PHS MoU Document
B-IF2.01-03-TS

Title: Public Personal Handy-Phone System : Interface between Public Cell Station and ISDN-based PHS Switching Center-PHS Service Control Procedure

Version: 03

Date: July 14, 1999

PHS MoU Classification: Unrestricted

List of contents:

The clauses marked by * are not included in this specification.

Number of pages: 58

PHS MoU Group

c/o Association of Radio Industries and Businesses (ARIB)
14F, Nittochi Bldg., 4-1, Kasumigaseki 1-choume, Chiyoda-ku, Tokyo 100, Japan
TEL +81-3-5510-8599 FAX +81-3-3592-1103

PHS MoU Document
B-IF2.01-03-TS

History of Revised Versions

Version	Date	Outline
01	April 17, 1996	Established
01	Dec. 17, 1996	• Document No. is changed. (Formerly IF2.01) • Document title is changed. (Formerly Personal Handy-Phone System Public Cell Station-ISDN Interface-PHS Service Control Procedure-)
02	July 31, 1998	• Adding of the description of CS Type 2 and error correction.
03	July 14, 1999	Changing the description of “object ID”

Public Personal Handy-Phone System: Interface Between Public Cell Station and ISDN-Based PHS Switching Center-PHS Service Control Procedure

< Summary >

1. Relations with international standards

This specification specifies the generic procedures for the control of PHS supplementary services used for the interface between the public cell station (hereinafter referred to as public CS) and ISDN based on ITU-T Recommendation Q.932.

2. Differences from ITU-T Recommendation Q.932

The following specifications have been deleted from or added to ITU-T Recommendation Q.932.

(1) The generic protocol for supplementary services, i.e., a Facility information element, a FACILITY message, REGISTER message and the messages shown PHS MoU Specification IF2.02 clause 3 shall be used.

- in PHS MoU specification IF 2.02, the stimulus protocols will not be applied, and;
- the functional procedures using the functional protocol messages except a FACILITY message will not be applied.

(2) The following terms used in ITU-T Recommendation Q.932 shall be replaced with those of this specification as shown in the table below:

Table Summary-1/IF2.01. Differences from ITU-T Recommendation Q.932

ITU-T Recommendation Q.932 terminology	This specification terminology
ITU-T Recommendation Q.921	PHS MoU specification IF2.03
ITU-T Recommendation Q.931	PHS MoU specification IF2.02
ISDN user-network interface	Personal Handy-Phone system public cell station - ISDN interface
user-network interface	public cell station - ISDN interface
network	ISDN
user	public cell station

In other words, when the terms in the left column of above table are used in the referred part of ITU-T Recommendation Q.932 text, those shall be replaced by the terms in the right column of above table.

In addition, unless noted otherwise, when the part of ITU-T Recommendation Q.932 text referred by this specification refers to other sections, Annexes, appendices, etc., of ITU-T Recommendation Q.932, the reference means identical part of this specification in stead of ITU-T Recommendation

Q.932.

(3) The specification for PHS MoU specific supplementary services (recalling-type handover (hereinafter referred to as handover) and DTMF transmission) are added to ITU-T Recommendation Q.932 and included in an Annex D.

(4) The specification for PHS MoU specific supplementary services (location registration, authentication and call clearing information notification) are added to ITU-T Recommendation Q.932 and included in an Annex E.

(5) The documentation of facility information element component coding based on ITU-T Recommendation X.680 is added as Annex F in this specification..

Table Summary-2/IF2.01. Differences from ITU-T Recommendation Q.932 (1/3).

1 General	• This specification defines the generic procedures applicable for the control of supplementary services at the public CS-ISDN interface. • The detailed procedures applicable to individual supplementary services are provided.
2 Overview of the generic protocols and of their scope	• This protocol operates as part of layer 3 of the control plane at the T and U reference points, and assumes that the use of layers 1 and 2 specified by IF2.03, IF2.04, IF2.05 and IF2.06.
2.1 Three generic protocols	• Only the functional protocol is used.
2.1.1 Stimulus protocols	• The stimulus protocols are not included in this specification.
2.1.2 Functional protocol	• Functional procedures do not initiated by a Keypad or a Feature key management supplementary service invocation.
3 Co-existence of protocols supported by a network	• An ISDN supports functional protocol only.
4 Keypad protocol	• The keypad protocol is not included in this specification.
5 Feature key management protocol	• The feature key management protocol is not included in this specification.
6.1.1 Introduction	• This protocol utilizes functions and services provided by basic call control procedures defined in IF2.02 and the functions of the data link layer as defined in IF2.03.
6.1.3 Categories of procedures	• Only the common information element procedure is included in this specification.
6.2 Separate message category	• Separate functional messages are not included in this specification.
6.3 Common information element category	• The call control message of IF2.02 is also used to carry the Facility information element that requests the desired supplementary service.
6.3.1 Call related supplementary service procedures	• For call related supplementary service procedures, the procedures for call control as specified in §5 of IF2.02 are utilized.
6.3.2 Bearer connection independent supplementary service procedures	• For general rules, format and coding of call reference values see §4.3 of IF2.02. • The range 0 - 32767 (two octets length call reference value) is recommended for call reference. • Only the point-to-point, connection-oriented transport is used.

Table Summary-2/IF2.01 Differences from ITU-T Recommendation Q.932 (2/3)

6.3.4 Coding of the call reference	• For general rules, format and coding of call reference value, §4.3 of IF2.02 is applicable. • The range 0 - 32767 (two octets length call reference value) is recommended for call reference.
6.3.6 Error procedures	• In general, the error handling procedures specified in §5.8 of IF2.02 are applies with a replacement of a term "SETUP" in items a) and b) of §5.8.3.2/IF2.02, by "SETUP, REGISTER". • Error procedures for the supplementary services specified by this specification will be found in the Annex E of this specification.
6.4 Network side channel reservation function	• The network side channel reservation function is not included in this specification.
7 Message functional definition and content	• Some messages are used in addition to messages defined in §3 of IF2.02.
7.1 Messages for supplementary service control	• Only FACILITY and REGISTER messages are included in this specification.
7.1.1 FACILITY	• References for a Protocol discriminator information element, a Call reference information element, and a Message type information element are changed to those specified in IF2.02. • A Display information element is not included in this specification. • The length of a Call reference information element is 3 octets (including octet 1).
7.1.2 to 7.1.4	• HOLD, HOLD ACKNOWLEDGE, and HOLD REJECT messages are not included in this specification.
7.1.5 REGISTER	• References for a Protocol discriminator information element, a Call reference information element, and a Message type information element are changed to those specified in IF2.02. • A Display information element is not included in this specification. • The length of a Call reference information element is 3 octets (including octet 1).
7.1.6 to 7.1.8	• RETRIEVE, RETRIEVE ACKNOWLEDGE, and RETRIEVE REJECT messages are not included in this specification.
8 General message format and information element coding	• This clause should be read in conjunction with §4 in IF2.02.
8.1 Message type	• Only FACILITY and REGISTER messages are included in of this specification.

(4) B-IF2.01-03-TS

Table Summary-2/IF2.01. Differences from ITU-T Recommendation Q.932 (3/3)

8.2 Other information elements	• Only Facility and a Call state information elements are included in of this specification. • These information elements are coded according to the general coding rules as specified in §4.5.1 of IF2.02. • Protocol discriminator value is the same as the one specified in IF2.02.
8.2.2 Endpoint identifier	• An endpoint identifier is not included in this specification.
8.2.3 Facility	• Specific procedures for this Personal Handy-Phone System are specified in the Annexes D and E of this specification.
8.2.3.1.3 Invoke identifier tags	• The maximum value of an invoke identifier is 127.
8.2.4 to 8.2.9	• An Extended facility information element, a Feature activation information element, a Feature indication information element, an Information request information element, a Notification indicator information element, and a Service profile identification information element are not included in this specification.
9 Generic Notification Procedures	• These procedures are not included in this specification.
Annex A User service profiles and terminal identification	• User service profiles and terminal identification is not included in this specification.
Annex B SDL diagrams for Hold/Retrieve functions	• SDL diagrams for Hold/Retrieve functions is not included in this specification
Annex D The description of supplementary services specified for the Personal Handy-Phone system (handover procedure and DTMF transmission procedure)	• The description of supplementary services specified for the Personal Handy-Phone system (handover procedure and DTMF transmission procedure) is added as IF2.01 specific supplementary services.
Annex E Location registration function, authentication function and call clearing information notification	• Location registration function, authentication function and call clearing information notification function are added as IF2.01 specific supplementary services.
Annex F Facility information element component coding	• Facility Information Element Component Coding based on ITU-T Recommendation X.680 is added.
Appendix I Illustration of the application of the three protocol types	• Keypad protocol and feature key management protocol are not included in this specification. • Functional protocol is included in this specification.
Appendix II Functional reference model for the operation of supplementary services	• Keypad protocol and feature key management protocol are not included in this specification. • Functional protocol is included in this specification.

3. References

ITU-T Recommendation:	Q.932
ITU-T Recommendation:	X.680
PHS MoU Specifications:	IF2.02, IF2.03
ARIB Standard	RCR STD 28

4. Issues for Further Study

- Supplementary services for Personal Handy-Phone System other than handover, DTMF transmission, location registration and authentication.

Public Personal Handy-Phone System: Interface between Public Cell Station and ISDN-based PHS Switching Center-PHS Service Control Procedure

Contents

* : This mark indicates sections which are specified in ITU-T Q.932 but are not included in this PHS MoU specification.

LIST OF FIGURES

LIST OF TABLES

1. General

This specification defines the generic procedures applicable for the control of supplementary services at the Personal Handy-Phone system public cell station (hereinafter referred to as public CS) - ISDN interface. These procedures may be used for the invocation and operation of supplementary services in association with existing calls or outside any existing calls.

Except for handover , DTMF transmission , location registration and authentication procedures, the detailed procedures applicable to individual supplementary services are not specified in this specification.

2. Overview of the generic protocols and of their scope

A generic protocol is defined for the control of supplementary services at the Personal Handy-Phone system public CS - ISDN interface. This protocol operates at layer 3 of the control plane at the T and U reference points that described in Annex M of PHS MoU Specification IF 2.02 [11], and assumes that the use of layers 1 and 2 conforms to PHS MoU Specification IF 2.04, IF2.05, IF2.06 and IF2.03 [12]. In addition, this generic protocol assumes the existence of an established data link and uses the acknowledged information transfer service available at the layer 2 to layer 3 interface.

2.1 Generic protocol

A generic protocol is defined for the control of supplementary services, which is functional; this protocol is:

- the Functional protocol.

2.1.1 Stimulus protocols *

2.1.2 Functional protocol

The Functional protocol is based on the use of the Facility information element and the FACILITY message, as well as of other specific functional messages specified in clause 7 of this specification. This protocol is symmetrical and is applicable to both the basic and primary rate access structures.

3. Co-existence of protocols supported by a network *

4. Keypad protocol *

5. Feature key management protocol *

6. Functional protocol

6.1 General

6.1.1 Introduction

This subclause specifies the functional signalling procedures for the control of supplementary services at the Personal Handy-Phone system public CS - ISDN interface. This generic protocol utilizes functions and services provided by PHS MoU Specification IF 2.02 basic call control procedures and the functions of the data link layer as defined in PHS MoU Specification IF 2.03.

6.1.2 Scope of the procedures

The procedures defined in clause 6 specify the basic methodology for the control (e.g. invocation, etc.) of supplementary services. The procedures are independent of whether the public CS - ISDN interface is a basic or primary rate interface.

6.1.3 Categories of procedures

For the functional signalling for supplementary services, the common information element procedure is defined.

6.1.4 Supplementary service functions

The control of supplementary services by either the digital network or the public CS includes the following cases:

a) the invocation of call related supplementary services during the establishment of a call;

b) the invocation of supplementary services during the clearing of a call;

c) the invocation of call related supplementary services during the active state of a call;

d) the activation, deactivation, interrogation or registration of supplementary services independent from an active call;

e) the invocation of multiple, different supplementary services within a single message;

f) the invocation of supplementary services related to different calls; and

g) cancellation of invoked supplementary services.

The correlation of a call related supplementary service and the call which it modifies is provided by use of the call reference [case a), b), c), e), f) and g) listed above].

The correlation of call independent supplementary service invocations and their responses is provided by the combination of the call reference of the message containing the Facility information element and the invoke identifier present within the Facility information element itself [refer to cases d), e) and

g)].

The identification of different supplementary service invocations within one single message is provided by the invoke identifier of the corresponding Facility information element [refer to cases e) and g)].

