Test Technology Standards Committee (IEEE-SA TTSC)

Meeting Minutes

October 12th, 2022

1 Name of group

The Test Technology Standards Committee (IEEE-SA Sponsor C/TT) met.

2 Date and location of meeting

Wednesday, October 12th, 2022, continued October 26th, 2022, via IEEE Meetings WebEx (teleconference).

3 Officers

The presiding officer was Ian McIntosh, TTSC Chair. The recording secretary was Michael Wahl.

4 Attendance roster & membership updates

The roll from October 12th, 2022, was taken from the WebEx attendance list.

Adam Cron	Jason Doege	Saghir Shaikh
Al Crouch	Jason Peck	Saman Adham
Bambang Suparjo	Jeff Rearick	Sankaran Menon
Bradford Van Treuren	Michael Laisne	Steve Sunter
Erik Jan Marinissen	Michael Wahl (S)	Tao Sun
Francesco Lorenzelli	Mike Ricchetti	Tom Thompson (IEEE)
Heiko Ehrenberg	Po Yao Chuang	
Ian McIntosh (C)	Roger Sowada	

The roll from October 26th, 2022, was taken from the WebEx attendance list

Bradford Van Treuren	Jim O'Reilly	Saman Adham
Erik Jan Marinissen	Michael Laisne	Sankaran Menon
Heiko Ehrenberg	Michael Wahl (S)	Steve Sunter
Ian McIntosh (C)	Mike Ricchetti	Tao Sun
Jason Doege	Ric Dokken	Tom Thompson (IEEE)
Jason Peck	Roger Sowada	
Jeff Rearick	Saghir Shaikh	

C: Chair, VC; Vice Chair, S: Secretary. Adam Ley was excused.

New attendees

- Tao Sun, affiliated with S&C Electric Company, new member

- Francesco Lorenzelli affiliated with IMEC (supporting Erik Jan's presentation)
- Po-Yau Chuang, affiliated with IMEC (Supporting Erik Jan's presentation)
- Roger Sowada, Lockheed Martin, member of the 1581 WG)

Change of affiliation

- Saghir Shaikh is now with Intel Corp.

5 Call to order, Chair's remarks

The meeting was called to order at: (EDT) 11:05 AM, October 12th, 2022. The meeting was recorded for writing the minutes. The recording will be deleted immediately after the minutes have been written.

5.1 Patent slides (ref)

The presiding officer shared the patent slide set and provided opportunity for those present to fulfill their duty to inform. None present identified any potentially essential patent claim(s)/patent application claim(s). No comments were given.

5.2 Copyright slides (ref)

The presiding officer shared the copyright slide set and provided opportunity to fulfill their duty to inform. No comments were given.

5.3 Participant behavior slides (ref)

The presiding officer shared the copyright slide set. No comments were given.

6 Approval of the agenda

A motion for the approval of the agenda was made.

MOTION	Approval of the agenda
Mover	Steve Sunter
Second	Bradford Van Treuren
Votes	No objections were raised.
Decision	Approved

7 Approval of minutes of previous meetings

7.1 Regular meeting, July 13th, 2022

The minutes are available on the IEEE TTSC iMeet site. The following corrections were made:

- In 9.2.1, the comment on P1450 attributed to Heiko Ehrenberg should be attributed to Adam Ley.
- In 9.4.2, the two references "to R. Rearick" should be to "J. Rearick".

MOTION	Approval of the minutes
Mover	Heiko Ehrenberg
Second	Bradford Van Treuren
Votes	No objections were raised.
Decision	Approved

8 Action items review

	Action	Who	When
1	Create “cookbook” for how to startup a new (or revision) project/ working group. Essentially a “living document”. The work is ongoing.	Ian McIntosh	Forthwith
2	Raise questions in the SMTA forums concerning the use of 1149.8.1. Question raised on SMTA forums but no more information forthcoming than was previously available, i.e. a count of the number of downloads of the Testability Guidelines. A discussion of what data IEEE might be able to supply on downloads/purchases of the standard arose. Tom Thompson would need to enquire. IEEE Explore shows 884 full text views of the standard. That are quite many downloads, but the number provides no information of the grade of interest of the person/company. The discussion crossed over into a more general discussion on how to get information about the real usage of a standard. Steve Sunter made a point on the necessity of having an objective information on all standards usage. Such information could be the number of views per year, the number of downloads, or the number of purchases. Action as written is complete.	Ian McIntosh	Forthwith
3	Support Deepak in getting the subcommittee on languages started. I. McIntosh supported Deepak Asani in getting the subcommittee on languages started. Two meeting were held, third is scheduled next week. Action complete.	Ian McIntosh	Forthwith
4	Submit the updated P&P to AudCom.	Ian McIntosh	Forthwith

