

# THE CTSHL TEST SYSTEM



The California Instruments CTSHL is a complete, turnkey compliance test system for harmonics, flicker, and AC immunity testing. It covers standards such as IEC 61000-3-2, IEC 61000-3-12 (Harmonics), IEC 61000-3-3, IEC 61000-3-11 (Flicker), and various IEC 61000-4 AC immunity tests.

The CTSHL system integrates the following key components:

- Tahoe or Sequoia Series AC power source
- Power analyzer conditioning system (PACS)
- Output-matched network impedances (OMNIs)
- PC-based data acquisition system (DAQ)

This configuration ensures full compliance with IEC 61000-4-7 and IEC 61000-4-15 requirements. Measurements utilize precision Hall effect current transformers connected to a multichannel DAQ card in the PC. The system simultaneously captures voltage and current to determine:

- Harmonics (all classes)
- Interharmonics
- Flicker parameters (dt, dc, dmax, Pst, Plt, and 24x dmax)
- Inrush currents

The Windows™-based CTS software automates all required tests and generates detailed, customizable reports in MS Word format. Comprehensive data files are stored for posttest analysis.

## Complete Test Solution

CTSHL is a comprehensive test solution for emissions and immunity compliance testing of AC- and DC-powered products.

### Conducted Emissions Testing

- IEC 61000-3-2 Harmonics < 16 A
- IEC 61000-3-3 Flicker < 16 A
- IEC 61000-3-11 Flicker > 16 A
- IEC 61000-3-12 Harmonics > 16 A

### Immunity Testing

- IEC 61000-4-11 Dips & interruptions (optional)
- IEC 61000-4-13 Interharmonics (optional)
- IEC 61000-4-14 Voltage fluctuations
- IEC 61000-4-17 DC ripple
- IEC 61000-4-28 Frequency variations
- IEC 61000-4-29 DC dips & interruptions

### IEC 60725 Lumped reference impedance

### Direct PC Bus Access

- High sampling rate and resolution for accurate measurements and high-speed data transfers

### Supports European and Japanese standards

### User-Friendly Software Interface

- Provides IEC test setup, data analysis, display, MS Word test reports, and data files in Excel format

### Test Replay

- Single step and fast-forward replay of recorded test data

### Programmable AC Source

- CTSHL includes a Sequoia or Tahoe Series low-distortion, programmable AC source, compliant with the source requirements of IEC 61000-4-7

### Optional Power Quality Test

#### Software Routines

- MIL-STD 704
- MIL-STD 1399
- RTCA/DO-160
- B787B3-0147
- Airbus ABD 0100-1.8
- Airbus ABD A350
- Airbus AMD24

# CTSHL SOFTWARE SUITE

COMPLIANCE TEST SYSTEM FOR HARMONICS, FLICKER, AND AC IMMUNITY TESTING

## Harmonics Testing

The CTSHL software suite allows users to easily select test class options for currents up to 16 A per phase, including configurations for Classes C and D. For tests exceeding 16 A, the system supports limit selection based on IEC 61000-3-12 tables and RSCE criteria.

The Test Setup screen captures key details, including:

- Unit under test (UUT)
- Testing personnel
- Customer information
- Test parameters (e.g., test margin %, test duration)

All these details are automatically integrated into the generated MS Word test report for streamlined documentation and review.

During testing, the system provides real-time monitoring of harmonic currents, ensuring compliance with IEC 61000-4-7. It captures both steady-state and fluctuating harmonics, including transient behaviors from dynamic load changes — critical for meeting IEC 61000-3-2 and IEC 61000-3-12 requirements.

The analyzer, compliant with Class I standards, measures harmonics up to the 40th order using advanced filtering and sampling techniques. This ensures accurate data capture, even during load transitions. Features like graphical displays, detailed data logging, and continuous real-time monitoring simplify compliance tracking and reporting.

The CTSHL system's robust analysis tools enable users to perform in-depth assessments of harmonic distortion and compliance margins. Customizable thresholds and alerts allow for immediate identification of out-of-spec conditions, reducing testing delays and ensuring faster troubleshooting. The platform's user-friendly interface and integration with external devices — such as programmable AC sources — enhance flexibility and adaptability for a wide range of testing scenarios, making it an indispensable tool for regulatory compliance and product development.

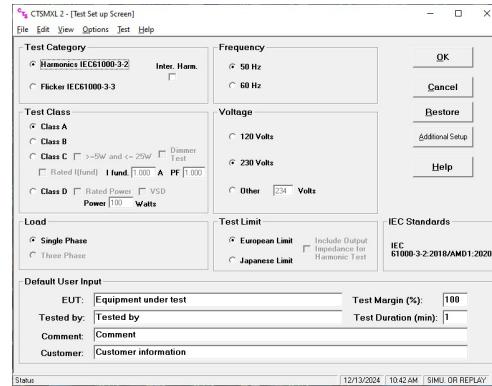


Figure 1. CTSL Test Setup Screen displays easily configurable test parameters.

