

Accredited Standards Committee*
NCITS, Information Technology



Doc. No.: T11.2/01-309v1
Date: Aug 06, 2001
Project: FC0 MJSQ ad hoc
Ref. Doc.:
Reply to: Dennis Petrich
Allen Kramer
Bill Ham

To: Membership of T11.2

From: Dennis Petrich, chair MJSQ working group
Allen Kramer, vice chair MJSQ working group
Bill Ham, secy MJSQ working group

Subject: Approved minutes of T11.2 FC0 MJSQ working group on
June 04, 2001

Agenda

1. Opening remarks and introductions
2. Attendance and membership
3. Approve agenda
4. Document distribution
5. Review minutes of previous meeting
6. Review old action items
7. Call for patents
8. FC-PI comment resolution
9. Liaison reports
 - 9.1 10GBE IEEE 802.3ae, Tom Lindsay, Stratos Lightwave
10. Discussions/presentations
 - 10.1 Two dimensional jitter, John Patron, Wavecrest
 - 10.2 Optical gamma T measurement method, Patron, Wavecrest
 - 10.3 Positioning of mask relative to the data
 - 10.4 Swept frequency issues for copper interconnect, Dean Vermeersch, AMP/Tyco
11. Schedule / content requirements for MJSQ-2, Petrich / Ham
12. Status of MJSQ-2 sections - Ham
 - 12.1 Creation of the structure of the MJSQ-2 document - Ham
 - 12.2 MJSQ-2 section assignment summary
 - 12.3 MJSQ-2 pilot sections
13. Old Business
14. New Business
15. Review action items
 - 15.1 Old action items from past meetings
 - 15.2 New action items from this meeting

- 16. Next meetings
- 17. Adjourn

Results of Meeting

1. Opening remarks and introductions

Dennis Petrich led the meeting. He opened the meeting at 9:00 AM and thanked the host, Craig Carlson of Qlogic, for hosting the meeting. Bill Ham took these minutes.

2. Attendance and membership

Attendance at plenary meetings does count toward minimum attendance requirements for T11.2 membership. Working group meetings are open to any person or organization directly and materially affected by T11.2's scope of work but do not count toward minimum attendance for T11.2 membership.

The following people attended the meeting:

Name	Company	Tel
Dan Harres	BOEING	314-232-5590
Paul Weis	BOEING	253 657-1280
Ronald Miller	BROCADE	(408) 487-8017
Nicholaos Limberopoulos	C&M CORP.	860-779-4815
Bill Ham	COMPAQ	508-841-2629
Bill Pagano	COMPAQ	719-548-3096
Edward Grivna	CYPRESS	(612) 851-5046
Kamran Mansoori	EMULEX	(714) 513-8011
Hari Naidu	FUJIKURA AMERICA	408-988-7420
Bruce Schober	HP	208.396.4102
Kevin Sherman	IBM	802.769.7742
Kevin Demsky	IBM	507-253-5799
Richard Johnson	INFINEON	408.501.5657
Schelto van Doorn	INTEL	408.496.3426
Michael Jenkins	LSI LOGIC	408-433-7901
Michael Chen	PRIMARION	310.792.6474
Dean Wallace	QLOGIC	949-389-6480
Allen Middleton	Qlogic	952.932.4000
Allen Kramer	SEAGATE	612-402-2624
Bruce Johnson	SEAGATE	612-806-2249
John Schroeder	SMITHS INDUSTRIES	(616) 241-7574
Dean Vermeersch	Tyco	717-986-3143

Tom Lindsay	STRATOS LIGHTWAVE	425-672.8005
Dave Lewis	VIXEL	425.806.4096
John Patrin	WAVECREST	952.857.1849
Dennis Petrich	WAVECREST	408-436-9000
David Instone	XYRATEX	01705-486363
Total: 27 attendees		

3. Approve agenda

Dennis moved and Bill Ham seconded that the agenda as shown above be approved. The motion passed without objection.

4. Document distribution

This section describes the availability of draft documents that are intended to be published as a result of work by the MJSQ committee.

Document distribution is now being done over the web. Documents relating to MJSQ work can be found on the T11 web site (www.t11.org) by going to "documents" and searching on the key words "jitter" and/or "MJSQ".

The only active document in this working group is the MJSQ-2 technical report presently at rev 0.0.

A summary of the presently active policy to document distribution is included for reference.

All presentations are posted electronically at the approved ftp within two weeks after the meeting. Format must be an approved electronic file format. While we are still paper based, a paper copy must also be given to the secretary at the working group meeting.

(Presentations are defined as material shown publicly in the Plenary or authorized working group meetings.)

