INTERNATIONAL CIVIL AVIATION ORGANIZATION

ASIA/PACIFIC REGIONAL INTERFACE CONTROL DOCUMENT FOR ATS DIGITAL SPEECH SIGNALLING SYSTEM

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CONTENTS

1. INTRODUCTION

1.1 Purpose

This document describes the procedures and definitions of the PSS1 protocol for digital voice communication networks in the ASIA/PACIFIC region.
PSS1 is the ISO standard corresponding to the CCITT DSS1 Digital Subscriber Signalling System with some additional features.

1.2 Organization

The Interface Control Document (ICD) defines the structure of the PSS1 signalling protocol layer, the layer 1 characteristics (physical layer), the layer 2 (data link layer) procedures and the layer 3 (network layer) procedures. In addition, this document specifies the configuration for implementation of this protocol and provides an international numbering plan.
Two network configurations are defined: a direct network connection in which the signalling and speech switching functions are included in the circuit terminating VSCS equipment, and a multiplexer configuration in which the signalling and switching is carried out by an external VSCS or PBX.

1.3 References

a) ITU-T Recommendation Q.920 (1993): ISDN user-network interface data link layer general aspects.

b) ITU-T Recommendation Q.921 (1993): ISDN user-network interface data link layer specification.

c) ISO/IEC 11572 ver.1 (1994): Information Technology, Telecommunications and Information Exchange Between Systems, Private Integrated Services Network, Circuit Mode Bearer Services, Inter-Exchange Signalling Procedures and protocol.

d) ISO/IEC 11579 (1994) : Information Technology - Telecommunications and information exchange between systems - Private integrated services network.

1.4 Abbreviations

ATS	Air Traffic Service
CES	Connection endpoint suffix
CME	Connection management entity
C/R	Command/response field bit
DISC	Disconnect
DLCI	Data link connection identifier
DL	Data link
DM	Disconnected mode
DSS1	Digital Subscriber Signalling System Number 1
EA	Address field extension bit
ECMA	European Computer Manufacturers Association
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FCS	Frame check sequence
FRMR	Frame reject
IEC	International Electrotechnical Commission
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITU-T	International Telecommunications Union - Telecommunications Standardization Sector
IVN	Intervening network
LAPD	Link access procedure on the D-channel
LME	Layer management entity

M	Modifier function bit
MDL	Management of data link layer
MP	Mapping functional grouping
MUX	Multiplexer
N(R)	Receive sequence number
N(S)	Send sequence number
PBX	Private Branch Exchange
PH	Physical layer
PINX	Private Integrated Network Exchange
PISN	Private Integrated Service Network
PSS1	Private Signalling System Number 1
P/F	Poll/Final bit
QSIG	Q reference point signalling system
REJ	Reject
RNR	Receiver not ready
RR	Receiver ready
S	Supervisory function bit
SABME	Set asynchronous balanced mode extended
SAP	Service access point
SAPI	Service access point identifier
SDL	Specification description language
SW	Switching functional grouping
TCC	Transit PINX Call Control
TDM	Time Distributed Multiplexer
TE	Terminal equipment
TEI	Terminal endpoint identifier
UA	Unnumbered acknowledgment
VCS	Voice Communication System
VSCS	Voice Switching and Control System
XID	Exchange Identification

2. PSS1 PROTOCOL LAYER STRUCTURE

2.1 PSS1 Protocol Layer Structure

The PSS1 protocol layer structure is shown in Figure 2.1-1.

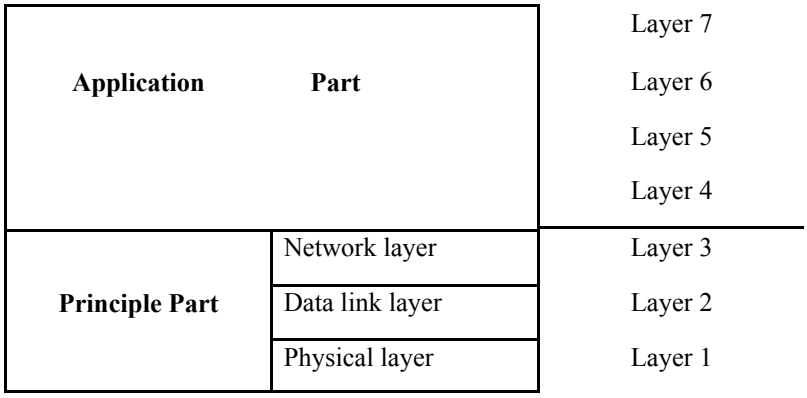

Figure 2.1-1 Layer Structure Diagram

2.2 Layer Structure for Connections

Layer 1 is represented in two configurations i.e. Direct Connection and Multiplexer Connection. Figure 2.2-1 shows the layer structure for the Direct Connection. Figure 2.2-2 shows the layer structure for the Multiplexer Connection.

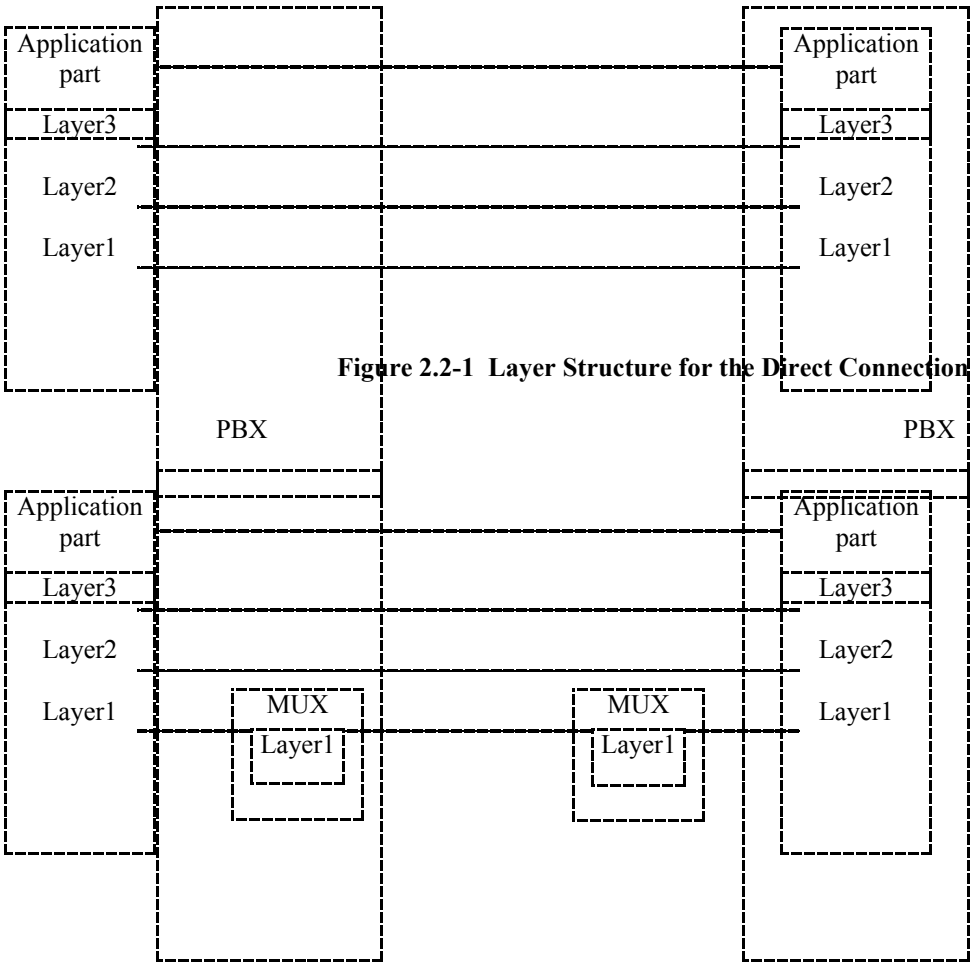

Figure 2.2-1 Layer Structure for the Direct Connection

Figure 2.2-2 Layer Structure for the Multiplexer Connection

2.3 Reference point and system structure

With reference to ISO 11579 standardized PISN model, the terms and the associated figure are shown below.

a) SW : includes switching information for user and signalling information. PBX shall be applied to SW in this system configuration.

b) MP : includes multiplexing, transmission, and voice compression functions. MUX shall be applied to MP in this system configuration .

c) IVN : real type of network which is employed for the provision of inter PINX connections.

d) C reference point : the boundary between IVN and MP
Q reference point : the boundary between SW and MP, inter-PINX call control functions and signalling information is defined.

