INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

REPORT OF

THE FIFTH MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) IMPLEMENTATION CO-ORDINATION GROUP OF APANPIRG (ATNICG/5)

Kuala Lumpur, Malaysia
31 May 2010 to 4 June 2010

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PART I – HISTORY OF THE MEETING

1.1 Introduction

1.1.1 The Fifth Meeting of the Aeronautical Telecommunication Network (ATN) Implementation Co-ordination Group (ATNICG/5) of APANPIRG was held at the Concorde Hotel, Kuala Lumpur, Malaysia from 31 May to 4 June 2010. The Meeting was hosted by Department of Civil Aviation, Malaysia.

1.2 Attendance

1.2.1 The Meeting was attended by 56 participants from 16 States (Bangladesh, Brunei Darussalam, China, Hong Kong China, Macao China, India, Indonesia, Japan, Malaysia, Nepal, New Zealand, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, and the USA) and representatives from an industry partner. A list of participants is provided at **Attachment 1**.

1.3 Opening of the Meeting

1.3.1 Welcoming the participants of the meeting, Mr. Azharuddin Abdul Rahman Director General of Civil Aviation Malaysia highlighted the development of aviation scenario both at the global and at the regional level. It was informed that a significant increase of traffic is being expected in the Asia and Pacific Regions in the near future. Mr. Rahman mentioned about the status of implementation of ATN/AMHS in Malaysia. He thanked ICAO Asia/Pacific Office for giving an opportunity of hosting the meeting to Malaysia.

1.3.2 On behalf of Mr. Mokhtar A. Awan, Regional Director, ICAO Asia and Pacific Office, Mr. Sujan K. Saraswati, Regional Officer, CNS of the ICAO Asia/Pacific Office expressed gratitude and appreciation to the Department of Civil Aviation, Malaysia for hosting the meeting and for the excellent arrangements made. He highlighted some of the significant achievements made in the implementation of ATN in region in the recent past and touched upon the challenges ahead. He emphasized the importance of cooperation and coordination for harmonized implementation of ATN/AMHS in the region. He also reminded that the objective of the meeting was to progress the tasks approved by APANPIRG.

1.3.3 Mr. Hoang Tran, Chairman of the ATNICG, in his opening remarks welcomed the participants and appreciated and thanked the Civil Aviation Department, Malaysia for the excellent arrangements made for the meeting and for the hospitality extended by them. Tracing the history of ATNICG, he reminded the meeting about the requirement to develop a plan for a seamless network to be used for the exchange of operational communications which include flight plan messages, meteorological information etc.

1.4 Officers and Secretariat

1.4.1 Mr. Hoang Tran, Chairman of the ATNICG presided over the meeting.

1.4.2 Mr. Sujan K. Saraswati Regional Officer CNS of the ICAO Asia and Pacific acted as the Secretary of the meeting.

1.5 Working Arrangements, Language and Documentation

1.5.1 The ATNICG met as a single body, except for a break-away ad-hoc working group created during the course of the meeting to review the implementation plan particularly with reference to specific sub-backbone networks. The working language for the meeting was English inclusive of all documentation and this Report. Lists of Working Papers and Information Papers are provided at **Attachment 2.**

1.6 Conclusions/Decisions - Definition

1.6.1 The ATNICG of APANPIRG records its actions in the form of Draft Conclusions, Draft Decisions and Decisions with the following significance:

a) Draft Conclusions deal with matters which, in accordance with the Sub-Group's Terms of Reference, require the attention of States/Organization or actions by ICAO in accordance with established procedures:

b) Draft Decisions relate solely to matters dealing with the internal working arrangements of APANPIRG and its contributory bodies;

c) Decisions relate solely to matters dealing with the internal working arrangement of the ATNICG.

1.7 Terms of Reference (TOR) of ATNICG

Title and Terms of Reference

Title: Aeronautical Telecommunication Network Implementation Co-Ordination Group (ATNICG)

Terms of Reference (TOR)

Coordinate ATN implementation and transitional issues in the Asia and Pacific regions and address relevant system management, operational procedures and emerging issues that may arise.

Composition

The Group will be composed of experts nominated by:

Australia, China, Hong Kong, China, Fiji, India, Indonesia, Japan, New Zealand, Republic of Korea, Singapore, Thailand and the United States of America.

Reporting

The Group will present its report to APANPIRG through the CNS/MET Sub-group.

1.8 List of Draft Conclusions, Conclusions and Decisions

Draft Conclusion 5/1	-	ICAO Doc 9896 Clarification
Draft Decision 5/2	-	Regional ATN/AMHS Implementation Planner
Draft Conclusion 5/3	-	AMHS connectivity with ICAO MID region
Draft Conclusion 5/4	-	Strategy for Implementation of Aeronautical Telecommunication Network (ATN) in the Asia/Pacific Region
Draft Conclusion 5/5	-	Phased testing for implementation of MTA – to – any – MTA connectivity
Draft Conclusion 5/6	-	AMC Information Form
Decision 5/7	-	Implementation of Directory Services
Draft Conclusion 5/8	-	Asia/Pacific ATN Interim Addressing Plan
Decision 5/9	-	AMHS Performance Assessment in Asia/Pacific Region
Draft Conclusion 5/10	-	Asia/Pacific ATN Network Service Access Point (NSAP) Addressing Plan
Draft Conclusion 5/11	-	Asia/Pacific AMHS Manual ANNEX C, Test Procedure for ATN Router Connection Test
Draft Conclusion 5/12	-	Asia/Pacific ATN Security Guidance Document
Draft Decision 5/13	-	Performance Framework Form
Draft Conclusion 5/14	-	Points for Proposed Defect Report (PDR) raised in the region
Draft Decision 5/15	-	Subject/Tasks list for ATNICG
Draft Conclusion 5/16	-	Japan/Russia routing change

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Agenda Item 1: Adoption of agenda

Meeting reviewed the proposed Agenda and decided to amend Agenda Item 12 to read "Asia/Pacific ATN Security". The following Agenda was adopted by the Meeting:

Agenda Item 1: Adoption of Provisional Agenda

Agenda Item 2: Review outcome of CNS/MET SG/13 and APANPIRG/20 Meetings

Agenda Item 3: Review the ICAO Doc 9880 and 9896 and on-going development Activities including the latest Report of the ACP WG-W

Agenda Item 4: Report on the ATNICG Working Group/7 Activities

Agenda Item 5: Review States' ATN/AMHS Implementation/Operational activities issues and test results for BBIS Network

Update regional implementation matrix table

Agenda Item 6: Review the implementation plan and status from other ICAO regions

Agenda Item 7: Review proposed modification to APANPIRG ATN Implementation Strategy

Agenda Item 8: AMC:
- AMC Standard Operating Procedure (SOP)
- AMHS Address Management

Agenda Item 9: Future use of Directory Service

Agenda Item 10: IP sub network Planning

Agenda Item 11: Review ATN/AMHS Implementation related regional guidance material
- Update documentation tree
- AMHS manual and appendices

Agenda Item 12: Asia/Pacific ATN Security
- Review AMC Security
- Discuss Implementation document: security checklist

Agenda Item 13: Review outcome of Flight Plan & ATS Message Implementation Task Force/2 Meeting

Agenda Item 14 Review Tables and Charts for the ground-to-ground part of the CNS FASID Table CNS 1E – AIDC Implementation Plan

Agenda Item 15: Review the Subject/Tasks List of the ATN Implementation Coordination Group and develop future work programme of the group

Agenda Item 16: Any other Business

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Agenda Item 2: Review outcome of CNS/MET SG/13 and APANPIRG/20 Meetings

2.1 Report on the outcome of CNS/MET SG/13 and APANPIRG/20 meetings was presented by the Secretariat through WP/2. Abstract of the report relevant for Aeronautical Fixed Services (AFS) and Aeronautical Mobile Services (AMS) is placed at **Appendix A** to this Report.

2.2 Meeting was informed about the Conclusions/Decisions adopted by APANPIRG based on the Draft Conclusions/Decisions developed by APANPIRG/4 meeting and recommended by CNS/MET SG/13 meeting. It was informed that all the Draft Conclusions/Decisions were adopted without any change except for the ATNICG/4 Draft Conclusion 4/5, wherein the word "Thailand" was replaced with the word "Aerothai" before APANPIRG adopted it as Conclusion 20/28. It was informed that APANPIRG after reviewing the evolutions that are taking place in the AFS telecommunication infrastructure suggested that ATNICG should develop a Working Paper (WP) on regional coordination approach to harmonize implementation.

2.3 Meeting also reviewed the Conclusions and Decisions adopted by APANPIRG and discussed follow-up action on them. APANPIRG recorded its appreciation for Civil Aviation Authority of Singapore and Singapore Aviation Academy for hosting the ATNICG/4 meeting.

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Agenda Item 3: Review the ICAO Doc 9880 and 9896 and on-going development Activities including the latest Report of the ACP WG-W

3.1 Through IP/3 presented by the Secretariat, the meeting was informed about the outcome of Aeronautical Communication Panel (ACP) Working Group of the Whole (WG-W) meeting held in Montreal from 18 to 22 January 2010. Informing the meeting about the status of activities of ACP Working Group – I (IPS) as informed to the ACP (WG-W) meeting, it was mentioned that IPS SARPs for inclusion in Annex 10, Volume III, Part I were developed by ACP WG-I in December 2007 and these SARPs were approved by Council for inclusion in Annex 10, Volume III in March 2008. Doc 9896 Edition I, providing guidance on ATN using IPS standards and protocols was published in November 2008. Structure of Doc 9896 was explained to the meeting. ACP (WG-W) was informed that Doc 9896 Edition 2 will be delivered in May 2010. Meeting was informed that ACP is more into the development of Standards and integration of industry inputs where as the regional bodies like APANPIRG were more concerned with the implementation issues. Regional bodies like APANPIRG have to interpret the guidance documents like Doc 9880 and Doc 9896 into the regional environment to see what applications can be supported on AMHS. It was informed that the network is a local issue and has to be decided bilaterally.

3.2 USA informed the meeting about the outcome of the Twelfth meeting of ACP WG – I from 19 to 21 May and the ACP WG-M meetings, held from 17 to 19 May 2010, both held in Paris. In response to a query, the meeting was informed that the only difference between Edition 1 and 2 of Doc 9896 was the inclusion of material on VoIP in the later version. It was also informed that ACP was considering to include some form of Directory Service in Doc 9896 (for ATN/IPS) also. The Meeting was informed that the last Working Group I meeting also addressed the issue of acquisition of a unique address block for ICAO. Various options, like accommodating the global requirements in the /32 prefix allocated for European region were also discussed.

3.3 Developments that have taken place in Aeronautical Mobile Airport Communication System (AeroMACS), a C-Band system based on IEEE 802.16e for surface movement was also briefed to the meeting.

Draft Conclusion 5/1 - ICAO Doc 9896 Clarification

That, ICAO be invited to provide clarifications on the following issues in respect of ATN/AMHS implementation.

i) VoIP should be limited to ATS ground service since the ICAO approach is to encourage data communication such as CPDLC. Furthermore, the VoIP performance is network dependent and thus performance acceptance is varied;

ii) The reference of Industry Request for Comments (RFC) is difficult to track change and availability of RFC in the industry; and

iii) IPv6 address structure need to be clarified by ACP WG. A proposal by ATNICG will be presented.

It was decided that a presentation will be made to the CNS/MET SG/14 describing the mentioned issues.

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Agenda Item 4: Report on the ATNICG Working Group/7 Activities

4.1 WP/4 was presented by the secretariat to inform the activities and results of ATNICG WG/6 meeting held from 22 to 25 September, 2009 was hosted by Aerothai in Hua Hin, Thailand and the ATNICG WG/7 meeting, also hosted by Aerothai was held on 29 January 2010 at ICAO APAC Office in Bangkok, Thailand.

4.2 The paper informed 15 Item Actions that need to have their status report for the CNS/MET SG/14. The following are the status of action items:

1) Action Item 1: that *a comprehensive report on implementation in a tabular form will be presented to CNS/MET SG/14 and APANPIRG/21 meetings* ***(Action Item 1)*****.** It was agreed that format developed by Hong Kong China for the purpose will be used: AMHS Implementation Planner that has been updated during ATNICG/5 will be presented.

2) Action Item 2: *It was decided that a member State, which is actively participating in the ACP activities will track the PDRs raised and arrangements will be made in reflecting these PDRs through amendment to the guidance documents* ***(Action Item 2)***. Proposed Defective Report (PDR) has been re-named as Amendment Proposal by the ACP. Member States is required to file Amendment Proposal to ICAO Asia/Pacific Regional Office (Secretariat to ATNICG). The FAA/USA will take responsibility on behalf of ATNICG to coordinate and tracking these changes with ACP WG-M.

3) *Meeting was of the view that all the issues like justification of ATN implementation, security of the network etc. should be adequately reflected in the strategy* ***(Action Item 3)***. The security issues has been addressed in Security Task List to support the Regional ATN Implementation Strategy

4) *USA offered to provide initial draft for additional tests recommended for transiting from point to point connectivity to logical connectivity by the first quarter of 2010 to Singapore. Singapore will then arrange to incorporate these tests in the AMHS manual* ***(Action Item 4)***. Completed update the Regional AMHS Manual.

5) *APANPIRG should acquire a regional address prefix of a certain length and incase it does not become possible to acquire the address prefix, then region should self-designate a prefix which unlikely to be allocated by IANA in near future* ***(Action Item 5)***. Continue to coordinate with ACP WG-I/M for IPv6 Addressing Plan. Based on the result of the ATNICG/5 discussion, there are currently two approaches in obtaining IPv6 address assigned block for the region:

   (1) Sharing address block obtained by Eurocontrol for European region: this option requires coordination with Eurocontrol and expect no cost will be incurred;

   (2) Obtain addressing block directly from Local Internet Registry (LIR): this approach is expected to incur recurring cost to member states.

6) Regional Implementation Strategy. It was agreed that *a companion paper should be developed to provide a more detailed description of each item in the strategy with examples and the rationale for the items when appropriate* ***(Action Item 6)***. Hong Kong, China has provided a detailed phased approach to the implementation strategy for the AMHS. This detailed implementation strategy has been incorporated into the Regional ATN Implementation Strategy.

7) *States were requested to provide the implementation schedule to Mr. P.K. Kapoor of India within two months of the meeting, so that the planner could be prepared **(Action Item 7)**. This action item should be read along with Action Item 1.* Subsequently since Mr. Kapoor could not attend the ATNICG WG/7 meeting, the planner was presented by Hong Kong China: The Implementation Planner has been updated.

8) While reviewing CAR/SAM region ATN Implementation Plan and the global IPv4 addressing scheme developed by them, meeting concluded that *Asia/Pacific ATN AMHS will adopt the IPv4 address assignment proposed by the CAR/SAM region, if the States want to use IPv4 network **(Action Item 8)***. IPv4 address plan has been reviewed and recommended to be adopted for IP network and IP sub-network in the region.

9) *This action item should be read with Action 5, where in Japan had proposed acquiring an address prefix in IPv6.* Meeting also proposed that *CAR/SAM region and Asia Pacific regional networks should be combined **(Action Item 9)**.* Refer to Action Item 5.

10) Issues related to TCP/IP – ATN/OSI interface were discussed and it was felt that these issues will come up when inter regional MTA implementation is initiated. *USA assured to present a paper on this issue when it completes the MTA interface with UK in 2010 using RFC 1006 over TCP/IP network **(Action Item 10)***. USA-United Kingdom (UK) AMHS service has been delayed. The FAA/USA will report in 2011 when the AMHS service will be operational.

11) Meeting while reviewing the Terms of Reference assigned to the Group by APANPIRG, noted that it has become important to deliberate some of the operational issues in addition to the implementation issues. *It was agreed that inclusion of operational issues in the Terms of Reference will be taken up for consideration in the next Working Group meeting **(Action Item 11)***. This issue will be addressed at the ATNICG WG/8 to be held in September 2010.

12) Meeting was informed that documentation tree was last updated in 2005 and it was considered necessary to review the currency of the documents and update them wherever required. Requirement of guidance on subjects like IPS Transition Plan, AMC, ICD (as taken up by Japan in ATNICG/4) etc. were identified. It was concluded that *the Task Leads will inform Mr. V. Patel (FAA) about the status of relevant documents, so that the currency of these could be ensured **(Action Item 12)***. Documentation Tree will be further updated at the ATNICG WG/8 to reflect the newly recommended implementation documents to support IPS and ICAO Doc 9705 Ed. 3.

13) After discussing the draft Asia/Pacific regional ATN/AMHS Strategy presented by Singapore, the Working Group was of the view that connectivity between the hubs should be left for the bilateral arrangements and should generally be based on X.25 or IP sub-network. The Strategy should ensure that there is no single point of failure. *It was agreed that a comprehensive amendment proposal will be presented to the ATNICG/5 for its review **(Action Item 13)***. The Regional ATN Implementation Strategy has been updated to include these issues.

14) Hong Kong China also proposed changes to the regional routing structure and *it was decided that concerned States, USA, Hong Kong China, Australia, Fiji etc. should consider Hong Kong China proposal and it should be reviewed in the next ATNICG meeting **(Action Item 14)***. This issue requires more coordination between impacted States.

15) Discussing the revised route structure consequent to the inclusion of Afghanistan in the region, it was decided that *a consolidated FASID Table CNS 1B and 1C will be presented to the next ATNICG meeting* ***(Action Item 15)***. The FASID tables have been updated during ATNICG/5 meeting.

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Agenda Item 5: Review States' ATN/AMHS Implementation/Operational activities issues and test results for BBIS Network

- **Update regional implementation matrix table**

5.1 Status of ATN/AMHS implementation in their administration was presented by Japan, Indonesia, India, China, Singapore and Republic of Korea through IPs 7, 8, 12, 10, 11 and 13 in the circulated format. In addition, Thailand and USA also briefed the meeting about the status of implementation of ATN/AMHS in their administrations. Korea informed the meeting about their readiness to connect with Japan. Japan has implemented AMHS Edition 2, where as the AMHS implemented in ROK is Edition 3. The issue of compatibility of different editions, hence is required to be resolved by Japan and ROK.

5.2 Japan proposed updates in the regional AFTN Directory in respect of their circuits. The details of the amendment to the AFTN Routing Director were presented by Japan separately under Agenda Item 16.

5.3 USA informed the meeting that in June, connectivity will be provided between US and UK on 128 kbps. Initially the connectivity will be on AFTN and after sufficient experience has been gained, the connectivity will be transferred to AMHS. USA expected to implement AMHS connectivity with Fiji in the 3rd quarter of 2010.

5.4 In response to a query, China informed the meeting that the system installed in China supports both ATN/OSI and IPv4. It was informed that China has some concerns regarding operating on IPS, which included security and non availability of operational procedures available to operate on IPS.

5.5 Thailand informed the meeting that their administration has decided to go for an alternate approach and their system is likely to be implemented in 2012.

5.6 Hong Kong China presented the implementation status of AMHS and regional implementation planner through WP/16 and invited the States to update the information provided in it. The meeting was reminded that this updated implementation planner will be presented to report the implementation progress and following draft Decision was adopted:

Draft Decision 5/2 - Regional ATN/AMHS Implementation Planner

That, the Asia/Pacific Regional Implementation Planner placed at **Appendix B** be adopted to report the ATN/AMHS implementation progress in the region.

The meeting decided that ATNICG outcomes will be presented to CNS/MET SG/14 as follows:

1) ATNICG/5 Report will be presented by Secretariat;

2) Regional ATN Implementation Strategy to be presented by Singapore;

3) AMHS Implementation Planner to be presented by Hong Kong China; and

4) A paper projecting implementation issues to be clarified by ICAO to be presented by ATNICG Chairman.

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Agenda Item 6: Review the implementation plan and status from other ICAO regions

6.1 Secretariat, through its WP/3, reported on the status of implementation of ATN/AMHS in the ICAO Middle East (MID) region. The meeting was informed that MID region had adopted ATN over IPS, which will maintain compatibility with AFTN, CIDIN and ISO/OSI based implementations. Meeting was informed that implementation of AMHS had been completed or was in very advanced state of completion in a number of States in the MID region. MID region currently has four links with Asia and Pacific regions (Bahrain/Singapore, Kuwait/Pakistan, Iran/Pakistan and Oman/India). The meeting was of the view that the Singapore, Pakistan and India should take initiative in transiting to AMHS connectivity following the prescribed procedure. Following draft Conclusion on this issue, hence was developed by the meeting.

Draft Conclusion 5/3 - AMHS connectivity with ICAO MID region

That, Singapore, Pakistan and India should take an initiative in transiting to AMHS connectivity with Bahrain, Kuwait, Iran and Oman respectively at the earliest.

6.2 Meeting was also informed about the commissioning of AMHS connectivity between Amman/Jordan and Abu Dhabi/United Arab Emirates on Virtual Private Network (VPN) (Public Internet) on 3 March 2010. It was subsequently informed that there were two other AMHS links between UAE/Oman and UAE/Qatar which were in operation.

6.3 Meeting was also informed about the policy adopted in ICAO MID region regarding the usage of public internet for operational use and registration of three persons (one each from engineering, operation and communication administration) from each State with the Eurocontrol AMC.

6.4 Regarding the implementation status in European region, the meeting was informed that there has not been much development since the last meeting except that a test was carried out between three nodes at Hungary, Slovak Republic and Austria for AMHS connectivity.

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Agenda Item 7: Review proposed modification to APANPIRG ATN Implementation Strategy

7.1 Through WP/19, Singapore presented the draft updates to the Strategy for Implementation of Aeronautical Telecommunication Network (ATN) in the Asia/Pacific Region as reviewed and updated in the Working Groups 6 and 7. Meeting suggested a number of alterations and ultimately it was decided that a separate group comprising of participants from Singapore, Hong Kong China, Japan, USA and India should review the updates offline. The draft Strategy was again presented to the ATNICG incorporating changes. The updated strategy is in three parts. First parts details the considerations based on which the strategy has been developed, the second part describes the general strategy for implementation of ATN infrastructure and associated ATN applications in the region and the third part recommends the actions to be taken in order to achieve the objectives of the strategy.

7.2 Strategy recommends deployment of a backbone network of ATN/OSI and a private network of ATN/IPS comprising of dedicated point-to-point circuits with no connectivity provided with the Public Internet. Strategy also recommends migration from the X.25 sub-network to IP sub-network connectivity. Usage of Public Internet however is accommodated for connectivity between MTAs and UAs. The meeting, after deliberations decided to recommend the adoption of the updated strategy and formulated the following draft Conclusion.

Draft Conclusion 5/4 - Strategy for Implementation of Aeronautical Telecommunication Network (ATN) in the Asia/Pacific Region

That, the document placed at **Appendix C** be adopted as Strategy for Implementation of Aeronautical Telecommunication Network (ATN) in the Asia/Pacific Region.

7.3 Hong Kong China proposed a procedure for phased approach to ensure an orderly testing and implementation of AMHS. Existing procedures require that interoperability tests should be conducted between MTA pairs before AMHS is put into operation. Considering large number of MTAs proposed in the region, tests between each possible pair is going to be very complex and will also be time consuming. The paper hence recommends that the comprehensive test recommended in Annex C and E of the AMHS Manual needs to be conducted only for the MTAs which are connected directly. For other MTA pairs, which are not connected directly, abridged interoperability test procedures stipulated in paragraph 4, Annex E of the AMHS Manual should be sufficient.

7.4 Description of activities in the four phases of testing is provided in the paper. Appendix to the paper provides a sample routing table showing the progression from AFTN routing in Phase I to direct MTA – to – any – MTA routing in Phase III. Meeting agreed with the suggestion made in the paper and formulated following recommendation:

Draft Conclusion 5/5 - Phased testing for implementation of MTA – to – any – MTA connectivity

That, the phased testing procedure to transit from AFTN routing to MTA – to – any – MTA routing provided in **Appendix D** to this paper be adopted and incorporated in the AMHS Manual.

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Agenda Item 8: AMC:

- **AMC Standard Operating Procedure (SOP)**
- **AMHS Address Management**

8.1 Thailand, through WP/15 presented the updated status on the Asia/Pacific Interim AMHS Database and AMC operated by AEROTHAI. It was informed that AEROTHAI had received updated information for the Register from Cambodia, India, Hong Kong China, Macau China, Malaysia, Mongolia, Myanmar, Nepal, New Zealand, Pakistan, Singapore, Sri Lanka, Thailand and USA. It was reminded that the data entry into the EUROCONTROL data based is required to follow the AIRAC Cycle. However, because of administrative inconveniences, some States are not in a position to follow the AIRAC cycle while submitting data. To overcome this problem, States were advised to provide data at their convenience to AEROTHAI and AEROTHAI then will inform the State as to which AIRAC cycle the data in respect of their administrations will be updated.

8.2 AEROTHAI also informed the meeting that the data provided by the States was sometimes not correct and so the paper went on to explain the type of data required to be provided for each item. AEROTHAI also proposed an information form for States to report their information. The form was included in the Working Paper and was subsequently distributed after the meeting. Meeting was reminded about the explanation on the requirement of data provided in ICAO State Letter. Meeting decided to formulate a draft Conclusion inviting the States to provide information in the prescribed form.

Draft Conclusion 5/6 - AMC Information Form

That, the States be invited to provide information in respect of their Administration in the format placed at **Appendix E** to this Report.

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Agenda Item 9: Future use of Directory Service

Two papers, WP/10 and WP/21 were presented by US and Fiji (Comsoft) under this Agenda Item.

9.1 USA, presented the summary of Directory Service concept as specified in ICAO Doc 9705, Edition 3, Sub-Volume VII and Asia/Pacific Directory Service guidance document through WP/10. Directory Service, based on X.500 allows the users to collect information describing the users, the applications and other resources in a common directory that is accessible to all authorized users and applications within the Aeronautical Telecommunication Network. It was also informed that the Directory Service also provides an "on-line" administrative tool to centrally manage information for the global ATN. Because of the low number of operating AMHS circuits and pending acquisition of wider operational experience in AMHS operations, Directory Service is yet to be adopted for operation. Currently, "off line" Directory Service provided by EUROCONTROL AMC, accessible through public Internet is being used.

9.2 Paper went on to describe the Directory structure and explained how the data is required to be organized in this structure. Requirements to be met for the eight types of ATN users were explained through a Table. In conclusion, the paper invited the meeting to analyze AMC functions that overlap the Directory functions, recognize and recommend the short term and long term Directory functions that can be implemented, analyze and specify if any operational procedures are required for the Directory function and identify and mitigate the obstacles in implementing Directory Service. The meeting was urged to present the first report on this issue at the ATNICG WG/8.

9.3 It was expressed that implementation of Directory Service at this stage, is premature and the "off line" service provided by EUROCONTROL AMC should continue to be used. Raising concern, some participants were of the view that in the 'on-line' Directory Service, if the directories provided in all the MTAs are not synchronized, the situation will become very complex.

9.4 Thailand, the task lead for the Directory Service, was urged to progress the implementation of this service through the following Decision developed by the meeting

Decision 5/7 - Implementation of Directory Services

That, ATNICG analyze and recommend Directory Services that can be implemented for future use, develop procedures for implementation, identify obstacles on its implementation and develop mitigation proposals for these obstacles.

9.5 Presentation made through WP/21, analyzed the current situation in terms of the "off-line" management, maintenance, distribution and activation of operational information in respect of AMHS and predicted the advantages of "on-line" Directory Service. It was informed that technology for providing "on-line" Directory Service was available, but organizational arrangements and procedures are yet to be developed. Benefits like automatic synchronization of data versions and facilitation of implementation of security were discussed in detail. Transition arrangements, taking benefit of both the "off-line" and "on-line" Directory Services were also discussed.

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Agenda Item 10: IP sub network Planning

10.1 Japan, in its WP/6 suggested IPv6 addressing plan for the Asia/Pacific region. The paper comprehensively describes the globally adopted IPv6 address plan and the ATN NSAP/NET address plan as defined in Doc 9880 Part II, Chapter 3[4] and goes on to propose how the two can be related. The paper recommends adoption of the proposed IPv6 address plan and suggests that the Working Group of ATNICG should be tasked to develop an Asia/Pacific ATN IPv6 Addressing Plan document based on the proposal for endorsement by APANPIRG.

10.2 The meeting was informed that acquiring a common prefix block for civil aviation at the global level was already included in the work-plan of ACP WG-I. After discussing issues related to the acquisition of block of addresses and the administration of this block at the regional level in detail the meeting was of the view that these issues were global in nature. It was therefore decided to recommend the suggested addressing plan for the consideration of ACP.

10.3 USA proposed IPv4 Addressing Plan for the Asia/Pacific Region through its WP/11. The plan proposed in the paper is based on the recommendation of Caribbean and South American Region and defines the recommended address format for IPv4 addresses. The paper, after discussing the fundamentals of the addressing plans and the considerations for choosing between public/private address blocks, discusses the plan adopted in the CAR/SAM region. Distribution of address space between various attributes is discussed in detail and scheme of blocks have been suggested for various users (including the regions). For Asia/Pacific Region 0010 has been suggested as the first four bits of the second byte for identification. The paper goes on to identify unique blocks for all the States in the region.

10.4 Based on the IPv4 and IPv6 addressing plans proposed by USA and Japan and considering

i) The coordination required to obtain a global IPv6 address prefix for the region, and the cost in acquiring and maintaining such address prefix;

ii) The desirability of an ICAO global IPv6 addressing scheme, which must be coordinated through the Aeronautical Communication Panel;

iii) The urgent need to migrate from AFTN to the AMHS, and the need for non-backbone States to use the Internet Protocol Suite to reduce their implementation costs; and

iv) That the proposed IPv4 addressing plan is considered sufficient to meet the requirements of ground-ground communication in the Asia/Pacific region in the short-to-medium term,

The meeting developed following draft Conclusion:

Draft Conclusion 5/8 - Asia/Pacific ATN Interim Addressing Plan

That,

i) The proposed IPv6 and IPv4 addressing schemes be submitted to ICAO and ICAO be requested to consider a global IPv6 addressing scheme for ground-ground communication

ii) The proposed IPv4 address plan placed at **Appendix F** be adopted to enable the Asia/Pacific ATN ground IPS network implementation to proceed using IPv4 in the interim with minimum delay, and

iii) The Asia/Pacific region transition to IPv6 once the above issues have been resolved.

10.5 Through its WP/13, Japan proposed a framework of an ICD for IPS routers with connections between administrative domains of the Asia/Pacific ATN. The paper stressed on the requirement of developing a common standard to facilitate uniform and harmonized implementation of ATN over IPS. After discussing various attributes of the ICD, the paper proposes a framework. While discussing the ICD, it was mentioned that there may be a requirement to amend the FASID table to accommodate the unique requirements of IPS (like speed etc.) The meeting agreed with the requirement of developing the guidance document and decided that an additional task should be created in the Subject/Tasks list to accommodate this requirement.

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Agenda Item 11: Review ATN/AMHS Implementation related regional guidance material

- **Update documentation tree**
- **AMHS manual and appendices**

11.1 Three Working Papers were presented under this Agenda Item. Japan presented the AMHS Performance Assessment in the Asia/Pacific Region through its WP/14. The assessment document developed by Japan to meet the requirements of the Subject/Task of developing/establishing/adopting/monitoring/analyzing performance indications and developing performance measuring specifics describes in details the scope of performance assessment, performance indicators, target performance indicators etc. The presentation specifically points out that ICAO guidance on Required Communication Performance (Doc 9869) is not very much applicable to the performance assessment of AMHS, since RCP specifies the requirements for two way communication, but AMHS is basically relevant for one way communication only. The report hence specifies some other parameters. Performance Indicators, for various requirements have been suggested in a tabular form in the paper. In response to a query, it was clarified that the intent of the report is to address the requirements of the whole system, and not for any specific element of the system. The document, attached to the presentation is the final version of the document developed to meet the requirement of the task. After, discussing various issues related to the performance aspects, the meeting decided to adopt it and review it periodically based on the experience gained over a period of time.

Decision 5/9 - AMHS Performance Assessment in Asia/Pacific Region

That, the document placed at **Appendix G** be adopted as the AMHS Performance Assessment in Asia/Pacific Region and be updated based on the experience gained over a period of time.

11.2 Singapore presented amendment to the Asia/Pacific ATN Network Service Access Point (NSAP) Addressing Plan through its WP/20. In the ATNICG WG/7 meeting, it was informed that Asia/Pacific ATN IDRP Routing Policy Version 3.1 provides for a common addressing prefix for the Asia/Pacific and NAM regions to achieve the ultimate goal of shortest path. This means that all the States in the two regions should have common 5-byte NSAP prefix and requires that Asia/Pacific ATN NSAP addressing plan should be changed to include Hexadecimal Code of '91' in the ADM field. The meeting reviewed the amendment and decided to recommend it for adoption by APANPIRG through CNS/MET SG. Following draft Conclusion was hence developed:

Draft Conclusion 5/10 - Asia/Pacific ATN Network Service Access Point (NSAP) Addressing Plan

That, The document placed at **Attachment H** to this report be adopted as the amended Asia/Pacific ATN Network Service Access Point (NSAP) Addressing Plan for Asia/Pacific Region.

11.3 Singapore, on behalf of ATNICG Task 3 Group also presented enhancements to Annex C of the Asia/Pacific AMHS Manual, through WP/17. In a briefing provided to the ATNICG Working Group/6 meeting held in September 2009, it was informed that the current test cases provided in Annex C to the Asia/Pacific AMHS Manual are somewhat limited in the scope of verifying routing capabilities of ATN routers operating in multiple domains. It was therefore agreed that two additional test cases should be included in the Annex to cater to this additional requirement. Amendment to Annex C to include these additional test cases was presented to the meeting. Meeting agreed with the proposal and formulated following draft Conclusion for the consideration of CNS/MET SG and APANPIRG.

Draft Conclusion 5/11 - Asia/Pacific AMHS Manual ANNEX C, Test Procedure for ATN Router Connection Test

That, the document placed at **Appendix I** to this report be adopted as the Test Procedure for ATN Router Connection Test, Annex C of Asia/Pacific AMHS Manual.

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Agenda Item 12: Asia/Pacific ATN Security

- **Review AMC Security**
- **Discuss Implementation document: security checklist**

12.1 USA presented WP/23, a power point presentation which describes the relationship between the Security Policy, Security Checklist, and Security Guidance documents. The Security Policy and Security Checklist have been adopted by APANPIRG. The policy defines the general security objectives which are achieved through a set of high level security services, which in turn are realized through the application of Management, Operational, and Technical Security Controls. The checklist is a list of controls which may be used by a Designated Approval Authority to approve a system for operation.

12.2 USA presented WP/22 which is the latest (June 2010) version of the guidance document. The guidance document provides background on the controls. The latest version incorporates several editorial changes and includes appendices for Outlines for a Contingency/Disaster Recovery Plan and an Incident Response Plan.

Draft Conclusion 5/12 - Asia/Pacific ATN Security Guidance Document

That, the document placed at **Appendix J** be adopted as 'Asia/Pacific ATN Security Guidance Document' to replace the existing Asia/Pacific ATN Security Guidance Document, Draft, First Edition".

12.3 Japan presented WP/12. This paper notes that the introduction of Internet Protocol Suite (IPS), which may potentially increase its vulnerability and require the introduction of security measures. This paper discusses resources that should be protected and means available to protect them. The issue of key management is also introduced. The paper recommends that the Asia/Pacific region should create a plan and policy for introducing security in the ATN IPS ground network before implementation of IPS begins. The meeting agreed with these recommendations and they were added to the task list. The US noted that the paper by Japan was a good example of controls for a specific operating environment (the IPS) and that such controls were identified in the Guidance Document at a high level.

12.4 USA presented WP/18, which also describes considerations related to security when operating in the IPS environment. It was noted by the meeting that WP/22 and WP/18 were complimentary.

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Agenda Item 13: Review outcome of Flight Plan & ATS Message Implementation Task Force/2 Meeting

13.1 A brief report on the outcome of the Second Meeting of the Asia/Pacific ICAO Flight Plan and ATS Messages Implementation Task Force and the Seminar (FPL&AM/TF/2 &SEMINAR) was presented by the Secretariat through the IP/3. The Task Force and the Seminar were held back to back from 17 to 20 November, 2009 in Bangkok. The Task Force, in addition to reviewing the outcome of the related meetings also reviewed the available documents and guidance material for their adequacy. It was agreed that a structured approach should be followed for the implementation of the amendment and the recommended structure was adopted by the meeting.

13.2 Participants pointed out a number of anomalies and sought clarifications on them from ICAO. It was considered that a limit should be specified for the field size so that there is uniformity in the format adopted by all States and this limit will also take into account the relevant requirements of Annex 10 Volume II AFTN provisions. The meeting was informed that the Third Meeting of the Asia/Pacific ICAO Flight Plan & ATS Messages Implementation Task Force has been scheduled from 22 to 23 August 2010.

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Agenda Item 14: Review Tables and Charts for the ground-to-ground part of the CNS FASID Table CNS 1E – AIDC Implementation Plan

14.1 Through IP/5, Secretariat informed the meeting that ICAO Asia/Pacific Office had circulated Asia Pacific Regions Air Navigation Plan (Doc 9673) Volume II Facilities and Services Implementation Documents (FASID) amendment proposal through its State Letter dated 26 March 2010. The proposal was based on the recommendations made in the last ATNICG meeting, reviewed by CNS/MET SG/13 and adopted by APANPIRG/20. Last date for the receipt of comments on the amendment proposal was 3 May 2010. FASID Tables CNS 1B, 1C and 1E circulated through the amendment proposal were presented to the meeting for its information.

14.2 Secretariat, through its WP/5 reminded the meeting that ICAO, industry and the States have adopted a performance based approach to planning and that in line with this approach a Performance Framework Form (PFF) had been developed in the last meeting, which had ultimately been adopted by APANPIRG/20 based on the recommendations of CNS/MET SG. The PFF was presented to the meeting for its review and update. The form was updated by the meeting based on the recent developments that had taken place in the implementation scenario. The meeting formulated following draft Decision recommending the adoption of the updated PFF for the consideration of CNS/MET Sub Group and the APANPIRG

Draft Decision 5/13 - Performance Framework Form

That, the draft updated form placed at **Appendix K** to this report be adopted as the Performance Framework Form on the Implementation of Aeronautical Telecommunication Network (ATN) for Ground-Ground Communication Network in Asia/Pacific Region.

14.3 Through its WP/8 Secretariat presented the Asia and Pacific Regional CNS/ATM Implementation Matrix to the meeting for its review. States were invited to review the information provided in the form in respect of their Administrations and inform corrections where required. The updated matrix is provided in **Appendix L** this Report.

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Agenda Item 15: Review the Subject/Tasks List of the ATN Implementation Coordination Group and develop future work programme of the group

15.1 Secretariat presented the ATNICG Subject/Tasks list through WP/7 for review by the meeting. The Subject/Tasks list presented was adopted by APANPIRG/20 last year through its Decision 20/26. Meeting reviewed the status of completion of various Tasks and updated information provided in the matrix. Meeting also reviewed the requirement of various tasks in view of the changed implementation scenario and revised the information where required.

15.2 The meeting was reminded about the requirement of amending the guidance documents on the basis of PDRs and the discussions on the subject which took place in ATNICG WG/6 held in September 2009. The meeting decided to add a sub-task to meet this requirement. Meeting also discussed the mechanism to be adopted for reporting the points for PDRs and developed following draft Conclusion defining the procedure.

Draft Conclusion 5/14 - Points for Proposed Defect Report (PDR) raised in the region

That, States may present their ATN/AMHS implementation related Points for Proposed Defect Report (PDR) to the ICAO APAC Office. These points will be presented to the ATNICG/ATNICG Working Group meeting (whichever is scheduled earlier) by the Secretariat for endorsement, so that these points, along with the ATNICG/ATNICG WG recommendations can be forwarded to ACP WG-M Secretariat through ICAO Asia/Pacific Office.

15.3 Meeting also added new sub-tasks or removed them on the basis of developments that have taken place. The revised Subject/Tasks list is placed at **Appendix M** to this report. Meeting developed following draft Decision recommending adoption of this revised Subject/Tasks list.

Draft Decision 5/15 - Subject/Tasks list for ATNICG

That, updated Subject/Tasks List placed at **Appendix M** be adopted as the Asia/Pacific Aeronautical Telecommunication Network Implementation Co-ordination Group (ATNICG) Subject/Tasks List.

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Agenda Item 16: Any other Business

16.1 Secretariat, through IP/4 informed the meeting about the status of implementation of table-driven codes for the dissemination of meteorological information through METAR/SPECI and TAF. It was informed that implementation of binary universal form (BUFR), earlier adopted for the exchange of meteorological information was shelved by ICAO until the results of study being carried out by a WMO Expert Team on the use of extensible markup language (XML) for dissemination of METAR/SPECI and TAF were known. It was also informed that concerns were expressed regarding the possible negative economic, operational and safety impacts of the migration to BUFR code particularly due to the fact that the aeronautical fixed telecommunication network (AFTN) was unable to handle binary codes such as BUFR. In response to the concerns raised in ICAO, WMO and ICAO jointly established an Expert Team on Operational Meteorological (OPMET) Data Representation (ET-ODR), which carried out a successful pilot project on the use of XML for the purpose during 2009. There was a strong consensus that an overall migration of all OPMET information was expected towards a weather exchange model (WXXM) based on extensible mark-up language (XML). It was reported that AFTN can support XML, but the usage was restricted by the capacity constraint of AFTN. Meeting decided that usage of AMHS for exchange of meteorological information over XML to mitigate these issues should be assessed and decided to create an additional task in the Subject/Tasks list to meet this and other application requirements for AMHS.

16.2 Presenting a brief report on the activities related to usage of Voice over Internet Protocol for ATM voice communication through IP/6, Secretariat informed the meeting about the specific cost and operational benefits VoIP had over the currently used systems like Time Division Multiplexing (TDM), Pulse Code Modulation (PCM) or simple analog technologies. It was informed that ACP Working Group of the Whole in its meeting held from 21 to 29 June 2005 adopted a recommendation that ICAO should study the development of standardization activities on VoIP protocols with a view to recommend their use in aeronautical communications and depending on the outcome of the study, develop SARPs and guidance material as necessary.

16.3 Aeronautical Communication Panel in its First meeting held in Montreal from 10 to 18 May 2007, agreed to assign this work of developing SARPs and guidance material to ACP Working Group I. ANC directed ACP WG-I to reference external mature standards for VoIP requirements, rather than developing standards at ICAO. In line with this recommendation, ACP WG-I has been coordinating with EUROCAE-67 to determine if the VoIP standards being developed by them can be referenced by ICAO. Interoperability between different voice communication systems (VCS) and different ground radio stations (GRS), an important key to this application was confirmed in a test carried out in Antipolis, France from 25 March to 3 April 2009. In the Third Meeting of ACP Working Group of the Whole, held from 18 to 22 January 2010, it was informed that the work on VoIP additions to ATN/IPS Manual will be completed by the ACP WG-I in the Third Quarter of 2010. It was informed that ACP WG –I had indicated its preference for the SIP protocol. India, Malaysia and USA informed the meeting that VoIP was being used by their administrations for the ground to ground voice communication. The meeting discussed the usage of VoIP for ATS communication and decided to monitor further development on this subject.

16.4 Japan presented their proposal for AFTN Routing change between Japan and Russia through their WP/9. Meeting was informed about the up-gradation of Moscow/Fukuoka circuit and other developments that have taken place in the relevant AFTN environment. Proposed Routing Change was presented to the meeting through the Table placed at **Appendix N.** Meeting reviewed the proposed routing change and adopted following draft Conclusion for the consideration of CNS/MET Sub Group and APANPIRG

Draft Conclusion 5/16 - Japan/Russia routing change

That, ICAO be requested to coordinate with Europe for updating AFTN routing directory and consequential change to the APAC AFTN routing directory.

16.5 USA presented International Transport of System Wide Information Management (SWIM) through IP/9. The paper proposes to utilize the independence of AMHS network from the sub-network. SWIM deploys Service Oriented Architecture (SOA) and proposes move from point to point network to controlled network. The system deploys a layered approach, with the top layer consisting of users, the middle layer comprising of the SWIM infrastructure and the global network infrastructure at the bottom layer. Issues like the performance requirements of AMHS at the application level, addition of 10 to 100 times overhead in XML, evolution of the global system etc. were raised in the meeting. The meeting was briefed about the work that is going on relevant to the subject.

Future Programme

16.6 Meeting decided to have the next Working Group meeting in September to review the outcome of APANPIRG/21, discuss various technical issues and monitor the progress of tasks assigned to the group. New Zealand offered to host the Eighth Meeting of the ATNICG Working Group in Christchurch. Meeting is tentatively scheduled in the week of 27 September 2010.

16.7 Republic of Korea offered to host the Sixth Meeting of the Aeronautical Telecommunication Network Implementation Co-ordination Group in Seoul. The meeting is tentatively scheduled for the week starting on 23 May 2011.

16.8 On behalf of the Group, Chairman ATNICG thanked Department of Civil Aviation, Malaysia for hosting the ATNICG/5 meeting, complemented the excellent arrangements made for the meeting and conveyed the appreciation of the group for the social programmes and other activities arranged for the participants.

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ABSTRACT OF THE REPORT RELEVANT FOR AERONAUTICAL FIXED SERVICES (AFS) AND AERONAUTICAL MOBILE SERVICES (AMS)

Aeronautical Fixed Service

Review Report of the Fourth Meeting of the ATN Implementation Coordination Group (ATNICG/4)

3.4.1 The meeting noted with appreciation the tasks accomplished by the ATNICG/4 Meeting which was hosted by Civil Aviation Authority of Singapore from 4 to 8 May 2009.

3.4.2 The meeting noted that no amendment to the Terms of Reference of ATNICG was identified. The meeting decided to endorse the updated Subject/Tasks List for ATNICG and adopted the following decision:

Decision 20/26 - Revision of Subject/Tasks List of ATNICG

That, the revised Subject/Tasks List of ATNICG provided in **Appendix A** to the Report on Agenda Item 3.4 be adopted.

IDRP Routing Policy

3.4.3 The meeting agreed that Version 2.0, the current version of the Asia/Pacific IDRP Routing Policy does not provide for an optimal routing of CLNP PDUs for some sites like Salt Lake City, USA and Moscow, Russian Federation, etc. which have multiple connections into Asia/Pacific Region. In addition, it was identified that in case of a backbone link failure, a non-backbone alternative path might be selected by the IDRP. To overcome these problems, the meeting recommended adoption of the revised version, Version 3.1 of the Asia/Pacific IDRP Routing Policy developed by ATNICG/4.

AMHS/ATN Network Management Operational Procedure Guidelines

3.4.4 To satisfy the requirements of APANPIRG Conclusion 15/15, AMHS/ATN Network Management Operational Procedure Guidelines was developed and presented to the meeting. It was noted that the document covered areas deemed necessary for efficient and effective operation of regional and global AMHS. It was clarified that the document does not include any information about performance requirements or specifications; it covers only the operational procedure issues.

AMHS Conformance Testing Document (AMHS Manual)

3.4.5 The meeting was informed that with the release of EUR AMHS Manual Version 3.0 in April 2008, it had become necessary to revise Asia/Pacific guidance document on AMHS Conformance Testing (AMHS Manual) accordingly. The revised Manual was reviewed by the CNS/MET SG/13 meeting and was recommended for adoption by APANPIRG.

Security Requirements

3.4.6 Aeronautical Telecommunication Network Security Checklist, intended to support Asia/Pacific ATN Security Policy was presented to the meeting for its consideration. The meeting was informed that the Checklist may be used by the administrations and organizations to verify if their implemented system includes appropriate security measures. The ATNICG/4 recommended that the system may be put into operation after the Designated Approval Authority has ensured that the recommended Checklist is completed.

3.4.7 In view of the foregoing, the meeting adopted following Conclusion:

Conclusion 20/27 - ATN/AMHS Guidance Material

That, the following guidance materials for ATN/AMHS Implementation be adopted and published.

- Version 3.1 of the Asia/Pacific IDRP Routing Policy provided in **Appendix B** to the Report on Agenda Item 3.4**;**
- AMHS/ATN Network Management Operational Procedure Guidelines provided in **Appendix C**;
- Amended AMHS Conformance Testing (AMHS Manual provided in **Appendix D;** and
- Aeronautical Telecommunication Network Security Checklist provided in **Appendix E.**

Short term procedure for Global AMHS address coordination

3.4.8 The meeting was reminded about the procedure prescribed by ICAO through State Letter dated 14 April 2009 for the purpose of AMHS address coordination through EU AMC. The State Letter mentioned that the AMC implemented by EUROCONTROL under the aegis of the ICAO EUR Office (Paris) for all operational purposes and the ICAO AMHS MD Register loaded with AMC data to ensure consistency will only be used as the systems for the short-term address management.

3.4.9 It was also advised in the State Letter that the States should register their nominated users and these users need to be trained before they are actually allowed to enter data into AMC. On the issue of address management, ATNICG/4 was of the view that for the Asia/Pacific Region all the data going into the AMC database should be submitted through Aeronautical Radio of Thailand (the agency designated in Asia/Pacific Region for coordinating with EUROCONTROL AMC on matters related to AMHS). It was agreed that the procedure for submission of AMC data through Aerothai will be notified to States by ICAO Asia/Pacific Office through a State Letter.

3.4.10 The ATNICG/4 had proposed that a copy of the information submitted by the States to the AMC database should also be provided to ICAO Asia/Pacific Office. The meeting reviewed the recommendation made by ATNICG and adopted following Conclusion:

Conclusion 20/28 - Short-term procedure for Global AMHS address Coordination

That, ICAO request States to register their AMHS addresses with EUROCONTROL AMC through Aeronautical Radio of Thailand (Aerothai) and provide a copy of this information to ICAO Asia/Pacific Office.

AMHS Addressing Scheme

3.4.11 The meeting noted details of the AMHS address management domain in terms of Country (C), Administrative Domain (ADMD or A) and the Private Domain (PRMD or P) attributes. The two types of address schemes XF and CAAS were also explained in terms of these attributes. It was informed that a Regional AMHS Naming Register had been created to record the addressing schemes adopted by different States. The meeting urged the States to update information in respect of their administration in the Naming Register. The meeting also agreed that BBIS hubs should be equipped to process messages both with the XF and CAAS addressing schemes to ensure interoperability and adopted the following Conclusion:

Conclusion 20/29 - AMHS Addressing Scheme

That,

a) States be urged to update information in respect of their administrations in the regional AMHS Naming Register; and

b) States hosting BBIS hubs be requested to process both the XF and CAAS addressing schemes.

FASID Tables CNS-1B, CNS-1C and CNS-1E

3.4.12 The meeting reviewed FASID Tables CNS-1B for ATN Router Plan, CNS-1C for AMHS Routing Plan and CNS-1E for the AIDC Routing Plan updated by ATNICG/4 and Communication Co-ordination Meeting held in Shenyang, China from 3 to 5 June 2009. After reviewing the Tables, the meeting formulated following Conclusion:

Conclusion 20/30 - Revision of FASID Tables CNS-1B, CNS-1C and CNS-1E

That, FASID Tables CNS-1B, 1C and 1E for ATN Router Plan, AMHS Routing Plan and AIDC Routing Plan be replaced with the revised CNS Tables provided in **Appendices F, G** and **H** respectively to the Report on Agenda Item 3.4.

Performance Based Approach

3.4.13 The meeting appreciated the progress made in the implementation of ATN in the region and appreciated the contribution made by the ATNICG. The meeting also placed on record its appreciation for Civil Aviation Authority of Singapore for hosting the ATNICG meeting in Singapore Aviation Academy.

COM Coordination Meeting

3.4.14 The meeting was informed that a Communication Co-ordination Meeting, hosted by ATMB, China was held in Shenyang from 3 to 5 June 2009. The meeting discussed issues related to the AFS network and adopted five action items to improve the performance of the AFTN/ATS Direct Speech Circuits and AIDC between China, Democratic People's Republic of Korea and the Republic of Korea. Status of implementation of specific AFS circuits and difficulties faced in the implementation were also reviewed.

Telecommunications Evolution

3.4.15 The United States informed the meeting about the evolutions that are taking place in the AFS telecommunication infrastructure. It was informed that AFTN is gradually being replaced with AMHS, a system designed to distribute the flight plans globally, distribute meteorological data and support systems like Ocean Tracking System (OTS), ATS Inter-facility Data Communications (AIDC), Search and International Rescue, etc. It was highlighted that the emerging technologies are being adopted and implemented by various regions. Issues related to need for harmonized and coordinated implementation were raised and it was suggested that ATNICG should develop a Working Paper on regional coordinated approach. It was recognized that implementation of security measures and operational compatibility in the structure adopted by different regions was found to be complex.

Aeronautical Mobile Service (AMS)

Use of SATCOM Voice for ATS Communication (SCV)

3.4.16 The meeting noted discussions regarding use of SCV for ATS Communication by the CNS/MET SG/13. A paper from Australia highlighted the reason why SCV was not recommended by APANPIRG for routine ATS communication which includes lack of message delivery standards (in both directions), lack of ATC infrastructure to support the operation and cost, reliability and security concerns, etc. It was proposed to develop standards to allow use of SCV for ATS purpose at global level. While discussing the proposal, the meeting reviewed the background information presented by the Secretariat on the position of APANPIRG regarding the use of SCV for emergency and non-routine ATS communication in addition to its AOC and public communication. The meeting also recalled relevant discussions at the twenty third meeting of the Informal south Pacific Air Traffic Service Coordinating Group (ISPACG/23) held from 26 to 27 March 2009 and also outcome of discussions on the use of SCV at the forty-fifth meeting of North Atlantic Systems Planning Group (NAT SPG) held from 23 to 26 June 2009. The meeting noted NAT SPG Conclusion 45/28 on amendment to the NAT Regional Supplementary Procedures (SUPPs) regarding the use of SATCOM voice for Air Traffic Service (ATS) Communication. The amendment proposal made provision to allow aircraft with installed avionics capable of SCV approved by the State of Operator or the State of Registry to use such equipment for ATS communications as an additional means to HF voice communications.

3.4.17 While some participants supported the proposal made by Australia, views were expressed that currently HF in some States does not have problem of congestion and hence there is no need to have secondary voice for HF. It was also indicated that use of SCV for ATS purposes would increase the workload of the controllers.

3.4.18 The meeting was also informed that technical SARPs for the use of AMSS including SCV have already been included in the relevant provisions. No further technical standard in terms of signal in air would be required to be developed for use of SCV for ATS purposes. It was noted that the development of guidance material and/or implementation guidelines to further progress the use of satellite voice communications is in the work programme of OPLINK Panel.

3.4.19 The meeting noted the information on the use of SCV systems in lieu of a second HF as provided by New Zealand. The weight of HF systems, the requirement for structural modifications of the aircraft etc. made the usage of SCV beneficial. It was clarified that the SCV system in use is the same as the commercially available one and is used in lieu of the second HF. It was further informed that:

Call setup can be variable but is usually a three stage process:

1) dial access number (Inmarsat or Iridium);
2) input PIN; and
3) input aircraft call number (usually done by software for security reasons) from ground to air calls, it can be anywhere between 20-50 seconds before the aircraft answers.

Satellite Data-link Operational Continuity Meeting (SOCM/1)

3.4.20 The meeting reviewed with appreciation the outcome of the first Satellite Data-link Operational Continuity Meeting (SOCM) held in Bangkok from 26 to 28 August 2009 in response to the requirements of APANPIRG Conclusion 19/24. The meeting attended by 56 participants representing stakeholders from different fields, reviewed the status of Satellite Data-link performance and provision. The meeting noted the issues identified and action items developed by the SOCM/1 meeting. The meeting also noted Satellite Communication Voice (SCV) related information and development. After reviewing the information on the Global Operational Data-link Document (GLOD), the meeting adopted following Conclusion urging the States and Aircraft Operators to provide information required for inclusion in the Appendices E and F of the Document.

Conclusion 20/31 - State and Operator aircraft information for GOLD

That,

a) States be urged to provide Region & State Information for inclusion in the GOLD Appendix E, by sending the completed forms(s) provided in **Annex 1** to this Report for their flight information regions (FIRs) or control areas (CTAs) by 30 October 2009; and

b) IATA be urged to coordinate with member airlines for providing operator & aircraft information for the GOLD Appendix F by sending completed form(s) as provided in **Annex 2** to this report for each variance, clarification, or addition to applicable aircraft type by 30 October 2009.

