



International
Electrotechnical
Commission

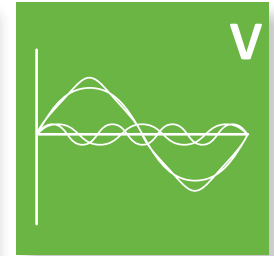
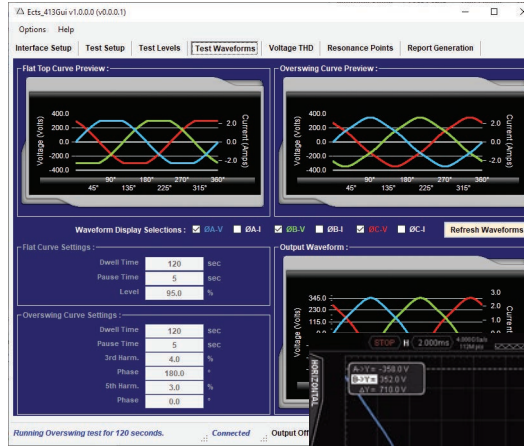
Available Features:

Includes Windows 10 GUI Software and Interharmonics Generator for the following IEC 61000-4 Power Line Immunity Test Standard:

- **IEC61000-4-13**, Harmonics and inter harmonics including mains signaling at AC power port, low frequency immunity tests

Common Features for all IEC 61000-4 Test Sequences Provided:

- Includes test levels for all EUT classes 1, 2, 3 and X. *Accommodates changing IEC standards if needed. Covers all EUT classes.*
- Pre-set test sequences and test levels conform to IEC 61000-4 test standards. *Ready to test out of the box. No need for any programming by the end-user saves time.*
- All IEC 61000-4-13 Immunity tests can be run in sequence or selected individually to allow close observation of EUT performance. *Enables detailed review of EUT behavior to help implement needed design changes.*
- Measurements such as AC source voltage distortion and resonance current are recorded and included in test reports. *Documents and validates AC source compliance and correct EUT behavior during test runs.*
- User guided prompts the operator through entire test procedure. *No detailed IEC Standards knowledge required on the part of the operator, less chance of mistakes.*
- Reports are generated in Rich Text Format for compatibility with most word processors, allowing customization of test reports. *Makes it easy to meet documentation requirements and augment technical construction files with test reports.*
- Option available on AFX Series, AZX Series and LMX Series Power Source Models



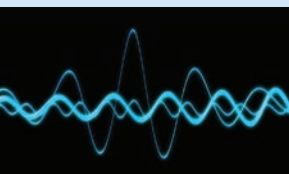
HARM & INTERHARM

IEC 61000-4-13 Immunity Testing

The EMC Directive is one of the 'New Approach' Directives and applies across all 27 member states of the European Union (EU). The Directive applies to all electronic or electrical products liable to cause or be disturbed by electromagnetic interference (EMI). As a result a large number of manufacturers in the electronics or electrical industries need to ensure that their products are compliant with the requirements of the Directive and be able to demonstrate that this is the case in order to affix the CE Mark.

One of these compliance test standards is IEC 61000-4-13 and deals with immunity to harmonics and Interharmonics that may occur on public utility networks.

The -413 Test Option is available on several Pacific Power Source model series and includes Windows 10 control software to run all necessary tests and create detailed test report for compliance documentation.



FREQUENCY CONVERSION

AEROSPACE

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MANUFACTURING

CUSTOM

IEC 61000-4-13 Harmonics and Inter Harmonics

The objective of the IEC 61000-4-13 standard is to ensure that products are impervious to the effects of signaling frequencies that may be present on the public utility power grid. Signaling over AC power lines is often used to remotely control switch gear or other devices.

The IEC 61000-4-13 test requirements are rather extensive compared to the other IEC 61000-4 tests. It also requires a second, asynchronous wave form generator capable of generating inter harmonics. Inter harmonics are not harmonically related to the fundamental power frequency (50Hz or 60Hz) and therefore, it is mandatory that a separate oscillator is used to generate these frequencies. AFX, AZX and LMX power source models can be ordered with the -413 interharmonics generator option.

