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BEARER SERVICES TO BE PROVIDED BY AN INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

Recommendation proposed by Working Group T/GT 7 "Services and Facilities" (SF)
Amendments proposed by Project Team Service Descriptions for the ISDN (SDI)

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CONTENTS

1. GENERAL

This Recommendation details the Bearer Services (BS) to be provided by ISDN.
The bearer services are described by a definition and a set of attribute values which fully describe the service from a user's point of view.

2. LIST OF BEARER SERVICES

A list of bearer services that the ISDN should provide is shown below together with an indication of their priority for introduction.

Bearer Service	Priority
1. Circuit-mode (8 kHz structured)	
1.1. 64 kbit/s unrestricted	
1.1.1. Demand	E
1.1.2. Permanent	E
1.2. 64 kbit/s usable for speech information transfer	
1.2.1. Demand	E
1.2.2. Permanent	A
1.3. 64 kbit/s usable for 3.1 kHz audio information transfer	
1.3.1. Demand	E
1.3.2. Permanent	E
1.4. Alternate speech/64 kbit/s non-speech	
1.4.1. Demand	A
1.5. 2x64 kbit/s unrestricted 8 kHz structured	A
1.6. 384 kbit/s unrestricted	
1.6.1. Permanent	A
1.7. 1920 kbit/s	
1.7.1. Demand	E
1.7.2. Permanent	E
1.8. 32 kbit/s for speech information transfer	
1.8.1. Demand	A
1.8.2. Permanent	A
2. Packet-mode	
2.1. Virtual call and permanent virtual circuit	
2.1.1. B-channel	E
2.1.2. D-channel	E
2.2. User signalling bearer service	E

Priority markings: E = Essential A = Additional

Other bearer services than those listed above will be possible in the future. This includes the reserved category of bearer services, frame relay and multi-rate bearer services.

3. DESCRIPTIONS OF BEARER SERVICES TO BE PROVIDED BY ISDNs

Descriptions of bearer services to be provided by an ISDN are contained in Annexes 1 to 10. Definitions are detailed below.

3.1. Circuit-mode Bearer Service Categories

3.1.1. *Circuit-mode 64 kbit/s Unrestricted 8 kHz Structured Bearer Service Category*

This bearer service category provides unrestricted information transfer between reference points. User information is transferred over a B-channel and signalling is provided over a D-channel.

3.1.2. *Circuit-mode 64 kbit/s, 8 kHz Structured Bearer Service Category Usable for Speech Information Transfer*

This bearer service category is intended to support speech information transfer between reference points. User information is provided over a B-channel and signalling is provided over a D-channel.

3.1.3. *Circuit-mode 64 kbit/s 8 kHz Structured Bearer Service Category Usable for 3.1 kHz Audio Information Transfer*

This bearer service category provides the transfer of speech and of 3.1 kHz bandwidth audio information such as voice band data via modems, facsimile groups 1, 2, and 3 information.
User information is transferred over a B-channel and signalling is provided over a D-channel.

3.1.4. *Circuit-mode Alternate Speech/64 kbit/s Unrestricted 8 kHz Structured Bearer Service Category*

This bearer service category provides the alternate of either speech or 64 kbit/s unrestricted digital information within the same call.
The request for this alternate capability and the initial mode desired by the users must be identified at call setup time.

3.1.5. *Circuit-mode 2x64 kbit/s Unrestricted 8 kHz Structured Bearer Service Category*

This bearer service category provides the unrestricted transfer of two 64 kbit/s user information flows over two B-channels at the user network interface.

3.1.6. *Circuit-mode 384 kbit/s Unrestricted 8 kHz Structured Bearer Service Category*

This bearer service category provides the unrestricted transfer of 384 kbit/s user information over a H0-channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may provided over a D-channel in the same or in another interface structure.

3.1.7. *Circuit-mode 1920 kbit/s Unrestricted 8 kHz Structured Bearer Service Category*

This bearer service category provides the unrestricted transfer of 1920 kbit/s user information over a H12-channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel.

3.2. Packet-mode Bearer Service Categories

3.2.1. *ISDN Virtual Call (VC) and Permanent Virtual Circuit (PVC) Bearer Services Provided on the B-channel of the User Access: Basic and Primary Rate*

This bearer service category provides unrestricted transfer (without alteration) of user

information in a packetised manner over a virtual circuit on a B-channel between reference points via the basic and primary rate access.

3.2.2. *ISDN Virtual Call (VC) and Permanent Virtual Circuit (PVC) Bearer Services Provided on the D-channel of the User Access: Basic and Primary Rate*

This bearer service category provides unrestricted transfer (without alteration) of user information in a packetised manner over a virtual circuit on a D-channel between reference points.

3.2.3. *User Signalling Bearer Service*

The User Signalling Bearer Service (USBS) is intended to support transfer of Service Data Units (SDUs) via the D-channel. It is to be used in applications where limited amounts of information are to be exchanged between customer installations, or where information must be exchanged between customer installations and High Layer Functions (HLFs) in the ISDN. Examples of such applications include support of user management protocols and transfer of control information between any kind of user equipment including ISPBXs across a public ISDN.

CIRCUIT-MODE 64 KBIT/S UNRESTRICTED 8 KHZ
STRUCTURED BEARER SERVICE CATEGORY

Annex 1

CIRCUIT-MODE 64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

1. DEFINITION

This bearer service category provides unrestricted information transfer between reference points. User information is transferred over a B-channel and signalling is provided over a D-channel.

2. DESCRIPTION

2.1. General Description

This bearer service category can be used to support various user applications.

Examples include:

Example 1: File transfer
Example 2: Multiple subrate information streams multiplexed into 64 kbit/s by the user
Example 3: Transparent access to public data network (Case A of ETS 300 107)
Example 4: Speech (see note 1)
Example 5: 3,1 kHz audio (see note 1).

Note 1: Whilst speech and 3.1 kHz audio have been given as one application for this bearer service category, it is recognised that it is the responsibility of the customers to ensure that a compatible encoding scheme is in operation. Customers should also recognise that no network provision can be made for control of such items as echo and loss, as the network is unaware of the application in use.

This circuit-mode bearer service category shall allow communication in both directions between:

- two users (e.g. terminals, private telecommunication network exchanges (PTNXs)) in a point-to-point configuration via the ISDN using 64 kbit/s digital signals over the B-channel;
- three or more users in a multipoint configuration as invoked by some supplementary services.

Each of the reference points can be either S or coincident S and T reference points.

Note 2: Network operators can also provide information transfer with the same attributes where the reference point is T.

CIRCUIT-MODE 64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

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3. PROCEDURES

3.1. Provision and Withdrawal

3.1.1. Provision of this bearer service category shall be by prior arrangement with the network operator.

3.1.2. As a network option this bearer service category can be offered with several subscription options which shall apply separately to an ISDN number or a group of ISDN numbers on the interface. For each subscription option, only one value can be selected.

It should be noted that in this context an interface may consist of a group of physical interfaces.

Subscription options for the interface are summarised below:

Subscription Option	***Value***
Maximum number of information channels available	m, where m is an even number not greater than the number of information channels on the interface.
Maximum number of total calls present	n, where n is not greater than the number of information channels on the interface.

The user can be identified by an ISDN number or a group of ISDN numbers on the interface.

More than one ISDN number can be associated with the interface only as part of a supplementary service such as the Multiple Subscriber Number supplementary service. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. the Call Waiting supplementary service).

As a network option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

3.2. Normal Procedures

All user-network signalling shall be performed over the D-channel. The network shall provide out-of-band indication to indicate call progress.

3.2.1. *Originating the Call (Call Establishment)*

A call is originated by the served user requesting from the network the required bearer service category. This request shall include an ISDN number identifying the called user. Other information, as required, for the bearer service and other information which may be required for use by the network in the supplementary service provided to the called user (e.g. Calling Line Identification Presentation supplementary service) may also be included.

The identity of the called user can be given to the network either en-bloc, containing all required information, or not en-bloc.

3.2.2. *Indication during Call Establishment*

After initiating a call the calling user shall receive an acknowledgement that the network is able to process the call. The called user shall receive an indication of the arrival of an incoming call of this bearer service category.

When an indication is received by the network that the called user is being informed of this call, the calling user shall also be given an indication that the incoming call is being offered to the called user.

When the connection is established, an indication of this shall be sent to the calling user. The called user may also provide other information, for use by the network in supplementary services provided to other users (e.g. the Calling Line Identification Presentation supplementary service).

Once the connection is established, the B-channel is then available for transmission of 64 kbit/s digital signals in both directions continuously and simultaneously, without alteration by the network. No restriction is placed by the network on the content of the digital signals (see note of clause 2).

3.2.3. *Terminating the Call*

The call may be terminated by either of the users by indicating this to the network. If one user terminates the call, and the other user has not yet terminated the call, an appropriate indication shall be sent to the other user.

3.3. User Requirements in case of Unsuccessful Outcome (Exceptional Procedure)

3.3.1. *Situation at the Calling User Side*

When the network receives an improper service request from a user, the network shall give that user the appropriated indication and the call establishment shall be ceased.

A user inputting an invalid ISDN number shall be given an appropriate failure indication by the network and the call establishment shall be ceased.

When the network receives an incorrect ISDN number from a user, the network shall give that user the appropriate indication and the call establishment shall be ceased.

Users can input network address information subsequent to the service request (i.e. overlap sending). In this case, if the user fails to enter address information or subsequent parts of the address within network determined time intervals, the network shall give that user the appropriate indication and the call establishment shall be ceased.

3.3.2. *Situations at the Called User Side*

A calling user attempting to establish a call to a user who is identified by the network to be busy (either network determined user busy or user determined user busy) will be given an appropriate indication by the network.

A user attempting to establish a call to a user where terminal equipment fails to respond will be given an appropriate indication by the network and the call setup will ceased.

On a call to a user whose terminal equipment has responded that the called user is being informed of the call, but has failed to establish the call within a defined period of time, the calling user attempting to establish the call will be given the appropriate failure indication by the network and the call establishment shall be ceased.

3.3.3. *Situations due to Network Conditions*

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) shall be given an appropriate indication by the network.

3.3.4. *Retention of Call Information*

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) or called user state (e.g. network determined user busy or user determined user busy) then according to a network option the network shall retain all of the information supplied by the calling user for the duration of the retention time.

3.4. Alternate Procedures

No invocation procedures are required for the reserved and permanent variants of this service. Registration, activation and deactivation procedures for these variants are outside the scope of this recommendation.

4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the customer accurately for the service.

5. INTERCOMMUNICATION CONSIDERATIONS

During an interim period some networks outside Europe may only support restricted 64 kbit/s digital information transfer capability, i.e. information transfer capability solely restricted by the requirement that the all-zero octet is not allowed.

5.1. Interworking with Non-ISDNs

In advance of provision of the ISDN, similar services supported by 64 kbit/s connectivity will be available to customers on what may be described as digital public switched telephone network, pre-ISDNs, pilot ISDNs, or extended integrated digital networks including intelligent network. Interworking with ISDN customers shall be required. To reflect this, as a broad guideline, network operators shall ensure these networks have the necessary functionality at the interworking point to provide service connectivity with the ISDN.

Note: A terminal according to ETS 300 103 connected to the ISDN via a terminal adaptor and using the circuit-mode 64 kbit/s unrestricted 8 kHz structured bearer service category requires the use of an InterWorking Function (IWF) (including a modem) in the network for calls to Public Switched Telephone Network (PSTN) users. To effect the connection, a 64 kbit/s connection would need to be used to the IWF and a PSTN connection of 3.1 kHz bandwidth shall be used to the PSTN user from the IWF. These functions can also be provided for incoming calls. The provision of the IWF is a network option, and if provided, the selection of modem types to be offered is also a network option.