6.2 Separate messages category *

6.3 Common information element category

A REGISTER, a FACILITY or an existing PHS MoU Specification IF 2.02 call control message is used to carry the Facility information element which requests the desired supplementary service.

This functional procedure provides a flexible and open ended approach to the provision of supplementary service protocols and:

- allows new services to be easily introduced;

- allows multiple supplementary service invocations within one message;

- supports supplementary services with a large number of variants without a proliferation of new messages; and

- supports non-call associated supplementary services.

In addition, the use of the FACILITY message allows the actions and events related to supplementary services to be clearly separated from those associated with basic call control, hence providing improved stability to the basic call control procedures of PHS MoU Specification IF 2.02.

6.3.1 Call related supplementary service procedures

For call related supplementary service procedures initiated at call establishment or call clearing, the procedures for call control as specified in 5/IF 2.02 are utilized. This enables, for example, the originating public CS to send a supplementary service invocation within a SETUP message and to receive from the ISDN a return result, return error, or reject component type in the Facility information element within an ALERTING message, CONNECT message, DISCONNECT message, or any other appropriate message from the service provider.

For call related supplementary service invocations during the Active state of a call, the FACILITY message is used for the exchange of the Facility information elements over the existing signalling connection. This signalling connection is identified by the call reference of the corresponding active call.

The call reference provides the means to correlate FACILITY messages belonging to the same signalling transaction. In the case of call related invocations, the call reference correlates the call with the appropriate supplementary service transaction. When a supplementary service affects more than one call, different call references are used to identify each call individually.

If a call related FACILITY message is sent using the call reference of a call in progress or of an active call, and this call is cleared due to call related causes, then the treatment of any outstanding supplementary service requests is dependent on the requirements of each individual service.

Additionally, the following guidelines apply:

1) A supplementary service functional protocol (using the Facility information element) may use an existing bearer associated call reference if it is to be coupled to the bearer, or it may use a call reference not associated with a bearer.

2) The implicit association provided by a PHS MoU Specification IF2.02 call reference shall always be cleared when a bearer connection is released.

3) If a bearer connection and a bearer unrelated call reference need to be associated at the receiving end, then the bearer unrelated protocol should include a request for the terminating end to associate the two call reference.

6.3.2 Bearer connection independent supplementary service procedures

This subclause defines the transport functions employed for operations independent of a bearer connection. These transport functions are provided at the public CS - ISDN interface by means of message exchange according to PHS MoU Specification IF2.02 and this specification and utilize the data link services as described in PHS MoU Specification IF2.03. The messages used for transport (i.e. REGISTER, FACILITY, RELEASE COMPLETE) carry the application oriented Facility information elements containing the operation components. The correlation among the various transport messages is provided by means of the call reference value of each message.

For general rules, format and coding of call reference values see 4.3/PHS MoU Specification IF2.02. The range 0 - 32767 (two octets length call reference value) is recommended for call reference.

Only the following bearer connection independent transport function is utilized:

- Point-to-point, connection oriented.

6.3.2.1 Point-to-point transport

Same specification as specified in 6.3.2.1/ITU-T Recommendation Q.932 is applied.

6.3.2.2 Connectionless transport *

6.3.2.3 Broadcast transport mechanism connectionless *

6.3.3 Responses to multiple supplementary service invocations

The correlation of responses to multiple supplementary service invocations is based on call references and invoke identifiers.

6.3.4 Coding of the call reference

For general rules, format and coding of call reference values, 4.3/IF 2.02 is applicable. The range 0 - 32767 (tow octets length call reference value) is recommended for call reference.

6.3.5 Formal definition of data types

Formal definition of data types to be used within the operations to be coded in the Facility information element are provided in ITU-T Recommendation X.229 [10] (Remote Operations, Protocol Specification). An extract of the relevant clauses of X.229 is provided in Appendix IV.

6.3.6 Error procedures

Same specification as specified in 6.3.6/ITU-T Recommendation Q.932 is applied.

6.3.6.1 Component related errors

If a facility information element is received with an invalid protocol profile in any message other than REGISTER, the procedures specified in 5.8.6/IF2.02 and 5.8.7/IF2.02 will apply as appropriate, no STATUS message shall be returned.

If a ISDN or a public CS which implements procedures given in 6.3 receives a Facility information element containing an invoke component indicating an operation that is not recognized, i.e. a particular supplementary service or function has not been implemented, then a Facility information element containing a reject component reporting the general problem "unrecognized operation" shall be returned to the sending entity. This rejection will not affect the handling of the message in which the Facility information element was included or of other information elements included in that message.

If the operation value in the Facility information element is understood but it is not defined to be sent in the message in which it was received, then a return error component with the value "procedural error" (see Recommendation Q.950) will be returned.

Other errors specific to individual supplementary services are treated according to procedures provided in individual supplementary services specifications.

6.3.6.2 Transport related errors

If a FACILITY message is received and it does not contain the Facility information element, the procedures specified in 5.8.6/IF2.02 will apply, no STATUS message shall be returned.

6.3.6.3 Call related errors

If the ISDN or the public CS recognizes a supplementary service in a SETUP message but is not able to process the requested operation, then the following operations apply:

1. the ISDN or the public CS may clear the call request and reject the supplementary service invocation by means of a RELEASE COMPLETE message which contains the Cause information

element and the return error or reject component type with the appropriate parameters in the Facility information element;

2. the ISDN or the public CS may continue to process the call request according to normal PHS MoU Specification IF 2.02 call control procedures, and reject the supplementary service invocation by including a return error or reject component type with an appropriate data element in the Facility information element by means of a FACILITY message or in any appropriate PHS MoU Specification IF 2.02 message;

3. the ISDN or the public CS may continue to process the call request according to the PHS MoU Specification IF 2.02 call control procedures, and ignore the supplementary service invocation.

The option to be used depends on the individual supplementary service procedures is defined in the individual supplementary service specifications.

The Cause information element in PHS MoU Specification IF 2.02 call control messages will be used to report PHS MoU Specification IF 2.02 errors outside the component portion of the Facility information element (octets 1-3). When no PHS MoU Specification IF 2.02 protocol error is found, the Cause information element will convey cause #31 - normal, unspecified. Protocol errors in the component portion of the Facility information element (octets 4-?) will be reported in a Reject component carried in a Facility information element.

If the call related FACILITY message is sent using the call reference of a call in progress or of an active call, and this call is to be cleared due to call related causes, then depending upon the supplementary service invoked, one of the following will occur:

- the ISDN or the public CS may retain both the connection and the call reference association and may send a response within a Facility information element in a FACILITY message prior to the initiation of the normal call clearing procedures; or

- the ISDN or the public CS may send a response within a Facility information element in the first clearing message. (i.e. DISCONNECT, RELEASE, or RELEASE COMPLETE message); or

- the ISDN or the public CS may continue with the clearing procedures.
  If the third option, if the signalling connection is cleared while a supplementary service related request is pending, handling of the outstanding request will be according to the individual supplementary service specifications.

If a data link reset or data link failure occurs and a supplementary service request is outstanding, the procedures specified in 5.8.8/IF2.02 and 5.8.9/IF2.02 will apply, respectively. The procedures associated with the treatment of the outstanding supplementary service requests in this case are for further study.

6.3.6.4 Call independent errorsa

Same specification as specified in 6.3.6.4/ITU-T Recommendation Q.932 is applied.

6.4 Network side channel reservation function *

7. Message functional definition and content

Message definitions given in 3/IF2.02 will apply with an addition that:

- Facility information element may optionally be included in any of the Call establishment or Call clearing messages as well as the REGISTER and FACILITY messages defined in this specification in either direction.

7.1 Messages for supplementary service control

Table 7-1/IF2.01 summarizes the messages specific to supplementary service control procedures.

Table 7-1/IF2.01 Messages specific to supplementary service control

	Reference
FACILITY	7.1.1
HOLD	7.1.2 [not included in this specification]
HOLD ACKNOWLEDGE	7.1.3 [not included in this specification]
HOLD REJECT	7.1.4 [not included in this specification]
REGISTER	7.1.5
RETRIEVE	7.1.6 [not included in this specification]
RETRIEVE ACKNOWLEDGE	7.1.7 [not included in this specification]
RETRIEVE REJECT	7.1.8 [not included in this specification]

7.1.1 FACILITY

This message may be sent to request or acknowledge a supplementary service. The supplementary service to be invoked, and its associated parameters, are specified in the Facility information element (see Table 7-2/IF2.01).

For the use of this message, see clause 6.

Table 7-2/IF2.01 FACILITY message content

Message type: FACILITY
Significance: local (Note 1)
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	4.2/IF2.02	both	M	1
Call reference	4.3/IF2.02	both	M	3 (Note 2)
Message type	8.1/IF2.01	both	M	1
Facility	8.2/IF2.01	both	M	8 - *

M Mandatory
O Option

NOTES
1. This message has local significance; however, it may carry information of global significance.
2. The length of a Call reference information element is suggested to be 3 octets.

7.1.2 HOLD *

7.1.3 HOLD ACKNOWLEDGE *

7.1.4 HOLD REJECT *

7.1.5 REGISTER

This message is sent by the pubic CS or the ISDN to assign a new call reference for non-call associated transactions(see Table 7-6/IF2.01).

For the use of this message, see clause 6.

Table 7-6/IF2.01 REGISTER message content

Message type: REGISTER
Significance: local (Note 1)
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	4.2/B-IF2.02	both	M	1
Call reference	4.3/B-IF2.02	both	M	3 (Note 2)
Message type	8.1/B-IF2.01	both	M	1
Facility	8.2/B-IF2.01	both	O (Note 3)	8 - *

M Mandatory
O Option

NOTES
1 This message has local significance; however, it may carry information of global significance.
2 The length of a Call reference information element is suggested to be 3 octets.
3 Included if the ISDN or public CS provides supplementary service information.

7.1.6 RETRIEVE *

7.1.7 RETRIEVE ACKNOWLEDGE *

7.1.8 RETRIEVE REJECT *

8 General message format and information element coding

This clause should be read in conjunction with 4/IF2.02 and contains the coding of the information elements specifically used by the procedures described in this specification.

8.1 Message type

The additional codings are defined in Table 8-1/IF2.01 for message type.

Table 8-1/IF2.01 IF2.01 message type

Bits 8	7	6	5	4	3	2	1	
0	0	1	-	-	-	-	-	(IF2.02 call information phase message group)
			0	0	1	0	0	HOLD [not included in this specification]
			0	1	0	0	0	HOLD ACKNOWLEDGE [not included in this specification]
			1	0	0	0	0	HOLD REJECT [not included in this specification]
			1	0	0	0	1	RETRIEVE [not included in this specification]
			1	0	0	1	1	RETRIEVE ACKNOWLEDGE [not included in this specification]
			1	0	1	1	1	RETRIEVE [not included in this specification]
0	1	1	-	-	-	-	-	(IF2.02 miscellaneous message group)
			0	0	0	1	0	FACILITY
			0	0	1	0	0	REGISTER

8.2 Other information elements

These information elements are coded according to the general coding rules as defined in 4.5.1/IF2.02.

NOTE The value used for Protocol discriminator shall be as defined for messages used in IF2.02.

Table 8-2/IF2.01 contains the codepoints allocated to the information elements defined in this specification.

Table 8-2/IF2.01 Information elements specific to supplementary service control

Bits									Subclause reference	Maximum length (Octets) (Note 1)
8	7	6	5	4	3	2	1			
0	:	:	:	:	:	:	:	Variable length information elements		
	0	0	1	1	1	0	1	Extended facility	8.2.4 [not included in this specification]	-
	0	0	1	1	1	0	0	Facility	8.2.3	(Note 3)
	0	0	1	0	1	0	0	Call state	8.2.1	3
	0	1	1	0	0	1	0	Information request	8.2.7 [not included in this specification]	-
	0	1	0	0	1	1	1	Notification indicator	8.2.8 [not included in this specification]	-
	0	1	1	1	0	0	0	Feature activation	8.2.5 [not included in this specification]	-
	0	1	1	1	0	0	1	Feature indication	8.2.6 [not included in this specification]	-
	0	1	1	1	0	1	0	Service profile identification	8.2.9 [not included in this specification]	-
	0	1	1	1	0	1	1	Endpoint identifier	8.2.2 [not included in this specification]	-
All other values are reserved (Note 2)										

NOTES

1. The length limits described for the variable length information elements below take into account only the present ITU-T standardized coding values. Future enhancements and extensions to this specification will not be restricted to these limits.
2. The reserved values with bits 5-8 coded "0000" are for future information elements for which comprehension by the receiver is required (see 5.8.7.1/IF2.02).
3. The maximum length of the Facility information element is application dependent consistent with the maximum length of the message.

