**3GPP TSG CN Plenary Meeting #15** **NP-020085**
**6th – 8th March 2002. Cheju, Korea.**

**Source:** **TSG CN WG3**

**Title:** **CR to Rel-5 on Work Item TEI5 (Terminology Updates)**

**Agenda item:** **9.14**

**Document for:** **APPROVAL**

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**Introduction:**

This document contains **4** CRs on **Rel-5** Work Item **"TEI5"**, that have been agreed by **TSG CN WG3**, and are forwarded to TSG CN Plenary meeting #15 for approval.

| Doc-2nd- | Subject | Spec | CR | Rev | Cat | Phase | Versi | Workitem |
|---|---|---|---|---|---|---|---|---|
| N3-020062 | Add GERAN Iu mode to scope | 29.414 | 007 | | D | Rel-4 | 4.3.0 | TEI5 |
| N3-020063 | Add GERAN Iu mode to scope | 29.415 | 005 | | D | Rel-4 | 4.2.0 | TEI5 |
| N3-020092 | Terminology clarifications as requested by TSG | 43.010 | 005 | 1 | D | Rel-5 | 4.1.0 | TEI5 |
| N3-020065 | Terminology clarifications as requested by TSG | 43.045 | 001 | | D | Rel-5 | 4.0.0 | TEI5 |

**3GPP TSG-CN WG3 Meeting #21**
**Sophia, France. 28th Jan - 1st February 2002.**

***Tdoc N3-020062***

*CR-Form-v5*

# CHANGE REQUEST

⌘ **29.414** **CR** **007** ⌘ **rev** **-** ⌘ Current version: **4.3.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Add GERAN Iu mode to scope |
| ***Source:*** | ⌘ | TSG_CN WG3 |
| ***Work item code:*** | ⌘ | TEI5 |
| ***Date:*** | ⌘ | 21.01.2001 |
| ***Category:*** | ⌘ | **D** |
| ***Release:*** | ⌘ | Rel-5 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *REL-4* | *(Release 4)* |
| *REL-5* | *(Release 5)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | Geran Iu mode is introduced in Rel.5 and not reflected correctly in scope picture |
| ***Summary of change:*** | ⌘ | Add GERAN Iu mode to scope picture |
| ***Consequences if not approved:*** | ⌘ | Inconsistent specifications (compare e.g. with TS 23.002) |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | 1 Scope |
| ***Other specs affected:*** | ⌘ | ☐ Other core specifications ⌘<br>☐ Test specifications<br>☐ O&M Specifications |
| ***Other comments:*** | ⌘ | No further impacts of GERAN Iu mode on this specification have been found. |

# 1 Scope

The present document specifies the bearer data transport and bearer control protocols used between MGWs within the CS core network across the Nb Interface. The present document assumes that the implementation of the split of the call control and the bearer transport and control, as specified in 3GPP TS 23.205 [1], see figure 1. The User Plane protocol that uses this bearer data transport (Nb UP) is described in 3GPP TS 29.415 [3]. Note that the present document does not preclude an implementation of a combined MSC Server and MGW.

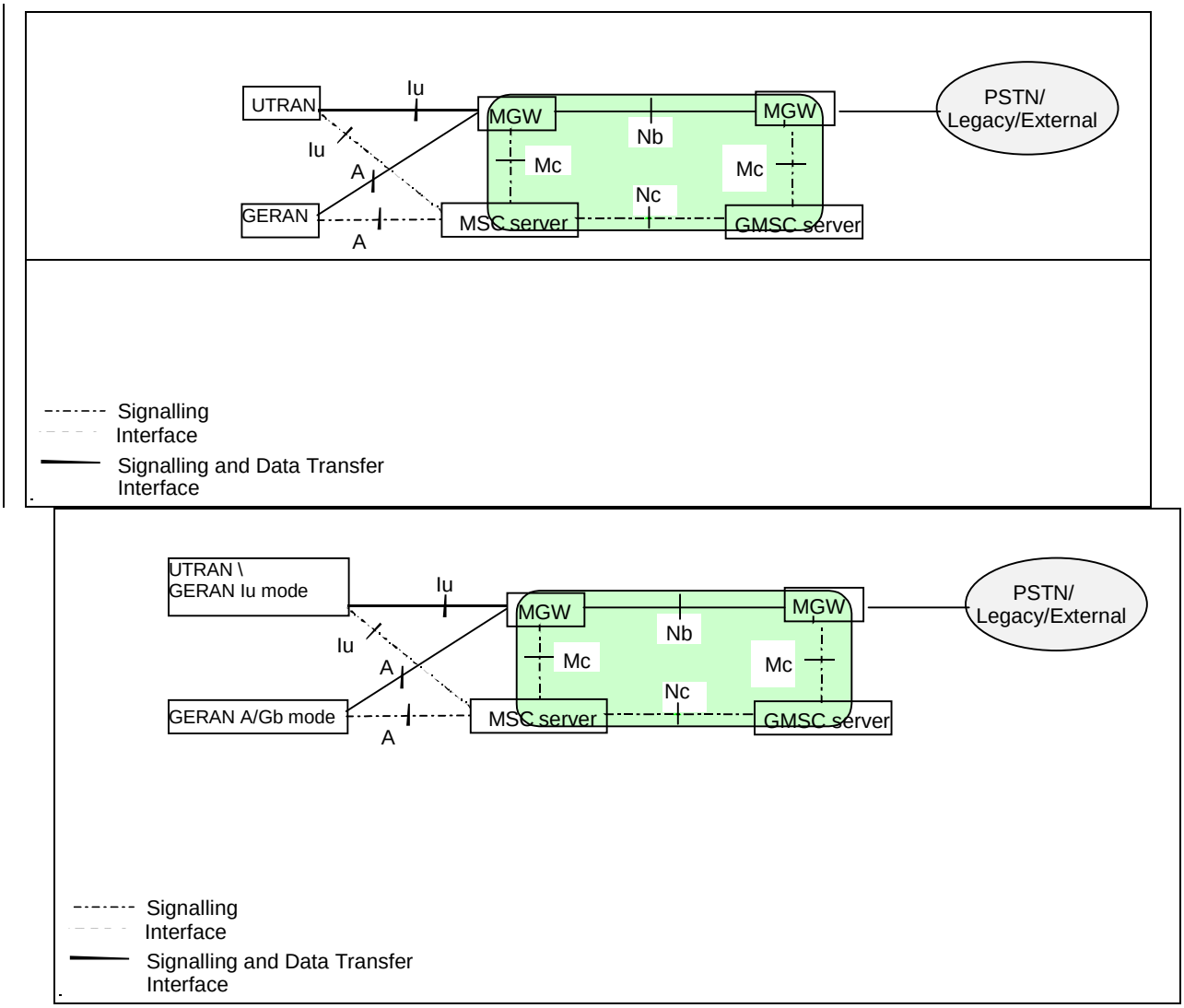


**Figure 1: CS core network logical architecture**

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**Sophia, France. 28th Jan - 1st February 2002.**

***Tdoc N3-020092***

*CR-Form-v5*

# CHANGE REQUEST

⌘ **43.010** **CR** **005** ⌘ **rev** **1** ⌘ Current version: **4.1.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

| | | |
|---|---|---|
| ***Title:*** | ⌘ | New terminology requested by GERAN |
| ***Source:*** | ⌘ | TSG_CN WG3 |
| ***Work item code:*** | ⌘ | TEI5 |
| ***Date:*** | ⌘ | 16-01-2002 |
| ***Category:*** | ⌘ | **D** |
| ***Release:*** | ⌘ | REL-5 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*
*2 (GSM Phase 2)*
*R96 (Release 1996)*
*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*REL-4 (Release 4)*
*REL-5 (Release 5)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To avoid possible confusion due to new terminology adopted in 3GPP in order to differentiate between networks, Radio Access Technologies (RAT) and modes of operation |
| ***Summary of change:*** | ⌘ | Terminology corrections |
| ***Consequences if not approved:*** | ⌘ | Inconsistency with GERAN specifications |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | All |
| ***Other specs affected:*** | ⌘ | ☐ Other core specifications<br>☐ Test specifications<br>☐ O&M Specifications |
| ***Other comments:*** | ⌘ | |

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3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 3GPP TS 43.010 ~~V4~~V5.~~1~~0.0 (~~2001~~2002-03)

*Technical Specification*

## 3rd Generation Partnership Project;
## Technical Specification Group Core Network;
## GSM Public Land Mobile Network (PLMN) connection types
## (Release ~~4~~5)

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

Keywords

GSM, A/Gb mode, PLMN

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# Contents

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

This specification is only applicable for a PLMN operating in A/Gb mode.

A ~~GSM~~ PLMN may be described by a limited set of access interfaces (refer to 3GPP TS ~~04.02~~24.002 and ~~02.01~~22.001) and a limited set of ~~GSM~~ PLMN connection types to support the telecommunication services described in the 3GPP 02-series of specifications. This Global System for Mobile communications Technical Specification (TS) identifies and defines these connection types in so far as they relate to the particular network capabilities for a ~~GSM~~ PLMN.

The basic lower layer capabilities of ~~a GSM~~a PLMN are represented by a set of ~~GSM~~ PLMN connection types. The definition of a set of ~~GSM~~ PLMN connection types provides the necessary input to identify network capabilities of ~~a GSM~~a PLMN. In addition to describing network capabilities of ~~a GSM~~a ~~-~~PLMN, the identification of connection types facilitates the specification of network-to-network interfaces. It may also assist in the allocation of network performance parameters.

This specification should be considered in conjunction with other 3GPP specifications with particular reference to 3GPP TS ~~01.02, 02.01~~22.001, 22.002, ~~02.03~~22.003, 03.01, 23.002, ~~04.02~~24.002 and ~~04.03~~44.004.

This specification provides a bridge between the service specification in the 3GPP TS 02 and 22-series of specifications and the more detailed specifications such as the 3GPP TS 03, 04, 23, 24, 27 and 29 series. As such, it establishes a framework for the specification and understanding of the more detailed specifications. It is therefore not a specification against which detailed conformance testing can be performed. However, it shall be considered mandatory for the understanding of the more detailed specifications and used to resolve issues of conflict in these specifications.

From R99 onwards the following services are no longer required by a PLMN:

- the dual Bearer Services “alternate speech/data” and “speech followed by data”
- the dedicated services for PAD and Packet access
- the single asynchronous and synchronous Bearer Services (BS 21..26, BS 31..34)

From Release 4 onwards the following services are no longer required by a PLMN:

- the synchronous Bearer Service non-transparent (BS 30 NT).
- the Basic Packet access
- the Teleservice Facsimile non-transparent (TS 61/62 NT).

If a PLMN network still provides these services it has to fulfil the specification of former releases.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.~~For a non-specific reference, the latest version applies.~~

[1] ~~3GPP TS 01.02: "Digital cellular telecommunications system (Phase 2+); General description of a GSM Public Land Mobile Network (PLMN)".~~Void

[2] ~~3GPP TS 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".~~Void

[3] 3GPP TS ~~02.01~~22.001: "~~Digital cellular telecommunications system (Phase 2+);~~ Principles of telecommunications services supported by a GSM Public Land Mobile Network (PLMN)".

[4] 3GPP TS 22.002: "Bearer Services (BS) supported by a Public Land Mobile Network (PLMN)".

[5] 3GPP TS ~~02.03~~22.003: "~~Digital cellular telecommunications system (Phase 2+);~~ Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[6] 3GPP TS 03.01: "~~Digital cellular telecommunications system (Phase 2+);~~ Network functions".

[7] 3GPP TS 23.002: "~~-~~Network architecture".

[8] 3GPP TS 23.009: "Handover procedures".

[9] 3GPP TS 23.034: "~~-~~High Speed Circuit Switched Data (HSCSD) - Stage 2 Service Description".

[10] 3GPP TS 23.040: "~~-~~Technical realization of the Short Message Service (SMS) Point-to-Point (PP)".

[11] 3GPP TS 23.041: "~~-~~Technical realization of Short Message Service Cell Broadcast (SMSCB)".

[12] 3GPP TS ~~03.45~~43.045: "~~Digital cellular telecommunications system (Phase 2+);~~ Technical realization of facsimile group 3 transparent".

[13] 3GPP TS ~~04.01~~44.001: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile Station - Base Station System (MS - BSS) interface General aspects and principles".

[14] 3GPP TS ~~04.02~~24.002: "~~Digital cellular telecommunications system (Phase 2+);~~ GSM Public Land Mobile Network (PLMN) access reference configuration".

[15] 3GPP TS ~~04.03~~44.004: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[16] 3GPP TS ~~04.05~~44.005: "~~Digital cellular telecommunications system (Phase 2+);~~ Data Link (DL) layer; General aspects".

[23] 3GPP TS 24.022: " Radio Link Protocol (RLP) ~~for data and telematic services on the Mobile Station - Base Station System (MS - BSS) interface and the Base Station System - Mobile services Switching Centre (BSS - MSC) interface~~ for circuit switched bearer and teleservices".

[17] 3GPP TS 04.06: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile Station - Base Station System (MS - BSS) interface Data Link (DL) layer specification".

[18] 3GPP TS 24.007: " Mobile radio interface signalling layer 3; General aspects".

[19] 3GPP TS 24.008: " Mobile radio interface layer 3 specification".

[20] 3GPP TS 24.011: "Point-to-Point (PP) Short Message Service (SMS) support on mobile radio interface".

[21] 3GPP TS 24.012: " Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[22] 3GPP TS 44.021: "~~Digital cellular telecommunications system (Phase 2+);~~ Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[24] 3GPP TS ~~05.01~~45.001: "~~Digital cellular telecommunications system (Phase 2+);~~ Physical layer on the radio path General description".

[25] 3GPP TS ~~05.03~~45.003: "~~Digital cellular telecommunications system (Phase 2+);~~ Channel coding".

[26] 3GPP TS ~~05.08~~45.008: "~~Digital cellular telecommunications system (Phase 2+);~~ Radio subsystem link control".

[27] 3GPP TS ~~06.31~~46.031: "~~Digital cellular telecommunications system;~~ Full rate speech; Discontinuous Transmission (DTX) for full rate speech traffic channels".

[28] 3GPP TS 27.001: " General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[29] 3GPP TS 27.002: " Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[30] 3GPP TS 27.003: " Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[31] 3GPP TS ~~08.04~~48.004: "~~Digital cellular telecommunications system (Phase 2+);~~ Base Station System - Mobile-services Switching Centre (BSS - MSC) interface Layer 1 specification".

[32] 3GPP TS ~~08.06~~48.006: "~~Digital cellular telecommunications system (Phase 2+);~~ Signalling transport mechanism specification for the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[33] 3GPP TS ~~08.08~~48.008: "~~Digital cellular telecommunications system (Phase 2+);~~ Mobile Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".

[34] 3GPP TS ~~08.20~~48.020: "~~Digital cellular telecommunications system (Phase 2+);~~ Rate adaption on the Base Station System - Mobile-services Switching Centre (BSS - MSC) interface".

[35] Void.

[36] 3GPP TS 29.007: "General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[37] ITU-T Recommendation I.460: "Multiplexing, rate adaption and support of existing interfaces".

[38] ITU-T Recommendation V.110: "Support of Data Terminal Equipments (DTEs) with V-Series interfaces by an integrated services digital network".

[39] ITU-T Recommendation V.21: "300 bits per second duplex modem standardised for use in the general switched telephone network".

[40] ITU-T Recommendation V.22: "1 200 bits per second duplex modem standardised for use in the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[41] ITU-T Recommendation V.22bis: "2 400 bits per second duplex modem using the frequency division technique standardised for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[42] ITU-T Recommendation V.24: "List of definitions for interchange circuits between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE)".

[43] ITU-T Recommendation V.26ter: "2 400 bits per second duplex modem using the echo cancellation technique standardised for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits".

[44] ITU-T Recommendation V.32: "A family of 2-wire, duplex modems operating at data signalling rates of up to 9 600 bit/s for use on the general switched telephone network and on leased telephone-type circuits".

[45] ITU-T Recommendation V.42bis: "Data Compression for Data Circuit terminating Equipment (DCE) using Error Correction Procedures".

[46] ITU-T Recommendation V.120: "Support by an ISDN of data terminal equipment with V-Series type interfaces with provision for statistical multiplexing".

[47] ITU-T Recommendation X.21: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for synchronous operation on public data networks".

[48] ITU-T Recommendation X.21bis: "Use on public data networks of Data Terminal Equipment (DTE) which is designed for interfacing to synchronous V-series modems".

[49] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".

[50] ITU-T Recommendation X.28: "DTE/DCE interface for a start-stop mode data terminal equipment accessing the Packet Assembly/Disassembly facility (PAD) in a public data network situated in the same country".

[51] ITU-T Recommendation X.30: "Support of X.21, X.21bis and X.20bis based Data Terminal Equipments (DTEs) by an Integrated Services Digital Network (ISDN)".

[52] ITU-T Recommendation X.31: "Support of packet mode terminal equipment by an ISDN".

[53] ITU-T Recommendation X.32: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and accessing a packet switched public data network through a public switched telephone network or an integrated services digital network or a circuit switched public data network".

[54] ITU-T Recommendation V.34 (1994): "A modem operating at data signalling rates of up to 28 800 bits for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits".

[55] ITU-T Recommendation I.440 (1989): "ISDN user-network interface data link layer - General aspects".

[56] ITU-T Recommendation I.450 (1989): "ISDN user-network interface layer 3 General aspects".

[57] ISO/IEC 6429 (1992): "Information technology - Control functions for coded character sets".

[58] 3GPP TS 23.060: " General Packet Radio Service (GPRS)".

[59] ITU-T Recommendation V.90 - A digital modem and analogue modem pair for use on the public switched telephone network (PSTN) at data signalling rates of up to 56 000 bit/s downstream and up to 33 600 bit/s upstream.

[60] 3GPP TS 21.905: " Vocabulary for 3GPP Specifications "

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document~~this specification~~, the following definitions apply.

**(DIGITAL) connection:** A concatenation of (digital) transmission channels or (digital) telecommunication circuits, switching and other functional units set up to provide for the transfer of (digital) signals between two or more points in a telecommunication network to support a single communication.

**~~GSM~~PLMN connection:** A connection that is established through ~~a GSM~~PLMN between specified ~~GSM~~PLMN reference points.

**~~GSM~~PLMN connection type:** A description of a set of ~~GSM~~PLMN connections which have the same characteristics.

**EDGE channels:** A general term referring to channels based on 8PSK modulation; i.e. TCH/F28.8, TCH/F32.0, and TCH/F43.2.

## 3.2 Abbreviations

Abbreviations used in this specification are listed in 3GPP TS ~~01.04~~21.905.

# 4 General considerations

Low layer capabilities are defined in 3GPP TS ~~02.01~~22.001 and characterized in 3GPP TS 22.002 for Bearer Services and 3GPP TS ~~02.03~~22.003 for Teleservices. Apart from the short message service and GPRS, all Bearer Services and Teleservices are provided using low layer capabilities in the connection mode.

Network capabilities to support the short message services are defined in 3GPP TS 23.040 and 3GPP TS 24.011 for the point-to-point service, and in 3GPP TS 23.041 and 3GPP TS 24.012 for the cell broadcast service. Network capabilities to support GPRS are described in 3GPP TS 23.060.

## 4.1 Relationship between lower layer capabilities and radio traffic channels

The realization of low layer capabilities for the provision of telecommunication services will make use of a physical medium consisting of a traffic channel TCH (refer to 3GPP TS ~~04.03~~44.004) or a combination of several full rate traffic channels (Multislot configuration for data) except for the short message point-to-point which uses a dedicated control channel DCCH (see 3GPP TS 24.011) or the cell broadcast service which uses the CBCH (see 3GPP TS 24.012). No multiplexing of data connections on one TCH is allowed.

Either a full rate or a half rate channel may be used depending on the requirements of the individual service. User data rates below or equal to 4 800 bit/s may be supported either on a full rate channel or on a half rate channel. Single slot configurations of 9.6Kbit/s and above are always supported on a full rate channel. Multislot configurations for data use combinations of 4.8 kbit/s or 9.6 kbit/s or 14.4 kbit/s full rate traffic channels only.

Technically every MS, regardless of whether it uses a half or a full rate TCH for speech transmission, should be able to use both half and full rate TCHs for data transmission and telematic services. However, particular designs of MS may only provide access to a limited set of services and therefore only use limited options.

For the alternate speech and group 3 facsimile teleservice, when a full rate traffic channel is required for the speech or data portion of the service, a full rate traffic channel will be used for the duration of the call, see 3GPP TS 22.002.

Within a~~GSM~~ PLMN, the transport of user data and access interface status information (if present) will use a rate adaptation method based on ITU-T Recommendation V.110 except on TCH/F14.4 or EDGE channels for which ~~GSM~~PLMN specific rate adaption is used between the mobile station and the interworking function. For the access interface, the rate adaptation schemes used are referenced in the 3GPP TS 27-series.

On the radio path, rate adaptation leads to rates of 43.5, 32.0, 29.0, 14.5, 12.0, 6.0 and 3.6 kbit/s per TCH (see 3GPP TS 44.021). However, in multislot configurations for data the 3.6 kbit/s per TCH/F rate is excluded. At the BSS to MSC interface, the rate adaptation scheme used is described in 3GPP TS ~~08.20~~48.020.

Protection of information from errors on the radio path (i.e. between MS and BSS) will be implemented by use of FEC techniques (see 3GPP TS ~~05.03~~45.003).

## 4.2 Transparent and non-transparent lower layer capabilities

Two classes of low layer capabilities have been identified (see 3GPP TS 22.002 and 3GPP TS ~~02.03~~22.003):

- a transparent class which is characterized by constant throughput, constant transit delay and variable error rate;
- a non-transparent class for which an ARQ technique is used (see 3GPP TS 24.022) on the radio path and extended to an appropriate interworking function. This class is characterized by improved error rate with variable transit delay and throughput. Data compression can optionally be used in combination of non-transparent lower layer capability, to increase the data rate on the DTE/DCE interface (or the equivalent interface depending on the TE type).

The considerations described above provide the basis for the definition of a limited set of connection types to be implemented by ~~a GSM~~an A/Gb mode PLMN.

## 4.3 The ~~GSM~~PLMN environment

### 4.3.1 The hand-over procedure

The ~~GSM~~PLMN connection is heterogeneous and merges PCM links and radio path as a unit for the user.

One of the most specific characteristics of the mobile networks is the hand-over procedure (see 3GPP TS 23.009, 24.008, ~~05.08~~45.008, ~~08.08~~48.008) which result in a temporary break of the TCH, and consequently in a loss of information.

The ~~GSM~~PLMN makes it possible to use one TCH slot for signalling (frame stealing for FACCH) in one TDMA frame resulting in a loss of information.

For the transparent data calls, this will result in a period of highly errored stream. For the non-transparent services, the use of the ARQ procedure (3GPP TS 24.022) will overcome this problem.

After a hand-over, in case of loss of synchronization, the process to recover synchronization, as described in 3GPP TS 29.007 and 44.021 should apply. If data compression is used, V.42bis procedure should apply.

### 4.3.2 DTX procedure

For the full rate speech traffic channel, DTX function goes along with other procedures such as voice activity detection, generation of comfort noise, and is described in 3GPP TS ~~06.31~~46.031.

For the non-transparent traffic channels, DTX apply according to 3GPP TS ~~08.20~~48.020.

# 5 Framework for the description of connection types

## 5.1 Introduction

~~A GSM~~A PLMN provides a set of network capabilities, which enable telecommunication services to be offered to a user.

A~~GSM~~ PLMN connection is a connection established between ~~GSM~~ PLMN reference points. A ~~GSM~~ PLMN connection type is a way of referring to and describing ~~a GSM~~ PLMN connection. Thus ~~a GSM~~a PLMN connection is a physical or a logical realization of ~~a GSM~~a PLMN connection type. Each ~~GSM~~ PLMN connection can be characterized as belonging to a PLMN connection type.

Figure 1 illustrates the concepts (see also figure 1 of 3GPP TS ~~02.01~~22.001).

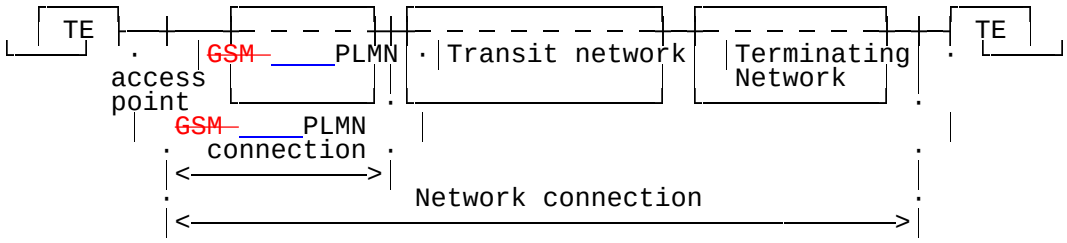



**Figure 1: Framework for the description of GSM PLMN connections**

## 5.2 Purpose of ~~GSM~~ PLMN connection types

The definition of a set of ~~GSM~~ PLMN connection types provides the necessary input to identify the network capabilities of ~~a GSM~~a PLMN. Other key requirements of ~~a GSM~~a PLMN are contained in other GSM specifications, in particular 3GPP TS 03.01, ~~04.01~~44.001 and ~~04.02~~24.002. In addition to describing network capabilities of ~~a GSM~~a PLMN, the

identification of connection types facilitates the specification of network-to-network interfaces. It may also assist in the allocation of network performance parameters.

NOTE 1: The user specifies only the telecommunication service required while the GSM PLMN allocates the resources to set up a connection of the specific type as necessary to support the requested service. It is further noted that, for certain service offerings, additional network functions, e.g. additional lower layer functions and/or higher layer functions, may be required (see figure 2).

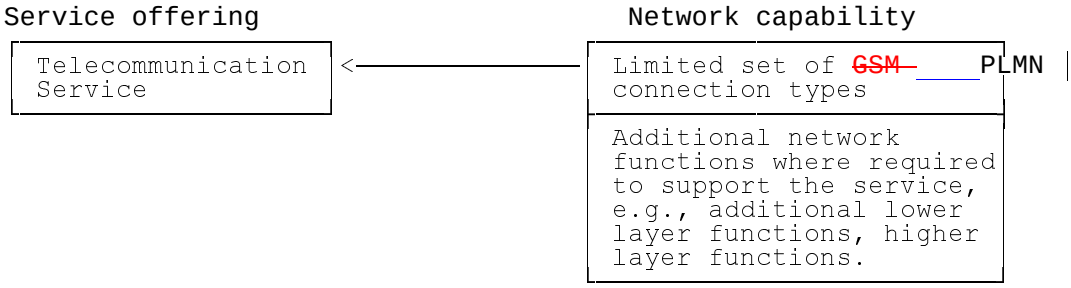



**Figure 2: The role of network capabilities in supporting service offerings**

## 5.3 Functions associated with ~~a GSM~~a PLMN connection

Any GSM PLMN connection involves an association of functions to support telecommunication services as shown in figure 3. Three sets of functions are required.

i) Connection means - including transmission and switching.

ii) Control functions and protocols - including signalling, flow/congestion control and routing functions.

iii) Operations and management functions - including network management and maintenance functions.

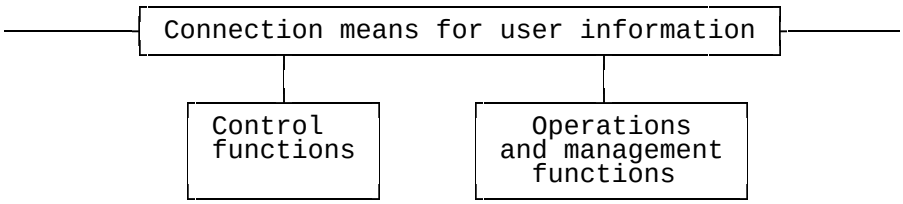


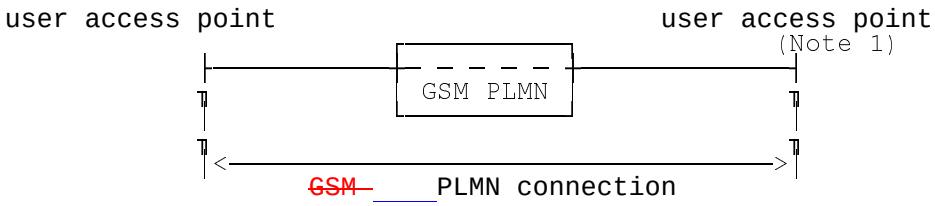

**Figure 3: Functional description**

## 5.4 Applications of GSM PLMN connection types

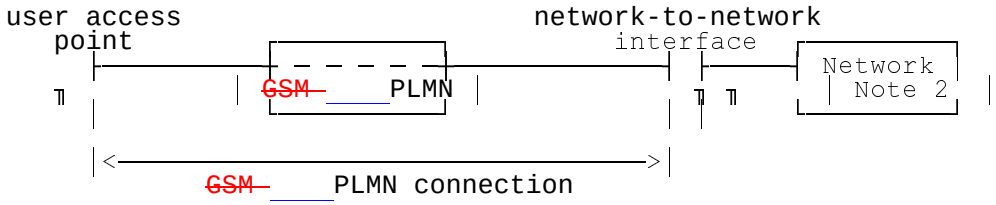
The following situations to which GSM PLMN connection types apply (see figure 4) may arise:

- Between two GSM PLMN user access points (refer to 3GPP TS ~~02.01~~22.001 and ~~04.02~~24.002): see figure 4a.
- Between ~~a GSM~~a PLMN user access point and a network-to-network interface: see figure 4b.
- Between ~~a GSM~~a PLMN user access point and an interface to a specialized resource within the GSM PLMN: see figure 4c.
- Between ~~a GSM~~a PLMN user access point and an interface to a specialized resource outside the GSM PLMN: see figure 4d.

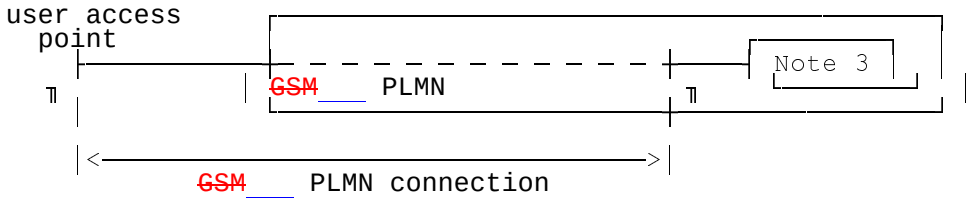
a)



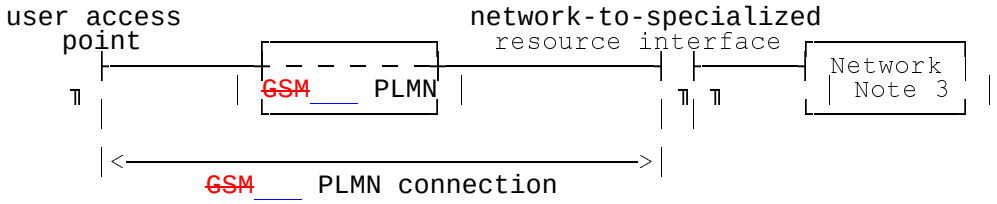

b)




c)



d)




NOTE 1: See 3GPP TS ~~02.01~~22.001.
NOTE 2: Network means here any fixed network as described in 3GPP TS ~~02.01~~22.001.
NOTE 3: The box represents a specialized resource. Its use originates from a service request. Further study is required to give some examples.

**Figure 4: Applications of ~~GSM~~ PLMN connection types**

## 5.5 ~~GSM~~ PLMN connection involving several networks

~~A GSM~~A PLMN connection may comprise a number of tandem network connections. Figure 5 shows an example in which each end network is ~~a GSM~~a PLMN. The intermediate network(s) must offer the appropriate network capabilities for the service provided by the (overall) ~~GSM~~ PLMN connection. In (overall) ~~GSM~~ PLMN connections involving several networks, each network provides a part of the connection and may be categorized by different attribute values.

The IWF/MSC can interwork with different type of networks, e.g.:

- analogue (A);
- digital circuit (D) with V.110/X.31 in band protocol;

Examples of such networks are:

- GSM (D);
- ISDN (A, D, P);
- PSTN (A).

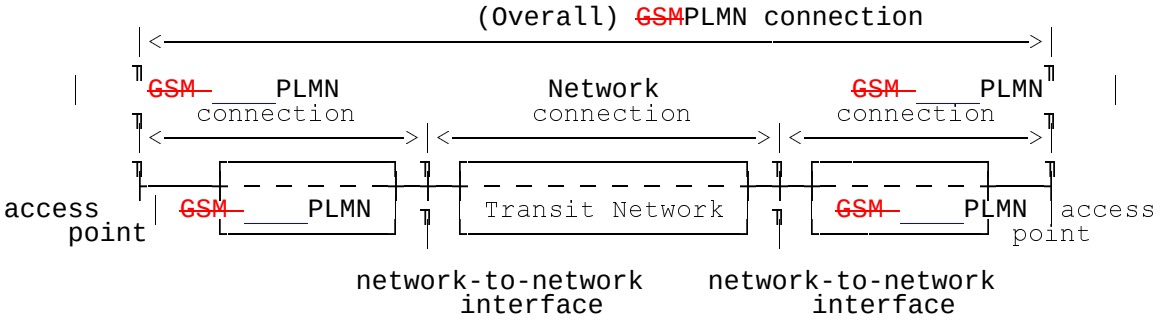



**Figure 5: Example of ~~a GSM~~a PLMN connection involving several networks**

# 6 ~~GSM~~PLMN connection types

## 6.1 Description of ~~GSM~~ PLMN connection types

The characterization of ~~GSM~~ PLMN connection types is done by using a set of attributes. ~~A GSM~~A PLMN connection type attribute is a specific characteristic of ~~a GSM~~a PLMN connection type whose values distinguish it from another ~~GSM~~ PLMN connection type. Particular values are assigned to each attribute when a given ~~GSM~~ PLMN connection type is described and specified.