Submission of Documents for T11 Document Numbers:

A online system is now available to provide document numbers and accept the submission of documents. The system is accessed via the t11 web page at <http://www.t11.org>. Follow the "docs" link in the left-hand frame, or at the bottom, and fill in a form giving details about the document. In order to complete the form, it will be necessary to enter a password. The password is given out at T11 meetings, or can be obtained from the T11 Chair. Instructions will then be given about uploading the file to the ftp site at <ftp.t11.org>.

We now use all electronic document distribution.

A T11.2 reflector is operational over the T11 site.

The committee forms its agenda by the following:

1. A call (reminder) for presentations by the chair 3 weeks in advance
2. Those wanting to be on the agenda submit request including:
title
presenter
time required
abstract
3. Chair creates agenda and posts 2 weeks in advance of the meeting
4. At the meeting it is the chairs's discretion to allow additional presentations

5. Review minutes of previous meeting

The minutes of the last MJSQ working group were reviewed with some minor editorial changes. Dennis moved and Bill Ham seconded that the minutes as modified be accepted. Motion passed without objection. The amended minutes will be posted to the ftp site under a document number with an "ap" in the document name.

Action item: Ham will get the document number and do the posting.

6. Review old action items

The old action items were reviewed and the status was updated.

7. Call for patents

Below is the formal call for patents which was issued by Dennis at the meeting:

PATENTS

- A call is hereby issued for the existence of patents required to implement the results of any & all T11 projects to be disclosed*

It is necessary for the holders to agree to license those patents in conformance with the ANSI patent policy if the project on which they read is to proceed

T11.2 is not involved in this process @ all !

- The contact @ ANSI is the General Counsel, Ms. Amy Marasco -(212)642-4954 or amarasco@ansi.org*
- Patent policy description @ www.ansi.org/proctbl.html, section 1.2.11*
- IBM has declared that it has patents which apply to the practice of FC & SBCON. The contact is:
Tom Slattery, Program Director, IBM Corporation, North Castle Drive,
Armonk, New York 10504
Tel: (914) 765-4351, Fax: (914) 765-4390, Email: tmslatt@us.ibm.com
Thanks to Stuart Berman of Vixel for tracking down this new contact*

There was no response to this call for patents.

8. FC-PI comment resolution

FC-PI rev 11 has been submitted for first public review.

There are five comments that relate somewhat to jitter.

8.1 Comment 1

Dave Instone noted that several instances exist where the 10^{-12} limit is inconsistently used. One of these was actually an error.

MJSQ recommendation: accept the comment

Tom Lindsay had four:

8.2 Comment 2

Technical

Page 60, Table 27

Currently, $X2=X1+0.19$. There is no known analytical or experimental record that determines the 0.19 value, whereas a recent analysis by Mike Jenkins (LSI) showed that 0.205 was reasonable. I propose the value be changed to 0.205.

The analysis by Mike Jenkins used where a sine wave having amplitude and frequency of the bit rate was used. (Note that this allows a sine wave to be launched.)

Straw poll: 14 in favor, 0 against, 4 abstain

Recommendation: accept the comment

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8.3 Comment 3

Technical

Page 83, section A.3, paragraph b)

The de-convolution is not very accurate as written. I propose the following.

a. The equation that currently reads $Q_n = -qnorm(BER_n, 0, 1)$ needs a correction factor. It should read:

$Q_n = -qnorm[(2/TD)*BER_n, 0, 1]$.

b. Insert the following after the sentence with the equation.

"TD is the transition density of the data pattern being used for the measurement. A typical value for 8B10B of TD=0.6 may be used."

c. Modify the values in the last sentence of b) so that it reads "For 1E-5, Q = 3.99 and for 1E-9, Q = 5.8. (Q = 6.87 for 1E-12)."

d. Equation 3 for TJ should use a multiplier of 13.73, not 14.

Straw poll: 14 in favor, 0 against, 4 abstain

MJSQ recommendation: accept the comment

8.4 Comment 4

Technical

Note 10 on page 33 - Table 6, Page 41 - Table 11, Page 42 - Table 12, and note 2 on Page 59 - Table 26

Clock tolerance specifications are inadequate. Present wording could allow a "wandering" clock to appear compliant if it was measured at only one instance in time. I propose the following wording.

"The measured frequency shall not exceed tolerance specifications when averaged over all instances of 200,000 bits (10 max length FC frames) and higher."

(FYI - there may also be a disconnect between clock tolerance and jitter test/specifications, but further study is required. No comment at this time).

New wording proposed: The data rate shall not exceed +/- 100 ppm from the nominal data rate over all periods equal to transmitted 200,000 bits (10 max length frames)

Motion to accept: 8 in favor, 1 against, 8 abstain

MJSQ recommendation accept the comment

8.5 Comment 5

Technical

Page 65, section 9.4

There is currently no definition of 0 and 1 along the time axis for electrical eye mask location (optical eye mask location is already controlled, and electrical methods should be consistent). I propose these 2 values be determined via the mean of the eye pattern crossing (taken at the average amplitude).

