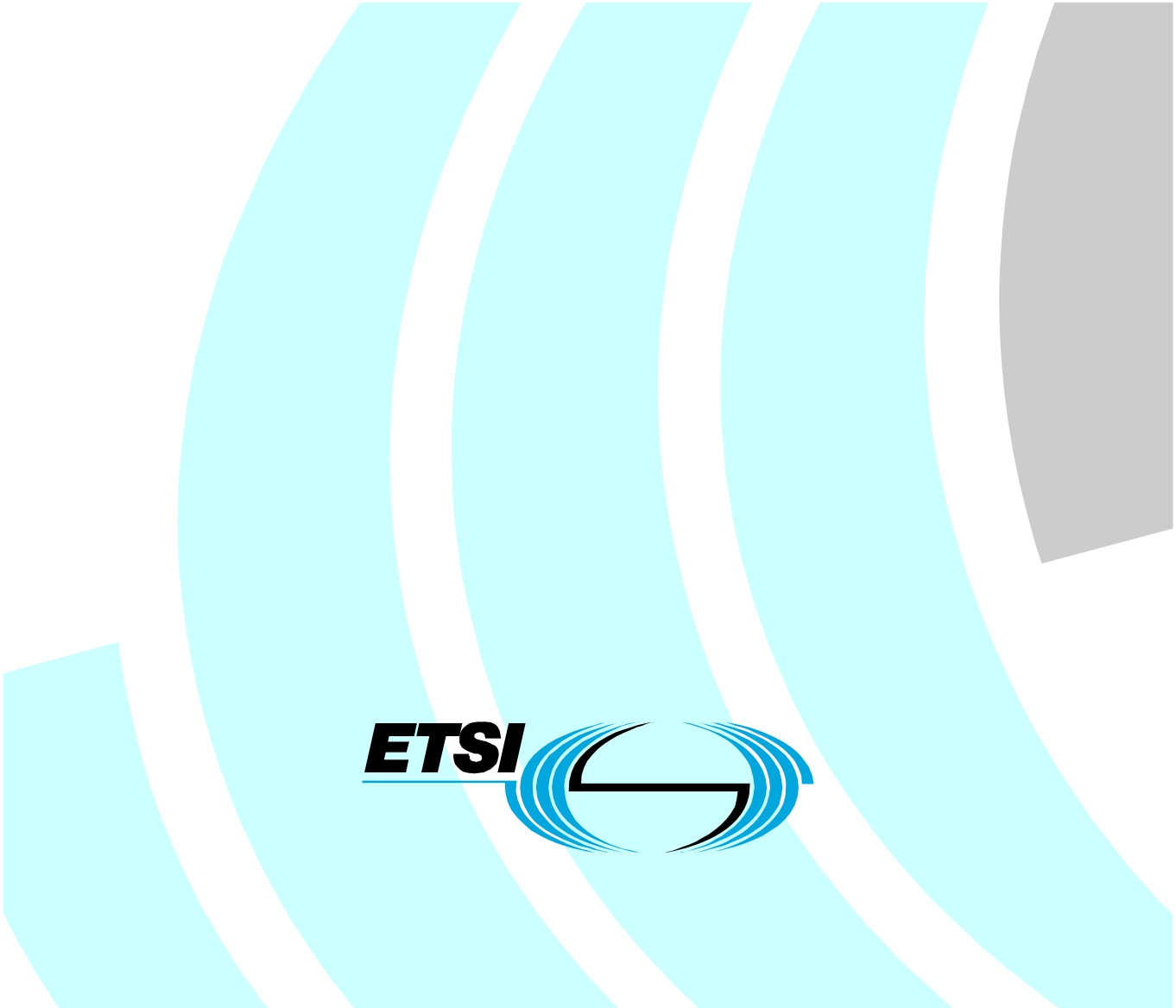
ETSI TS 186 016-3 V2.2.1 (2010-10)

Technical Specification

**Technical Committee for IMS Network Testing (INT);
Closed User Group (CUG);
Conformance Testing;
Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma specification**



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Contents

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee IMS Network Testing (INT).

The present document is part 3 of a multi-part deliverable covering Closed User Group (CUG), as identified below:

Part 1: "Protocol Implementation Conformance Statement (PICS)";

Part 2: "Test Suite Structure and Test Purposes (TSS&TP)";

Part 3: "Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma specification".

1 Scope

The present document specifies the Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma based on the Testsuite Structure and Testpurposes defined in TS 186 016-2 [3].

The TSS&TP have been developed to test the Closed User Group (CUG) PSTN/ISDN simulation services.

The test notation used in the ATS is TTCN-3 (ES 201 873-1 [7]).

The following test specification- and design considerations can be found in the body of the present document:

- the overall test suite structure;
- the testing architecture;
- the test methods and port definitions;
- the test configurations;
- the design principles, assumptions and used interfaces to the TTCN3 tester (System Simulator);
- TTCN styles and conventions;
- the partial PIXIT proforma;
- the modules containing the TTCN-3 ATS.

Annex A provides the Partial Implementation Extra Information for Testing (PIXIT) Proforma of the ATS.

Annex B provides the Testing and Test Control Notation (TTCN-3) part of the ATS.

2 References

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

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

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

2.1 Normative references

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

[1] ETSI TS 183 054: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN simulation services; Protocol specification Closed User Group (CUG)".

[2] Void.

[3] ETSI TS 186 016-2: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN simulation services; Closed User Group (CUG); Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

[4] IETF RFC 3261 (2002): "SIP: Session Initiation Protocol".

[5] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[6] ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

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

[8] Void.

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

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

[11] ETSI TS 102 027-3 (V3.1.1): "Methods for Testing and Specification (MTS); Conformance Test Specification for SIP (IETF RFC 3261); Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma".

[12] ETSI TS 102 351 (V2.1.1): "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); IPv6 Testing: Methodology and Framework".

[13] ETSI TS 186 005-2: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); Terminating Identification Presentation (TIP) and Terminating Identification Restriction (TIR); Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

[14] ETSI TS 186 017-2: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN simulation services; Anonymous Communication Rejection (ACR) and Communication Barring (CB); Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

[15] ETSI TS 186 018-2: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN simulation services; Malicious Communication Identification (MCID); Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

[16] ETSI TS 102 587-2: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Peer-to-Peer Digital Private Mobile Radio; Part 2: Conformance testing; Test Suite Structure and Test Purposes (TSS&TP) specification".

[17] IETF RFC 2617: "HTTP Authentication: Basic and Digest Access Authentication".

[18] IETF RFC 1321: "The MD5 Message-Digest Algorithm".

2.2 Informative references

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

[i.1] ETSI EG 202 568: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); Testing: Methodology and Framework".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 9646-7 [6], TS 102 587-2 [16] and ISO/IEC 9646-1 [5] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ISO/IEC 9646-1 [5] ISO/IEC 9646-7 [6] and the following apply:

NOTE: Abbreviations have been used both in the present document and in the TTCN-3 library modules (annex B).