The IEC 61000-4-13 test required are implemented in the provided by the **Ects_413Gui Windows software**. This software covers all defined EUT classes and nominal voltage and frequency combinations for single, split or three phase EUTs.

Harmonics and Inter Harmonics frequency ranges are swept using pre-scribed frequency step sizes resulting in long test times.

The appropriate IEC 61000-4-13 EUT class and type of test can be selected from the Test Setup tab based on nominal voltage, frequency, phase mode and the type of EUT.

Once selected, the selected test or tests can be started.

A typical IEC 61000-4-13 three phase interharmonic frequency sweep tests is shown in Figure 2.

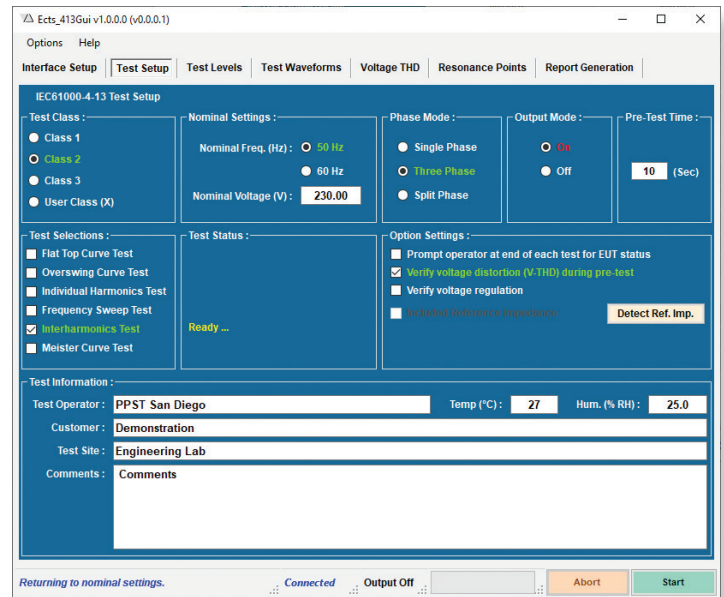


Figure 1: IEC 61000-4-13 GUI Test Execution Control Screen



Figure 2: IEC 61000-4-13 Inter Harmonic Frequency Sweep Test

IEC 61000-4-13 Table	Test	Voltage V_{LN} / V_{LL} (RMS)	Frequency (Hz)	Class/Test Level	Phase Mode
Table 1, 2 & 3	Odd Harmonics	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 ϕ , 3 ϕ
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 ϕ , 2 ϕ , 3 ϕ
Table 4	Inter Harmonics	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 ϕ , 3 ϕ
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 ϕ , 2 ϕ , 3 ϕ
Table 7	Flat Curve	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 ϕ , 3 ϕ
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 ϕ , 2 ϕ , 3 ϕ
Table 8	Over Swing	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 ϕ , 3 ϕ
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 ϕ , 2 ϕ , 3 ϕ
Table 9	Frequency Sweep	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 ϕ , 3 ϕ
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 ϕ , 2 ϕ , 3 ϕ
Table 11	Meister Curve	115 / 208Vac	60 Hz	Class 2	1 ϕ , 3 ϕ
		230 / 400Vac	50 Hz	Class 2	1 ϕ , 2 ϕ , 3 ϕ

Table 1: IEC 61000-4-13 Test Coverage

IEC 61000-4-13 AC Source Requirements

Table 5 of the IEC 61000-4-13 standard specifies AC generator performance requirements. The AFX, AZX and LMX Series AC power sources meet or exceed these requirements as indicated in table 5.

In addition to the AC Source requirements shown in Table 5, the AC voltage distortion of the AC Power Source output under load must meet the same requirements as for IEC 61000-3-2 Harmonics emissions testing. All Pacific Power Sources listed here have been verified to meet these distortion requirements.