3.4.21 To facilitate the input of data by States and users into Appendices E and F, the Airways Corporation of New Zealand has prepared an online capability for data lodgment. The GOLD page access menu should be accessed via the ISPACG CRA website at http://www.ispacg-cra.com, then follow the software prompts as appropriate.

3.4.22 The meeting noted various developments and information contained in the report of the SOCM/1 that had been carried out by stakeholders of the satellite communication service. The meeting was informed about the additional options that are available now. Reviewing the developments that have taken place in the recent past, the meeting was of the view that FSIT should
re-convene a meeting as soon as possible, ideally in October/November 2009 and should consider additional alternative solutions to deal with the problems faced, taking into account technical and business realities. The meeting also agreed that the Second meeting of SOCM should be organized in 2010 after FANS SIT reviews the status and provides updates on consolidated improvement plans. In view of foregoing, the meeting adopted the following Conclusion:

Conclusion 20/32 – Second Satellite Data-link Operational Continuity Meeting

That, ICAO be invited to organize 2nd Satellite Data-link Operational Continuity Meeting in 2010 for stakeholders to review the developments on the performance and provision of satellite data link communication in the Asia/Pacific Region and develop a solution.

3.4.23 Appreciating the necessity of Satellite Data-link Service meeting the specified requirements for the provision of PBN, the meeting concluded that the States shall ensure availability of required level of service for the provision of ADS-C and CPDLC before they plan horizontal separation based on RNAV 10 and RNP 4. Accordingly, meeting adopted following Conclusion:

Conclusion 20/33 – Coordinate Implementation of Reduced Horizontal Separations with CSPs

That, recognizing the technical limitations in satellite data link communications capability for the provision of ADS-C and CPDLC, States intending to implement reduced horizontal separations based on RNAV 10 and RNP 4 PBN specifications in oceanic and remote area commence early coordination with Communication Service Providers (CSPs) in order to ascertain adequate data link communication/surveillance capability to support the proposed implementation. Outcomes should be recorded in a formal Service Level Agreement (SLA) between implementing States and CSPs, jointly or severally, to ensure that capabilities are available to properly support RCP 240/D specifications contained in Appendices B and C to the GOLD on an ongoing basis.

3.4.24 Recognizing that RCP 240/D specification is an enabler for the implementation of PBN based 50 NM longitude and 30/30 NM separation, the meeting recommended that the limitation in providing satellite data-link communications capability be further addressed by ICAO at a global level and hence adopted following Conclusion formulated by the SOCM/1 meeting.

Conclusion 20/34 - Technical Limitations in Satellite Data Link Communications Capability

That, recognizing current technical limitations in satellite data communications capability that impacts PBN based separation applications particularly for RNAV10 and RNP 4 in the remote and oceanic areas, ICAO be invited to address this issue at global level.

Updated on MTSAT

3.4.25 Japan provided information on the Status of MTSAT and its high performance. The challenging issues identified by SOCM meeting held at end of August 2009 were highlighted and States and International Organizations were encouraged to consider using it as a redundant data-link as a near term solution.

ATS Datalink Network Plan in India

3.4.26 India provided information on their plans to implement ATS Datalink Network through ACARS to facilitate delivery of Departure Clearance, ATIS and VOLMET messages. It was informed that system for delivering D-ATIS and D-VOLMET messages through a central server installed in Mumbai and Departure Clearance systems installed in Delhi, Mumbai, Kolkata, Chennai, Bangalore and Hyderabad will be implemented by June 2010. Conceptual structure of the system was also explained.

Development of ICAO web-based aeronautical frequency management

3.4.27 The meeting noted progress in the development of a computer based programme for aeronautical VHF (air/ground) frequency assignment planning and management by the Secretariat. This programme, which would be made available to States through the ICAO web, is based on a global frequency list that comprises of the current separately managed and developed Regional frequency lists (Frequency List No.3). As a result, it was felt necessary to harmonize Regional differences between these frequency lists. Several observations were made by the Sub-group which are reflected in the report of meeting of the CNS/MET SG/13 for further consideration by the Secretariat.

Frequency assignment planning criteria

3.4.28 The meeting noted a proposal for introducing a matrix defining separation distances between different services. The meeting agreed that it would be preferred if this proposal could be reviewed on a global basis by an appropriate ICAO body, such as the Aeronautical Communications Panel. After review and approval of the planning criteria on a global level, these frequency assignment planning criteria would be considered for adoption by APANPIRG for use in the Asia/Pacific Region. It was noted that similar steps are expected to be taken in other ICAO Regions.

Frequency assignment planning criteria for VDL

3.4.29 The meeting reviewed frequency planning criteria for VDL (VDL Modes 2 and 4) that were approved by the Aeronautical Communications Panel. The meeting agreed to these planning criteria and requested the Secretariat to incorporate them into the planning criteria currently applicable to frequency list 3. These planning criteria are provided in **Appendix I** to the Report on Agenda item 3.4.

Demonstration of the VHF air ground communication frequency planning tool

3.4.30 The meeting received a detailed presentation and demonstration on the functions of the programme for VHF air-ground communications frequency planning in the frequency band 117.975 – 137 MHz.

3.4.31 The meeting was informed that a similar programme for NAV (ILS, VOR, DME, GBAS and NDB) systems is being developed. Considerations are given to include the possibility to assess potential interference from FM broadcasting stations, operating in the band below 108 MHz.

3.4.32 The meeting was of the opinion that the information on the programme and the database should not be made available on an open web-site (i.e. it should be password protected). Specific attention should be given by the secretariat to secure the integrity of the data base and to protect it from interference in particular from malicious users.

3.4.33 The meeting recorded its appreciation for the work performed on this project (as well as the project on SSR Mode S II code assignment planning) by the Secretariat and the close and productive cooperation between CNS/AIRS section ICAO headquarters and ICAO Asia/Pacific Office which assisted in improving efficiency in the coordination of frequency assignments while maintaining the central coordinating role.

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AMHS Implementation Planner

Interconnection, Connected to router of: *Administration (Location of Router)*	Stage	BBIS										
		Australia (Brisbane)	Australia (Melbourne)	China (Beijing)	Hong Kong, China (Hong Kong)	India (Mumbai)	Fiji (Nadi)	Japan (Fukuoka)	Singapore (Singapore)	Thailand (Bangkok)	USA (Salt Lake City)	USA (Atlanta)
Australia (Brisbane)	A						Q2/10					
	B											
	C											
	D						Q3/10	2010				
Australia (Melbourne)	A								Q4/06			
	B								TBD			
	C								TBD			
	D								TBD		2010	
China (Beijing)	A				Q2/10							
	B				Q2/10							
	C				Q3/10							
	D				Q3/10	2009 / 2010		2010		2009		
Hong Kong, China (Hong Kong)	A			Q2/10				TBD		TBD		
	B			Q2/10				TBD		TBD		
	C			Q3/10				TBD		TBD		
	D			Q3/10				TBD		TBD		
India (Mumbai)	A								Q3/09			
	B								Q4/09			
	C								Q4/09			
	D			2009 / 2010					Q4/10	2009 / 2010		
Fiji (Nadi)	A	Q2/10									Q2/10	
	B										Q3/10	
	C										Q3/10	
	D	Q3/10									Q3/10	
Japan (Fukuoka)	A				TBD				TBD			
	B				TBD				TBD			
	C				TBD				TBD			
	D	2010		2010	TBD				TBD		2006/ Implemented	
Singapore (Sinagpore)	A		Q4/06			Q3/09		TBD		Q4/06		
	B		TBD			Q4/09		TBD		Q4/10		
	C		TBD			Q4/09		TBD		Q4/10		
	D		TBD			Q4/10		TBD		TBD		
Thailand (Bangkok)	A				TBD				Q4/06			
	B				TBD				Q4/10			
	C				TBD				Q4/10			
	D			2009	TBD	2009 / 2010			TBD			
USA (Salt Lake City)	A						Q2/10					
	B						Q3/10					
	C						Q3/10					
	D		2010				Q3/10	2006/ Implemented				
USA (Atlanta)	A											
	B											
	C											
	D											

AMHS Implementation Planner

Interconnection, Connected to router of: *Administration (Location of Router)*	Stage	BBIS										
		Australia (Brisbane)	Australia (Melbourne)	China (Beijing)	Hong Kong, China (Hong Kong)	India (Mumbai)	Fiji (Nadi)	Japan (Fukuoka)	Singapore (Singapore)	Thailand (Bangkok)	USA (Salt Lake City)	USA (Atlanta)
Bahrain	A								2011			
	B								2011 (IPS-based connection)			
	C								2011			
	D								TBD			
Europe	A											
	B											
	C											
	D							TBD				
Italy	A											
	B											
	C											
	D									TBD		
Kuwait	A											
	B											
	C											
	D			TBD								
Russian Federation	A											
	B											
	C											
	D			TBD				TBD				
South Africa	A	TBD										
	B											
	C											
	D											
United Kingdom	A								Q4/10			
	B								Q4/10 (IPS-based connection)			
	C								Q4/10			
	D								TBD			
Indonesia (Jakarta)	A								Q1/08			
	B								Q1/09			
	C								Q2/10			
	D								TBD			
New Zealand (Christshurch)	A	Q4/12									Q4/12	
	B	Q4/12 (IPS-based connection)									Q4/12 (IPS-based connection)	
	C	Q1/13									Q1/13	
	D	Q1/13									Q1/13	
Timor States (Dili)	A											
	B											
	C											
	D											
Nauru (Nauru)	A											
	B											
	C											
	D											
Papau New Guinea (Port Moresby)	A											
	B											
	C											
	D											

AMHS Implementation Planner

Interconnection, Connected to router of: *Administration (Location of Router)*	Stage	BBIS										
		Australia (Brisbane)	Australia (Melbourne)	China (Beijing)	Hong Kong, China (Hong Kong)	India (Mumbai)	Fiji (Nadi)	Japan (Fukuoka)	Singapore (Singapore)	Thailand (Bangkok)	USA (Salt Lake City)	USA (Atlanta)
Solomon Islands (Honiara)	A											
	B											
	C											
	D											
Vanuatu (Port Vila)	A											
	B											
	C											
	D											
DPRKorea (Pyongyang)	A											
	B											
	C											
	D											
Macau, China (Macau)	A			Q1/09	Q2/09							
	B			Q1 - Q2/09	Q3/09							
	C			Q1 - Q2/09	Q3/09							
	D			TBD	Q4/09							
Mongolia (Ulaanbaatar)	A											
	B											
	C											
	D											
Myanmar (Yangoon)	A											
	B											
	C											
	D											
Nepal (Kathmandu)	A			Q4/10		Q4/10						
	B			Q4/10 (IP-based connection)		Q4/10 (IP-based connection)						
	C			Q1/11		Q1/11						
	D			Q1/11		Q1/11						
Pakistan (Karachi)	A					2009						
	B					Q1/10						
	C					Q1/10						
	D					Q2/10						
Republic of Korea (Seoul)	A											
	B											
	C											
	D											
Vietnam (Ho Chi Minh / Hanoi)	A				TBD				TBD			
	B				TBD				TBD			
	C				TBD				TBD			
	D				TBD				TBD			
Philippines (Manila)	A				TBD				2011			
	B				TBD				2011			
	C				TBD				2011			
	D				TBD				2011			

AMHS Implementation Planner

Interconnection, Connected to router of: *Administration (Location of Router)*	Stage	BBIS										
		Australia (Brisbane)	Australia (Melbourne)	China (Beijing)	Hong Kong, China (Hong Kong)	India (Mumbai)	Fiji (Nadi)	Japan (Fukuoka)	Singapore (Singapore)	Thailand (Bangkok)	USA (Salt Lake City)	USA (Atlanta)
Taibei	A				TBD							
	B				2009							
	C				2009							
	D				2012 - 13							
Bangladesh (Dhaka)	A											
	B											
	C											
	D											
Bhutan (Paro)	A											
	B											
	C											
	D											
Kenya	A											
	B											
	C											
	D											
Oman	A											
	B											
	C											
	D											
Sri Lanka (Colombo)	A								TBD			
	B								TBD			
	C								TBD			
	D								TBD			
Kiribati (Tarawa)	A											
	B											
	C											
	D											
New Caledonia (Noumea)	A											
	B											
	C											
	D											
Tuvalu (Funafuti)	A											
	B											
	C											
	D											
Wallis Island (Wallis)	A											
	B											
	C											
	D											

AMHS Implementation Planner

Interconnection, Connected to router of: *Administration (Location of Router)*	Stage	BBIS										
		Australia (Brisbane)	Australia (Melbourne)	China (Beijing)	Hong Kong, China (Hong Kong)	India (Mumbai)	Fiji (Nadi)	Japan (Fukuoka)	Singapore (Singapore)	Thailand (Bangkok)	USA (Salt Lake City)	USA (Atlanta)
Brunei Darussalam (Brunei)	A								TBD			
	B								TBD			
	C								TBD			
	D								TBD			
Malaysia (Kuala Lumpur)	A								Q1/2007	Q2/2010		
	B								Q1/2007	Q2/2010		
	C								Q4/2011	Q4/2011		
	D								Q4/2011	Q4/2011		
Cambodia (Phnom Penh)	A											
	B											
	C											
	D											
Lao PDR (Vientiane)	A											
	B											
	C											
	D											
American Samoa (Pago Pago)	A											
	B											
	C											
	D											
Marshall Islands	A											
	B											
	C											
	D											
Micronesia, Federated State of Chuuk	A											
	B											
	C											
	D											
Micronesia, Federated State of Kosrae	A											
	B											
	C											
	D											
Micronesia, Federated State of Ponapei	A											
	B											
	C											
	D											
Micronesia, State of Yap	A											
	B											
	C											
	D											
Palau	A											
	B											
	C											
	D											

Note:

A	Physical connections
B	Router Connection Tests
C	MTA Interoperability Tests
D	AMHS Commission
Q1/09	e.g. 1st Quarter in 2009

STRATEGY FOR IMPLEMENTATION OF THE AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) IN THE ASIA/PACIFIC REGION

Considering that:

1) the requirement for a robust ground-to-ground Aeronautical Telecommunication Network (ATN) to meet the growing need for digital data communication to support the Air Traffic Management Concept;

2) the availability of ICAO SARPs and technical manuals for the ATN based on the OSI protocols (ATN/OSI) and the Internet Protocol Suite (ATN/IPS), and the availability of equipment and readiness of vendors to support both ATN/OSI and ATN/IPS ground-to-ground communications;

3) the availability of AMHS Transition and Implementation guidance materials required to assist States to ensure harmonization of procedures and protocols and thereby assure inter-operability within the region;

4) the need to support States currently using AFTN terminals for communication with other States, and the need to replace these aging terminals with ATS Message User Agents (UA); and

5) the backbone States in the Asia/Pacific region have already implemented, or are in the process of procuring and implementing, AMHS based ATN/OSI.

THE GENERAL STRATEGY FOR THE IMPLEMENTATION OF THE ATN INFRASTRUCTURE AND ASSOCIATED ATN APPLICATIONS IN THE ASIA/PACIFIC REGION IS AS FOLLOWS:

a) strategically deploy a backbone network of ATN/OSI routers and AMHS Message Transfer System (MTS) to provide a reliable infrastructure to initially support ground-to-ground applications and the planned ATN/OSI air-ground applications.

b) strategically deploy an ATN/IPS backbone network as a private network which comprises dedicated point-to-point circuits without connection to the Public Internet to support data communication, and migrate ATN/OSI router interconnections from X.25 sub-network to IP sub-network connectivity;

c) permit non-backbone States, and States in other regions with connections to the Asia/Pacific region, to connect their Message Transfer Agents (MTA) to backbone States using either the OSI-based ATN Internet Communications Services (ICS) or the ATN IPS on a bilateral basis;

d) permit States with limited AFS connections or traffic with other States to operate only UA terminals and to use the MTA of another State, subject to bilateral agreement. Such UA to MTA connections may use the Public Internet subject to appropriate security provisions and access control;

e) complete migration from AFTN to AMHS within the time frame specified in the FASID ; and

f) once a robust ATN/IPS backbone network has been established, eventually phase out use of the ATN ICS by AMHS and operate the AMHS MTA network using the ATN/IPS as specified in ICAO Doc 9880 section 3.2.2.2.3.

IN ORDER TO ACHIEVE THE ABOVE STRATEGY THE FOLLOWING IS REQUIRED OF STATES IN THE ASIA/PACIFIC REGION:

g) States shall provide implementation in compliance with Annex 10 SARPS and ICAO Manuals, and with the Plans, Policies and AMHS Transition and Implementation guidance materials adopted by APANPIRG;

h) Backbone States shall implement AMHS MTAs that support both the ATN ICS and ATN/IPS network services as specified in ICAO Doc 9880 section 3.2.2.2. Non-backbone States may implement MTAs that support either or both network services.

i) Backbone States shall implement ATN/OSI routers with X.25 sub-network capability and later migrate to IP sub-network capability for interconnection with other Backbone States and Non-backbone States.

j) States shall work co-operatively to assist each other on a multinational basis to implement the ATN and AMHS in an expeditious and coordinated manner and to ensure system inter-operability; and

k) States shall organize training of personnel to provide necessary capability to maintain and operate the ground-to-ground ATN infrastructure and applications.

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PHASED APPROACH TESTING AND IMPLEMENTATION

To ensure an orderly test arrangement and coordinated implementation, the following phased approach is recommended:

Phase I (Initial stage: AFTN routing at MTA)

(a) MTAs of BBIS, BIS and EBIS to conduct interoperability test using the CITP with direct connected MTAs. (e.g. Hong Kong – Japan, Hong Kong – Macao);

(b) Cutover from AFTN to AMHS after successful completion of the interoperability test; and

(c) The MTA routing should follow the AFTN Routing Directory

Phase II (Intermediate stage – MTA direct routing to end BBIS)

(a) MTAs of BBIS, BIS and EBIS to conduct interoperability test with MTAs of BBIS without direct connection. The AITP is to be used. (e.g. Hong Kong – Singapore, Hong Kong –Australia, Hong Kong – India etc); and

(b) When all BBIS are up and running and interoperability test between each and every oneof them is completed, the MTAs should change from AFTN routing to direct BBIS routing. This has to be executed by changing the static routing table of AMHS and ICAO should be informed of the change so that the progress can be monitored.

Note: The following prerequisites should be ready before cutover to direct BBIS routing:

1) All States registered as an AMC user at Eurocontrol to follow AMHS address update procedures before AMC database for the Asia/Pacific Region is established;

2) Each BBIS has at least two BBIS links up and running and every BBIS is able to connect directly or indirectly with other BBIS in the region; and

3) For BBIS with inter-regional connections, alternate links should be available to cater for inter-regional link interruptions.

Phase III (Final Stage: direct MTA-to-any MTA routing within the region)

(a) Subject to traffic pattern and resources available, MTA of BIS and EBIS should schedule to conduct interoperability test among themselves using the AITP; and

(b) After successful completion of the interoperability test, the corresponding MTA pairs under test can be enhanced to direct MTA-to-any MTA routing instead of relaying through the end BBIS.

Note: Completion of Phase III would be subject to the resources available at each State. The target date may be decided by ATNICG depending on the progress.

Phase IV

(a) When IPS is ready and the AMHS within the region are able to support IPS, repeat the aforesaid interoperability tests using the IPS ATN.

(b) Transition the OSI router at BBIS to IPS first, then followed by BIS and EBIS.

4.2 A sample routing table showing the corresponding changes from AFTN routing in Phase I to direct MTA-to-any MTA routing in Phase III is given at Appendix A.

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AMC INFORMATION FORM

Network Inventory - Persons & Contact / COM Centre **(In column A and E : You can pick up from drop-down list)**

Country	First Name	Surename	Local Title	Personal Roles	Phone Number	FAX Number	E-mail Address	COM Centre Postal Address	AFTN Address (Option)

Example

System Administrator

Firstname	Somnuk	**Telex**	
Surname	Rongthong	**Email**	somnuk@aerothai.co.th
Phone1	6622859904	**AFTN**	VTBBYFYX
Phone2		**CIDIN/AFTN**	
Phone3		**CIDIN/OPMET**	
Fax	6622850240	**Sita**	

Applications

Code	Description
AFTN/AMHS GW	AFTN/AMHS Gateway
ATS MSGSRV	ATS Message Server

Administrative Status: EXTERNAL

Postal Address

Aeronautical Radio of Thailand
102 Ngamduplee RAMA 4 Road,
Tungmahamek Santhom
Bangkok 10120
THAILAND

AMC INFORMATION FORM

AFTN Capacities **(In each column, you can pick up from drop-down list)**

Ax - VCG mapping capability	Ad - Ax mapping capability	Ax - VCG mapping actual used	Ad - Ax mapping actual used

VCG = Virtual Circuit Groups

AMC INFORMATION FORM

AMHS Capabilities **(In column C, H and I : You can pick up from drop-down list)**

MTA Name	Maximum Content Length	Extended Encoded Information Types	Messages Lifetime (Minutes)				ATS Message Server	AFTN/AMHS Gateway	Currently Authorized Message Length	Maximum Number of Address	Converted General-Text Body Parts	Operation Status
			Urgent	Non Urgent	Normal	Report						

Remarks :

IA5 and General-Text Body Part (ISO 646) are mandatory requirements for an ATS Message Server compliant with the "EUR Profile for ATS Message Handling Service".

Maximum Content Length : A minimum value of 2000000 is necessary for an ATS Message Server to be compliant with the "EUR Profile for ATS Message Handling Service"

Messages Lifetime (Minutes) : Three fields for each message priority level, and one field for reports. The maximum value is 5760 (corresponds to four days).

Currently Authorized Message Length : A minimum value of 65536 is necessary for an ATS Message Server to be compliant with the "EUR Profile for ATS Message Handling Service".

Operation Status : 'OP' for operational, 'NON-OP' for not operational, and 'UNKNOWN'

AMC INFORMATION FORM

Connections **(In column D and H : You can pick up from drop-down list)**

Existing Connections

Remote COM	Protocol	Network Address	Link Type	Capacity	Supplier	Active	Circuit Type	Remark

Planned Connections

Remote COM	Protocol	Network Address	Link Type	Capacity	Supplier	Active	Circuit Type	Remark

AMC INFORMATION FORM

AMHS MTA Table

Contracting State	MTA ID	User Agent ID	Addressing Scheme (CAAS/XF)	Country-name	Administration-domain-name	Private-domain-name	Organization name	Organization unit-name-1	User Agent (Direct User only)	Description of user	MTA Name	NSAP address	T-sel Value	P-sel Value	S-sel Value	Capability
				(C)	(A)	(P)	(O)	(OU1)	(CN)							

THE PROPOSED IPv4 ADDRESS PLAN

1 Introduction

The IPv4 address scheme is proposed by the Caribbean and South American Regional for its ATN/IPS Network. The Caribbean and South American region also proposed in their plan for a global IPv4 addressing assignment which includes Asia/Pacific region. The Asia/Pacific Region is requested to review this proposed IP addressing assignment for consideration and adoption.

1.1 Objective

This document is meant to describe the addressing plan for IPv4 addresses throughout the Asia/Pacific Region. This document defines the recommended address format for IPv4 addresses. The IPv4 network is to be used within region.

1.2 References

[1]	ICAO Doc 9705-AN/956	Manual of Technical Provisions for the ATN
[2]	ICAO Doc 9896	Manual for the ATN using IPS Standards and Protocols
[3]	ICAO Doc 7910	ICAO Location Indicators
[4]	RFC 1518	An Architecture for IP Address Allocation with CIDR
[5]	RFC 1918	Address Allocation for Private Internets
[6]	RFC 2050	BGP-4 Internet Registry IP Allocation Guidelines
[7]	RFC 3330	Special-Use IPv4 Addresses
[8]	RFC 4271	BGP-4 Specification

1.3 Terms Used

Administrative Domain	–	An administrative entity in the ATN/IPS. An Administrative Domain can be an individual State, a group of States, an Aeronautical Industry Organization (e.g., an Air-Ground Service Provider), or an Air Navigation Service Provider (ANSP) that manages ATN/IPS network resources and services. From a routing perspective, an Administrative Domain includes one or more Autonomous Systems.
Autonomous System	–	A connected group of one or more IP prefixes, run by one or more network operators, which has a single, clearly defined routing policy.

Intra-domain (interior gateway) routing protocol	–	Protocols for exchanging routing information between routers within an AS.
Inter-domain (exterior gateway) routing protocol	–	Protocols for exchanging routing information between Autonomous Systems. They may in some cases be used between routers within an AS, but they primarily deal with exchanging information between Autonomous Systems.
Local Internet Registry	–	A Local Internet Registry (LIR) is an IR that primarily assigns address space to users of the network services it provides. LIRs are generally ISPs, whose customers are primarily end users and possibly other ISPs. [LACNIC]

1.4 Acronyms

AMHS	–	ATN Message Handling System
ARP	–	Address Resolution Protocol
ATN	–	Aeronautical Telecommunications Network
BGP	–	Border Gateway Protocol
DNS	–	Domain Name Service
IANA	–	Internet Assigned Numbers Authority
ICS	–	ATN Internet Communication Service
IP	–	Internet Protocol
IPv4	–	Internet Protocol Version 4
IPv6	–	Internet Protocol Version 6
IPS	–	Internet Protocol suite
LACNIC	–	Latin American and Caribbean Internet Address Registry
LIR	–	Local Internet Registry
OSPF	–	Open Shortest Path First
RIR	–	Regional Internet Registry

1.5 Overview of Addressing Issues

The following subsections present issues that affect the completion of the addressing plan for operating the IPS-based AMHS network.

1.5.1 Public or Private Address

An important decision for the region is whether to use private or public addresses. Private addresses can be used if coordinated by all participating States and Organization; however, it is possible that existing networks already use addresses in the private block ranges. Public addresses must be obtained from a Regional Internet Registry (RIR). The Internet Assigned Numbers Authority (IANA) has delegated responsibility for administration of Internet numbering to the Latin American and Caribbean Internet Address Registry (LACNIC).

1.5.2 Address of Systems in External Regions

Systems in external regions could be assigned an address from the APAC address space rather than use an address in their regional address block. Note however that this must be coordinated with private addresses so as to avoid collisions.

2 IPv4 Addressing Overview and Fundamentals

In the Internet Protocol a distinction is made between names, addresses, and routes. A name indicates what we seek. An address indicates where it is. A route indicates how to get there. The Internet protocol deals primarily with addresses. Its main task is to forward data to a particular destination address. It is the task of higher-level protocols to make the mapping from names to addresses, for example using a domain name service (DNS). The Internet protocol forwards packet data units (PDU) to a destination address using routing tables maintained by a routing protocol. The routing tables contain the address of the next hop along the route to the destination. There are in general two classes of routing protocols: inter-domain or exterior routing protocols such as the Border Gateway Protocol (BGP) and intra-domain or interior routing protocols such as the Open Shortest Path First (OSPF) protocol. In order to forward PDUs to the next hop address, there must be a mapping from this address to the link level address, for example, an Ethernet address. This mapping is maintained by an address discovery protocol such as the Address Resolution Protocol (ARP).

An IPv4 address consists of four bytes (32 bits). These bytes are also known as octets. For readability purposes, humans typically work with IP addresses in a notation called dotted decimal. This notation places periods between each of the four numbers (octets) that comprise an IP address. For example, an IP address that a computer sees as

00001010 00000000 00000000 00000001

is written in dotted decimal as

10.0.0.1

Because each byte contains 8 bits, each octet in an IP address ranges in value from a minimum of 0 to a maximum of 255. Therefore, the full range of IP addresses is from 0.0.0.0 through 255.255.255.255. That represents a total of 4,294,967,296 possible IP addresses.

A network may be set up with IP addresses to form a private or public network. On a private network a single organization controls address assignment for all nodes. On a public network there must be some conventions to assure that organizations do not use overlapping addresses. In the Internet this function is performed by the Internet Assigned Numbers Authority (IANA), which delegates authority to Regional Internet Registries (RIR). For the CAR/SAM Region the RIR is the Latin American and Caribbean Internet Address Registry (LACNIC).

IPv4 Addresses are a fixed length of four octets (32 bits). An address begins with a Network ID, followed by a Host ID as depicted in Figure 2-1.

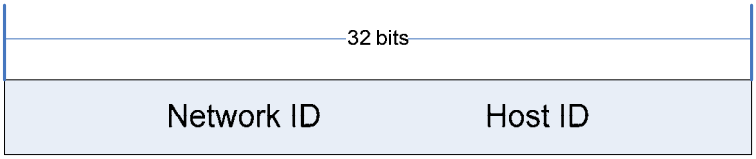


Figure 2-1. IPv4 Address Format

The original IP addressing scheme divided the Network ID from the Host ID is in a several octet boundaries. In this scheme the main classes of addresses were differentiated based on how many octets were used for the Network ID. This method is called classful addressing. Classful addressing was by convention further modified so that the Host ID could be split into subnet ID and sub host ID. This is typically accomplished using a subnet mask and is called classful addressing with subnetting. This eventually evolved into classless addressing where the division between the Network ID and Host ID can occur at an arbitrary point, not just on octet boundaries. With classless addressing the dividing point is indicated by a slash (/) followed the number of bits used for the Network ID. This value is called the prefix length of the address and the address value up to that point is called the network prefix.

Private Addressing is defined in RFC 1918. IANA has reserved the following three blocks of the IP address space for private Internets:

10.0.0.0 - 10.255.255.255 (10/8 prefix)
172.16.0.0 - 172.31.255.255 (172.16/12 prefix)
192.168.0.0 - 192.168.255.255 (192.168/16 prefix)

Because of the number of bits available to users, these blocks are referred to as a "24-bit block", a "20-bit block", and a "16-bit" block. An enterprise that decides to use IP addresses out of the private address space defined by RFC 1918, can do so without any

coordination with IANA or an Internet registry. Addresses within this private address space will only be unique within an enterprise or a group of enterprises (e.g., an ICAO region), which chose to cooperate over this space so they may communicate with each other in their own private Internet.

3 IPv4 Addressing

3.1 Overview CAR/SAM

3.1.1 During the fourth meeting of ATN/TF4 (Santo Domingo, Dominican Republic, 27 to 28 June 2008) the group analyzed different alternatives for the implementation of the TCP/IP in the CAR/SAM Regions identifying the available options that would facilitate this implementation in the AMHS Service and future applications. This was reviewed in accordance with Document 9880 Part IIB of the ICAO. In this respect the Meeting decided two viable options for the implantation the TCP/IP:

a) AMHS using the RFC1006 on Guiders TCP/IP (IPv4) to allow AMHS to directly interface with IPv4 Guiders for the intra-regional connections.

b) Configurating AMHS, as specified in a) with capacity for IPv4 conversion to IPv6 through the implementation of a function of IP router as gateway for the interregional connections.

3.1.2 The Sixth Meeting of Committee ATM/CNS (ATM/CNS/6) (Santo Domingo, Dominican Republic, 30 June to the 04 July 2008) analyzed this Plan of IP Addressing for CAR/SAM Regions and considered that such a plan would be sent to the ICAO for revision.

3.1.3 During the ACP/WG/I/8 (Montreal, Canada, 25 to 29 August 2008) it was concluded that it is possible to consider a regional scheme of IPv4 addressing. Taking into consideration that the private sector would be using the propose addressing scheme in other applications, the Meeting considered nonviable to apply the IP addressing scheme at a global level.

3.1.4 The Third Meeting of the Group of Regional Implementation SAM/IG/3 (Lima, Peru, 20 to 24 April 2009) considered that, taking into account specified in Table CNS 1Bb from the FASID, the AMHS system to be installed in the SAM Region will use IP protocol and will initially use the IPv4 version. The block of used IPv4 addresses will follow the format established during the ATM/CNS/SG/6 Meeting.

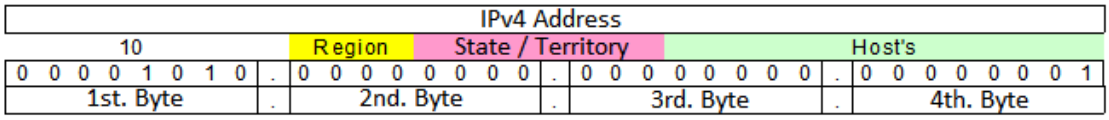
3.2 IP Addressing Plan

When we began to work on the plan of IP addressing, we once again reviewed the scheme that was originally proposed, analyzed the amount of States/Territories by

Region, the amount of addressing that each State/Territory could use and the amount of addressing reserved for the interconnection between States/Territories. The result of this study concluded that:

3.2.1 1 bit would be reduced to State/Territory level. This means the transfer of 256 States to 128 States by region. In the EUR/NAT Region, which is most numerous, has 53 States/Territories, means that there are many vacant numbers.

3.2.2 1 bit at Host's level would be added. This would allow the transfer from 4096 to 8190 hosts per State/Territory. This was considered due to the amount of future applications that would be implemented, mainly in the more developed States, and could cause the amount of directions not to be sufficient. The structure is shown below:



3.2.3 It should be noted the networks assigned to each State are private networks (RFC 1918). The first Bytes that integrate the assigned address will always maintain a decimal value of 10. Whereas the other three Bytes are used to distribute, in hierarchic form, the blocks of directions corresponding to each State.

3.2.4 The first four bits of the second Byte (4 bits) will be used to identify the regions in around which the States/Territories of the world are grouped:

- 0000 => SAM: South American Office.
- 0001 =>. NACC: North American, American Power station and Caribbean Office.
- 0010 => APAC: Asia and Pacific Office.
- 0011 => MID: Middle East Office.
- 0100 => WACAF: Western and Central African Office.
- 0101 => ESAF: Eastern and Southern African Office.
- 0110 => EUR/NAT: European and North Atlantic Office.

3.2.5 On the other hand, the last four bits of the second Byte, and the first three bits of the third Byte (7 bits) will be used to identify the States/Territories of each region.

3.2.6 Whereas the last five bits of the third Byte and the eight bits that compose the fourth Byte (13 bits) will be used by each one of the States/Territories to assign addressing to their terminals/servers

3.2.7 The proposed IPv4 address allocation scheme will be able to cover:

- 16 Regions.

- 128 States/Territories by each Region.
- 8190 Host' s for each State/Territory

3.2.8 The proposed IPv4 addressing plan would allow each State/Territory tobe able to make use of the block of directions assigned as needed.

a) Each State has been assigned 8190 usable Network addresses, which seem to be sufficient to cover existing needs.

b) In the development of the mentioned scheme, a flexible margin has been designated so that it will allow the future growth or change in the network in the future. For example, if a region were subdivided in two or more regions, or the emerging of a new State/Territory.

c) Argentina has already implemented its ATN network with a scheme of addresses different from the proposed one, prior to the publication of this document, has placed a border devise with the intention that this devise will make the address translation between the outer directions .

3.3 Network Assignment by Region (ASIA/PACIFIC)

Region	Issue	State/ Territory	Network	Direction Used	Decimal Notation	Binary Notation			
							Region	State/Territory	Host's
APAC	1	Australia	10 . 32 .0.0 / 19	First	10 . 32. 0 . 1	00001010.	0010	0000 . 000	00000 . 00000001
				Last	10 . 32. 31 . 254	00001010.	0010	0000 . 000	11111 . 11111110
	2	Bangladesh	10. 32. 64 .0 / 19	First	10 . 32. 32 . 1	00001010.	0010	0000 . 001	00000 . 00000001
				Last	10 . 32. 63 . 254	00001010.	0010	0000 . 001	11111 . 11111110
	3	Bhutan	10. 32. 64.0 / 19	First	10 . 32. 64 . 1	00001010.	0010	0000 . 010	00000 . 00000001
				Last	10 . 32. 95 . 254	00001010.	0010	0000 . 010	11111 . 11111110
	4	Brunei Danussaian	10. 32. 96.0 / 19	First	10 . 32. 96 . 1	00001010.	0010	0000 . 011	00000 . 00000001
				Last	10 . 32. 127 . 254	00001010.	0010	0000 . 011	11111 . 11111110
	5	Cambodia	10. 32. 128. 0 / 19	First	10 . 32. 128 . 1	00001010.	0010	0000 . 100	00000 . 00000001
				Last	10 . 32. 159 . 254	00001010.	0010	0000 . 100	11111 . 11111110
	6	China	10. 32. 160. 0 / 19	First	10 . 32. 160 . 1	00001010.	0010	0000 . 101	00000 . 00000001
				Last	10 . 32. 191 . 254	00001010.	0010	0000 . 101	11111 . 11111110
	7	Cook Islands	10. 32 . 192. 0 / 19	First	10 . 32 . 192 . 1	00001010.	0010	0000 . 110	00000 . 00000001
				Last	10 . 32 . 223 . 254	00001010.	0010	0000 . 110	11111 . 11111110
	8	Cook Islands	10. 32 . 224. 0 / 19	First	10 . 32 . 224 . 1	00001010.	0010	0000 . 111	00000 . 00000001
				Last	10 . 32 . 255 . 254	00001010.	0010	0000 . 111	11111 . 11111110
	9	Democratic people's Republic of Korea	10. 33 . 0 . 0 / 19	First	10 . 33 . 0 . 1	00001010.	0010	0001 . 000	00000 . 00000001
				Last	10 . 33 . 31 . 254	00001010.	0010	0001 . 000	11111 . 11111110
	10	Fiji	10. 33 . 32 . 0 / 19	First	10 . 33 . 32 . 1	00001010.	0010	0001 . 001	00000 . 00000001

				Last	**10 . 33 . 63 . 254**	00001010.	0010	**0001 . 001**11111 . 11111110
	11	**India**	**10. 17 . 64 . 0 / 19**	First	**10 . 33 . 64 . 1**	00001010.	0010	**0001 . 010**00000 . 00000001
				Last	**10 . 33 . 95 . 254**	00001010.	0010	**0001 . 010**11111 . 11111110
APAC	**12**	**Indonesia**	**10. 33 . 96 . 0 / 19**	First	**10 . 33 . 96 . 1**	00001010.	0010	**0001 . 011**00000 . 00000001
				Last	**10 . 33 . 96 . 254**	00001010.	0010	**0001 . 011**11111 . 11111110
	13	**Japan**	**10. 33 . 128 . 0 / 19**	First	**10 . 33 . 128 . 1**	00001010.	0010	**0001 . 100**00000 . 00000001
				Last	**10 . 33 . 159 . 254**	00001010.	0010	**0001 . 100**11111 . 11111110
	14	**Kiribati**	**10. 33 . 160 . 0 / 19**	First	**10 . 33 . 160 . 1**	00001010.	0010	**0001 . 101**00000 . 00000001
				Last	**10 . 33 . 191 . 254**	00001010.	0010	**0001 . 101**11111 . 11111110
	15	**Lao People's Democratic Republic**	**10. 33 . 192 . 0 / 19**	First	**10 . 33 . 192 . 1**	00001010.	0010	**0001 . 110**00000 . 00000001
				Last	**10 . 33 . 223 . 254**	00001010.	0010	**0001 . 110**11111 . 11111110
	16	**Malaysia**	**10. 33 . 224 . 0 / 19**	First	**10 . 33 . 224 . 1**	00001010.	0010	**0001 . 111**00000 . 00000001
				Last	**10 . 33 . 255 . 254**	00001010.	0010	**0001 . 111**11111 . 11111110
	17	**Maldives**	**10. 34 . 0 . 0 / 19**	First	**10 . 34 . 00 . 1**	00001010.	0010	**0010 . 000**00000 . 00000001
				Last	**10 . 34 . 31 . 254**	00001010.	0010	**0010 . 000**11111 . 11111110
	18	**Marshall Islands**	**10. 34 . 32 . 0 / 19**	First	**10 . 34 . 32 . 1**	00001010.	0010	**0010 . 001**00000 . 00000001
				Last	**10 . 34 . 63 . 254**	00001010.	0010	**0010 . 001**11111 . 11111110
	19	**Micronesia**	**10. 34 . 64 . 0 / 19**	First	**10 . 34 . 64 . 1**	00001010.	0010	**0010 . 010**00000 . 00000001
				Last	**10 . 34 . 95 . 254**	00001010.	0010	**0010 . 010**11111 . 11111110
	20	**Mongolia**	**10. 34 . 96 . 0 / 19**	First	**10 . 34 . 96 . 1**	00001010.	0010	**0010 . 011**00000 . 00000001

				Last	10 . 34 . 127 . 254	00001010.	0010	0010 . 011	11111 . 11111110
	21	Myanmar	10. 34 . 128 . 0 / 19	First	10 . 34 . 128 . 1	00001010.	0010	0010 . 100	00000 . 00000001
				Last	10 . 34 . 159 . 254	00001010.	0010	0010 . 100	11111 . 11111110
	22	Nauru	10. 34 . 160 . 0 / 19	First	10 . 34 . 160 . 1	00001010.	0010	0010 . 101	00000 . 00000001
				Last	10 . 34 . 191 . 254	00001010.	0010	0010 . 101	11111 . 11111110
	23	Nepal	10. 34 . 192 . 0 / 19	First	10 . 34 . 192 . 1	00001010.	0010	0001 . 110	00000 . 00000001
				Last	10 . 34 . 223 . 254	00001010.	0010	0001 . 110	11111 . 11111110
	24	New Zealand	10. 34 . 224 . 0 / 19	First	10 . 34 . 224 . 1	00001010.	0010	0001 . 111	00000 . 00000001
				Last	10 . 34 . 255 . 254	00001010.	0010	0001 . 111	11111 . 11111110
	25	Palau	10. 35 . 0 . 0 / 19	First	10 . 35 . 0 . 1	00001010.	0010	0010 . 000	00000 . 00000001
				Last	10 . 35 . 31 . 254	00001010.	0010	0010 . 000	11111 . 11111110
	26	Papua New Guinea	10. 35 . 32 . 0 / 19	First	10 . 35 . 32 . 1	00001010.	0010	0010 . 001	00000 . 00000001
				Last	10 . 35 . 63 . 254	00001010.	0010	0010 . 001	11111 . 11111110
	27	Philippines	10. 35 . 64 . 0 / 19	First	10 . 35 . 64 . 1	00001010.	0010	0010 . 010	00000 . 00000001
				Last	10 . 35 . 95 . 254	00001010.	0010	0010 . 010	11111 . 11111110
	28	Republic of Korea	10. 35 . 96 . 0 / 19	First	10 . 35 . 96 . 1	00001010.	0010	0010 . 011	00000 . 00000001
				Last	10 . 35 . 127 . 254	00001010.	0010	0010 . 011	11111 . 11111110
	29	Samoa	10. 35 . 128 . 0 / 19	First	10 . 35 . 128 . 1	00001010.	0010	0010 . 100	00000 . 00000001
				Last	10 . 35 . 159 . 254	00001010.	0010	0010 . 100	11111 . 11111110
	30	Singapore	10. 19 . 160 . 0 / 19	First	10 . 35 . 160 . 1	00001010.	0010	0010 . 101	00000 . 00000001
				Last	10 . 35 . 191 . 254	00001010.	0010	0010 . 101	11111 . 11111110
	31	Solomon Islands	10. 35 . 192 . 0 / 19	First	10 . 35 . 192 . 1	00001010.	0010	0010 . 110	00000 . 00000001
				Last	10 . 35 . 223 . 254	00001010.	0010	0010 . 110	11111 . 11111110

	32	Sri Lanka	10. 35. 224 . 0 / 19	First	10 . 35 . 224 . 1	00001010.	0010	0010 . 111 00000 . 00000001
				Last	10 . 35 . 255 . 254	00001010.	0010	0010 . 111 11111 . 11111110
	33	Thailand	10. 36 . 0 . 0 / 19	First	10 . 36 . 00 . 1	00001010.	0010	0011 . 000 00000 . 00000001
				Last	10 . 36 . 31 . 254	00001010.	0010	0011 . 000 11111 . 11111110
	34	Timor Leste	10. 36. 32 . 0 / 19	First	10 . 36. 32 . 1	00001010.	0010	0011 . 001 00000 . 00000001
				Last	10 . 36. 63 . 254	00001010.	0010	0011 . 001 11111 . 11111110
	35	Tonga	10. 36 . 64 . 0 / 19	First	10 . 36 . 64 . 1	00001010.	0010	0011 . 110 00000 . 00000001
				Last	10 . 36 . 95 . 254	00001010.	0010	0011 . 110 11111 . 11111110
APAC	36	Vanuatu	10. 36 . 96 . 0 / 19	First	10 . 36 . 96 . 1	00001010.	0010	0011 . 011 00000 . 00000001
				Last	10 . 36 . 127 . 254	00001010.	0010	0011 . 011 11111 . 11111110
	37	Vietnam	10. 36 . 128 . 0 / 19	First	10 . 36 . 128 . 1	00001010.	0010	0011 . 100 00000 . 00000001
				Last	10 . 36 . 159 . 254	00001010.	0010	0011 . 100 11111 . 11111110
	38	Isla de Pascua (Chilie)	10. 36 . 160 . 0 / 19	First	10 . 36 . 160 . 1	00001010.	0010	0011 . 101 00000 . 00000001
				Last	10 . 36 . 191 . 254	00001010.	0010	0011 . 101 11111 . 11111110
	39	French Polynesia	10. 36 . 192 . 0 / 19	First	10 . 36 . 192 . 1	00001010.	0010	0011 . 110 00000 . 00000001
				Last	10 . 36 . 223 . 254	00001010.	0010	0011 . 110 11111 . 11111110
	40	New Caledonia (French)	10. 36 . 224 . 0 / 19	First	10 . 36 . 224 . 1	00001010.	0010	0011 . 111 00000 . 00000001
				Last	10 . 36 . 255 . 254	00001010.	0010	0011 . 111 11111 . 11111110
	41	Wallis & Futuna Islands (French)	10. 37 . 0 . 0 / 19	First	10 . 37 . 0 . 1	00001010.	0010	0100 . 000 00000 . 00000001
				Last	10 . 37 . 31 . 254	00001010.	0010	0100 . 000 11111 . 11111110
	42	Niue (New Zealand)	10. 37 . 32 . 0 / 19	First	10 . 37 . 32 . 1	00001010.	0010	0100 . 001 00000 . 00000001
				Last	10 . 37 . 63 . 254	00001010.	0010	0100 . 001 11111 . 11111110

	43	Pecan Island (United Kingdom)	10. 37 . 64 . 0 / 19	First	10 . 37 . 64 . 1	00001010.	0010	0100 . 010	00000 . 00000001
				Last	10 . 37. 95 . 254	00001010.	0010	0100 . 010	11111 . 11111110
	44	American Samoa (United States)	10. 37 . 96 . 0 / 19	First	10 . 37. 96 . 1	00001010.	0010	0100 . 011	00000 . 00000001
				Last	10 . 37. 127 . 254	00001010.	0010	0100 . 011	11111 . 11111110
	45	Guam (United States)	10. 37 . 128 . 0 / 19	First	10 . 37. 128 . 1	00001010.	0010	0100 . 100	00000 . 00000001
				Last	10 . 37. 159 . 254	00001010.	0010	0100 . 100	11111 . 11111110
	46	Johnson Island Kingman Reef (United States)	10. 37 . 160 . 0 / 19	First	10 . 37. 160 . 1	00001010.	0010	0100 . 101	00000 . 00000001
				Last	10 . 37. 191 . 254	00001010.	0010	0100 . 101	11111 . 11111110
	47	Midway (United States)	10. 37 . 192 . 0 / 19	First	10 . 37. 192 . 1	00001010.	0010	0100 . 110	00000 . 00000001
				Last	10 . 37. 223 . 254	00001010.	0010	0100 . 110	11111 . 11111110
APAC	48	Northern Mariana Islands (United States)	10 . 37 .224. 0 / 19	First	10 . 37 . 224 . 1	00001010.	0010	0100 . 111	00000 . 00000001
				Last	10 . 37 . 255 . 254	00001010.	0010	0100 . 111	11111 . 11111110
	49	Palmyra (United States)	10 . 38 . 0 . 0 / 19	First	10 . 38 . 0 . 1	00001010.	0010	0101 . 000	00000 . 00000001
				Last	10 . 38 . 31 . 254	00001010.	0010	0101 . 000	11111 . 11111110
	50	Wake Islands (United States)	10. 38. 32 . 0 / 19	First	10 . 38 . 32 . 1	00001010.	0010	0101 . 001	00000 . 00000001
				Last	10 . 38 . 63 . 254	00001010.	0010	0101 . 001	11111 . 11111110
	51	VACANCY	10.37. 64 .0 / 19	First	10 . 38 . 64 . 1	00001010.	0010	0101 . 010	00000 . 00000001
				Last	10 . 38 . 95 . 254	00001010.	0010	0101 . 010	11111 . 11111110
	-	-	-						

	-	-	-						
	128	RESERVE	10. 47 . 2244 . 0 / 19	First	10 . 47 . 224 . 1	00001010.	0010	1111 . 111	00000 . 00000001
				Last	10 . 47 . 255 . 254	00001010.	0010	1111 . 111	11111 . 11111110

3.4 Using IPv4-Compatible Address Formats

In many instances, you can represent a 32-bit IPv4 address as a 128-bit IPv6 address. The transition mechanism defines the following two formats.

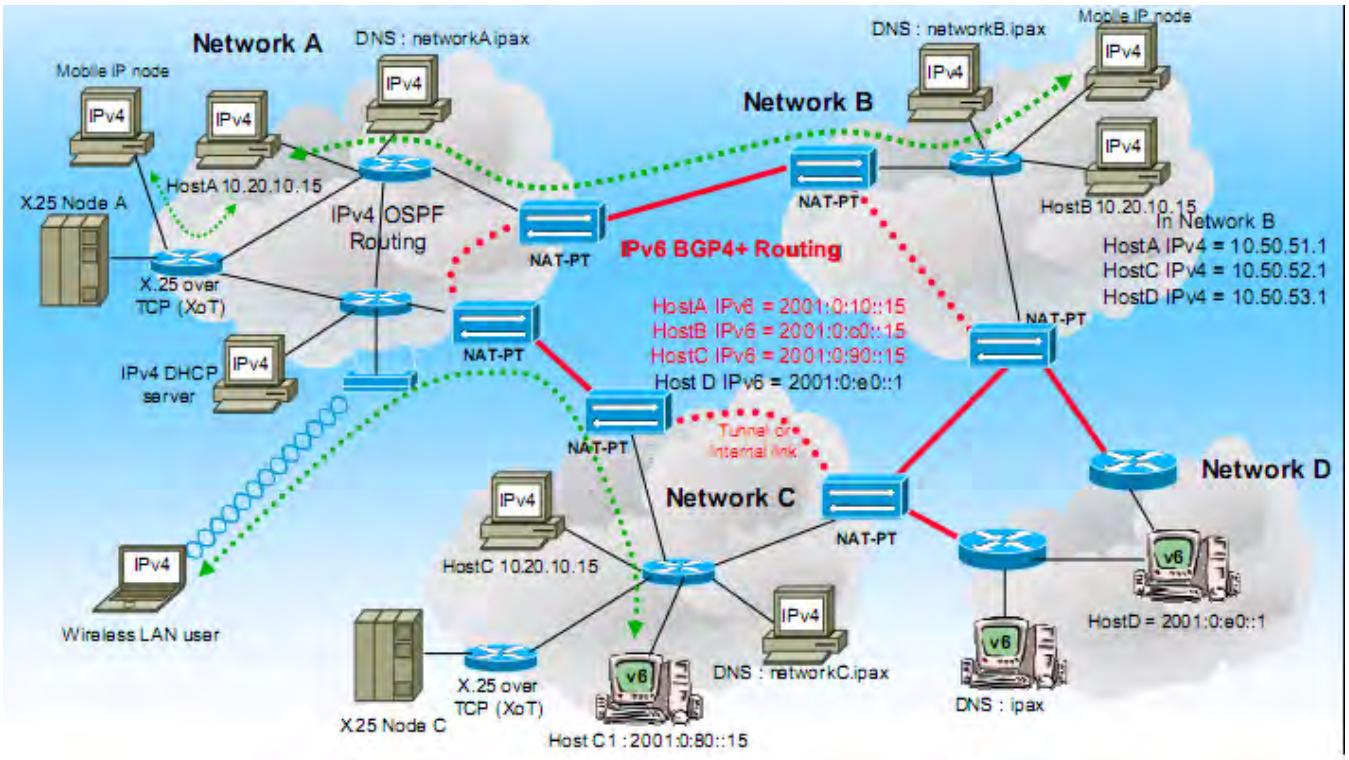
IPv4-compatible address

000 ... 000	IPv4 Address

IPv4-mapped address

000 ... 000	0xffff	IPv4 Address

The mapped address format is used to represent an IPv4 node. The only currently defined use of this address format is part of the socket API. An application can have a common address format for both IPv6 addresses and IPv4 addresses. The common address format can represent an IPv4 address as a 128-bit mapped address. However, IPv4-to-IPv6 protocol translators also allow these addresses to be used.



4. CONCLUSION

The meeting is invited to consider the proposed private network IPv4 address assignment for adoption. It is further recommended that the IPv4 address assignment table be modified to include States using Message Transfer Agent (MTA) only, since the connection between MTA and their associated User Agent (UA) is considered a local matter.

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AMHS PERFORMANCE ASSESSMENT IN THE ASIA/PACIFIC REGION

1. Background

In the Asia/Pacific region, the States have been installing the Aeronautical Message Handling System (AMHS) for interconnections to the networked AMHSs. Performance issues in general are major concerns of system operations after a system is installed and running, even if the system is stand-alone. In many cases, the system (or subsystem) is interconnected one to the others, and the performance issues of networked operations are further complicated than the ones of stand-alone system because of interactions among these systems. Such is the case of the AMHS, where the messaging services are based on interconnections among the AMHSs, where each AMHS is managed by different authority.

Although the States have been expressing their concerns on the AMHS performance, it is not obvious to recognize how to handle the performance issues. In order to address the AMHS performance issues properly, it is required to take into considerations of

1) the nature of the AMHS together with its networked operations,
2) the nature of AMHS performance,
3) the performance indicators to characterize the AMHS performance, and
4) the required activities related to the AMHS performance.

Since the detailed documents on the AMHS itself, shown above, i.e. 1), are available somewhere else, here it is necessary to address only the topics 2)-4) related to the AMHS performance.

2. Objectives of AMHS Performance Assessment

Why it is necessary to consider the AMHS Performance at the regional level? The States in the region develop and/or deploy the AMHS complied with the Standards; including SARPs, Regional ICD and others. Such Standards specify the functionality of the AMHS, mainly for the inter-operability among the AMHSs. The conformance test verifies the compliance of the installed AMHS system to such standards, but it is not used for assessing the installed AMHS performance. The AMHS is required to be assessed whether it is efficient as well as effective or not. It is necessary for each State to assess performance of the installed AMHS as a local activity. It is also necessary to assess the networked AMHS operations performance as a whole in the region, since the major services provided by the AMHS are messaging services among the installed AMHSs and the performance of the networked AMHS can not be assessed by individual State alone as a local activity. Hence, the assessment activities at the regional level require coordination among States in the region.

The objectives of the document are to clarify the AMHS performance assessment by providing descriptions of performance indicators; what are to be assessed, and the performance assessment; how these performance indicators to be assessed, in the Asia/Pacific region.

3. Scope of AMHS Performance Assessment

It is necessary to focus our attentions to relevant scope of the topic; 'AMHS Performance Assessment'. The scope of the topic can be divided into three domains of scope; what is the AMHS performance, how the AMHS performance assessment handled, and where the AMHS performance assessment conducted. The topic is further focused in each domain of Information (Performance Indicators), Procedure (Performance Assessment) and Organization (State and Region).

3.1 Informational Scope of AMHS Performance Assessment

It is necessary to identify the information relevant to the AMHS Performance Assessment. The materials from two different sources are used for references.

a) RCP Type Parameters

'ICAO Manual on Required Communications Performance (RCP)' describes the RCP type parameters as follows:

Communication transaction time - The maximum time for the completion of the operational

communication transaction after which the initiator should revert to an alternative procedure.
Continuity - The probability that an operational communication transaction can be completed within the communication transaction time.

