

**Access and Terminals (AT);
Short Message Service (SMS) for PSTN/ISDN;
Short Message Communication between a fixed
network Short Message Terminal Equipment and a
Short Message Service Centre**



Reference

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Keywords

SMS, point-to-point, PSTN, ISDN

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Access and Terminals (AT).

Introduction

The Short Message Service (SMS) is a service that allows text messages to be sent and received. The present document specifies protocols to provide this service on the fixed network. The transmission of messages of up to 160 characters is guaranteed, although much longer messages are possible.

The protocols specified in the present document support a User Based Solution (UBS), where messages are transported via a Short Message Service Centre (SM-SC) using a normal voice band call through the network using in band signalling. SMS messages are sent via the SM-SC using a store and forward principle.

The protocols specified in the present document provide a reliable service that ensures correct delivery of SMS messages and also allows the originating user to verify that an SMS has been correctly received by the receiving terminal.

The provider of the short message service does not necessarily have to be the operator of the public telecommunications network. The Short Message Service does require the CLIP function to be implemented in PSTN/ISDN.

It is noted that EN 300 659-3 [6] specifies a set of parameters for PSTN that describes a method of delivering Short Messages, however this is a different protocol from the SMS protocols specified in the present document.

The present document specifies two different protocols to provide the SMS over PSTN/ISDN. Both protocols offer the opportunity to exchange Short Messages with other networks, e.g. GSM and with other services, e.g. Email, Fax.

Each protocol has its advantages; the service provider can select which protocol to implement:

- Protocol 1 has the advantage of being fully compliant with the GSM SMS service.
- Protocol 2 has the advantage that it specifically focuses on the residential fixed network environment.

1 Scope

The present document deals with two different protocols to provide the Short Message Service for PSTN/ISDN using a User Based Solution (UBS). For both protocols it specifies the protocol layers used to transmit Short Message Information between Short Message Terminal Equipment connected to PSTN/ISDN and a Short Message Service Centre. It is up to the service provider to choose which protocol to use.

It does not specify the dial-in systems and the architecture of the short message service centres.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] ETSI TS 123 038: "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Alphabets and language-specific information (3GPP TS 23.038 Release 5)".
- [2] ETSI TS 123 040: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Technical realization of Short Message Service (SMS) (3GPP TS 23.040 Release 5)".
- [3] ETSI TS 124 011: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Point-to-Point (PP) Short Message Service (SMS) Support on Mobile Radio Interface (3GPP TS 24.011 Release 5)".
- [4] ETSI EN 300 659-1: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 1: On-hook data transmission".
- [5] ETSI EN 300 659-2: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 2: Off-hook data transmission".
- [6] ETSI EN 300 659-3: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Subscriber line protocol over the local loop for display (and related) services; Part 3: Data link message and parameter codings".
- [7] ETSI ES 200 778-2: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Protocol over the local loop for display and related services; Terminal Equipment requirements; Part 2: Off-hook data transmission".
- [8] ITU-T Recommendation V.25: "Automatic answering equipment and general procedures for automatic calling equipment on the general switched telephone network including procedures for disabling of echo control devices for both manually and automatically established calls".
- [9] ETSI EN 300 403-1: "Integrated Services Digital Network (ISDN); Digital Subscriber Signalling System No. one (DSS1) protocol; Signalling network layer for circuit-mode basic call control; Part 1: Protocol specification [ITU-T Recommendation Q.931 (1993), modified]".

- [10] ETSI EN 300 090: "Integrated Services Digital Network (ISDN); Calling Line Identification Restriction (CLIR) supplementary service; Service description".
- [11] ISO 3166-1: "Codes for the representation of names of countries and their subdivisions - Part 1: Country codes".
- [12] IETF RFC 3066: "Tags for the Identification of Languages".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Deliver Mode Identifier (DMI): special digit of the calling party number of the Short Message Service Centre presented to the SM-TE

NOTE: The value of this digit determines whether the Short Message Terminal Equipment shall accept and answer the call from the Short Message Service Centre or shall automatically call back the SM-SC.

Short Message Entity (SME): entity which may send or receive Short Messages

NOTE: The Short Message Entity (SME) may be located in an SM-TE, or an SM-SC.

SME Subaddress: address used for the addressing of a Short Message to a specific Short Message Entity (SME) connected to one subscriber line

NOTE 1: The addressed SME may be one of the Short Message Terminals connected in parallel to one subscriber line, as well as one of the Short Message Entities contained in a Short Message Terminal. The SME Subaddress length is one digit.

NOTE 2: Because of different purposes, the subaddressing as described by the present document does not correspond to the subaddressing as defined by TS 123 040 [2]. Both are different mechanisms that just share the same name due to historical reasons.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

APP	APPlication
CCBS	Completion of Calls to Busy Subscriber
CLI	Calling Line Identity
CLIP	Calling Line Identification Presentation
CM	Connection Manager
DLL	Data Link Layer
DMI	Deliver Mode Identifier
DSS1	Digital Subscriber Signalling No. 1
DTMF	Dual Tone Multi-Frequency
FSK	Frequency Shift Keying
GSM	Global System for Mobile communication
ISDN	Integrated Services Digital Network
ISO	International Standard Organization
ISUP	ISDN User Part
ITU	International Telecommunication Union
LSB	Least Significant Bit
MSB	Most Significant Bit
OSI	Open System Interface
PIN	Personal Identification Number
PL	Presentation Layer
PSTN	Public Switched Telephone Network

RL	Relay Layer
SIM	Subscriber Identification Module
SM	Short Message(s)
SM-AL	Short Message Application Layer
SM-DLL	Short Message Data Link Layer
SME	Short Message Entity
SME-M	Short Message Entity Master
SME-S	Short Message Entity Slave
SMS	Short Message Service
SM-SC	Short Message Service Centre
SM-TE	Short Message Terminal Equipment
SM-TE-O	Short Message Terminal Equipment Originated
SM-TE-T	Short Message Terminal Equipment Terminated
SM-TL	Short Message Transfer Layer
SS7	Signalling System No. 7
TBD	To Be Determined
TL	Transfer Layer
TP-FCS	Transfer Protocol - Failure Cause
UBS	User Based Solution

4 Functional description of UBS

Figure 1 gives an overview of the system architecture of SMS in the PSTN/ISDN. The system consists of a Short Message Terminal Equipment (SM-TE), a Short Message Service Centre (SM-SC) and the PSTN/ISDN.

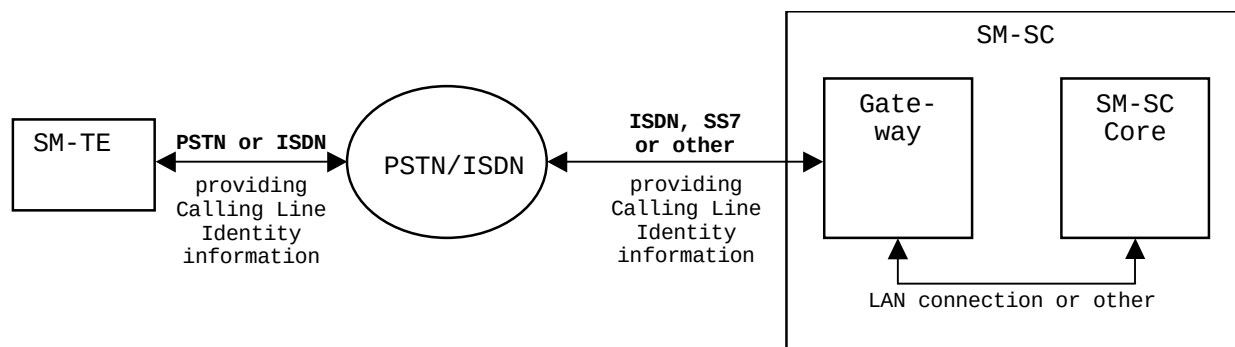


Figure 1: System overview

The SM-TE shall be connected to the network via a PSTN or an ISDN access. The SM-SC may be connected to the network via an ISDN primary rate interface, SS7 or other connection types.

It is up to the SM-SC to provide interconnection to other networks (e.g. GSM).

NOTE: The internal structure of the SM-SC depicted in figure 1 is just an example for a possible configuration. The SM-SC architecture is out of the focus of the present document.

To send and receive Short Messages a voice-band communication path is established in the PSTN/ISDN between the SM-TE and SM-SC using basic call control procedures according to the related access types. The general principle of a SM transfer from a sending SM-TE to a receiving SM-TE is depicted in figure 2.

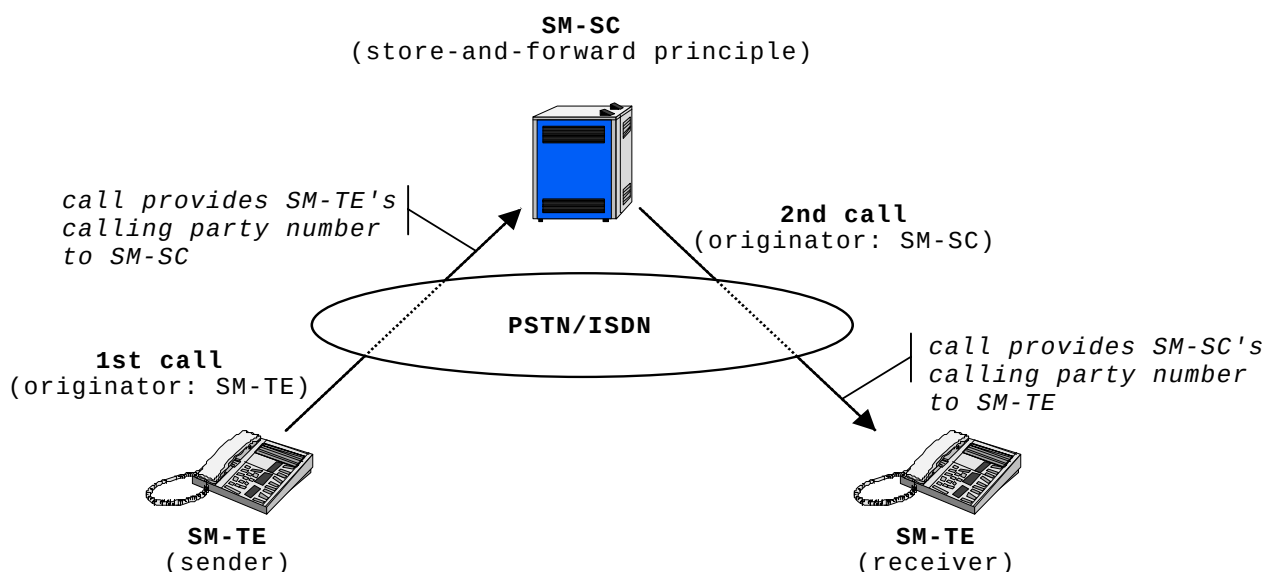


Figure 2: Short Message transfer - General principle

The SM transfer is split up into two steps, the SM submission (transfer of a SM from the "sender" to the SM-SC) and the SM delivery (transfer of a SM from the SM-SC to the "receiver").

In the first step (SM submission), the SM-TE establishes a call to the SM-SC to submit the SM to the SM-SC which acts following the store-and-forward principle. As marked in figure 2, the network shall provide the caller ID (the CLI) of the SM-TE to the SM-SC. The SM-SC uses this information to identify the SM-TE. Furthermore, the caller ID information may be used for billing purposes.

After the voice band connection between SM-TE and SM-SC has been established, the end-to-end SM data transfer phase is entered for Short Message transfer from SM-TE to SM-SC.

After the SM has been transferred, the connection between SM-TE and SM-SC is released.

In the second step (SM delivery), the SM-SC establishes a call to the SM-TE to deliver the SM to the SM-TE. In this case, the network shall provide the caller ID (the CLI) of the SM-SC to the SM-TE. The SM-TE uses this caller ID information to identify and connect an incoming call from the SM-SC automatically.

As in the first step, the Short Message is transmitted from the SM-SC to the SM-TE after the voice band connection between SM-SC and SM-TE has been established. After the SM has been transferred, the connection between SM-SC and SM-TE is released.

In case of a PSTN access the CLI is provided either with FSK signalling or with DTMF signalling according to EN 300 659-1 [4]. In case of an ISDN access the CLI is provided with the DSS1 protocol according to EN 300 403-1 [9].

The focus of the present document is to describe the end-to-end interworking and the protocol between the Short Message Terminal Equipment (SM-TE) and the Short Message Service Centre (SM-SC) via the PSTN/ISDN for SM data transfer.

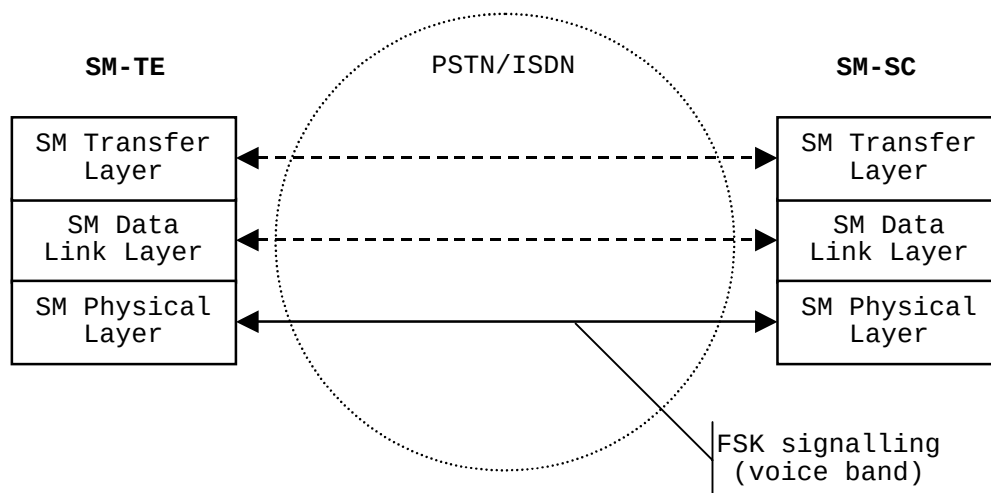


Figure 3: ISO/OSI layer model of "SMS data transmission via PSTN/ISDN connection"

The SMS protocol stack is shown in figure 3. This protocol stack consists of three layers. The Short Message Transfer Layer provides the interface to the application. To receive and transmit SM, the Transfer Layer uses the facilities of the Short Message Data Link Layer. This instance is responsible for the protected transmission of the SM between the involved entities. The Physical Layer uses a 1 200 Baud FSK modulation.

To establish and preserve a connection between the SM-TE and the SM-SC, each entity has to use the call control protocol required by the PSTN/ISDN. This call control protocol is not in the focus of the present document. In the annexes, the message flow in the voice band between the SM-TE and the SM-SC is described in form of message sequence charts. This sequence charts also describe the requirements for the call control from the Transfer Layer point of view.

Two different protocols have been developed to enable the Short Message transfer over PSTN/ISDN:

- The first protocol ("**Protocol 1**") is described in clause 5 and annex A.
- The second protocol ("**Protocol 2**") is described in clause 6 and annex B.

5 Protocol 1

5.1 Overview

In addition to the general description of the protocol stack depicted in clause 4, figure 4 gives a more detailed overview of the relationship between the protocol stack for SMS in PSTN/ISDN (as defined by protocol 1) and the GSM protocol stack.

Transfer Layer used in protocol 1 follows the GSM Transfer Layer in order to archive a system-immanent compliance with GSM thus simplifying the interworking with GSM, enabling the adoption of further improvements in GSM without the need of changing the SMS protocol in PSTN/ISDN and enabling the use of existing GSM SMS infrastructure also for SMS in PSTN/ISDN.

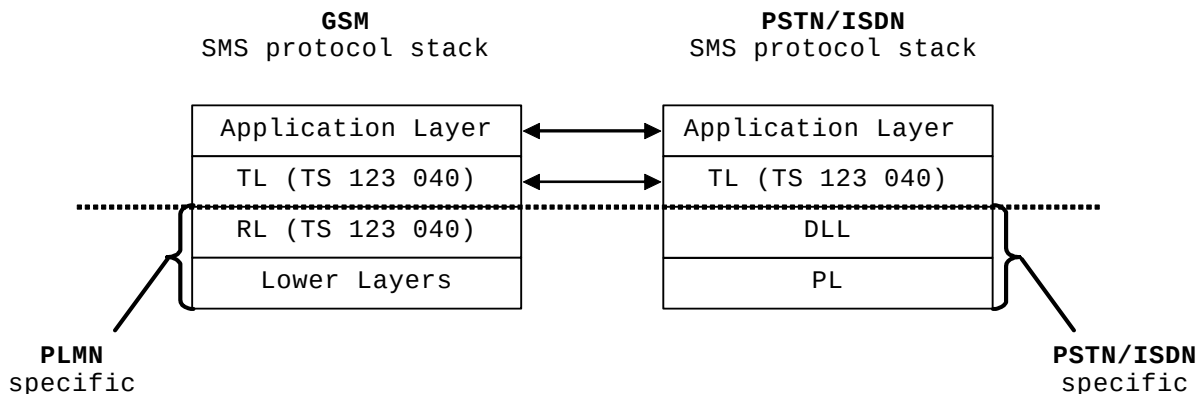


Figure 4: Relationship between SMS protocol stacks for GSM and for PSTN/ISDN as defined by protocol 1

- The Transfer Layer is used as described by the corresponding GSM specifications TS 123 040 [2] and TS 124 011 [3]. The default character set is used as defined in TS 123 038 [1].
- The requirements for the Data Link Layer (DLL) are specified by the present document.
- The Physical Layer requirements are described in EN 300 659-2 [5] for the FSK transmission function and ES 200 778-2 [7] for the FSK receiving function.

NOTE: EN 300 659-2 [5] and ES 200 778-2 [7] are defined for data transmission from PSTN/ISDN's Local Exchange to a TE. Nevertheless, the physical layer requirements defined in these standards apply to SMS transfer over PSTN/ISDN.

5.2 Interworking between SM entities and PSTN/ISDN

The basic requirement to transmit SM information via the PSTN/ISDN is a circuit switched connection between the involved SM entities (SM-TE and SM-SC). After the connection has been established, it makes no difference whether the SM-TE is connected to the PSTN or to the ISDN.

5.2.1 SM Submission from SM-TE to SM-SC

To establish a circuit-switched connection to the SM-SC, the SM-TE seizes the line and dials the number of the SM-SC. If the SM-TE is connected to a PSTN, it uses the pulse or tone (DTMF) dialling method. In case of ISDN access, the dialling information is transmitted to the network via D-Channel messages.

After the call has been answered by the SM-SC, the connection is ready for SM transfer between SM-TE and SM-SC and the SM-SC initiates the data transfer by sending the appropriate Data Link Layer message (DLL_SMS_EST).

For the case that there are more than one Short Message entities connected to the same destination subscriber line (e.g. two or more SM-TEs or a SM-TE containing two or more SMEs which may be assigned to different users), the sending user (GSM or PSTN/ISDN) can address the destined SME/user (PSTN/ISDN) by adding the respective destination SME Subaddress (one digit ranging from "0" to "9") at the end of the destination phone number.

The complete destination address information will then be transmitted within the GSM TL protocol parameter "Destination Address". The sending PSTN/ISDN user's SME Subaddress is transferred to the SM-SC within the SM submission call (see clause 5.5.7 for details). When delivering a SM, the SM-SC transmits the complete address of the sending user (originating phone number and originating SME Subaddress) within the GSM TL protocol parameter "Originating Address".

NOTE 1: This subaddressing is also possible when exchanging SM with GSM users, including the possibility of immediate reply from GSM to PSTN/ISDN including SME Subaddress.

NOTE 2: Because of different purposes, the subaddressing as described by the present document does not correspond to the subaddressing as defined by TS 123 040 [2]. Both are different mechanisms that just share the same name due to historical reasons.

It is up to the fixed network SM-SC to define the supported subaddress range and a default subaddress value which is used if no subaddress is specified by the sending user (e.g. "0") If the SM-SC does not support the subaddressing of Short Message Entities, it may ignore the destination SME Subaddress digit.

Besides this SME subaddressing service, which allows the addressing of different SM-TEs and SMEs/users connected to one subscriber line, the SM-SC may also provide the user the possibility to define password- or PIN-protected SMS mailboxes within the SM-SC. The application may access these mailboxes via appropriate hash codes, as usual in GSM.

All information between the entities is transmitted in the voice band using a FSK signalling in compliance with the ETSI specifications EN 300 659-2 [5] and ES 200 778-2 [7].

The following sequence chart (see figure 5) describes in principle the establishing of the circuit switched connection and the first steps to submit a SM from a SM-TE to a SM-SC.

A more detailed description of the interworking between the call control and the in-band protocol to transmit Short Messages from SM-TE to SM-SC and vice versa is given in annex A.

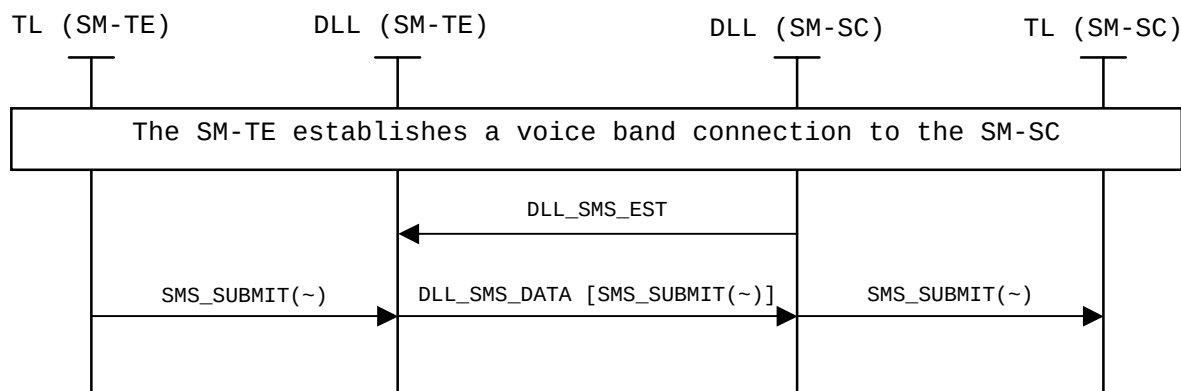


Figure 5: Establishment of the data link between SM-TE and SM-SC to submit a SM from the SM-TE to the SM-SC via a voice band connection (basic principle)

5.2.2 SM Delivery from SM-SC to SM-TE

To deliver a SM to the designated SM-TE, the SM-SC calls the SM-TE's subscriber line. The SM-TE interprets the received calling party number as depicted in figure 6 to identify the SM-SC and to decide how to handle the call. To enable this interpretation, one or more SM-SC numbers are stored in the memory of the SM-TE.

If the sequence of Basic SM-SC Number and Called SME Subaddress is equal to the respective values stored in the SM-TE, the incoming call is bearing a Short Message for this terminal. In this case, the terminal evaluates the Deliver Mode Identifier to decide whether to accept the call or to call back the SM-SC some seconds later for SM delivery. See clause 5.5 for details.

