SFF Committee documentation may be purchased (see 2.3).
SFF Specifications available at ftp://ftp.seagate.com/sff

SFF Committee

INF-8411 Specification for

High Speed Serial Testing for Backplanes

Rev 1.0 December 5 2003

Secretariat: SFF Committee

Abstract: This specification describes the results of testing SCA-2 connectors for multi gigabit applications on a backplane.

POINTS OF CONTACT:

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EXPRESSION OF SUPPORT BY MANUFACTURERS

The following member companies of the SFF Committee voted in favor of this industry specification.

TBD

The following member companies of the SFF Committee voted against this industry specification.

TBD

The following member companies of the SFF Committee voted to abstain on this industry specification.

TBD

If you are not a member of the SFF Committee, but you are interested in participating, the following principles have been reprinted here for your information.

PRINCIPLES OF THE SFF COMMITTEE

The SFF Committee is an ad hoc group formed to address storage industry needs in a prompt manner. When formed in 1990, the original goals were limited to defining de facto mechanical envelopes within which disk drives can be developed to fit compact computer and other small products.

Adopting a common industry size simplifies the integration of small drives (2 1/2" or less) into such systems. Board-board connectors carrying power and signals, and their position relative to the envelope are critical parameters in a product that has no cables to provide packaging leeway for the integrator.

In November 1992, the SFF Committee objectives were broadened to encompass other areas which needed similar attention, such as pinouts for interface applications, and form factor issues on larger disk drives. SFF is a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

Documents created by the SFF Committee are expected to be submitted to bodies such as EIA (Electronic Industries Association) or an ASC (Accredited Standards Committee). They may be accepted for separate standards, or incorporated into other standards activities.

The principles of operation for the SFF Committee are not unlike those of an accredited standards committee. There are 3 levels of participation:

- Attending the meetings is open to all, but taking part in discussions is limited to member companies, or those invited by member companies
- The minutes and copies of material which are discussed during meetings are distributed only to those who sign up to receive documentation.
- The individuals who represent member companies of the SFF Committee receive documentation and vote on issues that arise. Votes are not taken during meetings, only guidance on directions. All voting is by letter ballot, which ensures all members an equal opportunity to be heard.

Material presented at SFF Committee meetings becomes public domain. There are no restrictions on the open mailing of material presented at committee meetings. In order to reduce disagreements and misunderstandings, copies must be provided for all agenda items that are discussed. Copies of the material presented, or revisions if completed in time, are included in the documentation mailings.

The sites for SFF Committee meetings rotate based on which member companies volunteer to host the meetings. Meetings have typically been held during the ASC T10 weeks.

The funds received from the annual membership fees are placed in escrow, and are used to reimburse ENDL for the services to manage the SFF Committee.

If you are not receiving the documentation of SFF Committee activities or are interested in becoming a member, the following signup information is reprinted here for your information.

Membership includes voting privileges on SFF Specs under development.

CD_Access Electronic documentation contains:
- Minutes for the year-to-date plus all of last year
- Email traffic for the year-to-date plus all of last year
- The current revision of all the SFF Specifications, as well as any previous revisions distributed during the current year.

Meeting documentation contains:
- Minutes for the current meeting cycle.
- Copies of Specifications revised during the current meeting cycle.

Each electronic document mailing obsoletes the previous mailing of that year e.g. July replaces May. To build a complete set of archives of all SFF documentation, retain the last SFF CD_Access mailing of each year.

Name: _____ Title: _____

Company: _____

Address: _____

_____

Phone: _____ Fax: _____

Email: _____

Please register me with the SFF Committee for one year.

___ Voting Membership w/Electronic documentation $ 2,160

___ Voting Membership w/Meeting documentation $ 1,800

___ Non-voting Observer w/Electronic documentation $ 660 U.S.
$ 760 Overseas

___ Non-voting Observer w/Meeting documentation $ 300 U.S.
$ 400 Overseas

Check Payable to SFF Committee for $_____ is Enclosed

Please invoice me for $_____ on PO #: _____

MC/Visa/AmX_____ Expires_____

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Foreword

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors.

The first use of these disk drives was in specific applications such as laptop portable computers in which space was at a premium and time to market with the latest machine was an important factor. System integrators worked individually with vendors to develop the packaging. The result was wide diversity, and with space being such a major consideration in packaging, it was not possible to replace one vendor's drive with a competitive product.

The desire to reduce disk drive sizes to even smaller dimensions such as 1.8" and 1.3" made it likely that devices would become even more constrained in dimensions because of a possibility that such small devices could be inserted into a socket, not unlike the method of retaining semiconductor devices.

The problems faced by integrators, device suppliers, and component suppliers led to the formation of an industry ad hoc group to address the marketing and engineering considerations of the emerging new technology in disk drives. After two informal gatherings on the subject in the summer of 1990, the SFF Committee held its first meeting in August.

During the development of the form factor definitions, other activities were suggested because participants in the SFF Committee faced problems other than the physical form factors of disk drives. In November 1992, the members approved an expansion in charter to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

At the same time, the principle was adopted of restricting the scope of an SFF project to a narrow area, so that the majority of documents would be small and the projects could be completed in a rapid timeframe. If proposals are made by a number of contributors, the participating members select the best concepts and uses them to develop specifications which address specific issues in emerging storage markets.

Those companies which have agreed to support a documented specification are identified in the first pages of each SFF Specification. Industry consensus is not an essential requirement to publish an SFF Specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

Suggestions for improvement of this document will be welcome. They should be sent to the SFF Committee, 14426 Black Walnut Ct, Saratoga, CA 95070.

The development work on this specification was done by the SFF Committee, an industry group. The membership of the committee since its formation in 1990 has included a mix of companies which are leaders across the industry.

There are several projects active within the SFF Committee. At the date of printing document numbers had been assigned to the following projects. The status of Specifications is dependent on committee activities.