③ *Availability - The probability that an operational communication transaction can be initiated when needed.*

④ *Integrity - The probability that communication transactions are completed within the communication transaction time with undetected error.*

An operational communication transaction is defined as 'the process a human or system uses to send and/or receive an instruction, clearance, flight information, and/or request, and is completed when the human is confident that the transaction is satisfactorily complete'.

The problem to use the parameters listed above, especially 'communication transaction time' is that

(1) 'the (operational communication) transaction' is defined as a process of including 'send and receive' messages, meaning two-way communication,

(2) 'the initiator should revert to an alternative procedure' if such a transaction is not completed within the specified time, where an alternative procedure is implied voice communication.

In the AMHS, there is no concept 'response time' nor 'maximum time of completion' of messaging. The RCP is suitable to be applied to time critical and two-way communication, like ATC Air/Ground communication or AIDC, but not to AMHS.

By the same reason, the 'continuity' parameter is not suitable for the AMHS performance assessment, since 'be completed within the communication transaction time' can not be assessed in the AMHS environment.

It should be noted that the 'integrity' can be assessed only when an error is detected, since we can not assess the integrity where an error is not detected. The undetected errors could be avoided by detecting defects during the conformance testing.

b) Quality of Services

Since the RCP type parameters are not necessary satisfactory for the AMHS performance assessment, it is necessary to find suitable parameters, especially time related ones, for the AMHS performance assessment.

Another general source describes that the major requirements for supporting QoS (Quality of Service) in services are as follows:

①*Availability: Availability is the quality aspect of whether the service is present or ready for immediate use.*

②*Accessibility: Accessibility is the quality aspect of a service that represents the degree it is capable of serving a service request.*

Integrity: Integrity is the quality aspect of how the service maintains the correctness of the interaction in respect to the source.

Performance: Performance is the quality aspect of service, which is measured in terms of throughput and latency. Higher throughput and lower latency values represent good performance of a service. Throughput represents the number of service requests served at a given time period. Latency is the round-trip time between sending a request and receiving the response.

Reliability: Reliability is the quality aspect of a service that represents the degree of being capable of maintaining the service and service quality. The number of failures per month or year represents a measure of reliability of a service. In another sense, reliability refers to the assured and ordered delivery for messages being sent and received by service requestors and service providers.

⑥*Regulatory: Regulatory is the quality aspect of the service in conformance with the rules, the law, compliance with standards, and the established service level agreement.*

Security: Security is the quality aspect of the service of providing confidentiality and non-repudiation by authenticating the parties involved, encrypting messages, and providing access control.

The terms listed above are considered as the parameters of 'required quality of services'. The parameters, 'Availability', 'Accessibility', 'Integrity', and 'Reliability' are almost equivalent to the RCP type parameters, while 'Regulatory' and 'Security' are out of scope of the AMHS performance assessment.

The 'Performance' parameter includes 'Throughput' and 'Latency' where the 'Latency' is the round-trip time between sending a request and receiving the response, is not suitable to be applied for AMHS performance assessment.

It should be noted that the performance in the first reference, RCP document, is the 'operational performance', instead of the 'technical performance' (e.g. VDL, SATCOM), and the performance in the second reference is the service performance, instead of system performance.

By modifying the referred descriptions, the information for the AMHS performance assessment includes the followings:

① Availability - The probability that an AMHS service request can be initiated when needed.
② Integrity - The probability that an AMHS service request is completed without detected error(s), where the error includes message delivery error and delivered message error.
③ Throughput - The number of service requests served at a given time period.
④ Transmission - The time between sent and received by message sender and message receiver.

3.2 Procedural Scope of AMHS Performance Assessment

After the AMHS performance and the performance indicators are understood, the next topic is how to handle the AMHS performance using such indicators. The AMHS, or any other system, goes through the life cycle processes of planning, development/deployment and operation/maintenance. The AMHS performance assessment is mainly at the operational stage of the AMHS life.

Identifying the AMHS performance indicators, more detailed activities related to the AMHS performance assessment should be elaborated, including performance measurements and evaluation. Based on the defined/determined performance indicators, the AMHS performance will be measured. Based on the measured AMHS performance, the AMHS performance is assessed. Before assessing the AMHS performance, it is required to set a target of the AMHS performance, in terms of the AMHS performance indicators which are compared against the measured performance values.

The assessment activities include confirming the performance indicators, setting a target at the planning stage, and measuring the performance, evaluating the performance at the operational stage.

3.3 Organizational Scope of AMHS Performance Assessment

The topic; 'AMHS Performance Assessment' is discussed in the regional group. The major concern of the group is the 'AMHS Performance Assessment' in the Asia/Pacific region. Although the scope of the topic should be focused to the regional matter, it is unrealistic to assume AMHS Performance Assessment in the Asia/Pacific region without any AMHS Performance Assessment in individual State.

Organizationally, the States in the Asia/Pacific region are involved in the AMHS Performance Assessment in the Asia/Pacific region, and sometime it may need the bilateral coordination between States.

4. Performance Indicators Related to AMHS Performance Assessment

The performance indicators are listed in Table 1. The detailed descriptions are given as follows;

Table 1 Performance Indicators of AMHS Performance

Performance Indicator Category	Candidate Performance Indicators	States	Bilateral between States	Regional/ Global	Remarks
Availability	MTBF/MTTR	x			
Integrity	Quality of Message Delivery	x Note 2	x Note 2	x Note 2	
	Quality of Message Delivered	x Note 2	x Note 2	x Note 2	
Throughput: Demand of messaging	In-bound (receiving) message demand	x	x Note 1	x Note 1	throughput (time varying)
	Out-bound (sending) message demand	x			throughput (time varying)
Throughput: Capacity of AMHS server		x			Throughput (fixed, max # of messages able to be handled)
Transmission Time (Delay)	sender message-out to receiver message-in	x	x Note1		Time per message

Note 1: Although the message demand and time for transmission may not require the coordination at the level of regional/global or bilateral between States, it is useful to provide the in-bound demand characteristics, for instance, hourly basis, at each receiving AMHS server for predicting the time for transmission at the sender, since excess load at a receiver may cause delay on transmission. The detailed discussions will be provided in the later section.

Note 2: The integrity indicators at the regional level are to assess the integrity as a whole in the region, while the performance assessment activities at the State and bilateral level include the resolution of performance issues, if there are any.

4.1 Availability

The availability can be assessed by counting the number of failed service invocations, or by using MTBF (mean time between failures) or MTTR (mean time to repair). These indicators can be applied to the individual AMHS server, but it is hard to conceive the availability of the networked AMHS as a whole.

4.2 Integrity

There are two possible AMHS performance indicators related to the integrity. They are the quality of message delivery and the quality of delivered message. Since message delivery is an activity between servers, the assessment of integrity requires at least coordination among the States in the region.

4.2.1 Integrity: Quality of Message Delivery

The quality of message delivery indicates either how many messages out of the messages sent are undelivered to the intended recipients, or how many messages out of the messages sent are delivered to the intended recipients.

It should be noted that the delivered/undelivered should be detected by the AMHS. The undetected un-delivery is excluded from the performance assessment. Also excluded are the messages delivered to the incorrect recipients.

The undetected message delivery should be tested as a part of the conformance test.

4.2.2 Integrity: Quality of Message Delivered

The quality of message delivered indicates either how many messages out of the messages received have the

(detected) errors, or how many messages out of the messages received have no (detected) errors.

The undetected message errors should be tested as a part of the conformance test.

4.3 Throughput: Demand of messaging

The demand of messaging indicates the number of messages received and sent at each AMHS server. The demand changes during the operational hours so that the demand should be monitored accordingly, say for every one hour. The messaging demand between specific pair of AMHS servers may be monitored, but for the performance assessment purpose, it is more important to have the total number of messages to be received and sent at the AMHS server than message traffics between one specific pair of AMHS servers.

There are two classes of messaging demand,

- In-bound message demand
- Out-bound message demand.

The classifying demands into in-bound and out-bound, is important to characterize the messaging demand, since the peak demands of in-bound and out-bound messaging may differ during the operation. The in-bound message demand at one AMHS server may influence the transmission time of messages received at the AMHS server. The classification also helps to identify the capacity of the AMHS server, handling mixture of in-bound and out-bound demands, shown below.

In any case, it is not necessary to assess the messaging demand at the regional level, except to collect the statistics of messaging demand as a whole in the region.

4.4 Throughput: Capacity of AMHS server

The capacity of AMHS server indicates the ability to handle the number of messages in the service. The capacity of AMHS server may be visible when the messaging demand is close to or exceeds the capacity. The excess demand will cause delays in messaging services. By classifying messaging demands into in-bound and out-bound, it is easy to identify which one is dominant during the most heavily loaded time period.

It is the States' responsibility to identify the capacity of their AMHS servers.

4.5 Time Efficiency; Time for Transmission (Delay)

The time for transmission (delay) indicates the time interval required to transmit individual message, while the demand and the capacity given above are throughput, collective messaging performance of all messages received/sent at the AMHS server site.

The transmission time can be defined as the time from one server output to another server input

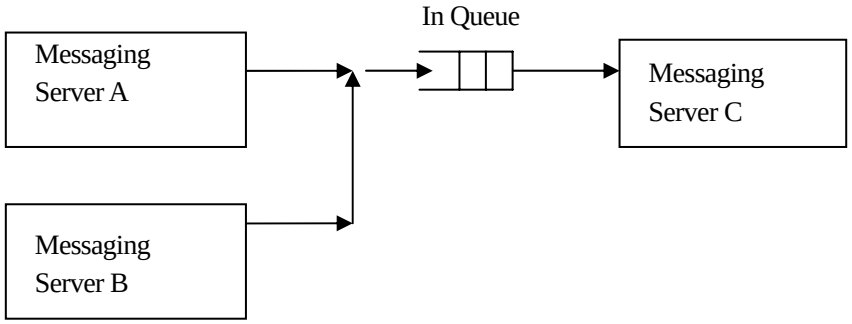


Fig.1 Messaging Servers and Input Queue

The figure shows the input queue at an AMHS server. In an actual implementation of AMHS server, the sender AMHS server would test availability of the receiver AMHS before actually sending messages, instead of enqueing messages in the input queue. But it is easy to model and understand such a situation by using input queue.

The time interval from one server output to another server input, may include the time for establishing

connection/association between AMHS servers, and actual message transmission time.

The message transmission time may be larger if the message is longer or the communication infrastructure is slow, while the time before actual transmission is taking place may increase if the many messages are competing to be received at the same destination AMHS server. The actual transmission time is almost fixed or predictable once the message to be sent is given, while the time before actual transmission is taking place may change depending on the dynamic operating environment at the receiving site.

A server, e.g. Server A in Fig. 1 sends messages to a server e.g. Server C in Fig. 1, without knowing the messaging demands originating at other sender messaging servers, e.g. Server B in Fig. 1, destined to the same receiver messaging server, e.g. Server C, a messaging request from one sender messaging server, e.g. Server A, may have to wait for longer time to be accepted by the receiver messaging server.

There are two possible definitions of message transmission time;

① From the time message transmission is invoked to the time message transmission is completed, including possible waiting time before actual transmission,

② From the time actual message transmission starts to the time message transmission is completed, excluding the possible waiting time before actual transmission.

The first one is more meaningful than the second one.

If the second definition is used, there is no good reason to assess the transmission time in a regular basis, because the transmission time can be easily predictable, given the size of messages.

If the first definition is used, there is a good reason to assess the realistic transmission time in a regular basis, but the monitored transmission time alone is not useful without information of the operational environment, e.g. in-bound message traffic, at the receiving site.

Since the messaging service scheme is the store-and-forward, there is no assurance for the messaging service to satisfy any time related requirements. Therefore, there is no meaning to relate the messaging service performance to any required performance.

Note: The AMHS messaging discussed here is the one-way message transmission, instead of two-way dialogue, so that there is no concept of 'response time' in the AMHS messaging. The time for transmission should not be confused with the response time, where the response time include two way transmission possibly including human factors in between, like the RCP proposed in the ICAO document.

The Time for Transmission is not appropriate for the performance indicator to be monitored regularly, since monitored transmission time is dynamic in nature and it does not make any sense without knowing operational environment of messaging. It can be monitored to identify the cause of anomaly when it is detected. In order to assess performance in case of anomaly, it is helpful to use the knowledge of in-bound demand pattern at a receiving AMHS site, since it is considered that in-bound demand pattern at a receiving AMHS site is stable and helpful for performance assessment.

5. AMHS Performance Indicators and their Assessment

In the section, the performance indicators and their related activities at the regional level, bilateral basis between States and the State level are proposed.

5.1 AMHS Performance Indicators and their Assessment at Regional Level

As described in the previous sections, performance indicators related to the capacity of messaging servers and the demand of messaging services have be captured properly, but these are managed locally at messaging service sites.

In the following, the AMHS performance indicators at the regional level are proposed, the indicator on quality on message delivery and quality of delivered messages, followed by in-bound demand at receiver.

5.1.1 Quality on Message Delivery

The quality of message deliveries can be monitored by the number of NDRs (Non Delivery Reports) per a day, week or month within the region. Since the many messaging servers are involved in the message delivery,

the quality on message deliveries has to be assessed as a regional matter rather than as an individual State matter. The region has to decide the level of acceptable quality.

5.1.2 Quality of Delivered Message

Similar to the quality on message deliveries, the quality of delivered messages, the number of messages with detected errors, has to be assessed as a regional matter.

5.2 In-bound Demand (at Receiver)

The States may need to know the in-bound demand at the sites of intended message recipients.

If a sender knows the in-bound traffic during certain hour of operation at the recipients, the sender may be able to measure and assess the time efficiency by some means. Without knowing the information, senders will not be able to identify which hour the recipients are in the busiest. The information can be provided in a relative scale as an in-bound demand profile, i.e. which hour is the busiest, rather than the absolute number of messages arriving at the site during a certain hour. The information is the collective one of all messages received at a site that there is no need to be broken down to the in-bound demand of between server pairs. Also there is no need to provide the out-bound demand, since it is no used for measurements for time efficiency.

a) Scheme to Inform In-Bound Demand at Receiving Sites

It should be noted that demand and capacity at all sites have to be analyzed before performance evaluation. Without knowing the operating environment, it is useless to conduct performance evaluation. There should also be a scheme to inform the total (possibly time varying) in-bound demand at each site from all other sites. The scheme may be provided as bilateral basis but a common scheme in the region is advisable. It should be also noted 'the total (possibly time varying) in-bound demand at any partner site from all other sites' may not be derived by '(possibly time varying) out-bound demands from each site to any direct MTA partners'.

5.3 AMHS Performance Indicators and Related Activities at State level

The following indicators are suggested for local performance assessment. These indicators are not required or are not necessary for other sites to know or to conduct their performance evaluation.

a) Availability

The performance assessment on availability of each AMHS is the responsibility of each State. The performance assessment on availability of AMHS as a whole in the Asia/Pacific region is not discussed in the document.

b) Integrity

The integrity of messaging services, in terms of quality of message delivery and quality of delivered message, should be assessed by the States as well as at the regional level. The purpose of integrity assessment at the State level and the regional level is different. The integrity issues of the States level or between two States should be resolved through the integrity assessments at the State level or between States, while at the regional level, the integrity of the messaging services as a whole within the region is assessed.

c) Demand

The numbers of in-bound and out-bound demands have to be monitored together with the demand variation during day, or week, if any.

d) Capacity

It is important to know the capacity of the server in its operations. The capacity can be detected by finding the peak demand for in-bound and out-bound.

e) Time Efficiency

Primarily, it is State's responsibility to assess the time efficiency of operation locally, but States may need the help of other States, the communicating partners, to provide the scheme to assess the time efficiency.

5.4 Summary: Proposed AMHS Performance Indicators and their Assessment in the Asia/Pacific region

5.4.1 Deriving 'Number of Messages'

In order to avoid misunderstanding of the descriptions given above, some formal notations are used in the section to describe the derivation of number of messages used in the document. There are differences in descriptions between two documents; the AMHS Messaging Management Manual and Asia/Pacific AMHS Performance Assessment, as shown below.

M is the set of MTAs in the Asia/Pacific region.

M ::= { M(i), i=1..n }, M is defined as a set of M(i)s: MTA at site i in the Asia/Pacific region.

D(i, j) = true, if M(i) and M(j) are direct MTA partners,
=false, otherwise.
If D(i,j) is true, then D(j,i) is also true

T(i,j,t,d) is the number of messages transmitted from M(i) to M(j) where D(i, j) = true, during Day= d in Hour = t, where d and t are in UTC.

R(i,j,t,d) is the number of messages received from M(j) to M(i) where D(i, j) = true, during Day= d in Hour = t, where d and t are in UTC.

Basically T(i,j,t,d) = R(j,i,t,d).

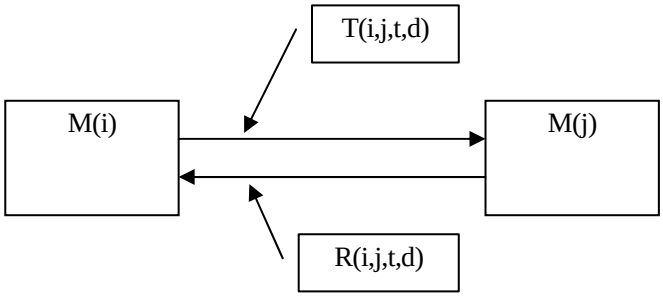


Fig. 3 Messaging between direct MTA partners

Note: *, @, + indicate accumulation of numbers over Hours in one day, over direct MTA partners, and over days in one month, respectively.

a) Number of messages transmitted

T*(i,j,d) = T(i,j,1,d) + T(i,j,2,d) + .. + T(i,j,24,d)
is the number of messages transmitted from M(i) to M(j) where D(i, j) = true, during Day= d from Hour = 1 to Hour= 24 in UTC.

$T^{@}(i,t,d) = T(i,1,t,d) + T(i,2,t,d) + .. + T(i,n,t,d)$, where n is the number of direct MTA partners to M(i),
is the number of messages transmitted from M(i) to all M(j)s where D(i, j) = true, during Day= d in Hour = t in UTC.

$T^{*+}(i,j) = T^{*}(i,j,1) + T^{*}(i,j,2) + .. + T^{*}(i,j,m)$
is the number of messages transmitted from M(i) to M(j) where D(i, j) = true, during one month from Day = 1 to the day m at end of the month in UTC.

$T^{@*}(i,d) = T^{@}(i,1,d) + T^{@}(i,2,d) + .. + T^{@}(i,24,d)$
is the number of messages transmitted from M(i) to all M(j)s where D(i, j) = true, during Day= d from Hour = 1 to Hour=24 in UTC.

$T^{@+}(i,t) = T^{@}(i,t,1) + T^{@}(i,t,2) + .. + T^{@}(i,t,m)$
is the number of messages transmitted from M(i) to all M(j)s where D(i, j) = true, in Hour = t during one month from Day = 1 to the day m at end of the month in UTC.

$T^{@*+}(i) = T^{@*}(i,1) + T^{@*}(i,2) + .. + T^{@*}(i,m)$
is the number of messages transmitted from M(i) to all M(j)s where D(i, j) = true, during one month from Day = 1 to the day m at end of the month in UTC.

$P_{transmitted}(i, j, d) = k$; Peak Hour k of the number of messages transmitted from M(i) to M(j) during Day= d where D(i, j) = true, is the Hour =k is t=k such that $T(i,j,k,d) = Max_t\{ T(i,j,t,d), t=1..24 \}$

$P^{+}_{transmitted}(i, j) = k$; Peak Hour k of the number of messages transmitted from M(i) to M(j) in one month where D(i, j) = true, is the Hour =k is t=k such that $Max_d Max_t \{ T(i,j,t,d), t=1..24, d=1..m \}$

$P^{@}_{transmitted}(i,d) = k$, Peak Hour k of the number of messages transmitted from M(i) to all M(j)s during Day= d where D(i, j) = true, is the Hour =k is t=k such that $T^{@}(i,k,d) = Max_t\{ T^{@}(i,t,d), t=1..24 \}$

$P^{@*+}_{transmitted}(i) = k$, Peak Hour k of the number of messages transmitted from M(i) to all M(j)s in one month where D(i, j) = true, is the Hour =k is t=k such that $Max_d Max_t\{ T^{@}(i,t,d), t=1..24, , d=1..m \}$

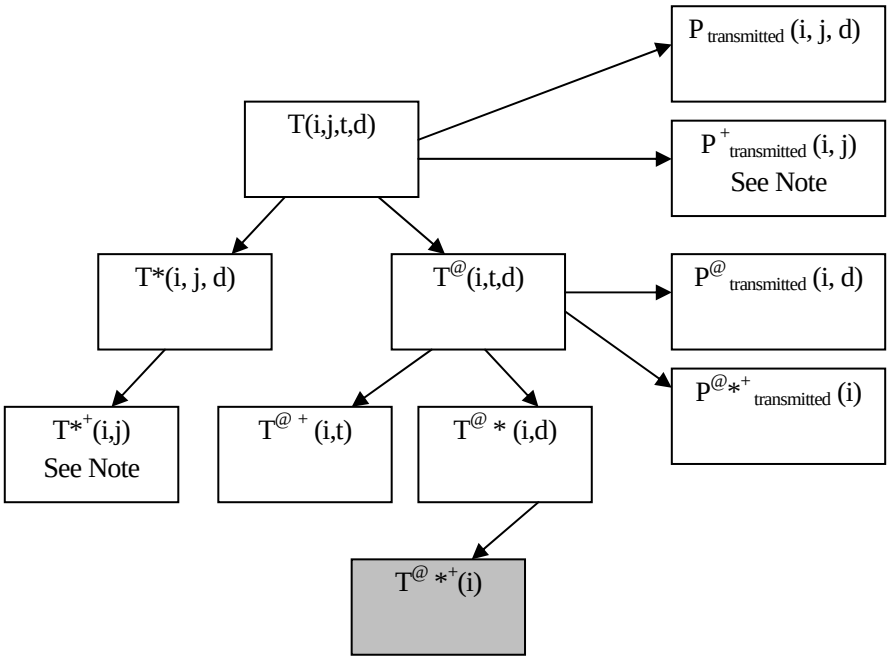


Fig.4 Tree for deriving statistical data 'Number of data messages transmitted'

Note: Two statistical data listed in the AMHS Messaging Management Manual are

Number of data messages transmitted

- *data corresponding to the peak hour traffic over the past month,*
  $Max_d Max_t \{ T(i,j,t,d), t=1..24, d=1..m \}$ where Peak Hour t=k is $P^{+}_{transmitted}(i, j) = k$,given above.

- *total data corresponding to the daily traffic over the past month.*
  $T^{*+}(i,j)$.

Fig.4 shows the derivation of statistical data shown above. All these statistical data are not necessary derived.

b) Number of messages received

R(i,j,t,d) is the number of messages received from M(j) to M(i) where D(i, j) = true, during Day= d in Hour = t, where d and t are in UTC.

$R^*(i,j,d) = R(i,j,1,d) + R(i,j,2,d) + .. + R(i,j,24,d)$
is the number of messages received from M(j) to M(i) where D(i, j) = true, during Day= d from Hour = 1 to Hour= 24 in UTC.

$R^{@}(i,t,d) = R(i,1,t,d) + R(i,2,t,d) + .. + R(i,n,t,d)$, where n is the number of direct MTA partners to M(i),
is the number of messages received at M(i) from all M(j)s where D(i, j) = true, during Day= d in Hour = t in UTC.

$R^{*+}(i,j) = R^*(i,j,1) + R^*(i,j,2) + .. + R^*(i,j,m)$
is the number of messages received from M(j) to M(i) where D(i, j) = true, during one month from Day = 1 to the day m at end of the month in UTC.

$R^{@}*(i,d) = R^{@}(i,1,d) + R^{@}(i,2,d) + .. + R^{@}(i,24,d)$
is the number of messages received at M(i) from any M(j)s where D(i, j) = true, during Day= d from Hour = 1 to Hour=24 in UTC.

$R^{@+}(i,t) = R^{@}(i,t,1) + R^{@}(i,t,2) + .. + R^{@}(i,t,m)$
is the number of messages received at M(i) from all M(j)s where D(i, j) = true, in Hour = t during one month from Day = 1 to the day m at end of the month in UTC.

$R^{@*+}(i) = R^{@}*(i,1) + R^{@}*(i,2) + .. + R^{@}*(i,d)$
is the number of messages received at M(i) from all M(j)s where D(i, j) = true, during one month from Day = 1 to the day m at end of the month in UTC.

$P_{received}(i, j, d) = k$; Peak Hour k of the number of messages received from M(j) to M(i) in Day = d where D(i,j) = true, is the Hour =k is t=k such that $R(i,j,k,d) = Max_t\{ R(i,j,t,d), t=1..24 \}$

$P^{+}_{received}(i, j) = k$; Peak Hour k of the number of messages received from M(j) to M(i) in one month where D(i, j) = true, is the Hour =k is t=k such that $Max_d Max_t \{ R(i,j,t,d), t=1..24, d=1..m \}$

$P^{@}_{received}(i,d) = k$, Peak Hour k of the number of messages received from all M(j)s to M(i) during Day= d where D(i, j) = true, is the Hour =k is t=k such that $R^{@}(i,k,d) = Max_t\{ R^{@}(i,t,d), t=1..24 \}$

$P^{@*+}_{received}(i) = k$, Peak Hour k of the number of messages received from all M(j)s to M(i) in one month where D(i, j) = true, is the Hour =k is t=k such that $Max_d Max_t\{ R^{@}(i,t,d), t=1..24, d=1..m \}$

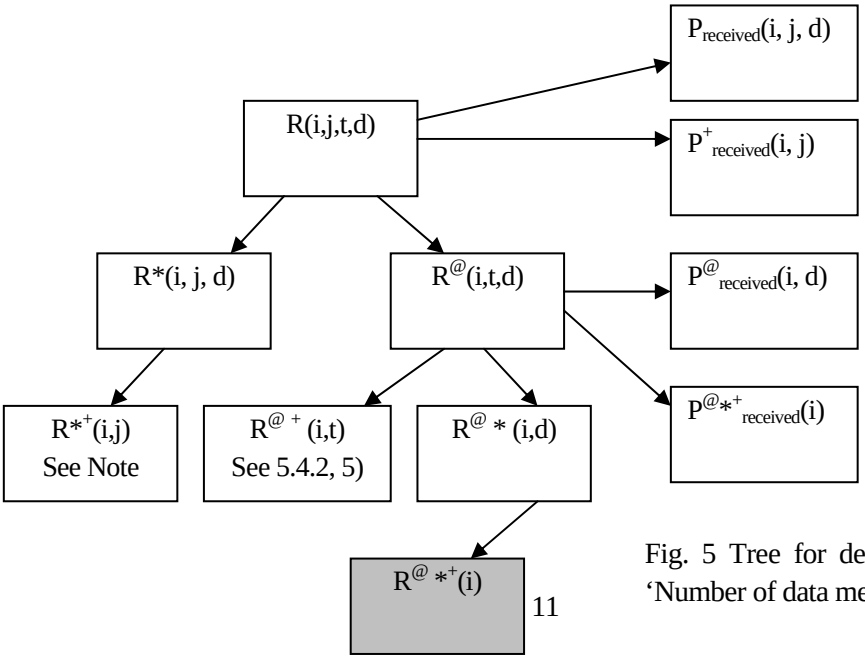


Fig. 5 Tree for deriving statistical data 'Number of data messages received'

Note: Two statistical data listed in the AMHS Messaging Management Manual are

Number of data messages received

- *data corresponding to the peak hour traffic over the past month,*
  $Max_d Max_t \{ R(i,j,t,d), t=1..24, d=1..m \}$ where Peak Hour is $P^+_{received}(i, j) = k$
- *total data corresponding to the daily traffic over the past month.* $R^{*+}(i,j)$

c) Number of all (transmitted and received) messages

$S(i,j,t,d) = T(i,j,t,d) + R(i,j,t,d)$ is the number of all (transmitted and received) messages between M(i) and M(j) where D(i, j) = true, during Day= d in Hour = t, where d and t are in UTC.

$S^*(i,j, d) = T^*(i,j, d) + R^*(i,j, d)$

is the number of all (transmitted and received) messages between M(i) and M(j) where D(i, j) = true, during Day= d from Hour = 1 to Hour= 24 in UTC.

$S^@(i,t, d) = T^@(i,t, d) + R^@(i,t, d)$

is the number of all (transmitted and received) messages at M(i) to/from all M(j)s where D(i, j) = true, during Day= d in Hour = t in UTC.

$S^{*+}(i,j) = T^{*+}(i,j) + R^{*+}(i,j)$

is the number of all (transmitted and received) messages between M(i) and M(j) where D(i, j) = true, during one month from Day = 1 to the day m at end of the month in UTC.

$S^{@+}(i,t) = T^{@+}(i,t) + R^{@+}(i,t)$

is the number of all (transmitted and received) messages at M(i) to/from all M(j)s where D(i, j) = true, in Hour = t during one month from Day = 1 to the day m at end of the month in UTC.

$S^{@*+}(i) = T^{@*+}(i) + R^{@*+}(i)$

is the number of messages all (transmitted and received) at M(i) to/from all M(j)s where D(i, j) = true, during one month from Day = 1 to the day m at end of the month in UTC.

$P_{sum}(i, j, d) = k$; Peak Hour k of the number of all (transmitted and received) messages between M(i) and M(j) in Day =d where D(i, j) = true, is the Hour =k is t=k such that $S(i,j,k,d) = Max_t\{ S(i,j,t,d), t=1..24 \}$

$P^+_{sum}(i, j) = k$; Peak Hour k of the number of all (transmitted and received) messages between M(i) and M(j) in one month where D(i, j) = true, is the Hour =k is t=k such that $Max_d Max_t \{ S(i,j,t,d), t=1..24, d=1..m \}$

$P^@_{sum}(i,d) = k$, Peak Hour k of the number of all (transmitted and received) messages at M(i) to/from all M(j)s in Day =d where D(i, j) = true, is the Hour =k is t=k such that $S^@(i,k,d) = Max_t\{S^@(i, t,d), t=1..24 \}$

$P^{@*+}_{sum}(i) = k$, Peak Hour k of the number of all (transmitted and received) messages at M(i) to/from all M(j)s in one month where D(i, j) = true, is the Hour =k is t=k such that $Max_d Max_t\{ S^@(i,t,d), t=1..24, d=1..m \}$

Note: The assessment on all (transmitted and received) messages should be the major concerns of State.

5.4.2 Proposed AMHS Performance Indicators in the Asia/Pacific Region

Proposed AMHS Performance Indicators are tabulated in the following table. The first two indicators are also listed as a part of statistics to be collected in the AMHS Messaging Management Manual.

Table 2 Proposed AMHS Performance Indicators

Indicators
1) Number of messages transmitted
2) Number of messages received
3) Number of non-delivery reports received
4) Number of received messages with detected error(s)
5) Hourly profile of received message traffic in one day

1) Number of messages transmitted

$T^{@} *^{+}(i)$

Note: The statistics listed in the AMHS Management Manual include 'Number of data messages transmitted', instead of 'Number of messages transmitted'. The difference between them means that whether the number of non-data messages, e.g. control messages, is included or not. In order to assess performance, the number of messages is proposed as one of indicators in the document. Also see note in 5.4.1, a)

2) Number of messages received

$R^{@} *^{+}(i)$

Note: The statistics listed in the AMHS Management Manual include 'Number of data messages received', instead of 'Number of messages transmitted'. The difference between them means that whether the number of non-data messages, e.g. control messages, is included or not. In order to assess performance, the number of messages is proposed as one of indicators in the document. Also see note in 5.4.1, b)

3) Number of non-delivery reports received

The number of non-delivery reports received *(editor's note)* is collected at the end of each month and reported. The number of non-delivery reports among the number of messages transmitted is evaluated as a messaging quality and assessed for satisfying the quality target.

Editor's note: The non-delivery reports received may be counted multiple times if the message causing the non-delivery is multi-pop message. There is a possibility to count the non-delivery report at the message origin only, but it is not desirable to change reporting procedures already exist. More over, such message transmission is counted multiple time, which causes some confusions. As a result, it is proposed to use the number of non-delivery report, with understanding that there could be a case shown above.

4) Number of received messages with detected error(s)

The number of received messages with detected error(s) in one month is collected at the end of each month and reported. The error detection should be limited to the errors in protocol, not the message contents. The number of received *(editor's note)* messages with detected error(s) among the number of messages received is evaluated as a messaging quality and assessed for satisfying the quality target.

Editor's note: Whether the received message with error is counted as the received message or not is depending on the timing the error detected.

If all received messages with error are excluded from the received message counting, then the error rate is

- {Number of received messages with error }/ { Number of received messages + Number of received messages with error}

while if all received messages with error are included from the received message counting, then the error rate is

- {Number of received messages with error }/ { Number of received messages }

In any case, the difference may be small, but it should be understood that the number of messages received may include the messages received with error.

5) Hourly profile of received message traffic in one day

Hourly profile of received message traffic in one day can be derived using $R^{@ +}$ (i,t) statistics given in Fig.5

5.4.3 AMHS Performance Data Collection and Assessment

The following procedure for statistical data collection and assessment is proposed.

a) Each State collects daily traffic data on 'Number of messages transmitted' $T^{@}$ * (i,d) and 'Number of messages received' $R^{@}$ * (i,d) and reports to the Regional Group. If T* (i,j,d) and R * (i,j,d) are collected as indicated in the AMHS Messaging Management Manual, generate $T^{@}$ * (i,d) and $R^{@}$ * (i,d).

b) Each State collects and reports 'Number of non-delivery reports received' and 'Number of received messages with detected error(s)' in one month to the Regional Group.
   - 'Number of all non-delivery reports received in the Region'/'Number of all messages transmitted in the Region' and
   - 'Number of all received messages with detected error(s) in the Region'/'Number of all messages received in the Region'

   should be derived by the Regional group. The Regional group decides whether the quality of messaging is satisfactory or not in the Region. The detailed analysis of each deficiency should be made among States involved.

c) 'Hourly profile of received message traffic in one day' for t=1..24 can be reported as $R^{@+}(i,t)$ given above, say once in a year, to the regional group for helping any direct MTA partners to conduct time efficiency evaluation at their convenient time.

6. Target of Performance Indicators

After agreeing the selection of performance indicators, the target values of performance indicators have to be determined. In the document, the following values are tentatively proposed as the target of each performance indicator.

Table 3 (Proposed) Target Values of Performance Indicator

Performance Indicator	Target
Quality of Message Delivery (detected message un-delivery)	less than or equal to 10^{-4}
Quality of Delivered Message (detected error rate)	less than or equal to 10^{-4}

7. Some Performance Issues other than AMHS Performance Assessment at Regional Level

7.1 AMHS Performance Assessment during Transition Period: AMHS, AFTN and AMHS+AFTN

In the previous sections, we considered only the AMHS performance, but in reality, there are AMHS services as well as AFTN services concurrently as depicted in Fig.6, although two services are isolated by the gateway function.

It is recommended to evaluate their performance separately between two services.

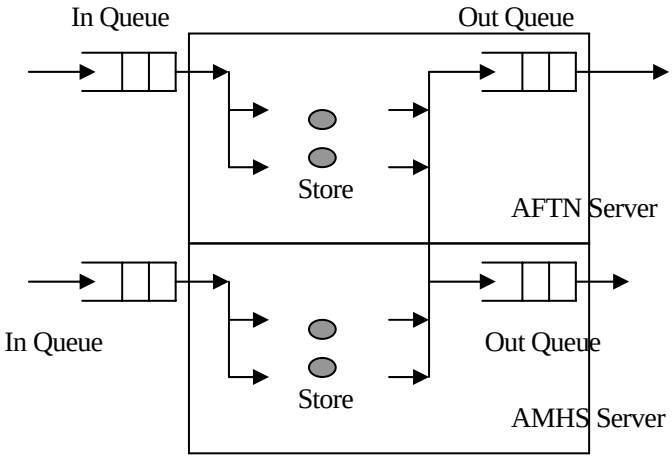


Fig.6 AFTN and AMHS server

Since the AMHS and the AFTN services co-exit in the region, the messages cross the boundary between two services. In some cases, the performance of both services may be reflected to the AMHS performance indicators, for instance the NDR crosses the boundary. The AMHS performance indicators may show more errors than the AFTN, since the message checking by the AMHS is stronger than the AFTN message checking. As far as the message originated at the AMHS sites, it should be considered as the part of the AMHS services, even if the messages cross the boundary of two services.

7.2 AMHS Performance Assessment across Regional Boundaries

The messages may cross the regional boundaries to other regions. As far as the message originated at the AMHS sites in the Asia/Pacific region, it should be considered as the part of the AMHS services in the region, even if the messages cross the boundaries of regions.

7.3 Performance Assessment at Network/Data Link Level below Messaging Services

Some concerns are expressed on the performance issues below the AMHS messaging services. Especially, in order to evaluate the AMHS performance, it is argued that some measures, like communication line loading as the AFTN performance assessment, are desirable, but it is not feasible. In the section, the reasons why it is not feasible will be explained.

a) AFTN line loading

In order to highlight the point, the nature of AFTN links and the monitoring of the AFTN communication line loading are illustrated in the Fig

In the AFTN, the messaging servers are interconnected via a point-to-point line as depicted in Fig. 7. For instance, the AFTN servers A and C, the AFTN servers B and C are interconnected via the Line X and Y respectively, although only one direction of message flow alone the lines is shown in Fig., with Queues. The Queue X indicates the possible delay of messaging from the Server A to C caused by the overloaded communication line X. By monitoring the loading of lines, the messaging between two specific servers can be detected to be inefficient because of the overloaded communication line. In that sense, it is meaningful to monitor the line loadings for knowing the level of messaging demand possibly exceeding the messaging capacity, since the bottleneck of the AFTN messaging is considered as the low line speed unable to handle the messaging demand.

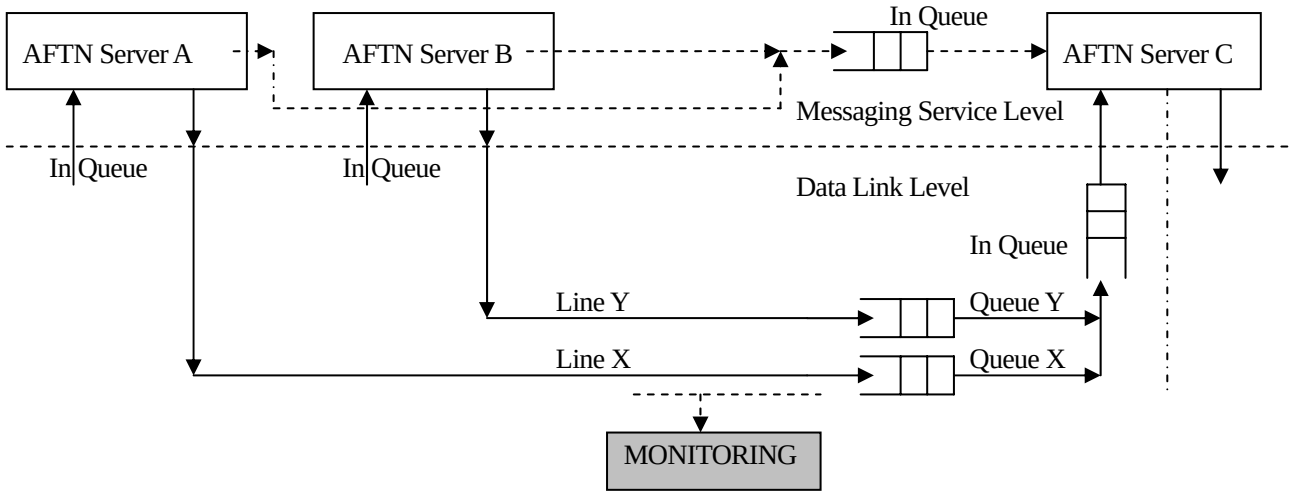


Fig.7 AFTN messaging servers and AFTN lines

It should be noted that

1) the line loading will be dynamic, so that the sampling time has to be selected properly,
2) by merely adding up the monitored traffic over lines, even if all line loadings are monitored at same time, it may not provide the information on transmission time mentioned above, for instance, during the busiest hour. The information gathered here, line loading, is one of the capacity (or throughput) related measures, rather than the measure of transmission time interval.

b) AMHS and Network Level Performance

In case of the AMHS, similar monitoring, like the AFTN line load monitoring, does not make any sense. In Fig.8, the Router network is shown where the packets are relayed between Routers. The AMHS messages may be

routed through better or the best possible paths depending on line loading and other factors. Since the routing is dynamic in nature; packets travel through possibly different paths for same destination, and the packets traveling through a particular line are mixed of different destinations, the monitoring of particular lines can not be related to any messaging performance between two specific AMHS servers. Technically speaking, it is not feasible to evaluate the AMHS messaging services through the Network Level monitoring.

The issue of evaluating performance of the Router Network will be handled as its own, independent to the AMHS messaging services. This is the reason why the document is titled AMHS performance instead of ATN performance, where the ATN includes the Network level, while the AMHS does not.

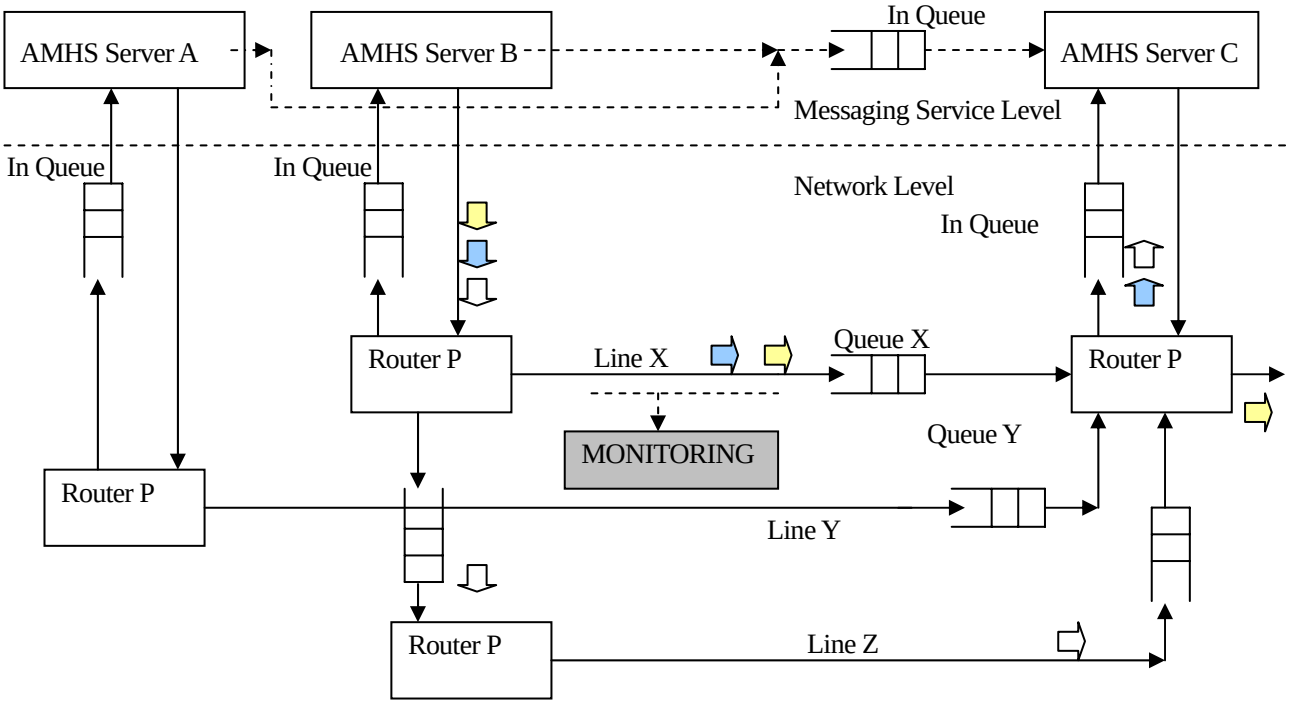


Fig.8 AMHS messaging servers and Router Network

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA AND PACIFIC OFFICE

ASIA/PACIFIC ATN NETWORK SERVICE ACCESS POINT (NSAP) ADDRESSING PLAN

Third Edition – September 2010

TABLE OF CONTENTS

SCOPE OF THE DOCUMENT

This document provides technical guidance on the Planning and the transition of Aeronautical Fixed Telecommunications Network (AFTN) communications to Aeronautical Telecommunications Network (ATN) within the Asia/Pacific Region. The material is intended for Regional Planning, although the plan itself is left to the States to proceed with planning and implementation.

Based upon the ATN SARPs as published in ICAO Annex 10 and Technical specifications as specified in ICAO Doc. 9705, ICAO Regions are expected to develop naming and addressing plans. This document provides guidance for the assignment of NSAP addresses within the Asia/Pacific Region. Each field of the NSAP address is presented with the recommended method of assigning values. Fields which are purely local State matters are identified.

DOCUMENT CONTROL LOG

Edition	Date	Comments	Section/pages affected
First	2001	This document was adopted by 12th meeting of APANPIRG held in 2001 for distribution to States in the Asia/Pacific and adjacent regions.	All
Second	March 2004	Re-issued as 2nd Edition of the Regional ATN Planning Document in March 2004.	All
Third	September 2010	i. Editorial updates – change of document version number ii. Updated table of contents iii. Creation of document control log iv. Inclusion of common address prefix for the Asia, Pacific and North America ICAO regions for the ADM field	All 2 3 9 to 11

1. INTRODUCTION

This paper presents the Network Service Access Point (NSAP) address assignment conventions for use in the Asia/Pacific Region.

The Asia/Pacific Regional ATN Addressing Plan consists of a set of recommendations for each State to assign regional NSAP addresses in a consistent manner. Using these recommendations, it should be possible to develop efficient routing policies that limit the amount of information exchange while providing comprehensive ATN services. Further, the application of this plan will permit simplified ATN service growth with a minimum of router re-configuration.

1.1 Objectives

The objectives of the document are to provide:

- Guidance in the specification of NSAP addresses,
- Guidance in the specification of routing domain identifiers (RDI) for Routing Domains (RD) and Routing Domain Confederations (RDC).

In providing guidance on the specification of NSAP addresses, each NSAP address field is described with the recommendations on how the field may be used. This is important so that consistency in the use of NSAP addresses is obtained and efficiency in routing is maintained.

The guidance on the specification of RD and RDC identifiers is a continuation to the specification of the NSAP address structure. By applying the rules of the address assignments to the addressing of RDs and RDCs, it will be ensured that the efficiency of the routing mechanisms is maintained.

1.2 Scope

The scope of the document includes:

- Describing the NSAP address format, and
- Recommending the values in the fields of the regional NSAP addresses.

The Asia/Pacific Regional ATN Addressing Plan will comply with the NSAP format as specified in ICAO Doc. 9705.

The Asia/Pacific Regional ATN Addressing Plan defines the method for assigning values to each of the fields of the NSAP address. States within the Region may choose to assign their NSAP addresses based upon the recommendations made here.

1.3 Document Structure

Section 2 contains the background information for the formulation of recommendations.
Section 3 contains the assumptions on which the recommendations are based upon.
Section 4 contains the NSAP address structure and the recommended values to be used in Asia/Pacific Region.

1.4 Terms Used

Network Addressing Domain – A subset of the global addressing domain consisting of all the NSAP addresses allocated by one or more addressing authorities.

Network Entity (NE) – A functional portion of an internetwork router or host computer that is responsible for the operation of internetwork data transfer, routing information exchange and network layer management protocols.

Network Entity Title (NET) – The global address of a network entity.

Network Service Access Point (NSAP) Address – A hierarchically organized global address, supporting international, geographical and telephony-oriented formats by way of an address format identifier located within the protocol header. Although the top level of the NSAP address hierarchy is internationally administered by ISO, subordinate address domains are administered by appropriate local organizations.

NSAP Address Prefix – A portion of the NSAP Address used to identify groups of systems that reside in a given routing domain or confederation. An NSAP prefix may have a length that is either smaller than or the same size as the base NSAP Address.

Routing Domain (RD) – A set of End Systems and Intermediate Systems that operate the same routing policy and that are wholly contained within a single administrative domain.

Routing Domain Confederation (RDC) – A set of routing domains and/or routing domain confederations that have agreed to join together. The formation of a routing domain confederation is done by private arrangement between its members without any need for global coordination.

Routing Domain Identifier (RDI) – A generic network entity title as described in ISO/IEC 7498 and is assigned statically in accordance with ISO/IEC 8348. An RDI is not an address and cannot be used as a valid destination of an ISO/IEC 8473 PDU. However, RDIs are like ordinary NETs, assigned from the same addressing domain as NSAP addresses.

1.5 References

Reference 1	Manual of Technical Provisions for the ATN (Doc 9705-AN/956) Third Edition.
Reference 2	Comprehensive Aeronautical Telecommunication Network (ATN) Manual (Doc 9739-AN/961) Second Edition 2002.
Reference 3	ACCESS - ATN Compliant Communications European Strategy Study Define Network topology – Addressing Plan Addressing Plan of the European ATN Network
Reference 4	ICAO Location Indicators – Document 7910
Reference 5	Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services - Document 8585

2. BACKGROUND

2.1 System Level Requirements

The ATN SARPs are divided into a set of System Level Requirements. These requirements are found in the ICAO Annex 10 text and are repeated in ICAO Doc. 9705 (Reference 1), Sub-Volume 1. The System Level Requirements detail specific requirements that all ATN compliant systems must meet and form the basis for the technical specifications. Some of the System Level Requirements may best be satisfied through Regional Planning and Regional specification of procedures.

The following list presents the important System Level Requirements and Recommendations that form the basis of the NSAP Addressing Plan.

- System Level Requirement #11 (Annex 10) presents the basis for the definition of NSAP addresses: "The ATN shall provide a means to unambiguously address all ATN end and intermediate systems."
- System Level Requirement #13 (Annex 10) presents the basis for the need of Regional Planning: "The ATN addressing and naming plans shall allow State and organizations to assign addresses and names within their own administrative domains."

System Level Requirement #11 forms the basis for assigning at least one unique NSAP address for each end system and intermediate system. The assignment of NSAPs to systems enables the unambiguous identification of ATN components and applications.

System Level Requirement #13 forms the basis for Regional Planning in the area of NSAP address assignment. The establishment of Regional plans for assigning addresses assists States and Organizations within a Region to develop consistent address assignment procedures that will result in more efficient routing policies.

2.2 Basis for ATN Address Planning

2.2.1 Regional Planning

At the second meeting of the ATN Panel, it was recognized that the establishment of naming conventions and registration procedures were necessary for the successful deployment of the ATN. Two specific Recommendations were developed at that meeting and subsequently approved by the Air Navigation Commission.

Recommendation 4/1 Advice to States on ATN addressing issues
"That ICAO advise States and international organizations to take the necessary actions for the assignment, administration, and registration of ATN names and addresses within their allocated name/address space, using the information provided."

Recommendation 4/2 Setting up an ICAO ATN addressing process
"That ICAO take the necessary actions to provide a facility for maintaining an up-to-date repository of ATN addresses and names registered in the Air Traffic Services Communication (ATSC) domain, and publish the repository entries at usual regular intervals."

2.2.2 Asia/Pacific Regional Planning

The APANPIRG agreed that a consistent plan for naming and addressing is required to simplify the transition to ATN.

3. ASSUMPTIONS

In developing the recommendations for the Asia/Pacific Regional ATN Addressing Plan, several assumptions were made about the structure of the Region's ATN implementation. Some of these assumptions may appear unnecessary, but they tend to guide the development of the recommendations presented in Section 4.

- The Asia/Pacific Regional ATN Addressing Plan will comply with the rules in ICAO Doc. 9705 (Reference 1). This means that the syntax, semantics and encoding rules of the NSAP address fields as specified in ICAO Doc. 9705 must be observed.
- There will be a number of ATN routers deployed in the Region. This assumption drives the need for multiple routing domains within the Region and the need to develop a plan that allows for efficient routing.
- The regional routing architecture will eventually include RDCs such as Island RDCs and Backbone RDCs. Therefore the Asia/Pacific Regional ATN Addressing Plan must allow for the addressing of these RDCs.
- The Region will have at least one ATN router in each defined routing domain. This assumption is based on the ATN requirement for the establishment of routing domains.
- The Region will support both ground-ground and air-ground services and applications.

4. NSAP ADDRESSING PLAN

4.1 Introduction

The Asia/Pacific Regional ATN Addressing Plan provides guidance to the States within the Region in assigning NSAP addresses to their ATN systems. The Plan addresses the need for consistency within the Region for address assignment.

To find a suitable ATN addressing convention that would be acceptable for use in the Asia/Pacific Region requires a routing architecture that minimizes routing updates and overheads within the ground ATN infrastructure for both ground-ground and air-ground services and applications.

The ATN addressing convention must allow for an addressing scheme that is:

- Practical - to provide autonomous administration of ATN addresses for States and Organizations, and
- Flexible - to allow for future expansion and/or routing re-configuration of the ground ATN infrastructure with minimal re-assigning of ATN addresses.

The recommendations made in the Asia/Pacific Regional ATN Addressing Plan are based on the work performed by the European ACCESS[1] Project (Reference 3).

4.2 NSAP Address Format

The NSAP address format is defined in ICAO Doc. 9705 (Reference 1), Sub-Volume 5. The format is based upon the requirements specified in the base standard (ISO/IEC 8348) and incorporates the specific ATN requirements for addressing both ground and mobile systems.

The structure of the Network Service Access Point (NSAP) address is depicted in Figure 4.2-1.

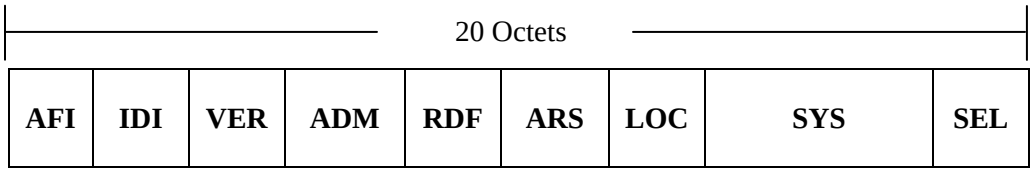


Figure 4.2-1 NSAP Address Format

The NSAP address structure contains 9 fields, which are described in Table 4.2-1.

Field Name	Field Description	Size	Syntax	Number of Characters/ Digits	Field Encoding
AFI	Authority and format Identifier	1 Octet	Decimal	2 Digits	BCD
IDI	Initial domain Identifier	2 Octets	Decimal	4 Digits	BCD
VER	Version	1 Octet	Hex	2 Digits	Binary
ADM	Administration Identifier	3 Octets	Alpha or Hex/Alpha	3 Characters 2 Digits character	IA-5 Binary/ IA-5
RDF	Routing Domain Format	1 Octet	Hex	2 Digits	Binary
ARS	Administration Region Selector	3 Octets	Hex	6 Digits	Binary
LOC	Location	2 Octets	Hex	4 Digits	Binary
SYS	System Identifier	6 Octets	Hex	12 Digits	Binary
SEL	NSAP Selector	1 Octet	Hex	2 Digits	Binary

Table 4.2-1 – Encoding Rules for the ATN NSAP

4.3 Recommended values for NSAP Address Fields assignment

4.3.1 The AFI and IDI Fields

The ATN Internet SARPs (Reference 1) require allocation of the following values:

- Decimal for the AFI field to indicate the type of NSAP being used. This value has been assigned the character sequence “47”.

[1] ACCESS (ATN Compliant Communications European Strategy Study) is a project funded by the European Commission and jointly produced by the following companies and administrations: National Air Traffic Services (NATS), Deutsche Flugsicherung (DFS) and Service Technique de la Navigation Aerienne (STNA).

- Decimal for the IDI field to designate ICAO. This value has been assigned the character sequence "0027".

As recommended in Reference ATN NSAP addresses and NETs will be written as the character sequence "470027+" where the "+" is used to separate the Binary Coded Decimal (BCD) fields from subsequent Hexadecimal fields. Hence the AFI and IDI fields will be set to 470027.

