EUR AMHS Manual

Appendix C

AMHS Testing Requirements	
Document Reference:	EUR AMHS Manual, Appendix C
Author:	ICAO AFSG PG
Revision Number:	Version 7.0
Date:	26/04/12
Filename:	EUR_AMHS_Manual-Appx_C-v7_0.doc

Document Control Log

Edition	Date	Comments	Section/pages affected
0.1	02/09/2005	Creation of the document.	all
0.2	25/01/2006	Renaming of the document, Deletion of chapter 2.3 (moved to Manual's chapter 7)	all
0.3	29/03/2006	Terminology (ATS Message Handling Service) corrected	all
1.0	27/04/2006	Adopted version (AFSG/9)	
1.1	14/01/2007	Editorial updates	References
2.0	26/04/2007	Adopted version (AFSG/10)	
3.0	24/04/2008	Adopted version (AFSG/11) – without changes	
3.1	17/11/2008	Change of references from ICAO Doc 9705 to ICAO Doc 9880, Part IIB, editorial improvements	all
3.2	12/12/2008	Incorporation of comments of PG M34 meeting, Addition of the Reference to ICAO Doc 9880, Part III	References, 5.1.2 Table 4
3.3	11/03/2009	Update of the referenced documents	References
4.0	02/04/2009	Adopted version (AFSG/12)	
5.0	17/06/2010	Adopted version (AFSG/14) – without changes	
5.1	25/09/2010	Incorporation of CP-AMHSM-10-001, minor editorial updates	References
5.2	05/11/2010	Incorporation of CP-AMHSM-10-001, Attm2	5.1.2, Table 4
6.0	14/04/2011	Adopted version (AFSG/15)	
7.0	26/04/2012	Adopted version (AFSG/16) – without changes	

Table of contents

1 INTRODUCTION 6

1.1 PURPOSE OF THE DOCUMENT 6
1.2 SCOPE OF THE DOCUMENT 6
1.3 DOCUMENT STRUCTURE 6
1.4 ACRONYMS 7

2 CONFORMANCE TESTING 8

2.1 OBJECTIVES 8
2.2 SPECIFIC ASPECTS OF AMHS TESTING 9

3 ASSUMED TEST SCENARIO 11

3.1 AMHS FUNCTIONALITY OF THE IUT 11
3.1.1 AMHS technical specifications provisions 11
3.1.2 Implementation specific AMHS features 12
3.2 MODELLING OF THE TEST ENVIRONMENT 13
3.3 USED TRANSPORT SERVICE FOR AMHS 14
3.4 COMMUNICATION WITH THE AFTN 15
3.5 POINTS OF REFERENCE FOR TESTING 15
3.5.1 Standardised points of reference 15
3.5.2 Proprietary points of reference 16

4 SUPPORTED SCOPE OF CONFORMANCE TESTING 18

4.1 GENERAL ASPECTS 18
4.2 GENERIC TEST CONFIGURATION 18
4.3 DEFINITION OF TEST GROUPS 20
4.3.1 Submission operations 20
4.3.2 Transfer operations 21
4.3.3 Delivery operations 22
4.3.4 Gateway operations 23
4.3.5 Naming and addressing 27
4.3.6 AMHS parameters 27
4.3.7 Traffic logging 28
4.4 DEFINITION OF TEST CASES 28

5 CONFIGURATION PARAMETERS 32

5.1 AMHS COMMUNICATION 32
5.1.1 AMHS application 32
5.1.2 Layer addresses 32
5.2 AFTN/CIDIN COMMUNICATION 33
5.2.1 AFTN application 33
5.2.2 Layer addresses 33

6 TEST DATA 35

References

[1] ICAO Doc 9880-AN/466: Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part II – Ground-Ground Applications - Air Traffic Services Message Handling Services (ATSMHS), First Edition – 2010Referred to as AMHS technical specifications

[2] ICAO Doc 9880-AN/466: Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part III – Upper Layer Communications Service (ULCS) and Internet Communications Service (ICS), , First Edition – 2010

[3] ICAO Annex 10 – Aeronautical Telecommunications, Volume II: Communication Procedures

[4] ICAO EUR Doc 005, EUR CIDIN Manual, Fifth Edition (2006)

[5] ISO/IEC 10021-2 – Information technology, Text communication – Message-oriented Text Interchange Systems – Part 2: Overall architecture

[6] ISO/IEC 10021-4 – Information technology, Text communication – Message-oriented Text Interchange Systems – Part 4: Message Transfer System: Abstract service definition and procedures

[7] ISO/IEC 10021-7 – Information technology, Text communication – Message-oriented Text Interchange Systems – Part 7: Interpersonal Messaging System

[8] ISO/IEC ISP 10611-3 – International standardized profile AMH1n – Message Handling Systems – Common Messaging –AMH11: Message transfer (P1)

[9] ISO/IEC ISP 12062-2 – International standardized profile AMH2n – Message Handling Systems – Interpersonal Messaging –AMH21: IPM content

[10] ISO/IEC ISP 12062-3 – International standardized profile AMH2n – Message Handling Systems – Interpersonal Messaging –AMH22: IPM requirements for message transfer (P1)

[11] SPACE Final Report, Version 1.0, STNA (02/12/2002)

[12] ISO/IEC 9646-1 – Conformance testing methodology and framework – Part 1: General concept (1994)

[13] ACCESS – Interim Deliverable 4: ATSMHS interoperability/conformance testing (16/04/1999)

[14] FIRST – Part 1a: Bilateral Basic Tests, Test Plan V1.0 (29/01/2004)

[15] FIRST – Part 1b: Bilateral Extended Tests, Test Plan Rev. 1.7 (29/08/2005)

[16] FIRST – Part 2: Trilateral Network Tests, Test Plan Rev. 0.14 (28/07/2005)

[17] EUR Doc 020 – EUR AMHS Manual, Appendix A "Abbreviations, Glossary and Definitions", latest version

[18] EUR Doc 020 – EUR AMHS Manual, Appendix B, European ATS Messaging Service Profile, latest version

Table of Figures

FIGURE 1: AMHS FUNCTIONALITY SPECIFIED BY THE AMHS TECHNICAL SPECIFICATIONS 11
FIGURE 2: ASSUMED OPERATIONAL ENVIRONMENT OF THE IUT 13
FIGURE 3: MODEL OF THE TEST ENVIRONMENT 14
FIGURE 4: GENERIC AMHS COMMUNICATION SCENARIO AND USED POINTS OF REFERENCE FOR CONFORMANCE TESTING 19
FIGURE 5: GENERIC TEST CONFIGURATION WITH POINTS OF REFERENCE 20
FIGURE 6: TEST CONFIGURATION "SUBMISSION" 21
FIGURE 7: TEST CONFIGURATION "TRANSFER" 22
FIGURE 8: TEST CONFIGURATION "DELIVERY" 23
FIGURE 9: TEST CONFIGURATION "GATEWAY" – USER MESSAGE FROM AMHS TO AFTN 24
FIGURE 10: TEST CONFIGURATION "GATEWAY" – USER MESSAGE FROM AFTN TO AMHS 25
FIGURE 11: TEST CONFIGURATION "GATEWAY" – HANDLING OF PROBES 26
FIGURE 12: APPROACH FOR DEFINITION OF TEST CASES 29
FIGURE 13: CLASSES OF "NEGATIVE TESTS" 30
FIGURE 14: INFORMATION OBJECTS SUPPORTED BY THE AMHS TEST TOOL 36

List of Tables

TABLE 1: LOWER PROTOCOL LAYERS (AMHS COMMUNICATIONS) 15
TABLE 2: LOWER PROTOCOL LAYERS (AFTN/CIDIN COMMUNICATIONS) 16
TABLE 3: APPLICABILITY OF NEGATIVE TESTING FOR TEST GROUPS (TESTING MATRIX) 31
TABLE 4: LAYER ADDRESSES (AMHS COMMUNICATIONS) 33
TABLE 5: LAYER ADDRESSES (CIDIN COMMUNICATIONS) 34

1 Introduction

1.1 Purpose of the Document

The purpose of the document is to define the functional requirements for AMHS testing procedures.

1.2 Scope of the Document

Based on known principles of testing and general assumptions on an AMHS test scenario, the scope of testing for an "AMHS Conformance Test" is specified. Elements of the specifications are generic test groups and related test configurations. Special attention is given to the “provocation” of an AMHS implementation with incorrect protocol behaviour (“negative testing”) to analyse its stability (robustness) in out-of-line situations.

Further requirements are specified in terms of configuration parameters (as number of ATS Message Servers and AMHS users represented by test equipment) and the components of AMHS and AFTN information objects to be handled.

In principle, these groups are also valid for interoperability tests. But especially the test groups dealing with “negative testing” cannot be performed by real systems due to the nature of an implementation to avoid such exception situations.

1.3 Document Structure

Chapter 2 is concerned with general aspects of conformance testing and identifies the principal differences to interoperability testing. Key elements of the envisaged test methodology are identified which form high-level requirements for an AMHS conformance testing equipment. References are made to ISO/IEC 9646 which provides a general concept of conformance testing and to deliverables of the ACCESS study concerning AMHS testing.

Chapter 3 deals with the scope of AMHS functions to be tested and identifies reference points at AMHS implementations which should be accessible for testing. In addition, the used transport service for AMHS communications is identified and the interface with AFTN at the implemented AFTN/AMHS Gateway is detailed.

Chapter 4 defines AMHS test groups for comprehensive conformance testing of AMHS native communications and gateway operations with the AFTN. Related test configurations are added with explanations on sequences of exchanged AMHS and AFTN information objects. In addition, principles for definitions of test cases are set up including the consideration of so-called “negative testing”.

Chapter 5 specifies the range of parameters values supported in test configurations which place quantitative requirements on the testing equipment as the number of represented adjacent ATS Message Servers and handled AMHS and AFTN users.

Finally, *chapter* 6 identifies the used AMHS and AFTN test data. In particular, the elements of AMHS information objects and their sub-components (as message and message transfer envelope) to be supported are specified in detail.

1.4 Acronyms

All items are compiled in EUR AMHS Manual, Appendix A "Abbreviations, Glossary and Definitions" [17].

2 Conformance Testing

The chapter provides an introduction to general aspects of conformance testing and identifies the principal differences to interoperability testing. Elements of the envisaged test methodology are identified which form high-level requirements for an AMHS conformance testing equipment.

References are made to ISO/IEC 9646 [12] and outcomes of the ACCESS study work [13].

2.1 Objectives

Generally, conformance testing attempts to determine whether a given implementation matches a specification. The implementation to be tested is referred to as the *implementation under test (IUT).* A tester provides the IUT with defined inputs and observes the resulting outputs. – ISO/IEC 9646-1 [12] provides a general concept of OSI conformance testing and definitions of related key terms.

Note. – According to ISO 9646-1, the term Implementation Under Test (IUT) refers to an implementation of one or more OSI protocols, being part of a real open system which is to be studied. The System Under Test (SUT) is the real open system in which the IUT resides. – In the following, the term IUT is used when referring to the AMHS implementation to be tested in consideration that only the AMHS aspects within a given (real) ATS communication system are addressed.

ISO/IEC 9646-1 distinguishes three types of standardised conformance testing:

- *Basic interconnection tests*, that is to determine whether or not there is sufficient conformance to the relevant protocols for interconnection to be possible without trying to perform thorough testing.