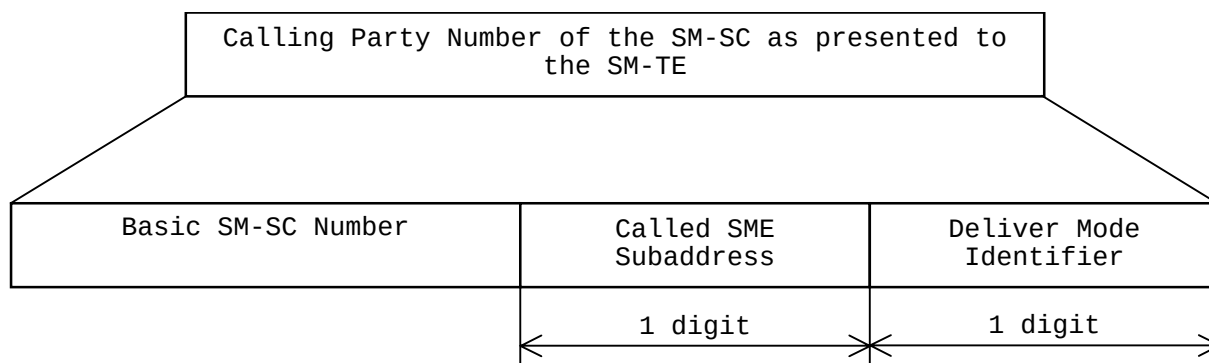


Figure 6: Interpretation of the Calling Party Number provided to the SM-TE

The Deliver Mode Identifier permits the SM-SC two possibilities to initiate a connection between the SM-SC and the SM-TE to deliver a SM to the SM-TE. The difference between these two possibilities is the billing of the costs of the connection.

The first option is that the SM-TE answers the call from the SM-SC after the caller ID of the SM-SC has been transmitted and evaluated. In this case the costs of the connection are charged for the SM-SC.

The second option is that the SM-SC terminates the call after a short time. This time shall guarantee that the SM-SC's caller ID has been transmitted to the SM-TE by the PSTN/ISDN. Using this option, the SM-TE does not answer calls from the SM-SC. After the call has been terminated, the SM-TE generates a call back to the SM-SC to receive the SM. In this case the costs of the connection are charged for the SM-TE.

The decision which Deliver Mode is used depends on the result of the evaluation of the received caller ID. See clause 5.5.6 for details.

5.3 Protocol architecture

5.3.1 Physical Layer

The Physical Layer provides a service to the Data Link Layer. This service enables the transfer of Data Link Layer messages via the voice band.

Every signalling between the SM-TE and the SM-SC is carried out in the voice band using a bi-directional, half duplex 1 200 Baud FSK modulation. The Physical Layer requirements are described in EN 300 659-2 [5] for the FSK transmission function and ES 200 778-2 [7] for the FSK receiving function.

The entity which answers an incoming call shall send the first FSK-frame to the entity which initiated the call.

The beginning of an SM submission (SM transfer from SM-TE to SM-SC) is depicted in figure 7 as an example. After the call has been established by the SM-TE and answered by the SM-SC, the first FSK frame (an SMS connection establish message) is sent out from the SM-SC to the SM-TE. The SM-TE responds with a second FSK frame which carries the SM data.

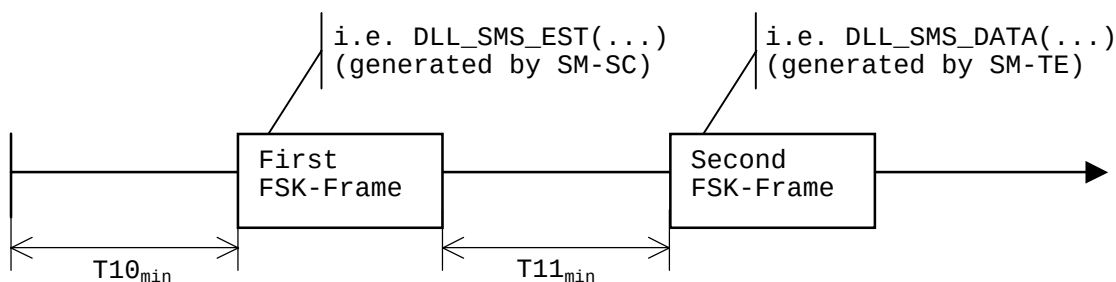


Figure 7: Timing diagram for a SM-TE originated call

To ensure that all involved network elements are in a state that permits the FSK information to be transmitted properly, a minimum delay time (T10) between the accepting of the call and the sending of the first FSK-Frame shall be kept by the answering entity. The minimum length of this delay shall be:

$$T10_{\min} = n \times 100 \text{ ms}; \quad n = 1 \text{ to } 256$$

The integer value n shall be defined by the network operator.

Due to the used half duplex communication via a network in which echo-suppressors or echo-cancellers may be active, a minimum delay time between two successive FSK frames of:

$$T11_{\min} = 100 \text{ ms}$$

shall be kept (ITU-T Recommendation V.25 [8]). This value takes in consideration the network echo suppressor suppression hangover time.

5.3.2 Data Link Layer

5.3.2.1 Overview

The Data Link Layer (SM-DLL) provides a service to the SM-TL. This service enables the SM-TL to send and receive messages from its peer entity. The SM-DLL is responsible for providing bit error detection capability and for prepending the Mark Signal to the SM-TL layer message. It also controls the response time of the peer entity.

The maximum payload of one Data Link Layer message is corresponding to the maximum message length of the Transfer Layer, which is 176 bytes. In case of future Transfer Layer messages larger than 176 byte the Data Link Layer shall segment these messages using the mechanism of extension bits in the message type coding.

NOTE: See clause 5.3.3.1 for information about the Transfer Layer, TL Message lengths and TL features like the Short Message Concatenation which allows the transfer of "long" SMs with up to 39 015 characters.

The Data Link Layer message format is similar to the message format of the off-hook caller ID information described in EN 300 659-2 [5].

The message format is depicted in figure 8.

Mark Signal	Message Type	Message Length	Payload (Transfer Layer Message)	Check-sum
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Figure 8: Data Link Layer message structure

Mark Signal:

The mark signal shall consist of a block of 80 mark bits $\pm$ 25 mark bits. It serves to synchronize the FSK receiver of the receiving entity. It shall be sent in both directions (from SM-TE to SM-SC and vice versa).

Message Type (1 octet):

The message type octet contains a binary encoded value to identify the message. The most significant bit of the message type octet is used as extension bit. If this bit is set to "0", the payload (a Transfer Layer message) carried by the current Data Link Layer message is segmented and one or more Data Link Layer messages will follow to complete the payload. If this bit is set to "1" the carried payload (a Transfer Layer message) is complete. The Message Type codes are defined in table 1.

Table 1: Message Type (for extension bit "x" see clause 5.3.2.1)

Message Type	Code (hex)	Code (bin)	Description	Remarks (informative): Corresponding GSM RL message (TS 123 040 [2])
DLL_SMS_DATA	11 h	x001 0001b	Carries SM data.	RP-MO-DATA RP-MT-DATA
DLL_SMS_ERROR	12 h	x001 0010b	Indicates that a Data Link Layer error has occurred. See table 2 for details.	none
DLL_SMS_EST	13 h	x001 0011b	Indicates that the Data Link Layer connection has been established.	none
DLL_SMS_REL	14 h	x001 0100b	Indicates the release of the Data Link Layer connection.	none
DLL_SMS_ACK	15 h	x001 0101b	Carries a positive SM acknowledgement.	RP-ACK
DLL_SMS_NACK	16 h	x001 0110b	Carries a negative SM acknowledgement.	RP-ERROR

Message length (1 octet):

The message length octet contains the binary encoded number of octets of the Data Link Layer message (excluding the message type, message length and checksum octets). The maximum message length is 176 octets.

Checksum (1 octet):

The checksum octet shall contain the two's complement of the modulo 256 sum of all the octets in the message starting from the message type octet up to the end of the message (excluding the checksum itself).

In order to avoid corruption of the checksum by premature cessation of transmission, the Stop bit following the checksum should be followed by an additional one to ten Mark bits.

5.3.2.2 Error Handling

In case of an error (a wrong checksum, an unknown message type etc.), the Data Link Layer of the receiving entity sends a message with the message type "DLL_SMS_ERROR" to the sending entity. This message contains one parameter which specifies the error. The message length of this message is set to 1. The error causes are defined in table 2.

Table 2: Error causes for DLL_SMS_ERROR

Error Code (bin)	Description
0000 0001 b	Wrong checksum
0000 0010 b	Wrong message length
0000 0011 b	Unknown message type
0000 0100 b	Extension mechanism not supported
1111 1111 b	Unspecified error cause

The Data Link Layer of the sending entity has to repeat the last message. If a message is confirmed negative for two times, the connection shall be released by both entities.

5.3.2.3 Timer

The response to the DLL message is controlled by the SM-DLL timer located at the initiator of the message. The Timer value shall be:

$$T_{12} = 4\ 000\ \text{ms}$$

If the timer expires, the connection shall be released by the sending entity.

5.3.3 Transfer Layer**5.3.3.1 Overview**

The Short Message Transfer Layer (SM-TL) provides a service to the Short Message Application Layer (SM-AL). The SM-AL is out of the focus of the present document. This service enables the SM-AL to transfer Short Messages to its peer entity, receive Short Messages from its peer entity and receive reports about earlier requests for short messages to be transferred.

The SM-TL is used as specified by TS 123 040 [2].

NOTE: Besides the basic SM transfer, the TL specified in TS 123 040 [2] also supports features like message concatenation allowing the transfer of "long" SMs with up to 39 015 characters, and is open to support new features like transfer of bitmaps, melodies, text styles and much more.

Because of the half duplex handshake transmission on the Physical Layer, every SMS_SUBMIT, SMS_DELIVER, SMS_COMMAND and SMS_STATUS_REPORT message shall be confirmed by the receiver. A detailed description of the message flow and the internal structures of the Transfer Layer are given in the annex A.

The maximum message length of a Transfer Layer protocol message is 176 octets (SMS_STATUS_REPORT), nevertheless providing the possibility to transfer of "long" SMs as mentioned above.

5.3.3.2 Error handling

In case of a negative confirmation (SMS_DELIVER_REP or SMS_SUBMIT_REP with negative content, e.g. "memory full"), the connection between the SM-TE and the SM-SC may be released by the receiver of the error message.

5.3.3.3 Timer

The Transfer Layer contains a timer to control connection establishment by the CM. The value of the Transfer Layer timer depends on the network characteristic and is out of the focus of the present document.

5.4 Requirements to the gateway

The gateway is the interface between the PSTN/ISDN and the SM-SC. The gateway has to establish and to terminate the Physical Layer connection between the environment of the SMS-provider and the network. After installation of the connection the gateway is circuit switched connected with the SM-TE.

The gateway shall support the message format of the Physical and Data Link Layer defined in the present document.

5.5 Requirements to the Short Message Terminal Equipment

SMS in the PSTN/ISDN will only be supported by SM-TE designed for this feature. This clause describes the main requirements to the SM-TE that have to be met to support SMS in the PSTN/ISDN.

5.5.1 SM-SC Phone numbers

For each Short Message Service Provider supported by the SM-TE the SM-TE shall be able to store at least one SM-SC number including one SME Subaddress digit. If a SM-TE contains more than one SME, the SM-TE shall provide the possibility to store one SME Subaddress value for each SME contained in the SM-TE.

The SM-SC number stored in the SM-TE is used in two cases. First, it is used for connection setup from the SM-TE to the SM-SC to submit SM-TE originated SM. Second, it is used to identify an incoming call from the SM-SC to the SM-TE to deliver SM-TE terminated SM.

The SME Subaddress values are used to allow the addressing of a Short Message to a specific SM-TE or SME contained in a SM-TE on one subscriber line. The SM-TE may protect the user's access to received SMs depending on the SME Subaddress the respective SM was received with, i.e. via PIN code.

To decide if the incoming call is a call from a known SM-SC and how to handle the incoming call, the SM-TE shall be able to detect the received caller ID and to evaluate if the received caller ID equals a known SM-SC number.

Furthermore, it shall be able to establish the value of the Called SME Subaddress and the Deliver Mode Identifier (see figure 6).

The SM-TE shall only process calls from the SM-SC if the Called SME Subaddress is equal to one of the values stored in the SM-TE. Depending on the value of the Deliver Mode Identifier, the SM-TE shall accept the call or call back the SM-SC some seconds later.

See clause 5.2.2 for more details.

5.5.2 Ringing suppression

SM-TE that support SMS in the PSTN/ISDN may not ring if called by the SM-SC.

SM-TE that are connected to the PSTN may suppress the first ringing cadence if the PSTN transmits the caller ID information between the first and the second ringing cadence. If the received caller ID information is equal to the number of the SM-SC, the SM-TE should suppress all following ringing cadences, too. If not, the SM-TE should start to ring with the second ringing cadence.

If the PSTN transmits the caller ID information prior to the first ringing cadence, the SM-TE should begin to ring with the first ringing cadence, if the caller ID is not equal to the number of the SM-SC.

SM-TE with ISDN access receive the caller ID information within the D-channel setup message. This type of SM-TE can immediately decide how to handle the incoming call.

5.5.3 SMS memory full

If the SMS memory of the SM-TE is full, the SM-TE shall only pick up calls from the SM-SC if the Deliver Mode Identifier equals "0". In this case, the SM-TE shall respond with a negative Deliver Report (see TS 123 040 [2] for details).

In all other cases (Deliver Mode Identifier equal to "1" to "9"), the SM-TE shall not accept the incoming call. If the Deliver Mode Identifier is not equal to "1" but equal to "2" to "9", the SM-TE may generate a return call after the user has deleted one or more Short Messages. In this case, the SM-TE shall restrict the time between the call from the SM-SC and the return call to the SM-SC. If it is not possible to call the SM-SC back during this time, the SM-TE shall delete the information about the call from the SM-SC. After a timeout the SM-SC may call the SM-TE again.

See table 3 in clause 5.5.6 for more information.

5.5.4 SM-TE busy

In some cases, for example if the SM-TE is busy on an external call, the SM-TE may not be able to accept calls from the SM-SC. If the SM-TE receives an information about this call (by off hook caller ID or by ISDN D-Channel information) the SM-TE shall only generate a return call to the SM-SC later on, if the Deliver Mode Identifier was not equal to "0" and "1". In this case the SM-TE shall restrict the time between the call from the SM-SC and the return call to the SM-SC. If it is not possible to call the SM-SC back during this time, the SM-TE shall delete the information about the call from the SM-SC.

If the SM-TE does not accept the call, the SM-SC shall call the SM-TE again on to complete the call. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible. See table 3 in clause 5.5.6 for more information.

5.5.5 Calling Line Identification Restriction (CLIR)

Depending on its network access, the SM-SC may (e.g. ISUP connection or ISDN with override category. See EN 300 090 [10]) or may not be able (e.g. ISDN connection without override category. See EN 300 090 [10]) to identify the caller in case of CLIR active.

In the latter case, the SM-SC shall proceed as follows if CLIR is activated by the SM-TE:

- If the SM-TE attempts to submit an SM, the SM-SC shall accept the call and proceed as in normal case, but shall reject the SM with a negative SUBMIT_REPORT (TP-FCS = 0xE0).
- If the SM-TE attempts to collect an SM from the SM-SC (the SM-TE shall call the SM-SC using the SM-SC number extended by the Deliver Mode Identifier that was received at a prior call from the SM-SC), the SM-SC shall not accept the call.

Independent on the network access of the SM-SC and the state of CLIR on the user's subscriber line, the Service Provider may offer the user the possibility to decide whether the originator's CLI shall be forwarded to the destination user as originating address or if this address shall be masked. As in GSM, the Service Provider may define an appropriate hash code to enable this function.

5.5.6 Handling of Incoming Calls bearing SM

The SM-TE shall only process calls from the SM-SC if the Called SME Subaddress value is equal to the SME Subaddress value stored in the SM-TE. Table 3 gives an overview, how the SM-TE shall handle these incoming calls.

If the Called SME Subaddress value does not match the SME Subaddress value stored in the SM-TE, the incoming call shall not be processed, answered or signaled by the SM-TE.

Table 3: Overview how the SM-TE shall handle incoming calls dependent on its operation state

State of the SM-TE	Incoming Call, Deliver Mode Identifier = 0	Incoming Call Deliver Mode Identifier = 1	Incoming Call Deliver Mode Identifier = 2..9
Idle; Sufficient memory for at least one SM	The SM-TE shall accept the call.	The SM-TE shall accept the call.	SM-TE shall not accept the call. It shall call back the SM-SC after the end of the call.
Idle; Not sufficient memory for at least one SM	The SM-TE shall accept the call and reject the SM with the TL message SMS_DELIVER_REPORT, failure cause "SIM SMS storage full" (see TS 123 040 [2], TP-FCS).	SM-TE shall not accept the call. The SM-SC shall call the SM-TE again later.	SM-TE shall not accept the call. The SM-SC shall call the SM-TE again later. The SM-TE may call back the SM-SC after sufficient memory becomes available.
Busy; No off-hook CLIP received/supported	The SM-TE does not realize that the current incoming call is established by the SM-SC. Therefore, it cannot accept the call. The SM-SC shall call the SM-TE again later. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible.		
Busy; Off-hook CLIP received/supported	SM-TE shall not accept the call. The SM-SC shall call the SM-TE again later. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible.	SM-TE shall not accept the call. The SM-SC shall call the SM-TE again later. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible.	SM-TE shall not accept the call. The SM-SC shall call the SM-TE again later. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible. The SM-TE may call back the SM-SC after it gets into the idle state.

5.5.7 Outgoing calls

If there is a SM to submit or to collect, the SM-TE may watch the external line for availability to ensure that submission or collection of the SM takes place as soon as possible. After the external line becomes available, the SM-TE should seize the line and call the SM-SC. The user may also be able to manually initiate the call to the SM-SC.

If there is an SM to submit, the SM-TE shall dial the basic number of the SM-SC which is stored in the SM-TE, extended by its own SME Subaddress and the digit "0".

If there is a SM to collect (the SM-TE has formerly received a call from the SM-SC with a Deliver Mode Identifier = 2..9), the SM-TE shall dial the number of the SM-SC extended by its own SME Subaddress and the formerly received Deliver Mode Identifier.

If a connection to the SM-SC could not be established at the first attempt, the SM-TE may make some further attempts before the submission is considered to be failed.

5.6 Extensions to the cited GSM standards

For the implementation of SMS for PSTN/ISDN, some additional Failure Causes are defined. These Failure Causes are transmitted within the parameter "TP-FCS" in the SUBMIT_REPORT and DELIVER_REPORT Messages defined in TS 123 040 [2]. In detail, these additional Failure Causes are:

Table 4: Additional Failure Causes (see TS 123 040 [2] for further Failure Causes)

TP-FCS Value (hex)	Meaning	When used	
		SM-TE-O	SM-TE-T
E0 to FE	Values specific to an application.	x	x
E0	Unknown SM-TE (transmission of the SM-TE Calling Line Identification is restricted).	x	
E1 (obsolete)	User Data with User Data Header not supported (Header Indicator = 1 not supported). See note.	x	x

NOTE: The Failure Cause "E1" is obsolete and should therefore not be used any more.

6 Protocol 2

6.1 Overview

This clause describes the connection establishments for the SM submission and delivery phase and the requirements for the layers of Protocol 2.

The Transfer Layer of Protocol 2 provides a complete set of parameters to support features related to the PSTN/ISDN environment (e.g. concerning the privacy aspects) and allows the transfer of a long SM text within the same TL message. It is also open to future extensions simply obtained by adding new parameters and info messages.

The Data Link Layer provides a reliable transport of Transfer Layer messages retransmitting the segments of the message which contain errors or have been lost.

The Physical Layer requirements are described in EN 300 659-2 [5] for the FSK transmission function and ES 200 778-2 [7] for the FSK receiving function.

NOTE: EN 300 659-2 [5] and ES 200 778-2 [7] are defined for data transmission from PSTN/ISDN's Local Exchange to a TE. Nevertheless, the physical layer requirements defined in these standards apply to SMS transfer over PSTN/ISDN.

6.2 Interworking between SM entities and PSTN/ISDN

The basic requirement to transmit SM information via the PSTN/ISDN is a circuit switched connection between the involved SM entities (SM-TE and SM-SC). After the connection has been established, it makes no difference whether the SM-TE is connected to the PSTN or to the ISDN.

6.2.1 SM Submission from SM-TE to SM-SC

To establish a circuit-switched connection to the SM-SC, the SM-TE seizes the line and dials the number of the SM-SC. If the SM-TE is connected to a PSTN, it uses the pulse or tone (DTMF) dialling method. In case of ISDN access, the dialling information is transmitted to the network via D-Channel messages.

After the call has been answered by the SM-SC, the connection is ready for SM transfer between SM-TE and SM-SC and the SM-SC initiates the data transfer by sending the appropriate Data Link Layer message (DLL_SMS_EST).

All information between the entities is transmitted in the voice band using a FSK signalling in compliance with the ETSI specifications EN 300 659-2 [5] and ES 200 778-2 [7].

The following sequence chart (see figure 9) describes in principle the establishing of the circuit switched connection and the first steps to submit a SM from a SM-TE to a SM-SC.

A more detailed description of the interworking between the call control and the in-band protocol to transmit Short Messages from SM-TE to SM-SC and vice versa is given in annex B.

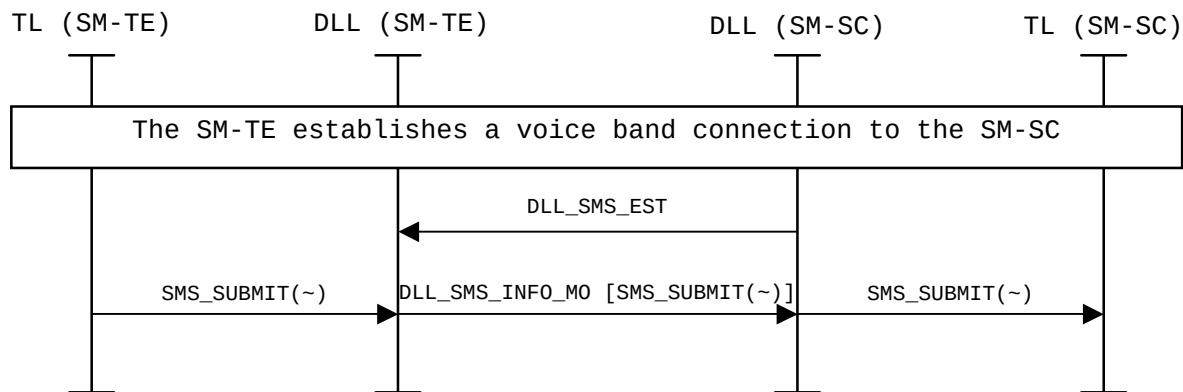


Figure 9: Establishment of the data link between SM-TE and SM-SC to submit a SM from the SM-TE to the SM-SC via a voice band connection (basic principle)

6.2.2 SM Delivery from SM-SC to SM-TE

The selected SM-TE answers the call from the SM-SC after the caller ID of the SM-SC has been received and evaluated.

In case that more than one Short Message entities are connected to the same destination subscriber line (e.g. two or more SM-TEs or a SM-TE containing two or more SMEs), the decision which SME shall answer the call depends on the result of the comparison of the received caller ID with both the stored calling number of the SM-SC in the SM-TE and with the stored SME Subaddress. The received caller ID will be interpreted by the SME as depicted in figure 10. The last digit of the received caller ID serves as Called SME Subaddress, the preceding digits serve to identify the SM-SC.

The SME Subaddress range is from 1 to 9; the default value is 1. The 0 value is reserved for future aims.

After the call has been answered by the SM-TE, the data link shall be established in the same way as described in clause 6.2.1 (the only difference is that in this case is the SM-TE that initiates the data transfer by sending the appropriate Data Link Layer message (DLL_SMS_EST)).

Optionally the SM-TE may receive more messages during the same call.

