GSM
TECHNICAL
SPECIFICATION

GSM 09.05

December 1996

Version 5.0.0

Source: ETSI TC-SMG

Reference: TS/SMG-040905Q

ICS: 33.020

Key words: Digital cellular telecommunications system, Global System for Mobile communications (GSM)

GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS

Digital cellular telecommunications system;
Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly (PAD) facility access (GSM 09.05)

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Foreword

This Global System for Mobile communications Technical Specification (GTS) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI).

This GTS defines the interworking functions and requirements to support Packet Assembly/Disassembly (PAD) services within the digital cellular telecommunications system.

The contents of this GTS are subject to continuing work within TC-SMG and may change following formal TC-SMG approval. Should TC-SMG modify the contents of this GTS it will then be republished by ETSI with an identifying change of release date and an increase in version number as follows:

Version 5.x.y

where:

  y   the third digit is incremented when editorial only changes have been incorporated in the specification;

  x   the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

The specification from which this GTS has been derived was originally based on CEPT documentation, hence the presentation of this GTS may not be entirely in accordance with the ETSI/PNE rules.

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0   Scope

This Global System for Mobile communications Technical Specification (GTS) identifies the interworking functions and requirements to support Packet Assembly/Disassembly (PAD) services in the PLMN.

GSM 09.05 applies to PAD access in order to provide communications with host systems connected to Packet Switched Public Data Network (PSPDN) for Mobile Stations (MS)s.

Within this GTS, the requirements for accessing an existing PAD in a PSPDN (basic PAD access) or accessing a dedicated PAD are considered separately. In each case, the general problem of charging is examined.

This GTS considers only the access by a MS to a PAD and not the reverse access (i.e. only mobile originated calls are supported).

1   Normative references

This GTS incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this GTS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

[1]   GSM 01.04 (ETR 350): "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2]   CCITT Recommendation E.164: "Numbering plan for the ISDN era".

[3]   CCITT Recommendation X.121: "International numbering plan for public data networks".

[4]   CCITT Recommendation X.3: "Packet Assembly Disassembly facility (PAD) in a public data network".

[5]   CCITT Recommendation X.28: "DTE/DCE interface for a start-stop mode data terminal accessing the PAD in a public data network situated in the same country".

[6]   CCITT Recommendation X.29: "Procedure for exchange of control information and user data between a PAD and a packet mode DTE".

[7]   CCITT Recommendation X.75: "Packet switched signalling system between public networks providing data transmission services".

[8]   GSM 02.02   (ETS 300 904): "Digital cellular telecommunications system (Phase 2+); Bearer Services (BS) supported by a GSM Public Land Mobile Network (PLMN)".

[9]   GSM 03.03   (ETS 300 927): "Digital cellular telecommunications system (Phase 2+); Numbering, addressing and identification".

[10]   GSM 03.10: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) connection types".

[11]   GSM 04.08   (ETS 300 940): "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".

[12]   GSM 04.21 (ETS 300 945): "Digital cellular telecommunications system; Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[13]	GSM 07.01 (ETS 300 913): "Digital cellular telecommunications system (Phase 2+); General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[14] GSM 07.02 (ETS 300 914): "Digital cellular telecommunications system (Phase 2+); Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[15] GSM 08.20: "Digital cellular telecommunications system; Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[16] GSM 09.03: "Digital cellular telecommunications system; Signalling requirements on interworking between the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN) and the Public Land Mobile Network (PLMN)".

[17] GSM 09.07 (ETS 300 976): "Digital cellular telecommunications system (Phase 2+); General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[18] ENV 41901 (1987): "Information systems interconnection - X.29-mode procedures between a packet mode DTE or a PAD and a PAD via a public or private X.25 packet switched network or ISO 8208 packet level entity and ISO 7776 link level entity. X.3 character-mode access via a public or private PAD attached to an X.25 packet switched network or ISO 8208 packet level entity and ISO 7776 link level entity. X.28 character-mode access via a telephonic circuit or data circuit to a PAD".