- *Capability tests*, which are used to verify the existence of one or more claimed capabilities of an IUT (*static* conformance requirements).

- *Behaviour tests* deal with *dynamic* conformance requirements, which specify the observable behaviour of an implementation. Behaviour tests include tests for valid behaviour of the IUT for both valid and invalid inputs by the tester.

The AMHS testing requirements specified in this document focus on *behaviour tests*, i.e. test exercises address implemented AMHS functions in a way as they should be used. *Basic interconnection tests* are an appropriate means to check the correctness of a test configuration before starting detailed test exercises.

The discussed AMHS conformance testing relates to that scope of functions which is typically implemented in an *International Communication Centre*, i.e.

1) AMHS message transfer,

2) AMHS submission and delivery operations with attached AMHS user terminals and

3) intercommunication with the AFTN/CIDIN by means of the AFTN/AMHS Gateway.

The interface to the AFTN (CIDIN) is only taken into account in the extent as specified in the AMHS technical specifications. For example, the AMHS technical specifications do not assume AFTN routing by the gateway. – The Basic ATS Message Handling Service is assumed as the service level supported by the IUT.

The conformance testing equipment acting as peer system of the AMHS IUT is referred to the *AMHS Test Tool*. The AMHS Test Tool provides the IUT with inputs, records and evaluates responses of the IUT.

The specified testing requirements refer to an initial functionality of the AMHS Test Tool. Potential future extensions are indicated in the context of the specified sub-items of the test tool.

2.2 Specific aspects of AMHS testing

The AMHS (MHS) functions to be tested reside in the *application layer* of the ISO/OSI reference model. The underlying layers provide supporting communication services, however, are not primary subject of testing.

In the framework of the ACCESS study [13] two methodologies have been discussed in the context of AMHS conformance testing:

(a) the testing of complete systems (“black boxes”) and

(b) the testing of individual protocol layers, in particular the application layer.

In case (a) only external interfaces which are part of the IUT are used for access by the conformance testing equipment. In case (b), on the other hand, the IUT has to be “opened up”, providing access to the layer to be tested. For this purpose special software modules have to be provided within the IUT for control and observation of the lower and upper service boundary at the layer under test (see ISO/IEC 9646-1).

In the end, the ACCESS study recommends for AMHS conformance testing that:

- the individual components and protocol layers of the IUT not be visible to the conformance testing equipment;
- access to the IUT by the test equipment is only via standard interfaces; and
- human readable terminal interfaces (as the Control Position of an AMHS gateway) are not accessed by the test equipment.

This recommended testing approach forms the baseline for the functional requirements placed on the AMHS Test Tool, as follows:

- The AMHS Test Tool will be interconnected with the IUT's external interfaces as far as they are standardised by the AMHS technical specifications. Such standardised interfaces are the *AMHS transfer ports* and the *AFTN/CIDIN interface*. The IUT is treated as a *black box*.
- Originations and receptions at user terminals have to be performed and observed by an operator who is familiar with the implemented HMI. From that follows that conformance testing needs certain operator assistance at the IUT. (The made

assumptions on interfaces which are available at individual IUTs will be outlined by means of an IUT model.)

3 Assumed Test Scenario

3.1 AMHS Functionality of the IUT

3.1.1 AMHS technical specifications provisions

The assumption is made that the IUT to be tested provides completely or partially the AMHS functionality as specified by the Doc 9880, Part II [1] in support of the *Basic* ATS Message Handling Service. Figure 1 identifies the key elements of the AMHS which are addressed by the AMHS technical specifications. The figure shall also indicate that the majority of the AMHS functionality is specified by references to the MHS standard series ISO/IEC 10021 and the related profile documentation ISO/IEC ISP 10611 (Common Messaging) and ISP 12063 (Interpersonal Messaging).

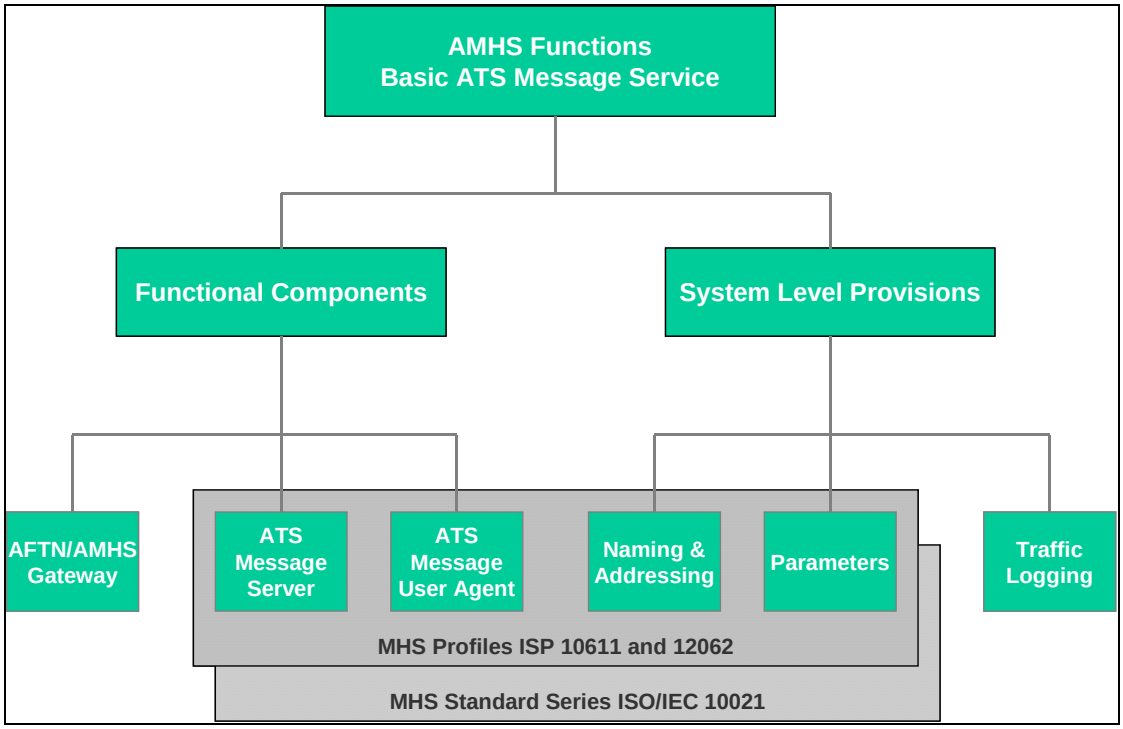

Figure 1: AMHS functionality specified by the AMHS technical specifications

The nucleus of the AMHS is formed by its three functional components:

- *ATS Message Server* performing *transfer* operations with adjacent ATS Message Servers (and AMHS gateways) by means of its inherent (MHS) Message Transfer Agent (MTA) [5]. In addition, *submission* and *delivery* operations are performed with one or more attached ATS Message User Agents. Optional (MHS) Message Stores (MS) [5] may provide retrieval services for ATS Message User Agents in connection with message delivery. – The MTA functions are specified in [6].

- *ATS Message User Agents* each including a (MHS) User Agent (UA) [5] as key component. An ATS Message User Agent interacts on one side with a (local) AMHS

user interface and accesses on the other side the transfer level of the AMHS by performing *submission* and *delivery* operations with the superordinated ATS Message Server. Communications between ATS Message User Agents (via ATS Message Servers) are end-to-end and have to comply with the IPM content as specified for the (MHS) Interpersonal Messaging System (IPMS) [7].

- *AFTN/AMHS Gateway* supporting interworking between users of the AMHS and AFTN. The gateway includes for operations with the transfer level of the AMHS an MTA. The mapping functions of the gateway reside in the Message Transfer and Control Unit (MTCU). The operations with AFTN [3] are performed with the AFTN components. Exception handling which needs operator assistance is moved to the Control Position.

The above listed functional components are typically implemented in International Communication Centres performing AMHS message transfers, AMHS message submission and delivery operations with attached AMHS user terminals and intercommunications with the AFTN. However, an AFTN/AMHS Gateway may be also implemented as stand-alone facility allowing existing AFTN communication facilities access to the AMHS.

In addition, the AMHS technical specifications address some aspects relating to the system level of an AMHS environment. The key ingredients at the system level of the AMHS are:

- *Naming and addressing* relating to the unambiguously identification of AMHS users and entities at upper layers protocols as needed for communications between AMHS systems. The specifications are based on MHS O/R addressing and ISO/OSI upper layer conventions. Examples are: the Common AMHS Addressing Scheme, Application Process Titles and Transport/Session/Presentation addresses.

- *Parameters* define specific AMHS conventions in the framework of the MHS standard. Examples are: The limitation of Receipt Notifications for IPMs with the *importance* value “high” and the definition of the ATS-Message-Header in the IPM body part.

- *Traffic logging* in functional components in support of message tracking across the AMHS.

The manner of implementation of the above identified AMHS functionality in the IUT is irrelevant for testing (*black-box* view). The above functional outline is used just as reference for the scope of conformance testing to be supported by the AMHS Test Tool.

3.1.2 Implementation specific AMHS features

Typically, an AMHS implementation includes features which are either beyond the scope of the technical specifications or seen as local issue. Examples are: User interfaces (HMI) for local submissions and deliveries, proprietary MTS access protocol and provisions for systems management (including statistics and diagnostic means).

Such features will not be subject of conformance testing, however, may be used in support of conformance testing. Example: IPM submission at local user terminals for verification of correct generation of the related P1 message.

3.2 Modelling of the test environment

Figure 2 illustrates the intended operational environment of the IUT at the level of messaging: Via Transfer Ports [6] of the IUT (logical) connections are established to *n* adjacent ATS Message Servers which in turn provide connectivity to *m* distant ATS Message User Agents. Local access to the AMHS is offered by *p* AMHS User Terminals attached to the IUT. Via the AFTN/AMHS Gateway there is a connection to an adjacent AFTN Communication Centre which in turn provides connectivity to *s* AFTN stations. – The figures *m*, *n*, *p* and *s* are seen as configuration parameters of the test configuration (see Section 5).

Note 1. – The specification of the AFTN/AMHS Gateway assumes an AFTN link to only one adjacent AFTN centre to minimise the AFTN functionality in the gateway [1]. However, in typical implementations, the AFTN/AMHS Gateway is collocated with AFTN centre functions supporting connections to a number of adjacent centres. This aspect of multiple AFTN connections is not considered for conformance testing against the AMHS technical specifications.

Note 2. – In the European Region, AFTN communications make use of the CIDIN transport service. This is taken into account for conformance testing, however, with the limitation, that only one CIDIN/AFTN link is established between the test tool and the IUT (see Figure 2).

Note 3. – In-depth testing of AFTN and CIDIN capabilities of the IUT is not seen as subject of AMHS conformance testing.