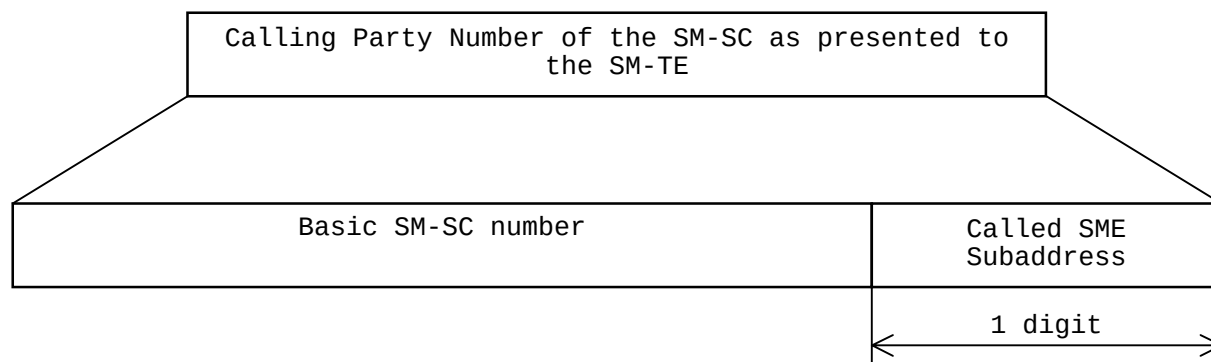


Figure 10: Interpretation of the Calling Party Number provided to the SM-TE

6.3 Protocol architecture

6.3.1 Physical Layer

The Physical Layer provides a service to the Data Link Layer. This service enables the transfer of Data Link Layer messages via the voice band.

Every signalling between the SM-TE and the SM-SC is carried out in the voice band using a bi-directional, half duplex 1 200 Baud FSK modulation. The Physical Layer requirements are described in EN 300 659-2 [5] for the FSK transmission function and ES 200 778-2 [7] for the FSK receiving function.

The entity which answers an incoming call shall send the first FSK-frame to the entity which initiated the call.

The beginning of an SM submission (SM transfer from SM-TE to SM-SC) is depicted in figure 11 as an example. After the call has been established by the SM-TE and answered by the SM-SC, the first FSK frame (an SMS connection establishment message) is sent out from the SM-SC to the SM-TE. The SM-TE responds with a second FSK frame which carries the SM data.

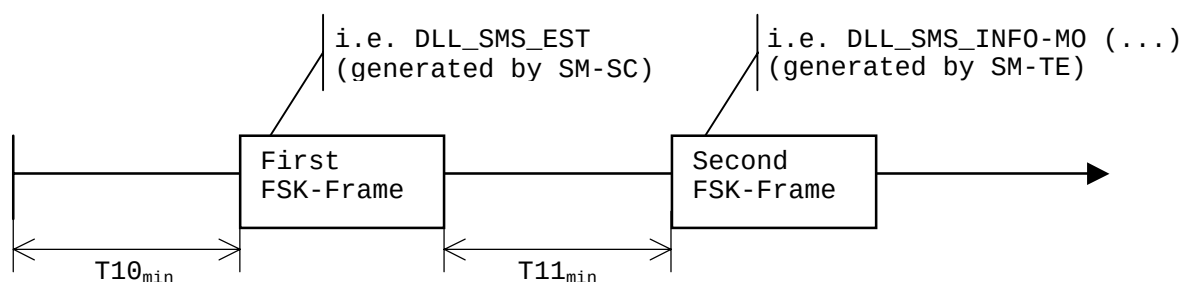


Figure 11: Timing diagram for a SM-TE originated call

To ensure that all involved network elements are in a state that permits the FSK information to be transmitted properly, a minimum delay time (T10) between the accepting of the call and the sending of the first FSK-Frame shall be kept by the answering entity. The minimum length of this delay shall be:

$$T10_{\min} = n \times 100 \text{ ms}; \quad n = 1 \text{ to } 256$$

The integer value n shall be defined by the network operator.

Due to the used half duplex communication via a network in which echo-suppressors or echo-cancellers may be active, a minimum delay time between two successive FSK frames of:

$$T11_{\min} = 100 \text{ ms}$$

shall be kept (ITU-T Recommendation V.25 [8]). This value takes in consideration the network echo suppressor suppression hangover time.

6.3.2 Data Link Layer

6.3.2.1 Overview

The Data Link Layer (SM-DLL) provides a service to the SM-TL. This service enables the SM-TL to send and receive messages from its peer entity. The SM-DLL is responsible for providing bit error detection capability and for prepending the Channel Seizure and Mark Signal to the SM-TL layer message. It also controls the response time of the peer entity.

The maximum payload of one Data Link Layer message is 255 bytes. In case of a Transfer Layer message larger than this value the Data Link Layer shall segment this message using the mechanism of extension bits in the message type coding.

The Data Link Layer message format is similar to the message format described in the document EN 300 659-1 [4].

The message format is depicted in figure 12.

Channel Seizure	Mark Signal	Message Type	Message Length	Payload (Transfer Layer Message)	Check-sum
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Figure 12: Data Link Layer Message Structure

Channel Seizure:

The Channel Seizure shall consist of 300 alternating "Space" and "Mark" bits, starting with a "Space". It shall be sent in both directions (from SM-TE to SM-SC and vice versa).

Mark Signal:

The mark signal shall consist of a block of 80 mark bits $\pm$ 25 mark bits. It shall be sent in both directions (from SM-TE to SM-SC and vice versa).

Message Type (1 octet):

The message type octet contains a binary encoded value to identify the message. The most significant bit of the message type octet can be used as extension bit. If this bit is set to "1", the payload (a Transfer Layer message) carried by the current Data Link Layer message is segmented and one or more Data Link Layer messages will follow to complete the payload. If this bit is set to "0" the carried payload (a Transfer Layer message) is complete. The Message Type codes are defined in table 5.

Table 5: Message Type (for extension bit "x" see clause 6.3.2.1)

Message Type	Code (hex)	Code (bin)	Meaning and use
DLL_SMS_EST	-	-	Response: to establish the Data Link layer (slave to master) Optionally the slave SM-TE may establish the Data Link Layer by sending a DLL_SMS_ACK0 transporting the SM-TE CAPABILITY message
DLL_SMS_INFO-MO	10 h	x001 0000b	Info: to transport SMS_SUBMIT messages (SM-TE to SM-SC)
DLL_SMS_INFO-MT	11 h	x001 0001b	Info: to transport SMS_DELIVERY or SMS_STATUS_REP messages (SM-SC to SM-TE)
DLL_SMS_INFO-STA	12 h	x001 0010b	Info: to transport SM-TE_STATUS messages (SM-TE to SM-SC)
DLL_SMS_NACK	13 h	0001 0011b	Response: to give a negative acknowledgement for a received DLL frame
DLL_SMS_ACK0	14 h	x001 0100b	Response: to give a positive acknowledgement for a received even DLL frame. Also used to transport SMS_SUBMIT_REP (SM-SC to SM-TE) or SMS_DELIVERY_REP (SM-TE to SM-SC) messages
DLL_SMS_ACK1	15 h	x001 0101b	Response: to give a positive acknowledgement for a received odd DLL frame. Also used to transport SMS_SUBMIT_REP (SM-SC to SM-TE) or SMS_DELIVERY_REP (SM-TE to SM-SC) messages
DLL_SMS_ENQ	16 h	0001 0110b	Enquire: to recover a transmission error or to maintain active the Data Link layer
DLL_SMS_REL	17 h	0001 0111b	Command: Release request

In the communication between the SM-TE and the SM-SC the caller entity is the Master (i.e. the one which sends the messages and receives the acknowledgements) while the called entity is the Slave (i.e. the one which receives the messages and sends back the acknowledgements). The "Sliding Window" protocol is used (with single window and module-2 message numbering). The first acknowledgement to a received message is DLL_SMS_ACK1. For the timing requirements see table 6.

The Slave, after having answered the call, will send a "Link established message" to the Master.

The "Link Established Message" (DLL_SMS_EST) is a Null Message (i.e. only Channel Seizure followed by the Mark Signal).

Optionally the SM-TE may establish the Data Link Layer by sending a DLL_SMS_ACK0 transporting the SM-TE CAPABILITY message. If the Data Link Layer is established by the DLL_SMS_EST, the SM_SC will assume the default SM-TE capabilities (see clause B.2.2.17).

The DLL_SMS_NACK, DLL_SMS_ENQ and DLL_SMS_REL messages do not have a Transfer Layer (DLL Message Length = 0) and therefore cannot be segmented.

The Transfer Layer of the DLL_SMS_ACK0 and DLL_SMS_ACK1 messages can either be present or not.

The Info messages (DLL_SMS_INFO-x) have always a Transfer Layer.

After having received an info message the Slave shall reply back to the Master by sending a positive (DLL_SMS_ACKx) or negative (DLL_SMS_NACK) acknowledgement.

The Slave shall use DLL_SMS_ACK1 for acknowledging odd frames and DLL_SMS_ACK0 for even frames.

The Slave shall include the TL Confirmation or Rejection in the payload of the DLL_SMS_ACKx message, as soon as available (after having received the complete TL message).

Should be the TL response not available, the Slave shall reply with a DLL_SMS_ACKx message with null payload when the proper timer expires.

The Master uses the DLL_SMS_ENQ message to maintain active the DLL while waiting for the reception of a response from the TL, for a maximum of Nwait+1 times (afterwards, if also the Nwait+1 DLL_SMS_ENQ message is acknowledged by the Slave with a DLL_SMS_ACKx message with null payload, the Master shall send the DLL_SMS_REL message or hang on).

On receiving a DLL_SMS_ENQ, the Slave shall send again the last positive acknowledgement sent, including the TL response in its payload, if available.

The Master also uses the DLL_SMS_ENQ message to recover a transmission error of an Info message due to loss of frame - the reply sent by the Slave lets the Master understand if the Info message or the DLL Response was lost.

The DLL_SMS_ENQ is not used to require the retransmission of a DLL Response message sent in reply to a Command message. In this case the Master shall send again the Command message Nretry times before disconnecting (see table 8).

The DLL_SMS_REL is used to initiate the disconnection procedure. In case that the first DLL_SMS_REL message sent by the Master is followed by another one or two others, the slave shall answer to each message with the same ACK-x used for the first DLL_SMS_REL of that sequence.

Message length (1 octet):

The message length octet contains the binary encoded number of octets of the Data Link Layer message (excluding the message type, message length and checksum octets). The maximum message length is 255 octets.

Checksum octet (1 octet):

The checksum octet shall contain the two's complement of the modulo 256 sum of all the octets in the message starting from the message type octet up to the end of the message (excluding the checksum itself).

In order to avoid corruption of the checksum by premature cessation of transmission, the Stop bit following the checksum should be followed by an additional one to ten Mark bits.

6.3.2.2 Error handling

In case of a DLL error (i.e. a bad checksum or an unknown message type), the Slave will send the DLL_SMS_NACK in reply to the Master that will send again the previous message (see also Nretry counter in table 8).

In case the Master does not receive the expected acknowledgement (loss of frame) it sends the DLL_SMS_ENQ message to recover the error. Depending on the DLL_SMS_ACKx received the Master will understand if the frame lost was the message previously sent or the correspondent acknowledgement.

In case the Master receives an out of sequence acknowledgement (i.e. a DLL_SMS_ACK0 when a DLL_SMS_ACK1 is expected or vice versa), it shall release the connection (hanging on).

The connection shall be released by the Master if the error is still present after two consecutive recovery attempts (see Nretry counter in table 8).

6.3.2.3 Timers and Response Time

Table 6 shows the Timers related to the Data Link Layer.

Table 6: Timers

Timer	Description	Start	Stop	Action at the timer expiry	Duration ±10 % (ms)	Application
Tm1	Maximum waiting time for receiving an acknowledgement message from the Slave.	End of the Info message transmission.	Acknowledgement reception.	Sending of a DLL_SMS_ENQ message.	800	Master
		End of the Command message transmission.		Sending again of the last Command message.		
Tm2	Maximum waiting time for receiving a message from the Master.	End of the transmission of the "Link Established Message" or of an acknowledgement.	Message reception.	Hanging on.	7 600	Slave
Tm3	Maximum waiting time for receiving the "Link Established Message".	End of the dialling phase.	"Link Established Message" reception.	Hanging on.	7 500	Master
Tm4	Waiting time for hanging on after a release request.	Acknowledgement of a DLL_SMS_REL message.	DLL_SMS_REL message reception.	Hanging on.	3 500	Slave
Tm5	Waiting time for sending a DLL_SMS_ENQ message to maintain active the Data Link level.	Reception of a positive acknowledgement without TL corresponding to a non extended info message (or to the last segment of an extended info message) or to a DLL_SMS_ENQ message sent to maintain active the Data Link layer.	Reception of a DLL_SMS_ACK-x with TL.	Sending of a DLL_SMS_ENQ message.	800	Master
Tm6	Waiting time before sending a positive acknowledgement without TL payload.	Transfer of the received payload to TL.	TL Response available (see note 1).	Sending of DLL_SMS_ACK-x without TL payload.	200	Slave
Tm7	Waiting time for forcing the disconnection procedure.	Transfer of the DLL_SMS_ACK-x message to the TL.	Request of sending a message from the TL.	Hanging on.	3 500	Master

Table 7: Response time

Time	Description	Start	Value (ms)	Application
T1	Timeout for sending an acknowledgement to the received message.	End of the reception of a message.	200	Slave
T2	Timeout for sending a message.	End of the reception of the "Link Established Message" or of an acknowledgement.	200 (see note 2).	Master
T3	Timeout for sending the "Link Established Message".	Connection establishment.	n'x100 (see note 3).	Slave

NOTE 1: If the TL Response is available before the Tm6 expiry, the Tm6 shall be stopped and the slave shall send a DLL_SMS_ACK-x containing it. In case the TL response is available after the Tm6 expiry, it shall be inserted in the next DLL_SMS_ACK-x which will be sent in response to the ENQ message coming from the Master.

NOTE 2: In principle shall be T2 smaller than Tm2. However, the reported preferred value is defined in order to optimize the service efficiency.

NOTE 3: n' shall be an integer value defined by the network operator and so that T3 shall be greater than T10_{min} (clause 6.3.1) and smaller than Tm3.

6.3.2.4 Counters

Table 8 applies:

Table 8: Counters

Name	Description	Value
Nretry	Maximum number of times a message negatively acknowledged shall be sent again. Maximum number of times a DLL_SMS_ENQ message or a DLL_SMS_REL message not receiving any DLL message in response or receiving an acknowledgement with DLL error shall be sent again.	2
Nwait	Maximum number of times an ENQ message shall be sent again to maintain the Data Link level active, in case there are no errors.	49

6.3.3 Transfer layer

6.3.3.1 Overview

The Short Message Transfer Layer (SM-TL) provides a service to the Short Message Application Layer (SM-AL). The SM-AL is out of the focus of the present document. This service enables the SM-AL to transfer Short Messages to its peer entity, receive Short Messages from its peer entity and receive reports about earlier requests for short messages to be transferred.

The following TL messages are provided:

SMS_SUBMIT	used by the SM-TE for SM submission to the SM-SC
SMS_SUBMIT_REP	used by the SM-SC for reporting to the SM-TE the confirmation or the rejection of the submitted SM
SMS_DELIVERY	used by the SM-SC for SM delivery to the SM-TE
SMS_DELIVERY_REP	used by the SM-TE for reporting to the SM-SC the confirmation or the rejection of the delivered SM
SMS_STATUS_REP	used by the SM-SC to inform the sender of the outcome of a short message at the recipient
SM-TE_STATUS	used by the SM-TE for informing the SM-SC about its new status
SM-TE_CAPABILITY	used by the SM-TE for informing the SM-SC about its capabilities

The SM-TL message has the following structure:

TL Message Length	Parameter #1	Parameter #...	Parameter #n
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The parameters carry the informative elements of the Transfer Layer.

TL Message Length

The TL Message Length (2 bytes) defines the length of the transfer Layer [LSB first, MSB last].

Parameter #x

The parameter format is:

- Parameter name (1 byte)
- Parameter length (2 bytes [LSB first, MSB last])
- Parameter value (> 0 bytes)

The following parameters are provided:

- 10h - Media Identifier (length: 1)
- 11h - Firmware Version (length: 6)
- 12h - SMS Provider Identifier (length: 3)
- 13h - Display Information (max length: 65 535)
- 14h - Date and Time (length: 8)
- 15h - Calling Line Identity (max length: 20)
- 16h - Reason for Absence of CLI (length: 1)
- 17h - Calling Terminal Identity (length: 1)
- 18h - Called Line Identity (max length: 20)
- 19h - Fax Recipient Name (max length: 255)
- 1Ah - Mail Address (max length: 256)
- 1Bh - Called Terminal Identity (length: 1)
- 1Ch - Notify (length: 3)
- 1Dh - Public Key (max length: 5)
- 1Eh - SM-TE Resources (max length: 67)
- 1Fh - Response Type (length: 1)
- 20h - Bearer Capability (max length: 20)
- 21h - Replace Short Message Type (length: 1)
- 22h - Validity-Period (length: 1)
- 23h - Data Information (max length: 65 535)

It is not possible to send more than one parameter of the same type in the same TL message; in this case only the first parameter shall be considered.

The structure of the TL messages and the values related to each parameter type are illustrated in annex B.

6.3.3.2 Error handling

After having received an info message, the TL of the Slave entity shall reply to the Master entity sending a Confirmation Response or a Reject Response depending on error detection.

6.3.3.3 Timer

The Transfer Layer contains a timer to control connection establishment by the CM. The value of the Transfer Layer timer depends on the network characteristic and is out of the focus of the present document.

6.4 Requirements to the gateway

The gateway is the interface between the PSTN/ISDN and the SM-SC. The gateway has to establish and to terminate the Physical Layer connection between the environment of the SMS-provider and the network. After installation of the connection the gateway is circuit switched connected with the SM-TE.

The gateway shall support the message format of the Physical and Data Link Layer defined in the present document.

6.5 Requirements to the Short Message Terminal Equipment

SMS in the PSTN/ISDN will only be supported by SM-TEs designed for this feature. This clause describes the main requirements to the SM-TE that have to be met to support SMS in the PSTN/ISDN.

6.5.1 SM-SC phone numbers

For each Short Message Service Provider supported by the SM-TE the SM-TE shall be able to store at least one SM-SC caller number.

This number is used in two cases. First, it is used for connection setup from the SM-TE to the SM-SC to submit SM-TE originated SM. Second, it is used to identify an incoming call from the SM-SC to the SM-TE to deliver SM-TE terminated SM.

The number used for calling the SM-SC can be different from the one used to answer the SM-SC call.

To decide if the incoming call is a call from a known SM-SC and how to handle the incoming call, the SM-TE shall be able to detect the received caller ID and to evaluate if the received caller ID equals a known SM-SC caller number.

The SM-TE shall answer only if the Called SME Subaddress (see figure 10) matches the value of the SME Subaddress stored in its memory.

6.5.2 Ringing suppression

SM-TE that support SMS in the PSTN/ISDN may not ring if called by the SM-SC.

SM-TE that are connected to the PSTN may suppress the first ringing cadence if the PSTN transmits the caller ID information between the first and the second ringing cadence. If the received caller ID information is equal to the number of the SM-SC, the SM-TE should suppress all following ringing cadences, too. If not, the SM-TE should start to ring with the second ringing cadence.

If the PSTN transmits the caller ID information prior to the first ringing cadence, the SM-TE should begin to ring with the first ringing cadence, if the caller ID is not equal to the number of the SM-SC.

SM-TE with ISDN access receive the caller ID information within the D-channel setup message. This type of SM-TE can immediately decide how to handle the incoming call.

6.5.3 SMS Memory Full

A SM-TE shall reject an incoming message with "Memory Full" cause if it is not able to store it in its memory and shall enter the state of "Memory Full".

In this state it shall continue to answer the incoming call from the SM-SC, as it could be able to receive messages shorter than the rejected one.

Starting from this state and after the deletion by the user of one or more stored message, the SM-TE may notify the SM-SC that memory is available again by sending an info Message (DLL_SMS_INFO-STA).

The SM-SC can call again the SM-TE later.

6.5.4 SM-TE busy

If an SM-TE is busy on an external call, the SM-TE may not be able to accept calls from the SM-SC. If the SM-TE receives information about this call (by off hook caller ID or by ISDN D-Channel information) the SM-TE shall inform the user of an incoming SM only if the Called SME Subaddress matches the one stored in the SM-TE. In case of no answer to the call, the SM-SC may call the SM-TE again later. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible.

See table 9 for more information.

6.5.5 Calling Line Identification Restriction (CLIR)

Depending on its network access, the SM-SC may (e.g. ISUP connection) or may not be able (e.g. ISDN connection) to identify the caller in case of CLIR active. In the latter case CLIR shall be deactivated; but the user may still request the privacy of the sending identity using the "Calling Terminal Identity" parameter (see annex B).

6.5.6 Handling of Incoming Calls bearing SM

The SM-TE shall provide the user the possibility to define or change the SME Subaddress (the range is from 1 to 9). In case of no user indication the default value (i.e. 1) applies.

Table 9 gives an overview, how the SM-TE should handle incoming calls.

Table 9: Overview how the SM-TE shall handle incoming calls dependent on its operation state

State of the SM-TE	Incoming Call, Called SME Subaddress matches the SME Subaddress value stored in the SM-TE	Incoming Call, Called SME Subaddress does not match the SME Subaddress value stored in the SM-TE
Idle;	The SM-TE shall accept the call.	The SM-TE shall not accept the call.
Busy; No off-hook CLIP received/supported	The SM-TE cannot understand that the SM-SC is calling. Therefore, it cannot accept the call. The SM-SC shall call the SM-TE again later. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible.	
Busy; Off-hook CLIP received/supported	The SM-TE understand that the SM-SC is calling. The SM-TE may or not accept the call. If available, the SM-SC may use the Supplementary Service CCBS to complete the call as soon as possible.	The SM-TE shall not accept the call.

If the received SM contains the Public Key parameter, the receiving SM-TE (or more generally the receiving SM Entity) shall accept it only if the Public key value is equal to one of the values previously stored by the user. If it is not equal, or the SM-TE does not support the feature, the SM-TE shall reject the SM.

The user can access to the received SM only after inputting the correct associated password, if previously stored by the user.

6.5.7 Outgoing calls

If there is a SM to submit or to collect, the SM-TE may watch the external line for availability to ensure that submission or collection of the SM takes place as soon as possible. After the external line becomes available, the SM-TE should seize the line and call the SM-SC. The user may also be able to manually initiate the call to the SM-SC. If there is a SM to submit, the SM-TE shall dial the number of the SM-SC which is stored in the SM-TE.

If a connection to the SM-SC could not be established at the first attempt, the SM-TE may make some further attempts before considering the submission failed.

The SM-TE shall provide the user the possibility to choose the destination SM-TE (or more generally the destination SME) to which the SM is addressed. The value defined by the user while composing the message shall be sent to the SM-SC via the "Called Terminal Identity" TL parameter inside the SM. In case of no user indication the default value (i.e. 1) shall be sent. The value defined shall be picked up by the SM-SC and put in the Called SME Subaddress used to establish the connection to the destination SME.

In order to allow a reply to the SM-TE which originates a SM, also the SME originating identity shall be sent to the SM-SC, via the "Calling Terminal Identity" TL parameter inside the SM.

If the SM-TE supports the feature, while composing a message the user shall be allowed to request a status report related to this SM. The information about the user request shall be sent to the SM-SC via the "Notify" TL parameter inside the SM.

