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**Advanced Testing Methods (ATM);
Evaluation criteria procedures for the standardisation of test
specifications for European functional standards**

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Foreword

ETSI Technical Reports (ETRs) are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

This ETR has been produced by the Advanced Testing Methods (ATM) Technical Committee of the European Telecommunications Standards Institute (ETSI). More specifically, it is the result of a joint effort of experts contributing to ETSI TC-ATM-Project Team 5 (PT5) of the European Workshop for Open Systems (EWOS) Expert Group in Conformance Testing (EGCT) working on the European Commission (EC) funded Bon de Commande BC-IT-01-ST. This project is being jointly undertaken by EWOS and ETSI. Due to the similarity in objectives, ETSI TC-ATM and EWOS EGCT have agreed to issue common texts, with a few specifics, one per body.

Introduction

Both EWOS and ETSI are currently performing joint work within the area of European Functional Standards that is defined within the M-IT-02 programme, and both of these organisations have responsibilities regarding the production of test specifications for the relevant Functional Standards.

It has been recognised that standardised Test Specifications are vital to enable a cohesive approach to conformance testing. However, to date little guidance has been available to the technical groups within EWOS and ETSI, as to what criteria and procedures should be used to enable their work to reach the standardisation level.

Several EWOS Expert Groups (EGs), sometimes in conjunction with ETSI committees, have either already commenced, or will shortly commence, programmes of work aimed at producing standardised conformance test specifications relating to European Functional Standards (ENVs) under the M-IT-02 programme. The test specifications will be issued as EWOS documents (EDs) and submitted to CEN/CENELEC for ratification as ENVs.

ETSI also performs work on ETSs (European Telecommunications Standards). An ETS can become a NET when adopted by the TRAC (Technical Recommendations Application Committee), which is part of CEPT. Therefore test specifications can also be issued as ETSs or NETs. Currently this version of the document does not cover ETSs or NETs.

The initial work of both EWOS and ETSI includes those Functional Standards for which conformance test services already exist in Europe. These testing services have resulted from a CEC initiative for the development of OSI Test Specifications and harmonised Testing Services throughout EC member states. The test specifications resulting from these projects, are being made available to the appropriate groups to form the basis for the standardised European Test Specifications. However, it is also anticipated that in some cases EWOS and ETSI will be required to produce test specifications for which there is no existing material.

NOTE: This first edition of ETR 025 is not yet fully aligned with reference [6] ("Profile Test Specifications and Conformance Test Reports, issue 7, 12/91") as shown in Clause 2.

A second edition is under preparation, where:

- 1) "Functional Standard Test Specifications (FSTS)" will read:
"Profile Test Specifications (PTS)". FSTS-S will read "PTS-S".
- 2) "European Protocol Test Specification Library" will read:
"Test Specification Library".

- 3) It will be explained that a PTS (alias FSTS) is related to one profile, even if several profiles are issued in the same Functional Standard (FS). Hence, "FSRL" and "FSPIXIT" will read "Profile RL" and "Profile IXIT" respectively.
- 4) The whole contents of Clause 5 and Annex B should be complemented by reference [6].

1 Scope

It is the objective of this document to define the procedures to be followed and the criteria to be applied during the definition of a test specification for a European OSI Profile or OSI Functional Standard.

The scope of this document is to provide EWOS EGs and ETSI TCs with a checklist of all the components or documents which compose a test specification. It describes the different procedures and the different steps in the test specification standardisation process. It also describes the criteria for evaluating existing test specifications and their coverage and gives guidelines and procedures for developing or completing test specifications.

The general structure of the following sections of this document is as follows:

- Clause 4: provides guidance on the general procedures to be followed in producing test specifications and on the establishment of Test Specification Project Teams (TS-PTs), if applicable. It is not a general rule in ETSI that this work is carried out by PTs;
- Clause 5: describes the structure and content of a Functional Standard Test Specification (FSTS);
- Clause 6: describes the test specification production process;
- Clause 7: defines the criteria to be applied in reviewing source material and in the production of test specifications;
- Annex A: contains the naming schema for test cases in Europe;
- Annex B: contains the rules for production of PCTRs and SCTRs in Europe.

2 References

For the purpose of this ETR the following references apply.

- [1] EWOS/TA/89/120: "Standardisation in Europe of conformance test specifications related to Functional Standards".
- [2] ETR 022 (1991): "Advanced Testing Methods (ATM); Vocabulary used in communication protocols conformance testing".
- [3] ETSI (12/1991): "Working Procedures for the Technical Assembly and its Working Bodies, Sections A - H".
- [4] EWOS/ETSI PT005 Technical Report, Annex C: "Procedures for Maintenance".
- [5] ISO/IEC CD 9646-6: "OSI Conformance Testing Methodology and Framework, Protocol Profile Test Specifications, August 1991, (ISO/IEC/JTC1/SC21 N.6177)".
- [6] ETG xx/ETR yyy: "Profile Test Specifications and Conformance Test Reports, issue 7, December 1991".
- [7] ISO/IEC 9646 Part 2, Annex A: "Guidance for protocols standards writers to facilitate conformance testing".
- [8] ISO/IEC/JTC1/SC21 N.6160: "Catalogue of PICS proforma notations".
- [9] "General Terms of Reference for the establishment and use of Project Teams (EWOS/SC N105)".

- [10] EN 45001 (1989): "General criteria for the assessment of testing Laboratories".
- [11] ETR 021 (1991): "Advanced Testing Methods (ATM); Tutorial on protocol conformance testing, (Especially OSI standards and profiles)".

3 Definitions and abbreviations

3.1 Definitions

For the purpose of this ETR the terms given are defined in ETSI ETR 022 [2].

