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Contents

Foreword

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

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z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document defines a data link layer protocol to be used for signalling, and possibly also for other applications, on the MS-BS interface.

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*.

[1] 3GPP TS 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 44.001: "Mobile Station - Base Station System (MS - BSS) Interface General Aspects and Principles".

[3] 3GPP TS 44.003: "Mobile Station - Base Station System (MS - BSS) interface Channel structures and access capabilities".

[4] 3GPP TS 44.004: "Layer 1 General requirements".

[5] 3GPP TS 44.005: "Data Link (DL) layer General aspects".

[6] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[7] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".

[8] 3GPP TS 24.010: "Mobile radio interface layer 3 Supplementary services specification; General aspects".

[9] 3GPP TS 44.012: "Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".

[10] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path".

[11] 3GPP TS 48.056: "Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 2 specification".

[12] 3GPP TS 48.058: "Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".

[13] CCITT Recommendation Z.100: "Specification and description language (SDL)".

3 Abbreviations

Abbreviations used in the present document are listed in 3GPP TS 21.905.

4 General

The present document describes the frame structure, elements of procedure, format of fields and procedures for the proper operation of the Link Access Procedure on the Dm channel, LAPDm.

NOTE 1: The term Dm channel is used for convenience to designate the collection of all the various signalling channels required in the GSM system. See also 3GPP TS 44.003.

The concepts, terminology, overview description of LAPDm functions and procedures, and the relationship with other Technical Specifications are described in general terms in 3GPP TS 44.005.

The frame formats defined for LAPDm are based on those defined for LAPD. However, there are important differences between LAPDm and LAPD, in particular with regard to frame delimitation methods and transparency mechanisms. These differences are necessary for operation within the constraints set by the radio path.

LAPDm supports two modes of operation:

- unacknowledged operation using UI frames;
- acknowledged operation using the multiple frame procedure.

As a choice of implementation, the two modes of operation may be implemented independently of each other. This is possible since there is no interactions between the two modes, other than queuing at the transmitter, even when they coexist on the same physical channel. For BCCHs and CCCHs only the unacknowledged mode of operation needs to be implemented.

LAPDm is used for information sent on the control channels BCCH, AGCH, NCH, PCH, FACCH, SACCH and SDCCH as defined in 3GPP TS 44.003.

NOTE 2: AGCH, NCH and PCH are sometimes referred to by the collective name CCCH and FACCH, SACCH and SDCCH are, similarly, referred to by the collective name DCCH.

LAPDm may also be used on other types of channel.

NOTE 3: As stated in 3GPP TS 44.005, the term "data link layer" is used in the main text of this Technical Specification. However, mainly in figures and tables, the terms "layer 2" and "L2" are used as abbreviations. Furthermore, in accordance with 3GPP TS 24.007 and 3GPP TS 44.018, the term "layer 3" is used to indicate the layer above the data link layer.

This Technical Specification is organized as follows:

The frame structure for peer-to-peer communication is given in clause 5. The elements of procedure and formats of fields are given in clause 6. The elements of layer-to-layer communication are contained in clause 7. The details of the peer-to-peer procedures are given in clause 8. clause 6 summarizes the special protocol operations used mandatorily with SAPI=0 and SAPI = 3.

The specification for the random access channel is contained in annex A, even though it is not a LAPDm function. The present document is descriptive and does not constrain the implementation of the random access function. The procedure is used for CHANNEL REQUEST on the RACH and HANDOVER ACCESS on the main DCCH.

(Annexes B to F are deleted).

Annex G gives an overview of actions taken on frames containing parameter errors.

4.1 Options

Support of short L2 header type 1 is an option in both the mobile station and the network; under certain conditions the support is mandatory, as specified in other Specifications. A layer 2 protocol entity not implementing short L2 header type 1 shall diagnose an E/A bit error and proceed as defined in annex G.2.3.