Add a separate paragraph at the end of 9.4 (before 9.4.1).

"To accurately determine the 0 mask time, use an oscilloscope having an internal time histogram capability. Set the time limits of the histogram to include all transitions within the crossing. Set the voltage limits of the histogram to a small fraction of the peak to peak amplitude of the eye and center them about the average value of the entire waveform . The 0 time to be used for the mask shall be the mean of the histogram. The 1 mask time is the 0 mask time plus 1 UI."

After significant MJSQ discussion, the sense of the group was that this topic is not ready to make a specific recommendation to incorporate into FC-PI.

MJSQ recommendation: reject the comment

9. Liaison reports

9.1 10GBE IEEE 802.3ae, Tom Lindsay, Stratos Lightwave

Tom presented the properties of the latest thinking in the 10GBE committee on specifying jitter. Most of the work is based on MJS with modifications that are needed to accommodate the requirements of Ethernet.

10. Discussions/presentations

10.1 Two dimensional jitter, John Patrin, Wavecrest

These presentations were not uploaded as of the meeting time.

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John presented data acquired from a Wavecrest instrument where three signal levels were examined: threshold, high and low. There was a significantly different time recorded at the different levels.

A number of questions were raised relating to the timing reference and the differentiation of DJ,SJ etc at the different levels. It was noted that the timing reference for quantifying jitter at other than the threshold cannot be maintained at the same time as the threshold timing since some rise time and other waveform issues are not accounted for.

Some scheme for talking about signal quality at other than the threshold needs to be developed.

John is actioned to verify and report on the details of the reference timings used.

John is actioned to post his presentation on the web site.

Dennis described an approach being used by Wavecrest using a bit clock for a common timing reference where individual jitter distributions are taken at different input signal levels. Work is underway to develop the math for integrating the measurements at different levels to a single population that exists within the boundaries of the mask being used. Another possibility is to use the measurements at the different levels to define the actual edge profile of the signal populations.

Dennis is actioned to prepare a more complete presentation on this subject. It was agreed that this area will form a key part of the MJSQ-2 document.

The general subject of calculating the number of events when an amplitude scan across a mask is done as compared to taking the total number of samples was discussed. This has been a conceptually difficult point for a while now.

A key observation was noted: each point recorded by a sampling instrument regardless of the amplitude position of the point is the ONLY point recorded for the entire bit time for that particular signal edge. In other words, the number of sampled points accurately reflects the entire population of bit edges and multiple samples within the same signal in the same bit time are not recorded. This means that one may examine the population of points within a narrow band around a particular amplitude level and accurately determine if the number of events in the "forbidden region" meet the "bit error rate" specification.

The general requirement therefore when considering amplitude other than the nominal receiver threshold is what is the amplitude that gives the

most population inside the mask? This feature greatly simplifies the mathematical derivation of the relationship between bit errors and signal properties.

10.2 Optical gamma T measurement method, Patrin, Wavecrest

John explored the material relating to an attempt to use the TIA approach for measuring the optical Gamma T output. John is actioned to put the document on the web and to create a new revision for the next meeting.

10.3 Positioning of mask relative to the data

Discussion on this topic continued in the April meeting and the discussion occupied most of the meeting.

The importance of the data pattern was re emphasized.

Dave Instone noted that the presently required data patterns do not include the idle pattern. The idle pattern is frequently the only pattern being transmitted at any point in time.

Motion Instone/Ham that a repeating stream of contiguous idle primitives be added (in MJSQ-2) to the list of required data patterns documented in MJS in Annex B.2.

Motion passes 11/0/3

There was much discussion about how the distribution of jitter could be restricted beyond the boundaries defined by simple peak to peak values at various signal levels. Restriction in this sense means, for example, requiring that the actual distribution have a mean that is approximately the same as the average of the peak to peak values or in another example requiring that the mean not vary more than a certain amount for different data patterns. There was no agreement on any scheme or any way to restrict the distributions that would be practically enforceable.

Numerous examples were shown and discussed where the simple mean of the distribution was meaningless. Further, using a mean of the distribution allows some measurement methods to appear to deliver a valid result but do not actually get accurate results at the 10^{-12} level.

It was suggested that it is easier to determine the mean than the peak to peak values and that one would not get very accurate results if the peak to peak were to be required. This view was countered by the view that if the peak to peak is not accurate or measured effectively that the entire result is not addressing requirements at the 10^{-12} level and

is therefore not valid. A peak to peak method should be as valid as any based on the mean.