3.2 Abbreviations

The following abbreviations apply to this ETR.

| | |
|--------|---|
| ASR | Abstract test Suite Selection Rules |
| ATM | Abstract Test Method |
| ATS | Abstract Test Suite |
| EGCT | Expert Group in Conformance Testing |
| ETSI | European Telecommunications Standards Institute |
| ETS | European Telecommunication Standard |
| ETCOM | European Testing for Certification for Office and Manufacturing protocols |
| ETR | ETSI Technical Report |
| EWOS | European Workshop for Open Systems |
| FS | Functional Standard(s) |
| FSTS-S | Functional Standard Test Specification Summary |
| I-ETS | Interim European Telecommunication Standard |
| ISP | International Standardised Profile |
| ITAEGS | IT Advisory Expert Group on Standardisation |
| IUT | Implementation Under Test |
| OSTC | Open Systems Testing Consortium |
| OTL | OSI Testing Liaison |
| PCTR | Protocol Conformance Test Report |
| PICS | Protocol Implementation Conformance Statement |
| PIXIT | Protocol Implementation eXtra Information for Testing |
| SCS | System Conformance Statement |
| SCTR | System Conformance Test Report |
| SUT | System Under Test |

| | |
|----------|--------------------------------------|
| TP | Test Purpose(s) |
| TSS | Test Suite Structure |
| TSS & TP | Test Suite Structure & Test Purposes |
| TTCN | Tree and Tabular Combined Notation |

4 Procedures

The purpose of this Clause is to provide guidance to the EWOS EGs and ETSI TCs concerning the procedures for the preparation and execution of their programmes of work on this topic. The procedures cover the following :

- the submission of test specifications by the organisations developing these specifications;
- the review of such test specifications by the EGs and TCs and the preparation of PT proposals to carry out the work, when applicable;
- liaison between the EGs and the EGCT or between TCs and ETSI ATM for guidance and advice;
- liaison between the EGs or TCs and the submitting organisations and their participation in the programme of work;
- the final quality control and acceptance of the submitted work.

4.1 General framework

EWOS/TA/89/120 [1], agreed jointly by CEC, CEN/CENELEC, ITSTC, ETCOM, ETSI, EWOS, OSTC and OTL, defines a general framework for the production of standardised test specifications for European Functional Standards (FS), including the following:

- ITSTC is responsible for steering the process and for establishing guidelines for the structure of test specification standards, with the advice of ITAEGS;
- existing material to be considered for standardisation shall be in the Public Domain and copyright-free when submitted to ITSTC;
- ITSTC, with the advice of ITAEGS, assigns the work item to CEN/CENELEC, ETSI or EWOS, as appropriate, together with relevant specifications submitted to them as above.

A number of guidelines were also specified, all of which were taken into account in the production of this document.

The following subclauses describe the general procedures in EWOS and ETSI respectively, for the establishment of work teams to carry out the work items assigned to them, for the approval and ratification of test specifications and for their progression as (ENVs) by CEN/CENELEC. The work teams responsible for the production of the test specifications are referred to in this document as Test Specification Project Teams.

4.1.1 EWOS procedures

In EWOS, the EWOS/TA delegates the work to an Expert Group (EG) which may propose to establish a Test Specification Project Team to do the work. The rules and procedures to set up EWOS PTs are explained in EWOS/SC N105 [9]. Any organisation which has submitted specifications for standardisation should be invited to participate in the Test Specification Project Team. The EGs and Test Specification Project Teams are able to call on the Conformance Testing Expert Group (EWOS EGCT) for advice and guidance on the establishment of the Test Specification Project Teams and for any methodology problems that may be encountered.

As soon as the Test Specification Project Team is set up and the submitted specifications are available, the work of reviewing and progressing the specifications commences. On completion the final specifications are submitted to the TA for approval and ratification as EWOS Documents (EDs) and then submitted to CEN/CENELEC for standardisation.

4.1.2 ETSI procedures

Within ETSI, the TC-ATM is responsible for the definition of the general aspects of the testing methodology.

The study items concerning test specifications are included in the ETSI work programme following the rules provided in the Working Procedures for the TA and its Working Bodies, Section F [3]. The study items are allocated to the appropriate TC and the study is performed under its responsibility by a Sub-Technical Committee (STC). Depending on the urgency and the manpower required, a Project Team (Test Specification Project Team) may be established following the rules provided in the Working Procedures for the TA and its Working Bodies, Section C [3].

The resulting draft of the Test Specification is agreed by the appropriate STC and TC and processed as a draft ETS or I-ETS according to the rules provided in the Working Procedures for the TA and its Working Bodies, Section G [3].

4.1.3 Ratification as a European standard

The test specifications submitted to CEN/CENELEC by EWOS as ED shall be subject to the normal rules and procedures for the ratification of ENVs.

Comments received by CEN/CENELEC during standardisation ballot are forwarded to ETSI or EWOS (as appropriate) for consideration. CEN/CENELEC will organise a meeting for resolution of ballot comments in which voting on progression to ENV will take place.

4.2 Planning the work programmes

The purpose of this subclause is to give general guidance to the EWOS EGs and ETSI TCs on the various factors that need to be taken into account in planning the work programmes of the Test Specification Project Teams.

In the planning phase it is necessary to identify relevant existing test specifications and to review them in terms of scope, coverage and general quality. The planning team should therefore be small in size (2 or 3 individuals) who have expertise both in the relevant protocols, conformance testing methodology and the requirements for testing conformance to the FS. Where possible experts with direct experience of relevant CTS programmes should be directly involved.

The result of this review is a detailed workplan for the production of the test standard itself, which will normally be carried out by a small team of experts - the Test Specification Project Team.

The work of both the planning and production phases may be eligible for CEC funding, if the topic is specifically covered by an EC mandate.

4.2.1 Preparation, background material

The EG or TC should take the following steps prior to planning their programme of work on test specifications:

- obtain from EWOS EGCT or ETSI TC-ATM all relevant methodology documents. These should include:
- the Tutorial on Conformance Testing (ETR 021 [11]/EWOS ETG 010);
- the FSTS specification document;
- a list of issues and a European position on these issues;
- clarification on some methodology areas;
- catalogue of existing test specifications;
- identify, and if possible, obtain any test specifications and accompanying documentation that may already exist. The primary source of directly relevant material would be the CTS programmes, although other relevant material may be being progressed by committees of the international standards organisations (ISO, CCITT, IEEE ...) or regional workshops like EWOS, AOW, OIW. It is anticipated that the individual EWOS EGs/ETSI TCs are generally aware of relevant activities both in and outside Europe;
- in the case of existing material, it is strongly recommended that an expert with a knowledge of that material should be invited to participate in the Test Specification Project Team if possible;
- in the case of existing CTS contributions, the representative could be nominated by the relevant RA or the relevant CTS Technical Project itself. In the case of ISO or CCITT test specifications, a European based representative of the relevant technical committee should be sought.

When all of the above are satisfied then the EG or TC can plan the work of the Project Team, using the information provided in the remainder of this document for guidance. Additional guidance and assistance in this task may be provided, if necessary, by either EWOS EGCT or ETSI TC-ATM as appropriate.

