

Scienlab Charging Discover Test Case Library

SL1094A



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Introduction

The Scienlab Charging Discovery System (CDS) from Keysight enables users to define, compile and execute custom test routines easily (see also item “SL1040A-S01” and “SL1093A-FP” in separate datasheets). In addition, Keysight provides complete test case libraries for all important charging conformance and interoperability standards. Each library is developed according to official specification and carefully verified with all CDS hardware configurations and every software release version. Hence, it is the quickest and most simple way to get valid test results out of the box.

This datasheet gives an overview of all currently available test case bundles and explains its content. Each library is based on a national or international standard that specifies a certain number of concrete test cases with detailed description of test actions and the expected behavior.

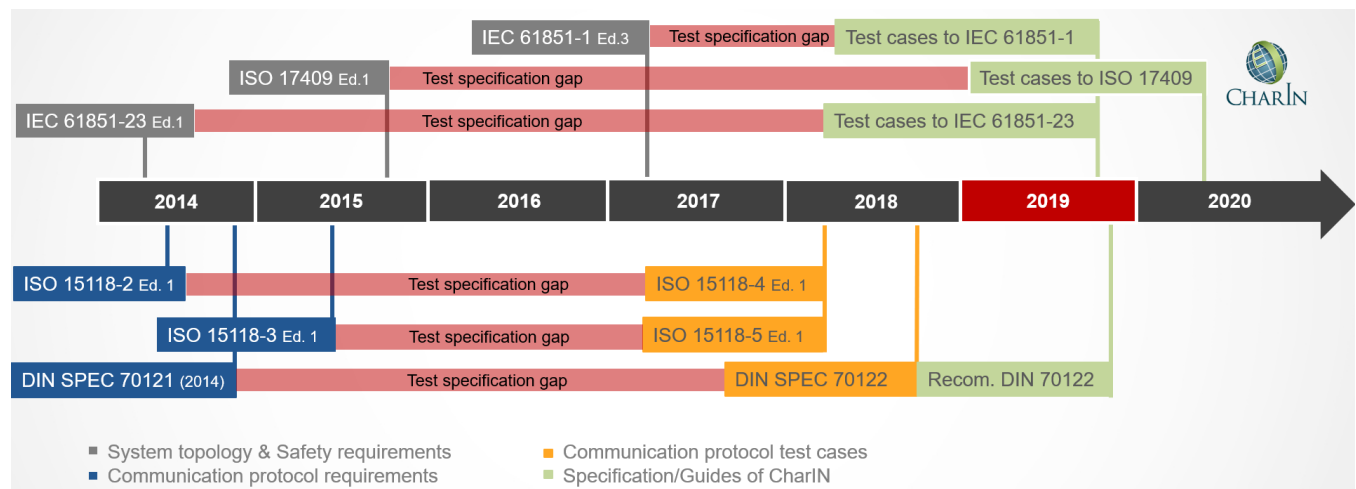
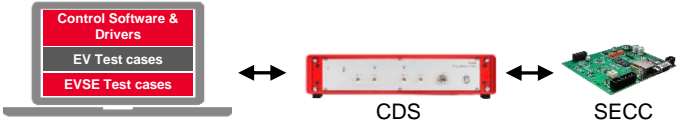
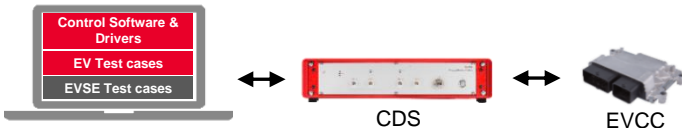




Figure 1: Overview of CCS interoperability related standards as timeline

In case of IEC 61851-1 and IEC 61851-23, the given items refer to the according test specifications provided by CharIN e.V., which are not released at the time of publication of this data sheet (expected for Q3 2019). Please note, that some test case packages such as ISO 15118-4/5 require additional software and driver options in order to be executed on the CDS hardware (see items SL1094A-40x).

Furthermore, this datasheet also contains Software maintenance contract options (see items R-14S-0xx-A & R-15S-0xx-A) which are recommended, because frequent updates of all test case packages are expected due to partially incomplete/immature specifications.

