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Agenda Item 2: Develop ATN Interface Control Documents

DRAFT ASIA/PACIFIC REGIONAL ROUTER INTERFACE CONTROL DOCUMENT (ICD) FOR AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) GROUND TO GROUND INTERMEDIATE SYSTEM (BIS ROUTER)

(Presented by USA)

INTERNATIONAL CIVIL AVIATION ORGANIZATION
ASIA AND PACIFIC OFFICE

DRAFT

ASIA/PACIFIC REGIONAL ROUTER INTERFACE CONTROL DOCUMENT (ICD)

FOR AERONAUTICAL TELECOMMUNICATION NETWORK (ATN) GROUND TO GROUND BOUNDARY INTERMEDIATE SYSTEM (BIS) ROUTER

ISSUE 1.2 - APRIL 2002

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EXECUTIVE SUMMARY

The Aeronautical Telecommunication Network (ATN) is a global inter-network that provides digital communications to satisfy the increasing telecommunications demand of air traffic service communication (ATSC), aeronautical operational control (AOC), aeronautical administrative communication (AAC), and aeronautical passenger communication (APC). The ATN standards used to develop the requirements for this document were developed by the International Civil Aviation Organization (ICAO) and are specified in ICAO DOC 9705 (revision 3) which is also called ICAO standards and recommended practices (SARPs).

The ATN is composed of an ATN network infrastructure and ATN applications that provide the global communication for ground-to-ground (G/G) and air-to-ground (A/G) services. The ATN network infrastructure includes the ATN backbone, communication link, ATN router, and end system. The ATN applications include among others, context management (CM), controller-pilot data link communication (CPDLC), and air traffic service message handling system (ATSMHS).

The Asia/Pacific region is undertaking the implementation of its ATN network to provide services for regional and global ATN services. This document specifies the interface requirements between the ATN G/G Boundary Intermediate System (BIS) Routers that interconnect ATN routing domains in the Asia/Pacific region. The NAS BIS routers that connect to BIS routers in Japan and Australia must comply with this document. This Interface Control Document (ICD) applies to both point-to-point circuits and public packet networks.

Although this is a router ICD, the fundamental BIS router requirements are provided in Appendix E. Appendix E could also be used as a procurement file.

Before this ICD can be finalized, the disposition of some requirements must be reviewed and resolved. The following table provides the requirements included in this document, which need to be reviewed (TBR) and to be determined (TBD).

Table P-1: TBD/TBR Summary Table

Section Number	Requirement	Status (TBD or TBR)
5.3.2.5	Length of CLNP data part	TBD
5.5.1.1.2.2	OPEN PDU maximum length	TBR
6.0	System Management	TBD
7.0	Performance Requirements	TBD
8.0	Security	TBD

1.0 Introduction

1.1 Purpose and Scope

The recommended functional characteristics for the Aeronautical Telecommunication Network (ATN) have been defined by the International Civil Aviation Organization (ICAO) and are published as ICAO DOC 9705 (revision 3), which also contains specifications for several initial aeronautical applications that will communicate using the ATN inter-network.

This document provides ground-to-ground (G/G) Boundary Intermediate System (BIS) ICD guidelines, and framework for the Asia/Pacific region which includes:

1. ISO layer 1 to layer 3 interface requirements between G/G BIS routers;

2. G/G BIS router functional requirements associated with ATN Protocol Requirements Lists (APRLs) relevant to support layer 1 to layer 3 interface requirements.

This document applies to both point-to-point circuit and X.25 sub-networks.

1.2 Organization

This Interface Control Document (ICD) addresses the physical, data link, and network layers of the ATN BIS router using the International Organization for Standardization (ISO) Information Processing Systems Open Systems Interconnection (OSI) Basic Reference Model. This document is based on the ICAO DOC 9705 document, revision 3.

This document is organized as follows:

- **Section 1, INTRODUCTION,** summarizes the contents of this document and reference documents.

- **Section 2, ATN BIS ROUTER OVERVIEW,** provides an overview for the ATN network architecture and BIS routers.

- **Section 3, PHYSICAL LAYER,** provides the physical interface requirements for point-to-point circuit or the X.25 sub-networks.

- **Section 4, DATA LINK LAYER,** provides the data link layer interface requirements using link access procedure balanced (LAPB) to support the interface between G/G BIS routers.

- **Section 5, NETWORK LAYER,** provides the interface requirements to support the network layer including the sub-networks, sub-network dependent convergence functions (SNDCF), connectionless network protocol (CLNP) and inter-domain routing protocol (IDRP).

- **Section 6, SYSTEM MANAGEMENT,** provides the system management requirements for the Asia/Pacific region.
- **Section 7, PERFORMANCE REQUIREMENTS,** provides the performance requirements for the Asia/Pacific region.
- **Section 8, SECURITY,** provides the BIS router security requirements for the Asia/Pacific region.

1.3 ATN Documentation Tree and Reference Documents

1.3.1 ATN Documentation Tree:

Figure 1-1 is the ATN documentation tree for the Asia/Pacific ATN documents. This figure provides a hierarchical representation of the relationship between the various ICAO, ATN and Asia/Pacific regional ATN documents. From this documentation tree, the relationship between this ICD and other documents is clearly defined.

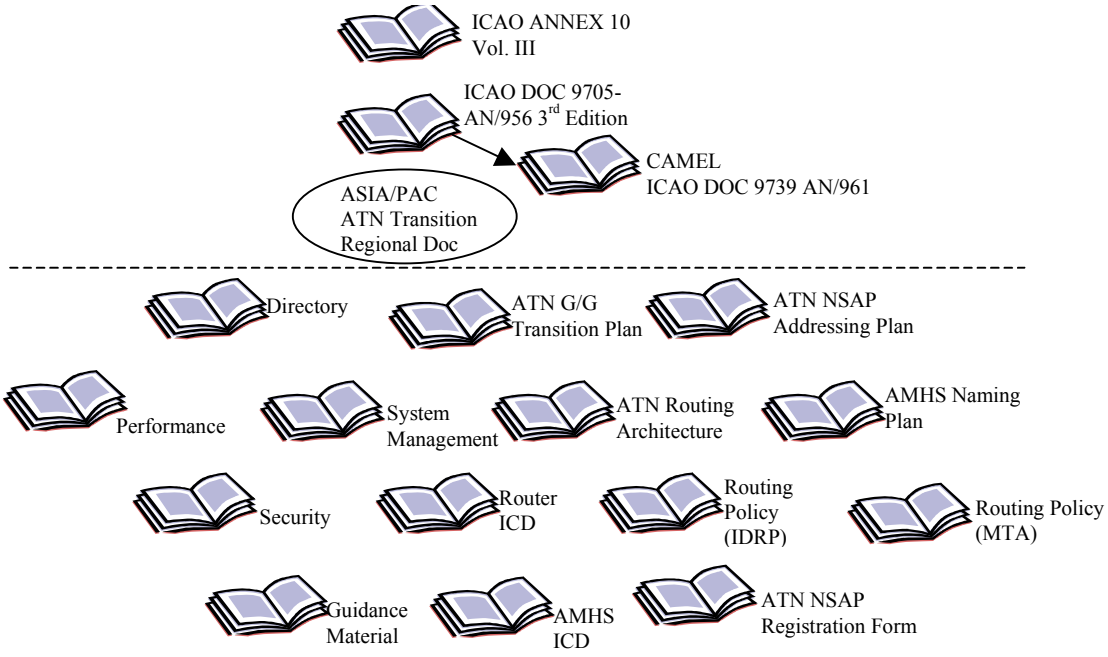

Figure 1-1: ATN Documentation Tree

1.3.2 Documents:

1.3.2.1 Applicable Documents

The following documents, with specific editions and/or versions based on ICAO DOC 9705 (SARPs, revision 3), contain requirements that are reference in this text. The requirements for the Asia/Pacific ATN BIS Router ICD are found in the following documents:

1. ITU-T X.25, 1996, Interface Between Data Terminal Equipment (DTE) and Data Circuit-terminating equipment (DCE) for Terminals Operating in the Packet Mode and Connected to Public Data Networks by Dedicated Circuit, Section 2, 3 and 4.

2. ISO/IEC 8208 - Data Communications - X.25 Packet Level Protocol for Data Terminal Equipment, 1995.

3. Manual of Technical Provisions for the Aeronautical Telecommunication Network (ICAO Doc.9705/AN/956), Third Edition – 2001, Volume V.

4. ISO/IEC 10747:1994 Information Technology -- Telecommunications and Information Exchange between Systems – Protocol for exchange of inter-domain routing information among intermediate systems to support forwarding of ISO 8473 PDUs.

5. ISO/IEC 8473-1:1994 Information Technology – Protocol for providing the connectionless-mode network service Part 1 – Protocol Specification.

6. ISO/IEC 8473-3:1995 Information Technology – Protocol for providing the connectionless-mode network service Part 3 – Provision of the underlying service by an X.25 sub-network.

7. Asia/Pacific ATN NSAP Addressing Plan, Date (TBD).

8. Asia/Pacific Region ATN Routing Policy (IDRP), Date (TBD).

1.3.2.2 Reference Documents

The following documents are reference documents applicable to the Asia/Pacific ATN BIS Router ICD. These documents do not form a part of this ICD and are not referenced within the document.

1. ICAO Annex 10 - Volumes I and II, Fifth Edition, Incorporating Amendment 70.

2. ISO/IEC TR 9575:1995 Information Technology – Telecommunications and Information Exchange between Systems -- OSI Routing Framework.

3. Asia/Pacific ATN Routing Architecture, Date (TBD).

1.4 Open Systems Interconnection (OSI) Model

The ISO defines a seven layer open systems interconnection (OSI) network model as shown in Figure 1-2.

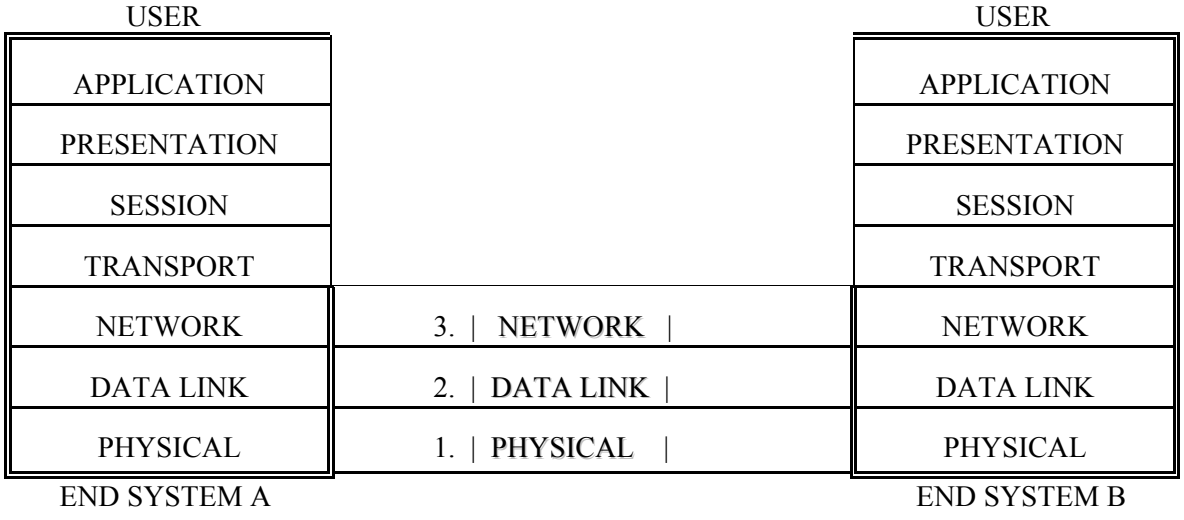

Figure 1-2: OSI 7 Layer Model

This ICD addresses the lower three layers of the OSI seven layer model between BIS routers. The physical layer covers the physical interface characteristics of either a point-to-point circuit or the packet switch network (PSN). The data link layer uses link access procedure, balanced (LAPB). The network layer can be further divided into three sub-layers.

The first sub-layer is called a sub-network layer, which is the X.25 packet layer protocol (PLP). The second sub-layer is a sub-network dependent convergence function (SNDCF). The third sub-layer includes

connectionless network protocol (CLNP,) and inter-domain routing protocol (IDRP). Figure 1-3 depicts the lower three layers of the OSI seven layer model.