AS	Application Server
ATS	Abstract Test Suite
CSCF	Call Session Control Function
CUG	Closed User Group
EDS	Encoding/Decoding System
ETS	Executable Test Suite
IBCF	Interconnection Border Control Function
ICB	Incoming Communication Barring
I-CSCF	Interrogating CSCF
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IUT	Implementation Under Test
OAE	Outgoing Access, Explicit request required
OAI	Outgoing Access, Implicit outgoing access for all communications
OCB	Outgoing Communication Barring
PA	Platform Adapter
P-CSCF	Proxy CSCF
PICS	Protocol Implementation Conformance Statement
PIXIT	Partial Protocol Implementation Extra Information for Testing
PTC	Parallel Test Component
SA	SUT Adapter
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SS	Supplementary Services
SUT	System under Test
TC	Test Case
TCI	TTCN-3 Control Interface
TCP	Transmission Control Protocol
TE	TTCN-3 Executable
TL	Test Logging
TM	Test Management
TRI	TTCN-3 Runtime Interface
TS	Test System
TSI	Test System Information
TSS	Test Suite Structure
TTCN	Testing and Test Control Notation
TTCN-3	Testing and Test Control Notation version 3
UDP	User Datagram Protocol
UE	User Equipment
XML	eXtensible Markup Language

4 Abstract Test Method (ATM)

4.1 Network architecture

The SUT is assumed as a complete IMS core network and contains the following components: P-CSCF, I/S-CSCF, E-CSCF and IBCF. As illustrated in the following figure the PCOs for the communication between the systems are Gm, Mw, Ic and Isc. Each component can play role of SUT.

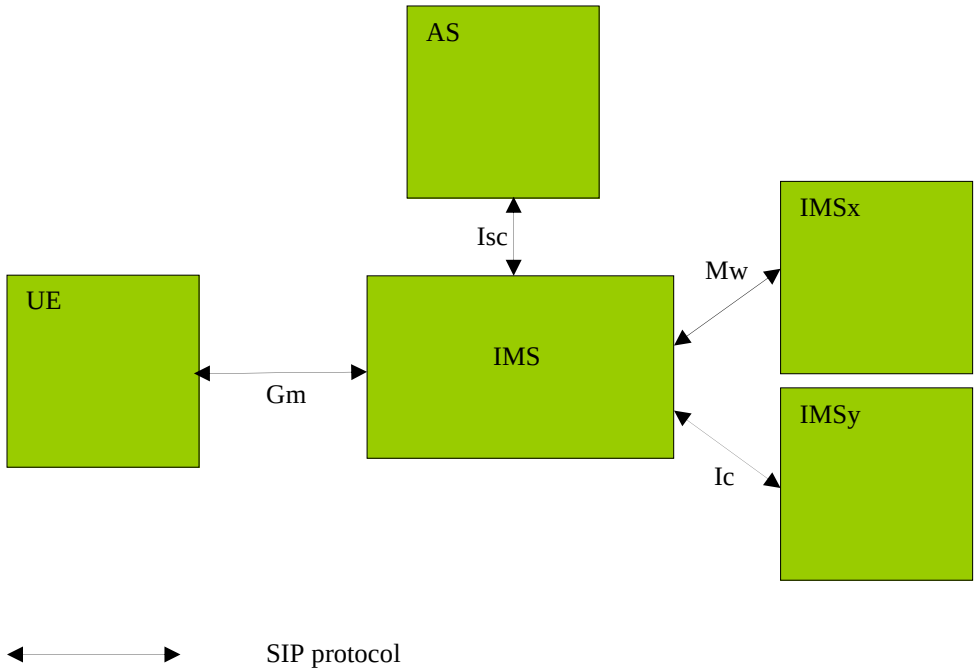

Figure 1: SUT test interface

4.2 Protocol architecture

The Implementation Under Test (IUT) for which this test case specification applies consists of the SIP protocol (see figure 2).

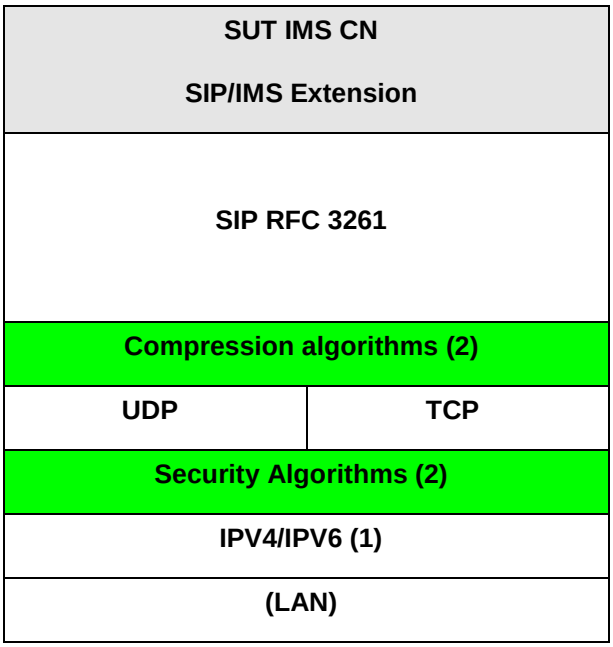

Figure 2: SIP protocol architecture

4.3 Test architecture

The target SUT to be covered by the test purposes of TS 186 016-2 [3] address the IMS functional entities that are accessible via the following interfaces: Gm, Mw, Ic and ISC.

This clause introduces the test configurations that have been used for the test purpose definitions. Depending on the specific configuration the test system (TS) simulates the behaviour of the UE or another IMS communicating with the SUT.

Figures 3 to 7 provide the different configurations in detail. The test configuration is specified in the context of TTCN-3 functions (e.g. *f_cf_1UeUp*). The letters "P", "S", "I" and "B" etc. indicate the CSCFs within the SUT or TS. If applicable used identifiers on user profiles (see clause 5.3.2.4) have also been added in the figures (e.g. "PCSCFwithHomeUE" corresponds to TTCN-3 constant c_userProfile_PCSCFwithHomeUE).

4.3.1 Test configuration

4.3.1.1 Configuration using Gm interface

The Gm interface is located between UE and IMS.

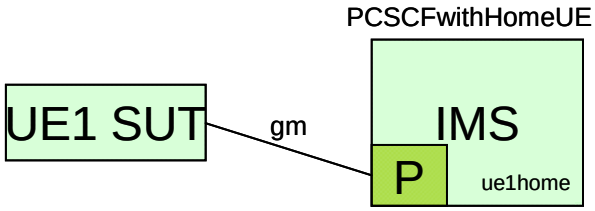

Figure 3: Test configuration with CF_1Ue

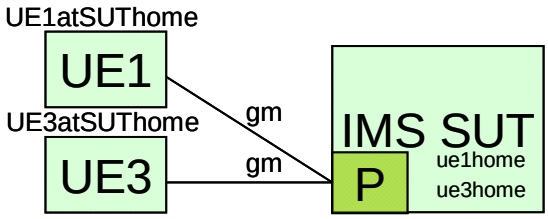

Figure 4: Test configuration with CF_2Ue

4.3.1.2 Configuration using ISC interface

The ISC interface provides an access to the AS.

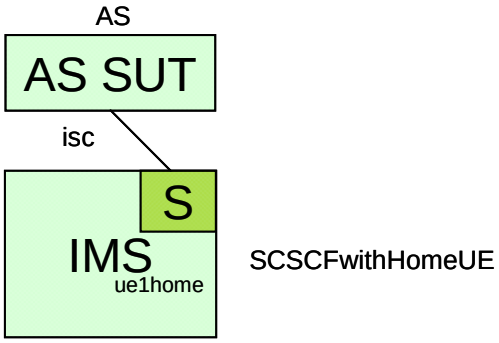

Figure 5: Test configuration with CF_1Scscf

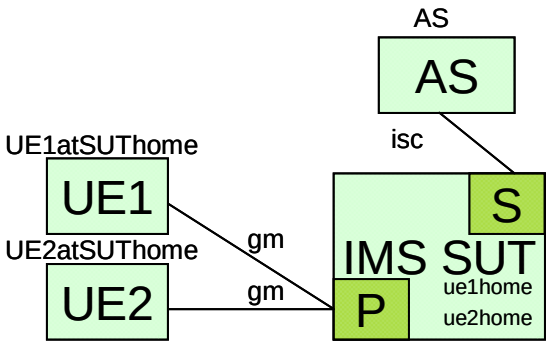

Figure 6: Test configuration with CF_1As2Ue

4.3.1.3 Configuration using Mw and Ic interfaces

The Mw or Ic interface is located between two different IMS, e.g. due to at least one user visiting a network outside of the home network.

