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Methods for Testing and Specification (MTS);
Technical Basis for Regulation (TBR) specification methodology

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Contents

Foreword

To implement the single market for telecommunications terminal equipment, the Commission of the European Community (CEC) has adopted a directive (91/263/EEC) [2], referred to as the "Terminal Directive" for the purposes of this TCR-TR.

A prerequisite to the free movement of such equipment is the full mutual recognition of type approvals, based on Common Technical Regulations (CTRs).

The technical basis for a CTR will be a Technical Basis for Regulation (TBR), which will draw together requirements from various ETSI Technical Standards (ETSs) or other harmonised standards to satisfy the "essential requirements", and the necessary testing to be performed to demonstrate conformity with these requirements.

To avoid disputes on the interpretation, it is therefore a necessity that the TBRs have a well defined and consistent form.

Also, since the set of requirements has to be formally agreed with ACTE (Approvals Committee for Telecommunications Equipment) in consultation with NTRAC (New Telecommunications Regulations Application Committee), the information has to be provided in a form, which shows the justification for inclusion of any of the individual requirements as being essential.

For the manufacturers, the TBRs shall clearly identify the technical requirements to be met to allow the placement of the equipment on the market, the free circulation, and the permission to connect the equipment to the public telecommunication networks.

This TCR-TR presents a methodology for drafting the contents of a TBR. This topic was addressed by Project Team 38 (PT38) and was originally planned to be a part of the PT38 Methodology Handbook.

It was decided to produce this document as a separate TCR-TR, as it is planned that a number of TBRs are to be produced or finalised in 1993, and there is an urgent requirement for a common standard of content and presentation, covering both the specification of requirements, and the associated tests.

This TCR-TR has been produced following review by TBR Drafting Teams, NTRAC representatives, ADLNB (Association of Designated Laboratories and Notified Bodies) representatives, and ETSI TC-MTS.

Introduction

This TCR-TR specifies a methodology for defining the contents of a TBR in a harmonised way. The methodology addresses both the requirements, and their associated test specifications. It is important to consider both of these aspects of the TBR in one document for two reasons:

- to ensure consistency between the requirements and the test specification;
- to ensure that where a TBR contains items which are optional to implement, the tests associated with the optional features are clearly identified.

This methodology recommends a structure which clearly identifies links between:

- the essential requirements in the Terminal Directive [2];
- the requirements in the TBR;
- the related test specifications;
- the standards from which the requirements and test specifications are derived.

Requirements and test specifications may be specified by means of text in the TBR, or alternatively, where the standardised text is suitable for direct use, by means of references to specific versions of standards.

A table/proforma is defined to act as both a summary of the requirements, and as a means to capture the implementation in a specific equipment. The proforma itself is normative, and may be found useful as a means for a manufacturer to communicate the implementation in an equipment to a testing laboratory, and for the testing laboratory to derive the correct set of test cases to be used. It is not, however, the intention of this TCR-TR to impose this particular methodology, and any other method which achieves the same technical result is satisfactory.

Other tables are defined to allow the correct set of test cases to be selected for the equipment. These tables and proformas are similar to those applicable to conformance testing in the voluntary sector.

The benefit of this methodology is to allow a common approach for specifying and testing TBRs, protocols and profiles, so that a similar family of test cases, selection rules and proformas can be used in each case. This will:

- minimise the overhead on the standards bodies in producing, standardising and maintaining the different components;
- minimise the overhead on manufacturers in designing and testing their equipment for the regulatory and voluntary sectors;
- minimise the costs to testing laboratories in offering and maintaining different test services.

In all cases, however, the paramount requirement is for a TBR which is clear, unambiguous, and easy to maintain.

1 Scope

The requirements are defined as those technical requirements which are the minimum required to ensure that the essential requirements defined in [2] are met.

The Terminal Directive (91/263/EEC) [2] identifies 7 categories of essential requirement, as follows:

a) user safety insofar as not covered by the Low Voltage Directive [9];
b) safety of employees of public network operators insofar as not covered by the Low Voltage Directive [9];
c) Electromagnetic Compatibility (EMC) insofar as not covered by the EMC Directive [8];
d) protection of public networks;
e) effective use of the radio frequency spectrum;
f) interworking with public networks;
g) end-to-end interworking (in justified cases).

Items a) and b) are not covered in TBRs, according to article 6.2 of the Terminal Directive [2], but are covered by harmonised standards. If information on harmonised safety standards or procedures is included in the TBR, it shall be made clear that it is informative, and other standards or solutions may be used.

Items c) to g) are covered by the TBR, as appropriate.

For test specifications the methodology proposed in this TCR-TR is based on the concepts for conformance testing which were specifically developed for layer 2 and higher layers. Part of this methodology is not applicable for layer 1 testing, especially the rules for describing abstract tests. For this special area the relevant techniques for description of test methods, and tests to be performed should not be changed.

The rules of this TCR-TR are intended to be applied to new TBRs, and adopted by existing TBRs as and when there is a requirement to change for other technical reasons.

This TCR-TR was prepared prior to the decision to produce TBRs for Satellite Earth Stations (SES), and therefore no specific requirements of SES have been taken into account. A further edition of the TCR-TR may be required for satellite TBRs.

2 References

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

[1]   Handbook on CTRs (1993): "NTRAC Ad Hoc Group, Issue 2". **To be used for specific guidance for individual TBRs.**

[2]   Terminal Directive 91/263/EEC: "Council Directive on the approximation of the laws of the member states concerning telecommunications terminal equipment, including the mutual recognition of their conformity". **To be used to determine the essential requirements to which TBR requirements relate**.