The effect of the distribution on the tolerance test was also discussed. There were no specific distributions mentioned but an examination of MJS-1 provides a possible starting point. In the example given in MJS-1 it is implicitly suggested that there is no DCD and no UDJ (other than the impressed sinusoidal) present in the signal launched toward the receiver in the tolerance test. Further, the DDJ was created by a cable or filter having certain unspecified frequency transfer properties. If the properties of the scheme used to create the DDJ were specified this scheme could provide some starting points for defining the tolerance conditions.

However, by using this as the jitter tolerance specification there is still an issue with the fact that the jitter output does not have any distribution requirements specified. Therefore, one could have a link that passes the jitter tolerance test based on the controlled distribution described above but the same link would fail if using a compliant output signal with a different distribution.

It appears that there are only two approaches that can resolve this conflict:

- (1) require the output distribution to be a benign subset of the required jitter tolerance distribution or
- (2) require that the tolerance test be done for any physically realizable output distribution with the specified peak to peak properties.

Perhaps there are other possibilities and this subject will be again addressed at the next meeting.

In order to move this forward the group accepted the idea that all measurements and budgeting should be based on the assumption that the receiver sets its internal timing reference at the mean time of the transitions (i.e. the mean of the distribution).

Resolving this issue is at the core of the MJSQ effort. How it is resolved will affect receivers, transmitters, interconnect, and measurement processes.

The present status is:

- that the signal output specification allows time translation of the mask to obtain a fit - this implies that the 10^{-12} edges of the distribution are available at different signal amplitude levels

- that the receiver is assumed to set its internal timing references to the mean of the distribution - receivers that do not behave in this manner may not work with the signal budgets developed.
- that there is a need to pick one of the options listed above for matching the output and tolerance specifications (or find a new approach)

Material below this point under this item is retained for continuity from the last minutes.

This topic was revisited again from the last meeting. The general discussions relate to the positioning of the mask with respect to the data is not presently well specified or uniformly practiced. Some folks are using the features of the distribution that best suits their application.

Several distributions were schematically drawn for comment as follows:

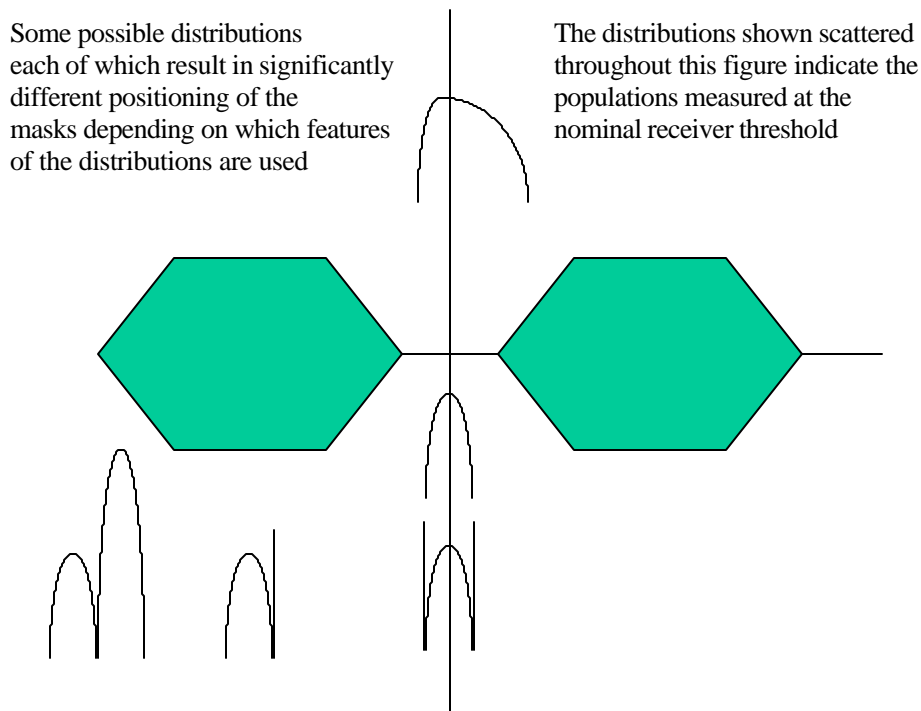


Figure 1 - Features of jitter distribution to be used for mask placement

There were three schools of thought brought forward if using the threshold crossing as the timing event:

- (1) Use the mean of the distribution to define the position of the mask and
- (2) Center the mask around the extremes (10**-12 level)
- (3) Fit the mask within the distribution if possible (after discussion this one was determined to be essentially the same as (2) and therefore will not be pursued)

With a more generalized jitter concept where the amplitude is considered the following was also suggested:

- (4) Optimize the position of the mask with respect to the entire data distribution (time axis translations only).

In all cases a specified set of data patterns shall be used to determine compliance.

