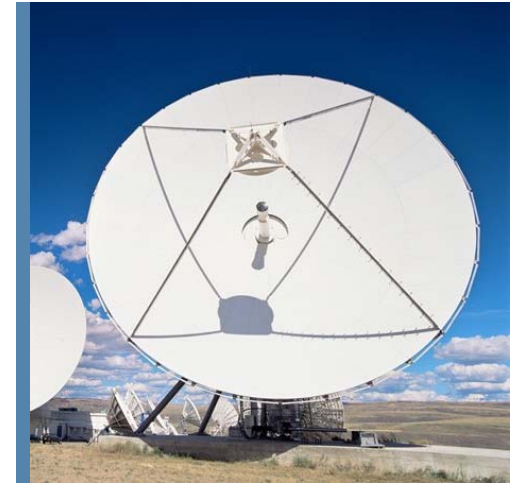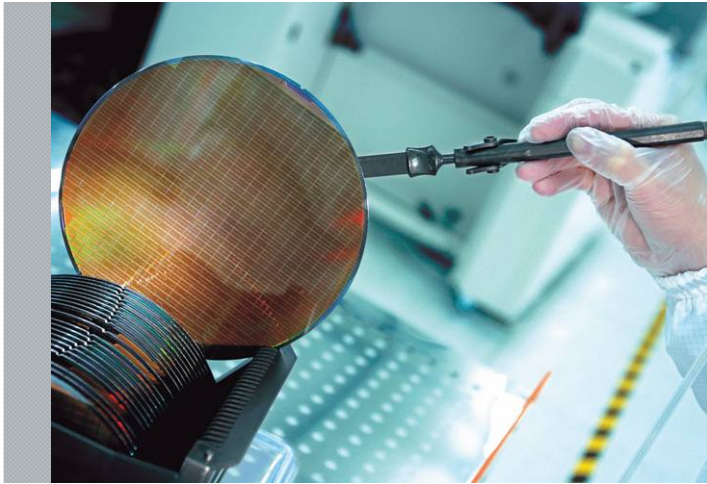# SFF-8431 SFP+ Technology

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Agenda

- Tektronix Ethernet Solution – Background Information

- SFP-TX – SFP+ Automation and Debug Solution

- Questions and open discussion

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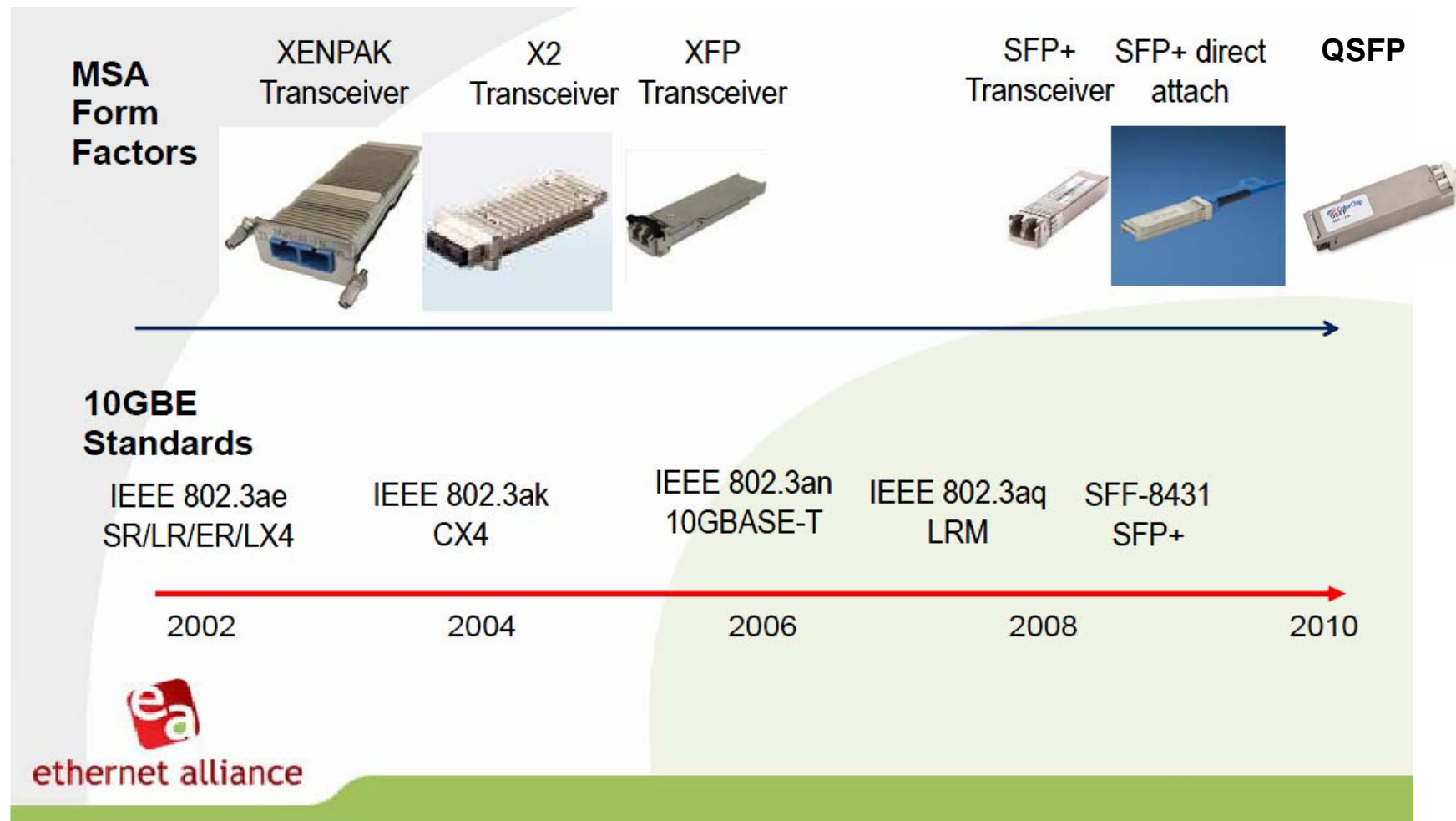# Tektronix Ethernet Solution – Background Information