2 Definitions and abbreviations

Abbreviations used in this GTS are listed in GSM 01.04.

Facility Request: Table 09.05/7 (given in annex 4), extracted from CCITT Recommendation X.28 lists the facility request/indication codes.

> NOTE: The facility "Closed User Group" is not part of the dedicated PAD access.

3 Circuit switched access to a PAD in the PSPDN (Basic PAD access)

3.1 General

The basic PAD access is the access to a X.28 dial in port in a PSPDN without or via one or more transit ISDN or PSTN networks. This access is provided by GSM bearer services 21 - 26. However, it should be noted that the X.28 PAD does not support out-band flow control and does not support 7 bit characters without parity. The general interworking requirements are defined in GSM 09.07.

> NOTE: In cases where no transit networks are used, the interface between the PLMN and the PAD is outside the scope of this GTS and implementation dependent.

Table 09.05/1: Network interworking requirements for basic PAD access

Bearer Service in GSM PLMN	Access at Mobile Station	Bearer service in ISDN (note 1)	Bearer service in PSTN (note 1)	Bearer service in PSPDN
21	Data Cct 300 bit/s			
22	Data Cct 1,2 kbit/s			
23	Data Cct 1 200/75 bit/s	Cct mode 3,1 kHz Audio	Cct mode 3,1 kHz Audio	(note 2)
24	Data Cct 2,4 kbit/s			
25	Data Cct 4,8 kbit/s			
26	Data Cct 9,6 kbit/s			

NOTE 1:   if used as a transit network.

NOTE 2:   The default profile of the accessed PAD applies.

3.2   Home PAD access

Home PAD access would normally be available for a mobile subscriber both when he/she is present in the home PLMN and when in a visited PLMN. Figure 09.05/1 illustrates both of these examples where he/she is accessing a PAD via the home PSTN. To access the PAD the user would need to be registered with the PSPDN and have his/her own NUI if a specific profile or local charging are required.

In this instance to initiate a call to the PAD the mobile subscriber sets up a call to the PSTN number associated with the PAD. The interworking function provides only the necessary modem, RLP (if required) etc., as indicated in the call set-up message and does not provide any additional functionality associated with PAD access. This access being available to the mobile subscriber from the home PLMN implies the use of a national PSTN call and when in a foreign PLMN the use of an international PSTN call.
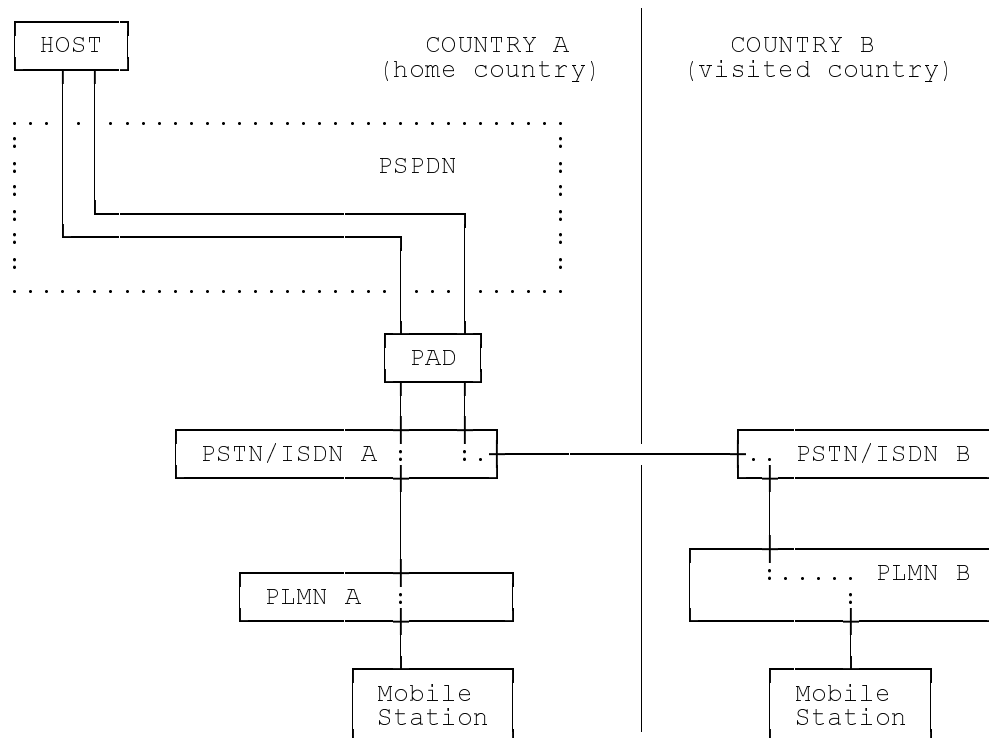
Figure 09.05/1: Home PAD access