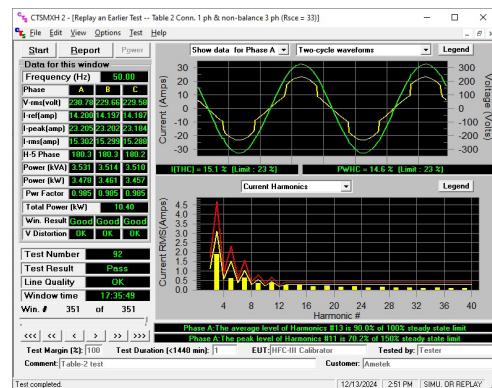


Figure 2. 61000-3-12 Table 2 allows you to replay your test data file to analyze results.

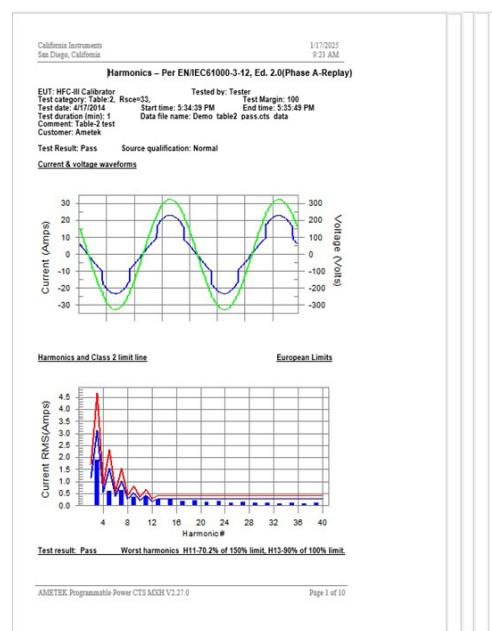


Figure 3. Test reports generated in MS Word.

## Flicker Testing

The system offers full compliance testing for IEC 61000-3-3 and IEC 61000-3-11, delivering a comprehensive solution to assess and evaluate flicker caused by equipment connected to the AC mains. With advanced technology and intuitive features, it ensures accurate measurements and analysis for compliance verification.

The Windows-based CTSHL software automates flicker tests and provides real-time results for  $P_{st}$  (short-term flicker) and  $P_{lt}$  (long-term flicker). There's no need to wait for the entire test to complete — pass/fail status is displayed during testing, enabling quick decision-making.

For compliance with flicker standards:

- A Ztest reference impedance (OMNI-3-75) supports IEC 61000-3-11 flicker testing (-CTSH)
- A Zref impedance (OMNI-3-37) supports IEC 61000-3-3 flicker testing (-CTSL)

The system captures dynamic load changes and provides detailed test reports, simplifying documentation and posttest analysis.

With its precision monitoring capabilities, the system detects even subtle voltage fluctuations that contribute to flicker, ensuring accurate results across a range of operational scenarios. Advanced filtering and signal processing eliminate noise interference, allowing engineers to focus on actionable data while maintaining compliance. For broader flexibility, the CTSHL software supports customizable test parameters, including user-defined thresholds and testing durations. Integration with external hardware, such as programmable AC sources, further enhances adaptability, making the system ideal for both R&D environments and production compliance testing.

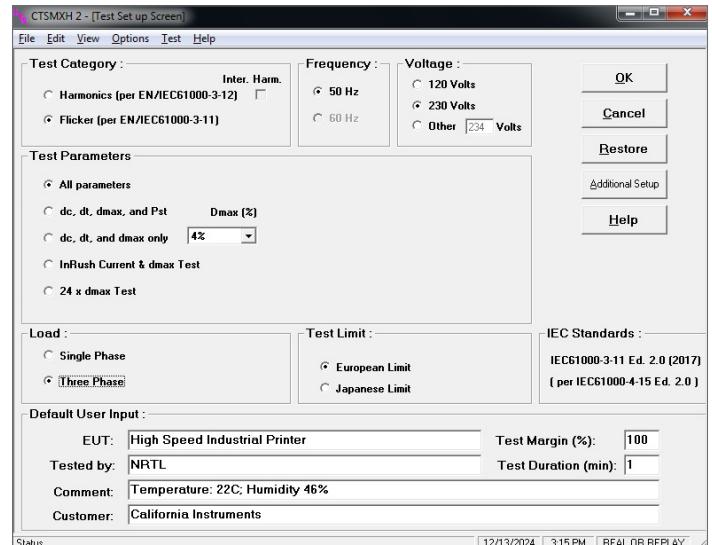


Figure 4. CTSHL Test Setup Screen allows you to select your flicker test.