A list of definitions of attributes and values is contained in the annex A to this specification.

~~A GSM~~A PLMN connection type is partitioned into connection elements. This partitioning is based on the two most critical transitions of a connection, firstly, the change of signalling system, secondly, the type of transmission system. In ~~a GSM~~a PLMN, the change in signalling and transmission between the radio interface and the A interface leads to two connection elements, the radio interface connection element and the A interface connection element. Subclause 6.3 describes the relationship between the attribute values of connection elements and connection types.

To complete the description of ~~GSM~~PLMN connection types, the definition of functions within the different entities of ~~a GSM~~a PLMN which are involved in the realization of ~~a GSM~~a PLMN Connection is needed. These functions will be used in subclauses 6.4 and 6.5 to describe the limited set of ~~GSM~~PLMN connection types.

The following functions have been identified:

- rate adaptation functions;
- the radio link protocol function;
- the forward error correction function;
- the Layer 2 relay function.

### 6.1.1 Rate adaptation

The RA0 rate adaptation is only used with asynchronous interfaces. Incoming asynchronous data is padded by the addition of stop elements to fit the same or nearest higher synchronous rate defined by 2 to the power n (where n≤ 6) times 600 bit/s, 14.4 kbit/s or 28.8 kbit/s. Thus 300 bit/s user data signalling rate shall be adapted to a synchronous 600 bit/s stream. This function is described in 3GPP TS 44.021. The RA0 used in ~~GSM~~ the PLMN is not identical to that described in ITU-T Recommendation V.110 which converts the 14,4 and 28,8 kbit/s user rates to 19,2 and 38,4 kbit/s, respectively.

The intermediate rate adaptation function (RA1) is a rate adaptation function which turns either the output of the RA0 function or a synchronous user data stream into a data stream at 8, 16, or 32 kbit/s by bit repetition and frame addition. This function is described in 3GPP TS 44.021.

The adaptation of intermediate rates to 64 kbit/s (RA2) performs the final conversion from the intermediate rates generated by the RA1 function to 64 kbit/s.

The radio interface intermediate rate adaptation function (RA1') is in the case of transparent data transmission a variant of the RA1 function and it adapts synchronous user data stream or the output of the RA0 function to one of the following data rates: 3.6, 6.0 or 12.0 or 14.5 kbit/s over the radio path. In case of a TCH/F28.8 channel two 14.5 kbit/s substreams produced by the RA1' function are multiplexed into a 29.0 kbit/s air interface channel by an EDGE multiplexing function. For the non-transparent case, the RA1' function provides direct access to the 12.0 or 6.0 kbit/s data rates. This is achieved by allowing the V.110 frame status bits to be used as additional data bits. This function is described in 3GPP TS 44.021 and 3GPP TS ~~08.20~~48.020. RA1' is not applied in TCH/F14.4 or EDGE non-transparent operation.

For TCH/F14.4 channel coding three ~~GSM~~ PLMN-specific adaptation functions are used: namely, RA1'/RAA', RAA', and RAA'' (3GPP TS ~~08.20~~48.020). On the network side of the air interface, the 14.5 kbit/s substreams multiplexed into a 29.0 or 43.5 kbit/s air interface channel are transferred just as in a multislot connection of TCH/F14.4 substreams. RA1'/RAA' adapts between the 14.5 air-interface rate and the 16 kbit/s rate used across the Abis-interface. RAA' adapts between the 16 kbit/s Abis Interface-rate and 16.0 kbit/s A-interface substream. (Up to four such A-interface

substreams may be multiplexed into the 64kbit/s A-interface stream). RAA'' converts between the A-interface data substream(s) and the overall synchronous stream. In non-transparent operation the RAA'' converts between the A-interface stream and the 290-bit blocks containing bits M1, M2, and 288 data bits as described in 3GPP TS 44.021.

In multislot data configurations the intermediate rates 16, 32, and 64 kbit/s are supported on those sections of the network where the overall data stream is not split into multiple channels (3GPP TS 44.021 and ~~08.20~~48.020). RA1-adaptation is not applied to rates higher than 38.4 kbit/s. Instead, ~~a GSM~~a PLMN-specific rate adaptation function RA1'' to user rates 48 and 56 kbit/s is applied; this function adapts between these rates and the 64 kbit/s "intermediate" rate. The RA2 function passes rate 64 kbit/s on as such.

In multislot data connections, the rate adaptation functions are performed per TCH/F between the Split/Combine-functions. On the A-interface up to four TCH/Fs are multiplexed into one 64 kbit/s channel according to the procedures defined in 3GPP TS ~~08.20~~48.020. However, multiplexing is not applied to those user rates which make use of more than four TCH/Fs; for such rates the Split/Combine-function is located at the BSS.

The splitting and recombining of the data flow into/from TCH/Fs takes place at the RA1-function or RAA" function (transparent service) at the MSC/IWF and at the MS's RA1/RA1'- or RA1'-function, or between the RLP and RA1' (RA1' not applied to TCH/F14.4) (non-transparent service) at the MS and between RA1 or RAA"and RLP at MSC/IWF (figures 6 and 7). The TCH/Fs are treated as independent channels between the Split/Combine-functions.

For user rates requiring more than four TCH/Fs (transparent only) the Split/Combine-function is located at the RA1/RA1'-or RA1'-function at the MS and at the RA1'/RA1-function at the BSS (figures 6 and 7). The rate adaptation functions for the various user data rates are summarized in tables 1 to 3. It should be noted that in the case of synchronous data transmission, the RA0 is not present.

For 56 and 64 kbit/s connections using a 2×TCH/F32.0 channel configuration across the radio interface, no rate adaptation is applied as the PLMN offers a '64 kbit/s pipe' between TE and an external network.

For 32 kbit/s connections using a 1×TCH/F32.0 channel configuration across the radio interface, the ITU-T I.460 rate adaptation is applied as described in ~~GSM~~ 3GPP TS 44.021.

**Table 1: Rate adaptation functions for the support of TE2 in the transparent case**

| R I/F | RA0 | | RA1' | Radio I/F |
|---|---|---|---|---|
| async | <------> | sync | | |
| ≤ 2.4 | <------> | ≤ 2.4 | <----------> | 3.6 |
| 4.8 | <------> | 4.8 | <----------> | 6.0 |
| 9.6 | <------> | 9.6 | <----------> | 12.0 or 2 × 6.0 |
| 14.4 | <------> | 14.4 | <----------> | 14.5 or 2 × 12.0 or 3 × 6.0 |
| 19.2 | <------> | 19.2 | <----------> | 2 × 12.0 or 4 × 6.0 |
| 28.8 | <------> | 28.8 | <----------> | 1 x 29.0 or 2 x 14.5 or 3 × 12.0 |
| | | 32 | <----------> | 1 × 32 |
| 38.4 | <------> | 38.4 | <----------> | 3 x 14.5 or 4 × 12.0 |
| | | 48.0 | <----------> | 4 x 14.5 or 5 × 12.0 |
| | | 56.0 | <----------> | 2 x 32.0 or 4 x 14.5 or 5 × 12.0 note 1 |
| | | 64.0 | <----------> | 2 x 32.0 or 5 x 14.5 or 6 × 12.0 note 1 |

NOTE 1: AIUR of 11.2 kbit/s per 12.0 kbit/s air interface channel (3GPP TS 44.021).

**Table 2: Rate adaptation functions for the support of TE1/TA in the transparent case**

| RA0 | | RA1 | | | RA2 | S I/F | RA2 | | RA1/RA1' | Radio I/F |
|---|---|---|---|---|---|---|---|---|---|---|
| async | | sync | | | | | | | | |
| ≤ 2.4 | <------> | ≤ 2.4 | <------> | 8 | <------> | 64 | <------> | 8 | <------> | 3.6 |
| 4.8 | <------> | 4.8 | <------> | 8 | <------> | 64 | <------> | 8 | <------> | 6.0 |
| 9.6 | <------> | 9.6 | <------> | 16 | <------> | 64 | <------> | 16 | <------> | 12.0 or 2 × 6.0 |
| 14.4 | <------> | 14.4 | <------> | 32 | <------> | 64 | <------> | 32 | <------> | 14.5 or 2 × 12.0 or 3 × 6.0 |
| 19.2 | <------> | 19.2 | <------> | 32 | <------> | 64 | <------> | 32 | <------> | 2 × 12.0 or 4 × 6.0 |
| 28.8 | <------> | 28.8 | <------> | 64 | <------> | 64 | <------> | 64 | <------> | 1 x 29.0 or 2 x 14.5 or 3 × 12.0 |
| | | | | 32 | <------> | 64 | <------> | 32 | <------> | 1 × 32 |
| 38.4 | <------> | 38.4 | <------> | 64 | <------> | 64 | <------> | 64 | <------> | 3 x 14.5 or 4 × 12.0 |

| | RA1'' | | RA2 | S I/F | RA2 | | RA1/RA1' | Radio I/F |
|---|---|---|---|---|---|---|---|---|
| | 48.0 | <------> | 64 | <------> | 64 | <------> | 64 | <------> | 4 x 14.5 or 5 × 12.0 note 1 |
| | 56.0 | <------> | 64 | <------> | 64 | <------> | 64 | <------> | 2 x 32.0 or 4 x 14.5 or 5 × 12.0 notes 1, 2 |
| | | | 64 | <------> | 64 | <------> | 64 | <------> | 2 x 32.0 or 5 x 14.5 or 6 × 12.0 notes 1, 2 |

NOTE 1: RA2 not applicable.

NOTE 2: AIUR of 11.2 kbit/s per 12.0 kbit/s air interface channel (3GPP TS 44.021).

**Table 3: RA1' function in the non-transparent case**

| | RA1' | |
|---|---|---|
| 6.0 | <------> | 6.0 |
| 12.0 | <------> | 12.0 |

NOTE: RA1' not applicable to TCH/F14.4, TCH/F28.8, or TCH/F43.2

## 6.1.2 Radio Link Protocol

The Radio Link Protocol (RLP) is a layer 2 LAPB based protocol which performs grouping of user data for the purpose of implementing error control and retransmission mechanisms in the case of non-transparent low layer capabilities. The RLP layer is in charge of the transmission of the data compression parameters to the peer RLP entity and to the L2R layer, when those parameters have to be negotiated. The function that realizes the implementation of the protocol (described in 3GPP TS 24.022) takes place at both ends of the ~~GSM~~ PLMN connection in the MT and the IWF/MSC.

## 6.1.3 Layer 2 Relay function

The Layer 2 Relay function (L2R) performs protocol conversion between the user data structure (e.g. characters or X.25 Layer 2 frames) and a structure more adapted to the radio link protocol. This function is described in the relevant 3GPP TS 27-series specifications.

The L2R function includes the data compression function.

## 6.1.4 Resources allocated by the ~~GSM~~ PLMN network

Part of the ~~GSM~~ PLMN connection concerns the resources allocated by the ~~GSM~~ PLMN network on the basis of the attribute values of the connection elements.

For the speech calls, the ~~GSM~~ PLMN codec is allocated.

For data calls, resources are provided at the IWF/MSC such as:

- V.110 based rate adaptation for such channel codings as TCH/F 4,8 and TCH/F9,6 and ~~GSM~~ PLMN specific rate adaption for channel codings TCH/F14.4, TCH/F28.8, TCH/F43.2 (3GPP TS 44.021, ~~08.20~~48.020);
- filtering of status bits (TS 27.001);
- RLP for non-transparent services (TS 24.022);
- Data compression (TS 24.022, 27.002).

These are sufficient for data services such as:

- asynchronous circuit (bearer service series 20), used with unrestricted digital information transfer capability;
- synchronous circuit (bearer service series 30), used with unrestricted digital information transfer capability when interworking with circuit switched digital networks.

In addition to the above listed resources, further resources are allocated in the other cases:

- modems for asynchronous circuit (bearer service series 20) or synchronous circuit (bearer service series 30) used with 3.1 kHz information transfer capability;
- fax adaptor for the fax group 3 (teleservice series 60);

## 6.2 ~~GSM~~PLMN connection elements

The radio interface connection element is the portion of the connection spanning from the Mobile Termination to an appropriate internal reference point within the Base Station System.

The A interface connection element is the portion of the connection from the above internal reference point within the base station to an appropriate internal reference point within the interworking function (IWF) of the MSC.

By using connection elements and attributes which have a layered nature the construction of a connection type is more easily viewed. The use of different values for the same attribute allows a greater degree of description and flexibility.

## 6.3 Rules of association for the attribute values of connection elements and connection types

This subclause describes the relationship between the attribute values of connection elements and connection types. For each attribute the various possible values recommended are listed. The definitions of the attributes and attribute values are contained in the annex A. In addition to the (possible) attribute values applicable to the connection elements, an association law is given (where appropriate) for each attribute to show how the value of the attribute for the overall connection type is obtained from the values of the attribute applicable to the connection elements.

### 6.3.1 Information transfer mode

Attribute values for connection elements:

Circuit.

Attribute values for overall connection type:

Circuit.

Association Law:

Circuit.

### 6.3.2 Information transfer rate (kbit/s)

Attribute values for connection elements:

3.6 or 6.0 or 12.0 or 13.0 or 14.5 or 29.0 or 32.0 or 43.5 or 64.0

or n × 6.0 ( 1 ≤ n ≤ 4 ) or n × 12.0 ( 1 ≤ n ≤ 6 ) or n x 14.5 ( 1 ≤ n ≤ 5 ) or 2 x 29.0 or 2 x 32.0

Attribute values for overall connection type:

3.6 or 6.0 or 12.0 or 13.0 or 14.5 29.0 or 32.0 or 43.5 or 64.0;

or n × 6.0 ( 1 ≤ n ≤ 4 ) or n × 12.0 ( 1 ≤ n ≤ 6 ) or n x 14.5 ( 1 ≤ n ≤ 5 ) or 2 x 29.0 or 2 x 32.0..

Association Law:

The value for the overall connection type will be equal to the lowest value of any of its connection elements.

### 6.3.3 Information transfer susceptance

Attribute values for connection elements:

Speech processing functions (e.g. ~~GSM~~ PLMN Speech Coding/A Law conversion, Discontinuous Transmission) and/or Echo suppression functions and/or Multiple satellite hops or null.

Attribute values for overall connection types:

Unrestricted Digital Information or Speech.

Association Law:

For an overall connection type to have the value Unrestricted digital no connection element may contain speech processing functions or echo suppression functions. Connection elements containing speech processing devices having the flexibility to change operation between speech and unrestricted digital would on the other hand be allowed to be part of a number of different connection types.

For an overall connection type to have the value speech it must contain ~~GSM~~ PLMN Speech Coding/A Law conversion equipment and echo suppression functions when appropriate.

### 6.3.4 Establishment of connection

Attribute values for connection elements:

Demand.

Attribute values for overall connection type:

Demand.

Association Law:

If any of the connection elements are Demand, then the overall connection type is Demand.

### 6.3.5 Symmetry

Attribute values for connection elements:

Bidirectional Symmetric.

Bidirectional Asymmetric (Multislot connections for data).

Attribute values for overall connection type:

Bidirectional Symmetric.

Bidirectional Asymmetric (Multislot connections for data).

Association Law:

The overall symmetry can only be generated from the connection elements by analysis of the connection element values in the context of the architecture of the connection.

### 6.3.6 Connection configuration Topology

Attribute values for connection elements:

Point-to-point.

Attribute values for the overall connection type:

Not applicable.

Association Law:

Not applicable.

### 6.3.7 Structure

Attribute values for connection elements:

Unstructured or Service Data Unit Integrity.

Attribute values for the overall connection type:

As per values for connection elements.

Association Law:

Unspecified.

### 6.3.8 Channels

#### 6.3.8.1 Information channel (rate)

Attribute values for connection elements:

Radio interface connection element: Full rate TCH or Full rate TCHs or Half rate TCH.

A interface connection element: 64.0 kbit/s.

Attribute values for the overall connection type:

Not applicable.

#### 6.3.8.2 Signalling channel (rate)

Attribute values for connection elements:

Radio interface connection element: Dm.

A interface connection element: Common channel signalling system (64.0 kbit/s).

Attribute values for the overall connection type:

Not applicable.

### 6.3.9 Connection control protocol

Attribute values for connection elements:

Radio interface connection element:

Layer 1: 3GPP TS ~~04.03~~44.004 and 3GPP TS 05-series.

Layer 2: 3GPP TS ~~04.05~~44.005 and 04.06.

Layer 3: 3GPP TS 24.007 and 24.008, 24.011.

A interface connection element:

Layer 1: 3GPP TS ~~08.04~~48.004.

Layer 2: 3GPP TS ~~08.06~~48.006.

Layer 3: TS 24.007, 24.008 and ~~08.08~~48.008.

Attribute values for the overall connection type:

Not applicable.

## 6.3.10 Information transfer coding/protocol

Attribute values for connection elements:

Radio interface connection elements:

Layer 1: 3GPP TS 44.021, 3GPP TS 05-series and 06-series.

Layer 2: 3GPP TS 04.06, 24.022 and 3GPP TS 27.002 or 3GPP TS 24.022 and 3GPP TS 27.003 or transparent.

Layer 3: Transparent, 3GPP TS 24.011.

A interface connection element:

Layer 1: 3GPP TS ~~08.04~~48.004 and 3GPP TS ~~08.20~~48.020.

Layer 2: 3GPP TS 24.022 and 3GPP TS 27.002 or 3GPP TS 24.022 and 3GPP TS 27.003 or transparent.

Layer 3: Transparent.

Attribute values for the overall connection type:

Not applicable.

## 6.3.11 Further attributes and attribute values

This subclause has outlined the relationships between those attributes values presently existing, the possibility for new values being added remains.

Table 4 summarizes the attributes values for ~~GSM~~ PLMN connection elements.

**Table 4: Values for attributes for ~~GSM~~ PLMN connection elements**

| Attributes | Values for attributes | |
|---|---|---|
| | Radio interface connection element | A interface connection element |
| 1 Information Transfer Mode | Circuit | Circuit |
| 2 Information Transfer Rate<br><br>Layer 1 | <br><br>3.6 or 6.0 or 12.0 or 13.0 or 14.5 or 29.0 or 32.0 or 43.5 or n × 6.0 ( 1 ≤ n ≤ 4 ) or n × 12.0 ( 1 ≤ n ≤ 6 ) or n x 14.5 ( 1 ≤ n ≤ 5 ) or 2 x 29.0 or 2 x 32.0 kbit/s | <br><br>64.0 kbit/s |
| 3 Information Transfer Susceptance | Speech processing equipment,<br>Echo suppression equipment,<br>Null | Speech processing equipment,<br>Echo suppression equipment,<br>Null |
| 4 Establishment of Connection | Demand | Demand |
| 5 Symmetry | Bidirectional symmetric<br>Bidirectional asymmetric | Bidirectional symmetric<br>Bidirectional asymmetric |
| 6 Connection Configuration Topology | <br>Point-to-point | <br>Point-to-point |
| 7 Structure | Unstructured<br>SDU integrity | Unstructured<br>SDU integrity |
| 8 Channel Rate<br><br>Information Channel<br>Signalling Channel | <br><br>TCH/F(s) or TCH/H<br>Dm | <br><br>64.0 kbit/s<br><br>Common channel signalling system |
| 9 Connection Control Protocol<br><br>Layer 1<br>Layer 2<br>Layer 3 | <br><br>3GPP TS ~~04.03~~44.004 and 05 series<br>3GPP TS ~~04.05~~44.005 and 04.06<br>3GPP TS 24.007, 24.008, 24.011 | <br><br>3GPP TS ~~08.04~~48.004<br>3GPP TS ~~08.06~~48.006<br>3GPP TS 24.007, 24.008, ~~08.08~~48.008 |
| 10 Information Transfer Coding/Protocol<br><br>Layer 1<br>Layer 2<br><br>Layer 3 | <br><br>3GPP TS 44.021 05 and 06 series<br>3GPP TS 24.022 and 27.002 or 24.022 and 27.003<br>04.06 or transparent<br>Transparent, 24.011 | <br><br>3GPP TS ~~08.04~~48.004 and ~~08.20~~48.020<br>3GPP TS 24.022 and 27.002 or 24.022 and 27.003<br>or transparent<br>Transparent |

## 6.4 Limited set of ~~GSM~~ PLMN connection types (all channel codings excluding TCH/F14.4 and EDGE)

From the two connection elements defined in subclause 6.2, the list of attributes and their possible values given in subclause 6.3, and from the service requirements defined in 3GPP TS 22.002 and ~~02.03~~22.003, a limited set of ~~GSM~~ PLMN connection types have been identified (see also table 5 and table 6 for the relationship between connection elements and telecommunication services).

Figure 6 gives the information transfer protocol models for the identified set of ~~GSM~~ PLMN connection types. The S bits correspond to status bits and the D bits to data bits (3GPP TS 44.021); S* indicates that S bits are used only when 3.1 kHz audio ex PLMN. D' bits corresponds to user bits passed in the place of status bits in the non transparent case Moreover, it should be noted that the RLP rate of 6 and 12 kbit/s correspond to the 8 and 16 kbit/s intermediate rate in the transparent case.

Protocol Models 1 b and e are the models for asynchronous data transmission in the transparent mode.

Protocol Models 2 b and e are the models for synchronous data transmission in the transparent mode.

Protocol Models 3 b and e are the models for character "asynchronous" mode data transmission in the non-transparent mode. In this case, L2RCOP represents the protocol used between the Layer 2 Relay functions (L2R) to convey characters between the MS and the IWF (see 3GPP TS 27.002). The data compression function is located in the L2R COP function.

In all of the above models, the b variants are for singleslot, the e variants are for multislot data configurations.

Protocol Model 5a is the model for the transparent support of group 3 facsimile transmission. Model 5b is for transparent support of group 3 facsimile transmission in multislot data configurations.

Protocol Model 6 is the model for speech transmission.

In the multislot-data models the data is split into parallel substreams between the Split/Combine-functions (S/C). These substreams are transmitted through parallel TCH/Fs which are treated as independent channels. Between the S/C-functions parallel RA- and FEC-functions are used.

For all the models, only the minimum functionality of the IWF is shown. Additional functions will be required for various interworking situations. These additional functions are described in specification 3GPP TS 29.007.

It should be noted that, in Figure 6, the representation of the transcoding and rate adaptation from the intermediate rate on the radio interface to the 64 kbit/s rate required by the MSC is not intended to indicate a particular implementation. The annex B to 3GPP TS 43.010 identifies alternative arrangements.

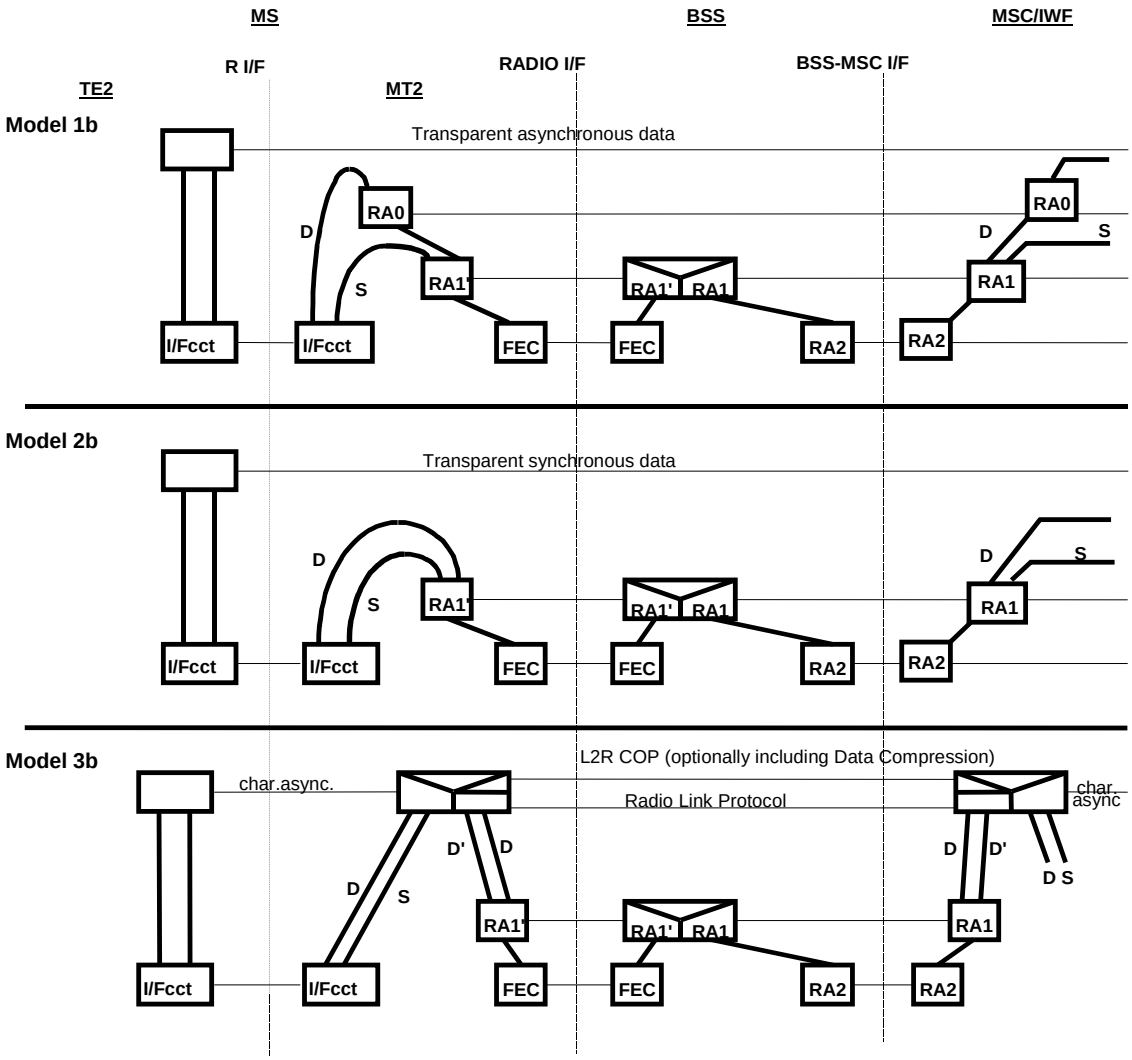



**Figure 6: Information transfer protocol models for ~~GSM~~PLMN connections**

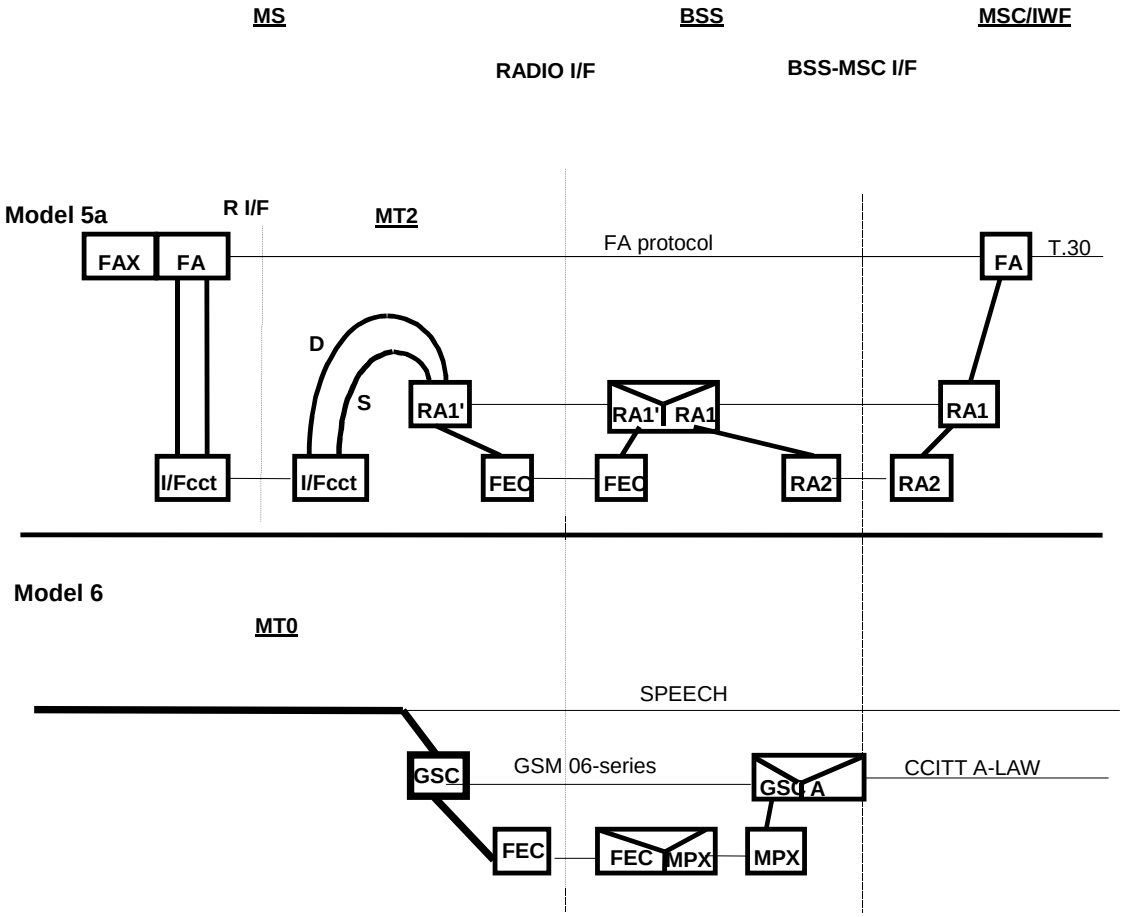



**Figure 6 (continued): Information transfer protocol models for ~~GSM~~PLMN connections**

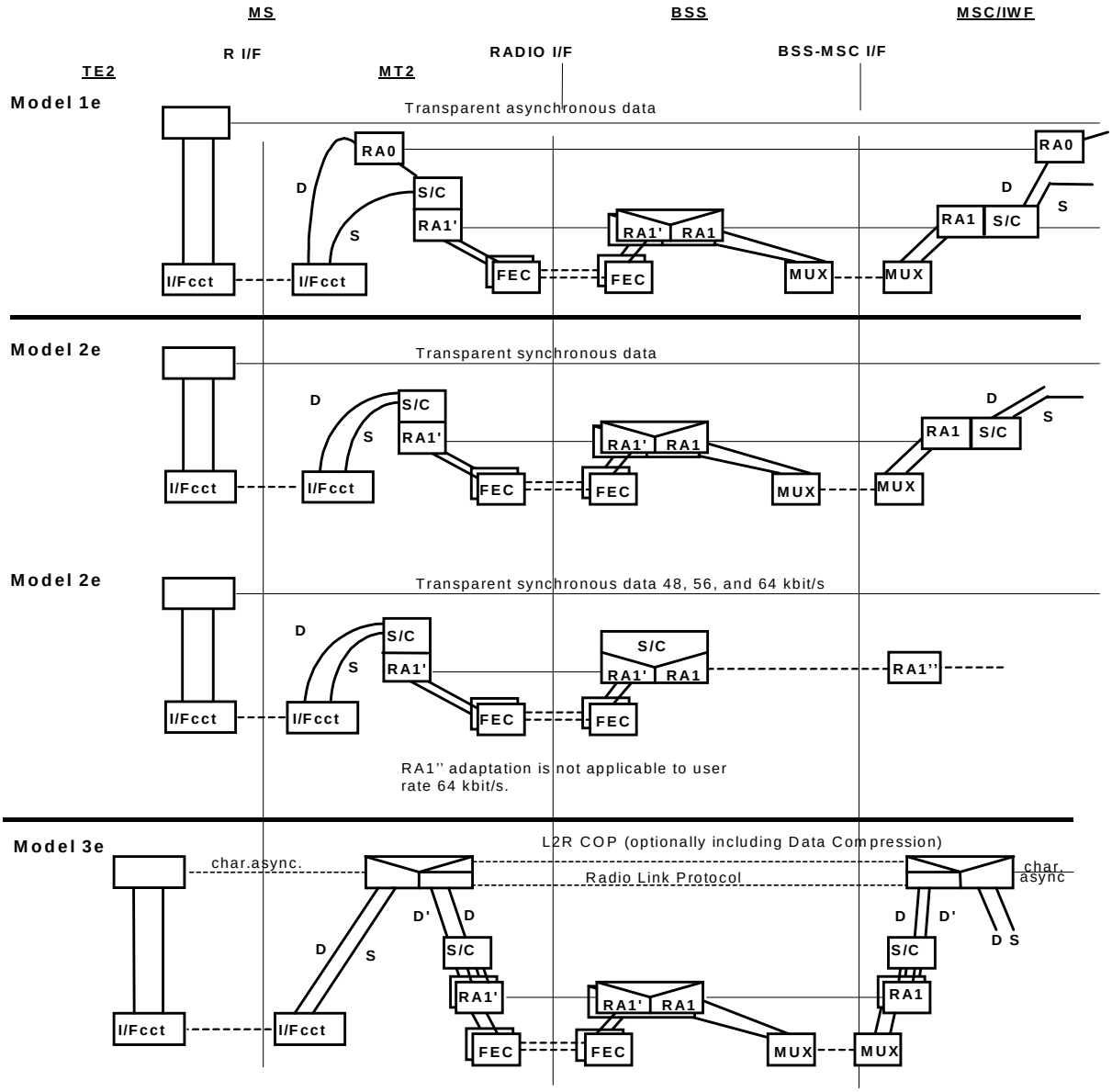



**Figure 6 (continued): Information transfer protocol models for ~~GSM~~PLMN connections**

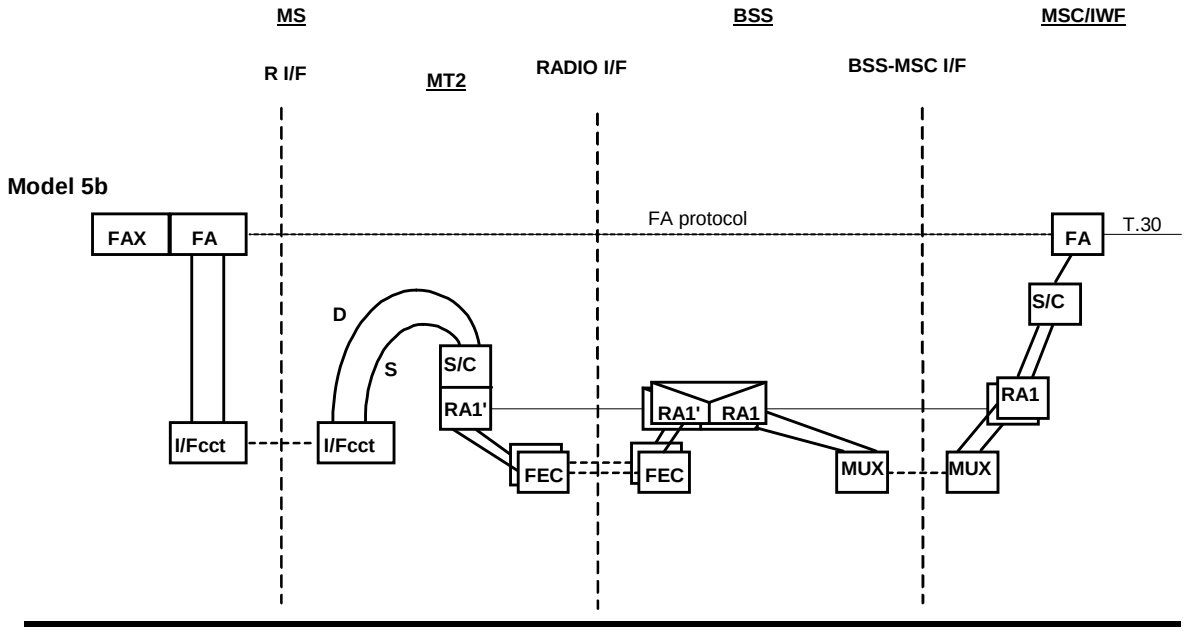



**Figure 6 (concluded): Information transfer protocol models for ~~GSM~~PLMN connections**

| Legend | to Figure 6: |
|---|---|
| FA | = Fax Adaptor |
| GSC | = GSM Speech Codec |
| FEC | = Forward Error Correction |
| MPX | = Multiplex/Demultiplex |
| MUX | = Multiplex/Demultiplex |
| S/C | = Split/ Combine |

## 6.5 Limited set of ~~GSM~~PLMN connection types (for TCH/F14.4 channel coding)

Figure 7 provides the information transfer protocol models for the identified set of ~~GSM~~PLMN connection types for support of TCH/F14.4. The description of models given in subclause 6.4 applies also to figure 7.