3.3   Visited PAD access

When the mobile subscriber is within a PLMN in a foreign country an alternative to home PAD access is given in figure 09.05/2. The PAD used in this case is a PAD within the visited country.

In this case the mobile subscriber initiates a PSTN call to the PAD in the visited country, and utilizes the international link within the PSPDN.

The mobile subscriber would need to be registered with the visited PSPDN to obtain an NUI if a specific profile or local charging are required, plus needing to know the correct PSTN number for accessing the PAD. The mobile subscriber would also need to know the user procedure for connecting to the PAD including the presentation of the NUA (international/national). Again the interworking function would not provide any additional requirements over and above the normal PSTN interworking.
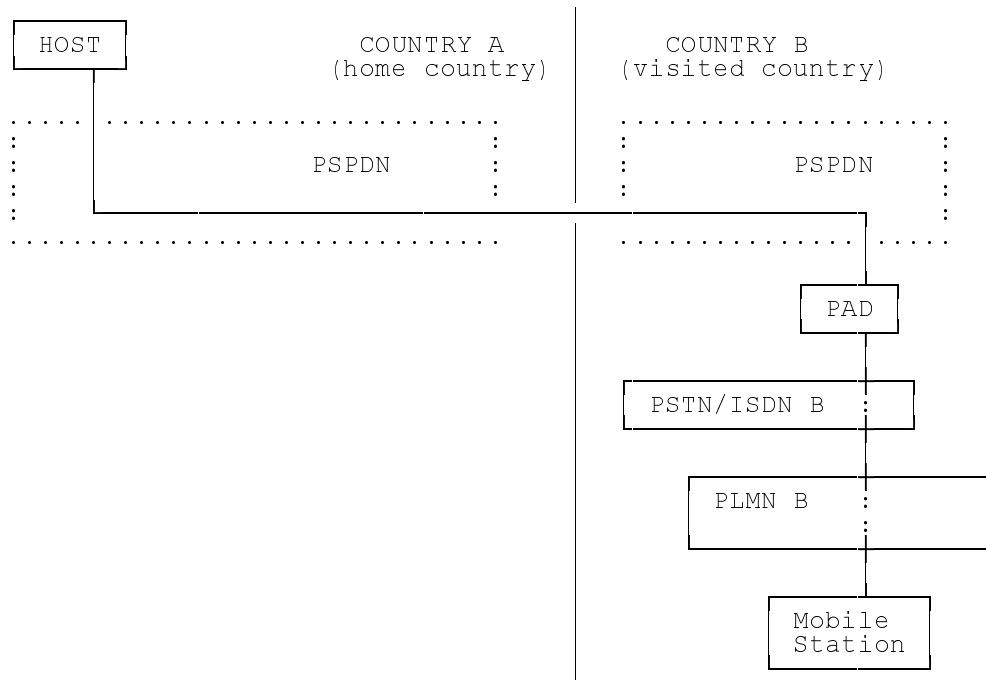
```
  ┌────────┐                COUNTRY A                 COUNTRY B
  │  HOST  │             (home country)           (visited country)
  └───┬────┘
 .....│.............................    ....................
 :    │                           :    :                   :
 :    │        PSPDN              :    :       PSPDN       :
 :    │                           :    :                   :
 :    └───────────────────────────────────────────────┐   :
 ..................................    ................│.....
                                                       │
                                                  ┌────┴───┐
                                                  │  PAD   │
                                                  └────┬───┘
                                          ┌────────────┴─┐
                                          │ PSTN/ISDN B  :│
                                          └──────────────┘
                                              ┌───────────┴──┐
                                              │  PLMN B    :  │
                                              └───────────┬──┘
                                                   ┌──────┴──┐
                                                   │ Mobile  │
                                                   │ Station │
                                                   └─────────┘
```

