



TC ANNUAL REPORTING FORM

IMS Technical Committee

TC10, Waveform Generation, Measurement, and Analysis

Reporting period

Starting date (dd/mm/yy)	Ending date (dd/mm/yy)	Date of submission (dd/mm/yy)
01/01/23	31/12/23	11/01/24

Website

<http://tc10.ieee-ims.org/tc10-home>

Last update (mm/yy)

2023

TC Chair or co-Chairs

First Name	Second Name	Family Name	Affiliation /Address	Membership number	Phone	e-mail address	Date of election
Nicholas	G	Paulter, Jr	NIST 100 Bureau Dr. Gaithersburg, MD 20899 USA	41340692	240-483-5947 (c)	nicholas.paulter@nist.gov	2018

Secretary (check the right box)

Present

Not Present

First Name	Second Name	Family Name	Affiliation /Address	Membership number	Phone	e-mail address	Date of election
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TC Membership list^(*)

First Name	Second Name	Family Name	Affiliation /Address	Membership number	Phone	e-mail address	TC assignments (joining year)
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(AVAILABLE FROM IEEE, also attached)

* Please add as many rows as needed

TC mission – field of expertise (max. 1000 char. Including spaces)

Develop, promote and support standards for specifying and measuring waveforms, and for specifying and testing instrumentation used for waveform measurement or generation;

Promote effective practices of waveform measurement, generation, and analysis through workshops, review papers, etc.;

Maintain liaison with other groups, societies, and standards organizations working in the same area.

TC meetings in the reporting period^(*)

Date (dd/mm/yy)	Online / Face2Face	Attendance (number)	TC Members	Information sent within 4 months to (Yes/No)		
				Chair of TSAC	IM Magazine	Other (specify)
17 Jan 2023	on-line	12	see list in appended meeting minutes			
18 Apr 2023	on-line	19	see list in appended meeting minutes			
18 Jul 2023	on-line	17	see list in appended meeting minutes			
17 Oct 2023	on-line	13	unofficial meeting minutes not included			

Minutes of the yearly meeting (separate file)¹

meetings are held quarterly, approved meeting minutes are attached

Participation in Society sponsored Events (Conferences, Symposia, Workshops)^(*)

¹ Yes/No, date of the yearly meeting;

* Please add as many rows as needed



Name of the Event	Starting date (event) (dd/mm/yy)	Ending date (event) (dd/mm/yy)	Date Participation (dd/mm/yy)	Type of participation (Yes/No)			
				Sponsorship	Session	Tutorial	Other (specify) ²

Involvement in standard development^(*)

Standard	Working Group	Revision	Activity in the reporting period, including dates	Notes, attendance
Std 181	Pulse Tech	2011	Kick-off meeting documentation completed and meeting scheduled for mid-Jan 2024.	
Std 1057	Waveform recorder	2017	No activity	
Std 1241	ADC	2023	Standard balloted and approved by IEEE SA. Published in 2023.	
Std 1681	DAC	2023	Standard balloted and approved by IEEE SA. Published in 2023.	
Std 2414	Jitter	2020	Recently published – no activity.	
Std 1696	Probe standards	2013	Several web-based meetings conducted. Revision in progress.	

Participation in the development of Society Educational Programs^(*)

Program name	Involvement of chapters and sections	Activity in the reporting period, including dates	Notes, attendance
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Other Activities (tutorials, teaching, career, cooperation, publications, joint activity with chapters or sections) ^(*)

Type of activity	Starting date (dd/mm/yy)	Ending date (dd/mm/yy)	Activity in the reporting period	Notes, attendance
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Article updating TC10 activities was published in Nov 2022. (L. De Vito, J. Jendzurski, S. Rapuano, W. B. Boyer, J. Blair and N. G. Paulter, "The IEEE Technical Committee 10-The Waveform Generation, Measurement, and Analysis Committee: Update 2021," in IEEE Instrumentation & Measurement Magazine, vol. 25, no. 8, pp. 16-18, November 2022, doi: 10.1109/MIM.2022.9908270.)