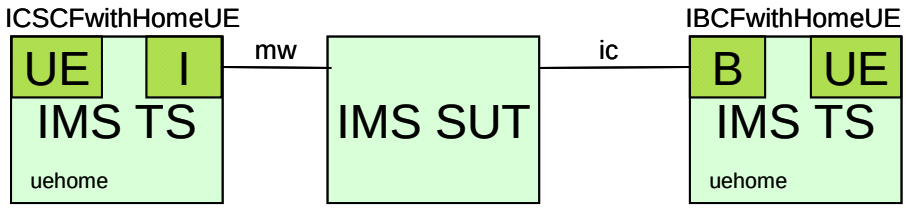

Figure 7: Test configuration with CF_1Scscf1Ibcf

4.3.2 Test system architecture

4.3.2.1 General

Test systems that implement this ATS shall conform to the requirements as defined in this clause.

4.3.2.2 Structure

An abstract architecture for a Test System (TS) implementing a TTCN-3 ATS is displayed in figure 8 and also stated in ES 201 873-5 [9].

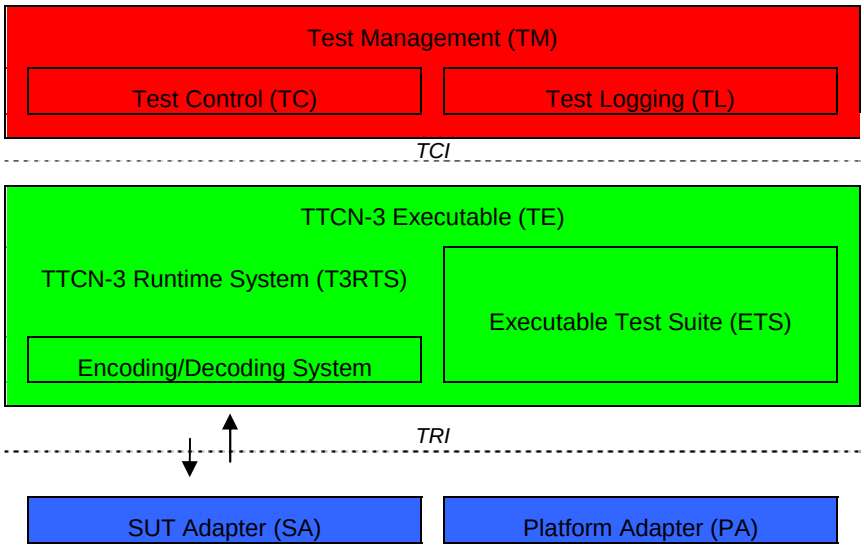

Figure 8: Abstract Test System Architecture

A TS has two interfaces, the TTCN-3 Control Interface (TCI) and the TTCN-3 Runtime Interface (TRI), which specify the interface between Test Management (TM) and TTCN-3 Executable (TE) entities, and TE, SUT Adapter (SA) and Platform Adapter (PA) entities, respectively. Out of these two interfaces the TRI has been standardized in ES 201 873-5 [9], whereas the specification and implementation of the TCI is in ES 201 873-6 [10].

The part of TS that deals with interpretation and execution of TTCN-3 modules, i.e. the Executable Test Suite (ETS), is shown as part of the TTCN-3 Executable (TE). This ETS corresponds either to the executable code produced by a TTCN-3 compiler or a TTCN-3 interpreter from the TTCN-3 ATS in a TS implementation. The remaining part of the TS, which deals with any aspects that cannot be concluded from information being present in the TTCN-3 ATS alone, can be decomposed into Test Management (TM), SUT Adapter (SA) and Platform Adapter (PA) entities. In general, these entities cover a TS user interface, test execution control, test event logging, communication of test data with the SUT and timer implementation.

The part of SA used for SIP message transfer shall implement the TRI adaptation as well as the SIP transport protocol architecture described in clause 4.2.

The Encoding/Decoding System (EDS) entity, as far as applied to SIP messages, with the TE and Test Logging (TL) entity within the TM shall comply with the conventions defined in clause 4.3.2 of TS 102 027-3 [11].

4.3.2.3 Interaction between TTCN-3 Executable (TE) and SUT Adapter (SA)

4.3.2.3.1 Sending and receiving SIP/IMS messages

Before starting a test case, the SA shall provide the transport of SIP messages by establishing appropriate connections on the lower layers (shown in figure 2).

In order to forward messages received into the SA to the test suite and to send them to the SUT a clear and unique association between the TTCN-3 TSI ports and the real IP and port addresses used by the SUT is needed during test execution. The SA retrieves this information via values of TTCN-3 module parameters, i.e. PIXITs and mappings to TSI ports, i.e. triMap operation invocations. TSI port names are the main source for the relating TSI ports with SUT IP addresses and ports.

Table 1 provides the relationships for TSI ports and SUT IP addresses and ports.

Table 1: TSI port mappings

TSI port	SUT (IP address, Port Id)	Test system (IP address, Port id)
UE1	PX_IMS_SUT_PCSCF1_IPADDR, PX_IMS_SUT_PCSCF1_PORT	PX_IMS_TS_UE1_IPADDR, PX_IMS_TS_UE1_PORT
UE2	PX_IMS_SUT_PCSCF2_IPADDR, PX_IMS_SUT_PCSCF2_PORT	PX_IMS_TS_UE2_IPADDR, PX_IMS_TS_UE2_PORT
UE3	PX_IMS_SUT_PCSCF3_IPADDR, PX_IMS_SUT_PCSCF3_PORT	PX_IMS_TS_UE3_IPADDR, PX_IMS_TS_UE3_PORT
PCSCF	PX_IMS_SUT_UE_IPADDR, PX_IMS_SUT_UE_PORT	PX_IMS_TS_PCSCF_IPADDR, PX_IMS_TS_PCSCF_PORT
SCSCF	PX_IMS_SUT_AS_IPADDR, PX_IMS_SUT_AS_PORT	PX_IMS_TS_SCSCF_IPADDR, PX_IMS_TS_SCSCF_PORT
MW_I1	PX_IMS_SUT_ICSCF_IPADDR, PX_IMS_SUT_ICSCF_PORT	PX_IMS_TS_SCSCF_IPADDR, PX_IMS_TS_SCSCF_PORT
IC1	PX_IMS_SUT_IBCF_IPADDR, PX_IMS_SUT_IBCF_PORT	PX_IMS_TS_IBCF1_IPADDR, PX_IMS_TS_IBCF1_PORT
AS1	PX_IMS_SUT_SCSCF_IPADDR, PX_IMS_SUT_ SCSCF_PORT	PX_IMS_TS_AS1_IPADDR, PX_IMS_TS_AS1_PORT
NOTE 1: TSI port names are defined in AtsIms_TestSystem module as part of the ImsComponent type. Module parameters for the address information are defined in LibIms_PIXIT module (see table 3; section LibIms). NOTE 2: For each test configuration listed above a TTCN-3 configuration functions has been implemented with the required mapping and unmapping statements (see table 3; module SS_Ims_TestConfiguration), e.g. f_cf_1Ueup map one UE1 related port of the test system to the SUT.		

Figure 9 illustrates the interconnection of TS and SUT in terms of signalling message associations.