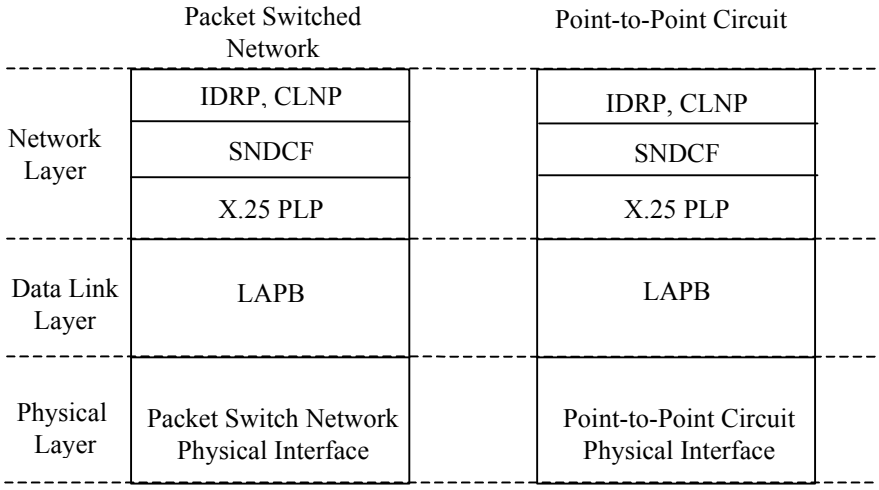

Figure 1-3: Lower Three Layers of OSI 7 Layer Model

1.5 General Requirements

The general requirements of the ATN BIS router covers the lower three layers of the OSI seven layer model as depicted in Figure 1-3. The ATN G/G BIS router in this document is defined as a class 4 router, in ICAO 9705, revision 3.

The network layer shall provide the exchange of packets between two BIS routers in accordance with routing protocols defined in ICAO 9705, and the routing policy specified in the " Asia/Pacific Region ATN Routing Policy (IDRP) " document.

The sub-network used in this document provides the interface between BIS routers in a different Routing Domains (RDs) and shall be either X.25 packet switched network (PSN) or a point-to-point circuit as depicted in Figure 1-4.

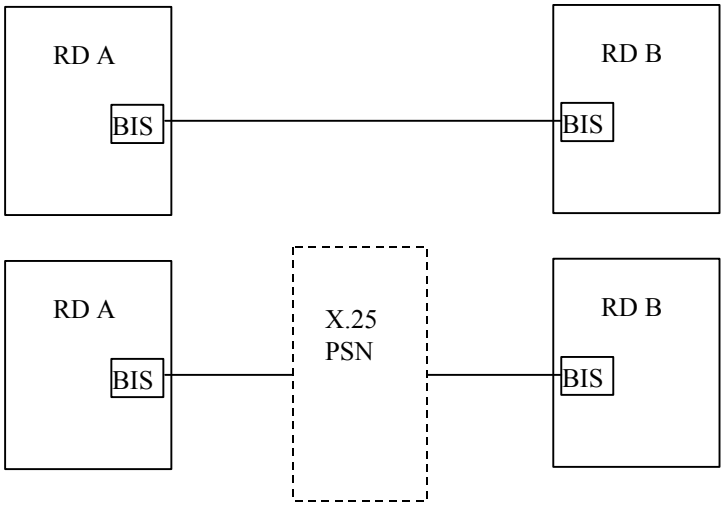

Figure 1-4: Connectivity Between Routing Domain A and B

2.0 ATN BIS Router Overview

To implement a scaleable ATN network architecture to provide global and dynamic communication services for the aviation community, the ATN has adopted the ISO Routing Framework presented in ISO TR 9575, which provides the structure necessary to support routing in the complex ATN ground system and the mobile system.

The Administrative Domain is defined to clearly indicate the domain of an organization's responsibility, and to differentiate communication within an organization from the communication between other organizations. An administrative domain is comprised of host computers, routers and networks operated by the same organization. A Routing Domain (RD), is a subset of the administrative domain, which implements a common routing algorithm. The routing control is based on the RD rather than the Administrative Domain.

The role of a router is defined as follows:

- A router that operates solely within a RD is termed an Intermediate System (IS); and
- A router that supports inter-domain routing is termed a Boundary Intermediate System (BIS).

Figure 2-1 shows the relation between different kinds of routers. In Figure 2-1, ES represents the End System defined as the end user host computer.

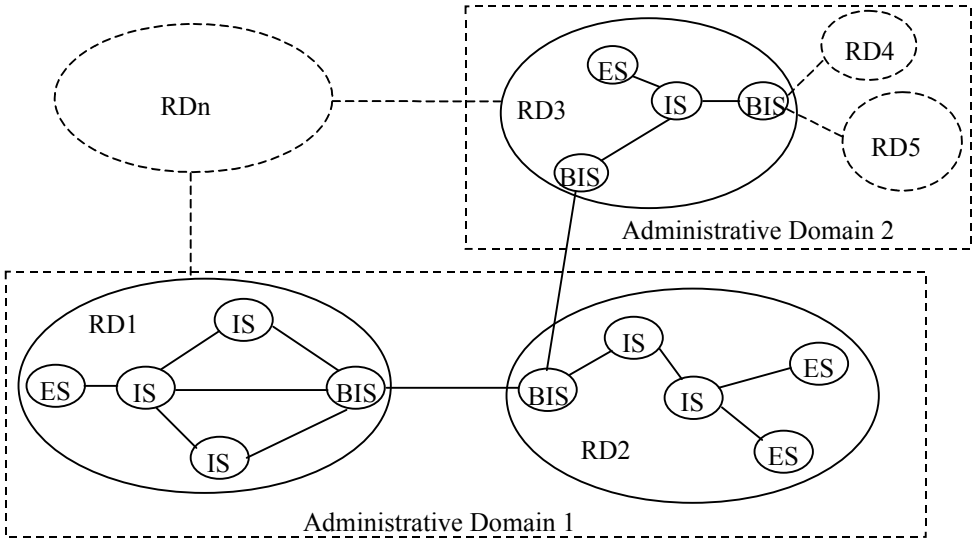

Figure 2-1: Role of ATN Router

To improve the routing efficiency, a set of routing domains can join together to form an ATN Island Routing Domain Confederation (RDC). The OSI term 'Routing Domain Confederation' is defined in ISO/IEC 10747. The Ground ATN Internet consists of one or more ATN Island RDCs. One or more routing domains within each ATN island RDC are designated as the ATN Island Backbone Routing RDC or simply 'Backbone'. The

Global ATN Backbone can further connect the ATN Island RDCs.

The Global ATN Backbone comprises at least one ATN RD from each ATN Island. The Global ATN Backbone can be interconnected either directly or indirectly via other members of the Global ATN Backbone. Figure 2-2 shows the generic ATN Internet architecture.

As defined in ISO/IEC 10747, the Transit Routing Domain (TRD) handles the transit traffic between RDCs while End Routing Domain (ERD) does not. Mobile RD refers to the airborne RD.

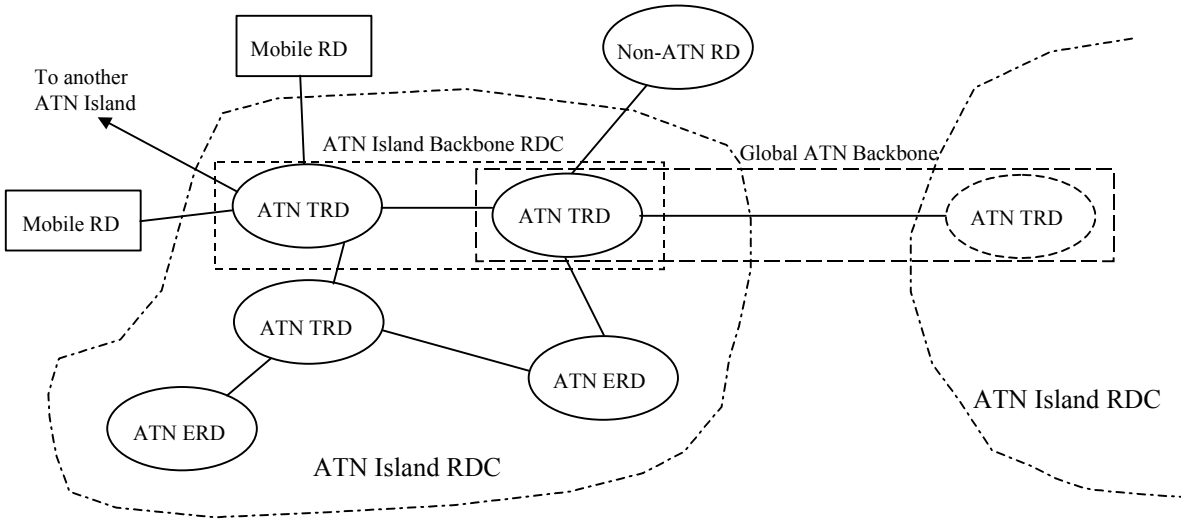

Figure 2-2: Generic ATN Internet Architecture

The BIS routers that form the Backbone are called Backbone BIS routers. The ATN Backbone BIS router may also serve as a Global ATN Backbone BIS router by using different interfaces for each backbone.

Figure 2-3 illustrates the Asia/Pacific regional ATN network architecture, which is presented in the "Asia/Pacific ATN Routing Architecture" document. A specific focus of this ICD is the Intra-Regional Backbone BIS router that provides the Intra-Regional Trunk Connection shown in Figure 2-3.

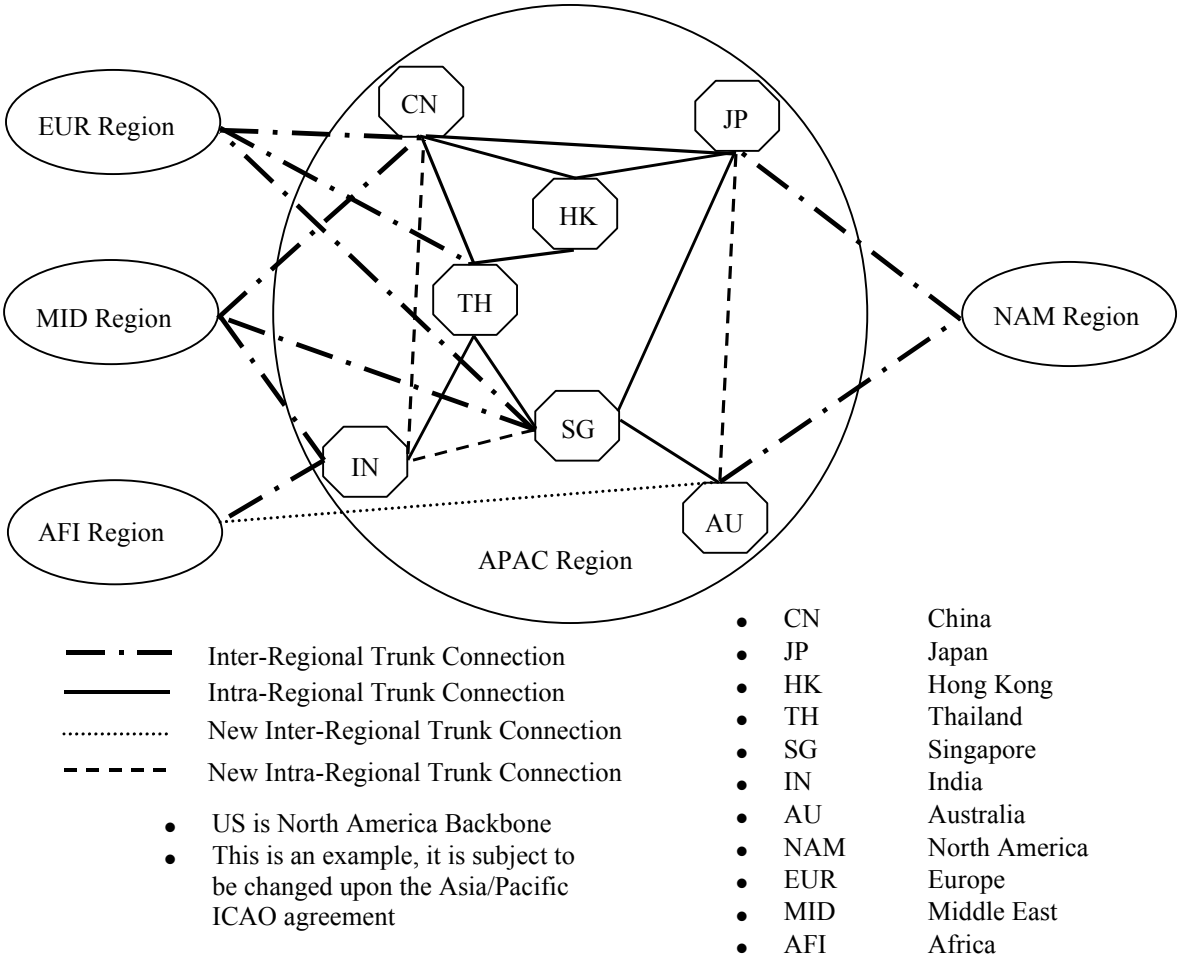

Figure 2-3: Asia/Pacific Regional ATN Network Architecture

3.0 Physical Layer (Layer 1)

The physical layer of the BIS router in this document supports the connection of either a point-to-point circuit or a packet network. The physical layer characteristic is a local issue and accepts the following requirements.

