



STAR-Dundee

SpaceWire Development Tools and Support Equipment

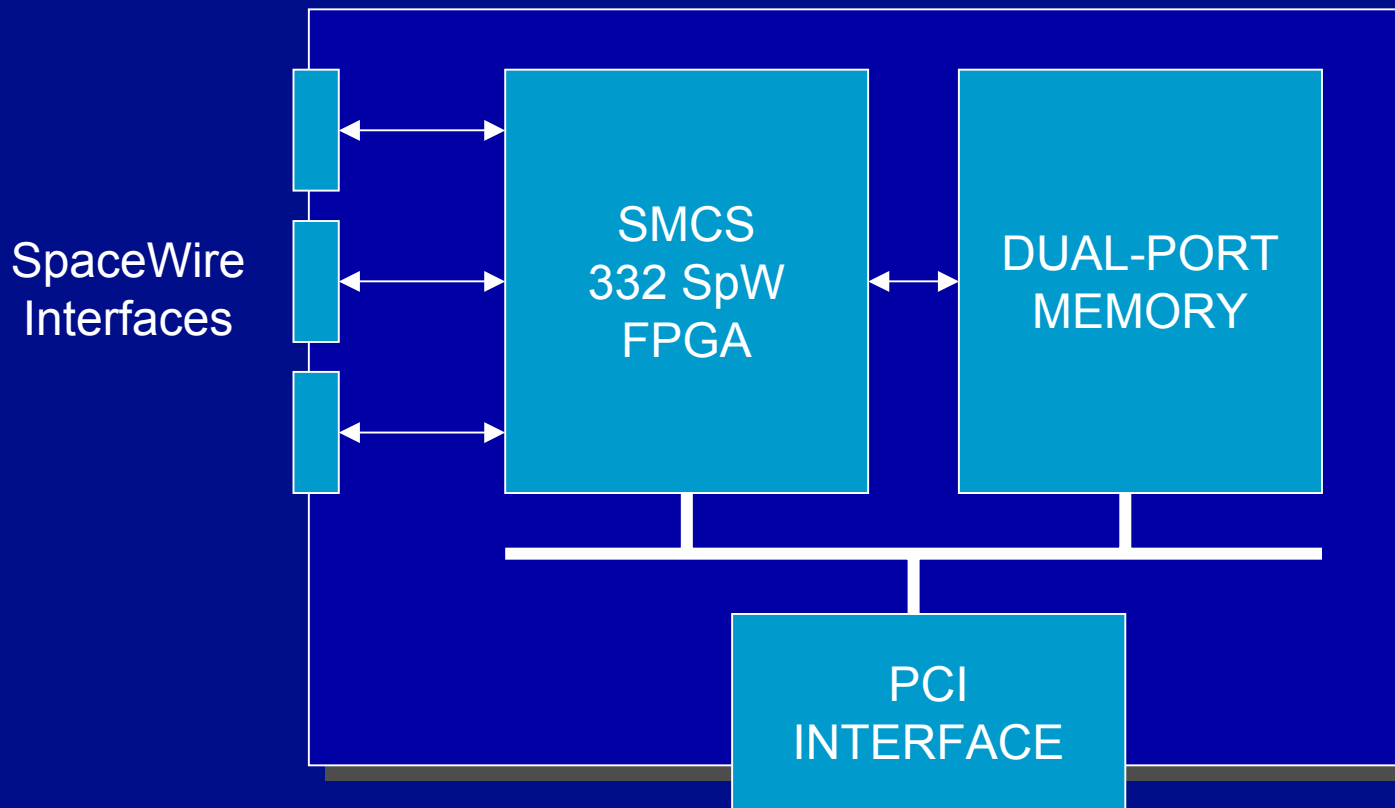
SpaceWire Working Group Meeting
Washington 2005