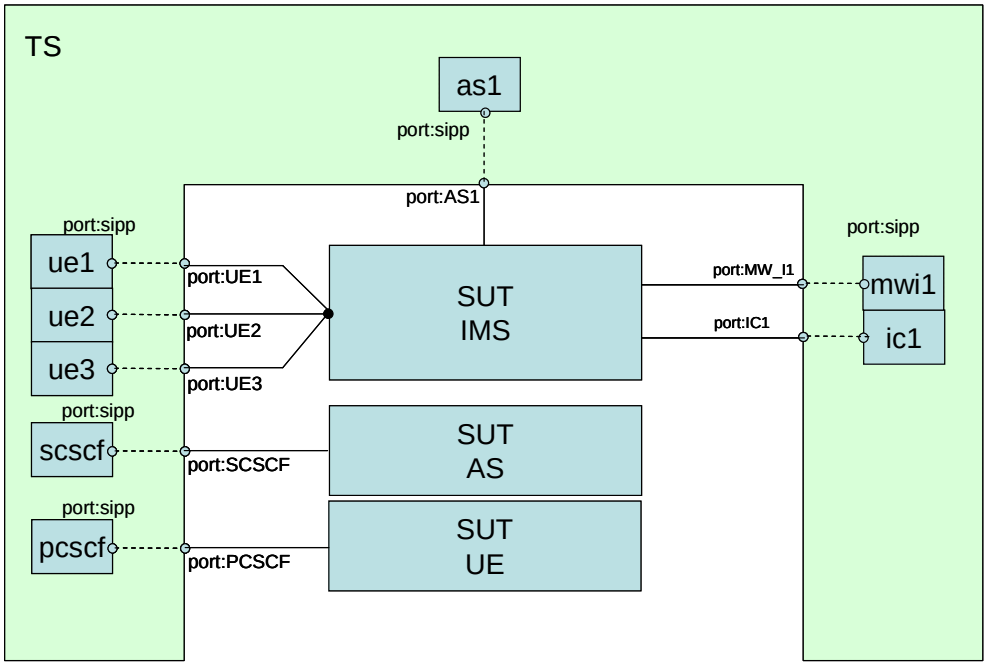

Figure 9: Abstract port association

4.3.2.3.2 Security and messages compression feature

Security transport layer and signalling compression may be used transparently to the ATS.

4.3.2.3.3 Additional SA constraints

In order to execute this test suite the SA should support:

- communication channel handling (at least UDP and possibly also TCP);
- IPv4 transport.

4.3.2.4 Encoding/Decoding requirements

4.3.2.4.1 Encoding/Decoding System requirements for basic SIP messages/headers

SIP is a text-based protocol that allows different syntactical presentations of the same information. In general, an implementation of this ATS should use a EDS to parse received encoded messages into TTCN-3 type structures and values and encode structured TTCN-3 type structures and values into encoded messages. This EDS is not part of the ATS. Still all encoded messages, i.e. the messages as they are transmitted by the SA to or received by the SA from the SUT, shall be logged.

The following terms shall be used for the conventions defined below:

Syntactic delimiter	syntactic delimiters are characters like "=" or ";" that are used to separate encoded values.
LWS	linear white spaces as defined in RFC 3261 [4].
Parameter name	name of header parameters as defined in RFC 3261 [4].
Parameter value	the value of a parameter as defined in RFC 3261 [4].
Undefined method	an undefined method is a method other than: "INVITE", "ACK", "OPTIONS", "BYE", "CANCEL" and "REGISTER".

Undefined header an undefined header is a header other than general-header, entity-header, request-header and response header as defined in RFC 3261 [4].

Unexpected header an unexpected header is a header, which shall not be present in a specific request message. This definition complies to the definition of NOT APPLICABLE in RFC 3261 [4], section 20 for request messages.

Decoder requirements

TTCN-3 fields should not contain syntactic delimiters like white space, semicolon, equal characters etc. in fully decoded fields. Instead the information provided by a parser shall be used to build the decoded message in TTCN-3. Decoded messages shall use the TTCN-3 enumeration types where ever appropriate, e.g. for the method and the header field name.

For **`charstring`** fields the following decoding rules shall be applied by the EDS:

1) Subsequent LWS shall compress to a single space character " ".

2) Decoded parameter names shall use only lower case letters.

3) Parameter values containing an integer value shall be decoded to a TTCN-3 integer value where a TTCN-3 **`integer`** type is used for a SIP parameter value.

The following decoding rules shall be applied by the EDS to each received message in the following order:

1) In case a request message indicating an undefined method is received by the test system, the message shall not be passed in the TE to the ETS.

2) In case an undefined header has been received the header field shall be decoded as **`UndefinedHeader`** field.

RFC 3261 [4] allows for multiple header field values of the same kind to either arrive in one or multiple occurrences of the corresponding header field. The SIP ATS has been written assuming only the first format. Therefore, should the EDS receive multiple header fields of the same kind in a SIP message, e.g. of a Via header field, it shall convert them into the equivalent single header field with multiple values. This can be achieved by adding the value of, e.g. the second received Via header field as the last value to the value(s) of the first Via header field.

Encoder requirements

Encoders shall follow all encoding rules that are defined in RFC 3261 [4] when encoding structured values received from templates. This applies in particular to but it is not restricted to section 7.3.1 of RFC 3261 [4].

Values of type **`Raw`** shall be send to the SUT without any modification.

4.3.2.5 Platform adaptation requirements

For the execution of this test suite implementations of the following external functions have to be provided (see table 3; LibSip_Steps):

1) *rndStr() return charstring;*
returns a random charstring;

2) *putInLowercase(charstring par_string) return charstring;*
returns the equivalent string in lower case;

3) *getIpAddr(charstring host_name) return charstring;*
resolves a domain name to its equivalent IPv4 address;

4) *calculateDigestResponse(charstring nonce, charstring cnonce, charstring user, charstring realm, charstring passwd, charstring alg, charstring nonceCount, charstring method, charstring qop, charstring URI, charstring HEntity) return charstring;*
generates a digest response according to RFC 2617 [17] (HTTP Authentication: Basic and Digest Access Authentication) and RFC 1321 [18]. The MD5 Message-Digest Algorithm, (see RFC 2617 [17], chapter 5 Sample implementation, for example usage, as the signature of calculateDigestResponse is according to the example given in the RFC).

5 The ATS development process

5.1 Requirements and Test Purposes

For each test purpose there is a table defined in clause 5 of TS 186 016-2 [3]. The requirements applicable to this TP are given by a reference to RFC 3261 [4] (SIP), or ES 183 054 [1]. There are no explicit formulations of requirements.

5.2 ATS structure

5.2.1 Test case grouping

The ATS structure defined in table 2 is based on the structuring of Test Purposes in clause 4 of TS 186 016-2 [3]. The group names in column 2 of table 2 are those assigned in the ATS; they are based on the names provided in clause 4 of TS 186 016-2 [3], but use the naming conventions defined for the ATS (see clause 5.3.2.2).

Table 2: ATS structure

CUG			
	originating_UE		CUG_U01_xxx
	originating_AS		
		CUG without preference	CUG_N01_xxx
		CUG without preference +OAE	CUG_N02_xxx
		CUG without preference+ OAI	CUG_N03_xxx
		CUG with preference	CUG_N04_xxx
		CUG with preference +OAE	CUG_N05_xxx
		CUG with preference +OAI	CUG_N06_xxx
		No CUG	CUG_N07_xxx
	terminating_AS		
		CUG with OA not allowed	CUG_N08_xxx
		CUG with OA allowed	CUG_N09_xxx
		No CUG	CUG_N10_xxx

5.2.2 Test case identifiers

The test case names are built up according to the following scheme:

<"TC">"_"<Group index>"_"<TC number>

where:

a) double quotes (") are used to enclose literal strings;

b) <Group path index> is the group index in column 4 of table 2 (which uniquely identifies the path of groups/subgroups);

c) <TC number> is a running 3-digit decimal number, starting in each subgroup path with "001".

