

Title: Public Personal Handy-Phone System : Network Interworking between a Public PHS Network and an ISDN, and between Public PHS Networks

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History of Revised Versions

Version	Date	Outline
01	Dec. 19, 1997	Established
02	July 31, 1998	64 kbit/s unrestricted data bearer service is added in section 5.

**Public Personal Handy-Phone System:
Network Interworking between a Public PHS Network and an ISDN,
and between Public PHS Networks**

< Summary >

1. Relationship with International Standards

This specification specifies interworking between a public PHS network and an ISDN, and between public PHS networks based on ITU-T Recommendation I.520 which specifies ISDN-ISDN interworking arrangements.

2. Differences to/from International Recommendations

(1) Network model and terminology

ITU-T Recommendation I.520 specifies interworking where both interworking networks are ISDNs. This specification changes this model such that one of the interworking networks is a public PHS network and the other network is either a public PHS network or an ISDN. The differences of model and terminology from ITU-T Recommendation I.520 are summarized in Table Summary-1/B-IW2.00.

(2) Specifications

The differences of specifications from ITU-T Recommendation I.520 are summarized in Table Summary-2/B-IW2.00.

The following specifications have been deleted from ITU-T Recommendation I.520:

- Packet mode bearer service;
- Additional packet mode bearer service;
- Transit network selection information element in IF2 and IF3;
- Key pad information element for overlap sending/receiving;
- Alternate speech/64 kbit/s unrestricted bearer service;
- Multi-use bearer service;
- Restricted 64 kbit/s transfer capability.

3. References

ITU-T Recommendations: I.5xx series

PHS MoU Documents: B-IF2.xx, B-IF3.xx, B-IWx.xx series

4. Items for Further Study

None

Table Summary-1/B-IW2.00 Differences of model and Terminology from ITU-T Recommendation I.520

Item	I.520	This specification
Interworking network model	Both sides of interworking networks are ISDNs.	One of the interworking networks is a public PHS network, and the other one is either a public PHS network or an ISDN.
Network configuration figure	Both networks are ISDNs.	Left side network is a public PHS network and right side network is either a public PHS network or an ISDN. (specified as “Public PHS network/ISDN”)
Terminology	ISDN - in a context of service	public PHS network
	ISDN(s) - in a context of interworking	public PHS network and public PHS network/ISDN
	ISDN-ISDN	public PHS network- public PHS network/ISDN
	64 kbit/s unrestricted data	32 kbit/s unrestricted data and 64 kbit/s unrestricted data
	Nx, Kx	IF3 (Nx), IF3 (Kx)
	ISDNcs	public PHS network (circuit switched)/ ISDN (circuit switched)
Reference	ITU-T Recommendations I.510, I.530, I.324 (for Nx, Kx definitions), Q.763, Q.931	PHS MoU Documents B-IW0.01, B-IW3.00, B-IW0.01, B-IF3.33, B-IF2.02

**Table Summary-2/B-IW2.00 Differences of specifications from ITU-T
Recommendation I.520**

Section	Differences
3. Required information and information handling	- Descriptions including Table 3/I.520 relating to packet mode bearer service are deleted.
4.1.2.2 User-to-user signalling services	- Transit network selection in Table 1/I.520 is changed to unnecessary.
4.2 ISDN-ISDN interface where both ISDNs provide X.31 case B based packet mode bearer services	- Key pad for called party number in category ii of Table 1/I.520 is deleted.
4.3 ISDN-ISDN interface where a circuit mode bearer service is provided by one ISDN to access either a PSPDN, or a PH and an X.31 case B packet mode bearer service provided by another ISDN	- This section relating to packet mode bearer service is not included.
4.5 ISDN-ISDN interface for additional packet mode bearer services	- This section relating to additional packet mode bearer service is not included.
4.6 ISDN-ISDN interface where an X.31 case B based packet mode bearer service is provided on one ISDN and an additional packet mode bearer services is requested on another ISDN	- This section relating to packet mode bearer service and additional packet mode bearer service is not included.
4.7 ISDN-ISDN interface for circuit mode to additional packet mode service	- This section relating to additional packet mode bearer service is not included.
5.1 Echo control processing	- Alternate speech/64 kbit/s unrestricted bearer service is deleted. - Multi-use bearer service is deleted. - 32 kbit/s unrestricted bearer service and 64 kbit/s unrestricted bearer service are described separately.
5.4 Compatibility checking between end users of different ISDNs	- IWF treatment on LLC information is described.
6. Functional interworking requirements for data transmission services	- This section relating to additional packet mode bearer service is not included.
7. Reference	- Reference is included in summary.
Annex A GLOSSARY and ABBREVIATIONS	- Annex A is added.
Appendix I ISDN connections involving restricted 64 kbit/s transfer capability	- This appendix relating to restricted 64 kbit/s transfer capability is not included.

