

ETSI/TC SMG

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Interworking between the PLMN and the CSPDN

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1. Reason for changes

No changes since the previously distributed version.

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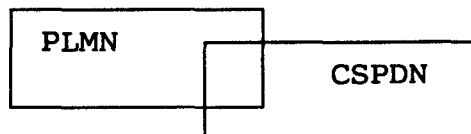
0. Scope

The purpose of this recommendation is to identify the IWFs and requirements to support interworking between PLMN and CSPDN.

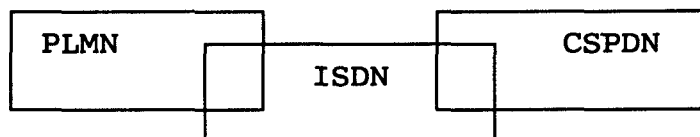
1. Introduction

There are two ways to interwork with the CSPDN, directly or via the ISDN.

Direct interworking:



Interworking via ISDN:



It is decided that only synchronous interworking with the speeds 2400, 4800 and 9600 shall be possible. Depending on the fact that it is impossible to flowcontrol the terminals connected to the CSPDN only transparent services in PLMN are used.

If there is a need for non-transparent service (e.g. for the teletex interworking) it will be supported in the same way as in interworking with ISDN.

No particular functionality is needed in a VPLMN without a connected CSPDN for support of CSPDN access for roaming subscribers.

2. References

Bearer Services	Refer to GSM 02.02
Teleservices	Refer to GSM 02.03
Supplementary Services	Refer to GSM 02.04
Numbering	Refer to GSM 03.03
Connection types	Refer to GSM 03.10
Technical realization of	
Supplementary services	Refer to GSM 03.11
Routing of calls to/from PDNs	Refer to GSM 03.70
TAFs for services using synchronous transparent bearer capability	Refer to GSM 07.03
Signalling interworking to ISDN	Refer to GSM 09.03

3. Definitions

Use is made of the following terms within this recommendation. These terms refer to information requirements necessary to support interworking functions, some of these terms will be identifiable with their use in other recommendations.

- Bearer capability information

Specific information defining the lower layer characteristics required within the network.

- Lower layer capability information

Information defining the lower layer characteristics of the terminal.

- Higher layer compatibility information

Information defining the higher layer characteristics of a teleservice used by the terminal.

- Protocol identifier

Information defining the specific protocols utilised for the support of data transfer by a terminal.

- Progress indicator

Information supplied to indicate to the terminal that the network interworking has taken place.

- Out of band parameter exchange

Information exchanged via an associated or non-associated signalling link e.g. SS No7.

<u>Term</u>	Recommendation where defined	
	<u>CCITT</u>	<u>GSM</u>
Bearer Service	I.112, I.210, I.211	02.02
Exchange	I.112	
Packet assembly/disassembly	X.15	
Terminal Adaptor (Functions)	I.411	(07 series)
Interworking Function	X.300	
Attributes	I.112, I.130, I.211	
Connection capabilities	I.340	
D channel	I.412	
B channel	I.412	

4. Abbreviations

CSPDN	Circuit Switched Public Data Network
DTE	Data Terminal Equipment
IDN	Integrated Digital Network
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part (of Signalling System No.7)
MSC	Mobile Switching Center
NT	Network Termination
PLMN	Public Land Mobile Network
SS No.7	Signalling System No.7
TA	Terminal Adaptor
TE	Terminal Equipment
TUP	Telephone User Part (of Signalling System No.7)
DSE	Data Switching Exchange
IWF	Inter Working Functions
DNIC	Data Network Identification Code
VPLMN	Visited PLMN

5. Network Characteristics

5.1. Key Characteristics of Network Concerned

Characteristics	GSM PLMN	CSPDN	ISDN
Subscriber Interface	Digital	Digital	Digital
User-network signalling	GSM 04.08	X.21, X.21bis	
User-terminal equipment supported	See GSM 07.03	X.21, X21bis- terminals	
Inter-exchange signalling	SS No.7 ISUP, TUP+, MAP	X.71	ISUP, TUP+
Transmission facilities	Digital	Digital	Digital
Exchange types	Digital	Digital	Digital
Information transfer mode	Circuit	Circuit	Circuit
Information transfer capability	Digital unrestricted	Curcuit switched data transmisson services	Digital unre- stricted

6. Interworking classification

6.1. Service interworking

No service interworking has been identified as a requirement of the GSM system.

6.2. Network interworking

Network interworking is required whenever a PLMN and a non-PLMN together are involved to provide an end to end connection and may be required in instances of PLMN to PLMN connections.

The concept of Bearer Services was developed for the ISDN and has been extended to GSM. A bearer service is defined as: A type of telecommunication service that provides the capability for the transmission of signals between user-network interfaces.