CIRCUIT-MODE 64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

5.2. Interworking with Private ISDNs

The situation where the communicating users are attached to private ISDN and public ISDN is detailed in clauses 2 and 3.

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category.

If the in-band communication is interrupted by the network as a result of one user invoking a supplementary service (e.g. the Call Hold supplementary service or the Terminal Portability supplementary service) then the network will provide an appropriate indication in the B-channel.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

The attributes are defined in CCITT Recommendation I.140, Annex A, § A.

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	64 kbit/s
3. Information transfer capability	Unrestricted
4. Structure	8 kHz integrity
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry	Bidirectional symmetric/unidirectional
7. Communication configuration	Point-to-point/multipoint
Access attributes:	
8. Access channel	B (64 kbit/s) for user information; D (16 or 64 kbit/s) for signalling
9. Access protocol	Signalling: ETSs 300 125 and 300 102 (see note)

Note: For reserved/permanent services the operational, administrative, and maintenance messages (OAM) related to these services may be conveyed over the D-channel.

CIRCUIT-MODE 64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

General attributes:

10. Supplementary services provided	See Recs T/CAC S 10.5 to 10.7 and CCITT Rec. I.250
11. Quality of service	
12. Interworking possibilities	See Rec. T/CAC S 10.4
13. Operational and commercial aspects	See CEPT User Handbook, ISDN.

8. DYNAMIC DESCRIPTION

The dynamic description for this bearer service on a demand basis shall be as specified in CCITT Recommendation I.220.

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR SPEECH INFORMATION TRANSFER

Annex 2

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR SPEECH INFORMATION TRANSFER

1. DEFINITION

This bearer service category is intended to support speech information transfer between reference points. User information is provided over a B-channel and signalling is provided over a D-channel.

2. DESCRIPTION

This circuit-mode bearer service category shall allow communication in both directions between:

- two users (e.g. terminals, PBXs) in a point-to-point configuration to communicate via the ISDN using speech encoding into 64 kbit/s digital signals over the B-channel for the duration of a call;
- three or more users in a multipoint configuration as invoked by some supplementary services.

The network operator may apply echo control or circuit multiplication and therefore,the characteristics of the speech path may be modified during the call.

The network provides tones and/or announcements to support this bearer service category. Tones and/or announcements can be used to indicate the progress or otherwise of a call. The application and meaning of the tones and announcements is a national matter and outside the scope of this recommendation.

The digital signal at the reference point shall conform to the CCITT Recommendation G.711 (A-law). The network may use processing techniques appropriate for speech such as analogue transmission, echo cancellation and low bit rate encoding. Hence, bit integrity is not assured. This bearer service is not intended to support modem derived voice band data.

All CCITT Recommendations for the transfer of speech information in the network apply to this service.

Each of the reference points can be either an S or coincident S and T reference points (see CCITT Recommendation I.411).

Note: Network operators can also provide information transfer with the same attributes where the reference point is T.

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR SPEECH INFORMATION TRANSFER

Within this bearer service category the following service variants are distinguished with respect to establishment of communications:

- On demand
- Reserved
- Permanent

3. PROCEDURES

3.1. Provision and Withdrawal

Provision of this bearer service category shall be by prior arrangement with the network operator.

As a network option this bearer service can be offered with several subscription options which apply separately to each ISDN number or group of ISDN numbers on the interface. For each subscription option, only one value can be selected.
It should be noted in this context that an interface may consist of a group of physical interfaces.

Subscription options for the interface are summarised below:

Subscription Option	Value
Maximum number of information channels available	m, where m is not greater than the number of information channels on the interface
Maximum number of total calls present	n, where n is not greater than the number of information channels on the interface

The user B can be identified by an ISDN number or a group of ISDN numbers on the interface.

More than one ISDN number can be associated with the interface only as part of a supplementary service such as the Multiple Subscriber Number. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. Call Waiting).

As a network option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

3.2. Normal Procedure

Procedures in this clause are applicable to the demand variant of this bearer service category. No invocation procedures are required for this reserved and permanent variants of this service. Registration activation and deactivation for these variants are outside the scope of this recommendation.

The network shall provide out-of-band indications to indicate call progress.

Network generated in-band tones and/or announcement shall be provided for this bearer service category.

3.2.1. *Originating the Service (Call Setup)*

A call is originated by a served user requesting from the network the required bearer service category. This request shall include a number identifying the called user. Other information, as required for use by the network in the supplementary service provided to the called user (e.g. Calling Line Identification Presentation supplementary service) may also be included.

The identity of the called user can be given to the network either en-bloc, containing all the required information, or not en-bloc.

3.2.2. *Indication During Call Establishment*

After initiating a call the calling user shall receive an acknowledgement that the network can process the call. The called user shall receive an indication of the arrival of an incoming call of this bearer service category.

When an indication is received by the network that the called user is being informed of the call, the calling user shall also be given an indication that the incoming call is being offered to the called user. When the call reaches the called user and the connection is established, an indication of this shall be sent to the calling user. The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. the Connected Line Identification Presentation supplementary service).

Once the connection is established, the B-channel shall be available for transmission of 64 kbit/s signals supporting speech in both directions.

3.2.3. *Terminating the Call*

The call may be terminated by either of the users by indicating this to the network. If one user terminates the call, and the other user has not yet terminated the call an appropriate indication is sent to the other user.

3.3. User Requirements in case of Unsuccessful Outcome (Exceptional Procedure)

3.3.1. *Situations at the Calling User Side*

When the network receives an improper service request from a user, the network shall give that user the appropriate indication and the call establishment shall be ceased.

A user inputting an invalid ISDN number shall be given an appropriate indication by the network and the call establishment shall be ceased.

When the network receives an incorrect ISDN number from a user, the network shall give that user the appropriate indication and the call establishment shall be ceased.

Users can input network address information subsequent to the service request (i.e. overlap sending). In this case, if the user fails to enter address information or subsequent parts of the address within network determined intervals, the network shall give that user the appropriate indication and the call establishment shall be ceased.

3.3.2. *Situations at the Called User Side*

A calling user attempting to establish a call to a user who is identified by the network to be busy (either network determined user busy or user determined user busy) will be given an appropriate indication by the network.

A user attempting to establish a call to a user whose terminal equipment fails to respond shall be given the appropriate indication by the network and the call establishment shall be ceased.

On a call to a user whose terminal equipment has responded that the called user is being informed of the call, but has failed to establish the connection within a defined period, the calling user attempting to establish the call shall be given the appropriate indication by the network and the call establishment shall be ceased.

3.3.3. *Situations due to Network Conditions*

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) shall be given the appropriate indication by the network.

3.3.4. *Retention of Call Information*

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) or called user state (e.g. network determined user busy or user determined user busy) then according to a network option, the network shall retain all of the information supplied by the calling user for the duration of the retention time.

4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the customer accurately for the service.

5. INTERWORKING CONSIDERATIONS

5.1. Interworking with Non-ISDNs

Interworking is required between the ISDN and the PSTN for this bearer service category.

Calls using this bearer service can be terminated in the PSTN and the calling user shall be given an indication that interworking occurred.

5.2. Interworking with Private ISDNs

The situation where the communicating users are attached to a private and a public ISDN is detailed in clauses 2 and 3.

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR SPEECH INFORMATION TRANSFER

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6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability with this bearer service category.

If the in-band communication is interrupted by the network as a result of one user invoking a supplementary service (e.g. the Call Hold or the Terminal Portability supplementary services) then the network shall provide an appropriate indication in the B-channel.

Note: Users are advised to hold the end-to-end in-band information transfer prior to invoking such supplementary services.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

The attributes are defined in CCITT Recommendation I.140, Annex A, § A.

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	64 kbit/s
3. Information transfer capability	Speech (encoded according to CCITT Rec. G.711 A-law) (See note 1)
4. Structure	8 kHz integrity
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry	Bidirectional symmetric
7. Communication configuration	Point-to-point/multipoint
Access attributes:	
8. Access channel	B (64 kbit/s) for user information D (16 or 64 kbit/s) for signalling
9. Access protocol	User information: CCITT Rec. G.711 Signalling: ETSs 300 125 and 300 102 (See note 2)
General attributes:	
10. Supplementary Services provided	See Rec. T/CAC S 10.5 to 10.7 and CCITT Rec. I.250
11. Quality of service	
12. Interworking possibilities	See Rec. T/CAC S 10.4
13. Operational and commercial aspects	See CEPT User Handbook, ISDN.

Note 1: When crossing an international boundary between network operators which employ different encoding laws, the network shall perform the necessary A to μ law convertion (see CCITT Recommendation G.711).

Note 2: For reserved/permanent services the operational, administrative, and maintenance messages (OAM) related to these services may be conveyed over the D-channel.

8. DYNAMIC DESCRIPTION

The dynamic description for this bearer service on a demand basis shall be as specified in CCITT Recommendation I.220.

Annex 3

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR 3.1 KHZ AUDIO INFORMATION TRANSFER

1. DEFINITION

This bearer service category provides the transfer of speech and of 3.1 kHz bandwidth audio information such as voice band data via modems, facsimile groups 1, 2, and 3 information. User information is provided over a B-channel and signalling is provided over a D- channel.

2. DESCRIPTION

The circuit-mode 64 kbit/s 8 kHz structured bearer service category usable for 3.1 kHz audio information transfer corresponds to the service which is currently offered in the PSTN.

Note: The maximum modem bit rate that can be used by users in application of this bearer service category depends on the modulation standard employed by the user and on the transmission performance within or between different network operators. The extent of support is a network or bilaterally agreed matter.

This circuit-mode bearer service category shall allow:

- two users (e.g. terminals, private telecommunication network exchanges (PBXs)) in a point-to-point configuration to communicate in both directions via the ISDN using 3.1 kHz audio information encoding into 64 kbit/s digital signals over the B-channel for the duration of a call;
- three or more users in a multipoint configuration as invoked by some supplementary services.

The network provides tones and/or announcements to support this bearer service category. Tones and/or announcements can be used to indicate the progress or otherwise of a call. The application and meaning of the tones and announcements is a national matter and outside the scope of this recommendation.

Connections provided for these services shall offer the transfer capability for the information indicated above.

This means that the network may include speech processing techniques provided that they are appropriately modified or functionally removed prior to non-speech information transfer. The control of echo control devices, speech processing devices, etc. shall be made by use of a 2100 Hz (disabling) in-band tone. Bit integrity is not assured. The network may use analogue transmission.

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR 3.1 KHZ AUDIO INFORMATION TRANSFER

All CCITT Recommendations for the transfer of speech information in the network apply to this bearer service category.

Each of the reference points can be either an S or coincident S and T reference points.

Note: Network operators can also provide information transfer with the same attributes where the reference point is T.

The digital signal at the coincident S and T reference point (see CCITT Recommendation I.411) conforms to CCITT Recommendation G.711 (A-law).

Within this bearer service category the following service variants are distinguished with respect to establishment of communications:

- On demand
- Reserved
- Permanent

3. PROCEDURES

3.1. Provision and Withdrawal

Provision of this bearer service category shall be by prior arrangement with the network operator.

As a network option this bearer service can be offered with several subscription options which apply separately to each ISDN number or group of ISDN numbers on the interface. For each subscription option, only one value can be selected.
It should be noted in this context that an interface may consist of a group of physical interfaces.

Subscription options for the interface are summarised below:

Subscription	**Value**
Maximum number of information channels available	m, where m is not greater than the number of information channels on the interface
Maximum number of total calls present	n, where n is not greater than the number of information channels on the interface

The user B can be identified by an ISDN number or a group of ISDN numbers on the interface.

More than one ISDN number can be associated with the interface only as part of a supplementary service such as the Multiple Subscriber Number supplementary service. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. the Call Waiting supplementary service).