² For example, Involvement in reviewing papers (and indicate approximate number of paper reviews for the listed event)

^{*} Please add as many rows as needed



Recommended candidates^(*)

Type (ADCOM, Fellow, Award –specify-)	First Name	Second Name	Family Name	Affiliation /Address	Motivation
	IEEE SA Standards Lifetime Achievement Award, Jerome Blair, Sep 2023, "For more than 30 years of outstanding contributions to the science and technology of waveform generation, measurement, and analysis and to the development of associated international documentary standards"				
	IEEE SA Standards Medallion, Sergio Rapuano, Sep 2023, "For outstanding leadership, determination, and dedication in the development of IEEE 2414-2020, IEEE Standard for Jitter and Phase Noise"				

TC operating Plan: near-term plans for the upcoming year, including scheduled meetings, activities, and so on (max. 1000 char. Including spaces)

- Maintain valid membership list
- Hold periodic on-line TC10 WebEx meetings
- Maintain IEEE TC10 and IEEE SA web sites
- Convene I2MTC-2024 Special Session, "Waveform acquisition and analysis"

TC operating plan: long term vision from 2-5 years out, based on IMS Strategic Plan, including areas of strength , areas for improvement, how is the subject area going to change, planned actions for lifting achievement succession plans etc. (max. 1000 char. Including spaces)

- Maintain current TC-10 membership and broaden industry involvement
- Increase TC10 visibility, in collaboration with IEEE IMS and IEEE SA
- Increase interest in participation as an officer
 - Identify chair for ADC (1241) Working Group
 - Identify chair for 181 Working Group

^{*} Please add as many rows as needed



TC convergence, synergy, cooperation with other TC, from I&M or other societies (max. 1000 char. Including spaces)

Comments/Suggestions (max. 1000 char. Including spaces)

* Please add as many rows as needed

IEEE Waveform Generation Measurement and Analysis Technical Committee (TC10)
Approved Meeting Minutes
17 January 2023 / 11:00 AM –13:00 PM (UTC-5)

1. Call to Order
2. Introductions and Roll Call
 - a. Nick Paulter, TC10 chair, presided and took minutes
3. Approval of the Agenda
 - a. Motion for agenda approval was provided by Gregory and seconded by Sergio. No dissenting opinion.
 - b. The approved agenda is available on iMeetCentral (<https://ieee-sa.imeetcentral.com/login>).
4. Approval minutes from 18 October 2022 meeting
 - a. Motion for minutes approval was provided by John and seconded by Fritz. No dissenting opinion.
 - b. The approved minutes are available on iMeetCentral (<https://ieee-sa.imeetcentral.com/login>).
5. TC10 administrative
 - a. Comments, concerns, issues for IEEE SA tools was solicited.
 - i. There have been three issues for the 17 January 2023 meeting in which attendees did not receive WebEx invitation, which has e-mailed separately. If this issue has not been resolved, IEEE-SA will be asked for assistance.
 - b. Next meeting will be 18 April 2023 starting at 1100 (UTC-4).
6. Working Groups Updates
 - a. Revision of IEE Std 181, IEEE Standard for Transitions, Pulses, and Related Waveforms
 - i. Lead: Nick Paulter
 - ii. PAR expires 2025. We will wait until the 1241 is approved for publication before starting on the 181.
 - iii. Attendees expressed their interest to participate in the revision of the 181.
 - b. Revision of IEEE Std 1241, IEEE Standard for Terminology and Test Methods for Analog-to-Digital Converters
 - i. Lead: Nick Paulter
 - ii. Status
 1. PAR extension has been approved.
 2. Comment Resolution Group formed and convened. Resolution for comments provided and submitted to P1241 WG for review and approval.
 - c. Revision of IEEE Std 1658, IEEE Standard for Terminology and Test Methods of Digital-to-Analog Converter Devices
 - i. Lead: Luca DeVito
 - ii. Status
 1. PAR extension has been approved.
 2. Comment Resolution Group formed and meeting scheduled.
 - d. Revision of IEEE Std 1696, IEEE Standard for Terminology and Test Methods for Circuit Probes

- i. Lead: John Jendzurski
- ii. John has received a Word copy of the standard from the IEEE-SA and converted it to the current IEEE-SA documentary standards format.
- iii. John will share with the working group before the end of January 2023.

