ETSI

EUROPEAN
TELECOMMUNICATION
STANDARD

ETS 300 394-2-4

February 1998

Terrestrial Trunked Radio (TETRA);
Conformance testing specification;
Part 2: Protocol testing specification for Voice plus Data (V+D);
Sub-part 4: Abstract Test Suite (ATS) for
Medium Access Control (MAC)

ETSI

Contents

Foreword

This European Telecommunication Standard (ETS) has been produced by the Terrestrial Trunked Radio (TETRA) Project of the European Telecommunications Standards Institute (ETSI).

Every ETS prepared by ETSI is a voluntary standard. This ETS contains text concerning conformance testing of the equipment to which it relates. This text should be considered only as guidance and does not make this ETS mandatory.

This ETS will consist of two parts with various sub-parts:

Part 1:   "Radio";

Part 2:   "Protocol testing specification for Voice plus Data (V+D)".

Transposition dates	
Date of adoption of this ETS:	6 February 1998
Date of latest announcement of this ETS (doa):	31 May 1998
Date of latest publication of new National Standard or endorsement of this ETS (dop/e):	30 November 1998
Date of withdrawal of any conflicting National Standard (dow):	30 November 1998

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1 Scope

This European Telecommunication Standard (ETS) contains the Abstract Test Suite (ATS) to test the TETRA Medium Access Control (MAC) layer. The MAC protocol is specified in ETS 300 392-2 [2]. The Test Suite Structure (TSS) and Test Purposes (TPs) for this ATS are defined in ETS 300 394-2-1 [1].

The objective of this test specification is to provide a basis for approval tests for TETRA equipment giving a high probability of air interface inter-operability between different manufacturer's TETRA equipment.

The ISO standard for the methodology of conformance testing, ISO/IEC 9646-1 [3], ISO/IEC 9646-2 [4], ISO/IEC 9646-3 [5] and ISO/IEC 9646-5 [6], as well as the ETSI rules for conformance testing, ETS 300 406 [8] and ETR 141 (see annex D), are used as a basis for the test methodology.

Annex A provides the Tree and Tabular Combined Notation (TTCN) part of this ATS.

Annex B provides the Partial Protocol Implementation eXtra Information for Testing (PIXIT) Proforma of this ATS.

Annex C provides the Protocol Conformance Test Report (PCTR) Proforma of this ATS.

2 Normative references

This ETS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1]   ETS 300 394-2-1: "Radio Equipment and Systems (RES); Trans-European Trunked Radio (TETRA) system; Conformance testing specification; Part 2: Protocol testing specification for Voice plus Data (V+D); Part 2-1: Test suites structure and test purposes".

[2]   ETS 300 392-2: "Radio Equipment and Systems (RES); Trans-European Trunked Radio (TETRA) system; Voice plus Data (V+D); Part 2: Air Interface (AI)".

[3]   ISO/IEC 9646-1 (1991): "Information technology - Open Systems Interconnection - Conformance Testing Methodology and Framework - Part 1: General Concepts" (see also CCITT Recommendation X.290 (1991)).

[4]   ISO/IEC 9646-2 (1991): "Information technology - Open Systems Interconnection - Conformance Testing Methodology and Framework - Part 2: Abstract Test Suite Specification" (see also CCITT Recommendation X.291 (1991)).

[5]   ISO/IEC 9646-3 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The tree and tabular combined notation" (see also CCITT Recommendation X.292 (1992)).

[6]   ISO/IEC 9646-5 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 5: Requirements on test laboratories and clients for the conformance assessment process" (see also CCITT Recommendation X.292 (1992)).

[7]   ISO/IEC 9646-6 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".

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

3 Definitions and abbreviations

3.1 TETRA definitions

For the purposes of this ETS, the definitions given in ETS 300 392-2 [2] apply.

3.2 TETRA abbreviations

For the purposes of this ETS, the following TETRA abbreviations apply:

LLC	Logical Link Control
MAC	Medium Access Control
MS	Mobile Station
SDU	Service Data Unit

3.3 ISO 9646 definitions

For the purposes of this ETS, the following ISO/IEC 9646-1 [3] definitions apply:

Abstract Test Suite (ATS)
Abstract Test Method (ATM)
Implementation Conformance Statement (ICS)
Implementation Under Test (IUT)
Implementation eXtra Information for Testing (IXIT)
Lower Tester (LT)
PICS proforma
PIXIT proforma
Point of Control and Observation (PCO)
Protocol Implementation Conformance Statement (PICS)
Protocol Implementation eXtra Information for Testing (PIXIT)
Service Access Point (SAP)
Single Party Testing (SPyT)
System Under Test (SUT)
Upper Tester (UT)

