, and wait till the samples are synchronized  6. Disconnect all PTP grand masters and wait the holdover time (TVTR/TCTR.HoldTmms) plus 30 seconds  7. Connect the PTP grand master and wait till the samples are synchronized | | |
| Comment  Note: This test may not be practical for devices with holdover mode exceeding 24 h. Such devices are exempt from step 6 and are expected to ensure compliance by design  Tested with configuration: X | | |

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| **sSvp10** | **Verify that the DUT is synchronized with PPS time source** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.904, 6.904.7  PIXIT: Svp6, Svp7 | | |
| Expected result  3. When PPS is connected DUT sends sampled value messages with SmpSynch = 2 within 30 seconds  4. When DUT has left the hold-over mode it sends messages with SmpSynch = 0.  SmpCnt shall wrap as if a synchronization pulse would be present  When SmpSynch = 0 the maximum processing delay does not change by more than ±100 μs from the value measured during the 1 min synchronized state test  5. Within the maximum resynch time (PIXIT Svp7) the SmpSynch = 2. The values of SmpCnt and SmpSynch shall in all cases correspond to the time scale and source used for the samples in that ASDU. The sample following a jump have the adjusted values of both SmpCnt and SmpSynch | | |
| Test description  1. Configure the DUT with the lowest rate backwards compatible configuration and PPS  2. Generate current and/or voltage signals  3. Capture the sampled values messages  4. Disconnect the PPS after 10 seconds and wait the holdover time (TCTR/TVTR.HoldTmms) plus 30 seconds  5. Connect the PPS | | |
| Comment  Note: This test may not be practical for devices with holdover mode exceeding 24 h. Such devices are exempt from step 4 and are expected to ensure compliance by design  Tested with configuration: X | | |

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| **sSvp11** | **Verify that after restoring the power the DUT shall publish valid 9-2 messages within specified time (PIXIT).** | **Passed**  **Failed**  **Inconclusive** |
| PIXIT Svp8, Svp10 | | |
| Expected result  3. DUT sends synchronized and valid sampled value messages within the PIXIT specified time after restoring the power; DUT may send values with validity=invalid during the start-up | | |
| Test description  1. Configure the DUT with the lowest rate backwards compatible configuration  2. Generate current and/or voltage signals, after 10 seconds disconnect and restore the power supply  3. Capture the sampled values messages until valid samples are transmitted | | |
| Comment  Tested with configuration: X | | |

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| **sSvp12** | **Verify that in SIMULATION the Reserved1.Simulate=set** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61850-9-2 Clause 5.3.4.4.4  PIXIT Svp3 | | |
| Expected result  3. DUT sends sampled value messages with Reserved1.Simulate=set for each message | | |
| Test description  1. Configure the DUT with configuration same as sSvp1 and enable SIMULATION  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second | | |
| Comment  Tested with configuration: X | | |

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| **sSvp13** | **Signals that are not measured or calculated shall have the corresponding Quality bit = Invalid (PIXIT)** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.903.9  IEC 61850-9-2 Amd1 Table 17, Annex C.3.5  PIXIT Svp9 | | |
| Expected result  3. Signals that are not measured or calculated or as specified in the PIXIT shall have the corresponding Quality bit Invalid (0x0002). Any derived values shall have quality bit invalid as well | | |
| Test description  1. Configure the DUT with the lowest rate backwards compatible configuration as specified in the PIXIT to force quality invalid  2. Generate current and/or voltage signals and force quality invalid  3. Capture the sampled values messages for at least 1 second | | |
| Comment  IEC 61850-9-2 Ed2 Amd1 Annex C.3.5 states: Servers compliant with the current standard shall not use the formerly “Reserved” value. As such Invalid value 0x0001 is not allowed  Tested with configuration: X | | |

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| **sSvp14** | **Verify minimum & maximum length MsvID** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 6.903.11 | | |
| Expected result  3. DUT sends sampled value messages with maximum length MsvID for each sample  5. DUT sends sampled value messages with 1 char length MsvID for each sample | | |
| Test description  1. Configure the DUT with configuration same as sSvp1 and maximum length MsvID (129 for the preferred configuration)  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second  For the preferred variant  4. Configure the DUT a preferred configuration and 1 char length MsvID  5. Capture the sampled values messages for at least 1 second | | |
| Comment  Tested with configuration: X and Y | | |

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| **sSvp15** | **Verify synchSourceId matches the GMC ID** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61850-6 Ed2 Amd1 Table 30  SCL Services.SMVSettings.synchSrcId=true | | |
| Expected result  3. DUT sends sampled value messages with synchSourceId matching the GMC ID | | |
| Test description  1. Configure the DUT with configuration same as sSvp1and enable the optional field synchSourceId and synchronize it to a PTP master clock  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second | | |
| Comment  Tested with configuration: X | | |