7. Discussion topics

- a. IEC sample-by-sample (SBS) waveform uncertainty standard
 - i. The IEC TC85 WG22 has started an informal activity to develop an SBS waveform uncertainty documentary standard. This is an informal WG22 activity until the document development has become more mature, at which time the WG22 will submit a proposal for a new standard to the IEC.
 - ii. Nick will investigate setting-up an IEEE ListServ for this activity to foster a liaison between the TC10 and the WG22. TC10 members are welcome to participate.
- b. TC10 technical presentations
 - i. Allan Belcher provided a technical presentation titled “Measuring wide band nonlinearity: Beyond the limits of conventional test methods.” The presentation was followed by questions and discussion.
 - ii. Fritz Caspers volunteered to provide a presentation at the next TC10 quarterly meeting.

8. Adjourn

- a. Motion to adjourn was made and seconded.
- b. Meeting adjourned around 1240 (UTC-5).

9. Tasks

- a. Outstanding tasks (not completed from previous lists)
 - i. WG chairs - review web pages (<https://sagroups.ieee.org/im-wma-tc10/>) for content
- b. New
 - i. Nick Paulter - upload agenda and draft minutes of 17 Jan 2023 meeting
 - ii. Nick Paulter - upload approved minutes of 18 Oct 2022 meeting

Attendee list with affiliation:

Attendee name	Affiliation
Allan Belcher	Signal Conversion, Ltd, UK
Bill Boyer	Sandia Natl. Lab., retired, USA
Fritz Caspers	CERN, Switzerland
Razvan Ciocan	Draper, USA
Yuji Gendai	THine Electronics, Japan
John Jendzurski	National Institute of Standards and Technology, USA
Gregory Kyriazis	National Institute of Metrology, Quality and Technology (INMETRO), Brazil
Kruno Miličević	Computer Science and IT Osijek (FERIT), Croatia; Random Red, Ltd., Croatia
Alessandro Mingotti	University of Bologna, Italy
Nicholas Paulter	National Institute of Standards and Technology, USA
Sergio Rapuano	University of Sannio, Italy
Han Wang Yoo	Automation and Control Institute, Austria

IEEE Waveform Generation Measurement and Analysis Technical Committee (TC10)
Meeting Minutes
18 April 2023 / 11:00 AM –13:00 PM (UTC-4)

1. Call to Order
2. Introductions and Roll Call
 - a. Nick Paulter, TC10 chair, presided and took minutes
3. Approval of the Agenda
 - a. Motion for agenda approval was provided by Gregory and seconded by John J. No dissenting opinion.
 - b. The approved agenda is available on iMeetCentral (<https://ieee-sa.imeetcentral.com/login>).
4. Approval of minutes from 23 January 2023 meeting
 - a. Motion for minutes approval was provided by John J. and seconded by Luca. No dissenting opinion.
 - b. The approved minutes are available on iMeetCentral (<https://ieee-sa.imeetcentral.com/login>).
5. TC10 administrative
 - a. Comments, concerns, issues for IEEE SA tools was solicited.
 - i. Bill Boyer, 1057 Working Group chair would like to establish a ListServ. Patrycja Juorz, IEEE SA staff, suggested to send her a request.
 - b. Next meeting will be 18 July 2023 starting at 1100 (UTC-4).
 - c. The names of meeting attendees, with affiliations, is listed in a table on the last page of the meeting minutes.
6. Working Groups Updates
 - a. Revision of IEE Std 181, IEEE Standard for Transitions, Pulses, and Related Waveforms
 - i. Lead: Nick Paulter
 - ii. Awaiting for publication of the IEEE P1241 before starting this activity.
 - b. Revision of IEEE Std 1241, IEEE Standard for Terminology and Test Methods for Analog-to-Digital Converters
 - i. Lead: Nick Paulter
 - ii. Status
 1. Submitted to RevCom, who will make a recommendation that will be sent to the IEEE SA Standards Board. This item is on the RevCom meeting agenda for 15 May 2023.
 2. Assuming the IEEE SA Standards Board approves the revision, the IEEE SA editors will prepare the document for publication. This process requires review and approval by the Working Group.
 3. Nick asked for volunteers to review the IEEE-SA-prepared document. Balázs, Razvan, John J., and Nick will review the document.
 - c. Revision of IEEE Std 1658, IEEE Standard for Terminology and Test Methods of Digital-to-Analog Converter Devices
 - i. Lead: Luca DeVito