EXAMPLE:

TC_CUG_N01_001:

i) the identifier has Group index " CUG_N01", i.e. it is in the subgroup having complete path: SuplementaryServicee_CUG/SS_CUG_SIPSIP/ originating_UE;

ii) the identifier is the first test case of this group/subgroup.

NOTE: This naming scheme provides a 1-1 correspondence of TP identifiers as defined in TS 186 016-2 [3] and test case names. The TP identifier of TC_ CUG_N01_001 is TP CUG_N01_001.

5.3 ATS specification framework

5.3.1 ATS Library

For this ATS the TTCN-3 library modules are basically organized as:

1) AtsCommon modules – project includes test cases from documents TS 186 005-2 [13], TS 186 016-2 [3], TS 186 017-2 [14] and TS 186 018-2 [15];

2) LibIms modules;

3) LibSip modules (RFC 3261 [4]);

4) LibCommon modules (taken from an improved version of TS 102 351 [12]).

NOTE: Due to the common LibSip and LibIms library approach with some other parallel running projects there is necessary to create tag version of all library modules.

Table 3 shows the organization of the ATS as library of modules.

Table 3: Library of modules

Module Class	Module Id	Description
AtsCommon	SS_Ims_PICS	Module Parameter declarations associated with PICS.
	SS_Ims_PIXITS	SIP common Module Parameter declarations associated with PIXIT.
	SS_Ims_TestConfiguration	Functions which implement the configuration of the SUT adapter and mapping of test components for establishing and tearing down different test configurations.
	SS_Ims_TestSystem	TSI components, test system internal ports.
	SS_Ims_TestCases	Test case definitions.
	SS_Ims_TCFunctions	Test case functions.
LibIms	LibIms_PIXITS	IMS specific common Module Parameter (e.g. addresses related to SUT components and TS) declarations associated with PIXIT.
	LibIms_Interface	IMS component.
	LibIms_SIPTypesAndValues	IMS specific user and interface specific profile data (see note).
	LibIms_Templates	Modified templates with IMS specific header fields.
	LibIms_Steps	functions using IMS specific types.
LibSip	LibSip_PIXITS	SIP general common Module Parameter (e.g. SDP/SIP procedure options) declarations associated with PIXIT.
	LibSip_Interface	SIP component.
	LibSip_SIPTypesAndValues	SIP message types and constants, simple user profiles (see note).
	LibSip_SDPTypes	SDP types and constants.
	LibSip_Templates	Basic and modified templates with SIP specific header fields.
	LibSip_Steps	SIP specific behaviour function library.
	LibSip_XMLTypes	XML types for SIP tests.
	XSDAUX	Basic types used in XML.
LibCommon	LibCommon_AbstractData	Generic data types for a stack and its operations.
	LibCommon_BasicTypesAndValues	Basic type and value definitions (integer and Boolean).
	LibCommon_DataStrings	Bit and Octet string types.
	LibCommon_Sync	Co-ordination/synchronization of test components.
	LibCommon_TextStrings	Basic character and string types with fixed length.
	LibCommon_Time	Time handling functions and module parameter.
	LibCommon_VerdictControl	Basic functions for setting of test component verdicts.
NOTE: In order to build a comprehensive library all SIP message header (incl. IMS specific) have been defined in LibSip_SIPTypesAndValues only.		

5.3.2 Use of TTCN-3

5.3.2.1 General

TTCN-3 as defined in ES 201 873-1 [7] is used as ATS specification language.

A number of requirements have been identified for the development and production of the TTCN-3 specification for the SIP IMS ATS:

1) Top-down design.
2) A uniquely defined testing architecture and test method.
3) Uniform TTCN-3 style and naming conventions.
4) TTCN-3 is human-readable.
5) TTCN-3 specification is feasible, implementable, compilable and maintainable.
6) Test cases shall be designed in a way to be easily adaptable, upwards compatible with the evolution of the base protocol and protocol interworking of future releases.
7) The test declarations, data structures and data values shall be largely reusable.
8) Modularity and modular working method.
9) Minimizing the requirements of intelligence on the emulators of the lower testers.
10) Giving enough design freedom to the test equipment manufacturers.

Fulfilling these requirements should ensure the investment of the test equipment manufacturers and users of the ATS having stable testing means for a relatively long period.

5.3.2.2 TTCN-3 naming conventions

Like in other software projects using a programming language, the use of naming conventions supports or increases:

a) the readability;
b) the detection of semantic errors;
c) the shared work of several developers;
d) the maintainability.

The naming conventions applied to the SIP/IMS ATS are based on the following underlying principles:

- when constructing meaningful identifiers, the general guidelines specified for naming in clause 8 [i.1] should be followed;
- the names of TTCN-3 objects being associated with standardized data types (e.g. in the base protocols) should reflect the names of these data types as close as possible (of course not conflicting with syntactical requirements or other conventions being explicitly stated);
- the subfield names of TTCN-3 objects being associated with standardized data type should also be similar to corresponding element names in the base standards (be recognizable in the local context);
- in most other cases, identifiers should be prefixed with a short alphabetic string (specified in table 3) indicating the type of TTCN-3 element it represents;
- prefixes should be separated from the body of the identifier with an underscore ("_");
- only test case names, module names, data type names and module parameters should begin with an upper-case letter. All other names (i.e. the part of the identifier following the prefix) should begin with a lower-case letter.

Table 4 specifies the naming guidelines for each element of the TTCN-3 language indicating the recommended prefix and capitalization.

Table 4: TTCN-3 naming conventions

Language element	Naming convention	Prefix	Example	Notes
Module	Use upper-case initial letter	none	IPv6Templates	
TSS grouping	Use all upper-case letters as specified in clause 7.1.2.1.1	none	TP_RT_PS_TR	
Item group within a module	Use lower-case initial letter	none	messageGroup	
SIP message type	Use upper-case initial letter	none	Request, Response	Note 2
SIP header type	Use upper-case initial letter	none	MaxForwards	Note 2
Basic common data types (e.g. bit string types of fixed length)	Use upper-case initial letter	none	Take from common module	
Other Data types	Use upper-case initial letter	none	SetupContents	
Signature template	Use lower-case initial letter	s_	s_callSignature	
Port instance	Use lower-case initial letter	none	signallingPort	
Test component ref	Use lower-case initial letter	none	userTerminal	
Constant	Use lower-case initial letter	c_	c_maxRetransmission	
External constant	Use lower-case initial letter	cx_	cx_macId	
Function	Use lower-case initial letter	f_	f_authentication()	
External function	Use lower-case initial letter	fx_	fx_calculateLength()	
Altstep (incl. Default)	Use lower-case initial letter	a_	a_receiveSetup()	
Test case	Use naming as specified in clause 5.2.2	TC_	TC_IMST2_xxxxx	
Variable (local)	Use lower-case initial letter	v_	v_macId	
Variable (defined within a component)	Use lower-case initial letters	vc_	vc_systemName	
Timer (local)	Use lower-case initial letter	t_	t_wait	
Timer (defined within a component)	Use lower-case initial letters	tc_	tc_authMin	
Module parameter	Use initial upper case letters	PX	PX_MAC_ID	Note 1
Parameterization	Use lower-case initial letter	p_	p_macId	
Enumerated Value	Use lower-case initial letter	e_	e_syncOk	
NOTE 1: In this case it is acceptable to use underscore as a word delimiter. NOTE 2: This convention has been used in TS 102 027-3 [11] (SIP ATS).				