For the purposes of this ETS, the following ISO/IEC 9646-3 [5] definitions apply:

TTCN.GR
TTCN.MP

For the purposes of this ETS, the following ISO/IEC 9646-5 [6] definitions apply:

Protocol Conformance Test Report (PCTR)
PCTR proforma

3.4 ISO 9646 abbreviations

For the purposes of this ETS, the following ISO/IEC 9646-1 [3] abbreviations apply:

ASP	Abstract Service Primitive
ATM	Abstract Test Method
ATS	Abstract Test Suite
IUT	Implementation Under Test
LT	Lower Tester
NWK	Network Layer
PCO	Point of Control and Observation
PDU	Protocol Data Unit
PICS	Protocol Implementation Conformance Statements
PIXIT	Protocol Implementation eXtra Information for Testing
SAP	Service Access Point
SPyT	Single Party Testing
SUT	System Under Test

TC	Test Case
TP	Test Purpose
TSS	Test Suite Structure
TTCN	Tree and Tabular Combined Notation
UT	Upper Tester

For the purposes of this ETS the following ISO/IEC 9646-5 [6] abbreviations apply:

PCTR	Protocol Conformance Test Report

4 Abstract Test Method (ATM)

This clause describes the ATM used for testing the TETRA MAC protocol. It is the embedded variant of the remote test method used in Single Party Testing (SPyT) context, as defined in ISO/IEC 9646-2 [4], clause 11. This test method has been selected, because:

- this test method implies no specific requirements from the Implementation Under Test (IUT);

- the upper Service Access Point (SAP) of the IUT cannot be directly observed;

- the variety of the possible TETRA implementations is a serious technical obstacle for the adoption of a different ATM;

- this test method places minimum limitations in the realization of conformance testing.

The selected test method is illustrated in figure 1.
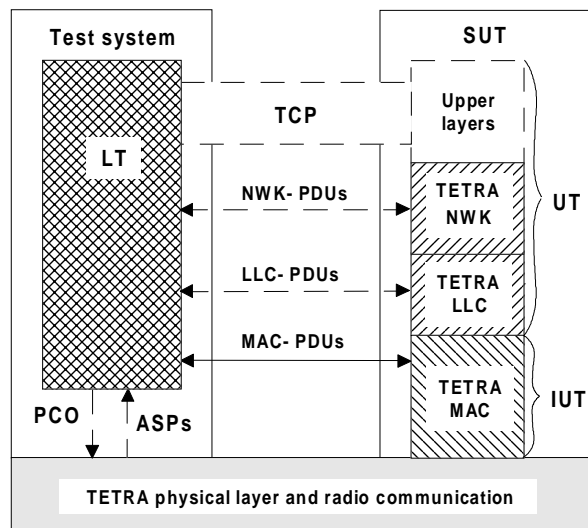
Figure 1: Remote SPyT test method for TETRA MAC

4.1 Lower Tester (LT)

A LT is located in a remote TETRA test system. It controls and observes the behaviour of the IUT.

4.2 Upper Tester (UT)

There is no explicit UT in the remote test method, but the TETRA Network (NWK) layer, Logical Link Control (LLC) layer and the layers above inside the System Under Test (SUT) are used implicitly for testing the MAC layer.

4.3   Test Co-ordination Procedures (TCP)

The implicit send events defined by the provider of an implementation in annex B serve the purpose of the TCP. They are used as an input to the IUT communicating with the UT to initiate test events at the MAC layer.

In addition to the implicit send events, some NWK layer Protocol Data Units (PDUs) sent inside the MAC Service Data Units (SDUs) to the IUT are used for test co-ordination purposes. These PDUs, as sent to the IUT, should produce NWK layer responses, which then further on should cause MAC PDU transmissions by the IUT that are observable by the LT. The same functionality is achieved using the LLC acknowledgements in some test cases.

4.4   Point of Control and Observation (PCO)

The PCO for MAC layer testing is located inside the MAC protocol, i.e. between the upper and lower MAC. All test events at the PCO carrying service user data are specified in terms of MAC layer PDUs. Only few Abstract Service Primitives (ASPs) are defined for control or observation purposes. The mapping of the MAC PDUs into the physical layer frame structure is left to the test implementation.

5   ATS conventions

This clause describes the conventions applied to define the ATS and gives the naming conventions chosen for the different elements of the ATS.

The ATS conventions are intended to give a better understanding of the ATS but they describe also the conventions made for the development of the ATS, thus for any later maintenance purposes or further development of the ATS, the conventions described in this clause shall be considered.