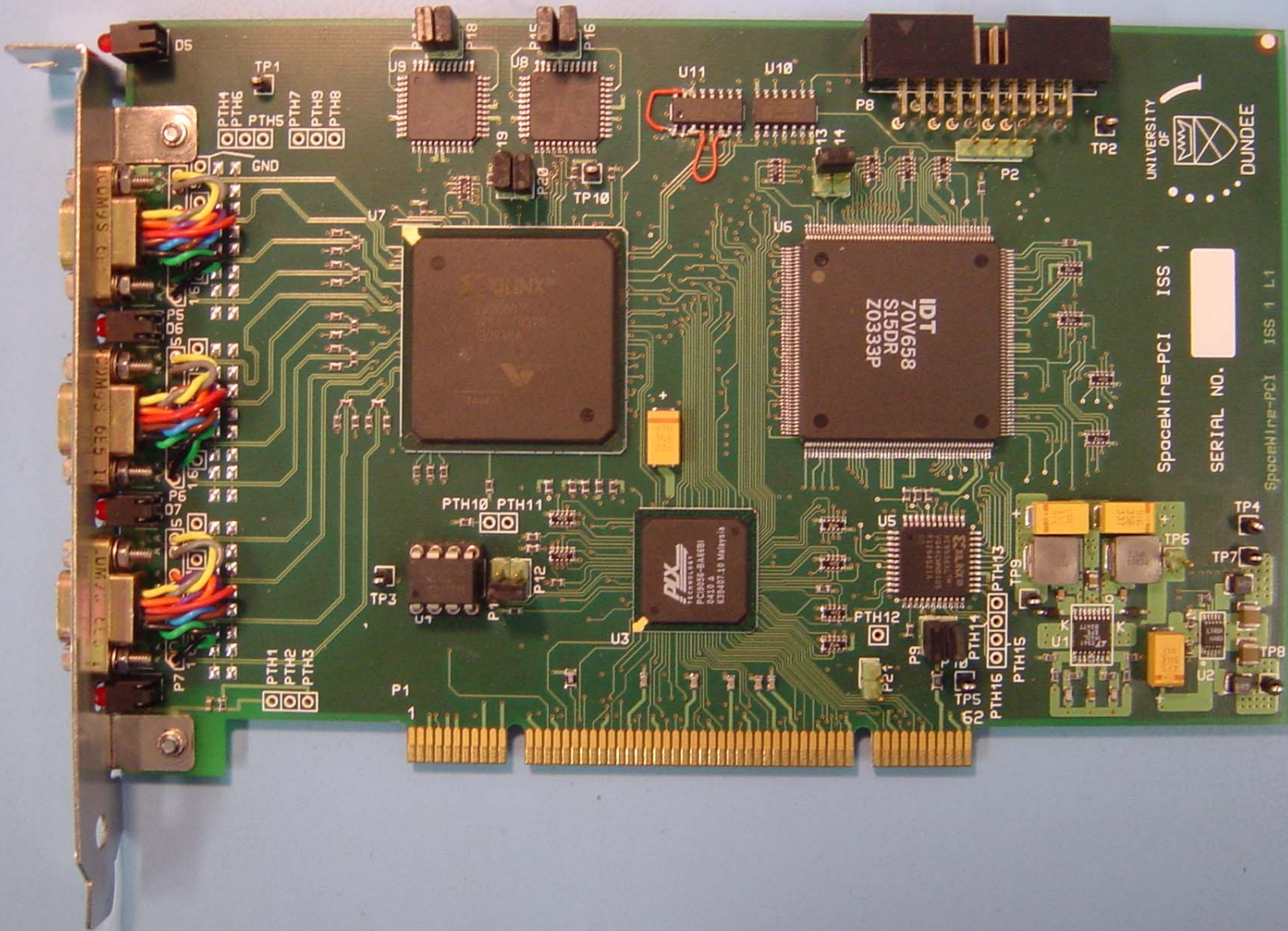
Steve Parkes
STAR-Dundee Ltd



STAR-Dundee

SpaceWire-PCI-2

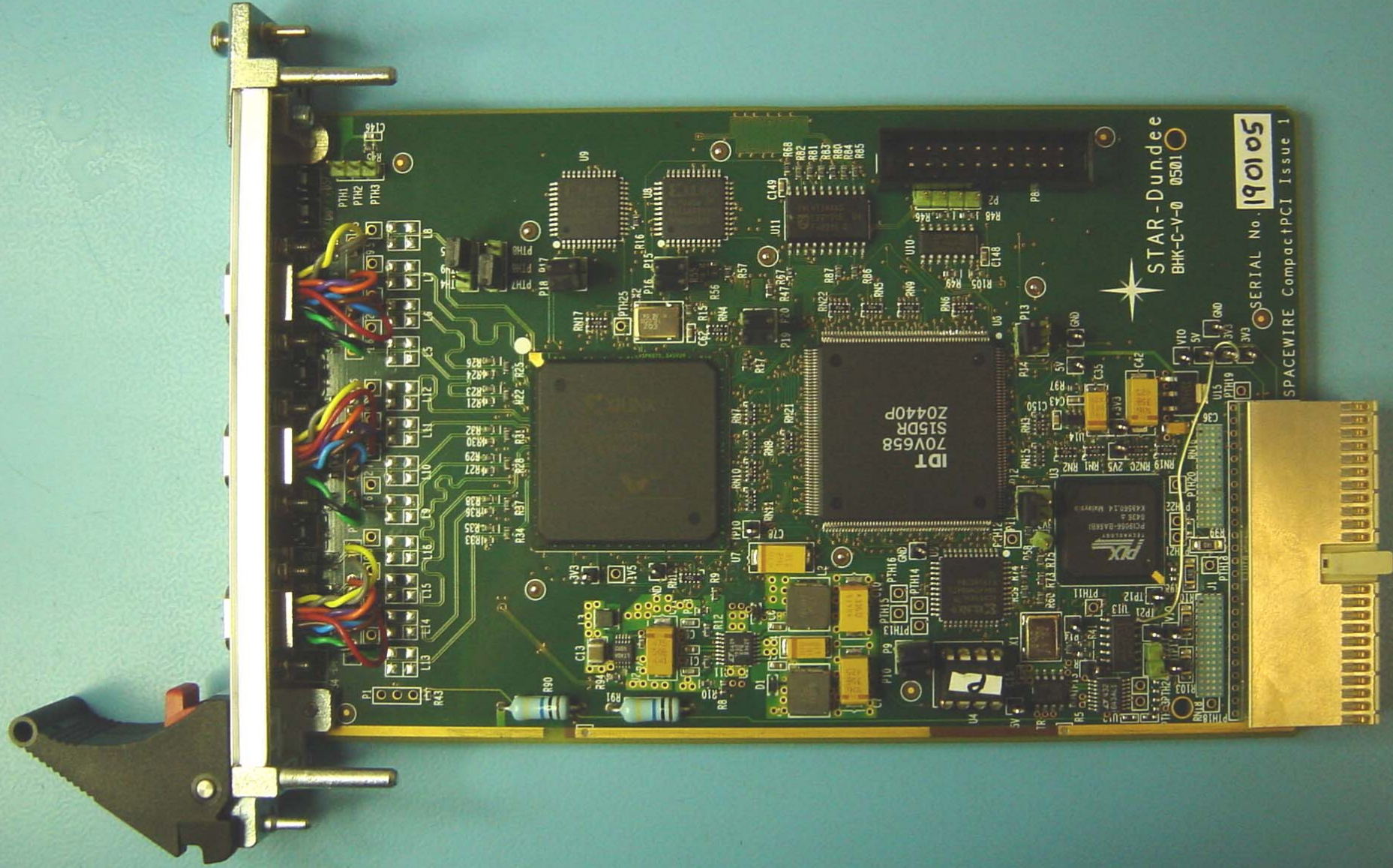




SpaceWire-PCI ISS 1

SERIAL NO.

SpaceWire-PCI ISS 1 L1



STAR-Dundee
BHK-C-V-0 05010

SERIAL No. 190105
SPACEWIRE CompactPCI Issue 1

IDT
70V658
S15DR
Z0440P

PXI
9095F-04X00I

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PH12
PH13

R34 R37 R38 R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R52 R53 R54 R55 R56 R57 R58 R59 R60 R61 R62 R63 R64 R65 R66 R67 R68 R69 R70 R71 R72 R73 R74 R75 R76 R77 R78 R79 R80 R81 R82 R83 R84 R85 R86 R87 R88 R89 R90 R91 R92 R93 R94 R95 R96 R97 R98 R99 R100

