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Part 1: TTCN‑3 Core Language

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# Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

The present document is part 1 of a multi-part deliverable covering the Testing and Test Control Notation version 3, as identified below:

**Part 1: "TTCN‑3 Core Language";**

Part 2: "TTCN‑3 Tabular presentation Format (TFT)";

Part 3: "TTCN‑3 Graphical presentation Format (GFT)";

Part 4: "TTCN‑3 Operational Semantics";

Part 5: "TTCN‑3 Runtime Interface (TRI)";

Part 6: "TTCN‑3 Control Interface (TCI)";

Part 7: "Using ASN.1 with TTCN‑3";

Part 8: "The IDL to TTCN-3 Mapping";

Part 9: "Using XML schema with TTCN-3";

Part 10: "TTCN-3 Documentation Comment Specification";

Part 11: "Using JSON with TTCN-3".

NOTE: Part 2 of this multi-part deliverable is in status "historical" and is not maintained.

# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp%21/Howtostart/ETSIDraftingRules.aspx) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document defines the Core Language of TTCN‑3. TTCN‑3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of CORBA® based platforms, APIs, etc. TTCN‑3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of the present document.

TTCN‑3 is intended to be used for the specification of test suites which are independent of test methods, layers and protocols. In addition to the textual format defined in the present document, while GFT (ETSI ES 201 873‑3 [i.2]) defines a graphical presentation format for TTCN‑3. The specification of these formats is outside the scope of the present document.

While the design of TTCN‑3 has taken the eventual implementation of TTCN‑3 translators and compilers into consideration the means of realization of Executable Test Suites (ETS) from Abstract Test Suites (ATS) is outside the scope of the present document.

# 2 References

## 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI ES 201 873-4: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 4: TTCN-3 Operational Semantics".

[2] ISO/IEC 10646 (2017): "Information technology -- Universal Coded Character Set (UCS)".

[3] Recommendation ITU-T X.292: "OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications - The Tree and Tabular Combined Notation (TTCN)".

NOTE: The corresponding ISO/IEC standard is ISO/IEC 9646-3: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 3: The Tree and Tabular Combined Notation (TTCN)".

[4] Recommendation ITU-T T.50: "International Reference Alphabet (IRA) (Formerly International Alphabet No. 5 or IA5) - Information technology - 7-bit coded character set for information interchange".

NOTE: The corresponding ISO/IEC standard is ISO/IEC 646: "Information technology -- ISO 7-bit coded character set for information interchange".

[5] Recommendation ITU-T X.290: "OSI conformance testing methodology and framework for protocol Recommendations for ITU-T applications - General concepts".

NOTE: The corresponding ISO/IEC standard is ISO/IEC 9646-1: "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework; Part 1: General concepts".

[6] IEEE 754™: "IEEE Standard for Floating-Point Arithmetic".

## 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Void.

[i.2] ETSI ES 201 873-3: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 3: TTCN-3 Graphical presentation Format (GFT)".

[i.3] ETSI ES 201 873-5: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 5: TTCN-3 Runtime Interface (TRI)".

[i.4] ETSI ES 201 873-6: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 6: TTCN-3 Control Interface (TCI)".

[i.5] ETSI ES 201 873-7: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 7: Using ASN.1 with TTCN-3".

[i.6] ETSI ES 201 873-8: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 8: The IDL to TTCN-3 Mapping".

[i.7] ETSI ES 201 873-9: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 9: Using XML schema with TTCN-3".

[i.8] ETSI ES 201 873-10: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 10: TTCN-3 Documentation Comment Specification".

[i.9] Void.

[i.10] Object Management Group (OMG) (2001): "The Common Object Request Broker: Architecture and Specification - IDL Syntax and Semantics". Version 2.6, FORMAL/01-12-01.

[i.11] ETSI ES 202 781: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: Configuration and Deployment Support".

[i.12] ETSI ES 202 784: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: Advanced Parameterization".

[i.13] ETSI ES 202 785: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: Behaviour Types".

[i.14] ETSI ES 202 782: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: TTCN-3 Performance and Real Time Testing".

[i.15] Void.

[i.16] Void.

[i.17] ETSI ES 201 873-1 (V1.1.2): "Methods for Testing and Specification (MTS); The Tree and Tabular Combined Notation version 3; Part 1: TTCN-3 Core Language", 2001.

[i.18] ETSI ES 201 873-1 (V2.2.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2003.

[i.19] ETSI ES 201 873-1 (V3.1.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2005.