- ii. Status
 - d. 1. Submitted to RevCom, who will make a recommendation that will be sent to the IEEE SA Standards Board. This item is on the RevCom meeting agenda for 15 May 2023.
 - e. Revision of IEEE Std 1696, IEEE Standard for Terminology and Test Methods for Circuit Probes
 - i. Lead: John Jendzurski
 - ii. John has received a Word copy of the standard from the IEEE-SA and converted it to the current IEEE-SA documentary standards format.
 - iii. John will share with the working group before the end of January 2023.
- 7. Discussion topics
 - a. 802.3dj (<https://www.ieee802.org/3/dj/index.html>) – John Calvin
 - i. PAM4 106 gigabaud signal supporting 1.6 TB/s interface will be completed by 2025.
 - ii. Measurement issue/problem: need to measure 2 mV eye height opening
 - 1. TC10 members are invited to help address this measurement need.
 - b. IEEE TC10 history – Bill Boyer
 - i. Bill started compiling the history of the IEEE TC10. This was suggested during e-mails regarding IEEE award nominations as this information would vanish when the older TC10 members terminate their IEEE TC10 activity.
 - ii. Nick has compiled a list of the older, superseded TC10-related standards. These can be found in our iMeetCentral repository: <https://ieee-sa.imeetcentral.com/tc10-general/folder/WzIwLDE2NjE3Mjc2XQ>.
 - c. IEC sample-by-sample (SBS) waveform uncertainty standard
 - i. The IEC TC85 WG22 has started an informal activity to develop an SBS waveform uncertainty documentary standard, for which there is interest by some TC10 members.
 - ii. Nick has established an IEEE ListServ for this collaborative activity to foster a liaison between the TC10 and the WG22.
 - d. TC10 technical presentations
 - i. Fritz Caspers provided a technical presentation titled “Microwave Sensors and Sensor Systems for Particle Accelerators.” The presentation was followed by questions and discussion.
 - 1. Access to Fritz’s papers can be found by searching “Fritz Caspers” at: <https://cds.cern.ch/?ln=en>.
- 8. Adjourn
 - a. Motion to adjourn was made and seconded.
 - b. Meeting adjourned around 1245 (UTC-4).
- 9. Tasks
 - a. Outstanding tasks (not completed from previous lists)
 - i. WG chairs - review web pages (<https://sagroups.ieee.org/im-wma-tc10/>) for content
 - b. New
 - i. Nick Paulter - upload agenda and draft minutes of 18 Apr 2023 meeting
 - ii. Nick Paulter – upload approved minutes of 17 Jan 2023 meeting
 - iii. Identify volunteer to provide presentation at upcoming (18 July 2023) meeting

Attendee list with affiliation:

Attendee name	Affiliation
Allan Belcher	Signal Conversion, Ltd, UK
Bill Boyer	Sandia Natl. Lab., retired, USA
John Calvin	Keysight, USA
Fritz Caspers	CERN, Switzerland
Charles Cerny	USAF Research Laboratory, USA
Razvan Ciocan	Draper, USA
Luca de Vito	University of Sannio, Italy
Yuji Gendai	THine Electronics, Japan
Grazia Iadarola	Polytechnic University of Marche, Italy
Patrycja Jarosz	IEEE SA, USA
John Jendzurski	National Institute of Standards and Technology, USA
Gregory Kyriazis	National Institute of Metrology, Quality and Technology (INMETRO), Brazil
Donald Larson	Entegra Corp., USA
Kruno Miličević	Computer Science and IT Osijek (FERIT), Croatia; Random Red, Ltd., Croatia
Alessandro Mingotti	University of Bologna, Italy
Gearoid Oheidhin	GE Renewables, UK
Nicholas Paulter	National Institute of Standards and Technology, USA
Balázs Renczes	Budapest University, Hungary
Ioan Tudosa	University of Sannio, Italy

IEEE Waveform Generation Measurement and Analysis Technical Committee (TC10)
Meeting Minutes
18 July 2023 / 11:00 AM –13:00 PM (UTC-4)

1. Call to Order
2. Introductions and Roll Call
 - a. Nick Paulter, TC10 chair, presided and took minutes
3. Approval of the Agenda
 - a. Motion for agenda approval was provided by John J. and seconded by Sergio. No dissenting opinion.
 - b. The approved agenda is available on iMeetCentral (<https://ieee-sa.imeetcentral.com/tc10-general/folder/WzIwLDE0NDI3NzE4XQ>).
4. Approval of minutes from 18 April 2023 meeting
 - a. Motion for minutes approval was provided by Luca and seconded by Charles. No dissenting opinion.
 - b. The approved minutes are available on iMeetCentral (<https://ieee-sa.imeetcentral.com/tc10-general/folder/WzIwLDEzMjA3MTQwXQ>).
5. TC10 administrative
 - a. Comments, concerns, issues for IEEE SA tools was solicited.
 - i. Bill Boyer, 1057 Working Group chair, has difficulties logging into WebEx meetings. Nick mentioned that WebEx has made changes to their application, and this could be causing problems. Patrycja Juorz, IEEE SA staff, should be contacted for assistance.
 - b. Next meeting will be 17 October 2023 starting at 1100 (UTC-4).
 - c. Chair positions
 - i. Nick is seeking a co-chair for the Std 181 Working Group
 1. Luca has tentatively agreed
 - ii. Nick is seeking a chair for the Std 1241 Working Group (not mentioned during meeting)
 - iii. Nick is seeking a chair for the TC10
6. Working Groups Updates
 - a. Revision of IEE Std 181, IEEE Standard for Transitions, Pulses, and Related Waveforms
 - i. Lead: Nick Paulter
 - ii. Awaiting for publication of the IEEE P1241 before starting this activity.
 - b. Revision of IEEE Std 1241, IEEE Standard for Terminology and Test Methods for Analog-to-Digital Converters
 - i. Lead: Nick Paulter
 - ii. Status
 1. The IEEE SA Standards Board approved the revision. The IEEE SA editors will prepare the document for publication. This process requires review and approval by the Working Group.
 2. Balázs, Razvan, John J., Jerry, Charles, Sergio, Gearoid, and Nick will review the document.