If the SM-TE supports the feature, while composing a message the user shall be allowed to protect the message with a Public Key. The Public Key value defined by the user shall be sent to the SM-SC via the "Public Key" TL parameter inside the SM.

If the SM-TE supports the feature, while composing a message the user shall be allowed to define the destination device to which the SM is addressed (e.g. SM-TE, fax or electronic mailbox). The destination device value defined by the user shall be sent to the SM-SC via the "Media Identifier" TL parameter inside the SM. In each case the user shall be allowed to fill in the associated parameters (e.g. fax recipient name, destination mail/e-mail address, destination phone number, etc.).

Annex A (normative):

Protocol 1 - Message Sequence Charts

NOTE: The parts of the message sequence charts which describe the interaction between the Data Link Layers (DLL) of the two involved Short Message Entities (SM-TE and SM-SC) are normative. The parts that describe the interaction between Data Link Layer (DLL), Transfer Layer (TL), Connection Manager (CM) and Application (APP) inside of one Short Message Entity (SM-TE or SM-SC) are informative.

A.1 SM from SM-TE to SM-SC

The following clauses formally describe the transmission of short messages (SMS_SUBMIT) from SM-TE to SM-SC.

The handling of commands (SMS_COMMAND) is the same as of SMS_SUBMIT messages described in the following clauses. To derive the SMS_COMMAND message sequence charts from the SMS_SUBMIT message sequence charts, the following replacements shall be applied:

"SMS_SUBMIT" is to be replaced by "SMS_COMMAND"

"SMS message" is to be replaced by "Command"

It is also possible to transmit one or more SMS_COMMAND and/or one or more SMS_SUBMIT within the same session as described in clause A.1.2 "Send more than one (as example: two) SM in one session".

A.1.1 Normal Case

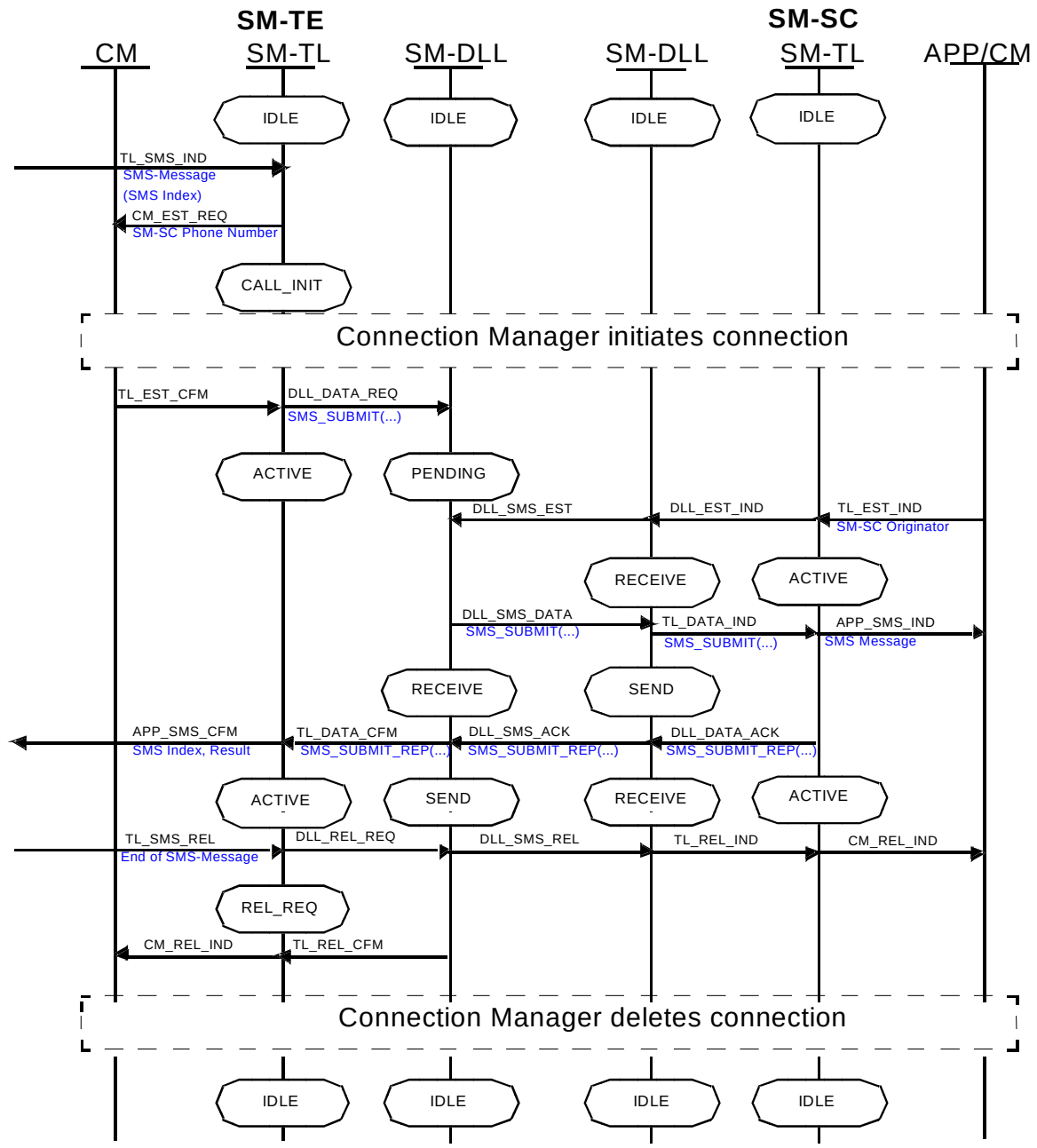
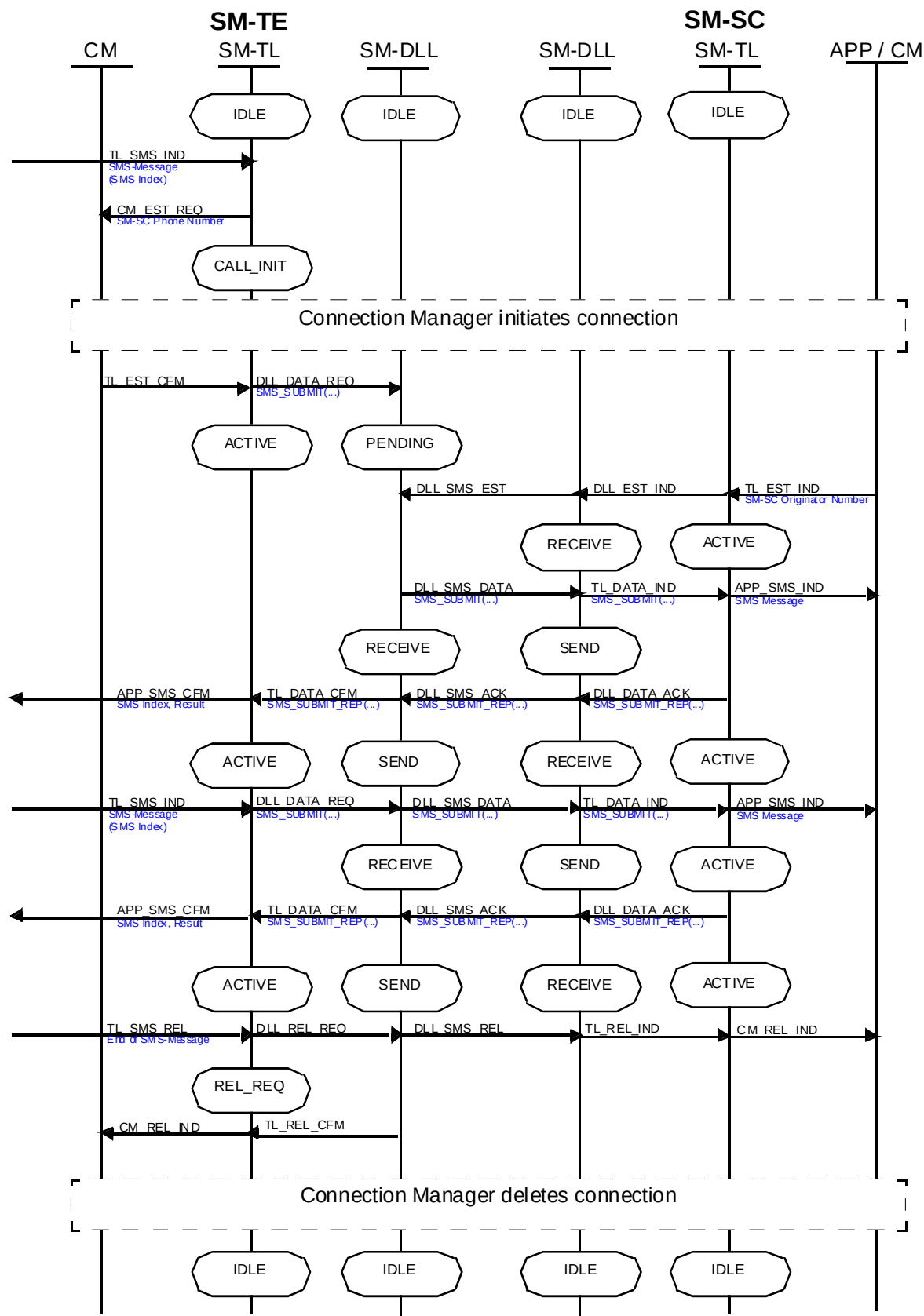


Figure A.1.1: Normal Case

A.1.2 Send more than one (as example: two) SM in one session



NOTE: In case that the second SM is not accepted by the SM-SC, the SM-TE should make at least one more submission attempt in a new session before considering the transmission of this SM failed.