5.3.2.3 Additional TTCN-3 IMS/SIP naming convention

In addition to the general TTCN-3 naming conventions listed in the previous clause the following rules have been applied to templates

Table 5: TTCN-3 naming conventions

Language element	Naming convention	Prefix	Example	Notes
Message template	Use lower-case initial letter, followed by message type in upper-case letters (for requests) or "Response" keyword	m_	m_BYE_Request_UE	
Message template with wildcard or matching expression	Use lower-case initial letters	mw_	mw_SUBSCRIBE_Request_IMS	

Templates have been defined in a 3-step approach. First, a dummy template is defined for every message type and direction, e.g. m_ACK_Dummy and mw_ACK_Dummy. Secondly, for each message type and direction a base template has been defined that modifies respective dummy templates and includes all mandatory header fields. Template identifiers of this modifications include the keyword "Base", e.g. m_ACK_Request_Base, mw_ACK_Request_Base. More specific templates are then derived on the basis of these base templates and modify fields that need to be restricted for a very specific purpose, e.g. m_ACK_Request_route, etc.

5.3.2.4 Additional concepts and conventions

IMS procedures and tests requires the inclusion of user identification and network address information in SIP messages. Since this information depends on the specific SUT at hand it is defined using module parameters. Due to the big amount of such parameters a profile concept have been introduced for particular parameter collections (records) that are related to IMS users and interfaces.

The so-called user profile information (see table 3; module LibSip_SIPTypesAndValue) contains the following elements: userprofile identifier, current IP port and address to exchange SIP messages, IP port and address for further contact,
IP address used by the TS to exchange media streams, public identity (home domain, username), quality-of-protection parameters, authentication parameters (RFC 2617 [17], section 3.2.2). A list of user profile identifiers (module LibIMS_SIPTypesAndValue) introduces available settings for UE with different locations and homes:
e.g. c_userProfile_UE1atSUThome should be used in case where UE1 is a registered user of SUT and currently not visiting another IMS. User profiles are constructed from module parameters (see table 3; module LibIMS_Steps).

Additionally some interface information is needed to indicate or validate IMS component addresses to be used in SIP header fields like Via, Route, etc. They are defined in a similar way as user profiles (see table 3; LibIms_SIPTypeAndValues) and contain IP address, port and domain information. For example c_interfaceProfile_IMS_SUT_IBCF1 defines an IBCF access point at the SUT. Interface profiles are also constructed based on module parameters (see table 3; module LibIMS_Steps).

5.3.2.5 PICS information

No TTCN-3 control part has been defined for this test suite. If applicable PICS information is evaluated at the beginning of each test case definition using an "if" statement. Log information is provided in case that a test has not been executed due to PICS setting violation.

5.3.2.6 Test Suite documentation

In order to allow browsing of the SIP/IMS ATS without the use of a specific TTCN-3 test development environment, the TTCN ATS is made available in HTML format with hyperlinks between entities in the ATS. The documentation in the ATS makes use of special comment tags used by the tool that converts the ATS to the HTML format. These tags are defined in clause 9 of [7] and the tags shown in table 6.

Table 6: TTCN-3 comment tags

Tag	Description
@author	Specifies the names of the authors or an authoring organization which either has created or is maintaining a particular piece of TTCN-3 code.
@desc	Describes the purpose of a particular piece of TTCN-3 code. The description should be concise yet informative and describe the function and use of the construct.
@remark	Adds extra information, such as the highlighting of a particular feature or aspect not covered in the description.
@img	Associates images with a particular piece of TTCN-3 code.
@see	Refers to other TTCN-3 definitions in the same or another module.
@url	Associates references to external files or web pages with a particular piece of TTCN-3 code, e.g. a protocol specification or standard.
@return	Provides additional information on the value returned by a given function.
@param	Documents the parameters of parameterized TTCN-3 definitions.
@version	States the version of a particular piece of TTCN-3 code.

5.4 ATS archive

Annex B contains the ATS archive (ts_18601603v020201p0.zip file expanding to text files with TTCN-3 code).

Annex A (normative): Partial PIXIT proforma

A.1 Introduction

This partial PIXIT proforma contained in the present document is provided for completion, when the related Abstract Test Suite is to be used against the Implementation Under Test (IUT).

The completed partial PIXIT will normally be used in conjunction with the completed PICS, as it adds precision to the information provided by the PICS.

A.2 PIXIT items

According to the interworking type of ATS defined in the present document, the PIXIT are divided in SIP-related PIXIT and IMS-related PIXIT.

NOTE: The tables in this clause have been generated automatically from the TTCN-3 modules.

A.2.1 SIP-related PIXIT

Each PIXIT item corresponds to a Module Parameter of the ATS.

NOTE: The SIP-related PIXIT definitions are part of a SIP TTCN-3 library that contains additional PIXIT definitions on SIP and TS address information that are not used in this ATS and therefore not present in the following table.

Table A.1: SIP-related PIXIT items

No	PIXIT Name	Description
1	PX_SIP_SDP_dyn	charstring for SDP dynamic port
2	PX_SIP_SDP_b_modifier	charstring for SDP bandwidth modifier
3	PX_SIP_SDP_b_bandwidth	integer for SDP bandwidth value
4	PX_SIP_SDP_encoding	charstring for SDP media attribute encoding supported by the IUT
5	PX_SIP_TRANSPORT	charstring for Used Transport in upper case "UDP"/"TCP"
6	PX_SIP_SUT_PORT	integer for SUT port number to exchange SIP messages
7	PX_SIP_SUT_IPADDR	charstring for SUT IP address to exchange SIP messages
8	PX_SIP_TS1_PORT	integer for port number used by the TS1 to exchange SIP messages
9	PX_SIP_TS1_IPADDR	charstring for IP address used by the TS1 to exchange SIP messages
10	PX_SIP_TS1_LOCAL_DOMAIN	charstring for identity of the tester local domain
11	PX_SIP_TS1_LOCAL_USER	charstring for identity of the tester local user
12	PX_SIP_TS1_BEARER_IPADDR	charstring for IP address used by the TS to exchange media streams
13	PX_SIP_TS2_PORT	integer for port number used by the TS2 to exchange SIP messages
14	PX_SIP_TS2_IPADDR	charstring for IP address used by the TS2 to exchange SIP messages
15	PX_SIP_TS2_LOCAL_DOMAIN	charstring for identity of the tester local domain
16	PX_SIP_TS2_LOCAL_USER	charstring for identity of the tester local user
17	PX_SIP_TS2_BEARER_IPADDR	charstring for IP address used by the TS to exchange media streams
18	PX_SIP_REGISTRATION	boolean for the SIP user if it have to register itself before executing a test case
19	PX_SIP_SUT_REGISTRAR_DOMAIN	charstring for REGISTRAR domain
20	PX_SIP_CheckConversation	boolean for True, if conversation check is implemented.
21	PX_SIP_REGISTER_AUTHENTICATION_ENABLED	boolean for option controlling if authentication is enabled/disabled for REGISTER messages
22	PX_SIP_INVITE_AUTHENTICATION_ENABLED	boolean for option controlling if authentication is enabled/disabled for INVITE messages
23	PX_SIP_SUT_UE1_QOP	charstring for RFC 2617 [17], clause 3.2.1 qop options: Quoted string of one or more tokens indicating the "quality of protection" values supported by the server. The value"auth" indicates authentication; the value "auth-int" indicates authentication with integrity protection
24	PX_SIP_SUT_UE1_USERNAME	charstring for RFC 2617 [17], clause 3.2.2 username: The name of user in the specified realm
25	PX_SIP_SUT_UE1_PASSWD	charstring for RFC 2617 [17], clause 3.2.2.2 passwd: A known shared secret, the password of user of the specified username
26	PX_SIP_SUT_UE2_QOP	charstring for RFC 2617 [17], clause 3.2.1 qop options: Quoted string of one or more tokens indicating the "quality of protection" values supported by the server. The value"auth" indicates authentication; the value "auth-int" indicates authentication with integrity protection
27	PX_SIP_SUT_UE2_USERNAME	charstring for RFC 2617 [17], clause 3.2.2 username: The name of user in the specified realm
28	PX_SIP_SUT_UE2_PASSWD	charstring for RFC 2617 [17], clause 3.2.2.2 passwd: A known shared secret, the password of user of the specified username
29	PX_SIP_T1	float for T1 RTT estimate (500 ms)
30	PX_SIP_TF	float for TDELAY default value for timeout on outgoing SIP request (ie 64*T1)

