

## Dranetz HDPQ Family and IEEE 519-2014

### INTRODUCTION

IEEE Std 519-2014, titled IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems, is the most recent revision of the IEEE recommended practices for harmonics measurement and compliance. IEEE 519-2014 is a revision to IEEE 519-1992 and includes some significant changes and updates to the compliance limits and how harmonics are measured.

The Dranetz HDPQ family of instruments are the first to fully comply with the measurement requirements of IEEE 519-2014. IEEE 519-2014 references the international harmonics measurement standard IEC 61000-4-7 for its measurements. Although many PQ instruments available today measure to IEC 61000-4-7, IEEE 519-2014 adds two additional parameters, along with new statistics reporting for harmonic compliance. Therefore, instruments that only measure to IEC 61000-4-7 are missing required capabilities and only get you partially towards measuring compliance in accordance with IEEE 519-2014.

This application note focuses on the harmonic measurement and compliance reporting aspects of IEEE 519-2014 and how they apply to the Dranetz HDPQ family of products.

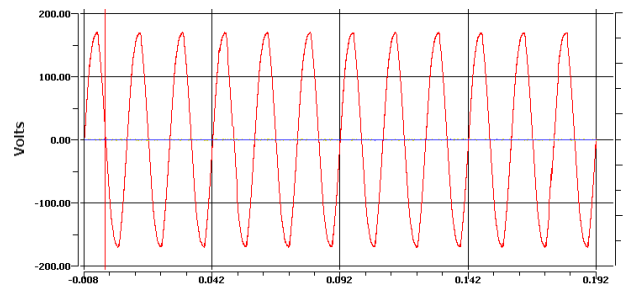
### HARMONIC MEASUREMENT STANDARDS

The original IEEE 519-1992 standard included descriptive information about harmonics and harmonic compliance limits, but did not include details on how to measure the data to compute harmonics. The formulas for THD and other harmonic-based parameters were defined, but it did not specify instrument data acquisition methods to ensure consistent and repeatable harmonic measurements between devices from different manufacturers. The result was different manufacturers used different harmonic measurement techniques that produced different and inconsistent results.

IEEE 519-2014 addresses this by referencing the harmonic measurement techniques of IEC 61000-4-7.

IEC 61000-4-7, and the broader IEC 61000-4-30 power quality measurement standard are well established, and have been adopted around the world. IEEE 519-2014 states "...any instrument used should comply with the specifications of IEC 61000-4-7 and IEC 61000-4-30." Dranetz is a global supplier of power quality monitoring products and has complied with both of these standards since their inception in the early 2000's.

IEC 61000-4-7 defines a harmonic measurement window width of 200ms, which is 12 cycles at 60Hz and 10 cycles at 50Hz. Each (DFT, Discrete Fourier Transform) harmonic analysis uses this 200ms window of data for its computations and this window is the smallest resolution for harmonic measurements in the Dranetz HDPQ family. See the 12 cycle/60Hz example below from a Dranetz HDPQ product:



### NEW PARAMETERS FOR IEEE 519-2014

For statistical analysis, IEEE 519-2014 adds two parameters to the measurement methods in IEC 61000-4-7: Very Short Time Harmonics and Short Time Harmonics. It is important to note that these two new parameters are unique to IEEE 519-2014 and are not part of IEC 61000-4-7. This means that an instrument measuring to IEC 61000-4-7 does not necessarily comply with IEEE 519-2014 unless the new statistical evaluation and compliance reporting methods are also included.

Very short time harmonics are assessed over a 3-second interval and include 15 consecutive 200ms (12/10 cycle) windows. Without going into the specific details, frequency components are aggregated over

this interval and are then used for statistical evaluation.

Short time harmonics are assessed over a 10-minute interval and are an aggregation of 200 consecutive very short time values. Like very short time harmonics, short time harmonics are aggregated over the required (10 minute) interval and then used for statistical evaluation.