F = Forwarded	The document has been approved by the members for forwarding to a formal standards body.
P = Published	The document has been balloted by members and is available as a published SFF Specification.
A = Approved	The document has been approved by ballot of the members and is in preparation as an SFF Specification.
C = Canceled	The project was canceled, and no Specification was Published.
D = Development	The document is under development at SFF.
E = Expired	The document has been published as an SFF Specification, and the members voted against re-publishing it when it came up for annual review.
e = electronic	Used as a suffix to indicate an SFF Specification which has Expired but is still available in electronic form from SFF e.g. a specification has been incorporated into a draft or published standard which is only available in hard copy.
i = Information	The document has no SFF project activity in progress, but it defines features in developing industry standards. The document was provided by a company, editor of an accredited standard in development, or an individual. It is provided for broad review (comments to the author are encouraged). As the copyright on such documents is retained by the author, the INF or 'i' specifications cannot be freely copied for distribution.
s = submitted	The document is a proposal to the members for consideration to become an SFF Specification.

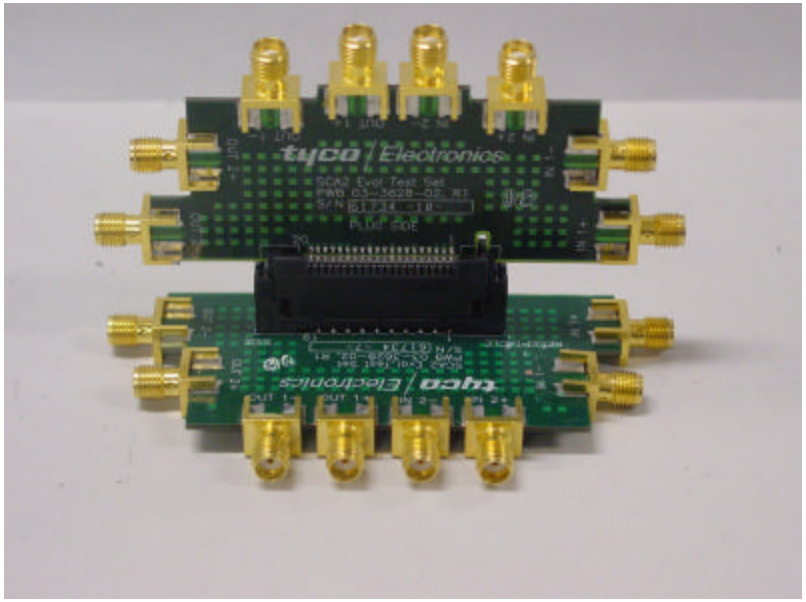
Spec #	Rev	List of Specifications as of February 2, 2004
SFF-8000		SFF Committee Information
INF-8001i	E	44-pin ATA (AT Attachment) Pinouts for SFF Drives
INF-8002i	E	68-pin ATA (AT Attachment) for SFF Drives
SFF-8003	E	SCSI Pinouts for SFF Drives
SFF-8004	E	Small Form Factor 2.5" Drives
SFF-8005	E	Small Form Factor 1.8" Drives
SFF-8006	E	Small Form Factor 1.3" Drives
SFF-8007	E	2mm Connector Alternatives
SFF-8008	E	68-pin Embedded Interface for SFF Drives
SFF-8009	4.1	Unitized Connector for Cabled Drives
SFF-8010	E	Small Form Factor 15mm 1.8" Drives
INF-8011i	E	ATA Timing Extensions for Local Bus
SFF-8012	3.0	4-Pin Power Connector Dimensions
SFF-8013	E	ATA Download Microcode Command
SFF-8014	C	Unitized Connector for Rack Mounted Drives
SFF-8015	E	SCA Connector for Rack Mounted SFF SCSI Drives
SFF-8016	C	Small Form Factor 10mm 2.5" Drives
SFF-8017	E	SCSI Wiring Rules for Mixed Cable Plants
SFF-8018	E	ATA Low Power Modes
SFF-8019	E	Identify Drive Data for ATA Disks up to 8 GB
INF-8020i	E	ATA Packet Interface for CD-ROMs
INF-8028i	E	- Errata to SFF-8020 Rev 2.5
SFF-8029	E	- Errata to SFF-8020 Rev 1.2
SFF-8030	1.8	SFF Committee Charter
SFF-8031		Named Representatives of SFF Committee Members
SFF-8032	1.5	SFF Committee Principles of Operation

INF-8033i	E	Improved ATA Timing Extensions to 16.6 MBs
INF-8034i	E	High Speed Local Bus ATA Line Termination Issues
INF-8035i	E	Self-Monitoring, Analysis & Reporting Technology
INF-8036i	E	ATA Signal Integrity Issues
INF-8037i	E	Intel Small PCI SIG
INF-8038i	E	Intel Bus Master IDE ATA Specification
INF-8039i	E	Phoenix EDD (Enhanced Disk Drive) Specification
SFF-8040	1.2	25-pin Asynchronous SCSI Pinout
SFF-8041	C	SCA-2 Connector Backend Configurations
SFF-8042	C	VHDCI Connector Backend Configurations
SFF-8043	E	40-pin MicroSCSI Pinout
SFF-8045	4.5	40-pin SCA-2 Connector w/Parallel Selection
SFF-8046	E	80-pin SCA-2 Connector for SCSI Disk Drives
SFF-8047	C	40-pin SCA-2 Connector w/Serial Selection
SFF-8048	C	80-pin SCA-2 Connector w/Parallel ESI
SFF-8049	E	80-conductor ATA Cable Assembly
INF-8050i	1.0	Bootable CD-ROM
INF-8051i	E	Small Form Factor 3" Drives
INF-8052i	E	ATA Interface for 3" Removable Devices
SFF-8053	5.5	GBIC (Gigabit Interface Converter)
SFF-8054	0.1	Automation Drive Interface Connector
INF-8055i	E	SMART Application Guide for ATA Interface
SFF-8056	C	50-pin 2mm Connector
SFF-8057	E	Unitized ATA 2-plus Connector
SFF-8058	E	Unitized ATA 3-in-1 Connector
SFF-8059	E	40-pin ATA Connector
SFF-8060	1.1	SFF Committee Patent Policy
SFF-8061	1.1	Emailing drawings over the SFF Reflector
SFF-8062		Rolling Calendar of SSWGs and Plenaries
SFF-8065	C	40-pin SCA-2 Connector w/High Voltage
SFF-8066	C	80-pin SCA-2 Connector w/High Voltage
SFF-8067	3.2	40-pin SCA-2 Connector w/Bidirectional ESI
INF-8068i	1.0	Guidelines to Import Drawings into SFF Specs
SFF-8069	E	Fax-Access Instructions
INF-8070i	1.3	ATAPI for Rewritable Removable Media
SFF-8072	1.2	80-pin SCA-2 for Fibre Channel Tape Applications
SFF-8073	C	20-pin SCA-2 for GBIC Applications
INF-8074i	1.0	SFP (Small Formfactor Pluggable) Transceiver
SFF-8075	1.0	PCI Card Version of SFP Cage
SFF-8076	-	SFP Additional IDs
INF-8077i	3.1	XFP (10 Gbs Small Form Factor Pluggable Module)
SFF-8078	C	XFP-E
SFF-8079	1.0	SFP Rate and Application Selection
SFF-8080	E	ATAPI for CD-Recordable Media
SFF-8082	3.1	Labeling of Ports and Cable Assemblies
SFF-8085	0.9	100 Mbs Small Formfactor Transceivers
SFF-8089		SFP Rate and Application Selection Values
INF-8090i	5.5	ATAPI for DVD (Digital Video Data)
SFF-8101	C	3 Gbs and 4 Gbs Signal Characteristics
SFF-8110	C	5V Parallel 1.8" drive form factor
SFF-8111	1.3	1.8" drive form factor (60x70mm)
SFF-8122		1.8" (60x70mm) w/SCA-2 Connector
SFF-8120	2.6	1.8" drive form factor (78x54mm)
SFF-8123	2.1	1.8" (60x70mm) w/Serial Attachment Connector