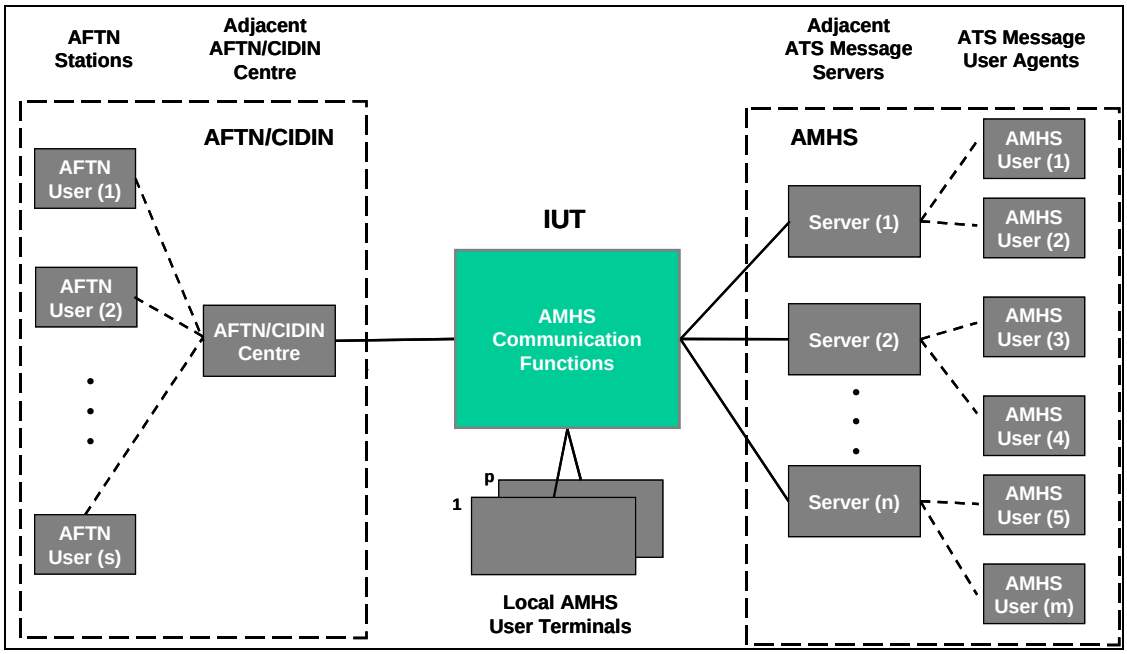

Figure 2: Assumed operational environment of the IUT

The AMHS Test Tool simulates an operational environment for the IUT as depicted in Figure 2. Figure 3 shows the corresponding model of the test configuration. The *COM Interfaces* of the test tool include *n* MTA instances representing the *n* adjacent ATS Message Servers of the IUT and an AFTN/CIDIN source/sink representing the AFTN/CIDIN environment. Other major functional components of the test tool are the *Test Repository* (containing predefined test scripts and associated test data), *Test Script Editor* (providing an HMI for specifications of test scripts and test data), *Test Log* (containing all the exchanged information objects) and *Test*

Evaluation (performing test evaluations based on the test log against various criteria). The *Test Driver* controls the execution of test scripts and enters exchanged information objects in the test log. Finally, the component *Test Management* is tasked with the overall management and administration of the test tool.

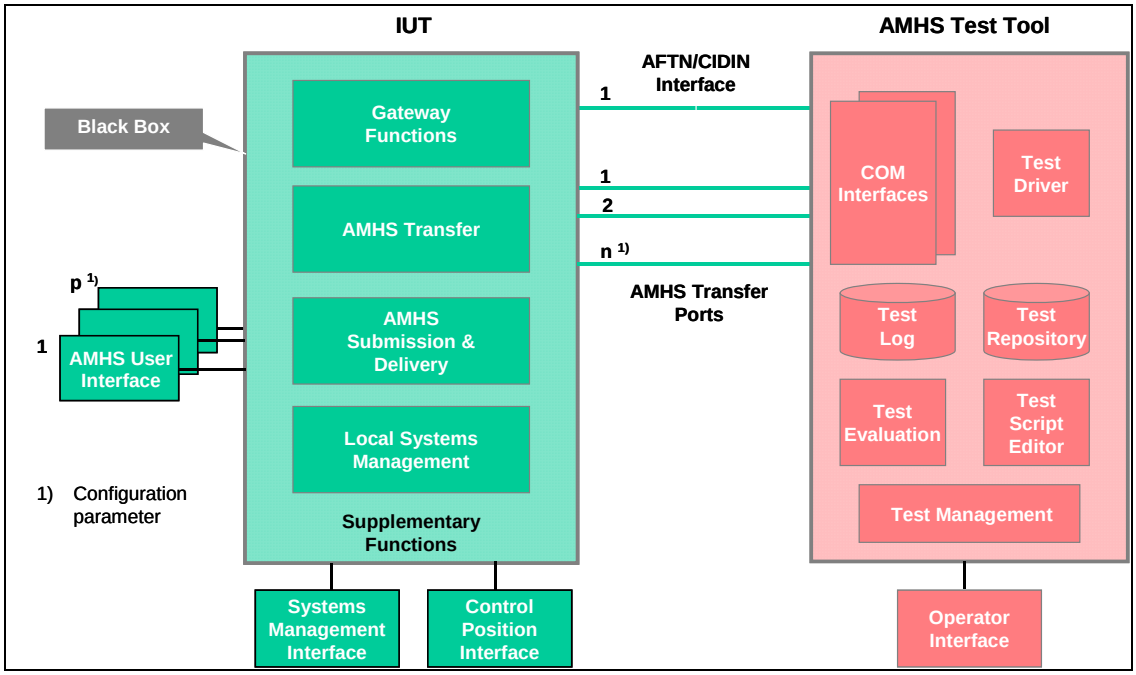

Figure 3: Model of the test environment

The IUT is represented in the modelled test configuration (*Figure 3*) by its functional components which will be subject of testing, i.e. AMHS transfer, AMHS submission/delivery and AMHS gateway functions (cf. Section 3.1). The inclusion of other indicated components of the IUT (as Systems Management Interface) will be addressed in subsequent sections.

The *n* MTA names, the addresses of the *m* ATS Message User Agents, *s* AFTN stations and *p* AMHS User Terminals are considered as configuration parameters which are jointly set up in the IUT and AMHS Test Tool.

Note. – The above outlined functional model includes an abstract, logical view on the AMHS Test Tool for the purpose of understanding the intended testing approach. The real design of the test tool is subject of separate documentation.

3.3 Used Transport Service for AMHS

According to the AMHS technical specifications [1] AMHS communications make use of the *ATN Internet Communications Service* (Layer 4). However, there is a common understanding in the European Region to implement (at least initially) the AMHS on top of an IP infrastructure. In terms of communications: The ISO Transport Service of the class TP0 will be provided over a TCP/IP stack by using the convergence function defined with RFC 1006. The AMHS communications in the test configuration follow this European approach.

Note. – Further extensions of the AMHS Test Tool may also support the ATN Internet Communications Service (aspect of inter-Regional or boundary centres) and TP0 over X.25 (ECG requirement).

3.4 Communication with the AFTN

The AMHS technical specifications [1] specify for the AFTN/AMHS Gateway an AFTN interface by referring to Annex 10, Volume II [3], i.e. the (asynchronous) *AFTN Teletypewriter Procedures* apply. However, in the European Region, typically, AFTN communications make use of the CIDIN transport service. Therefore, the AMHS Test Tool should support CIDIN communication in connection with the "AFTN application" [4].

Note. – Extensions of the AMHS Test Tool may also support AFTN asynchronous communications and/or AFTN over X.25.

3.5 Points of Reference for testing

With the black-box view at the IUT, the verification of implemented functionality is limited to test inputs and examinations of resulting responses at external (open) interfaces of the IUT. Standardised interfaces of the IUT are directly interfaced by the AMHS Test Tool. At non-standardised (proprietary) user interfaces of the IUT observations of operator inputs and displayed information are needed. Example: Origination of IPMs to be submitted or presentations of delivered IPMs at local AMHS user interfaces.

Such interfaces of the IUT which are used for conformance testing are referred to as *points of reference*. In the following, these points of reference will be detailed with reference to Figure 3.

3.5.1 Standardised points of reference

3.5.1.1 AMHS Communications

The IUT shall offer *Transfer Ports* [6] for P1 communication with *n* adjacent ATS Message Servers. The lower protocol layers (layers 1 to 4) shall be configured as indicated below:

Layer 4	Layer 3	Layer 2	Layer 1
ISO TP0 RFC 1006 TCP	IPv4	ISO LLC1	10/100 Base T (Ethernet)

Table 1: Lower protocol layers (AMHS communications)

The Transfer Ports of the IUT and AMHS Test Tool shall be physically interconnected via a LAN (Ethernet).

3.5.1.2 AFTN/CIDIN Communications

The IUT should offer a CIDIN/AFTN interface. That means, the IUT conveys AFTN-formatted messages by using the CIDIN transport service (cf. Section 3.4). The CIDIN protocol layers are configured as follows:

Layer 4	Layer 3	Layer 2	Layer 1
CIDIN Transport Layer	CIDIN Network Layer (3b), Network Layer (3a): X.25 (PVC)	HDLC	X.21/V.11 or X.21bis/V.28

Table 2: Lower protocol layers (AFTN/CIDIN communications)

Note. – If the IUT supports only AFTN asynchronous communications or AFTN over X.25 the "Extensions" of the AMHS Test Tool has to be used. The conformance testing is independent from the physical connection used.

3.5.2 Proprietary points of reference

The scope of conformance testing includes submission and delivery operations with local *AMHS user interfaces* of the IUT. Notifications for specified out-of-line situations shall be sent to the *Control Position* of the AFTN/AMHS Gateway [1]. Further, traffic logs generated by the IUT during test exercises have to be verified against the AMHS technical specifications [1] by means of retrieval services provided at the IUT's *Operator Positions*.

The style of input and presentation of test data at the above identified three working positions is seen as a local implementation matter and is, therefore, out of scope of conformance testing. The inclusion of these working positions in testing is limited to observation and interpretation of test data.

Below, the three types of working positions are handled in more detail.

3.5.2.1 AMHS user interface

AMHS user interfaces provided at the IUT allow submission of IPMs and Probes and in the opposite direction delivered IPMs, IPNs and Reports have to be brought to the attention of AMHS users. The style of origination and presentation of the mentioned AMHS information objects is seen as subject of implementation. The inclusion of submission and delivery operations in conformance testing requires observations of operator interaction during test exercises.

Note. – Although the MTS access is seen as an implementation matter when supporting only the Basic ATS Message Handling Service, conformance testing shall verify the correct mapping of originated information objects onto P1 information objects; vice versa

delivery operations have to map P1 information objects onto displayed objects in a correct manner.

3.5.2.2 Control Position

There is an AMHS technical specifications requirement to notify the Control Position of the AFTN/AMHS gateway on specified deviations from the gateway's normal operations. Notifications may be issued for the operators information only or may require operator assistance for recovery from an occurred communication problem. How the Control Position is implemented is out of scope of the AMHS technical specifications. However, the correct presentation of notifications at the IUT's Control Position is seen as subject of conformance testing. Appropriate observations have to accompany certain test exercises.

3.5.2.3 Access to systems management functions

Access to IUT's systems management functions by means of a related working position shall be possible for:

- Preparation of the IUT for the test configuration, and
- verification of traffic logs generated by the IUT during test exercises.

