



Austrian Aerospace



Department of Applied Computing

SpaceWire Conformance Tester Validation

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Introduction

- SpaceWire Standard defines conformance criteria
- SpaceWire Conformance Tester (SpW CT) checks these criteria
- Conformance testing is done by external connection to the SpaceWire interface to be tested (UUT); This allows testing of a range of components (simple interface, router, System-on-Chip with SpaceWire interface)
- Degrees of cooperation of the UUT are needed for conformance testing

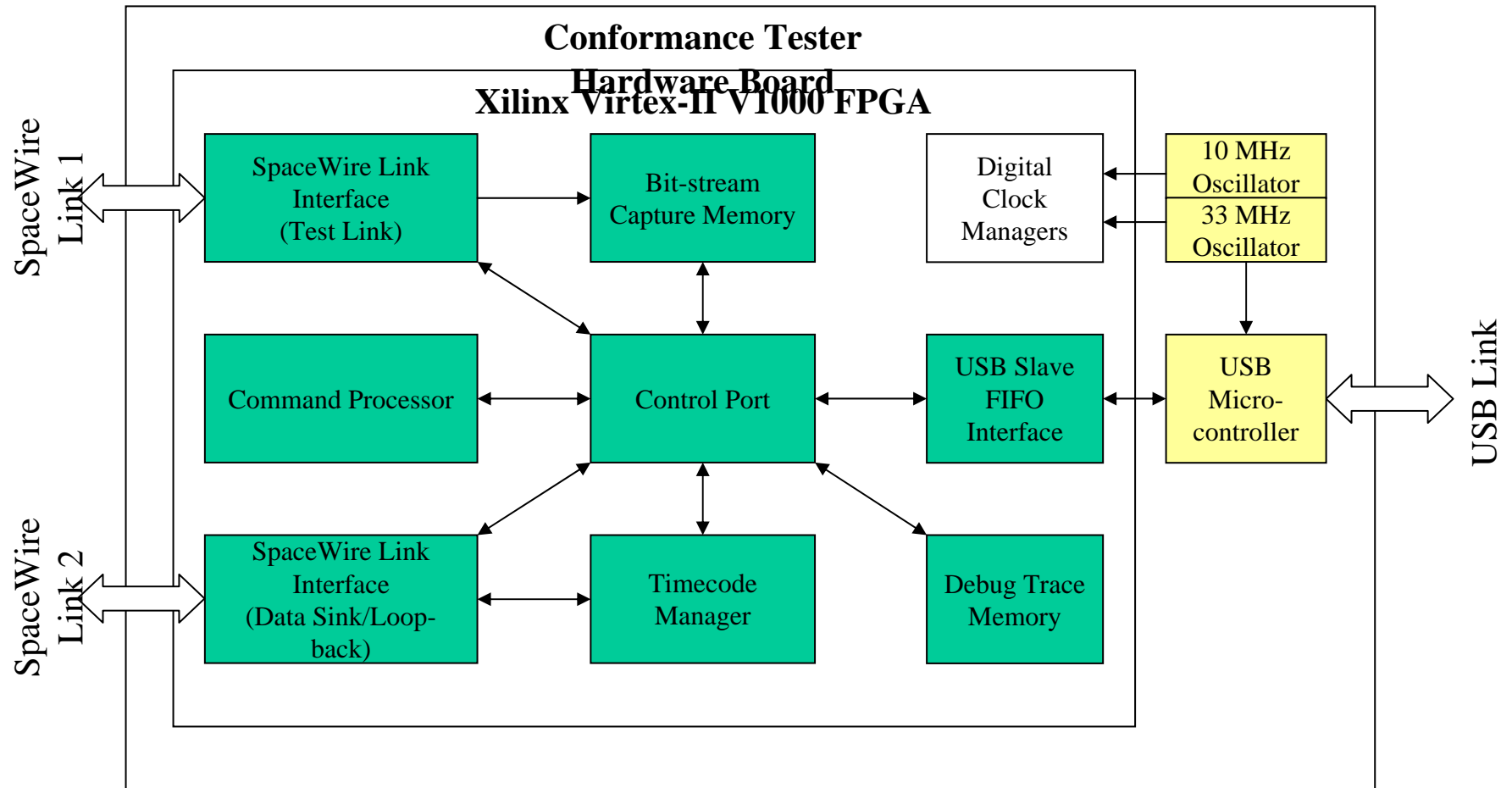


SpW CT Overview

- PC SW steers the conformance testing
- Java user interface
- USB connection to the control PC
- Simple SpW connection between the SpW CT and the UUT is needed