3.1 Physical Layer for Point-to-Point Circuit

3.1.1 The minimum data rates shall be 9600 bps.

3.1.2 End-to-end performance shall comply with the performance requirements specified in section 7.

3.2 Physical Layer for Private/Public Packet Network

3.2.1 The minimum data rates shall be 9600 bps.

3.2.2 End-to-end performance shall comply with the performance requirements specified in section 7.

4.0 Data Link Layer (Layer 2)

The data link layer of ATN BIS router defined in this document uses link access procedure balanced (LAPB). The following sections provide the requirements for LAPB. LAPB shall comply with ITU-T X.25, 1996.

4.1 Procedures

4.1.1 Link-level control procedures between the BIS routers, or BIS router and public network service provider, shall be comply with LAPB procedure.

4.1.2 Link-level control procedures between the BIS routers, or BIS router and public network service provider, shall be configured in an Asynchronous Balanced Mode (ABM) defined in ITU-T X.25 section 2.3 and 2.4.

4.1.3 BIS router shall be configured as Data Terminal Equipment (DTE), as specified in ITU-T X.25 for both point-to-point circuit and PSN.

4.2 Frame Structure

The unit of transmission is the frame that shall comply with the LAPB frame structure as defined in ITU-T X.25 section 2.2.

4.3 Link Control Parameter Setup

Table A-1 in appendix A defines the recommended X.25 data link layer level parameter setup which is highlighted in the following.

4.3.1 Time-out functions are necessary to ensure recovery action is taken by a combined station to respond to I-frames, S-frames, and U-frames that require acknowledgment. Timers shall be adjustable in one-second increments within a range of 2 to 120 seconds, or as determined by the public network provider.

4.3.2 To avoid resource contention, one station shall be designated the primary/combined station and have shorter timer values than the other station.

4.3.3 The retransmission attempts parameter shall indicate the maximum number of unsuccessful transmission attempts to complete successful transmission. The value of 3 to 7 is recommended for private interfaces, or determined by the PSN provider.

4.3.4 The maximum number of sequentially numbered outstanding I frames shall be seven for private interfaces.

4.3.5 The DTE and DCE shall use the same value for maximum number of sequentially numbered outstanding I frames in all cases.

4.3.6 The maximum number of sequentially numbered outstanding I frames shall be determined by the PSN provider when using public networks.

4.3.7 Interfaces operating over satellite circuits shall use modulo 128 numbering for the maximum number of sequentially numbered outstanding I frames, and select a value appropriate for the frame size and signaling speed.

5.0 Network Layer (Layer 3)

The ATN network layer includes three sub-layers. The first sub-layer is the sub-network, which is X.25 PLP layer complying with ISO/IEC 8208. The second sub-layer is SNDCF complying with ISO/IEC 8473-3. The third sub-layer includes CLNP and IDRP that comply with ISO/IES 8473-1 and 10747 respectively with specific requirements defined by ICAO DOC 9705.

5.1 ISO/IEC 8208 Sub-Network

The BIS router is capable of establishing one or more connections to other ATN BIS routers via a point-to-point circuit or X.25 sub-network. For both point-to-point circuit and X.25 network, the sub-network layer shall use ISO/IEC 8208 to access the services of the data link layer.

5.1.1 Procedures

Packet level procedures between the sub-networks are described herein and in accordance to the international standard ISO/IEC 8208, 1995, section 4 through section 11.

5.1.2 Packet Structure

The packet structure shall comply with the packet structure described in ISO/IEC 8208 section 12.

5.1.3 Functionality and Specific Setup

The sub-network layer shall support the functions defined in ISO/IEC 8208. The functions and specific setup are highlighted as follows.

5.1.3.1 Each X.25 PLP shall maintain a closed user group database indicating the X.121 address of all X.25 subscribers that are to receive messages, and are not connected via PVC.

5.1.3.2 Each BIS router shall be capable of initiating a ISO/IEC 8208 sub-network connection.

5.1.3.3 At the completion of the last complete message, the processor shall expect to receive a CLEAR INDICATION packet after an idle time period.

5.1.3.4 If CLEAR INDICATION is not received at the completion of the last complete message, the processor shall not clear the call until it has been idle for approximately four minutes.

5.1.3.5 The usage of diagnostic codes shall be established by mutual agreement.

5.1.3.6 ISO/IEC 8208 recommended interface parameters in Table A-2 in Appendix A should be used for point-to-point circuit. The public network providers provide the interface parameters for public network connection.

5.1.3.7 When a point-to-point circuit provides connectivity, the DTE addresses shall be 10 decimal digits and be agreed during the implementation planning.

5.1.3.8 For public network connection, the DTE addresses shall be 14 decimal digits and be provided by the local service provider.

5.1.3.9 Each BIS router shall be capable of terminating a sub-network connection.

5.1.3.10 A BIS router that receives a termination of a sub-network connection originated by the other BISs shall not attempt to re-establish that sub-network connection.

5.1.3.11 The M-bit shall be supported to indicate a message transfer that consists of more than one packet.

5.1.3.12 Standard ISO/IEC 8208 error handling procedures shall be followed while in data transfer mode, with the following exceptions: receipt of a Q-bit set to 1 shall be ignored; receipt of a D-bit set to 1 shall be ignored.

5.2 Sub-Network Dependent Convergence Functions (SNDCF)

Sub-Network Dependent Convergence Functions (SNDCF) must be implemented in the BIS router for each type of underlying sub-network. The purpose of a SNDCF is to provide the connectionless SN-Service assumed by the ATN Internet Protocol over real sub-network.

In general, the SNDCF does the mapping service between the CLNP and the sub-network. No explicit sub-network dependent convergence protocol control information is exchanged between peer network entities during the data phase of operation. Generation of an SN-UNITDATA Request by the CLNP results in the generation of a corresponding sub-network-specific UNITDATA request by the SNDCF. The receipt of a sub-network-specific UNITDATA indication associated with delivery of a connectionless data unit to its destination causes the SNDCF to generate an SN-UNITDATA Indication to the CLNP. When a BIS router interfaces with another BIS router via the X.25 PSN (ISO 8208) or point-to-point circuit, SNDCF shall be in compliance with the following requirements:

1. The SNDCF shall provide byte and code independent service to the CLNP as specified in ICAO 9705, revision 3 section 5.7.2;

2. The SNDCF that is used with the ISO 8208 sub-network for the BIS router shall comply with the APRL given in Appendix B.

5.3 Connectionless Network Protocol (CLNP)

The CLNP is a connectionless network protocol. The BIS router interprets the CLNP packet and sends it to another BIS router without flow control or connection setup. The BIS router CLNP requirements are specified as follows.

5.3.1 Protocol Functions

The CLNP protocol functions shall be as specified in section 5.6.2 and 5.6.3 of ICAO 9705 and the APRLs in appendix C.

5.3.2 Packet Structure and Encoding of PDUs

Figure 5-1 illustrates the structure of CLNP protocol data unit (PDU) which is network PDU (NPDU).

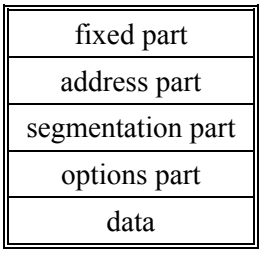

Figure 5-1: CLNP PDU Structure

The structure of each part of PDU is depicted in Figures 5-2 through Figure 5-7. All protocol data units shall contain an integral number of octets. The octets in a PDU are numbered starting from one(1).

5.3.2.1 Fixed Part

The structure of the Fixed Part is shown in Figure 5-2.

				Octet
Network Layer Protocol Identifier				1
Length Indicator				2
Version/Protocol Id Extension				3
Lifetime				4
SP	MS	E/R	Type	5
Segment Length				6,7
Checksum				8,9

Figure 5-2: CLNP PDU Header - Fixed Part

5.3.2.1.1 The Network Layer Protocol Identifier shall be set to 81(HEX) to identify this network layer protocol.

5.3.2.1.2 The Network Layer Protocol Identifier shall be set to 00(HEX) to identify the inactive network layer protocol subset.

5.3.2.1.3 The Version field shall be set to 01(HEX) to identify the standard version 1 of this protocol.

5.3.2.1.4 The Length Indicator shall have a maximum value of 254. The value 255 is reserved for possible future extension.

5.3.2.1.5 The flag field includes segmentation permitted (SP), more segments (MS), error report (E/R) and type. The segment length field shall specify the entire length of the PDU in octets including both header and data.

5.3.2.1.6 The checksum shall be computed on the entire PDU header.

5.3.2.1.7 The functional requirements of fixed part shall comply with ISO/IEC 8473-1, section 7.2 and

CLNP APRL in Appendix C.

5.3.2.2 Address Part

The structure of the Address Part is shown in Figure 5-3.

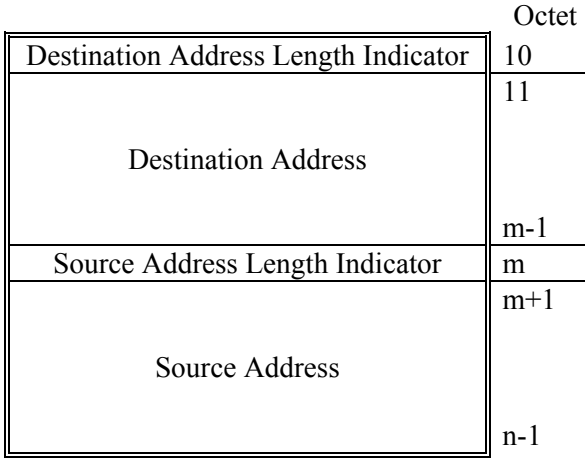

Figure 5-3: CLNP PDU Header - Address Part

Both CLNP source and destination addresses use the Network Service Access Point (NSAP) specified in ISO 8348 and has the format as defined in Figure 5-4.

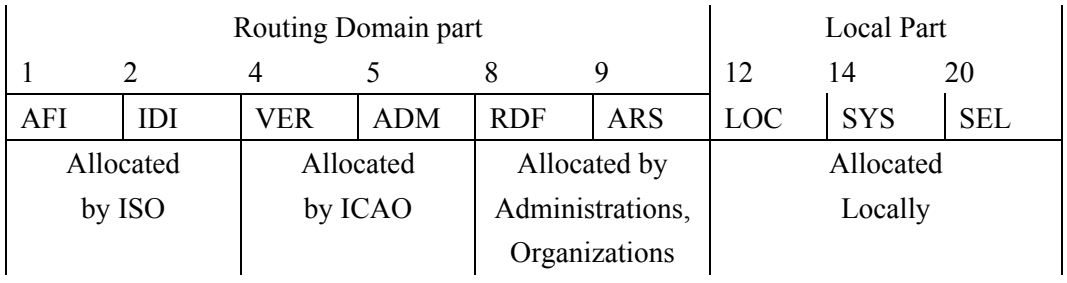

Figure 5-4: CLNP NSAP Addressing

Each field in figure 5-6 is defined as below:

- AFI - authority/format identifier (ISO; 1 Octet)
- IDI - initial domain identifier (ISO; 2 Octets)
- VER - version identifier (ICAO; 1 Octet)
- ADM - administrative identifier (ICAO/IATA; 3 Octets)
- RDF - routing domain format (ICAO/IATA ; 1 Octet)
- ARS - administrative region selector (ICAO/IATA;3 Octets)
- LOC - location identifier (National Authority; 2 Octets)
- SYS - system identifier (National Authority; 6 Octets)
- SEL - NSAP selector (National Authority; 1 Octet)

5.3.2.2.1 The details of CLNP addressing for Asia/Pacific region shall comply with the "Asia/Pacific ATN NSAP Addressing Plan" document.

5.3.2.3 Segmentation Part

Figure 5-5 shows the structure of the Segmentation Part.

	Octet
Data Unit Identifier	n, n+1
Segment Offset	n+2, n+3
Total Length	n+4, n+5

Figure 5-5: CLNP Header - Segmentation Part

The requirements for segmentation shall comply with the requirements in ISO/IEC 8473-1, section 7.4 and CLNP APRL in Appendix C.