8.2.1 Call state

The call state information element is coded as shown in Figure 4.13/IF2.02 and Table 4-7/IF2.02. Table 8-3 contains additional codepoint(s) required for uses within supplementary service control.

Table 8-3/IF2.01 Call state information element

Call state value (octet 3)	
Bits	
6 5 4 3 2 1	
0 1 1 1 1 1	Call independent service

8.2.2 Endpoint identifier *

8.2.3 Facility

Same specification as is specified in 8.2.3/ITU-T Q.932 with modification of the following point is applied:

(1) procedures required for the individual supplementary services will be specified in Q.95X Series Recommendations and the individual supplementary service specifications.

8.2.3.1 Remote Operations Protocol

This subclause defines the PDU contents for the Protocol Profile of Remote Operations Protocol.

8.2.3.1.1 Component (octets 4, etc.)

Same specification as is provided in 8.2.3.1.1/ITU-T Q.932 is applied with addition of a following comment to ASN.1 definition of InvokeIdentifierType ::= INTEGER (-32768..32767) in Table 8-7 Facility information element component coding:

-- For this specification it is recommended to use
-- InvokeIdentifierType ::= INTEGER (-128..127)

8.2.3.1.2 Invoke identifier tags

Same specification as is provided in 8.2.3.1.2/ITU-T Q.932 except for the following point(s) is applied:

1) The descriptions related to the dummy call reference;
2) The broadcast CEI; and
3) The specific CEI.

For this PHS MoU specification, maximum value of invoke identifier is limited up to 127.

8.2.3.1.3 Treatment of existing ITU-T Q.931 information elements as parameters

Same specification as is provided in 8.2.3.1.3/ITU-T Q.932 with the following replacement(s) is applied:

1) The reference to Q.931 should not be replaced by IF2.02.

8.2.4 Extended facility information element *

8.2.5 Feature activation *

8.2.6 Feature indication *

8.2.7 Information request *

8.2.8 Notification indicator *

8.2.9 Service profile identification *

9. Generic notification procedure *

Annex A
User service profiles and terminal identification *

Annex B
SDL diagrams for Hold/Retrieve functions *

Annex C
Definition of address types

(This Annex forms an integral part of this Specification)

Same specification as is provided in Annex C/ITU-T Q.932 is applied.

Annex D
The description of supplementary services
specified for the Personal Handy-Phone system
(handover procedure and DTMF transmission procedure)

(This Annex forms an integral part of this Specification)

Handover procedure and DTMF transmission procedure are specified in MoU Specification IF 1.00.

D.1 The definitions of the operations

The definitions of handover operation and DTMF transmission operation are defined in the following ASN.1 module provided by ARIB.

Note that local timer value for the following each operation needs to be defined by each network operater.

RCR-Service-Operations {ccitt (0) member-body (2) japan (440) rcr (200028) personal-handy-phone-system (65) module (0) rcr-service-operations (1)}

```
DEFINITION ::=
BEGIN
EXPORTS  pBSendingService, handover
IMPORTS  OPERATION, ERROR
         FROM
         Remote-Operation-Notation {joint-iso-ccitt remote-operations (4) notation (0)}
         notAvailable, insufficientInformation, invalidCallState, basicServiceNotProvided,
         proceduralError
         FROM
         General-Error-List {ccitt recommendation q 950 general-error list (1)}
         Q931InformationElement
         FROM
         Embedded-Q931-Types {ccitt recommendation q 932 embedded-q931-types (5)}
         ;
PBSendingServiceType ::= OPERATION
        ARGUMENT SET OF {pBSignal   [1]   IMPLICIT PBSignal}
pBSendingService PBSendingServiceType ::=
        {ccitt (0) member-body (2) japan (440) rcr (200028) personal-handy-phone-system (65)
operation (1) PB-sending-service (1)}
HandoverType ::= OPERATION
         ARGUMENT SET {handoverCategory   [2]  IMPLICIT HandoverCategory,
                       callingPartyNumber   Q931InformationElement,
                       resultOfCalculation   [3]  IMPLICIT OCTET STRING OPTIONAL}
                  ---The calling number information element is the telephone number of the
                     activator of this operation.
                  ---"resultOfCalculation" shows the ciphering pattern for authentication, and
                     its length is variable.
        RESULT
```

ERRORS {notAvailable, insufficientInformation, invalidCallState, basicServiceNotProvided, proceduralError}

handover HandoverType ::=

{ccitt (0) member-body (2) japan (440) rcr (200028) personal-handy-phone-system (65) operation (1) handover (2)}

PBSignal ::= IA5String(FROM("0"|"1"|"2"|"3"|"4"|"5"|"6"|"7"|"8"|"9"|"*"|"#"|))

HandoverCategory ::= ENUMERATED {newLink (1)}

---*"newLink" shows recalling-type handover.*

END --*of RCR-Service-Operations*

(NOTE) PB means DTMF.

D.2 Examples of signalling flows and coding

Examples of DTMF transmission operation signalling flow are shown in Figure D-1/IF2.01 and Figure D-2/IF2.01.

An example component coding of DTMF transmission operation is shown in Table D-1/IF2.01.

An example of handover operation information flow is shown in Figure D-3/IF2.01.

An example of component coding of handover operation is shown in Table D-2/IF2.01.

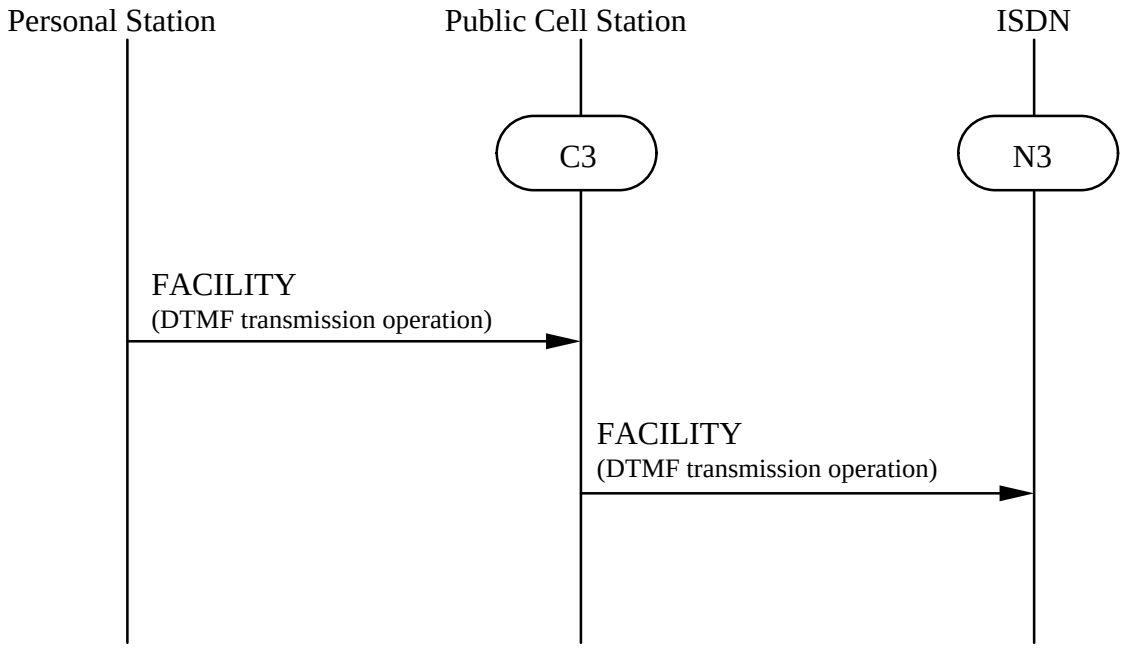


Figure D-1/IF2.01 Example of DTMF transmission operation signalling flow (Outgoing call proceeding call state)

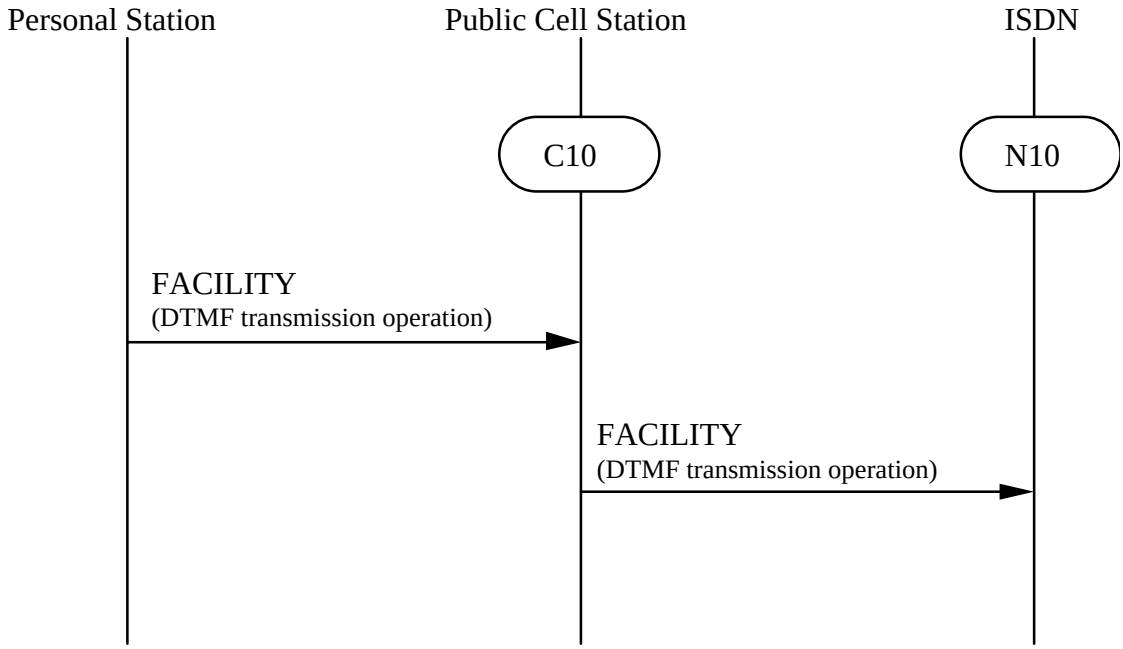
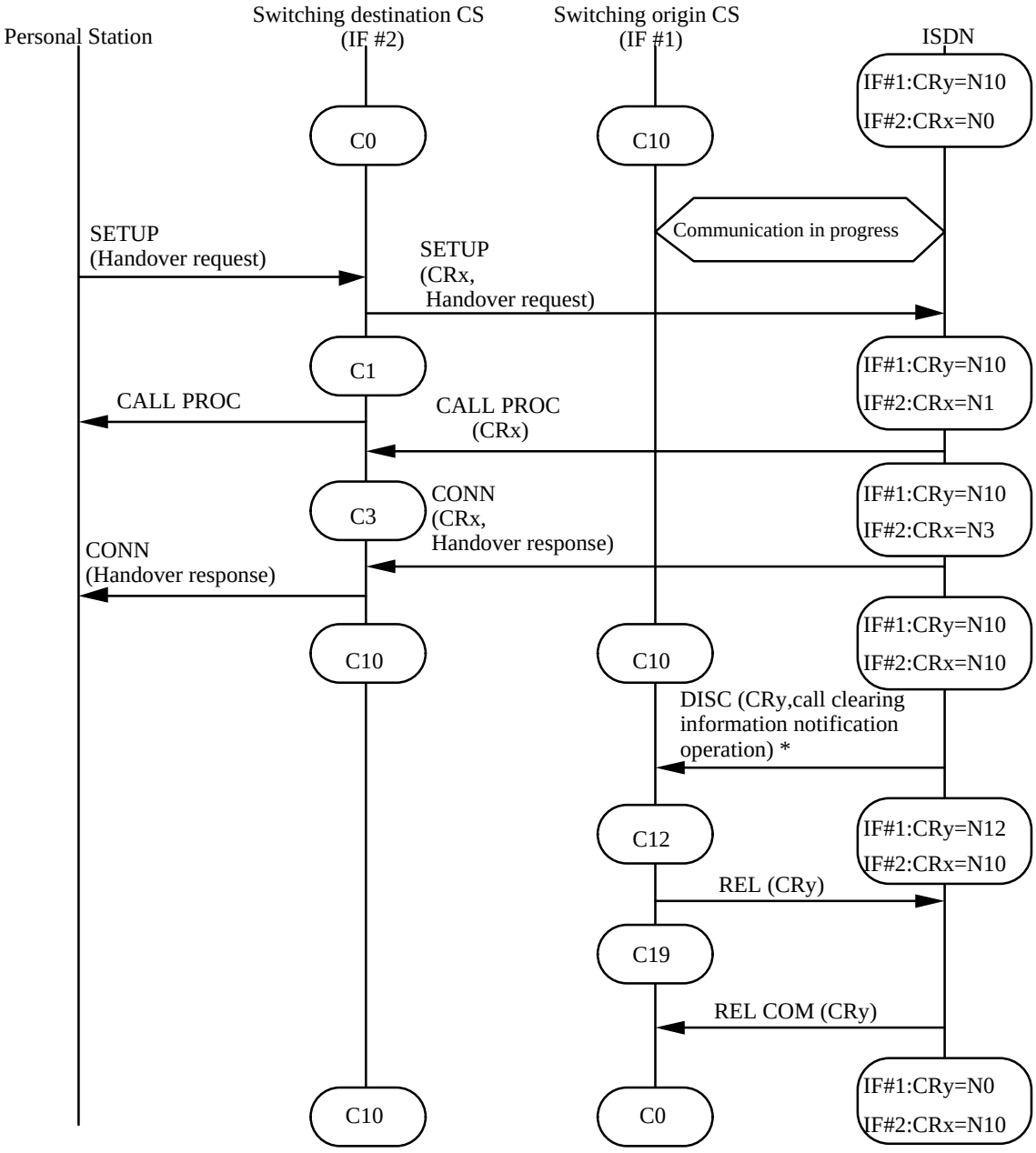