SpW CT Overview





Conformance Test Coverage

Subclause of SpW Standard	Title	Coverage %	UUT cooperation
5.3	Connectors	25	no
5.5	PCB tracks	10	no
6	Signal level	80	low
7	Character level	70	low
8	Exchange level	95	low
9	Packet level	100	high
10.4	SpaceWire nodes	100	high
10.6	Network level errors	100	high



User Interface

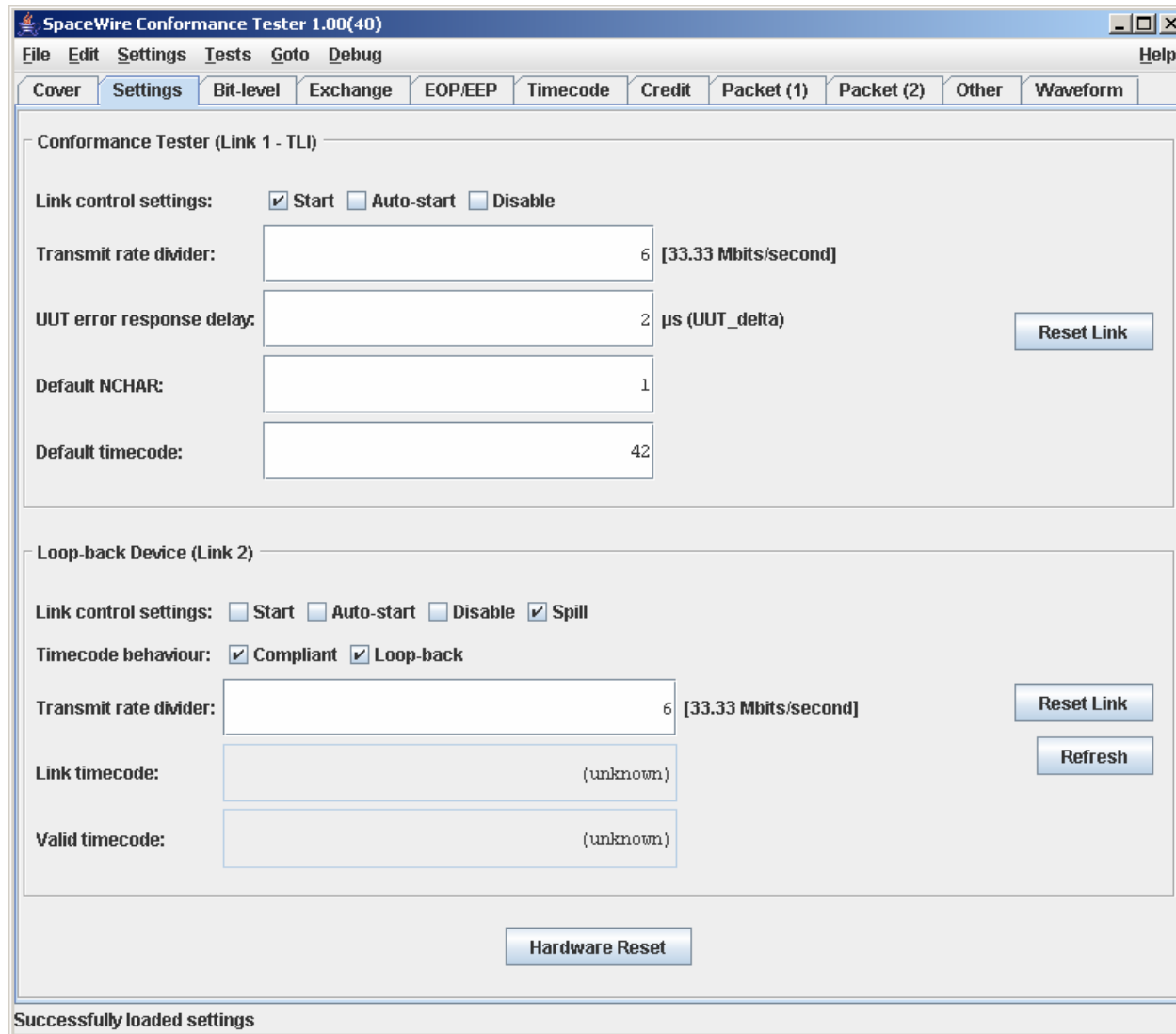
The screenshot shows the 'SpaceWire Conformance Tester 1.00(40)' application window. The title bar includes standard window controls. The menu bar contains 'File', 'Edit', 'Settings', 'Tests', 'Goto', 'Debug', and 'Help'. Below the menu bar is a tabbed interface with tabs for 'Cover', 'Settings', 'Bit-level', 'Exchange', 'EOP/EEP', 'Timecode', 'Credit', 'Packet (1)', 'Packet (2)', 'Other', and 'Waveform'. The 'Settings' tab is active, displaying a form with the following fields:

- Test title: SpW Conformance Tester / DSM Validation
- Device name: DSM ASIC
- Device version: Prototype
- Test operator: Gerald Kempf
- Institution: Austrian Aerospace GmbH

Below these fields is a 'Notes/comments:' section with a large empty text area. At the bottom of the window, a status bar displays the message 'Successfully loaded settings'.



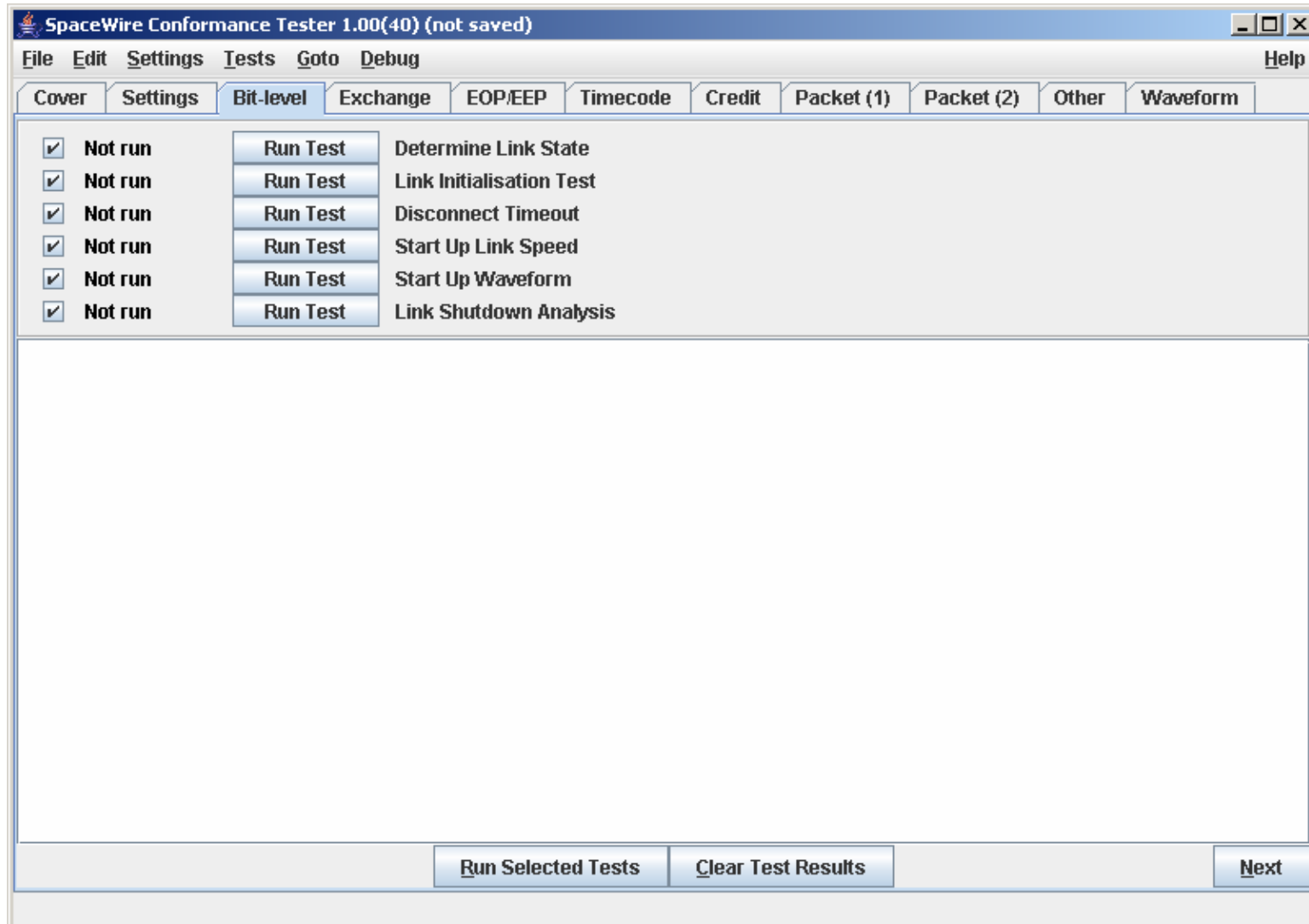
User Interface



The screenshot shows the 'SpaceWire Conformance Tester 1.00(40)' application window. The interface includes a menu bar (File, Edit, Settings, Tests, Goto, Debug, Help) and a tabbed interface with tabs for Cover, Settings, Bit-level, Exchange, EOP/EEP, Timecode, Credit, Packet (1), Packet (2), Other, and Waveform. The 'Settings' tab is active, showing two main sections: 'Conformance Tester (Link 1 - TLI)' and 'Loop-back Device (Link 2)'. The 'Conformance Tester' section has fields for 'Link control settings' (Start checked, Auto-start and Disable unchecked), 'Transmit rate divider' (6, [33.33 Mbits/second]), 'UUT error response delay' (2, μ s (UUT_delta)), 'Default NCHAR' (1), and 'Default timecode' (42). A 'Reset Link' button is present. The 'Loop-back Device' section has 'Link control settings' (Start, Auto-start, and Disable unchecked; Spill checked), 'Timecode behaviour' (Compliant and Loop-back checked), 'Transmit rate divider' (6, [33.33 Mbits/second]), 'Link timecode' (unknown), and 'Valid timecode' (unknown). 'Reset Link' and 'Refresh' buttons are present. A 'Hardware Reset' button is at the bottom. A status bar at the bottom left reads 'Successfully loaded settings'.