The choice of method is expected to have major consequences on actual pass/fail for several practical applications. How the receiver centers itself is a key part of this issue.

This subject needs more discussion at the next meeting.

Al Kramer is actioned to test his system using CJTPAT before the next meeting.

Motion Petrich/Jenkins the MJSQ requires that if the position of the mask with respect to the entire data distribution (time axis translations only) can be adjusted such that there is acceptably low population within the mask then a pass condition exists. This criteria applies to all interoperability points.

Motion passes: 17/1

Motion Ham/xxx that MJSQ requires that an entire mask be specified for each interoperability point. Note: the mask could be the same at different interoperability points and the mask shall be applied according to the measurement requirements appropriate for the point.

Motion fails due to lack of a second. It was noted that the failed motion is unnecessary as it is implicitly contained in the first motion.

Concern was expressed about all the implications of the above motion in that it is different from both SFF-8410 for copper and OFSTP-4 for optical where use of the mean is clearly stated as the means for positioning the mask. It was also noted that the depth of understanding is not adequate at this point to support the motion.

Motion Petrich/Lindsay to reconsider the above motion. [Reconsideration means that the above motion has no effect and the issue is still open.]

Motion to reconsider fails 7/7/8. Having no majority the previous motion stands.

It appears quite clear that this issue of mask placement is not resolved and needs to stay on the active agenda. A core question is: what is the intended use of the measurement?

10.4 Swept frequency issues for copper interconnect, Dean Vermeersch, AMP/Tyco

Dean is actioned to put this presentation on the web site.

The significant effects of suckout were demonstrated.

It was suggested that a requirement be placed on copper interconnect that suckout intensity be limited to 3 dB from the second order curve fit to the S21 data.

11. Schedule / content requirements for MJSQ-2, Petrich / Ham

It was suggested that MJSQ-2 document proceed by eliminating all sections that are not required to do optical gamma T and copper beta R.

12. Status of MJSQ-2 sections - Ham

The following material is left in the minutes until such time as the MJSQ-2 document reflects the agreements.

12.1 Creation of the structure of the MJSQ-2 document - Ham

An attempt was made to reduce the scope of the MJSQ-2 document by identifying sections that are presently not being actively supported. Some of those sections are identified by the blue highlight in the list below.

Following is the presently agreed organization of the MJSQ-2 document with names of those responsible for specific sections:

Sections 1 thru 5 - Ham

1. Introduction

1.1. Document scope and purpose

- 1.2. Document organization
- 2. T11.2 Membership
- 3. References
- 4. Definitions and conventions
 - 4.1. Conventions
 - 4.2. Acronyms
 - 4.3. Definitions
- 5. Scope
 - 5.1. Motivation and goals
 - 5.2. Authority
- 6. Jitter overview
 - 6.1. FC-0 and MJS (-1) interface overview - Ham
 - 6.2. Fibre channel storage implementation - copy if possible
 - 6.3. Jitter contribution elements - [Ham]
 - 6.3.1. Reference times - TBD
 - 6.3.2. Signal amplitude effects - TBD
 - 6.3.3. 9.6. Amplitude to phase conversion - TBD
 - 6.3.3. Generalized jitter concepts - 2D stuff
 - 6.3.4. Deterministic contributors (copy)
 - 6.3.5. Random contributors (copy)
 - 6.4. Improved Bit Error Rate vs. Jitter Model (copy from MJS-1) - Tom Lindsay if mods needed
 - 6.4.1. Description of Mathematical Model
 - 6.4.2. Random Jitter
 - 6.4.3. Addition of Deterministic Jitter
 - 6.5. Equalization - Mike Jenkins
 - 6.5.1. Filtering
 - 6.5.2. Pre-emphasis
 - 6.5.3. Adaptive transmitters
 - 6.5.4. Adaptive receivers
 - 6.5.5. Distributed
 - 6.6. Separation of jitter components - Tom Lindsay (Mike Li)
 - 6.6.1. Need to separate components
 - 6.6.2. General considerations
 - 6.6.3. Mathematical basis
 - 6.6.4. Accuracy and precision
 - 6.6.5. Tools
 - 6.7. Jitter accumulation and transfer- Tom Lindsay
 - 6.8. Data rate considerations
 - 6.9. Effects of parallel lanes/paths - skew, cross talk - Ham from SFF
 - 6.10. Pattern dependent random jitter - Mike Jenkins
 - 6.11. Jitter methodologies (copy from MJS if relevant)
 - 6.11.1. Current practice and specifications
 - 6.11.2. Jitter measurement definitions
- 7. Jitter test methodologies - Ham
 - 7.1. Goals - Ham
 - 7.2. Level 1 and level 2 tests - Ham
 - 7.3. System considerations - TBD
 - 7.4. Component considerations - TBD