5.3.2.4 Options Part

The Options Part of the PDU header is illustrated in Figure 5-6.

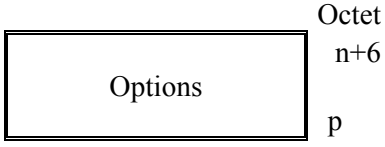

Figure 5-6: CLNP PDU header - Options part

In the ATN, the following CLNP optional header parameters are used.

- Priority
- Security
- Congestion notification

The requirements for the above three optional header parameters shall comply with ISO/IEC 8473-1, section 7.5 and CLNP APRL in Appendix C.

5.3.2.5 Data Part

The Data Part of the PDU is illustrated in Figure 5-7.

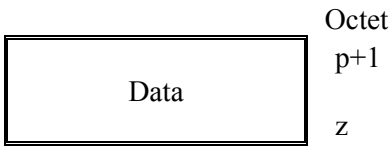

Figure 5-7: CLNP PDU header - Data part

The maximum length of data part shall be TBD.

5.4 Intra-Domain Routing Protocol

The intra-domain routing protocol is beyond the scope of this ICD.

5.5 Inter-Domain Routing Protocol (IDRP)

IDRP is a "distance vector" routing protocol used to support "policy based" routing specified in ISO/IEC 10747, and is a routing information exchange protocol that supports:

- The advertisement to routers in another Routing Domain of routes to local destinations.
- The re-advertisement of routes received from routers in other RDs to a router in another Routing Domain.
- The policy based interpretation of routing information received from other routers including a decision on a choice between alternative routes to the same destination.
- Policy based control over the advertisement and re-advertisement of routes.
- The realization of large scaleable Inter-networks.

5.5.1 BIS Protocol Data Unit (BISPDU)

The routing functionality of IDRP is accomplished by exchange of various BISPDU. The BISPDU is encapsulated in the data portion of the CLNP packet. Routing Information Base (RIB) controls the features of IDRP routing. The following sections define format of BISPDU and the RIB attributes.

5.5.1.1 BISPDU Structure

The structure of BIS protocol data unit (BISPDU) is described as below.

5.5.1.1.1 BISPDU Header

Figure 5-8 depicts the structure of the BISPDU Header.

Inter-Domain Routing Protocol Identifier (1 Octet)
BISPDU Length (2 Octets)
BISPDU type (1 Octet)
Sequence (4 octets)
Acknowledgement (4 Octets)
Credit Offered (1 octet)
Credit Available (1 Octet)
Validation Pattern (16 octets)

Figure 5-8: BISPDU Header

Each part of BISPDU is defined in ISO/IEC 10747 and the IDRP shall support six types of BISPDU:

1. OPEN PDU
2. UPDATE PDU
3. IDRP ERROR PDU
4. KEEPALIVE PDU
5. CEASE PDU
6. RIB REFRESH PDU

5.5.1.1.2 OPEN PDU

The OPEN PDU is used by a BIS to start a BIS-BIS connection. The first PDU sent by either side is an OPEN PDU. The OPEN PDU contains the fixed header and the additional fields shown in Figure 5-9.

Fixed Header
Version (1 octet)
Hold Time (2 octets)
Maximum PDU Size (2 octets)
Source RDI Length Indicator (1 octet)
Source RDI (variable)
RIB-AttsSet (variable)
Confed-IDs (variable)
Authentication Code (1 octet)
Authentication Data (variable)

Figure 5-9: OPEN PDU

5.5.1.1.2.1. The OPEN PDU shall be compliant with the requirements as specified in ISO/IEC 10747, section 6.2.

5.5.1.1.2.2. The OPEN PDU shall support RIB attributes specified in IDRP APRLs in Appendix D.

5.5.1.1.2.3. The OPEN PDU shall apply IDRP type 1 Authentication as specified in ISO/IEC 10747 as a means of ensuring the integrity of routing information exchanged with adjacent ATN RDs.

5.5.1.1.2.4. The maximum length of OPEN PDU is 3000 octets (TBR).

5.5.1.1.3 UPDATE PDU

An UPDATE PDU is used to advertise feasible routes to a neighbor BIS or to withdraw multiple unfeasible routes from service. The components of the UPDATE PDU are depicted in Figure 5-10.

Fixed Header
Unfeasible Route Count (2 octets)
Withdrawn Routes (variable)
Total Path Attributes Length (2 octets)
Path Attributes (variable)
Network Layer Reachability Information (variable)

Figure 5-10: UPDATE PDU

5.5.1.1.3.1. The UPDATE PDU shall be compliant with the requirements as specified in ISO/IEC 10747, section 6.3.

5.5.1.1.3.2. The UPDATE PDU shall support the Path Attributes defined by IDRP APRLs in appendix D.

5.5.1.1.4 IDRP ERROR PDU

IDRP ERROR PDUs report error conditions which have been detected by the local BIS. In addition to its fixed header, the IDRP ERROR PDU contains the following fields as depicted in Figure 5-11.

Fixed Header
Error Code (1 octet)
Error Subcode (1 octet)
Data (variable)

Figure 5-11: IDRP ERROR PDU

5.5.1.1.4.1. The IDRP ERROR PDU shall be compliant with the requirements as specified in ISO/IEC 10747, section 6.4.

5.5.1.1.4.2. The error condition shall be handled in the way defined by IDRP APRLs in appendix D.

5.5.1.1.5 KEEPALIVE PDU

A KEEPALIVE PDU consists of a PDU header with a length of 30 octets.

5.5.1.1.5.1. The KEEPALIVE PDU shall be compliant with the requirements as specified in ISO/IEC 10747, section 6.5.

5.5.1.1.5.2. A BIS shall use the periodic exchange of KEEPALIVE PDUs with an adjacent BIS to verify that the peer BIS is reachable and active.

5.5.1.1.6 CEASE PDU

A CEASE PDU consists of only a PDU header and has a length of 30 octets.

5.5.1.1.6.1. The CEASE PDU shall be compliant with the requirements as specified in ISO/IEC 10747, section 6.6.

5.5.1.1.6.2. A CEASE PDU shall be used by the originating BIS to instruct the peer BIS to close the BIS-BIS connection.

5.5.1.1.7 RIB REFRESH PDU

The RIB REFRESH PDU is used to allow a BIS to send a refresh of the routing information to a neighboring BIS, or to solicit a neighboring BIS to send a refresh of its routing information to the local BIS. The RIB REFRESH PDU contains a fixed header. The additional fields are shown in Figure 5-12.

Fixed Header
Opcode (1 Octet)
RIB-Atts (Variable)

Figure 5-12: RIB REFRESH PDU

5.5.1.1.7.1. The UPDATE PDU shall be compliant with the requirements as specified in ISO/IEC 10747, section 6.7.

5.5.1.1.7.2. RIB REFRESH PDU shall support the RIB attributes provided by IDRP APRLs in appendix D.

5.5.1.2 RIB Attributes

The attributes within the RIB are used to support the routing requirements. The ATN BIS route shall support the following RIB attributes.

5.5.1.2.1 The BIS router shall support default routing information bases (Adj-RIBs-In, Adj-RIBs-Out, Loc-RIB and FIB) for the empty RIB-Att.

5.5.1.2.2 The BIS router shall support the use of the DIST_LIST_INC attribute.

5.5.1.2.3 A BIS router shall support the use of the optional transitive attribute MULTI-EXIT DISC.

5.5.1.2.4 The BIS router shall recognize the MULTI-EXIT DISC attribute in UPDATE PDUs received, and propagate such routes to other routers.

5.5.1.2.5 The BIS router shall support routing information bases for the SECURITY RIB-Att.

5.5.1.2.6 The BIS router shall negotiate the use of the SECURITY RIB_Att, and only the SECURITY RIB_Att.

5.5.2 Procedures

The overview of general BIS router functional requirements are provided in Appendix E.

5.5.2.1 The ATN BIS router shall support the IDRP for the exchange of routing information with

adjacent ATN BIS routers in accordance with section 5.8.3 of ICAO 9705, and IDRP APRLs defined in appendix D.

5.5.2.2 Each BIS router shall support the routing policy specified in the "ATN Routing Policy for Asia/Pacific Region" document.

6.0 System Management

The system management requirements shall meet the requirements defined in "Asia/Pacific Regional System Management" (under development).

7.0 Performance Requirements

The router performance shall meet the requirements defined in "Asia/Pacific Regional Router Performance" (under development).

8.0 Security

The security shall meet the requirements defined in "Asia/Pacific Regional Router Security" (under development).

APPENDIX A - X.25 RECOMMENDED INTERFACE PARAMETERS FOR POINT-TO-POINT CIRCUIT

A.0 X.25 Recommended Interface Parameters for Point-to-Point Circuit

This appendix provides the X.25 recommended interface parameters for point-to-point circuit.

A.1 Data Link Layer Interface Parameters

Table A-1 provides the data link layer (LAPB) interface parameters.

Table A-1: Data link Layer Interface Parameters

Parameter	BIS Router A	BIS Router B	Comments
Max Outstanding Frames (k)	7	7	127(satellite)
ACK Receipt Timer (T1)	6	6	Based on 9.6Kb and 256 byte packets.
ACK Send Timer (T2)	500 milliseconds	500 milliseconds	T2 < T1
Idle Channel State Timer (T3)	18-21 seconds	18-21 seconds	T3 > T4
Idle Probe Timer (T4)	3 seconds	3 seconds	
Maximum Number Bits in I-Frame (N1)	2104	2104	N1 > Maximum Packet Size
Frame Retry Counter (N2)	3-7	3-7	
Frame Sequence	Modulo 8	Modulo 8	

A.2 Packet Layer Interface Parameters

Table A-2 provides the packet layer (ISO 8208) interface parameters.

Table A-2: Packet Layer (ISO 8208) Interface Parameters

Parameter	BIS Router A	BIS Router B	Comments
Reference Standard (Packet/Network layer)	ISO 8208	ISO 8208	
Packet Sequence	Modulo 8	Modulo 8	128 for Satellite
Packet Negotiation	No	No	
Packet Data Size	256	256	
Allowed Packet Data Size during Negotiation	None	None	
Allowed Packet Data Size (agreed in advance)	64, 128, 256	64, 128, 256	
Window Size Negotiation	No	No	
Window Size, W (Receive/Send)	7/7	7/7	1 to 7 1 to 127 (sat)
Total LCNs	5	5	
LCN Order	Descending	Ascending	
LCN Base	1	1	
Total PVCs	3	3	
Total two way Virtual Circuits	1	1	
Total Outgoing Virtual Circuits	1	1	
Total Incoming Virtual Circuits	1	1	
Total SVCs	2	2	
Delivery Confirmation Bit (D-bit)	Not supported	Not supported	
More Bit (M-bit)	Yes	Yes	
DTE Restart Request Timer (T20)	60 seconds	60 seconds	
DTE Call Request Timer (T21)	180 seconds	180 seconds	
DTE Reset Confirmation Timer (T22)	60 seconds	60 seconds	
DTE Clear Confirmation Timer (T23)	60 seconds	60 seconds	
DTE Window Transmission Timer (T24)	60 seconds	60 seconds	

Parameter	BIS Router A	BIS Router B	Comments
DTE Packet Acknowledgement Timer (T25)	200 seconds	200 seconds	
DTE Interrupt Timer (T26)	180 seconds	180 seconds	
DTE Reject Timer (T27)	180 seconds	180 seconds	
Restart Request Retransmission Counter (R20)	2	2	
Restart Request Retransmission Count (R22)	2	2	
Clear Request Retransmission Count (R23)	2	2	
Data Packet Retransmission Count (R25)	2	2	
Reject Retransmission Count (R27)	2	2	
Restart Request Timer (T10)		60 seconds	
Call Request Timer (T11)		180 seconds	
Reset Confirmation Timer (T12)		60 seconds	
Clear Confirmation Timer (T13)		60 seconds	
Window Transmission Timer (T14)		60 seconds	
Packet Acknowledgement Timer (T15)		180 seconds	

APPENDIX B- SNDCF (ISO/IEC 8473-3) APRLS

B.0 SNDCF (ISO/IEC 8473-3) APRLs

An implementation of the SNDCF for ISO/IEC 8208 sub-networks shall be used in ATN BIS router and its PICS (Protocol Implementation Compliance Statement) shall be in compliance with the APRLs (ATN Protocol Requirements Lists) given in this appendix.