4.2.2 Producing the workplan

In this phase the planning team reviews the available test specifications in order to evaluate how much work is required to enable them to be ratified as ENVs. The representative of the submitting organisation, who should have a detailed knowledge of the specifications, should be able to provide the EG or TC with relevant information to assist them in this work.

- a) The first task is to compile a list of existing relevant test specifications that are available for use. The Catalogue of Existing Test specifications, available from EWOS EGCT or ETSI TC-ATM, is a useful reference for such material. Copies of relevant material should be obtained for use in the project.
- b) The second task is to identify those test specification components that do not exist (see Clause 5 of this document).

NOTE: In the worst case, there might be no existing material at all. However, even in the absence of a relevant CTS project, it is possible that some work will be in progress in the international standards bodies which should form a basis for work in EWOS/ETSI.

- c) The third task is to review the available material using the criteria specified in Clause 7. From this a list of shortcomings and defects can be drawn up to define the status of the submitted material. On the basis of this information the programme of work can be deduced, together with estimates of effort and cost to be included in the Project Team proposal.

- d) A proposal for a Test Specification Project Team to execute the test specification work and to check the quality of this work is prepared for EWOS/ETSI TA approval as appropriate. This Project Team has to report to the appropriate protocol EG or TC.

The review task described in c) should be performed in sufficient detail to provide a reasonably accurate estimate of the amount of work to be done and the skills required by the Test Specification Project Team.

4.3 Procedures for Test Specification Project Teams

The prime task of the Test Specification Project Team is to produce a set of test specifications for a defined European Functional Standard (i.e. an FSTS), either based on material produced by the CTS projects, or, in the absence of such material, based on other relevant material that may be available from other sources. The Test Specification Project Team should therefore consist of a small group of experts who can fulfil the following roles:

- a Project Manager, with a knowledge of the FS, the conformance requirements of the FS, conformance testing methodology, and experience of managing projects developing abstract test specifications;
- a Quality Assurance person, with a knowledge of the FS, the conformance requirements of the FS, ISO 9646 [7], and of the European extensions and guidelines, to be responsible for conducting periodic reviews of material produced during the project;
- one or more technical experts, with a knowledge of the protocols comprising the FS and with practical experience in the use of (TTCN) and the development of Abstract Test Suites for the relevant protocols. These experts should be expected to work full time on the project and should have access to all of the necessary source material and tools (both hardware and software), needed for the task.

The structure and content of an FSTS is fully described in Clause 5 of this document. The process of producing an FSTS is described in Clause 6, and the criteria to be applied in reviewing both existing material and in the final quality review of the FSTS material is defined in Clause 7.

This subclause specifies the general procedures for the production and progression of FSTS by the EWOS and ETSI Test Specification Project Teams. This can be considered to consist of 3 main phases:

- a) completing the assembly of all the relevant material to be used in the project, as specified in subclause 4.2.1;
- b) the technical work of progressing existing FSTS material and producing new material, as necessary. The output of this phase is a complete draft of the FSTS. In order to progress submitted material to standardisable test specifications the Test Specification Project Team will need to take note of the following inputs:
- the Functional Standard Testing Methodology documents, as specified in subclause 4.2.1;
 - material submitted by the test specifications developing organisations;
 - existing work in the international standards arena (e.g. ISO, CCITT, IEEE, etc.) which is relevant to the Functional Standards in question.

The latter is essential to ensure that the test specifications submitted for ratification as ENVs are also suitable for input to the appropriate international standards committees.

- c) the internal quality review of the FSTS produced to ensure that it meets all of the criteria mentioned in Clause 7, and the correction, as far as is possible, of faults or deficiencies identified.

The outputs produced are:

- a deliverable of the FSTS, for progression to ENV;

- a Project Report, summarising the work of the Test Specification Project Team;
- an Exception Report, resulting from the quality review, detailing any deficiencies in the FSTS, together with an agreed outline plan for the rectification of the deficiencies.

The parent group of the Test Specification Project Team, i.e. the relevant EWOS EG or ETSI TC, have responsibility for approving these deliverables prior to submission to the EWOS/ETSI TA for final approval.

4.4 Notes on the progression of test specifications

The initial work of the Test Specification Project Teams is concerned with the progression of the test specifications produced by the CTS projects to produce standardisable FSTS. As such the Test Specification Project Teams will already have a large amount of existing test specification material on which to work. As these test specifications were produced at an early stage in the development of ISO 9646 [7], and before the availability of standardised PICS proformas most of the work of the Test Specification Project Team will be concerned with the update of this material. In particular, it is probable that the major problem will be the use of early and non-standard forms of the test notation TTCN.

In the future, it is possible that EWOS EGs/ETSI TCs may propose to produce FSTS for which there is no corresponding CTS work planned or in progress. In these cases, if approval is given for such projects to proceed, the Test Specification Project Team should be required to take particular note of existing material and work in progress outside of Europe, to ensure that the work of the Test Specification Project Teams is not either duplicating existing work or in disagreement with international work. However, the wisdom of producing test specifications in the absence of any programme to produce executable test suites and tools that would enable the test specifications to be verified and validated in practice should be questioned.

4.5 Future update and maintenance of test specifications

CEN/CENELEC and ETSI expect that the EWOS EGs and ETSI TCs shall also be responsible for on-going maintenance of the test specifications.

The task of maintaining and editing the source text for the specifications is therefore likely to be a prolonged and time consuming task possibly requiring the use of particular items of equipment and software tools (e.g. TTCN editing tools) and, also requiring a long term commitment on behalf of the editor.

It is possible that, in the case of CTS material, the representative of the organisation responsible for supplying the initial specifications may be willing to accept this responsibility. However, the EWOS EGs and ETSI TCs should ensure that agreements on such long term commitments are taken into account at the planning stage.

The maintenance and change control of EWOS/ETSI documents rests with EWOS EGs/ETSI TCs and EWOS/ETSI TAs. The technical aspects of maintenance can be subcontracted to the organisation that submitted the conformance test specifications.

A general framework for maintenance of FSTS is presented in EWOS/ETSI PT005 Technical Report, Annex C [4].

5 Components of Functional Standard Test Specifications (FSTSs)

Functional Standard Profile Test Specifications (FSTSs) are completely defined ETG xx/ETR yyy [6].