It is important to mention, that the following test case packages have different test objectives. Some are focusing entirely on protocol test, others are designed to test electrical safety and performance. Thus, some test cases can be executed on a simple hardware without restrictions, while other more system-related test cases require an extended hardware setup including power source/load. The following overview illustrates four examples:

Component test EVSE	
<p>In case of testing the charging communication controller of an EVSE only, all protocol test cases can be executed by using the minimum CDS configuration. Only the Realtime computer plug-in unit and the according communication modules (for PLC or CAN interfaces) are required.</p>	
Component tests EV	
<p>In case of testing the charging communication controller of an electric vehicle only, all protocol test cases can be executed on the same hardware setup as in the previous case.</p>	
Full system test EVSE	
<p>When testing the entire product, an extended setup with HV module and EVSE plug-in adapter are required for contacting the Device under Test (DUT) (see SL1040A datasheet). In addition, a suitable AC or DC power load must be provided to run through the entire charging sequence and reach all desired test steps.</p> <p>Note: For some safety critical failure injection test cases, further HW modules may be required also.</p>	 <p>Note: Example shows Regenerative Power Source/load of type RP79xx from Keysight</p>
Full system test EV	
<p>When testing the charging interface of an entire electric vehicle, a full CDS configuration with HV module, charging adapters a suitable AC or DC power source is required.</p>	 <p>Note: Example shows Regenerative Power Source/load of type RP79xx from Keysight</p>

Option Class EVSE Test Cases

SL1094A-100 Test Case EVSE – SAE J2953/2 (Charging Discover)

Origin of requirements: SAE J2953/1 (October 2013), SAE J1772 (October 2012)

Origin of test specification: SAE J2953/2, published January 2014

Test scope: AC charging only; interoperability and functional safety

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, frequency, duty cycle)
- Check for correct detection of safety related events and correct DUT reaction (e.g. termination of charging session when pressing the latch button of the charging adapter)
- Test of capability for scheduled charging sessions (e.g. user-initiated delay of charging session, user-initiated interrupt of and automatic resume to charging session)

Quantity: 26 AC Test cases

Note: This standard has been originally intended for simultaneous testing of EV and EVSE and using a break-out box fixture for data logging. Keysight implementation contains individual EV or EVSE test cases instead. Only this way interdependencies between two DUTs can be eliminated and the verdict becomes traceable.

SL1094A-101 Test Case EVSE – GB/T 34657.1 (Charging Discover)

Origin of requirements: GB/T 18487.1-2015, GB/T 27930-2015

Origin of test specification: GB/T 34657.1, published October 2017

Test scope: AC and DC charging; interoperability

- Test of “Charging phase and charging end phase”
- Test of “Charge control pilot circuit”
- Test of “Abnormal charging states”, such as communication interruptions
- Charging output control tests

Quantity: 9 AC Test cases & 14 DC Test cases

SL1094A-102 Test Case EVSE – GB/T 34658 (Charging Discover)

Origin of requirements: GB/T 27930, published 2015

Origin of test specification: GB/T 34658, published October 2017 (May 2018)

Test scope: DC charging only; conformance test of protocol

- Test of “Low-voltage auxiliary power-on” and “Charging handshake process”
- Test of “Charging parameter configuration phase”
- Test of “Charging phase and charging end phase”

Quantity: 52 DC Test cases

SL1094A-104 Test Case EVSE – DIN SPEC 70122 (Charging Discover)

Origin of requirements: DIN SPEC 70121, published December 2014

Origin of test specification: DIN SPEC 70122, published November 2018

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of DIN 70121 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all V2G Messages (Charging setup, charging loop and termination of charging)
- Test of “SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging

Quantity: 201 DC Test cases

SL1094A-105 Test Case EVSE – ISO 15118-4/-5 DC EIM (TTCN-3)

Origin of requirements: ISO 15118-2/-3, published April 2014/ May 2015

Origin of test specification: ISO 15118-4/-5, published February 2018

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of ISO 15118-2:2014, 15118-3:2015 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all SLAC- and V2G Messages
- Test of “SLAC, SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging
- Test of all “V2G Messages” (Charging setup, Charging loop and termination of charging)

Quantity: 234 DC Test cases

SL1094A-106 Test Case EVSE – ISO 15118-4/-5 AC EIM (TTCN-3)