Figure D-2/IF2.01 Example of DTMF transmission operation signalling flow (Active call state)

Table D-1/IF2.01 DTMF transmission operation (invoke)

Octets	Bits 8	7	6	5	4	3	2	1
4	1	0	1	0	0	0	0	1
	Component type tag (Invoke)							
5	Length of component							
6	0	0	0	0	0	0	1	0
	Component identifier tag (Invoke identifier)							
7	Length of component identifier							
8	Invoke identifier							
12	0	0	0	0	0	1	1	0
	Operation value tag (Object identifier)							
13	Length of operation value							
14a	0	0	0	0	0	0	1	0
14b	1	0	0	0	0	0	1	1
14c	0	0	1	1	1	0	0	0
14d	1	0	0	0	1	1	0	0
14e	1	0	0	1	1	0	1	0
14f	0	1	0	1	1	1	0	0
14g	0	1	0	0	0	0	0	1
14h	0	0	0	0	0	0	0	1
14i	0	0	0	0	0	0	0	1
15.1	0	0	1	1	0	0	0	1
	Tag class (Universal)		Element form (Constructor)		Tag (SET OF)			
15.2	Length of components							
15.3.1	1	0	0	0	0	0	0	1
	Tag class (Context-specific)		Element form (Primitive)		Tag (PB signal)			
	Length of component							
	PB signal (IA5 Characters (0-9,#,*))							

(NOTE) PB means DTMF.



* : Refer to Annex E about Call clearing information notification facility

Figure D-3/IF2.01. Example of handover operation signalling flow

Table D-2/IF2.01. Handover operation[invoke]

Octets	Bits 8	7	6	5	4	3	2	1
4	1	0	1	0	0	0	0	1
	Component type tag (Invoke)							
5	Length of component							
6	0	0	0	0	0	0	1	0
	Component identifier tag (Invoke identifier)							
7	Length of component identifier							
8	Invoke identifier							
12	0	0	0	0	0	1	1	0
	Operation value tag (Object identifier)							
13	Length of operation value							
14a	0	0	0	0	0	0	1	0
14b	1	0	0	0	0	0	1	1
14c	0	0	1	1	1	0	0	0
14d	1	0	0	0	1	1	0	0
14e	1	0	0	1	1	0	1	0
14f	0	1	0	1	1	1	0	0
14g	0	1	0	0	0	0	0	1
14h	0	0	0	0	0	0	0	1
14i	0	0	0	0	0	0	1	0
15.1	0 0 Tag class (Universal)		1 Element form (Constructor)	1	0	0	0	1
				Tag (SET)				
15.2	Length of components							
15.3.1	1 0 Tag class (Context-specific)		0 Element form (Primitive)	0	0	0	1	0
				Tag (Handover category)				
	0	0	0	0	0	0	0	1
	Length of component							
	0	0	0	0	0	0	0	1
	Handover category (new link)							
15.3.2	1 0 Tag class (Context-specific)		0 Element form (Primitive)	0	0	0	1	1
				Tag (Result of calculation)				
	Length of component							
	Result of calculation							
15.3.3	0	1	0	0	0	0	0	0
	Q.931 information elements tag							
	Length of component							
	0	1	1	0	1	1	0	0
		Calling party number information element						
	Length of calling party number contents							
	1 ext	Type of number			0	0	0	1
					Numbering plan id. (ISDN/telephony numbering plan)			
	0	Number digit (IA5 characters (0~9,#,*))						

[return result]

Octets	Bits 8	7	6	5	4	3	2	1
4	1	0	1	0	0	0	1	0
	Component type tag (Return result)							
5	Length of component							
6	0	0	0	0	0	0	1	0
	Component identifier tag (Invoke identifier)							
7	Length of component identifier							
8	Invoke identifier							

Annex E

Location registration function, authentication function and call clearing information notification function

(This Annex forms an integral part of this specification)

E.1 Location registration function

E.1.1 Definition

The location registration function is used for registering the relationship of the number, which is dialed by a remote user for an incoming call, and the interface, to which the incoming call is delivered, to the ISDN.

E.1.2 Description

An example of this function in this specification is as follows:
When a public CS provides an incoming call service to a personal station which can change the communicating public CSs, the public CS can provide an incoming call delivery service supprted by the location registration function of an ISDN by means of invoking a location registration procedure to an ISDN.

This function is specified only at the interface between a public CS and an ISDN.

E.1.3 Procedures

E.1.3.1 Normal procedure

A REGISTER message and a Facility information element are used in this procedure.
This operation is classified in the operation class 2 of the ROSE operation and always invoked by the public CS.

The public CS invokes this service by sending a REGISTER message to an ISDN. This message includes a Facility information element which contains an invoke component with the following data elements:

Registration category :	outgoing-incoming location registration
Q.931 Calling party information element :	The number dialable by a remote user for an incoming call

The invoke identifier value used for invocation of this service is independent from the call reference value used in a REGISTER message.

After sending a REGISTER message to the ISDN, the public CS enters the Call Independent Service call state (C31). Upon receiving the REGISTER message, the ISDN shall also enter the Call Independent Service call state (N31).

In normal procedure, this operation shall be completed by sending a RELEASE COMPLETE message from the ISDN. This message includes the Cause information element that shall indicate cause #16 "normal call clearing" and the Facility information element which contains return result.

The invoke identifier value of the component in the Facility information element carried by the RELEASE COMPLETE message is the same as that is used in the component of the Facility information element carried by the REGISTER message.

After sending a RELEASE COMPLETE message to the public CS, the ISDN enters the Idle call state (N0). Upon receiving the RELEASE COMPLETE message, the public CS shall also enter the Idle call state (C0).

E.1.3.2 Error procedures

Error procedures specified in 6.3.6/MoU IF2.01 are applied.

If the timer (note) for location registration operation expires in the public CS side, it is recommended for the public CS to clear the operation by sending a RELEASE COMPLETE message to the ISDN. In this message, the Cause information element shall indicate cause #31 "normal, unspecified".

Note: Timer for the location registration operation in the public CS side is 20 seconds. This timer starts by sending a REGISTER message, and stops on the receipt of a RELEASE COMPLETE message.

If an error occurs, the ISDN may clear the operation by sending a RELEASE COMPLETE message that contains the Cause information element that shall indicate cause #29 "facility rejected" and the Facility information element which contains return error with the appropriate error value as shown in Table E-1/IF2.01.

Table E-1/IF2.01 Error value used for the location registration operation

userNotSubscribed (0) :	This error indicates that the user has not subscribed to this service. This error is used when the information relating the number that is dialable by a remote user for an incoming call is not retained by the ISDN, although its structure is consistent with the numbering plan of the ISDN. When the public CS receives a return error with this error value to the operation, the public CS should not repeat the same operation.
notAvailable (3) :	This error indicates the error that is not temporary and does not require to inform details occurred in the ISDN side to the public CS. When the public CS receives a return error with this error value to the operation, the public CS should not repeat the same operation.
insufficientInformation (5) :	This error indicates that the content of an operation argument is incomplete or absent.
proceduralError (43) :	This error indicates that one or more operation PDUs in received transport message have a valid content but are not specified as valid information content for that transport message.
temporaryFailure (P2) :	This error indicates an error that is temporary and does not require to inform details occurred in the ISDN side to the public CS.
addressError (P3) :	This error is used when the information relating the number that is dialable by a remote user for an incoming call is not retained by the ISDN, although its structure is consistent with the numbering plan of the ISDN. When the public CS receives a return error with this error value to the operation, the public CS should not repeat the same operation.
timerExpiry (P5) :	This error indicates the expiration of authentication operation timer.
userConditionNotAllowed (P6) :	This error indicates that the operation is not available according to the user profile. When the public CS receives a return error with this error value to the operation, the public CS should not repeat the same operation.
switchingEquipmentCongestion (P7) :	This error indicates that the switching equipment in the ISDN is experiencing a period of traffic congestion. When the public CS receives a return error with this error value to the operation, the public CS should not repeat the same operation..
authenticationError (P10) :	This error indicates the failure of authentication. When the public CS receives a return error with this error value to the operation, the public CS should not repeat the same operation..

If the public CS receives a Cause information element that indicates cause #38 "network out of order" or cause #42 "switching equipment congestion" or cause #31 "normal, unspecified" to the operation which has been sent from the public CS, the public CS should not repeat the same operation.

E.1.4 Interaction with other supplementary services

In this specification, no interaction with other supplementary services occurs. It is for further study for interaction with other supplementary services which will be specified in the future.

E.1.5 Example for Coding and Signalling flow

An example coding of an invoke in a Facility information element is shown in Table E-2/IF2.01. An example coding of a return result in a Facility information element is shown in Table E-3/IF2.01.

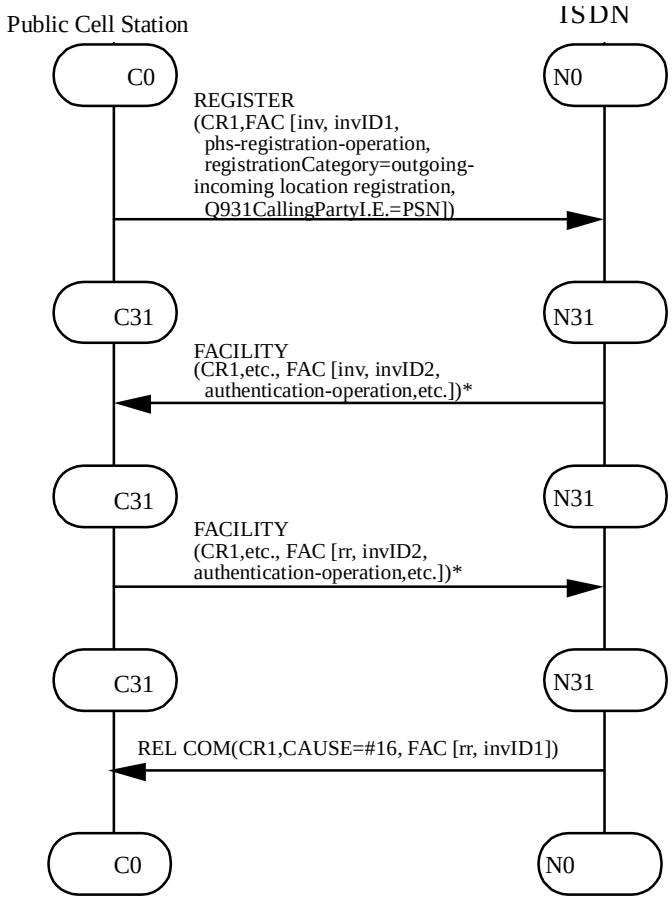
An example signalling flow for normal operation is shown in Figure E-2/IF2.01.