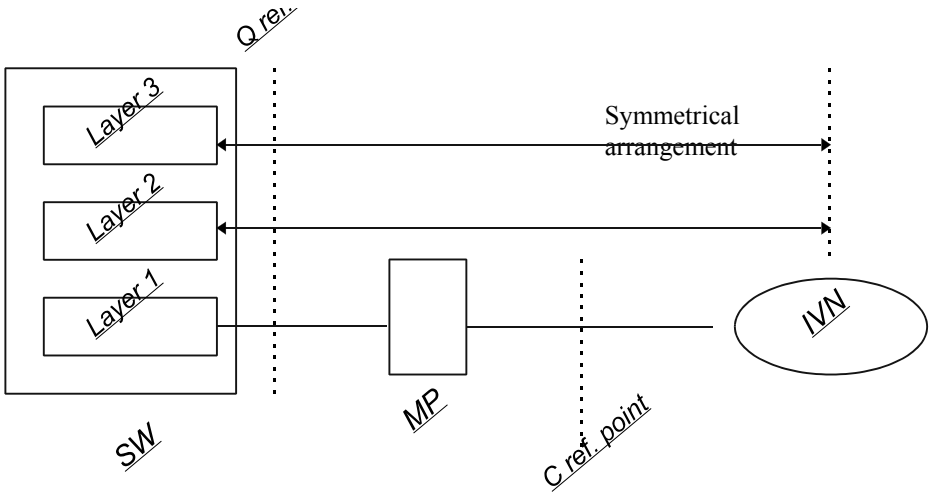

Figure 2.3-1 ISO reference point and PSS1 system structure

3. Layer 1 (Physical Layer)

3.1 Direct Connection

The physical interface and sub-multiplexing techniques of Direct Connection have been selected to support the ATS QSIG digital signalling. The future specification of other physical interfaces (e.g., at 2048 kbps) is not precluded

3.1.1 Physical and electrical interface requirements

The MP function shall meet the requirements for physical and electrical characteristics specified in ETS 300 290 [6] and its amendment [7]. The MP function shall also meet the requirements specified in TBR 14 [17] and its amendment [18].

NOTE: The requirements of TBR 14 are a subset of those in ETS 300 290.

3.1.2 Rate adaptation and sub-multiplexing

The MP function shall meet the requirements specified in ECMA- "Mapping/16" [2] for sub-multiplexing a 64 kbps circuit-mode inter-VCS connection into 4x16 kbps channels.
The MP function shall provide a rate adaptation capability. Incoming speech information shall be adapted to the internal channel rate. Outgoing speech information shall be adapted from the internal channel rate to the rate required by the external transmission facility, as specified in ECMA- "Mapping/16" [2].

3.1.3 Alarm Indication Signal (AIS)

If the MP function receives more than 3 octets containing a bit pattern that is all ones from the external transmission facility, it shall assume this to be an Alarm Indication Signal (AIS). The MP function shall assume the transmission facility and / or the peer VCS is out of service and take appropriate management action.
The MP function shall be capable of sending AIS towards the external transmission facility when it detects loss of bit violations in the received bit stream. On resumption of normal bit violations the MP function shall stop sending AIS.

NOTE: There may be other, implementation dependent, circumstances when the MP function is required to send AIS. These are outside the scope of this specification.

3.1.4 Synchronization

Synchronization functions of the MP function shall be compatible with the synchronization strategy of the overall system. That is to say, the MP function shall be capable of either:

1) extracting the timing received at the receive side of the physical interface and delivering it as an external clock source for the entire system, and synchronizing the MP function's own output timing to this source;
2) synchronizing the MP function's own output timing to another clock source not derived from the physical interface associated with this MP function.

Selection of the option shall be determined based on system configuration and runtime determination

3.2 Multiplexer Connection

The Multiplexer Connection layer 1 defines the physical layer of the PSS1 protocol. The reference point in this definition shall be located between the PBX and the MUX shown in Figure 2.2-2.

1) The voice channel shall have a transmission rate of 64 kbps /channel and can be split into its logical subparts.

Note 1: The transmission rate of the voice channel is 64 kbps. Considering the channel cost, this channel is generally transmitted after undergoing voice compression to 8 kbps.

Note 2: There are many commercially available MUXs (TDM) incorporating the voice compression function. Consequently, this protocol can be implemented most economically by using commercially available MUXs and commercially available PBXs.

Note 3: There are several voice compression systems, but the same voice compression system must be used at each end. Therefore, normally MUXs of the same type shall be used at both ends of the connection.

2) The transmission rate of the control channel is 16kbps or 64kbps.

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Note 4: The compression rate of control channel at C reference point shall be determined between 2 states.

4 Layer 2(Data Link Layer)

4.1 Procedures

This specification defines the overview and details of the link access procedure-D (LAPD). This specification is based on ITU-T Recommendations Q.920 and Q.921. The detail definitions and parameters should be determined by the states that will implement this protocol.

4.2 Definitions

4.2.1 Primitives

Interfaces between adjacent layers, between layer and its layer management, are accomplished by means of primitives. Primitives represent, in an abstract way, the logical exchange of information and control between adjacent layers.

a) DL-ESTABLISH
The DL-ESTABLISH primitives are used to request, indicate and confirm the outcome of the procedures for establishing multiple frame operation.

b) DL-RELEASE
The DL-RELEASE primitives are used to request, indicate and confirm the outcome of the procedures for terminating a previously established multiple frame operation, or for reporting an unsuccessful establishment attempt.

c) DL-DATA
The DL-DATA primitives are used to request and indicate layer 3 messages which are to be transmitted or have been received, by the data link layer using the acknowledged information transfer service.

d) MDL-ASSIGN
The MDL-ASSIGN primitives are used by the layer management entity to request that the data link layer associates the TEI value contained within the message portion of the primitive with the specified Connection Endpoint Suffix (CES), across all Service Access Point Identifiers (SAPIs). The MDL-ASSIGN primitive is used by the data link layer to indicate to the layer management entity the need for a TEI value to be associated with the CES specified in the primitive message unit.

e) MDL-REMOVE
The MDL-REMOVE primitives are used by the layer management entity to request that the data link layer removes the association of the specified TEI value with the specified CES, across all SAPIs. The TEI and CES are specified by the MDL-REMOVE primitive message unit.

f) PH-DATA
The PH-DATA primitives are used to request and indicate message units containing frames used for data link layer peer-to-peer communications passed to and from the physical layer.

g) PH-ACTIVATE
The PH-ACTIVATE primitives are used to request activation of the physical layer connection or to indicate that the physical layer connection has been activated.

h) PH-DEACTIVATE
The PH-DEACTIVATE primitive is used to indicate that the physical layer connection has been deactivated.

4.2.2 Data Link Connection Identification (DLCI)

Refer to ITU-T Q920 clause 3.4.1 for details.

4.2.3 Service Access Point Identifier (SAPI)

The SAPI identifies a point at which data link layer services are provided by a data link layer entity to a layer 3 or management entity. Consequently, the SAPI specifies a data link layer entity that should process a data link layer frame and also a layer 3 or management entity which is to receive information carried by the data link layer frame. The SAPI allows 4 service access points to be specified, where bit 3 of the address field octet containing the SAPI is the least significant binary digit and bit 8 is the most significant. For this ICD, only a SAPI value of ZERO is used. The SAPI values are allocated as shown in Table 4.2-1.