This Clause describes the structure and content of a FSTS. An FSTS defines a test specification for a European Functional Standard. Clause 6 of this ETR describes the process of deriving an FSTS, and Clause 7 describes the criteria to be met for FSTS components to be of standardisable quality. An FSTS is the collection of test specification documents relating to a particular European Profile or Functional Standard. These documents may be derived from Base Standard documents or an International Standardised Profile (ISP), but in a large number of cases will need to be created.

The components of an FSTS are described below. These components are of three kinds, and are documented in the FSTS Summary (FSTS-S) which provides references to, or contains, all of the following components for a specific FSTS:

- those which apply to the FS and the FSTS as a whole;
- those which apply to each protocol comprising the FS;
- those which apply to each test method for each protocol.

5.1 Global FSTS components

a) FSTS Summary (FSTS-S)

A document which identifies and provides references to, or contains, the following components for a specific FSTS.

b) FSRL/FSPICS Proforma (Reference from FSTS-S)

FS Requirements List, a proforma which, by reference to the relevant set of Base Standard PICS proformas, summarises the conformance requirements, including the constraints for the FS. Alternatively an FSPICS may be provided which is a set of PICS for each protocol in the FS already modified for use in the FS and containing the constraints defined by the FS.

c) FSPIXIT Proforma (Reference from FSTS-S)

A proforma which, by reference to the relevant set of partial PIXIT proformas, summarises the extra information for testing for the FS.

d) SCS Proforma (Contained in the FSTS-S)

System Conformance Statement (SCS) proforma, i.e. a document which summarises the claims of conformance for an implementation of a FS.

e) SCTR Proforma (Contained in the FSTS-S)

The System Conformance Test Report (SCTR) proforma which is the model proforma to be used for this FS, and complies with Annex B of this document.

5.2 Components for each protocol in the FS

a) PICS Proforma (Reference from, or part of, the FSTS-S)

The PICS proforma for the protocol. This is expected to be provided as either an integral part or an annex to the Base Standard for each protocol. In the absence of such a document, the Test Specification Project Team is expected to derive a suitable PICS proforma, which will be contained in the FSTS-S and submitted to the relevant Base Standard organisation.

b) TSS & TP (Reference from FSTS-S)

The Test Suite Structure and Test Purposes document (TSS & TP), which defines the overall structure and scope of the test suite for the Base Standard. All Abstract Test Suites (ATS) for different test methods for the protocol shall comply with this document.

c) Additional TSS & TP (Contained in or referenced by the FSTS-S)

- a reference to a document defining any additional test purposes that are required to test the protocol in the FS environment, and how they fit into the structure of the Base Standard test suite. These TSS & TP are to be standardised in Europe within the European Protocol Test Specification Library, as explained in subclause 5.4.2;

- any additional test purposes because of lack of coverage or errors in the base protocol TSS&TP standard;
- any additional test purposes specific to that one FS.

5.3 Components for each test method for each protocol in the FS

a) ATS (reference from FSTS-S)

The Abstract Test Suite for the protocol. This is the largest and most technically complex of the FSTS documents. The requirements to be met by ATS specifications are specified in ISO 9646 Part 2 [7]. This references either the Base Standard Test Suite, or where none exists, the European Protocol Test Specification Library.

b) PCTR Proforma (contained in the FSTS-S)

Protocol Conformance Test Report (PCTR) proforma, which specifies the model PCTR proforma for this protocol/ATM combination, and complies with Annex B of this document.

c) ASR (contained in the FSTS-S)

Abstract Test Suite Selection Rules (ASR) for the protocol, which, in combination with a completed PICS, define which Abstract Test Cases apply to the IUT;

d) ATS to TP Map (contained in the FSTS-S)

This may be implicit, but in some cases, for example re-mapping an existing Test Suite, it may be explicit;

e) TMP (reference from FSTS-S)

Reference to the TMP, if relevant.

f) Partial PIXIT Proforma (contained in or referenced by the FSTS-S)

g) Additional Test Cases (contained in or referenced by the FSTS-S)

- a reference to a document defining any additional test cases that are required to test the protocol in this specific FS environment;
- any additional test cases because of lack of coverage or errors in the base protocol ATS;
- any additional test cases specific to that FS.

h) Untestable test purposes (contained in the FSTS-S)

- A document defining which test purposes for this test method cannot be used, (this may be implicit in the PCTR).

It is not mandatory that all test specifications components defined above are separate documents. It is possible that more components are implicitly defined in one document. For example, the ATS to TP Map can be implicitly defined into the ATS document.

5.4 Standardisation structure for FSTS components

There are three categories of documents to be considered when standardising the FSTS.

5.4.1 The functional standard

This is considered to be a multi-part EN(V) following the M-IT-02 taxonomy. The first part contains the FS itself, the second shall contain the FSTS-S.

5.4.2 The European protocol test specification library

The Test Specification Library contains Test Specification material which is common to a number of different profiles.

This is a set of multi-part EN(V)s which follow the taxonomy of the protocols and not the taxonomy of the profiles.

Each of them is related to a given base protocol standards. The FSTS-S will reference TSS, TP, one or more ATS and, eventually, the TMP contained in this library.

5.4.3 The conformance testing Base Standard

This is an international standard at IS or DIS status or equivalent. The FSTS-S will reference TSS, TP, one or more ATS and eventually the TMP, contained in the Base Standard.

The reason for this approach is as follows:

- the FSTS-S shall contain everything which is specific to the FS. This includes for each protocol, TSS, TP and Test Cases which are specific, and also the specific proformas.
- the European Protocol Test Specification Library contains test specification material which is common to a number of different FS, but is not yet contained in the Base Standard. The collection of this material into one repository avoids duplication of work in creating new material, simplifies maintenance, and provides a point of consolidation for the submission of the material to the base standards committees. A particularly relevant example is the collection of the embedded test suites for ACSE, Presentation and Session which will contain material common to a number of FS. The library can be considered in two parts; the first is a temporary home for test specification material which shall migrate to the Base Standard, the second is a permanent repository for common material which is only relevant in a Functional Standard environment.
- the most desirable reference is to the Base Standard, and if material exists at this level it should be referenced in preference.

