# 2017 GENERAL Meeting Minutes of Power Quality Subcommittee – Harmonics WG (519 and 519.1)

## Meeting Location and Time

Chicago, Illinois  
Tuesday, 2017 July 18, 09:00 to 11:00  
Sheraton Grand Chicago

## MEEting Minutes

### Attendees

Kenn Sedziol Gary Chang

Dan Sabin Jiri Drapela

Rey Ramos Harish Sharma

Theo Laughner Kevin Kittredge

Steven Johnston Scott Peele

Mack Grady Sarah Ronnberg

Math Bollen Carl Miller

Jan Meyer Bill Howe

Francisc Zavoda Matt Norwalk

Paulo Ribeiro Gary Nuzzi

Joe Grappe Wilson Xu

Chester Li Dave Mueller

Alfredo Testa Roberto Langella

Julio Barros Marc Patterson

Mark Halpin Elizabeth Devore

Joseph Sneed Ricardo Torquato

Albert Keri Dave Gilmer

The meeting was called to order by David Zech at 09:00. Minutes were recorded by Matt Norwalk.

### Old Business

Patent slides reviewed – No members had issues

Agenda reviewed by the Chair

Minutes from the 2017 JTCM were reviewed, no comments or objections received.

Motion to approve - Scott Peele, Second - Steven Johnston

### New Business

The PAR Scope was reviewed by the Chair, no objections received. The PAR was submitted in March 2017 and was approved.

**Discussion of question from overseas about measuring limits in Table 1** - Question concerned the use of L-N or L-L voltage measurements. Math Bollen stated that measurements at Transmission should be L-L, below Trans is measured L-N. Math agreed to send references for the WG to review. The Chair reviewed Table 1 in IEEE 519 and solicited a proposal for revisions to the table off line. Scott Peele commented that L-N reads will pick up zero sequence components which may not be present in L-L reads. Mark Halpin commented that L-N readings could be different enough to allow a customer to pass a L-L limit, but not a L-N limit. Mark also commented that transmission PTs will be connected L-G. Scott commented that with many PQ monitors, one can back into phase to phase values if you have phase to neutral measurements, which will include the zero sequence components.

**IEC update from Mark Halpin** – 61000-3-6, limit allocation for installations, is going through 5 year revision cycle. Significant reductions in the complexity of the procedures are planned. There is more push from user community to use current limits and not voltage limits. Third edition of document to come out in 2019 or 2020. Harmonic limits for equipment in the IEC community, tried in the IEEE, not much progress and was abandoned. Project team in IEC has been assembled to look at the technical requirements that need to be considered to transition the IEC limits for use in North America. The impedance differences between North America and Europe is one of many comparisons being performed. Also, a new effort associated with developing limits for small energy producers (roof top PV) (Mark noted that European network is much different than North America and is more of a concern in their design). This group is expected to begin work in middle of 2018. Equipment manufacturers are involved in both efforts. Mark also provided some history on the reasons why past efforts failed and commented that the current project team may also run into issues, but is just starting.

**Update on THD definition** – Math Bollen commented that name should be changed. The Chair stated that one suggestion was TWD, one member commented that the W may confuse readers with an existing THWD which is a “weighted term.” Suggestions also included using I & V designations in each definition to avoid confusion. Dave Mueller suggested always using THDv and THDi to set a good precedence. Mark Halpin commented there is a large difference between traditional THD and TWD, existing limits would be exceeded by approximately 200%. The Chair asked if someone could put together some information on the subject. The Chair solicited volunteers, Mark Halpin is willing to contribute along with Dan Sabin. The Chair requested that submissions include the monitor that was used. Dan Sabin requested calculations that are requested to be used. Harish Sharma agreed to provide an example at the winter meeting. The Chair commented that Marty Page, Mark Halpin, and Gary Nuzzi were working on the measurement method for RMS value and will update the WG at the next meeting.

**Limits Above the 50th** – Math commented that reviewers rejected a paper on high order harmonics. Math appealed to the IEEE Editorial Board. Wilsun Xu provided background on some of the papers that were accepted that covered PWM switching. More discussion is needed. The Chair solicited feedback from the group on how high the limits should be moved up to. Mark commented that we may not have the right experts on high frequencies involved in the WG to determine in impact and mitigation. The Chair is looking for a clear definition of what harmonics should be included. Scott Peele feels that a separate WG should be formed to look at harmonics above the 50th. Mark commented that radio frequency experts may be interested in WG. Quasi CISPER detector was discussed and the applicability to measurements using PTs and CTs was discussed. Math agreed to lead a group to discuss measurement techniques and solicited volunteers. Prior to the meeting, Marty Page made a proposal to increase the limits in IEEE 519 Tables 2, 3, and 4 to the 63rd harmonic.