- Tektronix has strong portfolio of products and solution in Ethernet Space – RT Scope, Sampling scope, BERTScope and now Optametra products

- TDSET3 – available since 2003 with over 2500+ end-users and still growing

- XGbT – Tektronix released 10GBASE-T solution in 2009 and we have added over 60 end-users worldwide

- 802.3az – EEE – Software and Fixture are used by many customers worldwide over 15 customer added since Dec 2010

- SFP-TX will be launched in AUG 2011, Tektronix will be first to market

- 10GBASE-KR - 802.3ap™-2007 – currently working on KR and we have a phase zero solution available – Plan to launch Automation and Debug solution in Q3/Q4-2011

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SFP-TX – SFP+ Automation and Debug Solution

10Gigabit Ethernet Interface Evolution

MSA Form Factors

| XENPAK Transceiver | X2 Transceiver | XFP Transceiver | SFP+ Transceiver | SFP+ direct attach | QSFP |

10GBE Standards

IEEE 802.3ae SR/LR/ER/LX4	IEEE 802.3ak CX4	IEEE 802.3an 10GBASE-T	IEEE 802.3aq LRM	SFF-8431 SFP+
2002	2004	2006	2008	2010

ethernet alliance

Source : Ethernet Alliance

Next Big Thing SFF-8431 SFP+

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SFF-8431 SFP+ Technology overview

1. SFP+ is a next-generation hot-pluggable, small footprint, serial-to-serial multi-rate optical transceiver for 8.5GbE and 11.1GbE Datacom and Storage Area Networks (SAN) applications.

2. SFP+ technology moved the clock and data recovery units out of the module and onto the line card – Reducing size drastically

3. As a result, the modules are smaller, consume less power, allow increased port density, and are less expensive compared to XFP.

4. High density capable Up to 48 ports in a rack

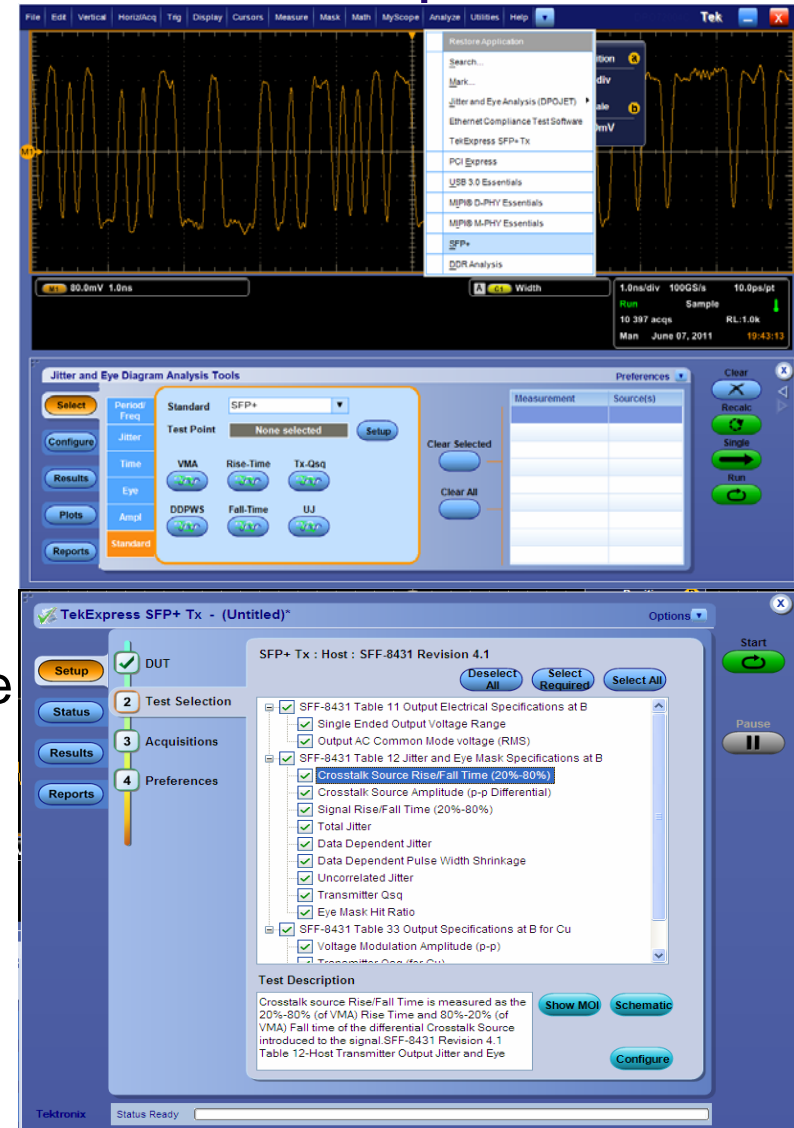5. Low power per port - Host Port power < 1 W and Low Latency