- 7.5. Instrumentation considerations - TBD
 - 7.5.1. LESB
 - 7.5.2. BER
 - 7.5.3. FC compliant
 - 7.5.4. Non-FC compliant
 - 7.5.5. Built in test features
- 7.6. Test fixture considerations - Ham
- 7.7. System / environmental noise considerations
- 7.8. Reference standards / calibration considerations
- 7.9. Data output format considerations
- 7.10. Jitter output test methodologies (copy from MJS)
(need effect of high pass filter discussion)
- 7.10. Jitter tolerance test methodologies (copy from MJS)
(need reference to jitter output section for tolerance test conditions)
- 8. Requirements for specific tests
[Only one example is shown for simplicity - need to generate a comprehensive list - this will be a very long section]
 - 8.1. Optical Gamma T output (started already)
 - 8.1.1. FC device (requires full protocol signals to work) - Rich Feldman
(Bert and scope methods only)
 - 8.1.1.1. Overview
 - 8.1.1.2. Test Fixtures
 - 8.1.1.3. Instrumentation
 - 8.1.1.4. Calibration
 - 8.1.1.5. Test execution
 - 8.1.1.6. Data output formats
 - 8.1.1.7. Acceptable values
 - 8.1.2. FC protocol neutral component - TBD
 - 8.1.2.1. Overview
 - 8.1.2.2. Test Fixtures
 - 8.1.2.3. Instrumentation
 - 8.1.2.4. Calibration
 - 8.1.2.5. Test execution
 - 8.1.2.6. Data output formats
 - 8.1.2.7. Acceptable values
 - 8.2. Copper Gamma T output
 - 8.2.1. FC device transmitter (requires full protocol signals to work) -
Dave Instone?
 - 8.2.1.1. Overview
 - 8.2.1.2. Test Fixtures
 - 8.2.1.3. Instrumentation
 - 8.2.1.4. Calibration
 - 8.2.1.5. Test execution
 - 8.2.1.6. Data output formats
 - 8.2.1.7. Acceptable values
 - 8.2.2. FC protocol neutral component - TBD
 - 8.2.2.1. Overview
 - 8.2.2.2. Test Fixtures
 - 8.2.2.3. Instrumentation
 - 8.2.2.4. Calibration

- 8.2.2.5. Test execution
- 8.2.2.6. Data output formats
- 8.2.2.7. Acceptable values
- 8.3. Copper Beta R tolerance (already started)
- 8.3.1. FC device (requires full protocol signals to work) - Allen Kramer
 - 8.3.1.1. Overview
 - 8.3.1.2. Test Fixtures
 - 8.3.1.3. Instrumentation
 - 8.3.1.4. Calibration
 - 8.3.1.5. Text execution
 - 8.3.1.6. Data output formats
 - 8.3.1.7. Acceptable values
- 8.4. Optical Gamma R tolerance - Tom Lindsay
 - 8.4.1. FC device (requires full protocol signals to work)
 - 8.4.1.1. Overview
 - 8.4.1.2. Test Fixtures
 - 8.4.1.3. Instrumentation
 - 8.4.1.4. Calibration
 - 8.4.1.5. Text execution
 - 8.4.1.6. Data output formats
 - 8.4.1.7. Acceptable values
 - 8.4.2. FC protocol neutral component
 - 8.4.2.1. Overview
 - 8.4.2.2. Test Fixtures
 - 8.4.2.3. Instrumentation
 - 8.4.2.4. Calibration
 - 8.4.2.5. Text execution
 - 8.4.2.6. Data output formats
 - 8.4.2.7. Acceptable values

Further sections will be added to section 8 for all interoperability points and all versions - these sections will re-use major parts of the above sections

9. 10 Examples

- 9.1. Jitter budget allocations - TBD
- 9.2. Jitter tolerance specification - TBD
- 9.3. Revised jitter output allocation tables - TBD
- 9.4. Separation of jitter components - Dennis Petrich
- 9.5. Jitter accumulation (+ or-) - Mike Jenkins
- 9.7. Proper use of eye diagrams and masks - TBD

Annex A - Implementation strategies - TBD

- A.1 Repeaters
- A.2 Latency
- A.3 Bandwidth

[These following annexes are extracted from MJS-1 for reference - need to consider what we need for MJSQ-2.]