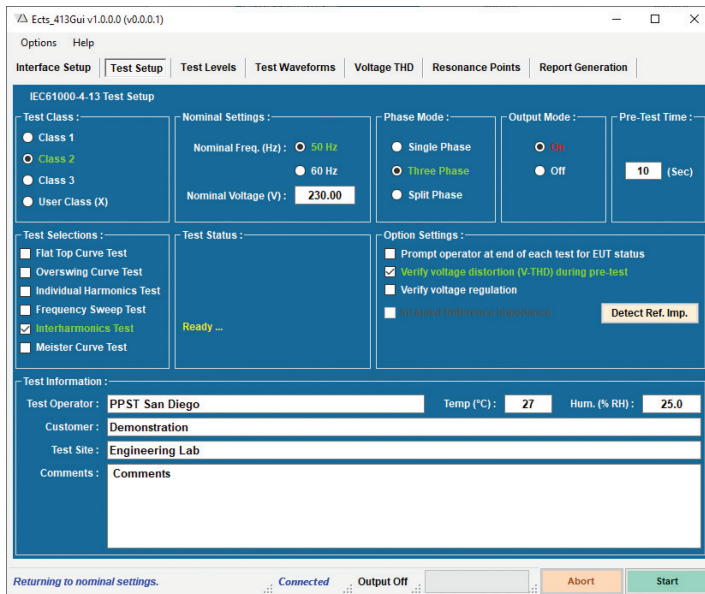
Parameter	IEC 61000-4-13 Requirement	AFX / AZX / LMX AC Source Compliance
Fundamental Voltage:		
- Magnitude U1	Nominal main voltage $\pm 2\%$ single phase Nominal main voltage $\pm 2\%$ three phase	Voltage Accuracy: $\pm 0.5\%$ single phase Voltage Accuracy: $\pm 0.5\%$ three phase
- Frequency	50Hz $\pm 0.5\%$ or 60Hz $\pm 0.5\%$	50Hz $\pm 0.01\%$
- Angle between phases	120° $\pm 1.5^\circ$ (star connection)	120° $\pm 0.5^\circ$
Individual Harmonics:		
- Order	2 to 40	2 to 51
-Magnitude Uh Range Accuracy	0% - 14% Larger of $\pm 5\%$ of Un or $\pm 0.1\%$ of U1	0% to 100% < 3% of Un
- Phase angle h = 2 to 9	0°, 180°	Programmable 0° to 359°
- Accuracy of zero phase crossing with respect to fundamental	$\pm 2^\circ$ of fundamental	$\pm 0.5^\circ$ of fundamental
Inter Harmonics		
-Magnitude Range Accuracy	0% to 10% Larger of $\pm 5\%$ of Un or $\pm 0.1\%$ of U1	0% to 100% < 3% of Un
-Frequency Range Steps for adjusting Maximum error of adjusted value	0.33 x f1 to 40 x f1 0.1 x f1 to 0.5 x f1 $\pm 0.5\% f$	0.33 x f1 to 80 x f1 Exceeds requirements $\pm 0.01\% f$

Table 2: IEC 61000-4-13, Table 5 Generator Requirements

IEC413 Option Graphical User Interface

The included Ects_413Gui Windows 10 graphical user interface provides an easy way for the operator to select the appropriate test parameters, EUT classes and tests for execution. Once a test or all tests are completed, a

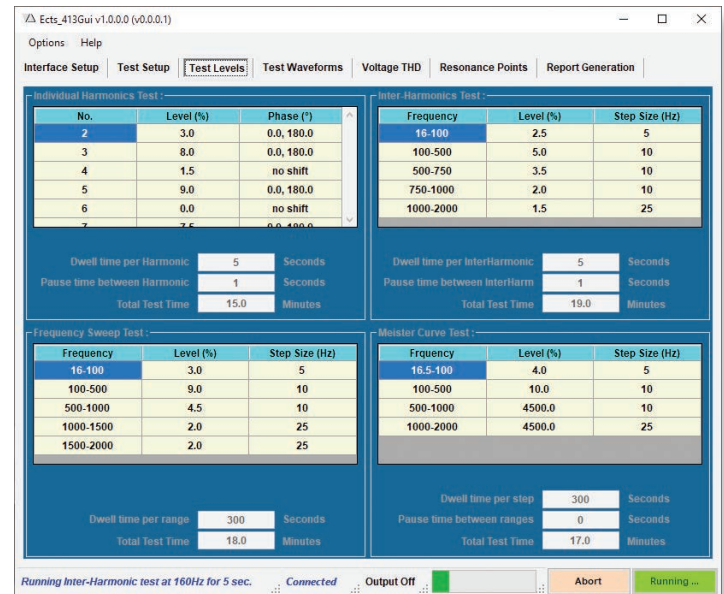
comprehensive test report is generated to document all test parameters and results. The following control and display screen are part of the Ects_413Gui program