The APRLs use the following conventions and symbols:

M	[M]andatory - the capability must be supported
MO	Mandatory to implement but optional for use
O	[O]ptional - The capability may optionally be supported
O.<n>	[O]ptional, but support of at least one of the group of options labeled by the numeral <n> is required
X or P	prohibited/precluded i.e. the capability must not be supported.
OX or OP	Optional to implement but precluded for use
<pred>:	Condition item symbol, including predicate identification
^	Logical negation, applied to a condition item's predicate
<r>	Receive aspects of an item
<s>	Send aspects of an item
Y	[Y]es, indicates that an implementation must support the item
N	[N]o, indicates that there is no requirement for the an implementation

B.1 SNDCF for use with ISO 8208 Sub-networks - Function

Table B-1 provides the functions of SNDCF for use with ISO 8208 sub-network.

Table B-1: SNDCF for use with ISO 8208 Sub-networks - Function

Item	Function	ISO/IEC 8473-3 Reference	Status	ATN Support	BIS Router Support
XSNUD	Is Sub-network User Data of at least 512 octets transferred transparently by the SNDCF ?	5.2	M	M	Y
XSNTD	Is Transit Delay determined by the SNDCF prior to the processing of user data ?	5.2	M	M	Y
	Call Setup Considerations	5.31			
	Is a new call setup:				
XCalla	a. when no suitable call exists ?	5.3.1 a.	O.3	O.3	Y
XCallb	b. when queue threshold reached ?	5.3.1 b.	O.3	O.3	N

Item	Function	ISO/IEC 8473-3 Reference	Status	ATN Support	BIS Router Support
XCallc	c. by systems management ?	5.3.1 c.	O.3	O.3	Y
XCalld	d. when queue threshold reached and timer expires ?	5.3.4	O.3	O.3	N
XCalle	e. by other local means?	5.3.1	O.3	O.3	N
	Call clearing considerations Are calls cleared:	5.3.2			
XClra	a. when idle timer expires	5.3.2 a., 5.3.4	O	O	Y
XClrb	b. when need to re-use circuit	5.3.2 b.	O	O	Y
XClrc	c. by systems management	5.3.2 c.	O	O	Y
XClrd	d. by provider ?	5.3.2 d.	M	M	Y
XClrer	e. by other local means?	5.3.2	O	O	N
XPD	X.25 Protocol Discrimination	5.3.3	M	M	Y
XVCC	Resolution of VC collisions	5.3.5	M	M	Y
XMCR	Multiple VCs responding	5.3.6	M	M	Y
XMCI	Multiple VCs initiating	5.3.6	O	O	N
Xpri	X.25 Priority procedure	5.3.7	O	M	N

B.2 SNDCF for use with ISO 8208 Sub-networks - X.25 Call User Data

Table B-2 provides the call user data requirements of SNDCF for use with ISO 8208 sub-network.

Table B-2: SNDCF for use with ISO 8208 Sub-networks - X.25 call user data

Item	Parameter	ISO/IEC 8473-3 Reference	Status	ATN Support	BIS Router Support
PD-s	<s> Protocol Discriminator	5.3.3	M	M	Y
PD-r	<r> Protocol Discriminator	5.3.3	M	M	Y
LI-s	<s> Length Indication	5.3.6	XMCI:M	XMCI:M	N
LI-r	<r> Length Indication	5.3.6	M	M	Y
Ver-s	<s> SNCR Version	5.3.6	XMCI:M	XMCI:M	N
Ver-r	<r> SNCR Version	5.3.6	M	M	Y
SNCR-s	<s> SNCR Value	5.3.6	XMCI:M	XMCI:M	N
SNCR-r	<r> SNCR Value	5.3.6	M	M	Y

B.3 SNDCF for use with ISO 8208 Sub-networks - ISO 8208 SNDCF Timers

Table B-3 provides the timers of SNDCF for use with ISO 8208 sub-network.

Table B-3: SNDCF for use with ISO 8208 Sub-networks - ISO 8208 SNDCF Timers

Item	Timer	ISO/IEC 8473-3 Reference	Status	Values	ATN Support	BIS Router Support
XIDL	X25 VC Idle	5.3.4	XClra:O	Any	XClra:O	Y, 0 to 72000 sec.
XNVC	additional VC	5.3.4	O	Any	M	Y, 0 to 72000 sec.

B.4 SNDCF for use with ISO 8208 Sub-networks - Multi Layer Dependencies

Table B-4 provides multi layer dependency requirements of SNDCF for use with ISO 8208 sub-network.

Table B-4: SNDCF for use with ISO 8208 Sub-networks - Multi layer dependencies

Item	Dependency	ISO/IEC 8473-3 Reference	Status	ATN Support	BIS Router Support
XSSg-r	<r> Maximum SN data unit size (Rx)	5.2	>=512	>=512	>=512
XSSg-s	<s> Maximum SN data unit size (Tx)	5.2	>=512	>=512	>=512
Xvc	X.25 Virtual call service	5.3.8	M	M	Y
Xdt	X.25 Data transfer	5.3.8	M	M	Y
Xfc	X.25 flow control procedures	5.3.8	M	M	Y
Xfrp	X.25 flow control + reset packets	5.3.8	M	M	Y
Xccp	X.25 call setup and clear packets	5.3.8	M	M	Y
Xdp	X.25 DTE and DCE data packets	5.3.8	M	M	Y
Xrs	X.25 restart procedures	5.3.8	M	M	Y
XDct	X.25 DCE timeouts	5.3.8	M	M	Y
XDtT	X.25 time limits	5.3.8	M	M	Y
Xpco	X.25 network packet coding	5.3.8	M	M	Y
Xfcn	X.25 flow control parameter negotiation	5.3.8	O	O	Y
Xtd	X.25 transit delay selection and negotiation	5.3.8	O	O	Y
Xtc	X.25 throughput class negotiation	5.3.8	O	O	Y
Xoth	Other X.25 elements	5.3.8	O	O	Y

APPENDIX C- CLNP APRLS

C.0 CLNP APRLs

This appendix provides CLNP APRLs (ATN Protocol Requirements Lists) for ATN BIS router. The APRLs define the capabilities and options of the protocol that, at minimum, are required to be implemented for the ATN BIS router under ATN environment.

The APRLs in this appendix use the conventions and symbols defined in the beginning of appendix B.

C.1 Support of ATN-Specific Network Layer Features

Table C-1 provides the requirements for CLNP network layer features.

Table C-1: Support of ATN-specific network layer features

Index	Item	ATN SARPs Reference	ATN Support	BIS Router Support
ATN CLNP1	Encoding and use of the Security Parameter	5.6.2.2	M	Y
ATN CLNP2	Management of Network Priority	5.6.2.3, 5.2.8.4	M	Y
ATN CLNP4	Echo Request Function	5.6.3.3	O	Y
ATN CLNP5	Congestion Management	5.6.2.4	M	Y
ATN CLNP6	Echo Response Function	5.6.3.4.1	M	Y
ATN CLNP7	Echo Response parameter setting	5.6.3.4.2,5.6.3.4.3 5.6.3.4.4	M	Y

C.2 Major Capabilities

Table C-2 provides the CLNP major capabilities.

Table C-2: Major Capabilities

Item	Capability	ISO/IEC 8473 Reference	Status	ATN Support	BIS Router Support
ES	End System		O.1	O.1	N
IS	Intermediate System		O.1	O.1	Y
FL-r	<r> Full protocol	8473-1: 6	M	M	Y
FL-s	<s> Full protocol	8473-1: 6	M	M	Y
NSS-r	<r> Non-segmenting subset	8473-1: 5.2	M	M	Y
NSS-s	<s> Non segmenting subset	8473-1: 5.2	IS:M ^IS:O	IS:M ^IS:O	Y

Item	Capability	ISO/IEC 8473 Reference	Status	ATN Support	BIS Router Support
IAS-r	<r> Inactive subset	8473-1: 5.2	ES:O	ES:O	N
IAS-s	<s> Inactive subset	8473-1: 5.2	IAS-r:M ^IAS-r:X	IAS-r:M ^IAS-r:X	N
S802	SNDCF for ISO 8802	8473-2: 5.4	O.2	O	Y
SCLL	SNDCF for CL Link Service	8473-4: 5.3.1	O.2	O	Y
SCOL	SNDCF for CO Link Service	8473-4: 5.3.2	O.2	O	Y
SX25	SNDCF for ISO 8208	8473-3: 5.4	O.2	O	Y
ATN SNDCF	SNDCF for Mobile Sub-networks	ATN SARPs Ref: Chapter 5.7	N/A	ISMOB:M ISGRD:O ^IS:O	N/A

ISMOB: If ISO/IEC 8473 is used over Mobile Sub-networks, then ISMOB is true, else ISMOB is false.

ISGRD: If ISO/IEC 8473 is used over Ground Sub-networks, then ISGRD is true, else ISGRD is false.

O.1: The supported functions, NPDUs, associated parameters and timers required for Intermediate Systems are provided in the APRLs. C.3 through C.10.

O.2: APRLs for the SNDCF for use with ISO/IEC 8208 sub-networks are provided in B.1 through B.4.

C.3 Boundary Intermediate Systems - Supported Functions

Table C-3 describes the ATN BIS supported features.

Table C-3: Intermediate Systems - Supported Functions

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iPDUC	PDU Composition	6.1	M	M	Y
iPDUD	PDU Decomposition	6.2	M	M	Y
iHFA	Header Format Analysis	6.3	M	M	Y

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iPDUL	<s> PDU Lifetime Control	6.4	M	M	Y
iRout	Route PDU	6.5	M	M	Y
iForw	Forward PDU	6.6	M	M	Y
iSegm	Segment PDU	6.7	iDSNS:M	iDSNS:M	Y
iReas	Reassemble PDU	6.8	O	O	Y
iDisc	Discard PDU	6.9	M	M	Y
iErep	Error Reporting	6.10	M	M	Y
iEdec	<s> Header Error Detection	6.11	M	M	Y
iSecu	<s>Security	6.13 ATN SARPs Ref: 5.6.2.2	O	M	Y
iCRR	<s> Complete Route Recording	6.15	O	OX	N
iPRR	<s> Partial Route Recording	6.15	O	M	Y
iCSR	Complete Source Routing	6.14	O	OX	N
iPSR	Partial Source Routing	6.14	O	OX	N
iPri	<s> Priority	6.17, ATN SARPs Ref: 5.6.3.5	O	M	Y
iQOSM	<s> QOS Maintenance	6.16	O	M	Y
iCong	<s> Congestion Notification	6.18, ATN SARPs Ref: 5.6.2.4	O	M	Y
iPadd	<s> Padding	6.12	M	M	Y
iEreq	Echo request	6.19, ATN SARPs Ref: 5.6.3.3	O	O	Y
iErsp	Echo response	6.20	O	M	Y
iSegS	Create segments smaller than necessary	6.8	O	O	N

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iDSNS	Simultaneous support of sub-networks with different SN-User data sizes	6.7	O	O	Y

C.4 Supported Security Parameters

Table C-4 describes the ATN BIS supported security parameters.

Table C-4: Supported Security Parameters

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iSADSSEC	Source Address Specific Security	7.5.3.1	iSecu:O.5	iSecu:O	N
iDADSSEC	Destination Address Specific Security	7.5.3.2	iSecu:O.5	iSecu:O	N
iGUNSEC	Globally Unique Security	ATN SARPs Ref. 5.6.2.2	iSecu:O.5	iSecu:M	Y

O.5: The Security parameter within a single NPDU specifies a security format code indicating Source Address Specific, Destination Address Specific or Globally Unique Security.

C.5 Quality of Service Maintenance Function

Table C-5 describes the ATN BIS quality of service maintenance function.

Table C-5: Quality of Service Maintenance Function

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
IQOSNAVAIL	If requested QOS not available, deliver at different QOS	6.16	iQOSM:M	iQOSM:M	Y
IQOSNOT	Notification of failure to meet requested QOS	6.16	iQOSM:O	iQOSM:O	N
	Which of the following formats of QOS are implemented ?				
ISADDQoS	Source Address Specific QoS	7.5.6.1	iQoSM:O.3	iQOSM:O	N
IDADDQoS	Destination Address Specific QoS	7.5.6.2	iQoSM:O.3	iQOSM:O	N
IGUNQoS	Globally Unique QoS	7.5.6.3	iQoSM:O.3	iQOSM:M	Y
iSvTD	Sequencing versus Transit Delay	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N
iCongE	Congestion Experienced	7.5.6.3	iGUNQoS:O.4	iGUNQoS:M	Y
iTDvCst	Transit Delay versus Cost	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N
iREPvTD	Residual Error Probability versus Transit Delay	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iREPvCst	Residual Error Probality versus Cost	7.5.6.3	iGUNQoS:O.4	iGUNQoS:O.4	N

O.3: The Quality of Service Maintenance parameter within a single NPDU specifies a QoS format code indicating Source Address Specific, Destination Address Specific or Globally Unique QoS.