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# SFP-TX – SFP+ Compliance and Debug Solution

- Tektronix is first in market to provide a Comprehensive Automated and Debug Solution for SFF-8431 SFP+ host and module

- Brand new UI and software which is very well integrated with scope

- One-button Selection of Multiple Tests

- Remote Programming Interface - NI LabVIEW or NI TestStand™ or other scripting languages

- Real-time waveform capture and Pre-recorded waveform support

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Tektronix SFP-TX – Automation & DPOJET Option

- One part number enable both

  Automation and DPOJET options

- No Dongle required, Floating license available

- TekExpress SFP-TX option lets compliance users automate their setup & quickly generate reports

- DPOJET SFP-TX option lets debug users get into debug mode and analyze their devices

- Meets Compliance needs of SFF-8431 revision 4.1

- User defined mode lets user perform measurements on different signal type like 8180, PRBS9 & PRBS31

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Test connection

DUT — HCB-Fixture — DC Blocks — Digital Oscilloscope — Ch1 — Ch2

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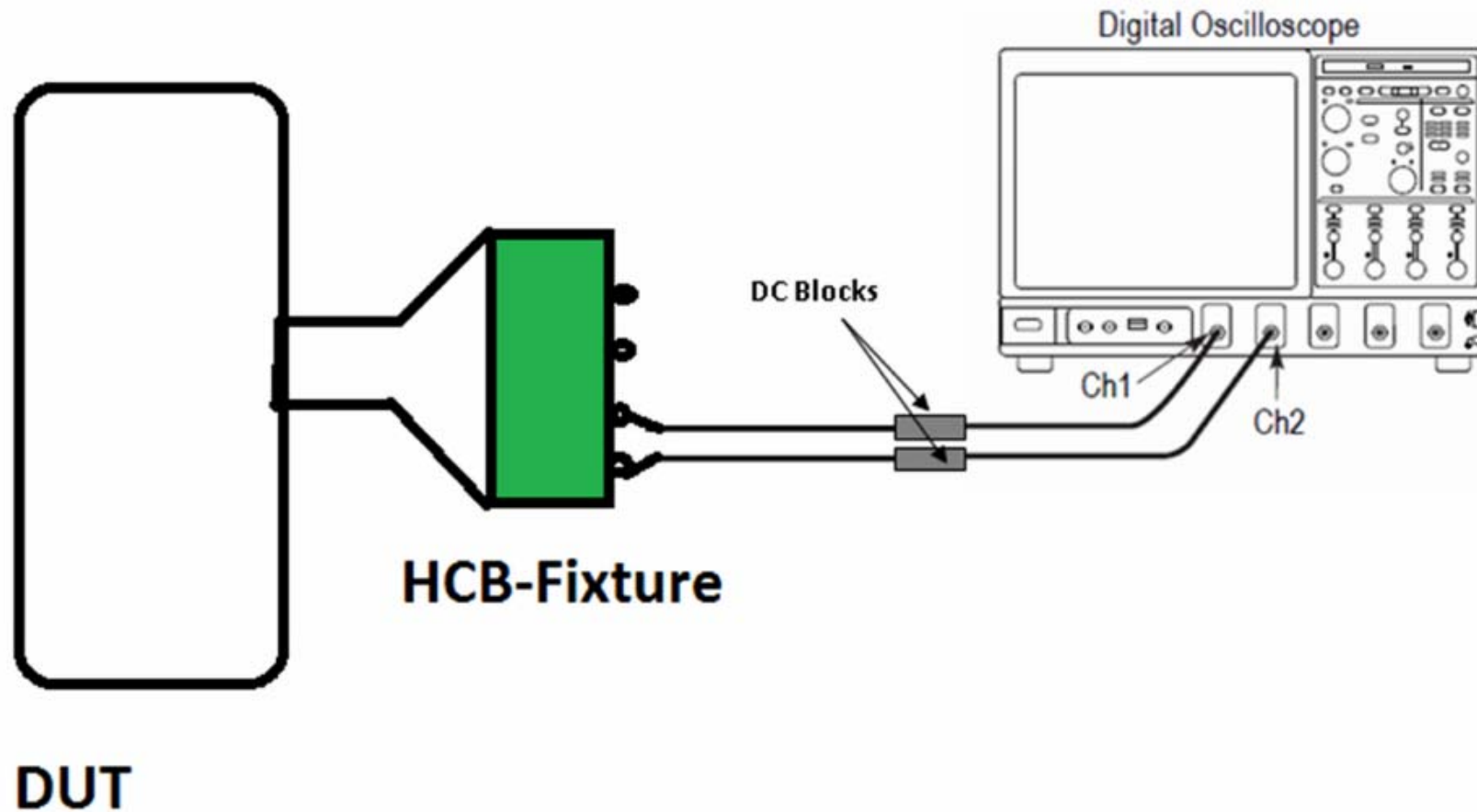
SFP-TX Host Transmitter Measurements

