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Overview of outstanding issues and some recommendations

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Foreword

This Technical Committee Reference Technical Report (TCR-TR) has been produced by the Methods for Testing and Specification (MTS) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI) following consultation with all TC/STC Chairmen.

A TCR-TR is a deliverable for use inside ETSI which records output results of ETSI TC or STC studies which are not appropriate for European Telecommunication Standard (ETS), Interim European Telecommunication Standard (I-ETS) or ETSI Technical Report (ETR) status. They can be used for guidelines, status reports, co-ordination documents, etc. They are to be used to manage studies inside ETSI and shall be mandatorily applied amongst the concerned TCs. They shall also be utilized by the TC with overall responsibility for a study area for co-ordination documents (e.g. models, reference diagrams, principles, structures of standards, framework and guideline documents) which constitute the agreed basis for several, if not all, TCs and STCs to pursue detailed standards.

This TCR-TR 006 edition 2 supersedes edition 1 of the TCR-TR, published in 1992.

TC MTS has conducted an assessment of the implementation in ETSI of the recommendations contained in the first edition, and has questioned those recommendations in the light of an updated analysis of the context and the market needs.

The result is that some of the provisions that were contained in the 1992 edition 1 are still valid, but with some adaptations not having been implemented to the required extent (e.g. maintenance of Test Suites). Other adaptations have become pointless as they have been fully implemented (e.g. ETSI status in the European Organisation for Testing and Certification (EOTC)), some others needed to be radically updated (e.g. the rule that mandated the systematic production of conformance testing specifications for all standards). New recommendations are added in edition 2 (e.g. on standards validation), for completeness and consistency.

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1   Scope

This TCR-TR 006 Edition 2 describes the reasoning behind and provides some recommendations for a new European Telecommunications Standards Institute (ETSI) policy related to the production of test specifications in ETSI, addressing the direct benefits and needs of the ETSI members.

Beyond the recommendations strictly related to "testing" and "certification", this TCR-TR also addresses some new aspects, such as "validation", that are related to the technical quality of all ETSI specifications in general (for example, validation techniques are applicable to the test specification for a given protocol, as well as to the protocol specification itself).

ETSI can be expected to accept mandates from the European Commission (EC)/European Free Trade Association (EFTA) Secretariat to write regulatory test specifications such as those contained in Technical Bases for Regulation (TBR)s. Dealing with such standards in detail is beyond the scope of this TCR-TR.

2   References

For the purposes of this TCR-TR, the following references apply:

[1]   IS 9646 (1992): "IT&T Conformance Testing - Methodology and Framework".

[2]   ETS 300 406 (1995): "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[3]   TCR-TR 048 (1995) "Methods for Testing and Specification (MTS); Implementation Conformance Statement (ICS); proforma style guide" (endorsement of ETR 212).

[4]   ETR 212 (1995) "Methods for Testing and Specification (MTS); Implementation Conformance Statement (ICS); proforma style guide".

[5]   ITU-T Recommendation Z.100 (1994) "Specification and Description Language (SDL)".

[6]   ISO/IEC DIS 8824-1 series, also published as draft ITU-T Recommendation X.680 series "The Abstract Syntax Notation One (ASN.1)"

3   Definitions and abbreviations

3.1   Definitions

For the purposes of this TCR-TR, the following definitions apply:

base specification: A technical specification that puts requirements on implementors of equipment or services. For example, the specification of a protocol, a telecommunication service, an interface, an abstract syntax, encoding rules, information objects, physical characteristics, radio spectra, etc. Base specifications are defined by opposition to test specifications: base specifications do not cover testing aspects.

base standard: A standardized base specification.

test specification: A specification related to the manner in which to test a product or a service. For instance, a test specification may contain the description of test methods, a set of test purposes, an Abstract Test Suite (ATS) (e.g. a conformance ATS usable for testing that a protocol conforms to a given base standard).

test standard: A standard document, or a set of standard documents, containing a conformance testing specification. A test specification is not necessarily a test standard and may have a lower status.

validation (of a standard): The process by which appropriate methods, procedures and tools are used to evaluate that a standard:

- satisfies the purpose expressed in the record of requirements on which the standard is based;

- when implemented is able to offer, at minimal cost, all the functionality and performance expressed in the record of requirements;

- can be fully implemented;

- conforms to the established criteria for standards.

certification body: A body performing certification (i.e., any recognized organization which issues "individual product" certificates of conformity or "type" certificates of conformity, on the basis of analyzing Conformance Testing (CT) reports). In this TCR-TR, the use of the term "certification" is limited to the "voluntary sphere", and does **not** cover the mandatory type approval of terminal equipment, as covered by European directives.