A.2.2 IMS-related PIXIT

Each PIXIT item corresponds to a Module Parameter of the ATS.

Table A.2: IMS-related PIXIT items (Ports and addresses of IUT)

No	PIXIT Name	Description
1	PX_IMS_SUT_PCSCF1_IPADDR	charstring for SUT - PCSCF1 IP address to exchange SIP messages - connection point for UE1
2	PX_IMS_SUT_PCSCF1_PORT	integer for SUT - PCSCF1 port number to exchange SIP messages - connection point for UE1
3	PX_IMS_SUT_PCSCF1_HOME_DOMAIN	charstring for SUT/PCSCF1 domain - connection point for UE1
4	PX_IMS_SUT_UE1_BEARER_IPADDR	charstring for IP address used by the TS to exchangemedia streams for UE1
5	PX_IMS_SUT_UE1_HOME_DOMAIN	charstring for identity of the tester UE1 local domain
6	PX_IMS_SUT_UE1_PUBLIC_USER	charstring for identity of the tester UE1 local user
7	PX_IMS_SUT_UE1_PRIVAT_USERNAME	charstring for RFC 2617 [17], clause 3.2.2 username of UE1: The name of user in the specified realm
8	PX_IMS_SUT_UE1_PRIVAT_PASSWD	charstring for RFC 2617 [17], clause 3.2.2.2 passwd of UE1: A known shared secret, the password of user of the specified username
9	PX_IMS_SUT_UE1_QOP	charstring for RFC 2617 [17], clause 3.2.1 qop options of UE1: Quoted string of one or more tokens indicating the "quality of protection" values supported by the server; the value "auth" indicates authentication; the value "auth-int" indicates authentication with integrity protection
10	PX_IMS_SUT_UE1_REGISTRAR	charstring for home(SUT) REGISTRAR domain of UE1
11	PX_IMS_SUT_PCSCF2_IPADDR	charstring for SUT - PCSCF2 IP address to exchange SIP messages - connection point for UE2
12	PX_IMS_SUT_PCSCF2_PORT	integer for SUT - PCSCF2 port number to exchange SIP messages - connection point for UE2
13	PX_IMS_SUT_PCSCF2_HOME_DOMAIN	charstring for SUT/PCSCF2 domain - connection point for UE2
14	PX_IMS_SUT_UE2_BEARER_IPADDR	charstring for IP address used by the TS to exchange media streams for UE2
15	PX_IMS_SUT_UE2_HOME_DOMAIN	charstring for identity of the tester UE2 local domain
16	PX_IMS_SUT_UE2_PUBLIC_USER	charstring for identity of the tester UE2 local user
17	PX_IMS_SUT_UE2_PRIVAT_USERNAME	charstring for RFC 2617 [17], clause 3.2.2 username of UE2: The name of user in the specified realm
18	PX_IMS_SUT_UE2_PRIVAT_PASSWD	charstring for RFC 2617 [17], clause 3.2.2.2 passwd of UE2: A known shared secret, the password of user of the specified username
19	PX_IMS_SUT_UE2_QOP	charstring for RFC 2617 [17], clause 3.2.1 qop options of UE2: Quoted string of one or more tokens indicating the "quality of protection" values supported by the server; the value "auth" indicates authentication; the value "auth-int" indicates authentication with integrity protection
20	PX_IMS_SUT_UE2_REGISTRAR	charstring for home(SUT) REGISTRAR domain of UE2
21	PX_IMS_SUT_UE3_BEARER_IPADDR	charstring for IP address used by the TS to exchange media streams for UE3
22	PX_IMS_SUT_UE3_HOME_DOMAIN	charstring for identity of the tester UE2 local domain
23	PX_IMS_SUT_UE3_PUBLIC_USER	charstring for identity of the tester UE3 local user
24	PX_IMS_SUT_UE3_PRIVAT_USERNAME	charstring for RFC 2617 [17], clause 3.2.2 username of UE3: The name of user in the specified realm
25	PX_IMS_SUT_UE3_PRIVAT_PASSWD	charstring for RFC 2617 [17], clause 3.2.2.2 passwd of UE3: A known shared secret, the password of user of the specified username

No	PIXIT Name	Description
26	PX_IMS_SUT_UE3_QOP	charstring for RFC 2617 [17], clause 3.2.1 qop options of UE3: Quoted string of one or more tokens indicating the "quality of protection" values supported by the server; the value "auth" indicates authentication; the value "auth-int" indicates authentication with integrity protection
27	PX_IMS_SUT_UE3_REGISTRAR	charstring for home(SUT) REGISTRAR domain of UE3
28	PX_IMS_SUT_UE4_BEARER_IPADDR	charstring for IP address used by the TS to exchange media streams for UE4
29	PX_IMS_SUT_UE4_HOME_DOMAIN	charstring for identity of the tester UE2 local domain
30	PX_IMS_SUT_UE4_PUBLIC_USER	charstring for identity of the tester UE4 local user
31	PX_IMS_SUT_UE4_PRIVAT_USERNAME	charstring for RFC 2617 [17], clause 3.2.2 username of UE4: The name of user in the specified realm
32	PX_IMS_SUT_UE4_PRIVAT_PASSWD	charstring for RFC 2617 [17], clause 3.2.2.2 passwd of UE4: A known shared secret, the password of user of the specified username
33	PX_IMS_SUT_UE4_QOP	charstring for RFC 2617 [17], clause 3.2.1 qop options of UE4: Quoted string of one or more tokens indicating the "quality of protection" values supported by the server; the value "auth" indicates authentication; the value "auth-int" indicates authentication with integrity protection
34	PX_IMS_SUT_UE4_REGISTRAR	charstring for home(SUT) REGISTRAR domain of UE4
35	PX_IMS_SUT_unknownUE_PUBLIC_USER	charstring for identity of unknown UE public user
36	PX_IMS_SUT_EMERGENCY_HOME_DOMAIN	charstring for identity of emergency service local domain
37	PX_IMS_SUT_EMERGENCY_SERVICE	charstring for identity of the emergency service
38	PX_IMS_SUT_EMERGENCY_SERVICE_INVALID	charstring for identity of the invalid emergency service
39	PX_IMS_SUT_IBCF1_IPADDR	charstring for SUT/IBCF1 IP address to exchange SIP messages
40	PX_IMS_SUT_IBCF1_PORT	integer for SUT/IBCF1 port number to exchange SIP messages
41	PX_IMS_SUT_IBCF1_HOME_DOMAIN	charstring for SUT/IBCF1 domain
42	PX_IMS_SUT_IBCF2_IPADDR	charstring for SUT/IBCF2 IP address to exchange SIP messages
43	PX_IMS_SUT_IBCF2_PORT	integer for SUT/IBCF2 port number to exchange SIP messages
44	PX_IMS_SUT_IBCF2_HOME_DOMAIN	charstring for SUT/IBCF2 domain
45	PX_IMS_SUT_PCSCF_IPADDR	charstring for SUT/P-CSCF IP address to exchange SIP messages
46	PX_IMS_SUT_PCSCF_PORT	integer for SUT/P-CSCF port number to exchange SIP messages
47	PX_IMS_SUT_PCSCF_HOME_DOMAIN	charstring for SUT/P-CSCFdomain
48	PX_IMS_SUT_SCSCF_IPADDR	charstring for SUT/S-CSCF IP address to exchange SIP messages
49	PX_IMS_SUT_SCSCF_PORT	integer for SUT/S-CSCF port number to exchange SIP messages
50	PX_IMS_SUT_SCSCF_HOME_DOMAIN	charstring for SUT/S-CSCFdomain
51	PX_IMS_SUT_ICSCF_IPADDR	charstring for SUT/I-CSCF IP address to exchange SIP messages
52	PX_IMS_SUT_ICSCF_PORT	integer for SUT/I-CSCF port number to exchange SIP messages
53	PX_IMS_SUT_ICSCF_HOME_DOMAIN	charstring for SUT/I-CSCFdomain
54	PX_IMS_SUT_AS_IPADDR	charstring for SUT - AS IP address to exchange SIP messages - connection point for SCSCF
55	PX_IMS_SUT_AS_PORT	integer for SUT - AS port number to exchange SIP messages - connection point for SCSCF
56	PX_IMS_SUT_AS_HOME_DOMAIN	charstring for SUT/AS domain
57	PX_IMS_SUT_IMGCF_IPADDR	charstring for SUT/I-MGCF IP address to exchange SIP messages
58	PX_IMS_SUT_IMGCF_PORT	integer for SUT/I-MGCF port number to exchange SIP messages
59	PX_IMS_SUT_IMGCF_HOME_DOMAIN	charstring for SUT/I-MGCFdomain