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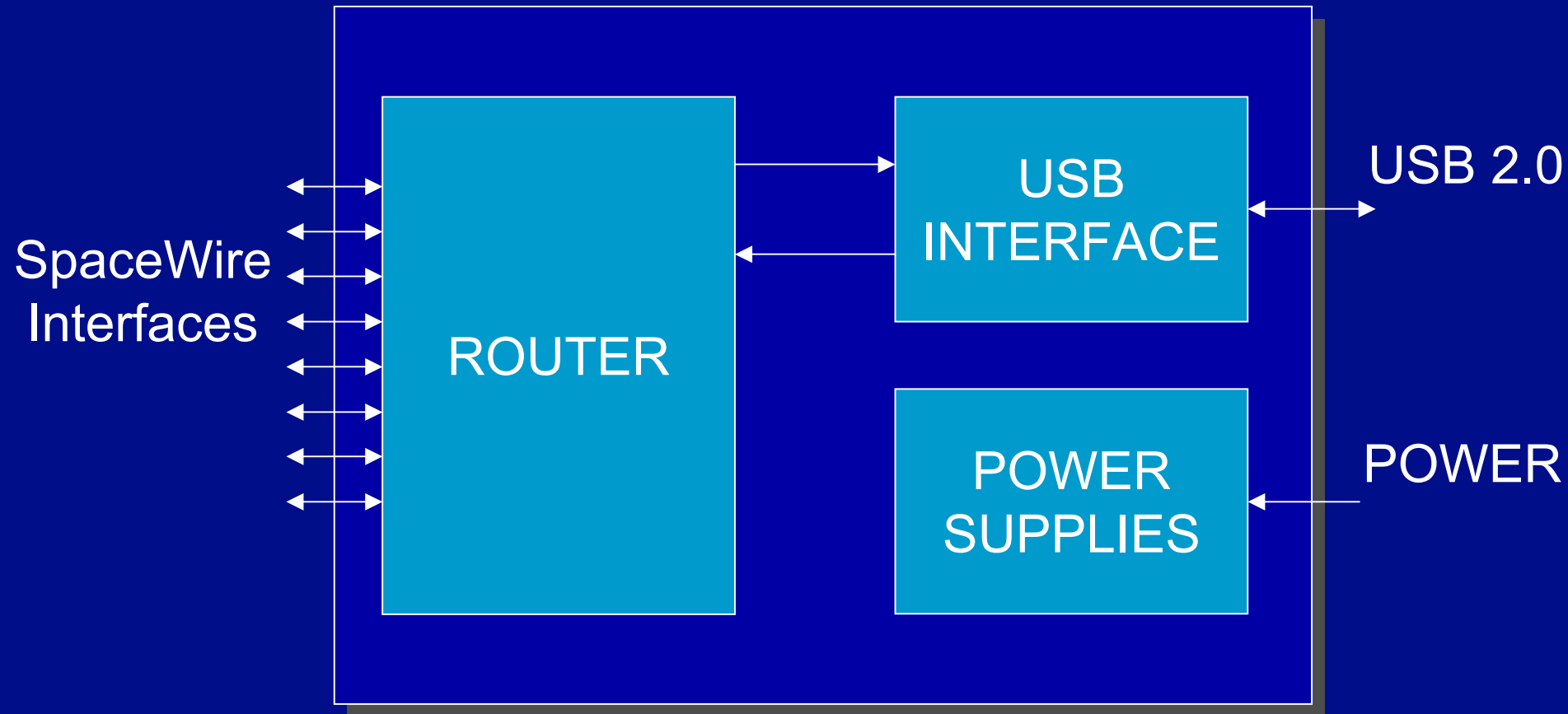
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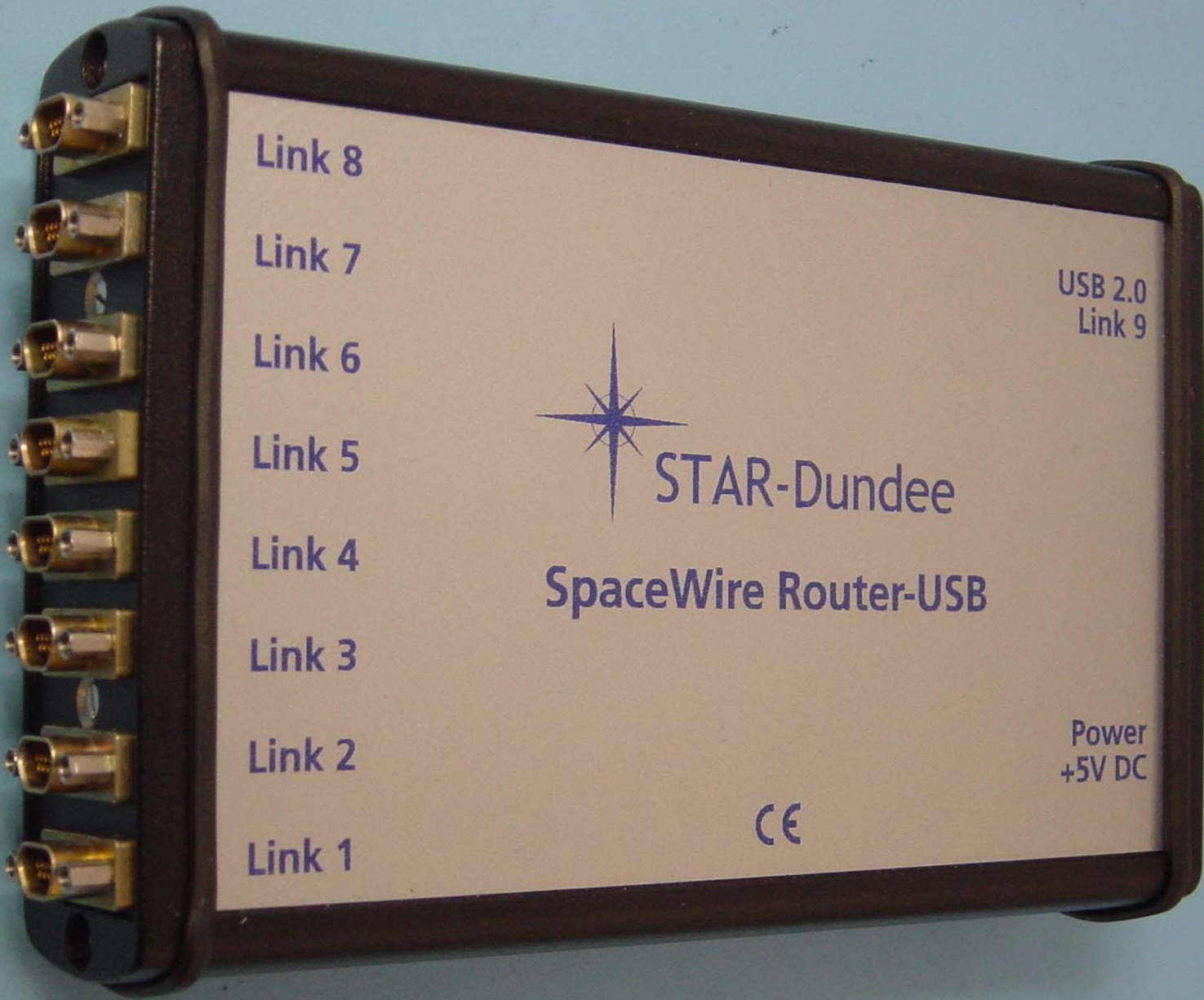
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SpaceWire Router-USB