SFF-8200e	1.1	2 1/2" drive form factors (all of 82xx family)
SFF-8201	2.1	2 1/2" drive form factor dimensions
SFF-8212e	1.2	2 1/2" drive w/SFF-8001 44-pin ATA Connector
SFF-8221	3.4	Pre-Aligned 2.5" Drive >10mm Form Factor
SFF-8222	1.1	2.5" Drive w/SCA-2 Connector
SFF-8223	2.2	2.5" Drive w/Serial Attachment Connector
SFF-8225	C	2.5" Single Voltage Drive
SFF-8300	1.2	3 1/2" drive form factors (all of 83xx family)
SFF-8301	1.4	3 1/2" drive form factor dimensions
SFF-8302e	1.1	3 1/2" Cabled Connector locations
SFF-8323	1.2	3 1/2" drive w/Serial Attachment Connector
SFF-8332e	1.2	3 1/2" drive w/80-pin SFF-8015 SCA Connector
SFF-8337e	1.2	3 1/2" drive w/SCA-2 Connector
SFF-8342e	1.3	3 1/2" drive w/Serial Unitized Connector
INF-8350i	6.1	3 1/2" Packaged Drives
SFF-8400	C	VHDCI (Very High Density Cable Interconnect)
SFF-8410	16.1	High Speed Serial Testing for Copper Links
INF-8411	1.0	High Speed Serial Testing for Backplanes
SFF-8412	12.2	HSOI (High Speed Optical Interconnect) Testing
SFF-8415	4.1	HPEI (High Performance Electrical Interconnect)
SFF-8416	7.1	HPEI Bulk Cable Measurement/Performance Reqmnts
SFF-8420	11.1	HSSDC-1 Shielded Connections
SFF-8421	2.4	HSSDC-2 Shielded Connections
SFF-8422	C	FCI Shielded Connections
SFF-8423	C	Molex Shielded Connections
SFF-8424	0.5	Dual Row HSSDC-2 Shielded Connections
SFF-8425	1.4	Single Voltage 12V Drives
SFF-8426		HSSDC Double Width
SFF-8430	4.1	MT-RJ Duplex Optical Connections
SFF-8441	14.1	VHDCI Shielded Configurations
SFF-8451	10.1	SCA-2 Unshielded Connections
SFF-8452	3.1	Glitch Free Mating Connections for Multidrop Aps
SFF-8453		Shielded High Speed Serial connectors
SFF-8460	1.2	HSS Backplane Design Guidelines
SFF-8464		Improved MM HSS Optical Link Performance
SFF-8470	2.9	Multi Lane Copper Connector
SFF-8471	C	ZFP Multi Lane Copper Connector
SFF-8472	9.3	Diagnostic Monitoring Interface for Optical Xcvrs
INF-8475i	2.2	XPAK Small Formfactor Pluggable Receiver
SFF-8480	2.1	HSS (High Speed Serial) DB9 Connections
SFF-8482	1.3	Internal Serial Attachment Connector
SFF-8483	C	External Serial Attachment Connector
SFF-8484	0.4	Multi Lane Internal Serial Attachment Connector
SFF-8485	0.3	Serial GPIO (General Purpose Input/Output) Bus
SFF-8500e	1.1	5 1/4" drive form factors (all of 85xx family)
SFF-8501e	1.1	5 1/4" drive form factor dimensions
SFF-8508e	1.1	5 1/4" ATAPI CD-ROM w/audio connectors
SFF-8523	1.2	5 1/4" drive w/Serial Attachment Connector
SFF-8551	3.2	5 1/4" CD Drives form factor
SFF-8572	C	5 1/4" Tape form factor
SFF-8610	C	SDX (Storage Device Architecture)

Evaluation of the Tyco SCA-2 Interconnect at data rates above 2.125Gbps

Revised 12/05/03



Michael Fogg (mike.fogg@tycoelectronics.com)
Michael Woodford (mwwoodford@tycoelectronics.com)
Revision 2b, December 5, 2003

Objective

- Fully characterize Tyco SCA-2 products
  - Straddle Mount Plug
  - Single Side Mount Plug
  - Vertical Receptacle
  - Extended Height, Vertical Receptacle
  - R/A Receptacle
- Determine suitability for 4X applications
- Provide Data, Models, and Design Recommendations for successful implementation
- Updated Presentation
  - Corrected Insertion and Return Loss Data
  - Additional data for Extended Height Vertical Receptacle

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Revision 2b, December 5, 2003

Status

- Test Boards are complete
- Measurements
  - Time domain measurements complete for all standard versions
  - Frequency domain measurements complete for all standard versions
- Model Information
  - Spice Models in validation for straddle mount plug, vertical receptacle
  - .s4p data available for all versions
  - For electrical models, contact www.amp.com/simulation
- Data for additional configurations available upon request