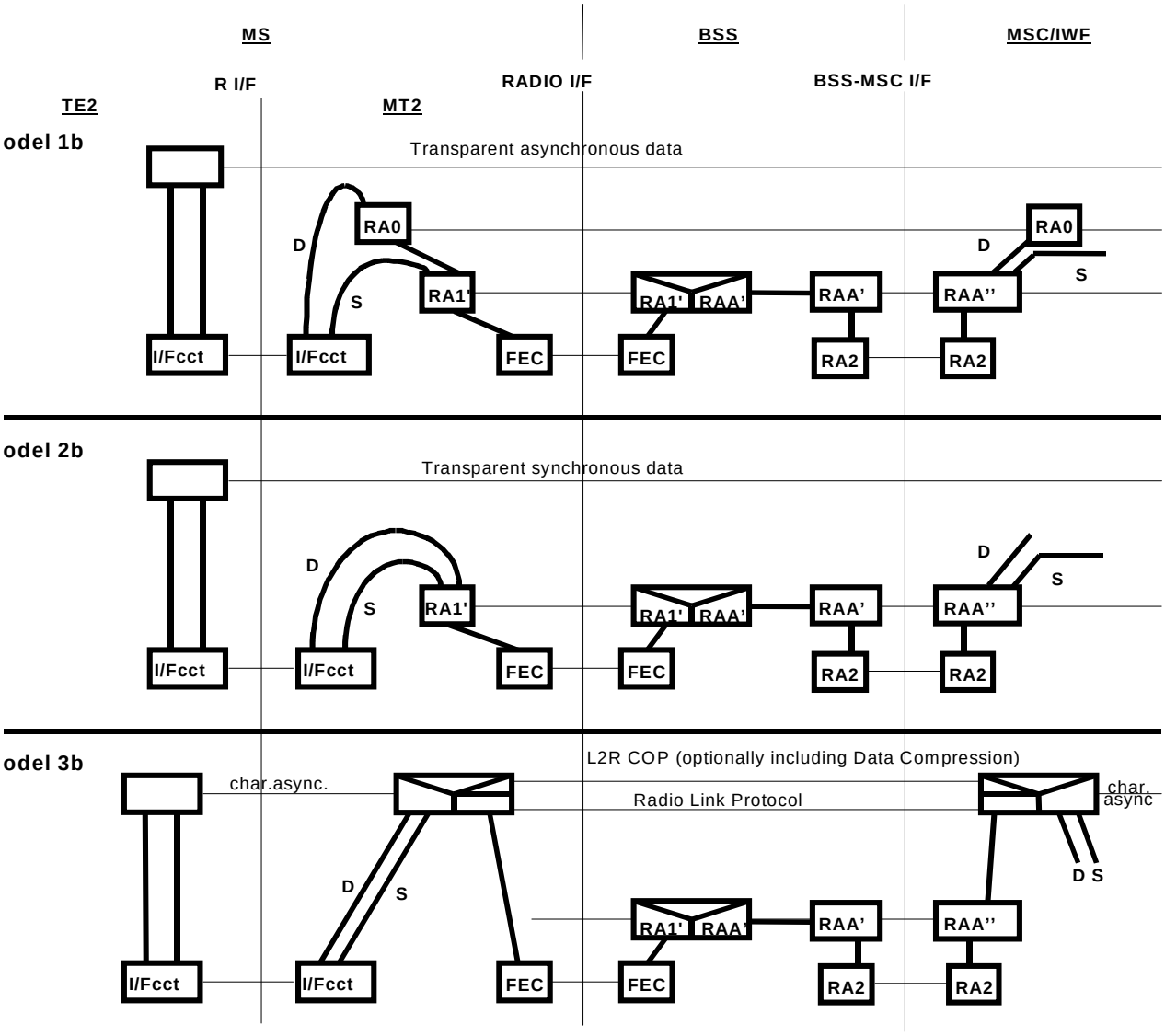



**Figure 7 : Information transfer protocol models for ~~GSM~~PLMN connections using 14.4 channels**

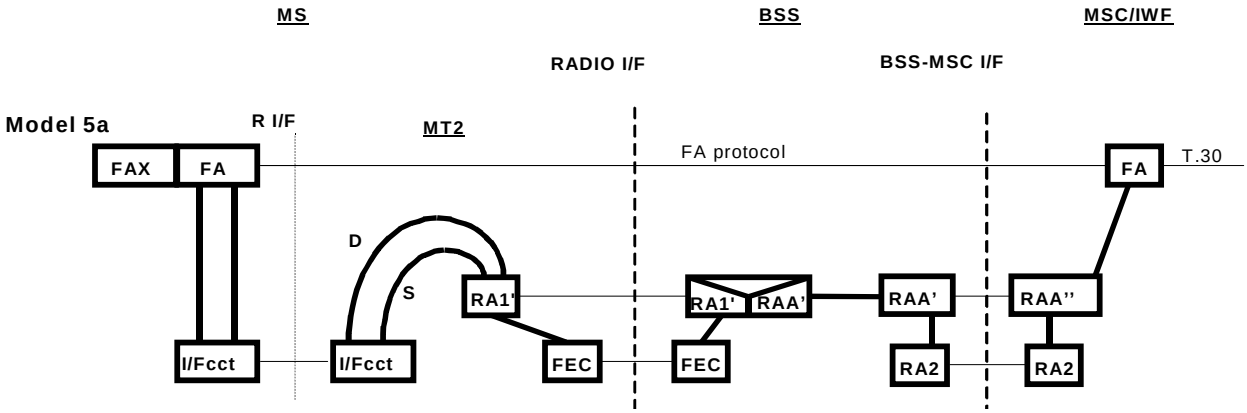



**Figure 7 (continued) : Information transfer protocol models for ~~GSM~~PLMN connections using 14.4 channels**

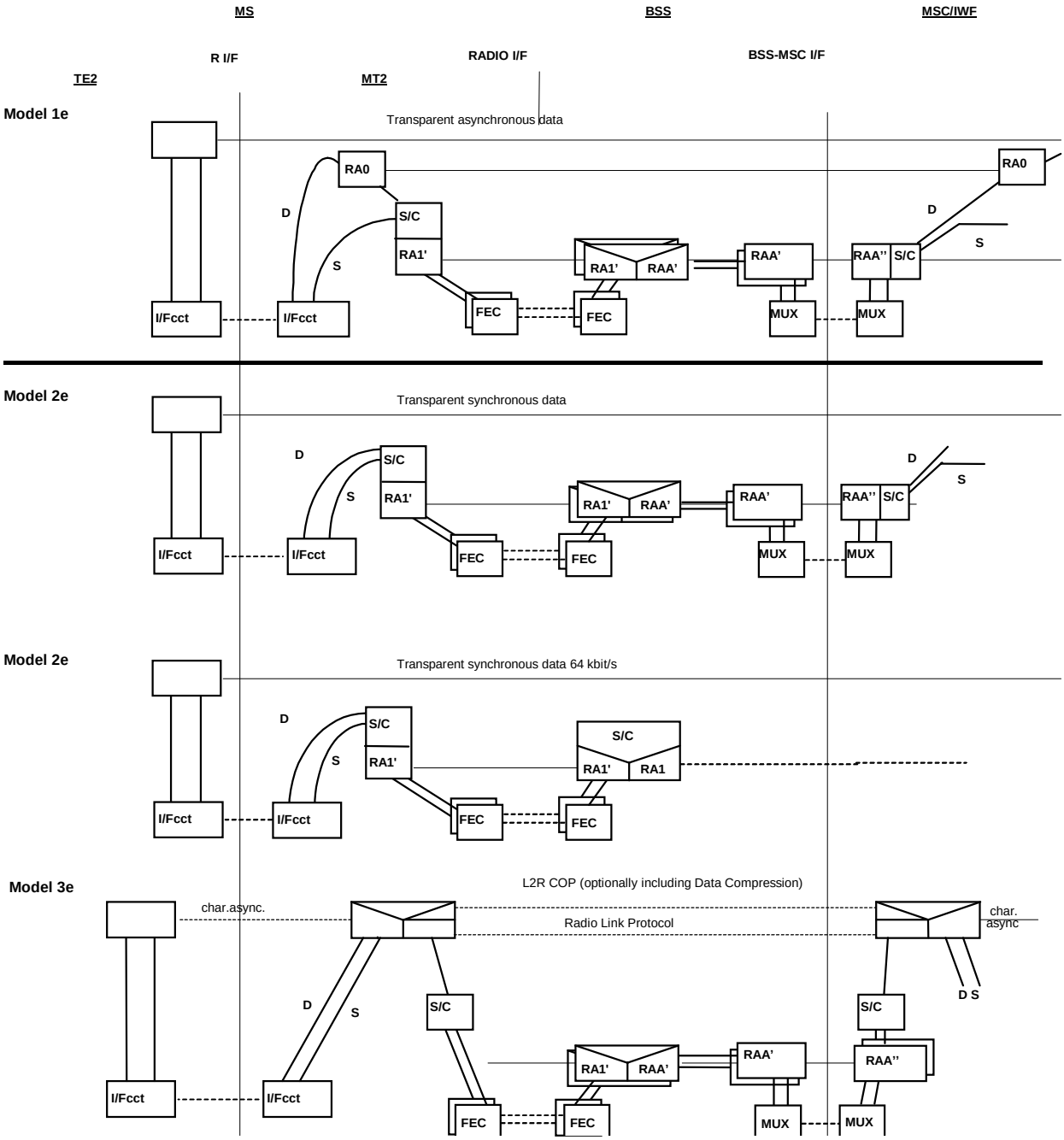



**Figure 7 (continued) : Information transfer protocol models for ~~GSM~~PLMN connections using 14.4 channels**

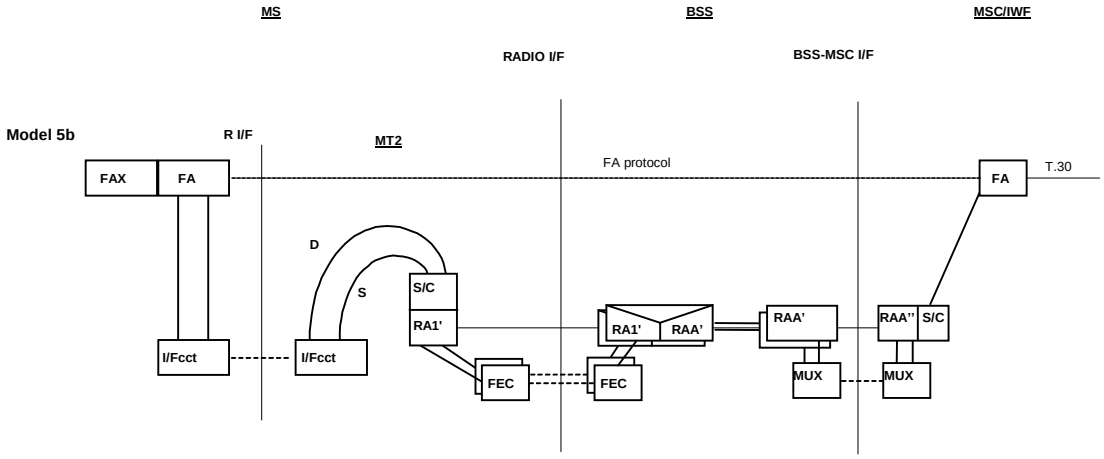



**Figure 7 (concluded) : Information transfer protocol models for ~~GSM~~PLMN connections using 14.4 channels**

| Legend | to Figure 7: |
|---|---|
| FA | = Fax Adaptor |
| GSC | = GSM Speech Codec |
| FEC | = Forward Error Correction |
| MPX | = Multiplex/Demultiplex |
| MUX | = Multiplex/Demultiplex |
| S/C | = Split/ Combine |

## 6.6 Limited set of ~~GSM~~PLMN connection types (for EDGE channels)

Figure 8 provides the information transfer protocol models for the identified set of ~~GSM~~PLMN connection types for support of TCH/F28.8 or TCH/F43.2 and figure 9 the models for the support of TCH/F32.0. The description of models given in subclause 6.4 applies also to figures 8 and 9.

When a TCH/F28.8 channel is used in multislot configurations, multiple EDGE multiplexing functions are applied on both sides of the air-interface; i.e. one multiplexing function — on each side of the air interface — is associated with each air-interface channel.

When TCH/F32.0 channels are used in double slot configurations, no rate adaptation is applied as the PLMN offers a '64 kbit/s pipe' between TE and an external network. When TCH/F32.0 channels are used in single slot configurations, the ITU-T I.460 rate adaptation is applied. (For details refer to 3GPP TS 44.021).

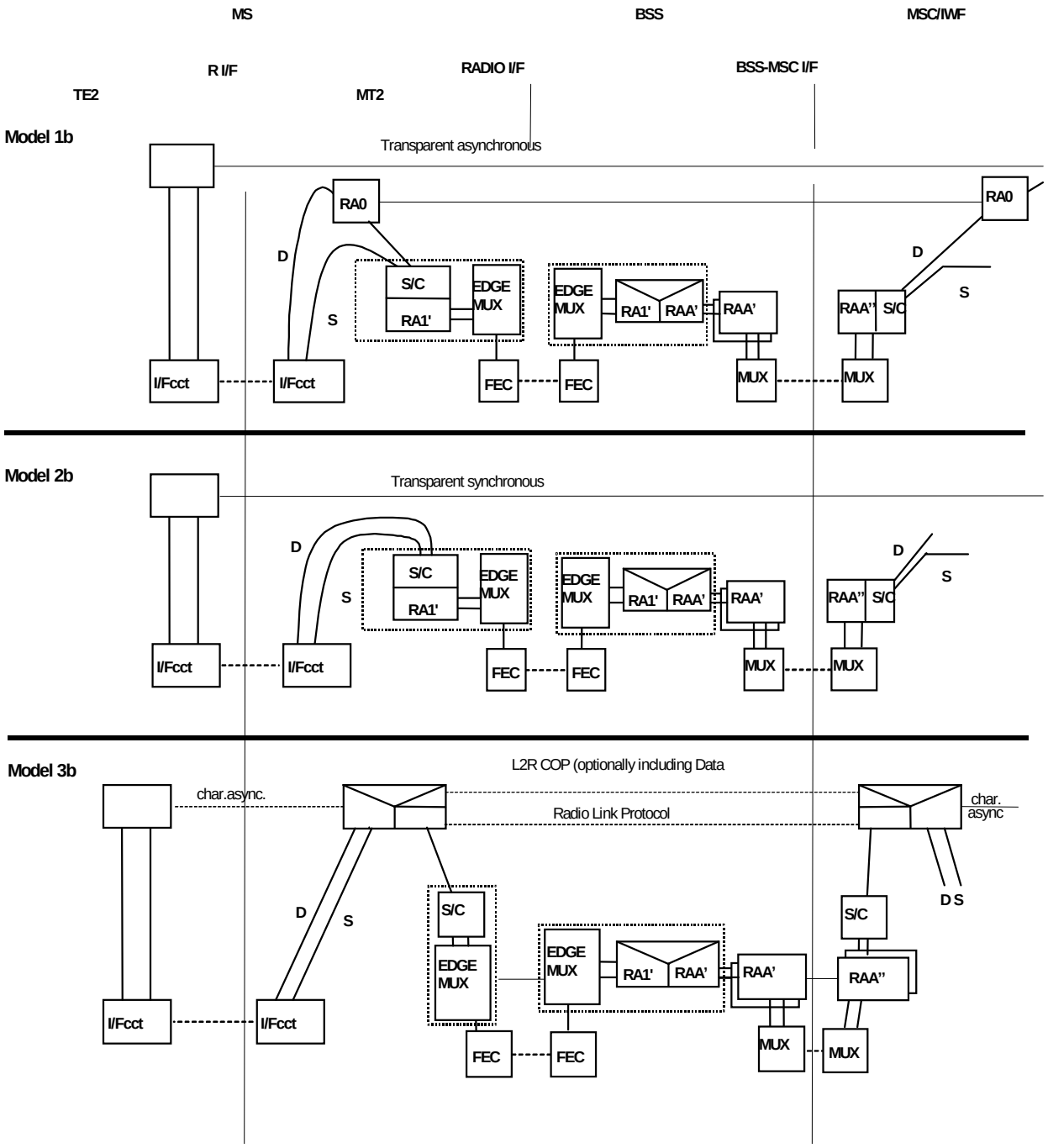



**Figure 8: Information transfer protocol models for ~~GSM~~PLMN connections using EDGE channels**

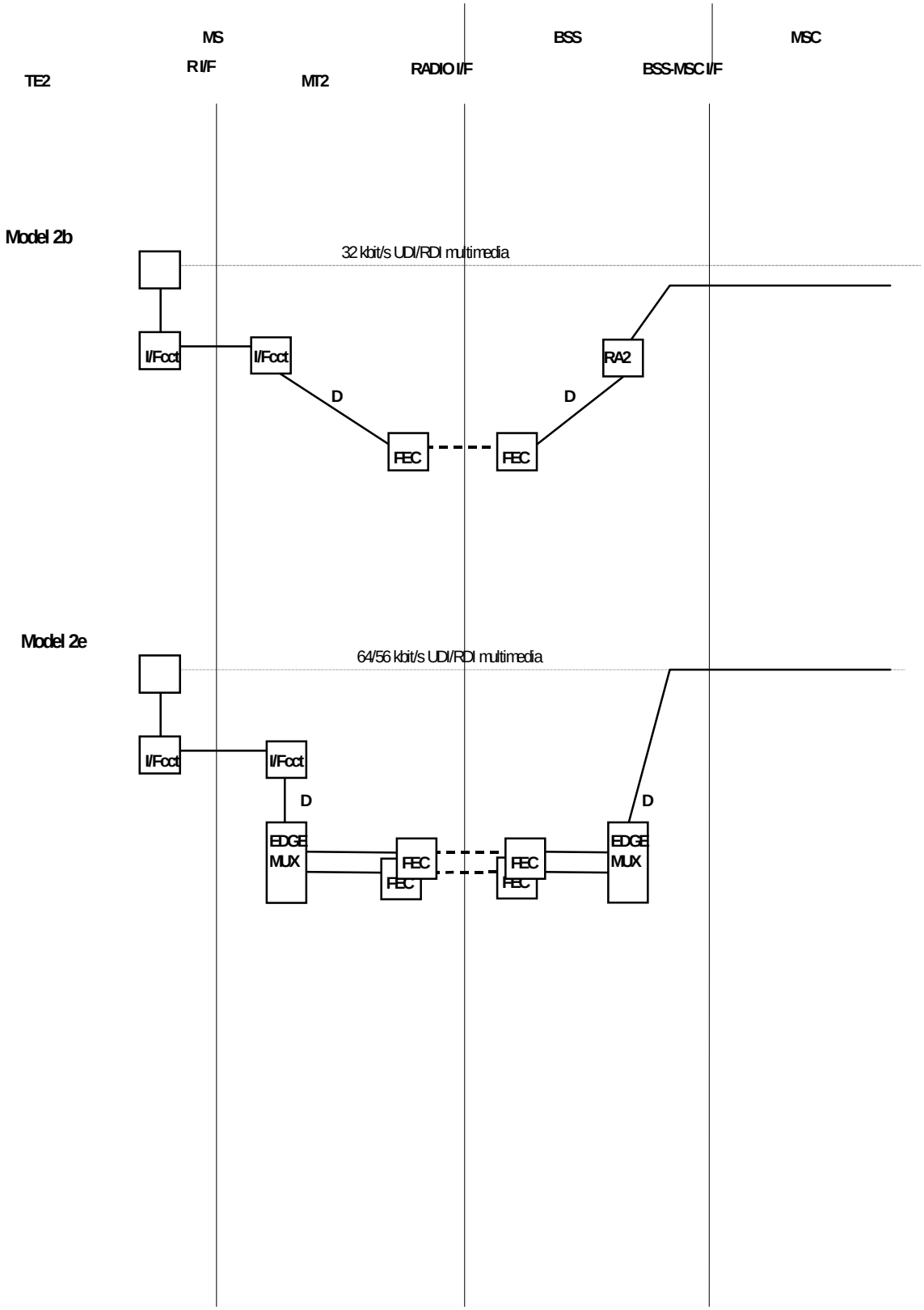



**Figure 9: Information transfer protocol models for ~~GSM~~PLMN connections using TCH/F32.0 EDGE channels**

# 7 Relationship between Telecommunication services and connection types

## 7.1 General

Given a request for a telecommunication service at the initiation of a call, the ~~GSM~~PLMN must establish a connection of a connection type that supports the attributes of the service requested. This establishment of a connection is effected at the time of call set up.

It should be noted that ~~GSM~~PLMN connection types represent the technical capabilities of ~~a GSM~~a PLMN and provide a basis for the definition of performance and interworking with other networks. Telecommunication services supported by ~~a GSM~~PLMN are the packages offered to customers and the definition of their attributes is the means to standardize the service offerings in all ~~GSM~~PLMNs.

Quality of service and commercial attributes are relevant to telecommunication services whereas connection types are characterized by network performance, network operations and maintenance attributes.

## 7.2 Relationship between Bearer services and connection types

Table 5 shows the relationship between Bearer services and ~~GSM~~PLMN connection types. In table 5, the connection elements for each connection type related to a Bearer service are shown.

Dominant attributes of the connection elements, such as information transfer mode, information transfer rate, information transfer capability and structure are indicated. The type of radio traffic channel used is also shown (half rate and full rate). In the multislot cases the minimum number of timeslots per connection (n) is 1.

## 7.3 Relationship between Teleservices and connection types

Table 6 shows the relationship between teleservices and connection type elements, for those teleservices having ~~a GSM~~PLMN connection type which does not correspond to the ~~GSM~~PLMN connection type of a bearer service. As in table 5/3GPP TS 43.010, dominant attributes of the connection elements and the type of radio traffic channel are shown. In the multislot cases the minimum number of timeslots per connection (n) is 1.

## 7.4 Network capability to support in-call modification

Specifications 3GPP TS 22.002 and ~~02.03~~22.003 identify a particular need for ~~a GSM~~a PLMN to support the Alternate speech and group 3 facsimile.

This service allows the use of in-call modification to change the mode of service. The network capability to support in-call modification is described in 3GPP TS 24.008. An in-call modification of the service mode is not possible for other services.

## 7.5 Network capability to support channel mode modification

Specification 3GPP TS ~~03.45~~43.045 (Technical Realization of the Group 3 Facsimile Teleservice) identifies a need for ~~a GSM~~a PLMN to support channel mode modification within the facsimile phase of the alternate speech and facsimile group 3 service. The network capability to support channel modification is described in 3GPP TS 24.008. Channel mode modification is not possible for other services. A channel mode modification results in a change of connection element over the radio interface with resultant change in access at the mobile station.

**Table 5: Relationship between Bearer services and ~~GSM~~PLMN Connection elements**

| Connection description | Bearer service user data rate | Radio interface connection element | Intermediate rate at the BSS-MSC interface | BSS-MSC connection element | Protocol model in figure 6, 7 or 8 |
|---|---|---|---|---|---|
| Circuit mode unstructured with unrestricted digital capability transparent. | Data circuit duplex async n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 4).<br>Data circuit duplex sync n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 5) or n × 1 1200 bit/s (n = 5 or 6). | cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 6) on n full rate channels. | 8 or 16 kbit/s per TCH/F.<br><br>For data connections using 5 or 6 TCH/Fs no intermediate rate(s) . | cct mode unstructured unrestricted 64 kbit/s. | Fig 6 : 1 e, 2 e |
| | Data circuit duplex async n × 14 400 bit/s ( n ≤ 3).<br>Data circuit duplex sync n × 14 400 bit/s (n ≤ 5) | cct mode unstructured unrestricted n x 14.5 kbit/s (n ≤ 5) on n full rate channels | 16 kbit/s per TCH/F. | cct mode unstructured unrestricted 64 kbit/s. | Fig 7 : 1 e, 2 e |
| | Data circuit duplex async 28 800 bit/s.<br>Data circuit duplex sync 28 800 bit/s<br>Data circuit duplex Sync 32 000 bit/s<br>Data circuit duplex sync 64 000 bit/s | cct mode unstructured unrestricted 29.0 kbit/s on full rate channel<br><br>cct mode unstructured unrestricted 32 kbit/s on full rate channel<br>cct mode unstructured unrestricted 2 x 32.0 kbit/s on full rate channels | 16 kbit/s per TCH/F.<br><br>32 kbit/s<br><br>No intermediate rate for the 64 000 bit/s rate | cct mode unstructured unrestricted 64 kbit/s. | Fig 8 : 1 b, 2 b<br><br>None |
| | Data circuit duplex async 14 400 bit/s<br>Data circuit duplex sync 14 400 bit/s | cct mode unstructured unrestricted 14.5 kbit/s on full rate Channel | 16 kbit/s | cct mode unstructured unrestricted 64 kbit/s. | Fig 7 : 1 b 2 b |
| | Data circuit duplex async 9 600 bit/s.<br>Data circuit duplex sync 9 600 bit/s. | cct mode unstructured unrestricted 12 kbit/s on full rate channel. | 16 kbit/s. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6 : 1 b Fig 6 2 b |
| | Data circuit duplex async 4 800 bit/s.<br>Data circuit duplex sync 4 800 bit/s. | cct mode unstructured unrestricted 6 kbit/s on full rate channel and half rate channel. | 8 kbit/s. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6 1 b Fig 6 2 b |
| | Data circuit duplex async 300.<br>Data circuit duplex async 1 200.<br>Data circuit duplex async 2 400.<br>Data circuit duplex sync 1 200.<br>Data circuit duplex sync 2 400. | cct mode unstructured unrestricted 3.6 kbit/s on full rate channel and half rate channel. | 8 kbit/s. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6 : 1 b Fig 6 1 b<br><br>Fig 6 1 b Fig 6 2 b Fig 6 2 b |

| Connection description | Bearer service user data rate | Radio interface connection element | Intermediate rate at the BSS-MSC interface | BSS-MSC connection element | Protocol model in figure 6, 7 or 8 |
|---|---|---|---|---|---|
| Circuit mode unstructured with unrestricted digital capability non transparent. | Data circuit duplex async n × 4 800 (n ≤ 4) or n × 9 600 bit/s (n ≤ 4). | cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels. | 8 or 16 kbit/s per TCH/F. | cct mode unstructured unrestricted 64 kbit/s. | Fig 6 3 e |
| | Data circuit duplex async n × 14 400 bit/s (n ≤ 4). | cct mode SDU unrestricted n × 14.5 kbit/s (n ≤ 4) on full rate channels. | 16 kbit/s | cct mode unstructured unrestricted 64 kbit/s. | Fig 7 : 3e |
| | Data circuit duplex async n x 28 800 bit/s (n ≤ 2).<br>Data circuit duplex async 43 200 bit/s | cct mode SDU unrestricted n × 29.0 kbit/s (n ≤ 2) on full rate channels.<br>cct mode SDU unrestricted 43.5 kbit/s on a full rate channel. | 16 kbit/s per TCH/F.<br>16 kbit/s per TCH/F. | cct mode unstructured unrestricted 64 kbit/s. | Fig 8 : 3 b |
| | Data circuit duplex async 14 400 bit/s | cct mode SDUunrestricted 14.5 kbit/s on full rate channel | 16 kbit/s | cct mode unstructured unrestricted 64 kbit/s. | Fig 7 : 3 b |
| | Data circuit duplex async 9 600 bit/s. | cct mode SDU unrestricted 12 kbit/s on full rate channel. | 16 kbit/s. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6 : 3 b |
| | Data circuit duplex async 4 800 bit/s. | cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s. | 16 kbit/s FR 8 kbit/s HR. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6 : 3 b |
| | Data circuit duplex async 300.<br>Data circuit duplex async 1 200.<br>Data circuit duplex async 2 400. | cct mode SDU unrestricted full rate channel, 12 kbit/s or half rate channel, 6 kbit/s. | 16 kbit/s FR 8 kbit/s HR. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6: 3 b<br>Fig 6 : 3 b<br>Fig 6 3 b |

| Connection description | Bearer service user data rate | Radio interface connection element | Intermediate rate at the BSS-MSC interface | BSS-MSC connection element | Protocol model in figure 6, 7 or 8 |
|---|---|---|---|---|---|
| Circuit mode unstructured with 3.1 kHz audio ex PLMN transparent. | Data circuit duplex async n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3). Data circuit duplex sync n × 4 800 bit/s (n ≤ 4) or n × 9 600 bit/s (n ≤ 3). | cct mode unstructured unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 3) on n full rate channels. | 8 or 16 kbit/s TCH/F. | cct mode unstructured unrestricted 64 kbit/s. | Fig 6 : 1 e, 2 e |
| | Data circuit duplex async n × 14 400 bit/s (n ≤ 2). Data circuit duplex sync n × 14 400 bit/s (n ≤ 2) | cct mode unstructured unrestricted x 14.5 kbit/s (n ≤ 2) on n full rate channels | 16 kbit/s per TCH/F | cct mode unstructured unrestricted 64 kbit/s. | Fig 7 : 1 e, 2e |
| | Data circuit duplex async 28 800 bit/s. Data circuit duplex sync 28 800 bit/s | cct mode unstructured unrestricted 29.0 kbit/s on a full rate channel | 16 kbit/s per TCH/F. | cct mode unstructured unrestricted 64 kbit/s. | Fig 8 : 1 b, 2 b |
| | Data circuit duplex asynch 14 400 bit/s synch 14 400 bit/s | cct mode unstructured unrestricted 14.5 kbit/s on full rate channels | 16 kbit/s | cct mode unstructured unrestricted 64 kbit/s. | Fig 7 : 1 b for async Fig 7 :2 b for synch |
| | Data circuit duplex async 9.6 kbit/s sync 9.6 kbit/s. | cct mode unstructured unrestricted 12 kbit/s full rate channel. | 16 kbit/s. | cct mode unstructured unrestricted 64 kbit/s. | Fig 6 : 1 b for asynch. Fig 6 : 2 b for synch. |
| | Data circuit duplex async 4.8 kbit/s sync 4.8 kbit/s. | cct mode unstructured unrestricted 6 kbit/s full and half rate channel. | 8 kbit/s. | | |
| | Data circuit duplex async ≤ 2 400 sync ≤ 2 400. | cct mode unstructured unrestricted 3.6 kbit/s full and half rate channel. | 8 kbit/s. | | |

| Connection description | Bearer service user data rate | Radio interface connection element | Intermediate rate at the BSS-MSC interface | BSS-MSC connection element | Protocol model in figure 6, 7 or 8 |
|---|---|---|---|---|---|
| Circuit mode unstructured with 3.1 kHz audio ex PLMN non transparent. | Data circuit duplex async n × 4 800 (n ≤ 4) or n × 9 600 (n ≤ 4) bit/s. | cct mode SDU unrestricted n × 6 kbit/s (n ≤ 4) or n × 12 kbit/s (n ≤ 4) on full rate channels. | 8 or 16 kbit/s per TCH/F. | cct mode unstructured unrestricted 64 kbits/s. | Fig 6 : 3 e |
| | Data circuit duplex async n × 14 400 bit/s (n ≤ 4). | cct mode SDU unrestricted n x 14.5 kbit/s (n ≤ 4) on n full rate channels | 16 kbit/s per TCH/F | cct mode unstructured unrestricted 64 kbits/s. | Fig 7 : 3 e |
| | Data circuit duplex async 28 800 bit/s.<br>Data circuit duplex async 43 200 bit/s | cct mode SDU unrestricted 29.0 kbit/s on a full rate channel.<br><br>cct mode SDU unrestricted 43.5 kbit/s on a full rate channel. | 16 kbit/s per TCH/F.<br><br>16 kbit/s per TCH/F. | cct mode unstructured unrestricted 64 kbits/s. | Fig 8 : 3 b |
| | | | | | |
| | Data circuit duplex asynch 14 400 bit/s | cct mode SDU unrestricted 14.5 kbit/s full rate channel | 16 kbit/s | cct mode unstructured unrestricted 64 kbits/s. | Fig 7 : 3b |
| | Data circuit duplex async 9.6 kbit/s | cct mode SDU unrestricted 12 kbit/s full rate channel. | 16 kbit/s. | cct mode unstructured unrestricted 64 kbit/s. | Fig 6 : 3 b |
| | Data circuit duplex async 4.8 kbit/s | cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s. | 16 kbit/s FR 8 kbit/s HR. | | |
| | Data circuit duplex async ≤ 2 400 | cct mode SDU unrestricted half rate channel, 6 kbit/s or full rate channel, 12 kbit/s. | | | |

**Table 6: Relationship between Teleservices and ~~GSM~~PLMN connection types**

| **Teleservice in a ~~GSM~~PLMN** | **Access at mobile station** | **Radio interface connection element** | **Intermediate rate at the BSS-MSC interface** | **BSS-MSC connection element** | **Protocol model in figure 6 or 7** |
|---|---|---|---|---|---|
| Telephony. | | cct mode speech. | NA. | cct mode structured 64 kbit/s speech. | Fig 6 : 6 |
| Emergency calls. | | cct mode speech. | NA. | cct mode structured 64 kbit/s speech. | Fig 6 : 6 |
| Alternate Speech/ Facsimile Group 3. | Data cct duplex synchronous access alternate speech/ group 3 fax. | cct mode speech alternating with unstructured unrestricted 3.6 or 6 or 12 kbit/s or n × 6 kbit/s (n ≤ 3) or n × 12 kbit/s (n ≤ 2) on FR transparent. | Speech NA 8 or 16 kbit/s per TCH/F. | cct mode structured 64 kbit/s alternate speech/unrestricted. | Fig 6 : 5a or 5b and 6 |
| | | cct mode speech alternating with unstructured unrestricted 14.5 kbit/s or n × 14.5 kbit/s (n ≤ 2) on FR transparent | Speech NA 16 kbit/s per TCH/F. | | Fig 7 : 5a or 5b and 6 |
| Automatic Facsimile Group 3. | Data cct duplex synchronous access group 3 fax. | cct mode unstructured unrestricted 3.6 or 6 or 12 kbit/s or n × 6 kbit/s (n ≤ 3) or n × 12 kbit/s (n ≤ 2) on FR transparent. | 8 or 16 kbit/s per TCH/F. | cct mode structured 64 kbit/s unrestricted. | Fig 6 : 5a, 5b |
| | | cct mode unstructured unrestricted 14.5 kbit/s or n × 14.5 kbit/s (n ≤ 2) on FR transparent | 16 kbit/s per TCH/F. | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

NA: Not Applicable

NOTE: The multislot data connections and the connections using TCH/F14.4 coding belong to the General Bearer Services (Classes 20 and 30 in 3GPP TS 22.002).