Link 8

Link 7

Link 6

Link 5

Link 4

Link 3

Link 2

Link 1



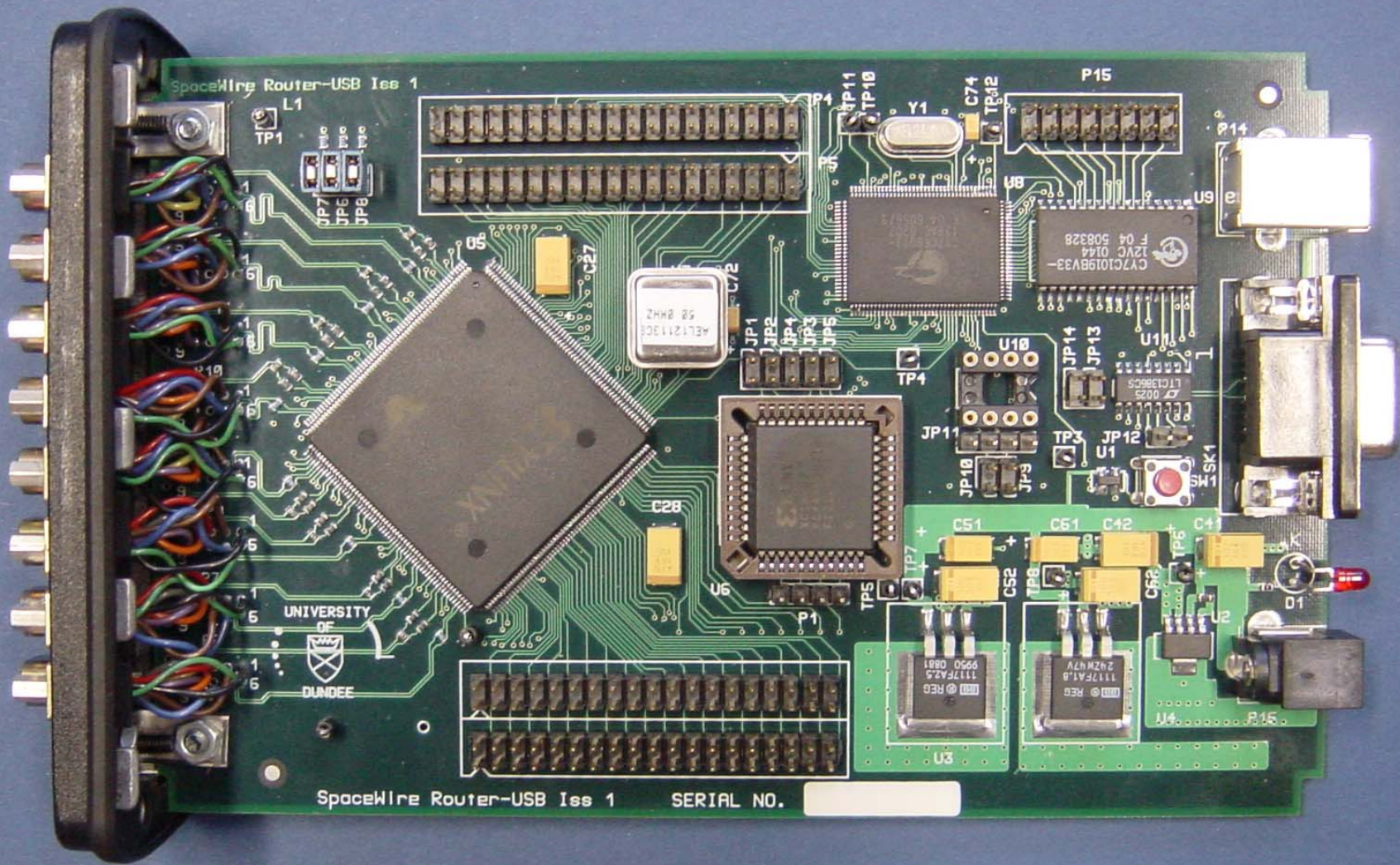
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SpaceWire Router-USB

USB 2.0
Link 9

Power
+5V DC





SpaceWire Router-USB Iss 1



SpaceWire Router-USB Iss 1 SERIAL NO. [REDACTED]

L1
TP1

JP7
JP6
JP8

P4
TP11
TP10

P15

C74

TP12

Y1

TP11

TP10

TP11

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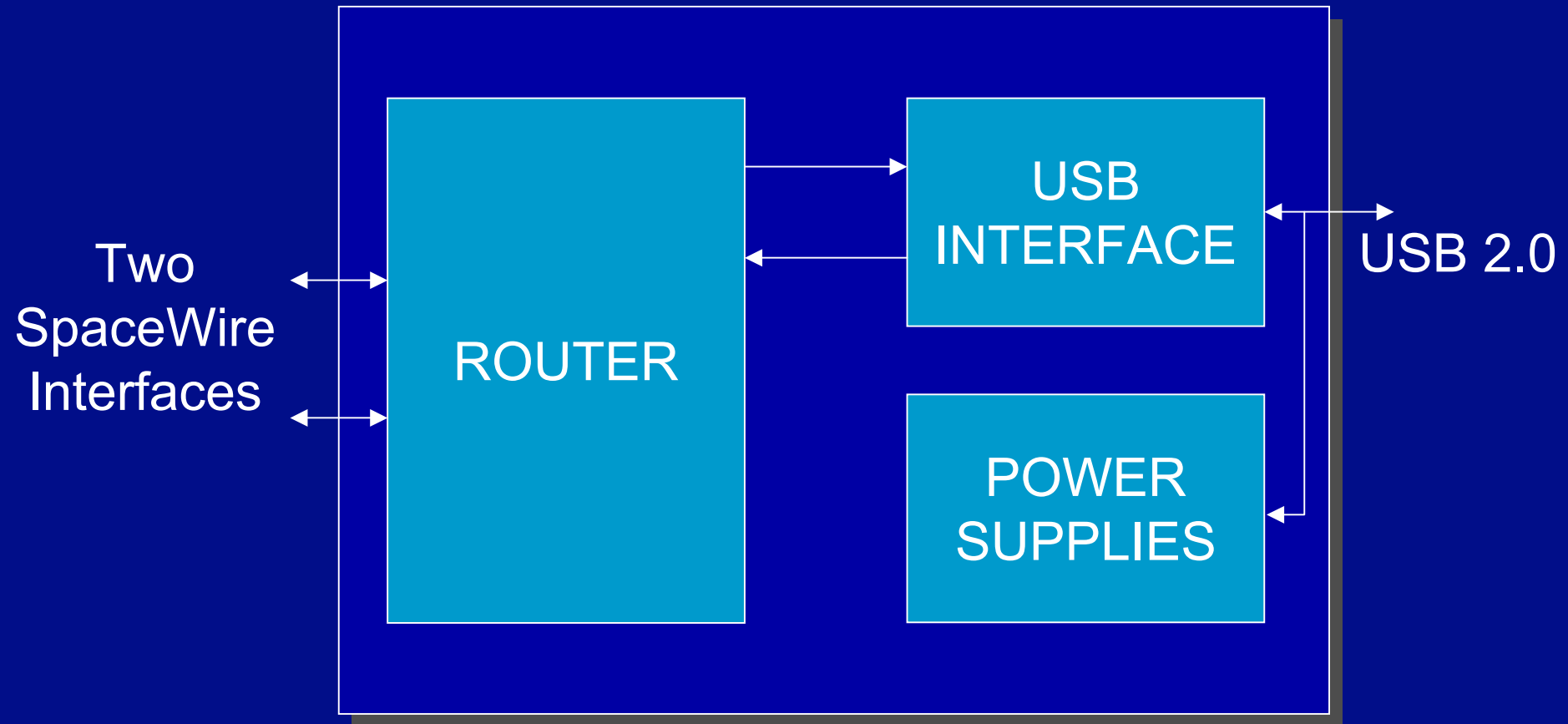
TP10