Figure A.1.2: Send more than one (as example: two) SM in one session

A.1.3 Failure detection in SM-SC Transfer Layer

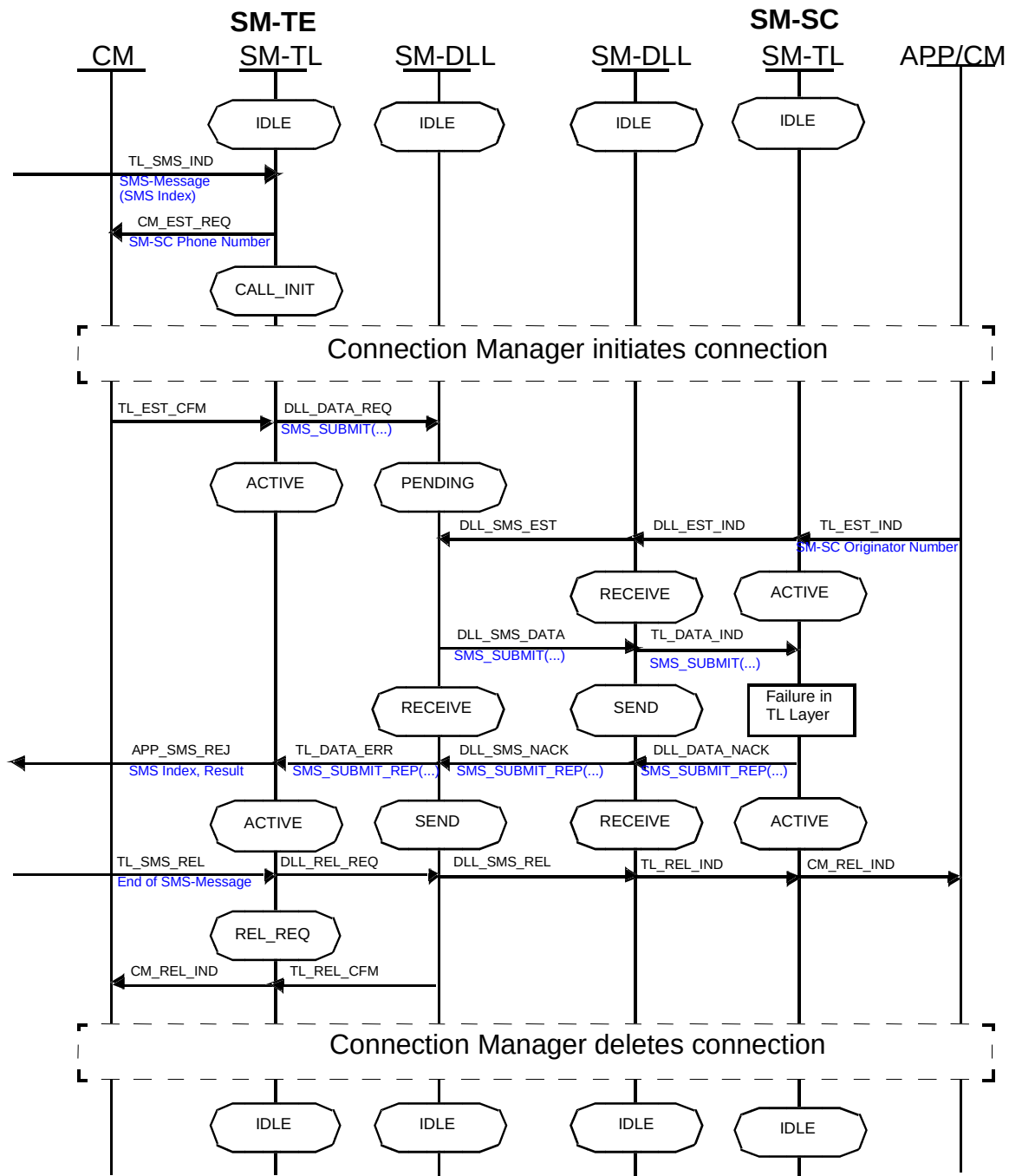


Figure A.1.3: Failure detection in SM-SC Transfer Layer

A.1.4 Error detection in SM-SC DL Layer, correctable

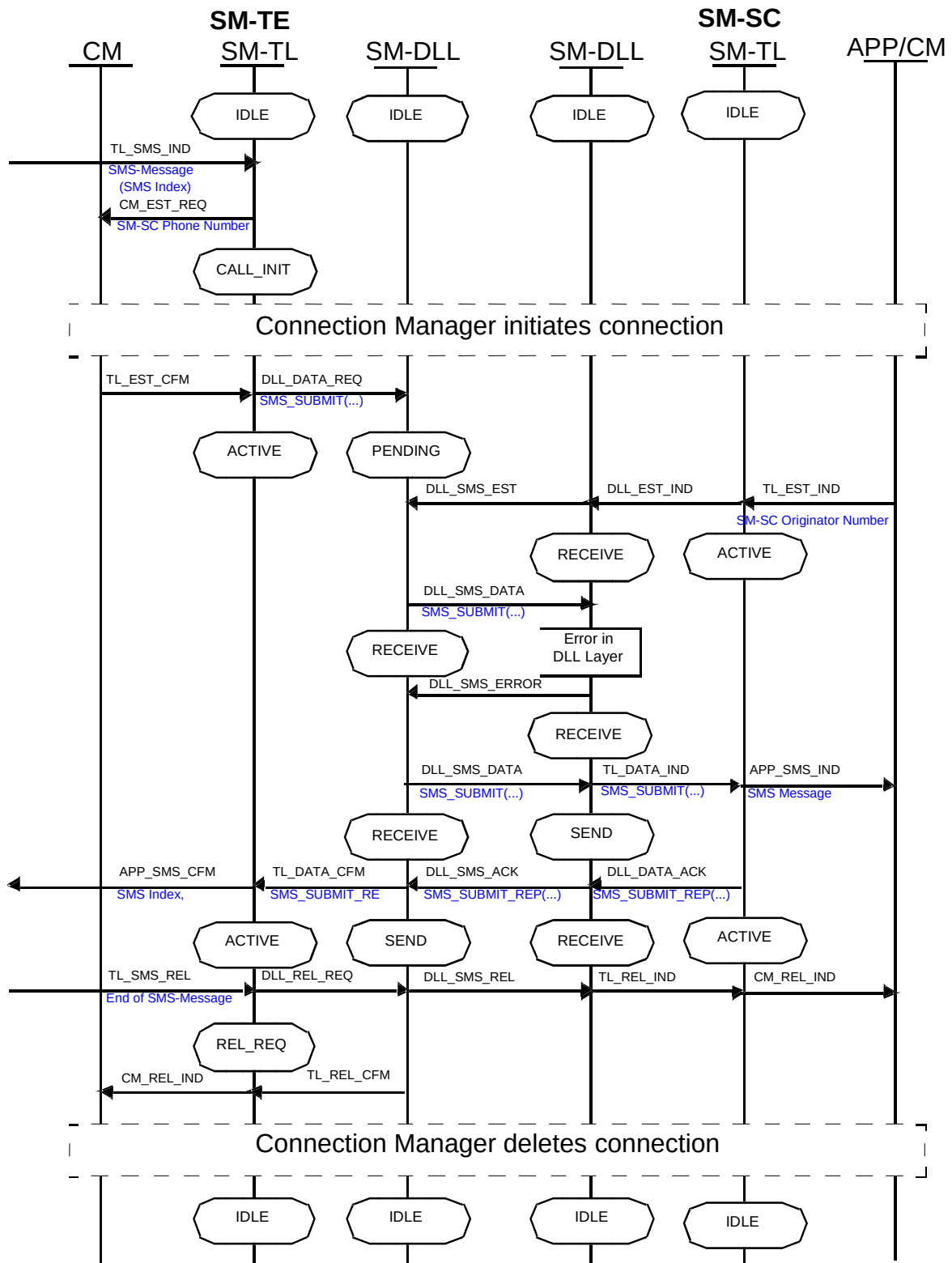


Figure A.1.4: Error detection in SM-SC DL Layer, correctable

A.1.5 Error detection in SM-TE DL Layer, correctable

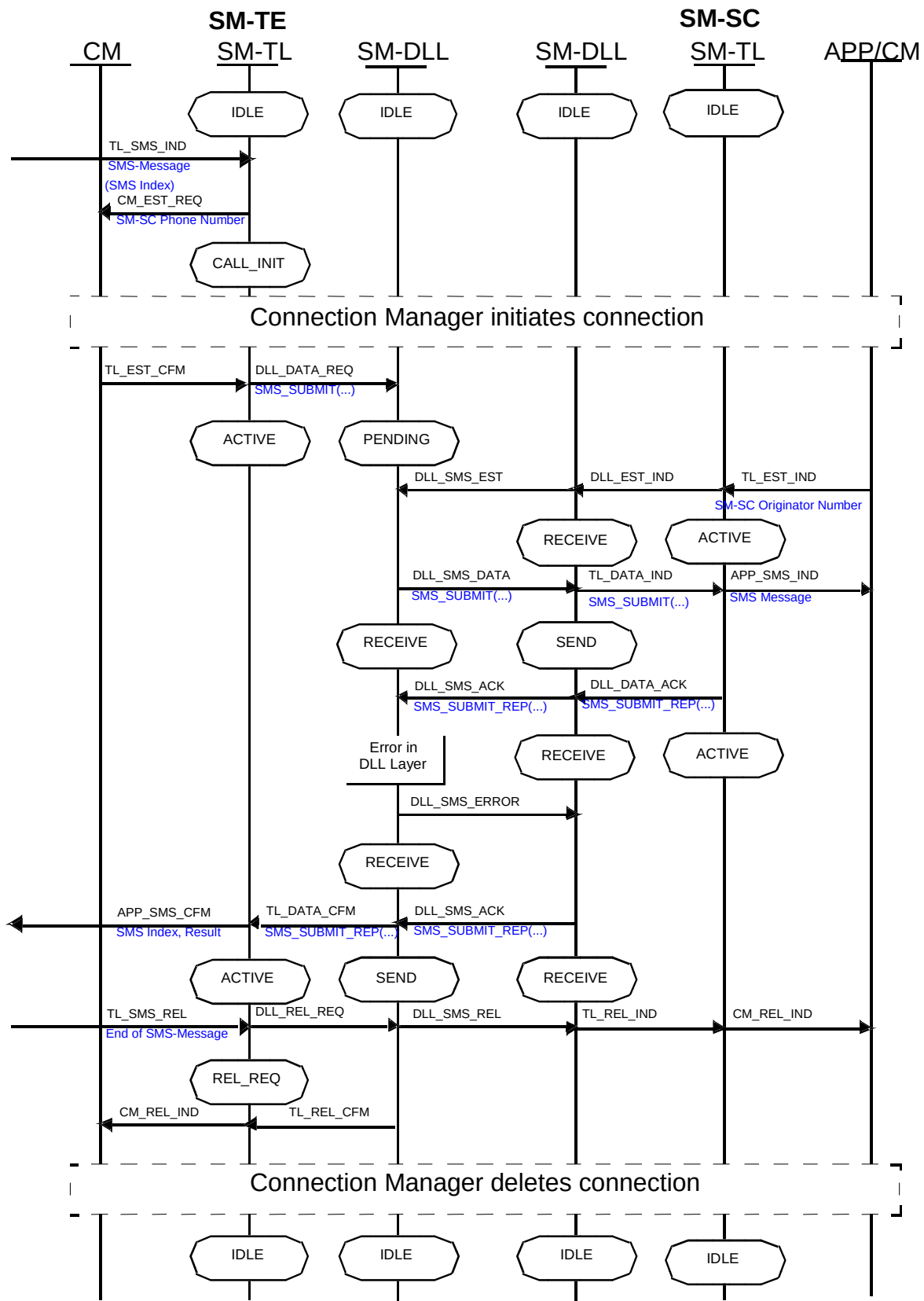


Figure A.1.5: Error detection in SM-TE DL Layer, correctable

A.1.6 Error detection in SM-SC DL Layer, not correctable

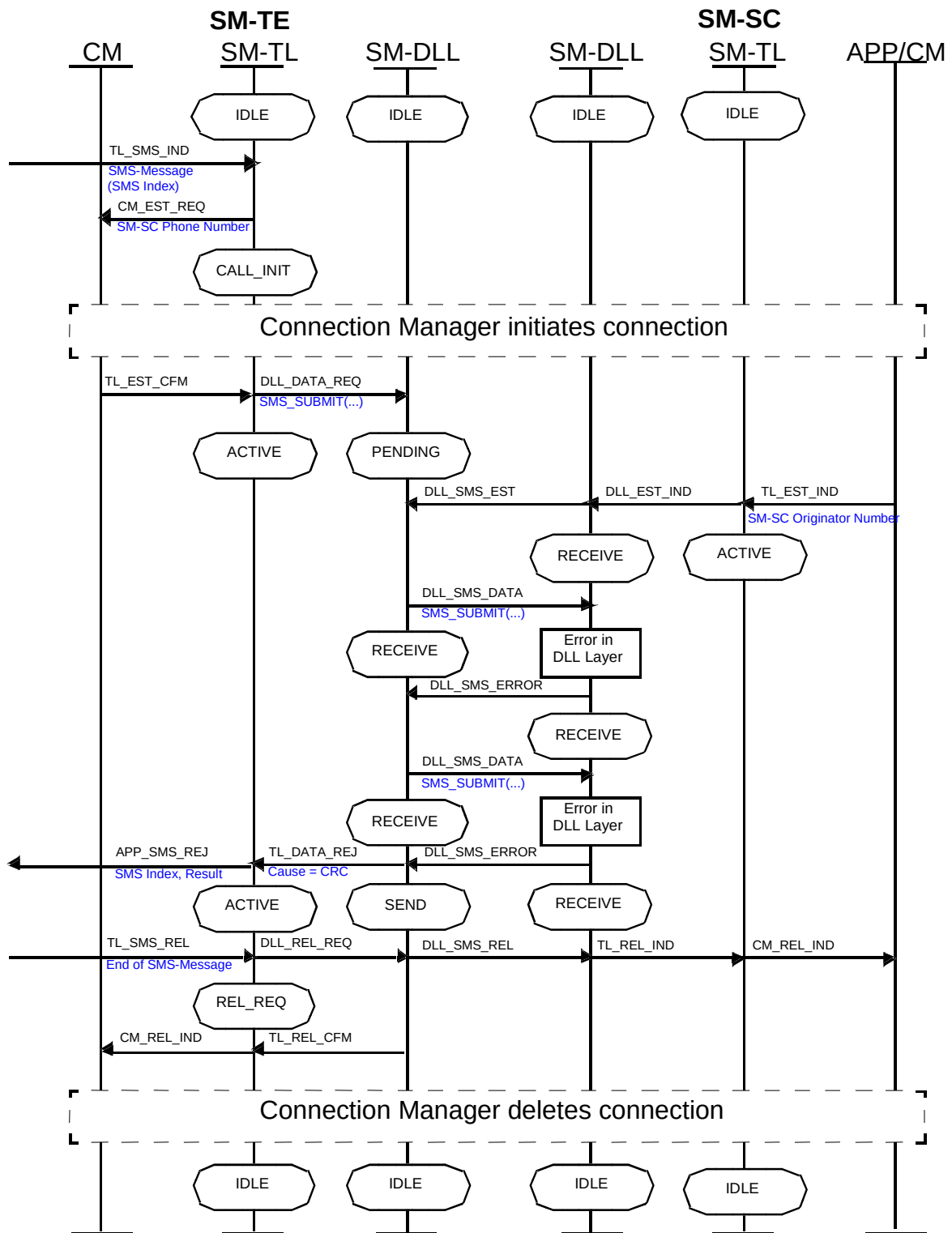


Figure A.1.6: Error detection in SM-SC DL Layer, not correctable

A.1.7 Error detection in SM-TE DL Layer, not correctable

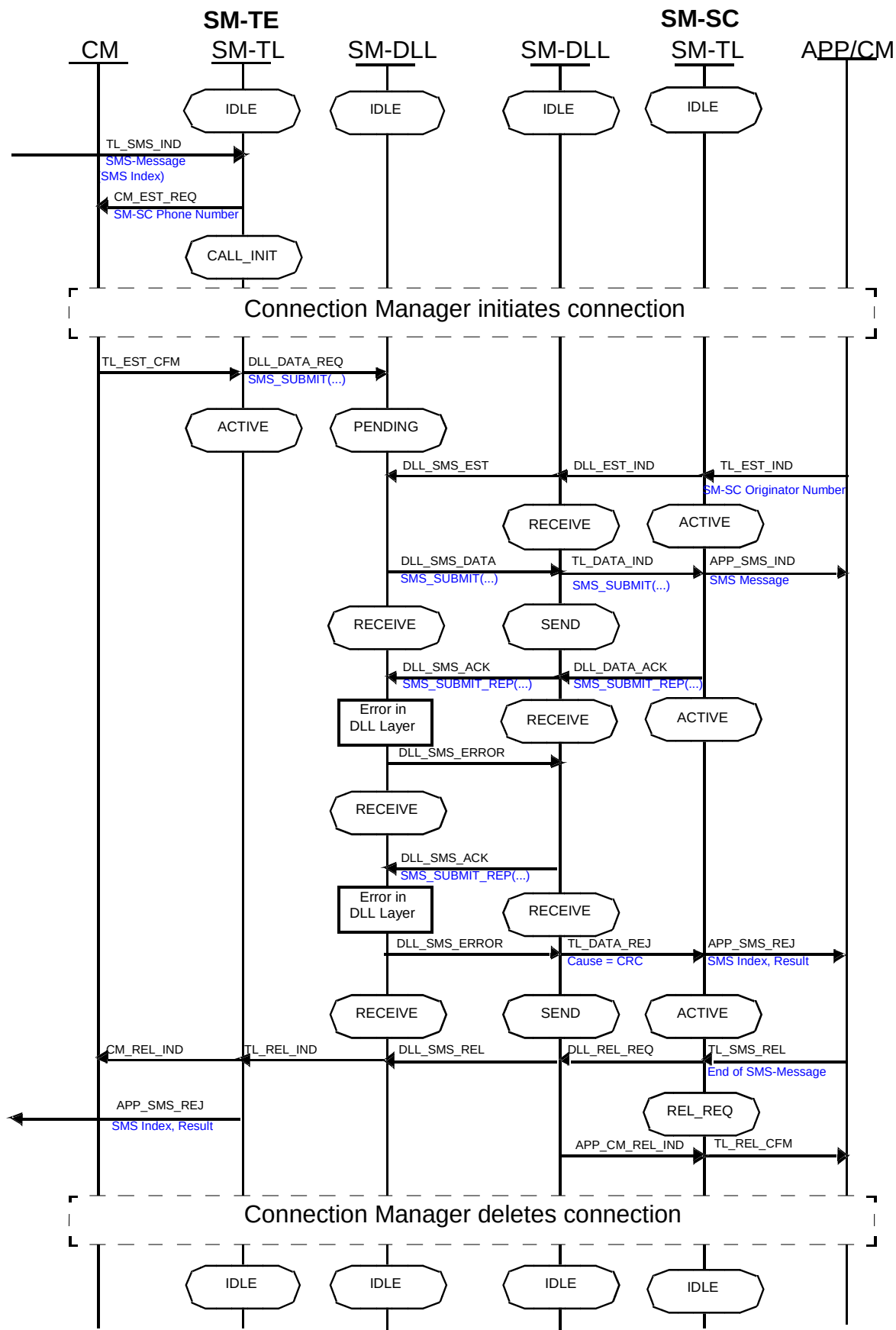


Figure A.1.7: Error detection in SM-TE DL Layer, not correctable

A.1.8 Timeout establish message in SM-TE DL Layer

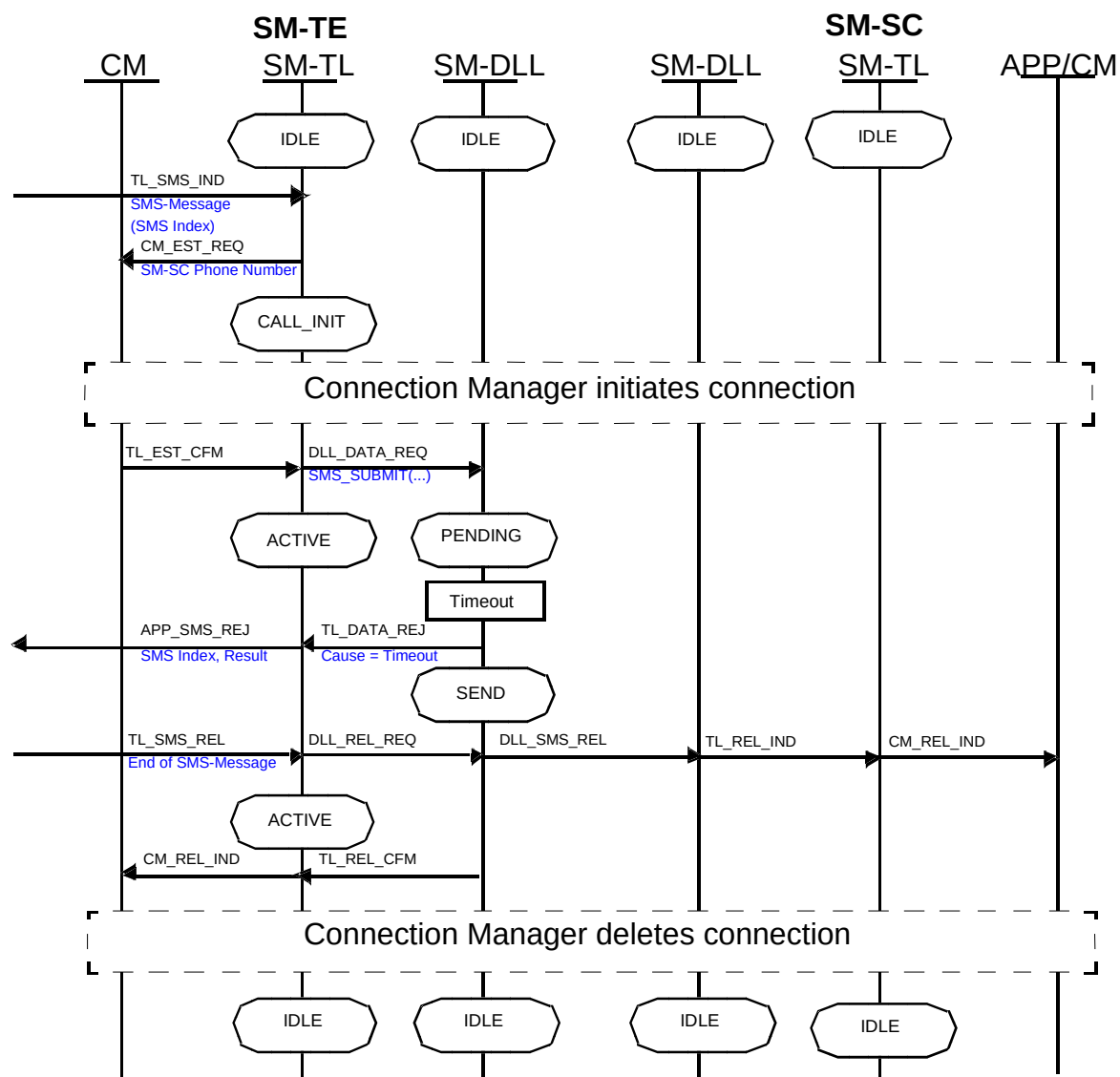


Figure A.1.8: Timeout establish message in SM-TE DL Layer

A.1.9 Timeout acknowledge message in SM-TE DL Layer

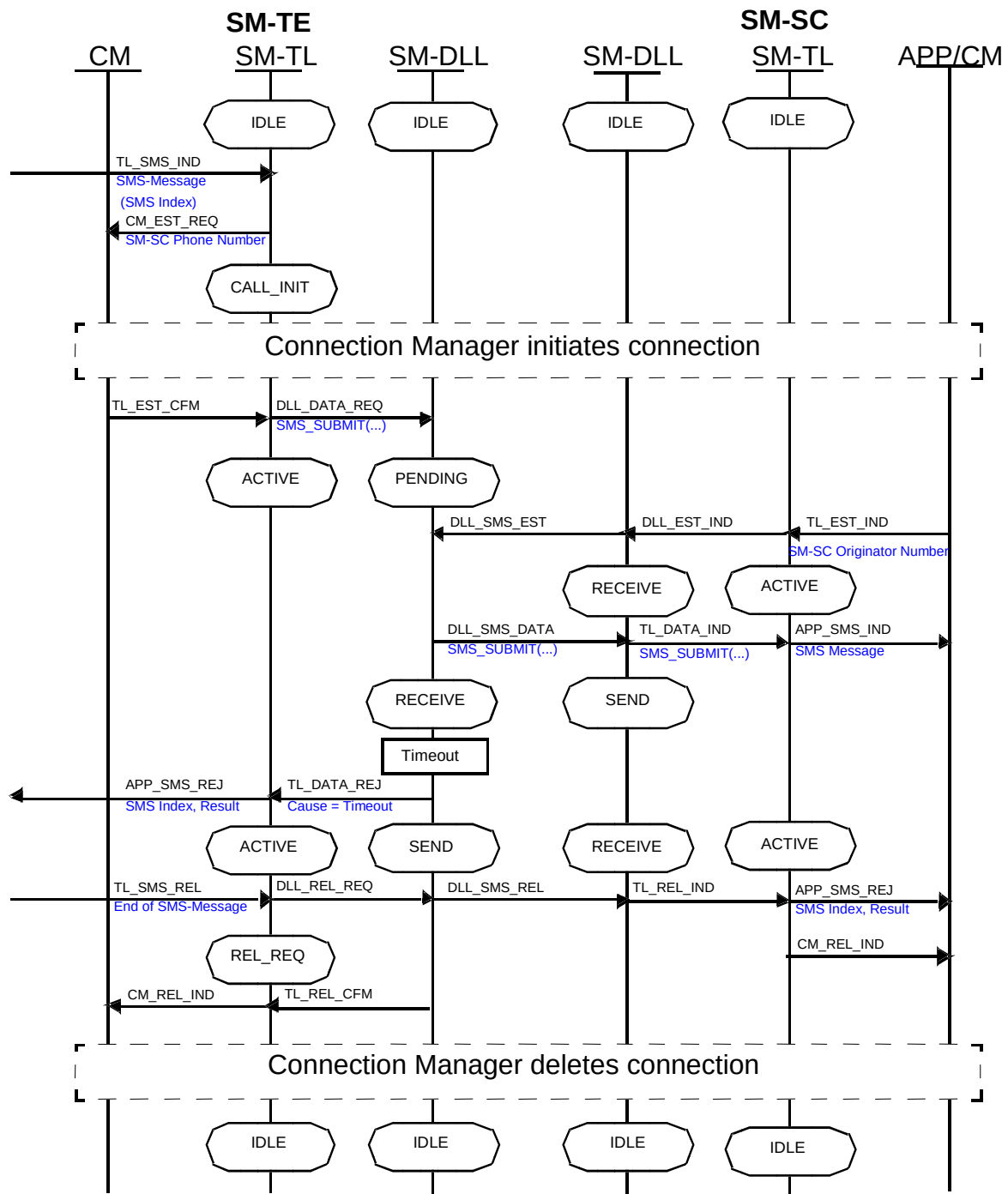


Figure A.1.9: Timeout acknowledge message in SM-TE DL Layer

A.1.10 No CM channel in SM-TE available

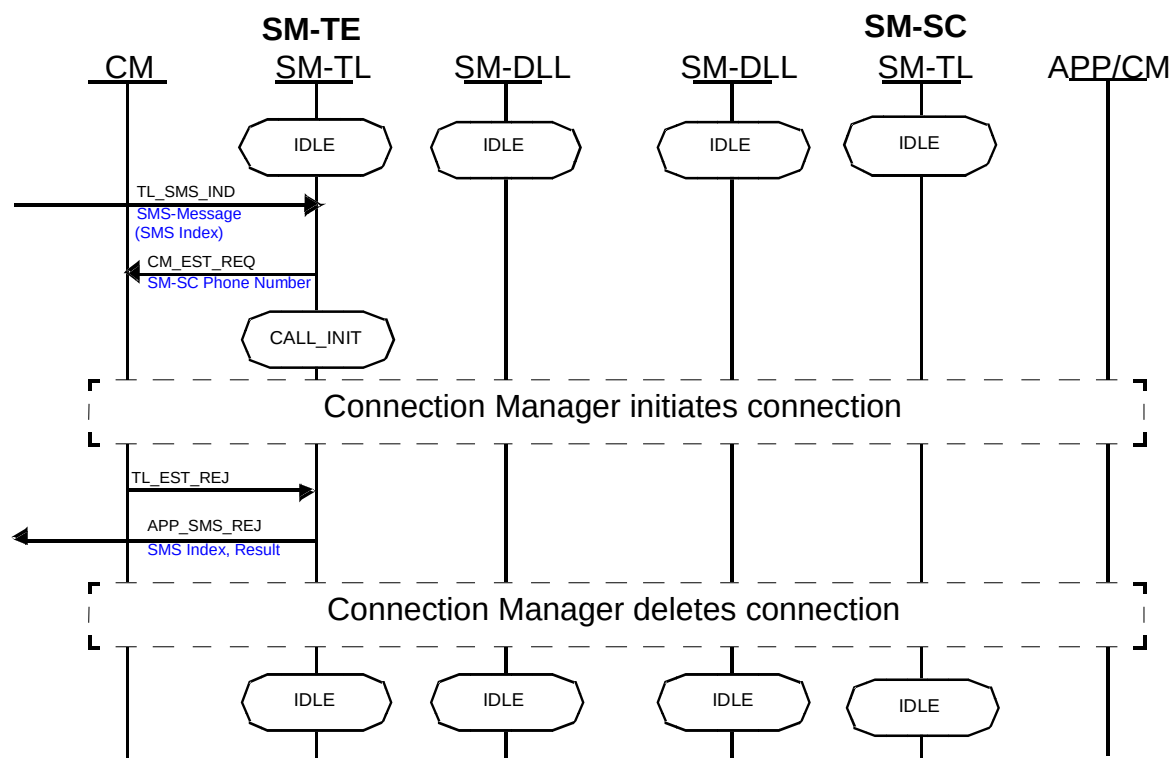


Figure A.1.10: No CM channel in SM-TE available

A.1.11 TL Message larger than 176 octets

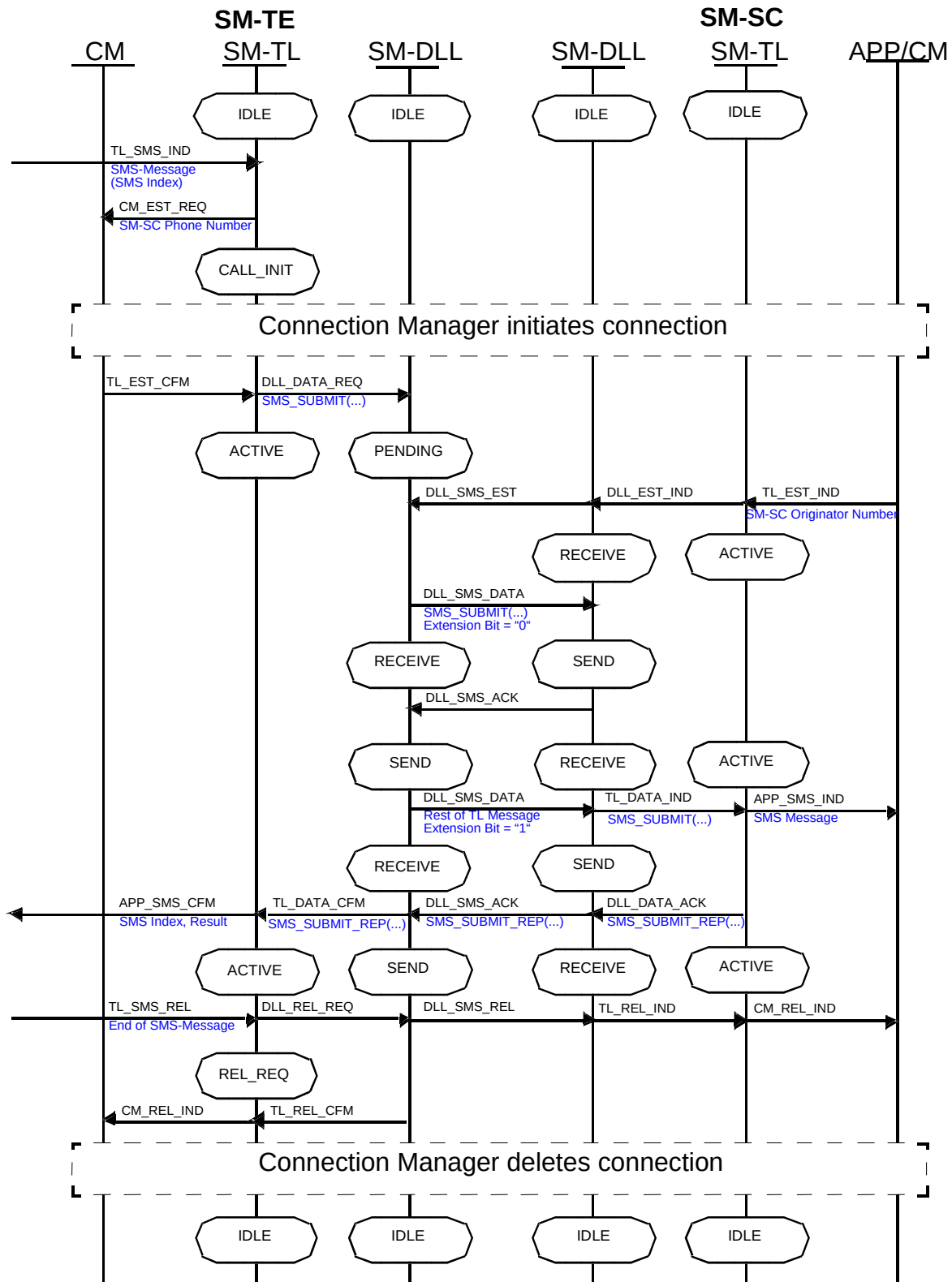


Figure A.1.11: TL Message larger than 176 octets

A.2 SM from SM-SC to SM-TE

The following clauses formally describe the transmission of short messages (SMS_DELIVER) from SM-SC to SM-TE.

The handling of status reports (SMS_STATUS_REPORT) is the same as of SMS_DELIVER messages described in the following clauses. To derive the SMS_STATUS_REPORT message sequence charts from the SMS_DELIVER message sequence charts, the following replacements shall be applied:

"SMS_DELIVER" is to be replaced by "SMS_STATUS_REPORT"

"SMS message" is to be replaced by "Status Report"

It is also possible to transmit one or more SMS_STATUS_REPORT and/or one or more SMS_DELIVER within the same session as described in clause A.2.3 "Send more than one (as example: two) SM in one session".