As a network option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR 3.1 KHZ AUDIO INFORMATION TRANSFER

3.2. Normal Procedure

Procedures in this clause are applicable to the demand variant of this bearer service category.

No invocation procedures are required for the reserved and permanent variants of this service. Registration, activation, and deactivation for these variants are outside the scope of this recommendation.

The network shall provide out-of-band indications to indicate call progress.

Network generated in-band tones and/or announcements shall be provided for this bearer service category.

3.2.1. *Originating the Call (Call Establishment)*

A call is originated by a served user requesting from the network the required bearer service category. This request shall include an ISDN number identifying the called user. Other information, as required for use by the network in the supplementary service provided to the called user (e.g. the Calling Line Identification Presentation supplementary service), may also be included.

The identity of the called user can be given to the network either en-bloc, containing all the required information, or not en-bloc.

3.2.2. *Indication During Call Establishment*

After initiating a call the calling user shall receive an acknowledgement that the network can process the call. The called user shall receive an indication of the arrival of an incoming call of this bearer service category.

When an indication is received by the network that the called user is being informed of the call, the calling user shall also be given an indication that the incoming call is being offered to the called user. When the call reaches the called user and the connection is established, an indication of this shall be sent to the calling user. The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. the Connected Line Identification Presentation supplementary service).

Once the connection is established, the B-channel shall be available for transmission of 64 kbit/s signals supporting speech or 3.1 kHz audio information in both directions.

3.2.3. *Terminating the Call*

The call may be terminated by either of the users by indicating this to the network. If one user terminates the call, and the other user has not yet terminated the call an appropriate indication is sent to the other user.

3.3. **User Requirements in case of Unsuccessful Outcome (Exceptional Procedure)**

3.3.1. *Situations at the Calling User Side*

When the network receives an improper service request from a user, the network shall give that user the appropriate indication and the call establishment shall be ceased.

A user inputting an invalid ISDN number shall be given an appropriate indication by the network and the call establishment shall be ceased.

When the network receives an incorrect ISDN number from a user, the network shall give that user the appropriate indication and the call establishment shall be ceased.

Users can input network address information subsequent to the service request (i.e. overlap sending). In this case, if the user fails to enter address information or subsequent parts of the address within network determined intervals, the network shall give that user the appropriate indication and the call establishment shall be ceased.

3.3.2. *Situations at the Called User Side*

A calling user attempting to establish a call to a user who is identified by the network to be busy (either network determined user busy or user determined user busy) will be given an appropriate indication by the network.

A user attempting to establish a call to a user whose terminal equipment fails to respond shall be given the appropriate indication by the network and the call establishment shall be ceased.

On a call to a user whose terminal equipment has responded that the called user is being informed of the call, but has failed to establish the connection within a defined period, the calling user attempting to establish the call shall be given the appropriate indication by the network and the call establishment shall be ceased.

3.3.3. *Situations due to Network Conditions*

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) shall be given the appropriate indication by the network.

3.3.4. *Retention of Call Information*

A user attempting to establish a call but meeting problems due to network conditions (e.g. congestion) or called user state (e.g. network determined user busy or user determined user busy) then according to a network option, the network shall retain all of the information supplied by the calling user for the duration of the retention time.

4. **NETWORK CAPABILITIES FOR CHARGING**

It shall be possible to charge the customer accurately for the service.

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR 3.1 KHZ AUDIO INFORMATION TRANSFER

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5. INTERCOMMUNICATION CONSIDERATIONS

5.1. Interworking with Non-ISDNs

Interworking is required between the ISDN and the PSTN for this bearer service category.

Calls from the PSTN will be presented to users in the ISDN using this bearer service category.

Calls using this bearer service can be terminated in the PSTN and the calling user shall be given an indication that interworking occurred.

5.2. Interworking with Private ISDNs

The situation where the communicating users are attached to a private and a public ISDN is detailed in clauses 2 and 3.

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability with this bearer service category.

If the in-band communication is interrupted by the network as a result of one user invoking a supplementary service (e.g. the Call Hold supplementary service or the Terminal Portability supplementary service) then the network shall provide an appropriate indication in the B-channel.

Note: Users are advised to hold the end-to-end in-band information transfer prior to invoking such supplementary services.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

The attributes are defined in CCITT Recommendation I.140, Annex A, § A.

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	64 kbit/s
3. Information transfer capability	3.1 kHz audio (encoded according to Rec. CCITT G.711 A-law) (See note 1)
4. Structure	8 kHz integrity
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry	Bidirectional symmetric

CIRCUIT-MODE 64 KBIT/S 8 KHZ STRUCTURED BEARER SERVICE CATEGORY USABLE FOR 3.1 KHZ AUDIO INFORMATION TRANSFER

7. Communication configuration	Point-to-point/multipoint

Access attributes:

8. Access channel	B (64 kbit/s) for user information D (16 or 64 kbit/s) for signalling
9. Access protocol	User information: CCITT Rec. G.711 Signalling: ETSs 300 125 and 300 102 (See note 2)

General attributes:

10. Supplementary services provided	See Recs T/CAC S 10.5 to 10.7 and CCITT Rec. I.250
11. Quality of service	
12. Interworking possibilities	See Rec. T/CAC S 10.4
13. Operational and commercial aspects	See CEPT: User Handbook, ISDN.

Note 1: When crossing an international boundary between network operators which employ different encoding laws, the network shall perform the necessary A to μ law convertion (see CCITT Recommendation G.711).

Note 2: For reserved/permanent services the operational, administrative, and maintenance messages (OAM) related to these services may be conveyed over the D-channel.

8. DYNAMIC DESCRIPTION

The dynamic description for this service on a demand basis shall be as specified in CCITT Recommendation I.220.

Annex 4

CIRCUIT-MODE ALTERNATE SPEECH/64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

1. DEFINITION

This bearer service category provides the alternate of either speech or 64 kbit/s unrestricted digital information within the same call.
The request for this alternate capability and the initial mode desired by the users must be identified at call setup time.

2. DESCRIPTION

2.1. General Description

This service is provided for the support of multiple capability terminals or single capability terminals.

For the speech mode of this bearer service category the same applies as for the speech bearer service category. For the unrestricted mode of this bearer service category the same applies as for the unrestricted (Note 1) bearer service category.

Note 1: During an interim period some networks may only support restricted 64 kbit/s digital information transfer capability, i.e. information transfer capability solely restricted by the requirement that the all-zero octet is not allowed. For interworking the rules given in Appendix 1 of Recommendation I.340 should apply. The interworking functions have to be provided in the network with restricted 64 kbit/s capability. The ISDN with 64 kbit/s transfer capability will not be affected by this interworking, other than by conveying the appropriate signalling message to and from the ISDN terminal.

Note 2: Initially, this service will only be applicable to multiple capability terminals. All references to single capability terminals reflect possible future enhancements and are subject to change and have only been included for information.

Once the connection is established, the user may repeatedly request, via appropriate signalling messages, to alternate from speech mode to 64 kbit/s unrestricted digital mode, or vice versa. The in-call modification shall be provided on a per call basis.

2.2. Specific Terminology

None identified.

CIRCUIT-MODE ALTERNATE SPEECH/64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE

2.3. Qualifications on the Applicability to Telecommunication Services

None identified.

3. PROCEDURES

3.1. Provision and Withdrawal

This service shall be provided by pre-arrangement with the network operator.

3.2. Normal Procedures

3.2.1. Activation, Deactivation and Registration

Not applicable.

3.2.2. Invocation and Operation

At the start of the call the request for an alternate speech/64 kbit/s unrestricted call and the initial mode, either speech or 64 kbit/s unrestricted call, must be identified. Following call set-up, the calling or called party may choose to modify the characteristics of the call during the conversation/data phase. During call establishment, the network shall choose a suitable route according to the information included in the setup message.

Depending on the terminal capability type the following procedures will apply:

a) for multiple capability terminals, the requesting user will send an invoke in-call modification request to the network;
b) for single capability terminals, the requesting user will change over the connection from the first terminal to the second terminal before sending an invoke in-call modification request to the network.

The network will on receipt of the in-call modification request from the calling/called party check if that call modification is allowed and if necessary resources are available.

If acceptable, the resources are reserved and an invoke in-call modification request is sent to the distant end. A timer will be started to supervise that the in-call modification is received successfully.

Depending on the terminal configuration at the destination end, the following procedures will occur:

a) for multiple capability terminals the distant user, if agreeing with the service change-over, will transmit a return result indication while the resources in the network are switched in, if reserved, and the call modification indication is sent to the initiating party;
b) for single capability terminals a call change-over will be performed from the first terminal to the second terminal. An in-call modification return result will be sent to the network which will switch in the resources, if reserved previously.

CIRCUIT-MODE ALTERNATE SPEECH/64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

3.3. User Requirements in case of Unsuccessful Outcome

3.3.1. *Activation/Deactivation/Registration*

Not applicable.

3.3.2. *Invocation and Operation*

If the network fails to change resources on receipt of the in-call modification return request, the connection will be cleared with a cause indication "temporary failure".

If on receipt of a call modification invocation request an exchange determines that in-call modification is not allowed, or not possible, a call modification return error indication will be sent. Receipt of the call modification return error indication will cause the reserved resources to be freed and the call modification return error indication to be delivered to the initiating party.

In case of in-call modification failure, the initiation terminal will resume to transmit and receive the bit stream for the old service having received the in-call modification return error indication.

3.4. Alternate Procedures

None identified.

4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the subscriber accurately for the service.

5. INTERCOMMUNICATION CONSIDERATIONS

5.1. Interworking with Non-ISDNs

Interworking is required between the ISDN and the PSTN for this bearer service category.

Calls from the PSTN will be presented to users in the ISDN using this bearer service category.

Calls using this bearer service can be terminated in the PSTN and the calling user shall be given an indication that interworking occurred.

5.2. Interworking with Private ISDNs

The situation where the communicating users are attached to a private ISDN and a public ISDN is detailed in clauses 2 and 3.

CIRCUIT-MODE ALTERNATE SPEECH/64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability with this bearer service category.

If the in-band communication is interrupted by the network as a result of one user invoking a supplementary service (e.g. the Call Hold supplementary service or the Terminal Portability supplementary service) then the network shall provide an appropriate indication in the B-channel.

Note: Users are advised to hold the end-to-end in-band information transfer prior to invoking such supplementary services.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	64 kbit/s
3. Information transfer capability	Alternately speech (Note 1) or unrestricted digital information 8 kHz integrity
4. Structure	8 kHz integrity
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry	Bidirectional symmetric
7. Communication configuration	Point-to-point/multipoint
Access attributes:	
8. Access channel	B for user information D for signalling (Note 2)
9. Access protocol	I-Series for D-channel
General attributes:	
10. Supplementary services provided	
11. Quality of service (Note 3)	
12. Interworking possibilities	
13. Operational and commercial	

Note 1: When crossing an international boundary between network operators which employ different encoding laws, the network shall perform the necessary A-μ law conversion (see Recommendation G.711).

CIRCUIT-MODE ALTERNATE SPEECH/64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

Note 2: For reserved/permanent services the operational, administrative, and maintenance messages (OAM) related to these services may be conveyed over the D-channel.

Note 3: A short service change over time (with high probability of not being exceeded) has been tentatively identified as a requirement.