TP11



STAR-Dundee

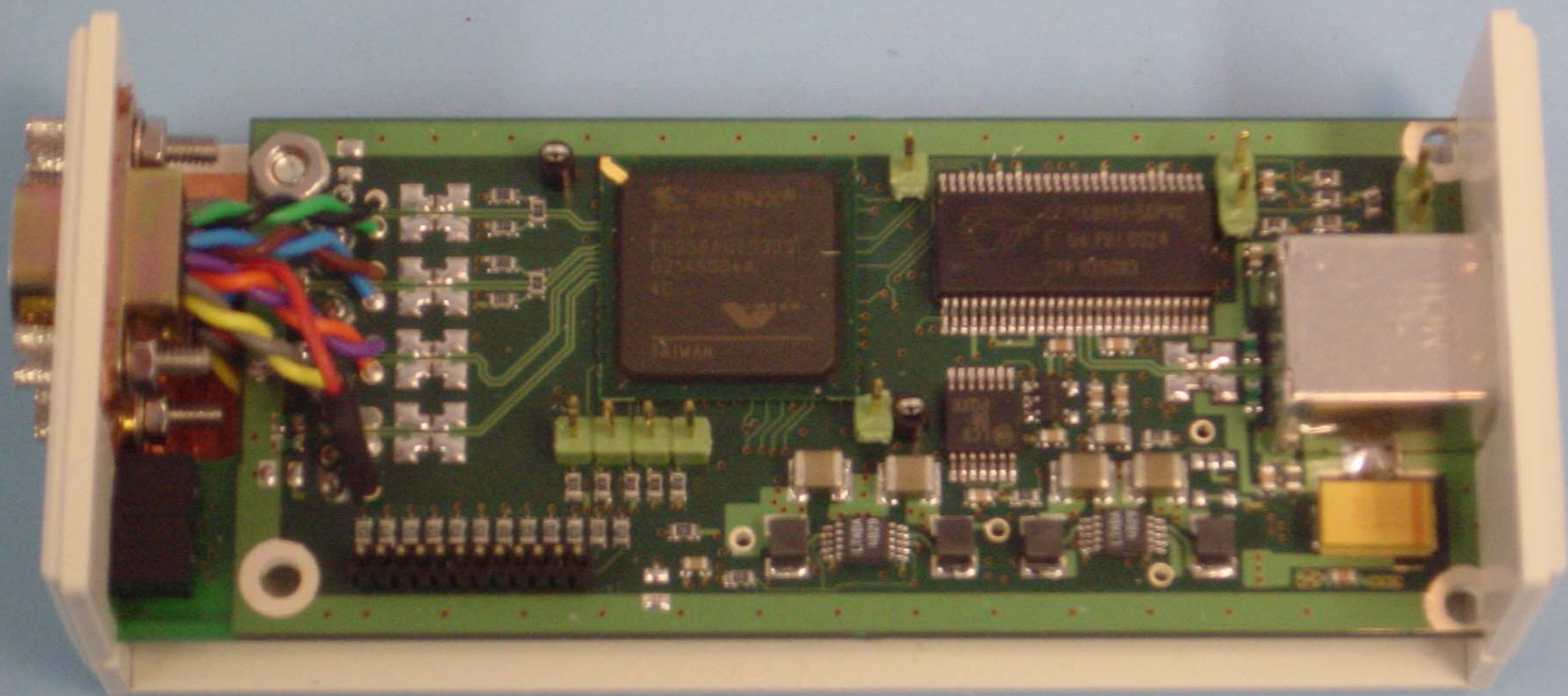
SpaceWire Brick





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SpaceWire-USB Brick







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SpaceWire Drivers

- SpaceWire Router-USB and Brick
 - Linux
 - Windows (2000, XP)
- SpaceWire PCI-2 and cPCI
 - Windows (98, 2000, XP)
 - VxWorks



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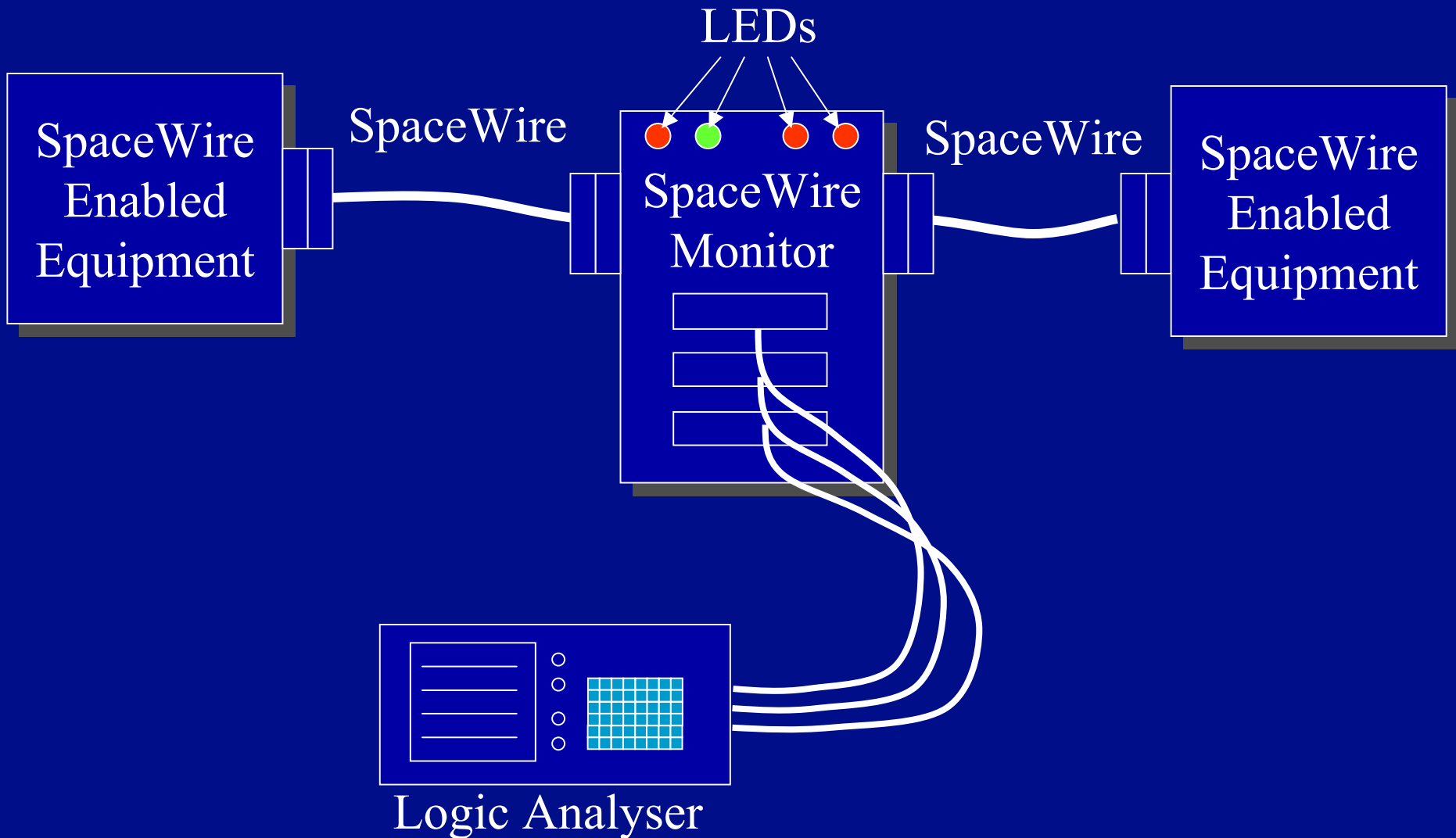
SpaceWire Test Software

- Validation software
 - Simple packet transmit and receive
 - Configuration of routers
 - Sending and receiving of test packets
 - Time-code transmit and receive
- PETRI software
 - Aimed at testing user equipment
 - Send commands, receive response
 - Commands defined in text file
 - When to receive defined in the text file
 - Run from command line
 - Responses put in text file
- Example application source code