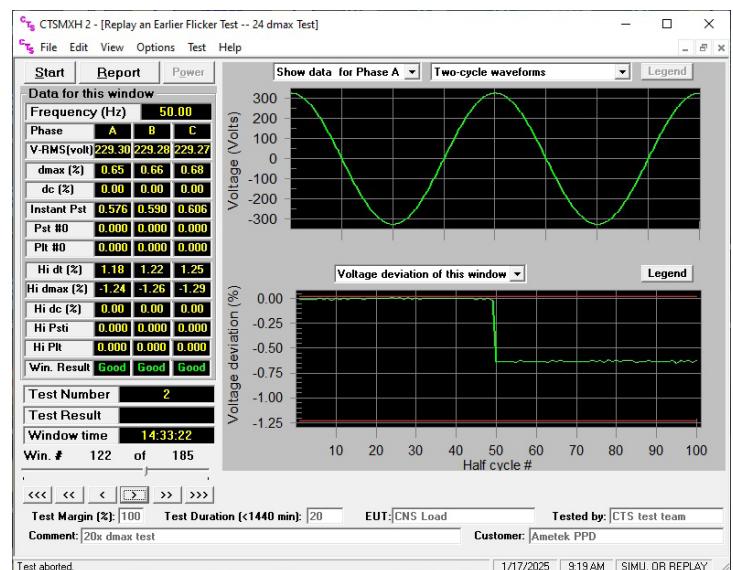


Figure 5. Flicker test.

## Specifications

MEASUREMENT	SPECIFICATION		UOM
BANDWIDTH			
Anti-aliasing	> 60 dB at 5 kHz		%
Bandpass ripple	< 2 % up to 2.5 kHz		
VOLTS			
Range	0.01 - 312.00		Vrms
Accuracy	$\pm 0.1\% \pm 0.05\% \text{ FS} \pm 3 \text{ mV}$		mV
Resolution	10		mV
RMS CURRENT			
Current ranges (auto)	16, 40, 75		Arms
Accuracy	$\pm 0.1\% \pm 0.05\% \text{ FS} \pm 5 \text{ mA}$		mA
Resolution	1		mA
POWER			
Range PACS-3-75	0.1 - 45,000		W/ph
Accuracy	$\pm 0.25\% \pm 0.25\% \text{ FS} \pm 20 \text{ mW}$		mW
Resolution	0.1		W
APPARENT POWER			
Range PACS-3-75	0.01 - 45,000		VA/ph
Accuracy	$\pm 0.15\% \pm 0.15\% \text{ FS} \pm 20$		mVA
Resolution	0.01		VA
POWER FACTOR			
Range	0.00 - $\pm 1.00$		
Accuracy	$\pm 0.05$		
Resolution	0.01		
CREST FACTOR			
Range	20:01		
Accuracy	$\pm 0.005$		
Resolution	0.001		
FREQUENCY			
Range	45 - 65		Hz
Accuracy	0.1 % of reading		Hz
Resolution	0.01		Hz
HARMONIC ANALYSIS			
Range			
Fundamental to 40th			
Accuracy fundamental	$\pm 0.05\% \text{ FS} \pm 0.05\%/\text{kHz}$		
Accuracy harmonics	$\pm 0.1\% \pm 0.1\%/\text{kHz}$		
Measurement window	10 or 12 periods		
Smoothing filter	1.5		sec
FLICKER			
Pst	Range	0.064 - 10.000	
	Accuracy	3	
	Resolution	0.001	
	Integration time	10	
Plt	Range	0.1 - 10.000	
dmax	Range	0 - 100	
dc	Range	0.1 - 100	
dt	Range	0.1 - 100	
dt over 3% (4%)	Range	0 - 1000	
		ms	

## Test Standards

SUPPORTED VERSION	TITLE
IEC 61000-3-2:2018+AMD1:2020 CSV	Limits for harmonic current emissions (equipment $\leq 16 \text{ A}$ per phase)
IEC 61000-3-3:2013+AMD1:2017+AMD2:2021 CSV	Limitation of voltage changes, voltage fluctuations, and flicker (equipment $\leq 16 \text{ A}$ per phase)
IEC 61000-3-11:2017 RLV	Limitation of voltage changes, voltage fluctuations, and flicker (equipment $\leq 75 \text{ A}$ per phase)
IEC 61000-3-12:2011+AMD1:2021 CSV	Limits for harmonic current emissions (equipment $\leq 16 \text{ A}$ per phase)
IEC 61000-4-11:2020 RLV <sup>[1]</sup>	Voltage dips, short interruptions, and voltage variations immunity tests (equipment $\leq 16 \text{ A}$ per phase)
IEC 61000-4-13:2002+AMD1:2009+AMD2:2015 CSV	Harmonics and interharmonics, including mains signaling at AC power port, low frequency immunity tests
IEC 61000-4-14:1999+AMD1:2001+AMD2:2009 CSV	Voltage fluctuation immunity test for equipment with input current not exceeding 16 A per phase
IEC 61000-4-17:1999+AMD1:2001+AMD2:2008 CSV	Ripple on DC input power port immunity test
IEC 61000-4-28:1999+AMD1:2001+AMD2:2009 CSV	Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase

Note <sup>[1]</sup>: Precompliance

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