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Revision 2b, December 5, 2003

Part Summary

Vertical Receptacle, Through Hole:	796068
Extended Vertical Receptacle, Through Hole:	787597
Vertical Receptacle Press Fit:	796068
Extended Height Vertical Receptacle Press Fit:	788389
Straddle Mount Plug:	84505
Single-Side Mount:	1123283
Vertical Plug Through Hole:	84488

For additional information and product prints:
www.tycoelectronics.com

For spice modeling information contact:
modeling@tycoelectronics.com

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Revision 2b, December 5, 2003

Testing Summary

- Test configuration (from SFF-8045)
  - 21
  - 22 Ground
  - 23 Ground
  - 24 +PORT 1_IN
  - 25 –PORT 1_IN
  - 26 Ground
  - 27 +PORT 2_IN
  - 28 –PORT 2_IN
  - 29 Ground
  - 30 +PORT 1_OUT
  - 31 –PORT 1_OUT
  - 32 Ground
  - 33 +PORT 2_OUT
  - 34 –PORT 2_OUT
  - 35 Ground

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Revision 2b, December 5, 2003

Time Domain Results-Crosstalk

- Multi-aggressor crosstalk
- 50 ps risetime
- 2X250mV differential Signal

Configuration	NEXT (%)	FEXT (%)
Vertical Rcpt-Straddle Mt Plug	2.5	2.3
Vertical Rcpt-Single Side Mt Plug	2.8	2.2
Vertical Rcpt-Vertical Plug Plug	2.7	2.2
Ext Ht Vertical Rcpt-Straddle Mt Plug	4.6	3.7

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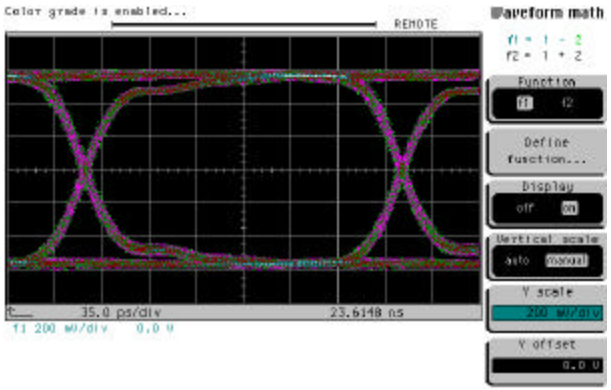
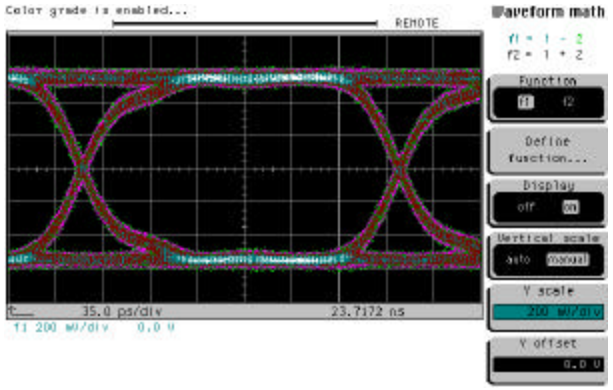
Time Domain Results

- 4.25Gbps Eye Patterns
  - Uncorrelated aggressor noise included

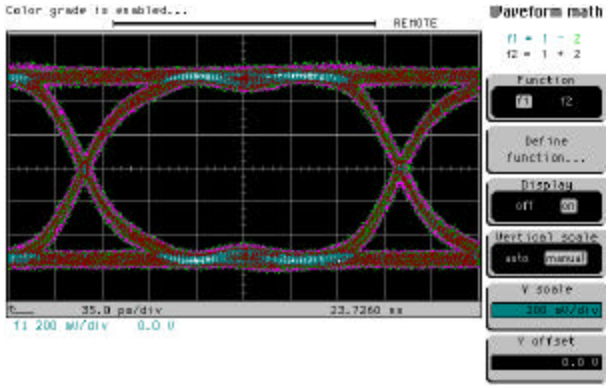


Reference Trace (No SCA-2 Connectors)
4.25 Gbps, 2^7-1 PRBS
1000mV, 9 ps jitter

Vertical Receptacle-
Straddle Mt. Plug
0.94V, 11 ps jitter



Vertical Receptacle-
Single Side Mt Plug
0.91V, 12 ps jitter



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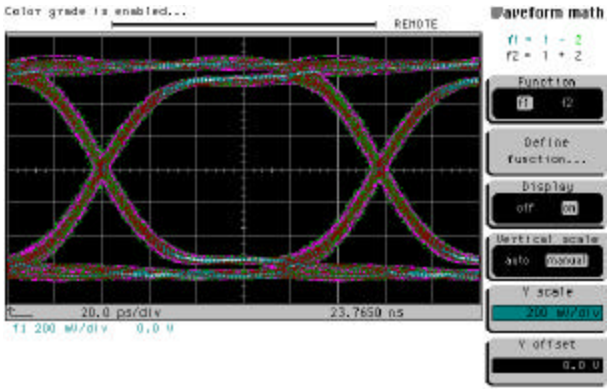
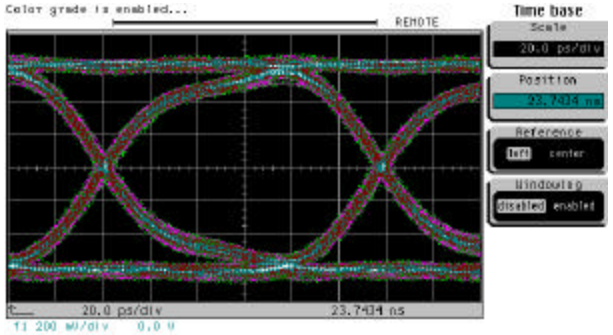
Time Domain Results