4.3.2 The VER Field

The VER field is used to partition the ATN Network Addressing domain into a number of sub-ordinate Addressing Domains.

The values currently specified in Reference for the VER field are summarized in Table 4.3.2-1.

VER Field Value	Network Addressing Domain	Common NSAP Address Prefix for Domain	Values to be used by States of Asia/Pacific Region
[0000 0001]	Fixed AINSC	470027+01	
[0100 0001]	Mobile AINSC	470027+41	
[1000 0001]	Fixed ATSC	470027+81	470027+81 (ATSO ISs and ESs)
[1100 0001]	Mobile ATSC	470027+C1	470027+C1 (General Aviation)

Table 4.3.2-1 – Defined Values for the VER Field

4.3.3 The ADM Field

The ADM field is used to further partition the ATN Network Addressing Domain. The field designates a single State or Organization. Depending on what the VER field is set to will determine what values should be used in the ADM field.

When the VER field is set to "01" (Fixed AINSC) or "41" (Mobile AINSC), three alphanumeric characters derived from Doc. 8585 should be used.

When the VER field is set to "81" (Fixed ATSC) or "C1" (Mobile ATSC), the ATN SARPs permits two possible ways for encoding the ADM field.

The first method recommends that the State's three character alphanumeric ISO country code is used, as defined in ISO 3166. States may choose this method, however it will provide less flexibility than the second method for the addressing of regional entities (e.g. regional RDCs or regional organizations that are not country specific).

The second method that is recommended for use in the Asia/Pacific Region is to use the first octet of the field to define the ICAO region. Individual regions may be indicated or a combined Asia, Pacific, North America (NAM) region may be used. This would permit the reduction of the routing information that would otherwise be generated. It is recommended that the remaining two octets of the field will further identify the country, RDCs and the regional organizations that are not country specific as follows:

- For the identification of a country, it is recommended that States use the ICAO two letter location indicator (Reference 4) instead of the two character alphanumeric ISO 3166 country code. The structure of the ICAO two letter location indicator allows for a more efficient identification of a location. For example, indicators starting with the same letter "V" designate several countries in the same local region (e.g. Thailand, Sri Lanka, India, Cambodia etc). The second letter will actually define the specific country within this local region (e.g. "VT" for Thailand, "VC" for Sri Lanka etc.). Where a country has several ICAO two letter location indicators allocated to it, the assigning authority of the ADM field will be responsible in determining the preferred location indicator to represent that country. For example, the indicators "VA", "VI", "VO", "VE" are assigned to India and one of these indicators will be selected to represent India. The encoding of the ICAO two letter location indicators will be upper case alphanumeric values.

- For regional organizations that are not country specific, it is recommended to allocate a lower case alphanumeric value so as there will be no conflict with the ICAO two letter location indicators.

- For the addressing of RDCs (e.g. Island RDCs, Backbone RDCs), in particular for those that are not country specific, it is recommended to allocate codes with the most significant bit set to 1 in the second octet. Valid values would be in the hexadecimal range [8000 – FFFF].

ICAO Asia/Pacific Regional Office would be the allocation authority of the ADM field. In summary, the values allocated for the ADM field is indicated in Table 4.3.3-1.

VER Field Network Addressing Domain	**ADM Field Values**
Fixed AINSC	Derived from the set of three-character alphanumeric characters from Doc. 8585 (Reference 5).
Mobile AINSC	Derived from the set of three-character alphanumeric characters from Doc. 8585.
Fixed ATSC	To allow for efficient routing information to be exchanged, it is proposed that the ICAO Regional code be used in the first octet of the ADM field followed by the ICAO two-letter location indicator for countries. The Regional codes are shown below. Regional Codes: [1000 0000] Africa [1000 0001] Asia [1000 0010] Caribbean [1000 0011] Europe [1000 0100] Middle East [1000 0101] North America [1000 0110] North Atlantic [1000 0111] Pacific [1000 1000] South America [1001 0001] Asia/Pacific/NAM For example Thailand would be represented as part of the Asia region by the hexadecimal sequence "815654" or as part of the combined Asia/Pacific/NAM region by the hexadecimal sequence "915654". Table 4.3.3-2 provides further examples

	for a selected number of countries. Where a two letter country code is not applicable, the following rules would apply: ICAO would assign lower case alphanumeric characters using a two letter value to organizations that wish to be based in a particular region. For example, if an organization is to be based in the Pacific region and wanted to be represented by the characters 'sa', this would be represented by the following hexadecimal sequence: 877361. ICAO would assign regional codes for RDCs where a country code or organization code is not applicable. Values would be assigned with the most significant bit set to 1 in the second octet. For example a RDC established in the Pacific region would be represented by the following hexadecimal sequence: 878100.
Mobile ATSC	Same for Fixed ATSC

Table 4.3.3-1 – Defined Values for the ADM Field

Fixed or Mobile Asia/Pacific ATSC Addressing Domain	Hexadecimal Code of the ADM Field	Comment
Australia	915942	Asia/Pacific/NAM Region + 'YB'
China	915A42	Asia/Pacific/NAM Region + 'ZB'
India	915649	Asia/Pacific/NAM Region + 'VA'
Fiji	914E46	Asia/Pacific/NAM Region + 'NF'
Japan	91524A	Asia/Pacific/NAM Region + 'RJ'
New Zealand	914E5A	Asia/Pacific/NAM Region + 'NZ'
Singapore	915753	Asia/Pacific/NAM Region + 'WS'
Thailand	915654	Asia/Pacific/NAM Region + 'VT'
United States	915553	Asia/Pacific/NAM Region + 'US'
Viet Nam	915656	Asia/Pacific/NAM Region + 'VV'

Table 4.3.3-2 – Example of Proposed ADM Value Assignment for Selected Asia, Pacific, and North America Entities

4.3.4 The RDF Field

The RDF field is historical and is not used. Therefore the RDF field shall be set to [0000 0000].

4.3.5 The ARS Field

The ARS field is used to:

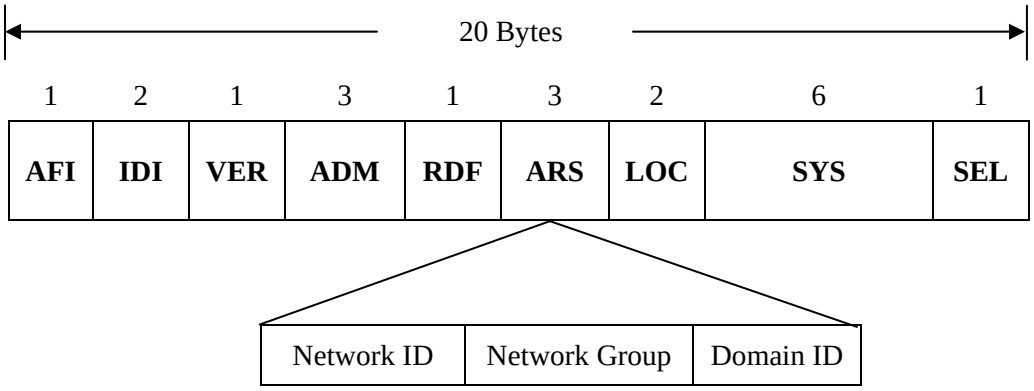
- Distinguish Routing Domains operated by the same State or Organization (in Fixed Network Addressing domains); and
- Identify the aircraft on which the addressed system is located (in Mobile Network Addressing Domains).

Each State or Organization identified in the ADM field will be responsible for assigning the values for the ARS field.
In accordance with the SARPs, for a Mobile Network Addressing Domain, the 24-bit ICAO Aircraft Identifier is inserted in the ARS field. However, no specific values have been specified for Fixed Network Addressing Domains.

The ARS field shall be assigned in a manner that simplifies the routing of data and makes provision for any potential lower level organizational units that could, in the future, operate an ATN Routing Domain.

The Asia/Pacific Regional ATN Addressing Plan recommends the ARS field be decomposed into three subfields as shown in Figure 4.3.5-1: Network ID, Network Group ID and Domain ID.

Figure 4.3.5-1 Recommended structure for ARS field



4.3.5.1 Network ID

Potential future operators of an ATN Routing Domain could be:

- A national Air Traffic Service Organization(s) (ATSO);
- A national military organization;
- A national meteorological organization; and
- An airport operator.

At present it is assumed that military organizations and meteorological organizations will not start up their own ATN Routing Domains and will be located within a national ATSO ATN Routing Domain. The same may apply to airport operators.

However in planning for the long term it is deemed necessary that provision is made available for these future possibilities.

In allowing for this possible expansion, it is recommended that the different ranges of values for the Network ID sub-field be allocated to the different national organizations as follows:

- Hexadecimal values [00 – 1F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national ATSO.
- Hexadecimal values [20 – 3F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national military organization.
- Hexadecimal values [40 – 5F] of the first octet of the ARS field be reserved for the addressing of domains and systems operated by the national airport operators. (Note: this range matches the ASCII range of alphabetical upper case characters).
- Hexadecimal values [60 – 7F] of the first octet of the ARS field is reserved for the addressing of domains and systems operated by the national meteorological organization.
- Hexadecimal values [80 – FF] are reserved.

A national organization would then be able to register one or several values for the Network ID sub-field within the range that has been reserved for its organization category.

In addition to the Network ID sub-field being used for distinguishing the different national organizations, it is proposed that this sub-field also be used for the identification of the particular role of the addressed domain. For example, setting the Network ID sub-field to the hexadecimal value “01” would represent the set of operational Routing Domains of the national ATSO. Setting the Network ID sub-field to hexadecimal “11” would represent the set of non-operational Routing Domains of the national ATSO. In using the Network ID sub-field in this manner, allow national ATSOs to provide for a duplicate non-operational network to be used for trials and pre-operational testing. Similar arrangements could be used for the other national organizations.

4.3.5.2 Network Group ID

This sub-field can be used to subdivide a ground ATN network into smaller groups. This field is unique within a particular network. This may be useful for future expansion by allowing regions to be formed within a particular network as defined by the Network ID. The formation of regions may be useful for the routing traffic exchanged within the network.

This sub-field is also used to designate an RDC. RDCs can also be used to assist in the formation of regions within an Administrative Domain and they offer an additional level of flexibility when used to combine RDs into a confederation. RDCs are designated by setting the uppermost bit of this sub-field to “1”.

4.3.5.3 Domain ID

This sub-field is a unique identifier assigned to each Routing Domain in the Network Group.

Table 4.3.5.3-1 shows possible examples on how the ARS field could be used. In the table two Network Groups "01" and "02" are defined. These two Network Groups can, for example, represent two FIRs in a country. One of the two Network Group contains two RDs and the other one contains three RDs. These two Network Groups can also address the initial RDs in a country (i.e. two RDs) with a planned expansion towards five RDs.

Network ID	Network Group ID	Domain ID	Comment
01	01	01 02	Network ID "01" indicates an ATSO operational network that contains two Network Groups "01" and "02". Network Group "01" contains two RDs "01" and "02". Network Group "02" contains three RDs "01", "02" and "03".
	02	01 02 03	

Table 4.3.5.3-1 – Example of ARS Value Assignment

4.3.5.4 Addressing RDCs in the ARS field

The Network Group ID sub-field is used to segregate the addressing space of actual RDs and RDCs. When the uppermost bit of the Network Group ID sub-field is set to "1" the second and third octets of the ARS field are assigned from the RDC addressing space (i.e., 8000-FFFF) and must be unique within that addressing domain. Otherwise, the sub-fields are assigned from the NSAP Address Space as described above for the Network Group ID and Domain ID sub-fields.
Similar principles as explained in sections 4.3.5.2 and 4.3.5.3 for the addressing of RDs can be applied to the addressing of RDCs, as required:

- The second octet of the ARS field may identify a group of RDCs.
- The third octet of the ARS field identifies RDCs.

4.3.6 The LOC Field

The LOC field is used to:

- Distinguish Routing Areas within Fixed Routing Domains, identified by the ARS field; and
- Distinguish Routing Areas and Routing domains within aircraft identified by the ARS field.

The assignment of the LOC field value is the responsibility of the State or organization that is the addressing authority for the routing domain in which the identified routing area is contained.
To assist States or organizations, it is recommended that the LOC field be divided into two sub-fields as shown in Figure 4.3.6-1: Sub-domain Group ID and Sub-domain ID.

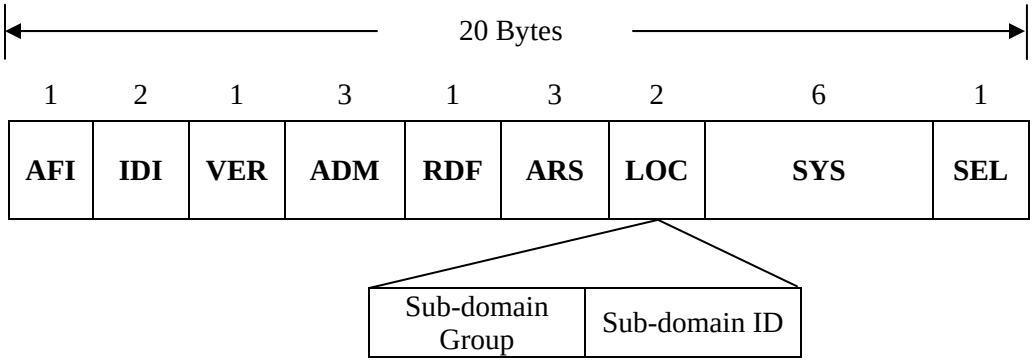


Figure 4.3.6-1 Proposed LOC Field Format

4.3.6.1 Sub-domain Group ID

This sub-field can be used to subdivide a domain into separate groups. For example, each control centre could define as a routing domain. A control centre may contain an En-Route facility, Terminal facilities, and Tower facilities. Each of these facilities can be classified as a different Sub-domain Group allowing addressing to be delegated to each facility, if desired. For this example, this sub-field can be assigned as shown in the Table 4.3.6.1-1.

Value (hex)	Description
00	Reserved
01	No specific group. Used for RDs that do not require subdivision
02	En-Route Sub-domain
03 – FF	Assigned as required

Table 4.3.6.1-1 – Example of Sub-domain Group ID Value Assignment

4.3.6.2 Sub-domain ID

This sub-field is a unique identifier assigned to each routing area within a Sub-domain Group. This sub-field allows multiple areas to exist within a sub-domain group and must be unique within the sub-domain. This subfield could be assigned as shown in the Table 4.3.6.2-1.

Value (hex)	Description
00	Reserved
01	No specific area. Used for Sub-domains that do not require subdivision
02 – FF	Assigned as required by the Sub-domain Group Addressing Authority

Table 4.3.6.2.1 – Example of Sub-domain ID Value Assignment

4.3.7 The SYS Field

The SYS field is used to uniquely identify an End-System or Intermediate-System. The allocation of the SYS field value is the responsibility of the organization that is the addressing authority for the routing area that contains the identified ATN End-System or Intermediate-System.

The type of values or structure for the SYS field is for individual authorities to choose, as appropriate.

It has been suggested that the 48-bit LAN address of a device attached to an IEEE 802 local area network that is being used as an ATN ES or IS, could be used in this field. However, this may have ramification if the SYS field is tied to a sub-network dependent information such as the physical network address (e.g. 48-bit LAN address) that is associated with a particular device. The problem will occur when the device is replaced by another device which will use a different 48-bit LAN address, requiring the NSAP address of the ATN ES or IS to be changed.

It is therefore recommended that the SYS field be used to identify the system without any dependency on physical information. Possible examples of this is to define whether the system is an IS or an ES, the type of function or role the system is used for (e.g. primary system, hot standby system, cold standby system, etc.), or the type of applications that are running on the system (e.g. AMHS, AIDC, ADS, CPDLC, Network Management, etc.).

A requirement found in Section 7.1.4.b.1 of ISO 10589 IS-IS states that all Level 2 ISs within a Routing Domain must have a unique SYS field value. In order to enforce this requirement related to IS-IS Level 2 addressing, it is recommended that the values assigned to the LOC sub-fields also be assigned to the upper two octets of the SYS field. Using this approach enables the addressing authority for each Sub-domain Group the flexibility to assign addresses without conflicting with addresses of other groups within the same Routing Domain.

4.3.8 The SEL Field

The SEL field is used to identify the End-System or Intermediate-System network entity or network service user process responsible for originating or receiving Network Service Data Units (NSDUs).

Table 4.3.8-1 identifies the defined values that shall be used in this field in accordance with Reference.

SEL Field Value	Usage
[0000 0000]	Used for an IS network entity except in the case of an airborne IS implementing the procedures for the optional non-use of IDRP.
[0000 0001]	Used for the ISO 8073 COTP protocol in the Ground or Airborne End-systems.
[0000 0010]	Used for the ISO 8602 CLTP protocol in the Ground or Airborne End-systems.
[1111 1110]	Used for an IS network entity belonging to an airborne IS implementing the procedures for the optional non-use of IDRP.
[1111 1111]	Reserved

Table 4.3.8-1 – Defined Values for the SEL field

4.4 Authority Responsible for NSAP Field Assignments

The responsibility for the assignment of values to each of the NSAP address fields is held by only one organization. This is to ensure that each NSAP address is unique within the ATN. Table 4.4-1 identifies which organization is responsible for the assignment of each field.

NSAP Field	Assignment Authority
AFI	ITU-T and ISO
IDI	ITU-T and ISO
VER	ICAO – defined in Doc. 9705
ADM	States or Organizations identified by the VER field and according to rules found in Doc. 9705 – Recommended values and responsible authority are provided in this plan.
RDF	Reserved
ARS	States or Organizations at the discretion – Recommended values in this plan
LOC	States or Organizations
SYS	States or Oganizations
SEL	ITU-T and ISO for standard transport protocol, States and Organizations for other values/uses

Table 4.4-1 – NSAP Address Field Assignment Responsibility

ANNEX C

Test Procedure
for
ATN Router Connection Test

ANNEX C

of

AMHS Manual

Document Control Log

Edition	Date	Comments	Section/pages affected
1.0	11/04/2007	Creation of the document.	all
1.0	September 2007	Document is endorsed by APANPIRG/18	all
2.0	22/09/2008	Editorial updates – change of document version number	all
3.0	September 2009	Editorial updates – change of document version number	all
3.1	2010	Proposed amendments (Draft)	

Table of Contents

1. Introduction

1.1 This document describes the test procedure for the Ground-Ground (G/G) Aeronautical Telecommunication Network (ATN) router connection.

2. References

[1] Asia/Pacific Regional ATN G/G Router ICD for ISO/IEC 8202 Sub-Network.

[2] ASIA/PAC Interface Control Document (ICD) for ATN G/G Router

[3] Test Plan for AMHS Technical Trial between Hong Kong, China and Japan.

[4] "Technical Memorandum of Cooperation between Engineering & Systems Division, Civil Aviation Department, Hong Kong China and Operations and Flight Inspection Division, Civil Aviation Bureau, Ministry of Land, Infrastructure and Transport, Japan: AMHS Trials and Service between Japan and Hong Kong, China", February 2003. (Amended 24 August 2004)

3. Test Overview and Scope

3.1 A joint ATN Router Connection Test between AMHSLAND1 and AMHSLAND2 using a 9.6kbps X.25 PSDN (packet-switched data network) circuit.

3.2 An ATN Router Connection Test is scheduled to verify the connectivity, interoperability, data relaying/routing and redundancy capabilities (where applicable) of the ATN Ground-Ground routers in AMHSLAND1 and AMHSLAND2.

3.3 The ATN Router Connection Test will also confirm that the functions of the AMHSLAND1 and AMHSLAND2 ATN routers were configured in preparation for more than 2 routers tests.

3.4 The system configuration for the test is shown in Figure 1. Routers in AMHSLAND1 and AMHSLAND2 are linked by an X.25 virtual circuit (VC) over a leased line connection (e.g.64 kbps).

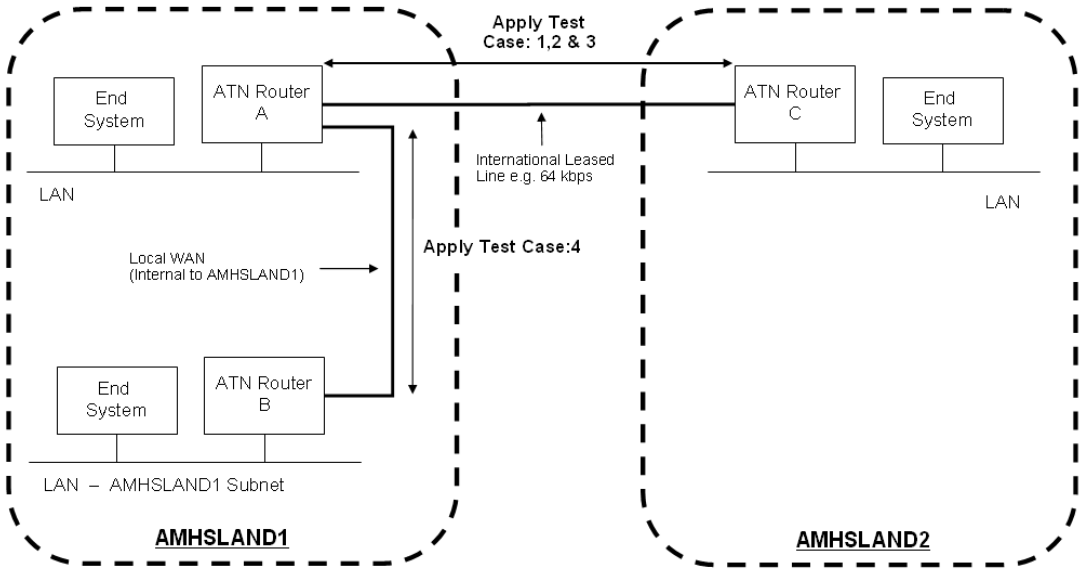


Figure 1 ATN Router Connection Test Configuration

3.5 To test data relay and routing functions, CLNP Echo Request (ERQ) Network Protocol Data Units (NPDU) will be generated by the routers and End Systems. To support these tests, all Intermediate Systems shall be capable of generating CLNP ERQ PDUs, and all Intermediate Systems and End Systems shall be capable of transmitting CLNP Echo Response (ERP) PDUs in response to the receipt of ERQ PDUs. Further, it is desirable that End Systems be capable of generating CLNP ERQ PDUs. Execution of some test items is contingent on End Systems' capabilities.

3.6 Since both AMHSLAND1 and AMHSLAND2 are ATN backbone sites, the proper updating of their routing tables should be tested in detail. This will ensure that the router could relay the data received from its counterpart to another router either within or outside its own domain/ATN site.

3.7 The ATN router network test is to verify the connectivity, interoperability, data relaying/routing and redundancy capabilities (where applicable) of the ATN Ground-Ground routers when expanded to a three and then four domains configuration. The system test configuration is as shown in Figure 2.

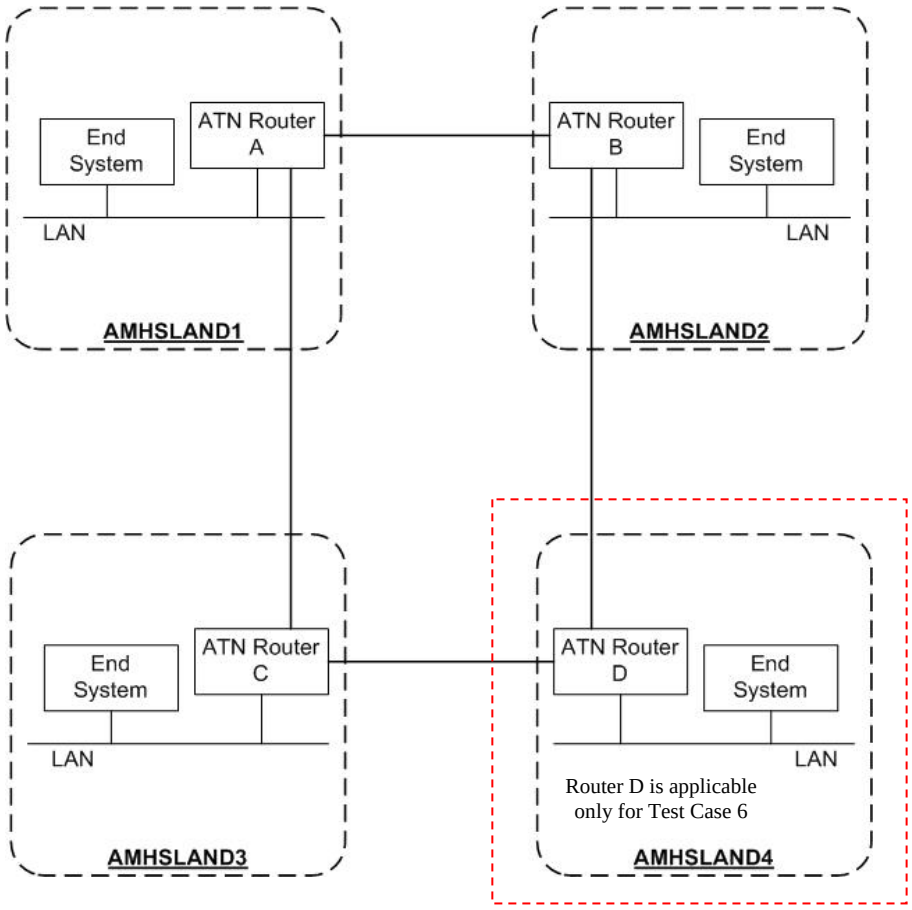


Figure 2 ATN Routers Connection (Multiple Domains) Test Configuration

3.8 A summary of test items for the ATN Router Connection Test is shown in Table 1.

Table 1 Summary of Test Items for ATN Router Connection Test

No.	Test Item	Details
1	Router Connection Establishment and Maintenance	Establish LAPB, X.25 VC and IDRP connections between routers. Exchange of KEEPALIVE PDUs to maintain IDRP connection.
2	NPDU Relay	Tests to confirm CLNP Echo function of routers, correct NPDU relay, and validation of handling of PDUs with invalid security option parameter.
3	Router end-to-end tests	IDRP route addition/deletion, carrier medium failure/restoration and router failure/recovery.
4	ATN router environment tests	Multiple router route addition/deletion, carrier medium failure/restoration and router failure/recovery.
5	ATN router network tests	Multiple router route addition/deletion, carrier medium failure/restoration and router failure/recovery in three-domain configurations. Confirm routing table updates and automatic re-route.
6	ATN router network tests	Multiple router route addition/deletion, carrier medium failure/restoration and router failure/recovery in four-domain configurations. Confirm routing table updates and automatic re-route.

4. Communication Parameters

4.1 The proposed communication parameters for the connection between the routers of AMHSLAND1 and AMHSLAND2 for test case 1 to 4 are listed in Table 2.

4.2 The proposed CLNP communication parameters for the End Systems are listed in Table 5. It is proposed to use the NSAP addresses of the AMHS systems that will be used in actual operation for the ES NSAP addresses.

4.3 The proposed communications parameters for the connection between the routers of AMHSLAND1, AMHSLAND2, AMHSLAND3 and AMHSLAND4 for test case 5 and 6 are listed in Table 6.

5. Schedule and Test Item Overview

5.1 The test items and planned schedule are shown in Table 7.

Table 2Router Communication Parameters

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1)	**Router (AMHSLAND2)**	
	1.1	NSAP/NET	ROUTER A: 47.0027.81.91524A.00.010101.0302.000000000000.00 ROUTER B (simulated third domain): 47.0027.81.914b00.00.010101.0302.000000000000.00	ROUTER C: 47.0027.81.915648.00.010101.0202.0202.012A.0100.00	1
CLNP (RPDU)	2.1	Priority	14	14	2
IDRP	3.1	NLRI	ROUTER A: 47.0027.81.91524A.00.010101 ROUTER B: 47.0027.81.914b00.00.010101	ROUTER C: 47.0027.81.915648.00.010101	
	3.2	RDI	ROUTER A: 47.0027.81.91524A.00.010101 ROUTER B: 47.0027.81.914b00.00.010101	ROUTER C: 47.0027.81.915648.00.010101	
	3.3	SecurityRegistrationID	06 04 2B 1B 00 00	06 04 2B 1B 00 00	2
	3.4	Tag Set Name	07 (ATSC Class Security Tag Set)	07 (ATSC Class Security Tag Set)	2
	3.5	ATSC Class	Class C	Class C	2
	3.6	Holding Time	180 sec	180 sec	2
	3.7	KEEPALIVE Send Timer	60 sec	60 sec	2, 3
	3.8	OPEN PDU Transmission	ROUTER A: AMHSLAND1-AMHSLAND2 : OPEN-PDU send ROUTER A: local circuit: OPEN-PDU send ROUTER B: OPEN-PDU receive	ROUTER C: AMHSLAND2 -AMHSLAND1: OPEN-PDU receive ROUTER C: local circuit: OPEN-PDU send	

Note 1: Compliant with Asia/Pacific ATN addressing plan.

Note 2: For all routers used in tests.

Note 3: The value of the KEEPALIVE send timer is the holding timer value divided by 3.

Table 3Router Communication Parameters (continued)

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1)	**Router (AMHSLAND2)**	
X.25	4.1	DTE Address	ROUTER A AMHSLAND1-AMHSLAND2 : 44442000023903 ROUTER A local circuit: 44442000023903 ROUTER B local circuit: 44440110110202	ROUTER C AMHSLAND1-AMHSLAND2 : 48404701021800 ROUTER C local circuit: local matter	
	4.2	LCGN	0	0	4
	4.3	LCN	10	10	4
	4.4	Packet Size	1024	1024	4
	4.5	Window Size	7	7	4
	4.6	Window Size Negotiation	Yes	Yes	4
	4.7	CR Packet Transmission	ROUTER A AMHSLAND1-AMHSLAND2 : Caller (CR send) ROUTER A local circuit: Caller (CR send) ROUTER B local circuit: Called (CR receive)	ROUTER C AMHSLAND1-AMHSLAND2 : Called (CR receive) ROUTER C local circuit: Caller (CR send)	
	4.8	Use of SQ	Yes	Yes	4
	4.9	Packet Sequence	Modulo 8	Modulo 8	4
	4.10	Packet Negotiation	Yes	Yes	4
	4.11	D Bit	OFF	OFF	4
	4.12	M Bit	Yes	Yes	4
	4.13	Restart Request Retransmission Count (R20)	1	1	4
	4.14	Reset Request Retransmission (R22)	1	1	4
	4.15	Clear Request Retransmission Count (R23)	1	1	4
	4.16	Restart Request Timer (T20)	180 sec	180 sec	4
	4.17	DTE Call Request timer (T21)	200 sec	200 sec	4
	4.18	Reset Confirmation Timer (T22)	180 sec	180 sec	4
	4.19	DTE Clear Confirmation Timer (T23)	180 sec	180 sec	4

Note 4: For AMHSLAND1-AMHSLAND2 circuit. Parameters for local circuits used in more than 2 routers tests are a local matter.

Table 4Router Communication Parameter (continued)

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1)	**Router (AMHSLAND2)**	
LAPB	5.1	Address	ROUTER A AMHSLAND1-AMHSLAND2 : 03 ROUTER A local circuit: 03 ROUTER B local circuit: 01	ROUTER C AMHSLAND1-AMHSLAND2 : 01 ROUTER C local circuit: local matter	
	5.2	Max Outstanding Number	7	7	5
	5.3	Idle Channel State Timer (T3)	60 sec	60 sec	5, 6
	5.4	ACK Receipt Timer (T1)	3 sec	3 sec	5, 7
	5.5	Frame Retransmission Count	5	5	5
	5.6	Maximum Number of bits in I-Frame (N1)	8248	8248	5, 8
	5.7	Frame Sequence	Modulo 8	Modulo 8	5
Physical	6.1	Interface	X.21/V.11 (Line Speed: 64 kbps)	V.11 (Line Speed: 64 kbps)	5
	6.2	Clock	Local Matter	Local Matter	5

Note 5: For AMHSLAND1-AMHSLAND2 circuit. Parameters for local circuits used in more than 2 routers tests are a local matter.

Note 6: APAC ROUTER ICD (ref. [1]) specifies router A: 18–60 seconds, router B: 12–60 seconds.

Note 7: APAC ROUTER ICD (ref. [1]) specifies 6 sec, based on 9,600bps line speed and 256 byte packets.

Note 8: Value depends on the max. X.25 packet size. N1 = packet header size (3) + packet size (bytes) + LAPB address part (1) + LAPB control part (1) + LAPB FCS part (2) in BITS. So if the packet size is 1024 bytes, then N1 is (3 + 1024 + 1 + 1 + 2) * 8 = 8248 bits.

Table 5 End System CLNP Communication Parameters

Protocol	Item No.	Item	Parameter	
			Router (AMHSLAND1)	**Router (AMHSLAND2)**
	7.1	NSAP	AMHSLAND1 ES: 470027.81.91524A.00.010101.0302.128001091001.01 Third domain ES: 470027.81.914b00.00.010101.0302.000000010051.01	AMHSLAND2 ES: 47.0027.81.915648.00.010101.0202.0202.8002.0100.01
CLNP	7.1	Traffic Type	1 (ATSC/No Traffic Type Policy Preference)	1 (ATSC/No Traffic Type Policy Preference)
	7.2	Security Class	1 (Unclassified)	1 (Unclassified)
	7.3	Priority	8	8
	7.4	Partial Route Recording	No	No

Table 6 Router Communication Parameters (continued)

Protocol	Item No.	Item	Parameter		Note
			Router (AMHSLAND1 & AMHSLAND3)	**Router (AMHSLAND2 & AMHSLAND4)**	
	8.1	NSAP/NET	ROUTER A (AMHSLAND1): 47.0027.81.91524A.00.010101.0302.000000000000.00 ROUTER C (AMHSLAND3): 47.0027.81.915654.00.010101.0302.000000000000.00	ROUTER B (AMHSLAND2): 47.0027.81.915648.00.010101.0202.0202.012A.0100.00 ROUTER D (AMHSLAND4): 47.0027.81.915753.00.010101.0202.0202.012A.0100.00	1
CLNP (RPDU)	9.1	Priority	14	14	2
IDRP	10.1	NLRI	ROUTER A: 47.0027.81.91524A.00.010101 ROUTER C: 47.0027.81.915654.00.010101	ROUTER B: 47.0027.81.915648.00.010101 ROUTER D: 47.0027.81.915753.00.010101	
	10.2	RDI	ROUTER A: 47.0027.81.91524A.00.010101 ROUTER C: 47.0027.81.915654.00.010101	ROUTER B: 47.0027.81.915648.00.010101 ROUTER D: 47.0027.81.915753.00.010101	
	10.3	SecurityRegistrationID	06 04 2B 1B 00 00	06 04 2B 1B 00 00	2
	10.4	Tag Set Name	07 (ATSC Class Security Tag Set)	07 (ATSC Class Security Tag Set)	2
	10.5	ATSC Class	Class C	Class C	2
	10.6	Holding Time	180 sec	180 sec	2
	10.7	KEEPALIVE Send Timer	60 sec	60 sec	2, 3
	11.1	NSAP	AMHSLAND1 ES: 470027.81.91524A.00.010101.0302.128001091001.01 AMHSLAND3 ES: 470027.81.915654.00.010102.0302.000000010051.01	AMHSLAND2 ES: 47.0027.81.915648.00.010101.0202.0202.8002.0100.01 AMHSLAND4 ES: 47.0027.81.915753.00.010101.0202.0202.8002.0100.01	

Note 1: Compliant with Asia/Pacific ATN addressing plan.

Note 2: For all routers used in tests.

Note 3: The value of the KEEPALIVE send timer is the holding timer value divided by 3.

Table 7 Test Items and Schedule

Schedule (UTC)		Test Item No.			Description
Day	**Time**				
		1			**Router Connection Establishment and Maintenance**
			1	1～2	Data link establishment
			2	1～4	X.25 VC establishment
			3	1～2	IDRP connection establishment
			4	1～2	Exchange of routing information (UPDATE PDU transmission)
			5	1～2	Maintenance of IDRP connection (KEEPALIVE PDU transmission)
		2			**NPDU Relay**
			1	1～3	ERQ/ERP NPDU transmission /reply from AMHSLAND1 router to AMHSLAND2 router
			2	1～3	ERQ/ERP NPDU transmission /reply from AMHSLAND2 router to AMHSLAND1 router
			3	1～3	ERQ/ERP NPDU transmission/reply from AMHSLAND1 ES to valid destination in AMHSLAND2 domain
			4	1～3	ERQ/ERP NPDU transmission from AMHSLAND2 ES to valid destination in AMHSLAND1 domain (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)
			5	1～2	ERQ NPDU transmission from AMHSLAND1 ES to unreachable ES in AMHSLAND2 domain
			6	1～2	ERQ NPDU transmission from AMHSLAND2 ES to unreachable ES in AMHSLAND1 domain (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)
			7	1～2	Routing process in AMHSLAND1 router for NPDU with invalid security option parameter
			8	1～2	Routing process in AMHSLAND2 router for NPDU with invalid security option parameter (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)
		3			**Router end-to-end tests**
			1	1～5	Manual router disconnection at AMHSLAND1 router and route deletion
			2	1	Route activation from AMHSLAND1 router
			3	1～5	Manual router disconnection at AMHSLAND2 router and route deletion
			4	1	Route activation from AMHSLAND2 router
			5	1～3	Carrier medium failure and route deletion at AMHSLAND1 router
			6	1	Carrier medium restoration and route addition at AMHSLAND1 router

Schedule (UTC)		Test Item No.			Description
Day	**Time**				
			7	1～3	Carrier medium failure and route deletion at AMHSLAND2 router
			8	1	Carrier medium restoration and route addition at AMHSLAND2 router
			9	1～2	Failure and recovery of AMHSLAND1 router (redundant configuration)
			10	1～2	Failure and recovery of AMHSLAND2 router
		4			**ATN Router Tests: Third Domain connected to AMHSLAND1**
			1	1 ~ 5	Router connection of ROUTER B to ROUTER A (ROUTER A–ROUTER C connection already established)
			2	1 ~ 5	Manual router disconnection at ROUTER A of ROUTER A–ROUTER B route
			3	1 ~ 4	Re-activation at ROUTER A of ROUTER A-ROUTER B route
			4	1 ~ 5	Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route
			5	1 ~ 4	Re-activation at ROUTER B of ROUTER A–ROUTER B route
			6	1 ~ 5	Router connection of ROUTER C to ROUTER A (ROUTER A-ROUTER B connection already established)
			7	1 ~ 5	Manual router disconnection at ROUTER C of ROUTER C–ROUTER A route
			8	1 ~ 4	Re-activation at ROUTER C of ROUTER C-ROUTER A route
			9	1 ~ 5	Manual router disconnection at ROUTER A of ROUTER C–ROUTER A route
			10	1 ~ 4	Re-activation at ROUTER A of ROUTER C–ROUTER A route
			11	1 ~ 3	Carrier medium failure of ROUTER A–ROUTER B circuit
			12	1 ~ 4	Carrier medium recovery of ROUTER A–ROUTER B circuit
			13	1 ~ 3	Carrier medium failure of ROUTER C–ROUTER A circuit
			14	1 ~ 4	Carrier medium recovery of ROUTER C–ROUTER A circuit
			15	1 ~ 2	Failure and recovery of ROUTER C
			16	1 ~ 2	Failure and recovery of ROUTER A
			17	1 ~ 2	Failure and recovery of ROUTER B
			18	1～6	End-to-End CLNP Echo Test between end systems in ROUTER C and ROUTER B domains (Subject to AMHSLAND2 ES ERQ NDU transmission capability.)

Schedule (UTC)		Test Item No.			Description
Day	**Time**				
		5			**ATN Router Network Test: Three Domain Configuration**
			1	1～4	Router Connection of ROUTER A to ROUTER B (ROUTER A – ROUTER C and ROUTER B – ROUTER C established)
			2	1～3	CLNP echo test between routers
			3	1～6	Manual router disconnection at ROUTER A of ROUTER A – ROUTER B route
			4	1 ~ 3	Router re-activation from ROUTER A
			5	1 ~ 6	ROUTER B – ROUTER C route
			6	1 ~ 3	Route re-activation from ROUTER B
			7	1 ~ 6	Manual router disconnection at ROUTER C of ROUTER C – ROUTER A route
			8	1 ~ 3	Route re-activation from ROUTER C
			9	1 ~ 4	Carrier media failure of ROUTER A – ROUTER B circuit and route deletion
			10	1 ~ 3	Carrier media restoration of ROUTER A – ROUTER B circuit and router addition
			11	1 ~ 4	Carrier media failure of ROUTER B – ROUTER C circuit and route deletion
			12	1 ~ 3	Carrier media restoration of ROUTER B – ROUTER C circuit and router addition
			13	1 ~ 4	Carrier media failure of ROUTER C – ROUTER A circuit and route deletion
			14	1 ~ 3	Carrier media restoration of ROUTER C – ROUTER A circuit and router addition
			15	1 ~ 2	Failure and recovery of ROUTER A
			16	1 ~ 2	Failure and recovery of ROUTER B
			17	1 ~ 2	Failure and recovery of ROUTER C
			18	1 ~ 3	CLNP echo test between routers

Schedule (UTC)		Test Item No.			Description
Day	**Time**				
		6			**ATN Router Network Test: Four Domain Configuration**
			1	1～6	Router Connection of ROUTER A to ROUTER B (ROUTER A – ROUTER C and ROUTER B – ROUTER D established)
			2	1～3	Router connection of ROUTER C to ROUTER D
			3	1～4	CLNP echo test between routers
			4	1 ~ 4	Manual router disconnection at ROUTER A of ROUTER A – ROUTER B route
			5	1 ~ 3	Route re-activation from ROUTER A
			6	1 ~ 4	Manual router disconnection at ROUTER B of ROUTER B – ROUTER D route
			7	1 ~ 3	Route re-activation from ROUTER B
			8	1 ~ 4	Manual router disconnection at ROUTER D of ROUTER D – ROUTER C route
			9	1 ~ 3	Route re-activation from ROUTER D
			10	1 ~ 4	Manual router disconnection at ROUTER C of ROUTER C – ROUTER A route
			11	1 ~ 3	Route re-activation from ROUTER C
			12	1 ~ 4	Carrier media failure of ROUTER A – ROUTER B circuit
			13	1 ~ 3	Carrier media restoration of ROUTER A – ROUTER B circuit and router addition
			14	1 ~ 4	Carrier media failure of ROUTER B – ROUTER D circuit
			15	1 ~ 3	Carrier media restoration of ROUTER B – ROUTER D circuit and router addition
			16	1 ~ 4	Carrier media failure of ROUTER D – ROUTER C circuit
			17	1 ~ 3	Carrier media restoration of ROUTER D – ROUTER C circuit and router addition
			18	1 ~ 4	Carrier media failure of ROUTER C – ROUTER A circuit
			19	1 ~ 3	Carrier media restoration of ROUTER C – ROUTER A circuit and router addition
			20	1 ~ 2	Failure and recovery of ROUTER A
			21	1 ~ 2	Failure and recovery of ROUTER B
			22	1 ~ 2	Failure and recovery of ROUTER C
			23	1 ~ 2	Failure and recovery of ROUTER D
			24	1 ~ 3	CLNP echo test between routers

6. Test Cases

The table below shows the protocol abbreviations used in sequence diagrams.

Table 8 Protocol Abbreviations

Abbreviation	Protocol	Name
SABM	LAPB	Set Asynchronous Balanced Mode
UA	LAPB	Acknowledgement frame
SQ	X.25	Restart Request
SI	X.25	Restart Indication
SF	X.25	Restart Confirmation
CR	X.25	Call Request
CC	X.25	Call Connected
CQ	X.25	Clear Request
CF	X.25	Clear Confirmation
OPEN PDU	IDRP	OPEN Protocol Data Unit
UPDATE PDU	IDRP	UPDATE Protocol Data Unit
KEEPALIVE PDU	IDRP	KEEPALIVE Protocol Data Unit
CEASE PDU	IDRP	CEASE Protocol Data Unit
ERQ NPDU	CLNP	Echo request Network PDU
ERP NPDU	CLNP	Echo response Network PDU
ER NPDU	CLNP	Error report Network PDU

6.1. Test Case 1: Router Connection Establishment and Maintenance

a) **Objective**

This test is to verify the establishment of LAPB data link, X.25 Virtual Circuit and IDRP connections between the AMHSLAND2 and AMHSLAND1 routers, the exchange of routing information by UPDATE PDUs, and the maintenance of the IDRP connection by the periodic exchange of KEEPALIVE PDUs. The test configuration is shown in Figure 3.

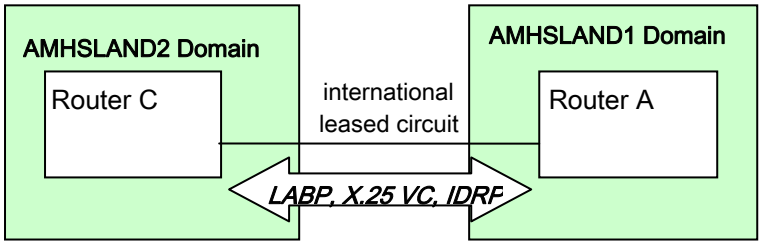


Figure 3 Configuration for router Connection & Maintenance Test

b) **Test Items**

- 1-1: Data link (LAPB) establishment
- 1-2: X.25 Virtual Circuit establishment
- 1-3: IDRP connection establishment (exchange of OPEN PDUs)
- 1-4: Exchange of routing information (exchange of UPDATE PDUs)
- 1-5: Maintenance of IDRP connection (exchange of KEEPALIVE PDUs)

Table 9 Router Connection Establishment & Maintenance Test Procedure

1. Router Connection Establishment & Maintenance		**Test Item**	**Procedure**	**Result**	**Date/Time**
Data link establishment	SABM transmission	1-1-1	Send SABM frame (address: 01) from ROUTER A and confirm ROUTER C receives it.	OK / NG	/ /
	UA transmission	1-1-2	Send UA frame (address: 03) from ROUTER C and confirm ROUTER A receives it and data link is established.	OK / NG	/ /
VC establishment	SQ transmission	1-2-1	Confirm ROUTER A sends SQ packet and ROUTER C receives it. (ROUTER C may send SQ packet, depending on the situation.)	OK / NG	/ /
	SI transmission	1-2-2	After receiving SQ packet from ROUTER A, confirm ROUTER C sends SI packet and ROUTER A receives it. (ROUTER C may send SQ packet, depending on the situation.)	OK / NG	/ /
	CR transmission	1-2-3	Confirm ROUTER A sends CR packet (packet size: 1024, LCGN: 0, LCN: 10, calling DTE address: ROUTER A DTE address, called DTE address: ROUTER C DTE address). Confirm ROUTER C receives it.	OK / NG	/ /
	CC transmission	1-2-4	Confirm ROUTER C sends CC packet (packet size: 1024, LCGN: 0, LCN: 10, calling DTE address: ROUTER A DTE address, called DTE address: ROUTER C DTE address). Confirm ROUTER A receives it, and VC is established.	OK / NG	/ /
IDRP connection establishment	OPEN PDU transmission from ROUTER A	1-3-1	After VC establishment, confirm ROUTER A sends an OPEN PDU. Confirm ROUTER C receives it.	OK / NG	/ /
	OPEN PDU transmission from ROUTER C	1-3-2	After receiving OPEN PDU from ROUTER A, confirm ROUTER C sends an OPEN PDU. Confirm that ROUTER A receives it, and IDRP connection is established.	OK / NG	/ /

1. Router Connection Establishment & Maintenance		**Test Item**	**Procedure**	**Result**	**Date/Time**
UPDATE PDU transmission	UPDATE PDU transmission from ROUTER A	1-4-1	After IDRP connection established, confirm ROUTER A sends an UPDATE PDU (security registration ID: 06042B1B0000, tag set name: 07, ATSC Class: ATSC Class C, holding timer: 180 sec) to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and routing information for ROUTER A is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C	1-4-2	After IDRP connection established, confirm ROUTER C sends an UPDATE PDU (security registration ID: 06042B1B0000, tag set name: 07, ATSC Class: ATSC Class C, holding timer: 180 sec) to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and routing information for ROUTER C is added.	OK / NG	/ /
IDRP connection maintenance	KEEPALIVE PDU transmission from ROUTER A	1-5-1	After IDRP connection established, confirm ROUTER A sends a KEEPALIVE PDU to ROUTER C every 60 seconds. At ROUTER C, confirm routing information received from ROUTER A is not deleted by receiving KEEPALIVE PDU continuously.	OK / NG	/ /
	KEEPALIVE PDU transmission from ROUTER C	1-5-2	After IDRP connection established, confirm ROUTER C sends a KEEPALIVE PDU to ROUTER A every 60 seconds. At ROUTER A, confirm routing information received from ROUTER C is not deleted by receiving KEEPALIVE PDU continuously.	OK / NG	/ /

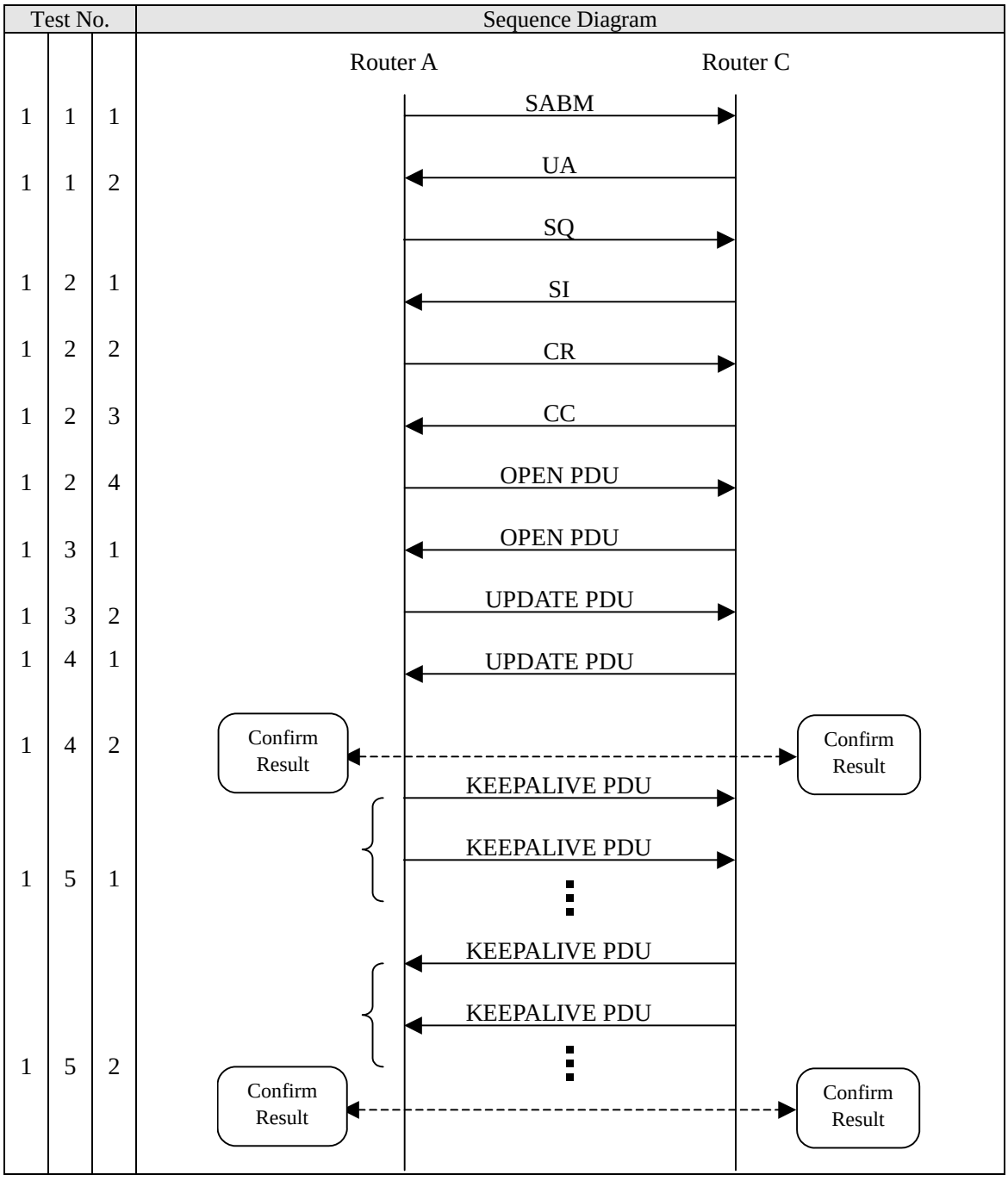


Figure 4 Sequence: Router Connection Establishment and Maintenance

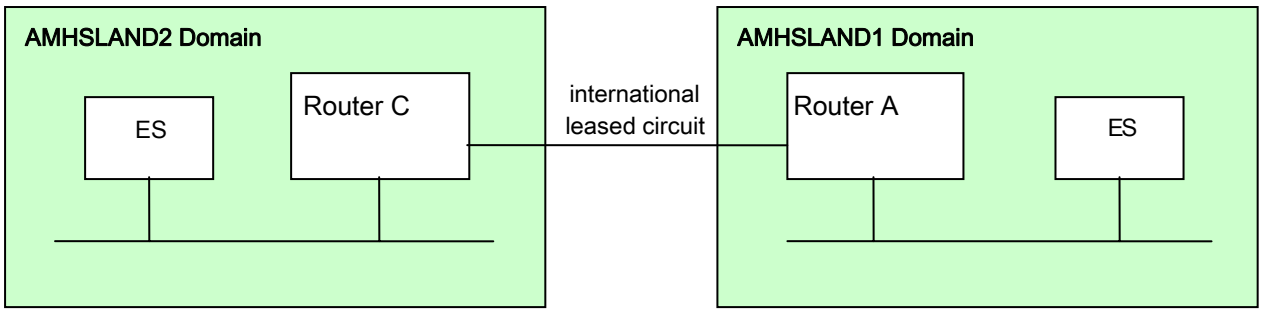
6.2. Test Case 2 : NPDU Relay

a) **Overview**

This test uses the CLNP Echo function to test correct relay and routing of CLNP NPDUs by the AMHSLAND2 and AMHSLAND1 routers. End Systems in both domains are used to verify end-to-end transmission of CLNP PDUs via the routers. The test configuration is shown in Figure 5. The test verifies the following:

(i) CLNP Echo Request/Echo Response function of both routers.
(ii) Relay of CLNP NPDUs by routers to the peer domain.
(iii) ER-PDU returned by peer router when sending a CLNP NPDU to an unknown address in the peer domain.
(iv) Non-relay of CLNP PDUs with incorrect security parameter by own domain router.

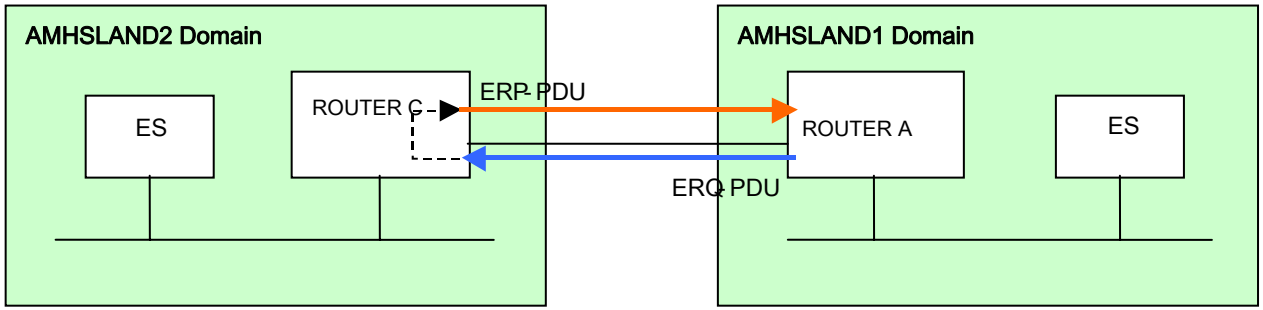
Figure 5 NPDU Transmission and Relay Test Configuration



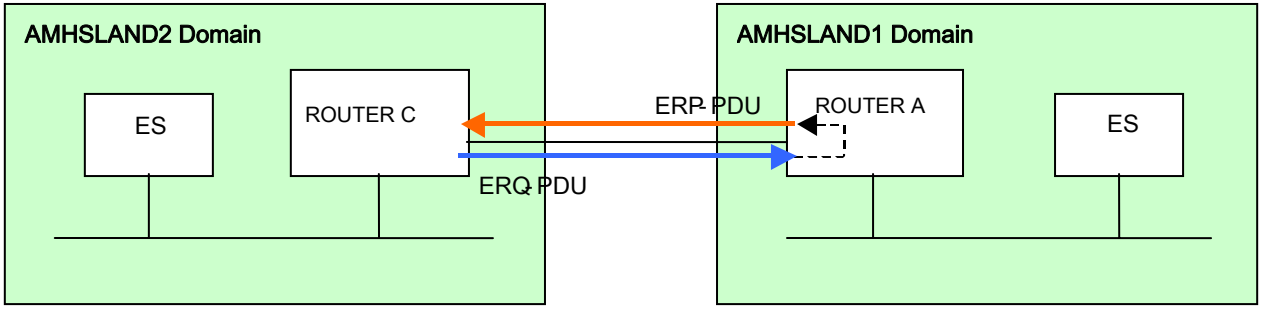
b) **Test Items**

Note: Some of these test items may not be carried out, depending on the capability of End Systems in each domain in to transmit ERQ-PDUs.