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1. Introduction

The number of public PHS networks existing in the world is increasing and public PHS networks must be introduced having inter-connectivity with existing ISDNs and other public PHS networks. Therefore public PHS network-ISDN as well as public PHS network-public PHS network interfaces should be standardized to facilitate the interworking between ISDNs and to extend connectivity world-wide.

2. Scope

The purposes of this document are

- 1) to identify the general arrangements for public PHS network-public PHS network/ISDN
 - interworking, and
- 2) to define the functions and other requirements for the public PHS network-public PHS
 - network/ISDN interface.

B-IW0.01 defines the reference point between two interconnected public PHS networks to be the IF3 (Nx) reference point. This Specification document identifies other Specification document which should be applied to the IF3 (Nx) reference point and clarifies the functions and requirements for interworking at the IF3 (Nx) reference point.

3. Required information and information handling

Figure 3-1/B-IW2.00 illustrates the general configuration for interworking between a public PHS network and a public PHS network/ISDN. The information given in Tables 3-1/B-IW2.00 and 3-2/B-IW2.00 when required, has to be carried by Signalling System No.7 (SS No.7) ISUP and is handled at the IWF in one of the following ways:

- i) information is terminated at the IWF and is not transferred to other public PHS
 - networks/ISDNs;
- ii) information is interpreted at the IWF and is transferred to other public PHS networks/ISDNs;
- iii) information is transferred through the IWF transparently;
- iv) information is newly generated at the IWF.

Tables 3-1/B-IW2.00 and 3-2/B-IW2.00 also show the classification of information into the above four categories for circuit mode bearer services and circuit mode supplementary services respectively.

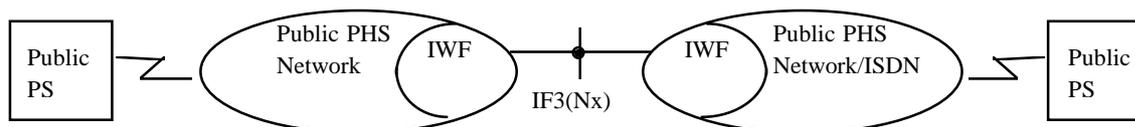


Figure 3-1/B-IW2.00 General configuration for interworking between public PHS network and public PHS network/ISDN

Table 3-1/B-IW2.00 Information required for IWF between public PHS network and public PHS network/ISDN for circuit mode bearer service

Category	Required information	B-IF2.02 (Q.931) information element	B-IF3.33 (Q.763) parameter name
i	First transit network subsequent to IWF	(Unnecessary)	(Unnecessary)
ii	Called party number (Note 1) Calling party's category (Note 2) Bearer capability Call indicators (Note 3) Use of satellite (Note 4)	Called party number (Unnecessary) Bearer capability (Unnecessary) (Unnecessary)	Called party number/ Subsequent number Calling party's category Transmission medium requirements User service information Forward call indicators Backward call indicators Nature of connection indicators
iii (Note 8)	Calling party number Subaddress Calling party's category Terminal compatibility (Note 5) User-to-user signalling Cause Charge	Calling party number Subaddress (Unnecessary) Low layer compatibility High layer compatibility Use-to-user information element Cause (Unnecessary)	Calling party number Access transport Calling party's category Access transport Use-to-user information Cause indicator Charge information
iv	Cause for interworking Charging information (Note 6) Change of service (Note 7)	Cause (Unnecessary) (Should be defined)	Cause indicator Charge information (Should be defined)
<p>NOTES</p> <ol style="list-style-type: none"> 1. For charging use. 2. For discrimination of priority call/ordinary call. 3. Those indicators are used to identify: <ol style="list-style-type: none"> a) international incoming call; b) available end-to-end signalling system; c) charged call/noncharged call. 4. When a satellite circuit is employed for an interworking call at the interworking point, this information is processed at the IWF. If a satellite circuit is not employed for a call, this information is transferred through the IWF transparently. 5. There may be cases where the terminal compatibility information is processed (see 5.4). 6. This information is used only when access charging is necessary. 7. All public PHS networks/ISDNs do not necessarily provide identical services (or connection types). When a change of services occurs at the IWF, the network should send the indication for change of services and may solicit acceptance of change of services to a calling user in certain cases (see 5.3.1). 8. The information in this category is transferred through the IWF transparently. 			