Table E-2/IF2.01 Location registration operation (invoke)

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	1	1	1	0	0	1
Facility information element identifier								
Length of facility contents								2
1 ext.	0	0	1	0	0	0	1	3
	Spare		Protocol Profile (Remote Operations Protocol)					
1	0	1	0	0	0	0	1	4
Component type tag (Invoke)								
Length of component								5
0	0	0	0	0	0	1	0	6
Component identifier tag (Invoke identifier)								
Length of component identifier								7
Invoke identifier								8
0	0	0	0	0	1	1	0	12
Operation value tag (Object identifier)								
Length of operation value								13
0	0	0	0	0	0	1	1	14.1
1	0	1	0	0	0	1	0	14.2
0	0	1	1	0	0	0	1	14.3
1	0	0	0	0	1	1	1	14.4
0	1	1	0	1	1	0	0	14.5
0	0	0	0	0	0	0	1	14.6
0	0	0	0	1	0	0	0	14.7
0 0	1	1	0	0	0	0	1	15.1
Tag class (Universal)	Element form (Constructor)	Tag (SET)						
Length of components								15.2
1	0	0	0	0	1	1	0	15.3.1
Tag class (Context-specific)	Element form (Primitive)	Tag (Registration category)						
0	0	0	0	0	0	0	1	15.3.2
Length of component								
0	0	0	0	0	0	0	1	15.3.3
Registration category (outgoing-incoming location registration)								
0	1	0	0	0	0	0	0	15.4.1
Q.931 information elements tag								
0	0	0	0	1	1	0	0	15.4.2
Length of component								
0	1	1	0	1	1	0	0	15.4.3
Calling party number information element								
0	0	0	0	1	0	1	0	15.4.4
Length of calling party number contents								
1 ext	Type of number		0	0	0	1		15.4.5
			Numbering plan id. (ISDN/telephony numbering plan)					
0	Number digit (IA5 characters (0~9,#,*))							15.4.6 ~15.4.14

Table E-3/IF2.01 Location registration operation (return result)

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	1	1	1	0	0	1
Facility information element identifier								
Length of facility contents								2
1	0	0	1	0	0	0	1	3
ext.	Spare		Protocol Profile (Remote operations Protocol)					
1	0	1	0	0	0	1	0	4
Component type tag (Return result)								
Length of component								5
0	0	0	0	0	0	1	0	6
Component identifier tag (Invoke identifier)								
Length of component identifier								7
Invoke identifier								8



*: These signalling flows are used for authentication, and included only for explanatory purpose. For the specification of authentication function, see E.2 of this Annex.

Figure E-1/IF2.01 An example signalling flow for location registration operation (normal procedure)

E.2 Authentication function

E.2.1 Definition

The authentication function is used for judging whether the service can be offered or not by executing a verification procedure for the Personal Handy-Phone number that represents the initiator of authentication function when the service is offered to the public CS.

E.2.2 Description

This section describes the authentication procedure for CS Type 1.
The FACILITY messages used in the authentication procedure described in this section are not applicable to CS Type 2, because the authentication function is not realized using IF2 in CS Type 2.

This function in this specification is as follows:

When a public CS provides an outgoing call or an incoming call or a location registration service to a personal station, the public CS can request the ISDN to judge whether the service can be offered or not to the personal station by using the authentication function of an ISDN.

This function is specified only at the interface between a public CS and an ISDN.

E.2.3 Procedures

E.2.3.1 Normal procedure

A FACILITY message and a Facility information element are used in this procedure.
This operation is classified in the operation class 2 of the ROSE operation and always invoked by the ISDN.

In the case of an outgoing call and an incoming call, the call reference value of a FACILITY message is same as that used for a SETUP message. In the case of a location registration service, the call reference value of a FACILITY message is the same as that of a REGISTER message. The invoke identifier value used for invocation of this service is independent from the call reference value used in a FACILITY message.

After sending a CALL PROCEEDING message for an outgoing call, after receiving a REGISTER message for a location registration service, or after receiving CALL PROCEEDING message for an incoming call, the ISDN provides this function by sending a FACILITY message to the public CS. This message includes a Facility information element which contains an invoke component with a random number as data element.

In normal procedure, this procedure shall be completed by sending a FACILITY message from the public CS. This message include a Facility information element which contains a return result with result of calculation as the data element.

E.2.3.2 Error procedures

Error procedures specified in 6.3.6/MoU IF2.01 are applied.

If the timer (note) for authentication operation expires in the ISDN side, it is recommended for the ISDN to clear the operation by sending a RELEASE COMPLETE message to the public CS. In this message, the Cause information element shall indicate cause #31 "normal, unspecified".

Note: Timer for the authentication operation in the ISDN side is 4 seconds. This timer starts by sending a FACILITY message containing invoke of authentication operation, and stops on the receipt of a FACILITY message containing return result or error to authentication operation.

If an error occurs, the public CS may report it by sending a FACILITY message that contains the return error with the appropriate error value shown in Table E-4/IF2.01 in the Facility information element.

Table E-4/IF2.01 Error value used for the authentication operation

notAvailable (3) :	This error indicates an error that does not require to inform details occurred in the public CS side to the ISDN.
insufficientInformation (5) :	This error indicates that the length of the random number provided by the ISDN is wrong.
invalidCallState(7) :	This error indicates that the service request does not acceptable under the current Basic Call Control state in the public CS.
proceduralError (43) :	This error indicates that one or more operation PDUs in received transport message have a valid content but are not specified as valid information content for that transport message.

If the ISDN receives a return error with error #3 "notAvailable" in the Facility information element in the case of an incoming call or an outgoing call, the ISDN shall clear the call with the Cause information element that indicates cause #31 "normal, unspecified".

If the ISDN receives a return error with any error value except error #3 or a reject with an appropriate parameter in the Facility information element in the case of an incoming call or an outgoing call, the ISDN shall clear the call with the Cause information element that indicates cause #41 "temporary failure".

If the ISDN receives a return error with error #3 "notAvailable" in the Facility information element in the case of a location registration service, the ISDN shall clear the location registration service by sending a RELEASE COMPLETE message containing a return error with error #3 "notAvailable" in the Facility information element.

If the ISDN receives a return error with any error value other than error #3 or a reject with an appropriate parameter in the Facility information element in the case of a location registration service, the ISDN shall clear the location registration service by sending a RELEASE COMPLETE message containing a return error type with error #N2 "temporaryFailure" in the Facility information element.

E.2.4 Interaction with other supplementary services

In the Outgoing Call Proceeding call state, the invoke identifier value for the authentication operation may conflict with that value for the DTMF transmission operation invoked by the public CS, which specified in Annex D/IF 2.01.

In this case, the ISDN shall execute the following process:

> The ISDN ignores the DTMF transmission operation. This means that the ISDN should not send a reject in a Facility information element and should not generate DTMF.

The public CS is recommended to execute the following process:

> The public CS executes the authentication operation, and stops the local timer for error response to DTMF transmission operation.

E.2.5 Examples for coding and signalling flows

An example coding of an invoke in a Facility information element is shown in Table E-5/IF2.01. An example coding of a return result in a Facility information element is shown in Table E-6/IF2.01.

Example signalling flows for normal operation are shown in Figure E-2/IF2.01 to Figure E-4/IF2.01.

Table E-5/IF2.01 Authentication operation (invoke)

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	1	1	1	0	0	1
Facility information element identifier								
Length of facility contents								2
1	0	0	1	0	0	0	1	3
ext.	Spare		Protocol Profile (Remote Operations Protocol)					
1	0	1	0	0	0	0	1	4
Component type tag (Invoke)								
Length of component								5
0	0	0	0	0	0	1	0	6
Component identifier tag (Invoke identifier)								
Length of component identifier								7
Invoke identifier								8
0	0	0	0	0	1	1	0	12
Operation value tag (Object identifier)								
Length of operation value								13
0	0	0	0	0	0	1	1	14.1
1	0	1	0	0	0	1	0	14.2
0	0	1	1	0	0	0	1	14.3
1	0	0	0	0	1	1	1	14.4
0	1	1	0	1	1	0	0	14.5
0	0	0	0	0	0	0	1	14.6
0	0	0	0	1	0	0	1	14.7
0	0	1	1	0	0	0	1	15.1
Tag class (Universal)		Element form (Constructor)	Tag (SET)					
Length of components								15.2
1	0	0	0	0	1	1	1	15.3.1
Tag class (Context-specific)		Element form (Primitive)	Tag (Random number)					
Length of component								15.3.2
Random number								15.3.3~

Table E-6/IF2.01 Authentication operation (return result)

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	1	1	1	0	0	1
Facility information element identifier								
Length of facility contents								2
1	0	0	1	0	0	0	1	3
ext.	Spare		Protocol Profile (Remote Operations Protocol)					
1	0	1	0	0	0	1	0	4
Component type tag (Return result)								
Length of component								5
0	0	0	0	0	0	1	0	6
Component identifier tag (Invoke identifier)								
Length of component identifier								7
Invoke identifier								8
0	0	1	1	0	0	0	0	9
Tag class (Universal)		Element form (Constructor)	Tag (SEQUENCE)					
0	0	0	0	0	1	1	0	10
Operation value tag (Object identifier)								
Length of operation value								12
0	0	0	0	0	0	1	1	13.1
1	0	1	0	0	0	1	0	13.2
0	0	1	1	0	0	0	1	13.3
1	0	0	0	0	1	1	1	13.4
0	1	1	0	1	1	0	0	13.5
0	0	0	0	0	0	0	1	13.6
0	0	0	0	1	0	0	1	13.7
0	0	1	1	0	0	0	0	14.1
Tag class (Universal)		Element form (Constructor)	Tag (SET)					
Length of components								14.2
1	0	0	0	1	0	0	0	14.3.1
Tag class (Context-specific)		Element form (Primitive)	Tag (Result of calculation)					
Length of component								14.3.2
Result of calculation								14.3.3~

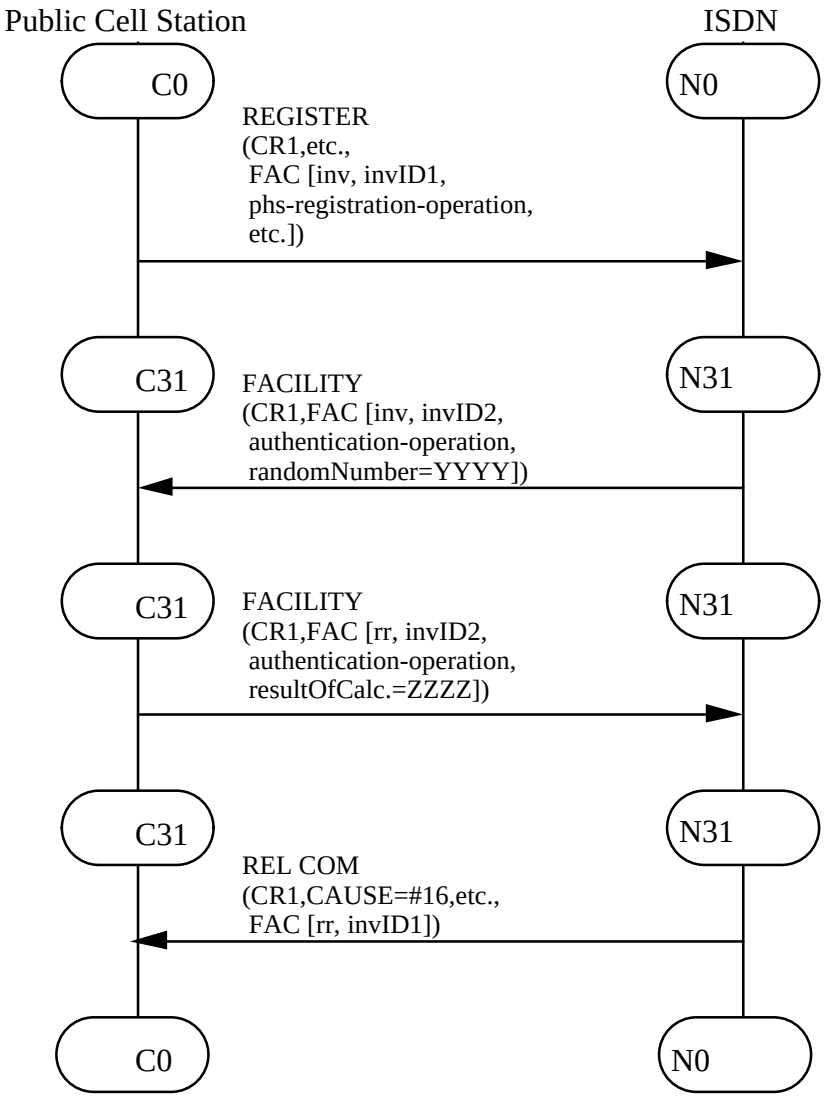


Figure E-2/IF2.01 An example signalling flow for authentication operation (location registration - normal procedure)