Table 4.2-1 SAPI values

SAPI value	Related layer 3 or layer management entity
0	Call control procedures
1	Reserved for packet mode communications using Q.931 call control procedures
16	Packet communication conforming to X.25 level 3 procedures
63	Layer 2 management procedures
All others	Reserved for future standardization

4.2.4 Terminal Endpoint Identifier (TEI)

A TEI is associated with a specific point-to-point data link between two States. The TEI value used by equipment conforming to this ICD shall be the value ZERO (0). The use of TEI values other than 0 are beyond the scope of this ICD. Equipment conforming to this ICD shall assign the value TEI = 0 independently at each end of a particular inter-equipment signalling channel. As only one TEI value shall be used, TEI administration is not required.

4.2.5 Service Characteristics

The data link layer provides services to layer 3 and management (of layer 2) and utilizes the services provided by the physical layer and layer management.

4.2.5.1 Services Provided To Layer 3

The specification of the interactions with layer 3 (primitives) provides a description of the services that the data link layer, plus the physical layer, offer to layer 3, as viewed from layer 3.

One form of information transfer service is associated with layer 3, and is based on acknowledged information transfer at the data link layer. The characteristics of the acknowledged information transfer service are summarized as follows:

a) provision of a data link connection between layer 3 entities for acknowledged information transfer of layer 3 message units;
b) identification of data link connection endpoints;
c) sequence integrity of data link layer message units in the absence of malfunctions;
d) notification to the peer entity in the case of errors (for example, in the case of loss of sequence);
e) notification to the management entity of unrecoverable errors detected by the data link layer; and
f) flow control

4.2.5.2 Services Provided To Layer Management

For the equipment conforming to this ICD, all layer management functions shall be performed locally. Therefore, no links for peer-to-peer management information are required.

4.2.5.3 Administrative Services

Refer to ITU-T Q920 clause 4.4 for details.

4.2.5.4 Services Required From The Physical Layer

Refer to ITU-T Q920 clause 4.6 for details.

4.2.6 Management Structure

The layer management entity (LME) provides for the management of resources that have a layer-wide impact. Access to the LME is provided by means of specific SAPI. Functions provided by the LME are as follows:

- TEI assignment;
- TEI removal.

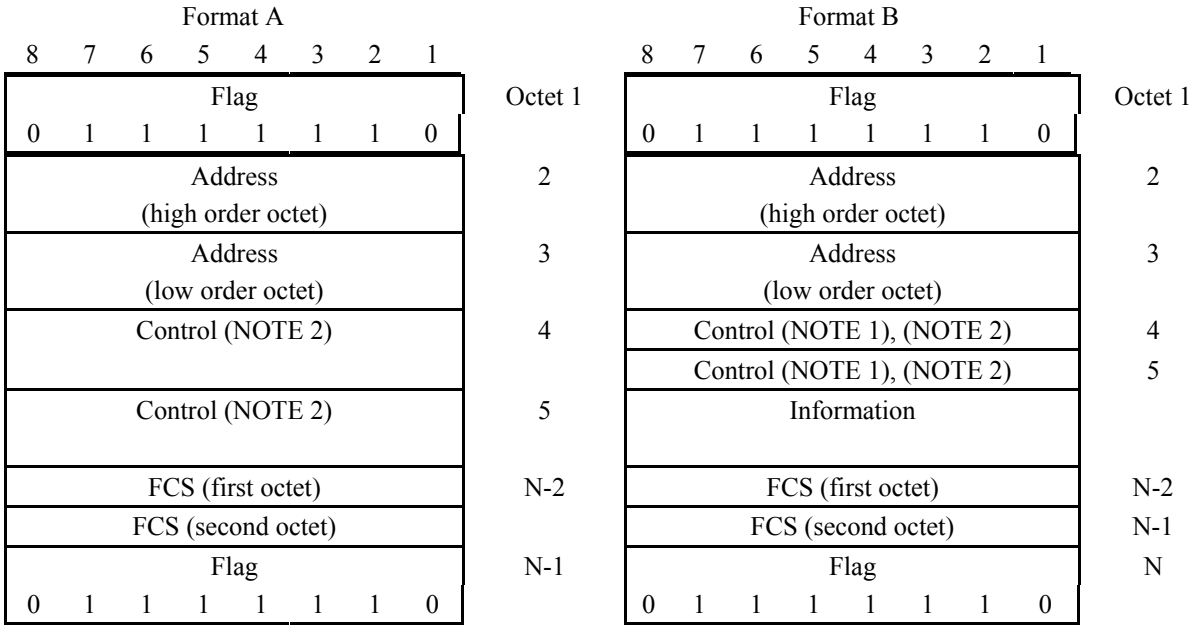
The connection management entity (CME) provides for the management of resources that have an impact on an individual connection. Selection of the CME is based on a specific data link layer frame type not used in the information transfer services. Functions provided by the CME are as follows:

- parameter initialization (optional);
- error processing;
- connection flow control invocation.

4.2.7 Frame Structure

4.2.7.1 Frame Format

All data link layer peer-to-peer exchanges use frames conforming to one of the formats shown in Figure 4.2-1 Two format types are shown: format A for frames where there is no information field and format B for frames containing an information field.



NOTE 1: For unacknowledged operation format B applies and octet control field is used.

NOTE 2: Frames of multiple frame operation with sequence numbers contain a two octet control field and frames without sequence numbers contain a one octet control field. Connection management information transfer frames contain a one octet control field.

Figure 4.2-1 Frame formats

4.2.7.2 Flag sequence
Refer to ITU-T Q921 clause 2.2 for details.

4.2.7.3 Address field
Refer to ITU-T Q921 clause 2.3 for details.

4.2.7.4 Control field
Refer to ITU-T Q921 clause 2.4 for details.

4.2.7.5 Information field
Refer to ITU-T Q921 clause 2.5 for details.

4.2.7.6 Transparency
Refer to ITU-T Q921 clause 2.6 for details.

4.2.7.7 Frame check sequence(FCS) field
Refer to ITU-T Q921 clause 2.7 for details.

4.2.7.8 Format convention
Refer to ITU-T Q921 clause 2.8 for details.

4.2.7.9 Frame abort
Refer to ITU-T Q921 clause 2.10 for details.

4.2.7.10 Invalid frames
An invalid or incompatible frame is that which:

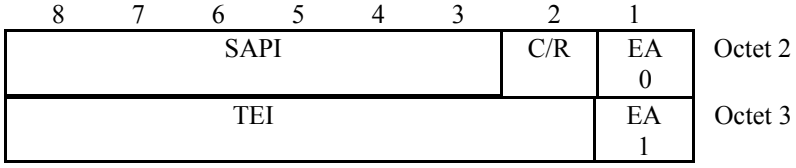
a) is not properly bounded by two flags.
b) contains a frame check sequence error.
c) contains a single octet address field.
d) contains a service access point identifier which is not supported by the receiver.
e) contains a TEI different from TEI(s) assigned to the TE.
f) has fewer than six octets between flags of frames that contain sequence numbers and fewer than five octets between flags of frames that do not contain sequence number , or does not consist of an integral number of octets prior to zero bit insertion or following zero bit extraction.

4.2.8 Elements Of Procedures And Field Formats

The elements of procedures define the commands and responses that are used on the data link connections carried on the D-channel.

4.2.8.1 Address field format

This item is based on ITU-T Q921 clause 3.2, and the Address field format is as in Figure 4.2-2. Refer to ITU-T Q921 clause 3.2 for details.



EA = Address field extension bit
C/R = Command/response field bit
SAPI = Service access point identifier
TEI = Terminal endpoint identifier

Figure 4.2-2 Address field format

4.2.8.2 Address field variables

a) Address field extension bit (EA)
Refer to ITU-T Q921 clause 3.3.1 for details.

b) Command/Response field bit (C/R)
This item is based on ITU-T Q921 clause 3.3.2, and the C/R field bit usage is as in Table 4.2-2. Refer to ITU-T Q921 clause 3.3.2 for details.