Figure 09.05/2: Visited PAD Access

4   Dedicated PAD access

4.1   Definition

The "dedicated PAD access" provides the shortest possible connection from the PLMN to a PAD for both home subscribers staying in the home PLMN as well as roaming foreign subscribers in the visited PLMN.

The MT or TA does not use the E.164 address of the PAD. A common access procedure as described below being applied by all PLMNs supporting this type of service hides the differences of existing PADs in GSM countries for GSM PLMN subscribers.

The mobile subscriber has only a subscription to his home PLMN for the use of the "dedicated PAD access". The applicable GSM bearer services are those of the 40-series.

The dedicated PAD provides general PAD functions according to CCITT Recommendation X.3, X.28 and X.29 and in addition PLMN specific functions (e.g. identification, profile selection) as defined in this specification.

In this type of PAD access, the PLMN has direct access to a PAD e.g. dedicated link, etc. In this GTS there is no difference between a PAD which has all its entry ports connected to the PLMN and a PAD which has only some entry ports dedicated to the PLMN.

For roaming subscribers, the user accesses a dedicated PAD of the visited PLMN, in that respect GSM 09.05 does not allow access to the dedicated PAD within the home PLMN. In this case only figure 09.05/2 is valid.

In this case, the PAD is either an existing one or one which is provided by the PLMN. It is a network operator option as to which should be provided. When the PAD is restricted solely to PLMN use then it is defined as a GSM variant PAD.

Charging procedures are covered in subclause 4.8. It is this type of PAD access and the procedures necessary to invoke it that will be discussed in the rest of this subclause.

It is a network operators option as to whether basic or basic and dedicated PAD access should be provided.

4.2   Location of the Dedicated PAD

4.2.1   PAD external to the PLMN

In some cases, the dedicated PAD may be physically outside the PLMN (e.g. part of the PSPDN):

a)   This case takes into account PADs which are not part of the PLMN but are connected to it by dedicated circuits.

b)   This case takes into account PADs which are not part of the PLMN, but where the PLMN establishes a circuit switched connection to the PAD in the PSTN/ISDN automatically, i.e. the user does not enter the directory number of the PAD, only the normal dedicated PAD short code access number.

The interface between the PLMN and the PAD (PSPDN) including administrative arrangements is based on bilateral agreement between network operators.

4.2.2   PAD internal to the PLMN

This case takes into account PADs which are part of the PLMN and are connected to the PSPDN or to the ISDN PH via X.25 or X.75.

It is possible that each MSC within the PLMN offers PAD access by a PAD integrated in the MSC.

4.3   GSM profile

There is a common set of profiles for the dedicated PAD access described in the annexes.

The user may use the default profile or may select one of the profiles defined in the annexes or may set individual parameters amongst those in the GSM profiles.

The profiles listed are:

1)   GSM default profile (annex 1).

2)   GSM version of five PAD profiles (annex 2).

3)   European Pre Standard ENV 41901 (annex 3).

4.4 Routing to and selection of PAD functions

4.4.1 Introduction

Two user friendly methods are defined to access a PAD. These are:

- a minimum standard access functionality which provides an uniform access to a PAD on a GSM PLMN;

- additional access functionalities which provide enhanced functions on some PLMNs, e.g. special profiles or auto selection of a terminal on a PSPDN (X.28 direct call).