4 Supported Scope of Conformance Testing

4.1 General aspects

The scope of testing covers the (native) AMHS communications and interoperations with the AFTN/CIDIN by means of the AFTN/AMHS Gateway. The AFTN/CIDIN interface is tested for verification of the gateway's capability to intercommunicate with AFTN/CIDIN, however, is not subject of dedicated conformance testing.

Communication services at lower communication layers (as TCP/IP, X.25, LAN) support the interconnection between the AMHS system and the AMHS Test Tool. In this way, lower communication layers will be included in the test tool, however, there is no intention performing lower layer protocol testing.

The following aspects of conformance testing shall be taken into account:

- *Protocol testing*, encompassing intra-AMHS communications (MTS, IPMS) and AMHS to AFTN/CIDIN mappings (and vice versa).

- *Functionality testing*, to ensure the appropriate implementation of AMHS functionality and services (as message submission, transfer, delivery) including the correct mappings between AMHS information objects and user data made visible at users' working positions.

- *Resilience testing*, particularly with regard to the stability of an AMHS implementation against external communication failures.

The reference specification for AMHS testing is the *Basic ATS Message Handling Service* as specified in the AMHS technical specifications [1].

Note. – The incorporation of the Extended ATS Message Handling Service shall be conceptually taken into account in a later extension of the AMHS testing requirements.

Below, the scope of conformance testing will be specified by definitions of generic *test groups* and related *test cases*. These definitions should be seen as a base (minimum) set which do not exclude testing using other equivalent or extended test arrangements.

4.2 Generic test configuration

The scope of AMHS functions expected from the IUT is defined firstly by the implemented AMHS *functional components*, i.e. ATS Message Server, AFTN/AMHS Gateway and ATS Message User Agent and secondly by supplementing *system level provisions* as AMHS naming/addressing, AMHS parameters and AMHS traffic logging (see Section 3.1).

Figure 4 places the above three functional components in a fictitious AMHS communication scenario with flows of AMHS information objects between two (*direct*) AMHS users. In addition, an AFTN/AMHS Gateway supports intercommunications with AFTN users (i.e. *indirect* users of the AMHS). The position of the gateway in Figure 4 should be seen just as an example.

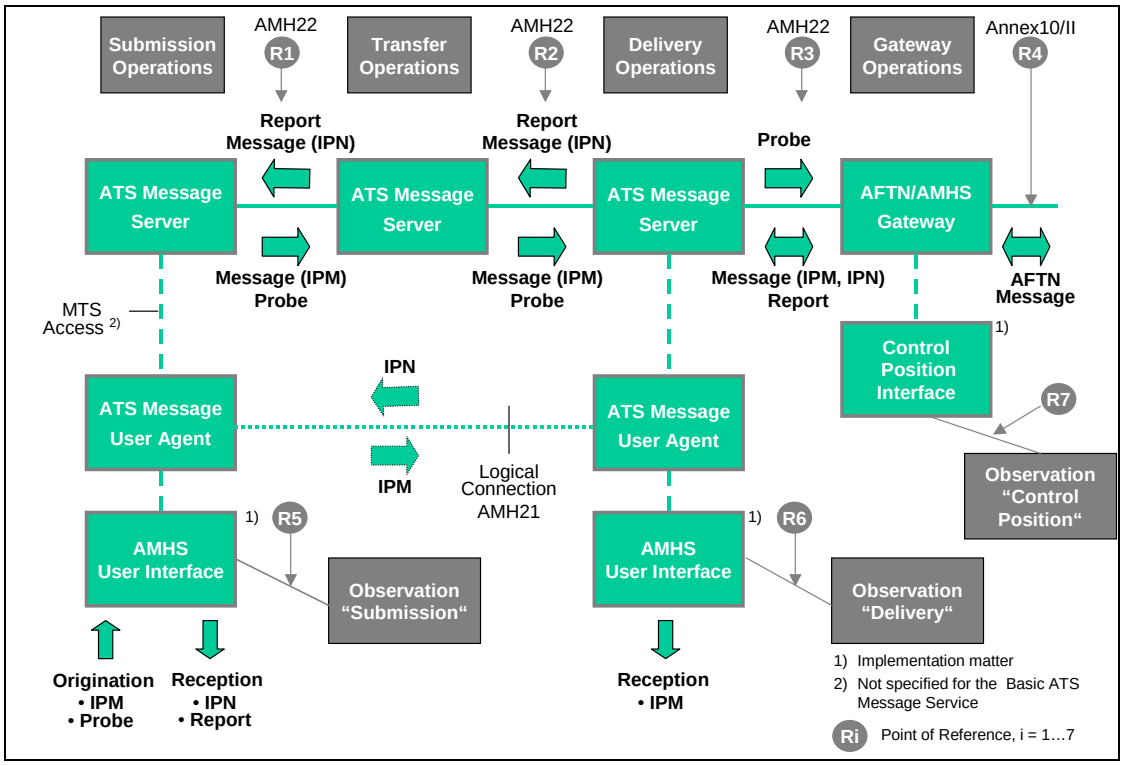

Figure 4: Generic AMHS communication scenario and used Points of Reference for conformance testing

The points of references *R1* to *R7* (in Figure 4) are allocated to the communication scenario according to the principles which have been stated in Section 3.5. The points *R1* to *R3* correspond to communication interfaces which are addressed by the MHS profiles AMH11 or AMH22, respectively [8], [10]. The exchange of IPMs and IPNs between the pair of ATS Message User Agents is subject of the MHS profile AMH21 [9]. Communications at the point *R4* follow the procedures laid down in Annex 10, Volume II, as far as applicable for the AFTN/AMHS Gateway.

The IUT is required to provide the communication functions of the ATS Message Server, ATS Message User Agent and AFTN/AMHS Gateway in any of their positions indicated in Figure 4. For related conformance testing the IUT is placed in various positions of the communication scenario (Figure 4) and the AMHS Test Tool performs the functions of the corresponding AMHS peer entity (entities). The resulting generic test configuration is depicted in Figure 5. The allocated points of reference *R1* to *R7* correspond to them of Figure 4. The reference point R8 is added for identification of the IUT's systems management interface (see Section 3.5.2.3).

Note. – In consideration of testing implementations of the Basic ATS Message Handling Service no point of reference is allocated to the MTS access.

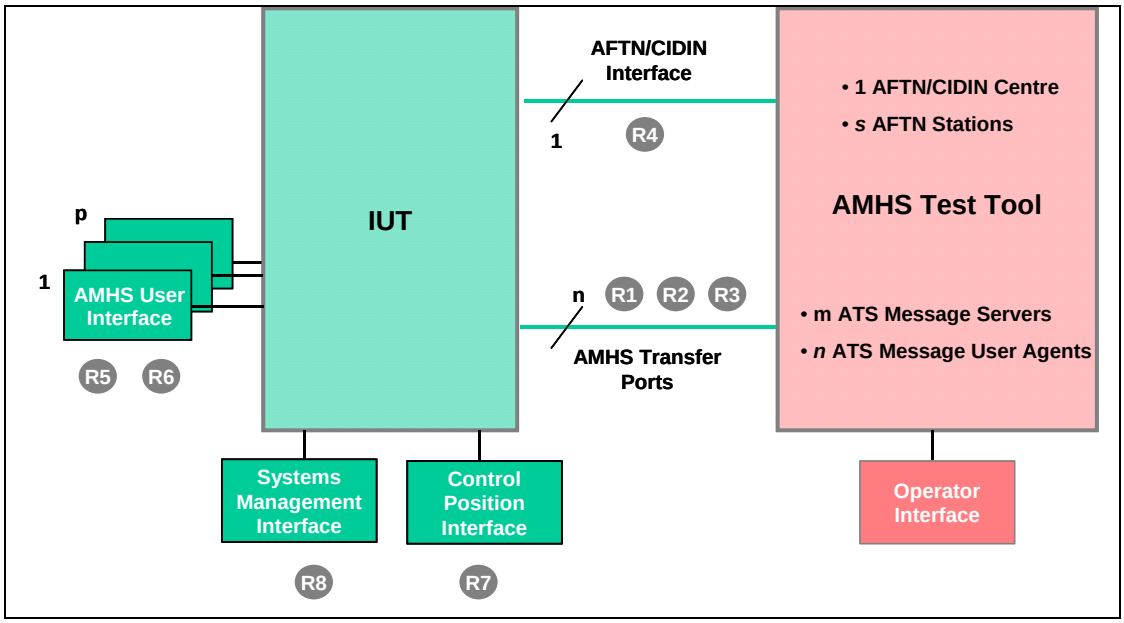

Figure 5: Generic test configuration with points of reference

Note. – In Figure 5 no AFTN user interface is forming part of the IUT. Such interfaces are outside of the scope of the specified AMHS functionality and are placed, therefore, in the IUT's test environment surrounding the IUT (see Figure 2). When testing AFTN/AMHS Gateway functions of the IUT the AFTN peer entities are always represented by the AMHS Test Tool. The AFTN related user actions should be performed by the AMHS Test Tool itself.

4.3 Definition of test groups

Generally, *test groups* provide a logical high-level ordering in test specifications (ISO 9646-2). Typically, a single test group addresses a particular functional area for which an IUT claims conformance. In the following, AMHS test groups are defined for the purpose of specification of high-level requirements placed on an AMHS Test Tool.

Figure 4 identifies four types of AMHS functional areas to be supported by the IUT: *Submission*, *Transfer*, *Delivery* and *Gateway* Operations. These types of AMHS operations will be constitute a first set of test groups. A second set of test groups is formed by the provisions at the AMHS system level as referred to in Section 3.1.1, i.e. *Naming & Addressing*, *Parameters* and *Traffic Logging*.

The defined test groups reflect the external view at the IUT's functionality and are independent of the chosen implementation model. Below, the defined test groups are handled in detail.

For each of the handled test groups the correspondent test configuration is indicated. These test configurations are of generic nature. In practice, test configurations may be combined for study of local interworking between functional areas in an IUT. Example: Combined test exercises for message submission and local gateway functions.

4.3.1 Submission operations

Subject of the test group *Submission* operations is the origination of *IPMs* and *Probes* at AMHS user interfaces at the IUT and the related generation of *P1 information objects* for

transfer to adjacent ATS Message Servers; returned *Reports* and *IPNs* have to be displayed at the IUT in an appropriate manner (see Figure 4).

Figure 6 depicts the test configuration for verification of the *Submission* operations. The test configuration follows from Figure 4 and Figure 5.