A.2.1 Normal Case, SM-TE does not pick up Call from SM-SC

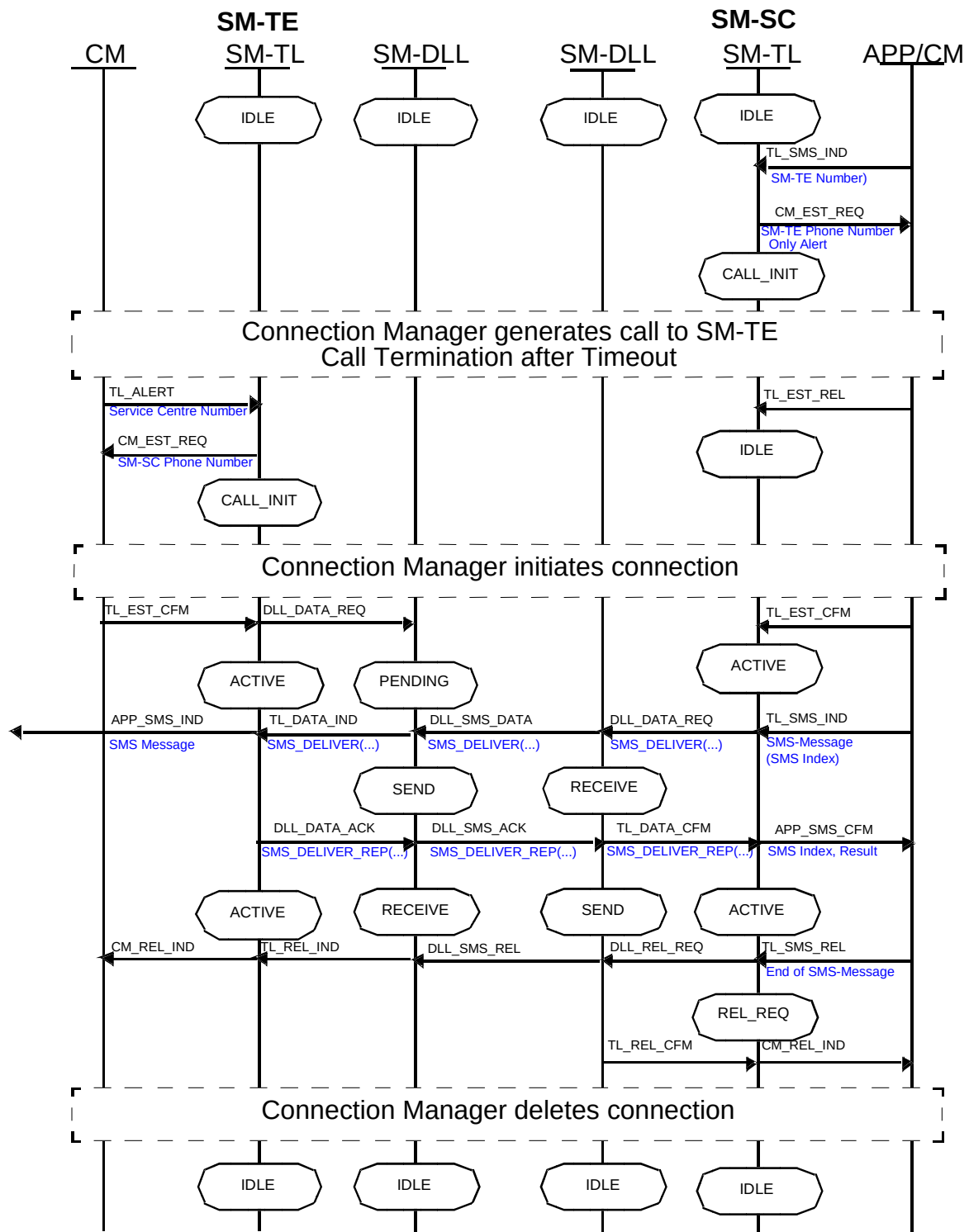


Figure A.2.1: Normal Case, SM-TE does not pick up Call from SM-SC

A.2.2 Normal Case, SM-TE picks up incoming call from SM-SC

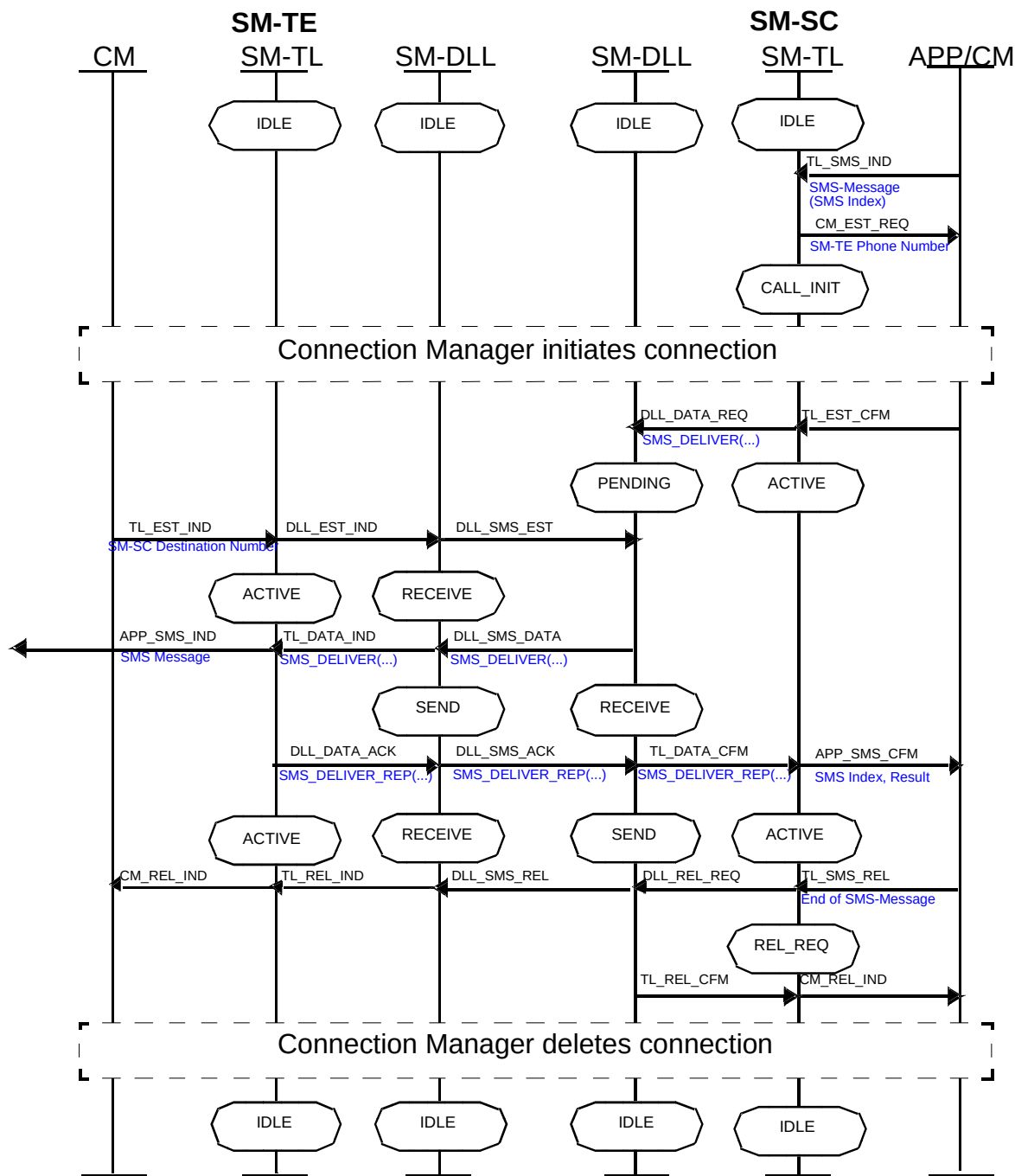


Figure A.2.2: Normal Case, SM-TE picks up incoming call from SM-SC

A.2.3 Send more than one (as example: two) SM in one Session

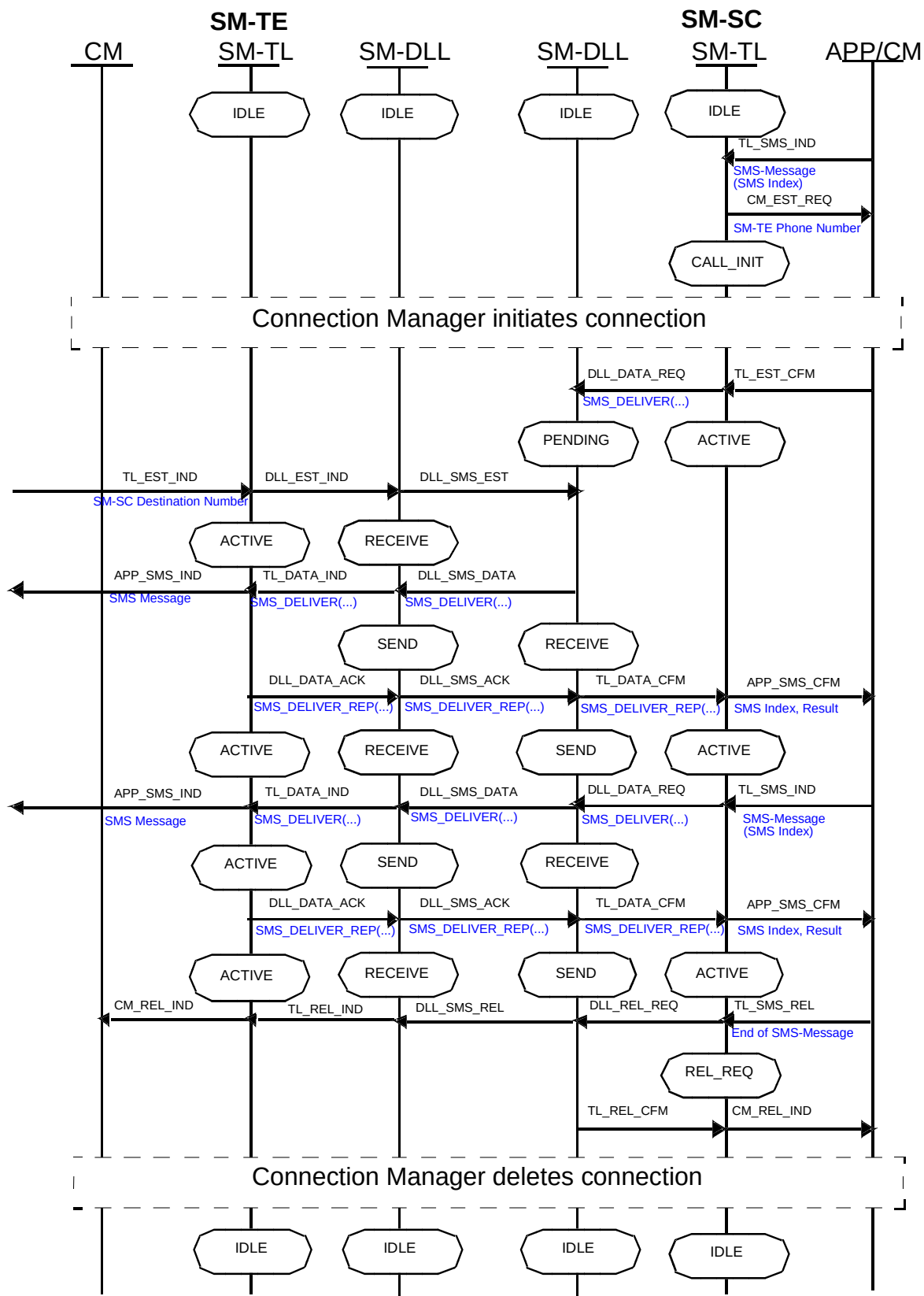


Figure A.2.3: Send more than one (as example: two) SM in one Session

A.2.4 Error detection in SM-TE Transfer Layer

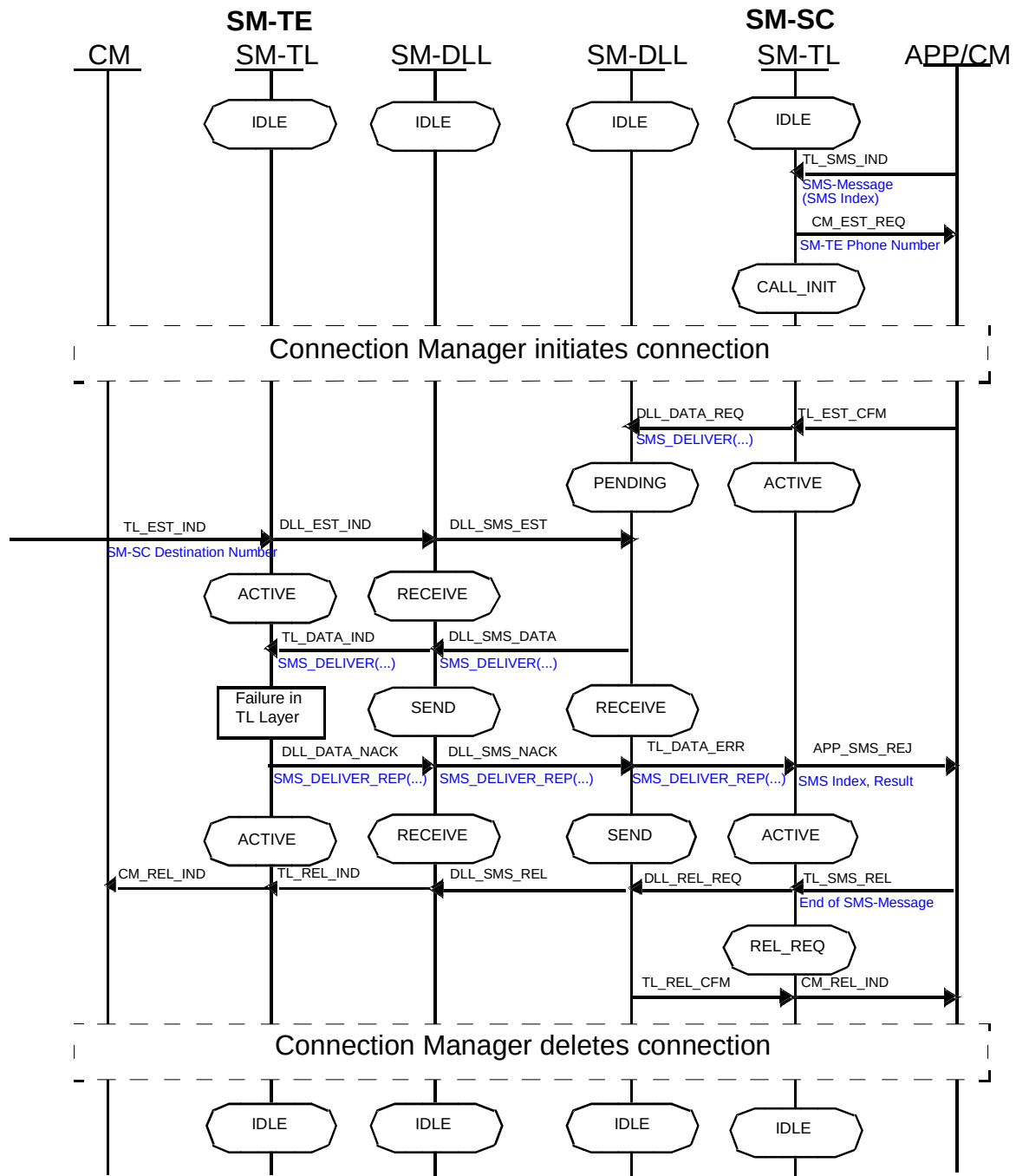


Figure A.2.4: Error detection in SM-TE Transfer Layer

A.2.5 Error detection in SM-TE DL Layer, correctable

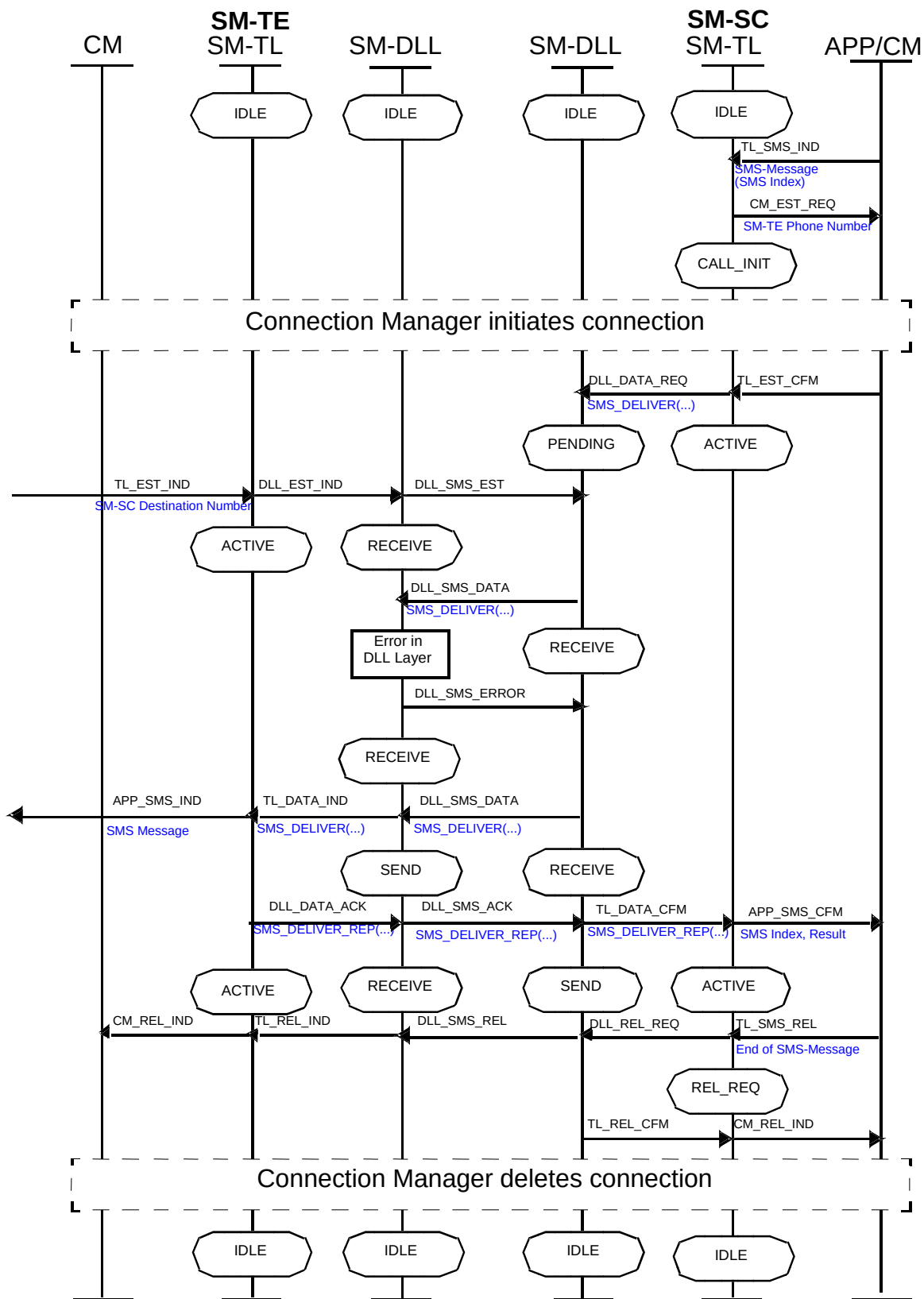


Figure A.2.5: Error detection in SM-TE DL Layer, correctable

A.2.6 Error detection in SM-SC DL Layer, correctable

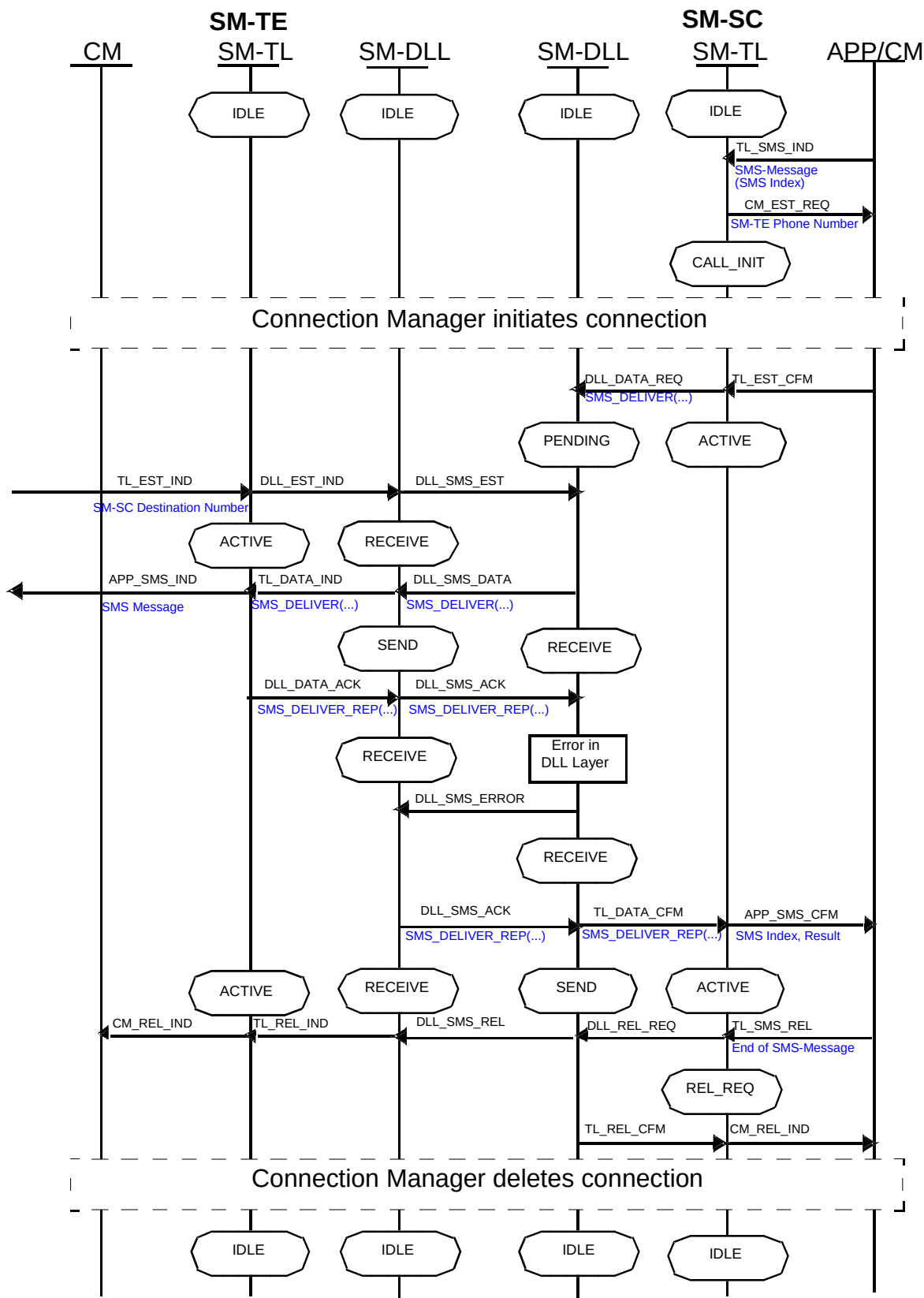


Figure A.2.6: Error detection in SM-SC DL Layer, correctable

A.2.7 Error detection in SM-TE DL Layer, not correctable

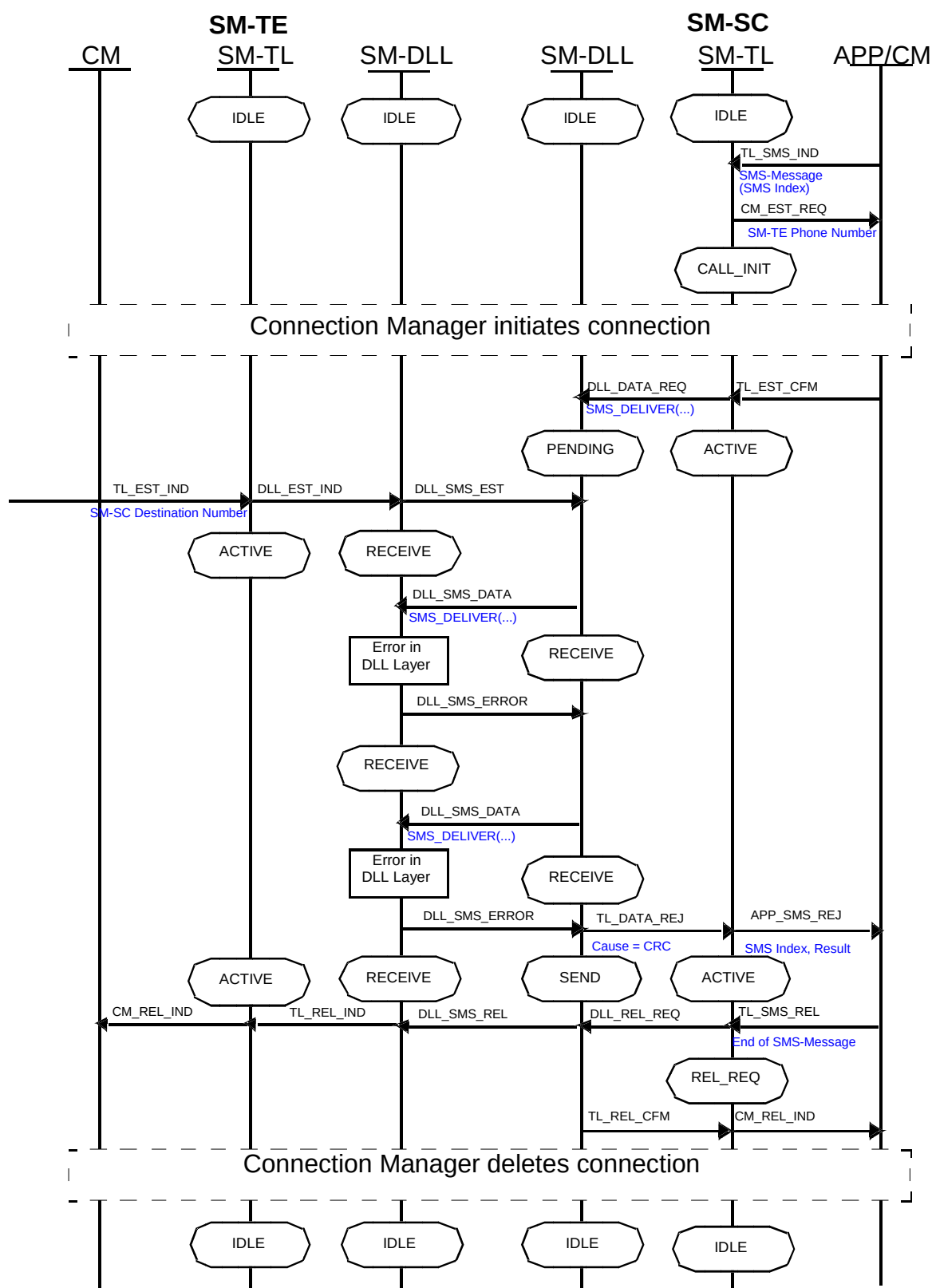


Figure A.2.7: Error detection in SM-TE DL Layer, not correctable

A.2.8 Error detection in SM-SC DL Layer, not correctable

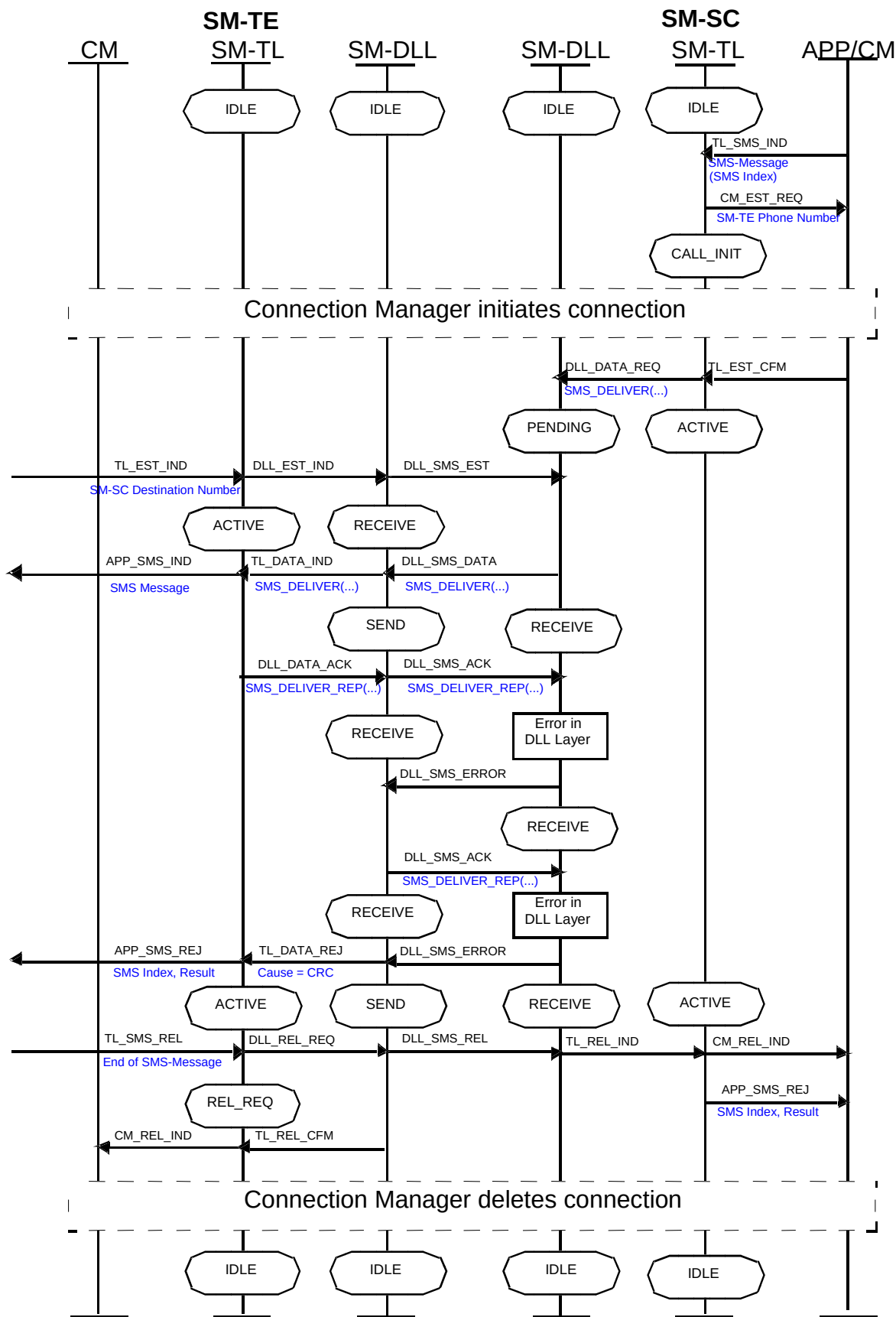


Figure A.2.8: Error detection in SM-SC DL Layer, not correctable

A.2.9 Timeout establish message in SM-SC DL Layer

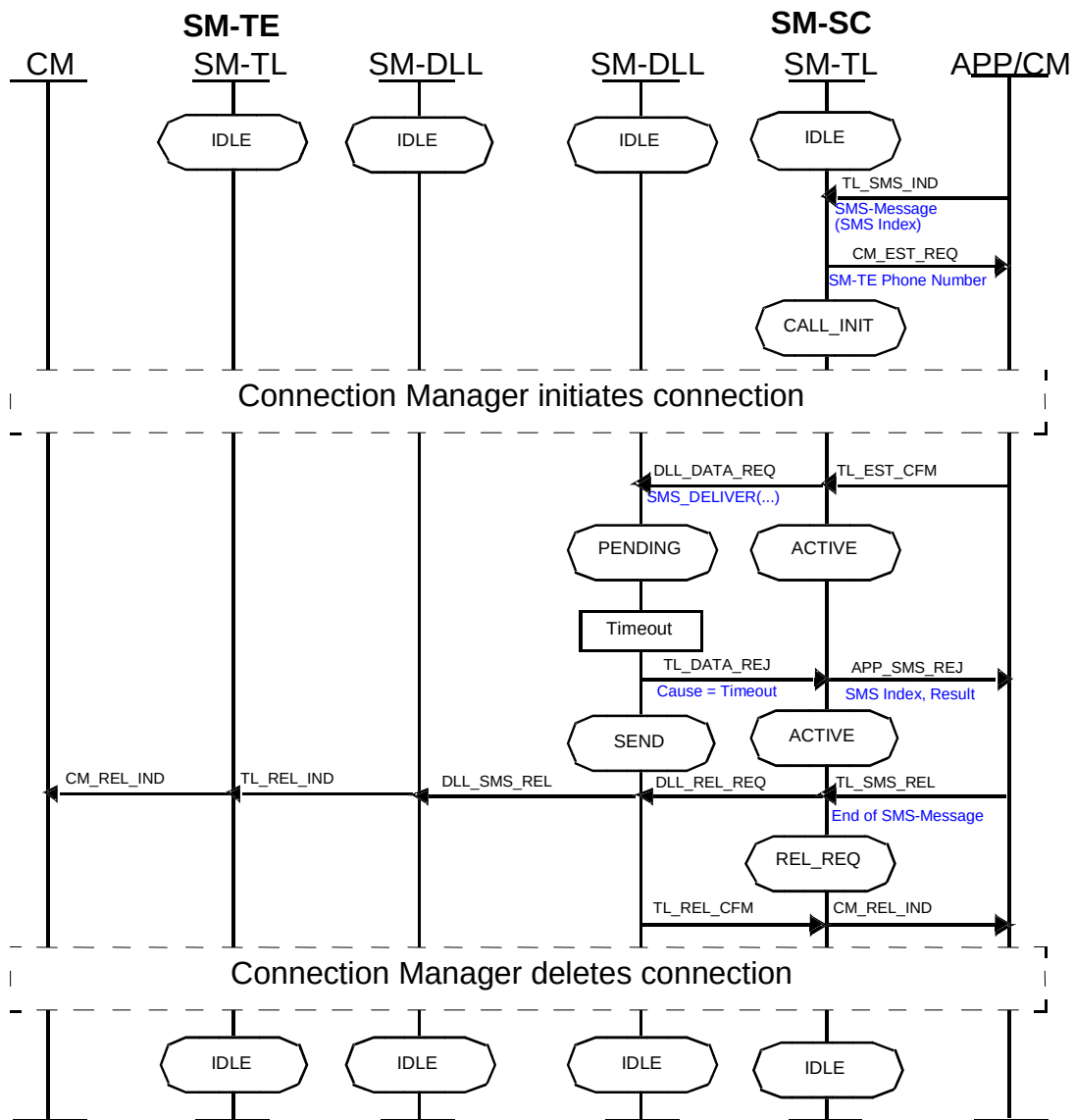


Figure A.2.9: Timeout establish message in SM-SC DL Layer

A.2.10 Timeout acknowledge message in SM-SC DL Layer

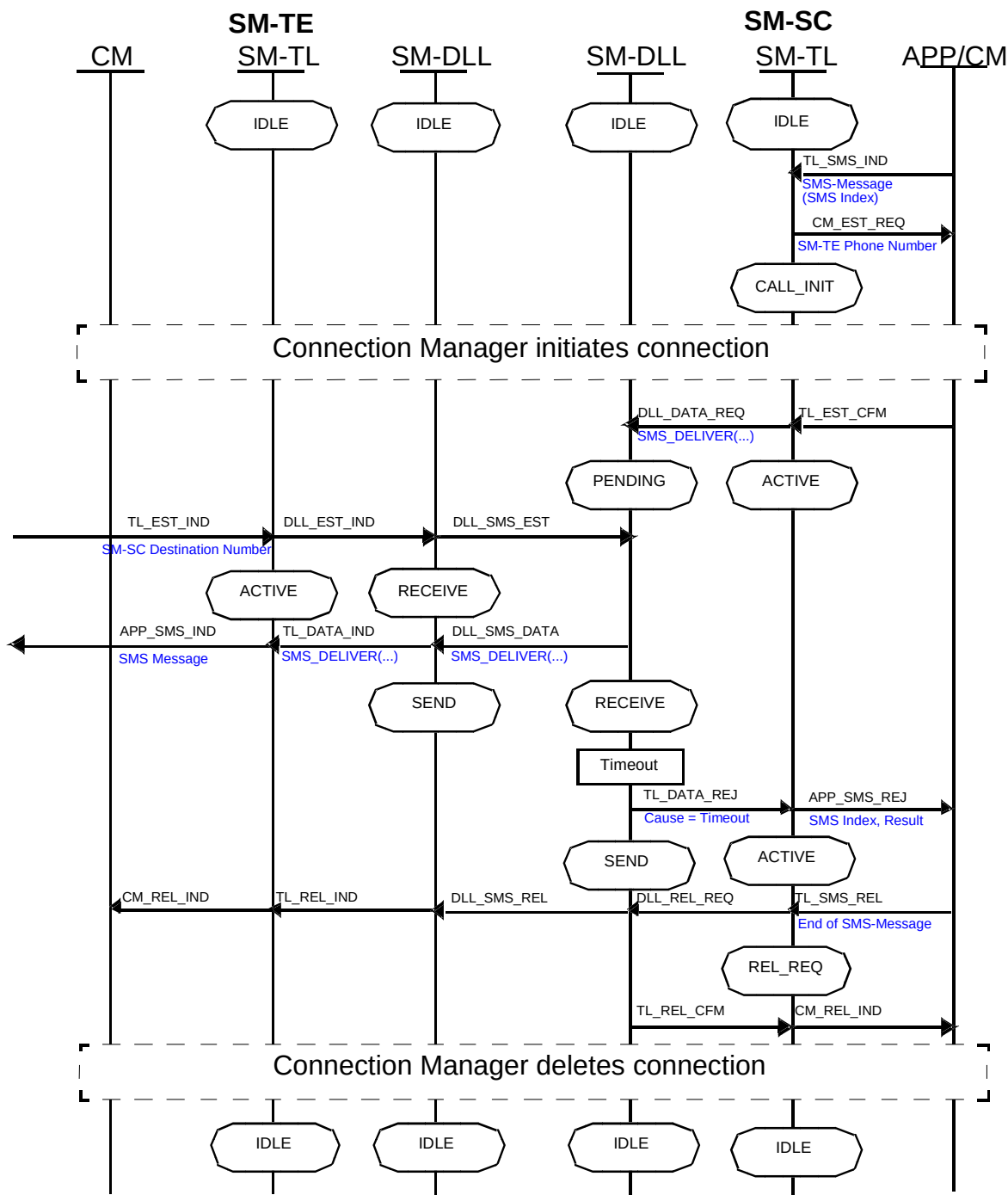


Figure A.2.10: Timeout acknowledge message in SM-SC DL Layer

A.2.11 No CM channel in SM-SC available

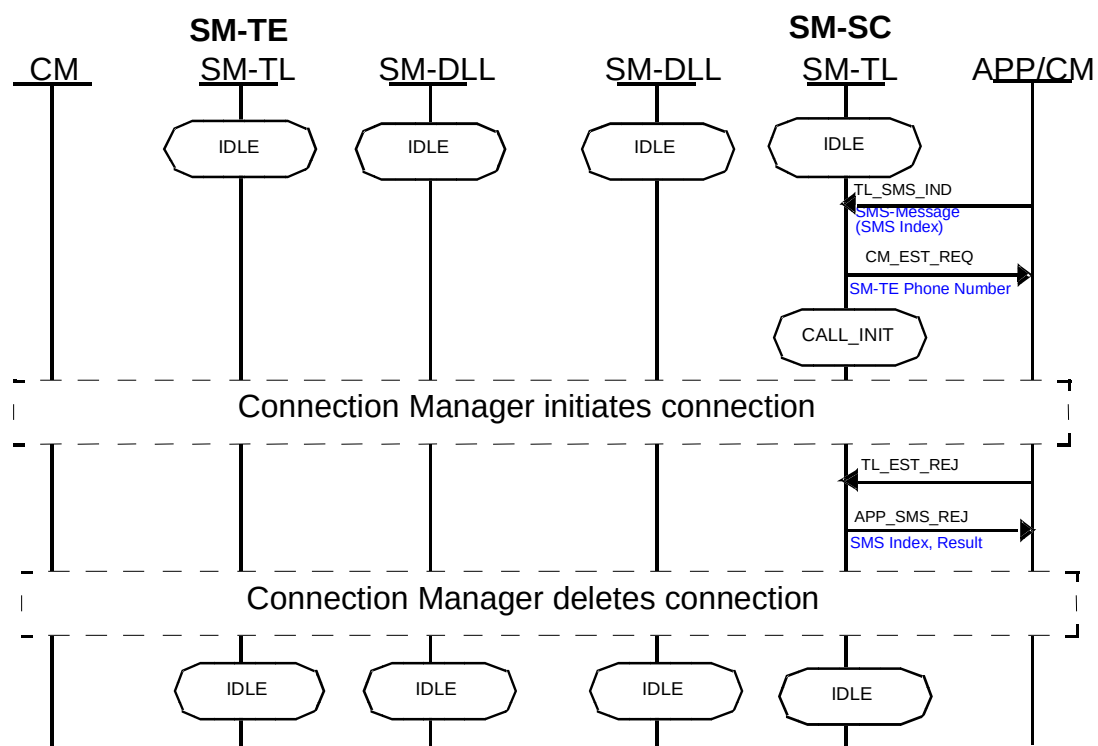


Figure A.2.11: No CM channel in SM-SC available

A.2.12 TL message larger than 176 octets

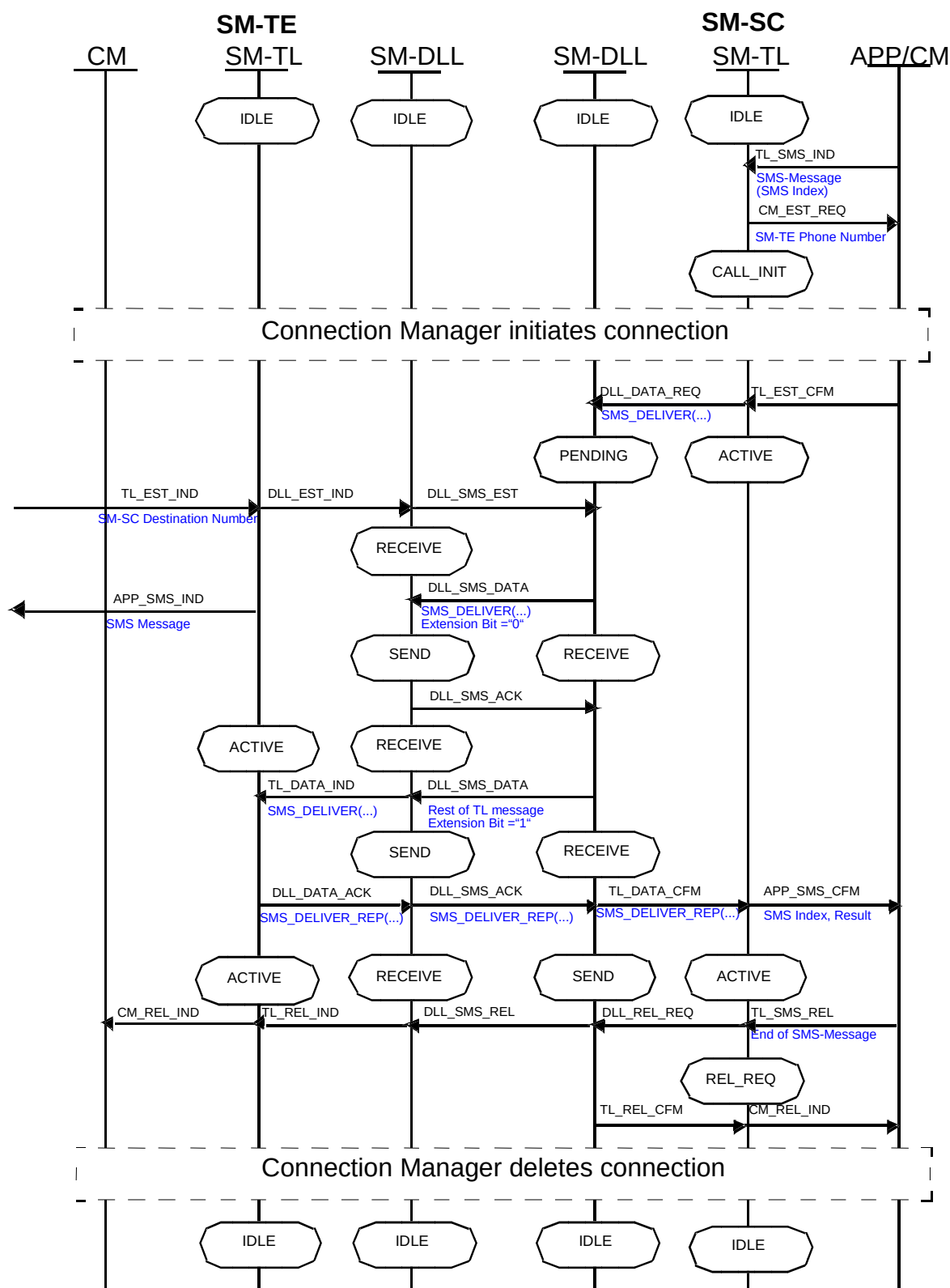


Figure A.2.12: TL message larger than 176 octets

Annex B (normative):

Protocol 2 - Message Sequence Charts and Parameters formats

B.1 Message Sequence Charts

NOTE: The parts of the message sequence charts which describe the interaction between the Data Link Layers (DLL) of the two involved Short Message Entities (SM-TE and SM-SC) are normative. The parts that describe the interaction between Data Link Layer (DLL), Transfer Layer (TL), Connection Manager (CM) and Application (APP) inside of one Short Message Entity (SM-TE or SM-SC) are informative.