7.2. Provision of Individual Bearer Services

In the following table the provision of individual circuit-mode alternate speech/64 kbit/s unrestricted 8 kHz structured bearer services is given. The definition of E (Essential) and A (Additional) can be found in CCITT Recommendation I.230.

a) Overall Provision: E (Note 1)

b) Variations of secondary attributes

Establishment of Communication		Symmetry	Communication Configuration	Provision
I.231.4/1	Demand	Bidirectional	pt-pt	E
I.231.4/2	Reserved		pt-pt	A
I.231.4/3	Permanent		pt-pt	E
I.231.4/4	Demand	Bidirectional	multipt	A
I.231.4/5	Reserved		multipt	A
I.231.4/6	Permanent		multipt	A

c) Access

Signalling and OAM (Note 2)		User Information		
Channel & Rate	Protocols	Channel & Rate	Protocols	Provision
D(16)	I.451 (Note 3)	B(64)	G.711/ user-defined	E
D(64)	I.451 (Note 3)	B(64)	G.711/ user-defined	E

Note 1: Some networks will offer the speech phase of these services in a manner identical to the 3.1 kHz audio service.

Note 2: Definition of protocols for OAM is not yet available.

Note 3: Demand services only.

8. DYNAMIC DESCRIPTION

The dynamic description for this service is not yet available.

Annex 5

CIRCUIT-MODE 2x64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

1. DEFINITION

This bearer service category provides the unrestricted transfer of two 64 kbit/s user information flows over two B-channels at the user network interface.

2. DESCRIPTION

This bearer service is the same as 64 kbit/s unrestricted but offers two B-channels routed together. It may be used for Videophone or data applications.

3. PROCEDURES

3.1. Provision and Withdrawal

3.1.1. Provision of this bearer service category shall be by prior arrangement with the network operator.

3.1.2. As a network option this bearer service category can be offered with several subscription options which shall apply separately to an ISDN number or a group of ISDN numbers on the interface. For each subscription option, only one value can be selected.

It should be noted that in this context an interface may consist of a group of physical interfaces.

Subscription options for the interface are summarised below:

Subscription Option	Value
Maximum number of information channels available	m, where m is not greater than the number of information channels on the interface
Maximum number of total calls present	n, where n is not greater than the number of information channels on the interface

The user can be identified by an ISDN number or a group of ISDN numbers on the interface.

More than one ISDN number can be associated with the interface only as part of a supplementary service such as the Multiple Subscriber Number supplementary service. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. the Call Waiting supplementary service).

As a network option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

3.2. Normal Procedures

All user-network signalling shall be performed over the D-channel. The network shall provide out-of-band indication to indicate call progress.

3.2.1. *Originating the Call (Call Establishment)*

A call is originated by the served user requesting from the network the required bearer service category. This request shall include an ISDN number identifying the called user. Other information as required for the bearer service and other information which may be required for use by the network in the supplementary service provided to the called user (e.g. Calling Line Identification Presentation supplementary service) may also be included.

The identity of the called user can be given to the network either en-bloc, containing all required information, or not en-bloc.

3.2.2. *Indication during Call Establishment*

After initiating a call the calling user shall receive an acknowledgement that the network is able to process the call. The called user shall receive an indication of the arrival of an incoming call of this bearer service category.

When an indication is received by the network that the called user is being informed of this call, the calling user shall also be given an indication that the incoming call is being offered to the called user.

When the connection is established, an indication of this shall be sent to the calling user. The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. the Calling Line Identification Presentation supplementary service).

Once the connection is established, the B-channel is then available for transmission of 64 kbit/s digital signals in both directions continuously and simultaneously, without alteration by the network. No restriction is placed by the network on the content of the digital signals (see note of clause 2).

3.2.3. *Terminating the Call*

The call may be terminated by either of the users by indicating this to the network. If one user terminates the call and the other user has not yet terminated the call, an appropriate indication shall be sent to the other user.

CIRCUIT-MODE 2x64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

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4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the subscriber accurately for the service.

5. INTERCOMMUNICATION CONSIDERATIONS

Not applicable.

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	2x64 kbit/s
3. Information transfer capability	Unrestricted (Note 1)
4. Structure	8 kHz integrity with Restricted Differential Time Delay (RDTD)
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry	Bidirectional symmetric/bidirectional/asymmetric/unidirectional
7. Communication configuration:	Point-to-point/multipoint
Access attributes:	
8. Access channel	Two B(64) for user information
9. Access protocol	I-Series for D-channel
General attributes:	
10. Supplementary services provided	
11. Quality of service	
12. Interworking possibilities	
13. Operational and commercial aspects	

Note 1: Digit Sequence Integrity (DSI) is ensured for each elementary 64 kbit/s information.

CIRCUIT-MODE 2x64 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

7.2. Provision of Individual Bearer Services

In the following table the provision of individual circuit-mode 2x64 kbit/s unrestricted 8 kHz structured bearer services is given. The definition of E (Essential) and A (Additional) can be found in CCITT Recommendation I.230.

a) Overall Provision: A

b) Variations of secondary attributes

Establishment of Communication		Symmetry	Communication Configuration	Provision
I.231.5/1	Demand	Bidirectional	pt-pt	E
I.231.5/2	Reserved		pt-pt	A
I.231.5/3	Permanent		pt-pt	E
	other combinations			A

c) Access

Signalling and OAM (Note 1)		User Information		
Channel & Rate	Protocols	Channel & Rate	Protocols	Provision
D(16)	I.451 (Note 2)	2xB(64)	user-defined	E
D(64)	I.451 (Note 2)	2xB(64)	user-defined	E

Note 1: Definition of protocols for OAM is not yet available.

Note 2: Demand services only.

8. DYNAMIC DESCRIPTION

The dynamic description for this service is not yet available.

Annex 6

CIRCUIT-MODE 384 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

1. DEFINITION

This bearer service category provides the unrestricted transfer of 384 kbit/s user information over a H0-channel at S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel in the same or in another interface structure.

2. DESCRIPTION

This bearer service is the same as 64 kbit/s unrestricted but offers six B-channels routed together. It may be used for videoconferencing or data applications.

3. PROCEDURES

3.1. Provision and Withdrawal

3.1.1. Provision of this bearer service category shall be by prior arrangement with the network operator.

3.1.2. As a network option this bearer service category can be offered with several subscription options which shall apply separately to an ISDN number or a group of ISDN numbers on the interface. For each subscription option, only one value can be selected.

It should be noted that in this context an interface may consist of a group of physical interfaces.

Subscription options for the interface are summarised below:

Subscription Option	Value
Maximum number of information channels available	m, where m is not greater than the number of information channels on the interface
Maximum number of total calls present	n, where n is not greater than the number of information channels on the interface

The user can be identified by an ISDN number or a group of ISDN numbers on the interface.

More than one ISDN number can be associated with the interface only as part of a supplementary service such as the Multiple Subscriber Number supplementary service. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. the Call Waiting supplementary service).

As a network option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

3.2. Normal Procedures

All user-network signalling shall be performed over the D-channel. The network shall provide out-of-band indication to indicate call progress.

3.2.1. *Originating the Call (Call Establishment)*

A call is originated by the served user requesting from the network the required bearer service category. This request shall include an ISDN number identifying the called user. Other information as required for the bearer service and other information which may be required for use by the network in the supplementary service provided to the called user (e.g. the Calling Line Identification Presentation supplementary service) may also be included.

The identity of the called user can be given to the network either en-bloc, containing all required information, or not en-bloc.

3.2.2. *Indication during Call Establishment*

After initiating a call the calling user shall receive an acknowledgement that the network is able to process the call. The called user shall receive an indication of the arrival of an incoming call of this bearer service category.

When an indication is received by the network that the called user is being informed of this call, the calling user shall also be given an indication that the incoming call is being offered to the called user.

When the connection is established, an indication of this shall be sent to the calling user. The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. the Calling Line Identification Presentation supplementary service).

Once the connection is established, the B-channel is then available for transmission of 64 kbit/s digital signals in both directions continuously and simultaneously, without alteration by the network. No restriction is placed by the network on the content of the digital signals (see note of clause 2).

3.2.3. *Terminating the Call*

The call may be terminated by either of the users by indicating this to the network. If one user terminates the call and the other user has not yet terminated the call, an appropriate indication shall be sent to the other user.

CIRCUIT-MODE 384 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the subscriber accurately for the service.

5. INTERCOMMUNICATION CONSIDERATIONS

Not applicable.

6. INTERACTIONS WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	384 kbit/s
3. Information transfer capability	Unrestricted
4. Structure:	8 kHz integrity
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry	Bidirectional symmetric/bidirectional asymmetric/unidirectional (Note)
7. Communication configuration	Point-to-point/multipoint
Access attributes:	
8. Access channel:	HO (384) for user information, D(16) or D(64) for OAM information
9. Access protocol:	I-Series for D-channel
General attributes:	
10. Supplementary services provided	
11. Quality of service	
12. Interworking possibilities	
13. Operational and commercial aspects	

CIRCUIT-MODE 384 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

7.2. Provision of Individual Bearer Services

In the following table the provision of individual circuit-mode 384 kbit/s unrestricted 8 kHz structured bearer services is given. The definition of E (Essential) and A (Additional) can be found in CCITT Recommendation I.230.

a) Overall Provision: A

b) Variations of secondary attributes

Establishment of Communication		Symmetry	Communication Configuration	Provision
I.231.6/1	Demand	Bidirectional	pt-pt	A
I.231.6/2	Reserved	Bidirectional	pt-pt	E
I.231.6/3	Permanent	Bidirectional	pt-pt	E
I.231.6/4	Reserved	Unidirectional	pt-pt	A
I.231.6/5	Permanent	Unidirectional	pt-pt	A
I.231.6/6	Reserved	Bidirectional	multipt	A
I.231.6/7	Permanent	Bidirectional	multipt	A
I.231.6/8	Reserved	Unidirectional	multipt	A
I.231.6/9	Permanent	Unidirectional	multipt	A

c) Access

Signalling and OAM (Note 1)		User Information		
Channel & Rate	Protocols	Channel & Rate	Protocols	Provision
D(64)	I.451 (Note 2)	HO (384)	user-defined	E
D(16)	I.451 (Note 2)	HO (384)	user-defined	E

Note 1: Definition of protocols for OAM is not yet available.

Note 2: Demand services only.

8. DYNAMIC DESCRIPTION

The dynamic description for this service is not yet available.

Annex 7

CIRCUIT-MODE 1920 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

1. DEFINITION

This bearer service category provides the unrestricted transfer of 1920 kbit/s user information over a H12-channel at the S/T reference point. The transfer of OAM information for reserved and permanent services may be provided over a D-channel.

2. DESCRIPTION

This bearer service is the same as 64 kbit/s unrestricted but offers 30 B-channels routed together. It may be used for videoconferencing or data applications.

3. PROCEDURES

3.1. Provision and Withdrawal

3.1.1. Provision of this bearer service category shall be by prior arrangement with the network operator.

3.1.2. As a network option this bearer service category can be offered with several subscription options which shall apply separately to an ISDN number or a group of ISDN numbers on the interface. For each subscription option, only one value can be selected.

It should be noted that in this context an interface may consist of a group of physical interfaces.

Subscription options for the interface are summarised below:

Subscription Option	Value
Maximum number of information channels available	m, where m is not greater than the number of information channels on the interface
Maximum number of total calls present	n, where n is not greater than the number of information channels on the interface

The user can be identified by an ISDN number or a group of ISDN numbers on the interface.

More than one ISDN number can be associated with the interface only as part of a supplementary service such as the Multiple Subscriber Number supplementary service. In the case of one ISDN number, the option given above for the number of calls can only exceed the number of information channels in association with a supplementary service (e.g. the Call Waiting supplementary service).

As a network option, separate values may be specified for incoming and for outgoing calls for either or both of the limits.

3.2. Normal Procedures

All user-network signalling shall be performed over the D-channel. The network shall provide out-of-band indication to indicate call progress.

3.2.1. *Originating the Call (Call Establishment)*

A call is originated by the served user requesting from the network the required bearer service category. This request shall include an ISDN number identifying the called user. Other information as required for the bearer service and other information which may be required for use by the network in the supplementary service provided to the called user (e.g. Calling Line Identification Presentation supplementary service) may also be included.