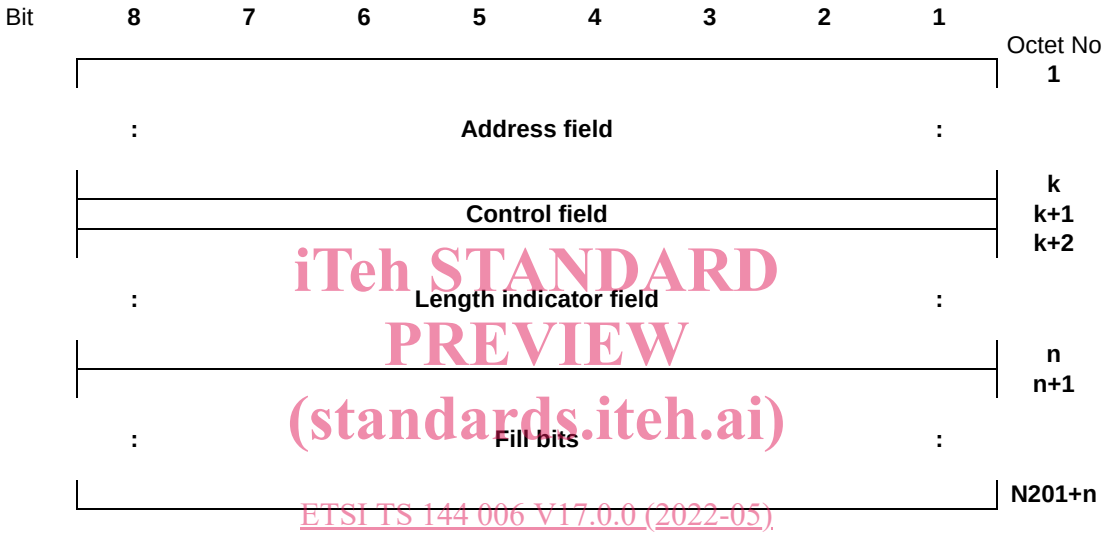
5 Frame structure for peer-to-peer communication

5.1 General

All data link layer peer-to-peer exchanges are in frames conforming to one of the formats shown in figure 1. Several format types are shown in the figure:

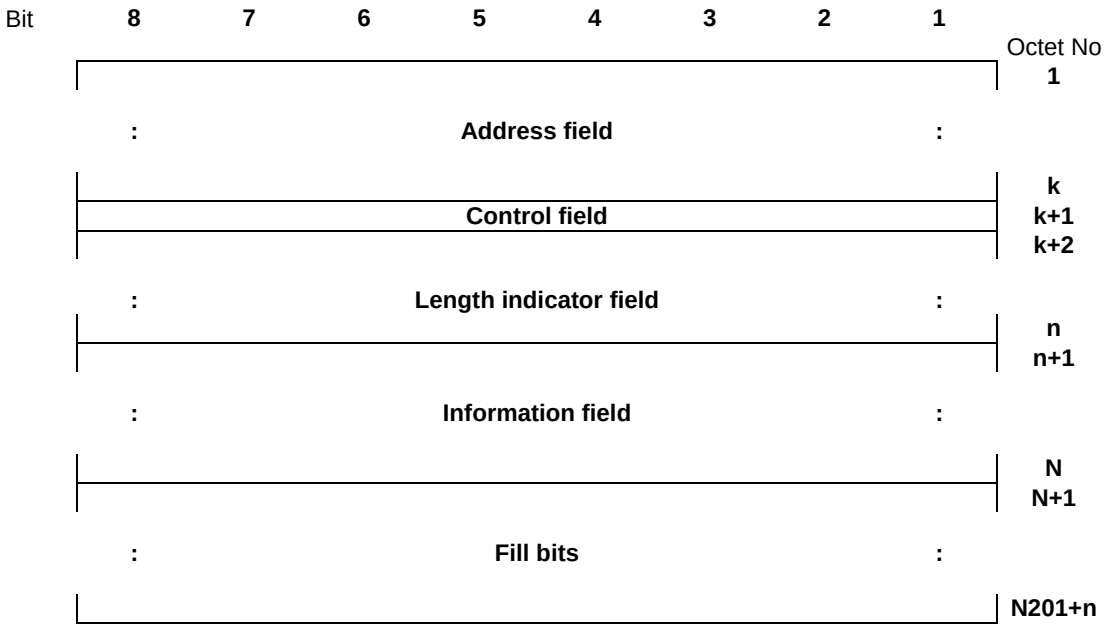
- Format A is used on DCCHs for frames where there is no information field.
- Formats B, Bter and B4 are used on DCCHs for frames containing an information field:
  - format Bter is used on request of higher layers if and only if short L2 header type 1 is supported and a UI command is to be transmitted on SAPI 0;
  - format B4 is used for UI frames transmitted by the network on SACCH;
  - format B is applied in all other cases.
- Format Bbis is used only on BCCH, PCH, NCH, and AGCH.
- In addition there is a Format C for transmission of random access signals.