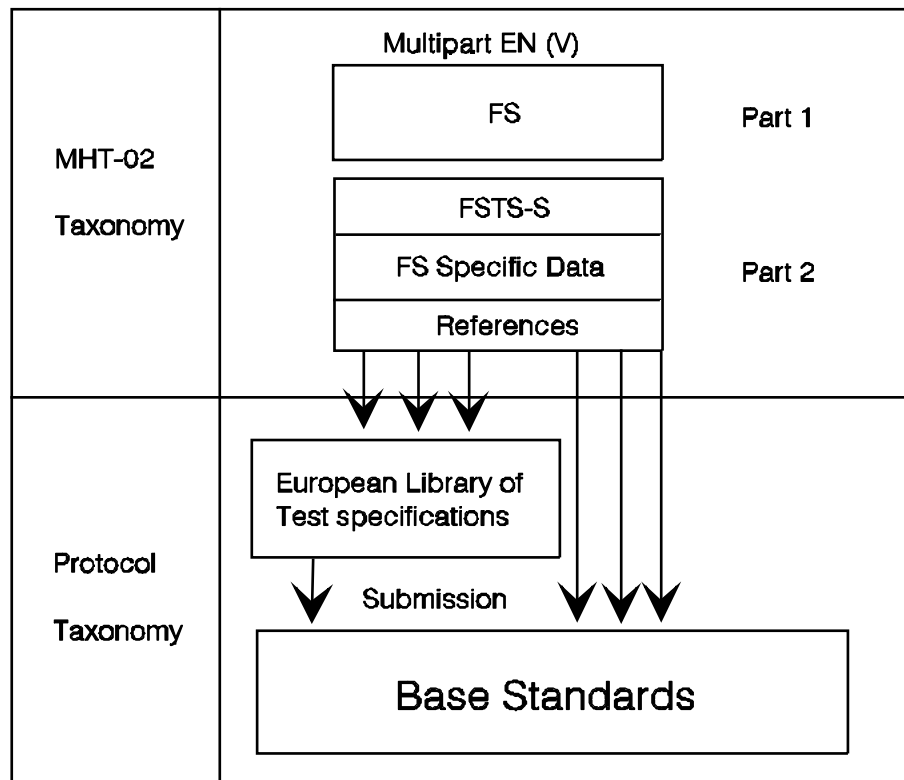


Figure 1: Structure of the European FSTS

6 The test specification production process

6.1 Initial requirements: protocol specifications, PICS Proformas, FSRL

Before undertaking the production of the FSTS, it is necessary to ensure that the specifications and the PICS proforma of each of the protocols comprising the FS are available.

Should the PICS proforma be found not in accordance with the ISO/IEC directives [7] (ISO/IEC 9646 [7], Part 2, Annex A) and the notations given in the ISO catalogue for PICS proforma notation [8], then an updating task should be undertaken, with the group responsible for the associated base protocol standard.

6.2 The FSTS production process

It is assumed that the FS itself is defined and harmonized with the M-IT-02 taxonomy, and each base protocol clearly identified.

The production of the complete test specification for a FS consists of the writing of the document named FSTS Summary defined in Clause 5, which holds the references to the set of associated documents, in the writing of profile specific extensions to documents like TSS and TP, ATS, and in the binding of these new documents (FSTS-S, Additional TPs and Test cases, ..) in a single package called FSTS.

The referenced documents are not included in the FSTS itself.

When a document to be referenced in the FSTS, and corresponding to a given protocol does not exist yet or could not be found from any other source, it shall be produced. If its contents are mature and of general interest for other FS, it shall become part of the European Protocol Test Specification Library, detailed in subclause 5.4. If its contents are specific to this profile or still immature, it shall be included in the FSTS-S.

Eventual changes on existing conformance test specifications shall be included temporarily in the FSTS-S and in parallel submitted to the Base Standard organization through defect report procedures.

The quality and presentation of the FSTS shall be consistent with the EWOS/ETSI procedures, defined for the acceptance of this package by the respective TA's, before this FSTS can be progressed as a separate part of a multi-part ENV.

6.2.1 TSS and TP production

The TSS and TP of a Base Standard indicates what should reasonably be tested for a given protocol. In some existing conformance testing specifications in Europe, the TSS and TP do not exist as a separate document but are embedded in the ATS.

The creation of the TSS and TP for each protocol of a FS shall include most of these phases:

- the production of the TSS and TP as a separate document;
- the alignment with the latest internationally agreed TSS and TP standard of each base protocol standard;
- the subsetting of the TP for the FS and the list of the TP retained;
- the subsetting of the TP for the ATM and the list of the TP retained;
- the definition and list of additional TP for the FS, either as correction of Base Standard deficiencies, or as additional TP required in the context of the FS;
- the update of the European Protocol Test Specification Library with mature and generally applicable TSS & TP which are not yet existing for the protocol standard at the international level.

6.2.2 Abstract Test Suite (ATS) production

The main source of the Abstract Test Suite (ATS) comes from the CTS programmes. Some of these ATS were developed rather early (it was the objective of the CTS programme to create a first generation of ATS) and developed against somewhat unstable standards. Another aspect is the evolution of the TSS and TP in parallel with the early development of the ATS, which may require a new alignment or a mapping between TP and test suites.

When examining the existing test cases, care should be taken to retain the most appropriate test method for the test of each protocol of the FS, and thus to select the appropriate ATS corresponding to this method.

The creation of the ATS for an FS-protocol shall include most of these phases:

- the alignment of the existing test suite (test suite coverage, TP to ATS mapping) with the latest internationally agreed TSS and TP standard of each base protocol standard;
- the subsetting of the ATS for the FS and the list of the ATS retained;
- the production of the specific ATS based on the additional TPs for that FS, either as correction of Base Standard deficiencies, or as additional ATS required in the context of the FS;
- the update of the European Protocol Test Specification Library with mature and generally applicable ATS which are not yet existing for the protocol standard at the international level.

6.2.3 PCTR proforma production

The PCTR proforma of each protocol shall be complemented with the list of Base Standard TP, the TP and Test cases retained for this FS, and the list of those selected for the ATM employed. It should be produced according to the rules given in Annex B of this ETR, and is contained in the FSTS-S.

6.2.4 Production of FSPIXIT proforma for the FS

The FSPIXIT is made by referencing the partial PIXIT proforma of each protocol, and by adding the peculiarities needed for the test of this FS. It shall be contained in the FSTS-S.

6.2.5 Production of SCTR proforma for the FS

The SCTR Proforma shall be made by following the rules given in Annex B of this ETR. It shall be contained in the FSTS-S.