No	PIXIT Name	Description
60	PX_IMS_SUT_CONF_PORT	integer for SUT/conference port number to exchange SIP messages
61	PX_IMS_SUT_CONF_HOME_DOMAIN	charstring for SUT/conference domain
62	PX_IMS_SUT_CONF_FACTORY_NAME	charstring for conference factory URI name
63	PX_IMS_TS_UE1_IPADDR	charstring for IP address used by the UE1 to exchange SIP messages
64	PX_IMS_TS_UE1_PORT	integer for port number used by the UE1 to exchange SIP messages
65	PX_IMS_TS_UE2_IPADDR	charstring for IP address used by the UE2 to exchange SIP messages
66	PX_IMS_TS_UE2_PORT	integer for port number used by the UE2 to exchange SIP messages
67	PX_IMS_TS_UE3_IPADDR	charstring for IP address used by the UE3 to exchange SIP messages
68	PX_IMS_TS_UE3_PORT	integer for port number used by the UE3 to exchange SIP messages
69	PX_IMS_TS_UE4_IPADDR	charstring for IP address used by the UE3 to exchange SIP messages
70	PX_IMS_TS_UE4_PORT	integer for port number used by the UE3 to exchange SIP messages
71	PX_IMS_TS_IBCF_IPADDR	charstring for TS/IBCF IP address to exchange SIP messages
72	PX_IMS_TS_IBCF_PORT	integer for TS/IBCF port number to exchange SIP messages
73	PX_IMS_TS_ICSCF_IPADDR	charstring for TS/I-CSCF IP address to exchange SIP messages
74	PX_IMS_TS_ICSCF_PORT	integer for IUT/I-CSCF port number to exchange SIP messages
75	PX_IMS_TS_PCSCF_IPADDR	charstring for TS/P-CSCF IP address to exchange SIP messages
76	PX_IMS_TS_PCSCF_PORT	integer for IUT/P-CSCF port number to exchange SIP messages
77	PX_IMS_TS_SCSCF_IPADDR	charstring for TS/S-CSCF IP address to exchange SIP messages
78	PX_IMS_TS_SCSCF_PORT	integer for TS/S-CSCF port number to exchange SIP messages
79	PX_IMS_TS_SCSCF_HOME_DOMAIN	charstring for TS/S-CSCFdomain
80	PX_IMS_TS_ECSCF_IPADDR	charstring for TS/E-CSCF IP address to exchange SIP messages
81	PX_IMS_TS_ECSCF_PORT	integer for TS/E-CSCF port number to exchange SIP messages
82	PX_IMS_TS_IMS1UE_PUBLIC_USER	charstring for public userinfo/displayname addressing IMS1UE (simulated by the TS)
83	PX_IMS_TS_IMS1UE_HOME_DOMAIN	charstring for TS/domain
84	PX_IMS_TS_ISUP_PUBLIC_USER	charstring for public userinfo addressing ISUPUE (simulated by the TS)
85	PX_IMS_TS_ISUP_HOME_DOMAIN	charstring for ISUP TS/domain or IPAddres
86	PX_IMS_TS_AS1_IPADDR	charstring for TS/AS1 IP address to exchange SIP messages
87	PX_IMS_TS_AS1_PORT	integer for TS/AS1 port number to exchange SIP messages
88	PX_IMS_TS_AS1_HOME_DOMAIN	charstring for TS/AS1 domain
89	PX_IMS_TS_AS2_IPADDR	charstring for TS/AS2 IP address to exchange SIP messages
90	PX_IMS_TS_AS2_PORT	integer for TS/AS2 port number to exchange SIP messages
91	PX_IMS_TS_AS2_HOME_DOMAIN	charstring for TS/AS2 domain

Table A.3: CUG-related PIXIT (ATS specific)

No	PIXIT Name	Description
1	PX_CugIndex_Registred_Restrictions_None	Integer (0 .. 32767) for a registered CugIndex_with Restrictions=None which refers to a value assigned by the network to identify a CUG
2	PX_CugIndex_Registred_Restrictions_OCB	Integer (0 .. 32767) for a registered CugIndex_with Restrictions=OCB which refers to a value assigned by the network to identify a CUG
3	PX_CugIndex_Unregistred_Restrictions_None	Integer (0 .. 32767) for an unregistered CugIndex_with Restrictions=None which refers to a value assigned by the network to identify a CUG
4	PX_CugNetworkIndicator	hexstring for Cug Network Indicator
5	PX_CugInterlockBinaryCode	hexstring for Cug Interlock Binary Code
6	PX_CugInterlockBinaryCode_RelatedToRegistredCUG_Index	hexstring for Cug Interlock Binary Code related to registered CUG Index
7	PX_CugInterlockBinaryCode_NotRelatedToRegistredCUG_Index	hexstring for Cug Interlock Binary Code not related to registered CUG Index

Annex B (informative): TTCN-3 library modules

B.1 Electronic annex, zip file with TTCN-3 code

The TTCN-3 library modules are contained in archive ts_18601603v020201p0.zip which accompanies the present document.

Annex C (informative): Bibliography

- ETSI ETS 300 406: "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- ISO/IEC 9646-6: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".
- ETSI TS 186 016-1: "Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN); PSTN/ISDN simulation services; Closed User Group (CUG); Part 1: Protocol Implementation Conformance Statement (PICS)".
- ETSI ES 201 873-2: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 2: TTCN-3 Tabular presentation Format (TFT)".

History

Document history		
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