Access at mobile station	Bearer service in GSM PLMN	Data transmission service in CSPDN	Bearer service in ISDN
Data cct duplex synchronous 2.4 kbit/s	Circuit mode unstructured (4 kbit/s) with unrestricted digital capability	circuit switched user class 4	cct mode structured 64 kbit/s unrestricted
Data cct duplex synchronous 4.8 kbit/s	Circuit mode unstructured (8 kbit/s) with unrestricted digital capability	circuit switched user class 5	
Data cct duplex synchronous 9.6 kbit/s	Circuit mode unstructured (16kbit/s) with unrestricted digital capability	circuit switched user class 6	

The network interworking is described in section 7.

6.3. Signalling interworking

6.3.1. Connection CSPDN

PLMN is connected to CSPDN using an interworking function. The interface between IWF and CSPDN is in accordance to CCITT X.71. If PLMN is connected to CSPDN via ISDN the interface to ISDN shall be according to 09.07 and the information rate adapted according to CCITT X.30.

6.3.2. Multiplexing schemes, CCITT X.51

The multiplexing schemes for the X.71 connections shall be in accordance with CCITT X.51. Housekeeping bits shall be allocated in the same way as for DSE to DSE in CSPDN.

6.3.3. Allocation of channels, X.54

The allocation of channels on the X.71 connection shall be according to CCITT recommendation X.54

6.4. Numbering

Numbering shall be in line with GSM 03.70.

6.5. Supplementary service interworking

6.5.1. Closed user group, CUG

It shall be possible to be a member of closed user groups both inside PLMN and CSPDN but this must not restrict from having traffic with a member in the other network. It shall also be possible to be a member of a group which contains users in both networks.

6.5.2. Calling line identification, CLI

It shall be possible to transmit calling line identification (A-party) between the networks. The number must be translated in accordance with GSM 03.70.

6.5.3. Connected line identification presentation, CLP

It shall be possible to transmit connected line identification presentation (B-party) between the networks. The number must be translated in accordance with GSM 03.70.

6.5.4. Redirected call

It shall be possible to transmit information that B-side is redirected between the networks

6.5.5. Reverse charging

It shall be possible to get reverse charging on per call basis.

7. Network interworking7.1. Checking bearer capability

The table shows bearer capability elements and the values. Just the element user rate is optionally.

Parameter name	In band	Out of band (Call set up or confirm.)	Out of band (Call set up ACK or proc)
Info transfer capability		Unrestricted digital	
User rate		2400,4800 9600	
Sync/Async		Sync	
Transparent/non-tr- ansparent service		Transparent	
Half/Full rate			

Table 3. Shows parameters which have to be considered by the IWF.

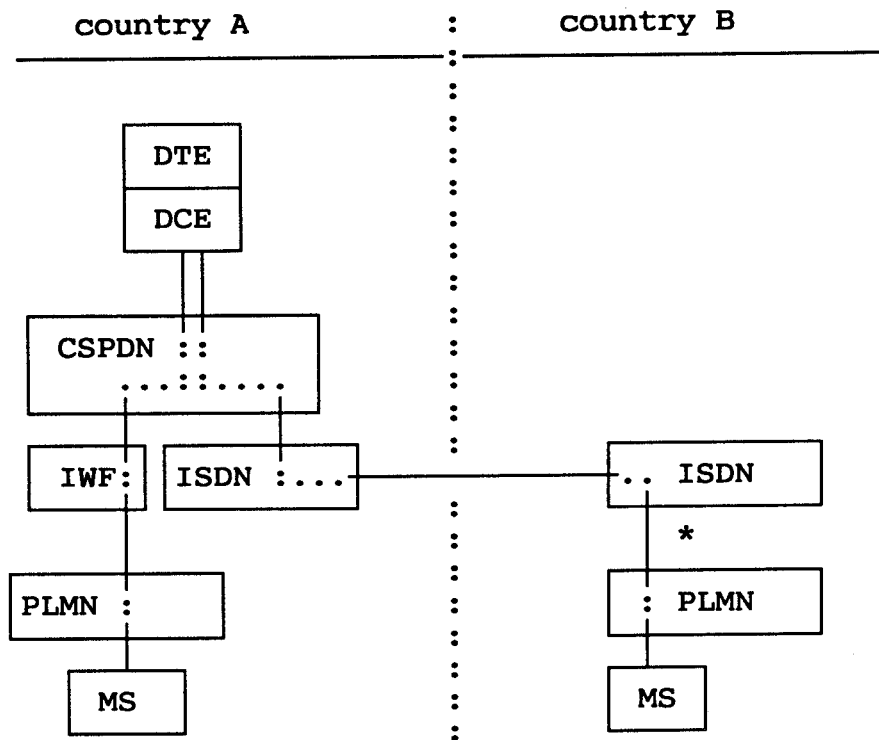
7.1.1. Network interworking mobile originated

Bearer capability compatibility checking of the mobile originated call is carried out by the IWF to determine the appropriate data transmission service class in the CSPDN. If it is not possible for the IWF to provide a bearer service match, then the IWF shall fail the call and indicate the reason to the user.