6.2.6 Production of SCS proforma for the FS

The SCS proforma shall be made. It shall be contained in the FSTS-S.

7 Criteria

For a test specification to be of standardisable quality it needs to be measured against certain criteria. The criteria are designed to ensure that all test specifications adhere to the necessary standards and recommendations. This is a necessity in order to achieve harmonised testing and test services.

Many of the criteria are fully defined within International Standards. References to these standards are made where applicable.

The following defined criteria are to be used when measuring a test specification for Standardisation within Europe. Each of the criteria handled are classified as Mandatory (M) or as Waiver Possible (WP).

Exceptions to the criteria exist, mainly regarding those test specification documents which already exist, and which need to be progressed as standards as a matter of urgency. Such test specifications may not have had the benefit of Base Standards or of a stable "template" standard, a prime example being the use of a standard Test Notation. Existing test specifications should therefore be considered individually regarding the exceptions and waivers of any of the criteria, and such exceptions should be documented in the Exception Report and should be explicitly approved by the EWOS or ETSI Technical Assemblies.

7.1 General compliance with ISO 9646 (M)

All test specification documents shall utilise the standard conformance testing methodology defined in ISO 9646 [7]: OSI Conformance Testing Methodology and Framework.

NOTE: ISO 9646 [7], Part 2 also places requirements on protocol specifications. Such compliance is a precondition for the protocol specification to provide an effective basis for conformance test specifications for that protocol.

7.2 Compliance with ISO 9646-2 (M)

FSTS shall meet the requirements for abstract test suite specifications stated in ISO 9646 [7], Part 2, i.e.:

- a) they shall be conformance test suites;
- b) they shall be specified in a test notation standardised by ISO/IEC or CCITT (except as specified under subclause 7.3 c));
- c) they shall satisfy all the requirements stated in Clauses 8 to 14 inclusive.

7.3 Test notation (WP)

The international standard test notation, TTCN, defined in ISO 9646 [7], Part 3: TTCN, should be used throughout the definition of an ATS.

The IS version of this standard was adopted in 1991.

EWOS EGCT and ETSI TC-ATM recommend the use of TTCN support tools for syntax-checking and to make the TTCN.MP versions of the Test Cases available.

The possibility to allow notations, other than IS TTCN, can be considered on an ad-hoc basis. Examples are:

- a) where it is too costly to update the test cases;
- b) where it is considered beneficial to produce an interim version based on non-standard TTCN, with the intention of updating to IS TTCN (see also subclause 7.11);
- c) or, where it is technically impossible to use TTCN notation.

All deviations from ISO 9646 [7], Part 3 should be documented in the Exception Report.

7.4 Relationship to the Base Standards (WP).

If the Base Standard ATS or PTS already exists at DIS/IS equivalent level then it is mandatory that the European test suite has a defined mapping to this. It is recommended that the test specification relates to the ATS with the highest status of standardisation. To relate correctly to the said Base Standard implies that, where feasible, Test Suite Structure and Test Purposes are adopted without modification, Test Cases are adopted and should retain or reference the Base Standard Test Suite numbering scheme and the PCTR is adopted without modification.

Functional Standard specific tests should only be created for reasons of extensions of coverage of the base Standard ATS or for specific requirements of the Functional Standard (see subclause 7.5). Any newly created test shall be put forward for inclusion in the Base Standard Test Suite. For further information see ISO/IEC//CD 9646-6 (ISO/IEC/JTC1/SC21 N. 6177) [5].

7.5 Coverage (WP)

It is important that all ATSs contain enough tests to provide adequate coverage of the FS being tested. A formula for gauging adequate coverage is defined within ISO 9646 [7], Part 2: "Abstract Test Suite Definition, Section 10.4: Coverage". This formula should be applied to any European ATS developed.

As a minimum, coverage of an ATS for connection oriented protocols should include all capability tests, behaviour test for mandatory features, and in addition one TP for every optional parameter. The rest is considered as Waiver Possible. If coverage is not complete then relevant information should be provided in the Exception Report.

7.6 Relationship to the European Functional Standard (M)

For an FSTS to become a European Standard it shall correctly reflect the requirements of the related European Functional Standard. "Correctly" implies that tests are within the bounds of the Functional Standard (as defined by the FSRL/FSPICS).

NOTE: Exclusion testing (testing the exclusion of features allowed in the Base Standard, but forbidden in the Functional Standard) is currently an open issue.

7.7 Public domain (M)

Any European test specification documents put forward for standardisation shall be able to be made available in the public domain and EWOS/ETSI shall be free to change and publish them.

7.8 Executable test suite availability (WP)

An FSTS may be approved as an ED prior to the availability of an Executable Test Suite but should not be proposed as an ENV unless an Executable Test Suite exists which substantially implements and demonstrates its soundness. This is to ensure that the FSTS is realistic and achieves the objectives of conformance testing.

7.9 Non testable test purposes (M)

There may be TPs listed within the TP document which are "non-testable" for the European profile. These TPs should be indicated within the FSTS-S.

7.10 PICS proforma availability (M)

If a Base Standard PICS proforma does not exist for any of the protocols in the FS then it shall be necessary to create interim PICS proformas for each relevant protocol in the context of the FS. Guidance on the development of PICS proformas is provided in ISO 9646 [7], Part 2, Annex A, and on the notations to be used in PICS proformas in ISO/IEC/JTC1/SC21 N. 6160 [8].

In the case where a relevant CTS PICS proforma exists, this can be used as the basis for this work.

An interim PICS proforma should be contributed to the relevant international standards body for standardisation.

7.11 Appropriate abstract test method (WP)

In the Protocol Profile Testing Methodology work, undertaken by ISO/IEC/JTC1/SC21/WG1, it is allowed to specify more than one Abstract Test Method and by this more than one Abstract Test Suite for each protocol in the profile. These are referenced by the PTS. This is totally in line with the ISO/IEC 9646 [7] philosophy, not to restrict the IUT implementation freedom.

The recommended European methodology for Functional Standard Conformance Testing does, in principle, not deviate from this position, but because of the considerable investment and amount of resources needed for the Functional Standard Test Specifications implementation, we consider it as a natural consequence that in practice only one ATS per protocol in the Functional Standard shall be standardised.