[3]   ISO/IEC 9646-2 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract test suite specification". **To be followed when producing the TBR test specification.**

[4]   ITU-TS Recommendation X.292 (1991): "Open Systems Interconnection conformance testing methodology and framework for protocol Recommendations for ITU-TS applications - The Tree and Tabular Combined Notation (TTCN)". **To be used for protocol test cases at Layer 2 and above.**

[5]   CEN/CENELEC PNE Rules (1991): "Rules for the drafting and presentation of European Standards". **To be followed in designing the TBR contents.**

[6]   ISO IEC/JTC1/SC21/N 7451: "ISO Committee Document (CD) for ISO/IEC 9646-7, 20 November 1992". **To be used for the definition of notations in the TBR-RT, where there is no ETSI standard.**

[7]   ISO/IEC 9646-1 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts". **To be used for the production of test purposes.**

[8]   EMC Directive - 89/336/EEC: "Council Directive on the approximation of the laws of the member states relating to electromagnetic compatibility".

[9]   Low Voltage Directive 73/23/EEC: "Council Directive on the harmonisation of the laws of member states relating to electrical equipment designed for use within certain voltage limits".

[10]   DTR/MTS-01007-2: "Methods for Testing and Specification (MTS); Conformance testing specification Production process".

[11]   ACTE 9(92) 12 / ADLNB SC/51 WG2/05 Rev. 1: "A contribution to CTR0 - The Framework CTR on Measurement Uncertainty".

3   Definitions and abbreviations

3.1   Definitions

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

Essential requirements: this term is used in the TCR-TR to mean the essential requirements as defined in the Terminal Directive [2].

Requirements: this term is used in the TCR-TR to mean the technical requirements which ETSI considers are required in an equipment in order to comply with the essential requirements.

Reference standards: this term is used for the standards or recommendations from which the requirements, and/or the associated test specifications, are derived.

3.2   Abbreviations

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

ACTE	Approvals Committee for Telecommunications Equipment
ADLNB	Association of Designated Laboratories and Notified Bodies
ATS	Abstract Test Suite
CEC	Commission of the European Community
Cn	Conditional expression number n
CTR	Common Technical Regulation
DIS	Draft International Standard
EC	European Community
EMC	Electro-Magnetic Compatibility
EN(V)	European Norm (Provisional)
IS	International Standard
M	Mandatory
N	Not a requirement
NET	Norme Européen de Télécommunication
NTRAC	New Telecommunications Regulations Application Committee
O	Optional
PCO	Point of Control and Observation
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
PNE	Presentation des Normes Européennes
STC	ETSI Sub Technical Committee
TBR	Technical Basis for Regulation
TBR-R	Technical Basis for Regulation Requirement
TBR-RT	Technical Basis for Regulation Requirements Table
TP	Test Purpose
TSS	Test Suite Structure
TTCN	Tree and Tabular Combined Notation
X	Excluded behaviour

4   Summary of the TBR structure and contents

This Clause provides a description of the overall structure and contents of the TBR. The following subclauses provide details on the requirements and the test specification parts.

The TBR has to define the requirements, and the associated test specification. TBRs may contain mandatory requirements, which must always be implemented, and optional requirements, which are not compulsory to implement, but must be tested if they are. Because of this mechanisms are required to enable the selection of tests associated with the implementation choices in a particular equipment.

4.1 Requirements

Requirements in TBRs should be the minimum necessary to comply with the essential requirements in [2].

The TBR may state the requirements by directly using reference standards. This may be achieved either by:

- directly including the relevant text, in which case the text is copied from the reference standard into the TBR; or
- including by reference, in which case a normative reference is made to a specific version of the reference standard.

The two cases are technically identical.

There may be a need to interpret, clarify or add to the text, and in such cases new text may be included in the TBR. The approach taken for a particular TBR has to be decided on a case by case basis. In all cases, however, apart from transitional cases, a reference back to the relevant clause in the reference standard is required, to justify the inclusion of the requirement.

Principle 1   Requirements must not be stated in terms of tests to be passed.

> **The requirements should be clearly stated, should be referenced to the relevant clause of the reference standard, and should not be expressed simply in terms of tests which must be passed.**

4.2 Test specification

The test specification must be clearly stated. It is not possible for the TBR to simply reference or replicate the reference standard test specification, identifying the various parts which should be used to test each requirement. The reference standard test specification may not be complete, and the selection process which is designed for the voluntary environment will not work in the regulatory domain because the regulatory requirements require a subsetting of the set of tests which are regarded as the minimum mandatory set in the voluntary sector. It is therefore necessary to modify parts of the test specification, and include them in the TBR.

Parameter values used in voluntary testing may have been specified for design purposes and must be reviewed to allow the greatest possible range for regulatory purposes, because if any product is outside the values allowed, all products of that type may be compulsory withdrawn from the market.

Problems with the TBR production on interpretation of the Terminal Directive [2] should be reported to the NTRAC correspondent for the TBR, so that the problems can be forwarded to NTRAC/ACTE for resolution. If there are different opinions on the interpretation, then these should also be reported. Any such problems should also be reported to the relevant STC, and the STC Chairman should be continually appraised of the progress in resolving such problems, so any delays in obtaining a resolution can be raised to the appropriate management level.

4.3 Contents of the TBR

The contents of the TBR follow the PNE rules [5] (except for the TTCN parts) and are explained in the following subclauses. An example of the TBR contents is shown in figure 1 below. Additional levels of numbering may be added to improve the logical structure.

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      5.3   Test case index table, optional test suite structure table.