- 8.5Gbps Eye Patterns
  - Uncorrelated aggressor noise included

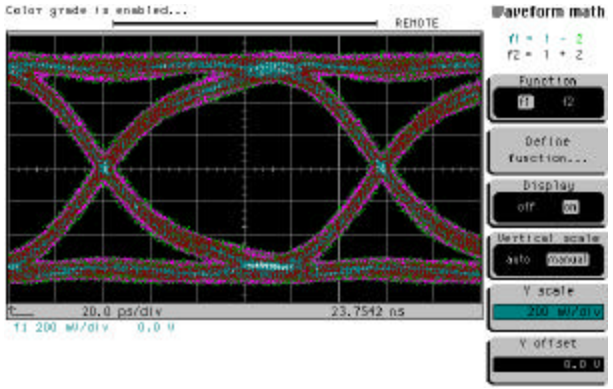


Reference Trace (No SCA-2 Connectors)
8.5 Gbps, 2^7-1 PRBS
1000mV, 9 ps jitter

Vertical Receptacle-
Straddle Mt. Plug
0.94V, 9 ps jitter



Vertical Receptacle-
Single Side Mt Plug
0.92V, 10 ps jitter



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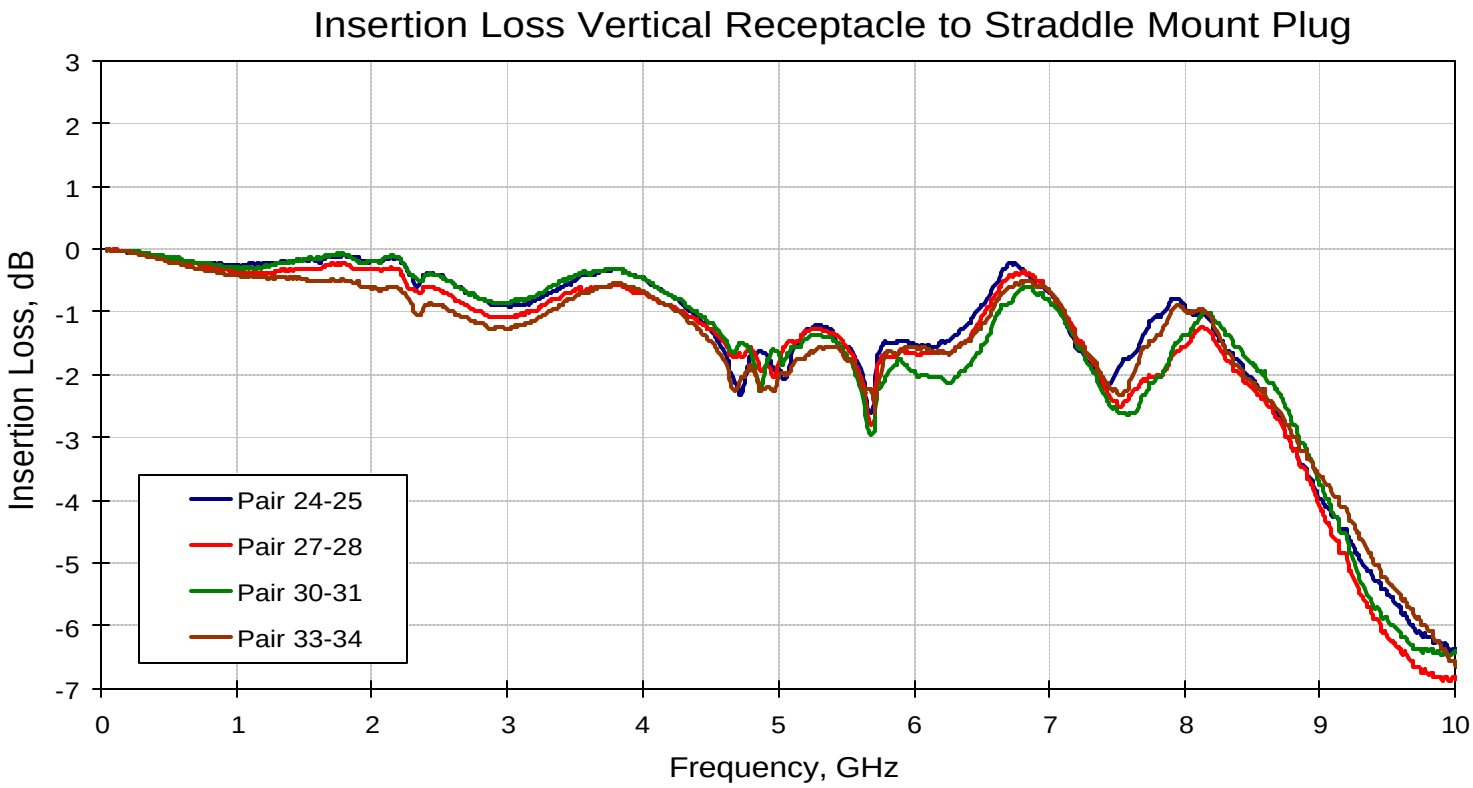
Revision 2b, December 5, 2003

Frequency Domain Results

- De-Embedded Insertion Loss (*Connector and Footprint Only)*
- *Receptacle P/N 796068, Plug P/N 84505*