[i.20] ETSI ES 201 873-1 (V3.2.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2007.

[i.21] ETSI ES 201 873-1 (V3.3.2): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2008.

[i.22] ETSI ES 201 873-1 (V3.4.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2008.

[i.23] ETSI ES 201 873-1 (V4.1.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2009.

[i.24] ETSI ES 201 873-1 (V4.2.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2010.

[i.25] ETSI ES 201 873-1 (V4.3.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2011.

[i.26] ETSI ES 201 873-1 (V4.4.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2012.

[i.27] ETSI ES 201 873-1 (V4.5.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2013.

[i.28] ETSI ES 201 873-1 (V4.6.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2014.

[i.29] ETSI ES 201 873-1 (V4.7.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2015.

[i.30] ETSI ES 201 873-1 (V4.8.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2016.

[i.31] ETSI ES 201 873-1 (V4.9.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language", 2017.

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in Recommendation ITU‑T X.290 [5], Recommendation ITU‑T X.292 [3] and the following apply:

**actual parameter:** value, expression, template or name reference (identifier) to be passed as parameter to the invoked entity (function, test case, altstep, etc.) as defined at the place of invoking

**assignment notation:** notation that can be used for record, set, record of and set of values, where the fields or the elements to which a value is assigned are identified explicitly within a pair of curly brackets ("{" and "}") by the field names or the positions of the elements

**basic types:** set of predefined TTCN‑3 types described in clauses 6.1.0 and 6.1.1 of the present document

NOTE: Basic types are referenced by their names.

**behaviour definition:** dynamic test behaviour, which is either a testcase, a function, or an altstep definition

**communication port:** abstract mechanism facilitating communication between test components

NOTE: A communication port is modelled as a FIFO queue in the receiving direction. Ports can be message‑based or procedure-based.

**compatible type:** TTCN‑3 is not strongly typed but the language does require type compatibility

NOTE: Variables, constants, templates, etc. have compatible types if conditions in clause 6.2.15 are met.

**completely initialized:** value or template is completely initialized if it is not uninitialized and, if its type is a structured type, all its required parts are completely initialized

NOTE 1: Additionally, templates are completely initialized if they are assigned a matching mechanism all parts of which are completely initialized. If a value or template is completely initialized, it fulfils the requirement of being "at least partially initialized".

NOTE 2: A value or template of a simple, **component** or **default** type is completely initialized if anything but the unchanged symbol "-" has been assigned to it.
A value or template of a **union** or **anytype** type is completely initialized if one of its variants has been completely initialized.
A value or template of a **record** or **set** type with only optional fields and the **optional** "**implicit omit**" attribute attached, is completely initialized if the value "{}" is assigned, as all fields are implicitly set to omit.
A value or template of a **record** or **set** type with no fields is completely initialized with assignment of the value "{}".
A value or template of a **record of**, **set of** or array type is completely initialized if at least the first n elements are completely initialized, where n is the minimal length imposed by the type length restriction or array definition. Thus in case of n equals 0, the assignment of the value "{}" also completely initializes such a **record of**, **set of** or array.

**component constant:** constant defined in a component type

**component data types:** collection of all data types, component types and structured types whose sub-elements are component data types

**component port:** port defined in a component type

**component template:** template defined in a component type

**component timer:** timer defined in a component type

**component variable:** variable defined in a component type

**control behaviour:** collection of module control functions with the name **control** and functions and altsteps called by **control** directly or through other control functions or altsteps, and are used for the dynamic execution of test cases

NOTE: Such functions and altsteps are called control functions and control altsteps respectively. Module control functions can be used as an entry point of executing a test suite. Declaring functions or altsteps with the modifier **@control** explicitly allows to distinguish them from test case behaviour definitions in their special role. Module control functions and behaviour definitions with the **@control** modifier are called explicit control behaviour definitions, i.e explicit control functions and explicit control altsteps.

**data types:** all types whose values or sub-elements cannot contain object references

NOTE: Data types include simple basic types, basic string types, and the special data type anytype. Data types also include all structured types where all their sub-elements are of a data type. All user defined types based on a data type are data types as well. See more details in table 3 of the present document.

**defined types (defined TTCN‑3 types):** set of all predefined TTCN‑3 types (basic types, all structured types, the type anytype, the address, port and component types and the default type) and all user-defined types declared either in the module or imported from other TTCN‑3 modules

**deterministic function:** function that for the same input in the in and inout parameters always yields the same output both for the return result as well as the inout and out parameters

NOTE 1: A non-deterministic function is one that is not deterministic.