User Interface



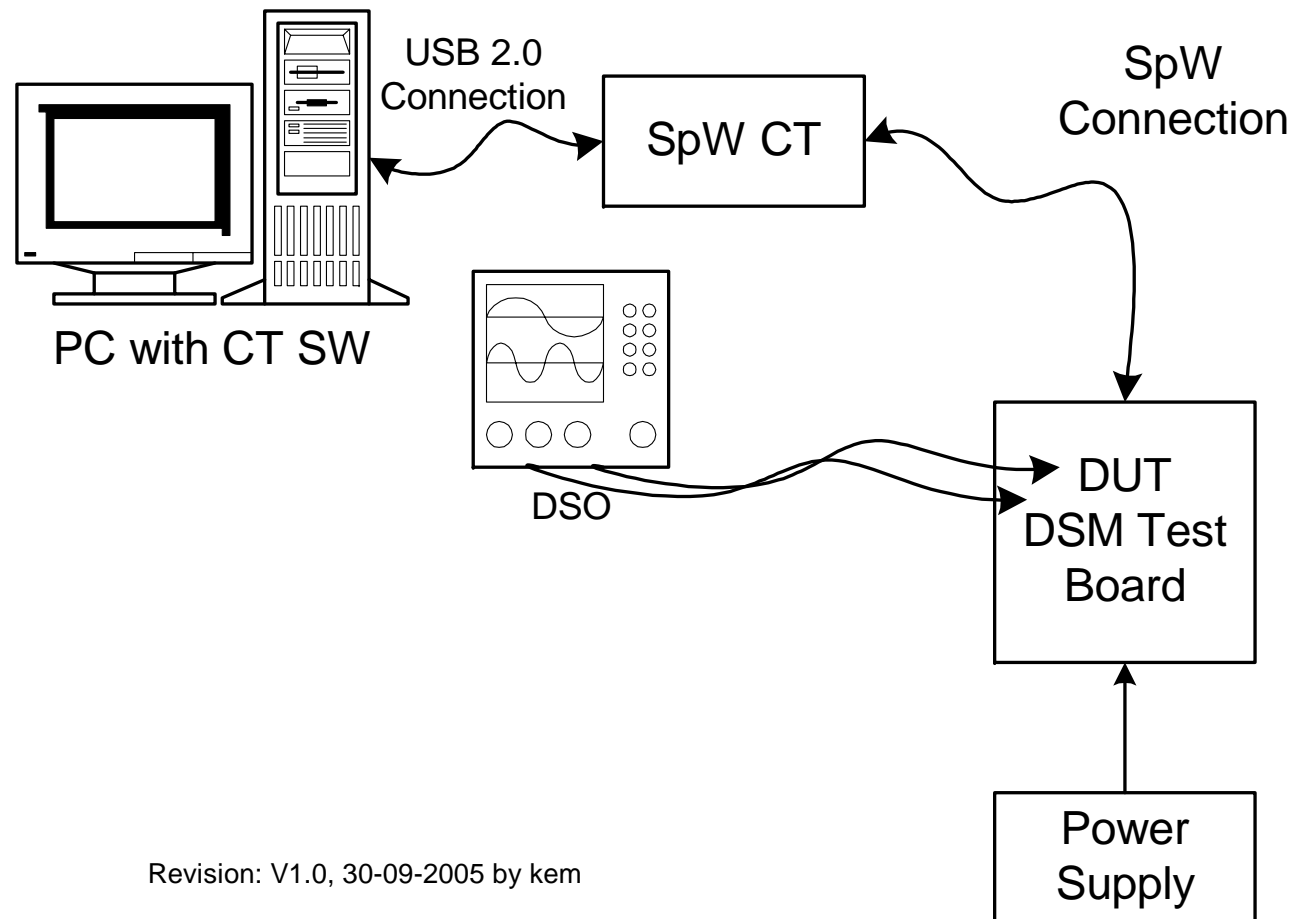


Units Under Test

- **Dynamic Switch Matrix ASIC**
 - SpW router ASIC
 - Supports SpW Standard Draft D (June 2000)
 - Data rate is 40 Mbps for Tx, SpW CT sends with 33 Mbps
- **Chirp Signal Generator FPGA**
 - Uses A SpW IF for command and control
 - Supports latest SpW Standard
 - Data rate is 10 Mbps for Tx, SpW CT sends with 10 Mbps
 - Time-Code not used (not accessible)
- **USB Platform FPGA**
 - Bridge PC - USB - SpW
 - Supports latest SpW Standard
 - Data rate is 48 Mbps for Tx, SpW CT sends with 50 Mbps
 - Time-Code accessible



Test Set-up Example DSM





Test Results - Example DSM

The screenshot shows the SpaceWire Conformance Tester 1.00(34) interface. The 'Bit-level' tab is selected, showing a list of tests with checkboxes for their status and 'Run Test' buttons. The test results are displayed in a text area below the list.

Test Name	Status	Action
Determine Link State	Success	Run Test
Link Initialisation Test	Success	Run Test
Disconnect Timeout	Success	Run Test
Start Up Link Speed	Failed	Run Test
Start Up Waveform	Not run	Run Test
Link shutdown analysis	Not run	Run Test

Test: Determine Link State
Status: Success
Result: UUT link is auto-start enabled
Note: See Waveform panel for updated waveform trace

Test: Link Initialisation Test
Status: Success
Result: Link initialisation was correct
Note: Used UUT error response delay (UUT_delta) of 2 microseconds

Test: Disconnect Timeout
Status: Success
Result: Timeout within valid range of 727 to 1000 ns
Note: Disconnect timeout between 870 and 880 ns (+/- 10 ns)

Test: Start Up Link Speed
Status: Failed
Result: Startup rate outside (10 Mbits/second +/- 1 Mbit/second)