The identity of the called user can be given to the network either en-bloc, containing all required information, or not en-bloc.

3.2.2. *Indication during Call Establishment*

After initiating a call the calling user shall receive an acknowledgement that the network is able to process the call. The called user shall receive an indication of the arrival of an incoming call of this bearer service category.

When an indication is received by the network that the called user is being informed of this call, the calling user shall also be given an indication that the incoming call is being offered to the called user.

When the connection is established, an indication of this shall be sent to the calling user. The called user may also provide other information for use by the network in supplementary services provided to other users (e.g. the Calling Line Identification Presentation supplementary service).

Once the connection is established, the B-channel is then available for transmission of 64 kbit/s digital signals in both directions continuously and simultaneously, without alteration by the network. No restriction is placed by the network on content of the digital signals (see note of clause 2).

3.2.3. *Terminating the Call*

The call may be terminated by either of the users by indicating this to the network. If one user terminates the call and the other user has not yet terminated the call, an appropriate indication shall be sent to the other user.

CIRCUIT-MODE 1920 KBIT/S UNRESTRICTED 8 KHZ STRUCTURED BEARER SERVICE CATEGORY

4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the subscriber accurately for the service.

5. INTERCOMMUNICATION CONSIDERATIONS

Not applicable.

6. INTERACTIONS WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Circuit
2. Information transfer rate	1920 kbit/s
3. Information transfer capability	Unrestricted
4. Structure	8 kHz integrity
5. Establishment of communication	Demand/reserved/permanent
6. Symmetry:	Bidirectional symmetric/bidirectional asymmetric/unidirectional (Note)
7. Communication configuration:	Point-to-point/multipoint
Access attributes:	
8. Access channel	H12 (1920) for user information, D(64) for OAM information
9. Access protocol	I-Series for D-channel
General attributes:	
10. Supplementary services provided	See Recs T/CAC S 10.5 to 10.7 and CCITT Rec. I.250
11. Quality of service	
12. Interworking possibilities	See Recommendation T/CAC S 10.4
13. Operational and commercial aspects	See CEPT: User Handbook, ISDN

CIRCUIT-MODE 1920 KBIT/S UNRESTRICTED 8 KHZ
STRUCTURED BEARER SERVICE CATEGORY

7.2. Provision of Individual Bearer Services

In the following table the provision of individual circuit-mode 1920 kbit/s unrestricted 8 kHz structured bearer services is given. The definition of E (Essential) and A (Additional) can be found in CCITT Recommendation I.230.

a) Overall Provision: A

b) Variations of secondary attributes

Establishment of Communication		Symmetry	Communication Configuration	Provision
I.231.8/1	Demand	Bidirectional	pt-pt	A
I.231.8/2	Reserved	Bidirectional	pt-pt	E
I.231.8/3	Permanent	Bidirectional	pt-pt	E
I.231.8/4	Reserved	Unidirectional	pt-pt	A
I.231.8/5	Permanent	Unidirectional	pt-pt	A
I.231.8/6	Reserved	Bidirectional	multipt	A
I.231.8/7	Permanent	Bidirectional	multipt	A
I.231.8/8	Reserved	Unidirectional	multipt	A
I.231.8/9	Permanent	Unidirectional	multipt	A

c) Access

Signalling and OAM (Note 1)		User Information		
Channel & Rate	Protocols	Channel & Rate	Protocols	Provision
D(64)	I.451 (Note 2)	H12 (1920)	user-defined	E

Note 1: Definition of protocols for OAM is not yet available.

Note 2: Demand services only.

8. DYNAMIC DESCRIPTION

The dynamic description for this service needs further study and is not yet available.

Annex 8

ISDN VIRTUAL CALL (VC) AND PERMANENT VIRTUAL CIRCUIT (PVC) BEARER SERVICES PROVIDED ON THE B-CHANNEL OF THE USER ACCESS: BASIC AND PRIMARY RATE

1. DEFINITION

This bearer service category provides unrestricted transfer (without alteration) of user information in a packetised manner over a virtual circuit on a B-channel between reference points via the basic and primary rate access.

2. DESCRIPTION

This service is described for both the point-to-multipoint and point-to-point configurations. This covers the passive bus and NT2 access arrangements.

This packet-mode bearer service allows users (e.g. terminals) in a point-to-point communication configuration to communicate via the ISDN using X.25 encoding, by means of procedures over a B-channel in both directions continuously and simultaneously, for the duration of a call as described in Draft ETS T/S 46-50 (CCITT Recommendation I.462/X.31). User class 30, as described in CCITT Recommendation X.1, is supported.

Note: In case of access via Terminal Adapter (TA) the following user classes are supported at the R reference point: 8-13 (see CCITT Recommendation X.1).

Each of the reference points can be either an S or coincident S and T reference point.

Note: Network operators can also provide information transfer with the same attributes where the reference point is T.

3. PROCEDURES

This Recommendation makes use of ETS 300 007 (CCITT Recommendation I.462/X.31, case B), which is a stage 3 standard, in order to provide a description of the procedures. This mechanism would not normally be used in a stage 1 description.

3.1. Provision and Withdrawal

This service shall be provided either by prior arrangement with the network operator or be available on a general basis.

The user can have subscription to a specific X.25 profile (essential for PVC operation) or to a standard service profile as described in Appendix A.

3.2. Normal Procedures

3.2.1. *Activation, Deactivation and Registration*

Not applicable.

3.2.2. *Invocation and Operation*

Virtual call and permanent virtual circuit procedures can be invoked and operated concurrently by a given terminal.

3.2.2.1. Virtual Call Procedures

If a B-channel has already been established between the terminal and the Packet Handler (PH), then X.25 packet layer calls may be made over an active LAPB data link. If no such B-channel connection exists, then channel establishment procedures are needed to provide a communication path between the terminal and the packet handler.

3.2.2.1.1. Layer 1 Activation and Channel Establishment

Layer 1 shall be permanently active or activated on demand by the DTE or the packet handler. The procedures for layer 1 activation depend on methods for layer 2 activation; see following sections. For Primary Rate Access (PRA) layer 1 is permanently active.

A B-channel connection to the packet handler is either semi-permanent or shall be established on demand. In the latter case detailed procedures for channel establishment by the terminal or by the network are to be found in T/S 46-50 using T/S 46-30 signalling procedures.

3.2.2.1.2. Layer 2 Activation (B-channel)

Two different methods of layer 2 activation can be identified:

Method 1 - Semi-permanent Layer 2
An X.25 LAPB link is activated at subscription time. The network shall keep the data link in the activated state. A permanent B-channel connection is required to the packet handler.

Method 2 - On-Demand Layer 2
A LAPB link is activated, in accordance with CCITT Recommendation X.25, over the B-channel. Its activation is initiated either by the TA/TE1 or the network.

3.2.2.1.3. Terminal Selection/Identification

For certain applications the subscription to the Multiple Subscriber Number or the Direct Dialling In supplementary service is necessary for the purpose of terminal selection.

For certain applications for outgoing calls the calling party number and/or the calling party sub-address shall be sent to the network by the calling user during call setup and used by the network as a network option for terminal identification or selection of the user's profile.

Public networks conforming to this Recommendation do not provide channel negotiation.

Successive incoming calls to the same ISDN number shall be directly multiplexed on an already established B-channel, irrespective of information contained in the X.25 called address extension facility field.

Note: In the case of no notification class the packet handler could make use of this information to identify a specific B-channel (Annex G of CCITT Recommendation X.25). This would be a non-standard use of a facility intended to support the OSI network service.

3.2.2.1.4. Call Establishment

T/S 46-50 procedures using T/S 46-30 signalling may be used to notify the user of incoming calls when conditional notification is applicable. Networks will provide at least one of the two notification classes defined in T/S 46-50: no notification class and conditional notification class. These classes may be provided on a network option basis.

X.25 packet layer call establishment procedures are operated on an active LAPB link.

Note: There is only one LAPB link active per B-channel.

3.2.2.1.5. Data Transfer

X.25 packet layer data transfer procedures apply.

3.2.2.1.6. Terminating the Call

X.25 packet layer call clearing procedures apply.

3.2.2.1.7. Layer 2 Deactivation

The terminal/network should deactivate the LAPB link after clearing the last VC unless layer 2 is semi-permanent or follow-on calls are expected.

3.2.2.1.8. Layer 1 Deactivation and Channel Release

After clearing the last VC the terminal/network should release the established B-channel (T/S 46-50 procedures), unless it is semi-permanent or follow-on calls are expected.

Layer 1 should be deactivated (from the network side only) if it is not needed by other services. However, it has to remain active for semi-permanent layer 2. Layer 1 is permanently active for Primary Rate Access (PRA).

3.2.2.2. Permanent Virtual Circuit Procedures

3.2.2.2.1. Layer 1 Activation and Channel Establishment

Layer 1 must be permanently active. The B-channel has to be established at subscription time. In addition, some networks may offer PVCs by using on-demand connections. In this case the user is identified by a specific E.164 number (MSN/DDI) and has a customised service profile. Furthermore, the user is responsible for initiating (and maintaining) the B-channel. The no notification class according to T/S 46-50, subclause 4.2.3.16, applies for VCs on these B-channels.

3.2.2.2.2. Layer 2 Activation

Layer 2 must be permanently active.

3.2.2.2.3. Terminal Selection and Identification

Fixed at subscription time.

3.2.2.2.4. Call Establishment

Not applicable.

3.2.2.2.5. Data Transfer

X.25 packet layer data transfer procedures apply.

3.2.2.2.6. Terminating the Call

Not applicable.

3.2.2.2.7. Layer 2 Deactivation

Layer 2 must be permanently active.

3.2.2.2.8. Layer 1 Deactivation and Channel Release

Layer 1 shall be permanently active. The B-channel shall be permanently established.

3.2.3. *Interrogation and Editing*

Not applicable.

3.3. Exceptional Procedures

3.3.1. *Activation, Deactivation and Registration*

Not applicable.

3.3.2. *Invocation and Operation*

3.3.2.1. Virtual Call

Control of the User Packet Handler B-channel:
In the case of calling/called user error, user state, or network conditions such as the temporary unavailability of the packet handler appropriate failure indications shall be signalled from the network to the user and the B-channel establishment or established B-channel shall be terminated.

The B-channel should not be released by the user until all X.25 virtual calls have been cleared. In the event of the user releasing the B-channel whilst existing X.25 calls are still in progress, the X.25 calls shall be cleared by the network and appropriate indications given to the user.

Control of X.25 Calls:
In the case of the X.25 call(s), then the procedures of X.25 shall apply.

3.3.2.2. Permanent Virtual Circuit

Control of the User Packet Handler B-channel:
For the on-demand option, in the case of calling/called user error, user state or network conditions, such as the temporary unavailability of the packet handler appropriate failure indications shall be signalled from the network to the user and the B-channel establishment or established B-channel shall be terminated.

The B-channel should not be released by the user. In the event of the B-channel being released the user shall re-establish the B-channel.

Control of the PVC:
In the case of the PVC, then the procedures of CCITT Recommendation X.25 shall apply.

3.3.3. *Interrogation and Editing*

Not applicable.

4. NETWORK CAPABILITIES FOR CHARGING

Charging principles should be similar to those for existing PSPDNs. Additional charging capabilities for the access to the packet handler may be required.

5. INTERCOMMUNICATION CONSIDERATIONS

5.1. Interworking between Public Networks

Full interworking must be ensured between this service and:

- existing PSPDN services
- other ISDN Virtual Call and Permanent Virtual Circuit services

This interworking shall be ensured without any service restrictions. However, degradation to some quality of service parameters, e.g. call setup time, may be experienced in some cases.