NOTE 2: In general, it cannot be decided if a function is deterministic or not. However, a function can be specified to be deterministic, i.e. the function is supposed to be deterministic. In this case, a violation of the determinism can be detected and handled accordingly. The handling however is tool-specific.

**dynamic parameterization:** form of parameterization, in which actual parameters are dependent on runtime events

EXAMPLE: The value of the actual parameter is a value received during runtime or depends on a received value by a logical relation.

**exception:** in cases of procedure-based communication, an exception (if defined) is raised by an answering entity if it cannot answer a remote procedure call with the normal expected response

**formal parameter:** typed name or typed template reference (identifier) not resolved at the time of the definition of an entity (function, test case, altstep, etc.) but at the time of invoking it

NOTE: Actual values or templates (or their names) to be used at the place of formal parameters are passed from the place of invoking the entity (see also the definition of actual parameter).

**fuzzy value or template:** value or template instance that is declared to be fuzzy and consequently the expression, initializing or partly initializing it (including actual parameters passed to **in** formal parameters), is subject to lazy evaluation

NOTE: During execution, this expression is re-evaluated each time when the fuzzy object is referenced, except when at the left hand side of an assignment or passing it to a fuzzy or lazy formal parameters. The result of this (re)evaluation is used as the actual value or template of the fuzzy instance. When new content is assigned to a fuzzy instance or to its subpart, the right hand side of the assignment is subject to lazy evaluation again.

**global visibility:** attribute of an entity (module parameter, constant, template, etc.) whose identifier can be referenced anywhere within the module where it is defined including all functions, test cases and altsteps defined within the same module

**implementation conformance statement (ICS):** See Recommendation ITU‑T X.290 [5].

**implementation extra information for testing (IXIT):** See Recommendation ITU‑T X.290 [5].

**implementation under test (IUT):** See Recommendation ITU‑T X.290 [5].

**in parameterization:** kind of parameterization where the value of the actual parameter (the argument) is assigned to the formal parameter when the parameterized object is invoked, but the value of the formal parameter is not passed back to the actual parameter when the invoked object completes

NOTE 1: In **in** parameterization, parameters are passed by value.

NOTE 2: The arguments are evaluated before the parameterized object is entered.

NOTE 3: Only the values of the arguments are passed and changes to the arguments within the invoked object have no effect on the arguments as seen by the invoking object.

**index notation:** notation to access individual elements of record of, set of, array and string values or templates, where the element to be accessed is identified explicitly by an index value enclosed in square brackets ("[" and "]") which specifies the position of that element within the referenced value or template and the index value is either an integer value, array of integers or record of integers

NOTE: Integer values used for indexing (either directly or as elements of the record of or array values) always lie within the index range of the type of the referenced value or template. Except for those arrays which are defined with an explicit index range, the index range always has 0 as the index for the first element.

**initialization:** value or template, or a value or template field is initialized when a content is first assigned to it

NOTE: The assignment may be explicit at the declaration of the given object, in which case the same restrictions apply as for the right-hand side of the assignment operation, or at first use on the left-hand side of an assignment, or may be implicit. Implicit initialization occurs when a yet uninitialized object is passed as actual parameter to an out formal parameter of a directly called testcase, function or altstep returns with a non-uninitialized value or template that is assigned to the actual parameter; or when module parameters not initialized in the TTCN-3 code get their runtime values before test suite execution.

**inout parameterization:** kind of parameterization that uses passing by reference, i.e. when the parameterized object is invoked, the formal parameter is linked with the actual parameter and gets direct access to the same data content that is currently represented by the actual parameter

NOTE 1: The invoked object uses the actual parameter directly, so that all changes made in the formal parameter become immediately effective on the actual parameter. If the same actual parameter is passed to two distinct formal parameters, a change in one formal parameter becomes immediately effective in the other one (and in the actual parameter).

NOTE 2: Inout parameters can be used for functions, altsteps, and test cases only, if not restricted by further rules, e.g. altsteps activated as defaults.

**invalid expressions/operations:** an expression or operation is invalid if it does not follow the conditions and restrictions of this standard. Such expressions and operations shall cause a dynamic error during execution, if possible be reported during compilation.