	Action	Who	When
	The draft was submitted. The AudCom reviewers objected to a couple of our tailoring edits which were resolved via the AudCom Administrator. Common WG P&P is approved, although formal notification is still to come from the AudCom Administrator. Note that WG P&Ps written to the 2017 Baseline now need to be brought in line with the new TTSC P&P. Using the Common P&P will do that. Only a few WGs are affected. The action is closed.		

9 Technical Topics

9.1 Standards Committee action requested/required

Erik Jan Marinissen presented a a proposal to start a study group on **3D Interconnect Repair**. The proposal. Was prepared by Sreejit Chakravarty (Intel), Adam Cron (Synopsys), and E. J. Marinissen (imec). The slides are available at https://ieee-sa.imeetcentral.com/p/aQAAAAAE-sMK.

The technical problem is that the number of tiles/chiplets per package is growing beyond 50, and the numbers of interconnects grows accordingly. The high number of interconnects increases the risk of connection faults. Thus, additional connections are implemented, e. g. 64 + 2, so that two interconnect faults can be repaired. As the tiles come from different manufacturers, it is essential that the information about repair options used is communicated between the two partners, e. g. which of the 66 lanes in the bundle are spares, and which can be/are mapped to the spares. Here the idea came up to create a new standard or to extend 1838 with 3D repair capabilities.

Standards for connecting tiles are e. g. the Advanced Interface Bus and the Universal Chiplet Interface Express, UCIe.

E. J. Marinissen suggested to start a study group with Sreejit Chakravarty as the chair. Some of the questions to be answered by the study group are

- Is there a need for interconnect repair standardization?
- Whant can/should be standardized?
- Should this be an extension of IEEE 1838 or should this be a new standard with its own number?

UCIe[1] is already published and there are activities which address the topic (M. Ricchetti), such as Bunch of Wires (BoW)[2][3], HBI[4], AIB[5], and JEDEC, which has some standards for testing stacked memory dies.

M. Laisne pointed out that it is essential to respect existing patents. He mentioned that Qualcomm has at least one.

The lively discussion on this topic led to the point that the TTSC decides to start a study group as suggested by E. J. Marinissen.

MOTION	Start a study group on Interconnect Repair Standardization
Mover	Adam Cron
Second	Saman Adham
Votes	No objections were raised.
Decision	Approved

Sreejit Chakravarty (Intel) was appointed as the study group chair. Interested persons shall contact Sreejit Chakravarty or E. J. Marinissen.

9.2 Regular order

9.2.1 Election's review

- P1149.1: S. Shaikh stated that the elections will conclude on 18th October. J. Doege stated that the currents status is that they have nominees for all positions and all have accepted
- P1450.6.2: S. Adham stated that the nomination period is done, and the acceptance period will be the next two weeks. As A. Ley may not be able to continue serving, the WG discussed alternatives, and M. Stanek accepted to take over his task.
- TTSC: H. Ehrenberg has started the nominations period. He mentioned that S. Adham is not eligible because he is the auditor.
  Amendment from the second part of the Meeting: H. Ehrenberg reminded the members that the call for nominations for officers of the TTSC is still open. The last date for nominations is November, 9th, 2022. As there are only few nominations the others should feel motivated to participate in nomination. There are at least nominations for every office. He also pointed out that M. Wahl will not stand for office again due to his

[1] https://www.uciexpress.org
[2] Bunch of Wires (BoW) PHY Specification, The Open Domain-Specific Architecture BoW Workstream DRAFT Version 1.1b, September 30th, 2022.
https://opencomputeproject.github.io/ODSA-BoW/bow_specification.html
[3] S. Ardalan et al., "Bunch of Wires: An Open Die-to-Die Interface," 2020 IEEE Symposium on High-Performance Interconnects (HOTI), 2020, pp. 9-16, doi: 10.1109/HOTI51249.2020.00017.
https://ieeexplore.ieee.org/document/9188283
[4] Insight into the OpenHBI Die-toDie Standard
https://www.synopsys.com/designware-ip/technical-bulletin/openhbi-die-to-die.html
[5] Chips Alliance, chipsalliace.org,
https://github.com/chipsalliance/AIB-specification

upcoming retirement. Please submit a new nomination if you have nominated M. Wahl.