Normative Annex   The TBR Requirements Table (TBR-RT)

Informative Annexes   As needed

Figure 1: Example of TBR contents list

The components are described in the following Clauses. Informative annexes should be provided to provide non-normative information.

5 The TBR requirements section

This section of the TBR will contain the definition of the set of requirements which are deemed by ETSI to be the minimum required to meet the essential requirements as defined in the Directive [2] for the technical area for which a TBR has been requested by the ACTE Committee. When preparing a TBR from a voluntary standard the requirements and values should be checked carefully to ensure that only requirements that are needed to conform to the essential requirements as defined in [2] are included.

This section consists of a set of numbered clauses, which each define a specific requirement, which is called a TBR-R. Each clause consists of textual material, a justification, and normative references.

There are two important principles governing the definition of requirements:

Principle 2   Requirements shall be based on reference standards.

> **All requirements shall have a basis in the reference standards. Products which are in conformance with the reference standards should also conform with the TBR. The TBR should be defining a subset, or relaxation of the requirements defined in the reference standard.**

Principle 3   Requirements shall be explicitly stated and justified.

> **The requirements shall be explicitly stated by replication of standardised text, by reference to standardised text, or by adaptation of standardised text. In each case appropriate justification for the inclusion of the requirement shall be given. Normative references shall be to specific versions of the referenced standards.**

This section applies to the whole scope of the TBR, including layer 1 aspects.

5.1 Textual material

This subclause of the TBR-R provides text to replicate, clarify, interpret or modify reference standard material.

5.1.1 Defining the requirement

The requirement may be defined in the following ways. In each case once the TBR has been approved the text, whether replicated, referenced, or modified, can only be changed by the appropriate change control on the TBR. References are to specific dated versions of the reference standards, and a re-issue of the reference standards has no effect on the contents of the TBR.

5.1.1.1 Replication of text

Text may be copied directly from a reference standard into the TBR. A normative reference shall state the origin of the text.

5.1.1.2 Referenced text

Text may be included in the TBR by use of a normative reference to a reference standard. This text becomes part of the TBR in the same way as if it had been replicated. In this case a reference may be made to the appropriate TBR-RT entry which will provide the link to the normative reference.

5.1.1.3   Modified or new text

Where standardised text cannot be used directly, through replication or reference, modified or new text shall be included in the TBR. An informative reference shall be given for the original text.

The subclause shall state whether it is:

- an interpretation, or clarification of the referenced standard text;
- an extension of the standard text;
- a change to the standard text.

5.1.2   Explanatory information

Explanatory text may be included to further amplify the requirement. This text shall not be normative.

5.1.3   General guidance

In all cases, where a standard is found to be deficient, a defect report or liaison statement shall be raised to the appropriate authority.

Where a requirement relates to an analogue value (for example a voltage) then in all cases a tolerance range shall be specified within which the value must fall in order to conform to the TBR.

The TBR shall state the environmental range within which the equipment must operate in terms of, for example, temperature, air pressure and relative humidity. If there is no specified environmental range then this shall be explicitly stated.

5.2   Justification of requirements

This subclause of the TBR-R shall justify the inclusion of a requirement by reference to the essential requirements defined in Article 4 of the Directive [2]. The relevant category(s) (c to g) shall be stated. Text shall be provided, justifying the requirement under the specified category(s).

In producing this subclause reference may be made to the Annexes of the CTR Handbook [1] which provide an interpretation of the essential requirements in different Technical Areas.

If a TBR is in transition to full compliance with this TCR-TR, then it is acceptable to only provide the category, with no supporting text.

5.3   References

Normative references shall be provided in Clause 2 of the TBR. Each TBR-R shall contain normative reference(s) to the reference standards on which the requirement is based. For replicated text this shows the original source of the material. For referenced text this shows the part of the reference standard which is being included by reference. For modified text an informative reference is provided showing the source of the original (unmodified) material.

References shall be to precise clauses of specific versions of documents.

Standards and Recommendations suitable for normative references are:

- ETSs (from ETSI);
- CCITT Recommendations (and ITU-T);
- CCIR Recommendations (and ITU-R);
- ISO standards (at the DIS or IS level);
- IEC Standards;
- EN(V) Standards (from CEN/CENELEC).

6   The TBR Requirements Table (TBR-RT)

6.1   Introduction to the TBR-RT

The TBR-RT serves a number of purposes, as follows:

-    it provides a tabular summary of all the requirements;

-    it shows the status of each TBR-R, whether it is essential to implement in all circumstances, or whether the requirement is dependant on the manufacturer having chosen to support a particular optional service or functionality. In particular it enables the TBR-Rs associated with a particular optional service or functionality to be grouped and identified;

-    it provides a proforma to capture the choices which the Manufacturer has made in implementing an equipment;

-    when completed in respect of a particular equipment it provides a means to undertake the static assessment of conformity with the TBR, and to select the appropriate test cases to be used in dynamically testing the equipment.

The TBR-RT is placed in an annex of the TBR in order that it may be photocopied and used as a proforma. To this end it should have the following copyright release statement:

"Users of this specification may freely reproduce the TBR-RT proforma in this annex so that it can be used for its intended purpose and may further publish the completed TBR-RT."

6.2   The format of the TBR-RT

Table 1: Example TBR-RT proforma

TBR Reference:			TBRxxxx				
NO	**CAT**	**REF**	**TBR-R**	**STATUS**	**SUPPORT**	**VALUES**	
						Allowed	Support

This is an **example** proforma based on [6]. TBR designers should adopt any ETSI standard for PICS proformas in preference, and adapt the proforma to the specific requirements of the TBR.

