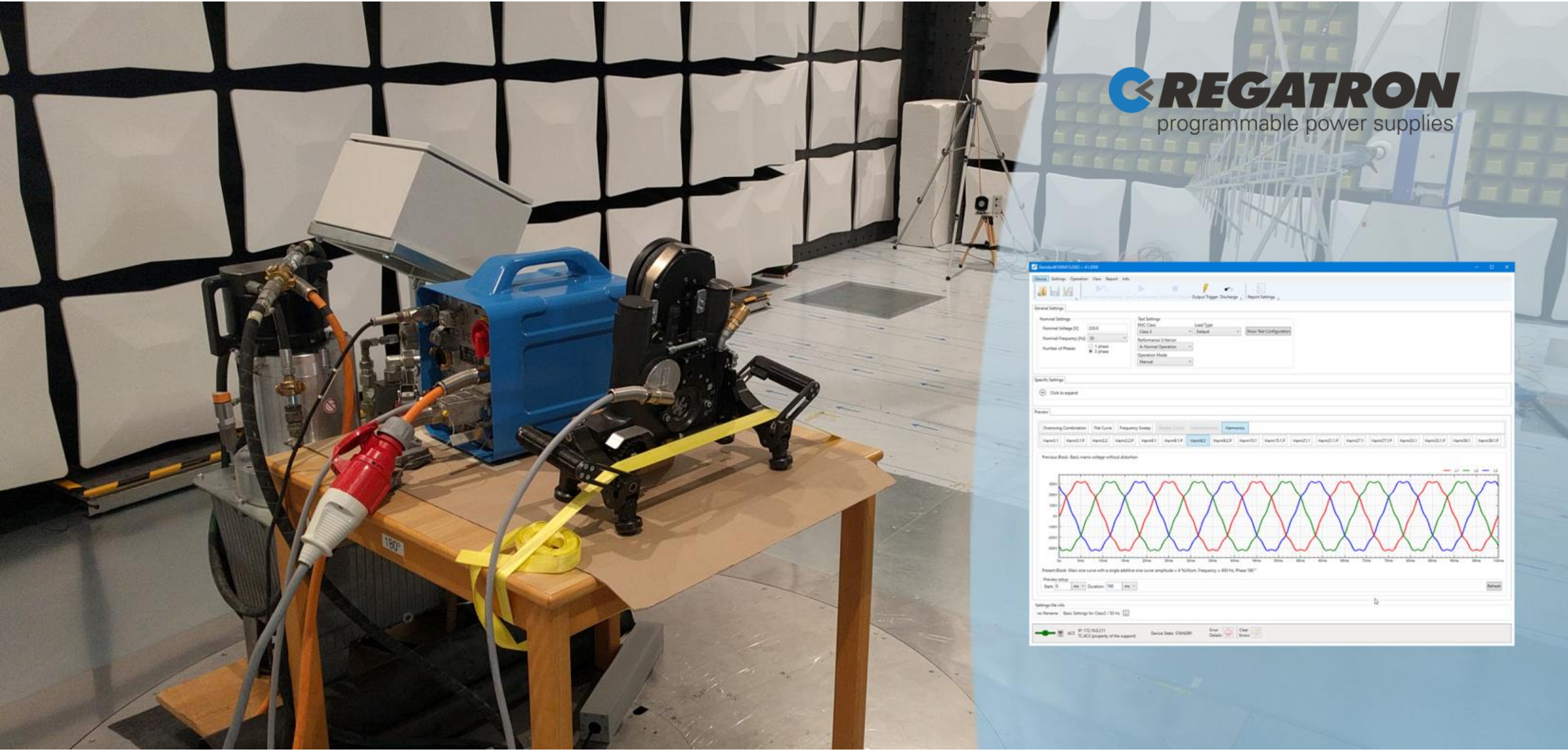

EMC Standards Test System for IEC/EN 61000-4-X

REGATRON offers a turnkey test environment for standard tests according to IEC/EN 61000-4-X EMC regulations, based on the proven 4-quadrant 3-phase power supply TC.ACS. The basic solution includes a TC.ACS device, the software interface ACSControl and the additional EMC standards package. In the case of full compliance test requirements for IEC/EN 61000-4-11 / 27 / 34 standards, the TC.ACS is combined with the TC.VSE device to test fast voltage slopes <5 µs and current peaks up to 1000 A. The ACSControl software features a separate test interface for each standard test with waveform visualization, tracing and verification capabilities, and automatic generation of a test report.