Format C frames are described in annex A. Format A, B, Bbis, Bter and B4 frames are described in the remainder of the present document.

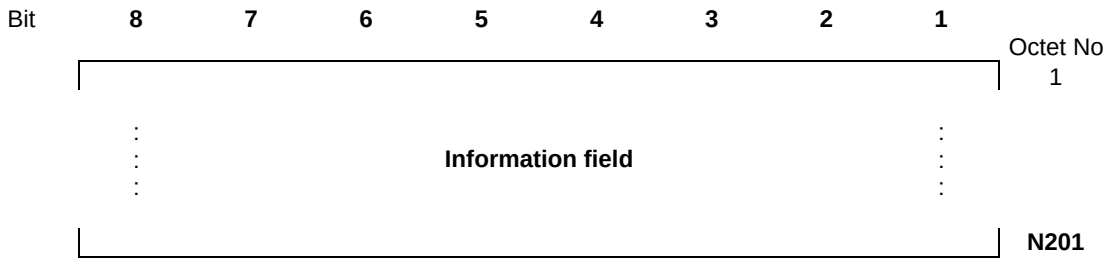


Format type A

Figure 1 (sheet 1 of 3): General frame formats

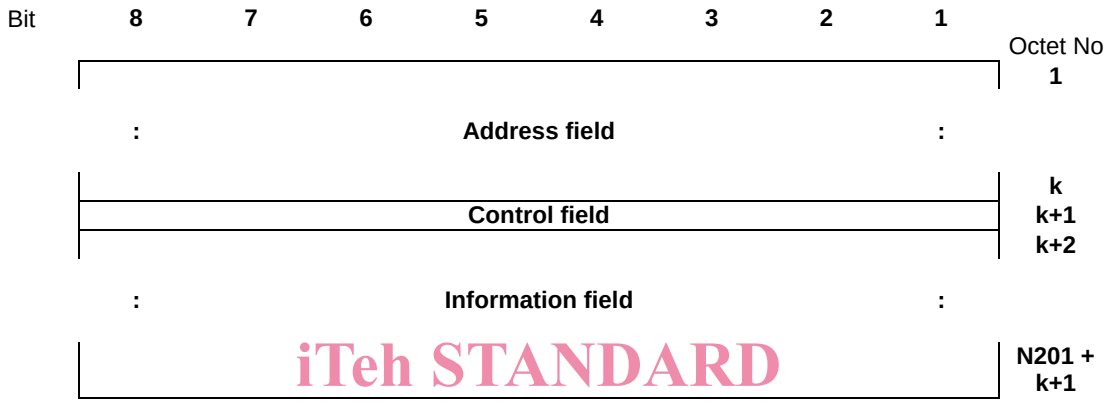


Format type B

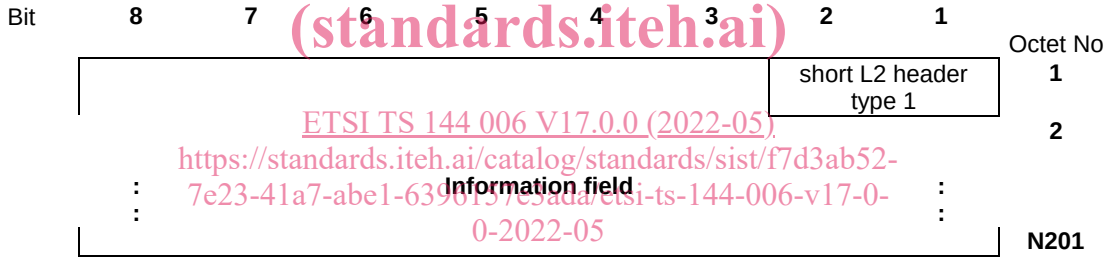


Format type Bbis

Figure 1 (sheet 2 of 3): General frame formats



Format type B4



Format type Bter

Figure 1 (sheet 3 of 3): General frame formats

The parameter N201 is the maximum number of octets which are partially or entirely available for the information field of a frame. It depends on the type of channel and the format, see sub-clause 8.8.3.

5.2 Frame delimitation and fill bits

Frame delimitation is provided by the physical layer:

- in format type A, B and B4 frames at the beginning of the frame for determining the start of the first octet in the address field, in format type Bter frames for determining the start of the octet containing the short L2 header type 1 (which is also the first octet used for the information field), and in format type Bbis frames for determining the start of the first octet for the information field;

- at the end of the frame for determining the last bit of the frame.

The end of the useful part of the frame, i.e. the end of the length indicator field in type A frames and the end of the information field in type B frames, is determined by a length indicator contained in the length indicator field. The useful part of a Bbis frames takes all N201 octets of that frame. The useful part of a Bter frame takes all N201 octets of that frame except those bits of octet 1 which contain the short L2 header type 1. The useful part of a B4 frame takes all N201 octets of that frame except those octets which contain the address field and the control field.