As well as compatibility checking, the network shall check the subscribers subscription parameters in the HLR/VLR, to ensure that the calling mobile does subscribe to the requested service.

7.1.1.1. Home IWF access

Home IWF access would be available to a mobile subscriber if the home PLMN has a CSPDN IWF. Figure 09.04/1 illustrates both the case when the mobile subscriber is present in the home PLMN and when present in a visited PLMN that does not support a CSPDN IWF.



* This connection presumes analysis of the X.121 DNIC

Figure 09.04/1 Home IWF access

7.1.1.2. Visited IWF access

A visited IWF access would be available to a mobile subscriber if the visited PLMN has a CSPDN IWF. This is shown in figure 09.04/2

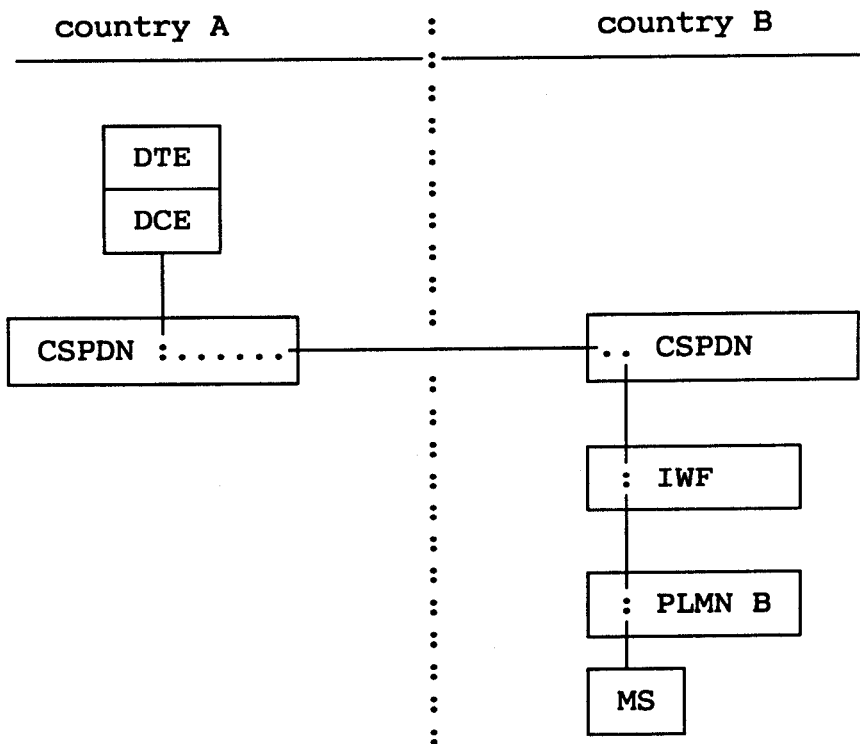
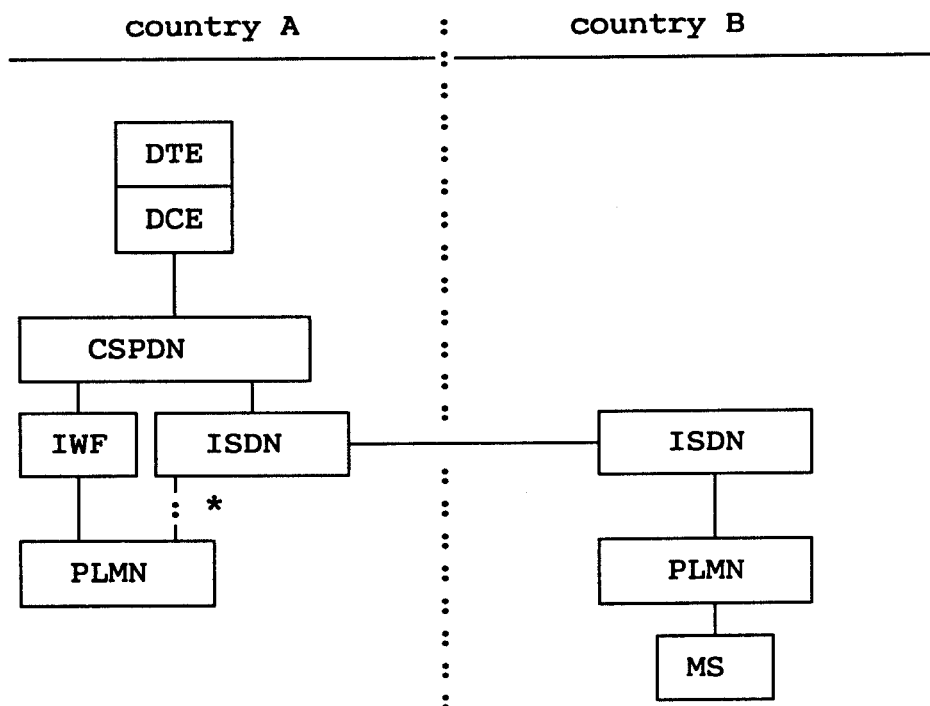