> NOTE: The "self-declaration of conformity" to a standard, issued by an equipment provider, although sometimes called by extension "self certification", is **not** covered by the term "certification" in this TCR-TR.

3.2   Abbreviations

For the purposes of this TCR-TR, the following abbreviations apply:

ASN.1	Abstract Syntax Notation One (defined in [6])
ATS	Abstract Test Suite (defined in [1])
CT	Conformance Testing (defined in [1])
ECITC	European Committee for IT&T Certification
EOTC	European Organisation for Testing and Certification
ETR	ETSI Technical Report
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
HLTF	High-Level Task Force
ICS	Implementation Conformance Statement (defined in [1])
NIT	Network Integration Testing
PCO	Point of Control and Observation (defined in [1])
SDL	Specification and Description Language (defined in [5])
TBR	Technical Basis for Regulation
TCR-TR	Technical Committee Reference Technical Report
TTCN	Tree and Tabular Combined Notation (defined in [1])

4   Analysis of the context

4.1   Background

Published in 1992, the first edition of TCR-TR 006 aimed at setting out the principles of ETSI's position and involvement in testing and in certification, and stated a policy whereby any standard (ETS) which put requirements on implementors - such as the protocols - should have been accompanied by a standardized conformance testing specification.

The main recognized justification for this ETSI involvement in producing testing standards was the technical contribution to the construction of a European "certification scheme", by producing the formal technical basis (e.g. the conformance testing Test Suites) to be used by the recognized European framework of accredited testing laboratories and certification bodies (the "voluntary sphere"). The test suite production was also needed for allowing regulation, e.g. by producing the Technical Basis for Regulation (TBRs), for those products that were covered by European Directives (the "mandatory sphere"). Of course all the test specifications developed were also available for those ETSI members willing to make use of them, perhaps with adaptations, according to their specific goals and needs.

As a matter of fact, in 1993 and 1994 this policy provoked the investment of impressive amounts of ETSI resource in the development of testing specifications. In 1994 more than 40 % of the project team budget was devoted to producing test specifications and more than 50 % of this effort was mandated, being in general related to regulatory purposes, i.e. devoted either to the direct production of TBRs - more than 10 % - or to the production of "generic" conformance test specifications, usable then also to derive TBRs.

However, the benefits to the ETSI members of this systematic development of testing specifications started to become controversial, at least to some members, when compared to the level of investment. At the same time, the expectations and assumptions placed in 1992 on the emergence of a certification system and its acceptance by the market also started to appear to be no longer fully justified. In addition, concerns of ETSI members about the real opportunity to systematically produce test specifications (outside the regulated sector) were accompanied by the idea that testing should have been retained perhaps, at least in some cases (e.g. for complex new products, services, technologies), in the domain of competition, outside the scope of standardization.

4.2 New needs, new rules

As a result of the new context described above, supporting a certification system is no longer sufficient justification for developing conformance testing specifications in a mandatory and systematic way. Testing and certification are therefore to be de-coupled. A careful examination of the possible objectives for developing test specifications shows that this activity is still important, and can significantly contribute to the success of ETSI standards. In addition to the original motivation, that was to facilitate marketing and procurement of products (via mutual recognition of test results and certification), the development of test specifications can facilitate the implementation of standards in the development of products and the deployment of services, by means of:

- a collaborative investment in testing technology;
- the provision of a consistent market for testing tool providers;
- an earlier availability of testing means;
- confidence in "reference" procedures for testing and avoidance of repeated testing;
- non-regression testing: reduction of testing cost, e.g. vs. network evolution;
- common grounds for inter-operators service testing.

The experience gained with the test specifications produced hitherto by ETSI, and used in different contexts by the different market players, has proven that these objectives were significant, and that developing test specifications helped to reach them.

The development of test specifications by ETSI has also allowed the emergence of stable languages, Tree and Tabular Combined Notation (TTCN), techniques and tools, that have been accepted by the market, and ease the testing activities in Europe. The development of conformance test specifications has also significantly contributed to the quality of base standards: a systematic exploration of the base standards by experts has brought to light a large number of errors that could be corrected in time. The consequence is that testing should not be banished from ETSI.

The production of testing specifications should no longer systematically apply to all standards, but apply selectively, only to standards where it is appropriate; and new testing standards should be a set, no longer limited just to the consideration of conformance testing standards. In addition, different possible levels of depth (and different levels of related development effort) for the elements of the mentioned set (a set of "testing components") can be decided.