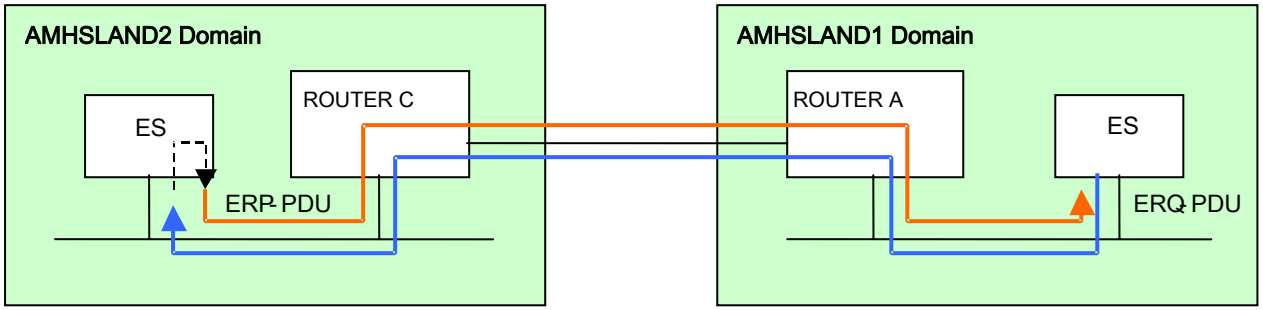
- 2-1: CLNP Echo from AMHSLAND1 router to AMHSLAND2 router.



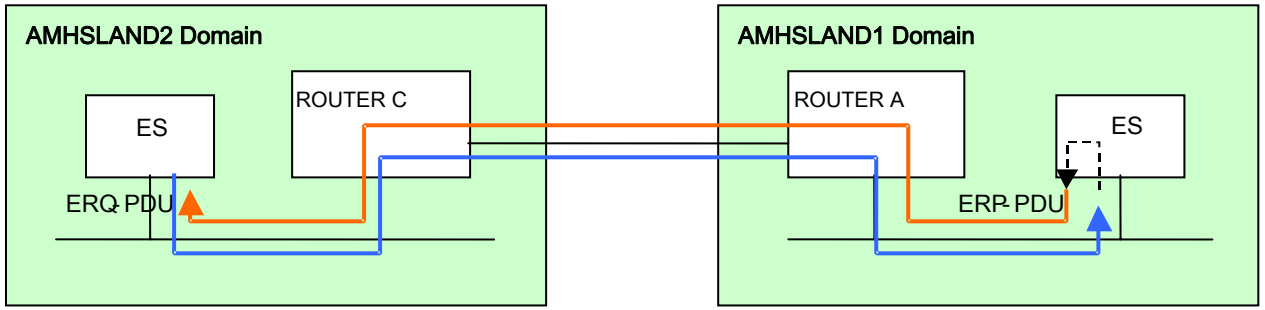
- 2-2: CLNP Echo from AMHSLAND2 router to AMHSLAND1 router.



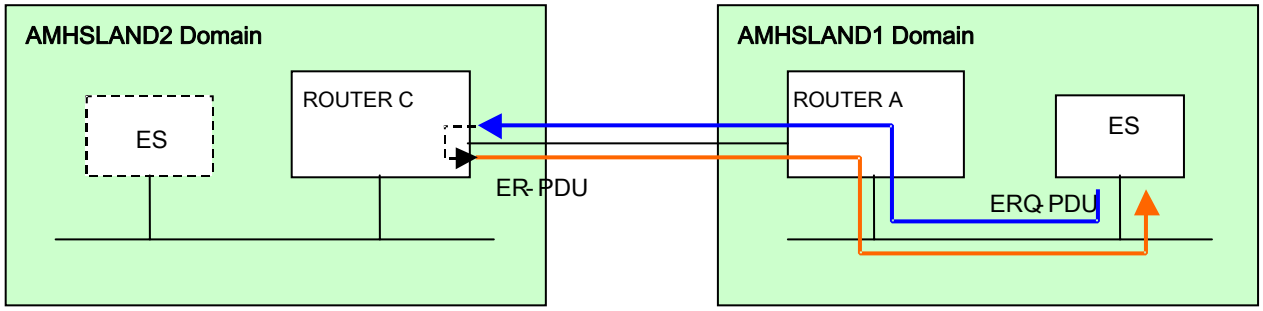
- 2-3: CLNP Echo from AMHSLAND1 End System to valid destination at AMHSLAND2.



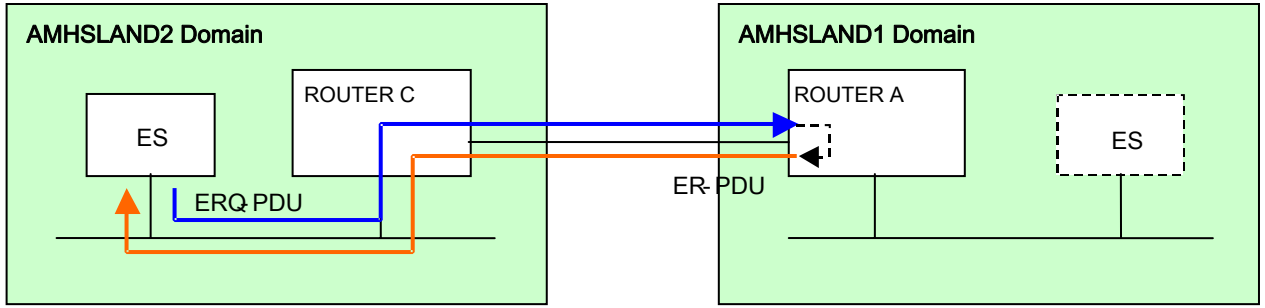
- 2-4: CLNP Echo from AMHSLAND2 End System to valid destination at AMHSLAND1.



- 2-5: CLNP Echo from AMHSLAND1 End System to unreachable AMHSLAND2 End System.

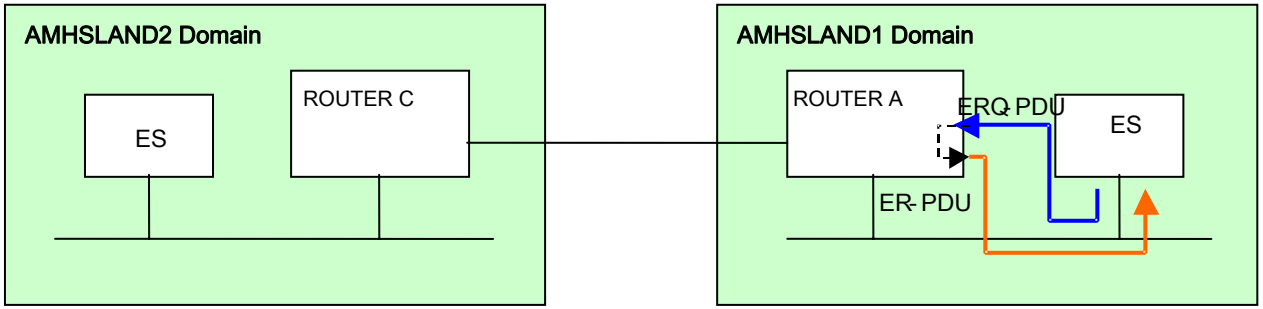


- 2-6: CLNP Echo from AMHSLAND2 End System to unreachable AMHSLAND1 End System.



- 2-7: Routing process in AMHSLAND1 router for NPDU with invalid security parameter.

Note: Transmission of ER NPDU depends on a value in the ERQ NPDU header.



- 2-8: Routing process in AMHSLAND2 router for NPDU with invalid security parameter.

Note: Transmission of ER NPDU depends on a value in the ERQ NPDU header.

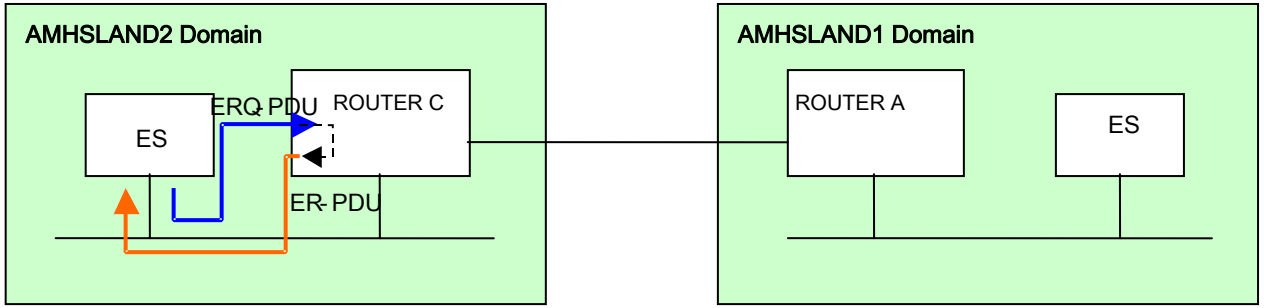


Table 10 NPDU Relay Test Procedure

2. NPDU Relay		**Test Item**	**Procedure**	**Result**	**Date/Time**
ERQ NPDU transmission from AMHSLAND1 router	ERQ NPDU transmission	2-1-1	Send ERQ NPDU from ROUTER A to ROUTER C. Confirm ROUTER C receives it.	OK / NG	/ /
	ERP NPDU transmission	2-1-2	After receiving ERQ NPDU, ROUTER C sends ERP NPDU to ROUTER A. Confirm ROUTER A receives it.	OK / NG	/ /
	Continuous ERQ/ERP NPDU transmission	2-1-3	Repeat from 2-1-1 to 2-1-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND2 router	ERQ NPDU transmission	2-2-1	Send ERQ NPDU from ROUTER C to ROUTER A. Confirm ROUTER A receives it.	OK / NG	/ /
	ERP NPDU transmission	2-2-2	After receiving ERQ NPDU, ROUTER A sends an ERP NPDU to ROUTER C. Confirm ROUTER C receives it.	OK / NG	/ /
	Continuous ERQ/ERP NPDU transmission	2-2-3	Repeat from 2-2-1 to 2-2-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND1 ES	ERQ NPDU transmission	2-3-1	Send ERQ NPDU from AMHSLAND1 ES to AMHSLAND2 ES. Confirm the AMHSLAND2 ES receives it.	OK / NG	/ /
	ERP NPDU transmission	2-3-2	After receiving ERQ NPDU, the AMHSLAND2 ES sends an ERP NPDU to the AMHSLAND1 ES. Confirm the AMHSLAND1 ES receives it.	OK / NG	/ /
	Continuous ERQ/ERP transmission	2-3-3	Repeat from 2-3-1 to 2-3-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND2 ES	ERQ NPDU transmission	2-4-1	Send ERQ NPDU from the AMHSLAND2 ES to the AMHSLAND1 ES. Confirm the AMHSLAND1 ES receives it.	OK / NG	/ /
	ERP NPDU transmission	2-4-2	After receiving ERQ NPDU, the AMHSLAND1 ES sends an ERP NPDU to the AMHSLAND2 ES. Confirm the AMHSLAND2 ES receives it.	OK / NG	/ /
	Continuous ERQ/ERP transmission	2-4-3	Repeat from 2-4-1 to 2-4-2 ten times and confirm there is no problem with ERQ/ERP transmission.	OK / NG	/ /

2. NPDU Relay		**Test Item**	**Procedure**	**Result**	**Date/Time**
ERQ NPDU transmission from AMHSLAND1 ES to unreachable system in AMHSLAND2 domain	ERQ NPDU transmission from AMHSLAND1 ES	2-5-1	AMHSLAND1 ES sends an ERQ NPDU with destination NSAP address set to an unreachable address in AMHSLAND2 domain. Confirm ROUTER C receives it.	OK / NG	/ /
	ERQ NPDU handling in AMHSLAND2 router	2-5-2	Confirm that ROUTER C discards the ERQ NPDU from AMHSLAND1 ES. Confirm that ROUTER C sends an ER NPDU to the AMHSLAND1 ES, and that the AMHSLAND1 ES receives it.	OK / NG	/ /
ERQ NPDU transmission from AMHSLAND2 ES to unreachable system in AMHSLAND1 domain	ERQ NPDU transmission from AMHSLAND2 ES	2-6-1	AMHSLAND2 ES sends an ERQ NPDU with destination NSAP address set to an unreachable address in AMHSLAND1 domain. Confirm ROUTER A receives it.	OK / NG	/ /
	ERQ NPDU handling in AMHSLAND1 router	2-6-2	Confirm that ROUTER A discards the ERQ NPDU. Confirm that ROUTER A sends an ER NPDU to the AMHSLAND2 ES, and that the AMHSLAND2 ES receives it.	OK / NG	/ /
Routing process in AMHSLAND1 router for NPDU with invalid security option parameter	ERQ NPDU transmission from AMHSLAND1 ES	2-7-1	AMHSLAND1 ES sends an ERQ NPDU with an invalid security option parameter (ATN Systems Management Communications/No Traffic Policy Preference) addressed to the AMHSLAND2 ES. Confirm ROUTER A receives it.	OK / NG	/ /
	ERQ NPDU processing in AMHSLAND1 router	2-7-2	Confirm ROUTER A discards ERQ NPDU and sends an ER NPDU to AMHSLAND1 ES. Confirm the AMHSLAND1 ES receives the ER NPDU.	OK / NG	/ /

2. NPDU Relay		**Test Item**	**Procedure**	**Result**	**Date/Time**
Routing process in AMHSLAND2 router for NPDU with invalid security option parameter	ERQ NPDU transmission from AMHSLAND2 ES	2-8-1	AMHSLAND2 ES sends ERQ NPDU with an invalid security option parameter (ATN Systems Management Communications/No Traffic Policy Preference) addressed to the AMHSLAND1 ES. Confirm ROUTER C receives it.	OK / NG	/ /
	ERQ NPDU processing in AMHSLAND2 router	2-8-2	Confirm ROUTER C discards ERQ NPDU and ROUTER C sends an ER NPDU to the AMHSLAND2 ES. Confirm the AMHSLAND2 ES receives the ER NPDU.	OK / NG	/ /

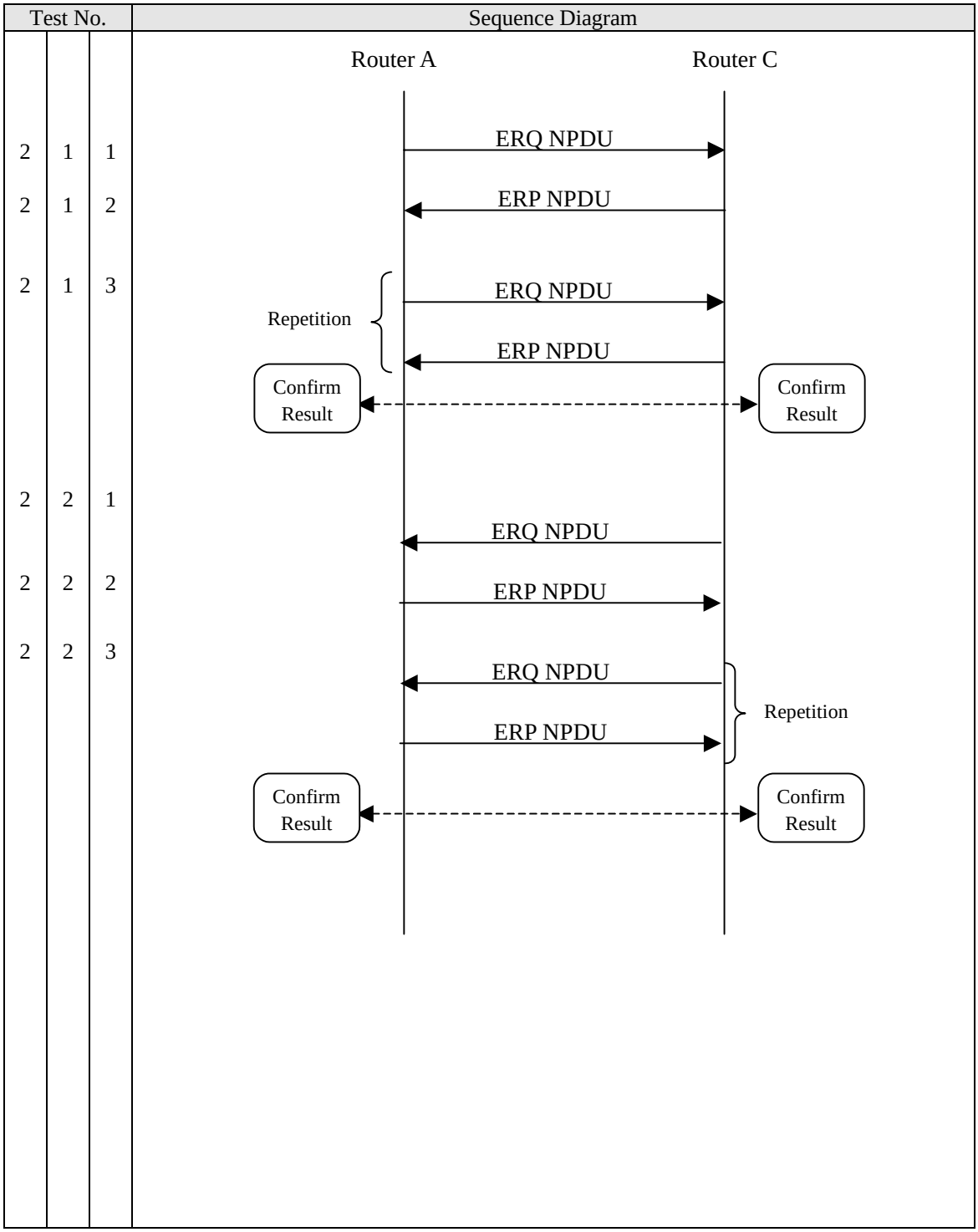


Figure 6 Sequence: NPDU Transmission between Routers

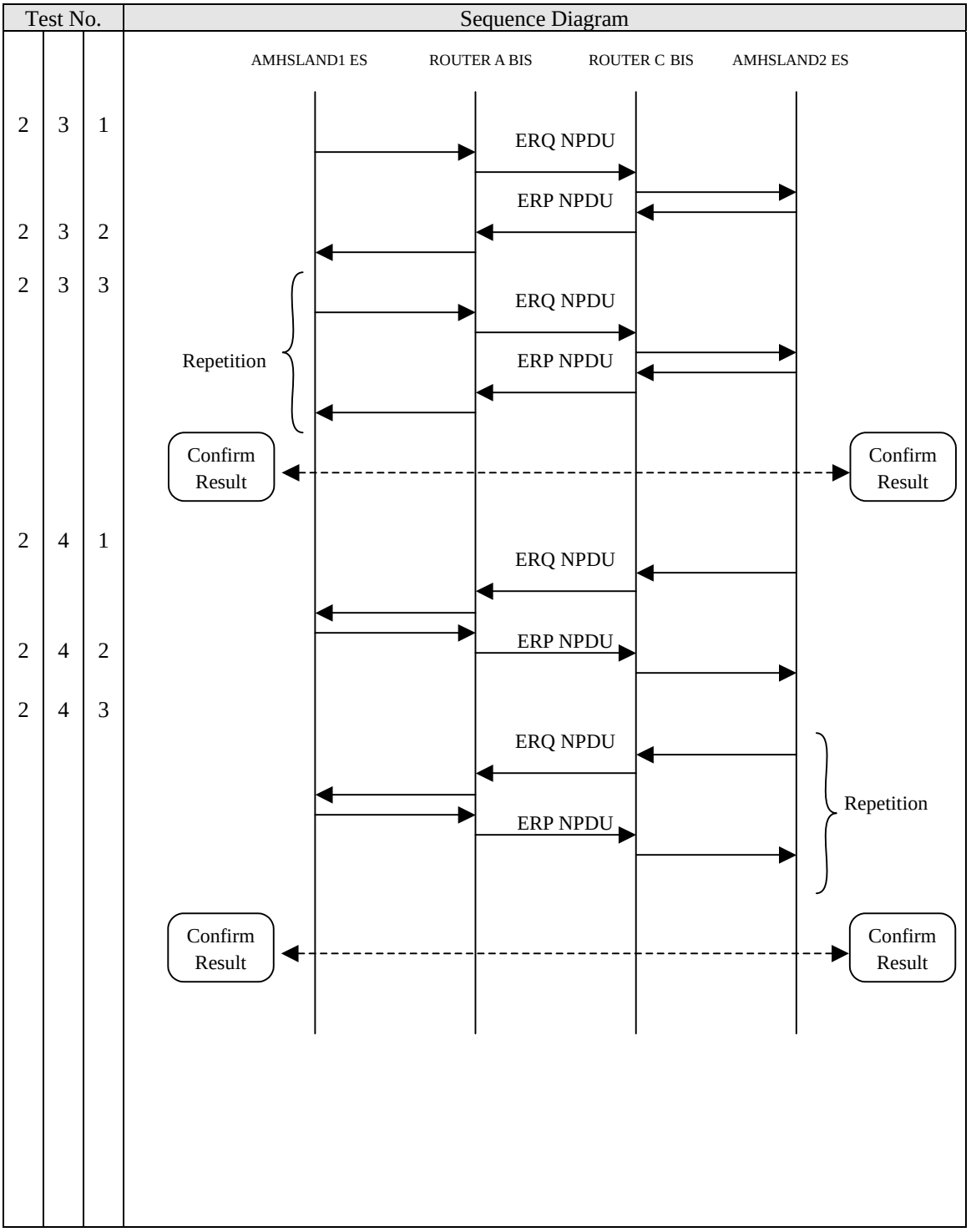


Figure 7 Sequence: NPDU Transmission between End Systems

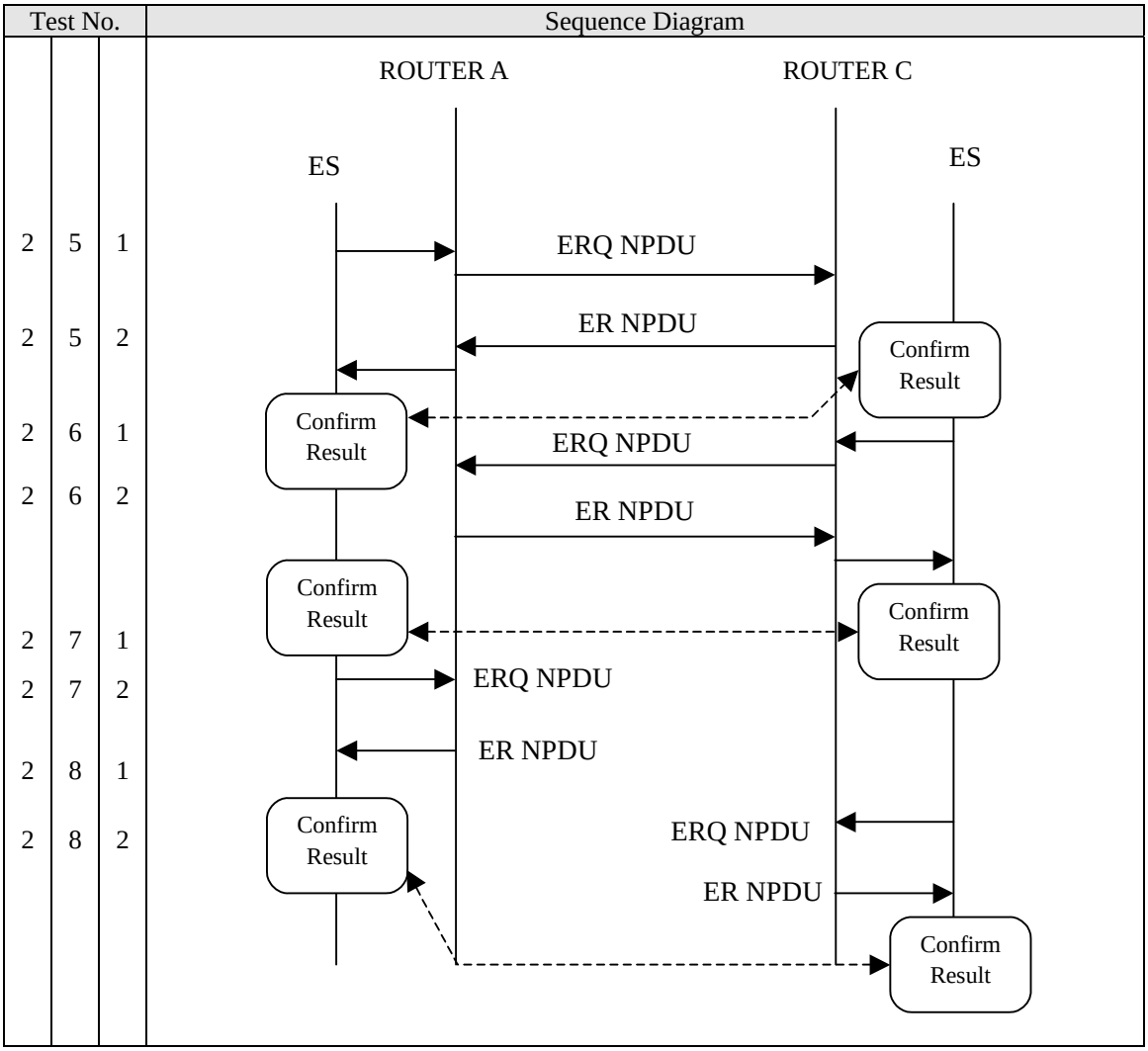


Figure 8 Sequence: NPDU Transmission to Unreachable ES and Handling of NPDU with Invalid Security Parameter

6.3. Test Case 3: Router End-to-End Tests

a) **Objective**

Technical trial to verify the automatic updating of routing tables in the ATN routers through IDRP protocol with routers connecting in end-to-end configuration between AMHSLAND1 and AMHSLAND2.

b) **Test Configuration**

The configuration for this test is shown in Figure 9.

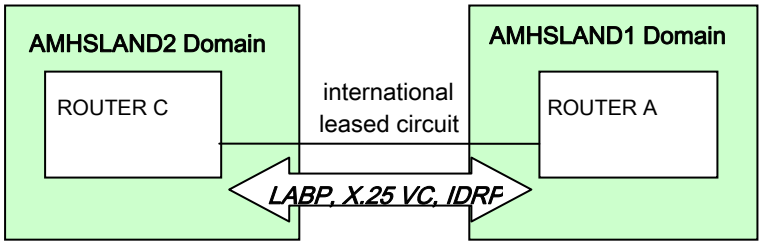


Figure 9 Router End-to-End Test Configuration

c) **Test Item Overview**

3-1: Manual router disconnection at AMHSLAND1 router and route deletion
3-2: Route addition (re-activation of connection) from AMHSLAND1 router
3-3: Manual router disconnection at AMHSLAND2 router and route deletion
3-4: Route addition (re-activation of connection) from AMHSLAND2 router
3-5: Carrier medium failure and route deletion at AMHSLAND1 router
3-6: Carrier medium restoration and route addition at AMHSLAND1 router
3-7: Carrier medium failure and route deletion at AMHSLAND2 router
3-8: Carrier medium restoration and route addition at AMHSLAND2 router
3-9: Failure and recovery of AMHSLAND1 router (redundant configuration)
3-10: Failure and recovery of AMHSLAND2 router

Note:
A detailed test of normal router connection (LAPB, X.25 VC and IDRP) is carried out in Test Items 1-1 through 1-5, and so is not repeated here.

Table 11 Router End-to-End Tests Test Procedure

3. Router End-to-End Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Manual router disconnection at AMHSLAND1 router and route deletion	CEASE PDU transmission from AMHSLAND1 router	3-1-1	At ROUTER A, manually close the router connection to ROUTER C. Confirm ROUTER A sends CEASE PDU.	OK / NG	/ /
	CEASE PDU transmission from AMHSLAND2 router and route deletion	3-1-2	Confirm ROUTER C receives CEASE PDU. After receiving CEASE PDU, confirm that ROUTER C sends CEASE PDU to ROUTER A, and that routing information for ROUTER A is deleted.	OK / NG	/ /
	Route deletion at AMHSLAND1 router	3-1-3	Confirm that ROUTER A receives CEASE PDU from ROUTER C, and that routing information for ROUTER C is deleted.	OK / NG	/ /
	CQ transmission	3-1-4	After IDRP disconnected, confirm ROUTER A sends CQ packet to ROUTER C. Confirm ROUTER C receives it.	OK / NG	/ /
	CF transmission	3-1-5	After receiving CQ packet, confirm ROUTER C sends CF packet to ROUTER A. Confirm ROUTER A receives CF packet, and VC is closed.	OK / NG	/ /
Route addition (re-activation of connection) from AMHSLAND1 router	Router connection restoration after disconnection	3-2-1	At ROUTER A, manually initiate router connection with ROUTER C. (VC call: originate, OPEN PDU: send.) Confirm the router connection is re-established.	OK / NG	/ /

3. Router End-to-End Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Manual router disconnection at AMHSLAND2 router and route deletion	CEASE PDU transmission from AMHSLAND2 router	3-3-1	At ROUTER C, manually close the router connection to ROUTER A. Confirm ROUTER C sends CEASE PDU.	OK / NG	/ /
	CEASE PDU transmission from AMHSLAND1 router and route deletion	3-3-2	Confirm ROUTER A receives CEASE PDU. After receiving CEASE PDU, confirm that ROUTER A sends CEASE PDU to ROUTER C, and that routing information for ROUTER C is deleted.	OK / NG	/ /
	Route deletion at AMHSLAND2 router	3-3-3	Confirm that ROUTER C receives CEASE PDU from ROUTER A, and that routing information for ROUTER A is deleted.	OK / NG	/ /
	CQ transmission	3-3-4	After IDRP disconnected, confirm ROUTER C sends CQ packet to ROUTER A. Confirm ROUTER A receives it.	OK / NG	/ /
	CF transmission	3-3-5	After receiving CQ packet, confirm ROUTER A sends CF packet to ROUTER C. Confirm ROUTER C receives CF packet, and VC is closed.	OK / NG	/ /
Route addition (re-activation of connection) from AMHSLAND2 router	Router connection restoration after disconnection	3-4-1	At ROUTER C, manually initiate router connection to ROUTER A. (VC call: receive, OPEN PDU: receive.) Confirm the router connection is re-established.	OK / NG	/ /
Carrier medium failure and route deletion at AMHSLAND1 router	Data link and VC disconnection	3-5-1	At ROUTER A, simulate a circuit failure by physically disconnecting ROUTER A from the DSU/modem. Confirm that the data link and VC are disconnected between ROUTER A and ROUTER C.	OK / NG	/ /
	IDRP disconnection at AMHSLAND1	3-5-2	After circuit failure, confirm IDRP connection at ROUTER A is closed.	OK / NG	/ /
	IDRP disconnection at AMHSLAND2	3-5-3	After circuit failure, confirm IDRP connection at ROUTER C is closed when the IDRP holding timer expires.	OK / NG	/ /

3. Router End-to-End Tests		Test Item	Procedure	Result	Date/Time
Carrier medium restoration and route addition at AMHSLAND1 router	Data link, VC, and router connection re-establishment	3-6-1	At ROUTER A, restore the circuit by re-connecting ROUTER A to the DSU/modem. Confirm router connection is re-established between ROUTER A and ROUTER C.	OK / NG	/ /
Carrier medium failure and route deletion at AMHSLAND2 router	Data link and VC disconnection	3-7-1	At ROUTER C, simulate a circuit failure by disconnecting the leased line circuit from the modem. Confirm data link and VC are disconnected between ROUTER A and ROUTER C.	OK / NG	/ /
	IDRP disconnection at AMHSLAND2	3-7-2	After circuit failure, confirm IDRP connection at ROUTER C is closed when the IDRP holding timer expires.	OK / NG	/ /
	IDRP disconnection at AMHSLAND1	3-7-3	After circuit failure, confirm IDRP connection at ROUTER A is closed.	OK / NG	/ /
Carrier medium restoration and route addition at AMHSLAND2 router	Data link, VC, and router connection re-establishment	3-8-1	At ROUTER C, restore circuit. Confirm the router connection is re-established between ROUTER A and ROUTER C.	OK / NG	/ /
Failure and recovery of AMHSLAND1 router	Failover from active to standby node	3-9-1	At ROUTER A, force failover from active node (#1) to standby node (#2) by rebooting active node. At ROUTER A, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /
	Failover back to previous active node	3-9-2	At ROUTER A, force failover from active node (#2) to standby node (#1) by rebooting active node. At ROUTER A, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /

3. Router End-to-End Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Failure and recovery of AMHSLAND2 router	Failover from active to standby node	3-10-1	At ROUTER C, force failover from active node (#1) to standby node (#2). At ROUTER C, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /
	Failover back to previous active node	3-10-2	At ROUTER C, force failover from active node (#2) to standby node (#1). At ROUTER C, confirm WAN line switches from active to standby node. Confirm that router connection is closed and then re-established.	OK / NG	/ /

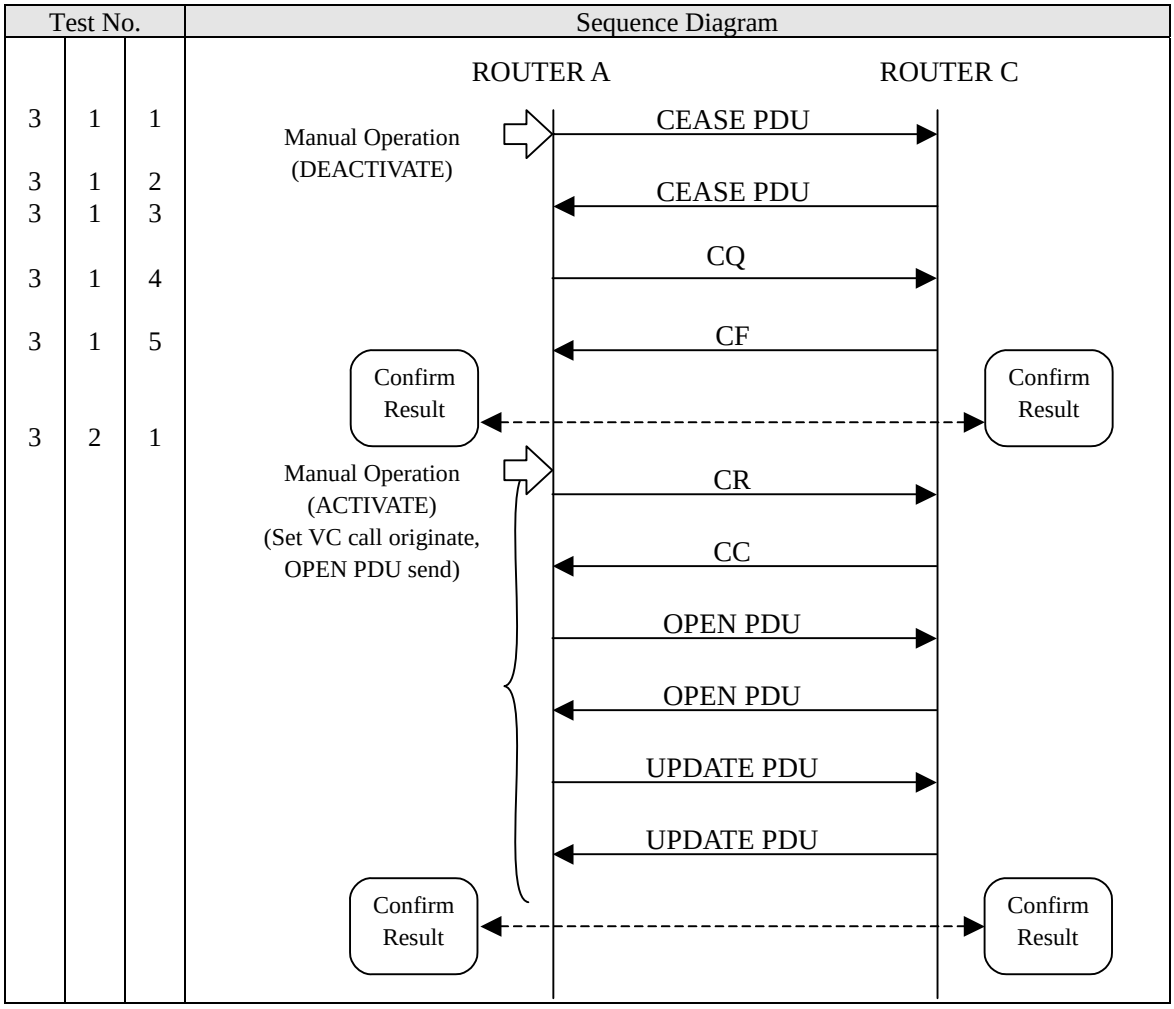


Figure 10 Sequence: Manual router Disconnection and Re-connection at AMHSLAND1 router

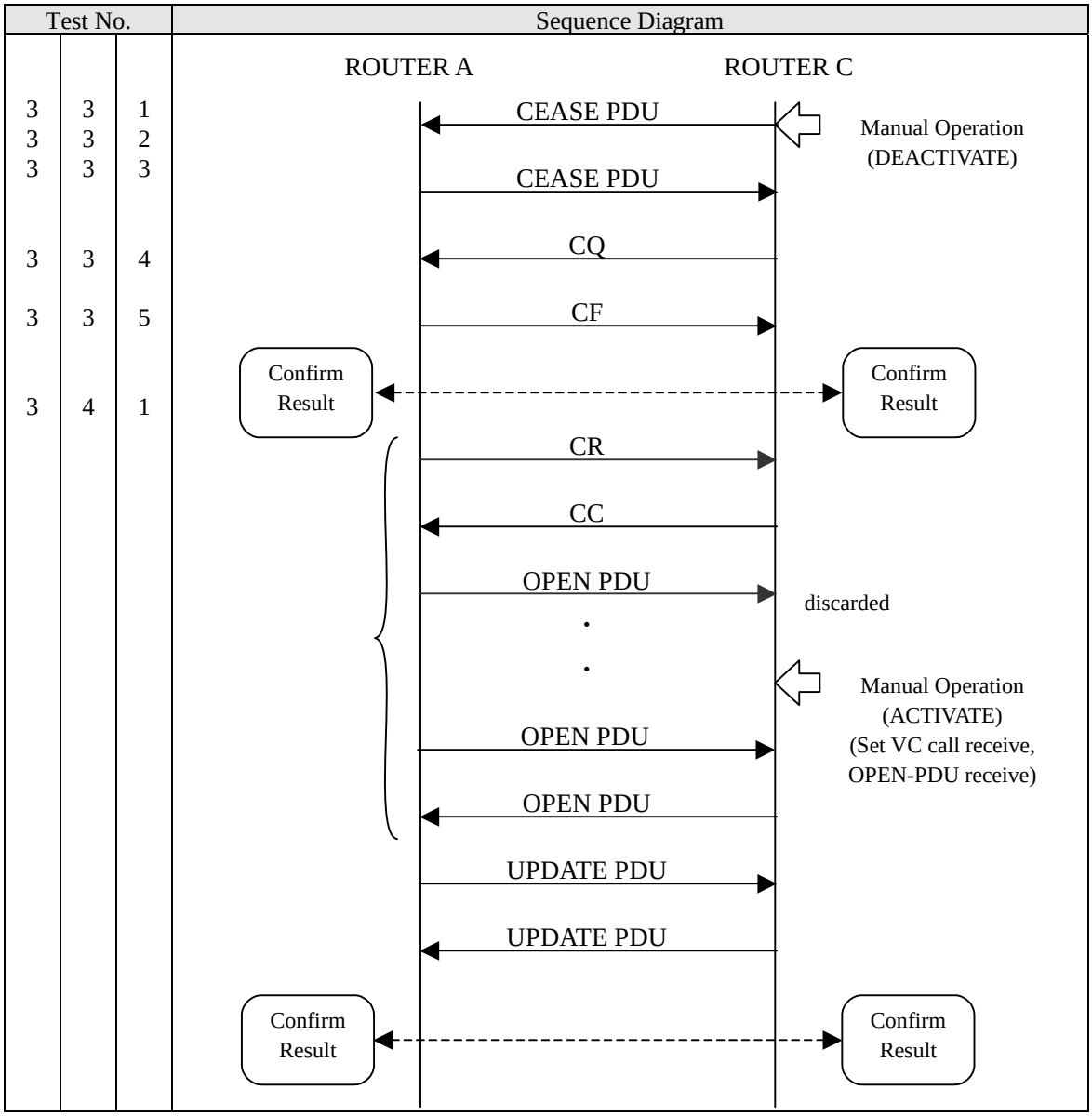


Figure 11 Sequence: Manual router Disconnection and Re-connection at AMHSLAND2 router

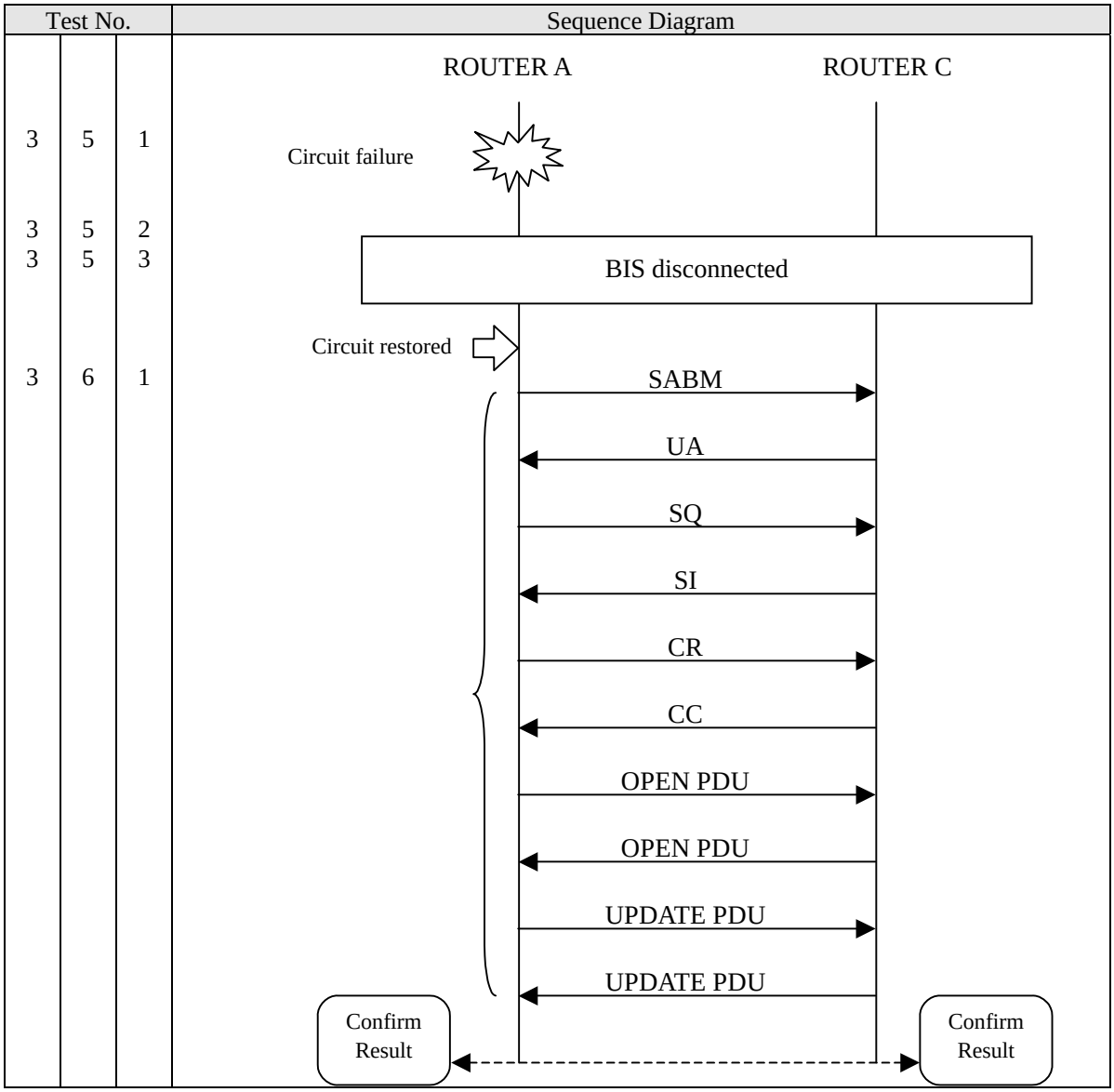


Figure 12 Sequence: Carrier medium failure and recovery at AMHSLAND1 router

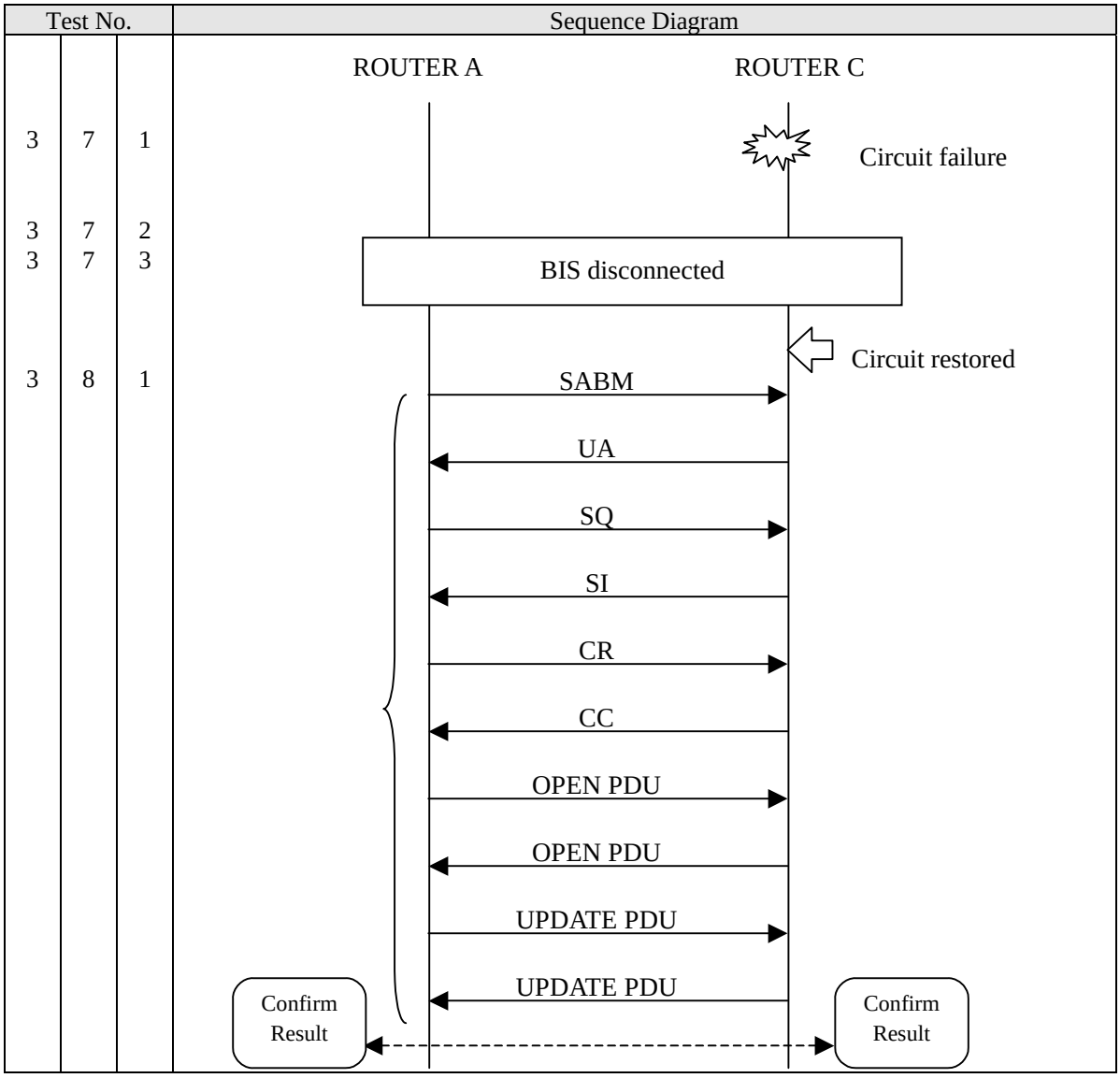


Figure 13 Sequence: Carrier medium failure and recovery at AMHSLAND2 router

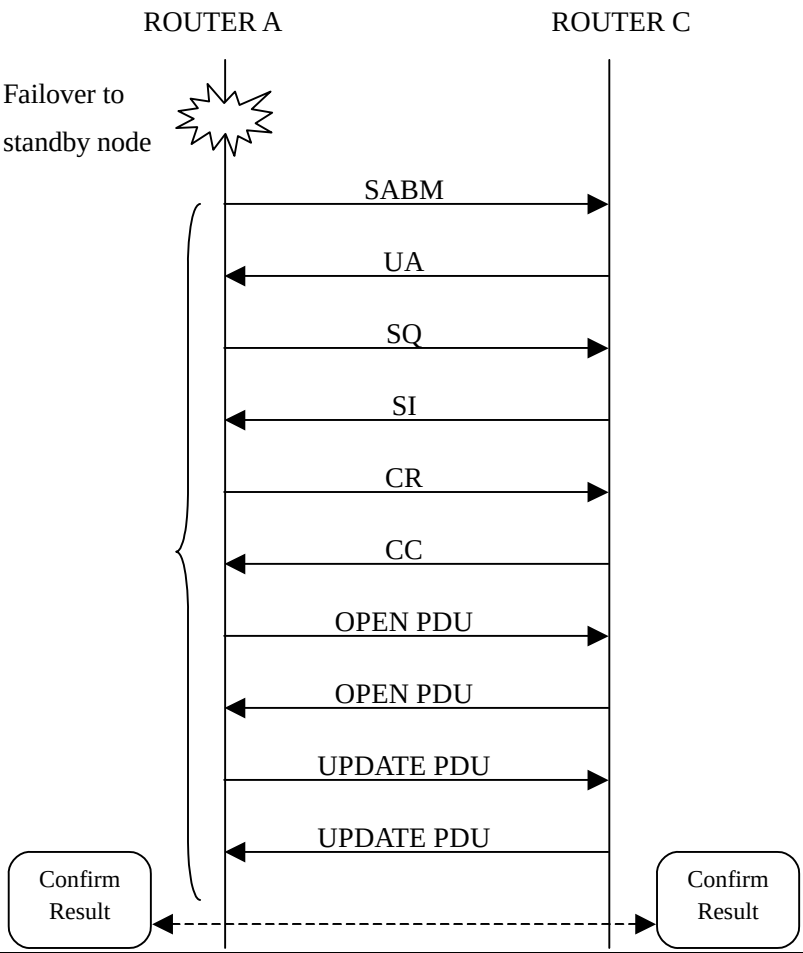
Test No.			Sequence Diagram
3 3	9 9	1 2	

Figure 14 Sequence: AMHSLAND1 router Failure and Recovery

Test No.			Sequence Diagram
3	10	1	
3	10	2	

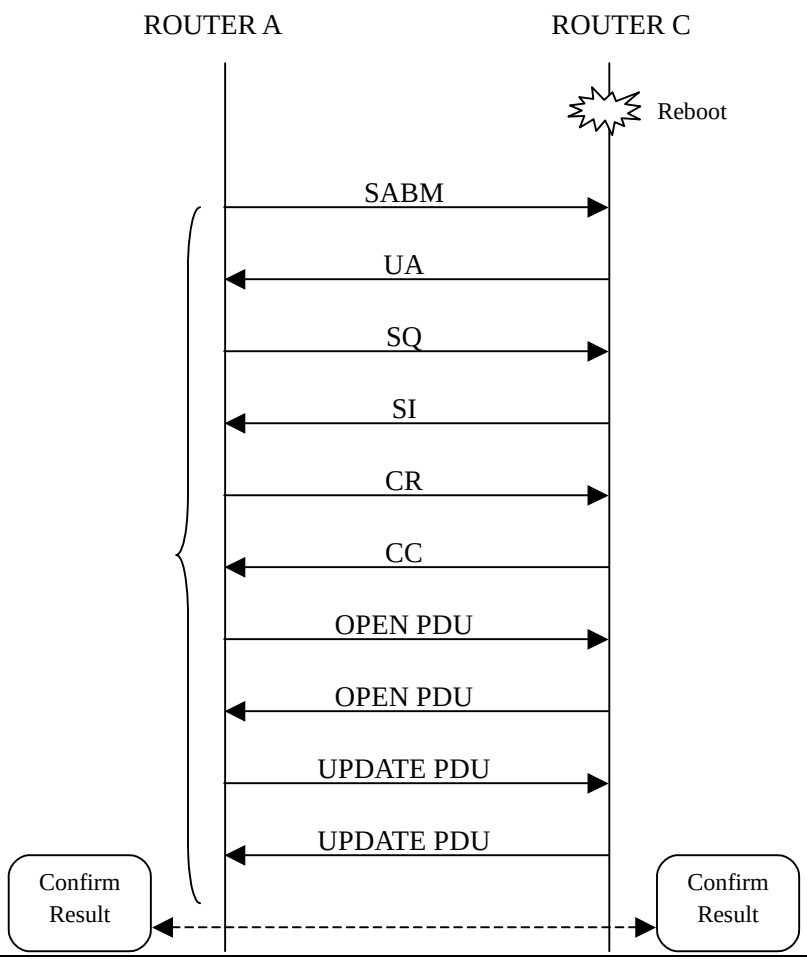


Figure 15 Sequence: AMHSLAND2 router Failure and Recovery

6.4. Test Case 4: ATN Router Tests (This cover additional tests for subnetwork)

a) **Objective**

Technical trial to verify the automatic updating of routing tables in ATN routers through the IDRP protocol with routers connected in 3routers configurations between AMHSLAND1, AMHSLAND2 and simulated third domains connected to AMHSLAND1 and AMHSLAND2. The test configurations are shown below.

