

Accredited Standards Committee*
NCITS, Information Technology



Doc. No.: T11.2/00-148v0
Date: Feb 14, 2000
Project: FC0 MJS ad hoc
Ref. Doc.:
Reply to: Dennis Petrich
Schelto Van Doorn
Bill Ham

To: Membership of T11.2
From: Dennis Petrich, chair MJS working group
Bill Ham, Secy MJS working group
Subject: Approved minutes of T11.2 FC0 MJS working group on
December 06 and December 09, 1999

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. Discussions/presentations
 - 8.1 An approach to separating DJ and RJ - Mike Li, Wavecrest
 - 8.2 An approach to jitter tolerance calibration - Dave Instone
 - 8.3 Off- center deterministic jitter - Dave Instone
 - 8.4 A TIA approach to measuring Crosstalk jitter (BUJ) on a FC channel - Dennis Petrich, Wavecrest
 - 8.5 Arming and gating proposal - Dennis Petrich
 - 8.6 Creation of the structure of the MJS-2 document - Ham
 - 8.7 MJS-2 section assignment summary
 - 8.8 MJS-2 pilot sections - Ham
 - 8.9 Follow up on golden PLL letter - Dennis Petrich, Wavecrest
9. Review action items
10. Next meetings
11. 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, Dave Deming of Solution Technology, for hosting the meeting. Bill Ham took these minutes. This meeting was split between

Monday, December 06, 1999 and Thursday, December 09, 1999. These minutes cover both days.

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	Status/Company	Tel
Jeff Scotten	o AGILENT	916-785-5412
Allen Liu	o AGILENT	408-435-6193
Dan Harres	o BOEING	314-232-5590
Paul Weis	o BOEING	253 657-1280
Ronald Miller	p BROCADE	(408) 487-8017
Nicholaos Limberopoulos	o C&M CORP.	860-779-4815
Suren Shah	o C&M CORP.	860-779-4357
Mike Dudek	p CIELO	303 464 2247
Scott Kipp	a CIELO	303 410-6007
Scott Dalton	o COMPAQ	(281) 518-0895
Bill Ham	p COMPAQ	508-841-2629
Edward Grivna	p CYPRESS	(612) 851-5046
Greg McSorley	a DATA GENERAL	(508) 480-8050
Hossein Hashemi	p EMULEX	714-513-8226
Suresh Roy	a FUJIKURA AMERICA	(408) 988-7463
Rich Feldman	p GADZOOX	(408) 360-6048
John Keller	o HP	408 435-6192
Bill Kelly	o IBM	914 892-9279
Clint Schow	o IBM	708 867-9600
Ron Soderstrom	a IBM	507-253-6290
Richard Taborek	p INDEPENDENT	408-370-9233
Schelto Van Doorn	p INFINEON	408-725-3436
Klaus Schulz	o INFINEON	(49) 3038626333
Michael Jenkins	p LSI LOGIC	408-433-7901
Rich Taborek	o NSERIAL	408-330-0488
Allen Kramer	p SEAGATE	612-402-2624
Roland Marbot	o ST MICROELECTRONICS	+33.4.7658.4556
Ali Ghiasi	p SUN	415-786-3310
Vit Novak	o SUN	(650) 688-9033
Dave Guss	O TEXAS INSTRUMENTS	714-573-6824
Douglas Day	o TOSHIBA AMERICA	408-526-2838
Shawn Hendricks	o US NAVAL POST GRAD	831-656-2066
Bob Rumer	o VITESSE	805-445-2290
Tom Lindsay	p VIXEL	425-806-4074
Dennis Petrich	p WAVECREST	408-436-9000
David Instone	p XYRATEX	01705-486363

Total: 36 attendees

3. Approve agenda

Schelto moved and Dave Instone 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 MJS committee.

Document distribution is now being done over the web. Documents relating to MJS 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 "MJS".

The only active document in this working group is the MJS-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

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4. At the meeting it is the chairs's discretion to allow additional presentations

5. Review minutes of previous meeting

The minutes of the October 1999 MJS working group were reviewed with some minor editorial changes. Mike Dudek moved and Dennis 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. Discussions/presentations

8.1 An approach to separating DJ and RJ - Mike Li, Wavecrest

Mike went through the background of an attempt to separate the jitter components. Unfortunately, Mike's terminology does not line up with the present MJS terminology. Specifically the role of uncorrelated bounded jitter (BUJ) is different in Mike's presentation. Mike put the BUJ into the "random" bucket which is clearly not the presently accepted MJS concept.

When reading this presentation please notice that random jitter includes both BUJ and Gaussian. This is an oversight that will be corrected in future presentations on this subject.

Another area where conflict exists is in the term White Noise. White noise does not imply Gaussian yet the White noise is listed under unbounded RJ. MJS requires that all random jitter be unbounded. Therefore the white noise listed in the presentation is a special kind of Gaussian white noise.

The fact that instruments that require external clock inputs can have serious errors in the clock path due to clock jitter along its path was explored. In many cases there is a serious phase difference between the reported data and the clock. This difference is manifested by different DJ at different clock to data delays.

Action item: Mike Dudek to measure the DJ and RJ down an operating link using the Wavecrest routine to validate that the components add up as expected.

8.2 An approach to jitter tolerance calibration - Dave Instone

Dave continued his work on defining a calibration condition for jitter tolerance. This presentation is found in 99-742v0. One key concept here is the use of practical waveforms produced by ISI to set up signals that closely match the receiver mask shape.