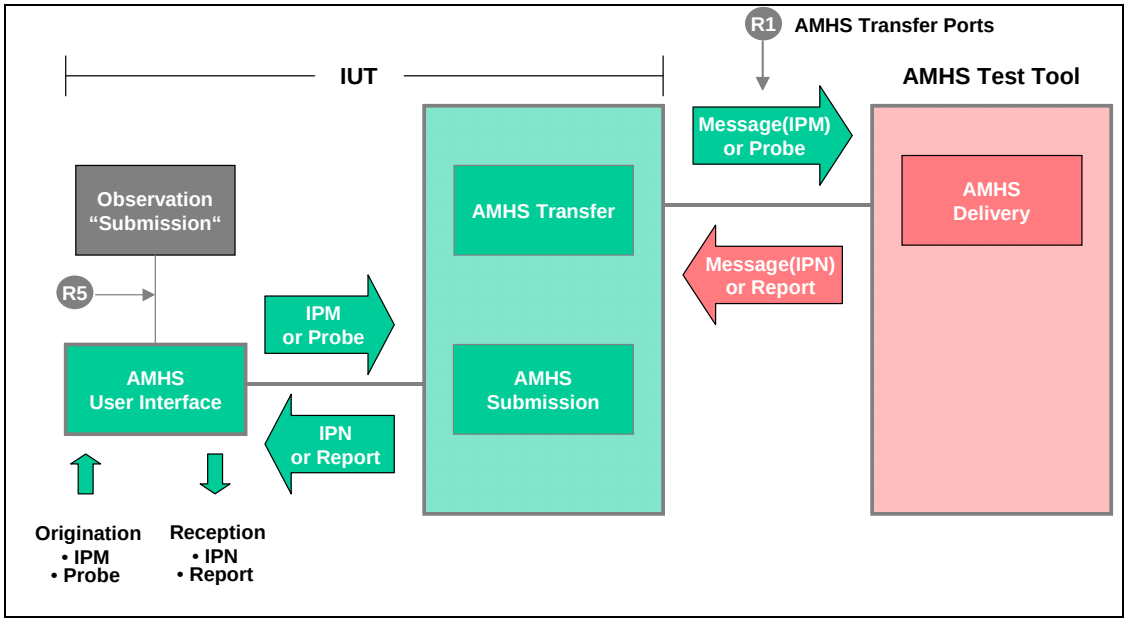

Figure 6: Test configuration "Submission"

For testing of the *Submission* operations the following actions may be performed:

- At an AMHS user interface of the IUT (reference point *R5* in Figure 6) predefined IPMs and Probes are originated for intended recipients. The AMHS Test Tool at the transfer ports of the IUT (*R1*) verifies the correct generation of the related Messages (IPMs) and Probes.

- In the opposite direction, the AMHS Test Tool responds at the transfer ports of the IUT (*R1*) with valid and invalid Messages containing IPNs (upon IPMs) and Reports (upon IPMs and Probes). The presentation of valid IPNs and Reports is observed at the originator's AMHS user interface (*R5*). Invalid responses may effect error notifications at an operator position of the IUT (fault management).

Note. – The local rejection of erroneous originations of IPMs and Probes at IUT's user interfaces is seen as a local implementation matter and is, therefore, out of the scope of conformance testing.

4.3.2 Transfer operations

Subject of the test group *Transfer* operations is the transfer of P1 information objects (i.e. Message, Report, Probe) by the IUT. Rejected transfers of messages and probes have to be indicated by returning of Non-Delivery Reports (NDR). The test group includes handling of multiple recipient addresses (multiple dissemination) and the expansion of Distribution Lists (DLs).

Figure 7 depicts the test configuration for verification of the *Transfer* operations. The test configuration follows from Figure 4 and Figure 5.

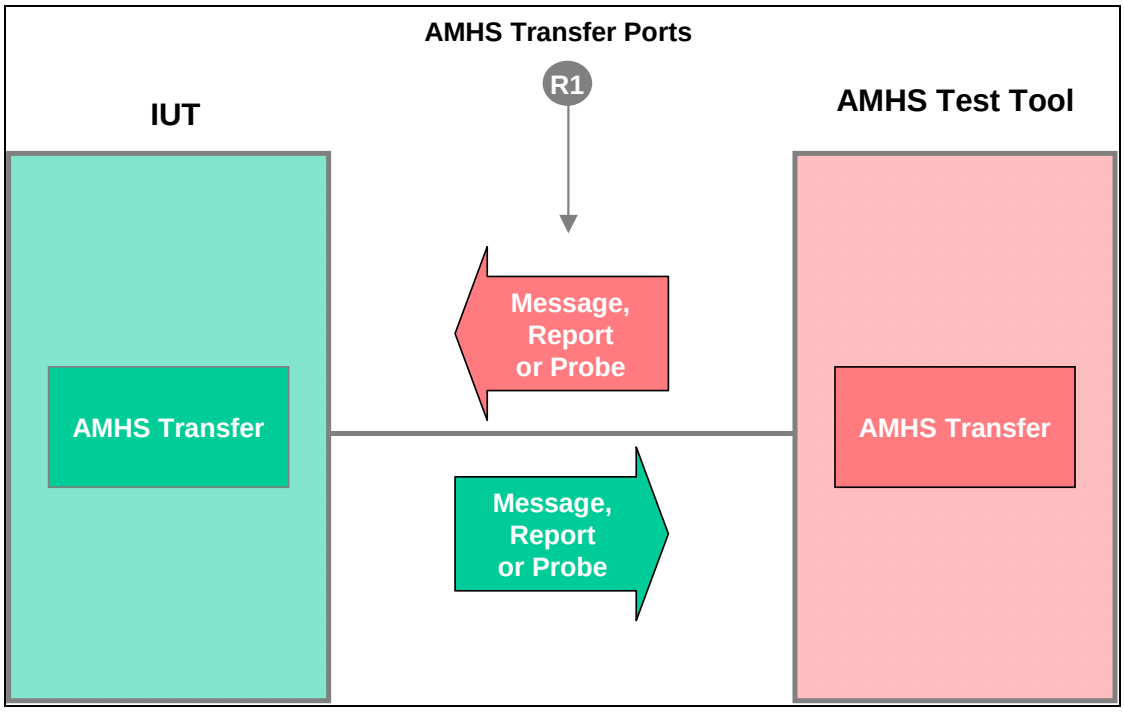

Figure 7: Test configuration "Transfer"

For testing of the *Transfer* operations the following actions may be performed:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 7) with valid and invalid Messages (containing IPMs or IPNs), Reports and Probes with recipient addresses which are *not* local to the IUT.

- The IUT responds at its transfer ports (*R1*) with the output of one or more Messages, (due multiple dissemination and/or DL resolution), one or more Probes (multiple dissemination) or just the received Reports. The AMHS Test Tool verifies the expected IUT behaviour. Invalid information objects generated by the AMHS Test Tool may effect error notifications at an operator position of the IUT (fault management).

4.3.3 Delivery operations

Subject of the test group *Delivery* operations is the display of received Messages (IPMs) at AMHS user interfaces of the IUT. In addition, the IUT shall generate Reports (DR, NDR) and/or IPNs (RN, NRN) according to the requests contained in the received Messages and Probes.

Figure 8 depicts the test configuration for verification of the *delivery* operations. The test configuration follows from Figure 4 and Figure 5.

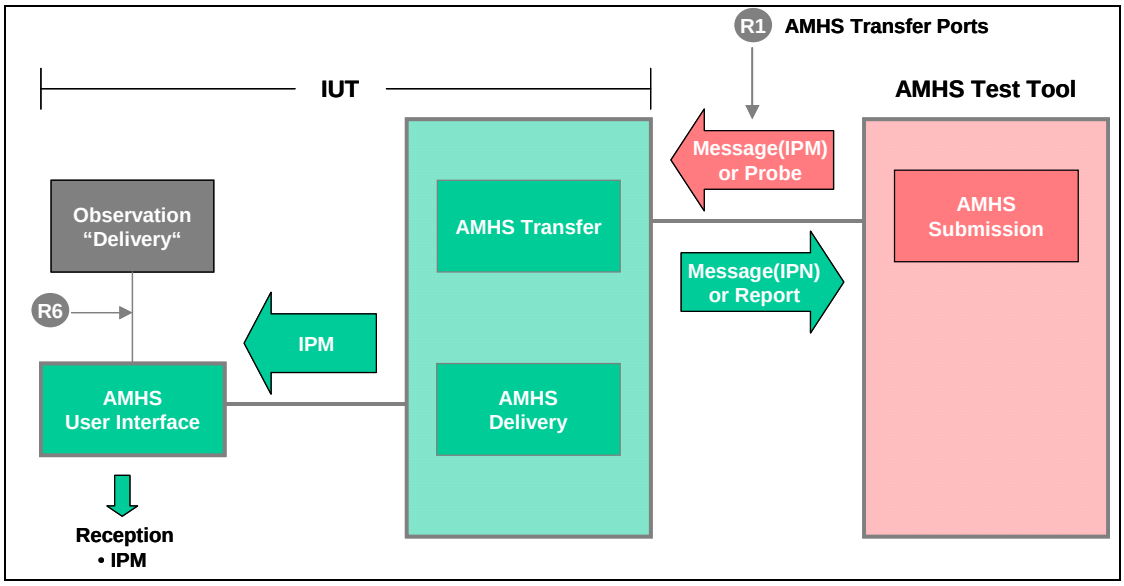

Figure 8: Test configuration "Delivery"

For testing of the *Delivery* operations the following actions may be performed:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 8) with valid and invalid Messages (containing IPMs) and Probes, both with recipient addresses which are local to the IUT.

- The IUT may respond with one or more of the following actions:

  - Display the received IPM at the appropriate AMHS user interface (*R6*),

  - Returning a Message (IPN) at its transfer Port (*R1*) according to the given *receipt notification request* in the subject IPM,

  - Returning a Report (DR or NDR) at its transfer ports (*R1*) according to the given *report request* in the subject Message or Probe.

4.3.4 Gateway operations

Subject of the test group *Gateway* operations is the bi-directional conversion between AMHS and AFTN user messages and the handling of accompanying service information, i.e. AFTN service messages (SVC), AFTN SS acknowledgements (SS ACK), AMHS Reports and AMHS Receipt Notifications. – Cf. AMHS technical specifications [1] para. 4.2.1.4.

Considering the functional complexity of the AFTN/AMHS Gateway, the test group is logically subdivided in three sub-groups: 1) Flow of user message from AMHS to AFTN, 2) Flow of user message from AFTN to AMHS and 3) Handling of Probes. The sub-groups 1) and 2) include the handling of accompanying service information.

4.3.4.1 User Message from AMHS to AFTN

Figure 9 depicts the test configuration for verification of the *Gateway* operations for the flow of a user message from AMHS to AFTN. The test configuration follows from the Figure 4 and Figure 5.