SL No.	Measuremnts	Signal Type Recommended	Limit Min	Target	Max	Units
Host Transmitter output electrical Specifications:						
1	Single Ended Output Voltage Range	PRBS31	-0.3		4	V
2	Output AC Common Mode voltage (RMS)	PRBS31			15	mV(RMS)
Host Transmitter Jitter and Eye Mask specifications						
3	Crosstalk source rise/fall time (20%-80%) (Tr, Tf)	8180		34		ps
4	Crosstalk source amplitude (p-p differential)	8180		1000		mV
5	Signal rise/fall time (20%-80%) (Tr, Tf)	8180	34			ps
6	Total Jitter (p-p) (Tj)	PRBS31			0.28	UI(p-p)
7	Data Dependent Jitter (p-p) (DDJ)	PRBS9			0.1	UI(p-p)
8	Data Dependent Pulse Width Shrinkage (p-p) (DDPWS)	PRBS9			0.055	UI(p-p)
9	Uncorrelated Jitter (RMS) (UJ)	PRBS9			0.023	UI(p-p)
10	Transmitter Qsq	8180	50			
11	Eye mask hit ratio(Mask hit ratio of 5×10-5)	PRBS31	X1=0.12UI, X2=0.33UI, Y1=95mV, Y2=350mV			
Host Transmitter output specifications for Cu (SFP+ host supporting direct						
12	Voltage Modulation Amplitude (p-p)	8180	300			mV
13	Transmitter Qsq Output AC Common Mode voltage	8180	63.1			
14	Output AC Common Mode Voltage	PRBS31			12	mV(RMS)
15	Host Output TWDPc	PRBS9			10.7	dBe