4.4.2 General selection procedures

Access to the PAD is determined by the value "X.28 dedicated access, universal NUI" in the bearer capability element "signalling access protocol" of the SETUP message (see GSM TS 07.01). In addition, there is an indication in the type of number (TON) field that it is a dedicated short code access, plus the appropriate NPI (private numbering plan) and short code information in the called party BCD Number.

The MSC/IWF on identifying the TON as "dedicated access, short code", uses the short code number to select a dedicated PAD/PAD profile and routes the call according to the short code selected to the appropriate PAD using the requested profile. When no short code information is contained then the default GSM profile is selected. In addition the MSC/IWF "registers" the user on PAD using the PLMN registration code, if applicable.

In addition the MSC/IWF determines the following points:

- User rate from the SETUP message to determine the correct setting of PAD parameter 11 for the transparent bearer service.

- Selection of the RLP function and rate for the non transparent bearer service.

- For the non transparent service flow control of the PAD has to be invoked.

4.4.3 Minimum Standard access functionality

The minimum standard access functionality is compatible for all PLMNs. This implies an uniform invocation procedure also in case of roaming. The subscriber requests the service as indicated in subclause 4.4.2 (general selection procedure). When a short code of 4 digits is used one of the PAD profiles defined in table 09.05/2 is selected. The first indication of PAD access seen by the user is the "PAD identification service signal". From then on, standard X.28 procedures are used to establish the packet call. The "selection PAD command signal" will always contain the called NUA in the international X.121 format without prefix.

Table 09.05/2: GSM standard access code associated PAD profile

GSM standard access code	Type of PAD profile
0000	GSM default profile (1)
0001	GSM profile 1 (2)
0002	GSM profile 2 (2)
0003	GSM profile 3 (2)
0004	GSM profile 4 (2)
0005	GSM profile 5 (2)
0006	reserved
...	....
0099	reserved

NOTE 1:   defined in annex 1.

NOTE 2:   defined in annex 2.

4.4.4 Additional access functionality

This access offers PLMN operators the opportunity to define special features specifically for the use of their customers in the home PLMN and in case of bilateral agreement also in the visited PLMN when roaming. Additionally, customers of other PLMNs may have access to these special features by reciprocal arrangements.

To access a special feature in the home PLMN or in an other PLMN which offers this feature by bilateral agreement, the mobile subscriber will use the general selection procedure described in subclause 4.4.2 but with 7 digit short code in the following structure:

> MCC MNC xx

where:

- MCC is the Mobile Country Code as defined in GSM 03.03 (3 digits);
- MNC is the Mobile network country code as defined in GSM 03.03 (2 digits);
- xx is the specific profile/function defined in the home network and possibly available in the visited network.

   NOTE: The additional access functionality is not defined. The Network Operator may use a specific profile (any setting of PAD parameters defined in CCITT Recommendation X.3 or even network specific parameters) and any other X.28-like feature (e.g. direct call or abbreviated address dialling).

When a subscriber requests a network specific access on a network which is unable to offer the desired profile or unable to interpret the code indicated, then the network will reject the call with the call failure cause indication No63 "service or option not available, unspecified" (ref. GSM 04.08).

4.5 Dedicated PAD functionality

The functions which have to be provided within the interworking are:

- To program the PAD parameters according to the profile selected by the user or according to the default profile (see annex 1).

- To establish connection/clearance to/from the PAD at the request of the mobile subscriber and to provide identification.

The first function allows for all users (home or visitors) to see the same PAD functionalities even when the actual PAD implementation is different in different PLMN's.

The second function provides for establishment of the connection to the PAD at the initiation of the mobile subscriber by means of the selection procedures as indicated in subclause 4.4. In addition it provides the automatic registration of the mobile subscriber on the PAD without requiring additional information from the mobile subscriber.

Clearance from the PAD will only be provided on receipt of call release. This enables the connection to the PAD to be retained during breaks on the radio link.