The fact that there are more test methods specified in ISO/IEC 9646 [7] is because no restrictions may be required on the availability of exposed interfaces of the implementations. In practice however, restrictions on the test method are caused by the costs of producing tests suites and the availability of exposed interfaces in IUTs. Therefore ETSI TC-ATM recommends the embedded test method because it does not impose an exposed interface for the implementation to test.

Because of the considerable investment in existing Test Suites the available material shall be used at the maximum.

Recommendation

When developing a new Abstract Test Suite, the first level of co-ordination is the Test Suite Structure (TSS) and the Test Purposes (TP), because they are method-independent.

For Functional Standard Conformance Testing, it is recommended to base new ATSS on the Embedded Test Methods, because it does not require for exposed interfaces for the IUT. However, for technical reasons, it may be not possible to test using embedded methods and in those cases Remote Single Layer Test Method is recommended (e.g. lower layer testing).

If the decision is taken to produce a new embedded test suite then an existing single layer test suite may provide a useful source of material.

The relevant experts who have to estimate the amount of work, have to compare the effort to upgrade the existing (single layer test suite), with the effort to construct a new Embedded Test Suite, which can be used for one/more FS.

They have also to take into account the restrictions that every test method puts on the requirements of exposure of interfaces.

It is recommended to use the Embedded Test Method for testing the layers of the FS below the uppermost layer, because it does not require exposed interfaces within the IUT. It may be, for technical reasons, not possible to use the embedded method and in those cases the Remote Single Layer Test Method is recommended (e.g. for lower layer testing).

Annex A: European test case naming schema

A.1 Introduction

When deriving a Test Suite Structure (TSS) for a European Profile, it would be standard practice to reference the Base Standard TSS and utilise the naming convention contained within it. However, work is progressing on creating European TSSs, Test Purposes (TP) and Abstract Test Suites (ATS) for which no corresponding Base Standard documentation exists and, in the interests of harmonisation, guidance is needed on both the TSS and naming conventions.

A.2 Test suite naming conventions

Test Suites are hierarchical in nature being composed of either some or all of the following; test groups, test cases, test steps and test events. For a detailed explanation of each and where they fit into the Test Suite structure, refer to IS 9646 [7], Part 1.

Each element within a Test Suite shall be assigned a descriptive name by which it can be uniquely identified. As test groups can be nested, an abbreviation comprising no more than 3 characters should also be associated with the descriptive name. For example, in the FTAM ATS:

'R/BV/Parameter Variation (PV)' which is then used in definition of test group
'R/BV/PV/Kernel (KE)' and so on.....

In this example the abbreviations relate to the Test group, i.e:

R = Responder
|
BV = Valid Behaviour
|
PV = Parameter Variation
|
KE = Kernel

A.3 Test Suite Structure (TSS)

In order for there to be commonality between the TSS of European Profiles, the following general rules should be observed.

- adopt a top down approach when deriving the TSS from the protocol Base Standard;
- place the name of the protocol at the top of the TSS tree e.g. FTAM;
- in some cases it may be appropriate to create test groups applicable to the protocol and insert beneath the protocol name, for example in the case of FTAM:

- Initiator (I);
- Responder (R);

NOTE: It would be just as reasonable to examine the protocol state machine to identify various states e.g. Link setup or data transfer, and create groups for these.

- examine the protocol Base Standard to identify the next level of functional grouping, for example the following groups may appear logical:
 - Basic Interconnection Tests (BIT);
 - Capability Tests (CA);

- Valid Behaviour Tests (BV);
- Invalid Behaviour Tests (BO);
- Inopportune behaviour (BI);
- create full names for the groupings and create meaningful abbreviations relevant to the protocol;
- place these names under each of the relevant branch of the TSS;
- for each functional grouping (branch of the TSS), investigate if can be further divided into sub-groups e.g. by PDU grouping;
- each test case identified should then be positioned in the correct location on the tree.

In figure A.1 the FTAM TSS illustrates some of these principles:

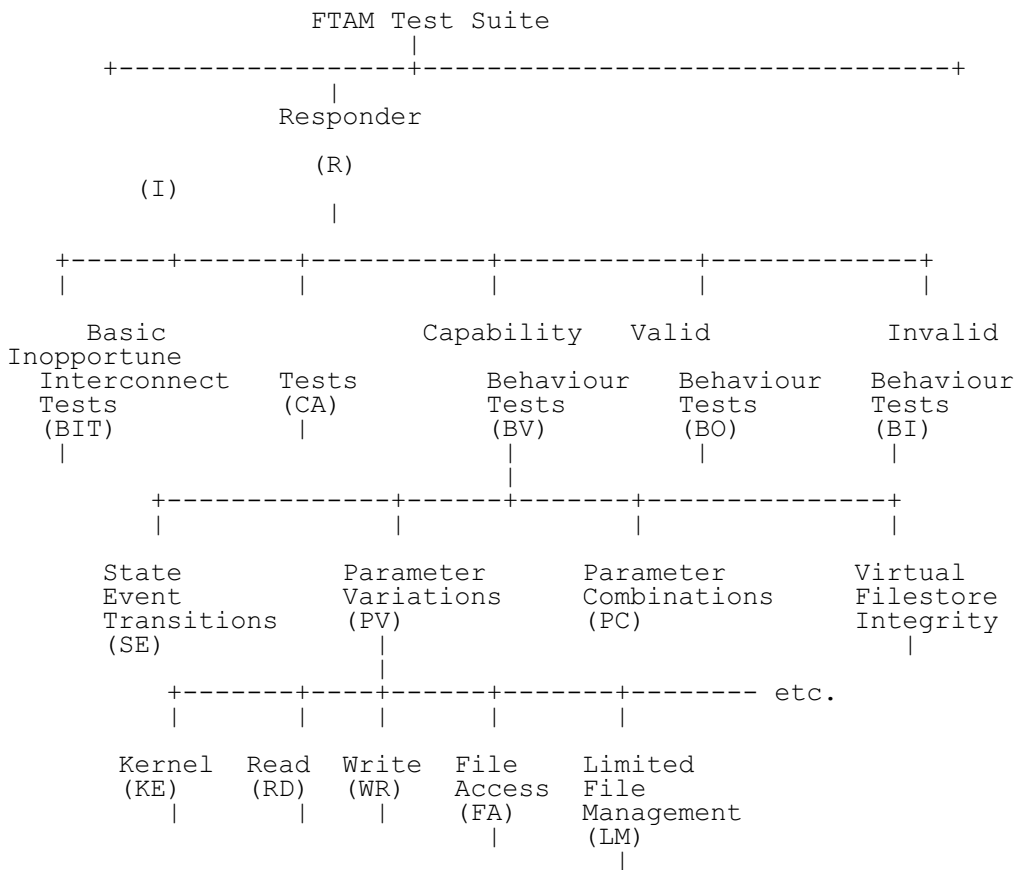


Figure A.1

From the above diagram you can see how the name FTAM/R/BV/PV/LM would uniquely identify a test group.