**known types:** set of all TTCN‑3 predefined types, types defined in a TTCN‑3 module and types imported into that module from other TTCN‑3 modules or from non-TTCN‑3 modules

**lazy evaluation:** evaluation of an expression, delayed during execution until the value or template instance, to which the result of the evaluation should have been assigned or passed to as actual parameter, is first referenced at another place than the left hand side of an assignment or an actual parameter passed to a fuzzy or lazy formal parameter

NOTE: During execution, this delayed evaluation is carried out at the first actual reference, even when the result is to be used in an expression that is also subject to lazy evaluation. For the evaluation the actual values at the time of the evaluation are to be used (not the actual values at the time of the assignment or parameter passing). This implies that components of the expression may be uninitialized at the time, when execution reaches the assignment or parameter passing, but may be initialized by the time of the evaluation that can lead to successful evaluation. If, by the time of the evaluation, execution has left the scope unit, in which one or more components of the expression is defined, the actual values of the component(s) at the time of leaving the scope unit are to be stored for the purpose of the delayed evaluation (but only for that, i.e. the values are not accessible for the user).

**lazy value or template:** value or template instance for which the expression, initializing or partly initializing it (including actual parameters passed to in formal parameters), is subject to lazy evaluation

NOTE: When, during execution, the delayed (lazy) evaluation is taking place, its result is stored in the lazy value or template and the lazy instance is used further on like ordinary values and templates, until the next use of the lazy variable or parameter on the left hand side of an assignment. When a new content is assigned to a lazy instance or to its subpart, the right hand side of the assignment is subject to lazy evaluation again. If, during execution, no expression referencing the lazy object is evaluated, the lazy value or template instance is never evaluated.

**left hand side (of assignment):** value or template variable identifier or a field name of a structured type value or template variable (including array index if any), which stands left to an assignment symbol (:=)

NOTE: A constant, module parameter, timer, structured type field name or a template header (including template type, name and formal parameter list) standing left of an assignment symbol (:=) in declarations and or a modified template definitions are out of the scope of this definition as not being part of an assignment.

**local visibility:** attribute of an entity (constant, variable, etc.) that its identifier can be referenced only within the function, test case or altstep where it is defined

**main test component (MTC):** See Recommendation ITU‑T X.292 [3].

**object:** instance of one of the object types (component, default, port and timer)

NOTE: Objects of type default, port or timer, which are owned by the component that instantiated them, are local objects while objects of type component are global objects. Global objects can be referenced from other component scopes while references to local objects can only be used by the component they are bound to.

**object reference:** special kind of value used for instances of component, default, port and timer types which represents a reference to an existing entity in the TE

NOTE: When used in assignments or parameter passing, only the reference to the entity is copied, but not the entity itself. An object reference can also be initialized with the special value null in which case it does not reference an object.

**out parameterization:** kind of parameterization where the actual parameter's content (the argument) is not passed to the formal parameter when the parameterized object is invoked, but the content of the formal parameter is passed back to the actual parameter when the invoked object completes, if the formal parameter has been initialized during the invocation and the actual parameter is the reference evaluated at the time of the invocation

NOTE 1: In **out** parameterization, parameters are passed by value.

NOTE 2: Out parameters can be used for functions, altsteps, and test cases only, if not restricted by further rules, e.g. **altstep**s activated as defaults.

NOTE 3: Formal an **out** parameters are uninitialized (unbound) when the invoked object is entered.

**parallel test component (PTC):** See Recommendation ITU‑T X.292 [3].

**partially initialized:** value or template is partially initialized if initialization has taken place on it or to at least one of its fields or elements

NOTE: A template variable is initialized if a matching mechanism has been assigned to it or to at least one of its fields or elements, directly or indirectly via expansion (see clause 15.6). A template is initialized if a matching mechanism has been assigned to it, directly or indirectly via expansion (see clause 15.6).

**passing by reference:** ability to link an actual parameter with a formal parameter of a function, altstep or test case and to control its actual value within the function, altstep or test case by using the formal parameter reference, i.e. no copy of the data content is made and the actual and formal parameters share the same data content

**passing by value:** ability to make a copy of a data content of an actual or formal parameter before passing it to a formal or actual parameter, i.e. the actual and formal parameters do not share the same data content

NOTE: When passing object references by value, a new reference is created, but the referenced entity remains the same.

**qualified name:** TTCN-3 elements can be identified unambiguously by qualified names

NOTE: For modules, the qualified name is the <module name>. For global definitions such as testcases, functions, etc., the qualified name is <module name>.<definition name>. For control, the qualified name is <module name>.control. For local definitions, such as variables, local templates, etc. within a global definition, the qualified name is <module name>.<global definition name>.<local definition name>.