Origin of requirements: ISO 15118-2/-3, published April 2014/ May 2015

Origin of test specification: ISO 15118-4/-5, published February 2018

Test scope: AC charging only; conformance test of protocol

- Test of concurrent handling of ISO 15118-2:2014, 15118-3:2015 and IEC 61851-1:2017 (PWM signal)
- Good- and error case tests through all SLAC- and V2G Messages
- Test of “SLAC, SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging
- Test of all “V2G Messages” (Charging setup, Charging loop and termination of charging)

Quantity: 213 AC Test cases

SL1094A-107 Test Case EVSE – ISO 15118-4/-5 TLS/PNC (TTCN-3)

Origin of requirements: ISO 15118-2, published April 2014

Origin of test specification: ISO 15118-4, published February 2018

Test scope: AC & DC charging; conformance test of protocol

- Good- and error case tests through PnC charging process with all V2G messages
- Good- and error case tests through certificate update & installation process
- Signature validation as part of all test runs and in-depth analysis tool for fault identification

Quantity: 256 AC Test cases & 285 DC Test cases

Note: This Test case package can only be ordered in combination with “*ISO 15118-4/-5 DC EIM (TTCN-3)*” Test case package (SL1094A-105).

SL1094A-108 Test Case EVSE – IEC 61851-23 (System C, CCS) (Charging Discover)

Origin of requirements: IEC 61851-23 Ed.2, draft version MT5-198

Origin of test specification: CharIN e.V., final version not published yet (draft)

Test scope: DC charging (only system C, CCS); conformance test for safety, interoperability

- Test of measurement and control accuracy of EVSE DC output in CCC and CVC
- Conformance check of CableCheck output voltage
- Test of safety behavior of DUT
(e.g. error/emergency shutdown in case of short circuit or PE loss in HV circuit)
- Test of correct insulation monitoring before and during charging session
- Test for detection and reaction in fault conditions (e.g. Short circuit in DC output)

Quantity: ~30 DC Test cases

Note 1: This Test case package contains some test cases, which requires additional CDS hardware options. For example, *“PE loss” and “DC+/- short circuit” test*: This kind of particular safety-relevant fault injection test cases may only be performed in a special laboratory environment. All insulation test cases require the CDS option “Insulation Resistance Emulator (SL1040A-IRE)”.

Note 2: This Test case package is based on yet incomplete Test Case specifications by Charin e.V. All upcoming (hardware compatible) specification updates and extensions are covered by the software maintenance contract for this test case package.

SL1094A-110 Test Case EVSE – IEC 61851-1 (Charging Discover)

Origin of requirements: IEC 61851-1 Ed.3, published February 2017

Origin of test specification: CharIN e.V., final version not published yet (draft)

Test scope: AC and DC charging; system requirements and basic signaling

- Measurement of PWM signal and conformance check according to normative tolerances
(e.g. CP voltage amplitude, frequency, duty cycle, etc.)
- Test of robustness and interoperability through systematic variation of all CP parameters during ongoing charging session
- Check for correct detection of safety error events, and correct DUT reaction
(e.g. Emergency shutdown in case of CP state E/F)
- Check for correct proximity pilot detection

Quantity: ~25 Test cases

Note: This Test Case package is based on yet incomplete Test Case specifications by Charin e.V. All upcoming (hardware compatible) specification updates and extensions are covered by the software maintenance contract for this test case package.

SL1094A-111 Test Case EVSE – DIN SPEC 70122 (TTCN-3)

Origin of requirements: DIN SPEC 70121, published December 2014

Origin of test specification: DIN SPEC 70122, published November 2018

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of DIN 70121:2014 and IEC 61851-1:2017 (PWM signal)
- Good- and error case tests through all V2G Messages (Charging setup, Charging loop and termination of charging)
- Test of “SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging

Quantity: 201 DC Test cases

Option Class EV Test Cases

SL1094A-201 Test Case EV – SAE J2953/2 (Charging Discover)

Origin of requirements: SAE J2953/1

Origin of test specification: SAE J2953/2

Test scope: AC charging only; conformance test of protocol

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, rise/fall times during CP state changes, etc.)
- Check for correct detection of safety related events and correct DUT reaction (e.g. termination of charging session when pressing the latch button of the charging adapter)
- Test of capability for scheduled charging sessions (e.g. user-initiated delay of charging session, user-initiated interrupt of and automatic resume to charging session)
- Test of continuation of the charging session in case of dynamic grid events (e.g. frequency variation, voltage swell/sag, voltage outages)

Quantity: 25 AC Test cases

Note: This standard has been originally intended for simultaneous testing of EV and EVSE and using a break-out box fixture for data logging. Keysight implementation contains individual EV or EVSE test cases instead. Only this way interdependencies between two DUTs can be eliminated and the verdict becomes traceable.