The voting will be done via e-mail towards the end of the year.

9.2.2 Election/re-election schedule

- **P1687.1** (A. Crouch): The election process has not yet started. The topic will be addressed on the nest meeting. The group will provide an elections auditor.
- **P2654:** I. McIntosh said that the appointment of the auditor from within the group will lead to a depleting the pool of possible candidates. He asked for volunteers from the TTSC. J. Rearick volunteered to act as the election's administrator. J. Doege volunteered to act as the auditor.

9.3 Status of projects in active development

- **P1450.1** (New interim chair required): G. Maston has been nominated as the interim chair, but is not able to fulfill that. R. Dokken[6] stated that he could take care of the administrative work, but he needed a technical expert such as G. Maston. J. Doege suggested to contact mentioned Julie Villar[7]. J. O'Reilly pointed out the importance of the standard for transferring design data to the tester and vice versa. R. Dokken suggested to I. McIntosh to explore this issue further together so that the WG gets running.
- **P1450.6** (New interim chair required), PAR approved 03 Dec 2020**:** I. McIntosh and S. Shaikh will talk offline to get the working group running and identify officers for the WG.
- **P1687.1** (Al Crouch): The PAR has been renewed.
- **P2427** (A. Coyette): T. Thompson stated that the group is in the comment resolution phase. Around 950 comments have been made. This will take some time. This might cause problems with the expiration date of the PAR. T. Thompson also said that a PAR extension would not be a problem if the WG shows good progress.
- **P1687.2** (S. Sunter): The PAR extension will not be agreed upon this October, more probably in six month. The technical reason is that it is open if PDL 0.5 would be a subset of TCL or PDL-like commands. It is also the question if anyone converts PDL level 1 to ATE code.
  J. Rearick said that having a neutral format which allows a backend data transformation to tester code could be fed by the outcomes of many groups. PDL is germane just to the 1687.2 working group. And they should finish that now, whether it includes this PDL 0.5 level or not. If not, TCL needs to be used to describe meaningful tests. We would be doing the community a disservice if we didn't at least address that.
- **P1149.4** (B. Suparjo): A. Cron asked B. Suparjo if they could go to ballot. B. Suparjo said that the draft was completed, but he has been on sabbatical and is in the middle of getting back to work. He will form the ballot group after he is settled.

[6] In the second part oft he meeting.
[7] She was with Synopys and worked with Tony Taylor and Greg Maston on 1450.1- Since 2019 she is working in a quite different industry, as can be seen in linkedin.

- **P2929** (S. Menon): Good progress, with 28-30 attendees. One chapter/clause complete, goal is to get 20-30% of the document in place by the year end.
- **P1450.6.2** (S. Adham) – One tiger team has just concluded and a second is starting work. Hope to have all technical aspect finished by July '23 and the document complete by the end of 2023.
- **P1450** (R. Dokken) – No report available

Motion to re-convening of the meeting due to the end of the scheduled meeting time.

MOTION	Recess and resume the meeting on October 26th, 2022, same time.
Mover	Saman Adham
Second	Saghir Shaikh
Votes	No objections were raised.
Decision	Approved

Meeting recessed at 12:07 EDT.

Meeting resumed on October 26th, 2022, at 11:06

9.4 Maintenance review

9.4.1 Without SC action, the following standards will expire at the end of 2022:

- 1149.8.1 C/TT/Boundary Scan Architecture
  IEEE Standard for Boundary-Scan-Based Stimulus of Interconnections to Passive and/or Active Components.
  No further information on usage available. It will become the status inactive reserved.

Without SC action, the following standards will expire at the end of 2025:

- 1149.6 C/TT/1149.6
  IEEE Standard for Boundary-Scan Testing of Advanced Digital Networks
  We discussed in the last meeting to initiate a study group. S. Shaikh is willing to take action, but was to busy up to now. Deferred to the next meeting.