Test Setup Tab

The test setup tab allows the operator to select the following settings:

- EUT Test Class 1, 2 3 or User (X)
- Nominal Voltage and Frequency
- Phase Mode - 1, 2 or 3 Phase
- Pre-Test Time, default 10 seconds
- Tests to be Included
 - Flat Top Curve
 - Over Swing Curve
 - Individual Harmonics
 - Frequency Sweep
 - Interharmonics
 - Meister Curve
- Options
 - Prompt Operator for Pass/Fail determination
 - Verify AC Source Voltage Distortion (Vthd)
 - Verify AC voltage load regulation
 - Include Reference Impedance
- Test Information



Test Level Tab

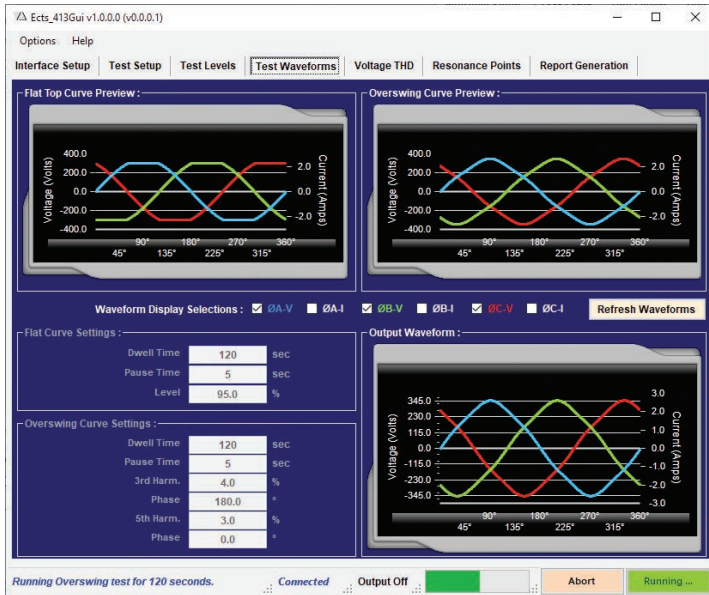
The test levels tab shows the Harmonics and Interharmonics levels for the selected EUT Test Class. For class 1, 2 and 3, this tab is for information purposes only as the levels are fixed to the IEC 61000-4-13 test levels and frequency ranges for the selected EUT class.

Dwell times for each frequency range and any delay time between successive ranges during execution can be adjusted by the user if desired.

For the User Class X, the operator can set custom test levels based on the relevant IEC product category standard if test levels other than for Class 1, 2 or 3 EUTs are called out.

Any User Class test levels can be saved to disk by the operator as needed for future use and can be recalled easily as needed.