If a frame contains a length indicator that has a value less than N201, the frame contains fill bits. Each fill bit shall be set to a random value when sent by the mobile station. Except for the first octet containing fill bits which shall be set to the binary value "00101011", each fill bit should be set to a random value when sent by the network. Otherwise, the network shall set all octets containing fill bits to the binary value "00101011".

5.3 Address field

The address field may consist of a variable number of octets. However, for applications on control channels the field consists of only one octet. The address field identifies the SAP for which a command frame is intended and the SAP transmitting a response frame. The format of the address field is defined in sub-clause 6.2.

5.4 Control field

The control field consists of one octet. The format of the control field is defined in sub-clause 6.4.

5.5 Length indicator field

The length indicator field may consist of a variable number of octets. However, for applications on control channels the field consists of only one octet. The format of the field is defined in sub-clause 6.6.

5.5a Short L2 header type 1

The short L2 header type 1 consists of two bits. Its contents are defined in sub-clause 6.4a.

5.6 Information field

The information field of a frame, when present, has the position in the frame defined in sub-clause 5.1.

The maximum number of octets in the information field (N201) is defined in sub-clause 8.8.3.

5.7 Transparency

Because of the frame delimitation technique used (see sub-clause 5.2), the frame can include any possible sequence of bits without the need for additional transparency mechanisms.

5.8 Format convention

5.8.1 Numbering convention

The basic convention used in this Technical Specification is illustrated in figure 2. The bits are grouped into octets.

The bits of an octet are shown horizontally and are numbered from 1 to 8. Multiple octets are shown vertically and are numbered from 1 to n.

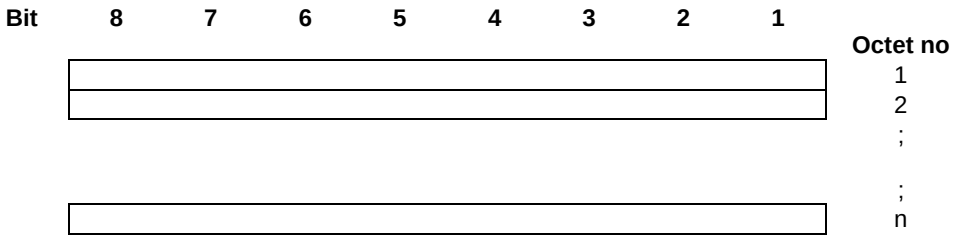


Figure 2: Format convention

5.8.2 Order of bit transmission

The order of bit transmission is defined in 3GPP TS 44.004.