**right hand side (of assignment):** expression, template reference or signature parameter identifier which stands right to an assignment symbol (:=)

NOTE: Expressions and template references standing right of an assignment symbol (:=) in constant, module parameter, timer, template or modified template declarations are out of the scope of this definition as not being part of an assignment.

**root type:** root types of types derived from TTCN-3 basic types are the respective basic types

NOTE 1: The root type of user defined record types is **record**, the root type of user defined record of and array types is **record of**, the root type of user defined set types is **set**, the root type of user defined set of types is **set of**. The root type of user defined union types is **union** and the root type of anytypes is **anytype**. The root types of special configuration types are **default** or **component,** respectively. Port types do not have a root type.

NOTE 2: As **address** is more a predefined type name than a distinct type with its own properties, the root type of an **address** type and all of its derivatives are the same as the root type was, if the type was defined with a name different from **address**.

**static parameterization:** form of parameterization, in which actual parameters are independent of runtime events; i.e. known at compile time or in case of module parameters are known by the start of the test suite execution

NOTE 1: A static parameter is to be known from the test suite specification, (including imported definitions), or the test system is aware of its value before execution time.

NOTE 2: All types are known at compile time, i.e. are statically bound.

**strong typing:** strict enforcement of type compatibility by type name equivalence with no exceptions

**system under test (SUT):** See Recommendation ITU‑T X.290 [5].

**template:** TTCN-3 data objects are values or templates by definition. A TTCN‑3 template identifies a subset of the values of its type (where the subset may contain a single instance of the type, several instances or all instances) or the matching mechanism **omit**

NOTE: Templates are defined by global and local templates, template variable definitions, or formal template parameters. Any of those are templates from the point of view of their usage, irrespective of their actual content; for example, a template variable containing a specific value is a template.

**template parameterization:** ability to pass a template as an actual parameter into a parameterized object via a template parameter

NOTE 1: This actual template parameter is added to the specification of that object and may complete it.

NOTE 2: Values passed to formal template parameters are considered to be in-line templates (see clause 15.4).

**test behaviour:** (or behaviour) test case, function or altstep started on a test component when executing an **execute** or a **start** component statement and all functions and altsteps called recursively

NOTE: During a test case execution each test component has its own behaviour and hence several test behaviours may run concurrently in the test system (i.e. a test case can be seen as a collection of test behaviour).

**test case:** See Recommendation ITU‑T X.290 [5].

**test case error:** See Recommendation ITU‑T X.290 [5].

**test suite:** set of TTCN‑3 modules that contains a completely defined set of test cases, optionally supplemented with one or more TTCN‑3 control functions

**test system:** See Recommendation ITU‑T X.290 [5].

**test system interface:** test component that provides a mapping of the ports available in the (abstract) TTCN‑3 test system to those offered by the SUT

**type compatibility:** language feature that allows to use values, expressions or templates of a given type as actual values of another type

EXAMPLE: At assignments, as actual parameters at calling a function, referencing a template, etc. or as a return value of a function.

**type context:** "In the context of a type" means that at least one object involved in the given TTCN-3 action (an assignment, operation, parameter passing, etc.) identifies a concrete type unambiguously

NOTE: Either directly (e.g. an in-line template) or by means of a typed TTCN-3 object (e.g. via a constant, variable, formal parameter, etc.).

**uninitialized:** value or template is uninitialized as long as no initialization of it or at least one of its parts has occurred

**unqualified name:** unqualified name of a TTCN-3 element is its name without any qualification

**user-defined type:** type that is defined by subtyping of a basic type or declaring a structured type

NOTE: User-defined types are referenced by their identifiers (names).

**valid expressions/operations:** valid expression/operations are expression/operation that follow the conditions and restrictions of this standard and can be safely compiled and executed.

**value:** TTCN-3 data objects are values or templates by definition. A TTCN‑3 value is an instance of its type

NOTE: Values are defined by module parameters, constants, value variables, or formal value parameters. Any of those are value objects from the point of view of their usage. A template containing only specific value matching - though referring to a single instance of its type - is not a value object, but is a template object.

**value list notation:** notation that can be used for record, set, record of and set of values, where the values of the subsequent fields or elements are listed within a pair of curly brackets ("{" and "}"), without an explicit identification of the field name or element position

**value notation:** notation by which an identifier is associated with a given value or range of a particular type

NOTE: Values may be constants or variables.

**value parameterization:** ability to pass a value as an actual parameter into a parameterized object via a value parameter

NOTE: This actual value parameter is added to the specification of that object and may complete it.