



Technical Paper

Key Changes and Differences between the New IEEE 519-2014 Standard and IEEE 519-1992

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Introduction

IEEE Std 519-2014 is a newly published revision to the IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. It supersedes the IEEE Std 519-1992 revision.

The overarching goal of the 2014 revision is the same as the 1992 version; to define the specific and separate responsibilities for each participant - utilities and users - to maintain the voltage THD within acceptable limits at the Point of Common Coupling (PCC) between the utility and the user, and protect the user and utility equipment from the negative impact of harmonics. The separate individual responsibilities are:

- User - limit harmonic currents at the PCC to prescribed levels
- Utility - limit voltage distortion at the PCC to prescribed levels by maintaining system impedance as necessary

To determine if your systems are compliant with IEEE 519-2014, use the HarmonicGuard® Solution Center at hgsc.transcoil.com.

Main Updates and Changes that may affect you

Applying Harmonic Limits at the PCC between Utility and User

The 2014 version re-emphasizes and clarifies IEEE Std 519, as written, is to be applied at the PCC – the point of common coupling between the utility and the user.

The size reduction of the document and the removal of conflicting material aids tremendously in clarifying:

- The standard is designed to be applied at the PCC
- The PCC is the point of common coupling between the utility and user

Current THD Limits at the PCC

A change was made to the Current Distortion Limits table to document what has been practiced in the field for many years – limiting the assessment of harmonic currents up to a maximum of the 50th harmonic. This is accomplished by clearly stating in Table 2 of IEEE Std 519-2014; the maximum individual harmonic range is $35^{th} \leq h \leq 50^{th}$.

Voltage THD Limits at the PCC

Table 11-1 Voltage Distortion Limits in the 1992 version was updated (Table 1 in the 2014 version) with the addition of a new voltage range and limits.

A new lower PCC voltage range of $V \leq 1.0\text{kV}$ was defined with higher allowable harmonic voltage limits: Individual Harmonic at 5% and Total Harmonic Distortion at 8%. These limits are higher than the next highest voltage range $1.0\text{kV} < V \leq 69\text{kV}$.

High Frequency Current Allowance in Low Current Distortion Systems

IEEE 519-2014 provides for an allowance of higher high-order harmonic current limits at a PCC that has

low lower-order harmonics. The allowance is applied to Table 2, Current Distortion Limits, if a prescribed minimum performance level is met. For example, if a power system with $I_{sc}/I_L < 20$ has 5th and 7th harmonic currents at <1% then all other harmonic limits in Table 2 may be exceeded up to a factor of 1.4 and still be in compliance.

Measurements

The IEEE Std 519-2014 version more clearly defines the statistical measurement levels for determining compliance. The new measurement methods will be especially useful for power systems with large amounts of cyclical loads or a power system with varying loads and distortion levels.

As described in more detail in the standard, the three statically based limit bands are:

1. Daily 99th percentile harmonic currents should be less than 2 times the Current Distortion limits in Table 2
2. Weekly 99th percentile harmonic currents should be less than 1.5 times the Current Distortion limits in Table 2
3. Weekly 95th percentile harmonic currents should be less than 1.0 times the Current Distortion limits in Table 2

Format Changes

The 2014 revision is a vastly simplified document compared to the 1992 version. A significant amount of educational material on generation and measurement of harmonics was either deleted or moved from the main body of the document into the appendices. For example, some of the sections that were removed include:

- Section 4 - Harmonic Generation: typical converters that produced harmonics
- Section 5 - System Response Characteristics: details on power system resonance and interaction with converters and power factor correction capacitors
- Section 6 - Effects of Harmonics including impacts on transformers, capacitors and meters
- Section 7 - Reactive Power Compensation and Harmonic Control: Typical passive filter circuits
- Sections 8 & 9 - Mathematic techniques to address THD calculations and measurements

Sections or information from the 1992 version that were moved to the 2014 version's appendices and simplified are:

- Interharmonics and flicker
- Telephone Influence Factor (TIF)
- Notch depth for limits SCR rectifiers

Additional key sections from the 1992 version that have been consolidated and made more concise:

- Section 9 - Measurements of harmonics
- Section 10 - Harmonic voltage current limits
- Section 11 - Addressing harmonic voltage limits

Interested parties may refer back to the 1992 version for educational details when needed.

IEEE Societies

The IEEE Std 519-1992 was a product of and collaboration between two IEEE Societies:

- Transmission and Distribution Committee of the IEEE Power and Engineering Society
- Static Power Converter Committee of the IEEE Industry Applications Society

The IEEE Std 519-2014 document is a product of one IEEE Society, The Transmission and Distribution Committee of the IEEE Power and Energy Society.

Conclusions

IEEE Std 519-2014 is a newly published revision to the IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems. It supersedes the revision IEEE Std 519-1992. This document summarizes key changes and updates made in this latest version.

Your system's compliance with IEEE 519-2014 can be determined with the [HarmonicGuard Solution Center](#).

References

- [1] "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", IEEE Std. 519-1992.
- [2] "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", IEEE Std. 519-2014.



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