Mike Jenkins moved and Mike Dudek seconded that the following concepts be adopted for MJS-2 "that measurement of the jitter and amplitude of the receiver jitter tolerance signal follow the technique described for jitter output measurement in MJS-2". (This includes the high pass filter function).

Motion passes unanimously.

Rich Feldman moved and Tom Lindsay seconded that the following concept be adopted for MJS-2 "that the signal for receiver tolerance testing be adjusted according to the concepts described in 99-742v0 and 99-618v0 with the actual parameters to be determined".

Motion passes unanimously.

A thread of these motions is to establish simple calibration conditions for the properties of the signals that can be reused without further calibration when more complex patterns and features are added.

8.3 Off- center deterministic jitter - Dave Instone

Dave showed data that has the time of the threshold crossings of repeated K28.5 signals significantly off the center position. This off center crossing is caused by over compensation in port bypass circuits. This data demonstrates that compensation can only be done optimally if one knows what needs to be compensated and that non optimal compensation actually reduces timing margin.

8.4 A TIA approach to measuring Crosstalk jitter (BUJ) on a FC channel - Dennis Petrich, Wavecrest

Dennis presented data using a test setup where an uncorrelated signal was summed with the primary signal to introduce cross talk-like noise. He showed that the cross talk jitter was definitely bounded and deterministic. Significantly the measured RJ (calculated from a tail fit algorithm) was nearly identical for a wide variety of cross talk intensities.

This data is the first presented to the MJS group that specifically addresses the BUJ issue. It appears that separation of BUJ from the total population is feasible if the BUJ source is present and causes some significant population of the total. Intense BUJ that rarely occurs needs to be removed before applying a separation algorithm. The algorithm to detect and remove these outliers from the tail fit exists within Wavecrest but has not yet been shown to MJS.

8.5 Arming and gating proposal - Dennis Petrich

This presentation was deferred to February.

8.6 Creation of the structure of the MJS-2 document - Ham

A complete review of the existing document and structure of MJS-2 was conducted. The most important activities focused on clear assignment of responsibility for the various sections of the document.

Following is the presently agreed organization of the MJS-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 - Wavecrest Mike Li
 - 6.3.1. Reference times - TBD
 - 6.3.2. Signal amplitude effects - TBD
 - 6.3.3. Generalized jitter concepts - TBD
 - 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
 - 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 paths - skew, cross talk, imbalance
 - 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 R output
 - 8.2.1. FC device transmitter (requires full protocol signals to work) - TBD
 - 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. Test 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
- 9.6. Amplitude to phase conversion - TBD
- 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 MJS-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.3.5.1.2 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: $f_c / 1\ 667$

Action item: Ham to create and post a rev 0 draft MJS-2 document based on the existing MJS-1 document and the discussions reported above in this meeting.

8.7 MJS-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 MJS-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%)
 - 8.3.1. 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.

Action item: Ham to post the section assignments to the T11.2 reflector and to the web site as a separate document.

8.8 MJS-2 pilot sections - Ham

This item was not specifically worked on. The time allocated on Thursday was used for development of the document organization. While these pilot sections continue to be valuable, the optical gamma T is being worked by Rich Feldman and the copper beta R is being worked by Allen Kramer.

8.9 Follow up on golden PLL letter - Dennis Petrich, Wavecrest

Dennis will review the responses from the previous letter recipients to determine the status and prognosis for the availability of real golden PLL's.

9. Review action items

Old action items from past meetings with status as of this meeting shown:

1. Dennis P. to compare the Wavecrest algorithm to his BERT scan results.
Status: carried over
2. Mike Jenkins to test Wavecrest's application against known theoretical data.
Status: carried over
3. Dennis Petrich to add definition of Gaussian noise source in terms of amplitude to phase conversion
Status: carried over
4. Fill in the details for the optical gamma T measurement:
Straight TIA Dennis Petrich
Protocol analyzer with golden PLL, Rich Feldman
Bit sequence triggered TIA, Dennis P
Status: transferred to normal work of creating the document
5. Ham will get the document number for the minutes and do the posting to the web site
Status: done 99-653v0
6. Dennis to contact Robert Mejia to determine the status and prognosis for the action item relating to the Noisecom.
Status: done plus some related material was uploaded
7. Dennis to conduct a review of the replies to the letter to suppliers requesting development of golden PLL's
Status: carried over (possible Tektronix GBIC tester option noted by Tom L.)
8. Dennis to create a proposal for a technique for generating an arming signal from a serial bit stream and the software to deal with the random insertion or deletion of fill words.
Status: done but not yet uploaded
9. Tom Lindsay to post his signal tolerancing presentation to the web site
Status: done 99-618v0

New action items from this meeting:

1. Ham will get the document number for the minutes and do the posting to the web site
Status: new
2. Mike Dudek to measure the DJ and RJ down an operating link using the Wavecrest routine to validate that the components add up as expected.

Status: new

3. Ham to create and post a rev 0 draft MJS-2 document based on the existing MJS-1 document and the discussions reported above in this meeting.
Status: new
4. Action item: Ham to post the MJS-2 section assignments to the T11.2 reflector and to the web site as a separate document.
Status: new

10. Next meetings

The next working group meeting will be requested for Monday February 14, 2000, in Huntington Beach CA from 9AM to 5PM. A second meeting on Thursday AM from 9:00 to 12:30 will be focused on developing the details of the test methods for MJS-2.

No interim meetings are presently planned.

11. Adjourn

The meeting adjourned at 12:00 on Thursday.