### IEEE 519-2014 HARMONIC STATISTICAL EVALUATION

IEEE 519-2014 states that very short time harmonics should be accumulated over a one-day period and the 99<sup>th</sup> percentile values should be calculated for each individual harmonic to the 50<sup>th</sup> each day. Short time harmonics should be accumulated over a one-week period, and the 95<sup>th</sup> and 99<sup>th</sup> percentile values should be calculated for each individual harmonic to the 50<sup>th</sup> each week. IEEE 519-2014 also includes recommended harmonic limits measured at the PCC (Point of Common Coupling). The intent is to manage the harmonics at the interface point between utility system owners and end users, so the specified limits apply only at the PCC and not for individual loads.

For voltage harmonics, the recommended limits for individual harmonics and VTHD are specified at various bus voltages measured at the PCC. Acceptable limits are based upon the bus voltage, with higher bus voltages having lower acceptable limits (they are farther away from the harmonic generating loads).

Similarly, recommended limits for individual current harmonics are specified at several different bus voltage levels at the PCC, but TDD (Total Demand Distortion) is referenced and not ITHD. This means that TDD must also be measured by the instrument. Current harmonics measured at higher bus voltage levels have lower acceptable limits (they are farther away from the harmonic generating loads).

The actual compliance limits are outside of the scope of this application note, so see section 5 of IEEE 519-2014 for more details.

### DRANETZ HDPQ IEEE 519-2014 REPORTS

Although Dranetz products have measured harmonics to IEC 61000-4-7 for many years, IEEE 519-2014 adds the two new harmonic measurement parameters and statistical evaluation required. The only Dranetz product that can fulfill these requirements is the Dranetz HDPQ family.

The Dranetz HDPQ family has a built in harmonic statistics report that compiles the very short time and short time harmonics. It produces pass/fail daily and weekly voltage and current harmonic compliance reports in accordance with the IEEE 519-2014 standard.

To view the report, press the **Harmonics Statistics Report** button in the **View Data** page.

You will then see a list of daily and weekly harmonic statistic reports over the last 31 days, with each indicating pass or fail. There will be one very short time 99<sup>th</sup> percentile report for each day, and two short time reports for each week, one for the 99<sup>th</sup> percentile and the other for the 95<sup>th</sup> percentile.

Harmonics Statistics					
Reports for 31 days prior to and including:			Apr 17, 2017		
Date	Interval	Statistic	Compliance	Channel	
Apr 17, 2017	Daily	Very Short (99th)	Pass		
Apr 16, 2017	Daily	Very Short (99th)	Pass		
Apr 15, 2017	Weekly	Short (99th)	Pass		
Apr 15, 2017	Weekly	Short (95th)	Pass		
Apr 15, 2017	Daily	Very Short (99th)	Pass		

Simply select a report in the list and press **OPEN** to view the details of the compliance for each harmonic to the 50<sup>th</sup>.

Harmonics Statistics Details									
Date:	Interval:			Statistic:				Compliance:	
Apr 17, 2017	Daily			Very Short (99th)				Pass	
Harm.	AV	AI	BV	BI	CV	CI	DV	DI	
2	0.047	2.193							
3	2.570	112.315							
4	0.067	2.037							
5	1.754	103.085							
6	0.030	1.983							
7	0.465	91.575							
8	0.027	2.169							
9	0.633	77.958							
10	0.017	2.205							
11	0.369	63.174							
12	0.013	2.103							
13	0.209	48.989							

### SUMMARY

IEEE 519-2014 is a significant update to the original version from 1992. In addition to specifying new harmonic compliance limits, IEEE 519-2014 specifies harmonic measurement techniques based upon the global standard IEC 61000-4-7 and adds new harmonic parameters to that are used for the compliance limits.

The Dranetz HDPQ family is the only product from Dranetz, and possibly all other manufactures, to fully conform to both the measurement and compliance reporting requirements of IEEE 519-2014.

**To CONTACT DRANETZ**

- Call 1-800-372-6832 (US and Canada) or 1-732-287-3680 for Technical or Sales support
- To submit a support request online, please visit:  
<http://www.dranetz.com/contact-us-2/technical-support-request/>