# Annex A (informative): List of definitions of ~~GSM~~PLMN connection type attributes and values

## A.1 Attribute definition and their values

Information transfer mode:

This attribute describes the operational mode for transferring (transportation and switching) user information through ~~a GSM~~a PLMN connection in the network.

Value: - Circuit

Information transfer capability:

This attribute describes the capability associated with the transfer of different types of information through ~~a GSM~~a PLMN connection.

Values: - Unrestricted digital information

- Speech

- Group 3 facsimile

- 3.1 kHz audio ex PLMN

- Restricted digital information (Note: this value is signalled in the "Other ITC" element, due to a lack of further code points in the "ITC" element.)

Information transfer rate:

This attribute describes either the bit rate (circuit mode) or the throughput (packet mode, for further study). It refers to the transfer of digital information on ~~a GSM~~a PLMN connection.

Values: - Appropriate bit rate

- Throughput rate

Establishment of connection:

This attribute describes the mode of establishment used to establish and release ~~GSM~~PLMN connections.

Value: - Demand

Symmetry:

This attribute describes the relationship of information flow between two (or more) access points or reference points involved in ~~a GSM~~a PLMN connection.

Values: - Bidirectional symmetric

- Bidirectional asymmetric (Multislot configurations for data)

Connection configuration:

This attribute describes the spatial arrangement for transferring information on a given ~~GSM~~PLMN connection.

Value: - Point-to-point

Structure:

This attribute refers to the capability of ~~a GSM~~a PLMN connection to deliver information to the destination access point or reference point in a structure that was presented in a corresponding signal structured at the origin (access point or reference point).

Values: - Service data unit integrity (see note 1)

- Unstructured (see note 2)

NOTE 1: Applicable for connection element "non transparent".

NOTE 2: Applicable for connection element "transparent".

Channel rate:

This attribute describes the channels and their bit rate used to transfer the user information and/or signalling information.

Value: - Name of channel (designation) and/or the corresponding bit rate

NOTE 3: This attribute can be used several times for connection characterization.

Connection control protocol, information transfer coding/protocol (layer 1 to 3):

These attributes characterize the protocols on the connection control and/or user information transfer channel.

Value: - Appropriate protocol for each layer

NOTE 4: This attribute can be used several times for connection characterization.

Synchronous/Asynchronous:

This attribute describes the type of transmission between the reference access points.

Values: - Synchronous

- Asynchronous

Negotiation:

This attribute describes the possibility of inband parameter exchange (according to V.110) between reference access points.

Value: - In band negotiation not possible

User Rate:

This element is relevant between the IWF and the fixed network.

Values: - 0.3 kbit/s

- 1.2 kbit/s

- 2.4 kbit/s

- 4.8 kbit/s

- 9.6 kbit/s

Intermediate rate:

This attribute defines the intermediate rate (according to 3GPP TS ~~08.20~~48.020 and ITU-T V.110) at the A interface connection element part.

Values: - 8 kbit/s

- 16 kbit/s

Fixed network user rate FNUR:

This element is relevant between the MSC and the fixed network.

Values: - 9.6 kbit/s

- 14.4 kbit/s

- 19.2 kbit/s

- 28.8 kbit/s

- 32.0 kbit/s

- 38.4 kbit/s

- 48.0 kbit/s

- 56.0 kbit/s

- 64.0 kbit/s

Acceptable channel coding(s) ACC:

This attribute indicates the channel codings acceptable to the MS. This parameter is given at call set-up and it is non negotiable.

Values: 4.8 kbit/s

and/or 9.6 kbit/s

and/or 14.4 kbit/s

and/or 28.8 kbit/s

and/or 32.0 kbit/s

and/or 43.2 kbit/s

Maximum number of TCH/Fs (Multislot configurations for data):

This attribute is given at call set-up and it enables the mobile user to limit the number of TCH/Fs used during the call.

Values: 1

2

3

4

5

6

7 (note 5)

8 (note 5)

NOTE 5: Not used by the currently specified services.

Wanted air interface user rate (AIUR):

This attribute is applicable to non-transparent services only, and it gives the AIUR that the mobile user wants and which the network tries to achieve but which it is not allowed to exceed.

Values: Not applicable

9.6 kbit/s

14.4 kbit/s

19.2 kbit/s

28.8 kbit/s

38.4 kbit/s

43.2 kbit/s

57.6 kbit/s

User initiated modification indication (Multislot configurations for data):

This element is relevant between the MT and the IWF.

Values: - User initiated modification not requested

- User initiated modification up to 1 TCH/F requested

- User initiated modification up to 2 TCH/F requested

- User initiated modification up to 3 TCH/F requested

- User initiated modification up to 4 TCH/F requested

The parameters where it is indicated that they are related to Multislot configurations for data are optional.

For multislot configuration, the following applies to the parameters contained in the BC-IE:

- Half rate channels are not supported. The MS shall code the radio channel requirement as "Full rate support only MS" or "Dual rate support MS, full rate preferred". In the second case, the network shall assign full rate channel(s) only.
- The "fixed network user rate" and "other modem type" take precedence over the "user rate" and "modem type", except for modem types “autobauding”, “modem for undefined interface” or “none”.
- The "intermediate rate" parameter is overridden. The intermediate rate used per each TCH/F is derived from the chosen channel type:

  | channel type | IR per TCH/F |
  |---|---|
  | TCH/F4.8 | 8 kbit/s |
  | TCH/F9.6 | 16 kbit/s |
  | TCH/F14.4 | 16 kbit/s (on the A interface but 32 kbit/s inside the MS) |

- The user rate per TCH is derived from the chosen channel type:

  | channel type | user rate per TCH |
  |---|---|
  | TCH/F4.8 | 4.8 kbit/s |
  | TCH/F9.6 | 9.6 kbit/s |
  | TCH/F14.4 | 14.4 kbit/s |

For CE: T, the padding procedure described in 3GPP TS 44.021 can be applied.

Network independent clocking on Tx:

This attribute defines the usage of NIC at the reference access point in the transmit direction.

Values: - Not required

- Required

Network independent clocking on Rx:

This attribute defines the usage of NIC at the reference access point in the receive direction.

Values: - Not accepted

- Accepted

Number of stop bits:

This attribute describes the number of stop bits for the asynchronous type of transmission between reference access points.

Values: - 1 bit

- 2 bit

Number of data bits excluding parity if present:

This attribute describes the number of data bits for a character oriented mode of transmission between reference access points.

Values: - 7 bit

- 8 bit

Parity information:

This attribute describes the type of parity information for a character oriented mode of transmission between the reference access points.

Values: - Odd

- Even

- None

- Forced to 0

- Forced to 1

Duplex mode:

This attribute describes the kind of transmission of the ~~GSM~~PLMN between reference access points.

Value: - Full duplex

Modem type:

This attribute describes the modem allocated by the IWF/MSC in the case of a 3.1 kHz audio used outside the ~~GSM~~PLMN information transfer capability.

Values: - V.21

- V.22

- V.22bis

- V.26ter

- V.32

- Autobauding type 1

- None

-

Other Modem Type (OMT):

This element is relevant between the MS and IWF.

Values: - No other modem type

- V.34

Compression

This attribute describes the possible usage of data compression between the reference access points. In the network to MS direction, it indicates the possibility of using data compression. In the MS to network direction, it indicates the allowance of data compression.

Values: - Data compression not possible/not allowed

- Data compression possible/allowed (see note 6)

NOTE 6: Only applicable for the asynchronous transmission between the reference access points, if connection element is "non transparent".

Radio channel requirement:

This attribute describes the available channels for the transfer of the user information between the reference access points.

Values: - Full rate channel (Bm)

- Half rate channel (Lm)

- dual rate/full rate preferred

- Dual rate/half rate preferred

Negotiation of Intermediate Rate Requested (NIRR)

This attribute indicates if 6 kbit/s radio interface rate is requested.

Values: - NIRR not requested/not accepted

- NIRR requested/accepted

Connection element:

This attribute describes the possible usage of ~~GSM~~layer 2 protocol between the reference access points.

Values: - Transparent

- Non-transparent (RLP)

- Both, transparent preferred

- Both, non transparent preferred

User information layer 2 protocol:

This attribute describes the layer 2 relay protocol used between the reference access points in non-transparent transmissions.

Values: - ISO 6429, code set 0

- X.25 (note 7)

- Character oriented protocol with no flow control

NOTE 7: This value was used by services defined for former ~~GSM~~ 3GPP releases and does not need to be supported.

Signalling access protocol:

This attribute characterizes the protocol on the signalling or user information transfer channel at the mobile reference access point.

Values: - I.440/450

- X.21 (note 7)

- X.28, dedicated PAD, individual NUI (note 7)

- X.28, dedicated PAD, universal NUI (note 7)

- X.28, non dedicated PAD (note 7)

- X.32 (note 7)

NOTE 7: This value was used by services defined for former ~~GSM~~ 3GPP releases and does not need to be supported.

Rate adaptation:

This attribute describes the rate adaptation used at the fixed reference access point.

Values: - V.110/X.30

- X.31 flag stuffing (note 7)

- No rate adaptation

- V.120 (Note: This value is signalled in the "Other Rate Adaption" element, due to a lack of further code points in the "Rate Adaptation" element.)

NOTE 7: This value was used by services defined for former ~~GSM~~ 3GPP releases and does not need to be supported.

Coding standard:

This attribute refers to the structure of the BC-IE defined in the 3GPP TS 24.008.

Value: - GSM

User information layer 1 protocol:

This attribute characterizes the layer 1 protocol to be used at the Um interface according to the 3GPP TS ~~05.01~~45.001.

Value: - Default

Rate adaption header/no header:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Rate adaption header not included

- Rate adaption header included

Multiple frame establishment support in data link:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Multiple frame establishment not supported. Only UI frames allowed

- Multiple frame establishment supported

Mode of operation:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Bit transparent mode of operation

- Protocol sensitive mode of operation

Logical link identifier negotiation:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Default, LLI=256 only

- Full protocol negotiation (note 8)

NOTE 8: A connection over which protocol negotiation will be executed is indicated in the "In-band/out-band negotiation" parameter.

Assignor/assignee:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Message originator is "default assignee"

- Message originator is "assignor only"

In-band/out-band negotiation:

This attribute is relevant between IWF and the fixed network. It is only applicable for V.120 rate adaptation.

Values: - Negotiation is done with USER INFORMATION messages on a temporary signalling connection

- Negotiation is done in-band using logical link zero.

## A.2 Definition of values

Unrestricted digital data information:

Transfer of information sequence of bits at its specified bit rate without alteration.

This implies: - bit sequence independence;

- digit sequence integrity;

- bit integrity.

Speech:

Digital representation of speech coded according to a specified encoding rule (e.g. A Law, 3GPP TS 06-series).

Demand connection:

~~A GSM~~A PLMN connection is set up at any time on demand via a digital channel in response to signalling information received from subscriber, other MSCs or other networks, i.e. on a per call basis.

Bidirectional symmetric:

This value applies when the information flow characteristics provided by the ~~GSM~~PLMN connection are the same between two (or more) access points or reference points in the forward and backward directions.

Bidirectional asymmetric (Multislot configurations for data):

This value applies when the information flow characteristics provided by the ~~GSM~~PLMN connection differ between two (or more) access points or reference points in the forward and backward directions on one or more TCH/Fs. In Multislot configurations for data the asymmetry is downlink biased, i.e. the MS may receive at a greater rate than it transmits.

Point-to-point connection:

This value applies when only two end points are provided by the connection.

Service data unit integrity:

This value applies when:

i) at each user-network interface, protocols provide a mechanism for identifying the boundaries of service data units; and

ii) all bits submitted within a single service data unit are delivered in a corresponding service data unit.

Unstructured:

This value is applicable when the ~~GSM~~PLMN connection neither provides structural boundaries nor preserves structural integrity.

# Annex B (informative):
# Location of the transcoding, multiplexing and RA2 functions

The location of the transcoding and data rate adaptation functions used to convert from the data rate used on the radio interface to the 64 kbits/s required by the MSC, is considered in this annex B. There are four alternatives which are equally valid from a connection type point of view. The selection of which alternative to use is not considered in 3GPP TS 43.010. The alternatives are shown in figure 10.

Alternative 1 assumes that all the transcoding and data rate adaptation is located at the BSS end of the A interface.

Alternative 2 assumes that all the transcoding and data rate adaptation is located at the MSC end of the A interface and gives no indication how the information is carried on the link.

Alternative 3 assumes that the information is transferred on the A interface in 8 or 16 kbit/s channels using one of the sub-multiplexing schemes described in CCITT Recommendation I.460. The same sub-multiplexing scheme is used for both speech and data.

Alternative 4 illustrates a multislot connection in which the information is transferred on the A-interface in 64 kbit/s channel into which up to four channels of intermediate rate 16 kbit/s have been multiplexed (refer to 3GPP TS ~~08.20~~48.020). Alternative 4 also shows a situation in which a multislot connection of 5 or 6 TCH/Fs is used; the rate between the RA1'/RA1- and RA1''-functions is 64 kbit/s.

The alternatives explained above correspond to all channels excluding TCH/F14.4 and EDGE.

Alternatives 1b, 2b, 3b, and 4b show similar approaches for channel codings TCH/F14.4, TCH/F28.8, and TCH/F43.2.

It should be noted that in all of the alternatives the transcoding and data rate adaptation are performed on the BSS side of the A-interface and is therefore considered to be a function of the BSS.

In the first three alternatives, the interface at the MSC is always based on 64 kbit/s without sub-multiplexing.

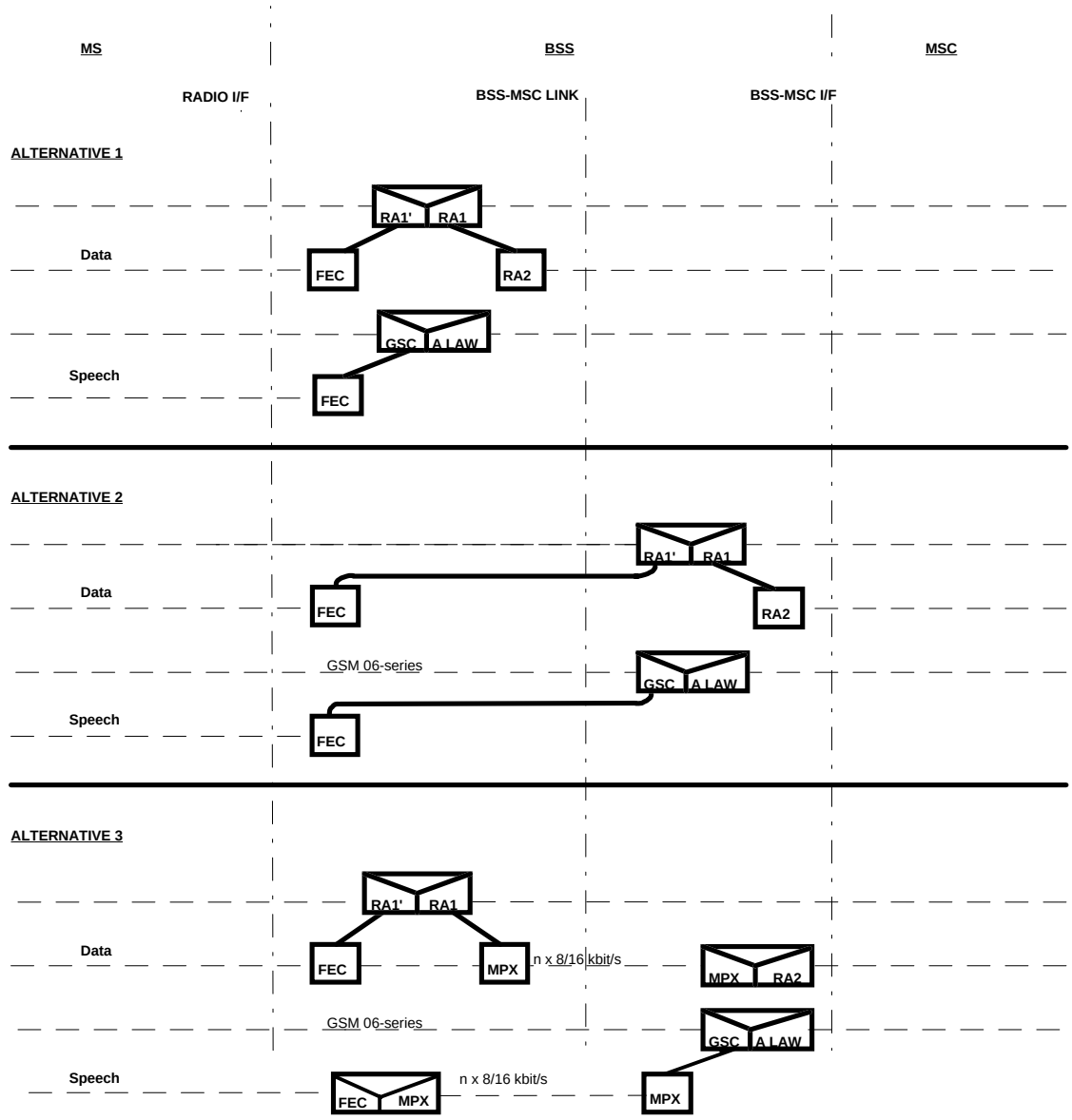



**Figure 10: Location of transcoding and rate adaptation**

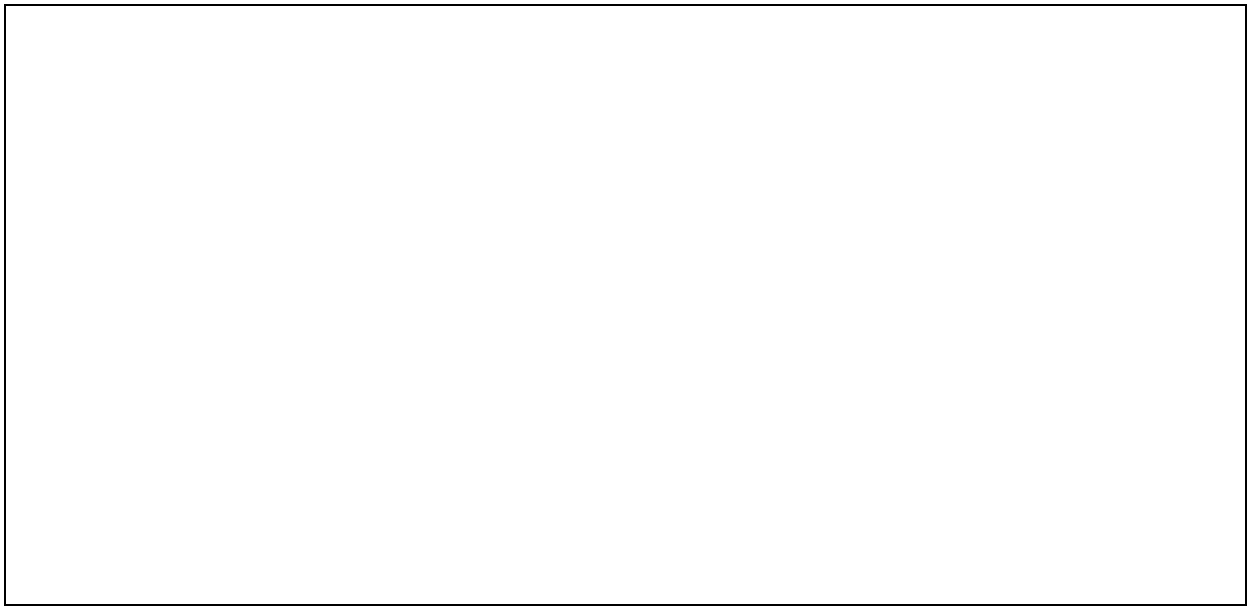


**Figure 10 (continued): Location of transcoding and rate adaptation**

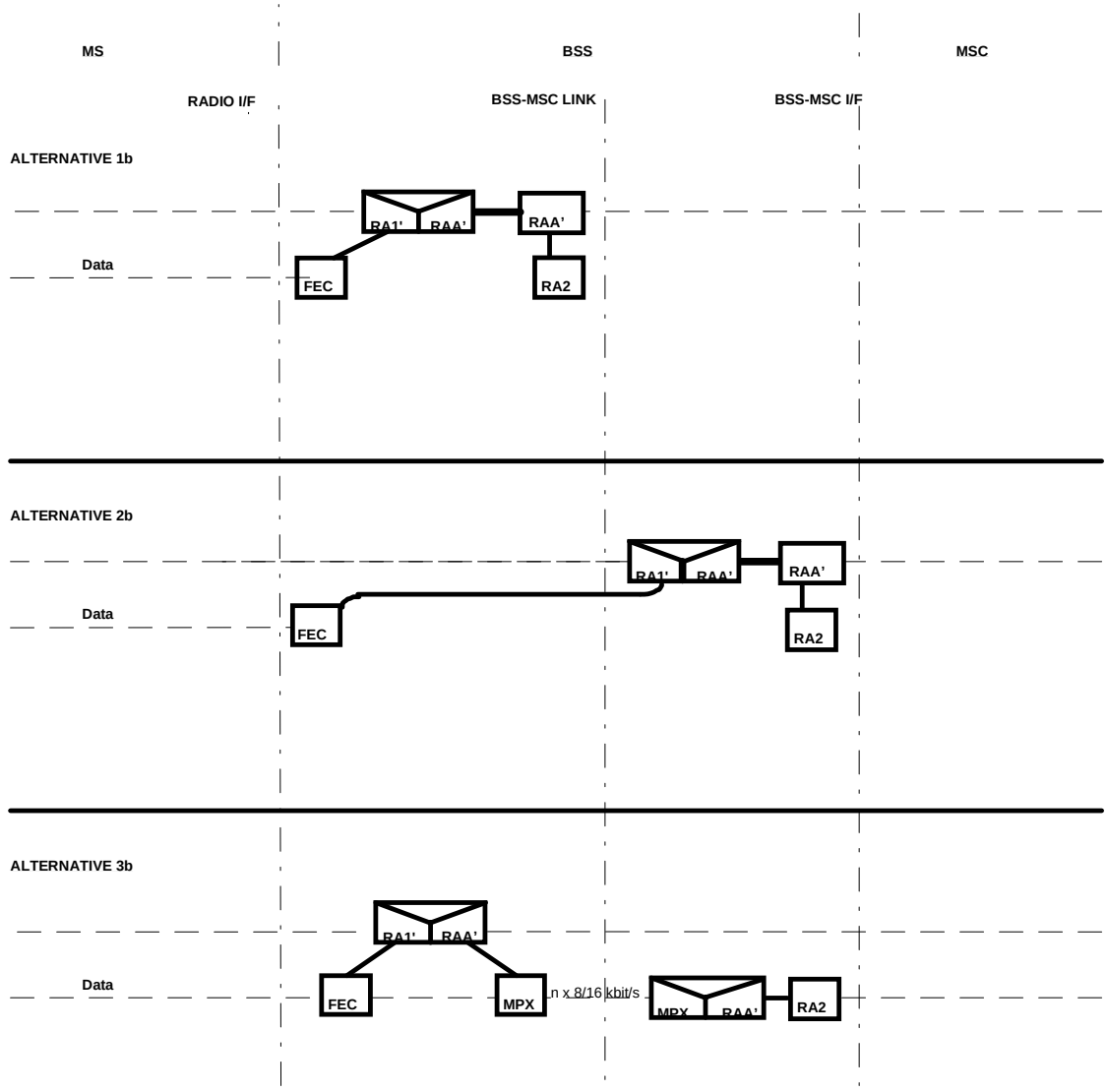



**Figure 10 (concluded): Location of transcoding and rate adaptation**

| Legend | to Figure 10 |
|---|---|
| GSC | = GSM Speech Codec |
| FEC | = Forward Error Correction |
| MPX | = Multiplex/Demultiplex |

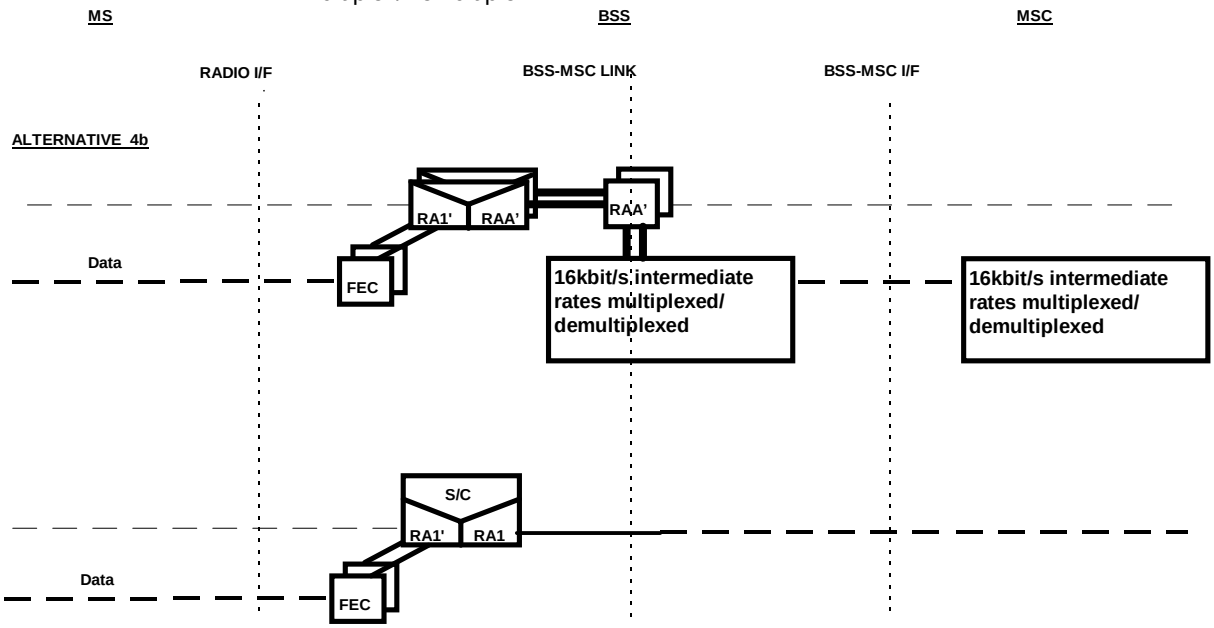



**Figure 10 (concluded): Location of transcoding and rate adaptation**

# Annex C (informative): Change History

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| - | S16 | | A001 | 2 | Data Compression | | 5.0.0 |
| - | S16 | | A002 | | Editorial correction to Channel Mode Modify | | 5.0.0 |
| - | s21 | | A003 | | V.120 Interworking and RDI | 5.0.0 | 5.1.0 |
| - | s21 | | A004 | | HSCSD | 5.0.0 | 5.1.0 |
| - | s22 | | A005 | | Introduction of 14.4 kbit/s | 5.1.0 | 5.2.0 |
| - | s23 | | A006 | | Editorial modifications | 5.2.0 | 5.3.0 |
| - | s24 | | A007 | | Removal of 2*14.4=19.2 Transparent configuration | 5.3.0 | 5.4.0 |
| - | s27 | | A008 | | Clarification of RA0 adaptation function | 5.4.0 | 7.0.0 |
| - | s27 | | A009 | | Information transfer protocol model updates | 5.4.0 | 7.0.0 |
| - | s29 | | A010 | | Introduction of EDGE channel codings into the specifications | 7.0.0 | 8.0.0 |
| 12-1999 | TSG#06 | | A011 | | Service Clean up R99 | 8.0.0 | 8.1.0 |
| 09-2000 | TSG#09 | NP-000551 | A012 | | 32 kbit/s UDI/RDI multimedia in GSM | 8.1.0 | 8.2.0 |
| 12-2000 | TSG#10 | NP-000604 | A013 | | TCH/F32.0 reference models | 8.2.0 | 8.3.0 |
| 12-2000 | TSG#10 | NP-000606 | A014 | | Removal of BS 30 NT | 8.3.0 | 4.0.0 |
| 03-2001 | TSG#11 | NP-010047 | 001 | | Removal of the S-reference point in MS | 4.0.0 | 4.1.0 |
| 03-2001 | TSG#11 | NP-010047 | 002 | | Addition changes for removal BS30NT of BS30 NT and packet access | 4.0.0 | 4.1.0 |
| 03-2001 | TSG#11 | NP-010046 | 003 | | Removal of FAX NT in GSM from Rel-4 | 4.0.0 | 4.1.0 |
| 03-2001 | TSG#11 | NP-010047 | 004 | | Removal of speech model | 4.0.0 | 4.1.0 |
| 03-2002 | TSG#15 | NP-010 | | | Terminology Clarifications as requested by TDG GERAN | 4.1.0 | 5.0.0 |

**3GPP TSG-CN WG3 Meeting #21**
**Sophia, France. 28th Jan - 1st February 2002.**

***Tdoc N3-020065***

*CR-Form-v5*

# CHANGE REQUEST

⌘ **43.045** **CR** **001** ⌘ **rev** **-** ⌘ Current version: **4.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network **X** Core Network **X**

| | | |
|---|---|---|
| ***Title:*** | ⌘ | New terminology requested by GERAN |
| ***Source:*** | ⌘ | TSG_CN WG3 |
| ***Work item code:*** | ⌘ | TEI5 |
| ***Date:*** | ⌘ | 16-01-2002 |
| ***Category:*** | ⌘ | **D** |
| ***Release:*** | ⌘ | REL-5 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

*Use one of the following releases:*

| | |
|---|---|
| *2* | *(GSM Phase 2)* |
| *R96* | *(Release 1996)* |
| *R97* | *(Release 1997)* |
| *R98* | *(Release 1998)* |
| *R99* | *(Release 1999)* |
| *REL-4* | *(Release 4)* |
| *REL-5* | *(Release 5)* |

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | To avoid possible confusion due to new terminology adopted in 3GPP in order to differentiate between networks, Radio Access Technologies (RAT) and modes of operation |
| ***Summary of change:*** | ⌘ | Terminology corrections |
| ***Consequences if not approved:*** | ⌘ | Inconsistency with GERAN specifications |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | All |
| ***Other specs affected:*** | ⌘ | ☐ Other core specifications<br>☐ Test specifications<br>☐ O&M Specifications |
| ***Other comments:*** | ⌘ | |

**How to create CRs using this form:**
Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

# 3GPP TS 43.045 ~~V4~~V5.0.0 (~~2001~~2002-03)

*Technical Specification*

**3rd Generation Partnership Project;**
**Technical Specification Group Core Network;**
**Technical realization of facsimile group 3 transparent;**
**(Release ~~4~~5)**

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

Keywords

<keyword[, keyword]>

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# Contents

# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

# 0 Scope

The present document deals with the procedures allowing the technical realization of the Group 3 facsimile Service within the ~~GSM~~A/Gb mode PLMN using transparent Network support, according to the definition of Teleservice 61 and 62 specified in the ~~GSM 0~~3GPP TS ~~2.03~~22.003 [2].