Table 3-2/B-IW2.00 Information required for IWF between public PHS network and public PHS network/ISDN for circuit mode supplementary services

Category	Required information	B-IF2.02 (Q.931) information element	B-IF3.33 (Q.763) parameter name
ii	Supplementary service request	Network specific facility Key pad facility Feature activation Feature indication	(Should be defined)
iii	Progress indicator Suspend/Resume indicator	Progress indicator Notification indicator	Access transport Suspend/Resume indicator

Additional information required specifically for OAM (Operational, Administrative and Maintenance) functions is for further study.

4. Description of public PHS network-public PHS network/ISDN interworking configurations

4.1 Public PHS network-public PHS network/ISDN interface where circuit mode bearer services are provided by both networks

See Figure 4-1/B-IW2.00.

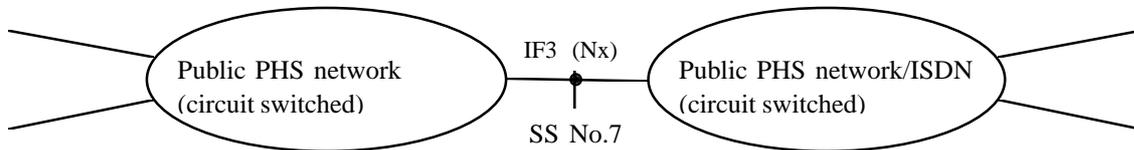


Figure 4-1/B-IW2.00 Public PHS network (circuit switched) interworking with public PHS network/ISDN (circuit switched)

4.1.1 Bearer services

Individual bearer service categories are defined in the I.230-Series Recommendations.

Layer 1 interworking specifications are recommended in Recommendation I.511. Layers 2 and 3 in the U-plane are passed transparently.

4.1.2 Supplementary services

4.1.2.1 Other than user-to-user signalling

For supplementary services other than use-to-user signalling, call control information is transferred via Signalling System No. 7 across the IF3 (Nx) reference point. The interface for user information transfer is not different from that of basic bearer services.

4.1.2.2 User-to-user signalling services

There are two methods of transferring user-to-user signalling. One is transfer of user-to-user signalling within B-IF2.02 call control messages which have been mapped into Signalling System No. 7 messages and then are conveyed via the Signalling System No. 7 network. The other is transfer of user-to-user signalling within stand alone USER INFO messages (which have been mapped into Signalling System No. 7 messages and then are conveyed via the Signalling System No. 7 network). In the case where user-to-user signalling is transferred via Signalling System No. 7 networks in both a public PHS network and a public PHS network/ISDN or at least in one of the networks, the Signalling System No. 7 protocol should be applied to the internetwork interface for user-to-user signalling.

4.1.3 Signalling System No. 7 for the control of circuit mode service at the IF3 (Nx) reference point

For the control of circuit mode services in the long term, Signalling System No. 7 with ISUP will be used at the IF3 (Nx) reference point.

4.2 Public PHS network-public PHS network/ISDN interworking via a transit network

Public PHS network-public PHS network/ISDN interworking via a transit network (see Figure 4-2/B-IW2.00) may be useful configuration in the short term for extending specific public PHS network services on an end-to-end basis. Special transmission, switching and signalling capabilities may have to be deployed in the transit network to ensure that the specific public PHS network service is available end-to-end.

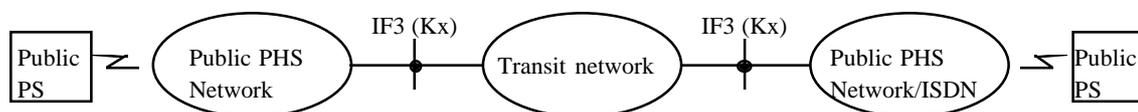


Figure 4-2/B-IW2.00 Interworking between public PHS network and public PHS network/ISDN via a transit network

The detailed interworking functions and interfaces for this configuration are for further study.