IEC413 Option Graphical User Interface

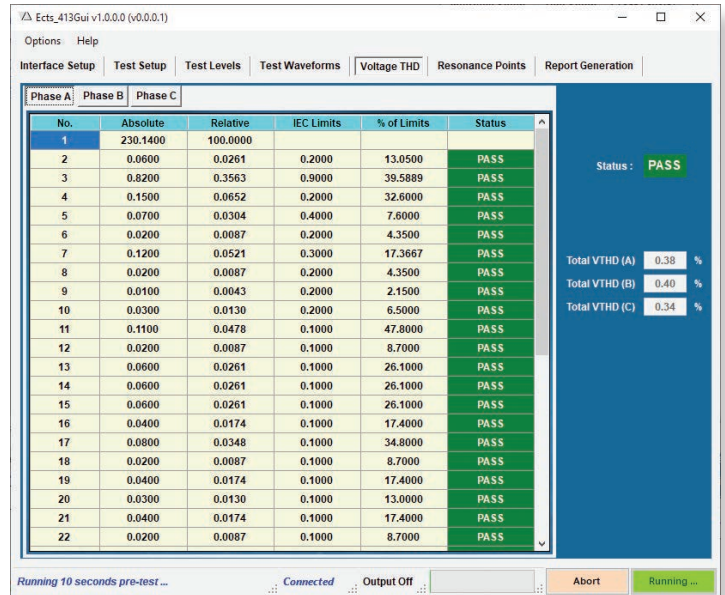


Test Waveforms Tab

The Test Waveform tab allows parameters for duration of each of the three IEC 61000-4-13 special waveforms to be set. It also shows a preview of the waveshapes. In the lower right hand corner, the actual waveforms generated by the AC power source on all three phases are displayed during a test run.

Test waveform included are:

- Flat Top Curve
- Over Swing Curve



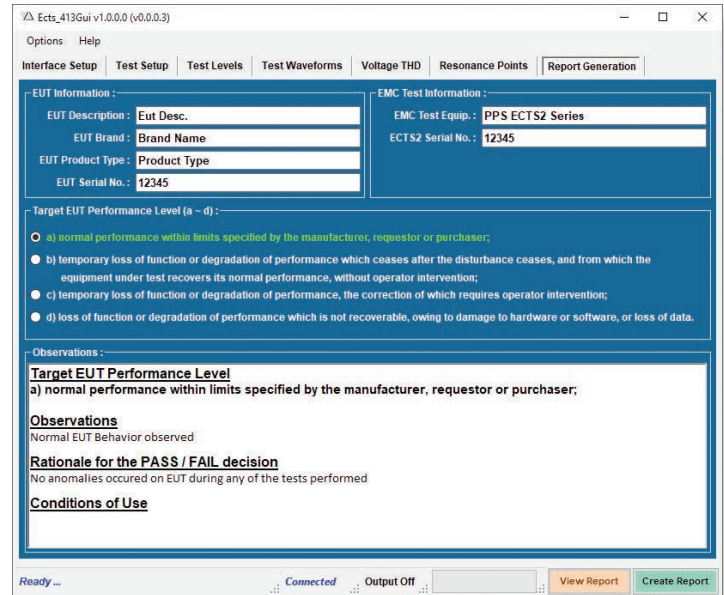
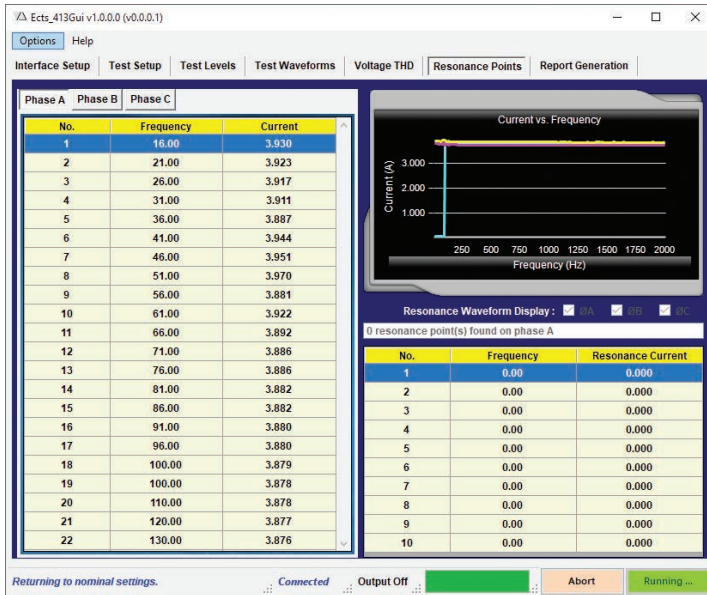
Voltage THD Check Tab

It is important that the AC power source used has a sufficiently low output impedance as to not affect the harmonics current amplitudes caused by generating the harmonics and interharmonics during the test. This ensures that results obtained on different EMC test systems are comparable.

To this end, the voltage distortion of the AC Power source must be checked. This is done by selecting the "Verify voltage distortion (V-THD) during pre-test" check box in the Test Setup Tab. The voltage harmonics from H2 through H40 are measured and compared against the maximum allowable limits per section xxx of the IEC 61000-4-13 standard.