IEC/EN 61000-4-X Standard Tests

- IEC/EN 61000-4-11:2004
  Voltage dips, short interruptions, and voltage variations immunity tests up to 16 A per phase. Full compliance testing requires additional hardware TC.VSE.
- IEC/EN 61000-4-13:2002 + A1:2009
  Harmonics and interharmonics immunity tests.
- IEC/EN 61000-4-14:1999 + A1:2001 + A2:2009
  Voltage fluctuation immunity test.
- IEC/EN 61000-4-27:2000 + A1:2009
  Unbalance, immunity test up to 16 A per phase. Full compliance testing requires the additional hardware TC.VSE.
- IEC/EN 61000-4-28 + A1:2004 + A2:2009
  Variation of power frequency, immunity test.
- IEC/EN 61000-4-34:2005 + A1:2009
  Voltage dips, short interruptions, and voltage variations immunity tests more than 16 A per phase. Full compliance testing requires the additional hardware TC.VSE.

System components

Voltage VAC (L-N)	Power kVA	Current Arms	Frequency Hz	Order Code
TC.ACS				
3× 0…305	30	43	0…1000	TC.ACS.30.528.4WR.S
3× 0…305	50	75	0…1000	TC.ACS.50.528.4WR.HC
TC.VSE				
3x 0…305		75 cont. 1000 peak	50/60	TC.VSE.50.528.2WR.S

Figure 1: Compact 19" units: 50 kVA 4-Q power supply TC.ACS together with voltage slope enhancer unit TC.VSE for standard testing according to IEC/EN 61000-4-11, -4-27, -4-34.

The multi-level inverter technology of TC.ACS together with a remarkable high switching frequency opens up the way to a wide base frequency range from DC up to 1000 Hz and an exceptionally high modulation bandwidth of 5 kHz with voltage slope of up to 4 V / µs. These capabilities provide the basis for the EMC testing according IEC/EN 61000-4-X. For even faster voltage slopes, TC.ACS can be combined with the solid state switching unit TC.VSE. The switching between the local grid voltage and the sychronised grid simulation of the TC.ACS unit allows voltage rise times and drops below 5 µs as requested by IEC/EN 61000-4-X.
Besides the specific use for EMC immunity testing the great benefit of the TC.ACS solution is the wide use in different applications.

- Full 4 quadrant regenerative Grid Simulator for inverter and on-board charger (OBC) testing
- Self-contained RLC load mode for various load and Anti-Islanding testings
- Full 4 quadrant hi-speed amplifier for versatile use in P-HIL applications
- EMC emmission testing according IEC/EN 61000-3-X
- Application range from a few kVAs scalable up to 2000+ kVA power systems
- Powerful application software ACSControl for flexible use in the laboratory with comprehensive API and optional CAN interface for integration into automated test rig

For further information please refer to the related datasheet: DS_TC.ACS.50.528.4WR.HC.LC_EN_...

Software ACSControl / Standards Option

While any grid disturbance can be programmed manually with the option GridSim, also those listed in IEC/EN 61000-4-X, the standards test option of ACSControl provides these tests preprogrammed and ready to be used.
This makes ACSControl a complete software environment that provides intuitive and overall control of the TC.ACS.
Each preprogrammed standard test consists of a certain number of sequences. These sequences consist of several blocks, which can be executed as a whole or as individually selected blocks.

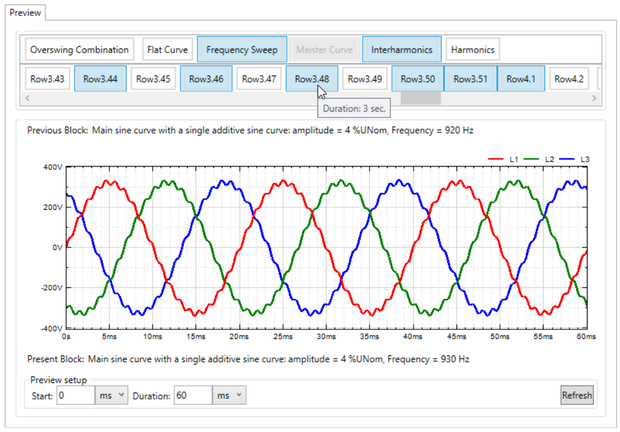

Figure 2: Individual block selection and preview

Test Programming

Each standard test has its dedicated control page where general and specific settings for the selected test can be modified by the user.

Depending on the selected standard, various EMC classes 1 to 4 predefined by the standard can be selected, as well as a “Class X”, where the values for disturbances such as dip deepness, harmonic content, frequency shift, etc. are freely adjustable.

While each block can be verified with a preview function (Figure 2), it is also possible to execute the test as a whole or just as selected parts.

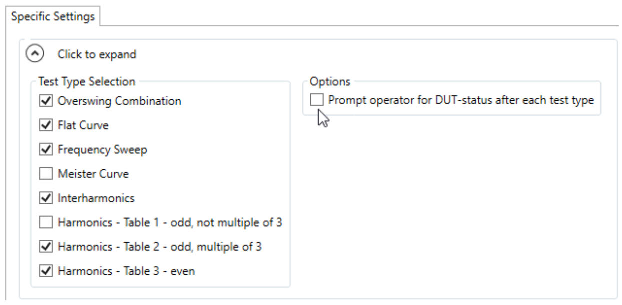

Figure 3: Free test selection with user interaction

After the execution of each test type, the user has the option to note all observations. These notes are included in a test report.
During commissioning of the DUT at nominal values, it is possible to check and verify all values with an external power analyzer.