The entries are defined as follows:

- the "NO" column specifies the entry number. Multiple numbering levels may be used to express major functionalities, and their supporting components;

- the "CAT" column indicates the class of essential requirement, as defined in [2]. Valid entries are C, D, E, F, and G, or any combination of these letters. This column is optional, as the category of essential requirement should already be stated in section 4 of the TBR (requirements);

- the "REF" column is used to reference the supporting text for the entry. This is either the clause number of the TBR-R in the requirements section of the TBR, or a normative reference where the text of the reference standard can be included unchanged;

- the "TBR-R" column is used to provide a short description of the requirement, for clarity;

- the "STATUS" column is used to indicate the status of the entry, as detailed in the following section;

- the "SUPPORT" column is blank in the proforma, and is designed to be completed in respect of a particular equipment to indicate the choices which have been made with respect to optional features;

- the "VALUES" column is designed to allow specification of parameter ranges to be supported and to provide a means to capture the actual range implemented in an equipment;

- each clause in the requirements section should have at least one entry in the TBR-RT. Additional entries may be included, for example:

    - to identify support of an optional feature, where the answer is used to resolve conditionals;

    - to ask several questions about the same TBR-R, for example support of different required values;

    - to differentiate between ways of satisfying a TBR-R, which require different test cases to be selected.

6.3 Notations in the TBR-RT

Notations are used in the Support and Status columns, and to define conditional expressions. The definitions of the notations follow the general principles of [6] but are not identical.

6.3.1 Status notations

The "STATUS" column shows the status of the entry as follows:

M   Mandatory, must be implemented under all circumstances;

O   Optional, may not be provided, but if provided must be implemented in accordance with the requirements;

O.n This status is used for mutually exclusive or selectable options among a set. The integer "n" shall refer to a unique group of options within the TBR-RT. A footnote to the TBR-RT shall explicitly state what the requirement is for each numbered group. For example, "It is mandatory to support at least one of these options", or, "It is mandatory to support exactly one of these options";

N   Not a requirement. The entry is out of scope of the TBR and it is not a requirement that the feature is supported. This value may be used as a result of evaluation of a conditional expression, and may also be used in deriving a TBR-RT from a PICS, by classing entries not appropriate for regulatory use as "N";

Cn   Conditional number "n". Reference is made to a Boolean expression "n" with predicates of support answers, which will resolve to either "M", "X" or "N" for a specific equipment;

X   Excluded or Prohibited. This notation is relevant in two circumstances:

    a)   the feature is permitted in one standard, but not permitted in the reference standard and not permitted in the TBR. This situation applies, for example, where the reference standard is a profile of other standard(s);

    b)   the reference standard itself prohibits particular behaviour under particular circumstances, and this behaviour must also be prohibited in the TBR.

TBR-Rs will have a status of "M" if they form part of the requirements which shall be met under all circumstances by the equipment.

TBR-Rs will have the status of "O" if they result from the implementation of an optional service. This means only that the optional service introduces additional requirements under [2], not that all aspects of the optional service become TBR-Rs.

Principle 4   Only those elements of optional services which impact upon essential requirements are TBR-Rs.

> **If an optional service or functionality is within the scope of the TBR, only those aspects of the optional service or functionality which affect the ability of the equipment to conform to the essential requirements in [2] when the option is supported shall be classed as TBR-Rs.**

Typically a major capability will be given the status of O, and the supporting PDU and parameter entries will have the status Cn, with a condition which evaluates to M if the support for the major capability is "Y" and to "N" if the support for the major capability is "N". More complex conditionals may be provided.

Principle 5   Optional status depends on the construction of CTRs by NTRAC and ACTE and may not be required.

> **If NTRAC and ACTE follow a strategy of defining CTRs such that all optional features are separated in different CTRs then the issue of optionality within one TBR does not arise, and the "O" status is not required.**

The precise syntax for the Cn Boolean expressions is defined in [6]. The status codes are not intended to be case sensitive; the conventional case is shown.

6.3.2   Support answer notations

The "SUPPORT" column is reserved for completion in respect of a particular equipment. Entries may be:

Y   indicating that the implementation claims to fully implement the TBR-R in accordance with the specification. An entry of "Y" against an X status entry means the equipment does not conform to the TBR;

N   indicating that the implementation does not claim support of this TBR-R in respect of the product to be placed on the market. This is a valid entry only for an O, X, N or Cn status entry, and an entry of "N" against an M status entry means the equipment does not conform to the TBR.

Principle 6   Equipment may support options which are not offered for EC type examination.

> **Equipment is to be tested in accordance with the manufacturers instructions. Equipment may technically support an optional facility which is not advertised in the operating instructions. In such case the manufacturer is entitled to provide a support answer of "N" and the TBR-R shall not be tested.**

The support answer codes are not intended to be case sensitive; the conventional case is shown.