Table 4.2-2 C/R field bit usage

Command/Response	Direction			C/R value
Command	Network side	=>	User side	1
	User side	=>	Network side	0
Response	Network side	=>	User side	0
	User side	=>	Network side	1

c) Service access point identifier (SAPI)
Refer to this ICD clause 4.2.3 for details.

d) Terminal endpoint identifier (TEI)
Refer to this ICD clause 4.2.4 for details.

2.8.3 Control field format

This item is based on ITU-T Q921 clause 3.4, and the **Control field format** is as in Table 4.2-3. Refer to ITU-T Q921 clause 3.4 for details.

Table 4.2-3 Control field formats

Control field bits (modulo 128)	8	7	6	5	4	3	2	1	
I format	N(S)							0	Octet 4
	N(R)							P	Octet 5
S format	X	X	X	X	S	S	0	1	Octet 4
	N(R)							P/F	Octet 5
U format	M	M	M	P/F	M	M	1	1	Octet 4

N(S)	Transmitter send sequence number
M	Modifier function bit
N(R)	Transmitter receive sequence number
P/F	Poll bit when issued as a command, Final bit when issued as a response
S	Supervisory function bit
X	Reserved and set to 0

4.2.8.4 Control field parameters and associated state variables

Refer to ITU-T Q921 clause 3.5 for details.

4.2.9 Frame Types

4.2.9.1 Information (I) command

Refer to ITU-T Q921 clause 3.6.2 for details.

4.2.9.2 Set asynchronous balanced mode extended (SABME) command

Refer to ITU-T Q921 clause 3.6.3 for details.

4.2.9.3 Disconnect (DISC) command

Refer to ITU-T Q921 clause 3.6.4 for details.

4.2.9.4 Unnumbered Information (UI) command

Refer to ITU-T Q921 clause 3.6.5 for details.

4.2.9.5 Receive Ready (RR) command/response
Refer to ITU-T Q921 clause 3.6.6 for details.

4.2.9.6 Reject(REJ) command/response
Refer to ITU-T Q921 clause 3.6.7 for details.

4.2.9.7 Receive Not Ready (RNR) command/response
Refer to ITU-T Q921 clause 3.6.8 for details.

4.2.9.8 Unnumbered Acknowledgment (UA) response
Refer to ITU-T Q921 clause 3.6.9 for details.

4.2.9.9 Disconnected Mode (DM) response
Refer to ITU-T Q921 clause 3.6.10 for details.

4.2.9.10 Frame Reject (FRMR) Response
Refer to ITU-T Q921 clause 3.6.11 for details.

4.2.9.11 Exchange Identification (XID) Command /Response
XID frames are not supported by this ICD.

4.2.10 Definition Of Peer-To-Peer Procedures

4.2.10.1 Procedure for the use of the P/F bit
Refer to ITU-T Q921 clause 5.1 for details.

4.2.10.2 Procedures for unacknowledged information transfer
Unacknowledged Information Transfer is not applicable to this ICD.

4.2.10.3 Terminal Endpoint Identifier (TEI) management procedures
a) General:
Equipment conforming to this ICD shall implement non-automatic TEI assignment procedures. The TEI Management procedures defined in the following clauses are defined internally to the equipment as no peer- to- peer management information transfer procedures are part of this ICD.

The applicability of automatic TEI assignment procedures and peer- to- peer management information transfer to equipment interconnection scenarios shall not b
used by equipment conforming to this ICD.

b) TEI assignment procedure:
The TEI value to be used for a particular data link shall be delivered by the Layer Management Entity (LME) to the Data Link Layer entity via the MDL_ASSIGN_REQUEST primitive.

c) TEI check procedure:
This procedure, to enable checking of a previously assigned TEI value, is not part of this ICD. Equipment conforming to this ICD shall only implement non-automatic
(i.e. fixed) TEI assignment procedures and therefore, on a physical point- to- point connection, multiple TEI assignment cannot occur.

d) TEI removal procedure:
The procedure, to enable removal of a previously assigned TEI value, is not part of this ICD. Equipment conforming to this ICD may initiate TEI removal procedures internally.

e) TEI identify verify procedures:
The procedure, to enable checking of a previously assigned TEI value, is not part of this ICD.

f) Formats and codes:
The definition of format and codes for messages related to TEI management procedures is not part of this ICD. No peer-to-peer messages are defined in this ICD f
the support of TEI management procedures.

4.2.10.4 Automatic negotiation of data link layer parameters

This procedure is not part of this ICD.

4.2.10.5 Procedures for establishment and release of multiple frame operation

Refer to ITU-T Q921 clause 5.5 for details.

4.2.10.6 Procedures for information transfer in multiple frame operation

Refer to ITU-T Q921 clause 5.6 for details.

4.2.10.7 Re-establishment of multiple frame operation

Refer to ITU-T Q921 clause 5.7 for details.

4.2.10.8 Exception condition reporting and recovery

a) N(S) sequence error
Refer to ITU-T Q921 clause 5.8.1 for details.

b) N(R) sequence error
Refer to ITU-T Q921 clause 5.8.2 for details.

c) Timer recovery condition
Refer to ITU-T Q921 clause 5.8.3 for details.

d) Invalid frame condition
Refer to ITU-T Q921 clause 5.8.4 for details.

e) Frame rejection condition
Refer to ITU-T Q921 clause 5.8.5 for details.

f) Receipt of an FRMR response frame
Refer to ITU-T Q921 clause 5.8.6 for details.

g) Unsolicited response frames
Refer to ITU-T Q921 clause 5.8.7 for details.

h) Multiple-assignment of TEI value
A data link layer entity shall assume multiple-assignment of a TEI value and indicate recovery as specified below by:

_ the receipt of a UA response frame whilst in the multiple-frame established state;

_ the receipt of a UA response frame whilst in the timer recovery state;

_ the receipt or a UA response frame whilst in the TEI-assigned state.

A data link layer entity, after assuming multiple-assignment of a TEI value shall inform the connection management entity by means of the MDL-ERROR-INDICATION primitive.

NOTE: As equipment conforming to this ICD will only implement non-automatic TEI-assignment procedures, on a single data link connection, multiple TEI assignment cannot occur.

5. LAYER 3 (Network Layer)

5.1 Procedures

Layer 3 is based on ISO/IEC11572 ver.1 (1994) which defines services and protocols applicable to Private Telecommunications Networks, and modified for ATS network use.

5.2 Definitions

5.2.1 Protocol Control states

Refer to ISO/IEC11572 clause 7, except for the following provisions:

a) Overlap Sending (2) shall not be used.
b) Overlap Receiving (25) shall not be used.

5.2.2 Call Control

Refer to ISO/IEC11572 clause 8, except for the following provisions.

a) TCC_Await Digits (1) shall not be used.
b) TCC_Await Additional Digits (2) shall not be used.
c) TCC_Overlap (3) shall not be used.

5.2.3 General procedures

Refer to ISO/IEC11572 clause 9, except for the following provisions.

a) Status enquiry procedures (see ISO/IEC11572, clause 9.3.1) shall not be used.
b) A STATUS message containing a call reference value associated with Overlap Sending and Overlap Receiving procedures (see ISO/IEC 11572, clause 9.3.2) shall not be used.

5.2.4 Circuit-switched Call Control procedures

Refer to ISO/IEC11572 clause 10, except for the following provisions.

a) Information channel selection (see ISO/IEC11572, clause10.1.2):
In the SETUP message, the Outgoing Side shall indicate the channel identification information element, in addition to the selected channel number: “channel is indicated, any alternative is acceptable”.
b) Overlap sending (see ISO/IEC11572, clause 10.1.3):
The Overlap Sending procedures shall not be used.
c) Call proceeding (see ISO/IEC 11572, clause 10.1.4):
Enbloc sending (see 10.1.4.1) shall be used, but overlap sending (see 10.1.4.2) shall not be used.

d) Call connected (see ISO/IEC11572, clause10.1.6):
CONNECT ACKNOWLEDGE message shall be mandatory, and T313 has to be implemented.

e) Transit PINX Call Control requirements (see ISO/IEC11572, clause 10.4):
State TCC_Await_Digits (see 10.4.2), State TCC_Await_Additional_Digits (see 10.4.3), and TCC_Overlap (see 10.4.4) shall not be used.

f) Originating PINX Call Control requirements (see ISO/IEC 11572, clause 10.5):
Originating PINX shall transmit a SETUP message. The SETUP message shall not include the following optional information elements:
   i) Sending complete
   ii) Calling party subaddress
   iii) Called party subaddress
   iv) Low layer compatibility
   v) High layer compatibility

5.2.5 Procedures for layer management

Refer to ISO/IEC11572 clause 11, except for the following provisions:

a) The restart procedure shall not be used to restart single channels. Hence, only the value “1 1 1” (All channels) shall be used in the Restart indicator information element.