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SpaceWire Monitor





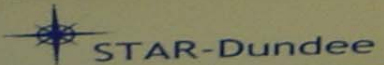
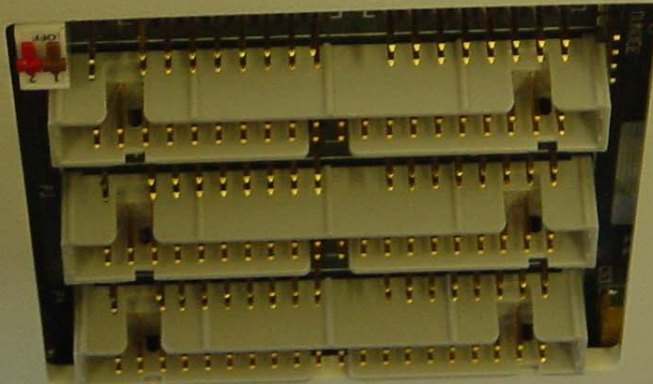
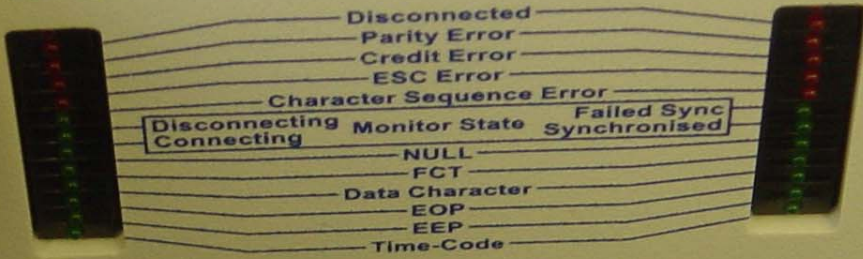
A B
UNBUFFERED

A B
BUFFERED

SpaceWire Monitor

A to B

B to A



Analyzer

Listing RECEIVER1

Cancel

Run

Markers
Off

Acquisition Time
07 Nov 2002 13:08:56

Label>

Base>

RXCHA1

RXCHA2

NCHAR1

NCHAR2

Time

Symbol

Symbol

Hex

Hex

Relative

| | | | | | |
|----|--------|--------|-----|-----|----|
| 30 | NULL | | 000 | 015 | 24 |
| 31 | ESCAPE | NCHAR | 000 | 016 | 16 |
| 32 | NULL | | 000 | 016 | 24 |
| 33 | ESCAPE | | 000 | 017 | 16 |
| 34 | | NCHAR | 000 | 017 | 8 |
| 35 | NULL | | 000 | 017 | 16 |
| 36 | ESCAPE | | 000 | 017 | 16 |
| 37 | NULL | NCHAR | 000 | 018 | 24 |
| 38 | ESCAPE | | 000 | 018 | 16 |
| 39 | NULL | | 000 | 019 | 24 |
| 40 | | NCHAR | 000 | 019 | 8 |
| 41 | ESCAPE | | 000 | 019 | 8 |
| 42 | NULL | EOP | 000 | 100 | 24 |
| 43 | | ESCAPE | 000 | 100 | 8 |
| 44 | ESCAPE | | 000 | 100 | 8 |
| 45 | | NULL | 000 | 100 | 16 |



STAR-Dundee

SpaceWire Link Analyser

- GUI specifically for SpaceWire
- Monitors traffic on link
- Triggers on specific SpaceWire events
- Or sequence of events
- Captures and displays SpaceWire events
- Oscilloscope or Logic Analyser
- Fault injection



STAR-Dundee

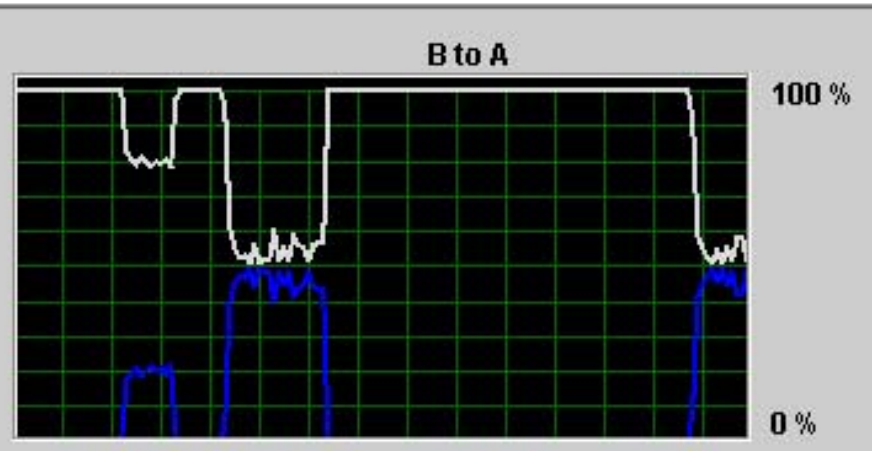
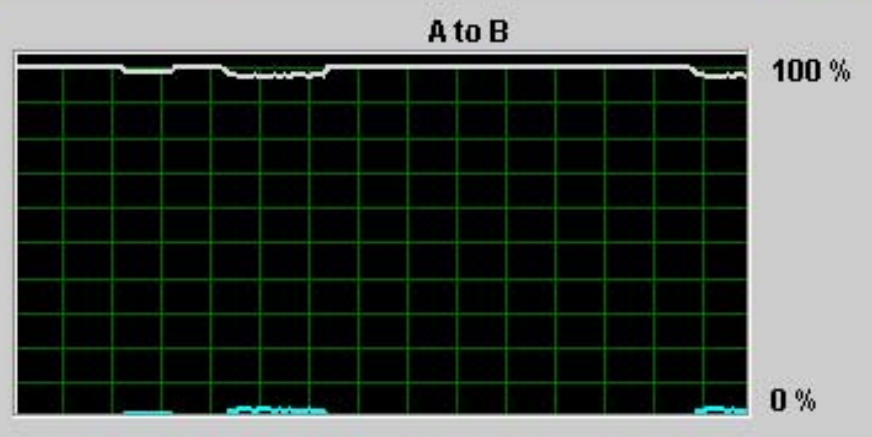
SpaceWire Link Analyser



1000
2000

Characters/Events Per Second ▾

| | A --> B | B --> A |
|---------------------|-------------|-------------|
| Signaling Rate | 200.001 MHz | 200.001 MHz |
| Disconnect Error | 0 | 0 |
| Parity Error | 0 | 0 |
| Credit Error | 0 | 0 |
| Escape Error | 0 | 0 |
| Char Sequence Error | 0 | 0 |
| Data Character | 0 | 9,689,501 |
| EOP Character | 0 | 485 |
| EEP Character | 0 | 0 |
| FCT Character | 1,211,240 | 0 |
| NULL Character | 24,394,329 | 12,888,020 |
| Time-code Character | 0 | 0 |



Clear Freeze



Comparator Select

A→B Short Comparator 1

Comparator Options for A→B Short Comparator 1

| | Mask | Type | Hex Value |
|---|-------------------------------------|------------------------|-----------|
| 1 | <input type="checkbox"/> | Header (Check Value) ▼ | 35 |
| 2 | <input type="checkbox"/> | Data ▼ | 56 |
| 3 | <input checked="" type="checkbox"/> | Data ▼ | 0 |
| 4 | <input checked="" type="checkbox"/> | Data ▼ | 0 |
| 5 | <input checked="" type="checkbox"/> | Data ▼ | 0 |
| 6 | <input type="checkbox"/> | EOP ▼ | 0 |
| 7 | <input checked="" type="checkbox"/> | Data ▼ | 0 |
| 8 | <input checked="" type="checkbox"/> | Data ▼ | 0 |

