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, 6.903.2PIXIT Svp1 |
| Expected result2. DUT samples the signals as configured3. 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 descriptionConfigure 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 supported1. Configure the DUT with PTP and wait till DUT is synchronized2. Generate current and/or voltage signals3. Capture the sampled values messages for 1 minute4. Repeat step 2 to 3 five times using PTPWhen PTP is not supported5. Configure the DUT with PPS and wait till DUT is synchronized6. Repeat step 2 to 3 five times using PPS |
| CommentThe 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 result3. 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 description1. Configure the with the same configuration as sSvp1, VLAN ID = 0x100 and APPID <> 0x4000 in case of a preferred configuration2. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second |
| CommentTested with configuration: X |

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| **sSvp3** | **Verify optional fields, confRev and nofAsdu** | **[ ]  Passed****[ ]  Failed****[ ]  Inconclusive** |
| IEC 61869-9 Clause 6.903.11Tissue #1692 |
| Expected result3. 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 SCL4. The frame contains the synchSourceId service parameter.5. The frame does not contain the synchSourceId service parameter. |
| Test description1. Configure the DUT with configuration same as sSvp12. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second4. 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 |
| CommentNote: confRev=1 is specified in 9-2LETested 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 14PIIXT Svp14 (maximum number of channels)ICD : value of LPHD.NamVariant.val |
| Expected result3,4. DUT sends sampled value messages as configured in SCL |
| Test descriptionFor each variant specified in ICD file NamVariant entries (combination of “F” and “S” values1. Configure the DUT with a dataset containing maximum number of current channel and voltage channels to fill remainder of maximum specified in PIXIT2. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second4. Repeat step 1-3 reversing role of voltage and current channels if this results in a different dataset |
| CommentTested 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 result3. 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 description1. Configure the DUT with configuration same as sSvp12. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second4. Repeat the test for a backwards compatible configuration |
| CommentTested 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 result2. DUT samples the signals as configured3. 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 description1. Configure the DUT with the first specified backwards compatible variant and the applicable 50 or 60 Hz nominal frequency2. Generate current and/or voltage signals3. Capture the sampled values messages for 1 minute4. Repeat step 1 to 3 five times5. Repeat steps 1-4 for each other declared backwards compatible variants6. 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. |
| CommentNote: * 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: XPreferred 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 result2. 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>
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| Test description1. Configure the DUT with the lowest frequency backward compatible variant.2. Capture the sampled values messages for at least 1 second3. Repeat steps 1-2 with configuration same as sSvp1 |
| CommentTested 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 6.903.9PIXIT: Svp5, Svp12 |
| Expected result3. 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 description1.  Configure the DUT with the highest frequency backwards compatible variant and the correct parameters and frequency2.  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 seconds3.  Capture the sampled values messages |
| CommentThis 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, 6.904.7IEC 61850-9-2 Ed2 Amd1 Clause 9 PIXIT Svp6, Svp7 |
| Expected result3. When PTP is connected DUT sends sampled value messages with SmpSynch = 2 within 30 seconds4. 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 = 26. 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 test7. 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 description1. Configure the DUT with configuration same as sSvp1 and connect PTP grand master2. Generate current and/or voltage signals3. 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 antenna5. Restore the PTP grand master from local to global, by for example connecting the GPS antenna, and wait till the samples are synchronized6. Disconnect all PTP grand masters and wait the holdover time (TVTR/TCTR.HoldTmms) plus 30 seconds7. Connect the PTP grand master and wait till the samples are synchronized |
| CommentNote: 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 designTested 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, 6.904.7PIXIT: Svp6, Svp7 |
| Expected result3. 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 description1. Configure the DUT with the lowest rate backwards compatible configuration and PPS2. Generate current and/or voltage signals3. Capture the sampled values messages 4. Disconnect the PPS after 10 seconds and wait the holdover time (TCTR/TVTR.HoldTmms) plus 30 seconds5. Connect the PPS |
| CommentNote: 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 designTested 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 result3. 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 description1. Configure the DUT with the lowest rate backwards compatible configuration2. Generate current and/or voltage signals, after 10 seconds disconnect and restore the power supply3. Capture the sampled values messages until valid samples are transmitted |
| CommentTested with configuration: X |