A pass or fail results is recorded and included in the test report. The example above shows a passing result.

IEC413 Option Graphical User Interface



Resonance Points Tab

A current resonance can occur when the inductive and capacitive components of the EUT impedance cancel each other out. If the harmonic or inter harmonic current at a constant harmonic voltage amplitude reaches a maximum value at a frequency f_{res} , and the current decreases by 3 dB in the frequency range f_{res} to $1.5 f_{res}$. A resonance frequency can cause significant thermal disturbances. Thermal effects are not considered in this standard.

When using an AC power source with a very low output impedance like those made by Pacific Power Source, it may be necessary to use an impedance network to find resonance conditions. In that case, the IEC product committee for a given EUT category may recommend the use of an IEC 60725 impedance network. This is the same impedance network found in Pacific's EMC Test Systems (LFZ Series).

If present or when using an ECTS2 Series EMC test systems, the LFZ impedance network is controlled by the Ects_413Gui program when selected.

During the Frequency test, the AC power source is used to measure current and look for resonance conditions. The frequency value for any resonance points found is recorded along with the resonance current and included in the test report.

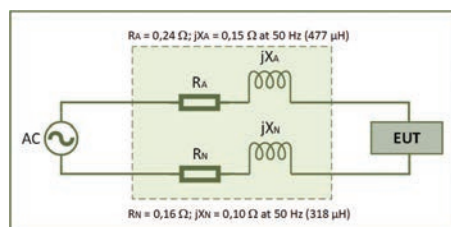


Figure 3: IEC 60725 Lumped Impedance Network (LFZ-1-16A)

Report Generation Tab

Test reports are important to show compliance to required CE mark test standards. The Ects_413Gui provides a comprehensive multiple pages test report in Rich Text Format (.rtf) than easily be converted to PDF, MS word or HTML formatted versions or used as is.

Test reports include all EUT information entered by the operator, EUT class selection, tests performed, any Vthd check data, resonance current data and pass or fail criteria a through d as determined by the test operator at the end of each test.

A sample report is shown below.

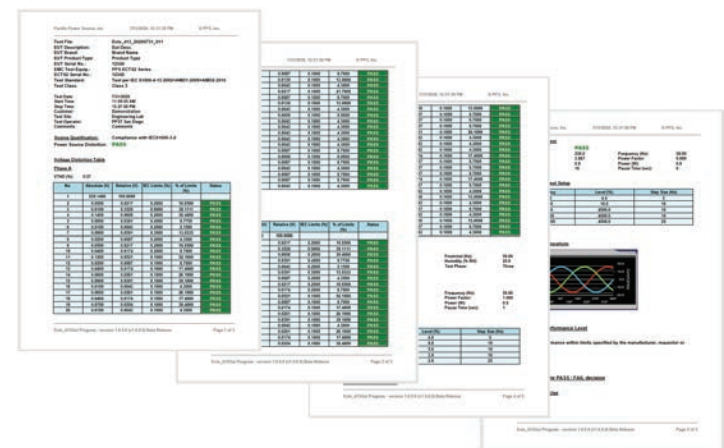


Figure 4: Sample IEC 61000-4-13 EUT Test Report Pages

Test Coverage By Source Model Series

IEC 61000-4 Test	Mode	AFX Series	AZX Series	LMX Series
IEC 61000-4-13	AC	Option C	Option C	Option C

Ordering Information

Order Example

Option C (Appends letter C to Power Source Model.)

- IEC 61000-4-13 Test Option

Note: This option must be ordered with the AC Power Source or ECTS2 System. Existing PPS AC Power Source owners can contact customer service for upgrade information.

Parts of the Standard Delivery

- Interharmonic Generator installed in AC Power Source
- Ects_413Gui for Windows 10 Software (download). License key provided with -413 Option.
- Ects_413Gui User Manual

Compatible with these AC Power Source Series



LMX Series - 500VA to 30kVA



AFX Series - 6kVA to 180kVA



AZX Series - 30kVA to 200kVA



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