5.2.6 Protocol timers

The standard values to be used for timers specified in ISO/IEC 11572 shall be those indicated in APPENDIX B section 4 “Layer 3 timer values”. Equipment shall support modification of these values as required.

5.2.7 Functional definition of messages

Refer to ISO/IEC11572 clause 13, except for the following provisions.

a) Message for general procedures (see ISO/IEC 11572, clause13.1):
STATUS ENQUIRY shall not be used.

b) Message for Circuit Mode Call Control (see ISO/IEC 11572, clause 13.2):
   i) CONNECT (see ISO/IEC 11572, clause13.2.3)
   shall not include the following information elements:
   Connected number, Connected subaddress, and Low layer capability.
   ii) INFORMATION (see ISO/IEC 11572, clause 13.2.6)
   shall not be used.

iii) SETUP (see ISO/IEC11572, clause 13.2.10)
shall not include the following information elements: Sending complete, Calling party subaddress, Called party subaddress, Low layer compatibility and High layer compatibility

iv) SETUP ACKNOWLEDGE (see ISO/IEC 11572, clause 13.1)
shall not be used.

5.2.8 General message format and coding of information elements

Refer to ISO/IEC11572 clause 14, except for the following provisions:

a) Message type (see ISO/IEC11572, clause 14.4):
SETUP ACKNOWLEDGE, INFORMATION and STATUS ENQUIRY shall not b used.

b) Coding rules (see ISO/IEC 11572, clause 14.5.1):
The following information elements shall not be used.

i) Sending complete
ii) Connected number
iii) Connected subaddress
iv) Calling party subaddress
v) Called party subaddress
vi) Low layer compatibility
vii) High layer compatibility

c) Bearer capability (see ISO/IEC11572, clause 14.5.5):
The following information is defined, and recommended specifically for ATS speech network.

i) Information transfer rate (Octet 4)

Bits	5	4	3	2	1	
	1	0	0	0	0	: 64kbps

Note: Although there is no definition for information transfer rate in ISO/IEC11572, rate shown above (64kbps) is defined for communication compatibility purpose.

ii) User information layer 1 protocol (Octet 5)

Bits	5	4	3	2	1	
	0	0	0	1	0	: ITU-T Recommendation G.711μ-law

d) Call state (see ISO/IEC11572, clause 14.5.6):
The following call states shall not be used:
i) Overlap sending
ii) Overlap receiving

e) Called party number (see ISO/IEC 11572, clause 14.5.7):
The following information only shall be used :
i) Numbering Plan identification (Octet 3)
Bits 4 3 2 1
1 0 0 1 : Private numbering plan

ii) Numbering identification (Octet 3):
Bits 7 6 5
0 1 1 : PISN specific number

f) Called party subaddress (see ISO/IEC 11572, clause 14.5.8)
shall not be used.

g) Calling party number (see ISO/IEC 11572, clause 14.5.9)
The following information only shall be used:
i) Numbering Plan identification (Octet 3)
Bits 4 3 2 1
1 0 0 1 : Private numbering plan

ii) Numbering identification (Octet 3)
Bits 7 6 5
0 1 1 : PISN specific number
However, Presentation indicator (Octet 3a) and Screening indicator (Octet 3a) shall not be used.

h) Calling party subaddress (see ISO/IEC11572, clause 14.5.10)
shall not be used.

I) Channel identification (see ISO/IEC 1157, clause 14.5.12)
The following information elements only shall be used:

i) Preferred/Exclusive (Octet 3)
Bit 4
0 : Indicated channel is preferred

ii) Signaling channel indicator (Octet 3)
Bit 3
0 : Channel identified is not the signaling channel

iii) Number/type (Octet 3.2)
Bit 5
0 : Channel is indicated by the number in the following octet

j) Connected number (see ISO/IEC 11572, clause 14.5.13)
shall not be used.

k) Connected subaddress (see ISO/IEC 11572, clause 14.5.14)
shall not be used.

l) High layer compatibility (see ISO/IEC 11572, clause 14.5.15)
shall not be used.

m) Low layer compatibility (see ISO/IEC 11572, clause 14.5.16)
shall not be used.

n) Sending complete (see ISO/IEC 11572, clause 14.5.19)
shall not be used.

6. NUMBERING PLAN

The numbering plan in ASIA/PACIFIC is defined as follows, in accordance with ICAO recommendation (ICAO ANNEX 10 vol. III part 2 chapter 4 , 4.1.6).

Numbering Plan

Center (4 digits)

Area identifier (2 digits)	Unit identifier	Position identifier

1) Area identifier:
The higher 2 digits of a country number in the international commercial telephone network is normally assigned (e.g. Japan 81, Thailand 66). If the country number is 1digit, the lower digit of the area identifier is filled by 0 in principle (e.g. USA & Canada 10, Russia 70). In this case, the lower digit may be separately assigned in each country or FIR etc., if necessary (e.g. USA 11, Canada 12). If the country number is 3 digits, the area identifier means a group of countries (e.g. New Caledonia 687, Samoa 685). In this case, the third digit of the country number may be treated as the first digit of the unit identifier mentioned below.

2) Unit identifier and Position identifier:
The remaining 4 digits are unit identifier and position identifier within the center.

APPENDIX A LAYER 2 PARAMETERS

The protocol parameters of Layer 2 are defined in table A.1.1 below:

Table A.1.1 : Layer2 protocol parameter values

No.	Parameter	Default Value	Value Range	General	Remarks
1	T200	200ms	100~1270ms	Timer generated at the end of a frame transmission.	Coordinated by States
2	N200	3	0~15	Maximum number of retransmission.	ditto.
3	N201	260	260	Maximum number of octets in an information field.	ditto.
4	N202	3	not specified	Maximum number of transmissions of the TEI Identity request message.	ditto.
5	k	≤127	1~7	Maximum number of outstanding, frames.	ditto.
6	T201	=T200	not specified	The minimum time between retransmission of the TEI Identity check messages.	ditto.
7	T202	2s	not specified	The minimum time between retransmission of the TEI Identity request messages.	ditto.
8	T203	10s	1s~127s	T203 represents the maximum time allowed without frames being exchanged.	ditto.

APPENDIX B LAYER 3 INFORMATION

Note: This appendix includes Layer 3 messages and information element coding used for the ATS network.

1. Functional definition of messages

1) Message for general procedures

(*1) M: Inclusion mandatory
O: Inclusion option

Message Type	Direction	Information Element	Type (*1)	Length
STATUS	Both	Protocol discriminator	M	1
		Call reference	M(note)	3
		Message type	M	1
		Cause	M	4-32
		Call state	M	3

Note: This message may be sent with global call reference.

2) Messages for Circuit Mode Call Control

Message Type	Direction	Information Element	Type	Length
ALERTING	incoming to outgoing	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Channel identification	O(note)	4-*
		Progress indicator	O	4

Note: Mandatory if ALERTING *is the first response to a* SETUP *message.*

Message Type	Direction	Information Element	Type	Length
CALL PROCEEDING	Incoming to Outgoing	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Channel identification	O(note)	4-*

Note: Mandatory if CALL PROCEEDING *is the first response to a* SETUP *message.*

Message Type	Direction	Information Element	Type	Length
CONNECT	Incoming to Outgoing	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Channel identification	O (note)	4-*
		Progress indicator	O	4

Note: Mandatory if CONNECT *is the first response to a* SETUP *message.*

Message Type	Direction	Information Element	Type	Length
CONNECT ACKNOWLEDGE	Outgoing to Incoming	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1

Message Type	Direction	Information Element	Type	Length
DISCONNECT	Both	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		cause	M	4-32

Message Type	Direction	Information Element	Type	Length
PROGRESS	Both	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Cause	O (note)	4-32
		Progress indicator	M	4

Note: Included if a call failure has to be reported and inbound tones/announcements are provided.