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| **sSvp12** | **Verify that in SIMULATION the Reserved1.Simulate=set** | **[ ]  Passed****[ ]  Failed****[ ]  Inconclusive** |
| IEC 61850-9-2 Clause 5.3.4.4.4PIXIT Svp3 |
| Expected result3. DUT sends sampled value messages with Reserved1.Simulate=set for each message |
| Test description1. Configure the DUT with configuration same as sSvp1 and enable SIMULATION2. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second |
| CommentTested 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 6.903.9IEC 61850-9-2 Amd1 Table 17, Annex C.3.5PIXIT Svp9 |
| Expected result3. 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 description1. Configure the DUT with the lowest rate backwards compatible configuration as specified in the PIXIT to force quality invalid2. Generate current and/or voltage signals and force quality invalid3. Capture the sampled values messages for at least 1 second |
| CommentIEC 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 allowedTested with configuration: X |

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| **sSvp14** | **Verify minimum & maximum length MsvID** | **[ ]  Passed****[ ]  Failed****[ ]  Inconclusive** |
| IEC 61869-9 Clause 6.903.11 |
| Expected result3. DUT sends sampled value messages with maximum length MsvID for each sample5. DUT sends sampled value messages with 1 char length MsvID for each sample |
| Test description1. Configure the DUT with configuration same as sSvp1 and maximum length MsvID (129 for the preferred configuration)2. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 secondFor the preferred variant4. Configure the DUT a preferred configuration and 1 char length MsvID5. Capture the sampled values messages for at least 1 second |
| CommentTested 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 30SCL Services.SMVSettings.synchSrcId=true |
| Expected result3. DUT sends sampled value messages with synchSourceId matching the GMC ID  |
| Test description1. Configure the DUT with configuration same as sSvp1and enable the optional field synchSourceId and synchronize it to a PTP master clock2. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second |
| CommentTested 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 6PIXIT Svp2 |
| Expected result3. DUT sends sampled value messages with quality bit TEST (0x0800) for each sample |
| Test description1. Configure the DUT with the lowest rate backwards compatible configuration and set Mod = Test2. Generate current and/or voltage signals3. Capture the sampled values messages for at least 1 second |
| CommentTested 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 907IEC 61850-9-2 Amd1 Table 17, Annex C.3.5PIXIT: Svp13 |
| Expected result4. Some but not all Current and Voltage samples have set detailQuality bit out-of-range and validity questionable.  |
| Test description1. Configure the DUT with the lowest rate backwards compatible configuration to force clipping2. 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.Clip4. Capture the sampled values messages |
| CommentNote: it might be reasonable impossible to force clipping. If so the result is InconclusiveTested with configuration: X |

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| **sSvs1** | **Verify that the DUT subscribes to one supported SV stream**  | **[ ]  Passed****[ ]  Failed****[ ]  Inconclusive** |
| IEC 61869-9PIXIT Svs1a |
| Expected result1-6. DUT subscribes to the sampled values and exposes the values according to PIXIT. |
| Test descriptionConfigure 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 priority2. SIMULATOR publishes SV stream with mismatching VLAN ID and mismatching VLAN priority3. SIMULATOR publishes SV stream without VLAN tag4. SIMULATOR publishes SV stream with VLAN ID = 05. SIMULATOR publishes SV stream with Reserved1: R value >0Configure 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  |
| CommentTested 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 61869-9PIXIT Svs2b, Svs12 (max channels), Svs13 (supported variants) |
| Expected result2,3 DUT subscribes to all the sampled values in the SV stream |
| Test description1. 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
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| CommentTested 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 / specifyF4800S1: 0 / specifyF4800S2: 0 / specifyF5760S1: 0 / specifyF12800S8: 0 / specifyF14400S6: 0 / specifyF15360S8: 0 / specifyF96000S1: 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 / specifyF4800S1: 0 / specifyF4800S2: 0 / specifyF5760S1: 0 / specifyF12800S8: 0 / specifyF14400S6: 0 / specifyF15360S8: 0 / specifyF96000S1: 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] |