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Eye Mask hit ratio :less than 5E10-5
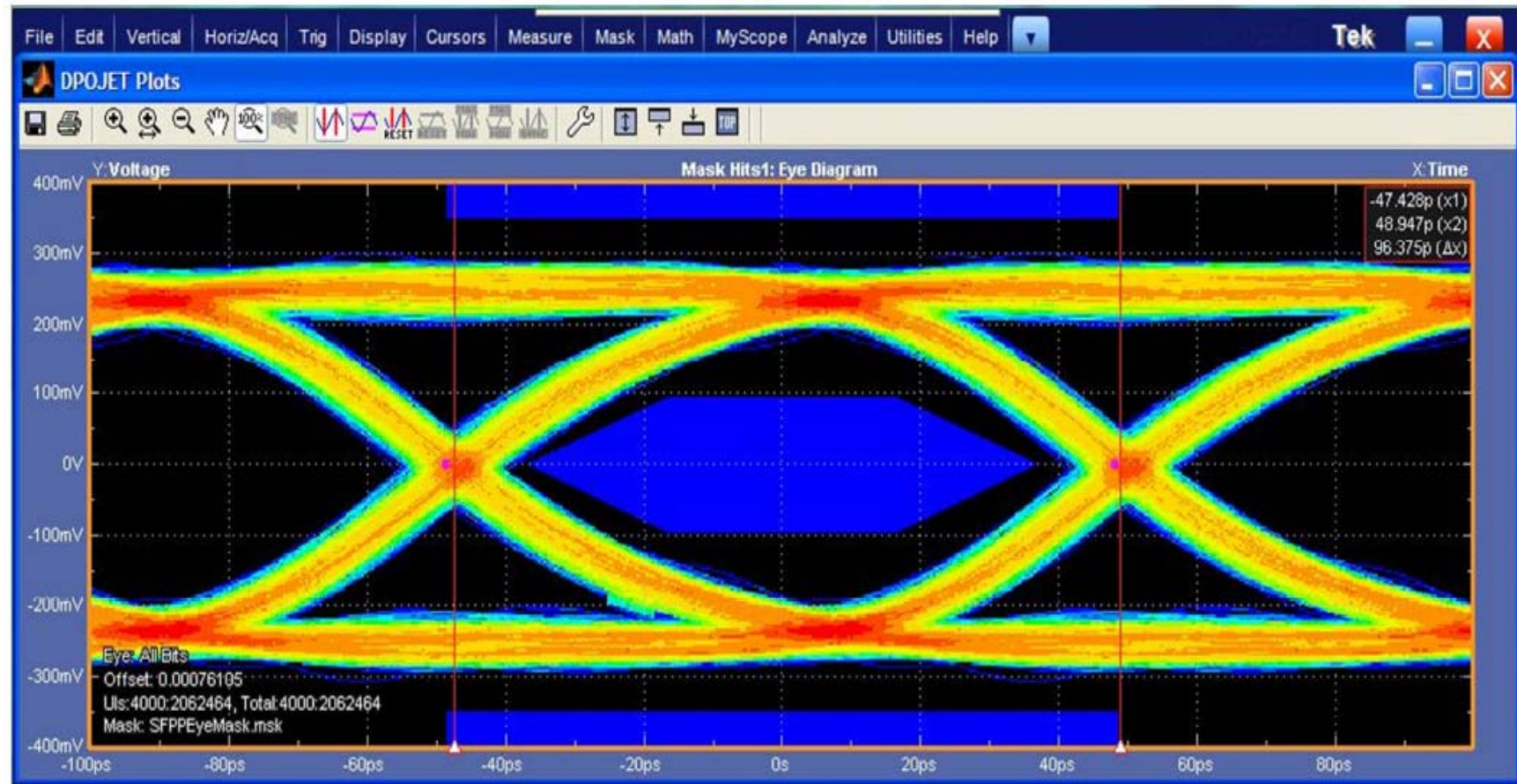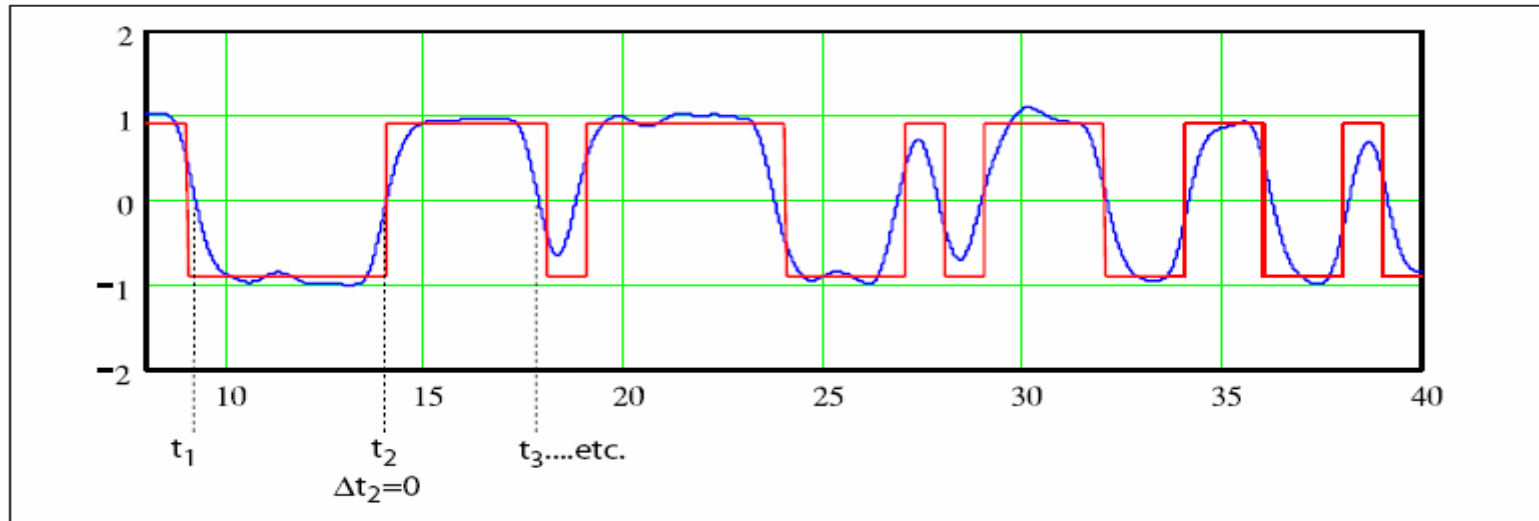
Tj

Tj @ 10-12 <0.28UI

DDJ and DDPWS measurement

Figure 47 DDJ Test Method

$$DDJ = max(\Delta t_1, \Delta t_2, \ldots \Delta t_n) - min(\Delta t_1, \Delta t_2, \ldots \Delta t_n)$$

$$DDPWS = T - min(t_2-t_1, t_3-t_2, \ldots t_{n+1}-t_n)$$
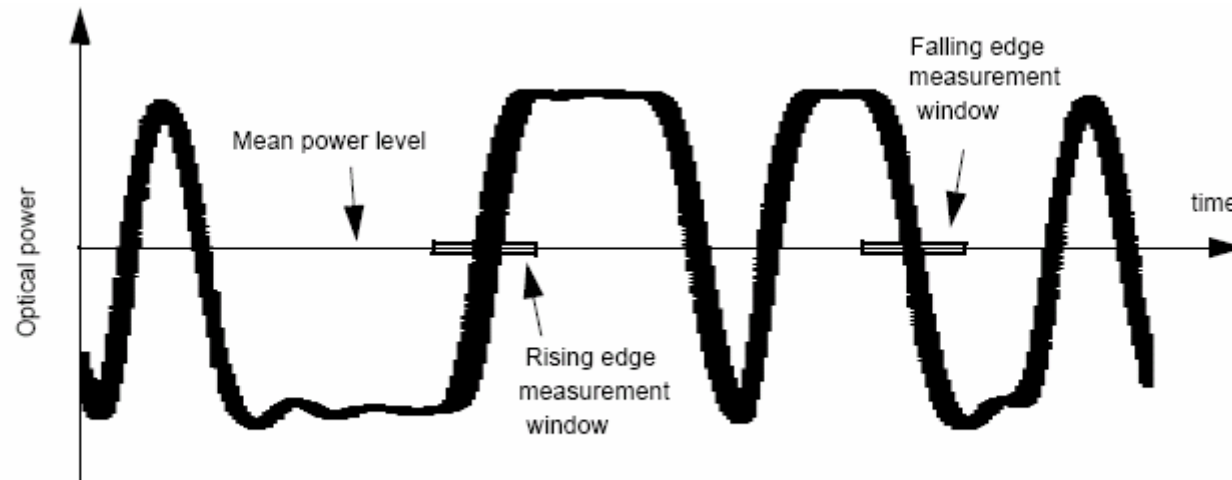
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UJ measurement

