

APPLICATION GUIDE

IEC61000-4-7 Harmonic & Interharmonic grouping

Introduction

The IEC61000-4-7 standard represents guidance for instrumentation manufacturers regarding harmonic and interharmonic testing and measurement techniques relating to testing to the limits specified in IEC61000-3-2 and IEC61000-3-12.

IEC61000-4-7:2002+A1:2009 (Ed 2.1) introduced the concept of harmonic grouping and interharmonic grouping.

Harmonic Grouping:

Figure 1 below provides a general structure for the signal processing chain within a harmonic analyzer compliant to IEC61000-4-7.

This diagram features several outputs, in order to gain a better understanding of the signal processing involved within each stage of the acquisition chain. Pre-processing and sampling conversion is outside the scope for this application note.

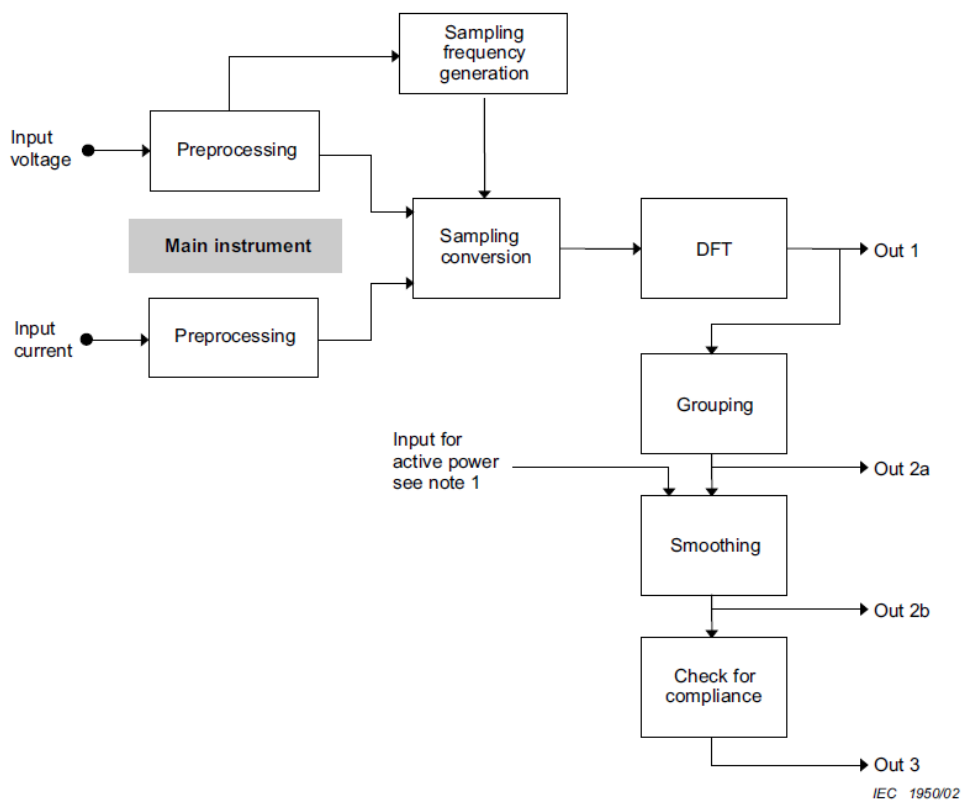


Figure 1.

OUT 1

Output 1 is the raw output of the DFT, this is a 5Hz resolution discrete Fourier transform output of the sampled data window.

Equation (1) in section 3.1 details the recommended Fourier transform

$$f(t) = c_0 + \sum_{m=1}^{\infty} c_m \sin\left(\frac{m}{N} \omega_1 t + \phi_m\right)$$

Equation 1.

Output 1 is passed to the Grouping operation, grouping is a source of much confusion in the industry as the IEC61000-4-7 standard describes both "Harmonic Grouping", as per section 5.5.1 and "interharmonic grouping, as per Annex A.

It is only "Harmonic grouping" that is required for the analysis of harmonic levels against the limits stipulated within IEC61000-3-2 and IEC61000-3-12.

"interharmonic grouping" is an informative analysis technique that at this time, is not required by IEC61000-3-2 and IEC61000-3-12. In the future, interharmonic grouping may have limits applied within future versions of IEC61000-3-2 and IEC61000-3-12 but at this time interharmonic grouping is for informative purposes only and is not required for compliance testing to IEC61000-3-2 and IEC61000-3-12.

Harmonic Grouping (Grouping)

The grouping process involves "the sum of squared intermediate lines between two adjacent harmonics according to equation 8". The important point to note within this statement is "adjacent", this means that the spectral component located in between each harmonic are squared and summed, with the adjacent spectral components being halved before squaring.

$$G_{g,n}^2 = \frac{C_{k-5}^2}{2} + \sum_{i=4}^4 C_{k+i}^2 + \frac{C_{k+5}^2}{2} \quad \{50 \text{ Hz system}\}$$

$$G_{g,n}^2 = \frac{C_{k-6}^2}{2} + \sum_{i=5}^5 C_{k+i}^2 + \frac{C_{k+6}^2}{2} \quad \{60 \text{ Hz system}\}$$

Equation 8.

This applies to all harmonics, including the 2nd harmonic.

Spectral components are spaced at 5Hz intervals, grouping for Harmonic 2 (H2) is indicated below for reference.

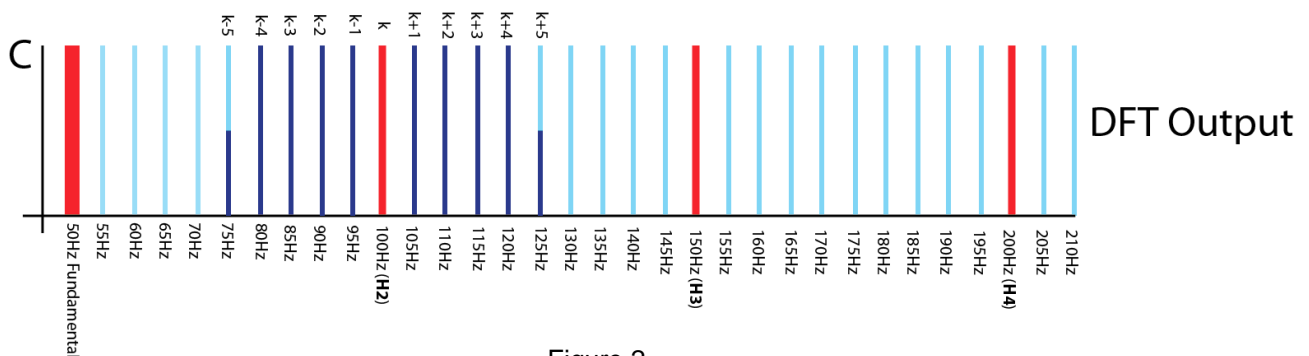


Figure 2.