Message Type	Direction	Information Element	Type	Length
RELEASE	Both	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Cause	O (note)	4-32

Note: Mandatory in the first call clearing message.

Message Type	Direction	Information Element	Type	Length
RELEASE COMPLETE	Both	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Cause	O (note)	4-32

Note: Mandatory in the first call clearing message.

Message Type	Direction	Information Element	Type	Length
SETUP	Outgoing to Incoming	Protocol discriminator	M	1
		Call reference	M	3
		Message type	M	1
		Bearer capability	M	4-11
		Channel identification	M	4-*
		Progress indicator	O	4
		Calling party number	O	4-*
		Called party number	M	4-*

3) Message for layer management

Message Type	Direction	Information Element	Type	Length
RESTART	Both	Protocol discriminator	M	1
		Call reference	M (note 1)	3
		Message type	M	1
		Channel identification	O (note 2)	4-*
		Restart indicator	M	3

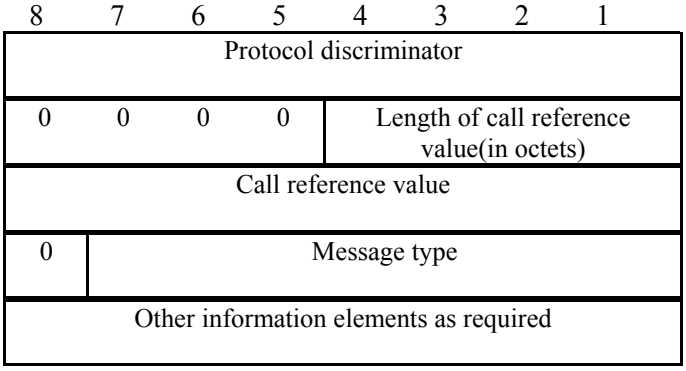
Note1 : This message is sent with the global call reference.
Note2 : Included when the Restart indicator information element indicates that a particular channel is to be restarted.

Message Type	Direction	Information Element	Type	Length
RESTART ACKNOWLEDGE	Both	Protocol discriminator	M	1
		Call reference	M (note 1)	3
		Message Type	M	1
		Channel identification	O (note 2)	4-*
		Restart indicator	M	3

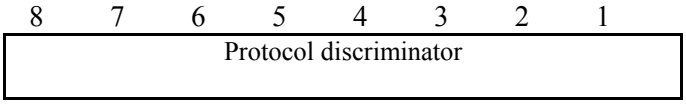
Note1 : This message is sent with the global call reference.
Note2 : Included when the Restart indicator information element indicates that a particular channel has been restarted.

2. General message format and coding of information elements

General message format



Protocol discriminator



Protocol discriminator
Bits 8 7 6 5 4 3 2 1
0 0 0 0 1 0 0 0 : ITU-T Q931 user-network call control message

Call reference

8	7	6	5	4	3	2	1	
0	0	0	0	Length of call reference value(in octets)				octet 1
CR-Flag	Call reference value							octet 2
Call reference value(cont.)								octet 3

CR-Flag

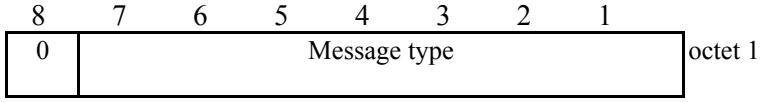
0 : Message is sent from the side that originated the CR (i.e. from the outgoing side)

1 : Message is sent to the side that originated the CR (i.e. from the incoming side)

Length of call reference value

The call reference value as defined for PSS1 shall always be two octets.

iii) Message type



Message type

Bits

8 7 6 5 4 3 2 1

0 0 0 0 0 0 0 0 : Escape to national or private message type

0 0 0 : *Call establishment messages:*

0 0 0 0 1 : ALERTING
0 0 0 1 0 : CALL PROCEEDING
0 0 1 1 1 : CONNECT
0 1 1 1 1 : CONNECT ACKNOWLEDGE
0 0 0 1 1 : PROGRESS
0 0 1 0 1 : SETUP
0 1 1 0 1 : SETUP ACKNOWLEDGE (PSS1 not used)

0 1 0 : *Call clearing messages*

0 0 1 0 1 : DISCONNECT
0 1 1 0 1 : RELEASE
1 1 0 1 0 : RELEASE COMPLETE
0 0 1 1 0 : RESTART
0 1 1 1 0 : RESTART ACKNOWLEDGE

0 1 1 : *Miscellaneous messages*

1 1 0 1 1 : INFORMATION (PSS1 not used)
1 1 1 0 1 : STATUS
1 0 1 0 1 : STATUS ENQUIRY (PSS1 not used)

2) Other information elements for Basic Call control

Bearer capability

8	7	6	5	4	3	2	1	
0	Bearer capability 0 0 0 0 0 1 0 0 Information element identifier							octet 1
Length of bearer capability contents								octet 2
1 exit	Coding standard	Information transfer capability						octet 3
1 exit	Transfer mode	Information transfer rate						octet 4
0/1 exit	0 1 Layer ID(1)	User information layer 1 protocol						octet 5

Coding Standard (Octet 3)

Bits 7 6

0 0 : ITU-T standard coding

Information transfer capability(Octet 3)

Bits 5 4 3 2 1

0 0 0 0 0 : Speech

Transfer mode (Octet 4)

Bits 7 6

0 0 : Circuit mode

Information transfer rate (Octet 4)

Bits 5 4 3 2 1

1 0 0 0 0 : 64 kbps

User information layer 1 protocol (Octet 5)

Bits 5 4 3 2 1

0 0 0 1 0 : ITU-T Recommendation G.711 μ-law

Call state

8	7	6	5	4	3	2	1	
0	Call state 0	0	0	1	0	1	0	0	octet 1 Information element identifier
Length of call state contents								octet 2
Coding standard	Call state value/ global call reference state value							octet 3

Coding standard (Octet 3)

Bits 7 6

0 0 : I TU-T standard coding

Call state value (Octet 3)

Bits 6 5 4 3 2 1	value	Circuit Mode Protocol Control State
0 0 0 0 0 0	0	Null
0 0 0 0 0 1	1	Call initiated
0 0 0 0 1 1	3	Outgoing call proceeding
0 0 0 1 0 0	4	Call delivered
0 0 0 1 1 0	6	Call present
0 0 0 1 1 1	7	Call received
0 0 1 0 0 0	8	Connect request
0 0 1 0 0 1	9	Incoming call proceeding
0 0 1 0 1 0	10	Active
0 0 1 0 1 1	11	Disconnect request
0 0 1 1 0 0	12	Disconnect indication
0 1 0 0 1 1	19	Release request

Global call reference value (Octet 3)

Bits 6 5 4 3 2 1	State
0 0 0 0 0 0	REST0 - null
1 1 1 1 0 1	REST1 - restart request
1 1 1 1 1 0	REST2 - restart

iii) Called party number

8	7	6	5	4	3	2	1	
0	Called party number 1 1 1 0 0 0 0 Information element identifier							octet 1
Length of called party number contents								octet 2
1	Type of number			Numbering plan identification				octet 3
0 spare	Number digits (note)							octet 4 repeated

Note : The number digits appear in multiple octets 4 in the same order in which they would be entered, i.e. the number digit which would be entered first is located in the first octet 4.

Type of number (Octet 3)
Bits 7 6 5
0 1 1 : PISN specific number

Numbering Plan identification (Octet 3)
Bits 4 3 2 1
1 0 0 1 : Private numbering plan

Number digits(Octet 4)
This field is coded with ITU-T Recommendation T.50 characters, according To the formats specified in the appropriate numbering/dialing plan.