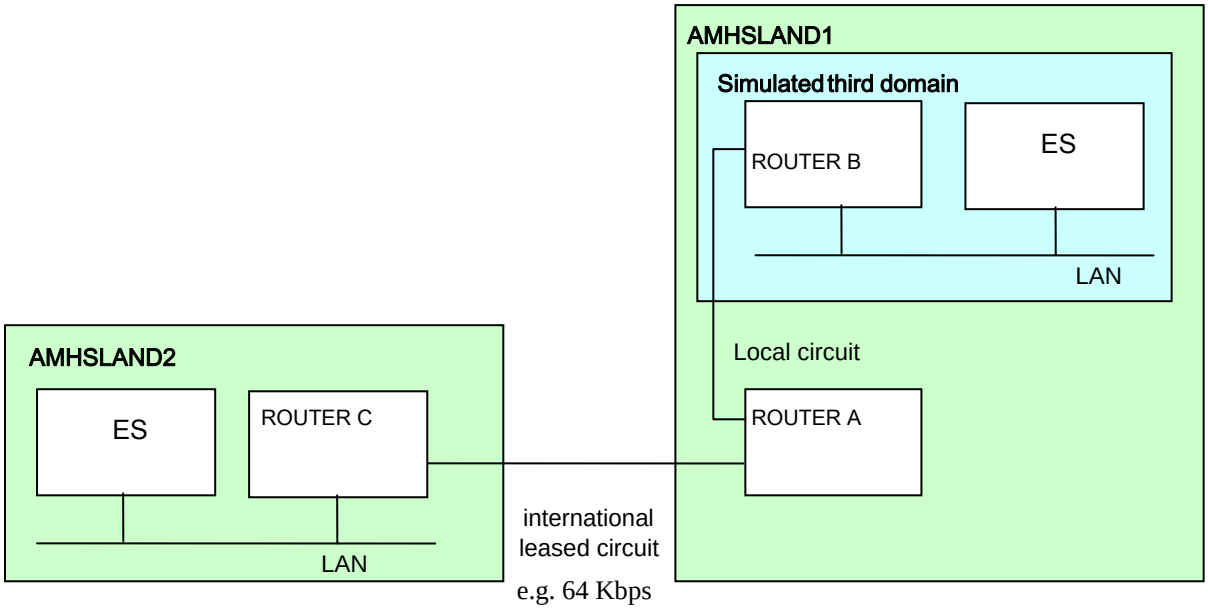


Figure 16 Test Configuration: Simulated Third Domain connected to AMHSLAND1

b) **Test Overview**

(i) Simulated third domain connected to AMHSLAND1.

ROUTER CONNECTION, DISCONNECTION AND RE-ACTIVATION

4-1: Router connection of ROUTER B to ROUTER A (ROUTER A-ROUTER C already established).
4-2, 4-3: Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route and re-activation.
4-4, 4-5: Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route and re-activation.
4-6: Router connection of ROUTER C to ROUTER A (ROUTER B-ROUTER A already established).
4-7, 4-8: Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route and re-activation.
4-9, 4-10: Manual router disconnection at ROUTER A of ROUTER C-ROUTER A route and re-activation.

COMMUNICATION CIRCUIT FAILURE AND RECOVERY

4-11, 4-12: Failure and recovery of ROUTER A-ROUTER B circuit.
4-13, 4-14: Failure and recovery of ROUTER C-ROUTER A circuit.

ROUTER FAILURE AND RECOVERY

4-15: Failure and recovery of ROUTER C.
4-16: Failure and recovery of ROUTER A.
4-17: Failure and recovery of ROUTER B.

END-TO-END DATA RELAY

4-18: End-to-End CLNP Echo Test between End Systems in ROUTER C and ROUTER B domains.
(Subject to End System ERQ-PDU transmission capabilities.)

Table 12 Router Connection, Disconnection and Re-activation Test Procedure: Router A – Router B

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER B to ROUTER A	Data link establishment between ROUTER A and ROUTER B	4-1-1	With VC and IDRP connections established between ROUTER C and ROUTER A, switch on ROUTER B to initiate router connection. Check and confirm data link and VC are established between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP connection establishment between ROUTER A and ROUTER B	4-1-2	After VC establishment, check and confirm IDRP connection established between ROUTER A and ROUTER B by exchange of OPEN PDUs. (First OPEN PDU sent by ROUTER A.)	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-1-3	After IDRP connection established, confirm ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, after receiving UPDATE PDU from ROUTER A, check that route information on ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	4-1-4	After IDRP connection established, confirm ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER B, check and confirm route information of ROUTER B is updated correctly.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-1-5	At ROUTER A, after receiving UPDATE PDU from ROUTER B, confirm ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that UPDATE PDU is received, and that route information of ROUTER B is added.	OK / NG	/ /
Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route	CEASE PDU transmission from ROUTER A	4-2-1	At ROUTER A, manually close the router connection to ROUTER B. Confirm ROUTER A sends a CEASE PDU to ROUTER B.	OK / NG	/ /
	CEASE PDU transmission from ROUTER B and route deletion	4-2-2	At ROUTER B, confirm receipt of CEASE PDU from ROUTER A. Confirm ROUTER B sends a CEASE PDU to ROUTER A, and that route information for ROUTER A and ROUTER C are deleted.	OK / NG	/ /
	Route deletion at ROUTER A	4-2-3	At ROUTER A, confirm receipt of CEASE PDU from ROUTER B, and that route information for ROUTER B is deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	VC disconnection between ROUTER A and ROUTER B	4-2-4	Confirm that the VC between ROUTER A and ROUTER B is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C, and route deletion	4-2-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that UPDATE PDU is received from ROUTER A, and that route information for ROUTER B is deleted.	OK / NG	/ /
Route re-activation from ROUTER A	Router connection re-activation from ROUTER A	4-3-1	At ROUTER A, manually initiate router connection to ROUTER B (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-3-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that route information to ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	4-3-3	Confirm that ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, check that route information to ROUTER B is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C and route addition	4-3-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check that route information to ROUTER B is added.	OK / NG	/ /
Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route	CEASE PDU transmission from ROUTER B	4-4-1	At ROUTER B, manually close the router connection to ROUTER A. Confirm ROUTER B sends a CEASE PDU to ROUTER A.	OK / NG	/ /
	CEASE PDU transmission from ROUTER A and route deletion	4-4-2	At ROUTER A, confirm receipt of CEASE PDU from ROUTER B. Confirm ROUTER A sends CEASE PDU to ROUTER B, and that route information for ROUTER B is deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	Route deletion at ROUTER B	4-4-3	At ROUTER B, confirm receipt of CEASE PDU from ROUTER A, and that route information for ROUTER A and ROUTER C are deleted.	OK / NG	/ /
	VC disconnection between ROUTER A and ROUTER B	4-4-4	Confirm that the VC between ROUTER A and ROUTER B is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C, and route deletion	4-4-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that an UPDATE PDU is received from ROUTER A, and that route information for ROUTER B is deleted.	OK / NG	/ /
Route re-activation from ROUTER B	Router connection re-activation from ROUTER B	4-5-1	At ROUTER B, manually initiate router connection to ROUTER A (VC call: called, OPEN PDU: receive). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-5-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm UPDATE PDU is received, and that route information to ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	4-5-3	Confirm that ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and that route information to ROUTER B is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C and route addition	4-5-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and that route information to ROUTER B is added.	OK / NG	/ /

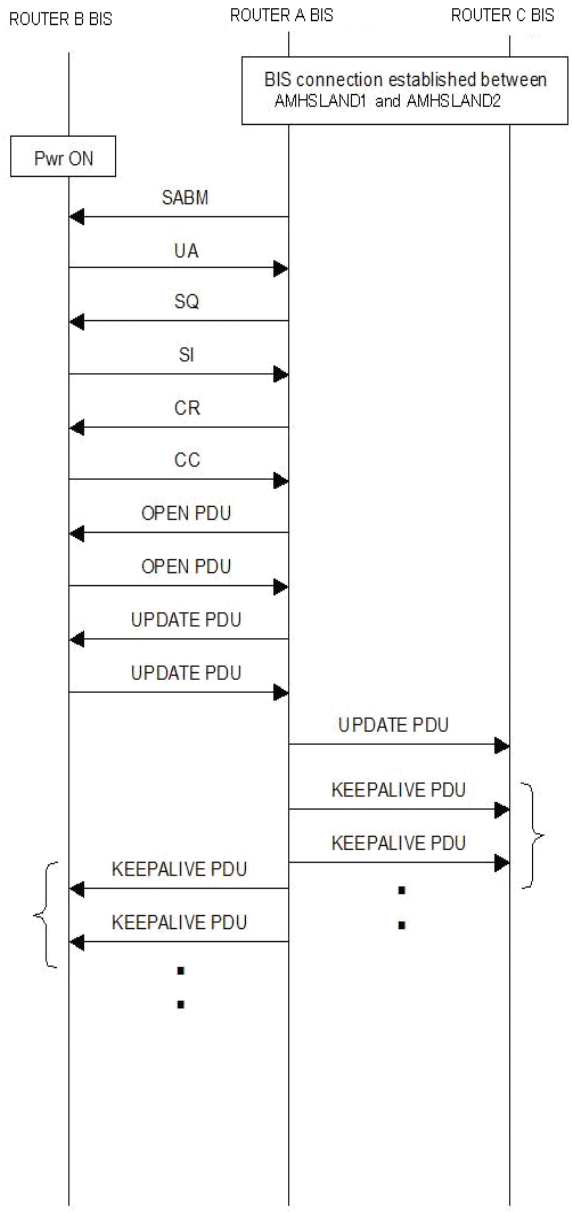
Test No.			Sequence Diagram
4	1	1	
4	1	2	
4	1	3	
4	1	4	
4	1	5	

Figure 17 Sequence: router connection of ROUTER B to ROUTER A (ROUTER A-ROUTER C already established)

Test No.			Sequence Diagram
4	2	1	
4	2	2	
4	2	3	
4	2	4	
4	2	5	
4	3	1	
4	3	2	
4	3	3	
4	3	4	

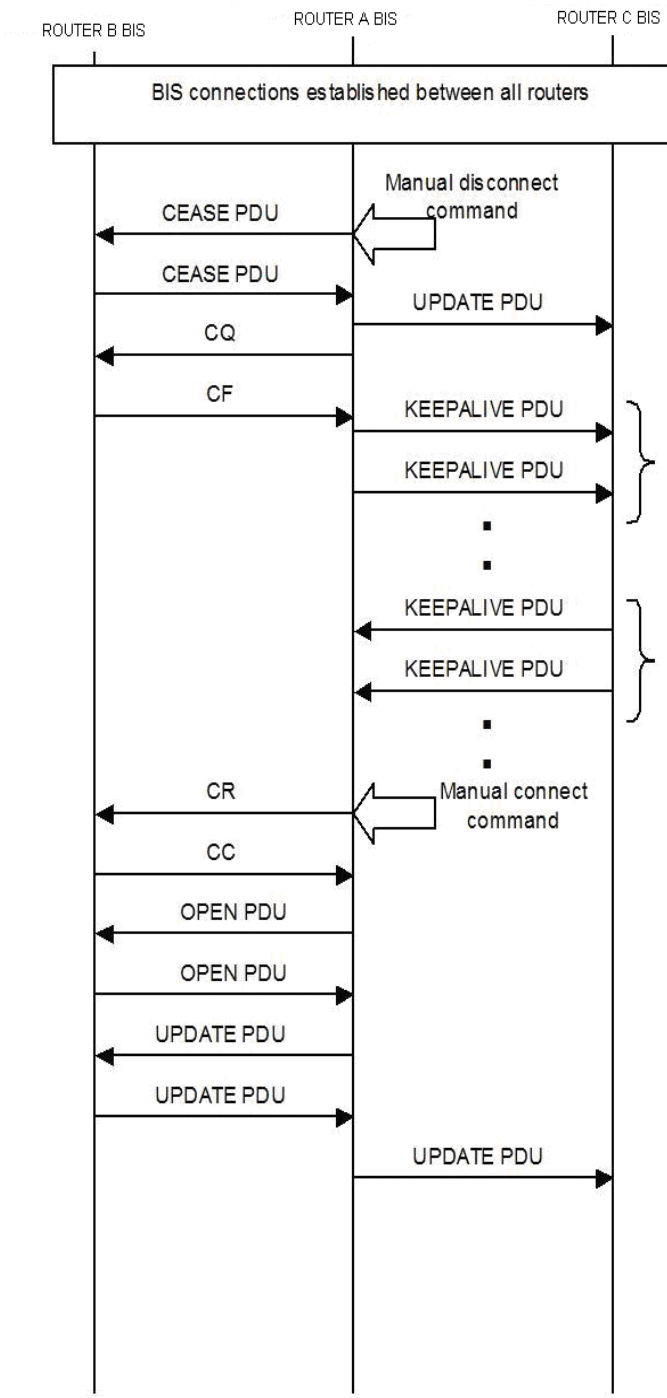


Figure 18 Sequence: Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route and re-activation.

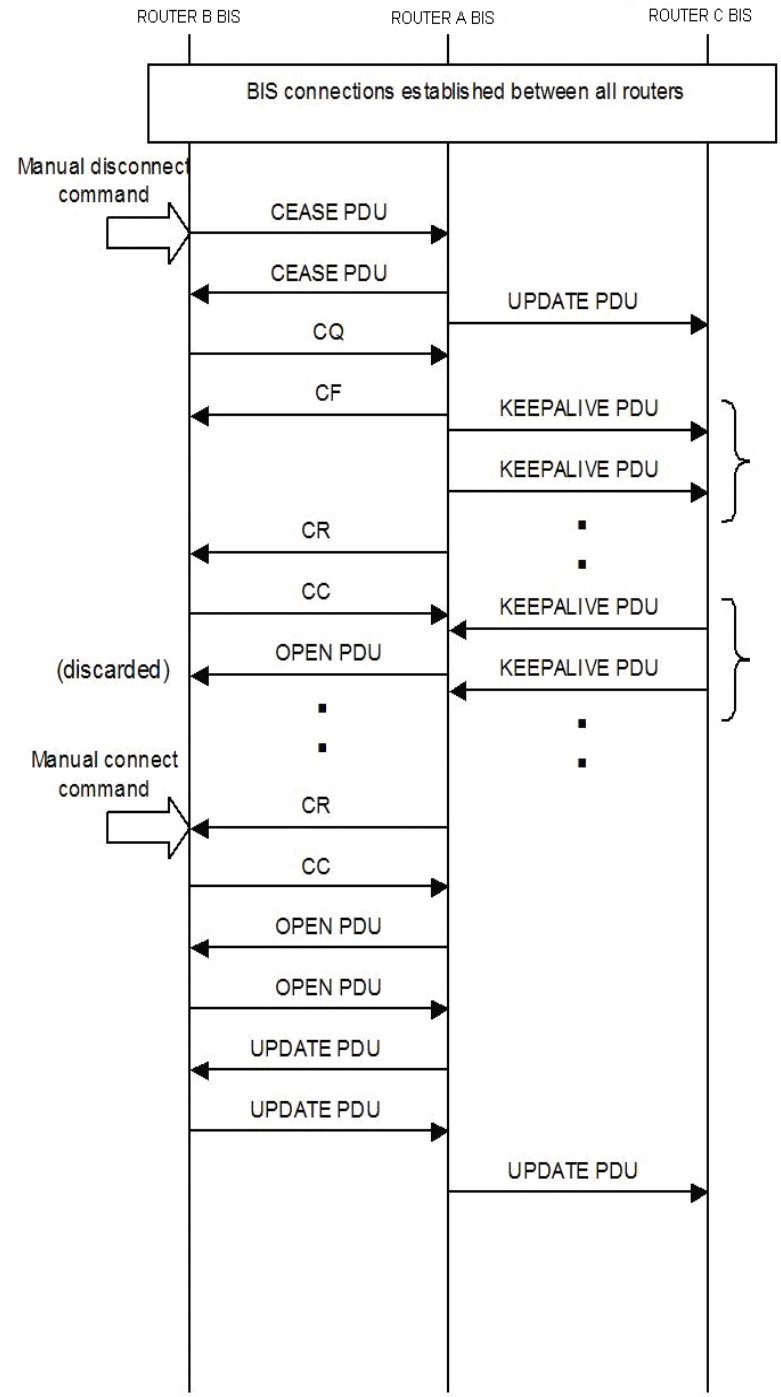
Test No.			Sequence Diagram
4	4	1	
4	4	2	
4	4	3	
4	4	4	
4	4	5	
4	5	1	
4	5	2	
4	5	3	
4	5	4	

Figure 19 Sequence: Manual router disconnection at ROUTER B of ROUTER A-ROUTER B route and re-activation.

Table 13 Router Connection, Disconnection and Re-activation Test Procedure: ROUTER C-ROUTER A

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER C to ROUTER A	Data link establishment between ROUTER C and ROUTER A	4-6-1	With VC and IDRP connections established between ROUTER A and ROUTER B, at ROUTER A, initiate router connection to ROUTER C. Check and confirm data link and VC are established between ROUTER C and ROUTER A.	OK / NG	/ /
	IDRP connection establishment between ROUTER C and ROUTER A	4-6-2	After VC establishment, check and confirm IDRP connection established between ROUTER C and ROUTER A by exchange of OPEN PDUs. (First OPEN PDU sent by ROUTER A.)	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-6-3	After IDRP connection established, confirm ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, after receiving UPDATE PDU from ROUTER A, check that route information on ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	4-6-4	After IDRP connection established, confirm ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER C, confirm route information of ROUTER C is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	4-6-5	At ROUTER A, after receiving UPDATE PDU from ROUTER C, confirm ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, after receiving UPDATE PDU from ROUTER A, confirm that route information of ROUTER C is added.	OK / NG	/ /
Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route	CEASE PDU transmission from ROUTER C	4-7-1	At ROUTER C, manually close the router connection to ROUTER A. Confirm ROUTER C sends a CEASE PDU to ROUTER A.	OK / NG	/ /
	CEASE PDU transmission from ROUTER A and route deletion	4-7-2	At ROUTER A, confirm receipt of CEASE PDU from ROUTER C. Confirm ROUTER A sends CEASE PDU to ROUTER C, and that route information for ROUTER C is deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	Route deletion at ROUTER C	4-7-3	At ROUTER C, confirm receipt of CEASE PDU from ROUTER A, and that route information for ROUTER A and ROUTER B are deleted.	OK / NG	/ /
	VC disconnection between ROUTER C and ROUTER A	4-7-4	Confirm that the VC between ROUTER C and ROUTER A is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B, and route deletion	4-7-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm that UPDATE PDU is received from ROUTER A, and that route information for ROUTER C is deleted.	OK / NG	/ /
Route re-activation from ROUTER C	Router connection re-activation from ROUTER C	4-8-1	At ROUTER C, manually initiate router connection to ROUTER A (VC call: called, OPEN PDU: receive). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-8-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and that route information to ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	4-8-3	Confirm that ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B and route addition	4-8-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm that UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /
Manual router disconnection at ROUTER A of ROUTER C-ROUTER A route	CEASE PDU transmission from ROUTER A	4-9-1	At ROUTER A, manually close the router connection to ROUTER C. Confirm ROUTER A sends a CEASE PDU to ROUTER C.	OK / NG	/ /

4. ATN Router Tests		Test Item	Procedure	Result	Date/Time
	CEASE PDU transmission from ROUTER C and route deletion	4-9-2	At ROUTER C, confirm receipt of CEASE PDU from ROUTER A, and that route information for ROUTER A and ROUTER B are deleted.	OK / NG	/ /
	Route deletion at ROUTER A	4-9-3	At ROUTER A, confirm receipt of CEASE PDU from ROUTER C, and that route information for ROUTER C is deleted.	OK / NG	/ /
	VC disconnection between ROUTER C and ROUTER A	4-9-4	Confirm that the VC between ROUTER C and ROUTER A is closed normally.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B, and route deletion	4-9-5	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm UPDATE PDU is received from ROUTER A, and that route information for ROUTER C is deleted.	OK / NG	/ /
Route re-activation from ROUTER A	Router connection re-activation from ROUTER A	4-10-1	At ROUTER A, manually initiate router connection to ROUTER C (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	4-10-2	Confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm UPDATE PDU is received, and that route information to ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	4-10-3	Confirm that ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B and route addition	4-10-4	Confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm UPDATE PDU is received, and that route information to ROUTER C is added.	OK / NG	/ /

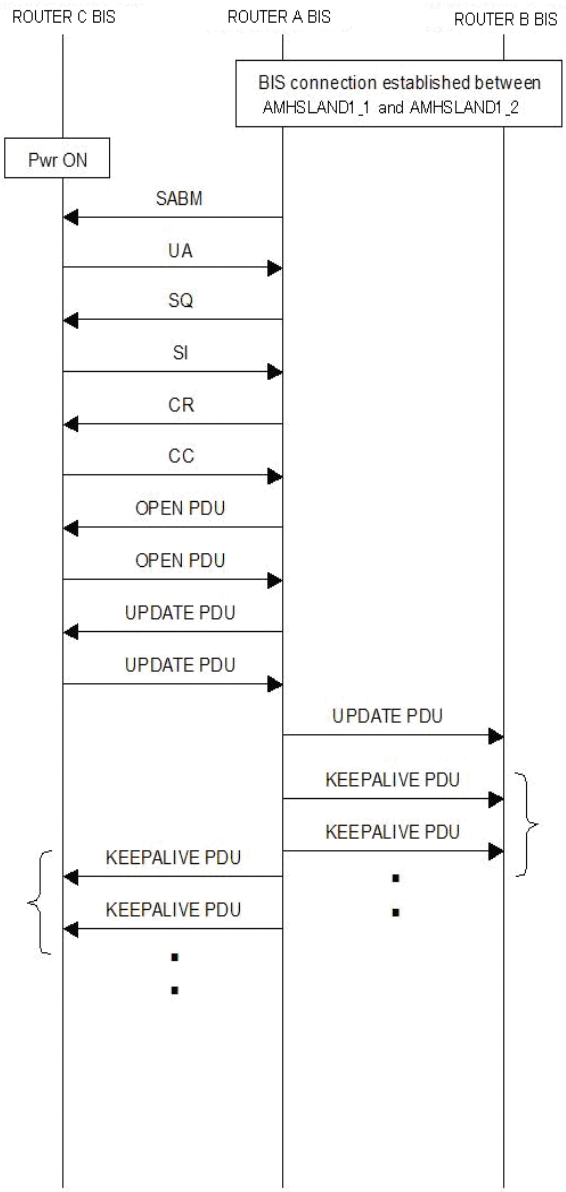
Test No.			Sequence Diagram
4	6	1	
4	6	2	
4	6	3	
4	6	4	
4	6	5	

Figure 20 Sequence: Router connection of ROUTER C to ROUTER A (ROUTER B-ROUTER A already established)

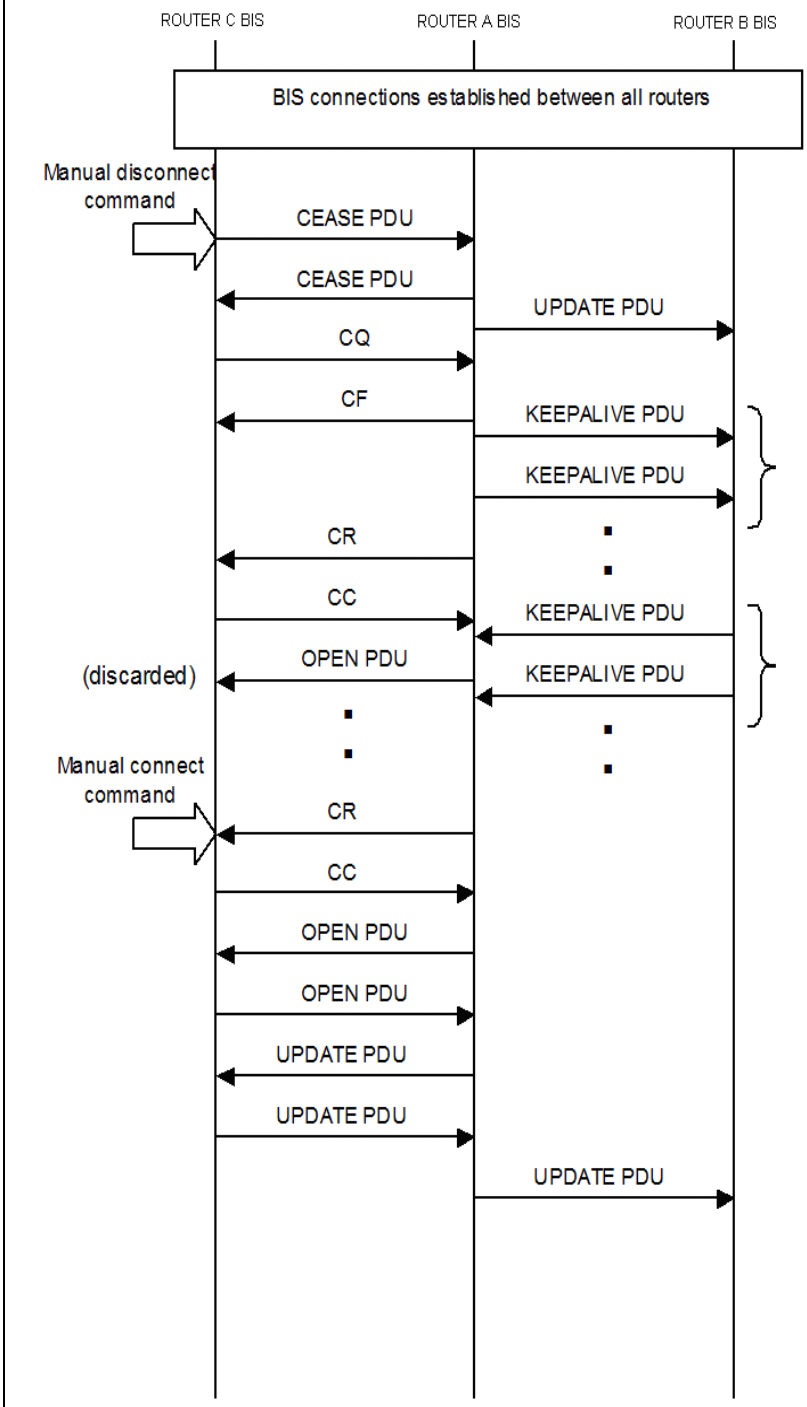
Test No.			Sequence Diagram
4	7	1	
4	7	2	
4	7	3	
4	7	4	
4	7	5	
4	8	1	
4	8	2	
4	8	3	
4	8	4	

Figure 21 Sequence: Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route and re-activation

Test No.			Sequence Diagram
4	9	1	
4	9	2	
4	9	3	
4	9	4	
4	9	5	
4	10	1	
4	10	2	
4	10	3	
4	10	4	

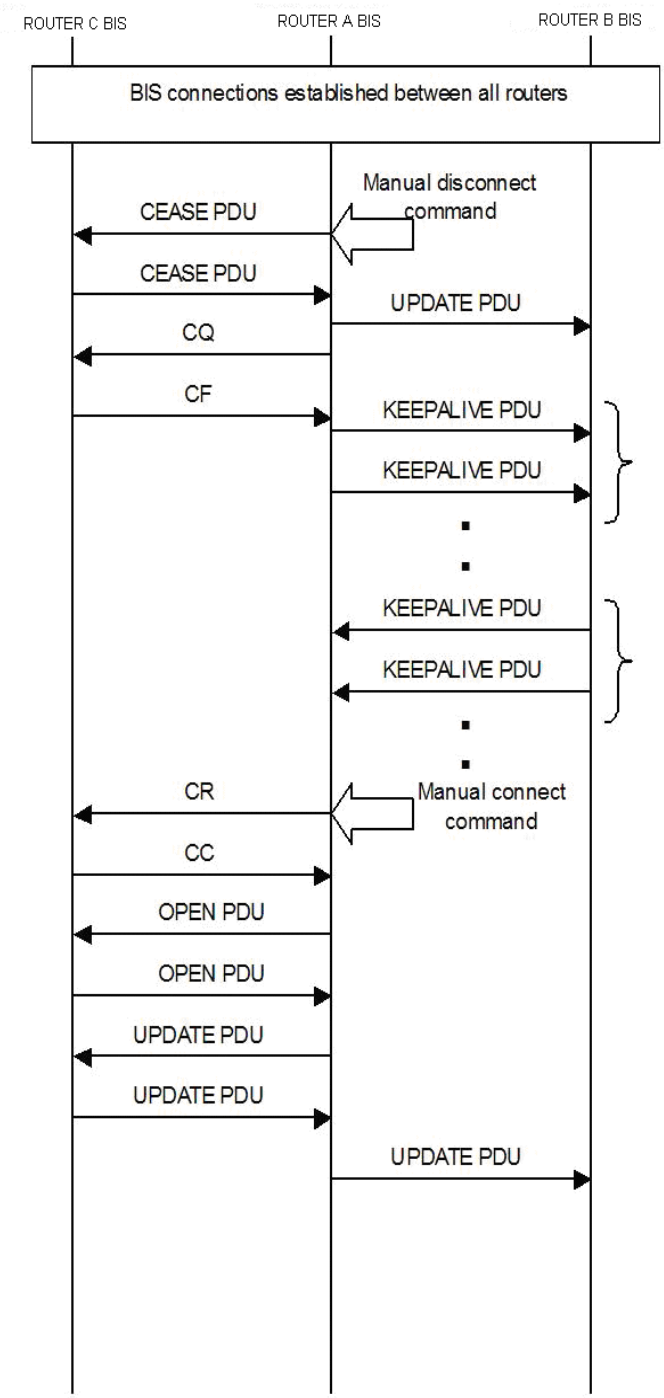


Figure 22 Sequence: Manual router disconnection at ROUTER A of ROUTER C-ROUTER A route and re-activation

Table 14 Communication Circuit Failure and Recovery Test Procedure: Third Domain connected to AMHSLAND1

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier media failure of ROUTER A-ROUTER B circuit and route deletion	Data link and VC disconnection	4-11-1	Simulate carrier medium failure between ROUTER A and ROUTER B by disconnecting WAN cable from ROUTER B. Check and confirm data link and VC are disconnected between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP disconnection and route update	4-11-2	Check and confirm that IDRP connection between ROUTER A and ROUTER B is closed. At ROUTER A, check that route information for ROUTER B is deleted. At ROUTER B, check that route information for ROUTER A and ROUTER C is deleted.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A and route update	4-11-3	Check that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check UPDATE PDU is received from ROUTER A, and that route information for ROUTER B is deleted.	OK / NG	/ /
Carrier media restoration of ROUTER A-ROUTER B circuit and route addition	Data link, VC, and router connection re-establishment	4-12-1	Restore the ROUTER A-ROUTER B router connection. Confirm router connection is re-established between ROUTER A and ROUTER B.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-12-2	After IDRP connection is established, confirm that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that an UPDATE PDU is received from ROUTER A, and that route information for ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B	4-12-3	After receiving UPDATE PDU from ROUTER A, check that ROUTER B sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER B, check that route information is added for ROUTER B.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-12-4	Check that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check that an UPDATE PDU is received from ROUTER A, and that route information is added for ROUTER B.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier media failure of ROUTER C-ROUTER A circuit and route deletion	Data link and VC disconnection	4-13-1	Simulate carrier medium failure between ROUTER C and ROUTER A by disconnecting WAN cable from ROUTER C. Check and confirm data link and VC are disconnected between ROUTER C and ROUTER A.	OK / NG	/ /
	IDRP disconnection and route update	4-13-2	Check and confirm that IDRP connection between ROUTER C and ROUTER A is closed. At ROUTER C, check that route information for ROUTER A and ROUTER B are deleted. At ROUTER A, check that route information for ROUTER C is deleted.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A and route update	4-13-3	Check that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that UPDATE PDU is received from ROUTER A, and that route information for ROUTER C is deleted.	OK / NG	/ /
Carrier media restoration of ROUTER C-ROUTER A circuit and route addition	Data link, VC, and Router connection re-establishment	4-14-1	Restore the ROUTER C-ROUTER A router connection. Confirm router connection is re-established between ROUTER C and ROUTER A.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-14-2	After IDRP connection is established, confirm that ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, check that an UPDATE PDU is received from ROUTER A, and that route information for ROUTER A and ROUTER B are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C	4-14-3	After receiving UPDATE PDU from ROUTER A, check that ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, after receiving UPDATE PDU from ROUTER C, check that route information is added for ROUTER C.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A	4-14-4	Check that ROUTER A sends an UPDATE PDU to ROUTER B. At ROUTER B, check that an UPDATE PDU is received from ROUTER A, and that route information is added for ROUTER C.	OK / NG	/ /

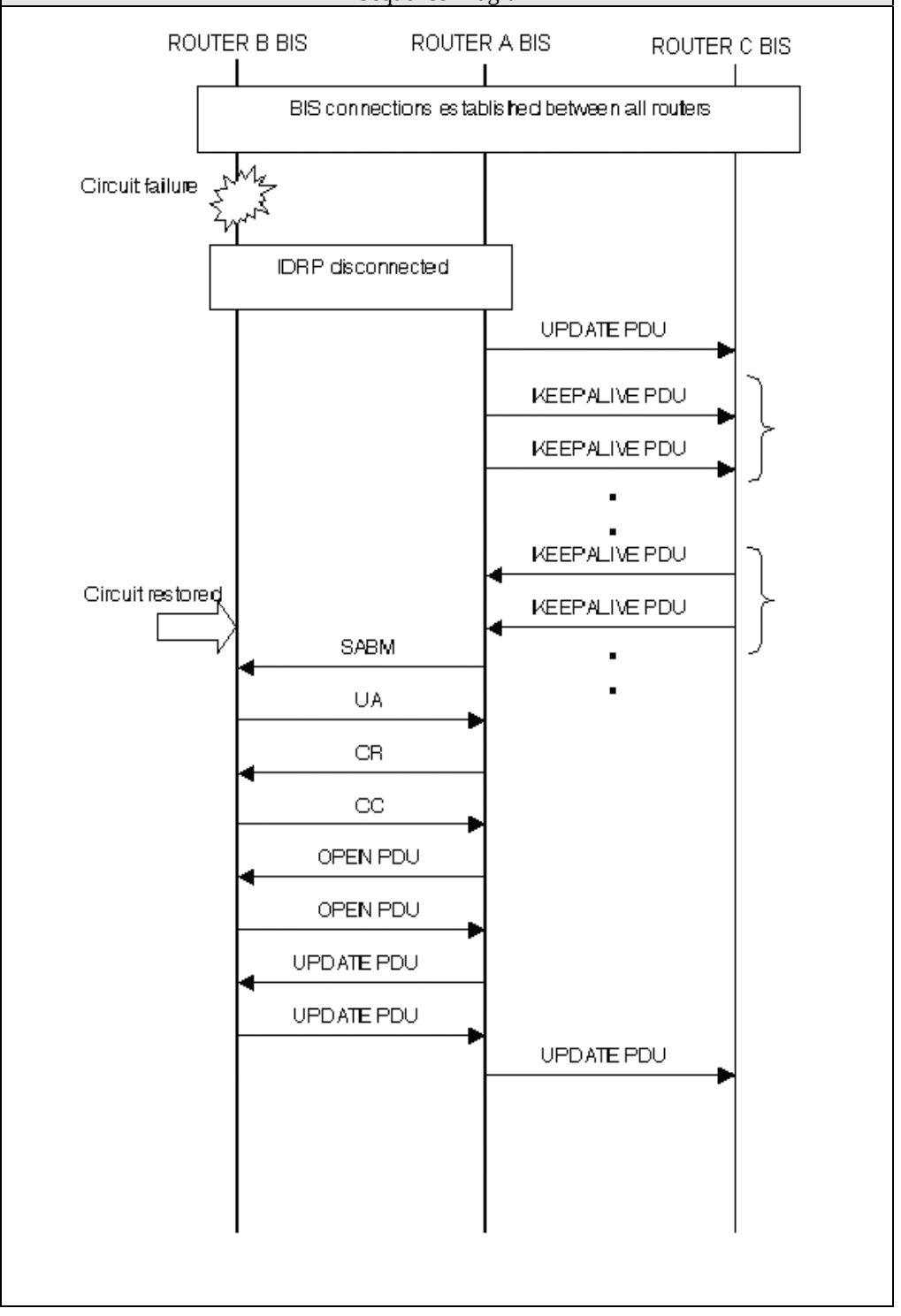
Test No.			Sequence Diagram
4	11	1	
4	11	2	
4	11	3	
4	12	1	
4	12	2	
4	12	3	
4	12	4	

Figure 23 Sequence: Failure and recovery of ROUTER B-ROUTER A circuit

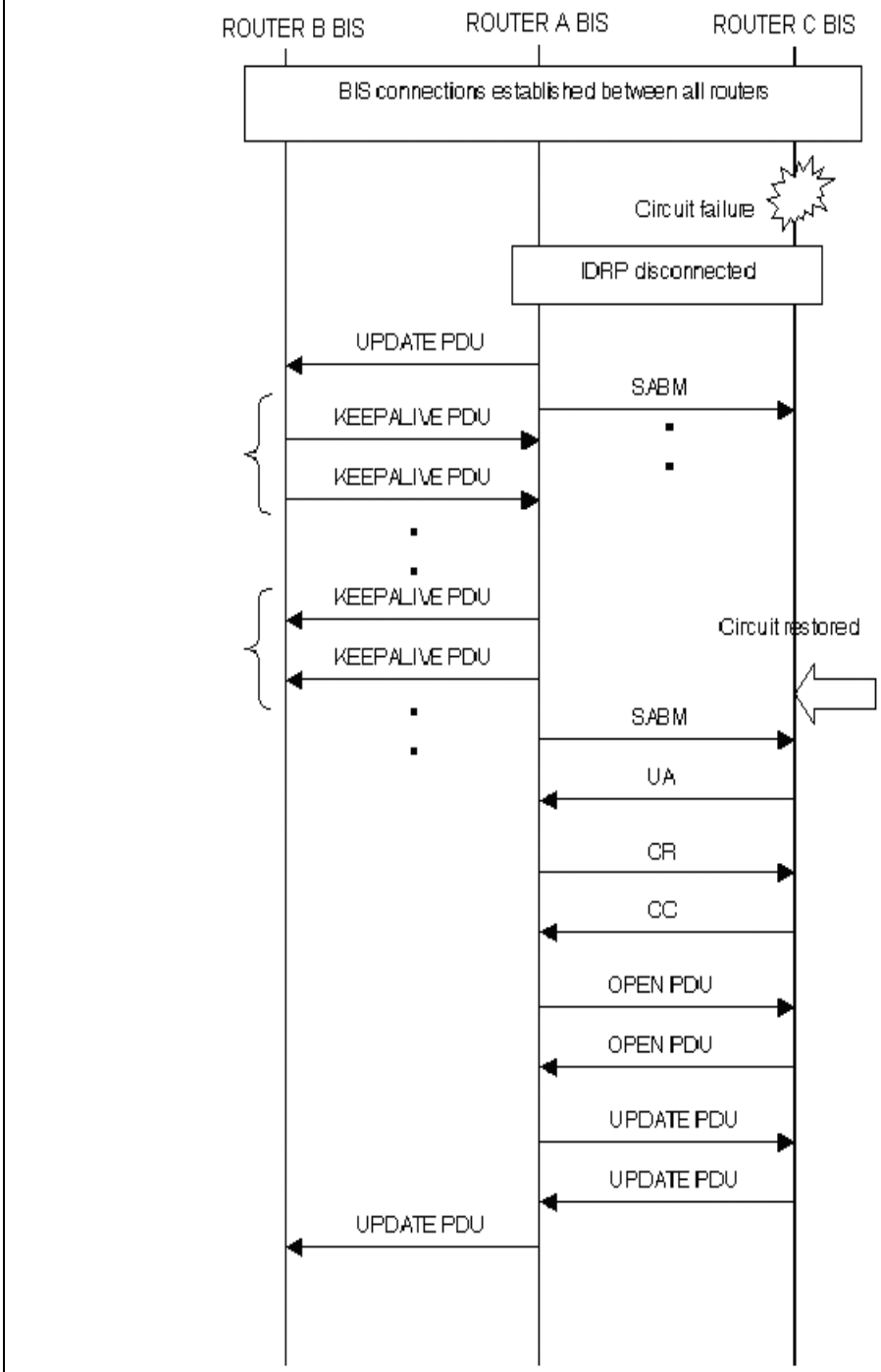
Test No.			Sequence Diagram
4	13	1	
4	13	2	
4	13	3	
4	14	1	
4	14	2	
4	14	3	
4	14	4	

Figure 24 Sequence: Failure and recovery of ROUTER C-ROUTER A circuit

Table 15 Router Failure and Recovery Test Procedure

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
Failure and recovery of ROUTER C	Failure of ROUTER C	4-15-1	Simulate failure and recovery of ROUTER C by rebooting the router. At failure: ・ At ROUTER A, check that routing information for ROUTER C is deleted. ・ At ROUTER B, check that routing information for ROUTER C is deleted.	OK / NG	/ /
	Recovery of ROUTER C	4-15-2	Check that the ROUTER C-ROUTER A router connection is automatically re-established after ROUTER C recovers. After recovery: ・At ROUTER A, check that routing information for ROUTER C is added. ・At ROUTER B, check that routing information for ROUTER C is added.	OK / NG	/ /
Failure and recovery of ROUTER A	Failure of ROUTER A	4-16-1	Simulate failure and recovery of ROUTER A by forcing failover. At failure: ・At ROUTER B, check that routing information for ROUTER A and ROUTER C are deleted ・At ROUTER C, check that routing information for ROUTER A and ROUTER B are deleted.	OK / NG	/ /

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
	Recovery of ROUTER A	4-16-2	Check that the ROUTER C-ROUTER A and ROUTER A-ROUTER B router connections are automatically re-established after ROUTER A recovers. After recovery: ・At ROUTER A, check that routing information is added for ROUTER C and ROUTER B. ・At ROUTER B, check that routing information for ROUTER C and ROUTER A are added. ・At ROUTER C, check that routing information for ROUTER A and ROUTER B are added.	OK / NG	/ /
Failure and recovery of ROUTER B	Failure of ROUTER B	4-17-1	Simulate failure and recovery of ROUTER B by rebooting the router. At failure: ・At ROUTER A, check that routing information for ROUTER B is deleted. ・At ROUTER C, check that routing information for ROUTER B is deleted.	OK / NG	/ /
	Recovery of ROUTER B	4-17-2	Check that the ROUTER A-ROUTER B router connection is automatically re-established after ROUTER B recovers. After recovery: ・At ROUTER A, check that routing information for ROUTER B is added. ・At ROUTER C, check that routing information for ROUTER B is added. ・At ROUTER B, check that routing information for ROUTER A and ROUTER C are added.	OK / NG	/ /

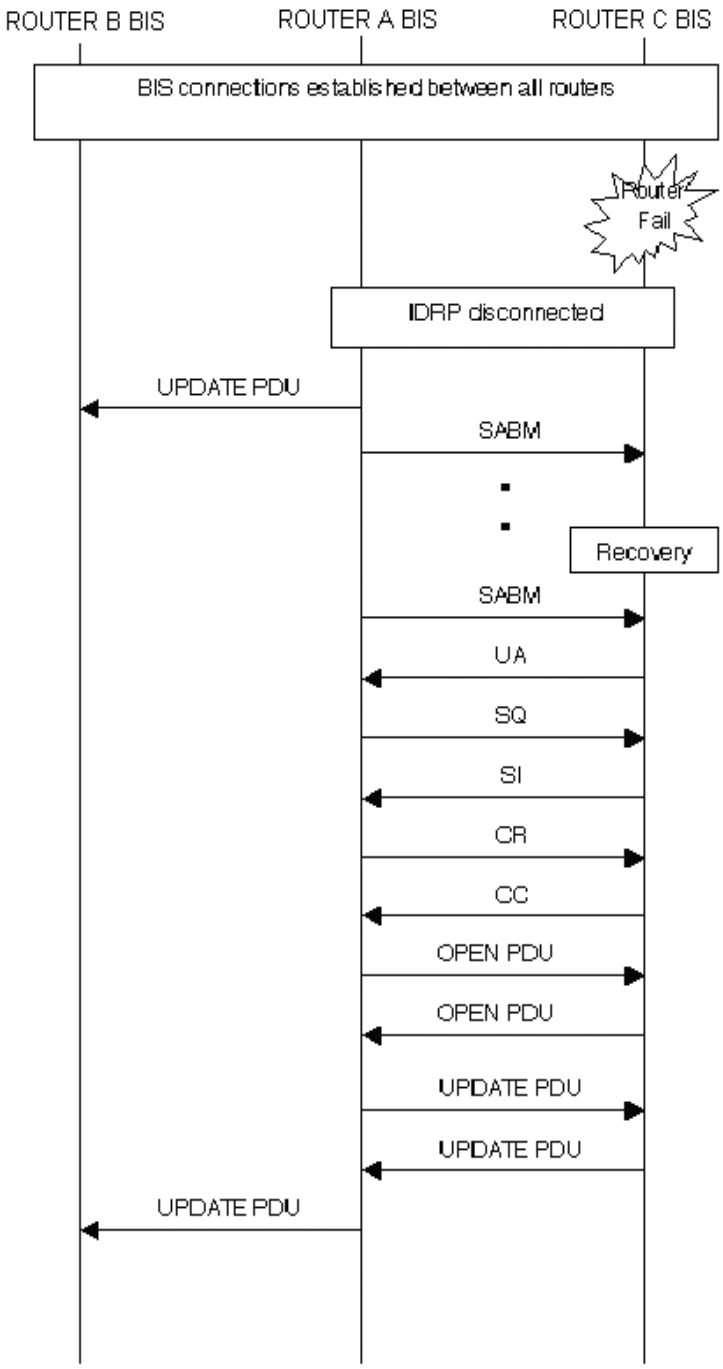
Test No.			Sequence Diagram
4	15	1	
4	15	2	

Figure 25 Sequence: Failure and Recovery of ROUTER C

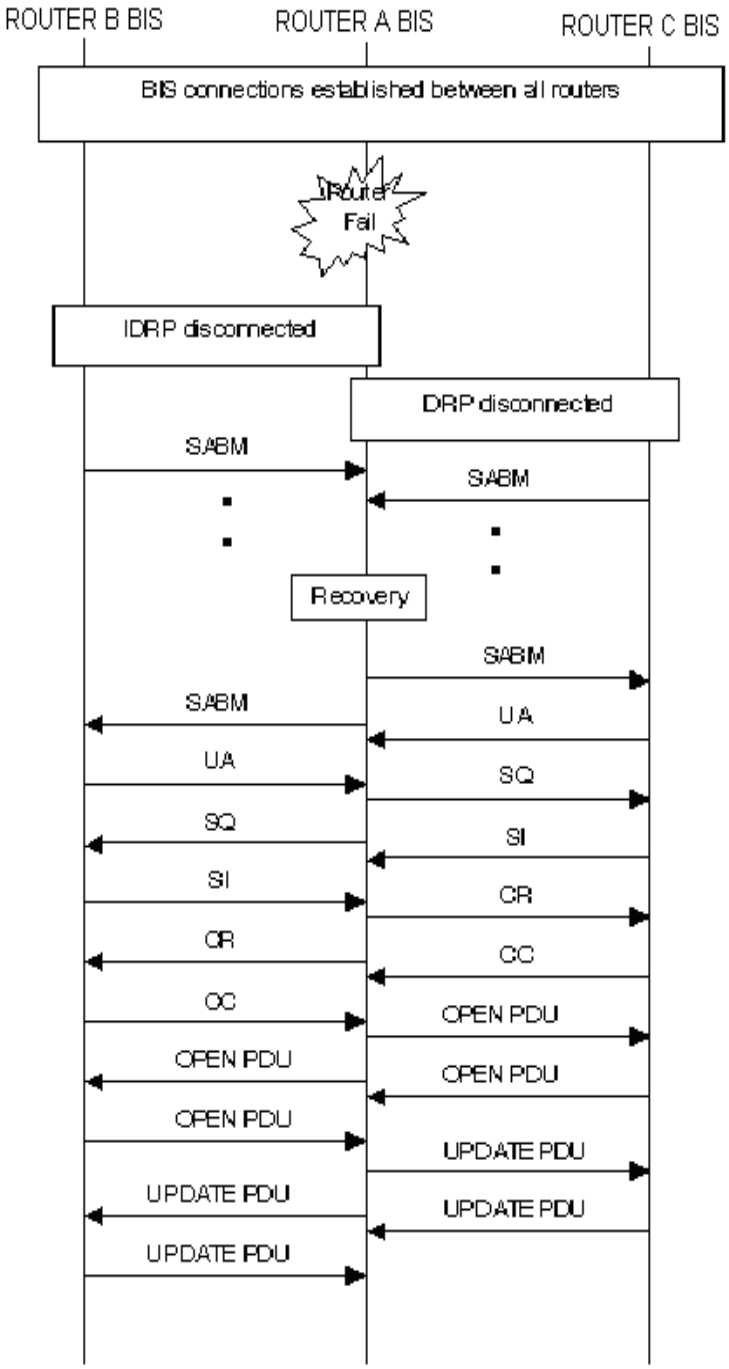
Test No.			Sequence Diagram
4	16	1	
4	16	2	

Figure 26 Sequence: Failure and Recovery of ROUTER A

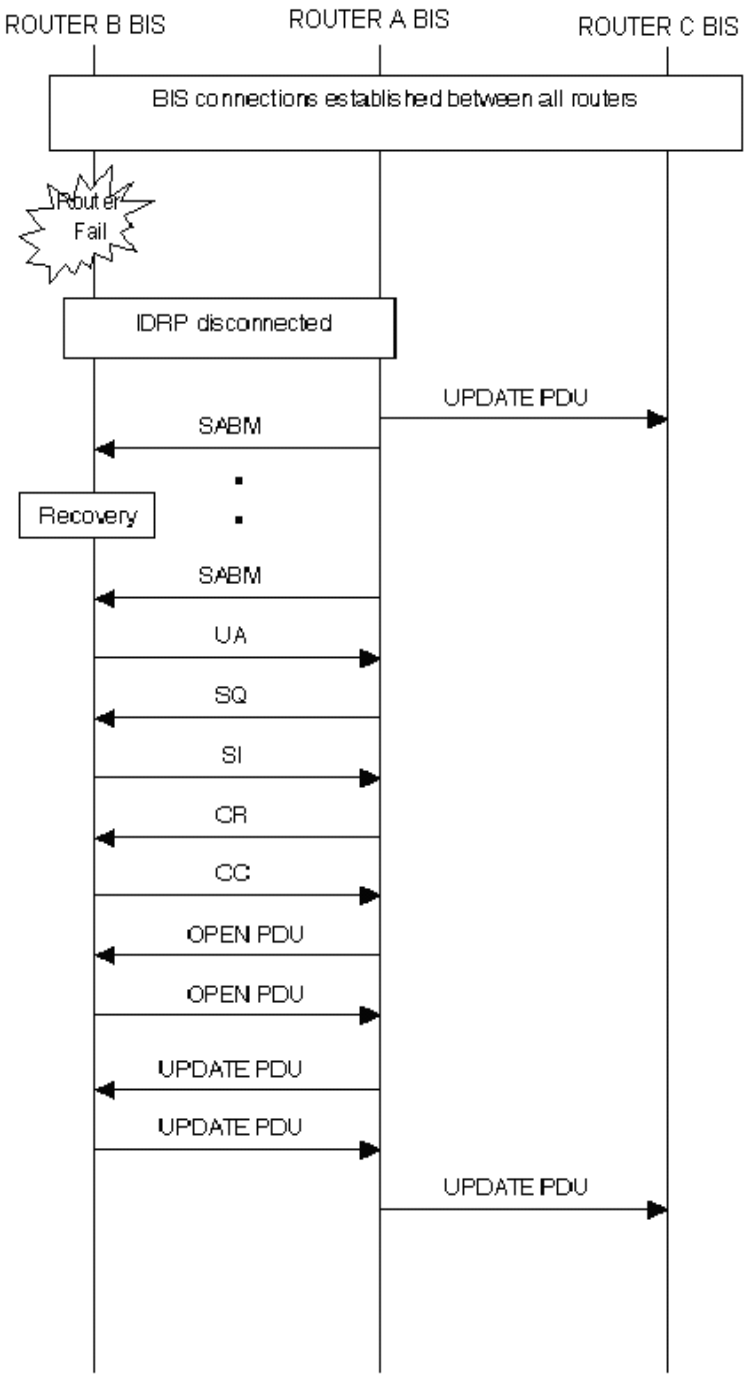
Test No.			Sequence Diagram
4	17	1	
4	17	2	

Figure 27 Sequence: Failure and Recovery of ROUTER B

Table 16 End-to-End CLNP Echo Test Procedure

4. ATN Router Tests		**Test Item**	**Procedure**	**Result**	**Date/Time**
End-to-End CLNP Echo Test between end systems in ROUTER C domain and ROUTER B domain	ERQ transmission	4-18-1	Send ERQ PDU from ES in ROUTER C domain to ES in ROUTER B domain. Confirm receipt of ERQ PDU at ES in ROUTER B domain.	OK / NG	/ /
	ERP transmission	4-18-2	Send ERP PDU from ES in ROUTER B domain to ES in ROUTER C domain. Confirm receipt of ERP PDU at ES in ROUTER C domain.	OK / NG	/ /
	Continuous ERQ/ERP transmission	4-18-3	Repeat 4-18-1 to 4-18-2 ten times to confirm that there is no problem with ERQ/ERP transmission and relay through the ROUTER A.	OK / NG	/ /
	ERQ transmission	4-18-4	Send ERQ PDU from ES in ROUTER B domain to ES in ROUTER C domain. Confirm receipt of ERQ PDU at ES in ROUTER C domain.	OK / NG	/ /
	ERP transmission	4-18-5	Send ERP PDU from ES in ROUTER B domain to ES in ROUTER C domain. Confirm receipt of ERP PDU at ES in ROUTER C domain.	OK / NG	/ /
	Continuous ERQ/ERP transmission	4-18-6	Repeat 4-18-4 to 4-18-6 ten times to confirm that there is no problem with ERQ/ERP transmission and relay through the ROUTER A.	OK / NG	/ /

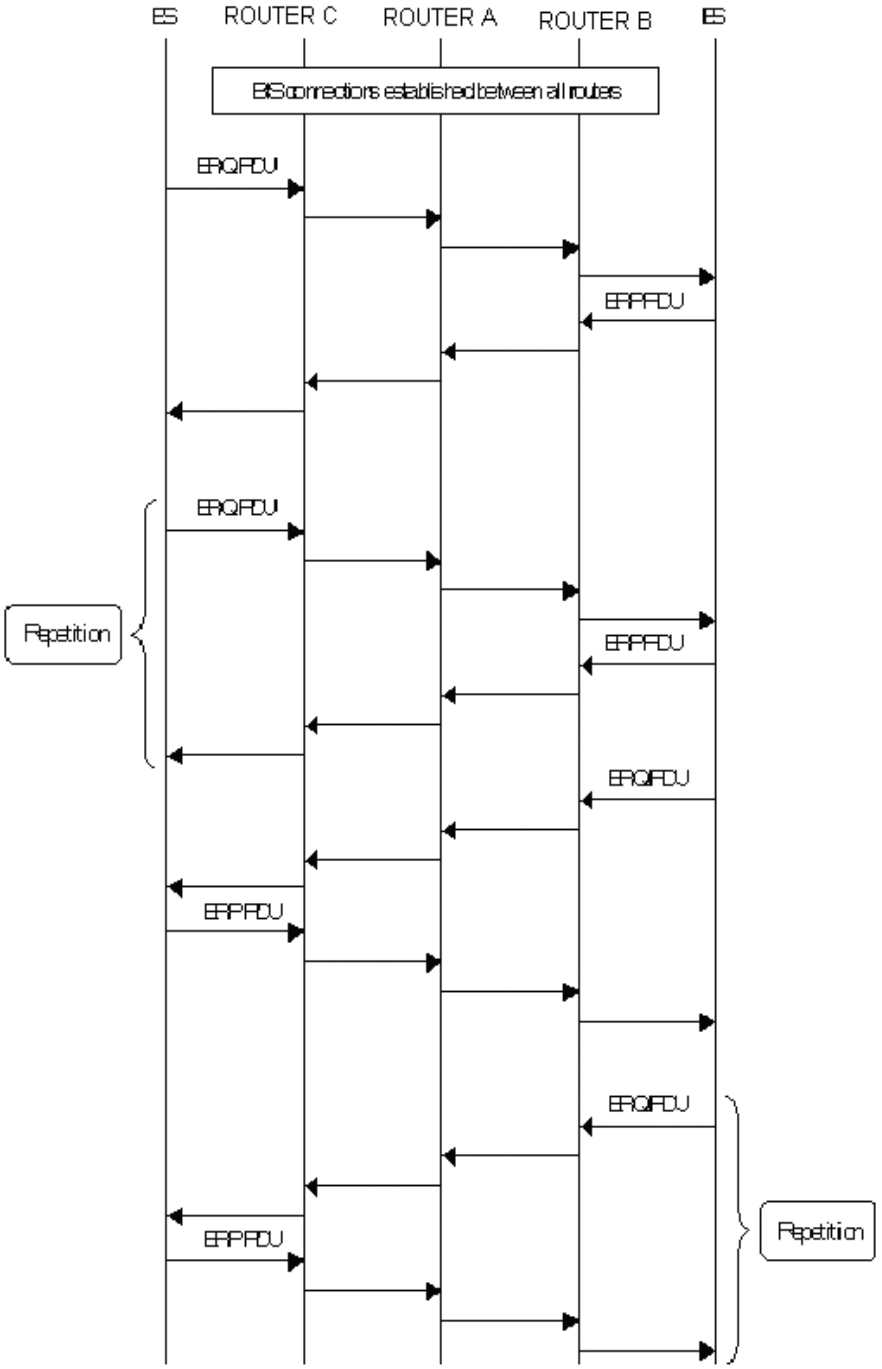
Test No.			Sequence Diagram
4	18	1	
4	18	2	
4	18	3	
4	18	4	
4	18	5	
4	18	6	

Figure 28 Sequence: End-to-End CLNP Echo Tests

6.5. Test Case 5: ATN Router Network Test

a) Objective

Technical trial to verify multiple router addition/deletion, carrier medium failure/restoration and router failure/recovery with routers connected in three-domain configurations i.e. AMHSLAND1, AMHSLAND2 and AMHSLAND3. The test will also verify routing table updates and automatic re-route. The test configurations are as shown below.