5.8.3 Field mapping convention

When a field is contained within a single octet, the lowest bit number of the field represents the lowest order value.

When a field spans more than one octet, the order of bit values within each octet progressively decreases as the octet number increases. In that part of the field contained in a given octet the lowest bit number represents the lowest order value.

For example, a bit number can be identified as a couple (o, b) where o is the octet number and b is the relative bit number within the octet. Figure 3 illustrates a field that spans from bit (1, 3) to bit (2, 7). The high order bit of the field is mapped on bit (1, 3) and the low order bit is mapped on bit (2, 7).

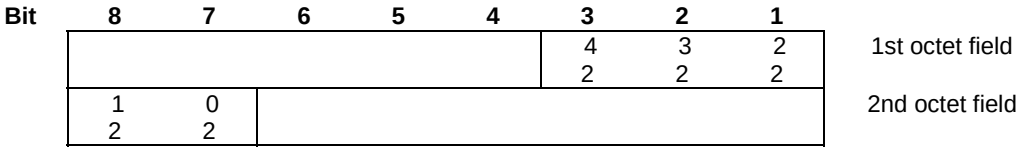


Figure 3: Field mapping convention

6 Elements of procedures and formats of fields for Data Link Layer peer-to-peer communication

6.1 General

The elements of procedures define the commands and responses that are used on the data link connections carried on the Dm channel.

Procedures are derived from these elements of procedures and are described in clause 8.

If a bit position is marked as "spare", it shall be coded as "0". For future compatibility reasons, an entity receiving frames, where spare bit positions are coded otherwise, shall ignore those values without notification of any error.

6.2 Address field format

The field consists of:

- the address field extension bit EA;
- the command/response bit C/R;
- the SAPI;
- and the Link Protocol Discriminator LPD.

The format of the address field for control channels is shown in figure 4.

The address field extension bit, EA, enables extension of the field to span more than one octet. The value "0" is used to indicate an extension, the value "1" shall be used for the final address field octet.

The Link Protocol Discriminator (LPD) corresponding to the use in this Technical Specification shall take the value "0 0", all other values are reserved.

NOTE: LPD = "0 1" corresponds to the data link protocol used for SMSCB (see 3GPP TS 44.012).

Bit	8	7	6	5	4	3	2	1
	Spare	LPD		SAPI			C/R	EA =1

Figure 4: Address field format

6.3 Address field variables

6.3.1 Address field extension bit (EA)

The address field range is extended by reserving the first transmitted bit of the address field octets to indicate the final octet of the address field. The presence of a "1" in the first bit of an address field octet signals that it is the final octet of the address field. Figure 4 shows the case where the field consists of one octet.

6.3.2 Command/response field bit (C/R)

The C/R bit identifies a frame as either a command or a response. The MS side shall send commands with the C/R bit set to "0", and responses with the C/R bit set to "1". The BS side shall do the opposite; that is commands are sent with C/R set to "1", and responses are sent with C/R set to "0". The combinations for the BS side and MS side are shown in table 1.

Table 1: C/R field bit usage

Type	Direction	C/R value
Command	BS side to MS side	1
	MS side to BS side	0
Response	BS side to MS side	0
	MS side to BS side	1

6.3.3 Service access point identifier (SAPI)

The service access point identifier (SAPI) identifies a point at which data link layer services are provided by the data link layer to a layer 3 entity (see 3GPP TS 44.005). The SAPI allows 8 service access points to be specified initially, where bit 3 of the address field octet containing the SAPI is the least significant binary digit and bit 5 is the most significant.

The SAPI values are allocated as shown in table 2.

Table 2: Allocation of SAPI values

SAPI value	Related entity
0	Call control signalling, mobility management signalling and radio resource management signalling (see 3GPP TS 44.018 and 24.010)
3	Short message service
All others	Reserved for future standardization

6.4 Control field formats

The control field identifies the type of frame, which will be either a command or a response. The control field will contain sequence numbers, where applicable.

Three types of control field formats are specified: numbered information transfer (I format), supervisory functions (S format), and unnumbered information transfer and control functions (U format). The control field formats for LAPDm are shown in table 3.