O.4: If the QoS format code indicates that the Globally Unique QoS maintenance function is employed, then each bit in the associated parameter value may be set to indicate the order of intra and inter domain routing decisions based on QoS. The parameter values which apply to inter-domain routing are provided in Table 4 of ISO/IEC 10747.

C.6 Boundary Intermediate Systems - Supported NPDUs

Table C-6 describes the ATN BIS supported NPDUs.

Table C-6: Boundary Intermediate Systems - Supported NPDUs

Item	Function	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iDT-t	DT (full protocol) transmit	7.7	M	M	Y
iDT-r	DT (full protocol) receive	7.7	M	M	Y
iDTNS-t	DT (non-segment) transmit	7.7	M	M	Y
iDTNS-r	DT (non-segment) receive	7.7	M	M	Y
IER-t	ER transmit	7.9	M	M	Y
IER-r	ER receive	7.9	M	M	Y
iERQ-t	ERQ transmit	7.10	iEreq:M	iEreq:M	Y
iERQ-r	ERQ receive	7.10	M	M	Y
iERP-t	ERP transmit	7.11	iErsp:M	iErsp:M	Y
iERP-r	ERP receive	7.11	M	M	Y

C.7 Boundary Intermediate Systems - Supported Data PDU (DT PDU) Parameters

Table C-7 describes the ATN BIS supported DT PDU parameters.

Table C-7: Boundary Intermediate Systems - Supported DT PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
idFxPt-s	<s> Fixed Part	7.2	M	M	Y
idFxPt-r	<r> Fixed Part	7.2	M	M	Y
idAddr-s	<s> Addresses	7.3	M	M	Y
idAddr-r	<r> Addresses	7.3	M	M	Y
idSeg-s	<s> Segmentation Part	7.4	M	M	Y
idSeg-r	<r> Segmentation Part	7.4	M	M	Y
idPadd-s	<s> Padding	7.5.2	M	M	Y
idPadd-r	<r> Padding	7.5.2	M	M	Y
idSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
idSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
idCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	-	N
idCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
idPRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
idPRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
idCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
idCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
idPSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
idPSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
idQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
idQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or iCong:M	Y
idPri-s	<s> Priority	7.5.7	M	M	Y

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
idPri-r	<r> Priority	7.5.7	iPRi:M	iPri:M	Y
idData-s	<s> Data	7.6	M	M	Y
idData-r	<r> Data	7.6	M	M	Y
idUnSup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded and where appropriate an Error Report PDU generated ?	6.19	M	M	Y
idUnSup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.19	M	M	Y

C.8 Boundary Intermediate Systems - Supported Error Report PDU (ER PDU) Parameters

Table C-8 describes the ATN BIS supported ER PDU parameters.

Table C-8: Boundary Intermediate Systems - Supported ER PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
ieFxPt-s	<s> Fixed Part	7.2	M	M	Y
ieFxPt-r	<r> Fixed Part	7.2	M	M	Y
ieAddr-s	<s> Address	7.3	M	M	Y
ieAddr-r	<r> Address	7.3	M	M	Y
iePadd-s	<s> Padding	7.5.2	M	M	Y
iePadd-r	<r> Padding	7.5.2	M	M	Y
ieSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
ieSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
ieCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	iCRR:M	N
ieCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
iePRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
iePRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
ieCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
ieCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
iePSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
iePSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
ieQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
ieQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or iCong:M	Y
iePri-s	<s> Priority	7.5.7	M	M	Y

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iePri-r	<r> Priority	7.5.7	iPri:M	iPri:M	Y
ieDisc-s	<s> Reason for Discard	7.9.5	M	M	Y
ieDisc-r	<r> Reason for Discard	7.9.5	M	M	Y
ieData-s	<s> Data	7.6	M	M	Y
ieData-r	<r> Data	7.6	M	M	Y
ieUnsup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded ?	6.21	M	M	Y
ieUnsup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.21	M	M	Y

C.9 Boundary Intermediate Systems - Supported Echo Request PDU (ERQ PDU) Parameters

Table C-9 describes the ATN BIS supported ERQ PDU parameters.

Table C-9: Boundary Intermediate Systems - Supported ERQ PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iqFxPt-s	<s> Fixed Part	7.2	M	M	Y
iqFxPt-r	<r> Fixed Part	7.2	M	M	Y
iqAddr-s	<s> Addresses	7.3	M	M	Y
iqAddr-r	<r> Addresses	7.3	M	M	Y
iqSeg-s	<s> Segmentation Part	7.4	M	M	Y
iqSeg-r	<r> Segmentation Part	7.4	M	M	Y
iqPadd-s	<s> Padding	7.5.2	M	M	Y
iqPadd-r	<r> Padding	7.5.2	M	M	Y

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iqSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
iqSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
iqCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	M	N
iqCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
iqPRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
iqPRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
iqCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
iqCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
iqPSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
iqPSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
iqQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
iqQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or ICong:M	Y
iqPri-s	<s> Priority	7.5.7	M	M	Y
iqPri-r	<r> Priority	7.5.7	iPRi:M	iPri:M	Y
iqData-s	<s> Data	7.6	M	M	Y
iqData-r	<r> Data	7.6	M	M	Y
iqUnSup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded and where appropriate an Error Report PDU generated ?	6.19	M	M	Y
iqUnSup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.19	M	M	Y

C.10 Boundary Intermediate Systems - Supported Echo Reply PDU (ERP PDU) Parameters

Table C-10 describes the ATN BIS supported ERP PDU parameters.

Table C-10: Boundary Intermediate Systems - Supported ERP PDU Parameters

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
ipFxPt-s	<s> Fixed Part	7.2	M	M	Y
ipFxPt-r	<r> Fixed Part	7.2	M	M	Y
ipAddr-s	<s> Addresses	7.3	M	M	Y
ipAddr-r	<r> Addresses	7.3	M	M	Y
ipSeg-s	<s> Segmentation Part	7.4	M	M	Y
ipSeg-r	<r> Segmentation Part	7.4	M	M	Y
ipPadd-s	<s> Padding	7.5.2	M	M	Y
ipPadd-r	<r> Padding	7.5.2	M	M	Y
ipSecu-s	<s> Security	7.5.3	iSecu:M	iSecu:M	Y
ipSecu-r	<r> Security	7.5.3	iSecu:M	iSecu:M	Y
ipCRR-s	<s> Complete Route Recording	7.5.5	iCRR:M	M	N
ipCRR-r	<r> Complete Route Recording	7.5.5	iCRR:M	-	N
ipPRR-s	<s> Partial Route Recording	7.5.5	M	M	Y
ipPRR-r	<r> Partial Route Recording	7.5.5	iPRR:M	iPRR:M	Y
ipCSR-s	<s> Complete Source Routing	7.5.4	iCSR:M	-	N
ipCSR-r	<r> Complete Source Routing	7.5.4	iCSR:M	-	N
ipPSR-s	<s> Partial Source Routing	7.5.4	M	M	Y
ipPSR-r	<r> Partial Source Routing	7.5.4	iPSR:M	-	N
ipQOSM-s	<s> QOS Maintenance	7.5.6	M	M	Y
ipQOSM-r	<r> QOS Maintenance	7.5.6	iQOSM or iCong:M	iQOSM or ICong:M	Y
ipPri-s	<s> Priority	7.5.7	M	M	Y
ipPri-r	<r> Priority	7.5.7	iPRi:M	iPri:M	Y
ipData-s	<s> Data	7.6	M	M	Y
ipData-r	<r> Data	7.6	M	M	Y

Item	Parameter	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
ipUnsup2	Are received PDUs containing parameters selecting unsupported type 2 functions discarded and where appropriate an Error Report PDU generated ?	6.19	M	M	Y
ipUnsup3	Are parameters selecting unsupported Type 3 functions ignored ?	6.19	M	M	Y

C.11 Boundary Intermediate Systems - Timer and Parameter Values

Table C-11 describes the ATN BIS Timer and parameter values.

Table C-11: Boundary Intermediate Systems - Timer and Parameter Values

Item	Timer	ISO/IEC 8473-1 Reference	Status	ATN Support	BIS Router Support
iReasTim	Reassembly Timer	6.8	iReas:M	M	Y

APPENDIX D - IDRP APRLS

D.0 IDRP APRLs

This appendix provides IDRP APRLs for ATN BIS routers. The APRLs define the capabilities and options that, at a minimum, are required to be implemented for the ATN BIS router under an ATN environment.

The APRLs provided in this appendix use the conventions and symbols defined in the beginning of Appendix B.

D.1 ATN Specific Protocol Requirements

Table D-1 describes the ATN specific protocol requirements.

Table D-1: ATN specific protocol requirements

Index	Item	ATN SARPs Ref	G-G Router	BIS Router Support
ATNIDRP1	Encoding and use of the Security Path Attribute	5.8.3.2.2, 5.8.3.2.3	M	Y
ATNIDRP2	Does this BIS immediately re-advertise routes if the security information contained in the routes's path attribute change?	5.8.3.2.7	M	Y
ATNIDRP3	Support of 'policy based route aggregation'	5.8.3.2.6.2	O	Y
ATNIDRP4	Support of 'policy based route information reduction'	5.8.3.2.6.5	O	Y
ATNIDRP5	Support of aggregation of routes with identical NLRI using 'true route aggregation'	5.8.3.2.6.3	O.1	Y
ATNIDRP6	Support of aggregation of routes with identical NLRI using 'route merging'	5.8.3.2.6.3	O.1	N
ATNIDRP7	Support of aggregation of security path attribute information field	5.8.3.2.6.4	M	Y

D.2 IDRP General

Table D-2 describes the IDRP general requirements.

Table D-1: IDRP General

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
BASIC	Are all basic BIS functions implemented?	12.1	M	M	Y
MGT	Is this system capable of being managed by the specified management information?	11	M	O	N
VER	Does this BIS support Version Negotiation?	7.8	M	M	Y
RTSEP	Does this BIS support the ROUTE_SEPARATOR attribute?	7.12.1	M	M	Y
HOPS	Does this BIS support the RD_HOP_COUNT attribute?	7.12.13	M	M	Y
PATH	Does this BIS support the RD_PATH attribute?	7.12.3	M	M	Y
CAPY	Does this BIS support the Capacity Attribute?	7.12.15	M	M	Y
FSM	Does this BIS manage BIS-BIS connections according to the BIS FSM description?	7.6.1	M	M	Y
FCTL	Does this BIS provide flow control?	7.7.5	M	M	Y
SEQNO	Does this BIS provide sequence number support?	7.7.4	M	M	Y
INTG1	Does this BIS provide Data Integrity using authentication type 1?	7.7.1	O.1	M	Y
INTG2	Does this BIS provide Data Integrity using authentication type 2?	7.7.2	O.1	O	N

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
INTG3	Does this BIS provide Data Integrity using authentication type 3?	7.7.3	O.1	O	N
ERROR	Does this BIS handle error handling for IDRP?	7.20	M	M	Y
RIBCHK	Does this BIS operate in a "fail-stop" manner with respect to corrupted routing information?	7.10.2	M	M	Y

D.3 IDRP Update Send Process

Table D-3 describes the IDRP update send process requirements.

Table D-3: IDRP Update Send Process

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
INT	Does the BIS provide the internal update procedures?	7.17.1	M	M	Y
RTSEL	Does this BIS support the MinRouteAdvertisementInterval Timer?	7.17.3.1	M	M	Y
RTORG	Does this BIS support the MinRDOriginationInterval Timer?	7.17.3.2	M	M	Y
JITTER	Does this BIS provide jitter on its timers?	7.17.3.3	M	M	Y

D.4 IDRP Update Receive Process

Table D-4 describes the IDRP update receive process requirements.

Table D-4: IDRP Update Receive Process

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
INPDU	Does the BIS handle inbound BISPDUs correctly?	7.14	M	M	Y
INCONS	Does this BIS detect inconsistent routing information?	7.15.1	M	M	Y

D.5 IDRP Decision Process

Table D-5 describes the IDRP decision process requirements.