Figure 68–9—Measurement windows for transmitter uncorrelated jitter

$$\text{Uncorrelated jitter (rms)} = \sqrt{(\sigma_r^2 + \sigma_f^2)/2}$$

where
σ_r is the standard deviation of the jitter on the rising edge
σ_f is the standard deviation of the jitter on the falling edge

Uj measurement is defined in IEEE 802.3 CL 68 P361

Transmitter Qsq

- Qsq=1/RN

- RN: $$RN = \frac{2 \times noise(RMS)}{(xMA)}$$

- Noise: $$noise(RMS) = \sqrt{(logicONEnoise(RMS)^2 + logicZEROnoise(RMS)^2)/2}$$

- XMA :VMA/OMA
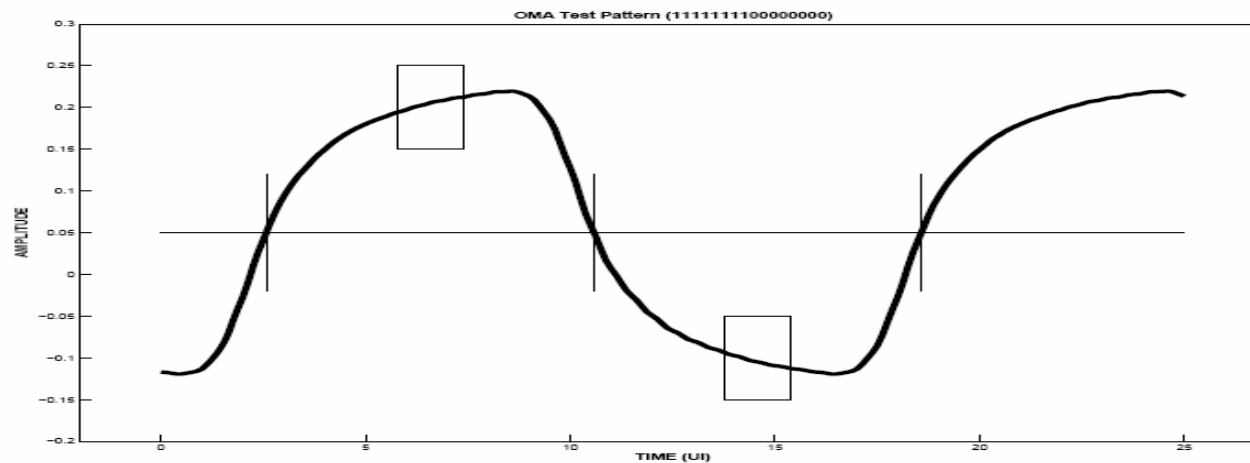
Figure 48 Example xMA waveform showing xMA measurement windows

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SFP-TX - Report

- SFP-TX software provides summary-reporting capability in .mht (HTML) format with pass/fail status.

- A detailed report includes test configuration details, waveform plots, and margin analysis.

- Report also provides additional details like calibration status, scope model, probe model, software version, date, execution time etc.

- Report configuration menu lets user configure reports, it provides options like auto increment, appending etc.

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Wilder - Host Compliance Board(HCB) - Test Fixture