5.2. Interworking between Private and Public ISDNs

This stage 1 description applies to B-channels which have been extended into a private ISDN whereby the private ISDN may or may not provide packet handling functions.

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. Values of Attributes

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Packet
2. Information transfer rate	Note: B-channel information transfer is 64 kbit/s. However, the throughput achieved depends on several conditions such as window size, characteristics of the destination DTE, and network conditions.
3. Information transfer capability	Unrestricted
4. Structure	Service data unit integrity
5. Establishment of communication	Demand/permanent
6. Symmetry	Bidirectional symmetric
7. Communication configuration	Point-to-point
Access attributes:	
8. Access channel	B-channel
9. Access protocol	
General attributes:	
10. Supplementary services and user facilities provided	Multiple Subscriber Number; Direct Dialling In; Sub-addressing Note: Only used in conditional notification for the first call to a DTE. Standard facilities according to CCITT Recommendation X.2 are offered, see Appendix B.
11. Quality of service	Generally in line with QOS experienced on PSPDNs. Degradation to some parameters, e.g. call setup time, may be experienced in some cases.
12. Interworking possibilities	See clause 5.
13. Operational and commercial aspects	See CEPT User Handbook, ISDN

7.2. **Provision of Individual Bearer Services**

a) Overall provision: Additional (A)

b) Variations of secondary attributes:

Information Transfer Rate	Establishment of Communication	Symmetry	Communication Configuration	Provision
See Attribute 2	Demand	Bidirectional symmetric	Point-to-point	A
See Attribute 2	Permanent	Bidirectional symmetric	Point-to-point	A

Appendix A

STANDARD SERVICE PROFILE

The following service profile is defined to be applicable to users who has not subscribed to a different, specific service profile. Support of the OSI network layer service is a general requirement of this standard service profile.

- Single link procedure, modulo 8
- Standard basic packet sequence numbering (modulo 8)
- Incoming/outgoing calls allowed
- Two-way logical channels: 2
- Default maximum packet length: 128 octets
- Default window size: 2
- Fast select acceptance facility
- Default throughput class: A (9600 bits/s)
- Throughput class negotiation facility available
- Transit delay negotiation allowed
- CCITT-specified DTE facilities to support the OSI network service (Annex G to CCITT Recommendation X.25)

Note: Type of address and numbering plan identifier will be available in the future (at the latest by time T).

Note: No other facilities available.

ISDN PACKET-MODE BEARER SERVICES (PMBS), B-CHANNEL

Appendix B

USER FACILITIES

X.2 (Version 84)		User Classes of Service provided by			
		CCITT		CEPT	
Optional User Facility		VC	PVC	VC	PVC
1.	OPTIONAL USER FACILITIES ASSIGNED FOR AN AGREED CONTRACTUAL PERIOD				
1.1.	Extended packet sequence numbering (modulo 128)	A	A	N	N
1.2.	Non-standard default window sizes	A	A	E	E
1.3.	Non-standard default packet sizes: 16, 32, 64, 2048, 4096	A	A	N	N
	256	A	A	E	E
	512, 1024	A	A	A	A
1.4.	Default throughput class assignment	A	A	E	E
1.5.	Flow control parameter negotiation	E	-	E	-
1.6.	Throughput class negotiation	E	-	E	-
1.7.	Packet retransmission	A	A	N	N
1.8.	Incoming calls barred	E	-	E	-
1.9.	Outgoing calls barred	E	-	E	-
1.10.	One-way logical channel outgoing	E	-	E	-
1.11.	One-way logical channel incoming	A	-	E	-
1.12.	Closed user group	E	-	E	-
1.13.	Closed user group with outgoing access	A	-	E	-
1.14.	Closed user group with incoming access	A	-	E	-
1.15.	Incoming calls barred within a closed user group	A	-	E	-
1.16.	Outgoing calls barred within a closed user group	A	-	E	-
1.17.	Bilateral closed user group	A	-	N	-
1.18	Bilateral closed user group within outgoing access	A	-	N	-
1.19.	Reverse charging acceptance	A	-	E	-
1.20	Fast select acceptance	E	-	E	-
1.21.	Multi-link procedure	A	A	A	A
1.22.	Charging information	A	-	A	-
1.23.	Direct call	A	-	N	-
1.24.	Hunt group	A	-	A	-
1.25.	On-line facility registration	A	-	A	-
1.26.	D-bit modification	A	A	N	N
1.27.	Local charge prevention	A	-	A	-
1.28.	Call redirection	A	-	E	-
1.29.	Network user identification	A	-	A	-
1.30.	Extended frame sequence numbering	A	A	N	N
1.31.	RPOA selection	A	-	N	-
2.	OPTIONAL USER FACILITIES ON A PER CALL BASIS				
2.1.	Closed user group selection	E	-	E	-
2.2.	Bilateral closed user group selection	A	-	N	-
2.3.	Reverse charging (Note 1)	A	-	E	-
2.4.	RPOA selection	A	-	N	-
2.5.	Flow control parameter negotiation	E	-	E	-
2.6.	Fast select	E	-	E	
2.7.	Throughput class negotiation	E	-	E	-
2.8.	Abbreviated address calling	A	-	N	-
2.9.	Charging information	A	-	A	-
2.10.	Transit delay selection and indication	E	-	E	-
2.11.	Call redirection or forwarding to alternate DTE	A	-	A	-
2.12.	Called line address modified notification	A	-	E	-
2.13.	Network user identification	A	-	A	-
2.14.	Closed user group with outgoing access selection	A	-	A	-

ISDN PACKET-MODE BEARER SERVICES (PMBS), B-CHANNEL

X.2 (Version 84)		User Classes Service provided by CCITT		CEPT	
Optional User Facility		VC	PVC	VC	PVC
3.	ADDITIONAL FEATURES				
3.1.	Extended interrupt	E	E	E	E
3.2.	CCITT-specified DTE facilities	E	-	E	-
4.	NEW FACILITIES FROM X.2 (Version 88)				
4.1.	Call deflection subscription	A	-	A	-
4.2.	Call deflection selection	A	-	A	-
4.3.	TOA/NPI address subscription	A	-	Note 2	-
4.4.	NUI override	A	-	A	-

Notes:

A:	Additional
E:	Essential for conformance
N:	Presently not offered, unlikely to be available on many networks in the future
1):	For the time being, only for national use
2):	In the future (at the latest time)

DTE:	Data Terminating Equipment
PVC:	Permanent Virtual Calls
NPI:	Numbering Plan Indicator
NUI:	Network User Identification
TOA:	Type Of Address
VC:	Virtual Calls

Annex 9

ISDN VIRTUAL CALL (VC) AND PERMANENT VIRTUAL CIRCUIT (PVC) BEARER SERVICES PROVIDED ON THE D-CHANNEL OF THE USER ACCESS: BASIC AND PRIMARY RATE

1. DEFINITION

This bearer service category provides the unrestricted transfer (without alteration) of user information in a packetised manner over a virtual circuit on a D-channel between reference points.

2. DESCRIPTION

This service is described for both the point-to-multipoint and point-to-point configurations. This covers the passive bus and NT2 access arrangements.

This packet-mode bearer service allows users (e.g. terminals) in a point-to-point communication configuration to communicate via the ISDN using X.25 encoding by means of procedures over a D-channel in both directions continuously and simultaneously for the duration of a call as described in Draft ETS T/S 46-50 (Recommendation I.462/X.31).

No distinct class is defined for the D-channel at 16 kbit/s. The use of class 30 may be available if the primary rate access (D-channel at 64 kbit/s) is offered.

Note: In case of access via Terminal Adapter (TA) the following user classes are supported at the R reference point: 8-10 and in addition, 11 or 13 on a 64 kbit/s D-channel (see CCITT Recommendation X.1).

Each of the reference points can be either an S or coincident S and T reference point.

Note: Network operators can also provide information transfer with the same attributes where the reference point is T.

3. PROCEDURES

This Recommendation makes use of ETS 300 007, which is a stage 3 standard, in order to provide a description of the procedures. This mechanism would not normally be used in a stage 1 description.

3.1. Provision and Withdrawal

This service shall be provided either by prior arrangement with the network operator or be available on a general basis.

The user can have subscription to a specific X.25 profile or to a standard service profile as described in Appendix A.

3.2. Normal Procedures

3.2.1. *Activation, Deactivation and Registration*

Not applicable.

3.2.2. *Invocation and Operation*

Virtual call and permanent virtual circuit procedures can be invoked and operated concurrently by a given terminal.

3.2.2.1. Virtual Call Procedures

3.2.2.1.1. Layer 1 Activation

Layer 1 shall be permanently active or activated on demand by the DTE or the Packet Handler (PH). For Primary Rate Access (PRA) layer 1 is permanently active.

3.2.2.1.2. Layer 2 Activation (Logical Link)

All packet information is conveyed in logical links identified by SAPI=16. Each terminal has its own logical link (SAPI=16) identified by TEI value.

Three different methods of layer 2 activation can be identified as network options:

Method 1 - Semi-permanent Layer 2
Logical links between the TA/TE1 and the network (packet handler) are activated at subscription time. The network shall keep the data link layer in the activated state.

Method 2 - On-demand Layer 2 with fixed TEI Values (See T/S 46-20)
The TEI of the TA/TE1 is assigned at subscription time (known by the network) i.e. manual TEI assignment is used. The activation of a logical link is initiated either by the TA/TE1 or the network depending on the direction of the first virtual call. No T/S 46-30 procedures are used.

Method 3 - On-demand Layer 2 with Dynamic TEI Allocation (See T/S 46-20)
The activation of a logical link is initiated either by the TA/TE1 or the network depending on the direction of the first virtual call. In the case of incoming calls (network to user), T/S 46-30 call offering procedure (conditional notification class according to ETSI T/S 46-50) may be used to interrogate the layer 2 address (TEI) to be used for the call.

NT2s may use multiple layer 2 connections (i.e. multiple TEIs) concurrently. However, this multiplexed layer 2 packet transfer capability implies that the incoming calls, if notification takes place, are notified via the broadcast link (SAPI=0) in order to allow the user (i.e. the NT2) to respond on the appropriate SAPI 0 data link, corresponding to the SAPI = 16 data link to be used for the X.25 incoming call packet presentation.

3.2.2.1.3. Terminal Selection/Identification

3.2.2.1.3.1. Terminal Interface Identification - Network to Terminal

Users can operate several packet terminals in their in-house installation. In general, an ISDN number is used to identify a user access. In addition, the Multiple Subscriber Number or Direct Dialling In facilities may be used, thus allowing users to allocate a specific ISDN number to a given terminal/terminal adaptor.

The packet handler selects a specific logical link (terminal) based on the ISDN number. Successive incoming calls to the same ISDN number shall be directly multiplexed on an already established logical link, irrespective of information contained in the X.25 called address extension facility field.

Note: In the case of no notification class the packet handler could make use of this information to identify a specific logical link (Annex G of Recommendation X.25). This would be a non-standard use of a facility intended to support the OSI network service. In addition to these methods, additional digits from the X.121 numbering scheme can be allocated to a user as described in CEPT Rec. T/CD 08-03 (equivalent to T/NA2 20-02), if the addressing scheme in Appendix C is used.

3.2.2.1.3.2. Terminal Interface Identification - Terminal to Network

In case of non-dynamic assignment of TEIs, the terminal is identified by the layer 2 address (TEI value).

In the case of dynamic assignment of TEIs and using MSN, DDI or X.121 sub-addresses, the terminal identity is derived from the first call request after successful activation of layer 2. In this case the terminal shall provide its identity immediately after layer 2 activation, otherwise a call to the terminal may not be successful.