7 Summary of derivation of essential requirements

The derivation of the Requirements (or set of TBR-Rs) both in total, and for a specific equipment is shown in figure 2 below:
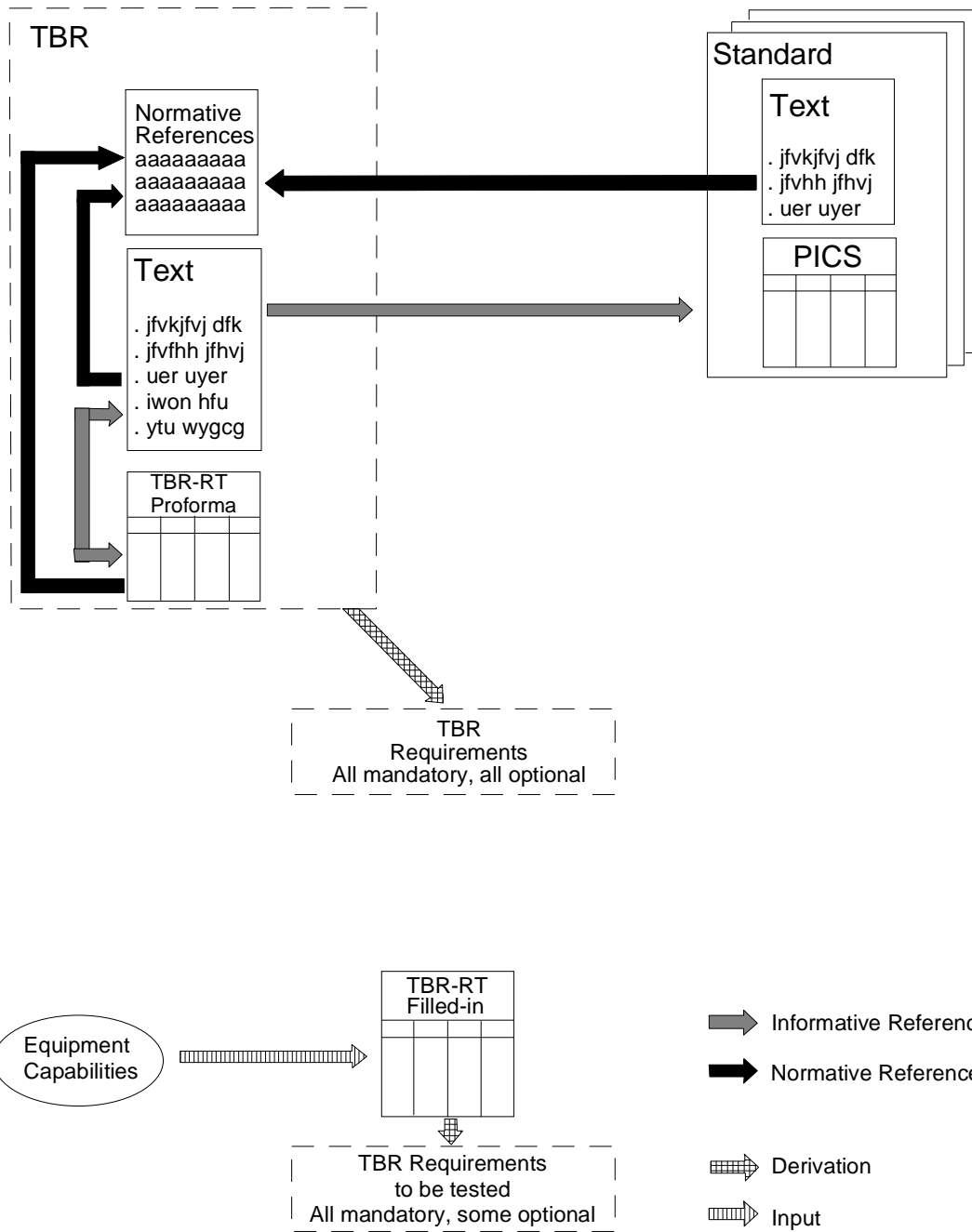
Figure 2: Derivation of requirements

8 The TBR test specification

This section defines the details of what is to be contained in the TBR test specification.

It is expected that a number of TBRs which are in a transitional state may not fully comply with the requirements of this section.

8.1 Introduction to the TBR test specification

The TBR test specification defines the tests which shall be carried out to ensure that the requirements are met, with a given selection of optional features in the equipment.

Principle 7   Tests are to be carried out in accordance with the manufacturers instructions.

> **The Terminal Directive [2] states that conformity with essential requirements is required when the equipment is properly installed and maintained, and used for its intended purpose. Thus no tests outside of the normal operating environment and use are required, unless there are specific requirements relating to such behaviour.**

The requirements are defined in the requirements section of the TBR, and summarised in the TBR-RT. The corresponding tests are documented in the TBR test specification which may either reference material in a reference standard, replicate material from a reference standard, or include new material.

If it is impracticable to test a particular requirement, for example because it would take a very long elapsed time, then this shall be clearly stated in the TBR test specification, and no test provided. It is outside of ETSI scope how this situation is dealt with by the designated laboratory and notified body.

There is not in general a one to one correspondence between the abstract test cases and the requirements. The relationship between test cases and TBR-RT entries is contained in the test case selection algorithm in the TBR test case selection expression table or test group expression table. The tests to be applied to a given equipment are identified through the TBR test case index table, which may reference a reference standard or the TBR test specification itself.

Principle 8   A test strategy should be defined overall for TBRs in a similar technical area.

> **When a family of TBRs are planned, covering a similar technical area, then it is best to produce a separate document which shows the general infrastructure for testing that family, including the test method to be used, the PCOs, interfaces, and modularity which is assumed. Individual TBRs can then include required parts of the common document by reference. This will avoid a situation where different testing approaches are taken for similar technical areas, leading to very high costs to the designated laboratory and the manufacturer.**

8.2 Test purposes and abstract test suite

This section is primarily concerned with the testing of protocols where the test cases are written in TTCN, as defined in [4]. A number of the concepts (for example test purposes) may also be applied to physical testing, and other parts may also be relevant to digital protocols at the physical layer.

8.2.1 General requirements

This section of the TBR contains test purposes, abstract test cases and the tables required by the test cases, for example constraints, variables, timers, etc.