## 0.1 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document in the same Release as the present document.


[1] ~~GSM 01.04: "Digital cellular telecommunication system (Phase 2+): "Abbreviations and acronyms"~~Void.

[2] ~~GSM 0~~3GPP TS 22.003: "~~Digital cellular telecommunication system (Phase 2+);~~ Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] ~~GSM 0~~3GPP TS ~~2.34~~22.034: "~~Digital cellular telecommunications system (Phase2+):~~ High Speed Circuit Switched Data (HSCSD) - Stage1".

[4] ~~GSM 0~~3GPP TS 43.010: "~~Digital cellular telecommunication system (Phase 2+);~~ GSM Public Land Mobile Network (PLMN) connection types".

[5] ~~GSM 0~~3GPP TS ~~3.34~~23.034: "~~Digital cellular telecommunications system (Phase2+):~~ High Speed Circuit Switched Data (HSCSD) - Stage2.

[6] ~~GSM 0~~3GPP TS 04.02: "~~Digital cellular telecommunication system (Phase 2+);~~ GSM Public Land Mobile Network (PLMN) access reference configuration".

[7] ~~GSM 0~~3GPP TS 04.08: "~~Digital cellular telecommunication system (Phase 2+);~~ Mobile radio interface layer 3 specification".

[8] ~~GSM 0~~3GPP TS 44.021: "~~Digital cellular telecommunication system (Phase 2+);~~ Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[9] ~~GSM 0~~3GPP TS ~~7.01~~27.001: "~~Digital cellular telecommunication system (Phase 2+);~~ General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[10] ~~GSM 0~~3GPP TS ~~7.03~~27.003: "~~Digital cellular telecommunication system (Phase 2+);~~ Terminal Adaptation Functions (TAF) for services using synchronous bearer capabilities".

[11] ~~GSM 0~~3GPP TS ~~9.07~~29.007: "~~Digital cellular telecommunication 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)".

[12] ~~CCITT~~ITU-T Recommendation T.35: "Procedure for the allocation of ~~CCITT~~ITU-T members' codes".

[13] ~~CCITT~~ITU-T Recommendation F.160 Fascicle II.5: "General operational provision for the international public facsimile".

[14] ~~CCITT~~ITU-T Recommendation T.4 Fascicle VII.3: "Standardization of group 3 facsimile apparatus for document transmission".

[15] ~~CCITT~~ITU-T Recommendation T.30 Fascicle VII.3: "Procedures for document facsimile transmission in the general switched telephone network".

[16] ~~CCITT~~ITU-T Recommendation V.21 Fascicle VIII.l: "300 bits per second duplex modem standardized for use in the general switched telephone network".

[17] ~~CCITT~~ITU-T Recommendation V.24 Fascicle VIII.l: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[18] ~~CCITT~~ITU-T Recommendation V.25bis Fascicle VIII.l: "Automatic calling and/or answering equipment on the general switched telephone network (GSTN) using the 100-series interchange circuits".

[19] ~~CCITT~~ITU-T Recommendation V.27ter Fascicle VIII.l: "4 800/2 400 bits per second modem standardized for use in the general switched telephone network".

[20] ~~CCITT~~ITU-T Recommendation V.29 Fascicle VIII.l: "9 600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits".

[21] ~~CCITT~~ITU-T Recommendation V.33 Fascicle VIII.l: "14 400 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits".

[22] ~~CCITT~~ITU-T Recommendation X.300 Fascicle VIII.6: "General principles for interworking between public networks, and between public networks and other networks for the provision of data transmission services".

[23] ~~CCITT~~ITU-T Recommendation V.17: "A 2-wire modem for facsimile applications with rates up to 14 400 bit/s".

[24] 3GPP TS 21.905: " Vocabulary for 3GPP Specifications "

## 0.2 Definitions and abbreviations

In addition to those below, abbreviations used in the present document are listed in ~~GSM~~3GPP TR ~~01.04~~21.905 [1].

| | |
|---|---|
| BCS | Binary Coded Signalling phase of Facsimile transmission as per ~~CCITT~~ITU-T T.30 |
| CT105 | Interchange Circuit 105 as per ~~CCITT~~ITU-T V.24 |
| CT106 | Interchange Circuit 106 as per ~~CCITT~~ITU-T V.24 |
| CT107 | Interchange Circuit 107 as per ~~CCITT~~ITU-T V.24 |
| CT108.2 | Interchange Circuit 108/2 as per ~~CCITT~~ITU-T V.24 |
| CT109 | Interchange Circuit 109 as per ~~CCITT~~ITU-T V.24 |
| CT114 | Interchange Circuit 114 as per ~~CCITT~~ITU-T V.24 |
| CT115 | Interchange Circuit 115 as per ~~CCITT~~ITU-T V.24 |
| FA/MT | The Fax Adaptor specifically located at MT side |
| FA/IWF | The Fax Adaptor specifically located at IWF side |
| MSG | Message phase of Facsimile transmission as per ~~CCITT~~ITU-T T.30 |

All protocol entities from ~~CCITT~~ITU-T Facsimile Recommendations (T.4 and T.30) apply; in the present document they are referenced to in the same way as in the above ~~CCITT~~ITU-T Recommendations (see also annex I to the present document).

# 1 Service definition

The fixed network Group 3 Facsimile service, as basically defined in ~~CCITT~~ITU-T Recommendation F.160, is an international telematic service for ISO A4 document transmission between two facsimile stations.

The service specification is comprised of two parts: the control protocol described in ~~CCITT~~ITU-T Recommendation T.30, and the document transmission coding described in ~~CCITT~~ITU-T Recommendation T.4.

The ~~GSM~~facsimile Teleservice is intended to allow facsimile connections between group 3 apparatus using:

- a ~~GSM~~PLMN as a stand alone facility, for mobile to mobile communication;
- a ~~GSM~~PLMN to gain access to fixed networks PSTN and ISDN, for mobile to/from land communication.

For this Teleservice, the document coding is as ~~CCITT~~ITU-T Recommendation T.4 with no modifications. The protocol used is ~~CCITT~~ITU-T Recommendation T.30 modified within the PLMN as detailed in the present document.

The interworking between different networks is based on ~~CCITT~~ITU-T Recommendation X.300.

The particular features of this Teleservice are:

- it uses point-point communication;
- the information transfer capability is dual "Speech"/"Group 3 Facsimile" for Teleservice 61 and "Group 3 Facsimile" only for Teleservice 62;
- both mobile originated and terminated calls are supported;
- the information transfer mode is circuit, duplex, synchronous and symmetric;
- different end-to-end transfer rates are used within the same call to take advantage of the better radio path error rate;
- use of a standard synchronous terminal adaptation function (as per ~~GSM 0~~3GPP TS ~~7.03~~27.003) within the MS.

# 2 Network architecture

The network architecture applicable to this Teleservice is shown in figure 1/~~03.45~~43.045, below.

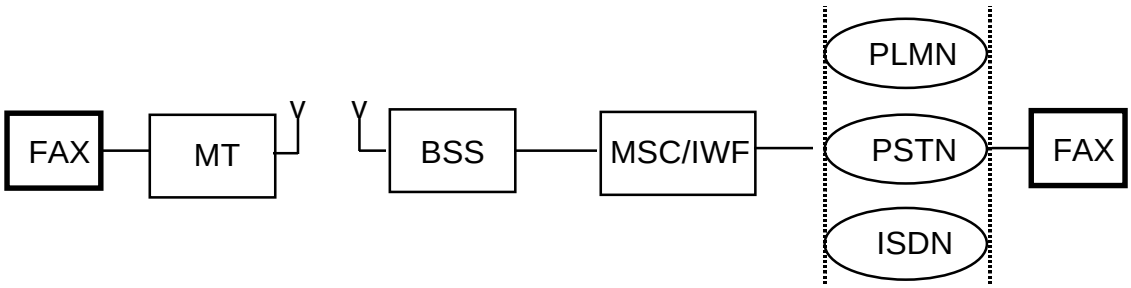



**Figure 1/~~03.45~~43.045: Network architecture**

This shows the case of mobile to fixed network interworking. For mobile to mobile calls, there would effectively be a loop back within the PLMN, using two IWFs.

# 3 Reference configuration at the mobile station

The mobile reference configurations described in this clause are defined as per ~~GSM 0~~3GPP TS ~~0~~24.002.

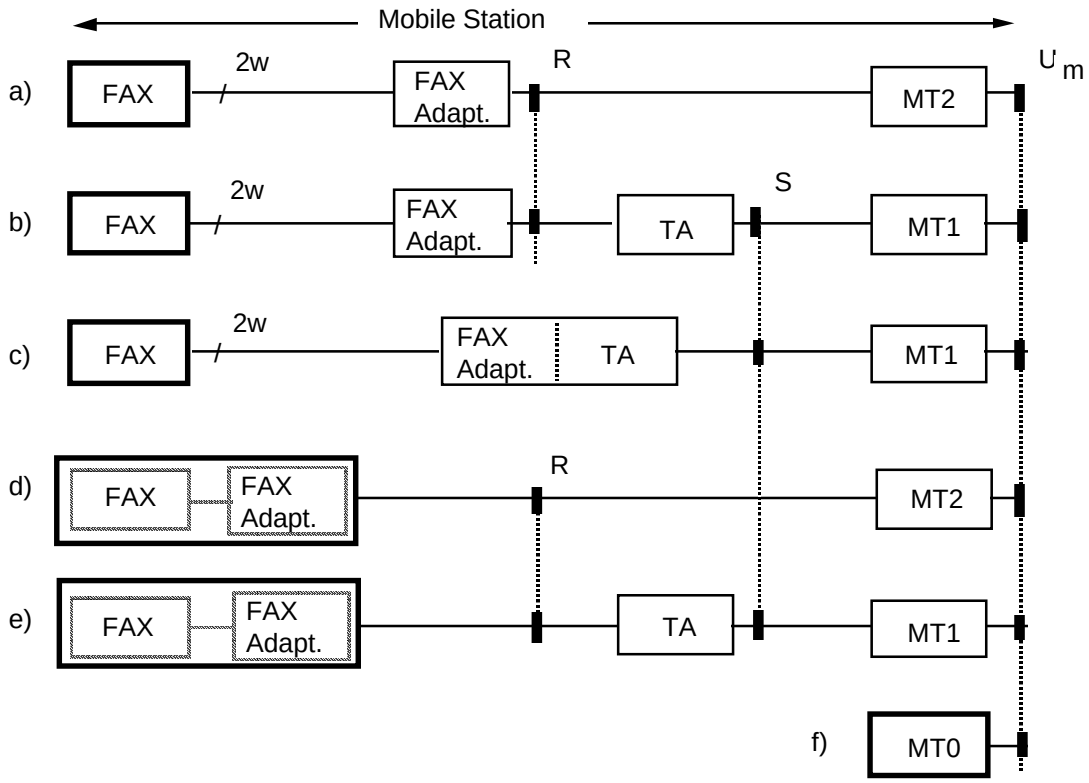



**Figure 2/~~03.45~~43.045: Reference configurations**

The Teleservice definition in ~~GSM 0~~3GPP TS ~~2.03~~22.003 regards the group 3 facsimile terminal as a 2-wire analogue terminated equipment. In order to connect this to the MT2 a separate "Fax Adaptor" device is necessary.

This configuration, shown in figure 2a/~~03.45~~43.045, has to be considered as the standard configuration, so that all the existing Group 3 facsimile apparatus can be connected to the PLMN.

An alternative realization would be to combine a standard group 3 facsimile machine and the Fax Adaptor into a specially developed "~~GSM~~PLMN facsimile machine", directly providing a digital output. Although such a device must appear to the MT2 as identical to the Fax Adaptor (i.e. with an identical interface and protocol), it would allow for a significantly smaller and simpler facsimile machine. This configuration is shown in figure 2d/~~03.45~~43.045 and is regarded as a desirable alternative.

In addition of course, it is always possible to realize an MT0, as per figure 2f/~~03.45~~43.045, where both the facsimile and mobile termination functions are considered to be part of one integrated unit.

The remaining configurations concern the use of an S interface and are considered as optional configurations. Their use is for further study.

The particular terminal adaptation functions used are those detailed in ~~GSM 0~~3GPP TS ~~7.03~~27.003 and the interface to the MT2 used is synchronous V.24 with an option for support of V.25bis procedures for autocalling and autoanswering.

## 3.1 Fax Adaptor functionality

The Fax Adaptor block, figure 3/~~03.45~~43.045, is intended to specifically complement the Group 3 facsimile apparatus in order to be able to communicate over a ~~GSM~~PLMN.

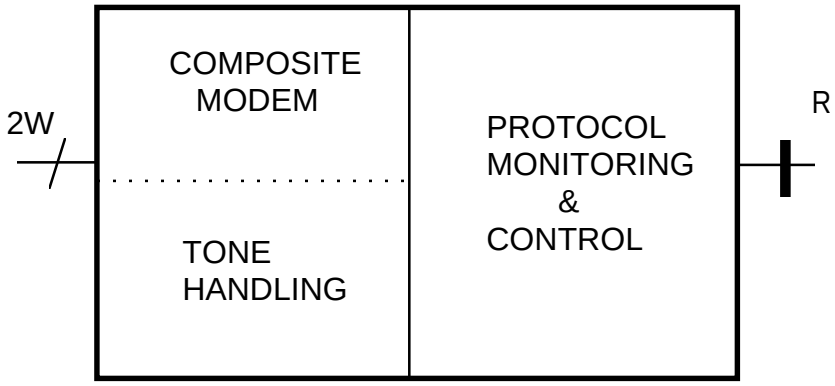



**Figure 3/~~03.45~~43.045: Fax Adaptor scheme**

Whether it has to be a function internal to the ~~GSM~~PLMN, or an external accessory associated with the Group 3 apparatus, is beyond the scope of the present document, and in any case, does not affect at all the working of the procedure as here described.

It can be functionally partitioned in two sections:

- an analogue section, dealing with:
  - the modulation and demodulation processes according to ~~CCITT~~ITU-T Recommendation V.21, V.27ter, V.29 and V.17 as explained in T.4 and T.30;
  - handling of the signalling on the 2-wire path to the facsimile machine, including autocalling and autoanswer functions where necessary (see clause 6).
- a digital section, dealing with:
  - monitoring and where necessary, manipulation of the T.30 protocol as detailed in the rest of the present document;
  - overall control of the adaptor;
  - connection over the synchronous V.24 interface to the MT as described in ~~GSM 0~~3GPP TS ~~7.03~~27.003;
  - where necessary, autocalling and autoanswering functions according to V.25bis.

In the following this specification will reference the Fax Adaptor functionality, considering the most general case where it operates as a full-featured (see figure 3/~~03.45~~43.045) separate block (see figure 2a/~~03.45~~43.045), as this reference configuration is implicitly or explicitly exhaustive of all service related technical aspects.

## 3.2 ~~GSM~~PLMN Facsimile Machine functionality

The special ~~GSM~~PLMN facsimile machine shown in the MS configuration of figure 2d/~~03.45~~43.045 has a similar functionality to the digital part of the Fax Adaptor, but without any of the analogue portions.

It appears over the V.24 interface as identical to the Fax Adaptor, i.e. the MT2 needs to have no knowledge of the particular configuration used.

When necessary this reference configuration, will be explicitly referenced to in the following; otherwise all technical aspects relevant to the configuration implicitly apply.

# 4 Connection types

Table 1/~~03.45~~43.045 shows the connection elements attributes applicable to this Teleservice (note), adapted from ~~GSM 0~~3GPP TS ~~3.10~~43.010.

NOTE: Teleservice 61 includes both speech and data connection types, but Teleservice 62 only the data connection type.

**Table 1/~~03.45~~43.045: Elements of connection types**

| Protocol type of Figure 6 of TS ~~GSM 0~~3GPP TS ~~3.10~~43.010 | Access to TAF of the Mobile Station | Radio interface connection element | Intermediate rate RA1 to RA2 | BS-MSC/IWF connection element |
|---|---|---|---|---|
| Model 6: Speech | - | Speech/GSM | - | ~~CCITT~~ITU-T A-law |
| Model 5: Facsimile Group 3 | C/D/S UDI<br>- 14.4 kbit/s<br>- 9.6 kbit/s<br>- 4.8 kbit/s<br>- 2.4 kbit/s (note) | C/D/S UDI<br>- 14.5 kbit/s<br>- 12.0 kbit/s<br>- 6.0 kbit/s<br>- 3.6 kbit/s | C/D/S UDI<br>- 16 kbit/s<br>- 16 kbit/s<br>- 8 kbit/s<br>- 8 kbit/s | C/D/S UDI<br>- 64 kbit/s<br>- 64 kbit/s<br>- 64 kbit/s<br>- 64 kbit/s |
| Model 5b Facsimile Group 3 | C/D/S UDI<br>- 14.4 kbit/s<br>- 9.6 kbit/s<br>- 4.8 kbit/s<br>- 2.4 kbit/s | C/D/S UDI<br>14,5 or 2X12 kbit/s<br>12 or 2X6 kbit/s<br>6 kbit/s<br>6 kbits | C/D/S UDI<br>16 or 2X16 kbit/s<br>16 or 2X8 kbits<br>8 kbit/s<br>8 kbit/s | C/D/S UDI<br>- 64 kbit/s<br>- 64 kbit/s<br>- 64 kbit/s<br>- 64 kbit/s |

NOTE: The highest Access Rate actually supported in this teleservice will be consistent with the highest Access Rate of the Transparent Bearer Service provided by the Network Operator.

C = Circuit switched S = Synchronous
D = Full-duplex UDI = Unrestricted Digital Information

**Table 1a/~~03.45~~43.045**

| Fax modem rates | No. of substreams | Radio i/f rate | Intermediate Rate | Padding Scheme |
|---|---|---|---|---|
| 14.4 kbit/s | 1<br>2 | 14,5 kbit/s<br>12 kbit/s | 16 kbit/s<br>16 kbit/s | |
| 12.0 kbit/s | 1<br>2 | 14,5 kbit/s<br>12 kbit/s | 16 kbit/s<br>16 kbit/s | FA(5D + S)<br>FA(5D + S) |
| 9.6 kbit/s | 1<br>2 | 12 kbit/s<br>6 kbit/s | 16 kbit/s<br>8 kbit/s | |
| 7.2 kbit/s | 1<br>2 | 12 kbit/s<br>6 kbit/s | 16 kbit/s<br>8 kbit/s | FA(3D + S)<br>FA(3D + S) |
| 4.8 kbit/s | 1 | 6 kbit/s | 8 kbit/s | |
| 2.4 kbit/s | 1 | 6 kbit/s | 8 kbit/s | |

FA = Padding is performed in the FA

(nD + mS) means that m SYNC frames will be added every n'th DATA frame

The MS must support the combinations in table 1a/~~03.45~~43.045, restricted to what has been negotiated between the MS and the network.

All transitions from one combination in table 1a/~~03.45~~43.045 to another combination in the same table, must be supported by the MS, as long as the fax modem rate is kept constant or the transition of fax modem rate is performed in steps of 2,4 kbit/s.

The figure 4/~~03.45~~43.045 shows the scheme of a typical ~~GSM~~PLMN connection for this Teleservice, considering respectively R and S access at Network Termination.

To grant full support to the ~~CCITT~~ITU-T Recommendation T.30, requiring different transmission speeds, the following strategy shall be implemented:

- PLMN provides for four Access Rates only, that is 14 400 bits/s, 9600 bit/s, 4800 bit/s, 2400 bit/s;
- radio channel modification procedures are used for switching between Speech phase and facsimile phase, as well as to select the suitable Access Rate (14 400,9600/4800/2400 bit/s) within the facsimile phase, as resulting from the preliminary end-to-end negotiation between the terminals;
- to transport Binary Coded Signalling (BCS) requiring a synchronous 300 bit/s bit-rate, speed conversion will be used at both the PLMN ends.

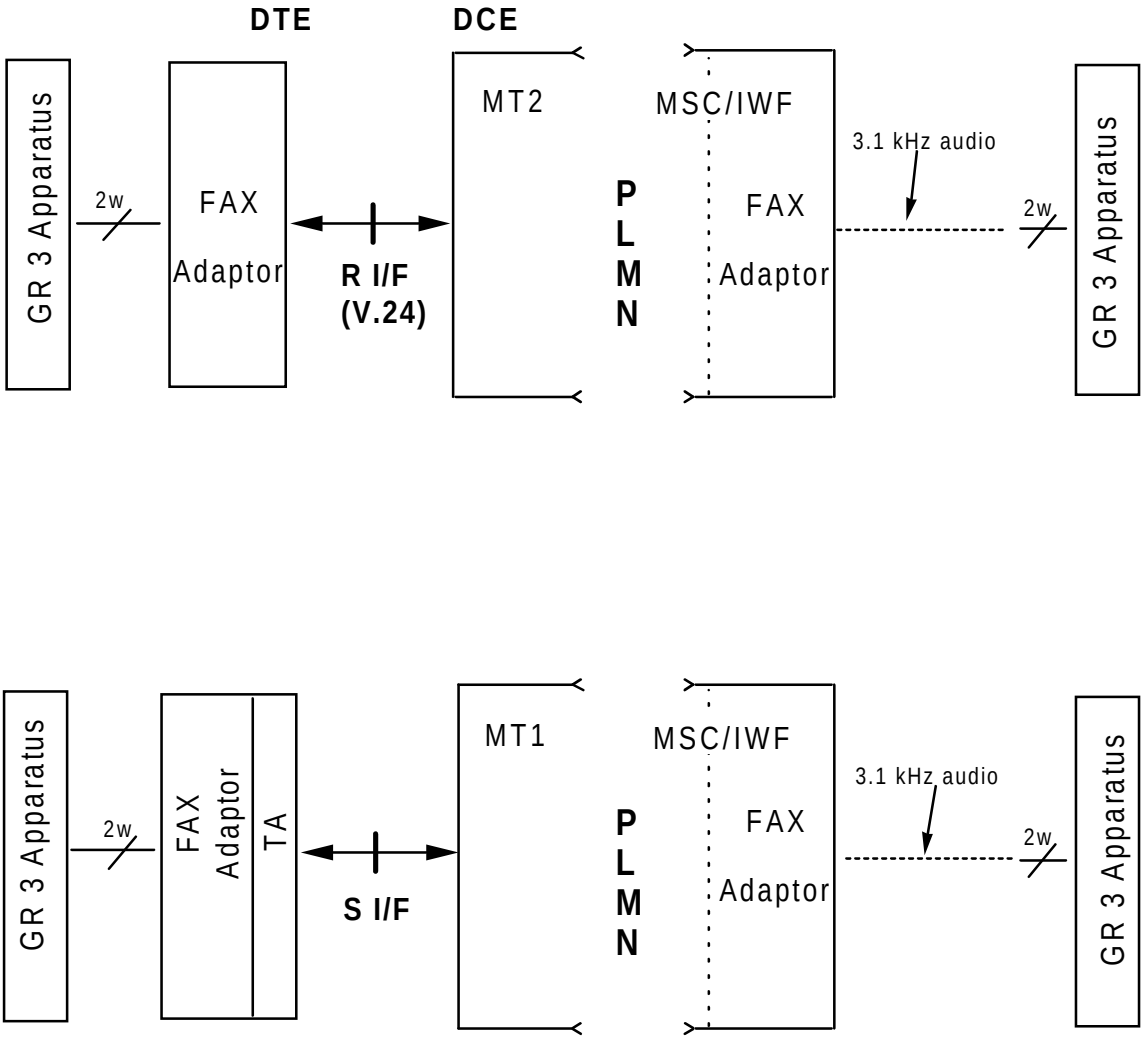



**Figure 4b/~~03.45~~43.045: Optional Teleservice connection (F.F.S)**

## 4.1 Information transfer protocol model

The Figure 5/~~03.45~~43.045 depicts the conceptual protocol model for this Teleservice, deduced from model 5 and 5b of Figure 6/~~03.10~~43.010.

The main point to be underlined is that all the protocol modules specific for this Teleservice are confined in the Fax Adaptation functions at both the MT and IWF ends. Note that model 5b of figure 6/~~03.10~~43.010 details the placing of the splitting and combiner function for multislot configurations.

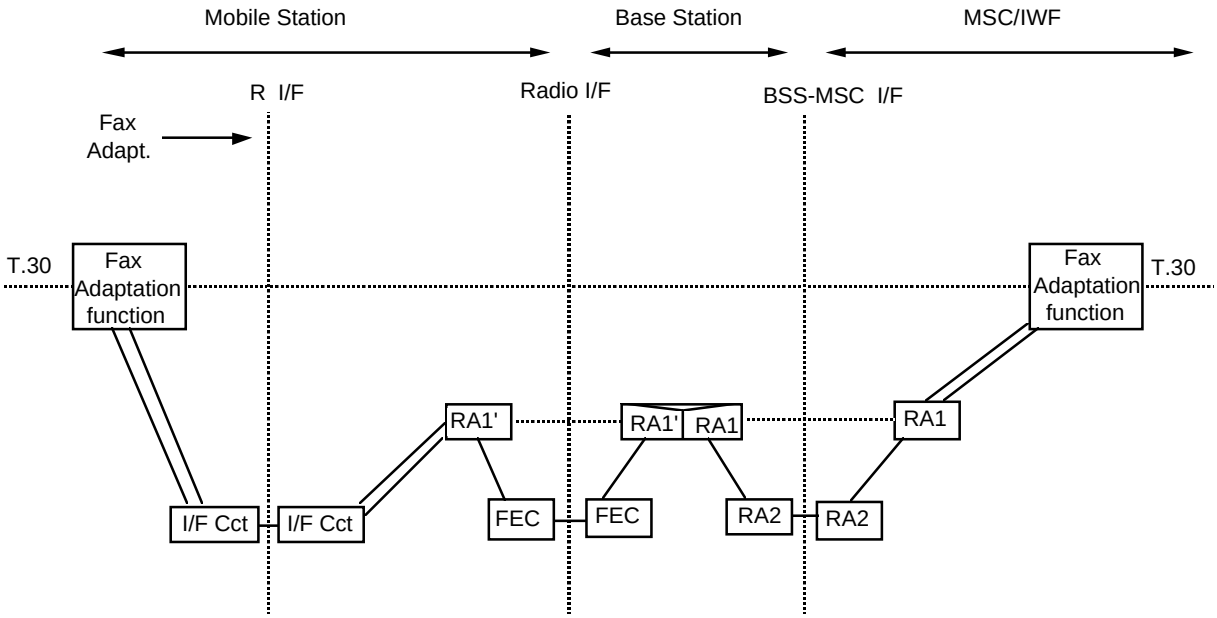



**Figure 5/~~03.45~~43.045: Information transfer protocol model**

## 4.2 Interactions with T.30

The philosophy of this specification is to allow the T.30 protocol to pass transparently wherever possible, through the Fax Adaptors at both ends of the PLMN channel. Manipulations are only made to the protocol where necessary to overcome problems resulting from the differences between the PSTN and the ~~GSM~~PLMN system. Basically, these problems fall into four categories:

- supporting facsimile on a digital connection type;
- bit errors during transfer of BCS frames;
- the need to change speed to reduce the impact of bit errors during transfer of Fax encoded Messages;
- inability to support some features of T.30.

### 4.2.1 Link control strategy

Though the T.30 procedure is plain half-duplex, between the FAs at both the ~~GSM~~PLMN ends a full-duplex mode connection will be established. Information transfer is structured in fixed length blocks, carrying either data received from the local modem, or idle synchronization patterns.

Establishment, maintenance and release of the data circuit is performed autonomously by each FA, by properly handling the physical interface to its local modem.

Due to the rigid timeout constrains in T.30 protocol procedure, which will be actually concatenated to the procedure defined here for the ~~GSM~~PLMN connection part, a strictly forwardonly approach is adopted for data link control; that is no retransmission means are explicitly introduced to recover corrupted information blocks.

Although in the majority of cases the T.30 protocol can take care of lost frames and easily recover, there are some particularly critical points where two consecutive segments in the procedure, without any interposed acknowledgement, require different transmission speeds (BCS speed/Message speed).

In these cases, to grant that a correct change-over from one modem type to another takes place at both the PLMN ends, some additional protection is necessary in the ~~GSM~~PLMN environment. This protection, actually at the beginning and at the end of the Fax page transmission, is given by means of a confirmation mechanism, whereby the originating FA waits while transmitting a fixed pattern until an explicit acknowledgement is received from the terminating FA. In these cases an interruption of the normal T.30 information flow may eventually result.

Aiming at minimizing any possible delay in the end-to-end transmission between the two facsimile apparatuses, the FAs will pass on information without error control of the message integrity (note). To this regard, however, it is worth underlining that an essential requirement in this procedure is the detection of some key messages exchanged between the terminals, carrying basic control information. Hence, in parallel to the primary information passing process, a continuous monitoring of the information flowing across the FA is necessary, to detect these messages, fully checked in their logical integrity.

NOTE: All V.21 modems in the FAs shall use the faster response time provided by ~~CCITT~~ITU-T Rec. V.21 (see table 2/V.21) for OFF to ON transition of CT109 and CT106.

In addition, as detailed below, some fields in some frames may need to be changed.

#### 4.2.1.1 Message detection

While in BCS, the following frames have to be detected:

- DIS/DTC, to monitor all operational parameters proposed to the sender terminal by the receiver terminal;
- DCS, to realize (see table 2/T.30) the actual message transmission speed accepted by the sender terminal and the relevant message transfer direction;
- NSF, to inhibit Non-Standard Facilities, if explicitly required by the user Fax Adaptor configuration;
- DCN, to initiate the Call release procedure.

During the Message phase (C phase of T.30) a single bit pattern has to be detected, the EOL character, a unique codeword that can never be found within a valid line of Fax coded Data (see ~~CCITT~~ITU-T Recommendation T.4, subclause 4.1.2), and therefore used to control the buffer level in each FA, as detailed in the following subclause 5.2.6.

### 4.2.2 Speed conversion for BCS phases

Given the signalling load caused by the Channel Mode Modify procedure, rather than changing the radio channel speed to 300 bit/s to carry the BCS frames, a speed conversion mechanism is exploited at both the PLMN ends, allowing to maintain the Channel rate of the Message phase (14 400/9600/4800/2400 bit/s) during BCS phases.

A speed conversion factor can be defined as:

$$\frac{\text{Fax Message speed (14 400 or 9600 or 4800 or 2400 bit/s)}}{\text{Standard BCS speed (300 bit/s)}}$$

which will assume the value 8 or 16 or 32 or 48, depending on the actual Message speed negotiated between the terminals.

On the basis of the above speed conversion factor, in the originating FA up-conversion to Message speed will be performed according to the repetition algorithm specified in subclause 5.2.3.2.

In the terminating FA, down-conversion to the BCS speed will require a decimation algorithm (see subclause 5.2.3.3); this algorithm is assumed implementation dependent, and hence its actual definition is beyond the scope of the present document.

As the actual Access Rate over the GSM-TCH may change throughout the Call, speed conversion factor needs to be updated in both FAs.

The FA/IWF will update this value upon successful completion of a CMM procedure (see subclause 4.3.2).

The FA/MT which does not have direct access to the ~~GSM~~PLMN signalling channel (except for MT0 configuration), shall estimate the actual Access Rate established over the GSM-TCH from the effective Access Rate of the MT data interface (or any other means in case of MT0); this check shall be performed whenever a BCS frame is sent towards the Radio path after which a change for GSM-TCH Access Rate may be expected (e.g., DIS and DCS frames for Normal Fax mode, PPR and CTC frames for Error Correction Mode).

### 4.2.3 Compatibility checking

Some features of T.30 cannot be supported in the ~~GSM~~PLMN environment. Fax Adaptation function is in charge of dealing with such compatibility checking.

#### 4.2.3.1 Group 1 and Group 2 support

Group 1 and Group 2 equipments are not supported by the Teleservice as described in the present document.

To this purpose, any tonal signalling specific to the above kind of Fax apparatus will be ignored by the Fax adaptation function at MS and IWF.

#### 4.2.3.2 2 400 bit/s handshaking

Only standard 300 bit/s Binary Coded Signalling is supported. To this purpose the FA will ignore this capability within the B segment of T.30 procedure, looking for DIS frame, by default, from V.21 modem only.

#### 4.2.3.3 Non-standard facilities

Non-standard facilities are supported in so far they are not in conflict with the standard procedure described in the present document. All the relevant BCS frames are passed end-to-end, unless an explicit deletion is required by the user (e.g. by a specific input at the Fax Adaptor associated with the MS). In this case, upon detection (see subclause 4.2.1.1) of the NSF frame identifier (the Facsimile Control Field octet according to T.30 terminology), the whole HDLC frame shall be stripped and replaced by a ~~GSM~~PLMN specific NSF frame, containing a Country Code and a unique identification of the FA manufacturer, encoded as per ~~CCITT~~ITU-T T.35 and according to national regulations; the Information field of this NSF frame shall have a maximum length of 6 octets, and shall not require any specific functionality in the PLMN.

#### 4.2.3.4 12 000 and 7200 bit/s Facsimile Document Transfer

End-to-end transfer of T.4 information at 12 000 and 7 200 bit/s can be supported, even if this Bearer Service is not provided by a ~~GSM~~PLMN.
To this purpose a 14 400 bit/s or 9 600 bit/s Access Rate shall be used in the PLMN, by exploiting only part of the available bandwidth. The originating FA will add padding information to data received from the MSG modem, before transmission over the GSM-TCH; the terminating FA will remove the same information to restore the net 12 000 or 7 200 bit/s continuous data stream to be transmitted over its local MSG modem.