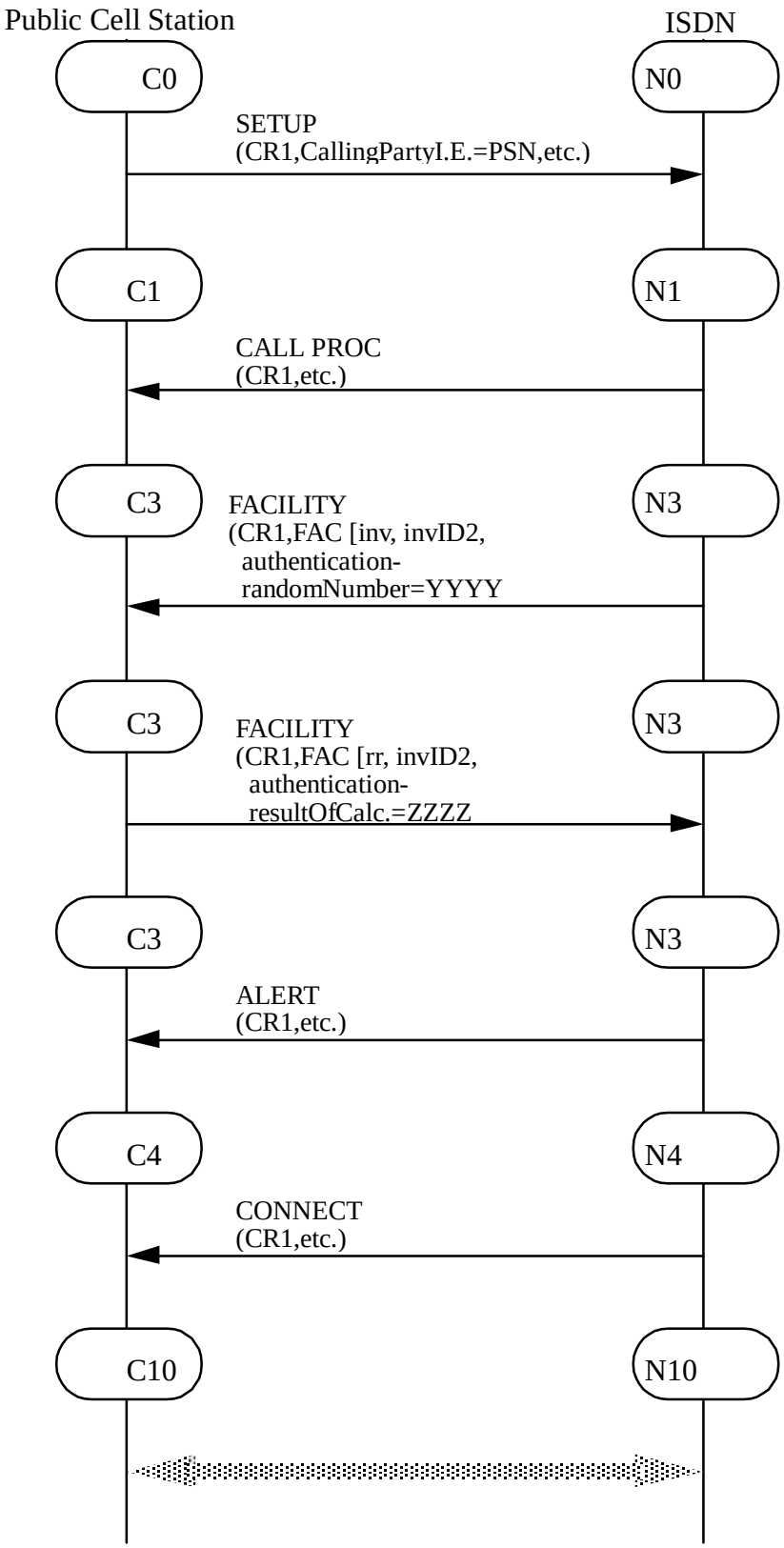


Figure E-3/IF2.01 An example signalling flow for authentication operation (outgoing call - normal procedure)

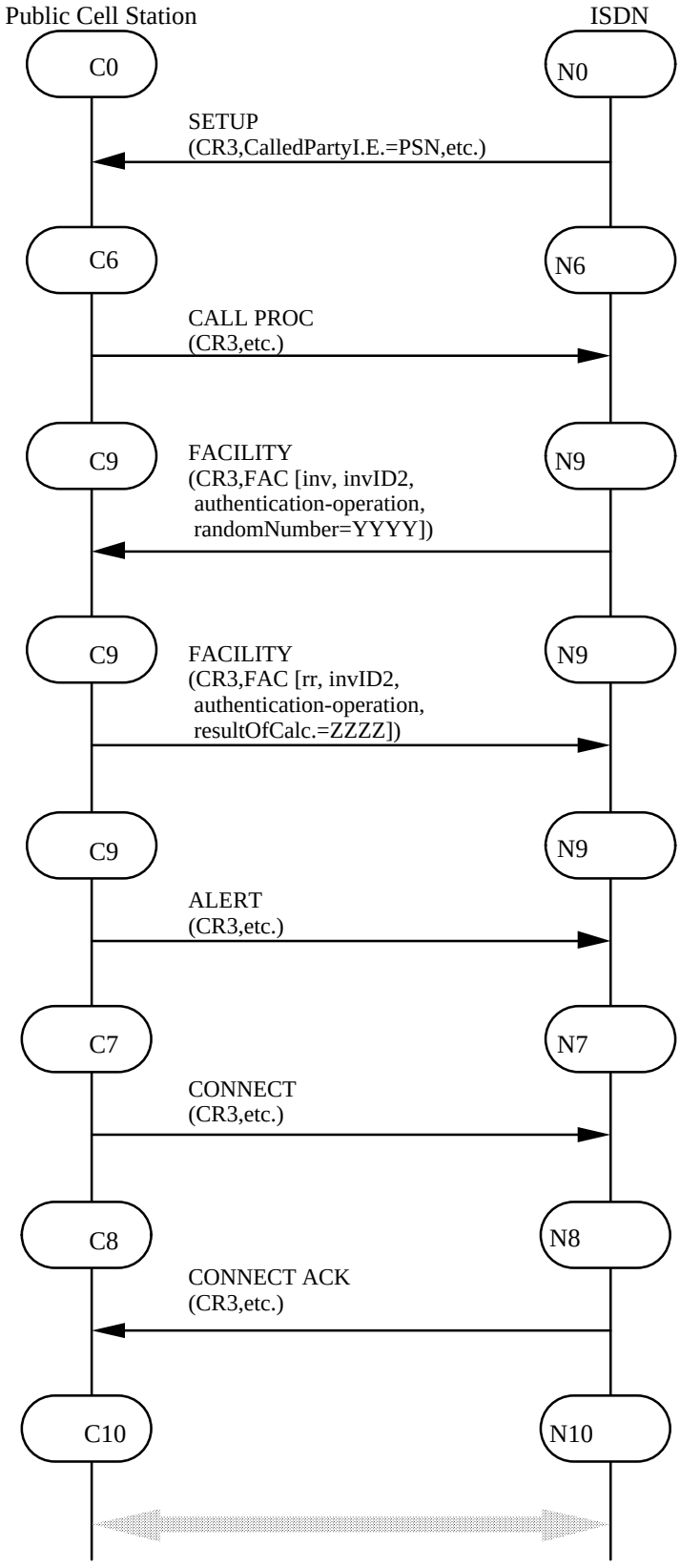


Figure E-4/IF2.01 An example signalling flow for authentication operation (incoming call - normal procedure)

E.3 Call clearing information notification function

E.3.1 Definition

The call clearing information notification function is used for indicating an information, which an ISDN can not indicate to a public CS by a CAUSE information element at a call clearing.

E.3.2 Description

This function in this specification is as follows:

This function is used when an ISDN indicates clear of call at the interface between public CS and an ISDN in the case of a handover.

A public CS can recognize by this signalling that a handover was executed.

This function is specified only at the interface between a public CS and an ISDN.

This function can be provided by an ISDN during an active call state.

E.3.3 Procedures

A DISCONNECT message and a Facility information element are used in this procedure.

This operation is classified in the operation class 5 of the ROSE operation and always invoked by the ISDN.

When a ISDN holds a new bearer channel in a handover function, the ISDN invokes this operation by sending a DISCONNECT message to a public CS which holds a previous bearer channel. This message contains the CAUSE information element that shall indicate cause #16 "normal call clearing" and the return result with the following data element in a Facility information element.

Call clearing information notification category: handover

The invoke identifier value used for invocation of this service is independent from the call reference value used in a DISCONNECT message.

The transition of call state at a public CS and an ISDN is the same as that of a normal call clearing procedure specified by IF2.02.

E.3.4 Interaction with other supplementary services

The call clearing information notification operation may conflict with that value for the DTMF transmission operation invoked by the public CS, which specified in Annex D/IF2.01.

In this case, the ISDN shall execute the following process:

> The ISDN ignores the DTMF transmission operation. This means that the ISDN should not send a reject in a Facility information element and should not generate DTMF.

The public CS is recommended to execute the following process:

> The public CS executes the call clearing information notification operation, and stops the local timer for error response to DTMF transmission operation.

E.3.5 Examples for coding and signalling flow

An example coding of an invoke in a Facility information element is shown in Table E-7/IF2.01.

An example signalling flow for normal operation are shown in Figure E-5/IF2.01.

Table E-7/IF2.01 Call clearing information operation (invoke)

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	1	1	1	0	0	1
Facility information element identifier								
Length of facility contents								2
1	0	0	1	0	0	0	1	3
ext.	Spare		Protocol Profile (Remote Operations Protocol)					
1	0	1	0	0	0	0	1	4
Component type tag (Invoke)								
Length of component								5
0	0	0	0	0	0	1	0	6
Component identifier tag (Invoke identifier)								
Length of component identifier								7
Invoke identifier								8
0	0	0	0	0	1	1	0	12
Operation value tag (Object identifier)								
Length of operation value								13
0	0	0	0	0	0	1	1	14.1
1	0	1	0	0	0	1	0	14.2
0	0	1	1	0	0	0	1	14.3
1	0	0	0	0	1	1	1	14.4
0	1	1	0	1	1	0	0	14.5
0	0	0	0	0	0	0	1	14.6
0	0	0	0	1	0	1	1	14.7
0	0	1	1	0	0	0	1	15.1
Tag class (Universal)		Element form (Constructor)	Tag (SET)					
Length of components								15.2
1	0	0	0	1	0	1	0	15.3.1
Tag class (Context-specific)		Element form (Primitive)	Tag(Call clearing information notification)					
0	0	0	0	0	0	0	1	15.3.2
Length of component								
0	0	0	0	0	0	0	1	15.3.3
Call clearing information notification category (handover(1))								

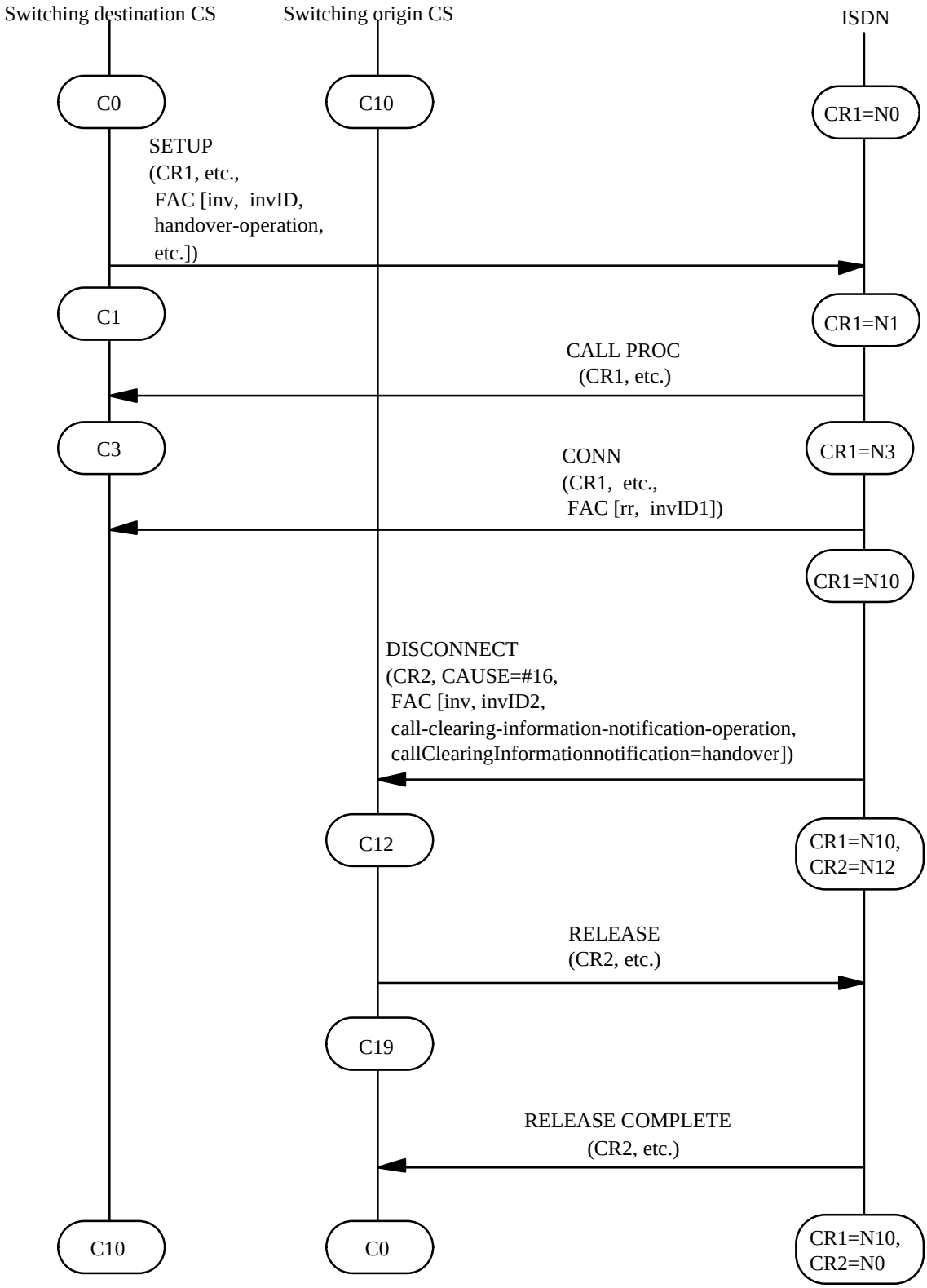


Figure E-5/IF2.01
An example signalling flow for call clearing information notification operation (normal procedure)