In conclusion, the decision on what to do and why, should be taken by ETSI according to analyses made on a case-by-case basis but always according to guidelines and reference criteria that ETSI should define, adopt and maintain, to ensure that harmonized solutions are taken. These analyses should integrate several factors, such as the cost, the type of product and service, the identification of parties interested in the testing matters (manufacturers, operators), etc.

In addition, the experience accumulated so far by ETSI in producing conformance testing standards suggests other improvements for the market success of standards. Those improvements are mainly related to maintenance and validation, such concepts not being only limited to the testing standards but applicable to all standards.

5 Recommendations

5.1 Clarity, structure and implementability of standards

The methodologists call "conformance requirements" the requirements expressed in a standard, and distinguish between static conformance requirements and dynamic conformance requirements. Static conformance requirements specify the limitations on the combinations of implemented capabilities, for instance compatible options, whilst dynamic conformance requirements specify what observable behaviour is permitted by the relevant specifications.

Producing an Implementation Conformance Statement (ICS) proforma is the best manner to identify and formalize all the static conformance requirements, to the benefit of both the standards makers and the implementors. The production of an ICS proforma is not to be limited to specific types of standard or standardization area (e.g. the protocols) but is applicable in principle - and may in general add quality - to any type of ETSI deliverable.

Expressing dynamic conformance requirements using formal languages such as Specification and Description Language (SDL), when applicable, is the best manner to identify and formalize the dynamic conformance requirements.

> **R1. ETSI should establish a working practice where any ETS which is produced that places requirements on an implementor contains conformance requirements explicitly and precisely stated, compliant with the relevant methodological standards and guides. In particular, the static conformance requirements should be embodied in an Implementation Conformance Statement (ICS) proforma complying with TCR-TR 048 "The ICS proforma Style Guide".**

5.2 Validation of standards

Standards' validation is a set of processes that can be applied to a standard - or a set of related standards - during their development, i.e. from conception and during their whole life-cycle. Validation is aimed at providing high quality standards. One example of validation is related to the activity performed by a tool when analyzing SDL specifications: this validation adds value and technical quality to the SDL specification.

Different validation techniques and approaches exist, that apply to different base standards according to their different nature (e.g., compilation & computer aided simulation in the case of standards making use of formal languages; reviews and technical analysis, pilot implementations, pilot experiments, in other cases).

Two main trends in the domain of standards validation co-exist: in some cases, ETSI can prefer, e.g., for market reasons, to publish a standard as soon as possible, even with errors, and have the market validate it as an "initial maintenance", before re-publication. The opposite approach is to publish only standards that have been sufficiently validated to allow safe investment in their implementation.

It should be noted that specific validation techniques exist that apply to testing standards, according to their nature (for example, compilation of TTCN; pilot implementations of executable Test Suites, pilot executions of Test Suites). Validation of testing standards, in particular when they are drafted using formal notations, such as TTCN [1], is particularly relevant to their quality and credibility.

> **R2a. Establish a practice whereby the management and planning for validation of a standard (the "validation plan"), using the various available validation techniques is incorporated in the initial workplan for any new work item.**
>
> **Establish a practice of requirements capture and agreement on "what a standard should do" before its development is started.**
>
> **Make validation of an ETS, according to the established validation plan, necessary before this ETS can be approved.**

R2b. Always incorporate validation by software tools in the validation plan of a standard when a formal language (like SDL, ASN.1, MSC, TTCN) is used formally in the normative or informative part of a standard.

5.3 Production of test specifications

Test specifications can be produced for many different reasons in relation with standards, in various technical domains.

As explained in subclause 4.2, one specific reason for developing a test specification is related to the opportunity to provide a harmonized and recognized technical basis to feed certification schemes. However, this is not considered a major reason and test specifications will more often be needed by ETSI members, outside certification, in order to facilitate the implementation of standards in the development of products and the deployment of services.

5.3.1 Testing

Experience has shown that the systematic production of full conformance test specifications for all standards is not required. Each base standard should be evaluated for the type and depth of test specifications needed, if any, on a case-by-case basis.

The whole range of technical possibilities, such as:

- complete test suite of Conformance Testing (CT) type (e.g. as those produced so far);
- different levels of depth of the test suite (e.g. number of tests);
- different types of test suites (e.g. of Network Integration Testing (NIT) type);
- definition of "Test Purposes" only (e.g. to limit the cost of production);
- definition of "Point of Control and Observation" (PCO) only.

should be considered, taking into account relevant criteria such as:

- type and complexity of the equipment concerned (terminal vs. network, etc.);
- time-scales to meet market opportunity;
- desire for supplier's declarations of conformity;
- other market needs.