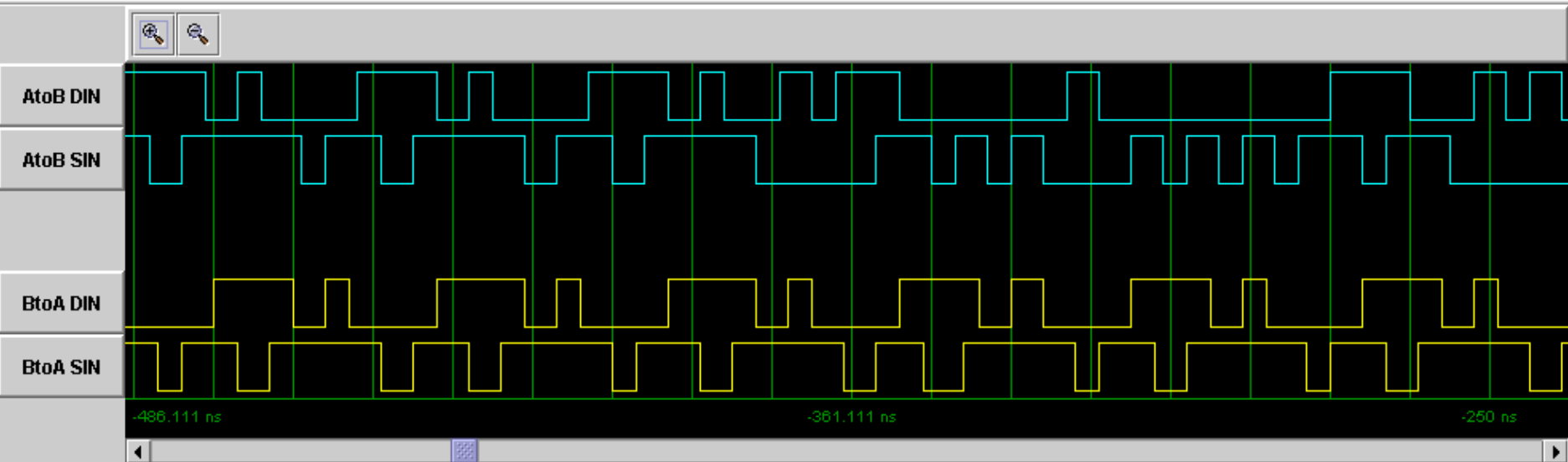


Set the trigger sequences

| | Enabled | Source | Event | Number Of |
|---|-------------------------------------|----------|---------------------------|-----------|
| 1 | <input checked="" type="checkbox"/> | A to B ▼ | Packet Header Character ▼ | 4 ▲▼ |
| 2 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |
| 3 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |
| 4 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |
| 5 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |
| 6 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |
| 7 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |
| 8 | <input type="checkbox"/> | A to B ▼ | Timecode Comparator ▼ | 1 ▲▼ |

OK

Cancel



Marker A **-5.450 us** Marker B **-5.450 us** Diff **0 ns**



| Time From Tri... | Time Delta | A→B | A→B Delta | B→A | B→A Delta |
|------------------|------------|---|------------|---|------------|
| -700 ns | | | | Header: 0x02 (Cargo Size = 6 bytes) | |
| | | | | 03 80 01 01 02 03 | |
| -400 ns | 300 ns | | | EOP (300 ns @ 23.333 Mbytes/s) | 300 ns |
| -140 ns | 260 ns | Header: 0x03 (Cargo Size = 5 bytes) | | | |
| | | 80 01 01 02 03 | | | |
| 140 ns | 280 ns | EOP (280 ns @ 21.429 Mbytes/s) | 280 ns | | |
| 414.860 us | 414.720 us | | | Header: 0x02 | 415.260 us |
| | | | | Cargo Size = 2012 bytes | |
| 415.460 us | 600 ns | Header: 0x03 | 415.320 us | | |
| | | Cargo Size = 2011 bytes | | | |
| 578.040 us | 162.580 us | | | EOP (163.180 us @ 12.336 Mbytes/s) | 163.180 us |
| 578.040 us | 460 ns | EOP (163.040 us @ 12.341 Mbytes/s) | 163.040 us | | |
| 914.760 us | 336.260 us | | | Header: 0x02 | 336.720 us |
| | | | | Cargo Size = 2012 bytes | |
| 915.360 us | 600 ns | Header: 0x03 | 336.860 us | | |
| | | Cargo Size = 2011 bytes | | | |
| 1.07798 ms | 162.620 us | | | EOP (163.220 us @ 12.333 Mbytes/s) | 163.220 us |
| 1.07798 ms | 400 ns | EOP (163.020 us @ 12.342 Mbytes/s) | 163.020 us | | |
| 1.33096 ms | 252.580 us | | | Header: 0x02 | 252.980 us |
| | | | | Cargo Size = 54 bytes | |
| 1.33156 ms | 600 ns | Header: 0x03 | 253.180 us | | |
| | | Cargo Size = 41 bytes | | | |
| 1.33372 ms | 2.160 us | UNKOWN END (2.160 us @ 19.444 Mbytes/s) | 2.160 us | | |
| 1.33374 ms | 20 ns | | | UNKOWN END (2.780 us @ 19.784 Mbytes/s) | 2.780 us |

Data View
 ASCII Integer
 Hex

Bit Width
 8 Bit (Byte) 16 Bit (Word)
 32 Bit (Double Word) 64 Bit (Quad Word)

Bytes per row

Cargo header bytes



| Time From Tri... | Time Delta | A→B | A→B Delta | B→A | B→A Delta |
|------------------|------------|---|------------|---|------------|
| -700 ns | | | | Header: 0x02 (Cargo Size = 6 bytes) | |
| | | | | 03 80 01 01 02 03 | |
| -400 ns | 300 ns | | | EOP (300 ns @ 23.333 Mbytes/s) | 300 ns |
| -140 ns | 260 ns | Header: 0x03 (Cargo Size = 5 bytes) | | | |
| | | 80 01 01 02 03 | | | |
| 140 ns | 280 ns | EOP (280 ns @ 21.429 Mbytes/s) | 280 ns | | |
| 414.860 us | 414.720 us | | | Header: 0x02 (Cargo Size = 2012 bytes) | 415.260 us |
| 415.460 us | 600 ns | Header: 0x03 (Cargo Size = 2011 bytes) | 415.320 us | 03 80 04 FE 00 00 00 00 D0 07 00 00 CD CD CD CD | |
| | | 80 04 FE 00 00 00 00 D0 07 00 00 CD CD CD CD CD | | CD CD CD CD CD CD CD CD CD CD CD CD CD CD CD CD | |
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Data View