E.4 Coding of a return error type in a Facility information element

Coding of return errors in a Facility information element is shown in Table E-8/IF2.01.
For the coding of rejects in a Facility information element, see 8.2.3/ITU-T Q.932.

Table E-8/IF2.01 Return error component

Bits 8	7	6	5	4	3	2	1	Octets
0	0	0	1	1	1	0	0	1
Facility information element identifier								
Length of facility contents								2
1	0	0	1	0	0	0	1	3
ext.	Spare		Protocol Profile (Remote Operations Protocol)					
1	0	1	0	0	0	1	1	4
Component type tag (Return result)								
Length of component								5
0	0	0	0	0	0	1	0	6
Component identifier tag (Invoke identifier)								
Length of component identifier								7
Invoke identifier								8
0	0	0	0	0	1	1	0	9
Tag class (Universal)		Element form (Primitive)	Error value tag (Object identifier)					
Length of error value								10
0	0	0	0	0	0	1	1	11.1
1	0	1	0	0	0	1	0	11.2
0	0	1	1	0	0	0	1	11.3
1	0	0	0	0	1	1	1	11.4
0	1	1	0	1	1	0	0	11.5
0	0	0	0	0	0	1	0	11.6
Error value								11.7

Table of error values

Bit 8	7	6	5	4	3	2	1		
0	0	0	0	0	0	1	0	P2	temporaryFailure
0	0	0	0	0	0	1	1	P3	addressError
0	0	0	0	0	1	0	1	P5	timerExpiry
0	0	0	0	0	1	1	0	P6	userConditionNotAllowed
0	0	0	0	0	1	1	1	P7	switchingEquipmentCongestion
0	0	0	0	1	0	1	0	P10	authenticationError

(a) Error values specified by this specification

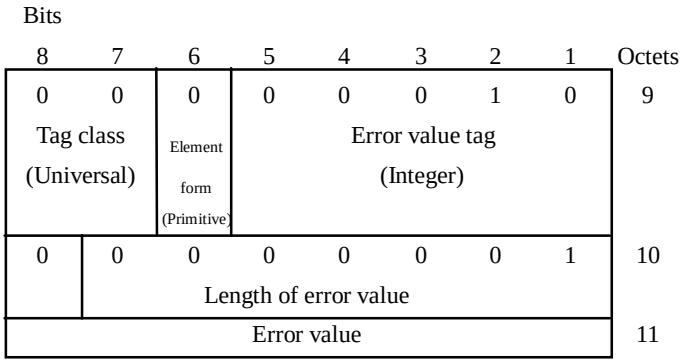


Table of error values

Bit 8	7	6	5	4	3	2	1	
0	0	0	0	0	0	0	0	userNotSubscribed
0	0	0	0	0	0	1	1	notAvailable
0	0	0	0	0	1	0	1	insufficientInformation
0	0	0	0	0	1	1	1	invalidCallState
0	0	0	0	1	0	0	0	basicServiceNotProvided
0	0	1	0	1	0	1	1	proceduralError

(b) Error values specified by ITU-T Q.950

E.5 ASN.1 modules for supplementary services

ASN.1 modules for supplementary services are classified as follows:

- ASN.1 module for operations

  - location registration operation
  - authentication operation
  - call clearing information notification operation

- ASN.1 module for errors

These two ASN.1 modules are shown in Table E-9/IF2.01 and Table E-10/IF2.01.

Table E-9/IF2.01 The ASN.1 module for the operations

```
PHS-Service-Operations
DEFINITIONS ::=
BEGIN
IMPORTS                 OPERATION, ERROR
                        FROM
                        Remote-Operation-Notation {joint-iso-ccitt remote-operations (4) notation
                        (0)}
                        notAvailable, insufficientInformation, invalidCallState,
                        basicServiceNotProvided, proceduralError
                        FROM
                        General-Error-List {ccitt (0) recommendation q 950 general-error-list (1)}
                        Q931InformationElement
                        FROM
                        Embedded-Q931-Types {ccitt recommendation q 932 embedded-q931-types
                        (5)}
                        temporaryFailure, addressError, timerExpiry, userConditionNotAllowed,
                        switchingEquipmentCongestion, authenticationError
                        FROM
                        {ccitt (0) network-operator (3) ntt (4401) phs-specific-service (1004) module
                        (0) error-list (1)}
                        ;
PSystemRegistrationType ::=OPERATION
        -- This operation is used for the location registration procedure.
         ARGUMENT SET       { registrationCategory [6] IMPLICIT RegistrationCategory,
                              callingPartyNumber      Q931InformationElement OPTIONAL }
        -- The number digits included in Calling party number information element are the numbers
           dialed by a remote user for incoming call.
         RESULT
          ERRORS  { notAvailable, insufficientInformation, proceduralError, temporaryFailure,
                    addressError, timerExpiry, userConditionNotAllowed,
                    switchingEquipmentCongestion, authenticationError}
pHSRegistration pHSRegistrationType ::=
        {ccitt (0) network-operator (3) ntt (4401) phs-specific-service (1004) operation (1) phs-
        registration-operation (8)}
AuthenticationType ::= OPERATION
        -- This operation is used for the authentication procedure.
         ARGUMENT SET       { randomNumber [7] IMPLICIT OCTET STRING OPTIONAL }
        -- Random number data element is sent by a ISDN.
         RESULT SET         { resultOfCalculation [8] IMPLICIT OCTET STRING OPTIONAL }
        -- Result of calculation data element is the random number enciphered for authentication.
        ERRORS              { notAvailable, insufficientInformation, invalidCallState,
                              proceduralError  }
authentication AuthenticationType ::=
        {ccitt (0) network-operator (3) ntt(4401) phs-specific-service(1004) operation (1)
        authentication-operation (9)}
CallClearingInformationType ::= OPERATION
```

```
        -- This operation is used for notifying the call clearing information.
        ARGUMENT SET        { callClearingInformationCategory [10] IMPLICIT
                              CallClearingInformationCategory }
callClearingInformation CallClearingInformationType ::=
        {ccitt (0) network-operator (3) ntt (4401) phs-specific-service (1004) operation (1) call-
        clearing-information-operation (11)}
RegistrationCategory    ::= ENUMERATED {outgoing-incoming location registration}
CallClearingInformationCategory         ::= ENUMERATED { handover (1) }
END -- of PHS-Service-Operations
```

Table E-10/IF2.01 The ASN.1 module for the errors

```
PHS-NetworkSpecific-Error-List
        {ccitt (0) network-operator (3) ntt (4401) phs-networkspecific-service (1004) module (0) error-
        list (1)}
DEFINITIONS ::=
BEGIN
EXPORTS         temporaryFailure, addressError, destinationOutOfOrder, timerExpiry,
                userConditionNotAllowed, switchingEquipmentCongestion, authenticationError;
temporaryFailure                ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) temporary-failure(2)}
addressError                    ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) address-error(3)}
destinationOutOfOrder           ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) destination-out-of-order(4)}
timerExpiry                     ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) timer-expiry(5)}
userConditionNotAllowed         ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) user-condition-not-
                                        allowed(6)}
switchingEquipmentCongestion    ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) switching-equipment-
                                        congestion(7)}
authenticationError             ERROR   ::= {ccitt network-operator ntt phs-networkspecific-
                                        service (1004) error (2) authentication-error(10)}
END --of PHS-NetworkSpecific-Error-List
```

Annex F

Facility Information Element Compornent Coding

The ASN.1 module for facility information element component using Abstract Syntax Notation One (ASN.1) based on ITU-T Recommendation X.680 is defined as follows.

```
Facility-Information-Element-Component-Version1
{itu-t(0) administration(2) japan(440) isdn(102) phs(4) module(0) facility-information-element-component(2) version1(1)}

DEFINITIONS::=
BEGIN
-- EXPORTS EVERYTHING
IMPORTS
ROS{} FROM
Remote-Operations-Generic-ROS-PDUs {joint-iso-itu-t remote-operations(4) generic-ROS-PDUs(6) version1(0)}
OPERATION FROM
Remote-Operations-Information-Objects {joint-iso-itu-t remote-operations(4) informationObjects(5) version1(0)}
;
--Component definition
--Operation and error of each supplemently survice are defined using  remote-operation-informationm-
--object-class notation in other recomendation.
Component{OPERATION:Invokable,OPERATION:Returnable} ::=
ROS{InvokeIdentifierType,{Invokable},{Returnable}}
-- This type is parametrized in that the valuse conveyed in the component portion depend on the set of
-- operations which can be invoked and the set of operations for whch  a  response may be generated.

InvokeIdentifierType ::= INTEGER(-32768..32767)

END -- of Facility-Information-Element-Component-Version1
```