B.1.1 Messages between layers in SME

Table B.1.1

Message	Description
from SM-AL to SM-TL	
TL_EST_REQ	SME-M_AL request to setup an end-to-end connection.
TL_SMS_REQ	SME-M_AL request to send an SM info.
TL_REL_REQ	SME-M_AL request to release an end-to-end connection.
from SM-TL to SM-AL	
APP_EST_CFM	SME-M_TL confirmation of the establishment of the end-to-end connection.
APP_EST_REJ	SME-M_TL rejection of the establishment of the end-to-end connection.
APP_SMS_CFM	SME-M_TL confirmation of the submission/delivery of the SM info to the SME-S_TL.
APP_SMS_REJ	SME-M_TL rejection of the submission/delivery of the SM info to the SME-S_TL.
APP_SMS_IND	SME-S_TL indication of a received SM Info.
from SM-TL to CM	
CM_CONN_REQ	SME-M_TL request of establishment of a circuit connection.
CM_REL_IND	SME_TL indication of not active data link.
from CM to SM-TL	
TL_CONN_CFM	SME-M_CM confirmation of establishment of a circuit connection.
TL_CONN_REJ	SME-M_CM rejection of establishment of a circuit connection.
TL_CONN_IND	SME-S_CM indication of establishment of a circuit connection.
from SM-TL to SM-DLL	
DLL_EST_REQ	SME-M_TL request of Activate the Data Link.
DLL_EST_IND	SME-S_TL indication of Transport Layer Activation.
DLL_INFO_REQ	SME-M_TL request of sending an Info.
DLL_REL_REQ	SME-M_TL request of release the Data Link.
DLL_INFO_CFM	SME-S_TL confirmation of a received Info.
DLL_INFO_REJ	SME-S_TL rejection of a received Info.
from SM-DLL to SM-TL	
TL_EST_CFM	SME-M_DLL confirmation of Data Link Activation.
TL_EST_REJ	SME-M_DLL rejection of Data Link Activation.
TL_INFO_CFM	Confirmation to SME-M_TL of SM submission/delivery to the SME-S_TL.
TL_INFO_REJ	Rejection to SME-M_TL of SM submission/delivery to the SME-S_TL.
TL_INFO_IND	Indication to SME-S_TL of a received Info.
TL_INFO_ABRT	Indication to SME-M_TL of unrecoverable errors occurred during submission/delivery of the SM.
TL_REL_CFM	Confirmation to SME-M_TL of the Data Link release.
TL_REL_ABRT	Indication to SME_TL of unrecoverable errors during the Data Link release.
TL_REL_IND	Indication to SME-S_TL of Data Link Layer deactivation.