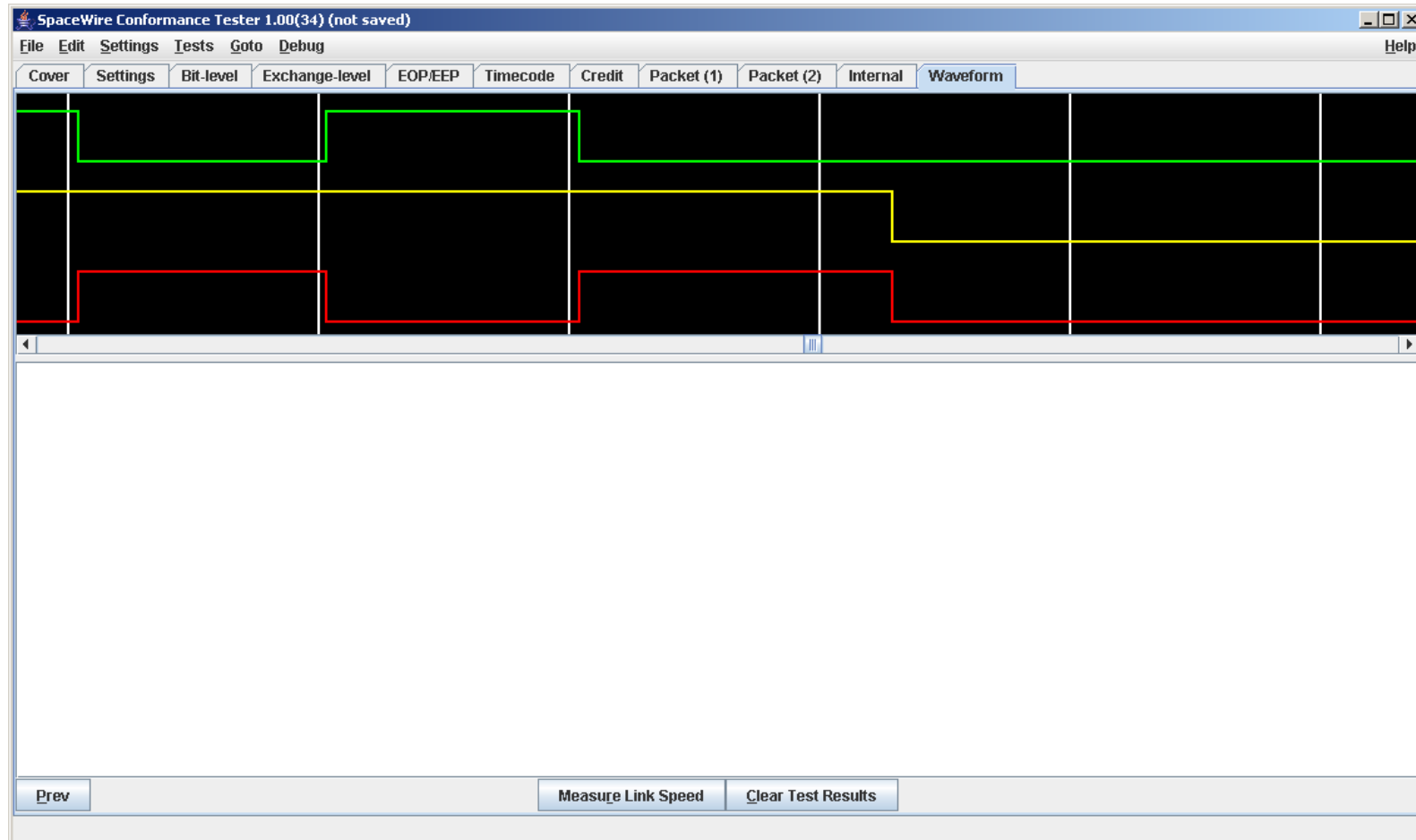
	Measurement	Accuracy	Minimum	Maximum
Bit-to-bit:	9.14 +/- 1.14	0.15	8.00 +/- 0.09	10.29 +/- 0.15
Rise-to-rise:	10.00 +/- 0.14	0.07	9.86 +/- 0.07	10.14 +/- 0.07
Fall-to-fall:	9.46 +/- 0.68	0.07	8.78 +/- 0.05	10.14 +/- 0.07

Note: Invalid bit-to-bit rate for 0.98% of measurement duration
Note: Invalid fall-to-fall rate for 1.80% of measurement duration
Note: Measurement duration 12.73 microseconds (127 bits)
Note: Average link rate 9.98 Mbits/second
Note: All rate measurements are in Mbits/second
Note: See Waveform panel for updated waveform trace

Buttons: Run Selected Tests, Clear Test Results, Next



Test Results - Example DSM





Test Results - Example DSM

The screenshot shows the SpaceWire Conformance Tester 1.00(34) interface. The window title is "SpaceWire Conformance Tester 1.00(34) (not saved)". The menu bar includes File, Edit, Settings, Tests, Goto, and Debug. The toolbar has buttons for Cover, Settings, Bit-level, Exchange-level, EOP/EEP, Timecode, Credit, Packet (1), Packet (2), Internal, and Waveform. The main area displays test results for DSM, with a table of test results and a log of test execution details.