5.1   Naming conventions

5.1.1   Declarations part

This subclause describes the naming conventions chosen for the elements of the ATS declarations part.

5.1.1.1   Test suite type and structured type definitions

The test suite type and test suite structured type identifiers describe the information elements, and each whole word included in the name is written in lowercase starting by an uppercase letter:

EXAMPLE: MultiFrameType   simple type
                      SSI_Type   simple type
                      MAC_ResourceType   structured type
                      TM_SDU_Type   structured type

In the case an abbreviation is included in the declaration name, there is an underscore ("_") before and/or after it, separating it from the rest of the identifier. This rule with abbreviations apply to all the naming conventions in the whole test suite.

5.1.1.2   Test suite operations definitions

The test suite operation identifiers are composed of strings in uppercase letters starting by the uppercase string "TSO_". The different strings in the definition are separated with underscores.

EXAMPLE: TSO_FIRST_FRAGMENT

5.1.1.3 Test suite parameter declarations

The test suite parameter identifiers are composed of strings in uppercase letters starting by the uppercase string "PIC_" or "PIX_" and separated by underscores.

If the test suite parameter references a PICS item, the prefix "PIC_" is used.

EXAMPLE: PIC_MINIMUM_MODE

If a test suite parameter references a PIXIT item, the prefix "PIX_" is used.

EXAMPLE: PIX_HOME_MCC

Complete names as defined in the specifications are used.

5.1.1.4 Test case selection expression definitions

The naming conventions for the test case selection expression definitions use free text starting with an uppercase letter. The name of the expression shall explain clearly the selection rule. The test case selection expressions are generally logical combinations of the test suite parameter definitions.

5.1.1.5 Test suite constant declarations

The test suite constant identifiers are composed of strings in uppercase letters starting by the uppercase string "TSC_".

EXAMPLE: TSC_SSI
                     TSC_ALL_SUBSCRIBER_CLASSES

Complete names as defined in the specifications are used. However, in the parameters including a dot character, the dot is replaced by an underscore.

5.1.1.6 Test suite variable declarations

The test suite variable identifiers are composed of string in lowercase letters starting by the lowercase string "tsv_".

EXAMPLE: tsv_llc_ul_sdu_number

If the test suite variable represents a system parameter or value, the name defined in the specifications is used. However, in the variables including a dot character, the dot is replaced by an underscore.

5.1.1.7 Test case variable declarations

The test case variable identifiers are composed of strings in lowercase letters starting by the lowercase string "tcv_".

EXAMPLE: tcv_boolean

5.1.1.8 PCO declarations

The only point of control and observation is named LMAC, with "L" referring to LT.

5.1.1.9   Timer declarations

Two kinds of timers can be distinguished:

1)   standardized:

> Those defined in the standard, e.g. T.201, use the same name as in the standard, beginning with a capital "T", except that the dot is replaced by an underscore.

> As there is a tolerance margin accepted for these timers, generally two values are needed:

> -   the maximum value allowed, which will use the suffix "_Max";
> -   the minimum value allowed, which will use the suffix "_Min".

EXAMPLE 1:   T_201_Min, T_201_Max

2)   non-standardized:

> Those not defined in the standard, i.e. for execution use, e.g. a timer waiting for a response. These timers begin with the prefix "T_", followed by a string in lowercase letters with each word in the following string starting with an uppercase letter.

EXAMPLE 2:   T_WaitSignallingOpportunities

5.1.1.10   ASP type definitions

No ASP definitions are used in the ATS.

5.1.1.11   PDU type definitions

The identifier of a PDU is given in a string in uppercase letters, which represents the layer message.

EXAMPLE 1:   MAC_ACCESS   for the uplink MAC random access PDU reception;
                        MAC_RESOURCE   for the downlink MAC PDU transmission.

Where the message is a composite word, an underscore character appears in the string.

EXAMPLE 2:   MAC_END_DOWN is downlink last fragment PDU transmission.

5.1.1.12   Alias definitions

No alias definitions are used in the test suite.

5.1.2   Constraints part

This subclause describes the naming conventions chosen for the elements of the ATS constraints part.

Constraint identifiers commence with uppercase. The remaining part of the name is separated from the beginning with an underscore and is written in lowercase with each word starting with an uppercase letter.

Identifier names of elements concerning the same subject have equivalent names in the declaration and the constraint part:

-      Declaration part: ACCESS_ASSIGN_Type
-      Constraint part: ACCESS_ASSIGN _frm_1_17_min_mode

If formal parameter lists are used, the variable names are written in lowercase. The variable name is the same as the name of the element it is representing starting with prefix "cpa_".