Annex B

Improved Test Bit Sequences

- B.1 Test bit sequence characteristics
 - B.1.1 Low Frequency Pattern
 - B.1.2 Low transition density patterns
 - B.1.2.1 Half-rate square pattern
 - B.1.2.2 Quarter-rate square pattern
 - B.1.2.3 Ten contiguous runs of 3
 - B.1.3 Composite patterns
- B.2 Compliant jitter test bit sequences
 - B.2.1 Random test bit sequence
 - B.2.1.1 Background - fibre channel frame
 - B.2.1.2 Original RPAT
 - B.2.1.3 Compliant RPAT (CRPAT)
 - B.2.2 Compliant Receive Jitter Test Bit Sequence
 - B.2.2.1 Receive Jitter Tolerance Pattern
 - B.2.2.2 Compliant Receive Jitter Tolerance Pattern
 - B.2.3 Supply Noise Test Bit Sequences
 - B.2.3.1 Supply Noise SPAT
 - B.2.3.2 Supply Noise CSPAT
- B.3 System Jitter Testing Issues

Annex C

Jitter Tolerance Test Methodologies

- C.1 Calibration of a Signal Source using the BERT Scan Technique
- C.2 Sinusoidal Jitter Modulation
- C.3 Direct Time Synthesis

Annex D

Jitter Output Test Methodologies

- D.1 Jitter Output Test Methodologies
- D.2 Time Domain Measurement - Scope and BERT Scan
 - D.2.1 Overview
 - D.2.2 Golden PLL
 - D.2.3 Time Domain Scope Measurement
 - D.2.4 BERT Scan
- D.3 Time Interval Analysis
 - D.3.1 Introduction
 - D.3.2 "Clock-less" Jitter Measurement
 - D.3.3 TIA Data Reduction Procedure
 - D.3.4 Total Jitter Calculation
 - D.3.5 Power Density Spectrum of Jitter
 - D.3.6 Data Dependent (ISI) Jitter Measurement
 - D.3.7 Jitter Measurements with a "Pattern Marker and known pattern"
 - D.3.8 Jitter Measurement Using a Sampling Oscilloscope (DDJ and PWD)
- D.4 Frequency Domain Measurement (Spectrum Analyzer)

Annex E

Practical Measurements

- E.1 Introduction
- E.2 Basic architecture
- E.3 Instrumentation interface adapters
 - E.3.1 Balanced copper
 - E.3.1.1 Source and sink adapters for balanced copper variants

- E.3.1.1.1 Balanced-unbalanced
- E.3.1.1.2 Balanced - balanced (alternative 1)
- E.3.1.1.3 Balanced - balanced (alternative 2)
- E.3.1.2 Tap adapters for balanced copper variants
 - E.3.1.2.1 Balanced-balanced (alternative 1)
 - E.3.1.2.2 Balanced - balanced (alternative 2)
 - E.3.1.2.3 Balanced-Unbalanced
- E.3.1.3 Extracting a balanced trigger signal
- E.3.2 Unbalanced copper
 - E.3.2.1 Source and sink adapters for unbalanced copper variants (alternative 1)
 - E.3.2.2 Source and sink adapters for unbalanced copper variants (alternative 2)
 - E.3.2.3 Tap adapters for unbalanced copper variants (alternative 1)
 - E.3.2.4 Tap adapters for unbalanced copper variants (alternative 2)
- E.3.3 Optical
 - E.3.3.1 Source interface adapters
 - E.3.3.2 Sink interface adapter
 - E.3.3.3 Optical tap
- E.3.4 Specific tests
- E.3.5 Description of baluns
 - E.3.5.1 Balun requirements
 - E.3.5.1.1 Core and transmission-line requirements
 - E.3.5.2 Specific wound core construction details
 - E.3.5.2.1 Alternative 1 - wound toroid construction
 - E.3.5.2.2 Alternative 2 - wound toroid construction
 - E.3.5.2.3 Alternative 3 - wound bead construction
 - E.3.5.3 Connection of wound cores into baluns
 - E.3.5.4 Other source/sink adapter components

Annex F

Practical Examples for Jitter Compliance

- F.1 Introduction
- F.2 Elements contributing to jitter
- F.3 Hubs
- F.4 Retiming hubs
- F.5 Repeating hubs

Annex G

Choosing the Corner Frequency: $f_c / 1\ 667$

12.2 MJSQ-2 section assignment summary

The following people have signed up for specific sections:

Allen Kramer, Seagate
 Tom Lindsay, Vixel
 Bill Ham, Compaq

Mike Li, Wavecrest
Mike Jenkins, LSI
Rich Feldman, Gadzoox
Dennis Petrich, Wavecrest
Brian Herzing, Methode

The following people have indicated that they would be willing to contribute to specific sections of the document but do not have specific sections assigned yet:

Douglas Nast, Boeing
Ron Miller, Brocade
Ed Grivna, Cypress Semiconductor

Summary of MJSQ-2 sections and owners with percentage completion ():