Another function of the PAD may be the conveyance of the MSISDN-number of the calling subscriber for passing to the called party. Where this procedure is provided the PSPDN will need to accept the entry of this information in the X.25/X.75 call request packet and may use it also for establishing a call-individual charge record. For this purpose the visited MSC will need to acquire an MSISDN-number of the calling DTE.

4.6 Transparent bearer service

For this service the user rate indicated in the call set up message is used both from the terminal to the MT and between the IWF and the dedicated PAD.

4.7   Non Transparent bearer service

For this service the user rate at each end may be different. The data rate between the IWF and the PAD is the highest mutually available.

In case of inband flow control using XON/XOFF, the dedicated PAD must have flow control enabled (parameter 5 and 12).

In case of out-band flow control, the dedicated PAD must have flow control disabled (parameter 5 and 12) but must accept and use the out-band flow control mechanism (e.g. X bits in V.110 frames). This is taken care of by using profile 5.

4.8   Identification and technical aspects of charging

Since the charging requirements for the dedicated PAD service assume in addition to the duration knowledge of the volume of data sent and the destination for each virtual call, mechanisms shall be provided in the MSC/IWF or the PAD to determine this information.

PLMN users are identified in the PLMN. A verified calling E.164 number is available. This number will be used in the charging record generated by the PAD.

In cases where the PAD is located in the PLMN or is directly connected to the ISDN, the PAD may generate the charging record and may use the verified number as calling address in the X.25/X.75 call packets. However, a generic PLMN number may be needed for roaming subscribers in order to avoid clearing due to loop detection on international connections.

In cases where it is not possible to transmit the verified calling number to the PAD, the IWF may use a universal NUI/Password for accessing the PAD. It is up to the implementation what calling address is used in X.25/X.75 call packets and how charging information is determined.

4.9   Supplementary service Interworking

Interworking of GSM PLMN supplementary services with PSPDN optional user facilities is not provided. The following SS apply: call barring of all outgoing calls and advice of charge. The advice of charge shall be applied for the circuit switched portion. The applicability to the volume part of the call is outside the scope of this specification.

Annex 1 (normative):   GSM default profile in dedicated PAD access

Table 09.05/4: GSM default profile in dedicated PAD access

Parameter reference number profiles	Parameter Description	Parameter setting for GSM default
1	PAD recall using a character	1
2	Echo	1
3	Selection of data forwarding signal	126
4	Selection of idle timer delay	0
5	Ancillary device control	1
6	Control of PAD service signals	1
7	Selection of operation of PAD on receipt of break signal from the start-stop mode DTE	21
8	Discard output	0
9	Padding after carriage return (CR)	0
10	Line folding	80
11	Binary speed of start-stop mode DTE	read only
12	Flow control of the PAD by the start-stop mode DTE	1
13	Linefeed insertion after carriage return	4
14	Linefeed padding	0
15	Editing	0
16	Character delete	127
17	Line delete	24
18	Line display	18
19	Editing PAD service signals	0
20	Echo mask	0
21	Parity Treatment	0
22	Page wait	0

Annex 2 (normative): GSM dedicated PAD Profile

Table 09.05/5: GSM dedicated PAD Profile

Parameter	Description	Parameter values in suboptions				
		1	2	3	4	5
1	PAD recall using a character	0	1	1	1	0
2	Echo	0	1	0	0	0
3	Selection of data forwarding signal	0	126	126	0	0
4	Selection of idle timer delay	20	0	0	1	1
5	Ancillary device control	1	1	1	1	0
6	Control of PAD service signals	0	1	1	0	0
7	Selection of operation of PAD on receipt of break signal from the start-stop mode DTE	2	2	21	21	8
8	Discard output	0	0	0	0	0
9	Padding after carriage return(CR)	0	0	0	0	0
10	Line folding	0	0	80	0	0
11	Binary speed of Start- Stop mode DTE	parameter with read only access				
12	Flow control of the PAD by the start-stop mode DTE	0	1	1	1	0
13	Line feed insertion after carriage return	0	0	4	0	0
14	Linefeed padding	0	0	0	0	0
15	Editing	0	0	0	0	0
16	Character delete	127	127	127	127	127
17	Line delete	24	24	24	24	24
18	Line display	18	18	18	18	18
19	Editing PAD service signals	0	0	0	0	0
20	Echo mask	0	0	0	0	0
21	Parity Treatment	0	0	0	0	0
22	Page Wait	0	0	0	0	0