9.4.2 Without SC action, the following standards will expire at the end of 2027:

All the standards listed below need to be address next year, latest in 2024.

- 1149.10 C/TT/HJTAG
  Standard for High-Speed Test Access Port and On-chip Distribution Architecture
  This WG was previously led by C.J. Clark.
- 1450.4 C/TT/P1450.4
  Standard for Extensions to Standard Test Interface Language (STIL) (IEEE Std 1450-1999) for Test Flow Specification

  Jim O'Reilly was past-chair, Ric Dokken was a participant. Ric Dokken is a heavy user of this standard and willing to drive it further on.

- 1804 C/TT/FACR 1804
  Standard for Fault Accounting and Coverage Reporting (FACR) for Digital Modules
  No action. Needs to be addressed next 2023.

9.4.3 Open issues

J. O'Reilly raised the question of the status of 1450.2 DC levels (2002, inactive-Reserved), 1450.3 Tester resource constraints (2007 was co-labeled by IEC). I. McIntosh suggested to shift this issue to the next meeting to provide time to check IEEE myProject for details.

9.5 Common P&P

The TTSC P&P have been approved by AudCom. An official note is still missing. The P&P should be used by all WGs. The P&P dated 2017 and older are obsolete.

10 New Business

None

11 Subcommittee reports

B. Van Treuren stated that the language subcommittee has made some progress. A discussion is going on whether ICL/PDL from 1687 should become a separate standard covering all aspects or remain in 1687 with other standards writing extensions to it. J. Doege said that there are legitimate concerns to the idea of ripping the languages out of the other languages.

An idea is coming up with a meta language that is extensible or provide other ways to interact with the standards.[8] The committee is meeting once a month.

12 Items reported out of executive sessions

None

13 Any other business

M. Ricchetti stated that IEEE Standard 1500-2022 was published on October 12th, 2022. The standard is made available to the members of the WG.

14 New Action Items

- I. McIntosh will check the status of 1450.2 DC levels (2002, inactive-Reserved) and 1450.3 Tester resource constraints (2007 was co-labeled by IEC).
- I. McIntosh and R. Dokken will discuss to form th1450.1 WG.
- I. McIntosh and S. Shaikh will talk off-line for finding officers for 1450.6.

[8] M. Wahl: While writing the minutes I had the idea of defining an information model similar to an ER model using an abstract language and then provide the mapping oft these entities onto the different languages. This meta level would make mapping much easier.

15 Next meeting

The next meeting will take place on January 18th, 2023, 11:00.

16 Adjourn

MOTION	To adjourn
Mover	M. Wahl
Second	J. Doege
Votes	No objections were raised.
Decision	Approved

The meeting was adjourned at 11:40 EST.

History of these minutes

- Meeting notes recorded by: Michael Wahl
- Minutes submitted by: Michael Wahl, TTSC Secretary

17 Appendix

17.1 IEEE TTSC Membership

Saman	Adham	Taiwan Semiconductor Manuf. Corp.
Adam	Cron	Synopsys, Inc.
Alfred	Crouch	Amida Technology Solutions
Anthony	Coyette	ON Semiconductor
Jason	Doege	Intel Corporation
Ric	Dokken	Roguevation, Inc.
Heiko	Ehrenberg	Goepel electronics LLC
Neil	Jacobson	Formidable Engineering Consultants
Michael	Laisne	Renesas
Adam	Ley	ASSET InterTech, Inc.
Erik Jan	Marinissen	imec / TU Eindhoven
Greg	Maston	Self emplyed
Ian	McIntosh	Leonardo S.p.A.
Sankaran	Menon	Intel Corporation
Jim	O'Reilly	Intel Corporation
Jason	Peck	Texas Instruments Inc.
Rajesh	Raina	NXP Semiconductors
Jeff	Rearick	Advanced Micro Devices (AMD)
Mike	Ricchetti	Synopsys, Inc.
Saghir	Shaikh	Broadcom Corporation
Steve	Sunter	Mentor, a Siemens Business
Bambang	Suparjo	Intel Corporation
Bradford	Van Treuren	VT Enterprises Consulting Services
Tom	Waayers	NXP Semiconductors
Michael	Wahl	University of Siegen