The relevant procedures are fully described in sections 5.2.3.4 and 5.2.3.5.

#### 4.2.3.5 Procedure interrupts

Procedure interrupts are only possible in Teleservice 61; in case of Teleservice 62 any attempt to invoke procedure interrupts by MMI on the MT (see subclause 4.3.1 below) will be ineffective.

### 4.2.4 Speed checking

Upon receiving DIS/DTC frame, the FA/IWF shall perform a basic speed checking procedure, aiming at verifying compatibility between the bit-rate possibilities offered by the called Fax apparatus (bit fields 11, 12, 13, 14 in the IF) and the actual Access Rates allowed on the ~~GSM~~PLMN (2 400/4 800/9 600/14400 bit/s); in addition, some of these bit rates may result inhibited during the call, if a speed lower than 9 600 bit/s has been chosen by the user in the call set up message (for example if a better error rate is required).

The following cases may occur:

- some of the bit-rates indicated in DIS/DTC are not allowed on GSM-TCH (e.g. the max speed indicated in setup is 9 600 bit/s, while DIS/DTC requests V.33); a possible strategy to cater for this case is altering the indication in DIS/DTC to a compatible value (e.g. V.29) by forcing appropriately the relevant bits (note); other strategies are possible and allowed, as long as the same goal of supporting the progress of the call is pursued, by constraining the Fax apparatuses to use as message speeds the access rates actually available in the PLMN.

NOTE: Is beyond the scope of this specification to specify the implementation strategy adopted to recalculate the frame CRC after the manipulation; additional delays, if any, shall not have a significant impact on T.30 operability.

- the full set of bit-rates indicated in DIS/DTC are not compatible with the allowed Access Rates on GSM-TCH (e.g. the max speed indicated in setup is 2 400 bit/s while DIS/DTC requests V.29 only); in this case the call shall be failed;

- the full set of bit-rates indicated in DIS/DTC are compatible with the allowed Access Rates on GSM-TCH; in this case no action shall be taken, independently of the access rate actually established.

It should be noted that the "14400 bit/s" as max speed indication in the SETUP message, does not preclude the establishment of a Call towards a Fax GR 3 equipment supporting only 9600, 4 800 and 2 400 bit/s as Message speed. As a matter of fact, due to the multiplexing mechanism for BCS phases the initial Access Rate (14 400 bit/s) will affect only the connection part between the called MS and the associated IWF, whilst the appropriate Message speed will be actually negotiated during the initial BCS phase, and settled upon reading the appropriate field in DCS frame (see subclause 4.2.1.1). Therefore, if a request for MSG transmission is received, without a valid DCS frame being detected in advance (hence the message speed is undefined), the FA/IWF shall release the call immediately.

## 4.3 Radio Channel Modification Procedures

There are two reasons why the characteristics of the radio channel may need to be changed during a call.

Firstly, for the swap from speech to data and vice versa. In this case the In Call Modification procedure as detailed in ~~GSM 0~~3GPP TS 24.008 is carried out.

Secondly, if a T.30 speed drop back is requested, a channel mode modify procedure as detailed in ~~GSM 0~~3GPP TS 24.008 is initiated to match the radio channel rate to the facsimile transmission speed to optimize the error rate.

### 4.3.1 In Call Modification (ICM)

Applies only for Teleservice 61.

The speech to facsimile change is initiated by MMI at the MS as in other data services starting the ICM procedure via MODIFY signalling. CT108.2 ON condition towards MT is a basic requirement to allow speech/data transition take place.

Additionally, the data call direction (DCD) must be known to both the FA's because of a correct tone handling. The DCD identifies the call direction from the calling to the called station according to ~~CCITT~~ITU-T T.30 phase "A" tonal signals.

The DCD is derived from the evaluation of the behaviour of the mobile Fax machine. No later than 3 sec after connecting the Fax apparatus to the line the FA/MT is able to determine the DCD. If a CNG tone or nothing is detected by the FA/MT the mobile Fax station is the calling station, if a CED tone or a BCS signal is detected by the FA/MT the mobile Fax station is the called station. The FA/MT indicates this towards the MT by means of CT105: CT105 OFF condition indicates "mobile terminated", CT105 ON condition indicates "mobile originated". The detection of CT105 condition and subsequent triggering of the MODIFY message has to be done 3 sec after reception of the ON condition of CT108.2.

A reverse DCD compared with the initial call setup direction is indicated to the FA/IWF by means of the "Reverse Call Setup Direction" (RCSD) information element within the MODIFY message. If the MODIFY message had contained this information element, the same information element shall be included in the MODIFY COMPLETE message (ACK). On the basis of RCSD and additional information about the initial call setup direction (e.g. Transaction Identifier flag as per ~~GSM 0~~3GPP TS ~~0~~4.07~~2~~4.007), the FA/IWF shall resolve the actual DCD.

At DCD condition "mobile originated" the FA/IWF has to transmit CNG if neither CED nor a BCS signal has been already received, otherwise nothing. At the DCD condition "mobile terminated" the FA/IWF has to transmit CED. At the moment when the CT107 goes to ON condition the FA/MT has to generate CED if CT105 was in ON condition, otherwise nothing (see subclauses 6.2.1 and 6.2.3).

Selection of the speech phase from the data phase (T.30 Procedure Interrupt request) may be initiated by the mobile Fax machine as well as by the fixed network fax machine (refer to the diagrams in figure II.-10/~~03.45~~43.045 and II.-11/~~03.45~~43.045). Upon receipt of the "alert operator" tone request will be accepted by manual intervention via MT

(phone off-hook), and is reflected to the Fax Adaptor (~~GSM~~PLMN Facsimile machine) by CT106 and CT109 going in OFF condition.

Upon monitoring the transit of the necessary sequence of BCS signals specific for PRI the CT108.2 goes to OFF condition causing ICM from the Fax data phase to the speech phase. In case of Procedure Interrupt request from the fixed network side (figure II-10/~~03.45~~43.045), a guard timer in the MS is necessary to protect against the possible loss of the response to the PRI-Q(PIN/PIP) sent from the MS. After the execution of ICM CT107 is set to OFF condition finishing the Fax data phase.

Subsequent re-selection of the data phase will be by manual intervention via the MS causing CT108.2 going to ON condition initiating ICM.

During the speech phase of a procedure interrupt, the "phone off-hook" condition of the MT is reported via the Fax Adaptor "R" interface (CT106/109 in OFF condition) to the fax apparatus which must remain functionally connected to the Fax Adaptor to maintain the connection.

The precise operation of the Fax Adaptor for the support of procedure interrupt is implementation dependent.

### 4.3.2 Channel Mode Modify (CMM)

The channel mode modification procedure is only initiated by the FA/IWF. Its purpose is to adjust the radio channel bit rate to match the message speed negotiated end-to-end between the facsimile machines.

The FA/IWF enters the CMM routine upon detecting the DCS frame sent either from the MS or from the PSTN.

In the first case, FA/IWF being actually the receiving side in the facsimile document transmission, the CMM procedure is executed as soon as the end of frame is detected.
That is, FA/IWF monitors the DCS frame and, if the requested rate differs from the existing radio channel rate, then in sequence:

- issues a CMM request to the new rate towards the ~~GSM~~PLMN signalling;
- waits for the acknowledgement of CMM completed (note);

NOTE: Information sent/received to/from the GSM-TCH while waiting for CMM completed is considered irrelevant, and left implementation dependent in the context of this Recommendation.

- returns back to the usual information passing process.

In the second case, FA/IWF being actually the transmitting side in the facsimile document transmission, the CMM procedure is executed after a suitable delay assumed as the time for transferring the DCS frame across the Radio channel.

That is, FA/IWF monitors the DCS frame and, if the requested rate differs from the existing radio channel rate, then in sequence:

- waits for a fixed time of 150 m/sec.;
- issues a CMM request to the new rate towards the ~~GSM~~PLMN signalling;
- waits for the acknowledgement of CMM completed;
- returns back to the usual information passing process.

If the CMM procedure fails, the IWF will initiate the release of the call. However, in calls restricted to one channel and radio interface rate not higher than 12 kbit/s, this does not necessarily apply.

As it will be seen below (see subclause 5.2.4), in both cases the execution of the CMM procedure has to be seen like an exception within the usual information passing process, even overlapping it to maintain the overall end-to-end fixed delay.

# 5 Use of terminal adaptation functions

According to the Connection types (figure 4/~~03.45~~43.045) there are two classes of TAFs to be considered.

## 5.1 Standard TAFs for synchronous services

Are those described in ~~GSM 0~~3GPP TS ~~7.03~~27.003 for synchronous bearer capabilities in the transparent mode. The Rate Adaption functions shall comply with the ~~GSM 0~~3GPP TS ~~4.21~~44.021.

The interchange circuit signalling mapping is in accordance with the ~~GSM 0~~3GPP TS ~~7.03~~27.003.

## 5.2 Specific TAFs for facsimile service

Integral part of an end-to-end connection for this Teleservice is the Fax Adaptation function, located at both the PLMN ends and in charge of adapting the T.30 protocol procedure to the ~~GSM~~PLMN environment, as described in clause 4 of the present document.

The main features relevant to the adaptation function are detailed in the following. For a better clarification, the Finite State Machine approach will be adopted in the following description of FA functionality, considering it as a set of states defined by specific interactions with both the ~~GSM~~PLMN digital channel and the analogue channel.

### 5.2.1 Working principle

The working principle of the proposed solution is depicted in figure 6/~~03.45~~43.045.

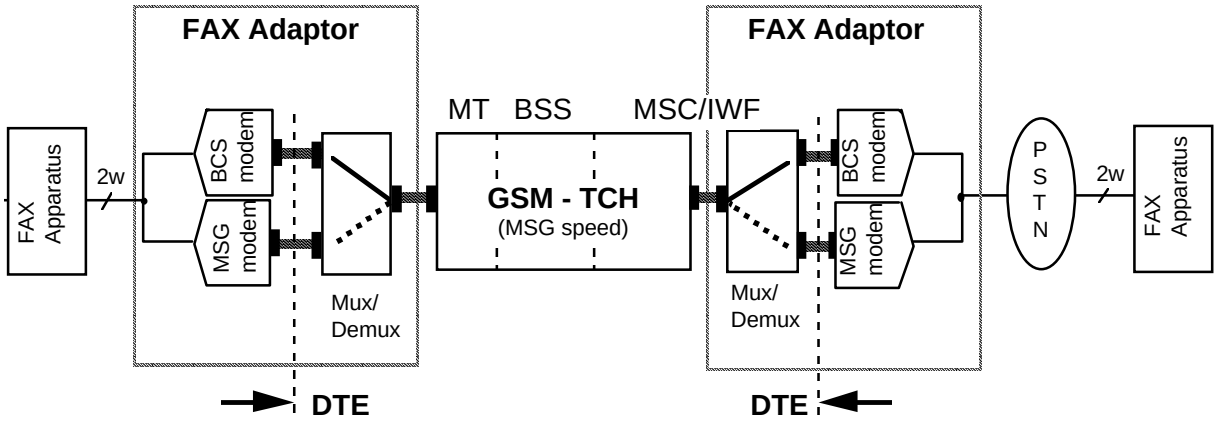



**Figure 6/~~03.45~~43.045: Fax Adaptor working principle**

The Fax Adaptor is split in its main functional blocks:

- a BCS (300 bit/s) modem capability (half duplex);
- a MSG (14400/12000/9600/7200/4800/2400 bit/s) modem capability (half duplex);
- Mux/Demux capability, to connect the ~~GSM~~PLMN traffic channel (full duplex) to either of these modems.

Looking at the overall Facsimile service architecture in ~~GSM~~PLMN (figure 5/~~03.45~~43.045), half-duplex transmission is initiated in either side of the connection by the actual request on the physical interface (CT109 ON on the local modem), is then continued on the PLMN traffic channel (TCH), and finally terminated on the appropriate modem at the remote side.

On the basis of the above assumptions, considering the Fax Adaptor a finite state machine, the whole Adaptation process can be described by a set of 5 states:

- IDLE state, when the FA is just connected to the GSM-TCH, sending synchronizing patterns over the radio path;
- BCS-REC state, when the FA is receiving data from the V.21 modem (BCS phases);

- BCS-TRA state, when the FA is transmitting data over the V.21 modem (BCS phases);
- MSG-REC state, when the FA is receiving data from the MSG modem (2400/4800/7200/9600/

  12000/14400 bit/s);
- MSG-TRA state, when the FA is transmitting data over the MSG modem.

## 5.2.2 Basic protocol structure

The protocol structure is based on a strictly synchronous approach, using 64 bit fixed length frames; that is each FA actually sends/receives information as 64 bit frames, in sequence and without interruption, during the whole duration of a call; the content of each frame depends on the specific state currently implemented.

The following set of frame types encompasses the full range of capabilities required:

- SYNC frame, explicitly designed to allow synchronization at the remote end, even in the adverse transmission environment like the cellular radio channel; it is a unique frame, used even as idle frame whenever there is no information to be sent over the radio path;
- STATUS frame, intended to carry both state identification codes, along with state specific information; this frame has a unique structured format to allow synchronization checking at remote side; the actual information content is related to the specific state;
- DATA frame which is fully unstructured, and carries Fax coded information during MSG phases.

### 5.2.2.1 Frame formats

To reduce complexity of finding synchronization over a 64 bit pattern, SYNC frames are obtained by concatenating two 32 bit sync codewords, the second one being the 1's complement notation of the first one.

The following codes shall be used for sync codewords:

MSB

hex code 3E375096: first sync codeword

hex code ClC8AF69: second sync codeword

To improve the probability of detecting synchronization, up to 3 errors are tolerate in each single sync codeword; even in this conditions, the false sync probability is quite negligible.

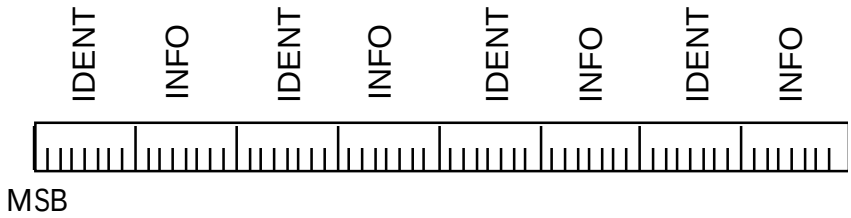



**Figure 7/~~03.45~~43.045: STATUS frame format**

STATUS frames have an internal 8 bit modularity (see figure 7/~~03.45~~43.045), where odd octets contain state identification codes (IDENT), and even octets contain status specific information (INFO). IDENT octets are split in two (four bit) fields, each one repeating the same code for status identification:

hex code 1: BCS-REC state

hex code 3: MSG-REC state

hex code 4: MSG-TRA state

To improve the probability of detecting the correct state, up to 3 corrupted codes are tolerate in the total 8 instances repeated within a single STATUS frame. INFO octets contain the same code repeated 4 times within one frame; in particular:

- for BCS-REC state this octet contains 8 bits received from the BCS modem;
- in all other states an idle code (hex code 0F) is inserted.

DATA frames are 64 bit fully unstructured information blocks; the last DATA frame in a Message phase will be truncated to the actual length of the bit stream to be transmitted.

A general rule concerning all the above frames is that most significant bits are transmitted first; in addition, a basic First-In First-Out functionality will be implemented in the information passing process.

## 5.2.3 Protocol description

The above defined Finite State Machine model will be used to fully describe the protocol procedure.

### 5.2.3.1 IDLE state

In each FA this state implies a continuous transmission of SYNC frames towards the radio path, to allow frame synchronization at the remote end. This state is entered into immediately after the end of the synchronization process over GSM-TCH, and will be returned to whenever loss of synchronization is assumed.

### 5.2.3.2 BCS-REC state

The basic function of FA in this state is transferring BCS information from local modem to GSM-TCH.

Transition to this state is triggered by CT109 ON condition of V.21 modem. Towards the radio path continuous transmission of STATUS frames is performed, according to the format described in the above subclause 5.2.2.1, as soon as 8 bits at least are available from the modem; information received from GSM-TCH is ignored while CT109 (local modem) is in the ON condition.

Every 8 bits received from the V.21 modem, the appropriate number of STATUS frames (1 or 2 or 4 or 6 depending on the current TCH access rate) will be originated.
Following CT109 (local modem) OFF condition, padding bits (e.g. ls) will be inserted to assemble the last octet.

Monitoring the content of certain BCS frames is required; the DCS frame requires a specific procedure, detailed in the following subclause 5.2.4 in the present document.

### 5.2.3.3 BCS-TRA state

The basic function of FA in this state is transferring BCS information from GSM-TCH to its local V.21 modem.

Transition to this state is triggered by reception of BCS-REC code from TCH. Towards the radio path continuous transmission of SYNC frames is performed, according to the format described in the above subclause 5.2.2.1.

The information received from GSM-TCH, after proper decimation (likely a voting algorithm, implementation dependent), is passed to the V.21 modem. Upon detecting again a SYNC frame, the modem is turned OFF and a transition to the IDLE state is performed.

Monitoring the content of certain BCS frames is required; the DCS frame requires a specific procedure, detailed in the following subclause 5.2.4 in the present document.

In addition a supervisoring function is required to check maintenance of synchronization, by examining the inherently structured STATUS frame format. Loss of synchronization will be assumed in case of reception of unstructured STATUS frames, that is, when the repetition mechanism for both the IDENT and the INFO octets does not allow unambiguous result to the voting algorithm. In this case an estimate of the INFO octet value in the received STATUS frames is anyway passed on to the V.21 modem, up to a maximum BCS-TRA duration of 2.5 sec.; at this point, if the correct synchronization has not been recovered yet, the modem is turned OFF and a transition to the IDLE state is performed.

In case of loss of V.110 synchronization on the PLMN side, the FA shall transmit 0s towards the analogue interface, as long as no data is available.

#### 5.2.3.4 MSG-REC state

The basic function of FA in this state is transferring MSG information from its local modem to GSM-TCH.

Transition to this state is triggered by the MSG modem being trained. Towards the radio path continuous transmission of STATUS frames interleaved with SYNC frames is performed. Actual transfer of Fax coded data over the radio path can be initiated only after the specific acknowledgement is received from the remote side, that is reception of MSG-TRA indication in a STATUS frame, signifying the correct state transition. All data received from the MSG modem will be stored in the FA buffer, to be passed on to GSM-TCH (First-In First-Out mechanism) as soon as this confirmation message is received. Transmission is performed by means of unstructured DATA frames, aligned to the last SYNC or STATUS frame; in this phase, information received from GSM-TCH is ignored.

Following CT109 OFF condition of MSG local modem, after all buffered data are transmitted (the last DATA frame is truncated if necessary), a transition to the IDLE state is performed. In this state the FA waits (meanwhile BCS data received from the local modem are ignored) for a minimum of 5 transmitted SYNC frames, in order to indicate to the remote FA the end of the message.

While waiting for the acknowledgement re-synchronization shall be performed if necessary, following reception of unrecognisable SYNC frames or unstructured STATUS frames.

In case of 7.2 kbit/s MSG speed, a SYNC frame will be stuffed every 3 DATA frames, to produce the data stream at 9.6 kbit/s. The overall protocol structure will result in multi-frame entities (3 DATA frames followed by a single SYNC frame), continuously sent over the radio path. Similar mechanisms for multislot configurations are specified in table 1a/~~03.45~~43.045 for MSG speed of 12 kbit/s.

#### 5.2.3.5 MSG-TRA state

The basic function of FA in this state is transferring MSG information from GSM-TCH to its local MSG modem.

Transition to this state is triggered by reception of MSG-REC code from TCH; towards the radio path continuous transmission of STATUS frames interleaved with SYNC frames is performed.

The MSG modem is trained and a timer (300 m/sec) corresponding to the round trip time over the GSM-TCH is started. After timeout, loss of synchronization in the information received from TCH, will be assumed as the first Fax coded DATA frame. From the receipt of Message on, continuous transmission of SYNC frames is performed.

All data received from the GSM-TCH will be stored in the FA buffer, to be passed on to the MSG modem (First-In First-Out mechanism) as soon as the modem training terminates (CT106 ON).
From this time on, re-synchronization will be attempted continuously; when an IDLE state is recognized again in the data stream received from the radio path, end of MSG phase will be assumed; then a transition to the IDLE state will be executed, where the FA will wait (ignoring data received from GSM-TCH) until the buffered information has been fully transmitted to the local MSG modem; the procedure will then proceed in the normal way.

In case of 12.0 or 7.2 kbit/s MSG speed, the above general rule applies as well.

NOTE: In this case, no longer an isolate SYNC frame can be interpreted as the end of MSG phase (transition to the IDLE state of the originating FA at the remote side).

However multi-frame synchronization shall be checked in addition, to remove the SYNC frame stuffed by the originating FA to match the 14.4 kbit/s or 9.6 kbit/s Access Rate over the PLMN. If necessary multi-frame re-synchronization shall be performed.

In case of loss of V.110 synchronization on the PLMN side, the FA shall transmit 0s towards the analogue interface, as long as no data is available.

### 5.2.4 DCS and TCF processing

Transmission of TCF is performed end-to-end between the two Fax apparatuses, and requires in both FAs a specific routine triggered by DCS command.

As far as the originating FA is concerned, the general procedure as described above for MSG phase (MSG-REC state) applies, but no acknowledgement is required, both at the beginning and at the end, and so no buffering is necessary. That is, just following CT 109 ON condition of the MSG modem, unstructured DATA frames are sent over the radio path, aligned to previous frames; upon CT 109 OFF condition the last frame is sent (truncated if necessary), and a transition to the IDLE state is performed.

As far as the terminating FA is concerned, after passing DCS command and waiting for the appropriate delay (75 m/sec), transition to the MSG-TRA is executed; here modem training shall be pre-empted and, as soon as the modem is ready for sending (CT 106 ON), loss of synchronization on TCH will be assumed as the first DATA frame containing TCF information and will be passed to the MSG modem. After 1.5 sec. timeout (standard TCF duration), the MSG modem will be turned OFF and the IDLE state entered as usual. Fill information (i.e. logical 0s) will be sent on the local modem if real TCF bit stream is not available.

When DCS frame requires a different Message speed with respect to the actual Access Rate established on the ~~GSM~~PLMN channel, CMM procedure will be issued (at IWF side only) as detailed in subclause 4.3.2 of the present document, just upon detecting the end of DCS frame, before any other task.

To ensure that the time gap between the DCS and TCF is within 75 +/- 20 ms period as specified in ~~CCITT~~ITU-T/T.30, the training shall be pre-empted in the terminating FA, as defined above.

## 5.2.5 DCN (disconnect) frame

The FA/MT, upon detection of the DCN frame (see T.30) sent by the local terminal to indicate the end of facsimile transmission, passes this information to GSM-TCH in the normal way and then, initiates the disconnection procedure towards MT, as defined in subclause 6.3/~~03.45~~43.045. When the DCN frame is received from GSM-TCH, disconnection procedure is initiated immediately by the FA/MT, as defined in subclause 6.3/~~03.45~~43.045.

## 5.2.6 Clocking

At MS the Fax Adaptor or ~~GSM~~PLMN facsimile machine will acquire received data bit timing on CT115 (from MT). The transmitter element timing CT114 (from MT) shall be synchronized to CT115.

Since a synchronous terminal adapter function is used, the clock rate over the V.24 interface will always reflect the rate over the radio interface.

In this Teleservice the Network Independent Clocking (NIC) mechanism is not used; to compensate against mismatching between PLMN clock speed and local modem clock speed, a FIFO buffering technique shall be adopted in the FAs on both the PLMN sides. The strategy to manage the buffer queue has a direct impact on the overall delay of the MSG phase, and therefore on T.30 operability in the ensuing post-message phase; basically this procedure is regarded as implementation dependent, and hence is beyond the scope of the present document. A possible implementation is described below, aiming at minimizing the addition delay.

In the originating FA, when the modem speed is lower, according to T.4 (subclause 4.1.3/T.4) a pause may be placed in the message flow by transmitting a FILL sequence (variable string of 0s) between a line of Data and an EOL character. When the modem speed is higher, as no flow control is provided by T.4 coding, the buffer will store excess data resulting from a Fax page transmission.

In the terminating FA the same control means will be exploited.

## 5.2.7 Timeouts

The overall Fax Adaptation function has no intrinsic timeout, and so relies fully on the timing constraints associated to the end-to-end T.30 procedure.

This means that, no matter of the reference configuration used at the MS, either the "standard" one (figure 2a/~~03.45~~43.045) or the "~~GSM~~PLMN Facsimile Machine" (figure 2d/~~03.45~~43.045), the progress of the Call for this Teleservice will be merely subject to the T.30 typical timing protections, settled externally (physically and/or functionally) with respect to the procedure as described above.

## 5.3 Specific TAFs for facsimile service (T.30/A)

The optional error correction procedure, as defined in ~~CCITT~~ITU-T T.4 and T.30 (annex A) Recommendations may be fully supported, provided some specific features are added to the Fax Adaptation procedure as resulting from the previous subclause 5.2/~~03.45~~43.045.

These features are relevant to:

- additional HDLC frame to be detected;
- handling of the Message phase;
- modification of the Channel rate (CMM request);

The Error Correction mode is entered upon detection of the relevant bits in the DIS/DTC frame.

If the FA does not support the ECM, the relevant bit in the DIS has to be set to zero by the FA.

### 5.3.1 Frame detection

During the BCS phases, beside the frames enlisted in subclause 4.2.1.1/~~03.45~~43.045, an additional frame (CTC) has to be detected, as it fixes the retransmission strategy chosen by the Fax transmitting terminal.

### 5.3.2 Message phase

The same buffering approach as for standard T.30 procedure (see subclause 5.2.3.1/~~03.45~~43.045) will be exploited to overcome the mismatching in clock speed between PLMN and the local modem; in this case however the HDLC flag code (hex 7E) will be used to control the buffer level, as the Fax coded data are structured in HDLC frames.

### 5.3.3 Additional CMM request

While in BCS the CTC frame has to be detected, due to the possible (not mandatory) request of changing the transmission speed to a fallback bit-rate.

The CMM request towards the PLMN (when appropriate) is issued at the IWF side, by exploiting the bit-rate indication in the CTC frame, similar to the indication in DCS frame.

Upon detecting the CTC frame, either sent by the PSTN or by the MS, provided the transmission speed indication is different from the existing Channel rate, as soon as the end of frame is detected, CMM request is issued, using exactly the same procedure as described for DCS in subclause 4.3.2 of the present document

If a 7,2 kbit/s MSG speed is requested in the CTC frame, no CMM request is necessary, and the specific procedure described in subclause 4.2.3.4 applies, using the same 9,6 kbit/s Access Rate over the PLMN channel.

# 6 Signalling aspects

~~GSM 0~~3GPP TS ~~7.03~~27.003 identifies the BC/LLC/HLC requirements to be supported by the MT.

In case of Teleservice 61 (Alternate Speech/Facsimile), both "Speech" and "Group 3 facsimile" Bearer Capability Information Elements (BC-IE) are necessary to set up the call; the sequence order in which these BC-IEs are transmitted identifies the service to be provided first by the PLMN. For Mobile Originated calls, the MT indicates in the SETUP message the first requirement e.g. speech, by sending this as the first BC-IE; for an "autocalling" facsimile request, the "Group 3 Facsimile" BC-IE is sent as the first one.

For Mobile Terminated calls, the MT may change the order of BCIEs and send them back in the CALL CONF message.

In case of Teleservice 62, a single BC-IE ("Group 3 Facsimile") is used.

Interworking between Teleservice 61 and 62 is specified in ~~GSM 0~~3GPP TS ~~2.03~~22.003 and ~~GSM 0~~3GPP TS ~~7.01~~27.001.

# 6.1 Handling of Tonal Signals

Because the ~~CCITT~~ITU-T defined service uses modems, there are some signals received from the analogue link at the IWF and (where used) the Fax Adaptor which do not have a direct binary representation. These signals cannot therefore be passed across the radio interface in the same way as the T.30 and T.4 information. These signals are the modem Called (CED) and Calling (CNG) tones sent at the start of each Fax data phase of the call; they are generated locally by the FA/MT and FA/IWF, exploiting an end-to-end time alignment mechanism, triggered by appropriate messages on the ~~GSM~~PLMN signalling channel. The procedure is detailed in the following.

# 6.2 Call establishment

The PSTN Facsimile apparatus may be manually or automatically calling.

## 6.2.1 Mobile Terminated Call - Speech then Fax

Refer to diagrams in figure II-5a/~~03.45~~43.045 and II-5b/~~03.45~~43.045. In both of the figures the initial call setup is mobile terminated. In figure II-5a/~~03.45~~43.045 the data call direction is also mobile terminated, in figure II-5b/~~03.45~~43.045 it is mobile originated.

In order to make the transition from the speech phase to the facsimile phase, the MODIFY command must be initiated by MMI at the MS

In the case where a ~~GSM~~PLMN facsimile machine is used, it will turn on CT108.2 when it is connected to the line by manual intervention.

In the case where a Fax Adaptor at MT is used, it will turn on CT108.2 when the mobile Fax Apparatus is connected to the line by manual intervention.

After determination of the data call direction and ICM (see subclause 4.3.1) and on completion of the synchronization process over the radio interface, CT107 shall be turned on by the MT; in the case where a Fax Adaptor is used, on receipt of CT107 from MT, the Fax Adaptor will complete the tonal handshaking according to the rules in subclause 4.3.1. The analogue link at FA/IWF side will be established in accordance with the T.30 Recommendation; provided the synchronization process is completed (CT108.2 ON condition), the appropriate tone according to the rules in subclause 4.3.1 shall be transmitted. In case of data call direction "mobile terminated" the CED tone shall be transmitted after a silence time of 1,8 to 2,5 sec. (see T.30/4.3.3.2) from the call being answered; during transmission of CED tone (2,6 sec. minimum duration, followed by a delay period of 75 +/- 20 m/sec) the IWF/FA will process data received from GSM-TCH as usual, but the relevant information (e.g. preamble of a BCS frame) shall be discarded without any buffering.

Note that CT109 and CT106 at the R interface of the MT must be in the ON condition before any further procedure can be carried out end-to-end between the Fax Adaptors; therefore, as soon as the synchronization process over the radio interface is completed, both CT109 and CT106 (MT side) are clamped to the ON condition by the FA/IWF (by setting the appropriate status bits in the V.110 frame), so fixing a full-duplex mode throughout the whole data phase of the call.

## 6.2.2 Mobile Terminated Call - Auto answer

Refer to the diagram in figure II-6/~~03.45~~43.045.

A call received from the PSTN will cause the MT to turn on CT125 at the R interface.

In the case where a ~~GSM~~PLMN facsimile machine is used, V.25bis auto answer process is handled directly by turning on CT108.2. In the case where a Fax Adaptor is used, CT125 will cause ring current to be sent to the mobile Fax apparatus. The Fax Adaptor will turn on CT108.2 when the mobile Fax Apparatus answers the call.

On receipt of CT108.2, the MT will answer the call and initiate the synchronization process over the radio interface.

On completion of the synchronization process over the radio interface, CT107 shall be turned on by the MT; in the case where a Fax Adaptor is used, on receipt of CT107 from MT, the Fax Adaptor will initiate the tonal handshaking by sending CNG (mandatory).

The analogue link at IWF side shall be established in accordance with the T.30 Recommendation; the same considerations apply as detailed in the previous subclause 6.2.1 for CED transmission.

Note that CT109 and CT106 at the R interface of the MT must be in the ON condition before any further procedure can be carried out end-to-end between the Fax Adaptors; therefore, as soon as the synchronization process over the radio interface is completed, both CT109 and CT106 (MT side) are clamped to the ON condition by the FA/IWF.

### 6.2.3 Mobile Originated Call - Speech then Fax

Refer to diagrams in figure II-7a/~~03.45~~43.045 and II-7b/~~03.45~~43.045. In both of the figures the initial call setup is mobile originated. In figure II-7a/~~03.45~~43.045 the data call direction is also mobile originated, in figure II-7b/~~03.45~~43.045 it is mobile terminated.

In order to make the transition from the speech phase to the facsimile phase, the MODIFY command must be initiated by MMI at the MS, which will result in a synchronization phase over the radio interface and connection to line of FA/IWF.

In the case where a Fax Adaptor is used, the mobile Fax apparatus must be connected to line by manual intervention at this stage, and will cause the Fax Adaptor to turn on CT108.2 towards the MT. In the case where a ~~GSM~~PLMN facsimile machine is used, CT108.2 shall be turned on when the ~~GSM~~PLMN facsimile apparatus is connected to line by manual intervention.

After determination of the data call direction and ICM (see subclause 4.3.1) and on completion of the synchronization process over the radio interface, the modem at IWF will be automatically selected and send the appropriate modem tone according to the rules in subclause 4.3.1 to the PSTN Fax apparatus. Also CT107 shall be turned on by MT, whereupon the FA/MT will complete the tonal handshaking according to the rules in subclause 4.3.1.

Note that CT109 and CT106 at the R interface of the MT must be in the ON condition before any further procedure can be carried out end-to-end between the Fax Adaptors; therefore, as soon as the synchronization process over the radio interface is completed, both CT109 and CT106 (MT side) are clamped to the ON condition by the FA/IWF.

### 6.2.4 Mobile Originated Call - Auto calling

Refer to the diagram in figure II-8/~~03.45~~43.045.

Over the V.24 interface the autocalling procedure of V.25bis is initiated, using the relevant HDLC format commands. This is done either directly from the ~~GSM~~PLMN facsimile machine or, in the case where a Fax Adaptor is used, by loop disconnect or DTMF dialling information between the mobile Fax apparatus and the Fax Adaptor.

When the call is answered, a synchronization phase will take place over the radio interface.