Calling party number

8	7	6	5	4	3	2	1	
0	Calling party number 1 1 0 1 1 0 0 Information element identifier							octet 1
Length of calling party number contents								octet 2
0/1 ext	Type of number			Numbering plan identification				octet 3
1 ext	Presentation indicator		0 0 0 Spare			Screening indicator		octet 3a
0 spare	Number digits							octet 4 repeated

Numbering Plan identification (Octet 3) ,and Type of number (Octet 3)
These information elements are coded as in the “called party number”.

Presentation indicator (Octet 3a)
Bits 7 6
0 0 : Presentation allowed

Screening indicator (Octet 3a)
Bits 2 1
1 1 : Network provided

Number digits (Octet 4)
These information elements are coded as in the “called party number”.

Cause

8	7	6	5	4	3	2	1	
0	Cause 0	0	0	1	0	0	0 Information element identifier	octet 1
Length of cause contents								octet 2
1 ext	Coding standard		0 spare	Location				octet 3
1 ext	Cause value							octet 4
Diagnostics (if any)								octet 5

Coding standard (Octet 3)
Bits 7 6
0 0 : ITU-T standardized

Location (Octet 3)
Bits 4 3 2 1
0 0 0 1 : Private network serving the local user

Cause value (Octet 4)
The following table B.3.1 applies to the coding of cause value.

Channel identification

8	7	6	5	4	3	2	1	
0	Channel identification 0	0	1	1	0	0	0 Information element identifier	octet 1
Length of channel identification contents								octet 2
1 ext	0	1	0 spare	Pref. /Excl.	Signaling channel ind.	Info. Channel selection		octet 3
1 ext	Coding standard		Numbe r/Map	Channel type				octet 3.2
0/1 ext	Channel number/Map							octet 3.3

Preferred/Exclusive (Octet 3)
Bits 4
0 : Indicated channel is preferred

Signaling channel indicator (Octet 3)
Bits 3
0 : Channel indicated is not the signaling channel

Information channel selection (Octet 3)
Bits 2 1
0 1 : As indicated in the following octets

Coding standard (Octet 3.2)
Bits 7 6
0 0 : ITU-T standard

Number/Map (Octet 3.2)
Bits 5
0 : Channel is indicated by the number in the following octet

Channel type (Octet 3.2)
Bits 4 3 2 1
0 0 1 1 : B channel units (64 kbps)

Channel number/Map (Octet 3.3)
Binary number assigned to the channel. Channels are numbered from 1 Upwards.

vii) Progress Indicator

8	7	6	5	4	3	2	1	
0	Progress indicator 0	0	1	1	1	1	0	octet 1 Information element identifier
Length of progress identification contents								octet 2
1 ext	Coding standard		0 spare	Location				octet 3
1 ext	Progress description							octet 4

Coding standard (Octet 3)

Bits	7 6	
	0 0	: ITU-T standard

Location (Octet 3)

Bits	4 3 2 1	
	0 0 0 1	: Private network serving the local user

Progress description (octet 4)

Bits	7 6 5 4 3 2 1	No.	
	0 0 0 0 0 0 1	1	: Call is not end-to-end ISDN.
	0 0 0 0 0 1 0	2	: Destination address is not ISDN.
	0 0 0 0 0 1 1	3	: Origination address is not ISDN.
	0 0 0 0 1 0 0	4	: Call has returned to the ISDN.
	0 0 0 1 0 0 0	8	: In-band information or appropriate pattern now available

viii) Restart indicator

8	7	6	5	4	3	2	1	
0	Restart indicator: 1 1 1 1 0 0 1 (Information element identifier)							octet 1
Length of restart indicator contents								octet 2
1 ext	0	0	0	0	Class			octet 3

Class (octet 3)

Bits	3 2 1	
	1 1 1	: All channels (note)

Note : All channels means the signaling channel on which the restart indicator is carried and all user information channels associated with that signaling channel.

3. Cause Value

The cause information element is coded as shown in table B.3.1.

Table B. 3. 1 Cause information element

Cause no.	Cause
1.	Unallocated (unassigned)number
3.	No route to destination
6.	Channel unacceptable
16.	Normal call clearing
17.	User busy
18.	No user responding
19.	No answer from user
21.	Call rejected
22.	Number changed
27.	Destination out of order
28.	Invalid number format
30.	Response to STATUS ENQUIRY
31.	Normal, unspecified
34.	No circuit/channel available
41.	Temporary failure
44.	Requested circuit/channel not available
57.	Bearer capability not authorized
58.	Bearer capability not presently available
63.	Service or option not available, unspecified
65.	Bearer capability not implemented
81.	Invalid call reference value
88.	Incompatible destination
96.	Mandatory information element is missing
97.	Message type non-existent or not implemented
98.	Message not compatible with call state or message non-existent or not implemented
99.	Information element non-existent or not implemented
100.	Invalid information element contents
101.	Message not compatible with call state
102.	Recovery on timer expire
111.	Protocol error, unspecified

4. Layer 3 timer values

The protocol timers are defined in table B.4.1.

Table B.4.1 Layer 3 Timer values

Timer	Purpose	Required value (Note)
T301	ALERTING received	120 s
T302	Sending of SETUP ACKNOWLEDGE	Not used
T303	On sending SETUP	4 s
Second T303	On retransmission of SETUP	4 s
T304	Receipt of SETUP ACKNOWLEDGE	Not used

T305	On sending DISCONNECT	30 s
T308	On sending RELEASE	4 s
Second T308	On retransmission of RELEASE	4 s
T309	SCM disconnection	90 s
T310	On receipt of CALL PROCEEDING	110s
T313	On sending CONNECT	4 s
T314	Segmentation timer	Not used
T316	On sending of RESTART	120 s
T322	STATUS ENQUIRY sent	Not used

APPENDIX C CONFIGURATION OF DIRECT CONNECTION

1. System Connection

Based on the description in Section 3.1, a typical network configuration is shown in Figure C.1.1 below.