3.2.2.1.4. Call Establishment

T/S 46-50 procedures using T/S 46-30 signalling may be used to notify the user of incoming calls, when conditional notification is applicable. Networks will provide at least one of the two notification classes defined in T/S 46-50: no notification class and conditional notification class. These classes may be provided on a subscription basis.

X.25 packet layer procedures are operated on an active logical link.

3.2.2.1.5. Data Transfer

X.25 packet layer data transfer procedures apply.

3.2.2.1.6. Terminating the Call

X.25 packet layer call clearing procedures apply.

3.2.2.1.7. Layer 2 Deactivation

The terminal/network should deactivate the layer 2 after clearing the last VC unless layer 2 is semi-permanent or follow-on calls are expected.

3.2.2.1.8. Layer 1 Deactivation

Layer 1 should be deactivated (from the network side), if it is not needed by other services. However, it has to remain active for semi-permanent layer 2 (see subclause 3.2.2.1.2.1.).

Layer 1 is permanently active for Primary Rate Access (PRA).

3.2.2.2. Permanent Virtual Circuit Procedures

3.2.2.2.1. Layer 1 Activation

Layer 1 must be permanently active.

3.2.2.2.2. Layer 2 Activation

Layer 2 must be permanently active. This may be achieved using method 1 or 2 (see 3.2.2.1.2.1. or 3.2.2.1.2.2.).

3.2.2.2.3. Terminal Selection/Identification

Fixed at subscription time.

3.2.2.2.4. Call Establishment

Not applicable.

3.2.2.2.5. Data Transfer

X.25 packet layer data transfer procedures apply.

3.2.2.2.6. Terminating the Call

Not applicable.

3.2.2.2.7. Layer 2 Deactivation

Layer 2 must be permanently available. This may be achieved using method 1 or 2 (see 3.2.2.1.2.1. or 3.2.2.1.2.2.).

3.2.2.2.8. Layer 1 Deactivation

Layer 1 must be permanently active.

3.2.3. *Interrogation and Editing*

Not applicable.

3.3. Exceptional Procedures

3.3.1. *Activation, Deactivation and Registration*

Not applicable.

3.3.2. *Invocation and Operation*

3.3.2.1. Virtual Call

In case of failure situations due to calling/called user error, user state, or network conditions, appropriate failure indications will be signalled from the network to the user and the call setup or activated call may be terminated.

3.3.2.2. Permanent Virtual Circuit

In case of failure situations due to user error, user state, or network conditions, appropriate failure indications will be signalled from the network to the user.

3.3.3. *Interrogation and Editing*

Not applicable.

4. NETWORK CAPABILITIES FOR CHARGING

Charging principles should be similar to those for existing PSPDNs. Additional charging capabilities for the access to the packet handler may be required.

5. INTERCOMMUNICATION CONSIDERATIONS

5.1. Interworking between Public Networks

Full interworking must be ensured between these services and:

- existing PSPDN services
- other ISDN virtual call and permanent virtual circuit services.

This interworking shall be ensured without any service restriction. However, degradation to some quality of service parameters, e.g. call setup time, may be experienced in some cases.

5.2. Interworking between Private and Public ISDNs

This stage 1 service description applies to point-to-point ISDN access arrangements (NT2, e.g. PABX) with or without a packet handler function. NT2 arrangements as a minimum require a frame handling capability.

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category.

7. ATTRIBUTES

This includes the provision of the individual bearer services.

7.1. VALUES OF ATTRIBUTES

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Packet
2. Information transfer rate	Note: The D-channel information transfer rate is either 16 kbit/s for basic access or 64 kbit/s for primary rate access, however, the throughput achieved depends on several conditions such as window size, characteristics of the destination DTE and network conditions.
3. Information transfer capability	Unrestricted
4. Structure	Service data unit integrity
5. Establishment of communication	Demand/permanent
6. Symmetry	Bidirectional symmetric
7. Communication configuration	Point-to-point
Access attributes:	
8. Access channel	D(16), D(64)
9. Access protocol	
General attributes:	
10. Supplementary services and user facilities provided	Multiple Subscriber Number; Direct Dialling In; Sub-addressing Note: Only used in conditional notification for the first call to a DTE. Standard X.2 facilities are offered, see Appendix B.
11. Quality of service	Generally in line with QOS experienced on PSPDNs. Degradation to some parameters, e.g. call setup time, may be experienced in some cases. However, transit delay may be increased and throughput may be lowered depending on the access arrangement to the packet handler.
12. Interworking possibilities	See Rec. T/CAC S 10.4
13. Operational and commercial aspects	See CEPT: User Handbook, ISDN.

7.2. **Provision of Individual Bearer Services**

a) Overall provision: Additional (A)

b) Variations of secondary attributes:

Information Transfer Rate	Establishment of Communication	Symmetry	Communication Configuration	Provision
See Attribute 2	Demand			
	D 16	Bidirectional symmetric	Point-to-point	A
	D 64	Bidirectional symmetric	Point-to-point	A
See Attribute 2	Permanent			
	D 16	Bidirectional symmetric	Point-to-point	A
	D 64	Bidirectional symmetric	Point-to-point	A

Appendix A

STANDARD SERVICE PROFILE

The following service profile is defined to be applicable to users who has not subscribed to a different, specific service profile. Support of the OSI network layer service is a general requirement of this standard service profile.

- Single link procedure, modulo 128
- Standard basic packet sequence numbering (modulo 8)
- Incoming/outgoing calls allowed
- Two-way logical channels: 2
- Default maximum packet length: 128 octets
- Default window size: 2
- Fast select acceptance facility
- Default throughput class: A (9600 bits/s)
- Throughput class negotiation facility available
- Transit delay negotiation allowed
- CCITT specified DTE facilities to support the OSI network service (Annex G to Recommendation X.25)

Note: Type of address and numbering plan identifier will be available in the future (at the latest by time T).

Note: No other facilities available.

Appendix B

USER FACILITIES

X.2 (Version 84)		User Classes of Service provided by CCITT		CEPT	
Optional User Facility		VC	PVC	VC	PVC
1.	OPTIONAL USER FACILITIES ASSIGNED FOR AN AGREED CONTRACTUAL PERIOD				
1.1.	Extended packet sequence numbering (modulo 128)	A	A	N	N
1.2.	Non-standard default window sizes	A	A	E	E
1.3.	Non-standard default packet sizes: 16, 32, 64	A	A	N	N
	256	A	A	A	A
1.4.	Default throughput class assignment	A	A	E	E
1.5.	Flow control parameter negotiation	E	-	E	-
1.6.	Throughput class negotiation	E	-	E	-
1.7.	Packet retransmission	A	A	N	N
1.8.	Incoming calls barred	E	-	E	-
1.9.	Outgoing calls barred	E	-	E	-
1.10.	One-way logical channel outgoing	E	-	E	-
1.11.	One-way logical channel incoming	A	-	E	-
1.12.	Closed user group	E	-	E	-
1.13.	Closed user group with outgoing access	A	-	E	-
1.14.	Closed user group with incoming access	A	-	E	-
1.15.	Incoming calls barred within a closed user group	A	-	E	-
1.16.	Outgoing calls barred within a closed user group	A	-	E	-
1.17.	Bilateral closed user group	A	-	N	-
1.18	Bilateral closed user group within outgoing access	A	-	N	-
1.19.	Reverse charging acceptance	A	-	E	-
1.20	Fast select acceptance	E	-	E	-
1.21.	Multi-link procedure - not relevant for D-channel				
1.22.	Charging information	A	-	A	-
1.23.	Direct call	A	-	N	-
1.24.	Hunt group	A	-	A	-
1.25.	On-line facility registration	A	-	A	-
1.26.	D-bit modification	A	A	N	N
1.27.	Local charge prevention	A	-	A	-
1.28.	Call redirection	A	-	E	-
1.29.	Network user identification	A	-	A	-
1.30.	Extended frame sequence numbering. Not applicable as a facility: - default and only mode is modulo 128				
1.31.	RPOA selection	A	-	N	-
2.	OPTIONAL USER FACILITIES ON A PER CALL BASIS				
2.1.	Closed user group selection	E	-	E	-
2.2.	Bilateral closed user group selection	A	-	N	-
2.3.	Reverse charging (Note 1)	A	-	E	-
2.4.	RPOA selection	A	-	N	-
2.5.	Flow control parameter negotiation	E	-	E	-
2.6.	Fast select	E	-	E	
2.7.	Throughput class negotiation	E	-	E	-
2.8.	Abbreviated address calling	A	-	N	-
2.9.	Charging information	A	-	A	-
2.10.	Transit delay selection and indication	E	-	E	-
2.11.	Call redirection or forwarding to alternate DTE	A	-	A	-
2.12.	Called line address modified notification	A	-	E	-
2.13.	Network user identification	A	-	A	-
2.14.	Closed user group with outgoing access selection	A	-	A	-

ISDN PACKET-MODE BEARER SERVICES (PMBS) D-CHANNEL

X.2 (Version 84)		User Classes of Service provided by CCITT		CEPT	
Optional User Facility		VC	PVC	VC	PVC
3.	ADDITIONAL FEATURES				
3.1.	Extended interrupt	E	E	E	E
3.2.	CCITT-specified DTE facilities	E	-	E	-
4.	NEW FACILITIES FROM X.2 (Version 88)				
4.1.	Call deflection subscription	A	-	A	-
4.2.	Call deflection selection	A	-	A	-
4.3.	TOA/NPI address subscription	A	-	Note 2	-
4.4.	NUI override	A	-	A	-

Notes:

A:	Additional
E:	Essential for conformance
N:	Presently not offered, unlikely to be available on many networks in the future
1)	For the time being, only for national use
2)	In the future (at the latest time)

DTE:	Data Terminating Equipment
PVC:	Permanent Virtual Calls
NPI:	Numbering Plan Indicator
NUI:	Network User Identification
TOA:	Type Of Address
VC:	Virtual Calls

Appendix C

TRANSITION SCHEMES FOR ADDRESSING AND NUMBERING

Considering that

- provision of PMBS via and within ISDN in Europe is fundamental,
- terminal interchangeability between countries is recognised as essential and that this implies the reduction of options and the harmonisation of the policies of involved European telecommunication network operators,
- harmonisation of addressing and numbering aspects is necessary.

This service description defines ISDN packet-mode VC and PVC using D-channel consistent with T/S 46-50 (CCITT Recommendation I.462/X.31).

In conformance with the above statement and to ensure total compatibility throughout Europe, it is stated that the users of the services are identified by ISDN E.164 numbers.

In order to reach this goal with the least possible impact, networks may provide, for an interim period, network options as means to encourage a smooth transition.

In particular, users that have subscribed to this service could still be identified by X.121 numbers, which would facilitate interworking between ISDNs and PSPDNs. Since only E.164 numbers can be conveyed in an incoming call signal for terminal selection purposes, X.121 numbers must be used only in conjunction with the no notification class defined in draft ETS T/S 46-50 (CCITT Recommendation I.462/X.31).

Annex 10

USER SIGNALLING BEARER SERVICE CATEGORY (USBS)

1. DEFINITION

The User Signalling Bearer Service (USBS) is intended to support transfer of Service Data Units (SDUs) via the D-channel. It is to be used in applications where limited amounts of information are to be exchanged between customer installations, or where information must be exchanged between customer installations and High Layer Functions (HLFs) in the ISDN. Examples of such applications include support of user management protocols and transfer of control information between any kind of user equipment including ISPBXs across a public ISDN.

2. DESCRIPTION

2.1. General Description

The USBS allows the user to send and receive information on a D-channel. This information is passed transparently (i.e. without modification of contents) through the network. The Signalling Data Units (SDUs) are expected to be delivered in sequence with a high probability. Probability of misdelivery, mutilation, and duplication is expected to be very low. Normally, the network will not interpret or act upon this information.