- The Host Compliance Board(HCB) allows predictable, repeatable and consistent results among Host vendors and will help to ensure consistency and true compliance in the testing of Hosts.
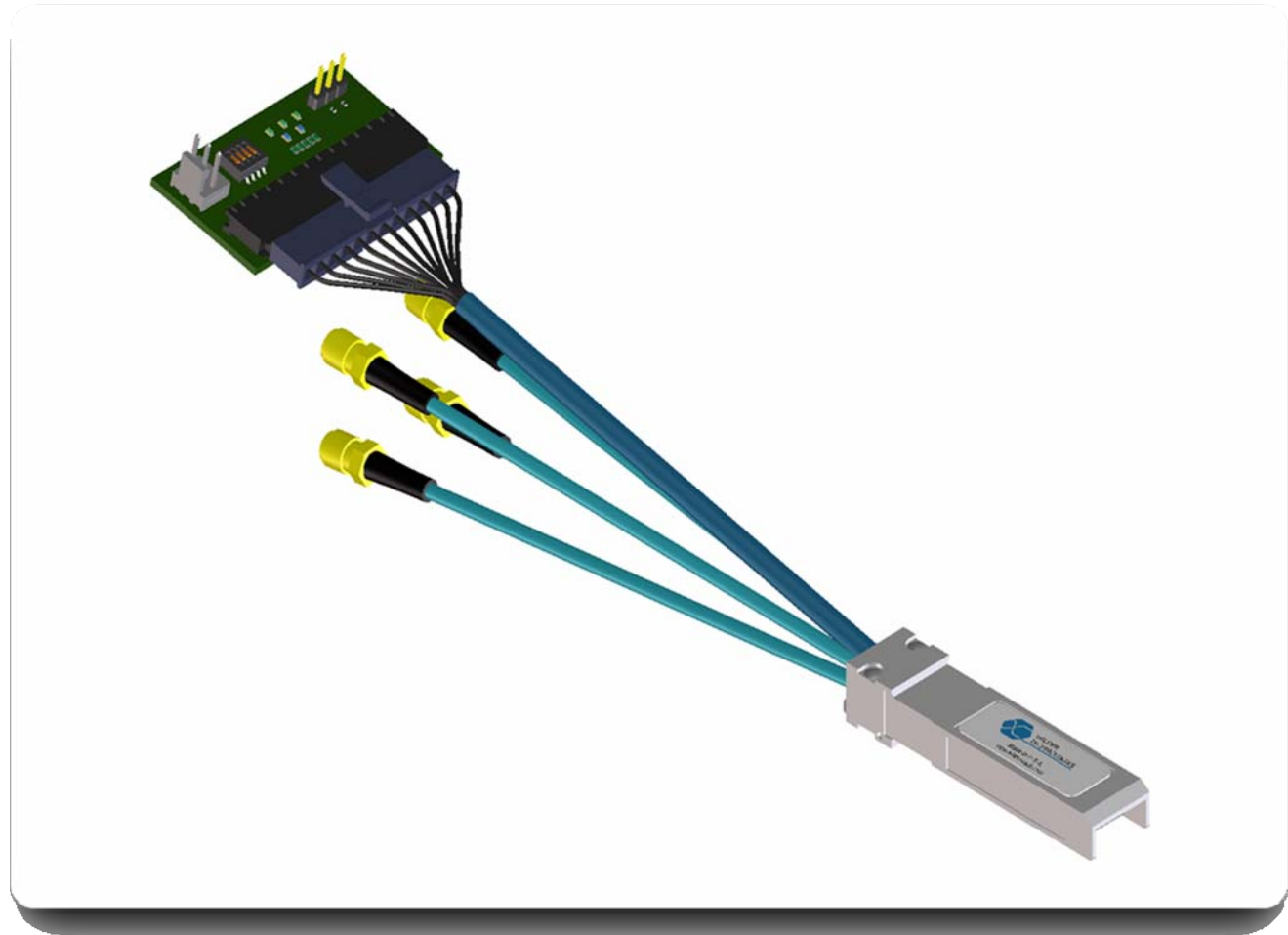
Proposed SFP+ Host Compliance Board(HCB) from Wilder

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Wilder - Host Compliance Board(HCB) - Test Fixture

- Part Number: 640-0540-000

- Description: SFP+-TPA-HCB-P Host Compliant Plug Test Adapter includes
    - One # Plug Test Adapter w/Switch Board
    - Two # Pico Pulse Lab 5501A DC Blocks
    - Two # Suhner 65_SMA-50-0-1/111_NE 50 Ohm Terminators