Status	Action	Test Name
Success	Run Test	Validate ErrorWait
Success	Run Test	Validate Ready
Failed	Run Test	Validate Started
Success	Run Test	Validate Connecting
Failed	Run Test	Validate Run

Response to TCODE: correct: moved to ErrorReset
Test parameters: UUT_delta = 2 us, NCHAR = 1, timecode = 42
Note: UUT might be in Started or Connecting not Ready when test was run

Test: Validate Started
Status: Failed
Result: UUT is not link-enabled.

Test: Validate Connecting
Status: Success
Result: All tests passed
Response to parity error: correct: moved to ErrorReset
Response to ESC-EOP: correct: moved to ErrorReset
Response to ESC-EEP: correct: moved to ErrorReset
Response to FCT: correct: did not move to ErrorReset
Response to NCHAR: correct: moved to ErrorReset
Response to TCODE: correct: moved to ErrorReset
Test parameters: UUT_delta = 2 us, NCHAR = 1, timecode = 42

Test: Validate Run
Status: Failed
Result: One or more tests failed
Response to parity error: correct: moved to ErrorReset
Response to ESC-EOP: correct: moved to ErrorReset
Response to ESC-EEP: correct: moved to ErrorReset
Response to one FCT: correct: did not move to ErrorReset
Response to NCHAR: correct: did not move to ErrorReset
Response to TCODE: failed: moved to ErrorReset
Test parameters: UUT_delta = 2 us, NCHAR = 1, timecode = 42

Prev Run Selected Tests Clear Test Results Next



Test Results - Example DSM

SpaceWire Conformance Tester 1.00(34) (not saved)

File Edit Settings Tests Goto Debug Help

Cover Settings Bit-level Exchange-level EOP/EOP Timecode Credit Packet (1) Packet (2) Internal Waveform

<input checked="" type="checkbox"/> Failed	Run Test	FCT Overflow Check
<input checked="" type="checkbox"/> Success	Run Test	NCHAR Overflow Check
<input checked="" type="checkbox"/> Success	Run Test	UUT Credit Error Check

Test duration:

Test: FCT Overflow Check
Status: Failed
Result: One or more tests failed

Response to 1 FCT:	correct: did not move to ErrorReset
Response to 2 FCTs:	correct: did not move to ErrorReset
Response to 3 FCTs:	correct: did not move to ErrorReset
Response to 4 FCTs:	correct: did not move to ErrorReset
Response to 5 FCTs:	correct: did not move to ErrorReset
Response to 6 FCTs:	correct: did not move to ErrorReset
Response to 7 FCTs:	correct: did not move to ErrorReset
Response to 8 FCTs:	failed: did not move to ErrorReset
Response to 9 FCTs:	failed: did not move to ErrorReset
Response to 10 FCTs:	failed: did not move to ErrorReset
Response to 11 FCTs:	failed: did not move to ErrorReset
Response to 12 FCTs:	failed: did not move to ErrorReset
Response to 13 FCTs:	failed: did not move to ErrorReset
Response to 14 FCTs:	failed: did not move to ErrorReset
Response to 15 FCTs:	failed: did not move to ErrorReset

Note: Require silent UUT or TLI at least half the UUT rate

Test: NCHAR Overflow Check
Status: Success
Result: UUT disconnected
Note: Require TLI rate to be at least 8x UUT rate

Test: UUT Credit Error Check
Status: Success
Result: No credit errors detected

Prev Run Selected Tests Clear Test Results Next



Conclusion

- SpW CT demonstrated with 3 UUT its performance
- Coverage of conformance testing is high if the UUT supports it
- It is easy to use
- The user needs to be able to interpret the results



Commercialisation

- Star Dundee will provide the SpW CT as a commercially available product
- Support and documentation will be provided by Star Dundee as well