5. Interworking functions

Interworking functions commonly employed for various types of interworking are described in B-IW0.01. The interworking functions specific to public PHS network-public PHS network/ISDN interworking are described here.

5.1 Echo control processing and speech processing

Table 5-1/B-IW2.00 shows the permitted relationship between circuit mode bearer services and various forms of speech processing functionality. These speech processing functions include digital

speech interpolation (DSI), low rate encoding (LRE) and digital circuit multiplication (DCM). Depending upon the particular relationship to the circuit mode bearer services, these processing functions are specified as essential, optional, prohibited or functionally disabled.

For a speech, 3.1 kHz audio, 32 kbit/s unrestricted, or 64 kbit/s unrestricted call within a public PHS network, appropriate network control is required to ensure that the relationship shown within Table 5-1/B-IW2.00 is realized. An example of this control might be routing (to exclude or include a function) or out-band signalling (to disable a function). Further, it is to be noted that a disabling tone (see Recommendation V.25 and B-IW3.00) may be used to functionally remove echo control devices on a 3.1 kHz audio bearer service connection.

For a call which involves communication through different public PHS networks, the network information regarding control of these functions needs to be extended across the public PHS network-public PHS network/ISDN internetwork interfaces. This information transfer is realized between the exchanges in interworking public PHS network-public PHS network/ISDN by means of

- 1) the Signalling System No. 7 ISUP bearer capability information element, and
- 2) the use of disabling tone (see Recommendation V.25 and B-IW3.00) by terminals, in the case of a 3.1 kHz audio bearer service.

The control of speech processing functions (DCM, A- μ law conversion, echo control, etc.) by exchanges is

- a) not needed when a disabling tone (see Recommendation V.25 and B-IW3.00) is used, in conjunction with the 3.1 kHz audio bearer service by a terminal(s), and
- b) to be implemented using out-band call processes (currently under study) when needed.

5.2 Generation of in-band tones and announcements for speech and 3.1 kHz audio bearer services

NOTE - This function is also necessary for a call within one public PHS network, which does not involve network interworking nor internal public PHS network interworking.

5.2.1 Unsuccessful call delivery

The point of call failure (i.e. the point at which the connection cannot proceed further) should generate the appropriate out-band clearing message toward the calling exchange. In response to this message, the calling exchange should send the appropriate out-band message to the calling user. However, for speech and 3.1 kHz audio bearer services, the network must be capable of generating the appropriate in-band tones or announcements. In this case, the clearing message should not be sent prior to the completion of the announcements.

5.2.2 Successful call delivery

For speech and 3.1 kHz audio bearer services, the terminating exchange should generate in-band ring back tone towards the calling user upon successful delivery of the call.

Table 5-1/B-IW2.00 Relationship between speech processing and bearer services within a public PHS network and for a public PHS network-public PHS network/ISDN interworking

Speech processing functions	Bearer service			
	1	2	3	4
	Speech	3.1 kHz audio a)	32 kbit/s unrestricted	64 kbit/s unrestricted
Echo control b)	E c) d)	E c) d)	FD	FD
A-μ law conversion e)	E	E	FD	FD
DSI	O	O f)	FD	FD
LRE	O	O f)	FD	FD
DCM	O	O f)	FD g)	FD h)
Analogue facilities	O	O f)	P	P

E Essential
O Optional
P Prohibited
FD Functionally disabled
DSI Digital speech interpolation
LRE Low rate encoding (e.g. Recommendation G.721)
DCM Digital circuit multiplication employing LRE and DSI and having controllable flexibility in modes of operation.

a) For the 3.1 kHz audio bearer service, echo control is included in the connection at the time of call set-up. It is disabled for the transmission of voice-band data by use of the disabling tone (see Recommendation V.25 and B-IW3.00).

b) Echo control needs to be disabled when continuity check is performed.

c) Although echo control may not be required in public PHS network-public PHS network/ISDN interworking for digital telephones (for further study), its inclusion for possible internetworking reasons for the speech bearer service is essential (see also B-IW3.00).

d) The necessity for network or terminal provided echo control in 4-wire end-to-end speech connections is for further study.

e) The IWF converting A-μ laws should also make the necessary bit translation in the bearer capability information element to indicate the law used.

f) The network may include signal processing techniques provided they are appropriately modified or functionally removed prior to information transfer.

g) The 32 kbit/s transparent capability will be invoked, subject to the available transmission capacity, by the adjoining exchange over a dedicated out-band signalling system.