- Website : www.wilder-tech.com/sfp-plus.htm

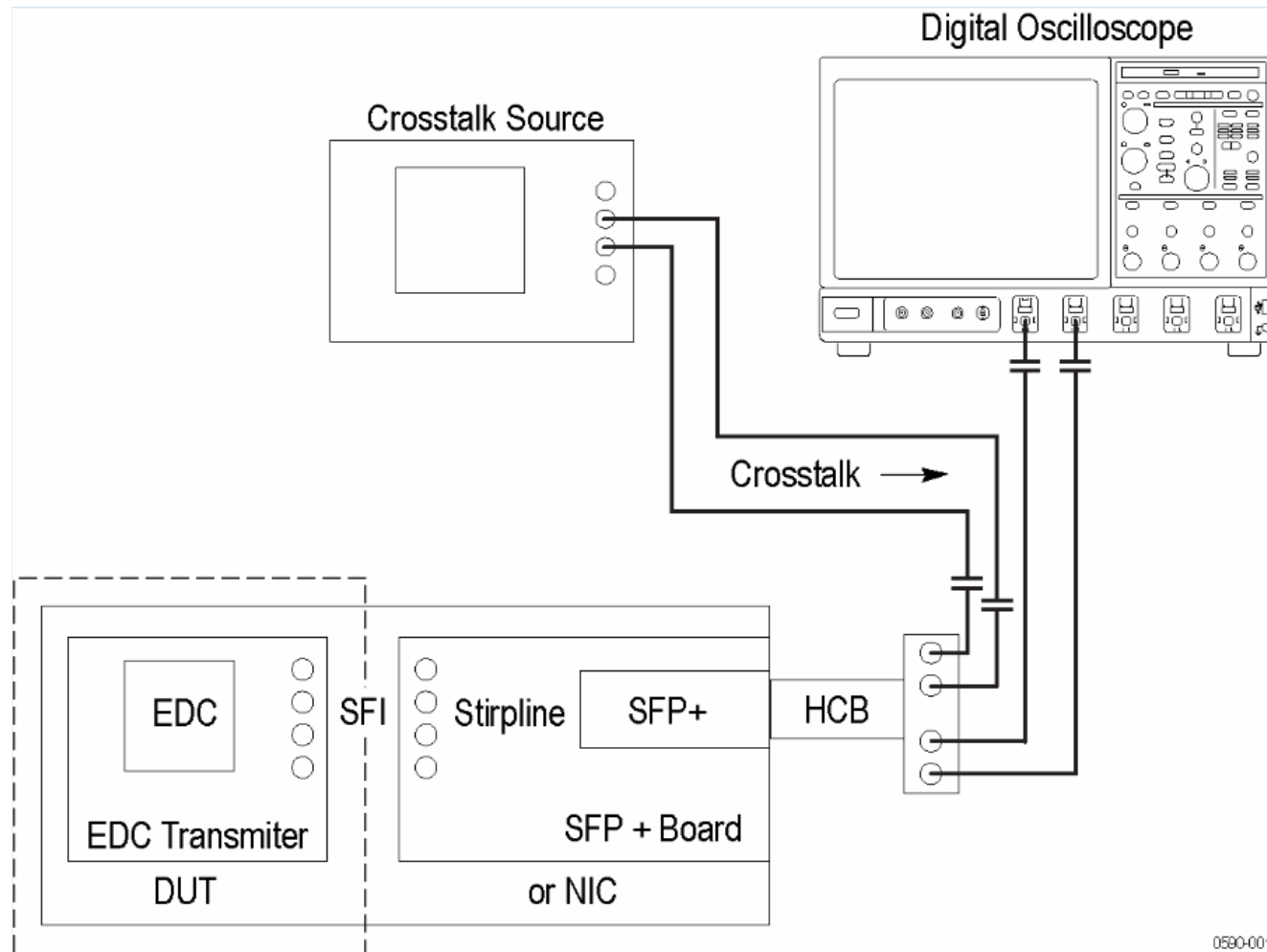**Tektronix**

SFP-TX Recommended Equipment

Mapping Technology to Oscilloscope Bandwidth Requirements

- SFF-8431 SFP+ provides 10.3125 Gbit/second connections with the minimum rise time requirement of 34 ps

- DPO/DSA/MSO 16 & 20 GHz scope has a rise time of 24.5ps & 18ps respectively

- 16GHz and above bandwidth oscilloscope meets the rise time requirements of SFF-8431 SFP+ signal

SFP-TX $5000

Oscilloscope	Accosceries	Software	Fixture	Demo DUT
DPO/DSA/MSO71604	Matched Pair SMA Cables	SFP-TX & DJA	Wilder /Spirent SFP+ Test Fixture	Intel X520 Server
DPO/DSA/MSO71604	Matched Pair SMA Cables	SFP-TX & DJA	Wilder /Spirent SFP+ Test Fixture	Server Adapter Card

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DEMO setup

Digital Oscilloscope

Crosstalk Source

Crosstalk →

EDC SFI Stirpline SFP+ HCB

EDC Transmiter

DUT

SFP + Board

or NIC

0590-001

SFP+ Setup Configuration Diagram

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SFP-TX : Features and Benefits

- Simplified Instrument Setup – Save Time and Resources

- SMA Cable Support – Reduced solution cost

- Margin Testing capability

- One-button Testing

- Fine Grain Programming Interface support helps in Automation, LabVIEW from NI can also be used to automated

- Detailed report available

- Auto Deskew – few hundred femtoseconds on C series scope

- No dongle required

- Tightly integrated with scope

- Node locked and Floating license mechanism supported

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SFP-TX - Solution Roadmap

- SFP-TX solution release 1 will be available AUG 2011

- SFP-TX solution Release 2 will be available in Q3/Q4 2011

- HCB from Tektronix will be available by AUG/Sep 2011* timeframe

SFF Committee members

AMCC
Amphenol
Arista Networks
Avago
Broadcom
Cinch
Clariphy
Cortina Systems
EMC
Emulex
ETRI
Finisar
Foxconn
Fujitsu CPA
Hewlett Packard
Hitachi GST
JDS Uniphase
Luxtera
Molex
NetLogic uSyst
OpNext
Panduit
Picolight
QLogic
Samsung
Sumitomo
Sun Microsystems
Tyco
Vitesse Semiconductor
W L Gore

Comax
FCI
ICT Solutions
Leoni Cables
Meritec
Seagate
Toshiba

* Tentative

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Tektronix SFP-TX - Solution – Key Takeaway

- Tektronix is first to market, no one else has a solution yet

- One Product i.e. SFP-TX will enable both DPOJET and Automation option

- Both Node locked and Floating license mechanism is available and dongle is not required

- HCB from Tektronix will be available by AUG/SEP 2011* timeframe

* Tentative

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SFP-TX Demo

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SU11_PS208_Ethernet 10G