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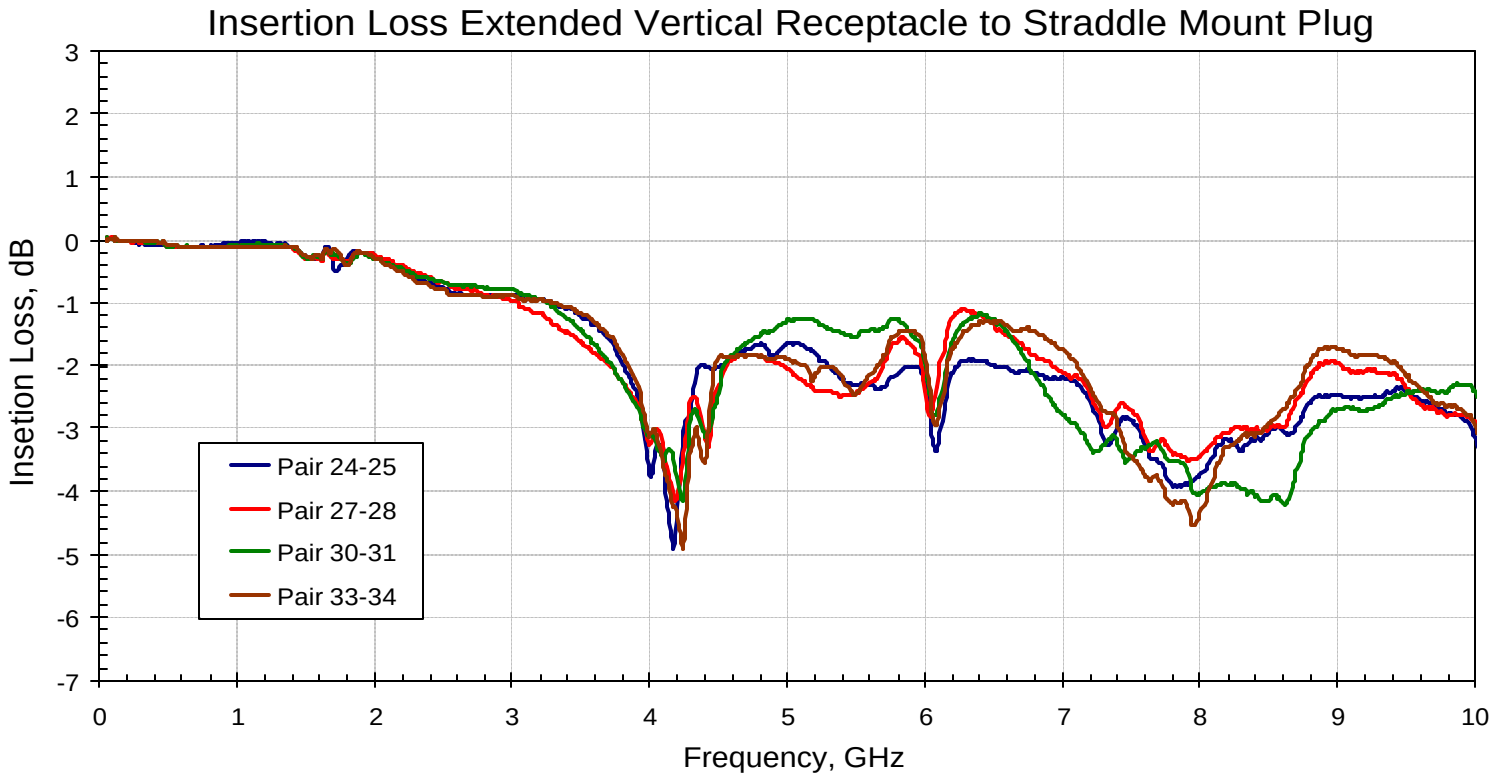
Revision 2b, December 5, 2003

Frequency Domain Results

- De-Embedded Insertion Loss (*Connector and Footprint Only)*
- *Receptacle P/N 788389, Plug P/N 84505*



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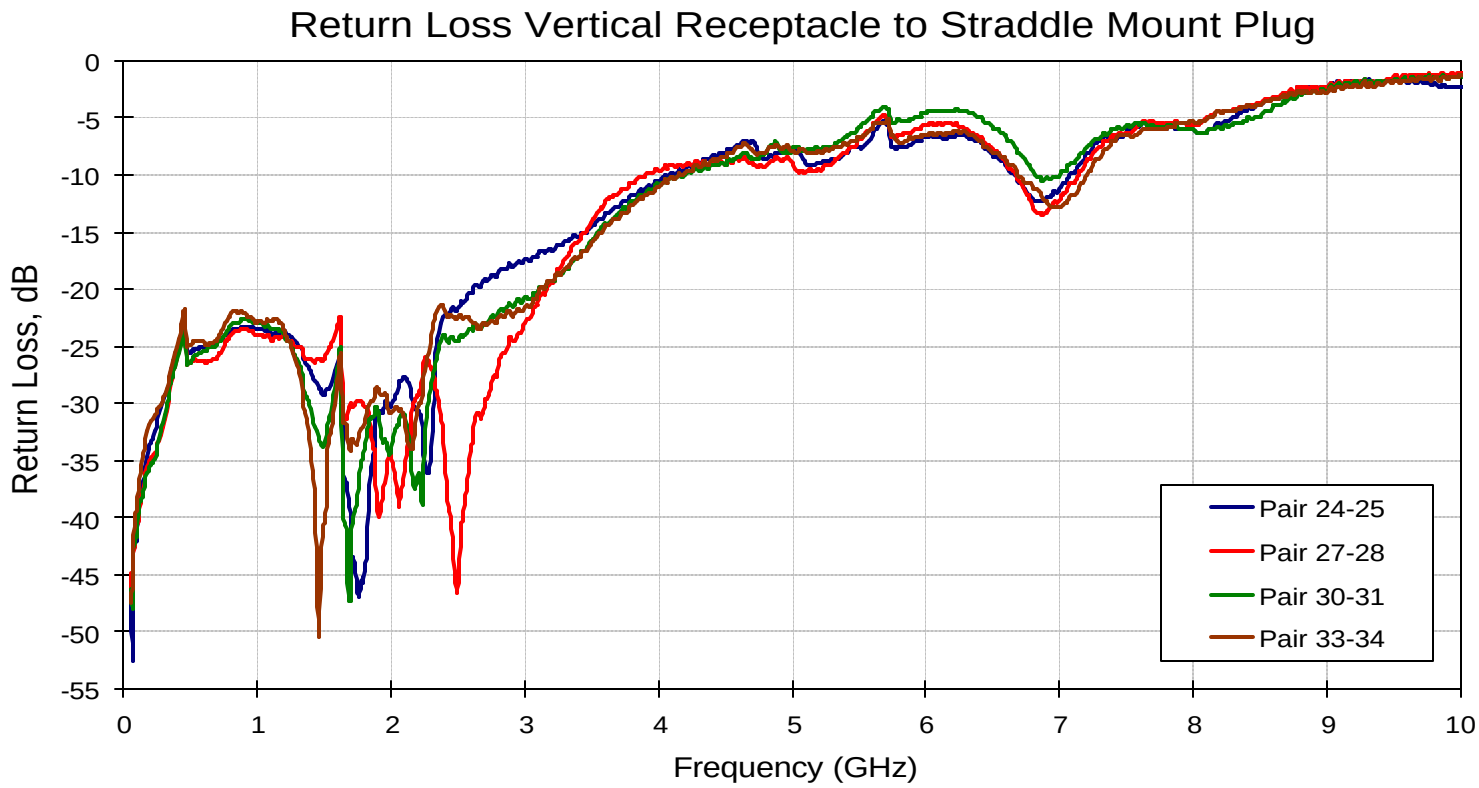
Revision 2b, December 5, 2003