This section only contains material which is not already contained in an existing standard. It is therefore restricted to new abstract test cases which have been written to test TBR-Rs, and modifications of existing standardised material. These abstract test cases are referenced from the TBR test case index table defined in subclause 8.4.

Material which is already standardised and can be reused without modification is directly referenced from the TBR test case index table, and/or the TBR test suite structure table, and it should not be replicated in the TBR. Subclause 8.4 explains this mechanism.

Test purposes should be produced according to ISO 9646-1 [7]. Each test purpose shall give a narrowly defined objective of testing, focusing on a single requirement.

Abstract test cases should be produced according to ISO 9646-2 [3]. The Abstract Test Suite (ATS) produced shall be self contained, and must therefore document in the TBR test specification all required tables of PDUs, constraints, etc.

For detailed guidance on the production of the TP and abstract test cases, refer to ETRxxx [10].

If all required TPs and abstract test cases are contained in referenced standards, this section of the TBR is empty.

Wherever possible tests should be written to control the external behaviour of the equipment, and should not require additional features in the equipment for testing purposes only. This will depend on the test method selected to a large extent, but it should be remembered that the Points of Control and Observation (PCOs) required to run the test in effect become requirements, as EC type examination cannot be performed without them.

Principle 9   Test points are in effect requirements.

> **EC type examination cannot be carried out if the appropriate PCOs are not implemented in the equipment to be placed on the market, as the tests cannot be conducted as intended by ETSI. Derogation from the planned tests, or substitutions such as the manufacturers declaration, are not within the scope of ETSI.**

The set of tests defined shall only require the correct implementation of the requirements. Thus the set shall not include tests which require optional functionality to be implemented.

If a requirement has a status of X, then a test should be defined to verify that the feature is not implemented, to the extent possible.

8.2.2 Test notations

For non-protocol requirements such as EMC requirements and Layer 1, the tests are written in an appropriate notation. Because of the highly variable nature of the notation, no specific methodology is defined. It is recommended, however, to reference tests in base standards wherever possible.

Tests for protocols in Layer 2 upwards shall be written in TTCN. TTCN must be produced in both the graphic rendition form, and the machine-processable form, as defined in [4]. The "IS" version of TTCN should be used.

TTCN documented in the TBR has its own rules of structure and layout, and does not have to follow the PNE rules [5]. It is recommended that the printed output from the TTCN editing tool is directly incorporated into the TBR, to avoid errors which may be introduced by reformatting or transcription.

8.2.3 Test method

The test method used will either be determined by the existing standardised material, or a new method may be selected. If standardised material exists, then it would normally be re-used unless it was for some reason inappropriate for use in EC type examination. If no standardised material exists, and it is necessary to select a test method, then consult ETRxxx [10] which provides guidance on this.

Abstract test cases written in TTCN are specific to a test method, and must be significantly modified or rewritten to use a different method. In selecting a test method consider:

- the extent of material which is available for reuse, and the costs of developing new material;

- the imposition of PCOs on the equipment under test;

- the availability of test tools to undertake EC type examination according to the chosen method;

- the practical costs of EC type examination to the designated laboratory and manufacturer.

The selection of a method, and the production of the associated abstract test cases, will in effect impose this test method (but not the test tool to be used), on the designated laboratory.

The distributed, remote and embedded test methods are to be preferred, as they minimise the PCO requirements on the equipment.

8.2.4 Abstract test cases

The abstract test cases make up a significant part of the abstract test suite. In producing the set of abstract test cases, consideration must be given to the following:

- the test cases in the referenced standards must be examined to see if they test a TBR-R, and retained only if they do. Where there are parameter values, these should be reviewed to ensure they are appropriate for application in the regulatory domain, i.e. they must apply to every product produced;

- invalid behaviour tests should be retained only if related to a TBR-R which requires a specific action as a result of invalid behaviour. Specific requirements for invalid behaviour may be defined in the requirements section of the TBR;

- all TBR-Rs with an "X" status in the TBR-RT should have a test to show that as far as possible, the feature is not implemented;

- at least one abstract test case should be available for each feature in the TBR-RT with status "M" or "O", and in some cases it will be necessary to produce a number of abstract test cases to check for different parameter values;

- no abstract test cases should be produced for features with status "N" in the TBR-RT.

8.3 Test case selection expression definition table

The test case selection expression table is defined in ISO 9646-3 [4]. This table contains a set of Boolean expressions in terms of TBR-RT support entries, which evaluate to true or false. Individual test cases are associated with a given expression through the TBR test case index table, and groups of test cases (test groups) are similarly associated with the expression through the TBR test suite structure table. The result of the evaluation of the Boolean expression controls the selection or otherwise, of the test, or test group.

Typically, one expression will be "TRUE", and will be associated with all tests for M or X status requirements, and there will be a set of expressions that evaluate the support answer of O status entries, and associate with the list of test cases or test groups corresponding to the TBR-Rs resulting from the optional capability.

If there are only M, X or N status entries in the TBR-RT, then this table has one entry of "TRUE".

8.4 TBR test case index table and TBR test suite structure table

The TBR test case index table is defined in ISO 9646-3 [4]. This table associates a given expression in the TBR test case selection expression definition table with a set of test cases. These may either be in the requirements section of the TBR, or in a referenced standard.

NOTE: All abstract test cases defined in the TBR test specification should be included somewhere in the index table, otherwise they can never be selected and are redundant.

If there are only M, X and N status entries in the TBR-RT, then the TBR test case index table simply consists of references to all the tests which will be run in all circumstances.

In addition, the TBR test suite structure table defines test groups which may also reference a selection expression, and the evaluation of the expression results in the entire test group being selected or otherwise. If this facility is used each test in the group must be examined to ensure that it really is related to a requirement. The TBR test suite structure table is defined in [4], and should be provided in the TBR only if selection by test group is required.