- c. Revision of IEEE Std 1658, IEEE Standard for Terminology and Test Methods of Digital-to-Analog Converter Devices
 - i. Lead: Luca DeVito
 - ii. Status
 - 1. The IEEE SA Standards Board approved the revision. The IEEE SA editors will prepare the document for publication. This process requires review and approval by the Working Group.
 - 2. Luca will send an e-mail inviting working group members to assist in the review.
 - d. Revision of IEEE Std 1696, IEEE Standard for Terminology and Test Methods for Circuit Probes
 - i. Lead: John Jendzurski
 - ii. The first five clauses have been reviewed. There are two more clauses to review.
7. Discussion topics
- a. New standards
 - i. Allan mentioned that the output of the current EURAMET activity, Horizon Europe, may produce results that warrant a new standard. More information will be available in the near future, no sooner than early 2024.
 - b. IEEE TC10 history – Bill Boyer
 - i. Bill has completed a draft of the history of the IEEE TC10. He will provide a copy for review to interested members.
 - ii. Charles mentioned that during his Region 1/Region 2 meeting that the IEEE history office is interested in holding a history conference. Charles will provide updates as they become available.
 - iii. Nick had contacted the IEEE history office to gather information on the original standards developed by the TC10. He was able to locate the older, superseded TC10-related standards and has posted them in our iMeetCentral repository: <https://ieeesa.imeetcentral.com/tc10-general/folder/WzIwLDE2NjE3Mjc2XQ>.
 - c. TC10 technical presentations
 - i. Allan Belcher provided a technical presentation titled “Measuring amplitude nonlinearity in beyond the state-of-the-art digitisers : part 2.” The presentation was followed by questions and discussion. Allan’s presentation has been uploaded to our iMeetCentral repository (<https://ieeesa.imeetcentral.com/tc10-general/folder/WzIwLDE0OTMwNzUwXQ/WzIsODQ4MjYzMjJd/>).
8. Adjourn
- a. Motion to adjourn was made. No dissention for this motion was given.
 - b. Meeting adjourned around 1240 (UTC-4).
9. Tasks
- a. Outstanding tasks (not completed from previous lists)
 - i. WG chairs - review web pages (<https://sagroups.ieee.org/im-wma-tc10/>) for content
 - b. New
 - i. Nick Paulter - upload agenda and draft minutes of 18 Jul 2023 meeting
 - ii. Nick Paulter – upload approved minutes of 18 Apr 2023 meeting
 - iii. Identify volunteer to provide presentation at upcoming (17 October 2023) meeting
 - iv. Nick Paulter – identify chair candidates for the 181 Working Group, the 1241 Working Group, and the TC10.

Attendee list with affiliation:

Attendee name	Affiliation
Allan Belcher	Signal Conversion, Ltd, UK
Jerry Blair	Keystone International Inc., retired, USA
Bill Boyer	Sandia Natl. Lab., retired, USA
Fritz Caspers	CERN, Switzerland
Charles Cerny	USAF Research Laboratory, USA
Luca de Vito	University of Sannio, Italy
Yuji Gendai	Thine Electronics, Japan
Grazia Iadarola	Polytechnic University of Marche, Italy
John Jendzurski	National Institute of Standards and Technology, USA
Kruno Miličević	Computer Science and IT Osijek (FERIT), Croatia; Random Red, Ltd., Croatia
Alessandro Mingotti	University of Bologna, Italy
Gearoid Oheidhin	GE Renewables, UK
Nicholas Paulter	National Institute of Standards and Technology, USA
Sergio Rapuano	University of Sannio, Italy
Balázs Renczes	Budapest University, Hungary
Ioan Tudosa	University of Sannio, Italy
Han Woong Yoo	Automation and Control Institute, Austria

TC10 Member List 2023

Abhilasha Kawle	Francisco Alegria	Nicola Giaquinto
Alessandro Mingotti	Francesco Lamonaca	Paolo Carbone
Ali Hassan	Francesco De Paulis	Paolo Crovetti
Andrea Cataldo	Fritz Caspers	Nicholas Paulter
Antonio Moschitta	Grazia Iadarola	PierAndrea Traverso
Eulalia Balestrieri	Gregory Kyriazis	Allan Belcher
Yeou Song Lee	Gearold O H Eidhin	Raffaele Fiengo
Rujun Chen	Hans Yoo	Sergio Rapuano
Michael Cracraft	Ioan Tudosa	Razvan Ciocan
Pasquale Daponte	Jerome Blair	Balázs Renczes
David Macii	John Jendzurski	Steven Tilden
William Boyer	John Calvin	Soumyajyoti Maji
Luca De Vito	Juan de la Rosa	Yossi Ehrlichman
Miguel Pereira	Izzet Kale	Vincenzo Paciello
Dominico Carni	Kevin Marquess	Xiaokang Yin
Dominique Dallet	Kruno Milicevic	Han Woong Yoo
Donald Larson	Fabio Leccese	Yuji Gendai
Charles Cerny	Marty Miller	
Egidio De Benedetto	Martin Hudlicka	