Table D-5: IDRP Decision Process

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
TIES	Does this BIS break ties between candidate routes correctly?	7.16.2.1	M	M	Y
RIBUPD	Does this BIS update the Loc-RIBs correctly?	7.16.2	M	M	Y
AGGRT	Does this BIS support route aggregations?	7.18.2.1, 7.18.2.2, 7.18.2.3	O	ATNIDRP3^ATNIDRP5: M	Y
LOCK	Does this BIS provide interlocks between its Decision Process and the updating of the information in its Adj-RIBs-In?	7.16.4	M	M	Y

D.6 IDRP Receive

Table D-6 describes the IDRP receive requirements.

Table D-6: IDRP Receive

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
RCV	Does the BIS process incoming BISPDUs and respond correctly to error conditions?	7.14, 7.20	M	M	**Y**
OSIZE	Does this BIS accept incoming OPEN PDUs whose size in octets is between MinBISPDULength and 3000?	6.2,7.20	M	M	**Y**
MXPDU	Does the BIS accept incoming UPDATE, IDRP ERROR and RIB REFRESH PDUs whose size in octets is between minBISPDULength and maxBISPDULength?	6.2,7.20	M	M	**Y**

D.7 IDRP CLNS Forwarding

Table D-7 describes the IDRP connectionless network service (CLNS) forwarding requirements.

Table D-7: IDRP CLNS Forwarding

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
PSRCRT	Does the BIS correctly handle ISO/IEC 8473 NPDUs that contain a partial source route?	8	M	O	N
DATTS	Does the BIS correctly extract the NPDU-derived Distinguishing Attributes from an ISO/IEC 8473 NPDU?	8.2	M	M	Y
MATCH	Does the BIS correctly match the NPDU-derived Distinguishing Attributes with the corresponding FIB-Atts?	8.3	M	M	Y
EXTF	Does the BIS correctly forward NPDUs with destinations outside its own routing domain?	8.4	M	M	Y

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
INTF	Does the BIS correctly forward NPDUs with destinations inside its own routing domain?	8.1	M	M	Y

D.8 IDRP Optional Transitive Attributes

Table D-8 describes the requirements for IDRP optional transitive attributes.

Table D-8: IDRP Optional Transitive Attributes

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
MEXIT	Does this BIS support use of the MULTI-EXIT DISC attribute?	7.12.7	O	O	Y

D.9 Generating Well-Known Discretionary Attributes

Table D-9 describes the requirements for generating well-known discretionary attributes.

Table D-9: Generating Well-Known Discretionary Attributes

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
EXTG	Does the BIS support generation of the EXT_INFO attribute?	7.12.2	O	O	N
NHRS	Does the BIS support generation of the NEXT_HOP attribute in support of route servers?	7.12.4	O	O	N
NHSN	Does the BIS support generation of the NEXT_HOP attribute to advertise SNPAs?	7.12.4	O	O	N
DLI	Does the BIS support generation of the DIST_LIST_INCL attribute?	7.12.5	O	O	Y

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
DLE	Does the BIS support generation of the DIST_LIST_EXCL attribute?	7.12.6	O	O	N
TDLY	Does the BIS support generation of the TRANSIT DELAY attribute?	7.12.8	O	O	N
RERR	Does the BIS support generation of the RESIDUAL ERROR attribute?	7.12.9	O	O	N
EXP	Does the BIS support generation of the EXPENSE attribute?	7.12.10	O	O	N
LQOSG	Does the BIS support generation of the LOCALLY DEFINED QOS attribute?	7.12.11	O	OX	N
HREC	Does the BIS support generation of the HIERARCHICAL RECORDING attribute?	7.12.12	O	OX	N
SECG	Does the BIS support generation of the SECURITY attribute?	7.12.14	O	M	Y
PRTY	Does the BIS support generation of the PRIORITY attribute?	7.12.16	O	O	N

D.10 Peer Entity Authentication

Table D-10 describes peer entity authentication requirements.

Table D-10: Peer Entity Authentication

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support

AUTH	Does this BIS correctly authenticate the source of a BISPDU?	7.7.2	O	M	N

Note. Only support for an Authentication Code 1 is required

D.11 Propagating Well-Known Discretionary Attributes

Table D-11 describes requirements for propagating well-known discretionary attributes.

Table D-11: Propagating Well-Known Discretionary Attributes

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
EXTGP	Does the BIS support propagation of the EXT_INFO attribute?	7.12.2	M	M	Y
NHRSP	Does the BIS support propagation of the NEXT_HOP attribute in support of route servers?	7.12.4	O	O	N
NHSNP	Does the BIS support propagation of the NEXT_HOP attribute to advertise SNPAs?	7.12.4	O	O	N
DLIP	Does the BIS support propagation of the DIST_LIST_INCL attribute?	7.12.5	O	M	Y
DLEP	Does the BIS support propagation of the DIST_LIST_EXCL attribute?	7.12.6	O	M	Y
TDLYP	Does the BIS support propagation of the TRANSIT DELAY attribute?	7.12.8	O	O	N
RERRP	Does the BIS support propagation of the RESIDUAL ERROR attribute?	7.12.9	O	O	N
EXPP	Does the BIS support propagation of the EXPENSE attribute?	7.12.10	O	O	N
LQOSP	Does the BIS support propagation of the LOCALLY DEFINED QOS attribute?	7.12.11	O	OX	N

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
HRECP	Does the BIS support propagation of the HIERARCHICAL RECORDING attribute?	7.12.12	O	OX	N
SECP	Does the BIS support propagation of the SECURITY attribute?	7.12.14	O	M	Y
PRTYP	Does the BIS support propagation of the PRIORITY attribute?	7.12.16	O	O	N

D.12 Receiving Well-Known Discretionary Attributes

Table D-12 describes the requirements for receiving well-known discretionary attributes.

Table D-12: Receiving Well-Known Discretionary Attributes

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
EXTR	Does the BIS recognise upon receipt the EXT_INFO attribute?	7.12.2	M	M	Y
NHRSR	Does the BIS recognise upon receipt the NEXT_HOP attribute ?	7.12.4	M	M	Y
DLIR	Does the BIS recognise upon receipt the DIST_LIST_INCL attribute?	7.12.5	M	M	Y
DLER	Does the BIS recognise upon receipt the DIST_LIST_EXCL attribute?	7.12.6	M	M	Y
TDLYR	Does the BIS recognise upon receipt the TRANSIT DELAY attribute?	7.12.8	M	M	Y
RERRR	Does the BIS recognise upon receipt the RESIDUAL ERROR attribute?	7.12.9	M	M	Y

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G Router	BIS Router Support
EXPR	Does the BIS recognise upon receipt the EXPENSE attribute?	7.12.10	M	M	Y
LQOSR	Does the BIS recognise upon receipt the LOCALLY DEFINED QOS attribute?	7.12.11	M	O	N
HRECR	Does the BIS recognise upon receipt the HIERARCHICAL RECORDING attribute?	7.12.12	M	M	Y
SECR	Does the BIS recognise upon receipt the SECURITY attribute?	7.12.14	M	M	Y
PRTYR	Does the BIS recognise upon receipt the PRIORITY attribute?	7.12.16	M	M	Y

D.13 IDRP Timers

Table D-13 describes the IDRP timer requirements.

Table D-13: IDRP Timers

Item	Description	ISO/IEC 10747 Ref.	ISO Status	G-G router	BIS Router Support
Ta	KeepAlive time	7.6.5	M	M	Y
Tr	Retransmission (tr) timer	7.6.5	M	M	Y
Tmr	maxRIBIntegrityCheck timer	7.10.2	M	M	Y
Tma	MinRouteAdvertisement timer	7.17.3.1	M	M	Y
Trd	MinRDOriginationInterval timer	7.17.3.2	M	M	Y
Tcw	closeWaitDelay timer	7.6.4	M	M	Y

APPENDIX E - ATN BIS ROUTER REQUIREMENTS

E.0 ATN BIS Router Requirements

E.1 Router Functional Requirements

The ATN BIS router shall be selected to accomplish the ATN network requirements specified in SARPs and related ISO standards. The BIS router shall support the interfaces defined in this ICD.

E.1.1 Routed Protocol (CLNP)

The BIS router shall support the Connectionless Network Protocol (CLNP) defined in ISO/IEC 8473 with the specific requirements for ATN specified in SARPs 5.6.3. The ATN specific requirements for ISO/IEC 8473 are as below,

(a) The BIS router shall support both the segmenting and the non-segmenting subsets of ISO/IEC 8473 (SARPs 5.6.3.1.1)

(b) The ATN specific use of the ISO/IEC 8473 security function is specified in SARPs 5.6.2.2

(c) The BIS router shall support the ECHO REQUEST Function as invoked by Network Layer management (SARPs 5.6.3.3.1)

(d) BIS router shall support the Echo Response Function of ISO/IEC 8473 (SARPs 5.6.3.4.1)

(e) If the data part of the received ERQ PSU contains an ERP PDU header, then the options part of the ERP PDU to be sent shall be identical to the options part of the ERP PDU header contained in the data part of the received ERQ PDU (SARPs 5.6.3.4.2)

(f) If the data part of the received ERQ PSU does not contain an ERP PDU header, then the security, priority , and QoS maintenance options of the ERP PDU shall be identical to the corresponding options in the header of ERQ PDU, if present (SARPs 5.6.3.4.3)

(g) If the data part of the received ERQ PSU does not contain an ERP PDU header, and if the security option (respectively the priority or QoS maintenance option) is not present in the received ERQ PDU header, then the security option (respectively the priority or QoS maintenance option) shall not be included in the ERR PDU (SARPs 5.6.3.4.4)

(h) If the data part of the received ERQ PSU does not contain an ERP PDU header, and if the partial recording of route option is present in the received ERQ PDU header, then the partial recording of route option shall be specified in the ERP PDU, with the second octet of the parameter value field set to the value 3 (SARPs 5.6.3.4.5)

(i) The ATN specific use of the ISO/IEC 8473 priority is specified in SARPs 5.2.8.4

E.1.2 Routing Protocol (IDRP)

The BIS router shall support the Inter-Domain Routing Protocol (IDRP) defined in ISO/IEC 10747 and with the ATN Specific Features specified in this section.

E.1.2.1 Use of the Security Path Attribute

a) ATN Routers supporting inter-domain routing shall support the IDRP Security Path Attribute with a Security Registration Identifier set to the value defined in SARPs 5.6.2.2.6 for the ATN Security Registration Identifier.

b) The Security Information provided with a so identified IDRP Security Path Attribute shall consist of zero one or more Security Tag Sets as defined in SARPs 5.6.2.2.6.

c) The ATSC Class Security Tag Sets shall be supported as defined in SARPs 5.8.3.2.3.3.

d) When an ATN Router supports data classified according to a security policy and for the purpose of implementing mandatory access controls, then the ATN Router should also support the security classification Security Tag Set defined in SARPs 5.6.2.2.6.

e) At most one ATSC Class Security Tag Set shall be present in a routers Security Path Attribute.

E.1.2.2 Encoding of the Security Path Attribute Security Information Field

The Security Path Attribute Security Information Field shall comprise zero, one or more Security Tag Sets as defined in SARPs 5.6.2.2.6.

E.1.2.2.1 Encoding of the ATSC Class Security Tag Set

(a) The Tag Set Name of the ATSC Class Security Tag Set shall be set to [0000 0110] if the associated route is available to both ATSC and non-ATSC traffic.

(b) The Tag Set Name of the ATSC Class Security Tag Set shall be set to [0000 0111] if the associated route is available to ATSC traffic only.

(c) The Security Tag shall always be one octet in length.

(d) If a Security Tag with one of these Tag Set Names is received which is longer than one octet, then all octets after the first octet shall be ignored.

(e) When a Security Tag with one of these Tag Set Names is present, the Security Tag shall identify the ATSC Class(es) supported by the route.

(f) The ATSC Class(es) supported shall be identified according to Table 5.8-6 in SARPs, where bit 0 is the low order bit, and setting a bit to one shall indicate that the corresponding ATSC Class is supported.

(g) A bit set to zero shall indicate that the corresponding ATSC Class is not supported.

E.1.2.3 Update of Security Information

E.1.2.3.1 The ATSC Class

(a) When a route is advertised to an adjacent Ground BIS, the router shall support the requirements specified in SARPs 5.8.3.2.4.2.1

(b) When an ATSC Class Security tag is added to a route, then the value of the Tag Set Name shall be set according to SARPs 5.8.3.2.3.3 and depending upon whether the adjacency has been specified to support ATSC traffic only or both ATSC and non-ATSC traffic.

(c) When the ATSC Class Security Tag indicating support for both ATSC and non-ATSC traffic is updated then the Tag Set Name shall be changed to that indicating support for ATSC only traffic if the adjacency is specified to support only ATSC traffic.

(d) In all other cases, the ATSC Class Security Tag Name shall not be modified.