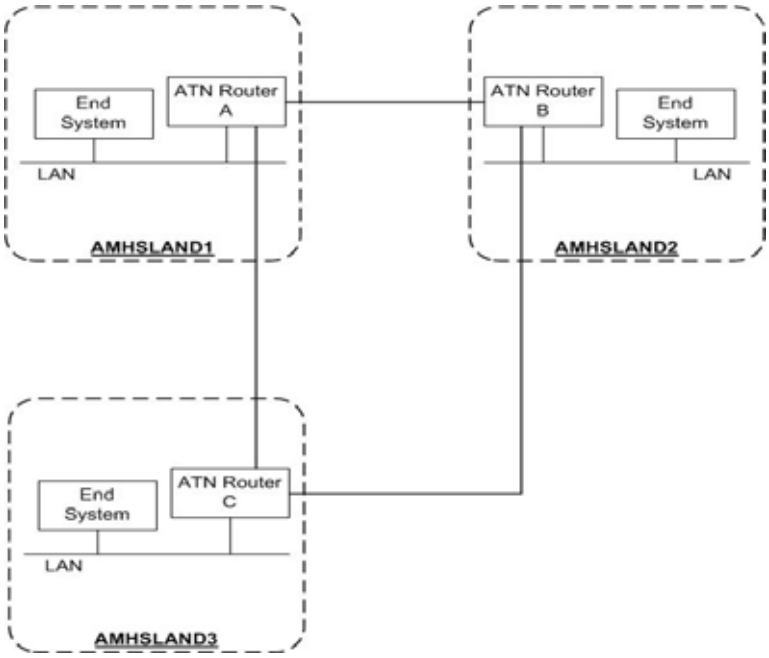


Figure 29 Test Configuration: Routers connected in three-domain configuration

b) Test Overview

(i) Router connected in three-domain configurations

ROUTER CONNECTION AND ECHO REQUEST (TABLE 17)

5-1: Router connection of ROUTER A to ROUTER B (ROUTER A-ROUTER C and ROUTER B-ROUTER C established).

5-2: Echo test between all routers.

ROUTER DISCONNECTION AND RE-ACTIVATION (TABLE 18)

5-3, 5-4: Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route and re-activation.

5-5, 5-6: Manual router disconnection at ROUTER B of ROUTER B-ROUTER C route and re-activation.

5-7, 5-8: Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route and re-activation.

COMMUNICATION CIRCUIT FAILURE AND RECOVERY (TABLE 19)

5-9, 5-10: Failure and recovery of ROUTER A-ROUTER B circuit.

5-11, 5-12: Failure and recovery of ROUTER B-ROUTER C circuit.

5-13, 5-14: Failure and recovery of ROUTER C-ROUTER A circuit.

ROUTER FAILURE AND RECOVERY (TABLE 20)

5-15: Failure and recovery of ROUTER A.

5-16: Failure and recovery of ROUTER B.

5-17: Failure and recovery of ROUTER C.

ROUTER CONNECTION AND ECHO REQUEST (TABLE 21)

5-18: Echo test between all routers.

Table 17 Router Connection and Echo Test Procedure: Routers A, B, C

5. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER A to ROUTER B	Data link establishment between ROUTER A and ROUTER B	5-1-1	With VC and IDRP connections established between ROUTER A and ROUTER C and also ROUTER B and ROUTER C, initiate the router connection between ROUTER A and ROUTER B. Check and confirm data link and VC are established between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP connection establishment between ROUTER A and ROUTER B	5-1-2	After VC establishment, check and confirm IDRP connection established between ROUTER A and ROUTER B by exchange of OPEN PDUs.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	5-1-3	After IDRP connection established, confirm ROUTER A sends UPDATE PDUs to ROUTER B. At ROUTER B, after receiving UPDATE PDUs from ROUTER A, check that route information on ROUTER A via one direct hop is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	5-1-4	After IDRP connection established, confirm ROUTER B sends UPDATE PDUs to ROUTER A. At ROUTER A, after receiving UPDATE PDUs from ROUTER B, check that route information on ROUTER B via one direct hop is added.	OK / NG	/ /
CLNP Echo Test between routers	ERQ transmission	5-2-1	Send ERQ PDU from ROUTER A to each of the other 2 routers (B, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
	ERQ transmission	5-2-2	Send ERQ PDU from ROUTER B to each of the other 2 routers (A, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
	ERQ transmission	5-2-3	Send ERQ PDU from ROUTER C to each of the other 2 routers (A, B). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /

Table 18 Router Disconnection and Re-activation Test Procedure: Routers A, B, C

5. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route	CEASE PDU transmission from ROUTER A	5-3-1	At ROUTER A, manually close the router connection to ROUTER B. Confirm ROUTER A sends a CEASE PDU to ROUTER B.	OK / NG	/ /
	CEASE PDU transmission from ROUTER B and route update	5-3-2	At ROUTER B, confirm receipt of CEASE PDU from ROUTER A. Confirm ROUTER B sends a CEASE PDU to ROUTER A and that route to ROUTER A is now via ROUTER C.	OK / NG	/ /
	Route update at ROUTER A	5-3-3	At ROUTER A, confirm receipt of CEASE PDU from ROUTER B, and that route to ROUTER B is now via ROUTER C.	OK / NG	/ /
	VC disconnection between ROUTER A and ROUTER B	5-3-4	Confirm that the VC between ROUTER A and ROUTER B is closed normally.	OK / NG	/ /
	ERQ transmission	5-3-5	Send ERQ PDU from ROUTER A to ROUTER B. Confirm receipt of ERP PDU from ROUTER B.	OK / NG	/ /
	ERQ transmission	5-3-6	Send ERQ PDU from ROUTER B to ROUTER A. Confirm receipt of ERP PDU from ROUTER A.	OK / NG	/ /
Route re-activation from ROUTER A	Router connection re-activation from ROUTER A	5-4-1	At ROUTER A, manually initiate router connection to ROUTER B (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER A	5-4-2	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for ROUTER B is updated, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER B	5-4-3	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for ROUTER A is updated, and that the route to ROUTER A is one direct hop.	OK / NG	/ /

5. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Manual router disconnection at ROUTER B of ROUTER B-ROUTER C route	CEASE PDU transmission from ROUTER B	5-5-1	At ROUTER B, manually close the router connection to ROUTER C. Confirm ROUTER B sends a CEASE PDU to ROUTER C.	OK / NG	/ /
	CEASE PDU transmission from ROUTER C and route update	5-5-2	At ROUTER C, confirm receipt of CEASE PDU from ROUTER B. Confirm ROUTER C sends a CEASE PDU to ROUTER B and that route to ROUTER B is now via ROUTER A.	OK / NG	/ /
	Route update at ROUTER B	5-5-3	At ROUTER B, confirm receipt of CEASE PDU from ROUTER C, and that route to ROUTER C is now via ROUTER A.	OK / NG	/ /
	VC disconnection between ROUTER B and ROUTER C	5-5-4	Confirm that the VC between ROUTER B and ROUTER C is closed normally.	OK / NG	/ /
	ERQ transmission	5-5-5	Send ERQ PDU from ROUTER B to ROUTER C. Confirm receipt of ERP PDU from ROUTER C.	OK / NG	/ /
	ERQ transmission	5-5-6	Send ERQ PDU from ROUTER C to ROUTER B. Confirm receipt of ERP PDU from ROUTER B.	OK / NG	/ /
Route re-activation from ROUTER B	Router connection re-activation from ROUTER B	5-6-1	At ROUTER B, manually initiate router connection to ROUTER C (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER B	5-6-2	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for ROUTER C is updated, and that the route to ROUTER C is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER C	5-6-3	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for ROUTER B is updated, and that the route to ROUTER B is one direct hop.	OK / NG	/ /

5. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route	CEASE PDU transmission from ROUTER C	5-7-1	At ROUTER C, manually close the router connection to ROUTER A. Confirm ROUTER C sends a CEASE PDU to ROUTER A.	OK / NG	/ /
	CEASE PDU transmission from ROUTER A and route update	5-7-2	At ROUTER A, confirm receipt of CEASE PDU from ROUTER C. Confirm ROUTER A sends a CEASE PDU to ROUTER C and that route to ROUTER C is now via ROUTER B.	OK / NG	/ /
	Route update at ROUTER C	5-7-3	At ROUTER C, confirm receipt of CEASE PDU from ROUTER A, and that route to ROUTER A is now via ROUTER B.	OK / NG	/ /
	VC disconnection between ROUTER C and ROUTER A	5-7-4	Confirm that the VC between ROUTER C and ROUTER A is closed normally.	OK / NG	/ /
	ERQ transmission	5-7-5	Send ERQ PDU from ROUTER A to ROUTER C. Confirm receipt of ERP PDU from ROUTER C.	OK / NG	/ /
	ERQ transmission	5-7-6	Send ERQ PDU from ROUTER C to ROUTER A. Confirm receipt of ERP PDU from ROUTER A.	OK / NG	/ /
Route re-activation from ROUTER C	Router connection re-activation from ROUTER C	5-8-1	At ROUTER C, manually initiate router connection to ROUTER A (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER C	5-8-2	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for ROUTER A is updated, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER A	5-8-3	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for ROUTER C is updated, and that the route to ROUTER C is one direct hop.	OK / NG	/ /

Sequence diagram to be inserted

Table 19 Communication Circuit Failure and Recovery Test Procedure: Routers A, B, C

5. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier media failure of ROUTER A-ROUTER B circuit and route deletion	Data link and VC disconnection	5-9-1	Simulate carrier medium failure between ROUTER A and ROUTER B by disconnecting WAN cable from ROUTER A. Check and confirm data link and VC are disconnected between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP disconnection and route update	5-9-2	Check and confirm that IDRP connection between ROUTER A and ROUTER B is closed. At ROUTER A, check that route information for ROUTER B via one direct hop is deleted. At ROUTER B, check that route information for ROUTER A via one direct hop is deleted.	OK / NG	/ /
	ERQ transmission	5-9-3	Send ERQ PDU from ROUTER A to each of the other 2 routers (B, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
	ERQ transmission	5-9-4	Send ERQ PDU from ROUTER B to each of the other 2 routers (A, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
Carrier media restoration of ROUTER A-ROUTER B circuit and route addition	Data link, VC, and router connection re-establishment	5-10-1	Restore the ROUTER A-ROUTER B router connection. Confirm router connection is re-established between ROUTER A and ROUTER B.	OK / NG	/ /
	Routing table entries for ROUTER A	5-10-2	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for ROUTER B and ROUTER C exists, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER B	5-10-3	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for ROUTER A and ROUTER C exists, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
Carrier media failure of ROUTER B-ROUTER C circuit	Data link and VC disconnection	5-11-1	Simulate carrier medium failure between ROUTER B and ROUTER C by disconnecting WAN cable from ROUTER B. Check and confirm data link and VC are disconnected between ROUTER B and ROUTER C.	OK / NG	/ /

5. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	IDRP disconnection and route update	5-11-2	Check and confirm that IDRP connection between ROUTER B and ROUTER C is closed. At ROUTER B, check that route information for ROUTER C via one direct hop is deleted. At ROUTER C, check that route information for ROUTER B via one direct hop is deleted.	OK / NG	/ /
	ERQ transmission	5-11-3	Send ERQ PDU from ROUTER B to each of the other 2 routers (A, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
	ERQ transmission	5-11-4	Send ERQ PDU from ROUTER C to each of the other 2 routers (A, B). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
Carrier media restoration of ROUTER B-ROUTER C circuit and route addition	Data link, VC, and router connection re-establishment	5-12-1	Restore the ROUTER B-ROUTER C router connection. Confirm router connection is re-established between ROUTER B and ROUTER C.	OK / NG	/ /
	Routing table entries for ROUTER A	5-12-2	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for ROUTER A and ROUTER C exists, and that the route to ROUTER C is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER B	5-12-3	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for ROUTER A and ROUTER B exists, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
Carrier media failure of ROUTER C-ROUTER A circuit	Data link and VC disconnection	5-13-1	Simulate carrier medium failure between ROUTER C and ROUTER A by disconnecting WAN cable from ROUTER C. Check and confirm data link and VC are disconnected between ROUTER C and ROUTER A.	OK / NG	/ /
	IDRP disconnection and route update	5-13-2	Check and confirm that IDRP connection between ROUTER C and ROUTER A is closed. At ROUTER C, check that route information for ROUTER A via one direct hop is deleted. At ROUTER A, check that route information for ROUTER C via one direct hop is deleted.	OK / NG	/ /

5. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	ERQ transmission	5-13-3	Send ERQ PDU from ROUTER C to each of the other 2 routers (B, A). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
	ERQ transmission	5-13-4	Send ERQ PDU from ROUTER A to each of the other 2 routers (B, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
Carrier media restoration of ROUTER C-ROUTER A circuit and route addition	Data link, VC, and router connection re-establishment	5-14-1	Restore the ROUTER C-ROUTER A router connection. Confirm router connection is re-established between ROUTER C and ROUTER A.	OK / NG	/ /
	Routing table entries for ROUTER A	5-14-2	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for ROUTER B and ROUTER A exists, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER B	5-14-3	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for ROUTER B and ROUTER C exists, and that the route to ROUTER C is one direct hop.	OK / NG	/ /

Sequence diagram to be inserted

Table 20 Router Failure and Recovery Test Procedure: Routers A, B, C

5. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Failure and recovery of ROUTER A	Failure of ROUTER A	5-15-1	Simulate failure and recovery of ROUTER A by rebooting the router. At failure: ・At ROUTER B, verify that routing information for ROUTER A is deleted, but that routing information for ROUTER C remains. ・At ROUTER C, verify that routing information for ROUTER A is deleted, but that routing information for ROUTER B remains.	OK / NG	/ /
	Recovery of ROUTER A	5-15-2	Check that the ROUTER A-ROUTER B and ROUTER A-ROUTER C router connections are automatically re-established after ROUTER A recovers. After recovery: ・At ROUTER A, check that routing information is added for ROUTER B and ROUTER C. ・At ROUTER B, check that routing information for ROUTER A is added. ・At ROUTER C, check that routing information for ROUTER A is added.	OK / NG	/ /
Failure and recovery of ROUTER B	Failure of ROUTER B	5-16-1	Simulate failure and recovery of ROUTER B by rebooting the router. At failure: ・At ROUTER A, verify that routing information for ROUTER B is deleted, but that routing information for ROUTER C remains. ・At ROUTER C, verify that routing information for ROUTER B is deleted, but that routing information for ROUTER A remains.	OK / NG	/ /

5. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	Recovery of ROUTER B	5-16-2	Check that the ROUTER A-ROUTER B and ROUTER B-ROUTER C router connections are automatically re-established after ROUTER B recovers. After recovery: ・At ROUTER B, check that routing information is added for ROUTER A and ROUTER C. ・At ROUTER A, check that routing information for ROUTER B is added. ・At ROUTER C, check that routing information for ROUTER B is added..	OK / NG	/ /
Failure and recovery of ROUTER C	Failure of ROUTER C	5-17-1	Simulate failure and recovery of ROUTER C by rebooting the router. At failure: ・At ROUTER A, verify that routing information for ROUTER C is deleted, but that routing information for ROUTER B remains. ・At ROUTER B, verify that routing information for ROUTER C is deleted, but that routing information for ROUTER A remains.	OK / NG	/ /
	Recovery of ROUTER C	5-17-2	Check that the ROUTER A-ROUTER C and ROUTER C-ROUTER B router connections are automatically re-established after ROUTER C recovers. After recovery: ・At ROUTER C, check that routing information is added for ROUTER A and ROUTER B. ・At ROUTER A, check that routing information for ROUTER C is added. ・At ROUTER B, check that routing information for ROUTER C is added.	OK / NG	/ /

Sequence diagram to be inserted

Table 21 Echo Test Procedure: Routers A, B, C

5. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
CLNP Echo Test between routers	ERQ transmission	5-18-1	Send ERQ PDU from ROUTER A to each of the other 2 routers (B, C). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /
	ERQ transmission	5-18-2	Send ERQ PDU from ROUTER B to each of the other 2 routers (A, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	5-18-3	Send ERQ PDU from ROUTER C to each of the other 2 routers (A, B). Confirm receipt of ERP PDU from each of the 2 routers.	OK / NG	/ /

Sequence diagram to be inserted

6.6. Test Case 6: ATN Router Network Test

a) Objective

Technical trial to verify multiple router addition/deletion, carrier medium failure/restoration and router failure/recovery with routers connected in four-domain configurations i.e. AMHSLAND1, AMHSLAND2, AMHSLAND3 and AMHSLAND4. The test will also verify routing table updates and automatic re-route. The test configurations are as shown below.

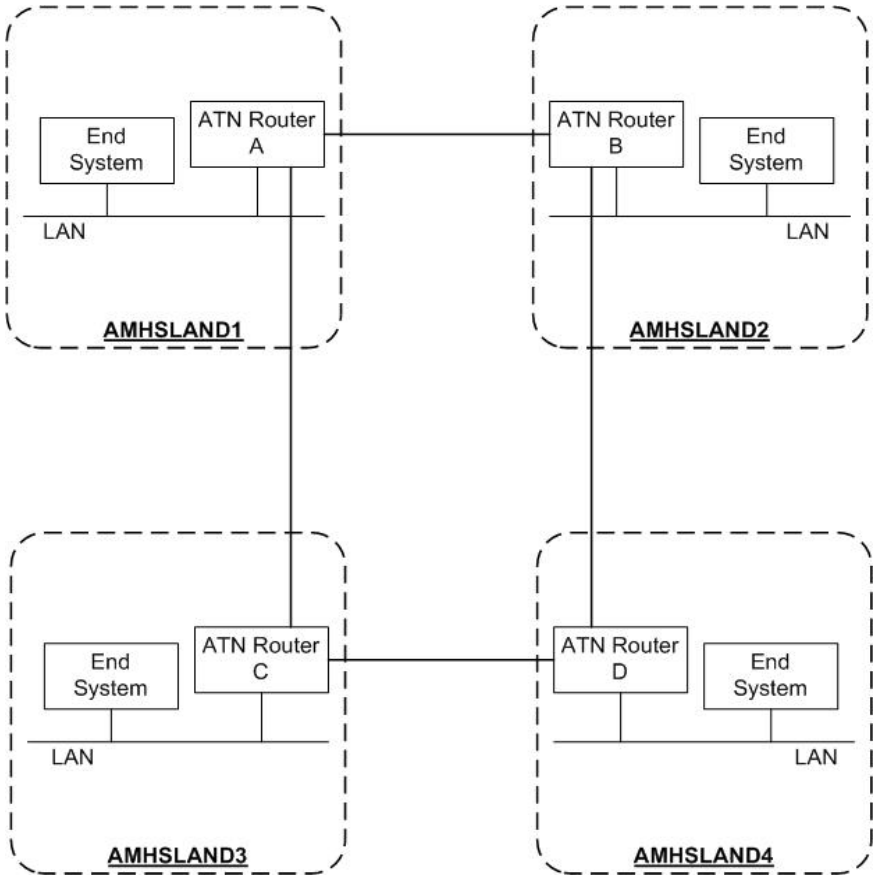


Figure 30 Test Configuration: Routers connected in three-domain configuration

b) Test Overview

(i) Router connected in four-domain configurations

ROUTER CONNECTION AND ECHO REQUEST (TABLE 22)

6-1: Router connection of ROUTER A to ROUTER B (ROUTER A-ROUTER C and ROUTER B-ROUTER D established).

6-2: Router connection of ROUTER C to ROUTER D.

6-3: Echo test between all routers.

ROUTER DISCONNECTION AND RE-ACTIVATION (TABLE 23)

6-4, 6-5: Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route and re-activation.

6-6, 6-7: Manual router disconnection at ROUTER B of ROUTER B-ROUTER D route and re-activation.

6-8, 6-9: Manual router disconnection at ROUTER D of ROUTER D-ROUTER C route and re-activation.

6-10, 6-11: Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route and re-activation.

COMMUNICATION CIRCUIT FAILURE AND RECOVERY (TABLE 24)

6-12, 6-13: Failure and recovery of ROUTER A-ROUTER B circuit.

6-14, 6-15: Failure and recovery of ROUTER B-ROUTER D circuit.

6-16, 6-17: Failure and recovery of ROUTER D-ROUTER C circuit.

6-18, 6-19: Failure and recovery of ROUTER C-ROUTER A circuit.

ROUTER FAILURE AND RECOVERY (TABLE 25)

6-20: Failure and recovery of ROUTER A.

6-21: Failure and recovery of ROUTER B.

6-22: Failure and recovery of ROUTER C.

6-23: Failure and recovery of ROUTER D.

ROUTER CONNECTION AND ECHO REQUEST (TABLE 26)

6-24: Echo test between all routers.

Table 22 Router Connection, Echo Test: Routers A, B, C, D

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER A to ROUTER B	Data link establishment between ROUTER A and ROUTER B	6-1-1	With VC and IDRP connections established between ROUTER A and ROUTER C and also ROUTER B and ROUTER D, initiate the router connection between ROUTER A and ROUTER B. Check and confirm data link and VC are established between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP connection establishment between ROUTER A and ROUTER B	6-1-2	After VC establishment, check and confirm IDRP connection established between ROUTER A and ROUTER B by exchange of OPEN PDUs.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER B	6-1-3	After IDRP connection established, confirm ROUTER A sends UPDATE PDUs to ROUTER B. At ROUTER B, after receiving UPDATE PDUs from ROUTER A, check that route information on ROUTER A and ROUTER C are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER A	6-1-4	After IDRP connection established, confirm ROUTER B sends UPDATE PDUs to ROUTER A. At ROUTER A, after receiving UPDATE PDUs from ROUTER B, check that route information on ROUTER B and ROUTER D are added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER A to ROUTER C	6-1-5	At ROUTER A, after receiving UPDATE PDUs from ROUTER B, confirm ROUTER A sends an UPDATE PDU to ROUTER C. At ROUTER C, confirm that UPDATE PDU is received, and that route information of ROUTER B and ROUTER D is added.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER B to ROUTER D	6-1-6	At ROUTER B, after receiving UPDATE PDUs from ROUTER A, confirm ROUTER B sends an UPDATE PDU to ROUTER D. At ROUTER D, confirm that UPDATE PDU is received, and that route information of ROUTER A and ROUTER C is added.	OK / NG	/ /

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Router connection of ROUTER C to ROUTER D	Data link establishment between ROUTER C and ROUTER D	6-2-1	Initiate the router connection between ROUTER C and ROUTER D. Check and confirm data link and VC are established between ROUTER C and ROUTER D.	OK / NG	/ /
	IDRP connection establishment between ROUTER C and ROUTER D	6-2-2	After VC establishment, check and confirm IDRP connection established between ROUTER C and ROUTER D by exchange of OPEN PDUs.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER D	6-2-3	After IDRP connection established, confirm ROUTER C sends UPDATE PDUs to ROUTER D. At ROUTER D, after receiving UPDATE PDUs from ROUTER C, check that appropriate route information for ROUTER A and ROUTER B are present in routing table.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER D to ROUTER C	6-2-4	After IDRP connection established, confirm ROUTER D sends UPDATE PDUs to ROUTER C. At ROUTER C, after receiving UPDATE PDUs from ROUTER D, check that appropriate route information for ROUTER A and ROUTER B are present in routing table.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER C to ROUTER A	6-2-5	At ROUTER C , after receiving UPDATE PDUs from ROUTER D, confirm ROUTER C sends an UPDATE PDU to ROUTER A. At ROUTER A, confirm that UPDATE PDU is received, check that appropriate route information for ROUTER B and ROUTER D are present in the routing table.	OK / NG	/ /
	UPDATE PDU transmission from ROUTER D to ROUTER B	6-2-6	At ROUTER D, after receiving UPDATE PDUs from ROUTER C, confirm ROUTER D sends an UPDATE PDU to ROUTER B. At ROUTER B, confirm that UPDATE PDU is received, check that appropriate route information for ROUTER A and ROUTER C are present in the routing table.	OK / NG	/ /
CLNP Echo Test between routers	ERQ transmission	6-3-1	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
CLNP Echo Test between routers	ERQ transmission	6-3-1	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-3-2	Send ERQ PDU from ROUTER B to each of the other 3 routers (A, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-3-3	Send ERQ PDU from ROUTER C to each of the other 3 routers (A, B, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-3-4	Send ERQ PDU from ROUTER D to each of the other 3 routers (A, B, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /

Sequence diagram to be inserted

Table 23 Router Disconnection and Re-activation: Routers A, B, C, D

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Manual router disconnection at ROUTER A of ROUTER A-ROUTER B route	CEASE PDU transmission from ROUTER A	6-4-1	At ROUTER A, manually close the router connection to ROUTER B. Confirm ROUTER A sends a CEASE PDU to ROUTER B.	OK / NG	/ /
	CEASE PDU transmission from ROUTER B and route deletion	6-4-2	At ROUTER B, confirm receipt of CEASE PDU from ROUTER A. Confirm ROUTER B sends a CEASE PDU to ROUTER A. However, confirm that route information for all 3 other routers still exists, and that the route to ROUTER A is through ROUTER D and ROUTER C.	OK / NG	/ /
	ERQ transmission	6-4-3	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-4-4	Send ERQ PDU from ROUTER B to each of the other 3 routers (A, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Route re-activation from ROUTER A	Router connection re-activation from ROUTER A	6-5-1	At ROUTER A, manually initiate router connection to ROUTER B (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER A	6-5-2	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for all 3 other routers exists, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER B	6-5-3	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for all 3 other routers exists, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
Manual router disconnection at ROUTER B of ROUTER B-ROUTER D route	CEASE PDU transmission from ROUTER B	6-6-1	At ROUTER B, manually close the router connection to ROUTER D. Confirm ROUTER B sends a CEASE PDU to ROUTER D.	OK / NG	/ /
	CEASE PDU transmission from ROUTER D and route deletion	6-6-2	At ROUTER D, confirm receipt of CEASE PDU from ROUTER B. Confirm ROUTER D sends a CEASE PDU to ROUTER B. However, confirm that route information for all 3 other routers still exists, and that the route to ROUTER B is through ROUTER C and ROUTER A.	OK / NG	/ /

6. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	ERQ transmission	6-6-3	Send ERQ PDU from ROUTER B to each of the other 3 routers (A, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-6-4	Send ERQ PDU from ROUTER D to each of the other 3 routers (A, B, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Route re-activation from ROUTER B	Router connection re-activation from ROUTER B	6-7-1	At ROUTER B, manually initiate router connection to ROUTER D (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER B	6-7-2	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for all 3 other routers exists, and that the route to ROUTER D is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER D	6-7-3	Following the exchange of UPDATE PDUs, verify at ROUTER D that route information for all 3 other routers exists, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
Manual router disconnection at ROUTER D of ROUTER D-ROUTER C route	CEASE PDU transmission from ROUTER D	6-8-1	At ROUTER D, manually close the router connection to ROUTER C. Confirm ROUTER D sends a CEASE PDU to ROUTER C.	OK / NG	/ /
	CEASE PDU transmission from ROUTER C and route deletion	6-8-2	At ROUTER C, confirm receipt of CEASE PDU from ROUTER D. Confirm ROUTER C sends a CEASE PDU to ROUTER D. However, confirm that route information for all 3 other routers still exists, and that the route to ROUTER D is through ROUTER A and ROUTER B.	OK / NG	/ /
	ERQ transmission	6-8-3	Send ERQ PDU from ROUTER D to each of the other 3 routers (A, B, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-8-4	Send ERQ PDU from ROUTER C to each of the other 3 routers (A, B, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Route re-activation from ROUTER D	Router connection re-activation from ROUTER D	6-9-1	At ROUTER D, manually initiate router connection to ROUTER C (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER D	6-9-2	Following the exchange of UPDATE PDUs, verify at ROUTER D that route information for all 3 other routers exists, and that the route to ROUTER C is one direct hop.	OK / NG	/ /

6. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	Routing table entries for ROUTER C	6-9-3	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for all 3 other routers exists, and that the route to ROUTER D is one direct hop.	OK / NG	/ /
Manual router disconnection at ROUTER C of ROUTER C-ROUTER A route	CEASE PDU transmission from ROUTER C	6-10-1	At ROUTER C, manually close the router connection to ROUTER A. Confirm ROUTER C sends a CEASE PDU to ROUTER A.	OK / NG	/ /
	CEASE PDU transmission from ROUTER A and route deletion	6-10-2	At ROUTER A, confirm receipt of CEASE PDU from ROUTER C. Confirm ROUTER A sends a CEASE PDU to ROUTER C. However, confirm that route information for all 3 other routers still exists, and that the route to ROUTER C is through ROUTER B and ROUTER D.	OK / NG	/ /
	ERQ transmission	6-10-3	Send ERQ PDU from ROUTER C to each of the other 3 routers (A, B, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-10-4	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Route re-activation from ROUTER C	Router connection re-activation from ROUTER C	6-11-1	At ROUTER C, manually initiate router connection to ROUTER A (VC call: caller, OPEN PDU: send). Confirm the X.25 VC and IDRP connection are established.	OK / NG	/ /
	Routing table entries for ROUTER C	6-11-2	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for all 3 other routers exists, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER A	6-11-3	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for all 3 other routers exists, and that the route to ROUTER C is one direct hop.	OK / NG	/ /

Sequence diagram to be inserted

Table 24 Communication Circuit Failure and Recovery Test Procedure: Routers A, B, C, D

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier media failure of ROUTER A-ROUTER B circuit	Data link and VC disconnection	6-12-1	Simulate carrier medium failure between ROUTER A and ROUTER B by disconnecting WAN cable from ROUTER A. Check and confirm data link and VC are disconnected between ROUTER A and ROUTER B.	OK / NG	/ /
	IDRP disconnection and route update	6-12-2	Check and confirm that IDRP connection between ROUTER A and ROUTER B is closed. However, confirm in ROUTER A that route information for all 3 other routers still exists, and that the route to ROUTER B is through ROUTER C and ROUTER D. Also, confirm in ROUTER B that route information for all 3 other routers still exists, and that the route to ROUTER A is through ROUTER D and ROUTER C.	OK / NG	/ /
	ERQ transmission	6-12-3	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-12-4	Send ERQ PDU from ROUTER B to each of the other 3 routers (A, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Carrier media restoration of ROUTER A-ROUTER B circuit and route addition	Data link, VC, and router connection re-establishment	6-13-1	Restore the ROUTER A-ROUTER B router connection. Confirm router connection is re-established between ROUTER A and ROUTER B.	OK / NG	/ /
	Routing table entries for ROUTER A	6-13-2	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for all 3 other routers exists, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER B	6-13-3	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for all 3 other routers exists, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
Carrier media failure of ROUTER B-ROUTER D circuit	Data link and VC disconnection	6-14-1	Simulate carrier medium failure between ROUTER B and ROUTER D by disconnecting WAN cable from ROUTER B. Check and confirm data link and VC are disconnected between ROUTER B and ROUTER D.	OK / NG	/ /

6. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	IDRP disconnection and route update	6-14-2	Check and confirm that IDRP connection between ROUTER B and ROUTER D is closed. However, confirm in ROUTER B that route information for all 3 other routers still exists, and that the route to ROUTER D is through ROUTER A and ROUTER C. Also, confirm in ROUTER D that route information for all 3 other routers still exists, and that the route to ROUTER B is through ROUTER C and ROUTER A.	OK / NG	/ /
	ERQ transmission	6-14-3	Send ERQ PDU from ROUTER B to each of the other 3 routers (A, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-14-4	Send ERQ PDU from ROUTER D to each of the other 3 routers (A, B, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Carrier media restoration of ROUTER B-ROUTER D circuit and route addition	Data link, VC, and router connection re-establishment	6-15-1	Restore the ROUTER B-ROUTER D router connection. Confirm router connection is re-established between ROUTER B and ROUTER D.	OK / NG	/ /
	Routing table entries for ROUTER B	6-15-2	Following the exchange of UPDATE PDUs, verify at ROUTER B that route information for all 3 other routers exists, and that the route to ROUTER D is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER D	6-15-3	Following the exchange of UPDATE PDUs, verify at ROUTER D that route information for all 3 other routers exists, and that the route to ROUTER B is one direct hop.	OK / NG	/ /
Carrier media failure of ROUTER D-ROUTER C circuit	Data link and VC disconnection	6-16-1	Simulate carrier medium failure between ROUTER D and ROUTER C by disconnecting WAN cable from ROUTER D. Check and confirm data link and VC are disconnected between ROUTER D and ROUTER C.	OK / NG	/ /
	IDRP disconnection and route update	6-16-2	Check and confirm that IDRP connection between ROUTER D and ROUTER C is closed. However, confirm in ROUTER D that route information for all 3 other routers still exists, and that the route to ROUTER C is through ROUTER B and ROUTER A. Also, confirm in ROUTER C that route information for all 3 other routers still exists, and that the route to ROUTER D is through ROUTER A and ROUTER B.	OK / NG	/ /

6. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	ERQ transmission	6-16-3	Send ERQ PDU from ROUTER D to each of the other 3 routers (A, B, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-16-4	Send ERQ PDU from ROUTER C to each of the other 3 routers (A, B, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
Carrier media restoration of ROUTER D-ROUTER C circuit and route addition	Data link, VC, and router connection re-establishment	6-17-1	Restore the ROUTER D-ROUTER C router connection. Confirm router connection is re-established between ROUTER D and ROUTER C.	OK / NG	/ /
	Routing table entries for ROUTER D	6-17-2	Following the exchange of UPDATE PDUs, verify at ROUTER D that route information for all 3 other routers exists, and that the route to ROUTER C is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER C	6-17-3	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for all 3 other routers exists, and that the route to ROUTER D is one direct hop.	OK / NG	/ /
Carrier media failure of ROUTER C-ROUTER A circuit	Data link and VC disconnection	6-18-1	Simulate carrier medium failure between ROUTER C and ROUTER A by disconnecting WAN cable from ROUTER C. Check and confirm data link and VC are disconnected between ROUTER C and ROUTER A.	OK / NG	/ /
	IDRP disconnection and route update	6-18-2	Check and confirm that IDRP connection between ROUTER C and ROUTER A is closed. However, confirm in ROUTER C that route information for all 3 other routers still exists, and that the route to ROUTER A is through ROUTER D and ROUTER B. Also, confirm in ROUTER A that route information for all 3 other routers still exists, and that the route to ROUTER C is through ROUTER B and ROUTER D.	OK / NG	/ /
	ERQ transmission	6-18-3	Send ERQ PDU from ROUTER C to each of the other 3 routers (A, B, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-18-4	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Carrier media restoration of ROUTER C-ROUTER A circuit and route addition	Data link, VC, and router connection re-establishment	6-19-1	Restore the ROUTER C-ROUTER A router connection. Confirm router connection is re-established between ROUTER C and ROUTER A.	OK / NG	/ /
	Routing table entries for ROUTER C	6-19-2	Following the exchange of UPDATE PDUs, verify at ROUTER C that route information for all 3 other routers exists, and that the route to ROUTER A is one direct hop.	OK / NG	/ /
	Routing table entries for ROUTER A	6-19-3	Following the exchange of UPDATE PDUs, verify at ROUTER A that route information for all 3 other routers exists, and that the route to ROUTER C is one direct hop.	OK / NG	/ /

Sequence diagram to be inserted

Table 25 Router Failure and Recovery Test Procedure: Routers A, B, C, D

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
Failure and recovery of ROUTER A	Failure of ROUTER A	6-20-1	Simulate failure and recovery of ROUTER A by rebooting the router. At failure: ・At ROUTER B, verify that routing information for ROUTER A is deleted, but that routing information for ROUTER C and ROUTER D remains. ・At ROUTER C, verify that routing information for ROUTER A is deleted, but that routing information for ROUTER B and ROUTER D remains. ・At ROUTER D, verify that routing information for ROUTER A is deleted, but that routing information for ROUTER B and ROUTER C remains.	OK / NG	/ /
	Recovery of ROUTER A	6-20-2	Check that the ROUTER A-ROUTER B and ROUTER A-ROUTER C router connections are automatically re-established after ROUTER A recovers. After recovery: ・At ROUTER A, check that routing information is added for ROUTER B, ROUTER C and ROUTER D. ・At ROUTER B, check that routing information for ROUTER A is added. ・At ROUTER C, check that routing information for ROUTER A is added. ・At ROUTER D, check that routing information for ROUTER A is added.	OK / NG	/ /
Failure and recovery of ROUTER B	Failure of ROUTER B	6-21-1	Simulate failure and recovery of ROUTER B by rebooting the router. At failure: ・At ROUTER A, verify that routing information for ROUTER B is deleted, but that routing information for ROUTER C and ROUTER D remains.	OK / NG	/ /

6. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
			・At ROUTER C, verify that routing information for ROUTER B is deleted, but that routing information for ROUTER A and ROUTER D remains. ・At ROUTER D, verify that routing information for ROUTER B is deleted, but that routing information for ROUTER A and ROUTER C remains.	OK / NG	/ /
	Recovery of ROUTER B	6-21-2	Check that the ROUTER A-ROUTER B and ROUTER B-ROUTER D router connections are automatically re-established after ROUTER B recovers. After recovery: ・At ROUTER B, check that routing information is added for ROUTER A, ROUTER C and ROUTER D. ・At ROUTER A, check that routing information for ROUTER B is added. ・At ROUTER C, check that routing information for ROUTER B is added. ・At ROUTER D, check that routing information for ROUTER B is added.	OK / NG	/ /
Failure and recovery of ROUTER C	Failure of ROUTER C	6-22-1	Simulate failure and recovery of ROUTER C by rebooting the router. At failure: ・At ROUTER A, verify that routing information for ROUTER C is deleted, but that routing information for ROUTER B and ROUTER D remains. ・At ROUTER B, verify that routing information for ROUTER C is deleted, but that routing information for ROUTER A and ROUTER D remains. ・At ROUTER D, verify that routing information for ROUTER C is deleted, but that routing information for ROUTER A and ROUTER B remains.	OK / NG	/ /

6. ATN Router Network Test		Test Item	Procedure	Result	Date/Time
	Recovery of ROUTER C	6-22-2	Check that the ROUTER A-ROUTER C and ROUTER C-ROUTER D router connections are automatically re-established after ROUTER C recovers. After recovery: ・At ROUTER C, check that routing information is added for ROUTER A, ROUTER B and ROUTER D. ・At ROUTER A, check that routing information for ROUTER C is added. ・At ROUTER B, check that routing information for ROUTER C is added. ・At ROUTER D, check that routing information for ROUTER C is added.	OK / NG	/ /
Failure and recovery of ROUTER D	Failure of ROUTER D	6-23-1	Simulate failure and recovery of ROUTER D by rebooting the router. At failure: ・At ROUTER A, verify that routing information for ROUTER D is deleted, but that routing information for ROUTER B and ROUTER C remains. ・At ROUTER B, verify that routing information for ROUTER D is deleted, but that routing information for ROUTER A and ROUTER C remains. ・At ROUTER C, verify that routing information for ROUTER D is deleted, but that routing information for ROUTER A and ROUTER B remains.	OK / NG	/ /
	Recovery of ROUTER D	6-23-2	Check that the ROUTER B-ROUTER D and ROUTER C-ROUTER D router connections are automatically re-established after ROUTER D recovers. After recovery: ・At ROUTER D, check that routing information is added for ROUTER A, ROUTER B and ROUTER C. ・At ROUTER A, check that routing information for ROUTER D is added. ・At ROUTER B, check that routing information for ROUTER D is added. ・At ROUTER C, check that routing information for ROUTER D is added.	OK / NG	/ /

Sequence diagram to be inserted

Table 26 Echo Test Procedure: Routers A, B, C, D

6. ATN Router Network Test		**Test Item**	**Procedure**	**Result**	**Date/Time**
CLNP Echo Test between routers	ERQ transmission	6-24-1	Send ERQ PDU from ROUTER A to each of the other 3 routers (B, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-24-2	Send ERQ PDU from ROUTER B to each of the other 3 routers (A, C, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-24-3	Send ERQ PDU from ROUTER C to each of the other 3 routers (A, B, D). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /
	ERQ transmission	6-24-4	Send ERQ PDU from ROUTER D to each of the other 3 routers (A, B, C). Confirm receipt of ERP PDU from each of the 3 routers.	OK / NG	/ /

Sequence diagram to be inserted

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

ASIA/PAC
AERONAUTICAL TELECOMMUNICATION NETWORK
SECURITY GUIDANCE DOCUMENT

DRAFT

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1. INTRODUCTION

This Security Guidance Document for the Asia/Pacific Region provides guidance on the implementation of security for states and organizations operating in the region.

1.1 Background

As noted in the Asia/Pacific System Security Policy [Asia/Pac SSP], the fundamental objectives for system security of the ATN are to:

1. Protect ATN data from unauthorized disclosure, modification, or deletion, and
2. Protect ATN resources from unauthorized use and denial of service.

These objectives are achieved through the application of a set of high-level security services. The Asia/Pacific Security Policy identifies the following services:

(1) Confidentiality. Ensures data is not disclosed to unauthorized entities.

(2) Data Integrity. Ensures data has not been altered or destroyed in an unauthorized manner.

(3) Authenticity. Ensures that the source of data or the identity of an entity is as claimed.

(4) Availability. Ensures resources, services, and data are accessible and usable on demand or in a timely, reliable manner by an authorized entity.

(5) Accountability. Enables activities to be traced to users and processes that may then be held responsible for those actions.

These security services are in turn realized by the implementation of a comprehensive set of management, operational, and technical controls. Controls may be organized into the following control classes:

Management controls are safeguards or countermeasures that focus on the management of risk and the management of system security.

Operational controls are safeguards or countermeasures for a system that are primarily implemented and executed by people.

Technical controls are safeguards or countermeasures for a system that are primarily implemented and executed by the system through mechanisms contained in the components of the system.

Figure 1.1 depicts the relationship between Security Objectives, Services, and Controls.

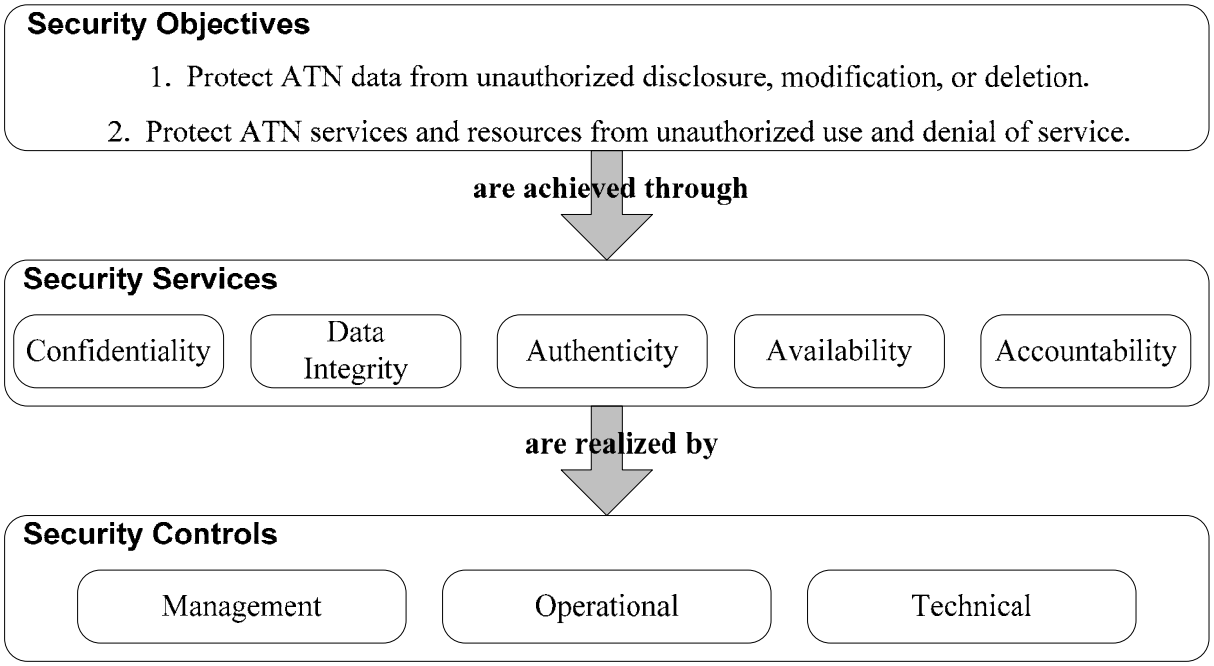


Figure 1-1. Security Objectives, Services, and Controls

1.2 Document Organization

In addition to this introduction, this document contains 4 major sections.

Section 2 provides a description of the 17 control families in the three Management, Operational, and Technical control classes. This section also provides a mapping from the high-level services to the control families.

Section 3 provides guidance on control families in the Management class. This section describes best practices for the management organization in an entity participating in the ATN.

Section 4 provides guidance on control families in the Operational control class. It describes procedures which constitute an effective security operation.

Section 5 provides guidance on control families in the Technical control class. Section 5 describes how technical controls are applied to various components of an ATN system. It gives specific examples of controls applied to each component.

2. SECURITY CONTROL FAMILIES

2.1 Description of Control Families

Access Control (AC) is the capability of the system to limit access to authorized users, processes acting on behalf of authorized users, and devices (including other systems) and to the types of transactions and functions that authorized users are permitted to exercise.

Awareness and Training (AT) ensures that operational personnel are aware of the security risks associated with their activities and the security policies which apply to their systems, and ensures that personnel are adequately trained to carry out their duties and responsibilities.

Audit and Accountability (AU) is the capability of the system to generate audit records that may indicate unauthorized or inappropriate system activity and that may be used to ensure that the actions of individual system users can be uniquely traced to those users so they can be held accountable for their actions.

Certification, Accreditation, and Security Assessments (CA) ensures that the organization's management assesses the security controls in their system and authorize (accredit) the system for operation.

Configuration Management (CM) ensures that operational personnel control changes to their system's configuration.

Contingency Planning (CP) ensures that operational personnel have a plan for continued operation to maintain availability of critical user and system-level information in emergency situations.

Identification and Authentication (IA) is the capability of the system to identify and verify (i.e., authenticate) system users, processes acting on behalf of users, or devices.

Incident Response (IR) ensures that operational personnel handle security incidents and promptly report incidents to appropriate authorities.

Maintenance (MA) ensures that operational personnel perform preventative and regular maintenance on their system.

Media Protection (MP) ensures that operational personnel restrict access to system media to authorized personnel and physically control system media in controlled areas.

Physical and Environmental Protection (PE) ensures that operational personnel limit physical access to systems and protect systems against environmental hazards.

Planning (PL) ensures that the organization's management develops and implements a security plan for the system.

Personnel Security (PS) ensures that operational personnel are trustworthy and meet security criteria for their positions.

Risk Assessment (RA) ensures that the organization's management assesses the risk and magnitude of harm that may result from security attacks on the system.

System and Services Acquisition (SA) ensures that the organization's management allocates the resources required to adequately protect their system.

System and Communications Protection (SC) is the capability of the system to monitor, control, and protect communications and includes architectural controls, confidentiality, data integrity and interoperability.

System and Information Integrity (SI) ensures that operational personnel remediate system flaws, provide protection from malicious code and other attacks on the system's integrity, and monitor alerts and advisories and take appropriate action in response.

2. 2 Realization of Security Services through Controls

Table 2-1 depicts a mapping from the Asia/Pacific System Security Policy to the controls identified in section 2.1.

Table 2-1. Mapping of Controls onto Asia/Pac System Security Policy

Asia/Pac System Security Policy	Technical Controls	Operational Controls	Management Controls
Confidentiality			
(a) ATN data shall be protected from unauthorized disclosure during processing, transmission, and storage commensurate with the designated sensitivity of the data.	System and Communications Protection (SC)	System and Information Integrity (SI) Physical and Environmental Protection (PE)	System and Services Acquisition (SA)
Data Integrity			
(a) ATN data shall be protected from unauthorized or undetected modification during transmission, storage, and processing.	System and Communications Protection (SC)	System and Information Integrity (SI) Physical and Environmental Protection (PE) Configuration Management (CM)	System and Services Acquisition (SA)
Authenticity			
(a) ATN users and processes shall be uniquely identified.	Identification and Authentication (IA)	Personnel Security (PS)	
(b) ATN users and processes shall be authenticated before being granted access to ATN data, services, and resources.	Identification and Authentication (IA) Access Control (AC)	Personnel Security (PS)	
(c) ATN data, services, and resources shall be protected from unauthorized use or tampering.	Access Control (AC)		
(d) ATN users and processes shall have access only to those ATN data, services, and resources for which they have authorization.	Access Control (AC)		
Availability			

Asia/Pac System Security Policy	Technical Controls	Operational Controls	Management Controls
(a) ATN data, services, and resources shall be available for use by authorized users and processes.	System and Communications Protection (SC)	System and Information Integrity (SI) Contingency Planning (CP) Incident Response (IR) Physical and Environmental Protection (PE) Personnel Security (PS)	System and Services Acquisition (SA)
Accountability			
(a) An audit trail of use of ATN data, services, and resources by ATN users and processes shall be maintained.	Audit and Accountability (AU)	Personnel Security (PS)	
Verification			
a. ATN systems shall be verified to have system security commensurate with the risk and magnitude of harm resulting from unauthorized disclosure, modification, or deletion of ATN data, or unauthorized use and denial of service of ATN services and resources.			Planning (PL) Risk Assessment (RA)
Authorization			
a. ATN systems shall be formally approved for operation by the cognizant Designated Approving Authority (DAA).			Certification, Accreditation, and Security Assessments (CA)
b. Significant changes to ATN systems shall require another formal approval (or re-authorization).			Certification, Accreditation, and Security Assessments (CA)

3. MANAGEMENT CONTROL GUIDANCE

As defined in section 1.1, Management Controls are safeguards or countermeasures that focus on the management of risk and the management of system security.

3.1 Certification, Accreditation, and Security Assessments (CA)

The Asia/Pacific System Security Policy requires that ATN systems be verified to have system security commensurate with the risk and magnitude of harm resulting from unauthorized disclosure, modification, or deletion of ATN data, or unauthorized use and denial of service of ATN services and resources. This requirement essentially says that a system should have controls in place to meet the fundamental objectives for system security as noted in section 1.1. Verification of system security is more generally termed certification. This is where an organization conducts a risk assessment (see 3.3) and an assessment of the security controls to determine the extent to which the controls are implemented correctly, operating as intended, and producing the desired outcome in terms of meeting the fundamental system security objectives. Management may use the Asia/Pacific System Security Checklist [Asia/Pac SSC]as a general guide in assessing security controls.

The Asia/Pacific System Security Policy also requires that ATN systems be formally approved (i.e., accredited) for operation by an individual responsible for security in the organization. This individual is called the Designated Approving Authority (DAA). The DAA is a senior organizational official that signs and approves the security accreditation thereby authorizing operation of the system.

3.2 Planning (PL)

A system may be authorized for operation by the organization's management even though there are controls not in place or controls which could be enhanced as determined by the security verification process. In this situation the organization would develop and implements a security plan for adding or enhancing controls in the system.

3.3 Risk Assessment (RA)

A formal risk assessment is the process by which an organization determines the risk and magnitude of harm resulting from unauthorized. The general process of risk assessment is depicted in Figure 3-1 from [NIST 800-100]. The process begins (1) with a characterization of the system. This involves identifying the data, resources, and services, that constitute the system and determining the importance of these items to the organization. The next steps are to identify threats to (2) and vulnerabilities of (3) the data, resources, and services. Identifiable threats (e.g., disclosure, modification, or loss of data) will have some probability of occurring and causing loss or damage to a system. An analysis (4) of the threats and vulnerabilities should

be conducted following a structured approach to analyze controls, estimate likelihood of threat occurrence, and assess the potential impact of the threats to arrive at a general risk determination. Risk analysis are generally and qualitative (e.g., high, medium, low). For each identifiable threat one or more controls should be recommended (5). The nominal controls in the Asia/Pacific System Security Checklist [Asia/Pac SSC] may be used as a general guide; however, additional system specific controls may also be necessary. The overall results of the risk assessment should be formally documented (6).

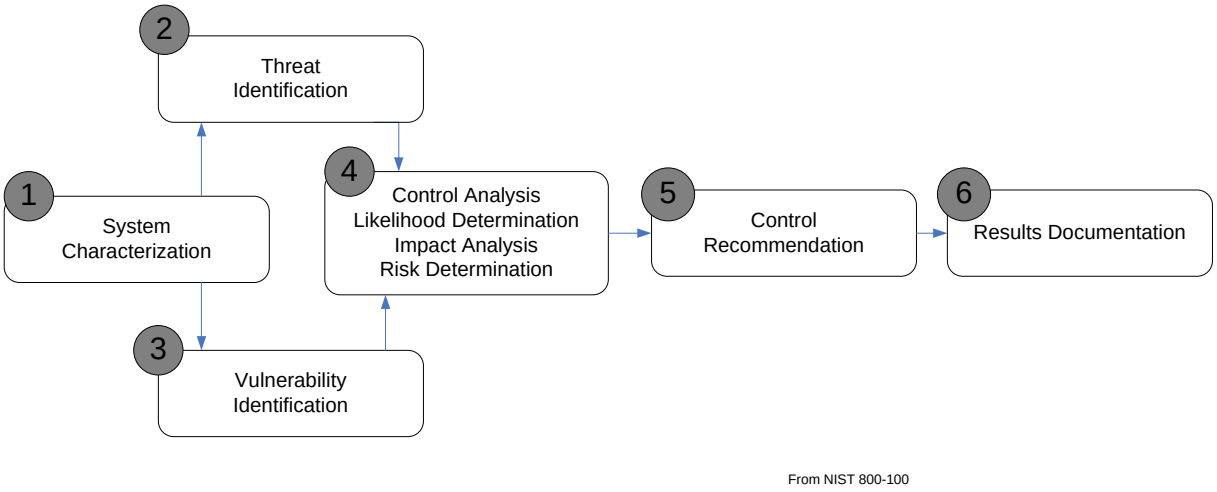


Figure 3-1. Risk Assessment Process

3.4 System and Services Acquisition (SA)

System and Services Acquisition (SA) is the control whereby an organization's management allocates the resources required to protect the system to level commensurate with the risks to the system. This activity should be applied as part of an on-going security policy for the organization. Specific resources should be allocated as a result of the CA and RA activities.

4. OPERATIONAL CONTROL GUIDANCE

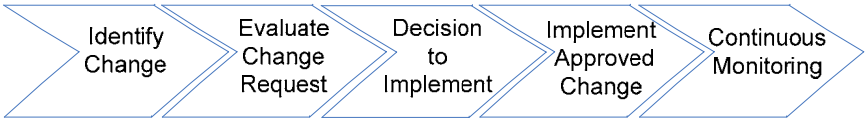
As defined in section 1.1, Operational Controls are safeguards or countermeasures for a system that are primarily implemented and executed by people.