ASCII
 Integer
 Hex

Bit Width

8 Bit (Byte)
 16 Bit (Word)
 32 Bit (Double Word)
 64 Bit (Quad Word)

Bytes per row

16

Cargo header bytes

0

Error Injection



A to B Error Injection

B to A Error Injection

Error Length μs ▼

Error Interval seconds ▼

Error Type **Burst Error** ▼

Inject Single Error

Enable Interval Error

Close

Apply

Cancel

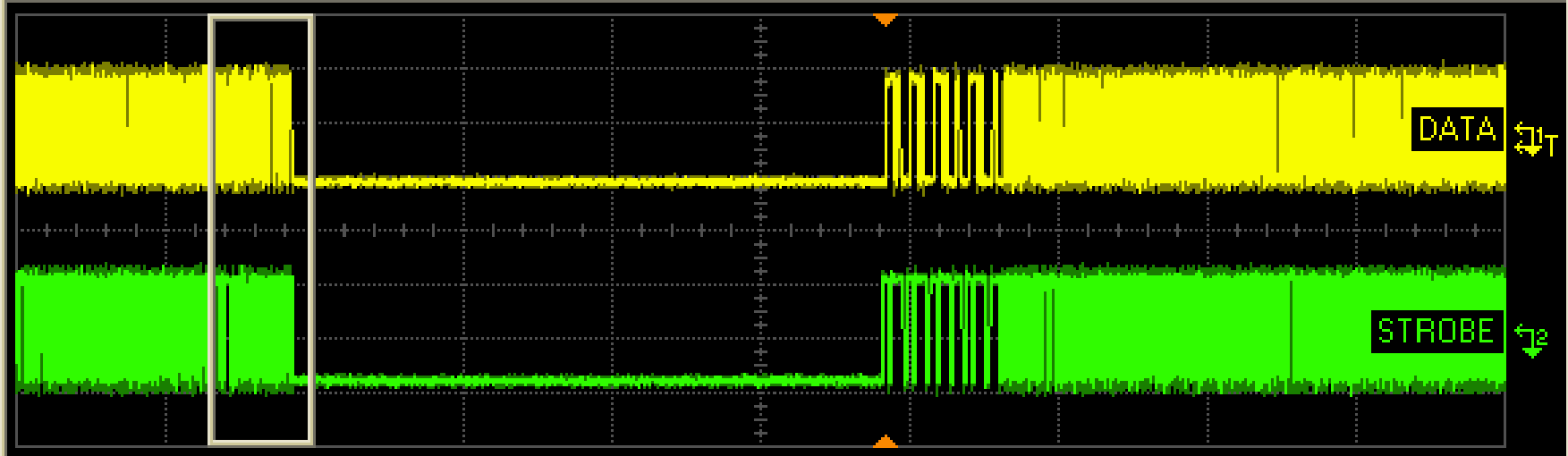
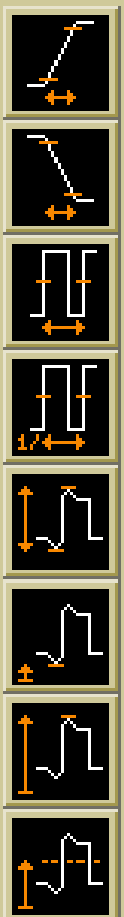
Close the dialog and save the settings

Acquisition is stopped.

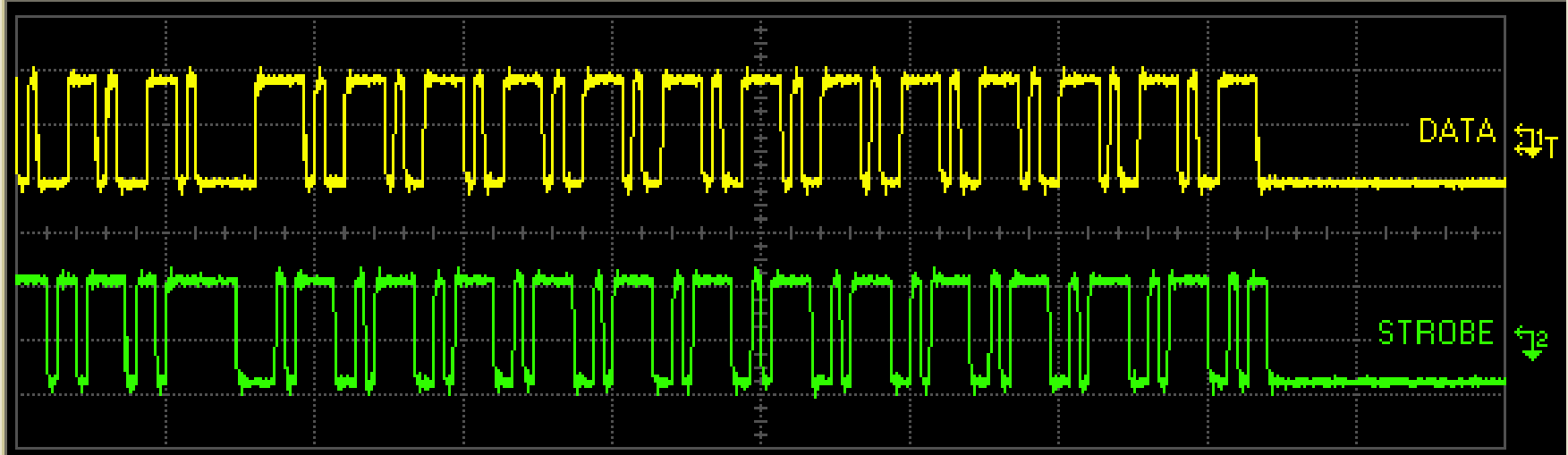
2.00 GSa/s 4.01 Mpts



1 On 400 mV/ 2 On 400 mV/ 3 On 4 On On

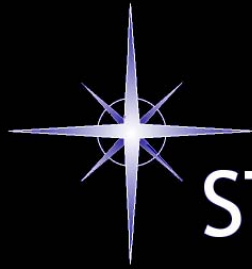


5.00 μ s/ -4.1818185 μ s



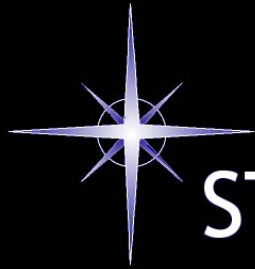
300 ns/ -20.9656500 μ s -140.0 mV

More (1 of 2)
Delete All



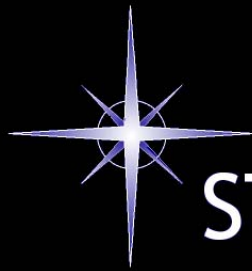
STAR-Dundee

- Products shipping now
 - SpaceWire Router-USB
 - SpaceWire USB Brick
 - SpaceWire Monitor
 - SpaceWire Link Analyser
 - SpaceWire PCI 2
 - SpaceWire cPCI
- CE/FCC certification



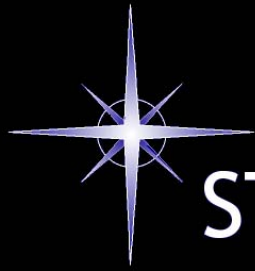
STAR-Dundee

- Products shipping with
 - Validation Software (USB & PCI)
 - PETRI Software (USB only)
 - Example Application in Source Code
- Applications Support



STAR-Dundee

- Coming soon
 - SpaceWire Conformance Tester
 - SpaceWire IP Tunnel
 - Remote Memory Access Protocol



STAR-Dundee

- Support for users of SpaceWire
 - Test equipment
 - Test software
 - Software drivers
 - Development support
 - IP support
 - ASIC support

SpaceWire IP

- **SpaceWire CODEC**
 - Configurable VHDL core
 - Suitable for ASIC and FPGA implementation
 - IP licence available from ESA or UoD
- **SpaceWire Router**
 - Configurable VHDL Router
 - Generics for
 - Number of SpaceWire Ports
 - Number of External Ports
 - IP licence from University of Dundee