Selectable test parameters

General Settings

- Nominal Voltage (Grid voltage for 4-11, 4-27, 4-34)
- Nominal frequency: 50/60 Hz
  (Grid frequency for 4-11, 4-27, 4-34)
- Number of phases: 1 phase / 3 phase

61000-4-11 Test Settings

- Direction of rotation
- EMC Class: 2, 3, X
- Dip vector calculation method: 1, 2
- Test type selection: Voltage dip, Voltage interruption, voltage variation
- Parent Standards: 38 (see Table 1)

61000-4-13 Test Settings

- EMC Class: 1, 2, 3, X
- Performance criterion: A, B, C , D
- Operation mode: Manual or wizard
- Load type: capacitve, resistive
- Test type: Overswing, flat curve, frequency sweep, meister curve, interharmonics, harmonics odd, harmonics odd multiples of 3, harmonics even
- Prompt operator for DUT status: selectable

61000-4-14 Test Settings

- EMC Class: 2, 3, X
- Performance criterion: A, B, C , D
- Voltage fluctuation: Un, Un-10%, Un+10%
- Prompt operator for DUT status: selectable

61000-4-27 Test Settings

- EMC Class: 2, 3, X
- Performance criterion: A, B, C , D
- Test type: 1, 2, 3 incl. sequence selection 1,2 3
- Prompt operator for DUT status: selectable

61000-4-28 Test Settings

- Test severity level: 2, 3, 4, X
- Performance criterion: A, B, C , D
- Frequency fluctuation
- Prompt operator for DUT status: selectable

61000-4-34 Test Settings

- Direction of rotation
- EMC Class: 2, 3, X
- Dip vector calculation method: 1, 2
- Test type selection: Voltage dip, Voltage interruption, voltage variation
- Parent Standards: 38 (see Table 1)

Parent Standards

IEC/EN 61000-6-1:2016	EN 61000-6-1:2007
IEC/EN 61000-6-2:2016	EN 61000-6-2:2005
IEC/EN 61000-6-5:2015 - Table 5	EN 61000-6-5:2015 - Table 5
IEC/EN 61000-6-5:2015 - Table 9	EN 61000-6-5:2015 - Table 9
IEC/EN 61000-6-7:2014	EN 61000-6-7:2015
IEC/EN 62041:2017 - Table A.7	EN 62041.2010 Table 10+11 Environment 1
IEC/EN 62041:2017 - Table 4.8	EN 62041.2010 Table 10+11 Environment 2
IEC/EN 60601-1-2:2014	EN 60601-1-2:2015
IEC/EN 606017-1-2:2007	EN 60601 1-2:2007
IEC/EN 61326-1:2012 - Table 1	EN 61326-1:2013 Table 1
IEC/EN 61326-1:2012 - Table 2	EN 61326-1:2013 Table 2
IEC/EN 61326-1:2012 - Table 3	EN 61326-1:2013 Table 3
IEC/EN 61347:2009	EN 61547:2009
IEC/EN 61800-3:2017 - Table 7 + 9	EN 61800-3:2004 + A1:2012
IEC/EN 61800-3-2:2017 - Table E.7 Environment 1	EN 61800-5-2:2017 - Table E.1 Environment 1
IEC/EN 61800-5-2:2017 - Table E.7 Environment 2	EN 61800-5-2:2017 - Table E.1 Environment 2
CISPR 14-2:2015	EN 55014-2:2015
CISPR 24:2010	EN 55024:2010 + A1:2015
CISPR 35:2016	EN 55035:2017

Table 1: Parent standards for 61000-4-11 and 61000-4-34

Sequence Tracing and Verification

After starting the test sequences, the state of advance is shown in the sequence tracer on the Graphical User Interface (GUI).

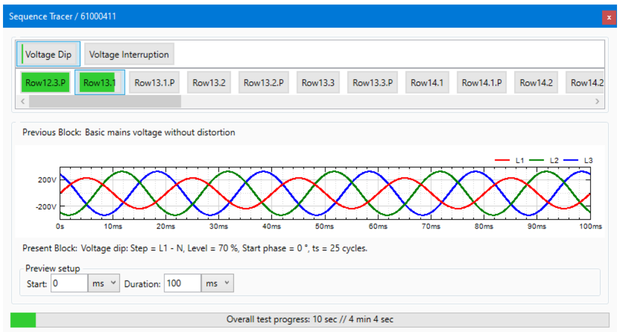

Figure 4: View of actual block and information about previous block

The TC.ACS system generates trigger signals for external measurements with power analyzers. This allows for catching every single step and thus each disturbance.