The generic ROS PDU is defined as follows. The definition is the same as the one provided in ITU-T Recomendation X.880 and is only provided here for convinience to the user.

```
Remote-Operations-Generic-ROS-PDUs {joint-iso-itu-t remote-operations(4) generic-ROS-PDUs(6) version1(0)}
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
-- exports everything
IMPORTS OPERATION, ERROR FROM Remote-Operations-Information-Objects {joint-iso-itu-t remote-operations(4) informationObjects(5) version1(0)};
```

```
ROS {InvokeId:InvokeIdSet, OPERATION:Invokable, OPERATION:Returnable} ::= CHOICE
{
        invoke          [1]  Invoke {{InvokeIdSet}, {Invokable}},
        returnResult    [2]  ReturnResult {{Returnable}},
        returnError     [3]  ReturnError {{Errors{{Returnable}}}},
        reject          [4]  Reject
}
(CONSTRAINED BY  {-- must conform to the above definition --}
! RejectProblem       : general-unrecognizedPDU)


Invoke {InvokeId:InvokeIdSet, OPERATION:Operations} ::= SEQUENCE
{
        invokeId        InvokeId   (InvokeIdSet)
                                   (CONSTRAINED BY   {-- must be unambiguous --}
                                   ! RejectProblem       : invoke-duplicateInvocation),
        linkedId        CHOICE {
                                        present   [0]  IMPLICIT present <    InvokeId,
                                        absent    [1]  IMPLICIT NULL
                                            }
                                   (CONSTRAINED BY   {-- must identify an outstanding operation  --}
                                   ! RejectProblem       : invoke-unrecognizedLinkedId)
                                   (CONSTRAINED BY   {-- which has one or more linked operations  -
-}
                                   ! RejectProblem       : invoke-linkedResponseUnexpected)
                                        OPTIONAL,
        opcode          OPERATION.&operationCode
                                   ({Operations}
                                   ! RejectProblem       : invoke-unrecognizedOperation),
        argument        OPERATION.&ArgumentType
                                   ({Operations} {@opcode}
                                   ! RejectProblem       : invoke-mistypedArgument)
                                        OPTIONAL
}
(CONSTRAINED BY  {-- must conform to the above definition --}
! RejectProblem       : general-mistypedPDU)
(
        WITH COMPONENTS
        {...,
            linkedId ABSENT
        }
|       WITH COMPONENTS
        {...,
            linkedId PRESENT,
            opcode
            (CONSTRAINED BY  {-- must be in the & Linked field of the associated operation  --}
            ! RejectProblem          : invoke-unexpectedLinkedOperation)
        }
)

ReturnResult {OPERATION:Operations}::= SEQUENCE
{
        invokeId     InvokeId
                                (CONSTRAINED BY         {-- must be that for an outstanding operation -
-}
                                ! RejectProblem       : returnResult-unrecognizedInvocation)
```

```
                        (CONSTRAINED BY         {-- which returns a result  --}
                        ! RejectProblem         : returnResult-resultResponseUnexpected),
        result          SEQUENCE
        {
        opcode          OPERATION.&operationCode
                        ({Operations})(CONSTRAINED BY {-- identified by invokeId --}
                        ! RejectProblem         : returnResult-unrecognizedInvocation),
        result          OPERATION.&ResultType
                        ({Operations} {@opcode}
                        ! RejectProblem         : returnResult-mistypedResult)
        }
                        OPTIONAL
}
(CONSTRAINED BY         {-- must conform to the above definition --}
! RejectProblem         : general-mistypedPDU)

ReturnError {ERROR:Errors} ::= SEQUENCE
{
        invokeId        InvokeId
                        (CONSTRAINED BY         {-- must be that for an outstanding operation --}
                        ! RejectProblem         : returnError-unrecognizedInvocation)
                        (CONSTRAINED BY         {-- which returns an error --}
                        ! RejectProblem         : returnError-errorResponseUnexpected),
        errcode         ERROR.&errorCode
                        ({Errors}
                        ! RejectProblem : returnError-unrecognizedError)
                        (CONSTRAINED BY         {-- must be in the & errors field of the associated operation  --}
                        ! RejectProblem : returnError-unexpectedError),
        parameter       ERROR.&ParameterType
                        ({Errors}{@errcode}
                        ! RejectProblem : returnError-mistypedParameter) OPTIONAL
}
(CONSTRAINED BY         {-- must conform to the above definition --}
! RejectProblem         : general-mistypedPDU)

Reject ::= SEQUENCE
{
        invokeId        InvokeId,
        problem         CHOICE
            {
                general         [0]  GeneralProblem,
                invoke          [1]  InvokeProblem,
                returnResult    [2]  ReturnResultProblem,
                returnError     [3]  ReturnErrorProblem
            }
}
(CONSTRAINED BY         {-- must conform to the above definition --}
! RejectProblem         : general-mistypedPDU)

GeneralProblem ::= INTEGER
{
        unrecognizedPDU (0),
        mistypedPDU (1),
        badlyStructuredPDU (2)
}
```

```
InvokeProblem ::= INTEGER
{
        duplicateInvocation (0),
        unrecognizedOperation (1),
        mistypedArgument (2),
        resourceLimitation (3),
        releaseInProgress (4),
        unrecognizedLinkedId (5),
        linkedResponseUnexpected (6),
        unexpectedLinkedOperation (7)
}

ReturnResultProblem ::= INTEGER
{
        unrecognizedInvocation (0),
        resultResponseUnexpected (1),
        mistypedResult (2)
}

ReturnErrorProblem ::= INTEGER
{
        unrecognizedInvocation (0),
        errorResponseUnexpected (1),
        unrecognizedError (2),
        unexpectedError (3),
        mistypedParameter (4)
}

RejectProblem ::= INTEGER
{
        general-unrecognizedPDU (0),
        general-mistypedPDU (1),
        general-badlyStructuredPDU (2),
        invoke-duplicateInvocation (10),
        invoke-unrecognizedOperation (11),
        invoke-mistypedArgument (12),
        invoke-resourceLimitation (13),
        invoke-releaseInProgress (14),
        invoke-unrecognizedLinkedId (15),
        invoke-linkedResponseUnexpected (16),
        invoke-unexpectedLinkedOperation (17),
        returnResult-unrecognizedInvocation (20),
        returnResult-resultResponseUnexpected (21),
        returnResult-mistypedResult (22),
        returnError-unrecognizedInvocation (30),
        returnError-errorResponseUnexpected (31),
        returnError-unrecognizedError (32),
        returnError-unexpectedError (33),
        returnError-mistypedParameter (34)
}

InvokeId ::= CHOICE
{
        present   INTEGER,
        absent    NULL
}

noInvokeId InvokeId ::= absent:NULL
```

```
NoInvokeId InvokeId ::= {noInvokeId}

Errors {OPERATION:Operations} ERROR ::= {Operations.&Errors}

Bind {OPERATION:operation} ::= CHOICE
{
        bind-invoke  [16]  OPERATION.&ArgumentType({operation}),
        bind-result  [17]  OPERATION.&ResultType ({operation}),
        bind-error   [18]  OPERATION.&Errors.&ParameterType ({operation})
}

Unbind {OPERATION:operation} ::= CHOICE
{
        unbind-invoke [19]  OPERATION.&ArgumentType({operation}),
        unbind-result [20]  OPERATION.&ResultType ({operation}),
        unbind-error  [21]  OPERATION.&Errors.&ParameterType ({operation})
}

END -- end of generic ROS PDU definition
```

Appendix I

Illustration of the application of the three protocol type

(This Appendix does not form an integral part of this Specification)

I.1 Introduction

Following subsets are defined based on ITU-T Recommendation Q.932.

This Appendix is provided as an illustration of the application of the protocol type defined in this Specification.

The signalling sequences shown are not exhaustive and are only intended to illustrate possible supplementary service control sequences.

I.2 Example use of the Keypad protocol *

I.3 Example use of the Feature key management protocol *

I.4 Examples use of the Functional protocol

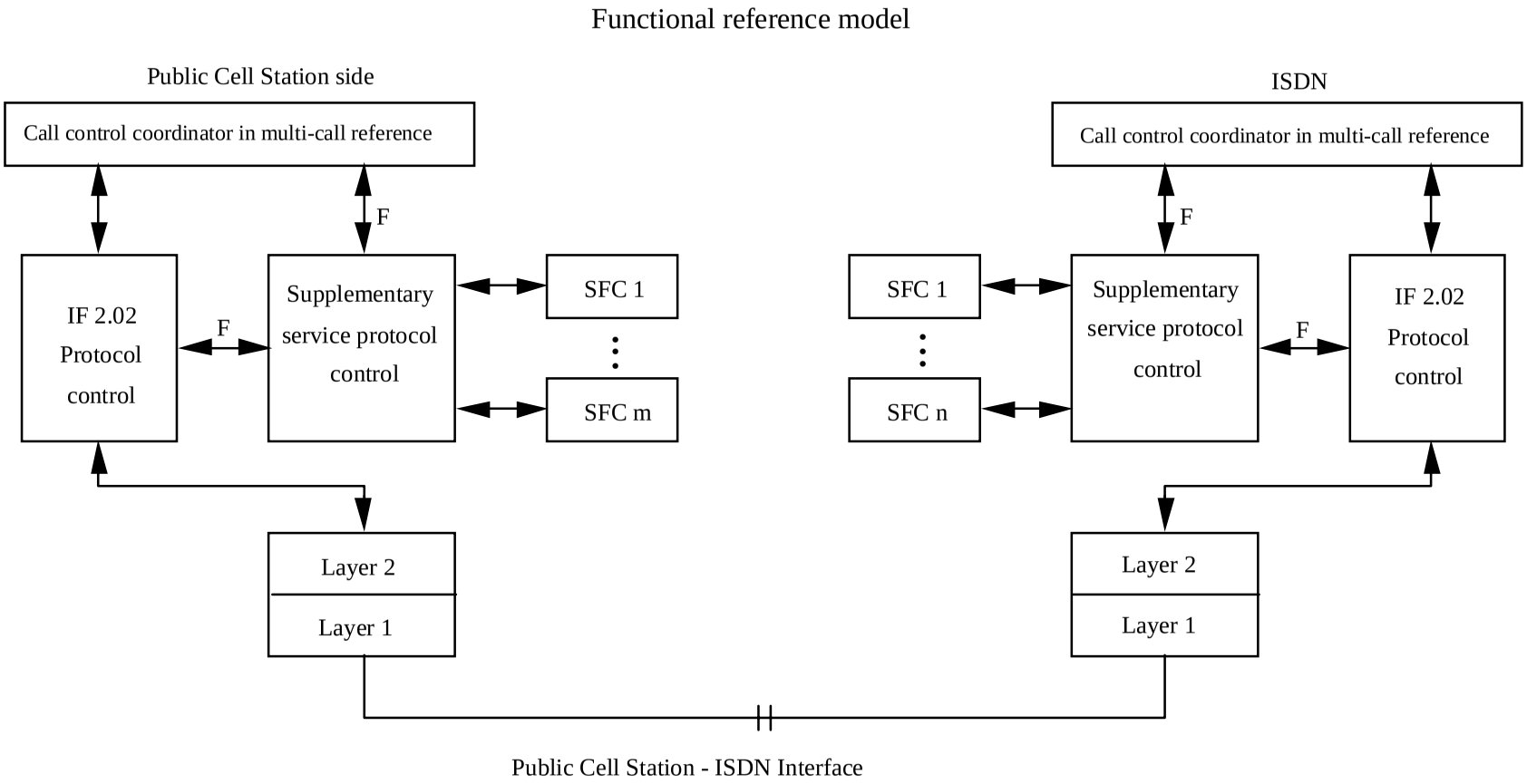
Same specification as is provided in Appendix I.4/ITU-T Q.932 is applied.

Appendix II

Functional reference model for the operation of supplementary services

(This Appendix does not form an integral part of this Specification)

This Appendix provides a functional model intended to show how the supplementary services can be operated by Functional protocol types to interact with a unique supplementary service protocol controller which interfaces with the relevant supplementary functional components which provides and coordinates the required functions associated to each supplementary service (e.g. control of resources).



SFC Supplementary functional component

F Functional interaction

Figure II-1/B-IF 2.01

Protocol architecture model

Appendix III

General description of component encoding rules

(This Appendix does not form an integral part of this Specification)

Same specification as is provided in Appendix III/ITU-T Q.932 is applied.

Appendix IV

Definition of operations, errors and data types

(This Appendix does not form an integral part of this Specification)

Same specification as is provided in Appendix IV/ITU-T Q.932 is applied.

Appendix V

List of object identifiers defined in MoU IF2.02

(This Appendix does not form an integral part of this Specification)

Nothing is defined by this specification.

This specification uses object identifiers defined by ITU-T Recommendation Q.932.

This specification also uses following object identifieres defined by NTT, Japan as specified in Annex E:

{ccitt (0) network-operator (3) ntt (4401) phs-networkspecific-service (1004) module (0) error-list (1)}	Table E-10
{ccitt (0) network-operator (3) ntt (4401) phs-specific-service (1004) operation (1) phs-registration-operation (8)}	Table E-9
{ccitt (0) network-operator (3) ntt(4401) phs-specific-service(1004) operation (1) authentication-operation (9)}	Table E-9
{ccitt (0) network-operator (3) ntt (4401) phs-specific-service (1004) operation (1) call-clearing-information-operation (11)}	Table E-9
{ccitt network-operator ntt phs-networkspecific-service (1004) error (2) temporary-failure(2)}	Table E-10
{ccitt network-operator ntt phs-networkspecific-service (1004) error (2) address-error(3)}	Table E-10
{ccitt network-operator ntt phs-networkspecific-service (1004) error (2) destination-out-of-order(4)}	Table E-10
{ccitt network-operator ntt phs-networkspecific-service (1004) error (2) timer-expiry(5)}	Table E-10
{ccitt network-operator ntt phs-networkspecific-service (1004) error (2) user-condition-not-allowed(6)}	Table E-10
{ccitt network-operator ntt phs-networkspecific-service (1004) error (2) switching-equipment-congestion(7)}	Table E-10

References

The followings are added to "References" of ITU-T Recommendation Q.932.

[11] PHS MoU Specification IF2.02 "Personal Handy-Phone System Public Cell Station - ISDN Interface -Layer 3 Specification-", Version.1, April, 1996.

[12] PHS MoU Specification IF2.03 "Personal Handy-Phone System Public Cell Station - ISDN Interface Layer 2 Specification-", Version.1, April, 1996.

[13] PHS MoU Specification IF1.00 "Personal Handy-Phone System", Version.1, April, 1996.

Acronyms used in this specification

The followings are added to "Acronyms used in this Recommendation" of ITU-T Q.932.

PHS Personal Handy-Phone System
RCR Research and development Center for Radio systems
ARIB Association of Radio Industries and Businesses