8.5 Test selection procedure

The test cases available in the referenced standards and the TBR must be reduced to the set of tests which it is appropriate to run to test that the requirements have been met for a particular instance of an equipment. This algorithm is explained in order that the TBR designer can understand the implications when designing the various Boolean expressions and tables.

This process starts with the TBR-RT filled in to reflect a particular equipment support of the optional capabilities.

Support answers of "N" to an entry of status "M", or "Y" to an entry of status "X" automatically result in a failure of the EC type examination. The expressions in the TBR test case selection expression table are then evaluated according to the support answers, and the list of test cases and test groups associated with each expression which evaluates to TRUE is selected.

These principles result in those tests which are applicable, and only applicable, to requirements, to be selected under given conditions.

Further selection algorithms may apply for operational reasons, but these are outside the scope of ETSI to define (see Annex B).

8.6 Environmental range

The environmental range in which the equipment is required to maintain conformity with the TBR may be defined in the requirements section of the TBR.

In order to ensure comparability of results at different testing laboratories, and not to place too onerous requirements on the testing laboratories, tests should be specified to be undertaken at the midpoint of the environmental range (with reasonable tolerance).

Designated laboratories may choose to test under other environmental conditions, for example at the extremes of the range, or where a specific equipment suggests a particular sensitivity to environmental conditions. This is outside the scope of ETSI.

8.7 Summary of derivation of test cases

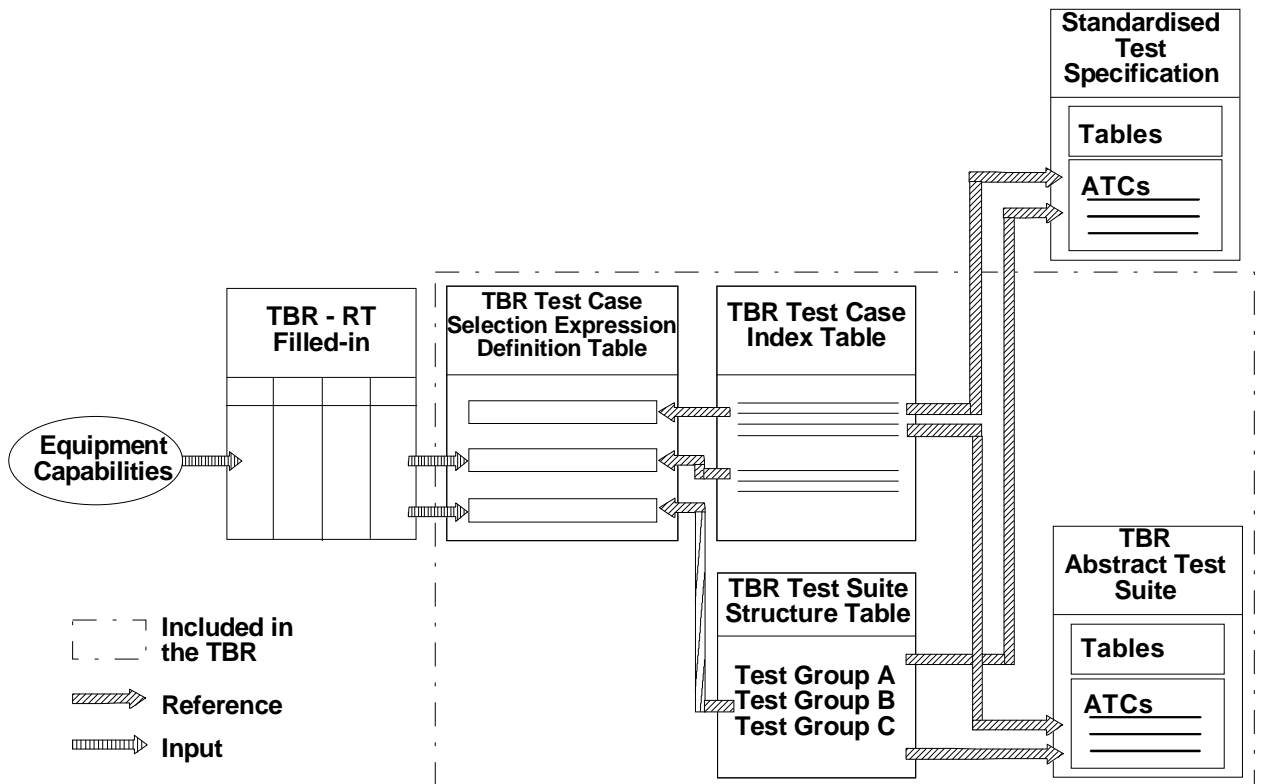The derivation of the test specification associated with a given equipment is shown in figure 3:

Figure 3: Derivation of test cases

9 Transition arrangements

9.1 Use of standards

The methodology contained in this TCR-TR is designed to work where the requirements are a subset of the referenced standards, and the referenced standards contain TSS&TP and IS level TTCN test cases. It is recognised that this will not be the case for some time to come, and the following transition arrangements should be followed:

- if there are no TP or ATS available in the reference standard, they should be included in the TBR test specification;

- if the ATS is written in pre-IS TTCN, then it should be upgraded to IS TTCN and documented in the TBR test specification.

In all cases the material produced should be submitted to the organisation responsible for the referenced standards so that it may be incorporated, and future versions of the TBR can reference or replicate the standard, rather than modify the material.