**Interharmonics Limits Team** – Alfredo Testa discussed work by the group including a panel session at the PES GM, including a presentation by Jan Meyer. Impact of IH discussed along with frequency ranges. Stated that some exceptions for lamps and controllers may be necessary. Team is expanding to include SMEs for lamps and controllers. Study of relevant documents includes 61000-2-2, 1547, and others. Presentation will be provided at the JTCM in 2018. Dave Mueller commented that we should be cautious in setting limits when the accuracy of measurement is in question. Mark Halpin commented that Roger Bergeron may have input for Alfredo and his group on 61000-2-2. The Chair solicited recommendations and wording for an update in the next revision, including whether it is informative or in the main body of the document.

**Transmission Harmonic limits** – Dave Mueller discussed the need to reduce harmonics at transmission levels, particularly above 161kV. The Chair commented that he has seen up to 2.5% on a 345 KV system and has not noticed any issues. Bill Howe cautioned that increasing limits in the absence of customer complaints is dangerous. Kenn Sedziol commented that discussions with individuals that were present when the limits were set is that they were arbitrary numbers. Kenn supports raising the numbers since there is no science to support existing limits. Bill Howe commented that limits should be replaced with scientifically derived limits. Mark Halpin raised the concern that once the document is elevated to a standard there will be a legal requirement to enforce harmonic limits. Many members disagreed that the requirement would apply to the TSO or DSO, and that those entities would have the ability to adopt all or part of the standard, similar to the National Electric Code in the USA. Theo Laughner commented that NERC is looking at harmonic limits. Members also discussed individual company compliance requirements which typically state that one consumer can’t interfere with another and that 519 is used when a problem occurs and that flexibility is there to determine the limit to use to resolve the issue.

The Chair solicited feedback on items within the recommended practice that are an issue in elevating the document to a standard.

**Update on 1547 PQ section** – Even harmonic limits should be increased at the higher even harmonic orders because the impact is not as large as at the lower even harmonic orders. VSC’s don’t output at the same frequencies as line commutated devices that were considered when 519 was developed. They output interharmonics as well as integer harmonics. For this reason the 1547 WG felt that some interharmonics limits needed were needed. The deviation from current limit enforcement for VSC’s was not taken on as there was no easy way to set limits using voltage. The 1547 WG recognizes it is a problem to use current for voltage source on the other side of an impedance. The members discussed the impact of interharmonics on lamps that the 1547 WG may not be considering. Further discussion was taken off line.

Mark Halpin discussed a specific comment from Siemens which proposes to take the same limits for even as for the odd harmonics above the 17th harmonic. Mark suggests that we consider increasing those lower order even harmonic limits in the next version of the document.

Regarding even harmonic limits in 519, Mark Halpin mentioned that the accuracy requirement in 61000-4-7 & 4-30 is greater than the limit numbers themselves.

Misapplication of 519 limits to equipment was discussed. Mark Halpin discussed providing reference to the IEC limits for equipment within 519, to try and decrease the misapplication. These limits would be for informational purposes only and would not be required for compliance with 519. Mark cautioned that converting European limits to North American values is exactly what IEEE P1836/P1837 tried to do and failed.

Mark Halpin solicited contributions.

**IEEE 519.1** – Mark Halpin is still waiting for many case study contributions for 519.1. Those contributions needed are copied here from the 2017 JTCM minutes for convenience.

1. Scope – Mark Halpin (write), Rich Bingham (review)
2. Point of common coupling – Mark Halpin (write), Rich Bingham (review)
3. Measurement – Rich Bingham (write), Dave Mueller (review)
4. Statistical Limits – Theo Laughner (write), Dave Zech (provide data and review)
5. 2nd order harmonic limit relaxation – Kenn Sedziol and Dave Zech (write)
6. Misapplication of harmonic limits to equipment – Dave Mueller (write), Ken Sedziol (review)
7. Interharmonics – Harish Sharma (write), Mark Halpin (review)

### Action items:

1. Math Bollen send information to David Zech for distribution to the WG about measuring voltage distortion L-L.
2. New THD definition team to come up with a proposal on a what to call the new definition, and propose a measurement method for the RMS value
3. Mark Halpin and Dan Sabin put together data showing comparison of THD using the old THD definition and the new definition. Present some examples to the WG at the 2018 JTCM. Harish Sharma provide an example at the 2018 JTCM. Any other interested parties wanting to contribute, please contact David Zech.
4. Math Bollen to lead a small group to research measurement techniques for high frequency harmonics.
5. Limits for harmonics > 50th team to provide recommendation about how high of a frequency (or harmonic order) the limits of Tables 2,3, and 4 should include.
6. Interharmonics limits team to provide recommendation on whether limits should be included in 519, or whether the information should be informative. If limits are to be included in 519, provide a recommendation of those limits.
7. Transmission voltage distortion limits team to provide recommendation for increasing THDv for > 161 KV