

## Harmonics Testing for Japan Electronic Industry Development Association (JEIDA)

### Overview

The Voltech PM3000A power analyzer and IEC1000-3 software permit the testing of harmonic current in accordance with the JEIDA standard. The purpose of this document is to familiarize the reader with the basic requirements of the Japan Electronic Industry Development Association (JEIDA) Ministry of International Trade and Industry (MITI) Guideline for the Suppression of Harmonics in Household and General-Use Equipment. Since the requirements of these documents are very similar to EN61000-3-2, only areas where differences exist will be covered.

### MITI Harmonic Emissions Testing Background

Requirements for harmonic emissions in the Japanese market were first published in the JEIDA document 'Primary Guideline' of July 1993. This document only covered equipment with a rated input power of up to 1kW. It was discontinued in October 1994 with the publication of the 'Guideline for the Suppression of Harmonics in Household and General-Use Equipment' which increased the equipment range to single and three-phase products of 20A/phase or less with supply voltages of 300V or less. A subsequent document, "Plan for Implementation of 'Guideline for Household and General-Use Equipment'" added measurement methods for equipment over 20A/phase, limits for three-phase equipment with nominal voltages up to 415V and provisional limits for three-phase equipment > 600W.

### The Key Difference between IEC and MITI Harmonic Emissions Testing

The objectives stated in the 'Guideline' document are to establish overall goals for the suppression of harmonic currents based on recommendations made by Japanese government agency reports while emphasizing compatibility with IEC standards. In most areas, the MITI guideline adopts the requirements of EN61000-3-2 directly. Classification of equipment, transitory harmonics, limits, measurement requirements and source requirements are the same with very few exceptions. However, the MITI guideline also notes that circumstances particular to Japan will be taken into account and this is where the key difference arises.

**The MITI guideline introduces a mains impedance network between the mains source and the EUT. This is different to the IEC standards which do not use an impedance network when testing current harmonics.** Additionally, a different impedance value is given for each operating voltage, current range and type of source connection as seen in the table below. The source impedance requirements were derived from typical values of voltage drop and phase angles measured in Japanese power distribution systems.

Equipment classification	Input current rating $\leq 20A$	Input current rating $> 20A$
Single-phase two wire, 100V	$0.4\Omega \pm 8\% + 0.37mH \pm 8\%$	$0.19\Omega \pm 10\% + 0.18mH \pm 10\%$
Single-phase two wire, 200V	$0.38\Omega \pm 8\% + 0.46mH \pm 8\%$	$0.21\Omega \pm 10\% + 0.25mH \pm 10\%$
Single-phase three wire	$0.19\Omega \pm 8\% + 0.23mH \pm 8\%$ phase $0.21\Omega \pm 8\% + 0.14mH \pm 8\%$ neutral	N/A
Three-phase (delta connection)	$0.19\Omega \pm 8\% + 0.23mH \pm 8\%$	$0.06\Omega \pm 10\% + 0.07mH \pm 10\%$

## Harmonic Limits

The 'Guideline' document establishes limits for equipment Classes A, B and D which are based on the nominal mains supply voltage. These limits are identical to the values found in EN61000-3-2 however, the IEC standard is only applied to 230/400V systems. Both 100 and 200V are typical in Japan and so each limit is normalized from the IEC levels by:

*Harmonic limit value harmonic*  $\times (230/V_{nom})$ , where  $V_{nom}$  is the nominal mains supply voltage (single phase).

This increases the harmonic current limits by 15% for equipment operating at 200V and by 230% for equipment operating at 100V. Limits for Class C equipment are based on a percentage of the input current thus, adjusting for the supply voltage is not required. The 'Plan for' document adds a limit table for three-phase systems. Again, the limits are identical to the IEC Class A limits but are normalized by:

*Harmonic limit value harmonic*  $\times (400/V_{nom})$ , where  $V_{nom}$  is the nominal mains supply voltage (phase-to-phase).

Since 400V is the phase-to-phase voltage in a system where the phase voltage is 230V, using either formula will result in the same percentage increase of limits for three-phase equipment as long as the correct value of  $V_{nom}$  is applied.

## Provisional Harmonic Limits for Equipment > 600W

The 'Guideline' document includes provisional limits for air conditioners and electronic computers with input power > 600W. These limits are applied until December 31, 1999 and they are to be re-evaluated at the conclusion of the provisional period. For high power equipment, the provisional limits can mean substantial increases up to several times the basic limit. The 'Plan for' document applies the same limits to three-phase equipment with the quantity  $(230/V_{nom})$  replaced by  $(400/V_{nom})$ .

Harmonic order n	Max. harmonic current (A) for equipment > 600W A [ $\times (230/V_{nom})$ ]
Odd harmonics	
3	2.30 + 0.00283 ( W -600 )
5	1.14 + 0.00108 ( W -600 )
7	0.77 + 0.00083 ( W -600 )
9	0.40 + 0.00033 ( W -600 )
11	0.33 + 0.00025 ( W -600 )
13	0.21 + 0.00022 ( W -600 )
15 ≤ n ≤ 39	{0.15 + 0.00020 ( W -600 )} x (15 / n)
Even harmonics	
2	1.08 + 0.00033 ( W -600 )
4	0.43 + 0.00017 ( W -600 )
6	0.30 + 0.00012 ( W -600 )
8 ≤ n ≤ 40	{0.23 + 0.00009 ( W -600 )} x (8 / n)

## Other Differences

Some additional differences between the MITI requirements and EN61000-3-2 are:

- It is stated in the 'Plan for' document that it is desirable for the input power to be within  $\pm 10\%$  of EUT's rating.
- The mains power source compliance is checked with no-load and with resistive loads corresponding to the EUT's rated power.
- Photo copiers < 10 ppm have no limits applied during the provisional period.
- Class D equipment of 75W or less has no limits applied until Dec. 31 2000.
- Notice of conformance is sent to the Japan Electronic Industry Development Association (JEIDA). An example of the form is given in the 'Plan for' document.

## EUT Test Conditions

The MITI guideline lists specific test conditions as below for:

Television Receivers  
 Audio Amplifiers  
 Videotape Recorders  
 Videodisc Players and Recorders  
 Lighting Equipment  
 Independent Dimming Devices  
 Vacuum Cleaners  
 Washing Machines

Microwave Ovens  
 Electromagnetic Cookers  
 Air Conditioners  
 Information Technology Equip.  
 Photocopiers and similar equip.  
 DC Power Supplies  
 Motorized Tools

## Test System

Harmonic emission test systems compliant for EN61000-3-2 can also meet the MITI requirements. The MITI source impedances must be added to the test system along with the special MITI limits which are normalized for line voltage and EUT power over 600W during the provisional period.

Using the latest Voltech IEC1000-3 software, JEIDA harmonic limits can be found by selecting the EN61000:1995 option in the product configure menu. Having selected the JEIDA limits option, the class multiplier option can be used to correct the harmonic limits according to the supply voltage being used. For example, if testing is to be done using a supply voltage of 100V, a class multiplier value of 2.3 should be entered as shown in the diagram below. The software will then adjust harmonic limits accordingly.