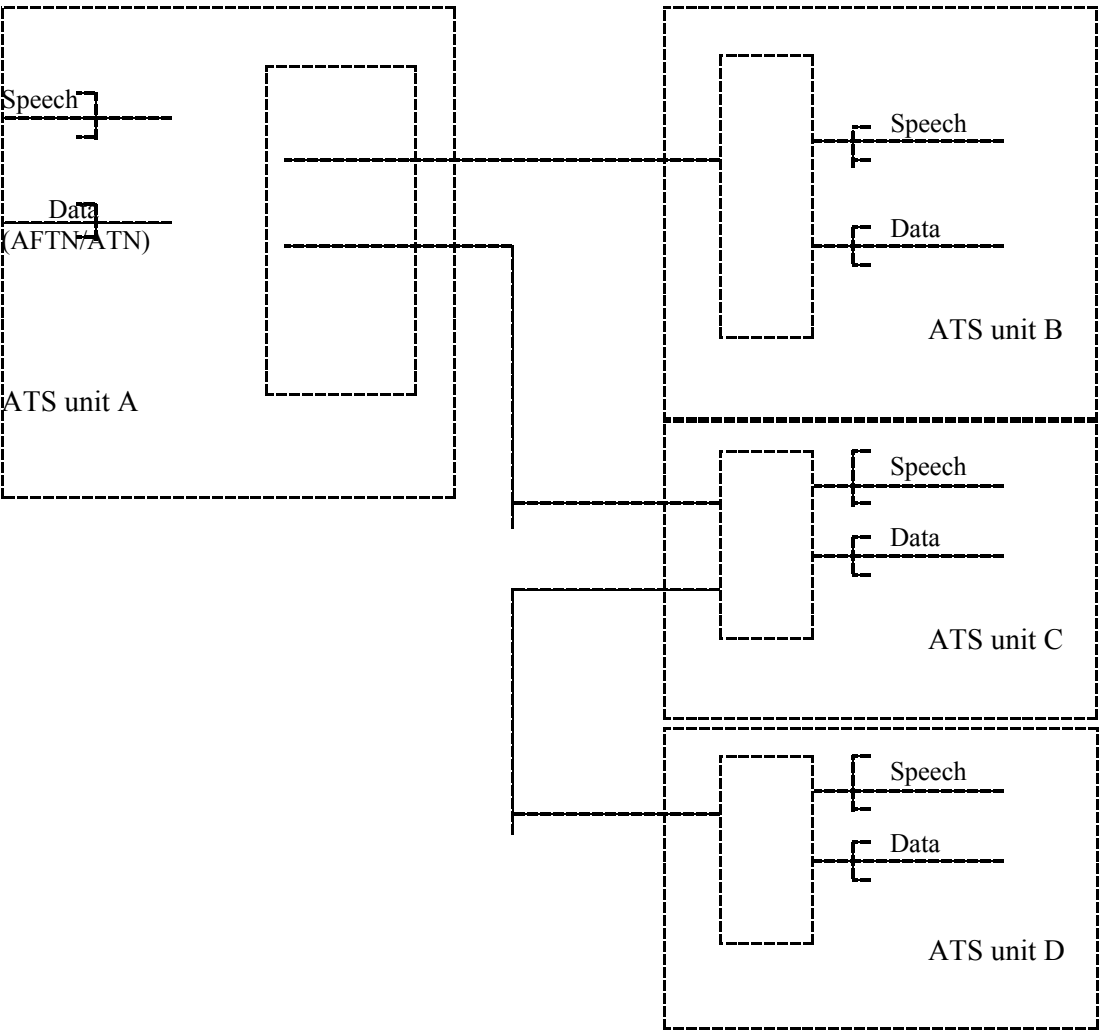


Figure C.1.1 A Typical Network Configuration

APPENDIX D CONFIGURATION OF MULTIPLEXER CONNECTION

1. System Connection

Based on the description in Section 3.2, a typical network configuration is shown in Figure D.1.1 below.

Figure D.1.1 A Typical Multiplexer Network Configuration

2. Voice Compression

Since the voice coding rate at the PBXs is PCM of 64kbps/channel, compression should be carried out at MUXs. The recommended voice compression rate of 8kbps should be implemented.

3. Example Bandwidth of International Circuit

It is explicit that the number of the ATS speech circuits differs from state to state. To support two ATS speech circuits and one AFTN data circuit, at least one 64 kbps circuit will be required between the two States. The details are as follows:

Two 8kbps voice circuits = 16kbps will be required for the ATS speech circuits.
Maximum bandwidth of 16kbps will be required for the D-channel. (Inter-MUX bandwidth compression of D-channel shall be determined between two states, if necessary) .
A certain bandwidth, such as 9.6kbps, will be required for the AFTN data circuit.
In addition some of the MUX may require the bandwidth of inter MUX control signal, such as 4kbps.

Therefore, 45.6kbps bandwidth will be necessary altogether, in such conditions as these above which require a 64kbps international circuit. The channel assignment is illustrated in Figure D.3.1.

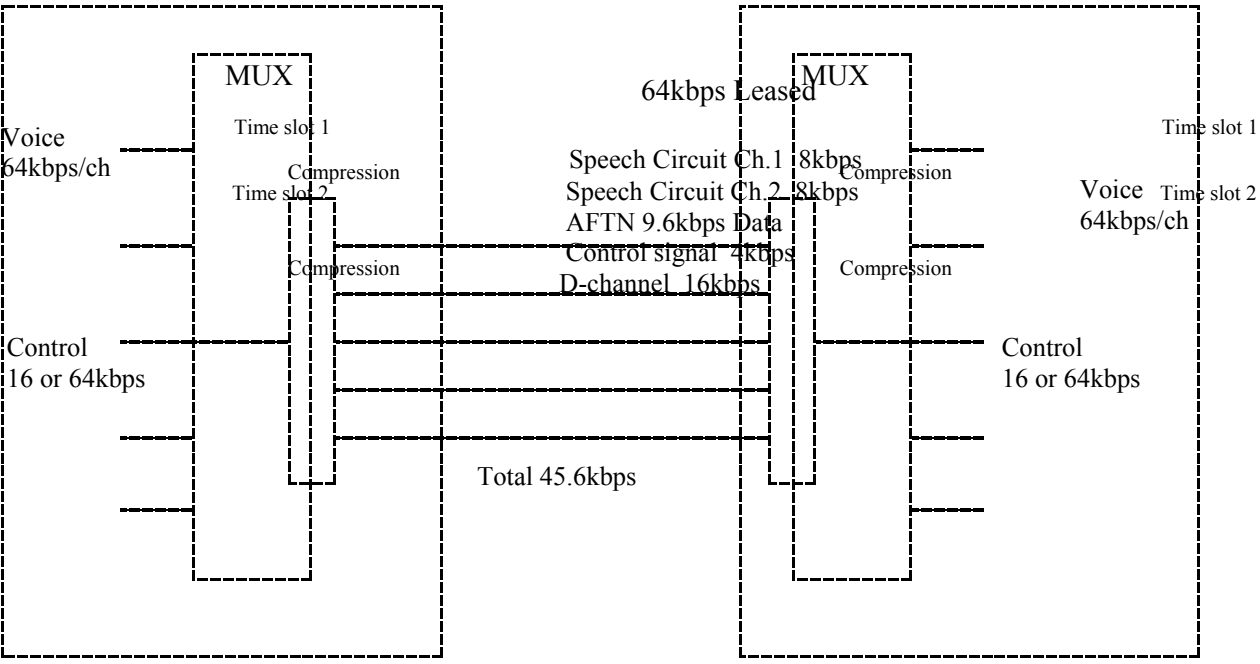


Figure D.3.1 Example Channel Assignment in 64 kbps Circuit

4. Interface of the International Circuit

The physical and electrical circuit interfaces provided differ with individual carriers in the Asia/Pacific area.

APPENDIX E ASIA/PACIFIC REGION ATS NUMBERING

Numbering ZONE 1

Country	Area identifier		Unit identifier		Remarks
United States of America	1	2 ~ 9			

Numbering ZONE 5

Country	Area identifier		Unit identifier		Remarks
Chile	5	6			

Numbering ZONE 6 (1 of 2)

Country	Area identifier		Unit identifier		Remarks
Malaysia	6	0			
Australia	6	1			
Indonesia	6	2			
Philippines	6	3			
New Zealand	6	4			
Singapore	6	5			
Thailand	6	6			
Mariana Islands	6	7	0		
Guam	6	7	1		
Brunei	6	7	3		
Nauru	6	7	4		

Numbering ZONE 6 (2 of 2)

Country	Area identifier		Unit identifier		Remarks
Papua New Guinea	6	7	5		
Tonga	6	7	6		
Solomon Islands	6	7	7		
Vanuatu	6	7	8		
Fiji	6	7	9		
Wallis Islands	6	8	1		
Cook Islands	6	8	2		
Niue Island	6	8	3		
American Samoa	6	8	4		
Samoa	6	8	5		
Kiribati	6	8	6		
New Caledonia	6	8	7		
Tuvalu	6	8	8		
French Polynesia	6	8	9		
Micronesia, Fed. States of	6	9	1		
Marshall Islands	6	9	2		

Numbering ZONE 7

Country	Area identifier		Unit identifier		Remarks
Russian Federation	7	0 3 4 8			

Numbering ZONE 8

Country	Area identifier		Unit identifier		Remarks
Japan	8	1			
Republic of Korea	8	2			
Vietnam	8	4			
Democratic People's Republic of Korea	8	5	0		
Hong-Kong (China)	8	5	2		
Macau	8	5	3		
Cambodia	8	5	5		
Lao People's Democratic Republic	8	5	6		
China	8	6			
Bangladesh	8	8	0		

Numbering ZONE 9

Country	Area identifier		Unit identifier		Remarks
India	9	1			
Pakistan	9	2			
Afghanistan	9	3			
Sri Lanka	9	4			
Myanmar	9	5			
Maldives	9	6	0		
Mongolia	9	7	6		
Nepal	9	7	7		