Frequency Domain Results

- De-Embedded Return Loss (*Connector and Footprint Only)*
- *Receptacle P/N 796068, Plug P/N 84505*



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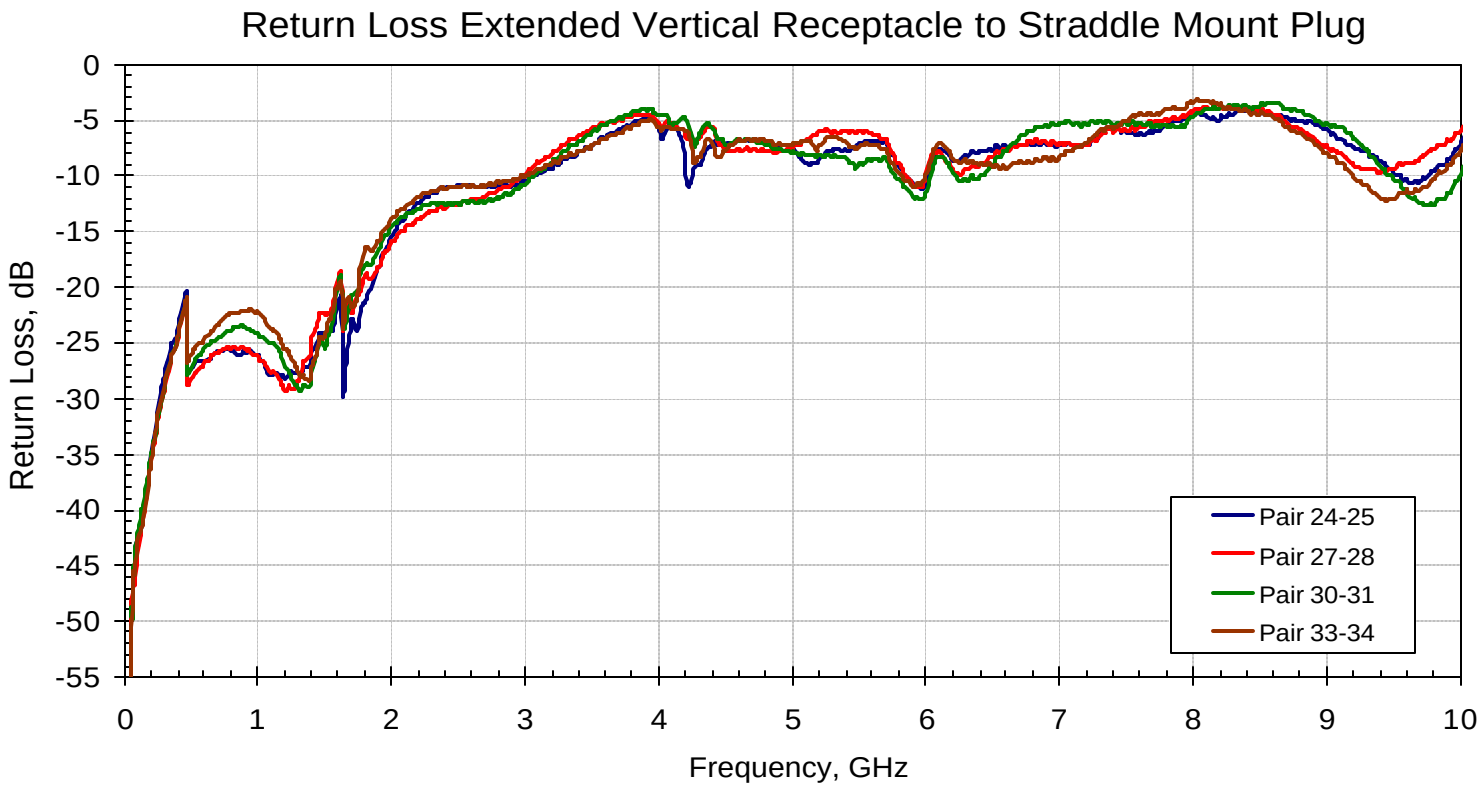
Revision 2b, December 5, 2003

Frequency Domain Results

- De-Embedded Return Loss (*Connector and Footprint Only)*
- *Receptacle P/N 788389, Plug P/N 84505*