Test Report

A test report with information regarding hardware and software versions of the testing equipment as well as which parts of the selected standard have been executed can be created automatically.
Further information such as operator, tested product, and ambient conditions to be included in the report may be specified in advance by the user. Optional user observations during the test may be entered after each test type and will also be included.

Standard conformity

To guarantee the conformity of the standard test, the voltage accuracy of the TC.ACS can be verified by calibrated external measurement tools before executing the test proceedure. In case the accuracy is not within the limits according to the IEC/EN 61000-4-X standard, Regatron provides an adjustment tool for the simulated voltage.
The voltage calibration of the TC.ACS can be done on-site by the end-user or any third party service provider. Calibrations and adjustments can be done by means of a step-by-step manual and the control and maintenance software ACSControl.

TC.VSE

For fully compliant standard testing according to the IEC/EN 61000-4-11, IEC/EN 61000-4-27, and IEC/EN 61000-4-34, the TC.VSE unit is required. The tests described in these standards require the execution of voltage drops, short interruptions, and voltage variations. Here, switching at any time, not only at zero crossing of the voltage, is mandatory. This leads to high pulse currents with below listed characteristics.

- Voltage rise time: 1 – 5 µs
- Peak currents (RMS): 250 A / 500 A / 1000 A
- Maximum constant current: 75 A

To satisfy these requirements, the TC.VSE unit operates in combination with the TC.ACS grid simulator. The main scope of the TC.VSE is to switch between two different voltage sources, e.g. your utility grid and TC.ACS. To guarantee the short switching time of a maximum of 5 µs the TC.VSE uses semiconductor switches.

The main functionalities of each source in this setup are:

- Mains: Generates the nominal voltage applied on the device under test. This source generates high currents. The standard requires a voltage tolerance of ±2% for the complete duration of the test at no load.
- TC.ACS: Generates a controlled output voltage according to the test sequence (voltage drops and variations). This source does not have to generate high current peaks or extremely fast voltage steps.

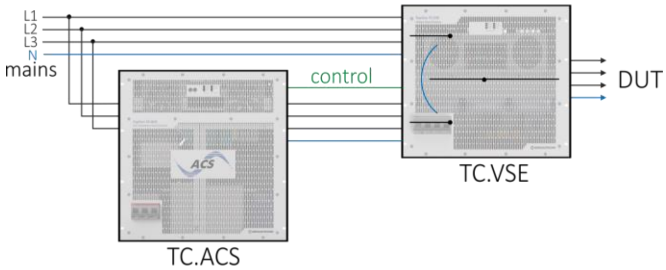

Figure 5: Compact 19“ units: 50 kVA 4-Q power supply TC.ACS together with voltage slope enhancer unit TC.VSE for standard testing according to IEC/EN 61000-4-11, -4-27, -4-34.

TC.VSE is fully controlled by TC.ACS grid simulator via analog and digital interfaces and the software option for standards testing.

For further information about TC.VSE unit, please refer to the related datasheet DS_TC.VSE.50.528.2WR.S_EN_...

Technology

- Technologically advanced, fast switching, compact 19-inch power modules
- Multi-level inverter technology
- Fundamental frequency up to 1000 Hz
- Modulation bandwidth 5 kHz leads to $100^{th}/83^{rd}$ harmonic at 50/60 Hz reproduced with exactness
- Modular design of TC.ACS allows system power up to 2000+ kVA
- Flexible use over pure EMC testing

Additional Functionality

Of course, the system can easily and comprehensively be adapted to various tasks beyond the ones listed in EN 61000-4-X. Tasks to be carried out within the fields of R+D, laboratory, end-of-line testing, and education such as:

- Variation of basic system voltages and frequency
- Voltage drops in the whole mains or individual drops per phase
- Micro ruptures and flickers
- Over- and under voltages
- Voltage asymmetries
- Superimposed harmonic and interharmonic voltage waveforms
- Individual variation of phase angles
- Transition from feeding to regeneration operation and vice versa

System Capability

The IEC/EN 61000-4-X standard test solution is available as single TC.ACS and TC.VSE units or, even more convenient, it comes fully integrated into an 19” cabinet with various options.

- Mobile solution with AC cable and connectors
- Increased emergency stop reliability supporting performance level PL c / PL e according to EN ISO 13849
- For all standard tests which do not require a TC.VSE, it provides a digital output to activate an external bypass contactor to minimize reconfiguring work.
- Turn-key cabinet solution or project-specific system integration according to customer’s specification
- TC.ACS liquid or air cooled

This product is developed, produced and tested by REGATRON, ISO 9001 certified.

For detailed technical information, contact your local sales partner or REGATRON.

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