EXAMPLE: MM_Group_ID_Downlink (cpa_GSSI: GSSI_Type)

5.1.3 Dynamic part

This subclause describes the naming conventions chosen for the elements of the ATS dynamic part.

5.1.3.1 Test case identifier

The identifier of a TC is built according to table 1:

Table 1: TC naming convention

<ts>_<x>_<s>_<nn>			
<ts> = test suite		MAC	Medium Access Control layer
x = Type of testing		CA BV BI TI	Capability tests Valid Behaviour tests Invalid Behaviour tests Timer expiry and counter mismatch tests
s = test subgroup (as many subgroups as required)			as defined in the test suite structure
<nn> = sequential number		(01-99)	TC Number

5.1.3.2 Test step identifier

The test step identifier is built with a string of lowercase letters leaded by a string of capital letter and joined by an underscore character. The first string indicates the main function of the test step; e.g. PRE for preamble and STP for general step. The second string indicates the meaning of the step.

EXAMPLES: PRE_IUT_Reset;
                  STP_AllReservedAccessAssign.

5.1.3.3 Default identifier

Only one default identifier is used, namely: OtherwiseFail.

5.1.3.4 ATS abbreviations

These abbreviations are used to shorten identifier names:

la	location area
mcc	mobile country code
mnc	mobile network code
ul	uplink
dl	downlink

5.2 TC and TP mapping

There is a one-to-one mapping between the TC identifiers and the TP identifiers. The correspondence rule is given by the following examples:

TP identifier	TC identifier
TP/MAC/CA-01	MAC_CA_01
TP/MAC/BV/MI-02	MAC_BV_MI_02
TP/MAC/BI/AD-01	MAC_BI_AD_01

Annex A (normative): ATS for TETRA MAC

The ATS is written in TTCN according to ISO/IEC 9646-3 [5].

As the ATS was developed on a separate TTCN tool the TTCN tables are not completely referenced in the contents table of this ETS. The ATS itself contains a test suite overview part which provides additional information and references.

A.1 The TTCN Graphical form (TTCN.GR)

The TTCN.GR representation of this ATS is contained in a Postscript file (MAC.PS contained in archive 39424e1.LZH) which accompanies this ETS.

A.2 The TTCN Machine Processable form (TTCN.MP)

The TTCN.MP representation corresponding to this ATS is contained in an ASCII text file (MAC.MP contained in archive 39424e1.LZH) which accompanies this ETS.

> NOTE: According to ISO/IEC 9646-3 [5], in case of a conflict in interpretation of the operational semantics of TTCN.GR and TTCN.MP, the operational semantics of the TTCN.GR representation takes precedence.

Annex B (normative): Partial PIXIT proforma for TETRA MAC

Notwithstanding the provisions of the copyright clause related to the text of this ETS, ETSI grants that users of this ETS may freely reproduce the PIXIT proforma in this annex so that it can be used for its intended purposes and may further publish the completed PIXIT.

The PIXIT proforma is based on ISO/IEC 9646-6 [7]. Any additional information needed can be found in this international standard document.

B.1   Identification summary

Table B.1

PIXIT number:	
Test laboratory name:	
Date of issue:	
Issued to:	

B.2   ATS summary

Table B.2

Protocol specification:	ETS 300 392-2
Protocol to be tested:	
ATS specification:	ETS 300 394-2-4
Abstract test method:	Remote test method, embedded variant

B.3   Test laboratory

Table B.3

Test laboratory identification:	
Test laboratory manager:	
Means of testing:	
SAP address:	

B.4   Client identification

Table B.4

Client identification:	
Client test manager:	
Test facilities required:	

B.5   SUT

Table B.5

Name:	
Version:	
SCS number:	
Machine configuration:	
Operating system identification:	
IUT identification:	
PICS reference for IUT:	
Limitations of the SUT:	
Environmental conditions:	

B.6   Protocol layer information

B.6.1   Protocol identification

Table B.6

Name:	TETRA - Medium Access Control (MAC) layer - ETS 300 392-2
Version:	
PICS references:	