The 64 kbit/s transparent capability will be invoked, subject to the available transmission capacity, by the adjoining exchange over a dedicated out-band signalling system.

NOTE – The bearer services in columns 1, 2, 3 and 4 of the table permit control of speech processing devices only at call set-up as required for the particular bearer service requested.

5.3 Call negotiation between a public PHS network and a public PHS network/ISDN

There are two aspects of call negotiation between a public PHS network and a public PHS network/ISDN: service agreement and connection agreement.

5.3.1 Service agreement between a public PHS network and a public PHS network/ISDN

Service agreement between a public PHS network and a public PHS network/ISDN is defined as established compatibility between the two networks on a requested service. The service agreement does not necessarily occur on a call-by-call basis, but in a pre-determined way which has been agreed by bilateral negotiation between the two networks. If the service agreement is established, connection agreement then begins between the two networks.

If the service agreement is not established, procedures are for further study, including the following four alternatives. Additionally, the impact of these alternatives on user-to-network protocols or internetwork protocols is for further study.

- 1) The call may be established without the service compatibility (e.g. in the case of a supplementary service request).
- 2) The call may be cleared.
- 3) Either of the two networks may negotiate with the originating user to change or abandon the user's service request.
- 4) Another alternative may be selected from the originating user's service profile.

5.3.2 Connection agreement between a public PHS network and a public PHS network/ISDN

Connection agreement between a public PHS network and a public PHS network/ISDN is defined as negotiation on the connection element between the two networks. Connection agreement is required when the connection elements employed in each public PHS network/ISDN are different, even if service agreement exists. The use of call progress indicators for this purpose is for further study.

In a speech bearer service, the objects for connection agreement might be the use of one of the following: UDI (unrestricted digital information), satellite circuits, DSI circuits, the difference of PCM coding rules, circuit selection between digital networks having different hierarchical structures, etc. Parameter exchange, if required, are executed by the two networks.

The connection agreement does not necessarily occur on a call-by-call basis, but in a pre-determined way which has been established by other Recommendations (e.g. Recommendation G.802 for interworking between hierarchies and Recommendation G.711 for A- μ law conversion) or agreed between a public PHS network and a public PHS network/ISDN.

5.4 Compatibility checking between end users of different public PHS networks/ISDNs

When the connection path between two terminals on different public PHS networks/ISDNs is established, low layer compatibility (LLC), high layer compatibility (HLC) or user defined compatibility may be examined on an end-to-end basis.

Compatibility checking items between end users are as follows:

1) Low layer compatibility

LLC information would normally be used for user-to-user call negotiation and would be passed transparently through the networks. The IWF may, where required, examine and act on LLC information (see 2.2.1.3/I.515) in the cases where the LLC checking lists (see B-IF2.02) employed by the two relevant networks are different.

LLC information as well as Bearer capability information is used by IWFs in public PHS networks to select either 32 kbit/s or 64 kbit/s unrestricted data bearer service of IF1 for incoming data calls to public PSs. The IWFs in public PHS networks may modify the LLC information in some cases (see B-IF1.01).

2) High layer compatibility

The HLC is to be conveyed transparently and the networks need not operate on it. The examination and action on HLC information by the IWF is for further study, in the case where the HLC checking lists employed by the two relevant networks are different.

3) User defined compatibility checking

User defined compatibility checking is the user responsibility. The network does not participate in this compatibility checking.

Annex A GLOSSARY and ABBREVIATIONS

This annex forms an integral part of this document.

GLOSSARY

A

B

C

D

E

F

G

H

I

IF3(Kx)

PHS MoU

The network interworking reference point is the IF3(Kx) reference point when the network directly interconnected to the public PHS network is a non-ISDN.

IF3(Nx)

PHS MoU

The network interworking reference point is the IF3(Nx) reference point when the network directly interconnected to the public PHS network is a public PHS network or an ISDN.

J

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ABBREVIATIONS

DCM	Digital Circuit Multiplication
DSI	Digital Speech Interpolation
HLC	High Layer Compatibility
ISUP	ISDN User Part
IWF	InterWorking Function
LLC	Low Layer Compatibility
LRE	Low Rate Encoding
PCM	Pulse Code Modulation
UDI	Unrestricted Digital Information