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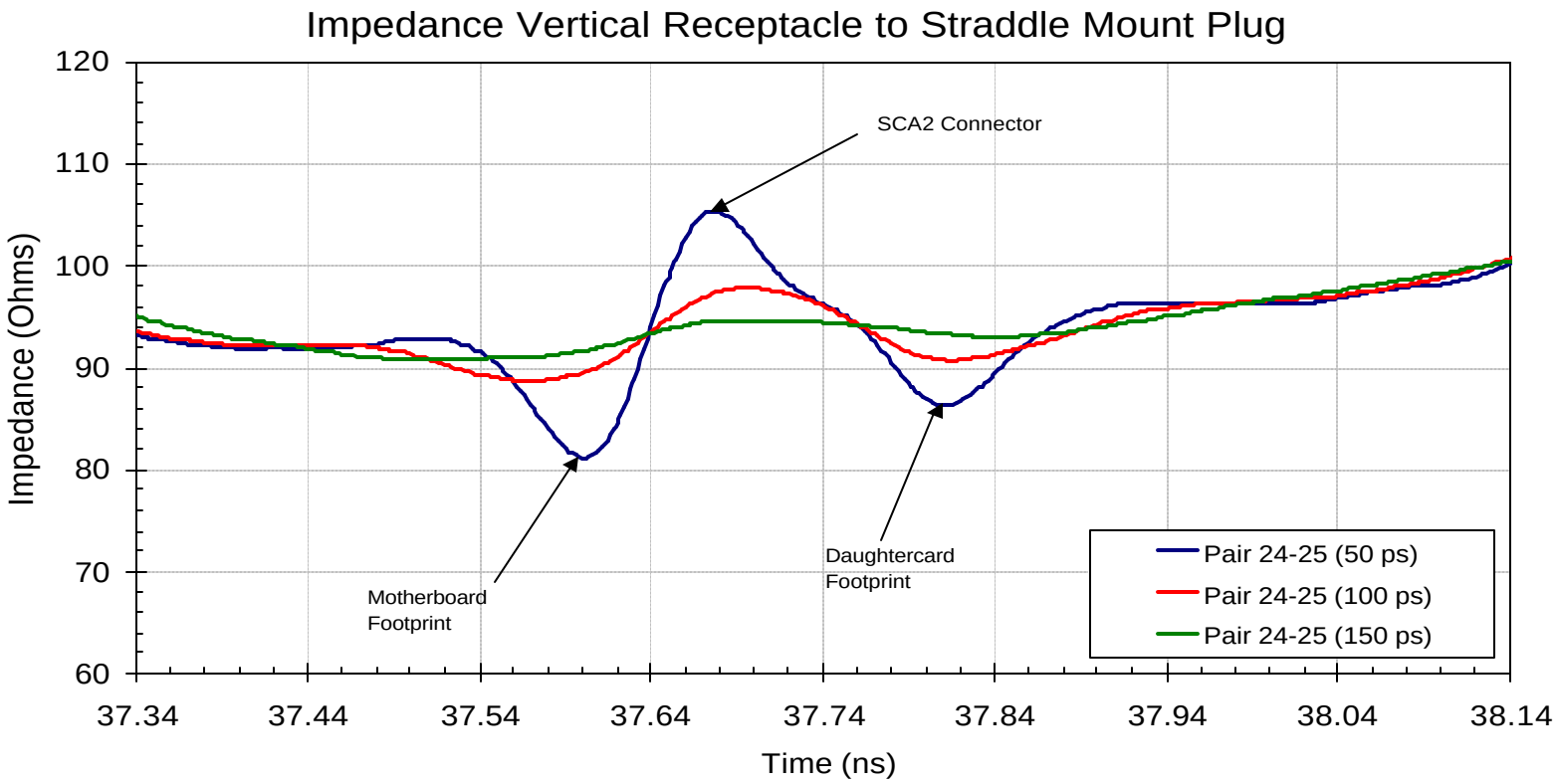
Revision 2b, December 5, 2003

Impedance Profiles

- Impedance data is consistent for all data pairs within a row
- Receptacle P/N 796068, Plug P/N 84505



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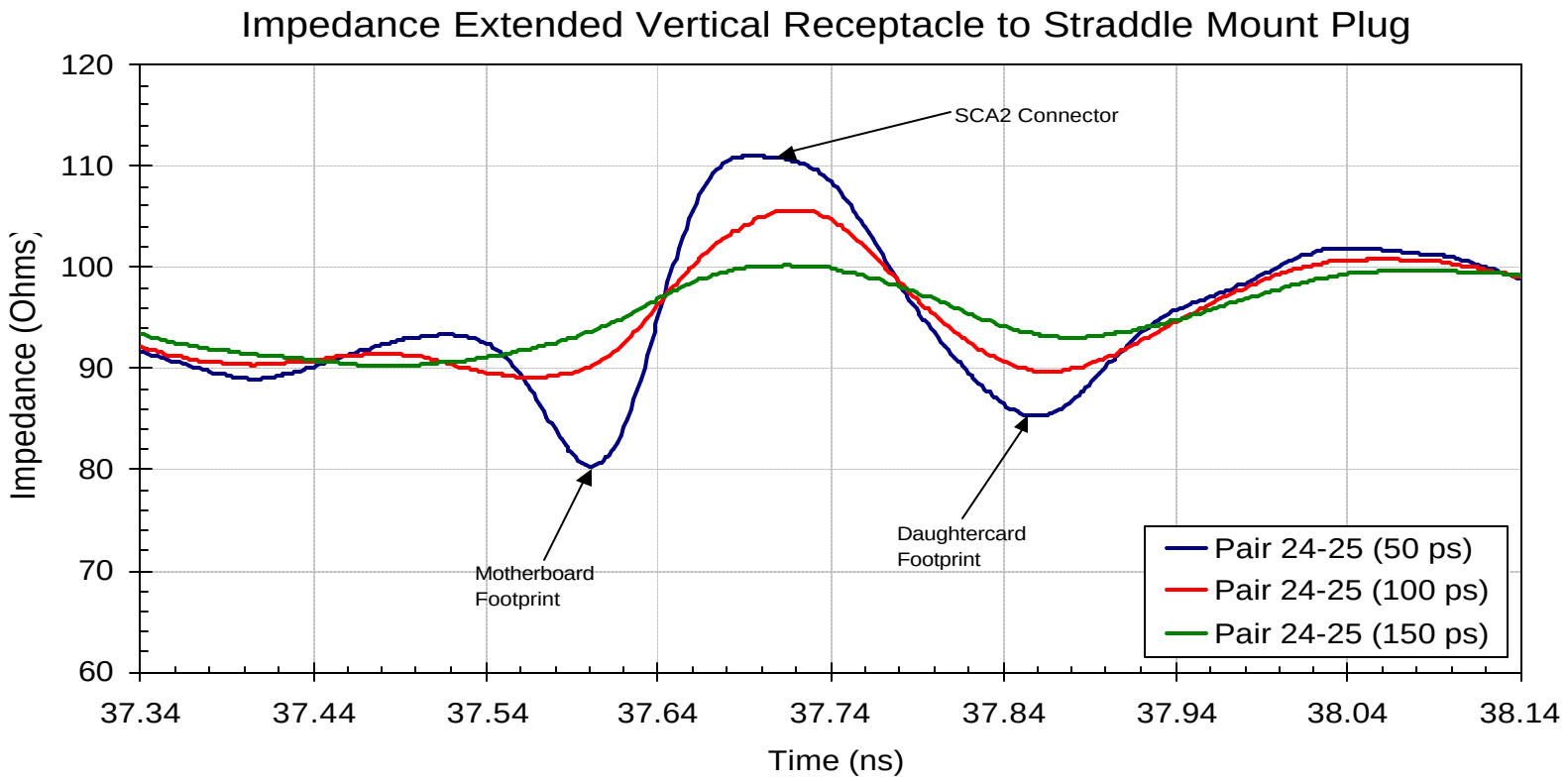
Revision 2b, December 5, 2003

Impedance Profiles

- Impedance data is consistent for all data pairs within a row
- Receptacle P/N 788389, Plug P/N 84505



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