B.6.2   IUT information

Table B.7: Parameter values

Item	Parameter	Parameter type	Explanation	Value or reference
1	PIX_GSSI_1	GSSI_Type	A unique group identifier, accepted by the MS. Needed to enable fragmentation	
2	PIX_GSSI_2	GSSI_Type	A unique group identifier, accepted by the MS. Needed to enable fragmentation	
3	PIX_GSSI_3	GSSI_Type	A unique group identifier, accepted by the MS. Needed to enable fragmentation	
4	PIX_SSI	SSI_Type	The ITSI value of the IUT	
5	PIX_HOME_LA	MM_LocationAreaType	The home location area of the MS	
6	PIX_HOME_MCC	MM_MCC_Type	The home mobile country code	
7	PIX_HOME_MNC	MM_MNC_Type	The home mobile network code	
8	PIX_NEW_LOCATION_AREA_1	MM_LocationAreaType	A unique registration area in the MS home MCC and MNC	
9	PIX_NEW_LOCATION_AREA_2	MM_LocationAreaType	A unique registration area in the MS home MCC and MNC	
10	PIX_NEW_LOCATION_AREA_3	MM_LocationAreaType	A unique registration area in the MS home MCC and MNC	

Annex C (normative):   Protocol Conformance Test Report (PCTR) proforma for TETRA MAC

The PCTR Proforma is based on ISO/IEC 9646-6 [7]. Any additional information needed can be found in this ETS.

C.1   Identification summary

C.1.1   Protocol conformance test report

Table C.1

PCTR number:	
PCTR date:	
Corresponding SCTR number:	
Corresponding SCTR date:	
Test laboratory identification:	
Test laboratory manager:	
Signature:	

C.1.2   IUT identification

Table C.2

Name:	
Version:	
Protocol specification:	
PICS:	
Previous PCTR if any:	

C.1.3   Testing environment

Table C.3

PIXIT number:	
ATS specification:	
Abstract test method:	Remote test method, embedded variant
Means of testing identification:	
Date of testing:	
Conformance log reference(s):	
Retention date for log reference(s):	

C.1.4 Limits and reservation

Additional information relevant to the technical contents or further use of the test report, or the rights and obligations of the test laboratory and the client, may be given here. Such information may include restriction on the publication of the report.

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C.1.5 Comments

Additional comments may be given by either the client or the test laboratory on any of the contents of the PCTR, for example, to note disagreement between the two parties.

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C.2 IUT conformance status

This IUT has or has not been shown by conformance assessment to be non-conforming to the specified protocol specification.

Strike the appropriate words in this sentence. If the PICS for this IUT is consistent with the static conformance requirements as specified in clause C.3 in this report and there are no "FAIL" verdicts to be recorded in clause C.6 strike the words "has or" otherwise strike the words "or has not".

C.3 Static conformance summary

The PICS for this IUT is or is not consistent with the static conformance requirements in the specified protocol.

Strike the appropriate words in this sentence.

C.4 Dynamic conformance summary

The test campaign did or did not reveal errors in the IUT.

Strike the appropriate words in this sentence. If there are no "FAIL" verdicts to be recorded in clause C.6 of this report strike the words "did or" otherwise strike the words "or did not".

Summary of the results of groups of test:

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C.5   Static conformance review report

If clause C.3 indicates non-conformance, this clause itemizes the mismatches between the PICS and the static conformance requirements of the specified protocol specification.

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C.6   Test campaign report

Table C.4

ATS reference	Selected	Run	Verdict	Observations (see note)
MAC_CA_01	Yes/No	Yes/No		
MAC_BV_MI_01	Yes/No	Yes/No		
MAC_BV_MI_02	Yes/No	Yes/No		
MAC_BV_AD_01	Yes/No	Yes/No		
MAC_BV_RA_01	Yes/No	Yes/No		
MAC_BV_RE_01	Yes/No	Yes/No		
MAC_BV_RE_02	Yes/No	Yes/No		
MAC_BV_RE_03	Yes/No	Yes/No		
MAC_BI_MI_01	Yes/No	Yes/No		
MAC_BI_AD_01	Yes/No	Yes/No		
MAC_BI_RA_01	Yes/No	Yes/No		
MAC_BI_RA_02	Yes/No	Yes/No		
MAC_TI_01	Yes/No	Yes/No		
MAC_TI_02	Yes/No	Yes/No		
NOTE: Reference to any observations made in clause C.7 in this report.				

C.7   Observations

Additional information relevant to the technical content of the PCTR are given here.

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Annex D (informative): Bibliography

- EWOS/ETSI Project Team No 5: "Project Report and Technical Report. OSI Conformance Testing Methodology and Procedures in Europe".

- ETR 022 (1991): "Advanced Testing Methods (ATM); Vocabulary of terms used in communications protocols conformance testing".

- ETR 141 (1994): "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; The Tree and Tabular Combined Notation (TTCN) style guide".

History

Document history			
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