On completion of the synchronization process over the radio interface, the modem at IWF will be automatically selected and send CNG (mandatory) to PSTN Fax apparatus. Also CT107 shall be turned on by MT. In the case where a Fax Adaptor is used, the receipt of CT107 shall cause the Fax Adaptor to connect to line.

Note that CT109 and CT106 at the R interface of the MT must be in the ON condition before any further procedure can be carried out end-to-end between the Fax Adaptors; therefore, as soon as the synchronization process over the radio interface is completed, both CT109 and CT106 (MT side) are clamped to the ON condition by the FA/IWF.

### 6.2.5 Mobile Originated Call - Manual calling

Refer to the diagram in figure II-9/~~03.45~~43.045.

When the call is answered a synchronization phase will take place over the radio interface, provided CT108.2 is in ON condition.

In the case where a Fax Adaptor is used, the mobile Fax apparatus must be connected to line by manual intervention at this stage, and will cause the Fax Adaptor to turn on CT108.2 towards the MT.
In the case where a ~~GSM~~PLMN facsimile machine is used, CT108.2 shall be turned on when the ~~GSM~~PLMN facsimile apparatus is connected to line by manual intervention.

On completion of the synchronization process over the radio interface, the modem at IWF will be automatically selected and send CNG (mandatory) to PSTN Fax apparatus. Also CT107 shall be turned on by MT. In the case where a Fax Adaptor is used, the receipt of CT107 shall cause the Fax Adaptor to connect to line.

Note that CT109 and CT106 at the R interface of the MT must be in the ON condition before any further procedure can be carried out end-to-end between the Fax Adaptors; therefore, as soon as the synchronization process over the radio interface is completed, both CT109 and CT106 (MT side) are clamped to the ON condition by the FA/IWF.

## 6.3 Call release

The normal call release procedure will be initiated at the MS, either by the ~~GSM~~PLMN Facsimile Machine or by the FA/MT, forcing CT108.2 in OFF condition; this will follow DCN frame (disconnect, see subclause 5.2.5 of the present document) occurrence, either sent over the GSM-TCH towards the remote Fax terminal or received via GSM-TCH from the remote Fax terminal.

In the former case CT109 will be actually turned OFF after a time delay of 200 m/sec from DCN being sent. In the latter case no delay is necessary before turning CT108.2 in OFF condition; when the received DCN is corrupted and hence undetected in the MS by the FA, the Call Control entity in the MSC/IWF will release the call over the PLMN connection element, following the disconnection over the PSTN.

# 7 Interworking to fixed networks

PSTN and ISDN only are considered, both used as transit network to complement the PLMN in the end-to-end connection between GR 3 facsimile apparatus, figure 8/~~03.45~~43.045.

As far as the signalling aspect are concerned, both general and Facsimile Teleservice specific requirements, as specified in ~~GSM 0~~3GPP TS ~~9.07~~29.007, apply. Clarifications given in the following deal with Traffic channel aspects only.

## 7.1 Interworking to PSTN

As the standard access of Group 3 facsimile terminals for this Teleservice is a 2-wire analogue interface, all the technical requirements for network interworking to PSTN are identical in principle to those encountered for the terminal connection to the MT.

The key functional block is the Fax Adaptor described in clauses 4 to 6 of the present document. As far as network interworking is concerned, the main function to be performed by such block is the correct managing of a composite modem, in accordance with the requirements of ~~CCITT~~ITU-T Rec. T.30.

- V.21 synchronous mode, as standard facility for all BCS phases;
- V.27ter for message speeds of 4 800 and 2 400 bit/s;
- V.29 for 9 600 and 7 200 bit/s message speed.
- V.17 for 7200, 9600, 12000 and 14400 bit/s message speed.

The mechanism for selecting the right modem is the following:

- the actual message speed is obtained by detecting the DCS frame (see table 2/T.30) while in BCS phase;
- on entering the Message phase, there is an interchange between the V.21 modem and the actual modem agreed upon between the terminals for message transmission;
- on exiting the Message phase the V.21 modem is selected again.

Times for settling the modems will be in accordance with the requirements of Recommendation T.30.

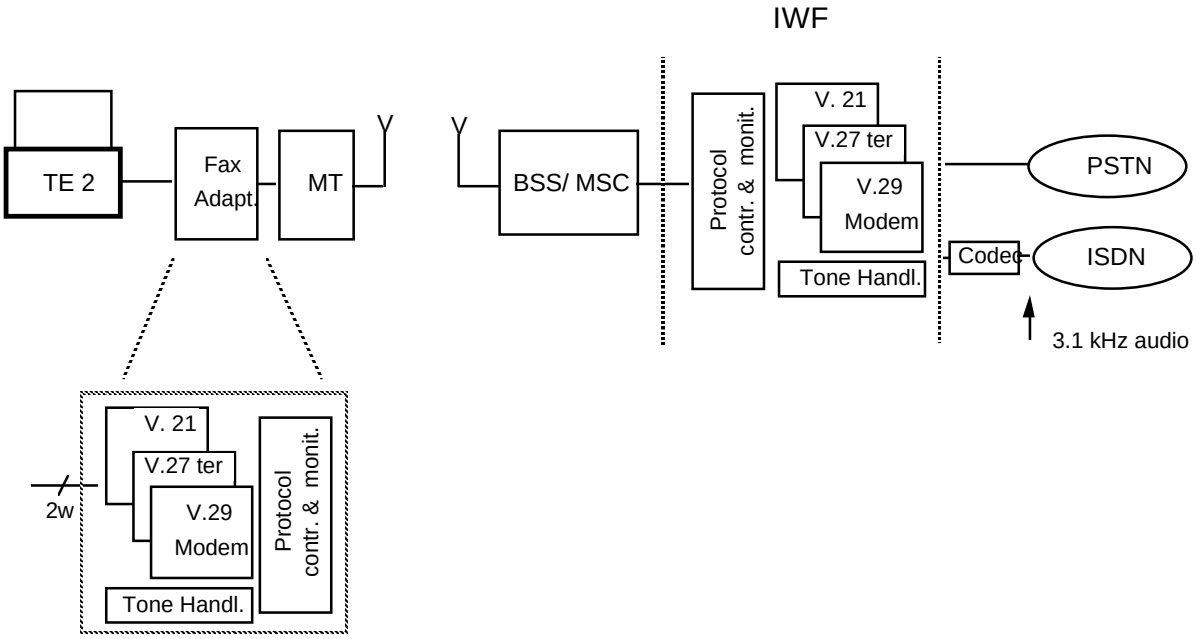



**Figure 8/~~03.45~~43.045: Network interworking**

## 7.2 Interworking to ISDN

The use of 3,1 kHz bearer capability of ISDN allows for an interworking of PLMN very similar in practice to the scheme for PSTN, figure 6/~~03.45~~43.045.

The Fax Adaptor function is in conformance with the description given in clauses 4 to 6 of the present document, and operates as detailed in subclause 7.1/~~03.45~~43.045.

# Annex I (informative): Protocol entities from ~~CCITT~~ITU-T T.30 and T.4

List of T.30 signals

| Abbre-viation | Function | Signal format | T.30 standard | T.30 err.corr. |
|---|---|---|---|---|
| CED | Called station identification | 2100 Hz | X | X |
| CFR | Confirmation to receive | X010 0001 | X | X |
| CRP | Command repeat | X101 1000 | X | X |
| CIG | Calling subscriber identification | 1000 1000 | X | X |
| CNG | Calling tone | 1100 Hz | X | X |
| CSI | Called subscriber identification | 0000 0010 | X | X |
| CTC | Continue to correct | X100 1000 | | X |
| CTR | Response to continue to correct | X010 0011 | | X |
| DCN | Disconnect | X101 1111 | X | X |
| DCS | Digital command signal | X100 0001 | X | X |
| DIS | Digital identification signal | 0000 0001 | X | X |
| DTC | Digital transmit command | 1000 0001 | X | X |
| EOM | End of message | X111 0001 | X | |
| EOP | End of procedure | X111 0100 | X | |
| EOR | End of retransmission | X111 0011 | | X |
| ERR | Response to end of retransmission | X011 1000 | | X |
| FCD | Facsimile coded data | 0110 0000 | | X |
| FCF | Facsimile control field | --- | X | X |
| FCS | Frame checking sequence | 16 bits | X | X |
| FIF | Facsimile information field | --- | X | X |
| FTT | Failure to train | X010 0010 | X | X |
| MCF | Message confirmation | X011 0001 | X | X |
| MPS | Multi-page signal | X111 0010 | X | |
| NSC | Non-standard facilities command | 1000 0100 | X | X |
| NSF | Non-standard facilities | 0000 0100 | X | X |
| NSS | Non-standard set-up | X100 0100 | X | X |
| PIN | Procedural interrupt negative | X011 0100 | X | X |
| PIP | Procedural interrupt positive | X011 0101 | X | X |
| PIS | Procedure interrupt signal | 462 Hz | X | X |
| PPR | Partial page request | X011 1101 | | X |
| PPS | Partial page signal | X111 1101 | | X |
| PRI | Procedure interrupt | X111 XXXX | X | |
| RCP | Return to control for partial page | 0110 0001 | | X |
| RNR | Receive not ready | X011 0111 | | X |
| RR | Receive ready | X111 0110 | | X |
| RTN | Retrain negative | X011 0010 | X | X |
| RTP | Retrain positive | X011 0011 | X | X |
| TCF | Training check frame | 0... 1.5s | X | X |
| TSI | Transmitting subscriber identification | X100 0010 | X | X |

List of ~~CCITT~~ITU-T T.4 signals

| Abbre-viation | Function | Signal format |
|---|---|---|
| EOL | End of line | 0000 0000 0001 |
| RTC | Return to control | 6 * EOL |

# Annex II (informative): Procedure examples

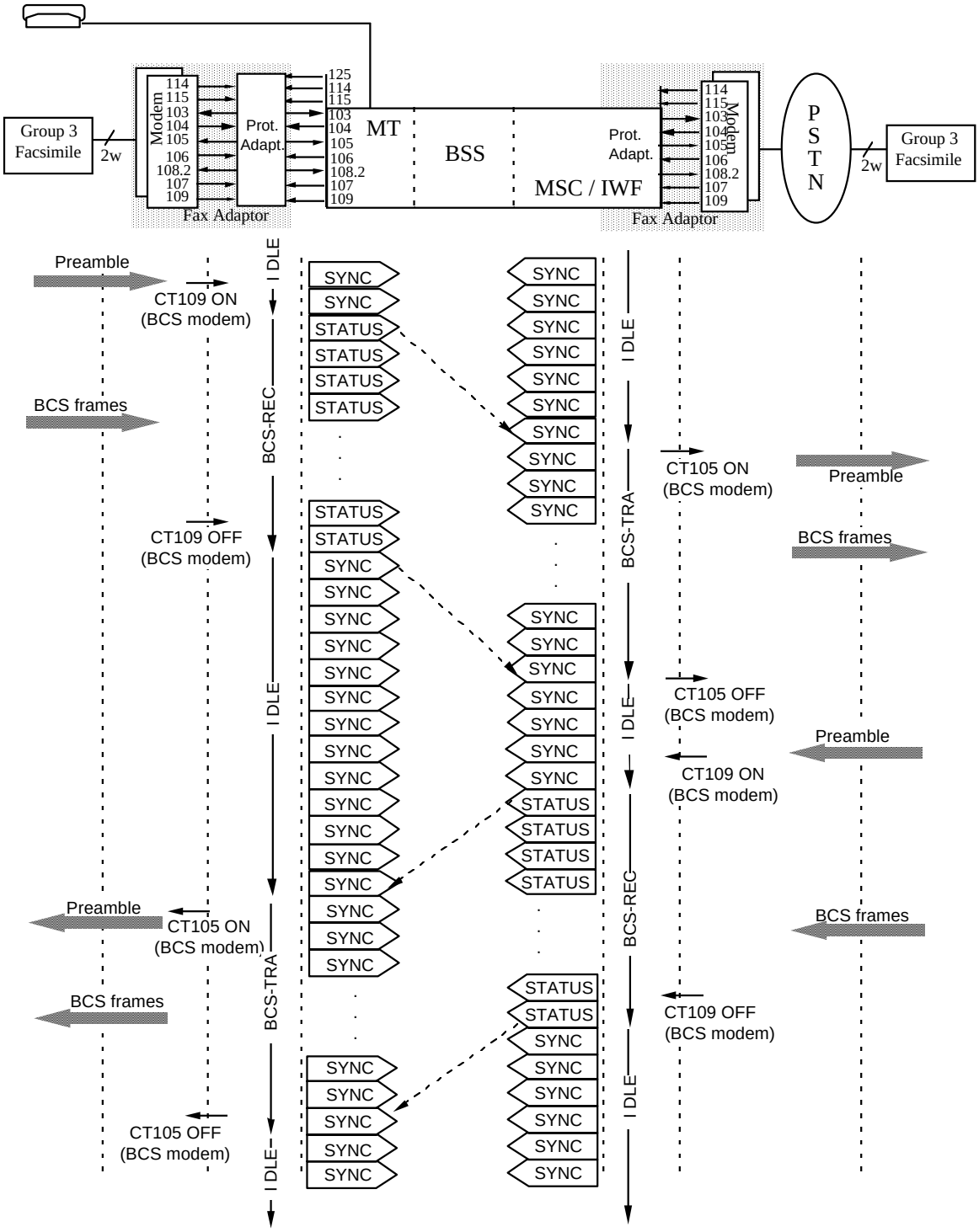



Fig. II-1/03.45
- Mobile originated facsimile transmission -
Typical BCS phase (command/response)

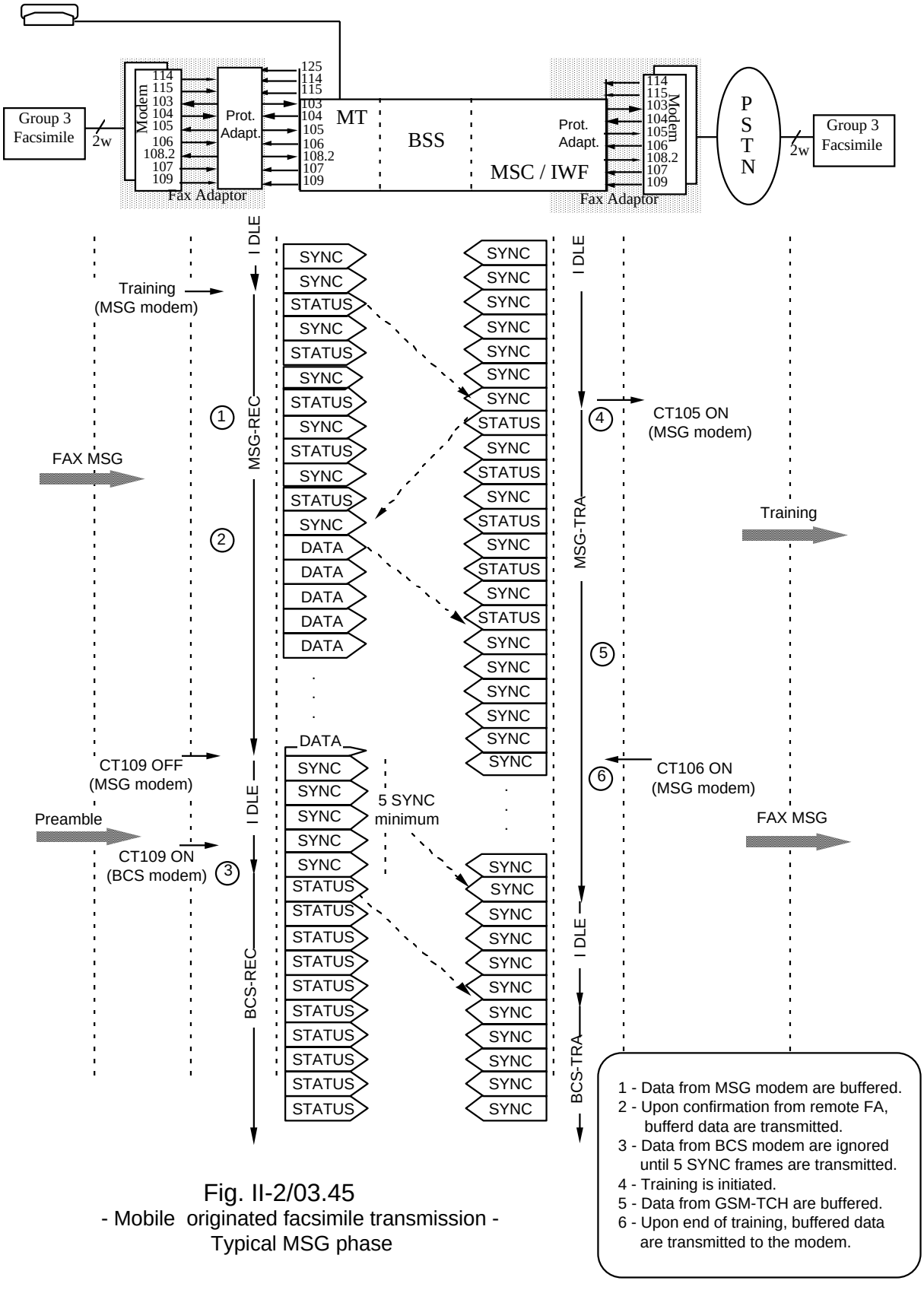



Fig. II-2/03.45
- Mobile originated facsimile transmission -
Typical MSG phase

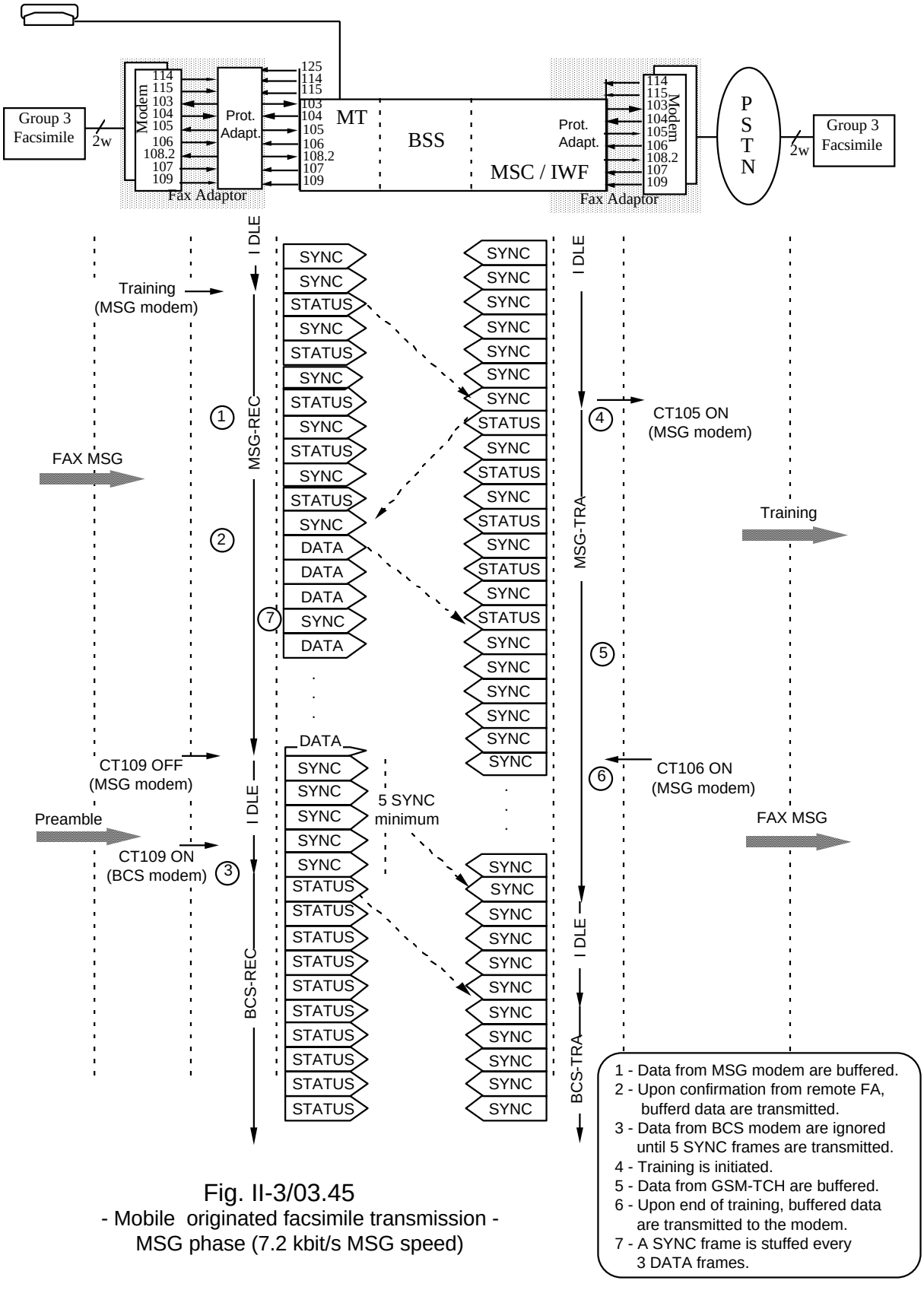



Fig. II-3/03.45
- Mobile originated facsimile transmission -
MSG phase (7.2 kbit/s MSG speed)

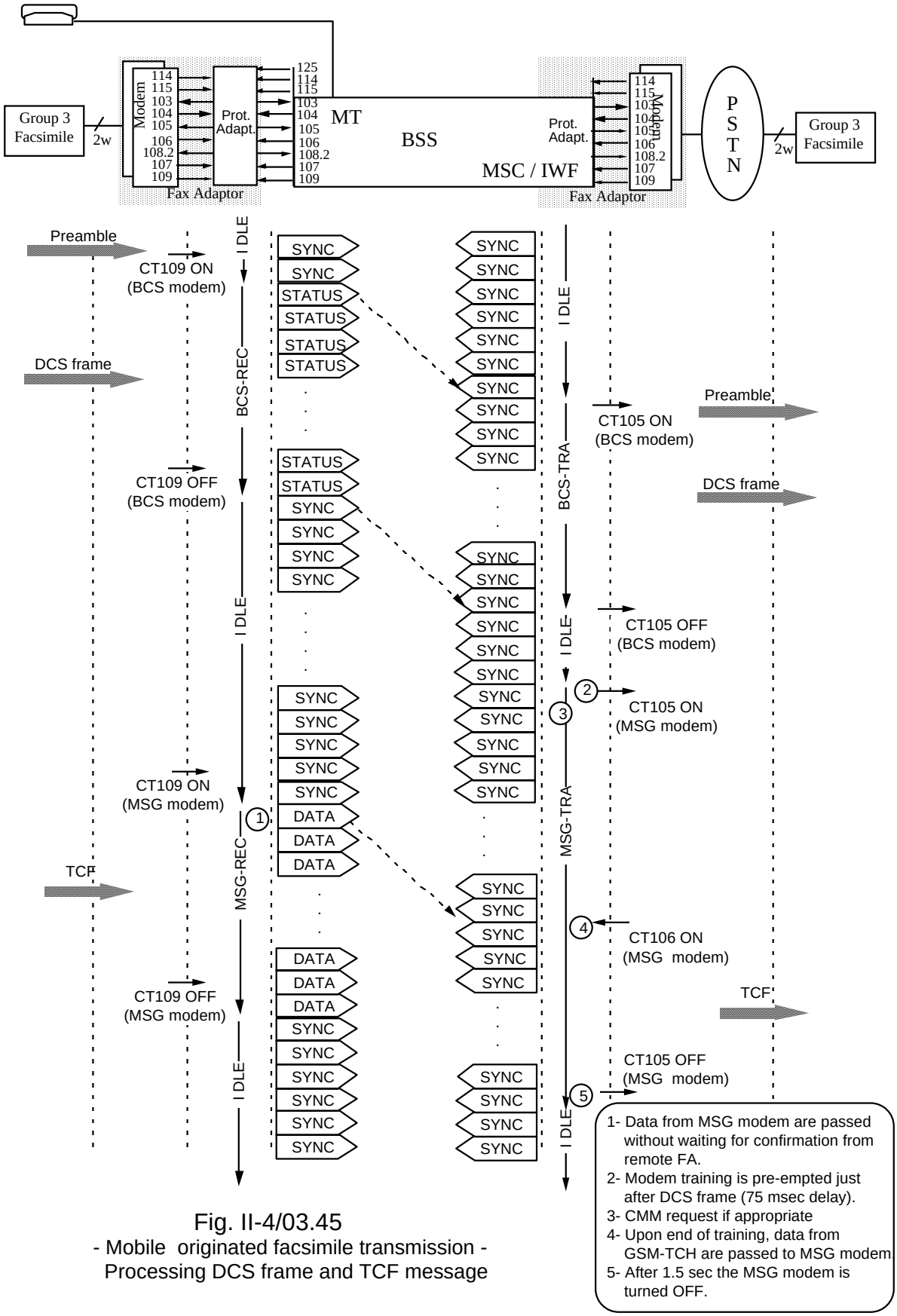



Fig. II-4/03.45
- Mobile originated facsimile transmission -
Processing DCS frame and TCF message

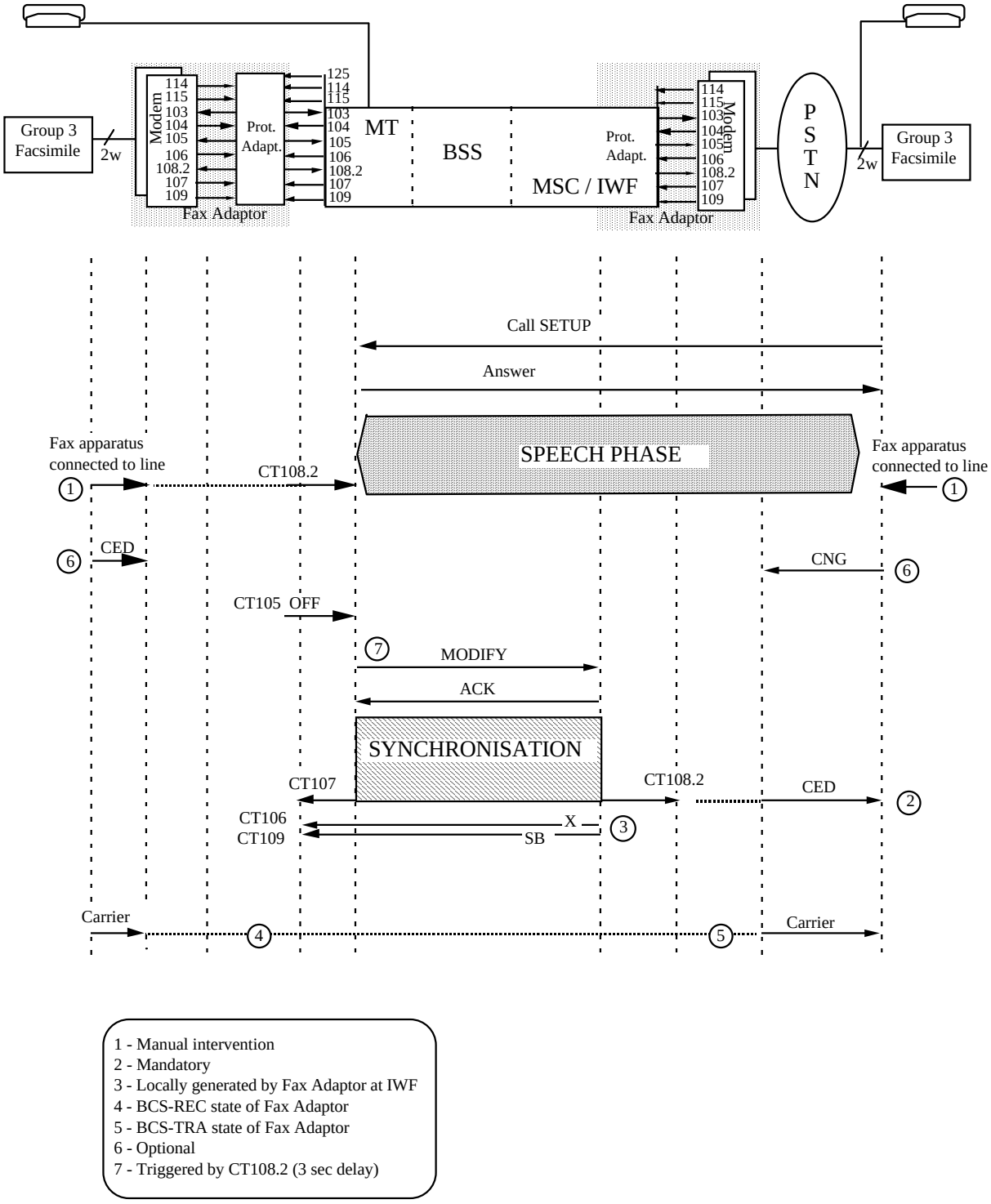



Fig. II-5a/03.45
- Mobile Terminated Call - Speech then Fax
(Data Call Direction is Mobile Terminated)

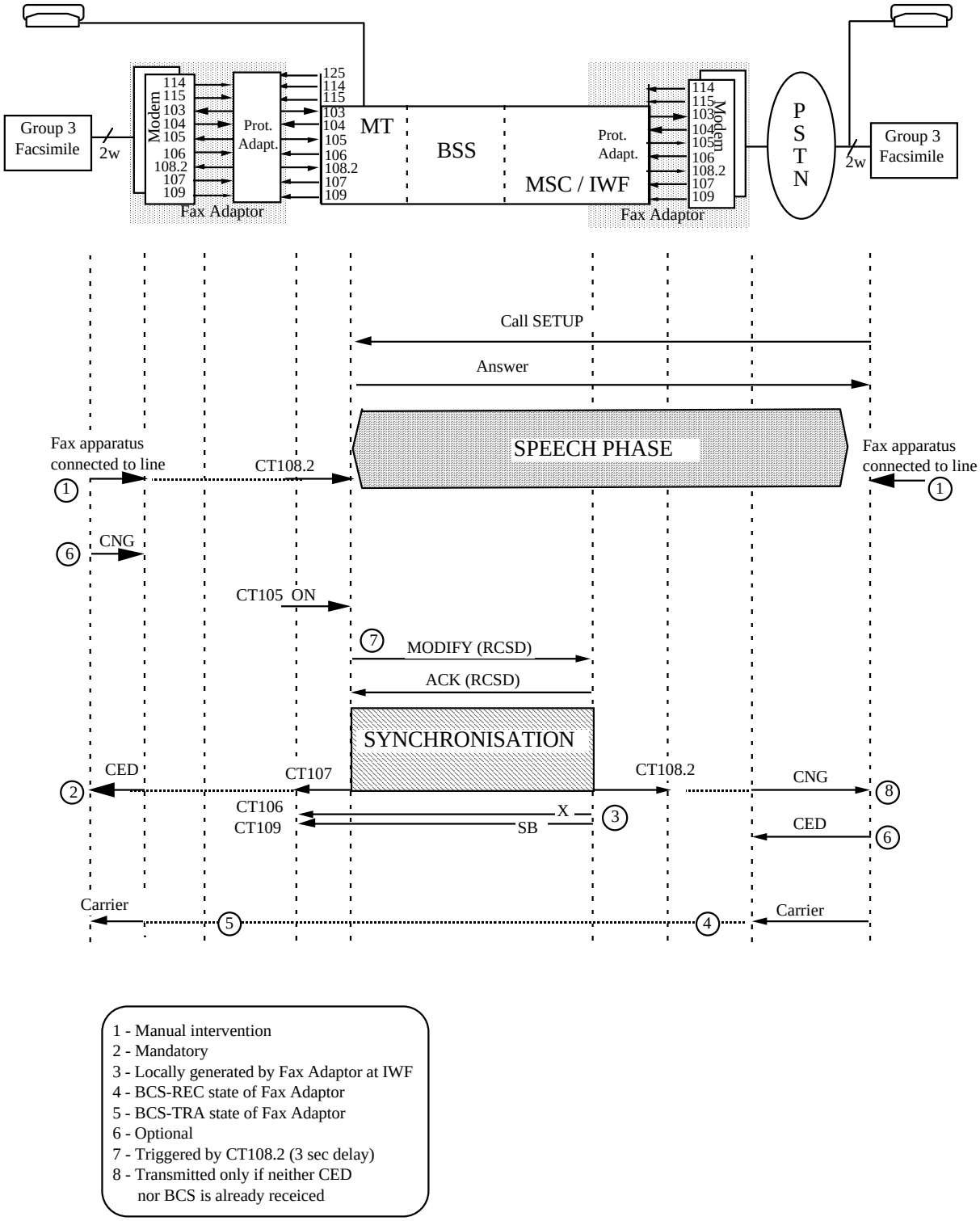



Fig. II-5b/03.45
- Mobile Terminated Call - Speech then Fax
(Data Call Direction is Mobile Originated)