9.2 Conversion of NETs to TBRs

Existing TBRs and TBRs derived from NETs will require reformatting to an extent. This will require the establishment of the TBR-RT and possibly TBR test case selection expression tables and TBR test case index tables. For layer 2 and above, the requirement for IS level TTCN may require a more substantial effort. ACTE should be informed of any substantial modifications of technical substance, or of any new requirements considered necessary.

9.3 Non-TTCN test specifications

It is known that for the initial application of the rules on test notations, the TBRs may be based on a test specification not using TTCN. At the earliest opportunity such test specifications should be replaced with abstract test suites written in TTCN, by ETSI.

9.4 Existing draft TBRs

Work is well advanced on some TBRs which are not produced according to this TCR-TR. Each STC/TC will have to decide the point at which the TBR is redrafted in accordance with this specification.

9.5 Detailed justifications

It is known that certain TBRs under development do not contain detailed textual justifications for the requirements, and that it would delay their production to include such text. In these cases a justification which just identifies the category in the Terminal Directive [2] is acceptable.

Annex A (informative):   Areas within scope, but not currently addressed

A.1   Specification of EMC requirements

Further study is required on the specification of EMC requirements (insofar as not already covered by the EMC Directive [8]), referencing CENELEC standards for physically connected terminals, and ETSI standards for radio connected terminals.

A.2   Layer 1 test specifications

The TCR-TR does not currently address the issue of test specifications for layer 1.

A.3   Maintenance

The maintenance of TBRs as referenced standards evolve is essential, and currently it is expected that any re-issue of a TBR will require the agreement of the ACTE Committee and the full public enquiry. This may be inappropriate for, for example, the correction of one test case.

It will also be necessary to monitor changes in reference standards to assess the impact of any changes on the TBRs.

Further study is required.

A.4   Specification of environmental range

Testing is to be carried out in the normal operational environment of the equipment. The TBR should therefore contain or reference the specification of the operating environment, temperature, humidity, supply voltages etc., and give guidance on the values within the range at which tests should be performed.

This topic is covered in this TCR-TR to some extent.

A.5   Tolerances

Where analogue measurements are required, a definition of the acceptable tolerance on the specified value is required. This TCR-TR requires each analogue value to be accompanied by a statement of the permitted tolerance.

Annex B (informative):   Testing laboratory issues

B.1   Selection of tests for operational reasons

Wherever possible tests will be written to control the external behaviour of the equipment, and should not require additional features in the equipment for testing purposes only. This will depend on the test method selected to a large extent, but if the required points of control and observation (PCOs) are not available to run the test, then the designated laboratory will have to make its own judgement on whether other forms of assurance are available as to whether the equipment meets the requirements.

ETSI regards the PCOs as requirements, and regards any subsetting of the tests for the above purpose as a derogation.

B.2   Use of manufacturers declaration

The TBR does not provide guidance on the acceptability or otherwise of the manufacturers declaration of conformity, in the event of a test being unable to be performed for operational reasons. Designated laboratories/notified bodies should develop their own policies in this area. This issue is not intended to relate to the Annex IV procedure for manufacturers declaration, but the substitution of a manufacturers declaration for a test during EC type examination by a designated laboratory.

B.3   PIXIT information

In the voluntary sector a proforma (the PIXIT) is provided to collect operational information, such as the way to access certain PCOs. A similar proforma may be required between the manufacturer and the designated laboratory, but as the contents will vary substantially according to the equipment and the particular TBR, it is not proposed to attempt to introduce a standardised proforma in this TCR-TR.

B.4   Stages of EC type examination

The EC type examination process may be considered in at least two stages:

Static: Where the support answers in the TBR-RT are used to evaluate the conditions in the TBR-RT, and to check that the claims made for the equipment by the manufacturer are consistent with support of the defined set of options. For example any support answer of "N" to a conditional which evaluates to "M" should result in a failure.

Dynamic: Where the selected test cases are run using a test tool, and the verdicts examined to ensure that the equipment behaves in accordance with the claims in the TBR-RT.

B.5   Impractical tests

Where no practical test can be defined by ETSI, for example because the running of a test would take a very long time, ETSI will make this clear in the TBR. The designated laboratory/notified body has to decide what other means of assurance it can get from the manufacturer to show that the particular requirement has been met.

B.6   Tolerancing issues

This TCR-TR requires tolerances on analogue values to be specified. It is outside of ETSI scope to define the test procedures to verify whether the equipment is indeed within the specified tolerance. The work of ADLNB on measurement uncertainties [11] is relevant.

B.7   Environmental variations

The TBR test specification provides tests for conformity with the requirements when the equipment is operated in its intended environment in accordance with manufacturers instructions. The designated laboratories/notified bodies must develop policies for handling situations where non-conformity is observed as a result of an invalid operator action, or the consequences of network malfunction or interference.

B.8   Environmental range

This TCR-TR requires the specification of the range of environment over which conformity with the TBR is required, and requires tests to be specified at the mid point of the range.

The designated laboratories/notified bodies must develop their own policies regarding whether additional tests are required at other points in the range, or what action to take if non-conformance is observed at other points in the range.

B.9   Test harnesses

It may be that PCOs required for testing are only available by means of some form of test harness which does not form part of the equipment to be placed on the market, but is required to allow the tests to be carried out. Such harnesses may range from simple extenders to complex hardware and software components.

Designated laboratories/notified bodies will have to form their own policies on the acceptability of tests carried out with such harnesses. The formal position of ETSI must be that the addition of a harness means that the equipment under test is no longer the equipment to be placed on the market, and is therefore unacceptable, but it is appreciated that this is a practical issue which needs to be addressed.

History

Document history	
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