Annex 3 (informative): PAD Profiles in ENV 41901

Table 09.05/6: PAD Profiles in ENV 41901

Parameter	Description	Parameter values in suboptions				
		1	2	3	4	5
1	PAD recall using a character	0	1	1	1	0
2	Echo	0	1	0/1	0	0
3	Selection of data forwarding signal	0	126	2/126	0	0
4	Selection of idle timer delay	20	0	0	1	1
5	Ancillary device control	*	*	*	*	0
6	Control of PAD service signals	*	*	*	*	*
7	Selection of operation of PAD on receipt of break signal from the start-stop mode DTE	2	2	21	21	8
8	Discard output	0	0	0	0	0
9	Padding after carriage return(CR)	*	*	*	*	0
10	Line folding	*	*	*	*	0
11	Binary speed of Start-Stop mode DTE	*	*	*	*	*
12	Flow control of the PAD by the start-stop mode DTE	0	1	1	1	0
13	Line feed insertion after carriage return	0	0	4	0	0
14	Linefeed padding	*	*	*	*	0
15	Editing	0	0	0/1	0	0
16	Character delete	127	127	127	127	127
17	Line delete	24	24	24	24	24
18	Line display	18	18	18	18	18
19	Editing PAD service signals	*	*	*	*	*
20	Echo mask	*	*	*	*	*
21	Parity Treatment	*	*	*	*	0
22	Page Wait	*	*	*	*	0

NOTE 1: Parameters 19 to 22 inclusive may not be available without option 1.

NOTE 2: Parameter 8 may be set to 0 by a packet mode DTE to recommence the delivery of data to a start-stop mode DTE after it has been inhibited as a result of the receipt of a break signal from a start-stop mode DTE by a PAD.

NOTE 3: Sub-option 1 is compatible with the CCITT transparent standard profile and sub-option 2 is compatible with the CCITT simple standard profile. CCITT Recommendations give no indications as to the circumstances under which parameters may be manipulated by a packet mode DTE. Thus as with sub-options 3, 4 and 5, parameters have been defined to be packet mode DTE independent or dependent and rules provided for parameter manipulation.

NOTE 4: Where table 09.05/6 shows the parameter setting as "*" the parameter is defined to be "packet mode DTE independent "; otherwise it is "packet mode DTE dependent".

NOTE 5: Sub option 0: GSM Default Profile (ref. table 09.05/4)
Sub option 1: Transparent Standard Profile
Sub option 2: Simple Standard Profile
Sub option 3: Message Profile
Sub option 4: Character Profile
Sub option 5: Transparent profile

Annex 4 (informative): Facility request/indication Codes

Table 09.05/7: Facility request/indication Codes

Code of the facility	Definition of the facility
4/7 -G-	Closed user group
4/2 -B-	Bilateral closed user group
5/2 -R-	Reverse charging
4/6 -F-	Fast Select
5/4 -T-	RPOA transit network selection
5/0 -P-	Packet size negotiation
5/7 -W-	Window size negotiation
4/4 -D-	Throughput class negotiation
4/3 -C-	Charging information
4/13 -M-	Called line address modification notification
5/5 -U-	Call redirection notification
4/14 -N-	Network user Identification
5/3 -S-	Called DTE reselection prevention
4/15 -O-	Closed User Group with outgoing access
4/5 -E-	Called Address extension
5/0 -Q-	Fast select with restriction on response

NOTE: The facility "closed user group" is not part of the dedicated PAD access.

History

Document history	
December 1996	Publication of GSM 09.05 version 5.0.0