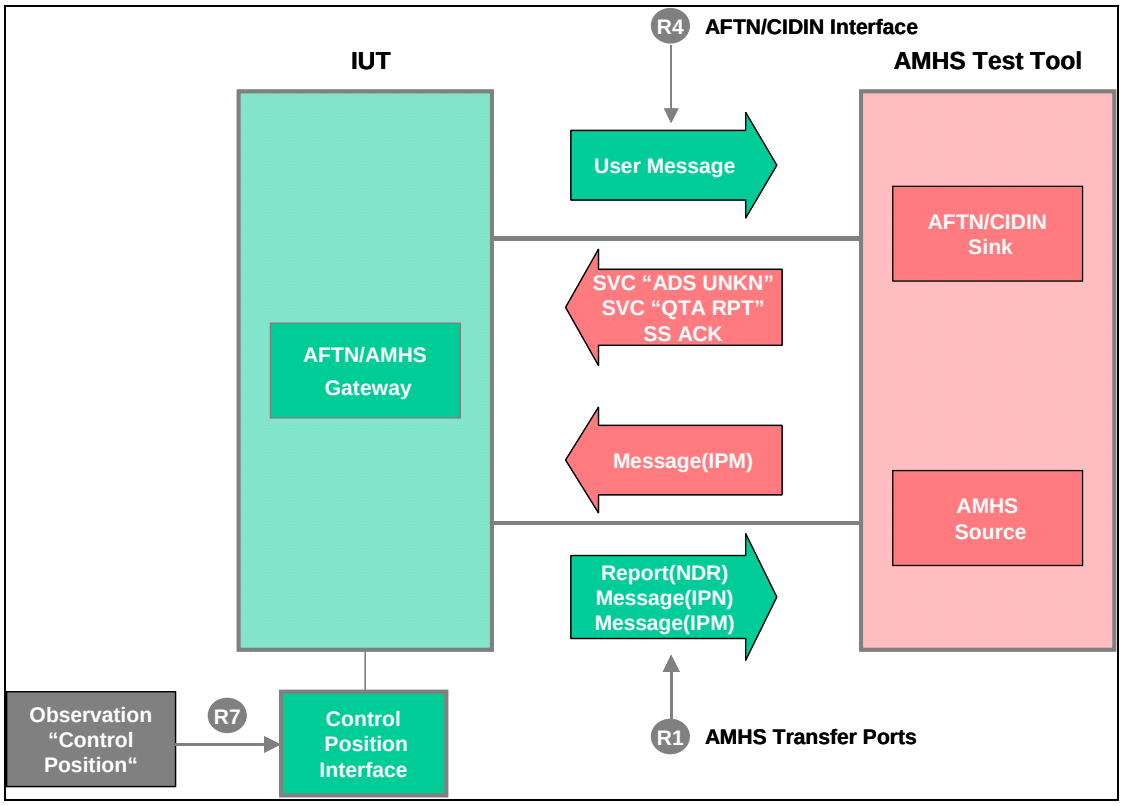

Figure 9: Test configuration "Gateway" – User message from AMHS to AFTN

The following actions may be performed with the Gateway test configuration depicted in Figure 9:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 9) with valid and invalid AMHS Messages containing IPMs. The IUT converts valid AMHS Messages in AFTN user messages which leave the IUT at its AFTN/CIDIN interface (*R4*), invalid AMHS Messages are rejected by the IUT with Non-Delivery Reports (NDR) which are returned to the AMHS Test Tool using the IUT's transfer ports (*R1*).

- The AMHS Test Tool provides the IUT at its AFTN/CIDIN interface (*R4*) with an AFTN SVC "ADS UNKNOWN" simulating the detection of an unknown destination address within the AFTN. The IUT converts the SVC "ADS UNKNOWN" in a Non-Delivery Report (NDR). In exceptional situation, the SVC "ADS UNKNOWN" is encapsulated by the IUT in an IPM. The NDR or IPM, respectively, is forwarded to the AMHS Test Tool via the IUT's transfer ports (*R1*).

- The AMHS Test Tool provides the IUT at its AFTN/CIDIN interface (*R4*) with an SS ACK. The IUT converts the SS ACK in an IPN of the type Receipt Notification (RN). In exceptional situation, the SS ACK is encapsulated by the IUT in an IPM. The IPN or IPM, respectively, is forwarded to the AMHS Test Tool via the IUT's transfer ports (*R1*).

- The AMHS Test Tool provides the IUT at its AFTN/CIDIN interface (*R4*) with an SVC "QTA RPT" requesting the repetition of an AFTN message sent before to a specified AFTN addressee. The IUT retransmits the respective AFTN message via its AFTN/AMHS interface (*R4*).

For certain out-of-line situations, which may occur during conversions in the AFTN/AMHS Gateway, the AMHS technical specifications [1] specify error notifications to be forwarded to the gateway's Control Position. Such notifications have to be observed during test exercises at the reference point *R7* in Figure 9.

4.3.4.2 User message from AFTN to AMHS

Figure 10 depicts the test configuration for verification of the *Gateway* operations for the flow of a user message from AFTN to AMHS. The test configuration follows from the Figure 4 and Figure 5.

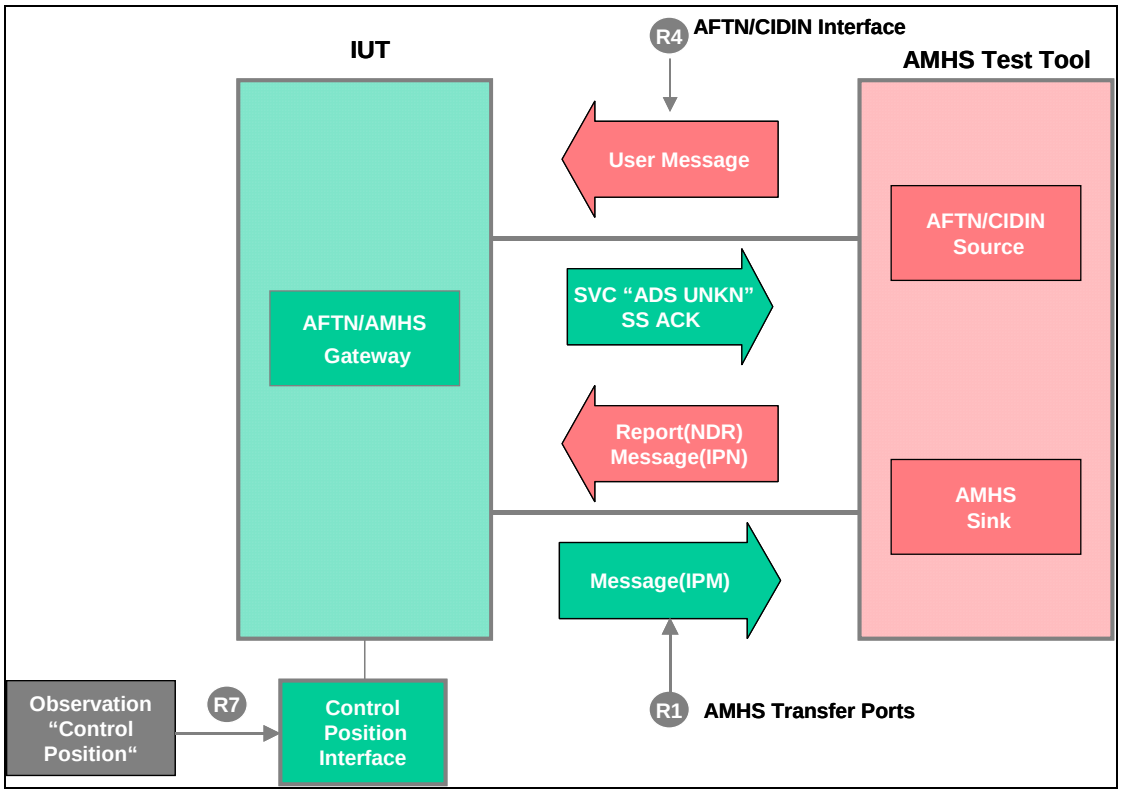

Figure 10: Test configuration "Gateway" – User message from AFTN to AMHS

The following actions may be performed with the Gateway test configuration depicted in Figure 10:

- The AMHS Test Tool provides the IUT at its AFTN/CIDIN interface (reference point *R4* in Figure 10) with valid and invalid AFTN user messages. The IUT converts valid AFTN user messages in AMHS messages containing IPMs which leave the IUT at its transfer ports (*R1*), invalid AFTN user messages are handled according to locally implemented procedures. When the conversion of AFTN addressee indictors fails, the IUT returns AFTN service messages of the type SVC "ADS UNKNOWN" to the AFTN (AMHS Test Tool) via its AFTN/CIDIN interface (R4).

- The AMHS Test Tool provides the IUT at its transfer ports (*R1*) with a Non-Delivery Report (NDR) simulating the detection of an unknown recipient address within the AMHS. The IUT converts the NDR in an AFTN service message of the type SVC "ADS UNKNOWN" which leaves the IUT via its AFTN/CIDIN interface (*R4*).

- The AMHS Test Tool provides the IUT at its transfer ports (*R1*) with an AMHS message containing a Receipt Notification (RN) indicating the reception of a SS-priority message at a specified AMHS recipient. The IUT converts the RN in a SS ACK which leaves the IUT via its AFTN/CIDIN interface (R4).

For certain out-of-line situations which may occur during conversions in the AFTN/AMHS Gateway, the AMHS technical specifications [1] specify error notifications to be forwarded to the gateway's Control Position. Such notifications have to be observed during test exercises at the reference point *R7* in Figure 10.

4.3.4.3 Handling of Probes

Figure 11 depicts the test configuration for verification of the *Gateway* operations when receiving a Probe. The test configuration follows from Figure 4 and Figure 5.

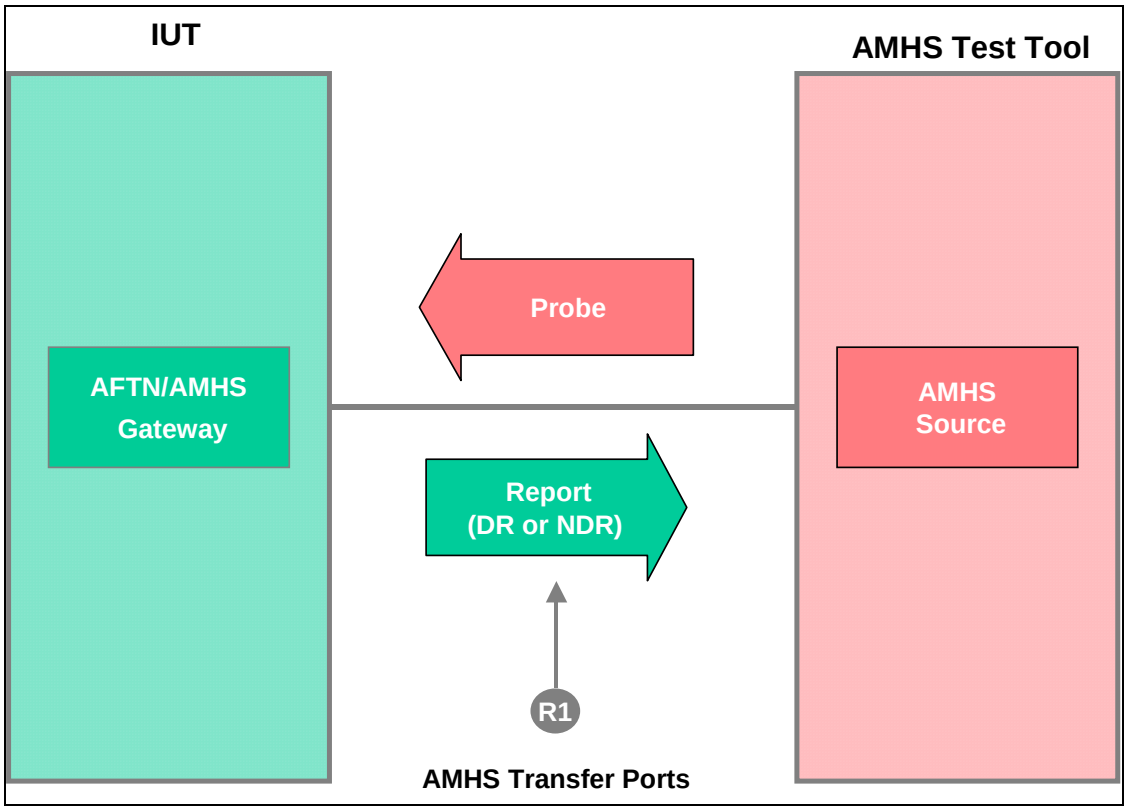

Figure 11: Test configuration "Gateway" – Handling of Probes

The following actions may be performed with the Gateway test configuration depicted in Figure 11:

- The AMHS Test Tool provides the IUT at its transfer ports (reference point *R1* in Figure 11) with valid and invalid Probes.