SL1094A-201 Test Case EV – GB/T 34657.2 (Charging Discover)

Origin of requirements: GB/T 27930, published 2015

Origin of test specification: GB/T 34657.2, published October 2017

Test scope: AC and DC charging; interoperability

- Test of “Charging phase and charging end phase”
- Test of “Charge control pilot circuit”
- Test of “Abnormal charging states”
- Charging output control tests

Quantity: 12 AC Test cases and 8 DC Test cases

SL1094A-202 Test Case EV – GB/T 34658 (Charging Discover)

Origin of requirements: GB/T 27930, published 2015

Origin of test specification: GB/T 34658, published October 2017

Test scope: DC charging only; conformance test of protocol

- Test of “Low-voltage auxiliary power-on” and “Charging handshake process”
- Test of “Charging parameter configuration phase”
- Test of “Charging phase and charging end phase”

Quantity: 49 DC Test cases

SL1094A-204 Test Case EV – DIN SPEC 70122 (Charging Discover)

Origin of requirements: DIN SPEC 70121, published December 2014

Origin of test specification: DIN SPEC 70122, published November 2018

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of DIN 70121 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all V2G messages (Charging setup, Charging loop and termination of charging)
- Test of “SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging

Quantity: 239 DC Test cases

SL1094A-205 Test Case EV – ISO 15118-4/-5 DC EIM (TTCN-3)

Origin of requirements: ISO 15118-2/-3, published April 2014/ May 2015

Origin of test specification: ISO 15118-4/5, published February 2018

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of ISO 15118-2:2014, 15118-3:2015 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all SLAC and V2G messages
- Test of “SLAC, SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging
- Test of all “V2G Messages” (Charging setup, Charging loop and termination of charging)

Quantity: 324 DC Test cases

SL1094A-206 Test Case EV – ISO 15118-4/-5 AC EIM (TTCN-3)

Origin of requirements: ISO 15118-2/-3, published April 2014/ May 2015

Origin of test specification: ISO 15118-4/5, published February 2018

Test scope: AC charging only; conformance test of protocol

- Test of concurrent handling of ISO 15118-2:2014, 15118-3:2015 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all SLAC and V2G messages
- Test of “SLAC, SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging
- Test of all “V2G Messages” (Charging setup, charging loop and termination of charging)

Quantity: 289 AC Test cases

SL1094A-207 Test Case EV – ISO 15118-4/-5 TLS/PnC (TTCN-3)

Origin of requirements: ISO 15118-2, published April 2014

Origin of test specification: ISO 15118-4, published February 2018

Test scope: AC and DC charging; conformance test of protocol

- Good and error case tests through PnC charging process with all V2G messages
- Good and error case tests through certificate update and installation process
- Signature validation as part of all test runs and in-depth analysis tool for fault identification

Quantity: 328 AC test cases and 346 DC test cases

Note: This test case package can only be ordered in combination with “*ISO 15118-4/-5 DC EIM (TTCN-3)*” Test case package (SL1094A-205).

SL1094A-208 Test Case EV – IEC 61851-1 (Charging Discover)

Origin of requirements: IEC 61851-1 Ed.3, published February 2017

Origin of test specification: CharIN e.V., final version not published yet (draft)

Test scope: AC and DC charging; system requirements and basic signaling

- Measurement of PWM signal and conformance check according to normative tolerances (e.g. CP voltage amplitude, presence of CP diode on EV side, etc.)
- Test of robustness and interoperability through systematic variation of all CP parameters during ongoing charging session
- Check for correct detection of safety error events, and correct DUT reaction (e.g. emergency shutdown in case of CP state E/F)
- Check for correct proximity pilot detection

Quantity: ~25 Test cases

Note: This Test Case package is based on yet incomplete Test Case specifications by Charin e.V. All upcoming (hardware compatible) specification updates and extensions are covered by the software maintenance contract for this test case package.