R3. The decision as to which type of test specifications to produce, if any, should be taken on a case-by-case basis according to criteria that will take into account the market need and opportunities, the objectives for developing test specifications (which should be clearly identified and stated), and the type of equipment concerned.

5.3.2 Certification

The need for voluntary certification has been found to be somewhat limited. Nevertheless, ETSI may be called upon to produce conformance testing standards for use in the voluntary certification regime. Such calls may originate from ETSI members who perceive technical/economic need in specific cases; or from requests from certification bodies, typically operating under the aegis of EOTC/ECITC. It is foreseen that these calls will be limited to specific areas, such as security and safety-critical technologies. Generally speaking, a conformance test specification intended to be used for a certification regime will not necessarily differ from one produced simply for a manufacturer's own in-house use or for an operator's third party testing.

R4. ETSI should evaluate proposals to produce conformance test specification standards for voluntary certification on a case-by-case basis, as for any other work item.

5.4 Quality and credibility of test specifications in ETSI

The test specifications, especially when produced using formal languages such as TTCN, are similar to software products. The quality and credibility of a test specification produced by ETSI depends, among other aspects, on the initial intrinsic technical relevance and usability, and on the ability to maintain the level of quality during their normal life-cycle.

5.4.1 Production and publication of test specifications

ETSI has published standards related to the production of testing specifications themselves. Those standards [2] should be taken into account when test specifications are to be produced.

> **R5.   When a methodology exists which is relevant to the kind of testing specifications provided, it should be applied. In particular, conformance testing specifications for protocols, for profiles, for information objects, for interfaces, and for services shall be compliant with ETS 300 406 "Protocol and profile conformance testing specifications; Standardization methodology [2]".**

> **Test specification standards should not have a different status from that of the base specifications to which they refer.**

> **R6.   When the need to produce testing standards is expressed in ETSI, e.g. by the relevant TC or set of TCs, the provision of these testing standards should be considered of equal level of priority to that of the base standards to which they relate.**

5.4.2 Maintenance of test specifications

The need for maintenance arises both from the identification of errors and from the opportunity to maintain alignment between the test specification and the related base standards, which may evolve. The two needs can be treated according to different procedures, the first requiring real time reactions and being an asynchronous process, the second having lower time constrains and being possibly synchronized with the planned evolution of the base standards.

It is now evident that the test specifications produced so far by ETSI have not been maintained to the extent that would have been opportune, perhaps due to insufficient commitment for a full implementation - at the technical, relational and operational level - of the pertinent recommendations contained in the TCR-TR 006 version 1 (R7 stated: "ETSI should develop procedures to effectively manage maintenance of Conformance Testing standards. For each standard a contact in the ETSI Secretariat should be appointed to collect, route and control handling of defect reports in tight co-operation with the responsible TC", and R10 stated: "ETSI TC/STC's developing Conformance Testing standards should establish technical contacts with bodies operating Telecoms Testing and Certification (e.g. ADLNB, ECITC Agreement Groups, etc.) to offer the support needed").

> **R7a. ETSI should implement at the technical and practical level fast-track methods and procedures for corrective maintenance, i.e. to quickly correct possible technical defects in the test specifications - which are related and expected to arise by their real usage and exploitation.**

> **R7b. ETSI should maintain test specifications logically aligned with the base specifications to which they relate.**

The recommendations R7a and R7b apply to both the conformance test specifications produced by ETSI hitherto, and to the test specifications (of types possibly different from conformance testing) that ETSI may produce in the future.

> **R8.   ETSI should favour the collection of defects of the test specifications it develops in order to ease their corrective maintenance, and act as an accumulator and catalyst of the experiences that derive from their exploitation, in order to address and follow the market needs.**

In order to implement R7 and R8, ETSI may make advantageous use of corrective technical maintenance activities taking place in external organisations (e.g. operating under the EOTC aegis). A better synchronization with those external processes is encouraged.

6 Conclusions

This TCR-TR highlights the opportunity for ETSI to relax the principle of producing Test Specifications in all cases, but suggests the adoption of a more flexible and market-oriented approach. The provisions contained herein are intended to give initial guidance on a new approach to testing in ETSI, and are in line with the new trends envisaged for ETSI by the High Level Task Force (HLTF).

They also highlight the close correlation between the quality of standards in general, validation of standards and the production of standards for testing. A major example of this is the considerable improvement in quality of the base standards that resulted, as a by-product, from the development of testing specifications. A revised policy on testing matters should be careful not to lose this improvement.

The set of recommendations contained herein make references to criteria and guides to which TC MTS, among others, is contributing. Some aspects however, need further study and investigation to complete the new technical vision on testing.

History

Document history		
October 1992	First Edition	
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