- The IUT verifies whether it could have effected translation in an AFTN user message by comparing certain parameters in the Probe with the capability of its gateway function. The IUT generates in dependence on the result of the verification either a Delivery Report (DR) or a Non-Delivery Report (NDR) which is returned to the AMHS Test Tool via a transfer port (R1).

4.3.5 Naming and addressing

Naming and addressing in the AMHS context relates to the unambiguously identification of 1) users to a global AMHS and 2) communication entities residing in the upper layers of the AMHS communication stack (AMHS technical specifications [1], 2.5). Focus of conformance testing is the IUT's capability to handle AMHS addressing schemes for identification of users. The second aspect is covered by setting up of configuration parameters in the test configuration (see Section 5).

The AMHS technical specifications [1] specify two user addressing schemes which are collectively referred to as MF-addressing schemes: the *XF-addressing scheme* and the *Common AMHS Addressing Scheme (CAAS)*. Preference should be given to the latter. In addition, the technical specifications allow to implement within an AMHS Management Domain *locally defined* schemes. The AMHS Test Tool supports the XF-addressing scheme and the CAAS. (Support of other addressing schemes may be subject of further extensions.)

The use of *directory names* is seen as a local matter when supporting the *Basic* ATS Message Handling Service (AMHS technical specifications [1], 2.2.3.3). Their support by the AMHS Test Tool may be subject of further extensions meeting the requirements of the *Extended* ATS Message Handling Service.

An IUT's capability to handle MF-addressing schemes is already implicitly verified with the operations related test groups as defined in Sections 4.3.1 to 4.3.4. However, for in-depth testing of implemented addressing features the establishment of a dedicated test group may be a suitable approach. Depending on the test purpose an appropriate test configuration may be selected from them depicted in Figure 6 to Figure 10.

Note. – The aspect of a dedicated test groups for in-depth testing of system level provisions applies also to the two remaining test groups defined below.

4.3.6 AMHS parameters

The AMHS technical specifications [1] 3.3 specify a number of operational conventions which have the nature of parameters from the MHS point of view. These parameters relate to:

- Use of MF-addresses (see Section 4.3.5)
- User data conventions
    - Only single body part in IPMs
    - Ia-5 text body (Basic ATS Message Handling Service)
- Use of ATS-Message-Header in the body part of IPMs (Basic ATS Message Handling Service)

- Restriction of Notification Requests (IPMS) for SS-priority messages.

Neither the AMHS technical specifications nor the MHS standard with related ISPs include requirements concerning the minimum size of messages to be supported by AMHS implementations. Closing this gap, the SPACE study [11] recommends for the European AMHS: 1) ATS Message Servers (MTAs) shall support at the minimum a P1 message length of 2 Mbytes and 2) ATS Message User Agents (UAs) shall accept initially a message-text length of at least 10 Kbytes (or 64 Kbytes according [18]). The AMHS Test Tool should support testing with these values.

In-depth testing of the AMHS parameters may be performed by means of a dedicated test group. Depending on the test purpose an appropriate test configuration may be selected from them depicted in Figure 6 to Figure 10.

4.3.7 Traffic logging

The AMHS technical specifications [1] specify long-term (30 days) logging requirements for the various types of functional components of the AMHS. The requirements make it possible to perform message tracing through the AMHS, in particular when an investigation is needed. The query of the logged information is seen as a local implementation detail.

Logging requirements are placed on the following functional components of the AMHS:

- ATS Message User Agent – [1] Section 3.1.3
- ATS Message Server – [1] Section 3.2.3
- AFTN/AMHS Gateway concerning its sub-components
    - ATN component – [1] Section 4.2.2.6
    - Message Transfer and Control Unit (MTCU) – [1] Section 4.1.3
    - AFTN component – [1] Section 4.2.1.8-11.

In-depth testing of the traffic logging may be performed by means of a dedicated test group. Depending on the test purpose an appropriate test configuration may be selected from them depicted in Figure 6 to Figure 10. Verification of the logged information will make use of the local query and tracing provisions. Access is typically provided at the system management interface of the IUT (cf. reference point *R8* in Figure 5).

4.4 Definition of test cases

According to ISO 9646-2 a *test case* comprises the actions to achieve a specific test purpose. Each test case normally has a single test purpose, such as that of verifying that the IUT has a certain required capability (e.g. the capability to support certain message lengths) or exhibits a certain required behaviour when a particular event occurs (e.g. transfer of submitted messages). Typically, a set of test cases aiming at a common functional area of an IUT are arranged to a *test group* (see Section 4.3).

There may be many criteria for methodical definitions of test cases (within a test group) to achieve an envisaged confidence in a particular functional area of the IUT. Figure 12 depicts

proposed two levels of high-order criteria for definitions of AMHS related test cases. The AMHS Test Tool should support conformance testing in a scope as outlined in Figure 12.

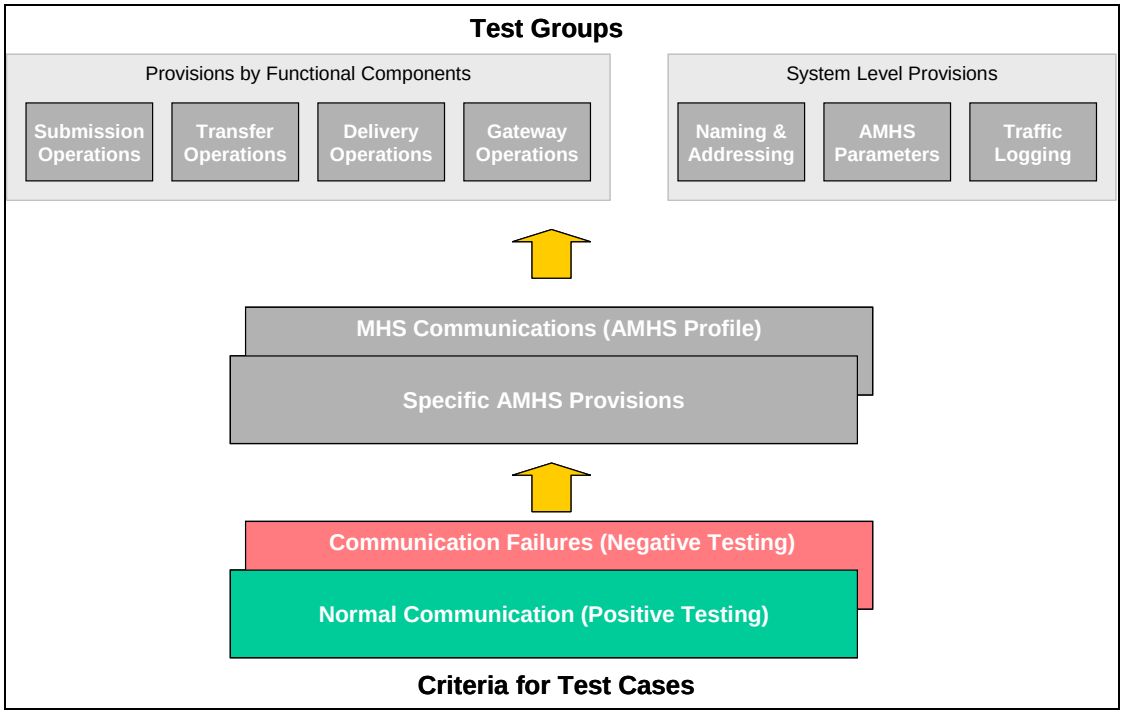

Figure 12: Approach for definition of Test Cases

In Figure 12 a distinction is made between communication requirements which are of general nature in MHS environments and such which are specific to AMHS. The first category of requirements is addressed in the AMHS technical specifications [1] just by references to the MHS standard (ISO/IEC 10021) and related profile documentation (ISPs). No further details of MHS procedures are provided with the AMHS technical specifications [1].

In addition, the AMHS technical specifications include a number of provisions which are specific for AMHS. Such provisions may relate to supplementary functional components (as AMHS gateways) or specify conventions for which MHS implementations are transparent (e.g. limited use of notification requests). The AMHS technical specifications specify the AMHS specific provisions in a “stand-alone” manner.

Note. – An example of the above made distinction between specific AMHS requirements and underlying MHS features are the AMHS traffic logging requirements: The traffic logging requirements at an ATS Message Server refer to the last element of the trace-information (AMHS technical specifications [1*] 3.2.3). The trace-information itself (forming part of the message-transfer-envelope) is specified in ISO/IEC 10021-4, 12.3.1. – It is up to the organisation which will operate an AMHS system to limit conformance testing to the technical specifications specific elements or to extend testing to the referenced trace-information as defined with the MHS standard.*

As second level criteria for definition of test cases a distinction is made between normal MHS/AMHS communications (*positive* testing) and enforcing fault situations (*negative* testing). Figure 13 details this further logical ordering of testing.

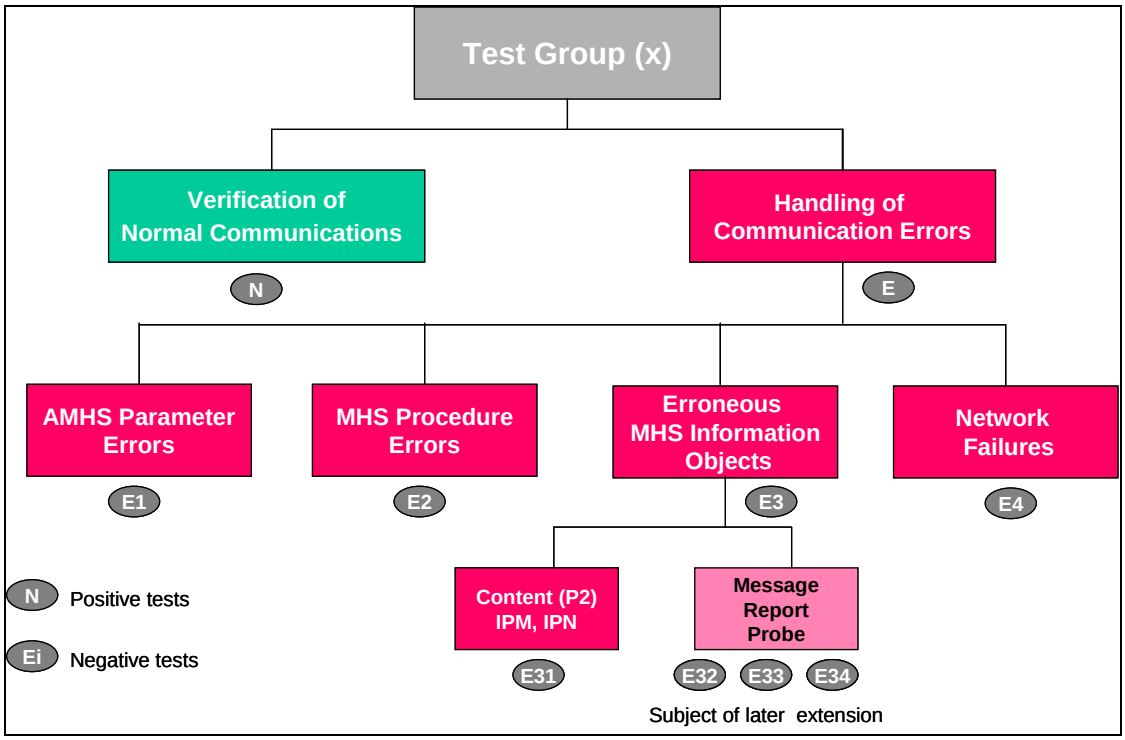

Figure 13: Classes of "Negative Tests"

The test categories indicated in Figure 13 are based on the following definitions:

Normal communications (N). – The AMHS Test Tool provides the IUT with correct inputs and the related responses (behaviour) of the IUT should be in compliance with the AMHS technical specifications. It should be noted that a correct response of the IUT not always equals to a successful transmission of an AMHS information object. Example: If the service element *DL-expansion-prohibited* has been set then a DL expansion will not occur.