SL1094A-210 Test Case EV – DIN SPEC 70122 (TTCN-3)

Origin of requirements: DIN SPEC 70121, published 2014

Origin of test specification: DIN SPEC 70122, published November 2018

Test scope: DC charging only; conformance test of protocol

- Test of concurrent handling of DIN 70121:2014 and IEC 61851-1:2017 (PWM signal)
- Good and error case tests through all V2G messages (Charging setup, Charging loop and termination of charging)
- Test of “SECC Discovery Protocol” and TCP/IPv6 binding process
- Test of “V2GTP” message encapsulation
- Test of “Supported Application Protocol Handshake” process and messaging

Quantity: 239 DC Test cases

Option Class TTCN-3-Software Package, CDS Drivers and Emulator Drivers

The following items are required to configure and execute all TTCN-3 based testcases from a custom control PC on a Charging Discovery System as target hardware.

SL1094A-400 – Software TTCN-3-WB-Express License incl. XSD-Plugin

TTworkbench is the full-featured integrated test development and execution environment (IDE). This tool allows you to test software products and services regardless of technology, operating system or implementation domain. Based on the standardized testing language TTCN-3 it enables test automation as well as unlimited extensibility.

This express license supports test management, execution and analysis of a provided set of plugins and test suites.

Summary of key features:

- Technology independent test system design in TTCN-3
- Constantly supporting the latest edition of TTCN-3
- High reusability and easy execution of predefined tests
- Highly extensible through variety of further plugins
- Definition, execution, saving and resuming of test campaigns project-wise
- Textual and graphical logging with different levels
- Text data view with analysis support
- Selection and configuration of test adapter and runtime plugins (ports, codecs, external functions)
- Statistics view
- Generation of test reports (HTML, PDF, Excel, Word)

The XSD language from W3C allows the specification of document types for XML documents. The TTplugin XSD allows importing of XSD schema definitions as equivalent type systems into TTCN-3.

Summary of Key features:

- Provides mapping from XSD to TTCN-3 data representations
- Provides runtime and code generation environment for XML-based codec

Note: Customer 1st Level Support for TTWB is provided by VERISCO.

SL1094A-401 – Software TTCN-3-WB-Basic License incl. XSD-Plugin

Content like item number SL1094A-400.

Additional content of this item:

- User-friendly text-based test case definition (including T3Doc)
- Platform-independent TTCN-3 compilation
- Generation of TTCN-3 test scripts out of traces

SL1094A-402 – Software TTCN-3-V2G-SIGMSG-Analyzer Plugin

Plugin for PWM signal, SLAC and V2G message analysis.

- SLAC MME frames with human readable header / payload output according to MME frame format
- EXI binary stream in HEX view for direct stream-to-stream comparison and coding analysis and coding error fault indication (detailed exception handling for fault indication)
- Output of EXI binary stream transcoded into XML representation for contextual analysis of V2G message content and coding error fault indication (detailed exception handling for fault indication)
- Visualizes IEC 61851.1 PWM signal (event based) with V2G messaging overlay (SLAC / SDP / V2G messages). Provides means for detailed timing analysis between incoming / outgoing PWM signaling and V2G messaging-events with graphical frontend for simplified tracing.

Note: This item is delivered as set of plugins for TTWorkBench.SL1094A-403 – Driver CDS TTCN-3 EV-Test.

SL1094A-403 – Driver CDS TTCN-3 EV-Test

Option to support PWM signaling, PLC communication and basic measurement support for AC/DC EV testing in combination with 3rd party SUT hardware adapter (Scienlab Charging Discovery System, CDS) in VERISCO CCS Conformance Test Automation Framework.

SL1094A-404 – Driver CDS TTCN-3 EVSE-Test

Option to support PWM signaling, PLC communication and basic measurement support for AC/DC EVSE testing in combination with 3rd party SUT hardware adapter (Scienlab Charging Discovery System, CDS) in VERISCO CCS Conformance Test Automation Framework.

SL1094A-405 – Driver AC Emulator (Scienlab AC Emulator – SL480/xx/xxACE1C)

Option to support control and full measurement of Scienlab AC Emulator in VERISCO CCS Conformance Test Automation Framework.

Note: This option is required for all AC test cases, which require energy transfer.

SL1094A-406 – Driver DC Emulator (Scienlab DC Emulator – SLxxxx/xx/xxDCE1C)

Option to support control and full measurement of any Scienlab DC Emulator in VERISCO CCS Conformance Test Automation Framework.

Note: This option is required for all DC test cases, which require energy transfer.