A.4 Exceptions

A number of situations may require the inclusion of additional test cases; Complementary Test Cases, Corrective Test Cases and Regional Variation Test Cases. The naming convention for these are as follows.

A.4.1 Complementary Test Cases

Complementary Test Cases are test cases which have been created to fulfil a testing requirement which is absent from the Base Standard TSS&TP. Such test cases should be avoided if possible. If necessary, they should be passed to the Base Standard TSS&TP developers to be considered for inclusion.

Whilst they are absent from the Base Standard TSS&TP the Complementary Test Cases shall adopt the following naming convention:

FTAM(COMP)/R/BV/PV/LM

The COMP after FTAM denotes that this is a Complementary Test Case. The naming convention then continues as defined above.

A separate list of COMP test cases shall be provided for easy reference.

A.4.2 Corrective Test Cases

Corrective Test Cases represent Base Standard test cases which have been corrected in some manner. As with the Complementary Test Cases, the Corrective Test Cases shall be passed to the relevant Base Standard TSS&TP developers for consideration.

Whilst awaiting correction, the Corrective Test Cases shall adopt the following naming convention:

FTAM(CORR)/R/BV/PV/LM

The CORR after FTAM denotes that this is a Corrective Test Case. The test case name shall be that of the Base Standard Test Case.

A separate list of CORR test cases shall be provided for easy reference.

A.4.3 Regional Variation Test Cases

Regional Variation Test Cases are tests which have been created to fulfil a regional requirement and which shall not appear in the Base Standard TSS&TP.

Regional Variation Test Cases shall adopt the following naming convention:

FTAM (M-IT-02 Profile id)/R/BV/PV/LM

The Profile id denotes that this is a Regional Variation Test for the European Profile (example AFT11).

A separate list of Regional Variation Test Cases shall be provided for easy reference.

Annex B: SCTR and PCTR proforma requirements

B.1 Introduction

Conformance Test Reports for European OSI FS should fulfil the requirements of both the EN 45000 series and ISO 9646 [7] to meet the requirements for European Certification. Such Conformance Test Reports are a combination of two types of document:

- a) the System Conformance Test Report (SCTR), which provides administrative information about the test laboratory and client, describes the SUT and summarises the test results for each protocol comprising the profile implemented in the SUT;

together with a set of:

- b) Protocol Conformance Test Reports (PCTRs), which provide, for each protocol implementation tested, detailed information about the Implementation Under Test (IUT) configuration, test method and environment and the test results for every test case executed.

B.2 EN 45000 requirements for SCTR and PCTR contents

The content of SCTR and PCTR proformas are standardised in ISO 9646 [7], Part 5, Annexes A and B respectively, and together these proforma fill most, but not all, of the requirements for test reports specified in EN 45001 [10]. The additional requirements are as follows:

- the accreditation status of the laboratory;
- a statement that the test results relate only to the items tested;
- a statement that the test report shall not be reproduced except in full without the approval of the test laboratory;
- the location where testing is carried out;
- the total number of pages in the test report;
- the signature and title of the person accepting technical responsibility for the report;

NOTE: This is not necessarily the test laboratory manager, it can be the responsibility of the technical supervisor.

- the order of execution of the tests.

B.3 Specification of European proformas for FSTS

Conformance Test Reports for European FS should fully comply with the requirements of both ISO 9646 [7] and EN 45001 [10]. Therefore European CTRs should be based on the ISO 9646 [7] proforma, but these should be extended as specified below to comply with EN 45001 [10].

It is also recommended that to help ensure consistency of test reports, that each Test Specification Project Team produces a machine readable SCTR proforma for the ESTS and PCTR proformas for each Abstract Test Method, based on these requirements and guidance. "Generic" versions of SCTR and PCTR proformas shall be available from EWOS EGCT and ETSI TC-ATM to assist in this process. However, it is only a requirement that the content of SCTR and PCTR proformas are mandatory requirements for each FSTS. This is so that test laboratories may use test reports in any appropriate natural language or style of presentation, provided the correct content is preserved.

B.3.1 Extensions and modifications to SCTR proforma

The front cover of the SCTR shall state the total number of pages in the SCTR;

Subclause 1.6 shall state:

"The test results presented in this test report apply only to the particular SUT and component IUTs declared in subclauses 1.4 and 1.7 of this SCTR, as presented for test on the date(s) declared in subclause 1.4, and configured as declared in the relevant PIXIT annexed to each PKCTR. This test report (SCTR and each referenced PCTR) shall not be reproduced except in full without the written permission of the test laboratory."

B.3.2 Extensions and modifications to PCTR proformas

- The front cover of each PCTR shall state the total number of pages in the PCTR;
- subclause 1.1 shall be amended to state "technical supervisor" in addition to "test laboratory manager" followed by an entry for "Position", before "Signature";
- laboratory identification;
- subclause 1.2 shall state the accreditation status of the laboratory;
- subclause 1.4 shall state:

"The limits and reservations stated in subclause 1.6 of the referenced SCTR also apply to this PCTR;

The order of the test cases listed in Clause 6 of this PCTR correspond to the ordering of tests defined in the test specification referenced in subclause 1.3. This does not indicate that the tests were executed in this order;

- Section which documents the order in which the TCs are executed;
- the relevant PIXIT and PICS for each IUT shall be appended to each PCTR.

In addition, in those cases where more than one ATS exists for the protocol, Clause 6 of the PCTR should list all tests listed in the relevant TSS & TP document, rather than the ATS. This is so that users of test reports can readily determine the scope of testing for the chosen test method in relation to the scope of testing for the protocol. In these cases the "Selected" column should be used to indicate those test purposes for which no relevant Abstract Test Cases exist.

History

| Document history | |
|-------------------------|---|
| May 1992 | First Edition Also known as EWOS ETG 008 |
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