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| **sSvp16** | **Verify that in TEST mode the quality bit TEST is set for each sample (PIXIT)** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61850-9-2 Clause 6  PIXIT Svp2 | | |
| Expected result  3. DUT sends sampled value messages with quality bit TEST (0x0800) for each sample | | |
| Test description  1. Configure the DUT with the lowest rate backwards compatible configuration and set Mod = Test  2. Generate current and/or voltage signals  3. Capture the sampled values messages for at least 1 second | | |
| Comment  Tested with configuration: X | | |

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| **sSvp17** | **When clipping occurs the detailed Quality “out-of-range” is set** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9 Clause 5.901. 6.903.9, Table 905, Table 907  IEC 61850-9-2 Amd1 Table 17, Annex C.3.5  PIXIT: Svp13 | | |
| Expected result  4. Some but not all Current and Voltage samples have set detailQuality bit out-of-range and validity questionable. | | |
| Test description  1. Configure the DUT with the lowest rate backwards compatible configuration to force clipping  2. Generate current signals with peak exceeding the clipping limits: TCTR.NamClipRtg, TCTR.Clip  3. Generate voltage signals with peak exceeding the clipping limits: TVTR.NamClipRtg, TVTR.Clip  4. Capture the sampled values messages | | |
| Comment  Note: it might be reasonable impossible to force clipping. If so the result is Inconclusive  Tested with configuration: X | | |

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| **sSvs1** | **Verify that the DUT subscribes to one supported SV stream** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9  PIXIT Svs1a | | |
| Expected result  1-6. DUT subscribes to the sampled values and exposes the values according to PIXIT. | | |
| Test description  Configure DUT to subscribe the lowest rate backwards compatible SV stream with a recommended destination MAC address  1. SIMULATOR publishes SV stream with matching VLAN ID and priority  2. SIMULATOR publishes SV stream with mismatching VLAN ID and mismatching VLAN priority  3. SIMULATOR publishes SV stream without VLAN tag  4. SIMULATOR publishes SV stream with VLAN ID = 0  5. SIMULATOR publishes SV stream with Reserved1: R value >0  Configure the DUT to subscribe to the lowest rate backwards compatible SV stream with a destination MAC address outside the recommended range.  6. SIMULATOR publishes SV stream with the destination MAC address outside the recommended range | | |
| Comment  Tested with configuration: X and Y | | |

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| **sSvs7** | **Verify the DUT subscribes to the specified minimum and maximum (PIXIT) number of dataset elements** | **Passed**  **Failed**  **Inconclusive** |
| IEC 61869-9  PIXIT Svs2b, Svs12 (max channels), Svs13 (supported variants) | | |
| Expected result  2,3 DUT subscribes to all the sampled values in the SV stream | | |
| Test description   1. Configure the DUT to subscribe to dataset containing maximum number of current channel and voltage channels to fill remainder of maximum specified in PIXIT 2. SIMULATOR publishes the SV stream corresponding to the dataset specified in the previous step 3. Repeat step 1-2 reversing role of voltage and current channels if this results in a different dataset | | |
| Comment  Tested with variants: X (and Y if needed) | | |

**PIXIT for IEC 61869-9 publisher**

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| **ID** | **Description** | **Value / Clarification** |
| Svp14 | Maximum number of channels by rate  (0=rate not supported) | F4000S1: 0 / specify  F4800S1: 0 / specify  F4800S2: 0 / specify  F5760S1: 0 / specify  F12800S8: 0 / specify  F14400S6: 0 / specify  F15360S8: 0 / specify  F96000S1: 0 / specify |

**PIXIT for IEC 61869-9 subscriber**

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| **ID** | **Description** | **Value / Clarification** |
| Svs12 | Maximum number of channels by rate  (0=rate not supported) | F4000S1: 0 / specify  F4800S1: 0 / specify  F4800S2: 0 / specify  F5760S1: 0 / specify  F12800S8: 0 / specify  F14400S6: 0 / specify  F15360S8: 0 / specify  F96000S1: 0 / specify |
| Svs13 | Supported variants (in 61869-9 NamVariant format) | Example: F4800S1I4U4;F4800S2I0-9U0-9 |

ANNEX H Server Certificate Template

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| **IEC 61850 Certificate Level A/B1** | | No. << certificate number>> |
| Issued to: | For the server product: | |
| <TEST INITIATOR>  <FULL ADDRESS> | <PRODUCT ID and NAME>  <IEC 61850 software/firmware version: <VERSION>> [Hardware version: xxxxx and/or  S/N: xxxx, yyyy(in case of multiple samples)]  [SV publish: F4000S1I4U4, F4800S2I12U4, F4800S2I4U12, etc.]  [SV subscribe: F4000S1 I4U4, F4800S2I12U4, F4800S2I4U12, etc] | |