SL1094A-407 – Driver RP79xx Regenerative Power System

Option to support control and full measurement of Keysight Regenerative Power System (RP79xx) in VERISCO CCS Conformance Test Automation Framework.

Software Maintenance Contract for Test Cases (Charging Discover)

R-14S-012-A Additional 12 Months SW Maintenance Contract for Test Cases (CD)

For the first 6 month after the initially operational handover all updates are free of charge. This Software maintenance contract starts after that period and is valid for 12 months. It includes updates for chosen test case packages ordered together with maintenance contract.

Note: This maintenance contract is only valid for those test case packages that were purchased in the same order.

R-14S-024-A Additional 24 Months SW Maintenance Contract for Test Cases (CD)

For the first 6 month after the initially operational handover all updates are free of charge. This Software maintenance contract starts after that period and is valid for 24 months. It includes updates for chosen test case packages ordered together with maintenance contract.

Note: This maintenance contract is only valid for those test case packages that were purchased in the same order.

R-14S-036-A Additional 36 Months SW Maintenance Contract for Test Cases (CD)

For the first 6 month after the initially operational handover all updates are free of charge. This Software maintenance contract starts after that period and is valid for 36 months. It includes updates for chosen test case packages ordered together with maintenance contract.

Note: This maintenance contract is only valid for those test case packages that were purchased in the same order.

Software Maintenance contract for Test Cases (TTCN-3)

R-15S-012-A Additional 12 months SW Maintenance Contract for Test Cases (TTCN-3)

For the first 6 month after the initially operational handover all updates are free of charge. This Software maintenance contract starts after that period and is valid for 12 months. It includes updates for chosen test case packages ordered together with maintenance contract.

Note 1: This maintenance contract is only valid for those test case packages that were purchased in the same order.

Note 2: Support and maintenance is mandatory for the first year. verisco GmbH will provide regular updates as part of the ongoing standardization activities as well as system and feature enhancements.

Note 3: Support & Maintenance does not include customer-specific Tool-chain Integration, Development Support, or in-depth Test Result interpretation. For such requests please send your specific support enquiry to sales.sl@keysight.com.

Note 4: This support and maintenance contract is only valid for end customers that conduct testing as part of in-house product development. It does not cover support and maintenance for 3rd party test service providers. Please contact sales.sl@keysight.com for support and maintenance fees in case the products are used for 3rd party testing services.

R-15S-024-A Additional 24 Months SW Maintenance Contract for Test Cases (TTCN-3)

For the first 6 month after the initially operational handover all updates are free of charge. This Software maintenance contract starts after that period and is valid for 24 months. It includes updates for chosen test case packages ordered together with maintenance contract.

Note 1: This maintenance contract is only valid for those test case packages that were purchased in the same order

Note 2: Support and maintenance is mandatory for the first year. verisco GmbH will provide regular updates as part of the ongoing standardization activities as well as system and feature enhancements.

Note 3: Support & Maintenance does not include customer-specific Tool-chain Integration, Development Support, or in-depth Test Result interpretation. For such requests please send your specific support enquiry to sales.sl@keysight.com.

Note 4: This support and maintenance contract is only valid for end customers that conduct testing as part of in-house product development. It does not cover support and maintenance for 3rd party test service providers. Please contact sales.sl@keysight.com for support and maintenance fees in case the products are used for 3rd party testing services.

R-15S-036-A Additional 36 Months SW Maintenance Contract for Test Cases (TTCN-3)

For the first 6 month after the initially operational handover all updates are free of charge. This Software maintenance contract starts after that period and is valid for 36 months. It includes updates for chosen test case packages ordered together with maintenance contract.

Note 1: This maintenance contract is only valid for those test case packages that were purchased in the same order.

Note 2: Support and maintenance is mandatory for the first year. verisco GmbH will provide regular updates as part of the ongoing standardization activities as well as system and feature enhancements.

Note 3: Support & Maintenance does not include customer-specific Tool-chain Integration, Development Support, or in-depth Test Result interpretation. For such requests please send your specific support enquiry to sales.sl@keysight.com.

Note 4: This support and maintenance contract is only valid for end customers that conduct testing as part of in-house product development. It does not cover support and maintenance for 3rd party test service providers. Please contact sales.sl@keysight.com for support and maintenance fees in case the products are used for 3rd party testing services.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