Figure 09.04/2 Visited IWF access

7.1.2. Network interworking mobile terminated

Bearer capability compatibility checking of the CSPDN originated call is carried out by the IWF to determine the appropriate bearer service selection in the PLMN. If it is not possible for the IWF to provide a bearer service match, then the IWF shall fail the call and indicate the reason for the user (if possible).

As well as compatibility checking, the network shall check the subscribers subscription parameters in the HLR, to ensure that the called mobile does subscribe to the re-uested service.



* If an interrogating node in ISDN is not supported

Figure 09.04/3 Terminating call

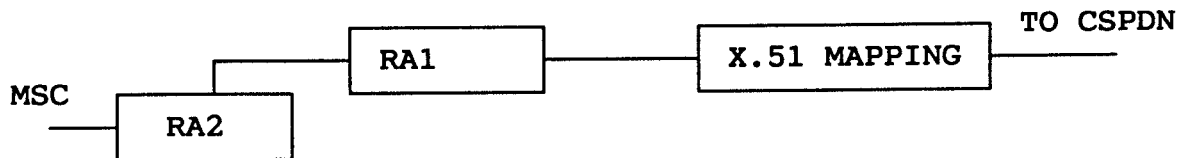
7.2. Transparent service support

7.2.1. MSC to IWF rate adaptation scheme

This link consists of a 64 kbit/s channel with the information, both user data and in band parameter information rate adapted in conformance to Rec 08.20.

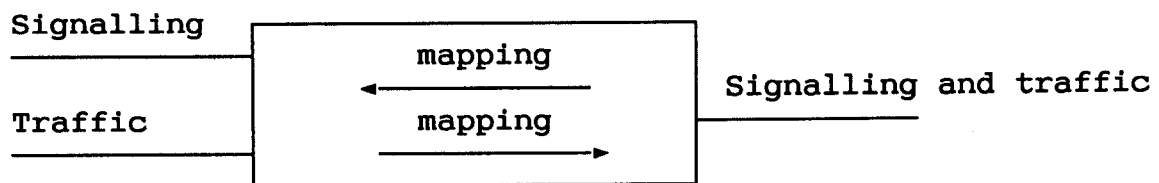
7.2.2. Rate adaptation in the IWF

This process is a reverse of that provided in the Terminal Adaptation Function of the MS. Recommendation 04.21 to the rate adaptation mechanism to be provided.



7.2.3. Mapping of signalling MS/IWF to CSPDN signalling

In GSM SS no7 is used for signalling. Towards CSPDN channel associated signalling defined in CCITT |.71 is used. Therefore the interworking function has to map between those two signalling systems.



7.2.4. Establishment of end-to-end terminal synchronisation

Prior to exposing the traffic channel of a PLMN connection to transmission of user data, the controlling entities of the connection have to assure of the availability of the traffic channel. This is done by a so called synchronisation process

- starting on the indication of "physical connection established" resulting from the PLMN-inherent outband signalling procedure
- ending by indicating the successful execution of this process to the controlling entity, which then takes care of the further use of the inband information (data,status).

Network interworking within an IWF is concerned with the terminating side (to the MS) and the transit side (to the fixed network) of a connection. Both sides have to be treated individually related to the synchronisation process.

With respect to the terminating side the procedure is as follows:

- sending of synchronisation pattern 1/OFF (all data bits "1", all status bits "0") to the MS using the RA1/RA2 rate adaption function

- searching for detection of the synchronisation pattern 1/OFF from the MS.

When the 1/OFF from the MS has been recognised as a steady state, the IWF continues sending the synchronisation pattern 1/OFF to the MS unless a timer T expires. From this time the information on the receiving lines from the MS and from the fixed network are directly mapped to the respective sending lines.

During the synchronisation process described above, i.e. while the synchronisation pattern is being sent by the IWF, the IWF will not send X.51-frame structure to the CSPDN transit network. Once timer "T" expires the synchronisation pattern will continue to be transmitted from the IWF to the MS, however, the IWF will start mapping the information received from the MS into X.51 frames to the CSPDN transit network. The IWF will start looking for the CSPDN frame alignment to be received from the CSPDN. On recognising frame alignment the IWF will cease sending its synchronisation pattern to the MS and connect the CSPDN through to the MS.

7.3. Non-transparent service support

See section 1.