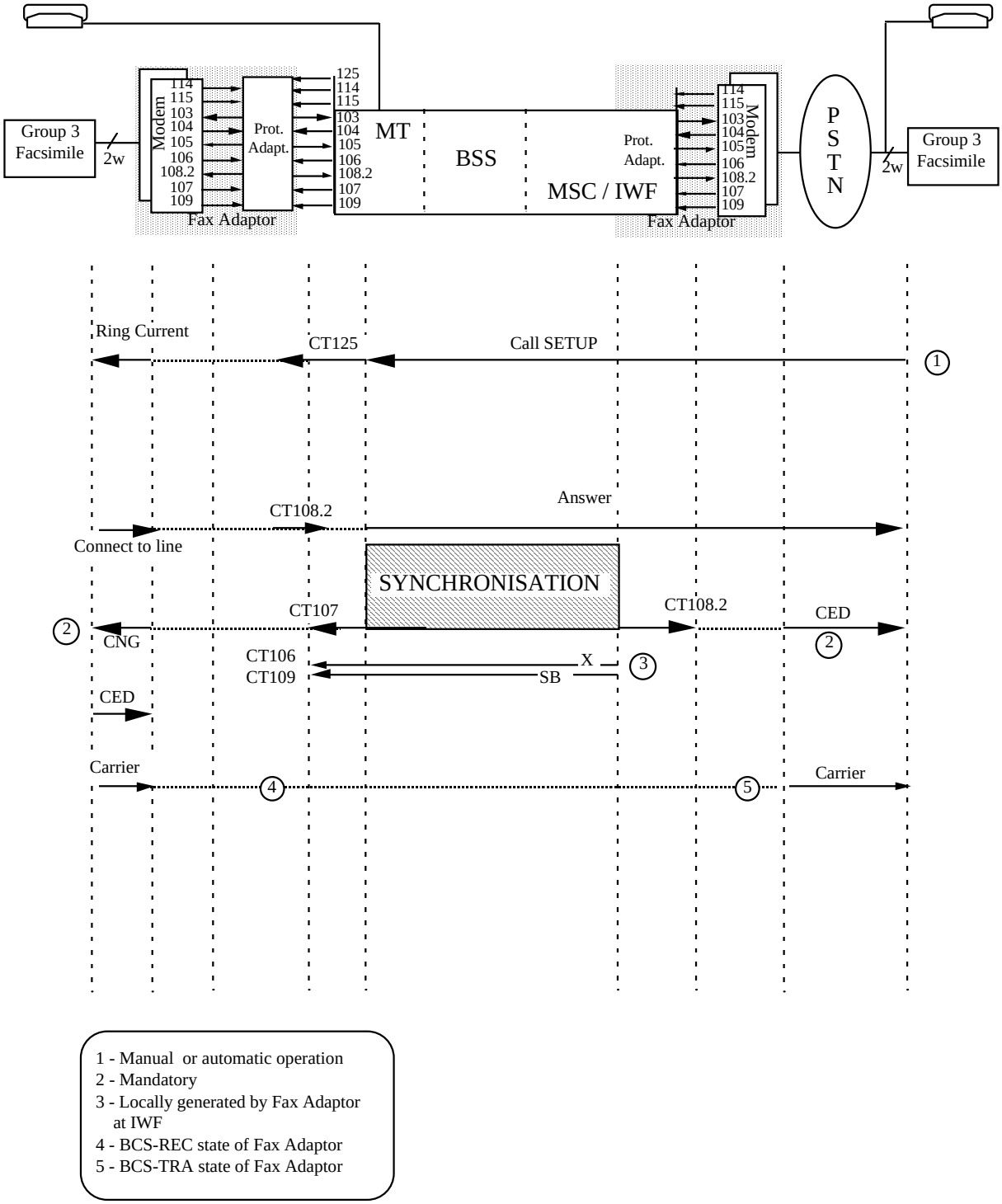



Fig. II-6/03.45
- Mobile Terminated Call - Auto Answer

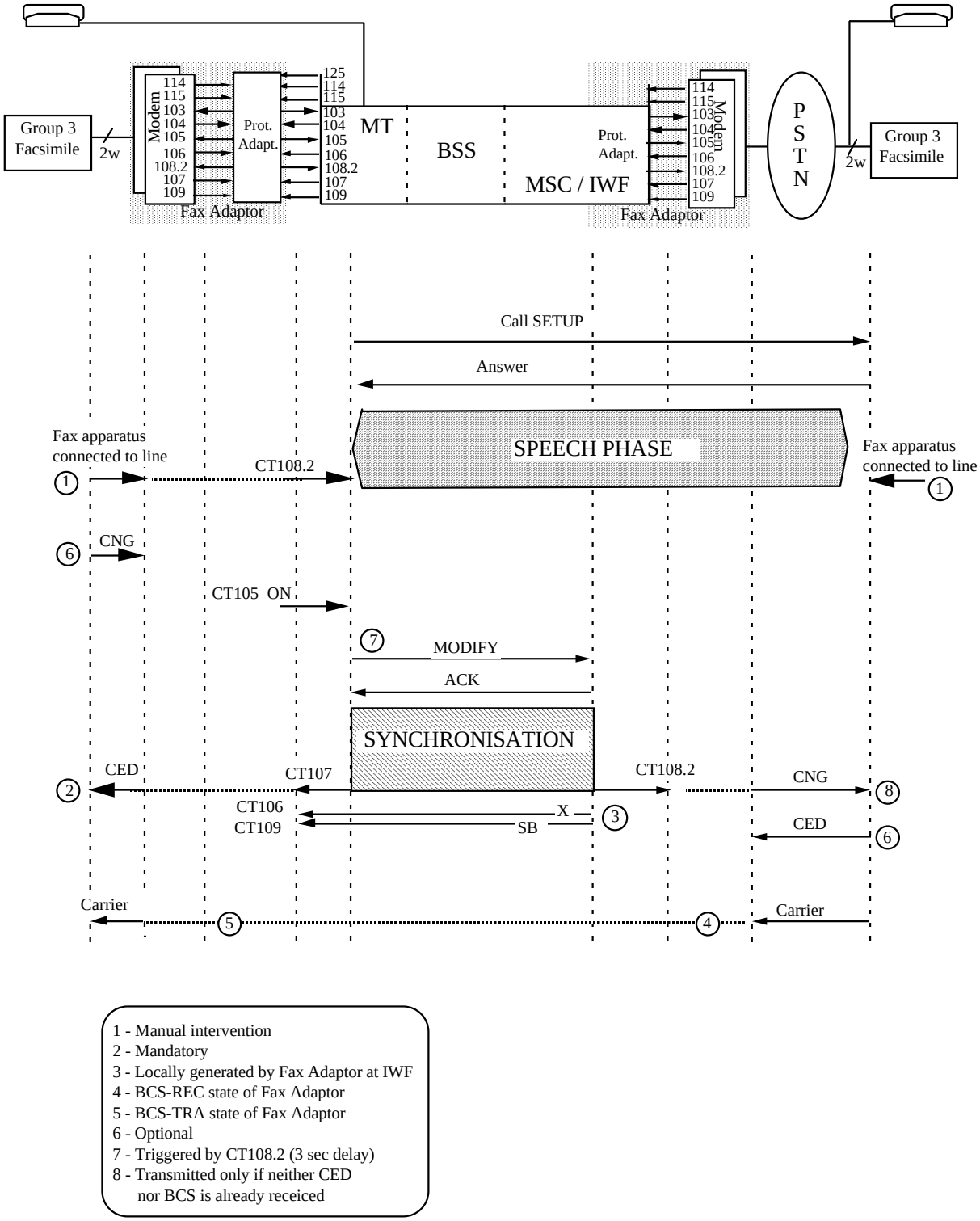



Fig. II-7a/03.45
- Mobile Originated Call - Speech then Fax
(Data Call Direction is Mobile Originated)

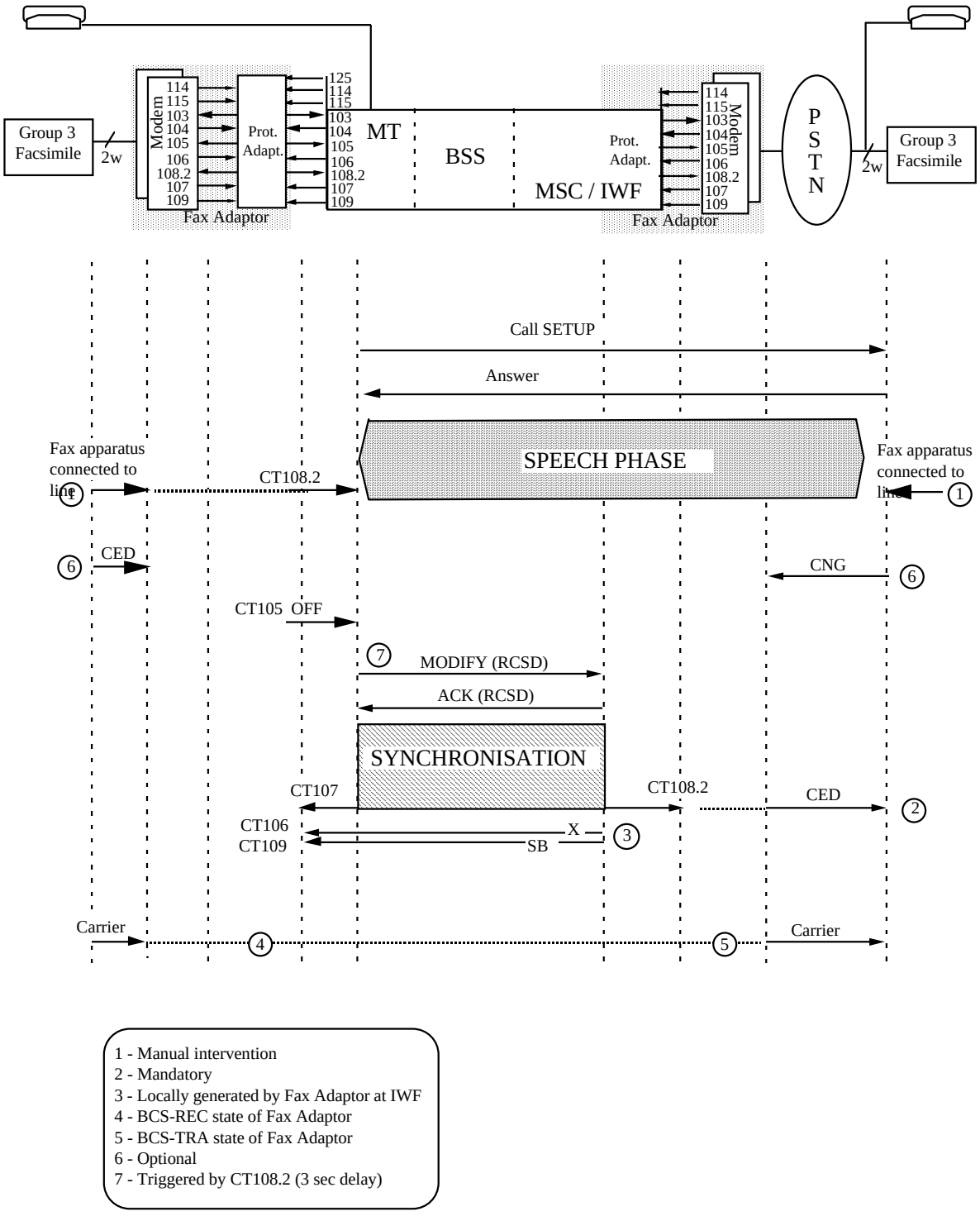



Fig. II-7b/03.45
- Mobile Originated Call - Speech then Fax (Data Call Direction is Mobile Terminated)

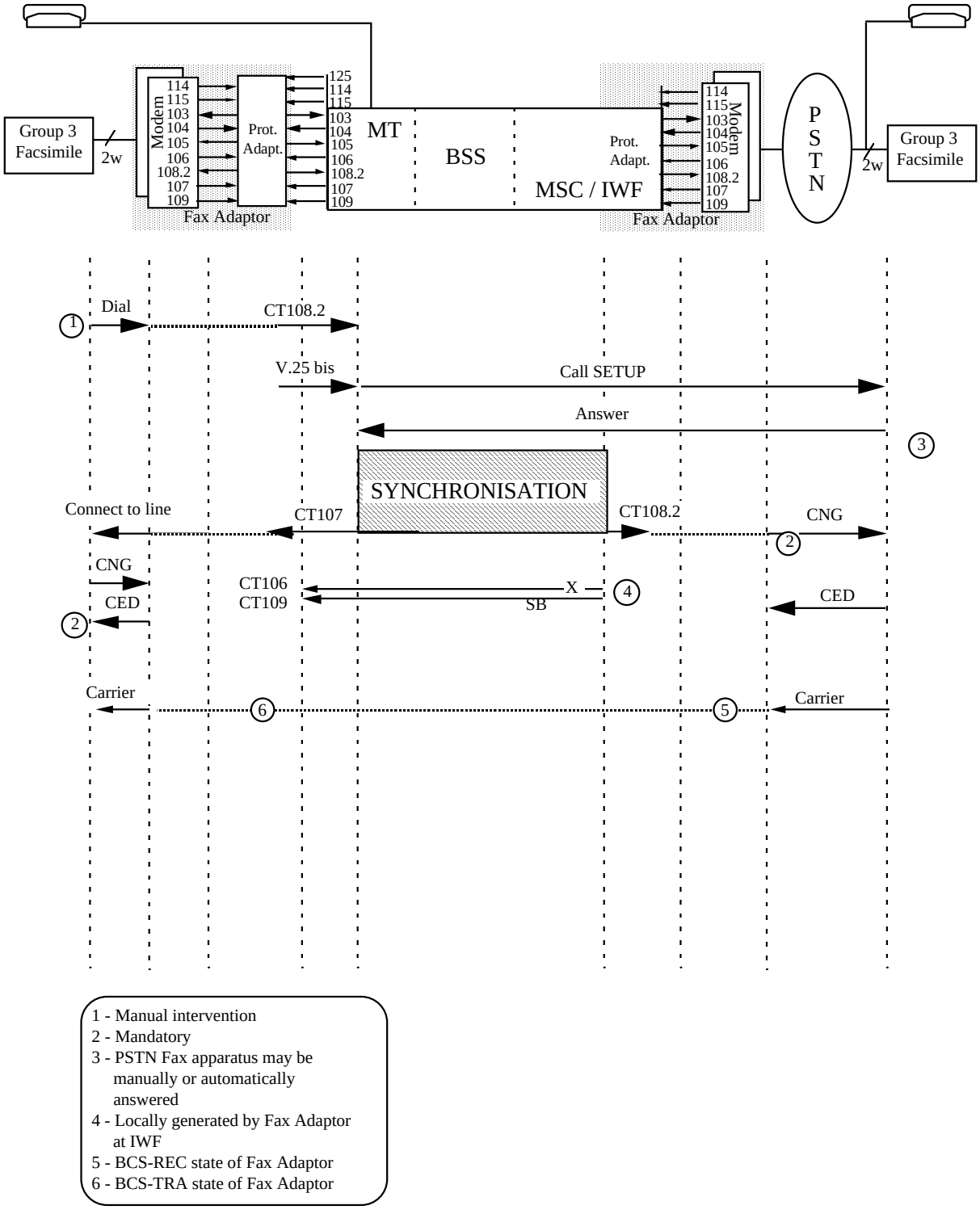



Fig. II-8/03.45
- Mobile Originated Call - Auto Calling

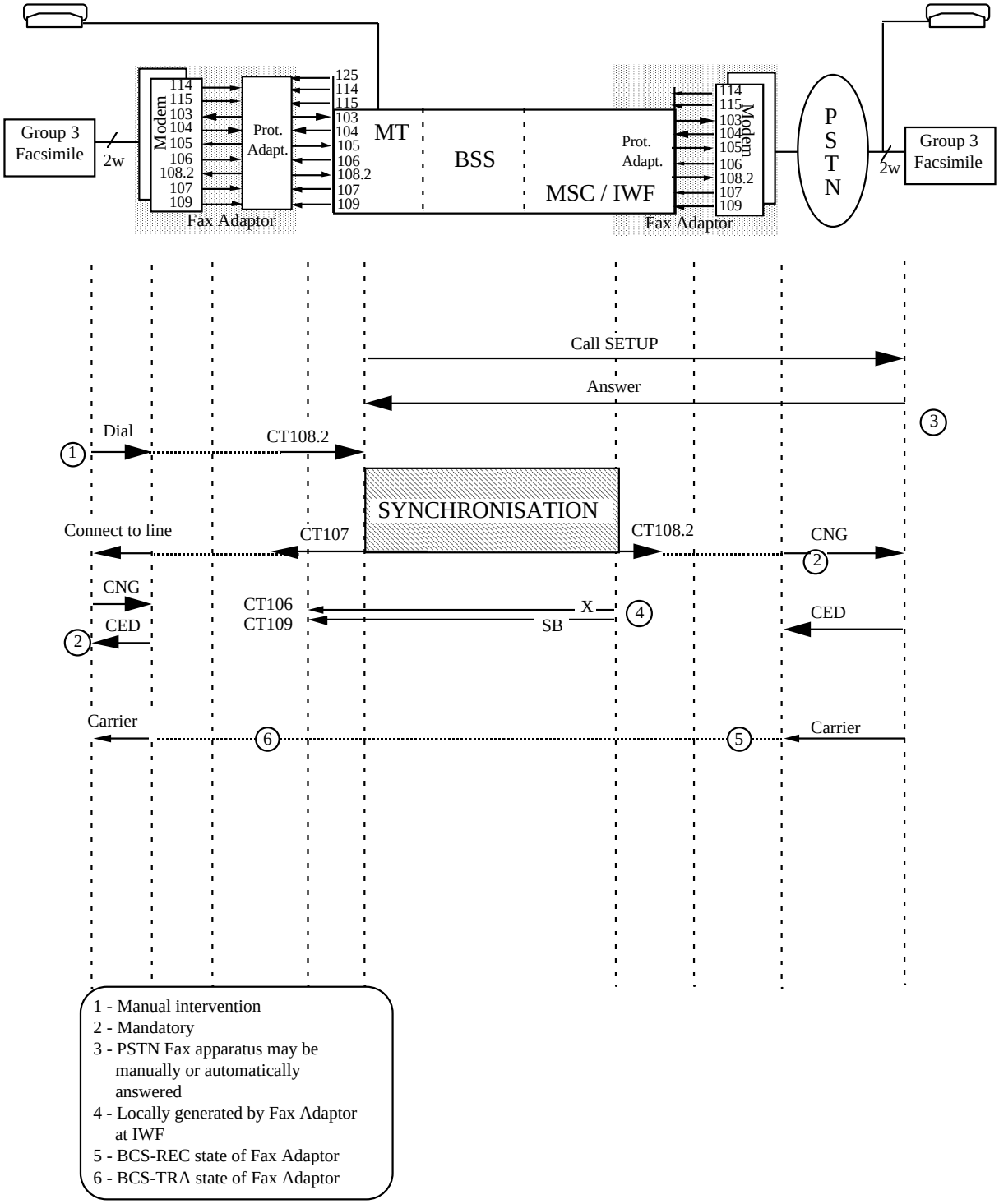
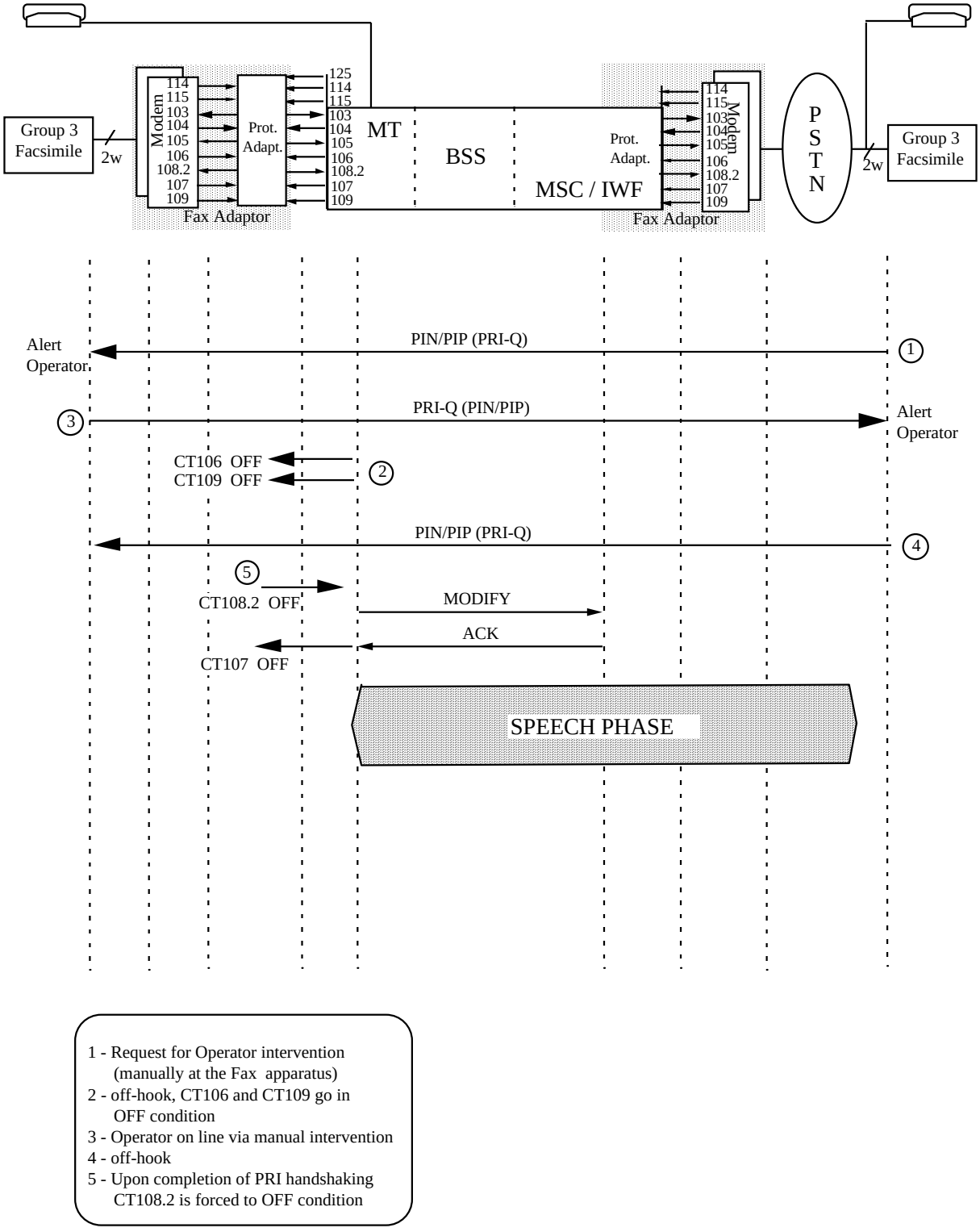



Fig. II-9/03.45
- Mobile Originated Call - Manual Calling




1 - Request for Operator intervention (manually at the Fax apparatus)
2 - off-hook, CT106 and CT109 go in OFF condition
3 - Operator on line via manual intervention
4 - off-hook
5 - Upon completion of PRI handshaking CT108.2 is forced to OFF condition

Fig. II-10/03.45
- Mobile Originated Call - Fax then Speech
(Procedure Interrupt requested from PSTN side)

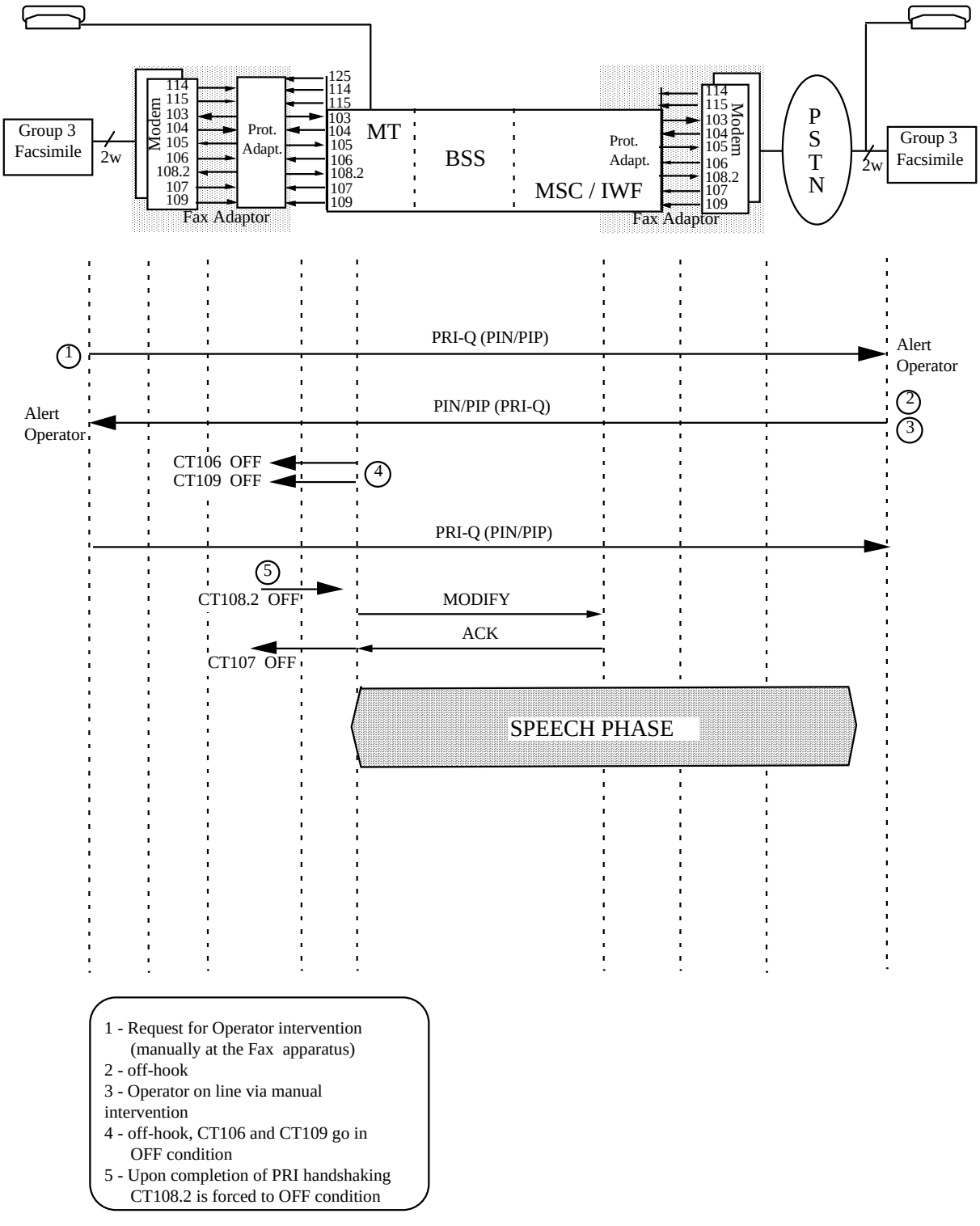



Fig. II-11/03.45
- Mobile Originated Call - Fax then Speech
(Procedure Interrupt requested from Mobile side)

# Annex III (informative): Change history

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| | SMG#11 | | | | Phase 2 version | | 4.4.2 |
| | SMG#20 | | | | Release 1996 version | | 5.0.0 |
| | SMG#20 | | | | ETSI version change | | 5.0.1 |
| | SMG#21 | 055/97 | A002 | | Support of HSCSD | | 5.1.0 |
| | SMG#21 | | | | ETSI version change | | 5.1.1 |
| | SMG#22 | 412/97<br>460/97 | A004<br>A003 | | Corrections and Alignments HSCSD<br>Introduction of 14.4 kbit/s | | 5.2.0 |
| | SMG#22 | | | | ETSI version change | | 5.2.1 |
| | SMG#27 | | | | Release 1997 version | | 6.0.0 |
| | SMG#29 | | | | Release 1998 version | | 7.0.0 |
| 12-1999 | TSG#06 | | | | Agreed to be created as a version 8 for Release 1999 | | 8.0.0 |
| 03-2001 | TSG#11 | | | | Upgraded to Release 4 | 8.0.0 | 4.0.0 |
| 03-2002 | TSG#15 | NP-010 | | | Terminology Clarifications as requested by TDG GERAN | 4.0.0 | 5.0.0 |

**3GPP TSG-CN WG3 Meeting #21**
**Sophia, France. 28th Jan - 1st February 2002.**

***Tdoc N3-020063***

*CR-Form-v5*

# CHANGE REQUEST

⌘ **29.415** **CR** **005** ⌘ **rev** **-** ⌘ Current version: **4.2.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

***Proposed change affects:*** ⌘ (U)SIM ☐ ME/UE ☐ Radio Access Network ☐ Core Network ☐

| | | |
|---|---|---|
| ***Title:*** | ⌘ | Add GERAN Iu mode to scope |
| ***Source:*** | ⌘ | TSG_CN WG3 |
| ***Work item code:*** | ⌘ | TEI5 |
| ***Date:*** | ⌘ | 21.01.2001 |
| ***Category:*** | ⌘ | **D** |
| ***Release:*** | ⌘ | Rel-5 |

*Use one of the following categories:*
***F*** *(correction)*
***A*** *(corresponds to a correction in an earlier release)*
***B*** *(addition of feature),*
***C*** *(functional modification of feature)*
***D*** *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

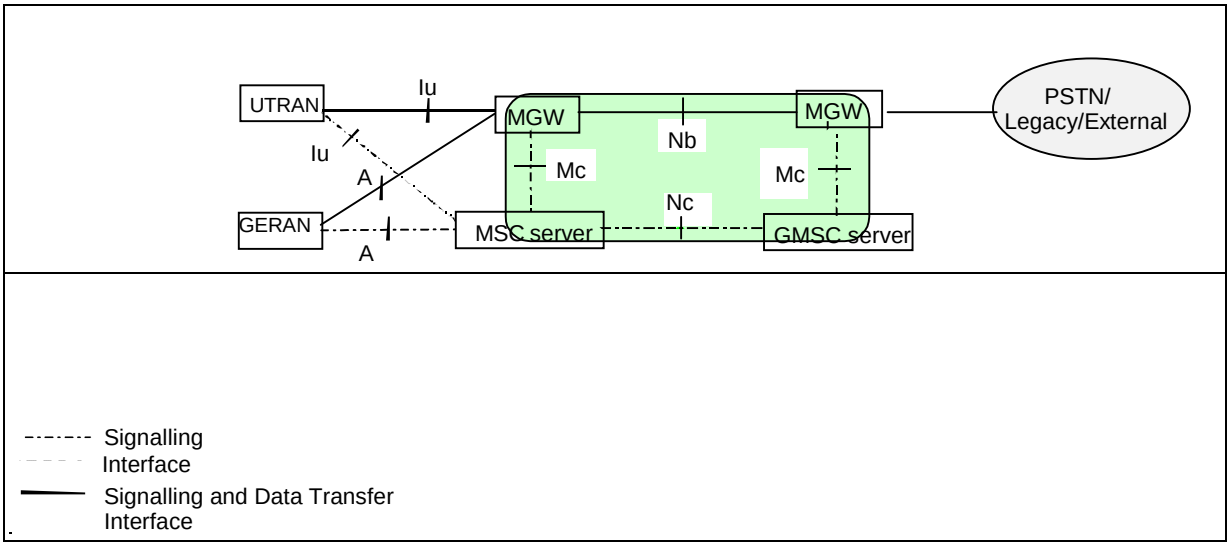
*Use one of the following releases:*
*2 (GSM Phase 2)*
*R96 (Release 1996)*
*R97 (Release 1997)*
*R98 (Release 1998)*
*R99 (Release 1999)*
*REL-4 (Release 4)*
*REL-5 (Release 5)*

| | | |
|---|---|---|
| ***Reason for change:*** | ⌘ | Geran Iu mode is introduced in Rel.5 and not reflected correctly in scope picture |
| ***Summary of change:*** | ⌘ | Add GERAN Iu mode to scope picture |
| ***Consequences if not approved:*** | ⌘ | Inconsistent specifications (compare e.g. with TS 23.002) |

| | | |
|---|---|---|
| ***Clauses affected:*** | ⌘ | 1 Scope |
| ***Other specs affected:*** | ⌘ | ☐ Other core specifications ⌘<br>☐ Test specifications<br>☐ O&M Specifications |
| ***Other comments:*** | ⌘ | No further impacts of GERAN Iu mode on this specification have been found. |

# 1 Scope

The present document specifies the user plane protocol of the bearer used between two MGWs within the CS core network, called the Nb UP protocol. The present document assumes the implementation of the split between call control and the bearer transport and control, as specified in 3GPP TS 23.205 [1], see figure 1. Note that the present document does not preclude an implementation of a combined MSC Server and MGW.



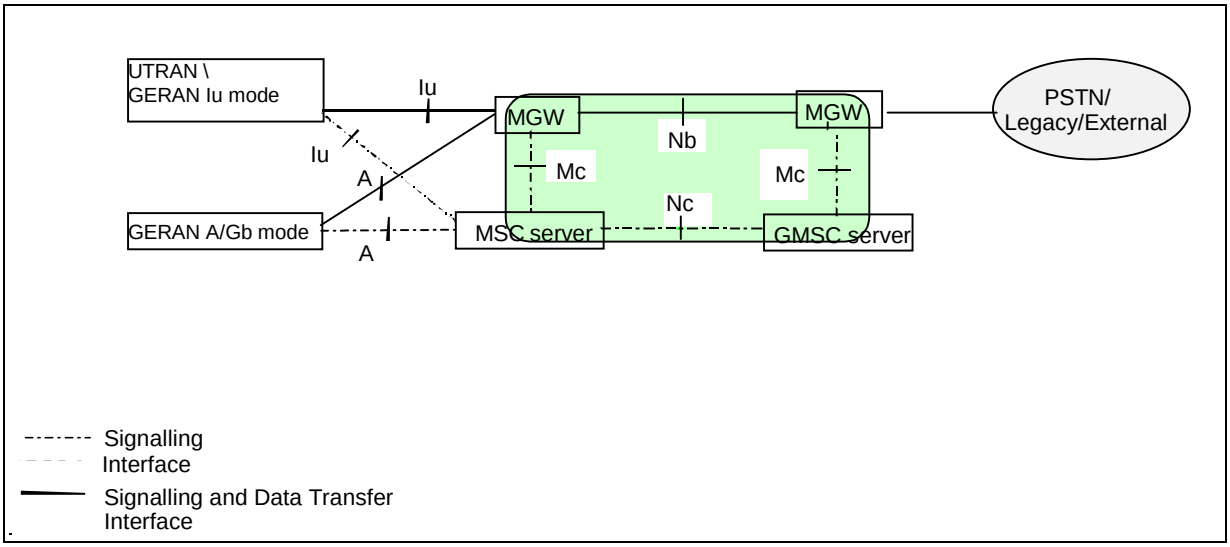




**Figure 1: CS core network logical architecture**