Sections 1 thru 6.2 - Ham (20%)
[6.0 is the overview section]
6.3. Jitter contribution elements - Wavecrest Mike Li (0%)
6.4. Improved Bit Error Rate vs. Jitter Model (copy from MJS-1) - Tom Lindsay if mods needed (95%)
6.5. Equalization - Mike Jenkins (10%)
6.6. Decomposition of jitter components from total jitter - Tom Lindsay (50%)
6.7. Jitter accumulation and transfer- Tom Lindsay (50%)
6.8. Budget allocation for components - Tom Lindsay (0%)
6.9. Data rate considerations
6.10. Effects of parallel paths - skew, cross talk, imbalance - TBD
6.11. Pattern dependent random jitter - Mike Jenkins (0%)
 7.1. Goals - Ham (10%)
 7.2. Level 1 and level 2 tests - Ham (80%)
 7.6. Test fixture considerations - Ham (50%)
 7.7. System / environmental noise considerations
 7.8. Reference standards / calibration considerations - Dennis Petrich (0%)
 7.9. Data output format considerations

7.10. Jitter tolerance test methodologies (copy from MJS)
7.11. Jitter output test methodologies (copy from MJS)
 8.1.1. Optical Gamma T FC device (requires full protocol signals to work) - Rich Feldman (Bert and scope methods only) (20%)
 8.1.1. Optical Gamma T FC device (requires full protocol signals to work) - Dennis Petrich (TIA methods) (0%)
 8.1.2. Optical Gamma T FC protocol neutral component - Brian Herzing (0%)
 8.2. Copper Gamma T output - Robert Mejia (5%)
 8.2. Copper Gamma R output.- FC device transmitter (requires full protocol signals to work) - Dave Instone?

- 8.3.1. Copper Beta R tolerance FC device (requires full protocol signals to work) - Allen Kramer (20%)
- 8.4. Delta T output - Tom Lindsay (0%)
- 8.4.2.1. 8.4. Delta R output - Tom Lindsay (0%)
- 9. Examples
- 9.1. Jitter budget allocations for components - TBD
- 9.2. Jitter tolerance specification - TBD
- 9.3. Revised jitter output allocation tables - TBD
- 9.4. Separation of jitter components - Mike Li (20%)
- 9.5. Jitter accumulation (+ or -) - Mike Jenkins (0%)
- 9.6. Amplitude to phase conversion - TBD
- 9.7. Proper use of eye diagrams and masks - TBD

Annex assignments are still TBD.

12.3 MJSQ-2 pilot sections

No new activity in this area.

13. Old Business

There was no old business conducted.

14. New Business

No new business was defined.

15. Review action items

[Note: the following material describes the practice being used in the MJSQ-2 minutes for presenting and reporting status on the action items.]

This section contains the action items agreed during the meeting. Only action items with identified people who are responsible to do the action are recorded. Once an action item has been created there are two ways to get an action item removed from this list: (1) complete the action item - preferred method - and (2) the action item has become no longer relevant or appropriate because events have changed since the action item was created. It is possible for an action item to be transferred to another person but that will not remove it from the list and the new

owner will be listed along with the record that the ownership has changed.

There are two divisions under this item: (1) old action items which were created in earlier meetings and (2) new action items which were created during this meeting. There is no tracking of the meeting where the action item was originally created (other than by looking back at previous minutes.)

All action items that were completed by the time the action items were reviewed are given the designation "done". The done action items will remain on the list in the draft and approved minutes for the meeting in which the action item was reported to have been completed. This is to ensure that the person responsible for the action item get the credit/blame for the work. Action items that were reported done in one meeting will be removed from the list for the minutes of the next meeting.

15.1 Old action items from past meetings

Status as of this meeting is shown:

Al Kramer to test his system using CJTPAT before the next meeting.
Status: carried over

Dennis Petrich to create a more complete presentation on two dimensional signal quality measurements.
Status: done

Bill Ham to post the minutes to the web site.
Status: done

Bill Ham to produce rev 01 of the document.
Status: carried over

Dennis to generate transition density plots and eye histogram overlays of the distributions for the data patterns described in MJS-1.
Status: carried over

Dave Instone to contact Schelto on section 3.1.82 in FC-PI rev 11 to have the "greater than or equal to" changed to "less than" for the FC-PI public review.
Status: public review comment submitted - done

15.2 New action items from this meeting

John Patrin to verify and report on the details of the reference timings used for the 2 dimensional measurements
Status: new

John Patrin to post his presentation on the web site.
Status: new

John Patrin is actioned to put the Gamma T output document on the web and to create a new revision for the next meeting.
Status: new

Dean vermeersch to put his presentation on suck out on the web.
Status: new

16. Next meetings

The next working group meeting will be requested for Monday August 06, 2001, in Waikoloa HI, from 9AM to 5PM.

An interim editing meeting is requested for June 26 at 9:00 AM to noon central time.

17. Adjourn

The meeting adjourned at 5:00PM.