Erroneous AMHS parameters (E1). – The AMHS technical specifications, Section 3.3 (Parameters), specify a number of specific AMHS conventions as use of MF-addresses, ATS-Message-Header, notification requests and single body part IPMs. It should be noted that violations of such AMHS conventions are not equal with faults in the MHS communication.

MHS procedural errors (E2). – The AMHS Test Tool does not act in compliance with the MHS procedures or the arrangements made in the test configuration. Examples: 1) The IUT is requested to send a message with a Report request, however, the AMHS Test Tool does not return any Report. 2) The AMHS Test Tool uses a recipient address which is unknown in the test configuration.

Erroneous MHS information objects (E3). – That means arguments have not allowed values or information objects are corrupted. A distinction is made between the levels of IPMS and MTS:

- IPMS (E31). – IPMs and IPNs sent to the IUT are not correctly encoded (syntax or semantic errors). Example: Mandatory arguments in the IPM heading are missing or there is no IPM body attached to the IPM heading.

- MTS (E32), (E33), (E34). – Messages, Reports and Probes sent to the IUT are not correctly encoded. Example: In a Report the *Report Transfer Content* is missing.

Network failures (E4). – Transient interruptions of network connections during transmission of AMHS information objects.

The AMHS Test Tool supports negative testing of the categories E1, E2 and E31 and E4 (Figure 13).

Note. – Negative testing of the categories E32, E33 and E34 may be subject of further extensions of the testing requirements if experience leads to this need.

A given test group may be transparent for one or more classes of "negative tests". For example, transfer operations are transparent for AMHS parameter errors (E1) and Content (IPMS) failures (E31). Table 3 indicates in a form of a matrix the valid interrelations between defined test groups and classes of negative tests. Such a testing matrix may be helpful to demonstrate the reached coverage of testing for a given set of test cases.

	Submission Ops	**Transfer Ops**	**Delivery Ops**	**Gateway Ops**	**Naming & Addressing**	**AMHS Parameters**	**Traffic Logging**
N	X	X	X	X	X	X	X
E1	X	n/a	X	X	X	X	n/a
E2	X	X	X	X	n/a	n/a	n/a
E31	X	n/a	X	X	n/a	n/a	n/a
E32-E34	X	X	X	X	n/a	n/a	n/a
E4	X	X	X	X	n/a	n/a	n/a

X = valid interrelation; n/a = not applicable

Table 3: Applicability of negative testing for test groups (testing matrix)

5 Configuration Parameters

The generic test configuration depicted in Figure 5 needs a number of quantitative adjustments before AMHS Test Tool and IUT are in a position to communicate with each other. The subjects of such adjustments are the values of *configuration parameters* which are inherent in the test configuration. Configuration parameters relate to the number of established communication links, number of simulated AMHS and AFTN users as well as to addresses associated with the various layers of communications. Below the configuration parameters are specified in the categories of AMHS and CIDIN/AFTN communications.

5.1 AMHS communication

5.1.1 AMHS application

- Number of transfer ports: 3
- Number of AMHS users: 30

Reference: Section 3.2, Figure 2 and Figure 3.

5.1.2 Layer addresses

No.	Address Type	AMHS technical specifications	Value	
			IUT	AMHS Test Tool
1	Application Process Title	2.5.2.1, 2.5.2.2, 2.5.2.3 of Doc 9880, Part II [1]; 2.3.2.2 of Doc 9880, Part III [2]		
2	AE-Qualifier	2.5.2.4, 2.5.2.5, 2.5.2.6 [1]	ATS Message Server: AMS(7)	
			AFTN/AMHS Gateway: GWB(8)	
3	Presentation Selector	2.5.2.7, 2.5.2.8, 2.5.2.9, 2.5.2.10, 2.5.2.11, 2.5.2.12 [1]	tbd	tbd
4	Session Selector	2.5.2.7, 2.5.2.8, 2.5.2.9, 2.5.2.10, 2.5.2.11, 2.5.2.12 [1]	tbd	tbd

No.	Address Type	AMHS technical specifications	Value	
			IUT	AMHS Test Tool
5	TSAP	2.5.2.7, 2.5.2.8, 2.5.2.9, 2.5.2.10, 2.5.2.11, 2.5.2.12 [1]	tbd	tbd
6	TCP Port	n/a	102	
7	IP Address	n/a	tbd	MTA(1): tbd
				MTA(2): tbd
				MTA(3): tbd
8	MAC Address	n/a	tbd	MTA(1): tbd
				MTA(2): tbd
				MTA(3): tbd

Reference: Sections 3.3 and 3.5.1.1.

Table 4: Layer addresses (AMHS communications)

5.2 AFTN/CIDIN communication

5.2.1 AFTN application

- Number of links: 1
- Number of AFTN users: 30

Reference: Section 3.2, Figure 2 and Figure 3.

5.2.2 Layer addresses

No.	Address Type	Reference	Value	
			IUT	AMHS Test Tool
1	CIDIN Entry (Ae)	[4] 6.1.2.1.4.5	*tbd*	*tbd*
	CIDIN Exit (Ax)	[4] 5.1.2.7	*tbd*	*tbd*

2	X.25 DTE	[4] 4.2.1.7	*tbd*	*tbd*

Reference: Sections 3.4 and 3.5.1.2.

Table 5: Layer addresses (CIDIN communications)

6 Test Data

The test data generated and evaluated in conformance testing environments with the AMHS Test Tool comprise (cf. Figure 5):

(1) AMHS and AFTN information objects exchanged between the AMHS Test Tool and IUT. These information objects are well defined by the AMHS technical specifications [1] and Annex 10, Vol. II [3], respectively.

(2) AMHS information objects entered and presented at AMHS user interfaces of the IUT. Even if these information objects are substantially specified by the AMHS technical specifications [1] their appearance at AMHS user interfaces is specific to a given IUT. In addition, when entering AMHS information objects certain parameters may be handled by the IUT as defaults and do not appear at user interfaces at all.

(3) The AMHS technical specifications specify events to be reported to the Control Position of an AFTN/AMHS Gateway. However, the style of reporting is an implementation matter.

(4) Traffic log data to be maintained by the IUT are specified in the AMHS technical specifications [1], however, their handling and presentation is specific for each IUT.

The correct interpretation of test data of the types (2) to (4) needs insight into the IUT's User Manual.

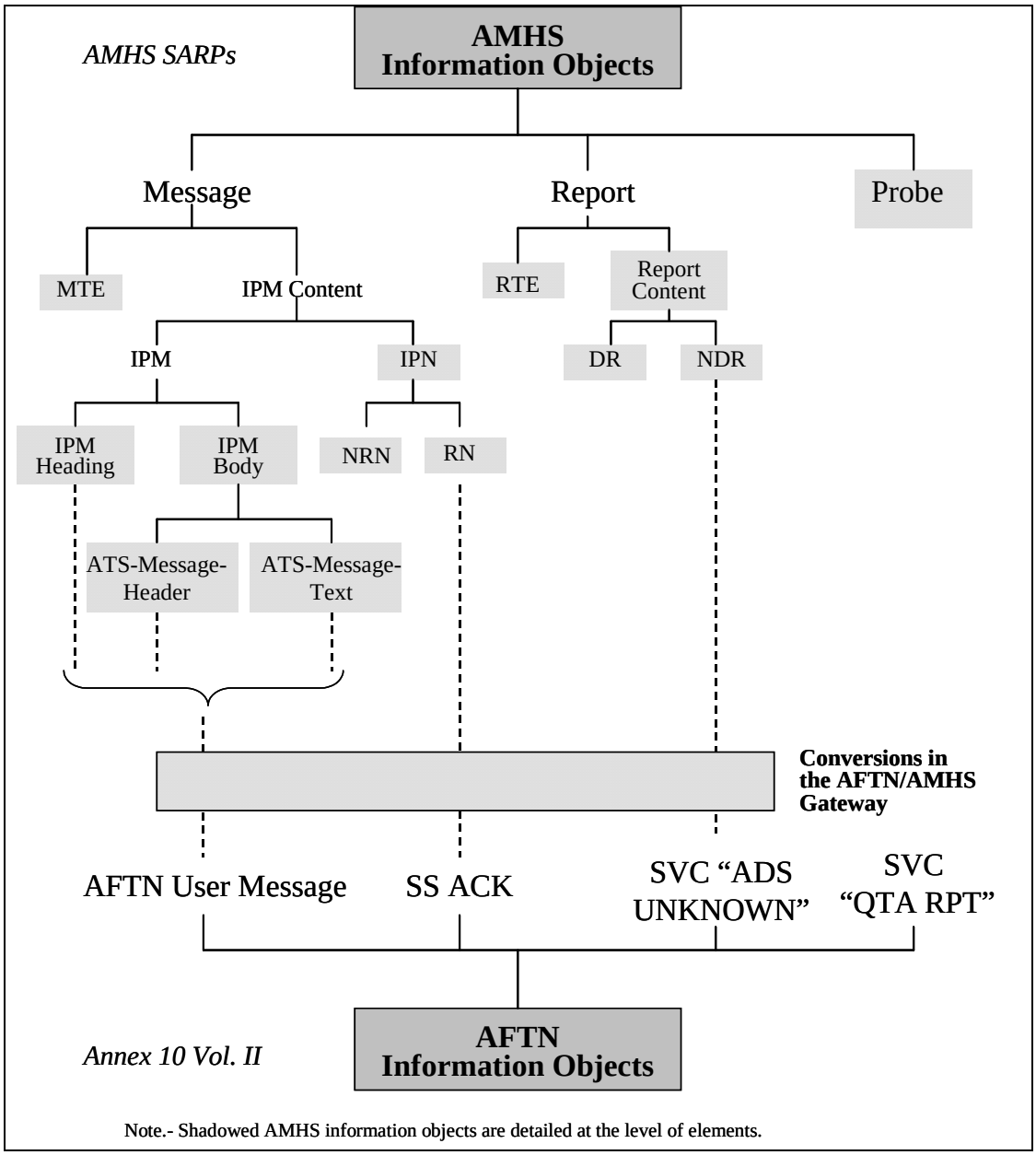

Figure 14: Information objects supported by the AMHS Test Tool

END of Appendix C