4.1 Awareness and Training (AT)

Awareness and Training (AT) is the control for disseminating security information that management and operational personnel need to do their jobs. Awareness and Training ensures that management and operational personnel understand their security responsibilities and therefore are able to properly use and protect the system data, resources, and services.

4.2 Configuration Management (CM)

Configuration Management (CM) is the control that ensures that operational personnel control changes to their system's hardware components, software components and system adaptation parameters. Figure 4-1 depicts the Configuration Management process.



From NIST 800-100

Figure 4-1. Configuration Management Process

The first step in the process is to identify the need for the change. There can be various reasons for change such as the need to support more bandwidth on a communication channel, the need to upgrade to a new Operating System if the current is no longer supported, and general functional enhancements or corrections to the system. The change should be submitted to a decision-making body in the organization, e.g., to a Configuration Control Board (CCB).

The next step is to evaluate the change request. An impact assessment should be conducted to determine the effect of the change to the system under change or to other interrelated systems. For example a change in the routing policy could affect all systems in the network. Thus a change needs to be evaluated to determine if it is technically correct and if the gains (performance, new functionality, etc) are cost effective.

Next the CCM must make a decision to implement. The CCB may approve, deny, or otherwise defer implementation of the change.

If a decision to implement the change is made, then it should first be tested in an off-line or test environment. Once tested, the change may be placed into the operational system and the associated configuration control documentation is updated.

Configuration Management does not actually start and stop with incremental changes. Rather it is an on-going process that requires continuous monitoring. Configuration Management requires that operational personnel are always aware of their current baseline (for example a specific software release) and that the system is observed in operation to determine if there is any degradation in functional or performance capabilities as the system baseline is changed. In addition to managing software releases, application of fixes (i.e. "patches") to the system and changes in adaptation parameters must also be managed and continuously monitored.

4.3 Contingency Planning (CP)

Contingency Planning (CP) is the control that ensures that operational personnel have a plan for continued operation to maintain availability of critical user and system-level information in emergency situations. Figure 4-2 from [NIST 800-34] depicts the Contingency Planning Process.

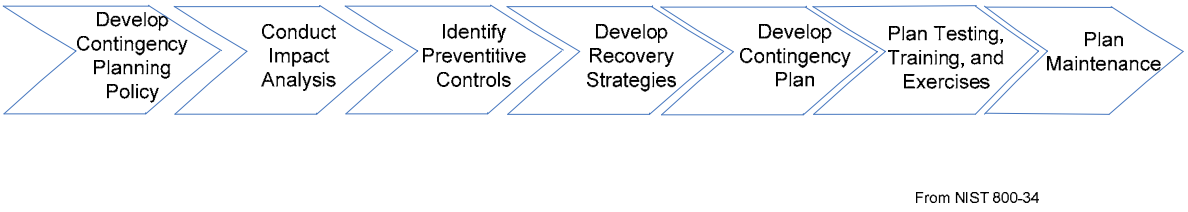


Figure 4-2. Contingency Planning Process

The organization should firstly have a policy for contingency planning that establishes the overall contingency objectives. There should be an impact analysis that evaluates the potential loss of a system or service. This may be the same as the system characterization in the Risk Assessment. The Preventive Controls are a subset of the overall CA controls which address the specific loss of systems and services. A recovery strategy should exist for each potential system/service loss. All the previous steps go into developing a formal Contingency Plan. Attachment A contains an outline for a Contingency Plan. Operational personnel should plan to test the Contingency Plan. Training should be conducted as necessary and actual exercises such as operation of backup systems should be conducted. As the system changes the contingency plan must be updated as part of a Plan Maintenance program.

4.4 Incident Response (IR)

Incident Response (IR) is the control that ensures that operational personnel handle security incidents and promptly report incidents to appropriate authorities. Figure 4-3 from [NIST 800-61] depicts the Incident Response Life Cycle.

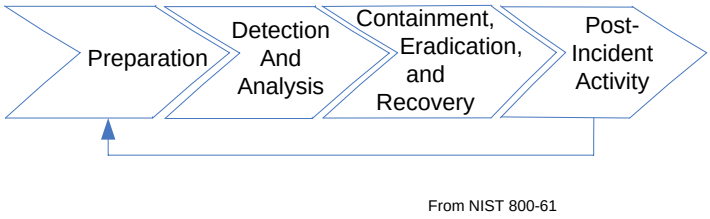


Figure 4-3. Incident Response Life Cycle

As depicted in Figure 4-3, Incident Response has several phases ranging from initial preparation through post-incident analysis which feeds back into the preparation phase. During preparation the organization selects and implements controls based on their risk assessment. The controls however cannot guarantee absolute protection and there will always be some residual risk. Therefore detection is required to alert the organization that an incident has occurred. Detection is primary through the technical controls described in section 5. When detected appropriate personnel within and external to the organization must be promptly notified. When an incident does occur, operational personnel can minimize the impact by firstly containing it before it spreads and does further damage. Measures should be taken to eradicate it as soon as possible so that recovery to normal services can be achieved. The post-incident analysis should attempt to identify the source of the incident as well as determine what additional controls can be implemented to prevent future occurrences, i.e., to apply “lessons learned” from the incident.

Attachment B contains an outline for an Incident Response Plan.

4.5 Maintenance (MA)

Maintenance (MA) is the control ensures that operational personnel perform preventative and regular maintenance on their system.

4.6 Media Protection (MP)

Media Protection (MP) is the control ensures that operational personnel restrict access to system media to authorized personnel and physically control system media in controlled areas.

4.7 Physical and Environmental Protection (PE)

Physical and Environmental Protection (PE) is the control ensures that operational personnel limit physical access to systems and protect systems against environmental hazards.

4.8 Personnel Security (PS)

Personnel Security (PS) is the control that ensures that operational personnel are trustworthy and meet security criteria for their positions.

4.9 System and Information Integrity (SI)

System and Information Integrity (SI) is the control that ensures that operational personnel remediate system flaws, provide protection from malicious code and other attacks on the system's integrity, and monitor alerts and advisories and take appropriate action in response.

5. TECHNICAL CONTROL GUIDANCE

5.1 Technical Controls

As defined in section 1.1, Technical Controls are safeguards or countermeasures that a system executes through mechanisms in the hardware or software components of the system itself. The technical controls addressed in this section are:

- AC - Access Control
- AU - Audit and Accountability
- IA - Identification and Authentication
- SC - System and Communications Protection

For the Management and Operational controls, general guidance was provided for each control. In this section Technical Controls are described in terms of the hardware or software components of the system to which they apply.

5.2 Technical Controls Applied to Information System Components

Technical Controls are best applied following a *Defense-in-Depth* strategy whereby multiple overlapping protection approaches are implemented. For the Asia/Pac ATN, this section provides guidance on the application of controls to the network, equipment, operating system, applications, and data. Figure 5-1 depicts the concept of Defense-in-Depth.

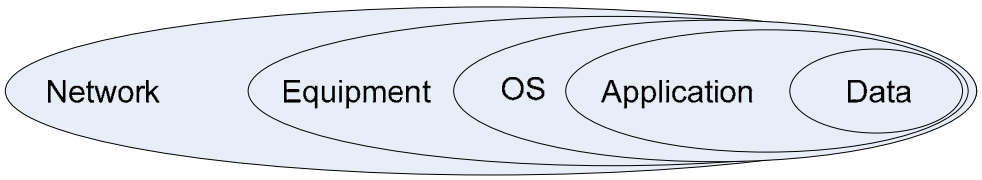


Figure 5-1: Defense-in-Depth

Figure 5-2 depicts the general technical controls applied to information system components.

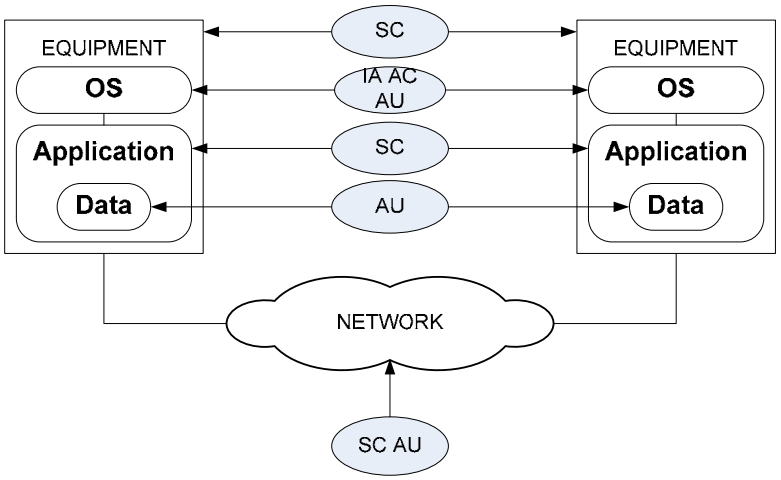


Figure 5-2: Technical Controls to ATN Component Mapping

As is depicted in Figure 5-2, the System and Communications Protection (SC) and Audit and Accountability (AU) control families apply to the Network. Note that network is used in a logical sense here so that protocol software in host systems is part of the network.

The System and Communications Protection (SC) control family also applies to equipment. This generally refers to architectural controls.

The Access Control (AC), Audit and Accountability (AU), and Identification and Authentication (IA) control families apply to the Operating System.

The Systems and Communications Protection (SC) control family applies to Applications.

The Audit and Accountability (AU) applies to Application Data.

5.2.1 Controls Applied to the Network

This section identifies network controls which may be applied in the Asia/Pac ATN in support of AMHS. Figure 5-3 provides an overview of the controls.

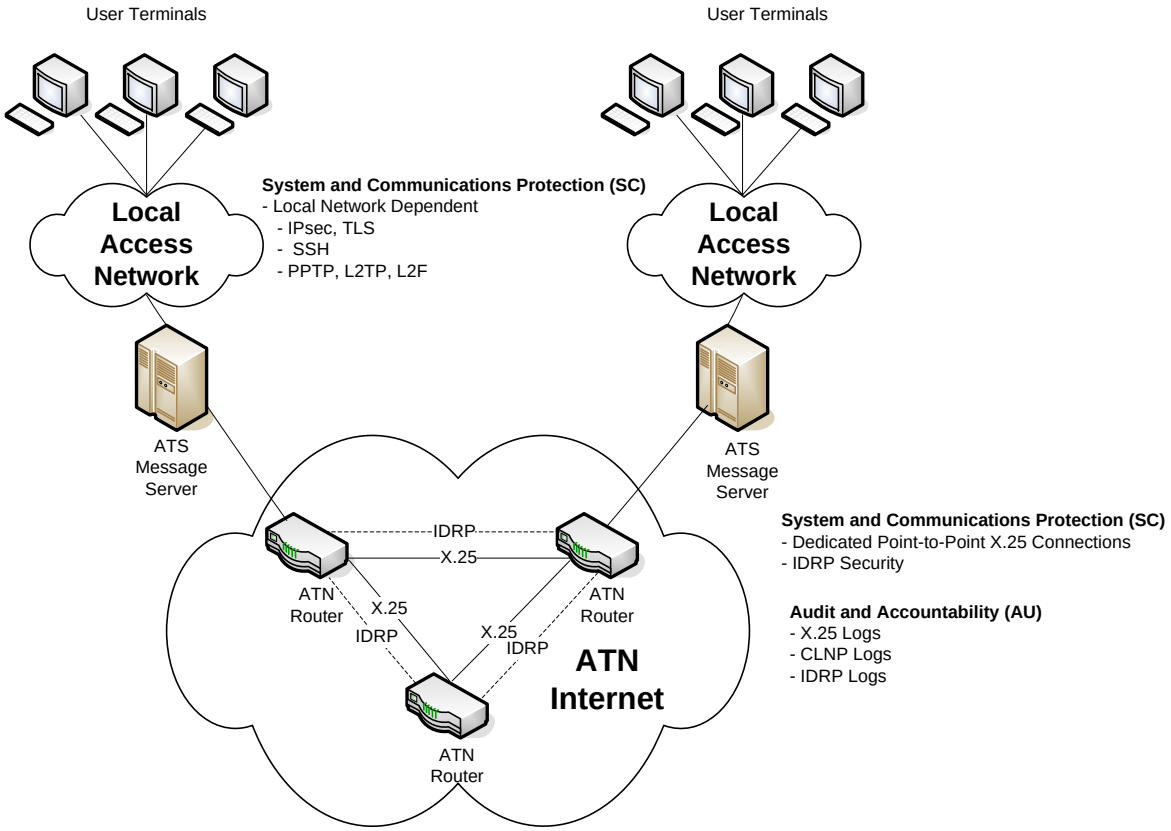


Figure 5-3: Network Controls

5.2.1.1 System and Communications Protection (SC)

5.2.1.1.1 Dedicated Point-to-Point X.25 Links

Currently interconnectivity in the Asia/Pac ATN Internet is through the use of dedicated point-to-point X.25 circuits. This limits access since X.25 circuits are associated with a specific physical port.

5.2.1.1.2 Inter-domain Routing Protocol Security

The Inter-domain Routing Protocol (IDRP) has defined options for authentication of routing data. Edition 3 of Doc 9705 defined a method of authentication using the HMAC keyed message authentication code. Edition 3 allows for two ATN routers to exchange public keys in public key certificates during the IDRP open exchange.

Rather than exchange certificates and implement a supporting Public Key Infrastructure (PKI) it is recommended that the routers derive a shared session key from a pre-shared value.

5.2.1.1.3 Local Access Network Security

The connection of User Terminal to the AMHS switching systems is a local matter. These connections may be secured in a number of ways.

One common method is to use the Secure Shell (SSH) protocol. SSH contains secure replacements for several unencrypted application protocols such as telnet, rcp, and FTP.

An alternative to SSH for HTTP type applications is to use Transport Layer Security (TLS). All major web-browsers support TLS. TLS authentication is typically one way, authenticating the client to a server.

If the local access network is an IP network then an IPsec Virtual Private Network may be used to secure Terminal to AMHS communications.

If the local access method is not a layer 3 network, then various Level 2 protocols may be used. Options include the Point-to-Point Tunneling Protocol (PPTP), the Layer 2 Tunneling Protocol (L2TP), and Layer 2 Forwarding (L2F).

5.2.1.1.4 IPsec with the IP SNDCF

In the ATN Internet of the future the Internet Protocol Subnetwork Dependent Convergence Function (IP SNDCF) may be used to interconnect ATN routers in place of X.25 links. In this case, it is recommended that the IP Security (IPsec) protocols be used. This may be with manual key establishment or dynamically using the Internet Key Exchange (IKE) protocol. IKE may be used with pre-shared keys or using public key certificates.

5.2.1.2 Audit and Accountability (AU)

5.2.1.2.1 System Logs

It is recommended that the communication logs of Asia/Pac ATN Routers be reviewed for anomalous activity. Specifically the following logs should be reviewed:

- X.25 Logs
- IDRP Logs
- Connectionless Network Protocol (CLNP) Logs

5.2.2 Controls Applied to Equipment

5.2.2.1 System and Communications Protection (SC)

5.2.2.1.1 Redundancy

Equipment may be configured redundantly to limit the effects of many attacks on systems including Denial-of-Service attacks.

5.2.3 Controls Applied to the Operating System

5.2.3.1 Identification and Authentication (IA)

5.2.3.1.1 User IDs and Passwords

System Administrators may configure the allowed users of the system. There are at least two classes of accounts which may be configured: normal system users and super-users.

5.2.3.2 Access Control (AC)

5.2.3.2.1 User Access

Once users have been identified and authenticated using IA controls, the system administrator may limit their operating environment, that is, an administrator may limit the types of transactions and functions that authorized users are permitted to exercise.

5.2.3.2.2 OS Checklists

The National Institute of Standards and Technology (NIST) maintains a Security Configuration Checklist Repository for various products and systems including all major Operating Systems. (http://checklists.nist.gov/repository/category.html)

5.2.3.3 Audit and Accountability (AU)

5.2.3.3.1 OS System Logs

The operating system logs should be reviewed on a regular basis for abnormal activity. This may be done manually or using automated tools such as TRIPWIRE.

5.2.4 Controls Applied to Applications

5.2.4.1 System and Communications Protection (SC)

5.2.4.1.1 AMHS Security

Figure 5-4 depicts AMHS Security which is applied from an originating ATS Message User Agent to a destination ATS Message User Agent.

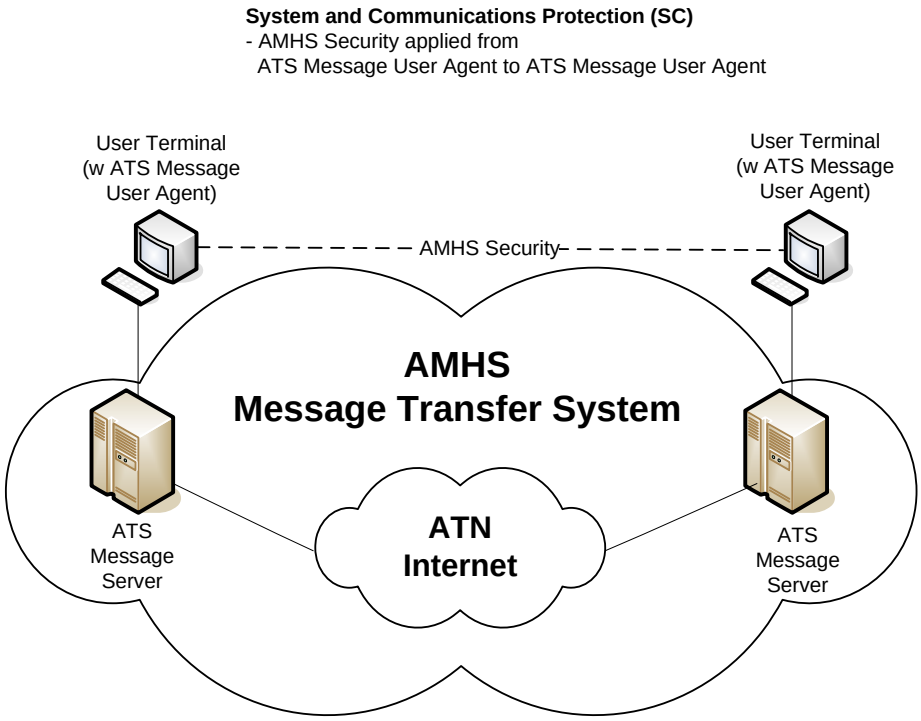


Figure 5-4: AMHS Security

AMHS security begins with the originating ATS Message User Agent digitally signing an Interpersonal Message using its Private Key. The message is sent through the ATS Message Transfer System to the recipient ATS Message User Agent. The recipient UA retrieves the Public Key of the originating UA from a public key certificate using a supporting directory service. With the originators public key the recipient UA can verity the signed message.

5.2.5 Controls Applied to Data

5.2.5.1 Audit and Accountability (AU)

5.2.5.1.1 AMHS Traffic Logging

Traffic Logging is required as part of the basic AMHS service. Specifically, Doc 9705 requires that "an AMHS Management Domain shall be responsible for long-term logging of all messages in their entirety which are originated by its direct AMHS users, for a period of at least thirty days."

6. References

[Asia/Pac SSP] ASIA/PAC Aeronautical Telecommunication Network System Security Policy, Second Edition, September 2008

[Asia/Pac SSC] ASIA/PAC Aeronautical Telecommunication Network System Security Checklist, First Edition, May 2009

[NIST 800-34] National Institute of Standards and Technology (NIST) Special Publication (SP) 800-34, "Contingency Planning Guide for Information Technology Systems"

[NIST 800-53] National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53, "Recommended Security Controls for Federal Information Systems"

[NIST 800-61] National Institute of Standards and Technology (NIST) Special Publication (SP) 800-61, "Computer Security Incident Handling Guide"

[NIST 800-100] National Institute of Standards and Technology (NIST) Special Publication (SP) 800-100, "Information Security Handbook: A Guide for Managers"

ATTACHMENT A
CONTINGENCY PLAN OUTLINE

1. INTRODUCTION

1.1 Purpose

1.2 Applicability

1.3 Scope

1.4 References

[NIST 800-34]	National Institute of Standards and Technology (NIST) Special Publication (SP) 800-34, "Contingency Planning Guide for Information Technology Systems", June 2002

2. CONCEPT OF OPERATION

2.1 System Description

2.2 Line of Succession

2.3 Responsibilities

3. NOTIFICATION/ACTIVATION

3.1 Notification Procedures

3.2 Damage Assessment

3.3 Plan Activation

4. RECOVERY

4.1 Sequence of Recovery Activities

4.2 Recovery Procedures

5. RECONSTITUTION

ATTACHMENT B
INCIDENT RESPONSE PLAN OUTLINE

1. INTRODUCTION

1.1 Purpose

1.2 Applicability

1.3 Scope

1.4 References

[CSIRT] Carnegie Mellon Software Engineering Institute "Handbook for Computer Security Incident Response Teams (CSIRTs)", April 2003

[NIST 800-61] National Institute of Standards and Technology (NIST) Special Publication (SP) 800-61, "Computer Security Incident Handling Guide", January 2004

[RFC 2196] Fraser, B. Ed., "Site Security Handbook", September 1997

[RFC 2350] Brownlee, N., and E. Guttman, "Expectations for Computer Security Incident Response", June 1998

2. Contact Information

2.1 Name of the Team 1

2.1.1 Team Member 1

Address

Time Zone

Telephone Number

Facsimile Number

Other Telecommunication

Electronic Mail Address

Public Keys and Encryption Information

Other Information

2.1.n Team Member n

2.x Name of the Team x

3. Charter

3.1 Mission Statement

3.2 Constituency

3.3 Sponsorship and/or Affiliation

Asia/Pacific Regional PFF – CNS 1

ASIA/PACIFIC REGION

PERFORMANCE FRAMEWORK FORM
(REGIONAL)

REGIONAL PERFORMANCE OBJECTIVE: - APAC-06 **IMPLEMENTATION OF AERONUTICAL TELECOMMUNICATION NETWORK (ATN) FOR GROUND – GROUND COMMUNICATION NETWORK**				
Benefits				
Safety	• Will provide reliable means of communication for Air Navigation Services, with the provision of automatic switching capability, in the event of failure of current media			
Efficiency	• Routers will have the capability of choosing between different media based on defined criteria. • Multiplicity of protocols used for different communication requirements will be avoided; • Provision for lower case characters and graphic message included;			
Strategy **Implementation strategy, short term (2009-2012)**				
ATM OC COMPONENTS	**TASKS**	**TIME FRAME**	**RESPONSIBILITY**	**STATUS**
SDM *(ATM Service Delivery Management)*	Ensure implementation of Ground to Ground Aeronautical Telecommunication Network (ATN) in the Asia and Pacific Regions			
	• Review the ATN Implementation Strategy, revise it when necessary taking into account the current developments.	2010	ATNICG.	The strategy to be reviewed and updated by ATNICG/5 Meeting scheduled to be held from 31 May to 4 June 2010
	o Review the Status of implementation of ATN at the Backbone Boundary Intermediate System hubs	2010	ATNICG	ATNICG to review the progress of ATN Implementation in its Fifth Meeting
	• States hosting Backbone Boundary Intermediate Stations to organize Testing of their system on bilateral basis	2010	States hosting Backbone Boundary Intermediate Systems	States to report the outcome of pre-operational trials/tests carried out by them at the ATNICG/5 meeting

Asia/Pacific Regional PFF – CNS 1

	• Implementation of AMHS Directory Service. Availability of off-line support by Eurocontrol AMC considered essential for the efficient management of AMHS Addresses. ICAO HQ has directed the States to register the operating personnel with AMC.	2010	ICAO Asia/Pacific Office, Aerothai.	Progress made in the registration of operators with AMC and entering of data into AMC to be reviewed by ATNICG/5
	• States hosting Backbone Boundary Intermediate System hubs to implement dual stack ATN (ATN over OSI and ATN over IPS). APANPIRG, through Conclusion 19/20 urges States to complete the implementation of dual stack ATN by 2011	2011	Asia and Pacific Region States hosting Backbone Boundary Intermediate Systems	States hosting BBIS hubs have been reminded of APANPIRG Conclusion 19/20 and urged to complete the installation by 2011
	• Completion of Networking with the BIS States	2012	Asia and Pacific Regions States	Some States started implementation and conducted operational trials
	• Review if implementation objectives have been met.	2009 - 2012	ATNICG	ATNICG to periodically review the status and dreiction in which the implementation is progressing and to ensure that the implementation efforts are leading towards the defined objectives
GPIs	GPI/17: Data link applications, GPI/22: Communication infrastructure			
References	• *Annex 10, Aeronautical Telecommunications, Volume III (Part I – Digital Data Communication Systems)* • *Manual on Detailed Technical Specifications for the Aeronautical Telecommunications Network (ATN) using ISO/OSI (Doc 9880)* • *ICAO Aeronautical Telecommunication Network (ATN) Manual for ATN using IPS Standards and Protocols (Doc 9896)* • *Manual on Required Communication Performance (Doc 9869)* • *Comprehensive Aeronautical Telecommunication Network (ATN) Manual (Doc 9739)* • *Manual of Technical Provisions for the Aeronautical Telecommunication Network (Doc 9705)* • *Regional Implementation guidance materials adopted by APANPIRG*			

CNS/ATM Implementation Planning Matrix

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
AUSTRALIA	ATN tests were conducted. BIS Router and Backbone BIS Router and AMHS implemented.	AFTN based AIDC Implemented between Brisbane and Melbourne, Auckland, Nadi and Auckland. AIDC is also in use between Melbourne and Mauritius.	Implemented and integrated with ATM systems to support FANS1/A equipped aircraft.	Implemented	Implemented		16 ADS-B sites are operational. A total of 28 UAP ground stations are expected to become operational throughout 2007. Additional 20 stations have been delivered in 2007 for installation at en-route radar site and other sites. 5NM Separation service has been introduced. NFRM on the carriage and use of ADS-B avionics has been issued. WAM installed in Tasmania. Commissioning expected 2009. Provides radar like WAM data and ADS-B data.	FANS 1/A ADS-C implemented.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
AUSTRALIA (Cont'd)							ASMGCS with multilateration being installed at Melbourne, Sydney, Brisbane and Perth. Operational between 2009 -2010 Multilateration based precision runway monitor to be commissioned in 2010.		
BANGLADESH	BIS Router and AMHS planned for 2011.	AIDC between Dhaka and CTG, Dhaka and Sylhet planned for 2011.		Not yet planned	Not yet planned		Not yet planned	Not yet planned	
BHUTAN	ATN BIS Router and UA service 2011.					Procedures developed for NPA.			
BRUNEI DARUSSALAM	ATN BIS Router planned for 2009 and AMHS planned for 2009-2011.								

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
CAMBODIA	BIS Router and AMHS planned for 2011.	Planned 2009	Planned 2009			Procedure developed for NPA.			
CHINA	ATN Router and AMHS deployed in 2008. Tripartite BBIS trial completed with Bangkok and Hong Kong, China in Jan. 2003. ATN trial with Hong Kong using XOT over internet conducted in 2006, Further trials planned in 2009. AMHS/ATN technical tests with Macau completed in 2009. ATN/AMHS tests with ROK, India , Hongkong China planned in 2010. .	AIDC between some of ACCs within China has been implemented. AIDC between several other ACCs are being implemented. AIDC between Sanya and Hong Kong put in to operational use in Feb 2007. AIDC between Qingdao and Incheon planned for 2013.	Implemented to ATS Rout. L888 route, Trial on HF data link conducted for use in western China.	Implemented in certain airspace. L888, Y1 and Y2 routes.	RNAV (GNSS) implemented in certain airports. Beijing, Guangzhou, Tianjin.	Ali, Linzhi and Lhasa airports	ADS-B trial has been conducted in 2006. 5 UAT ADS-B sites are operational and used for flight training of CAFUC. Another ADS-B project for ATS route between Chengdu and Jiuzhai using 1090ES conducted since 2008. Will be followed by Chengdu – Lhasa and B215 route.	FANS 1/A based ADS-C implemented. L888 route.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
HONG KONG, CHINA	ATN and AMHS technical trial with Japan conducted in 2003.	AFTN-based AIDC with Sanya put into operational use in February 2007.	FANS 1/A based CPDLC trials completed in 2002.	Implemented in certain airspace	Implemented in certain airspace.	RNAV (GNSS) departure procedures implemented in July 2005.	A-SMGCS trial using ADS-B/ Multilateration technology on the prime airport surveillance area completed in 2006.	FANS 1/A trials for ADS-C completed in 2002.	
HONG KONG, CHINA (Cont'd)	64 Kbps ATN Link with Bangkok put into operational use in June 2004. Preliminary ATN/AMHS technical trials with China (Beijing) using VPN over Internet connection conducted in September 2006. Operational AMHS commissioned in July2009. ATN/AMHS circuit with Macao put into operational use in Dec. 2009. ATN/AMHS interoperability tests with other adjacent communications centres with Taibei	AIDC trial with other adjacent ATS authorities planned for end 2009/2010. AIDC trial with Taibei to be undertaken in 2010	VDL Mode-2 technical trial conducted in 2002. D-ATIS, D-VOLMET and 1-way PDC implemented in 2001. PDC service upgraded to 2-way data link in June 2008.			Flight check for RNAV Procedures conducted in April 2008. 6- months operational trial commenced in February 2009.	A larger-scale A-SMGCS covering the whole Hong Kong International Airport put into operational use in April 2009. Data collection/ analysis on aircraft ADS-B equipage in Hong Kong airspace conducted on quarterly basis since 2004. ADS-B trial using a dedicated ADS-B system was conducted in April 2007. Further ADS-B trial planned for 2010.		

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
	(2009), Beijing (2010), Japan (2012) commenced in late 2009. ATN/AMHS into operation in end 2009.								
MACAO, CHINA	ATN/AMHS interoperability test with Beijing commenced in Mar 2009. ATN/AMHS circuit with Hong Kong put into operational use in end Dec 2009.								ATZ within Hong Kong and Guangzhou FIRs. In ATZ full VHF coverage exist. Radar coverage for monitoring purposes.
COOK ISLANDS									
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	The ATN BIS Router and AMHS to be implemented in 2011.	With neighboring ACCs to be implemented TBD		Implemented in certain ATS routes G711, B467		RNAV(GNSS) Non-precision approach to be implemented in 2011.	ADS-B has been used as back-up surveillance of SSR since 2008.		

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
FIJI	ATN BIS Router and AMHS implementation by 4th quarter 2010.	AFTN based AIDC implemented between Nadi, Brisbane, Auckland and Oakland.	Implemented and integrated with ATM systems to support FANS1/A equipped aircraft.	Implemented		Implemented	ADS-B implementation in 2009/2010.	FANS 1/A ADS-C implemented.	
FRANCE ***(French Polynesia Tahiti)***		Implementation of limited message sets with adjacent centres under discussion.	FANS-1. Implemented since 1996.					FANS 1/A ADS-C implemented since March 1999.	
INDIA	ATN BBIS router and AMHS Physical installation over. SAT in May 2008, coordinating with China, Thailand and Singapore for conduct of test.	AFTN Based AIDC Coordinating with Bangladesh and Pakistan and, we are ready.	FANS-1 implemented at Kolkata, Chennai, Mumbai and Delhi.	SBAS Technical development in 2007. Implementation planned for 2009.			Trial planned for 2006. ASMGCS Implemented at IGI Airport New Delhi.	FANS 1/A ADS-C implemented at Kolkata, Chennai, Delhi and Mumbai.	
INDONESIA	ATNBIS Router and AMHS are still on going trial with Singapore to be finished in 2010 (Part D: AMHS Commission)	Makasar and Brisbane is still on going trial AIDC, planned operational in 2011	FANS-1/A. CPDLC in Ujung Pandang FIRs already trial start from 2008 and will be implemented in 2009.			Procedure to be completed in 2006 for NPA.	22 ADS-B ground stations have been installed in 2009. Upgrading ATC automation at Makasar for ADS-B application capabilities in 2009.	FANS 1/A ADS-C trial planned at Jakarta and Ujung Pandang ACC in 2007.	MATSC new version with capability for ADS-B and Mode-S will be operated in 2009.

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
JAPAN	ATN BBIS already implemented. AMHS implemented between Japan and USA in 2005 and between Japan and Hong Kong, China, ROK, Singapore, Australia planned for 2009-2011. Connection test between Taibei 2008 – ongoing.	AIDC based. AFTN procedure implemented with Oakland and Anchorage. Planned between Incheon ACC and Fukuoka ATMC 2009. Between Fukoka, ATMC and Taibei ACC 2012.	FANS1/A system Implemented in Fukuoka FIR.	SBAS implemented RNAV5 implemented.	RNAV1 implemented	RNP Approach implemented	Two (2) Multilateration will be implemented in January 2010.	FANS 1/A. ADS-C implemented in Fukuoka FIR.	
KIRIBATI									
LAO PDR	ATN BIS Router and AMHS completed planned for implementation with Bangkok in 2010.	AIDC with Bangkok planned for 2010.		Implemented. Planned for 2011.					
MALAYSIA	ATN BIS Router completed 2007. AMHS planned in 2011	AFTN AIDC planned with Bangkok ACC in 2011.	Implemented for Bay of Bengal in July 2008.	Implemented for Oceanic Routes.	Basic RNAV implemented	NPA at KLIA implemented	Implementation of ADS-B proposed in 2010 - 2015.	FANS 1/A ADS-C implemented for Bay of Bengal on July 2008	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
MALDIVES	ATN BIS Router/AMHS planned for implementation in the 2011.	Planned for 2011.	FANS1/A installed Trials planned in last quarter of 2007.	Trials planed for 2005-2008. Implementation in later 2008.			Trials planned for 2007-2008. Implementation in late 2008.		
MARSHALL ISLANDS						NPA implemented at Majuro Atoll.			
MICRONESIA (EDERATED STATES OF)									
Chuuk				Implemented					
Kosrae				Implemented					
Pohnpei				Implemented					
Yap				Implemented					
MONGOLIA	ATN BIS Router and AMHS planned for 2005 and 2006. Trial with Bangkok conducted.		Function available. Regular trials are conducted.		GPS procedures are being developed and implemented at 10 airports.		ADS-B trial in progress implementation planned for 2006.	FANS 1/A ADS-C implemented since August 1998.	
MYANMAR	Implementation of AMHS to be completed by the end of 2010.	The capability of ATM Automation system to support AIDC by 2011	Implemented since August 1998.				A plan to implement ADS-B by 2011	Implemented since August 1998.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
NAURU									
NEPAL	BIS Router and AMHS planned for 2010.	AFTN/AMHS based AIDC between KTM-CAL, KTM-BAN, KTM-LHASA planned for 2010.			GPS departure and approach has been developed for 8 airports and planned for implementation in 2008.		ADS-B feasibility study planned for 2007.		
NEW CALEDONIA							Tontouta ACC 2009 Tontouta APP 2009.		
NEW ZEALAND	BIS Router and AMHS implementation planned for 2010.	AFTN based AIDC implemented between New Zealand, Australia, Fiji, Tahiti, Chile and USA.	FANS-1/A. Implemented	Will be implemented as required.	RNAV procedures being implemented as developed.	RNP AR APCH implemented at Queenstown (ZQN).	Domestic trial was conducted in 2005. Use will be re-evaluated in 2008. Trial of Area MLAT conducted in 2006. ADS-B planned as an element of MLAT at specific sites for domestic use.*	FANS 1/A Implemented	*MLAT being implemented in Auckland (Surface Movement) and Queenstown.

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
PAKISTAN	Implementation of ATN considered for Phase II (2005-2010).	Implemented between Karachi and Lahore ACCs	Implementation planned from 2005-2010.	Planned for 2005-2010.	RNAV arrival and departure procedure being developed.	NPA procedure are being developed.	Feasibility study for using ADS-B is in hand. One station was installed at ACC Karachi and evaluation is in progress.	Planned for 2005-2010.	Existing Radar system being upgraded.
PAPUA NEW GUINEA				Implemented		Implemented at certain aerodromes.			
PHILIPPINES	ATN G/G BIS Router/AMHS implemented in 2006. AMHS trials with Singapore by end 2008 and Hong Kong planned in 2009.	Planned for 2011.	CPDLC Planned for 2011.				Included in CNS/ATM Project and scheduled for implementation in 2011.	FANS 1/A ADS-C planned for 2011.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
REPUBLIC OF KOREA	ATN BIS Router/AMHS planned for 2011.	AFTN based AIDC planned for 2009 between Incheon ACC and Fukuoka ATMC. AIDC between Incheon and Qingdao planned for 2013.	PDC & D-ATIS implemented 2003.			NPA procedure developed at Incheon International Airport in 2008.	ADS-B trials planned for 2008-2009 at Incheon International Airport.	FANS 1/A based ADS-C implemented since 2003 for contingency purpose.	
SINGAPORE	AMHS implemented. ATN BIS Router trial with Malaysia commenced in 2007 and with Indonesia in 2009. . ATN/AMHS interoperability trial with India completed in Oct 2009. Commenced pre-ops trial in Dec 2009. Co-ordinating with UK and Australia on ATN/AMHS trial in Q4 2010.	AFTN based AIDC to be implemented	Implemented since 1997. Integrated in the ATC system in 1999.		RNAV SIDS and STARS implemented in 2006.	NPA Procedure implemented in 2005.		FANS 1/A ADS-C implemented since 1997. Integrated with ATC system in 1999.	

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
SRI LANKA	ATN BIS Router Planned for 2009. AMHS planned along with BIS in 2009.		PDLC in trial operation since November 2000.				ADS-B Trials planned for 2010 and implementation in 2011.	FANS 1 /A ADS-C trial since November 2000.	GPS based domestic route structure being developed.
THAILAND	BBIS/BIS Routers already implemented. Target date for AMHS in 2008.	AFTN based AIDC planned for 2010.	FANS-1/A Implemented.	Under implementation	Implemented at Phuket Airport	Implemented at Phuket	Multilateration implemented in 2006 at Suvarnbhumi Int'l. Airport. 22 ADS-B ground stations will be implemented in 2008.	FANS 1/A ADS-C Implemented.	
TONGA	AMHS planned for 2008.					NPA planned for 2007.	Trial planned for 2010		CPDLC and ADS-C is not considered for lower airspace
UNITED STATES	AMHS implemented. AMHS Atlanta Sept 2009 to serve CAR/SAM,/ North Atlantic/Europe	AFTN based AIDC implemented.	FANS-1/A based CPDLC implemented.	Implemented	Implemented		Implemented	Implemented	
VANUATU									

				Navigation*					
State/Organization	**ATN G/G Boundary Intermediate System (BIS) Router/AMHS**	**AIDC**	**CPDLC**	**En-route**	**Terminal**	**Approach**	**ADS-B/ Multilateration**	**ADS-C**	**Remarks**
VIET NAM	BIS Routers planned for 2009. ATN/AMHS trial in 2010 and operation in 2012.	AFTN based AIDC implemented in 2009. Trial for ATN based AIDC planned in 2010.	CPDLC operational trial conducted in early 2007.	For en-route TBD.	RNAV		TBD.	FANS 1/A ADS-C operational trial conducted for oceanic area of Ho Chi Minh FIR since March 2002.	

* Navigation – Navigation including Performance Based Navigation (PBN), APV and precision approach

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
1	ATN Implementation Coordination	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Review of implementation problems and develop co-ordinated solutions (2) Coordinate/compile the regional implementation schedule (3) Monitor Implementation	Expedite implementation activities, ensure system compatibility through out the region	(1) Co-ordination Report (2) Waterfall schedule (3) Monitor AMHS Implementation Planner	(1)Ongoing/Semi-annually until (2010)- (2) Schedule 09/2009 (3) On going	Kapoor (India)	All members	(1)Updated the information in the ATN Router and AMHS planning tables and the implementation status.(2) Completed, maintain the AMHS Implementation Planner ~~Waterfall~~
2	ATN Operational Procedures	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Development of Interim Database for Directory Services	Make available real time and quality assurance addresses for ATN message delivery	(1) Interim Database	(1) (2007)	Robert Hallman (USA)	Thailand, Hong Kong China, Japan	The database was demonstrated. Aerothai will maintain the database on behalf of the regional ICAO Office. Aerothai will serve as POC for AMC coordination between Asia/Pac States and Eurocontrol. ATN Operational Procedures is completed and forward for adoption.
				(2) Develop the operational database management procedures		(2) Operational Procedures	(2) (2007)			Completed.
3	ATN Certification & Validation Process	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Develop conformance procedures and checklist for AMHS and ATN routers	Expedite implementation activities, ensure global system compatibility	(1) Checklist	(1) (2007)	Sin Hie Sng (Singapore)	China, Hong Kong China, Indonesia,ROK,USA,	Completed

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
				(2) Develop validation process document		(2) Conformance Document	(2) 2007			Completed and forward to CNS/MET SG and APANPIRG/20 for review and adoption
						(3) Update to Conformance Document	(3) Ongoing until 2010			Completed ~~Document need to be kept up-to-date to reflect defect report from States~~
4	(1) ATN Documentation (2) Review all documents adopted by ATNICG and ATNTTF	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Study DIR objects/attributes proposed in ACP and follow development within other groups (2) Update document tree/establish tracking table for suspended dates (3) Standardized Report form and Guidance Material	Expedite implementation activities, ensure global system compatibility	(1) Directory Report (2) Tracking table/Updated documentation tree (3) AMC report (4)Report Form and Report Guidance	(1) Annually until (2010) (3) Periodically (4) 2010	Chonlawit B. (Thailand)	USA	Update the database. AMC mandated by ICAO. Training completed. Directory Service will be implemented in coordination with ACP and phases will be developed.
				(2) Development AIDC documentation (including ICD) and follow development within other groups		(2) AFTN AIDC/ATN Gateway Specification ATN AIDC ICD	(2) 2008 (ACP-dependent)	(Thailand)	Thailand	~~Postpone development of ATN-based AIDC ICD. Awaiting new format developed by OPMET Panel~~ Task Closed in view of the removal of provision from Doc 9880
				(3) Update of AMHS ICD to comply with SARPs 3rd Edition		(1) Report differences between existing ICD and requirements for Edition 3 of Doc 9705 (3) Updated AMHS ICD	(1) Sept 2010(3) (2007)	US	Japan	~~Provided to ATNICG/2 for endorsement. Adopted by APANPIRG/18. Completed~~

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
				Managing PDR	Update ICAO Documents (9880/9896)	PDR filing and tracking	On-going	US	All the Member States	Additional Task proposed in ATNICG/5
5	ATN Performance	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Develop/establish/adapt/monitor/identify/analyse performance indicators	Assure QOS, service continuity, timely delivery of services	(1) AMHS performance report	(1) Annually until (2010)	Japan	Republic of Korea, India	~~Review and update at ATNICG WG/6~~ Final Draft of the Document complete. Will be presented.
6	ATN Service Enhancements	D. Efficiency	GPI-17, GPI-19, GPI-22	(1) Review the impact of the implementation of Directory Services in the Region	Enhancing the service	(1) Report on directory	(1) Annually until (2010)	Fiji	USA, Thailand, New Zealand, Japan, Australia	Complete. AMC has been adopted by ICAO. Aerothai has been designed as POC for Asia/Pac region
				(2) ~~Development of profiles for the directory access and exchange protocols (Ref. Decision 7/9)~~ Directory Service - Implementation Strategy	Enhancing the operation	~~(2) Report on profiles~~ Requirement Analysis Report & Implementation Strategy	1)2011 2) 2012	Thailand		~~On-going~~ Additional Task
				~~(3a) Study IPv4 vs. IPv6 implementation, operational and transition impacts (3b) Investigation 9880 standard~~ ATN/IPS Implementation Plan	Inter-regional and intra regional network compatibility	1) ATN/IPS router ICD 2) IPS addressing plan 3) ATN/OSI - ATN/IPS Transition Plan 4) ATN/IPS routing policy 5) Update FASIS Tables to accommodate IPS	~~(3) 2011 (4) 2009/2010 (WG/6 and ATNICG/5) 1)~~ 2011 2)2011 3) 2011 4) 2012 5) 2011 6) 2010	USA	Australia, China, India, Fiji, HongKong, China, Japan, and USA	~~(4) USA will draft report~~ Proposed an additional task

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
				~~(4) Study for transition to BUFR code~~ Providing support for emerging requirements of OPMET, AIS/AIM, AIDC etc.	Enhancing the service	~~(4) Report on the impact of BUFR code to ATN~~ Task Report on XML based messages over AMHS platform	2011	USA	Hong Kong China,	Additional Task proposed in ATNICG/5
				(5) Study for transition of AFTN-based AIDC as an alternative to ATN based AIDC to ATN environment	Improving the service and lowering the operating cost	(5) Report on the impact of transition of AFTN-AIDC to ATN-AIDC AFTN AIDC/ATN Gateway Specification	(5) (2008)	Thailand	India, Indonesia, New Zealand, USA,	A Draft specification of AFTN AIDC/ATN Gateway was presented. Completed. Task closed in view of removal of provision from Doc ~~9880~~
		D. Efficiency	GPI-17, GPI-19, GPI-22	Analyze Common Address Prefix Proposal	Improving the service and routing efficiency	Report on common prefix based analysis conduced	End of 2008	Mark Brown (Japan)	Australia, Fiji, HongKong China, New Zealand and USA	Completed. Action Items developed at ATNICG/2 for follow-up at WG meetings.
7	Security	B. Security	GPI-17, GPI-19, GPI-22	(1) Develop ATN System Security policy	Safe and Secure Inter and Intra Regional Communication and service infrastructure	(1) Policy Document	(1) Annually until (2010)	Vidyut Patel (USA)	Australia, Hong Kong China	Adopted by APANPIRG/19
				(2) Develop ATN System Security Guidance		(2) Guidance Document	(2) (2011)			On-Going review and update

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
				(3) Develop ATN System Security Solution for Initial and Enhanced Services		**(3) Security, Technical, Management and Operational Control**	**(3) (2008)**			**Completed ~~On-Going review and update~~**
				(4) Co-ordinate and monitor ACP working group and other regions including Directory Service, PDRs		**(4) Report**	**(4) Semi-Annually until (2010)**		**Thailand**	**On-Going review and update**
				5) Develop IPS Security Policy and update the relevant guidance documents **(5) Develop ATN System Security Check List based on Security Control and Regional Incident Response Plan and Contingency Plan**		**Policy and updated guidance documents** **(5) Check List, Regional Incident Response Plan and Contingency Plan**	**2011** **(5) (2009)**			Proposed additional task to facilitate ATN/IPS **Forward to CNS.MET SG and APANPIRG for review and adoption**

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
8	ATN Service Enhancements (supporting amended ICAO Flight Plan and ATS Message Formats)	D - Efficiency	GPI - 17, GPI - 19, GPI - 22	1) Review the impact of the impleemntation of Amendment 1 to 15th Edition of Doc. 4444 effective 15 Nov. 2012 (PANS ATM Chapter 4 and Appendix 3 relating to the ICAO Flight Plan and associated ATS Message formats to the AFS	Enhancing the service	1) Report on capability of existing and planned AFS systems to the revised ICAO Flight Plan and ATS Message Format	1) Annually until 2011	USA	Fiji India Hong Kong New Zealand Singapore USA	Pending result from ICAO Flight Plan and ATS Message TF
				2) Indentify the new requirements for AMHS/AFTN to support new message format	Enhancing the operation	2) Report on impact of New ATS message format in AMHS	2) 2010	Thailand	Fiji India Hong Kong New Zealand Singapore USA	On-going task-Report at ATNICG/4
				3) Identify the link control procedure using the AMHS to support the revised ATS message format to the ATC automation system	Enhancing the service	3) Report whether special link control procedure is required	3) 2010	Thailand	Fiji India Hong Kong New Zealand Singapore USA	On-going task

The ATN PERFORMANCE OBJECTIVE

The APAC ATN ground-to-ground infrastructure will be fully operational 53 percent at 23 locations by December 2007.

(GPI-22) COMMUNICATION NETWORK INFRASTRUCTURE

Related ATM objectives: AMSS; HF data; VHF data; SSR Mode S; ATN

Scope: To evolve the aeronautical mobile and fixed communication infrastructure, supporting both voice and data communications, accommodating new functions as well as providing the adequate capacity and quality of service to support ATM requirements.

(GPI-19) METEOROLOGICAL SYSTEMS

Objective: To improve the availability of meteorological information in support of a seamless global ATM system.

No.	PERFORMANCE OBJECTIVE	ICAO Srategic Objective	Associated GPI	Tasks/Strategy	Benefits	Deliverables	Target Date	Leader	Supporting Members	ATNICG/5 Update
(GPI-17) IMPLEMENTATION OF DATA LINK APPLICATIONS **Scope:** Increase the use of data link applications **Related ATM objectives:** Application of data link; Functional integration of ground systems; with airborne systems; ATS inter-facility data communication (AIDC)										

PROPOSED AFTN ROUTING (JAPAN)

A	1		4			
ORIGIN DESTINATION	RJJJ		UHHH		UUUU	
AG	WS	vh	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
AN	WS	vh	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
AY	WS	vh	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
B	KS	ws	UU	n zb	BI	n
C	KS	ws	UU	n zb	EG	n
D	WS	vh	UU	n zb	LF	n
E	WS	vh	UU	n zb	(N)	n
F	WS	vh	UU	n zb	LF	n
G	WS	vh	UU	n zb	LE	n
H	WS	vh	UU	n zb	LG	n
K	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
L	WS	vh	UU	n zb	(N)	n
M	KS	ws	UU	n zb	EG	~~uh~~ n
NC	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NF(EX. NFT)	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NFT	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NG(EX. NGF)	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NGF	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NI	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NL	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NS(EX. NST)	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NST	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NT	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NV	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NW	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
NZ	KS	ws	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
OA	WS	vh	UU	n	LC	n
OB	WS	vh	UU	n	LC	n
OE	WS	vh	UU	n	LC	n
OI	WS	vh	UU	n	LC	n
OJ	WS	vh	UU	n	LG	n
OK	WS	vh	UU	n	LC	n
OL	WS	vh	UU	n	LC	n
OM	WS	vh	UU	n	LC	n
OO	WS	vh	UU	n	LC	n
OP	WS	vh	UU	n	LC	n
OR	WS	vh	UU	n	LC	n
OS	WS	vh	UU	n	LG	n
OT	WS	vh	UU	n	LC	n
OY	WS	vh	UU	n	LC	n
P	KS	ws	UU	n zb	EG	n
RC	RC	vh	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
RJ,RO	(N)	n	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
RK	RK	zb	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
RP	WS	vh	~~RJ~~ UU	~~uu~~ zb	RJ	~~uh~~ n
S	KS	ws	UU	n zb	LE	n
T	KS	ws	UU	n zb	EG	n
U(EX. UH,UI,UT)	UU	~~uh~~ zb	(N)	n	(N)	n
UH	~~UH~~ UU	~~uu~~ zb	(N)	n	(N)	n
UI	UU	~~uh~~ zb	(N)	n	(N)	n
UT	UU	~~uh~~ zb	(N)	n	UA	un
VA	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh
VC	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh

PROPOSED AFTN ROUTING (JAPAN)

A	1		4			
ORIGIN DESTINATION	RJJJ		UHHH		UUUU	
VD	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VE	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh
VG	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VH	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VI	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh
VL	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VM	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VN	ZB	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VO	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh
VQ	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh
VR	WS	vh	ZB	~~rj~~ n	~~UH~~ RJ	uh
VT	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VV(EX. VVT)	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VVT	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
VY	VH	ws	ZB	~~rj~~ n	~~UH~~ RJ	uh
WA	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WB(EX. WBA,WBS)	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WBA,WBS	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WI	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WM	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WP	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WR	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
WS	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
Y	WS	vh	~~RJ~~ UU	zb	RJ	~~uh~~ n
Z(EX. ZG,ZJ,ZK,ZM)	ZB	vh	ZB	~~rj~~ n	~~UH~~ RJ	~~rj~~ uh
ZG	ZB	vh	ZB	~~rj~~ n	~~UH~~ RJ	~~rj~~ uh
ZJ	ZB	vh	ZB	~~rj~~ n	~~UH~~ RJ	~~rj~~ uh
ZK	ZB	vh	ZB	~~rj~~ n	~~UH~~ RJ	~~rj~~ uh
ZM	ZB	vh	UI	zb	UI	

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ATTACHMENT 2

International Civil Aviation Organization

THE FIFTH MEETING OF AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) IMPLEMENTATION CO-ORDINATION GROUP OF APANPIRG (ATNICG/5)

Kuala Lumpur, Malaysia, 31 May – 4 June 2010

LIST OF WORKING, INFORMATION PAPERS & FLIMSY

WP/IP No.	Agenda Item	Title	Presented by
		WORKING PAPERS	
WP/1	-	Provisional Agenda	Secretariat
WP/2	2	Review of APANPIRG/20 and CNS/MET SG/13 Outcomes on AFS related Issues	Secretariat
WP/3	6	Implementation of ATN in ICAO MID Region	Secretariat
WP/4	4	Report on Regional ATN/AMHS related Activities	Secretariat
WP/5	14	Review of Performance Framework Form (PFF) for ATN	Secretariat
WP/6	10	Asia/Pacific IPv6 Addressing Plan Proposal	Japan
WP/7	15	Review ATNICG Subject/Tasks List	Secretariat
WP/8	5	Updated to Aeronautical Telecommunication Network Implementation Status in Asia and Pacific Regional CNS/ATM Matrix	Secretariat
WP/9	16	Proposing the AFTN Rouging Change between Russia and Japan	Japan
WP/10	9	ATN Directory Services	USA
WP/11	10	Proposed Asia/Pacific IPv4 Address Planning	USA
WP/12	10	Considerations for Introducing Security into the Asia/Pacific Regional Group ATN/IPS Network	Japan
WP/13	10	Asia/Pacific ATN IPS Router ICD Draft Proposal	Japan
WP/14	11	Proposed AMHS Performance Assessment in the Asia/Pacific Region	Japan

WP/IP No.	Agenda Item	Title	Presented by
WP/15	8	Update on the Asia/Pacific Interim AMHS Database and AMS Information Papers	Thailand
WP/16	5	Proposed AMHS Implementation Plan Information Papers	Hong Kong China
WP/17	11	Proposed Enhancements to Annex C of Asia/Pacific AMHS Manual	Singapore (On behalf of the ATNICG Task 3 Group
WP/18	12	Asia/Pacific Aeronautical Telecommunication Network Security Checklist	USA
WP/19	7	Review Strategy for the Implementation of Aeronautical Telecommunication Network (ATN) in the Asia/Pacific Region	Singapore on behalf of the ATNICG sub-group)
WP/20	11	Asia/Pacific ATN Network Service Access Point (NSAP) Addressing Plan	Singapore
WP/21	9	Evolution Strategy for the ATN Directory	Comsoft (On behalf of Fiji Islands
WP/22	12	Asia/Pacific Telecommunication Network Security Guidance Document (Draft Second Edition - June 2010)	USA
WP/23	12	ATNICG Security Policy, Guidance and Checklist	USA
WP/24	3	Draft Report of ACP WGM-16 Meeting	USA
		INFORMATION PAPERS	
IP/1	-	Meeting Bulletin	Secretariat
IP/2	3	Report on Aeronautical Communication Panel (ACP) and its Working Group Activities	Secretariat
IP/3	13	Report on the Second Meeting of the Asia/Pacific ICAO Flight Plan & ATS Messages Implementation Task Force and Seminar (FPL & AM/TF/2 & Seminar)	Secretariat
IP/4	16	Migration Towards the use of Table Driven Codes for OPMET	Secretariat
IP/5	14	Review the ASIA/PAC FASID Tables CNS 1B, 1C and 1E	Secretariat
IP/6	14	Voice over IP for ATM Ground to Ground Communication	Secretariat

WP/IP No.	Agenda Item	Title	Presented by
IP/7	5	Implementation Status Report	Japan
IP/8	5	Indonesia AMHS Implementation Status Report	Indonesia
IP/9	16	International Transport of System Wide Information Management (SWIM) Data	USA
IP/10	5	ATN/AMHS Implementation Activity in China	China
IP/11	5	Singapore Implementation Status Report	Singapore
IP/12	5	Implementation Status Report	India
IP/13	5	Implementation Status Report of the Republic of Korea	Republic of Korea
		FLIMSY	
Flimsy/1	-	Background Information on AMHS Standards	Comsoft

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