(e) When the ATSC Class is downgraded, the ATSC Class Security Tag Set shall be modified such that all bits indicating support for an ATSC Class higher than that supported by the local policy shall be set to zero, and the bit corresponding to the highest ATSC Class supported by local policy shall be set to one. All remaining bits shall be unaffected.

(f) When an ATSC Class Security Tag indicating support for ATSC only is present in a route, an Air/Ground Sub-network Security Tag when present in the same route shall not indicate support for any traffic type other than ATSC.

E.1.2.3.2 The Security Classification

The router shall support the classified data defined in SARPs 5.8.3.2.4.3.1.

E.1.2.4 Route Selection

ISO/IEC 10747 clause 7.16.2 permits a Loc-RIB that is identified by a RIB_Att containing the Security Path Attribute, to contain more than one route to the same NLRI, provided that those routes provide the same level of protection.

E.1.2.4.1 When the Security Registration Identifier in the IDRP Security Path Attribute is the ATN Security Registration Identifier, and when no security classification is present in the route's security information, then all such routes shall be assumed to offer the same level of protection.

E.1.2.4.2 During the Phase 2 Routing Decision process, router shall support the requirements specified in SARPs 5.8.3.2.5.2.

E.1.2.5 Route Aggregation and Route Information Reduction

ATN Routers shall implement the procedures for Route Aggregation and Route Information Reduction when required to do so according to SARPs 5.8.3.2.6.2 through SARPs 5.8.3.2.6.5.

E.1.2.5.1 Policy Based Router Aggregation

ATN Ground/Ground Routers should perform Route Aggregation and Route Information Reduction on routes to ground destinations, in line with local policy requirements for reducing the amount of routing information distributed within the ATN Ground Environment.

The selection of candidate routes for aggregation shall be performed separately for each adjacent BIS according to a filter on each route's destination, with a combination of inclusion and exclusion filters.

E.1.2.5.2 Aggregation of Routes in the Same Loc-RIB with Identical NLRI

(a) When two or more routes exist in the same Loc-RIB which have identical NLRI, then such routes shall be aggregated after the application of local policy rules that select routes for re-advertisement to each adjacent BIS.

(b) Such routes shall be consequently copied to the associated Adj-RIB-Out.

(c) For each adjacent BIS, the resulting aggregated route shall be inserted into the associated Adj-RIB-Out.

(d) In order to aggregate such routes, an ATN Router shall apply one of two strategies described in SARPs 5.8.3.2.6.3.4.

E.1.2.5.3 Aggregation of the Security Path Attribute Information Field

(a) ATSC and non-ATSC routes with dissimilar NLRI shall not be aggregated. Similarly, routes available to ATSC traffic only and routes available to both ATSC and non-ATSC traffic with dissimilar NLRI shall not be aggregated. Otherwise, the aggregation rules for the security information field contained in security path attributes that include the ATN Security Registration Identifier shall be as follows

(b) The router shall support ATSC Class Security Tag specified in SARPs 5.8.3.2.6.4.3

E.1.2.5.4 Route Information Reduction

An Air/Ground Router should perform Route Information Reduction as permitted by the ATN Addressing Plan, before advertising aggregated routes to an Airborne Router.

Route Information Reduction shall be performed using local policy rules. These routing policy rules are required to specify a shorter NSAP Address Prefix that replaces a set of NSAP Address Prefixes. Two types of rules specified in SARPs 5.8.3.2.6.5.2 shall be supported.

E.1.2.5.5 Frequency of Route Advertisement

ISO/IEC 10747 clause 7.17.3.1 requires that the advertisement of feasible routes to some common set of

destinations received from BISs in other Routing Domains must be separated in time by at least **minRouteAdvertisementInterval** except for certain identified cases. The list of exceptions to this requirement is extended by this specification.

(a) If a selected route to a given destination changes in respect of the Security Information contained in its Security Path Attribute, then that route shall be immediately re-advertised to all adjacent BISs to which that route had previously been advertised and not since withdrawn.

(b) The procedure for ensuring a minimum time interval of minRouteAdvertisementInterval between successive advertisements of routes to the same destination shall not apply in this case.

E.1.2.5.6 Interpretation of Route Capacity

For the ATN environment, the CAPACITY path attribute shall contain one of the values listed in Table 5.8-7 of SARPs.

Those capacity route metric values that are not assigned in Table 5.8-7 shall be reserved for future use by this specification.

E.1.2.5.7 Network Layer Reachability Information

In support of ATN communications, ATN Routers shall encode the NLRI Addr_info field of each route as a list of NSAP Address Prefixes.

The proto_type, and proto_length fields shall be set to 1 and the Protocol field shall be set to X'81' in order to signal support of ISO/IEC 8473.

When originating a route or performing route information reduction, an ATN Router shall only generate NSAP address prefixes that are octet-aligned as specified in SARPs 5.8.3.2.9.2.1.

E.1.2.6 BISPDU Authentication

E.1.2.6.1 Authentication type I

(a) ATN Routers shall support the validation of BISPDUs using Authentication Type 1.

(b) When an ATN Router, which does not support ATN security services or for which local policy does not permit authentication type 2, establishes a BIS-BIS connection, it shall set the value of the Authentication Code in the OPEN PDU to 1, in order to indicate that the Validation field in the header of all BISPDU sent over the BIS-BIS connection will contain an unencrypted checksum.

(c) When an authentication code of 1 is specified in the Authentication Code field of the OPEN PDU that initiated a BIS-BIS connection, then an ATN Router shall generate a validation pattern according to clause 7.7.1 of ISO/IEC 10747, for each BISPDU that it sends over that connection, and similarly validate the validation pattern of all received BISPDUs on such a connection.

(d) The type 1 authentication code shall be generated according to the MD4 specification published in RFC 1320.

E.1.2.6.2 Authentication Type 2

(a) An ATN Router that supports ATN security services shall establish a BIS_BIS connection with authentication type 2 only if type 2 authentications are permitted by local policy.

(b) When an ATN Router establishes a BIS_BIS connection with authentication type 2, then it shall set the value of the Authentication Code to 2 in the OPEN PDU.

(c) When an ATN Router establishes a BIS_BIS connection with authentication type 2, then it shall place a random variable (SARPs 5.8.3.2.10.3.1.6) in the Authentication Data field of the OPEN PDU.

(d) When an ATN Router establishes a BIS_BIS connection with authentication type 2, then it shall place a type 1 authenticator, generated according to clause 7.7.1 of ISO/IEC 10747, in the Validation Pattern field of the OPEN PDU.

(e) When an ATN Router receives an OPEN PDU with the Authentication Code field set to 2, then it shall validate the Validation Pattern field according to clause 7.7.1 of ISO/IEC 10747.

(f) When an ATN Router receives an OPEN PDU with the Authentication Code field set to 2 and the Authentication Data field contains the peer router's public key certificate, then it shall validate the certificate path according to the procedure specified in SARPs 8.4.5.

(g) When an ATN Router receives an OPEN PDU with the Authentication Code field set to 2, then it shall derive a shared session key using the ATN Key Agreement Scheme as specified in SARPs 8.5.4.

(h) If the Public Key Certificate received from a peer ATN router fails verification or if a valid shared session key cannot be derived, then the OPEN PDU shall be discarded without any further action.

(i) Once an ATN Router has derived a shared session key for a BIS_BIS connection, it shall place a message authenticator over the BISPDU, generated by using the ATN Keyed Message Authentication Code Generation Primitive (AMACGP) according to the procedure specified in SARPs 8.5.6.2.1, in the Validation Pattern field of all BISPDUs the router sends subsequent to the OPEN PDU exchange.

(j) When an ATN Router, which has derived a shared session key, receives a BISPDU with a type 2 message authenticator in the Validation Pattern field, then it shall verify the authenticator using the ATN Keyed Message Authentication Code Verification Primitive (AMACVP) according to the procedure specified in SARPs 8.5.6.2.2.

(k) Format and Encoding of IDRP BISPDU Fields to Support Authentication Type 2 shall comply with 5.8.3.2.10.1 in SARPs.

E.1.2.6.3 Restrictions on Route Advertisement
A route shall not be advertised to a BIS in another RD when:

(a) The route contains the receiving RD's RDI in its RD_PATH path attribute, or

(b) The route's RD_PATH path attribute contains the RDI of a routing domain confederation which is being entered when the route is advertised to the other RD.

E.1.2.7 Compliance with ISO/IEC 10747

(a) An ATN Ground Router supporting the ISO/IEC 10747 Inter-Domain Routing Protocol shall support all mandatory requirements as specified in clause 12.1 of ISO/IEC 10747.

(b) An ATN Router shall support the Security Path Attribute as specified in SARPs 5.8.3.2.2 and SARPs 5.8.3.2.3.

(c) The BIS router shall implement route aggregation and Route Information Reduction Procedures.

(d) The router shall utilize initial keepAlive timer values in the range of 5 to 60 seconds on ground/ground BIS-BIS connections.

E.1.3 Sub-network Dependent Convergence Function (SNDCF)
The requirements of SNDCF for X.25 sub-network are defined in ISO/IEC8473-3. The implementation of SNDCF shall be in compliance with the APRLs given in SARPs 5.7.5.3.2 through SARPs 5.7.5.3.5.

E.2 Router Requirements Checklist

Router selection depends on the network architecture, traffic and other local issues. Therefore, only minimum requirements are provided in Table E-1.

Table E-1: Minimum ATN BIS Router Requirements

Feature	Requirements	SARPs	ISO	Other reference
Interface				
Type	X.25		ISO 8208	
Quantity	Local Issue			
Speed	9600 bps and up		ISO 8208	ATN BIS ICD
Console Port	Local Issue			
Auxiliary Port	Local Issue			
Operating System				
Routing Protocol	IDRP	Section 5.8	ISO/IEC 10747	

Feature	Requirements	SARPs	ISO	Other reference
Routed Protocol	CLNP	Section 5.6.3	ISO 8473-1	
SNDCF	SNDCF for X.25	Section 5.7	ISO 8473-3	
Sub-network	X.25		ISO 8208	
Performance				Asia/Pacific Regional Router Performance" (under development)
Reliability				
Availability				
Forwarding Performance				
Service Performance				
Temperature & Environment	Local Issue			
Dimension & Weight	Local Issue			
Scalability	Local Issue			
Power Supply	Local Issue			
Security				
Access Control	Local Issue	Section 8.2		
Authentication		Section 5.8, 8.3	ISO/IEC 10747	ATN BIS ICD
Network Management				Asia/Pacific Regional System Management" (under development)

APPENDIX F - ACRONYMS

F.0 Acronyms

This appendix defines the acronyms used in this document.

A/G	AIR TO GROUND
AAC	Aeronautical Administrative Control
ABM	Asynchronous Balanced Mode
AIDC	ATS Interfacility Data Communications
AMHS	ATS Message Handling System
AOC	Aeronautical Operational Control
APC	Aeronautical Passenger Communication
APRLs	ATN Protocol Requirement Lists
ATN	Aeronautical Telecommunications Network
ATS	Air Traffic Service
ATSC	Air Traffic Service Control
BIS	Boundary Intermediate System
BISPDU	BIS Protocol Data Unit
CLNP	Connectionless Network Protocol
CLNS	Connection-Less Network Service
CPDLC	Controller Pilot Data Link Communications
DCE	Data Circuit-terminating Equipment
DM	Disconnected Mode
DTE	Data Terminal Equipment
E/R	Error Report
EIA	Electrical Industry Association
ERD	End Routing Domain
ES	End System
FIB	Forwarding Information Base
FSM	Finite State Machine
G-G(G/G)	Ground to Ground
ICAO	International Civil Aviation Organization

A/G	AIR TO GROUND
ICD	Interface Control Document
IDRP	Inter Domain Routing Protocol
IEC	International Electrotechnical Commission
ISO	International Standardization Organization
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Sector
LAPB	Link Access Procedure Balanced
NET	Network Entity Title
NPDU	Network Protocol Data Unit
NSAP	Network Service Access Point
OSI	Open Systems Interconnection
PDU	Protocol Data Unit
PIB	Policy Information Base
PICS	Protocol Implementation Compliance Statement
PSDN	Public Switched Data Network
PSN	Packet Switched Network
PVC	Permanent Virtual Circuit
QOS	Quality of Service
RD	Routing Domain
RDC	Routing Domain Confederation
RIB	Routing Information Base
SARPs	Standards and Recommended Practices
SNDCF	Sub Network Dependent Convergence Functions
SNPA	Sub Network Point of Attachment
SVC	Switched Virtual Circuit
TBD	to be Determined
TBR	to be Reviewed