Service data units transmitted by this service are limited to 128 octets embedded in call control messages and 251 octets in user information messages. As a network operator option, limitations may be placed on the amount of data a user is permitted to transfer in a given time period (e.g. the throughput can be limited through the use of explicit mechanisms, see Appendix A).

The USBS may be provided as an on-demand or as a permanent service.

The USBS is different from and should not be confused with the User-to-User Signalling supplementary service. The UUS supplementary service is used in conjunction with a circuit switched telecommunication service (a bearer service or a teleservice).

2.2. Specific Terminology

Temporary signalling connection: The connection established for realisation of the USBS.

USBS call: A temporary signalling connection.

User-to-User Signalling not associated to a circuit: Use of the USBS.

3. PROCEDURES

3.1. Provision and Withdrawal

The service shall be either provided on a subscription basis or, as a network option, may be generally available on basic rate and primary rate accesses.

There may be a limit on the maximum number of total USBS calls present per D-channel. If so, this limit will define the network determined user busy condition.

The service can be withdrawn at the request of the customer or for administrative reasons.

3.2. Normal Procedures

All user-network signalling shall be done on the D-channel.

3.2.1. *Activation, Deactivation and Registration*

Not applicable.

3.2.2. *Invocation and Operation*

Note: The following procedures are applicable only to the on-demand mode of establishment of communication. Procedures for the permanent mode will be included if and when the need for the latter has been justified.

3.2.2.1. Originating the Service (Call Setup)

The USBS call is originated by the user requesting from the network the required bearer service and identifying the called user. Other information may also be included, if required. The request may be sent either en bloc or overlap.

3.2.2.2. Signalling Indications during Call Setup

After initiating a call, the calling user shall receive an acknowledgement that the network is able to process the call. The called user shall receive an indication of arrival of an incoming call.

The calling user may also receive an indication that the incoming call has been offered to the called user, and that the called user equipment is alerting. When the called user answers the call and the connection is established, an indication shall be sent to the calling user.

3.2.2.3. Information Transfer Phase

Once the connection is established, charging may begin (if charging has a time component) and service data units may be transferred in both directions simultaneously without alteration by the network. No restriction is placed on the content of the service data units, as long as their length does not exceed a maximum of 251 octets. The network shall attempt to deliver service data units in the sequence received without duplication, mutilation or misdelivery.

3.2.2.4. Release Phase

The call may be released by either or both users indicating intention to release to the

network. The network then indicates to each user that the connection has been cleared.

3.2.3. *Interrogation and Editing*

Not applicable.

3.3. **Exceptional Procedures**

3.3.1. *Activation, Deactivation and Registration*

Not applicable.

3.3.2. *Invocation and Operation*

3.3.2.1. Failure Situations due to User Error

1) An improper service request from the user shall result in an appropriate failure indication by the network and the connection shall be released.

2) An invalid called party number from the user shall result in an appropriate failure indication by the network and the connection shall be released.

3.3.2.2. Failure Situations due to Called User State

1) A calling user attempting to establish a connection to a busy user (either network determined user busy or user determined user busy) shall receive an appropriate failure indication from the network and the connection shall be released.

2) If the called user fails to respond, the calling user shall receive an appropriate failure indication from the network and the connection shall be released.

3) If the called user responds to the connection attempt, but fails to indicate connection or release, the calling user shall receive an appropriate failure indication from the network and the connection shall be released.

4) If the called user elects not to accept the connection, the calling user shall receive an appropriate failure indication from the network and the connection shall be released.

3.3.2.3. Failure Situations due to Network Conditions

In extreme circumstances of network congestion or failure, service data units may be discarded. Users wishing to ensure reliable transport must employ end-to-end protocols (e.g. the class 4 transport protocol, see CCITT Recommendation X.224).

1) If USBS on demand is not available from the network, an appropriate failure indication shall be sent to the user and the connection shall be released.

2) If the network is temporarily unable to provide the USBS on demand, an appropriate failure indication shall be sent to the user and the connection shall be released.

3.3.3. *Interrogation and Editing*

Not applicable.

4. NETWORK CAPABILITIES FOR CHARGING

It shall be possible to charge the customer accurately for the service.

5. INTERWORKING CONSIDERATIONS

5.1. Interworking between Public Networks

Interworking between USBS and the following services requires further study:

1) Virtual call and permanent virtual circuit bearer service category (CCITT Recommendation I.232.1)

2) Additional packet-mode bearer services

3) PSPDN services

4) Telex

5) In-band systems (e.g. touch tone (DTMF) for telebanking and modem).

5.2. Interworking between Private and Public ISDNs

For further study.

6. INTERACTION WITH SUPPLEMENTARY SERVICES

Each supplementary service description identifies the applicability to this bearer service category (see Appendix D).

7. ATTRIBUTES

This includes the provision of the User Signalling Bearer Services.

The attributes are defined in CCITT Recommendation I.140 [11], Annex A, § A.1.1.

7.1. Values of Attributes

The values of the attributes are defined in CCITT Recommendation I.140 [11], Annex A, § 2.

USER SIGNALLING BEARER SERVICE CATEGORY (USBS)

Attributes	Values
Information transfer attributes:	
1. Information transfer mode	Packet
2. Information transfer rate	See Appendix A
3. Information transfer capability	Unrestricted digital information
4. Structure	Service data unit integrity
5. Establishment of communication	On demand, permanent
6. Symmetry	Bidirectional symmetric
7. Communication configuration	Point-to-point
Access attributes:	
8. Access channel and rate	D(16), D(64)
9. Access protocol	
10. Signalling access protocol layer 1	prETSs 300 012 or 300 011 (CCITT Recs I.430 D(16) or I.431 D(64))
11. Signalling access protocol layer 2	prETS 300 125 (CCITT Recs Q.921/I.441)
12. Signalling access protocol layer 3	CCITT Recs Q.931/I.451
13. Information access protocol layer 1	prETSs 300 012 or 300 011 (CCITT Recs I.430 D(16) or I.431 D(64))
14. Information access protocol layer 2	prETS 300 125 (CCITT Recs Q.921/I.441)
15. Information access protocol layer 3	CCITT Recs Q.931/I.451
General attributes:	
16. Supplementary services provided	See Appendix D
17. Quality of service	See Appendix C
19. Interworking possibilities	
20. Operational and commercial	

7.2. Provision of User Signalling Bearer Service

a) Overall provision: A

b) Variations of secondary attributes:

Establishment of Communication	Symmetry	Communication of Configuration	Provision
Demand	Bidirectional symmetric	Point-to-point	A
Permanent	Bidirectional symmetric	Point-to-point	FS

USER SIGNALLING BEARER SERVICE CATEGORY (USBS)

c) Access

Access Channel Control Signalling and OAM (note 1)		User Information		Provision
Channel and Rate	Protocols	Channel and Rate	Protocols	
D(16)	I.451 I.441 I.430	D(16)	I.451 I.441 I.430	A (Note 2)
D(64)	I.451 I.441 I.431	D(64)	I.451 I.441 I.431	A (Note 2)

Note 1: The definition of other protocols for OAM is for further study

Note 2: A: Additional bearer service category which may be available in some ISDNs and which may also be available internationally.

Appendix A

FLOW CONTROL MECHANISM FOR USBS

After answer, in each direction, a burst capability of sending N messages is immediately available where N equals the value of the burst parameter X. The value of N shall be decremented by one for every message sent by the user and incremented by Y at regular intervals of T (T = 10 secs) subject to the limitation that N may not exceed X: i.e. N + Y <=X.

The burst parameter X is a variable which shall be set to a value of X = 16.

The replenishment parameter Y shall be capable of taking a value of Y = 8.

According to this mechanism, the maximum throughput is 1.6 kbit/s.

Note: While some networks may support higher values of X and Y, the value of X and Y across international interfaces shall be as above. It is up to the network using higher values to take the appropriate actions, unless bilateral agreements exist.

If messages are received at a rate which exceeds the flow control limit set by the network, the network shall discard the messages that cannot be handled and respond to the first discarded message with a control indication.

When the flow control restrictions are removed, then, if a UUS message has been discarded due to the restriction, an indication shall be given to the user that further UUS messages can be accepted. Otherwise no indication shall be given.

Appendix B

CONGESTION CONTROL FOR USBS

This refers to real-time mechanisms to prevent and recover from congestion during periods of coincidental peak traffic demands or network overload (e.g. resource failures).

Congestion control overrides the normal flow control mechanism of Appendix A. The following general principles apply:

a) The user should suspend submission of SDUs when congestion level "receive not ready" is notified by the network.

b) The user may resume submission of SDUs when congestion level "receive ready" is notified by the network.

c) The user may attempt to resume submission of SDUs after a period T (T = 15 minutes) has elapsed since congestion level "receive not ready" has been notified by the network.

d) It is a network option to hold or discard SDUs received during situations of network congestion.

e) It is a network option, on notification of congestion level "receive not ready" from the user, to:

- act on this notification (as in a, b and c above), or
- deliver notification to the remote user, or
- perform neither or both preceding actions.

In general, the network will not provide limitless buffering capacity for a congested user.

Appendix C

QUALITY OF SERVICE

The quality of service is generally in line with that experienced for circuit-related ISDN signalling, including the User-to-User Signalling supplementary service.

In particular:

a) Call Setup Time
Of the same order as that for a circuit switched ISDN call.

b) Transit Delay
Of the same order as that for circuit related messages, and similarly dependent on distance traversed.

Average values of the order of one second are therefore typical.

Values for times between transmission of a message and reception of an acknowledging message should therefore be set to at least 14 seconds (the sum of the CCITT Blue Book I.451 timers T303 and T310). In many cases, a value of 44 seconds (the sum of the new values of timers T303 and T310) may be more appropriate.

c) Throughput
Appendix A limits the maximum average throughput to Y/T messages per second in each direction, while peak rate for a burst of up to Y messages in a period of T is limited only by signalling channel and processing bandwith.

The maximum average throughput is only attainable if Y messages are submitted in every period T. In this case, and assuming that every message contains the maximum of 251 octets, the maximum average throughput for an international call is 1.6 kbit/s.

d) Message Loss, Duplication and Mis-sequencing
Probabilities of the same order as for signalling messages.

Between exchanges, CCITT Recommendation Q.706 guarantees that due to failure in the message transfer part:

- not more than 1 in 10^7 messages will be lost;
- not more than 1 in 10^{10} messages will be duplicated or delivered out-of-sequence.

USER SIGNALLING BEARER SERVICE CATEGORY (USBS)

Appendix D

SUPPLEMENTARY SERVICES

Supplementary services applicable to USBS are those ISDN supplementary services which are not specifically circuit related.

Note: The applicability of services related to the busy condition is for further study.

SUPPLEMENTARY SERVICE	APPLICABILITY
Advice of Charge	Applicable
Call Waiting	N/A
Call Hold	N/A
Call Transfer	N/A
Number Identification Services: - Calling Line Identification Presentation - Calling Line Identification Restriction - Connected Line Identification Presentation - Connected Line Identification Restriction	 Applicable Applicable Applicable Applicable
Closed User Group	Applicable
Completion of Calls to Busy Subscriber	N/A
Conference Services	N/A
Direct Dialling In	Applicable
Diversion Services: - Call Forwarding Unconditional - Call Forwarding on Busy - Call Forwarding on No Reply - Call Deflection	 Applicable N/A Applicable Applicable
Freephone	Applicable
Malicious Call Identification	Applicable
Multiple Subscriber Number	Applicable
Sub-address	Applicable
Terminal Portability	N/A
Three Party Service	N/A
User-to-User Signalling Note: USBS is functionally equivalent to UUS1 + UUS3 without an associated circuit switched call	N/A