B.1.2 Connection establishment

B.1.2.1 Normal Case

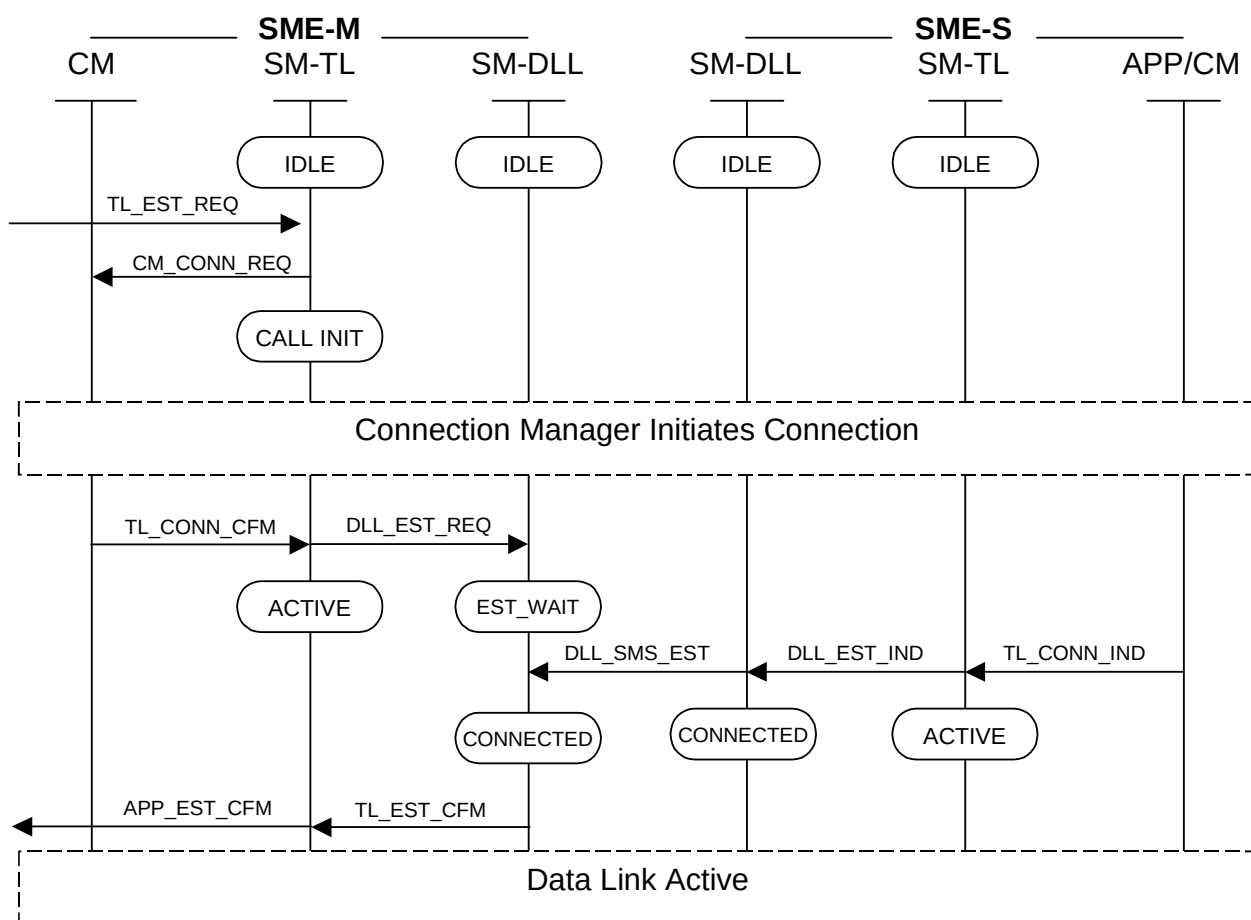


Figure B.1.2.1: Normal Case

B.1.2.2 No CM Channel available in SME-M

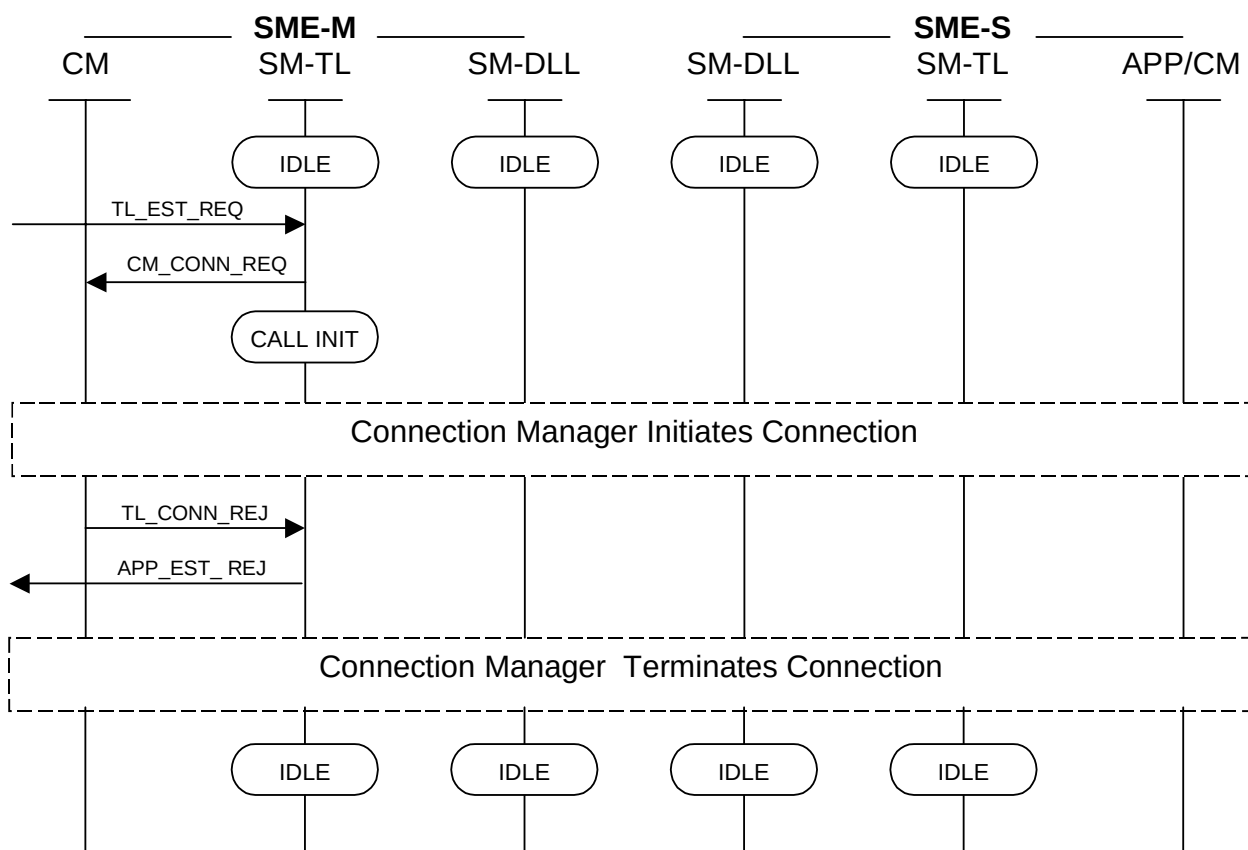


Figure B.1.2.2: No CM Channel available in SME-M

B.1.2.3 Timeout in DLL establishing

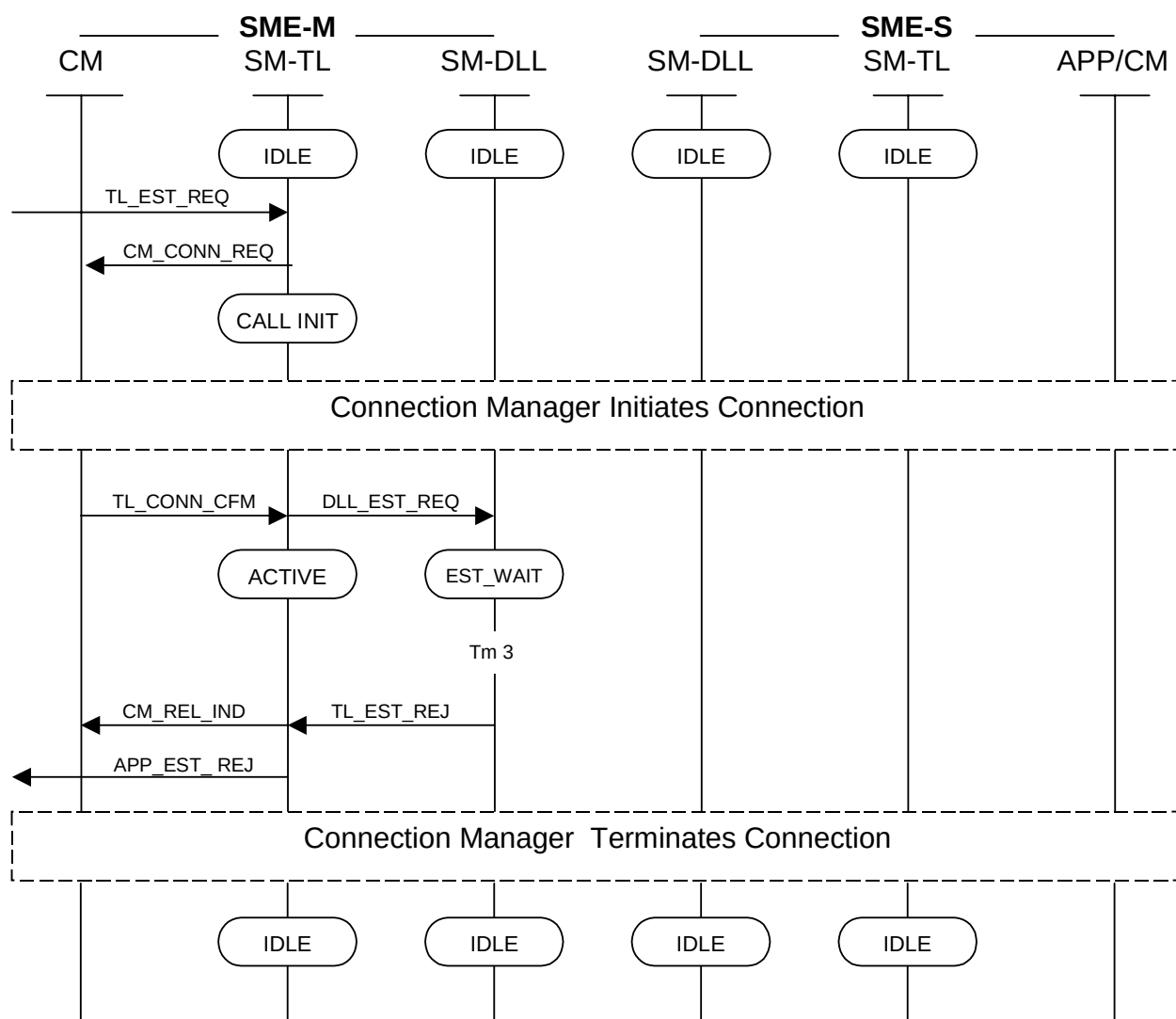


Figure B.1.2.3: Timeout in DLL establishing

B.1.3 SM from SME-M to SME-S

B.1.3.1 Single segment, the SME-S_SM-TL confirms the SM before Tm6 expiry

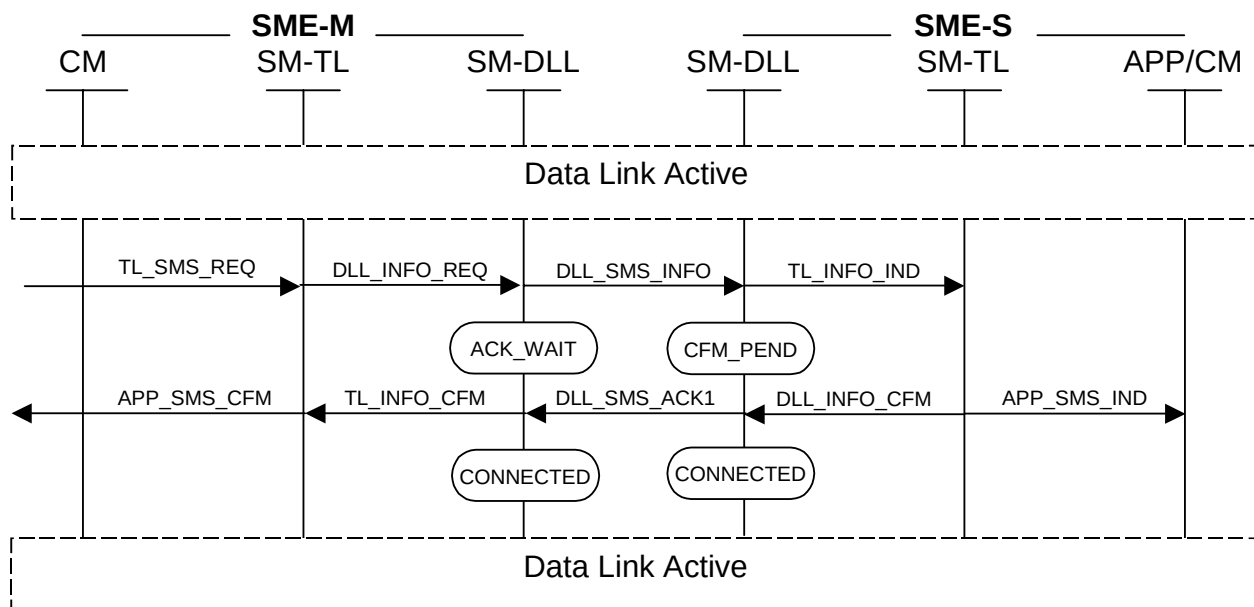


Figure B.1.3.1: Single segment, the SME-S_SM-TL confirms the SM before Tm6 expiry

B.1.3.2 Single segment, the SME-S confirms the SM after Tm6 expiry

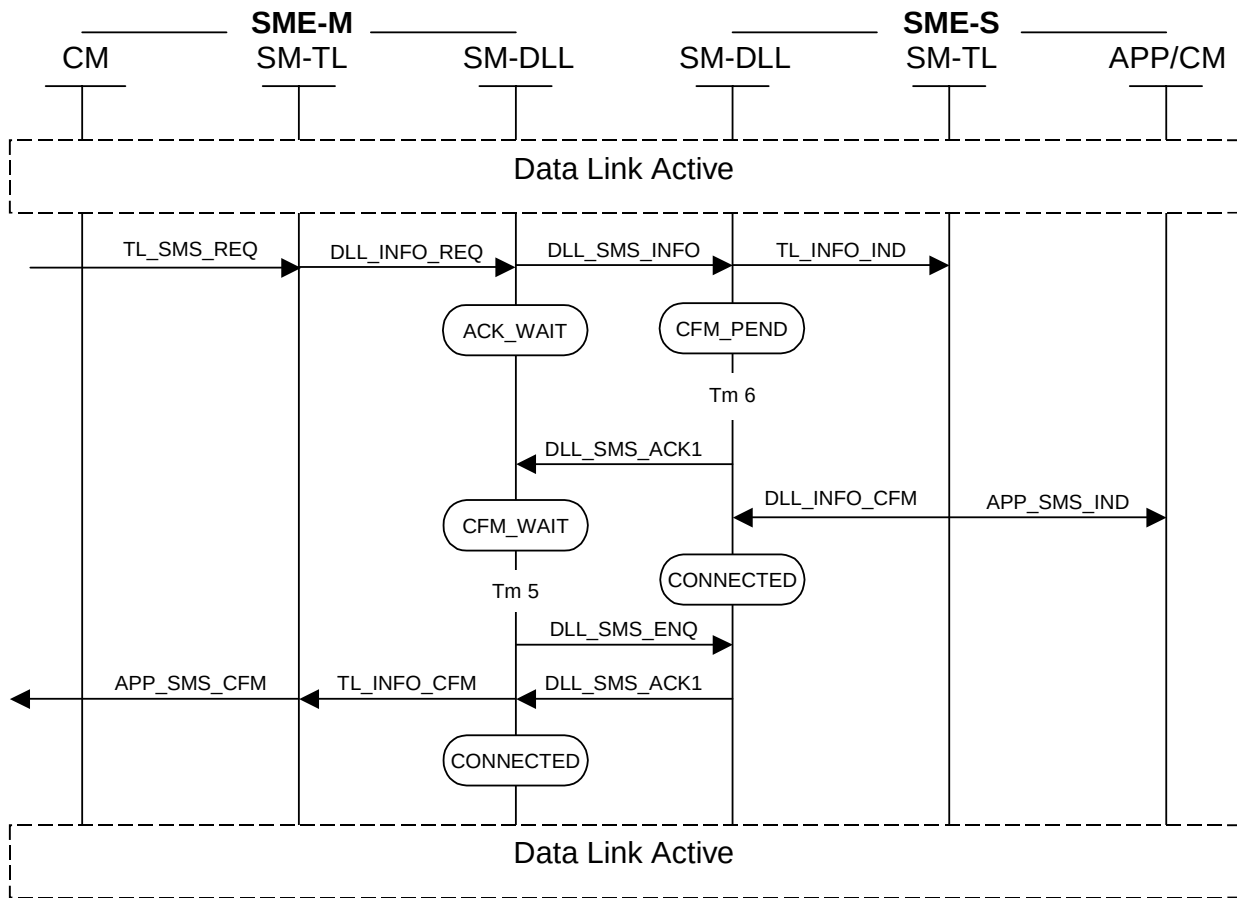


Figure B.1.3.2: Single segment, the SME-S confirms the SM after Tm6 expiry

B.1.3.3 Single segment, the SME-S rejects the SM before Tm6 expiry

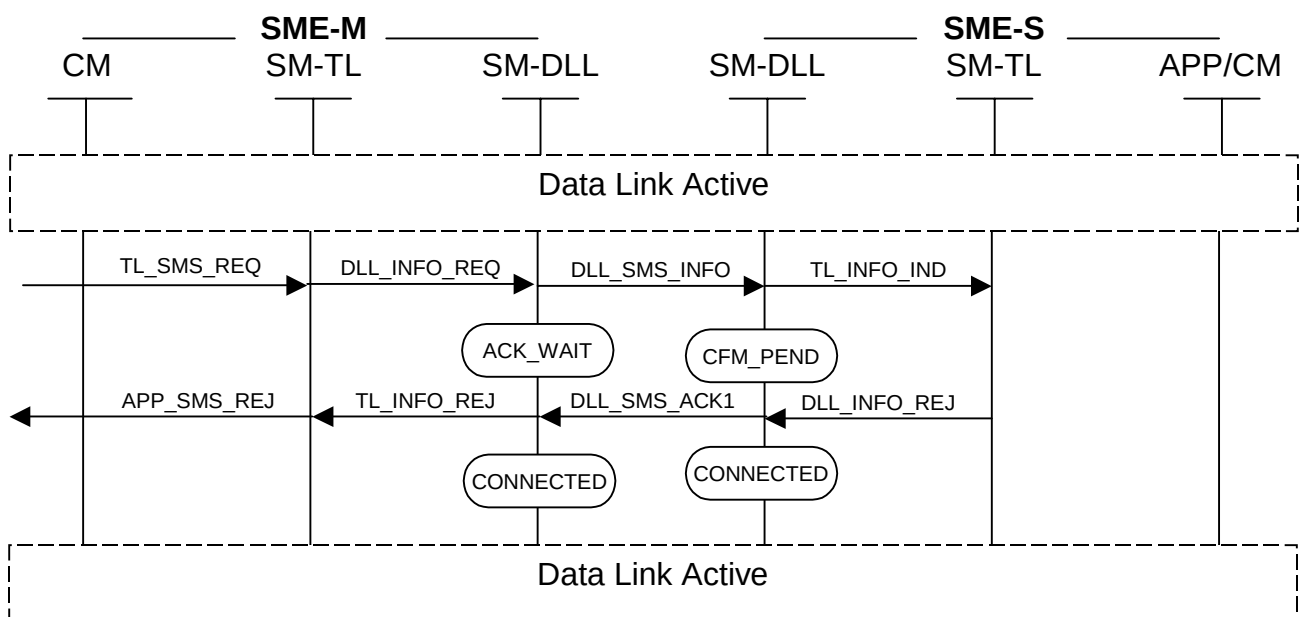


Figure B.1.3.3: Single segment, the SME-S rejects the SM before Tm6 expiry

B.1.3.4 Three segments, the SME-S confirms the SM before Tm6 expiry

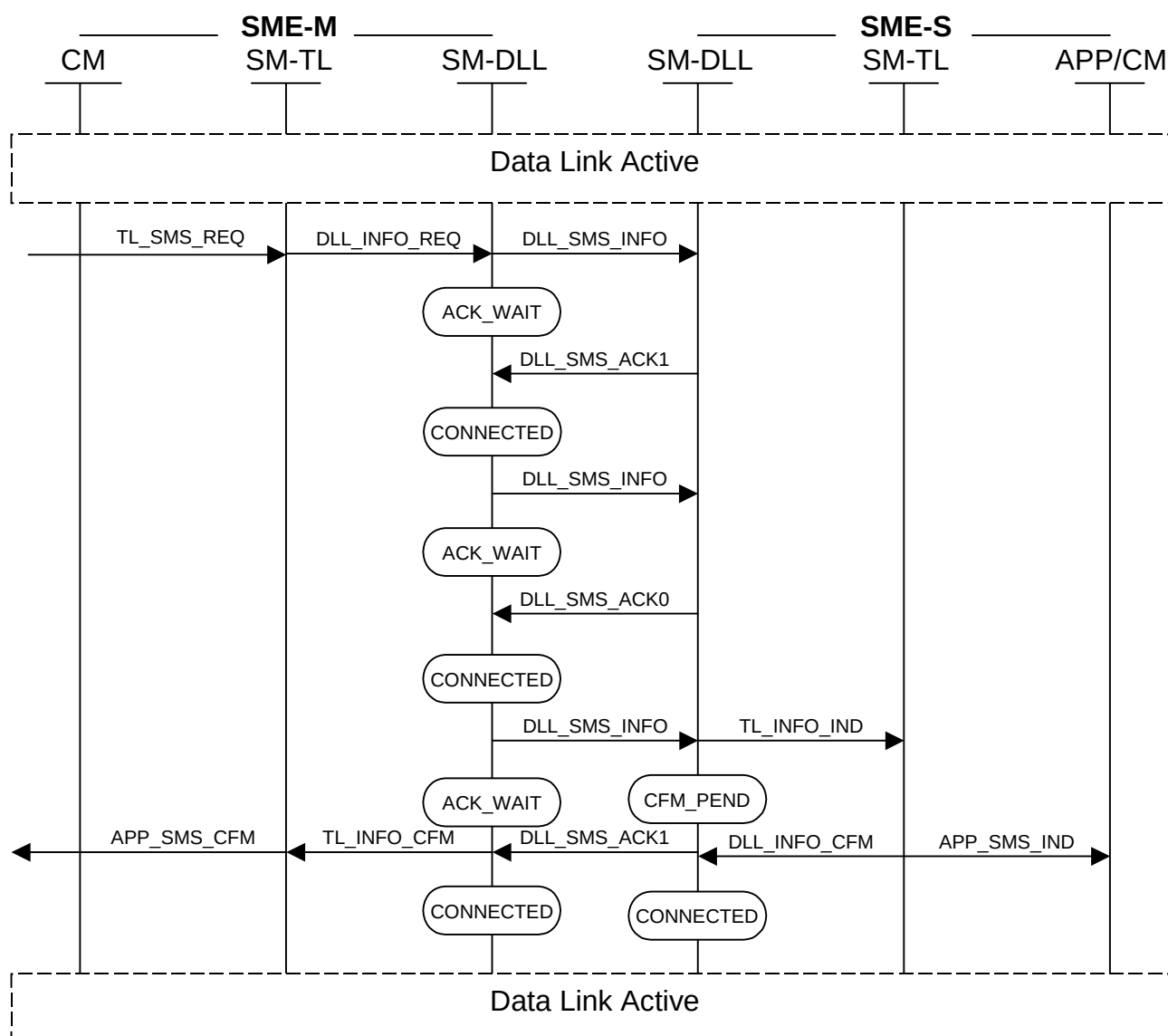


Figure B.1.3.4: Three segments, the SME-S confirms the SM before Tm6 expiry

B.1.3.5 Single segment, recoverable error in SME-S DLL, the SME-S confirms the SM before Tm6 expiry

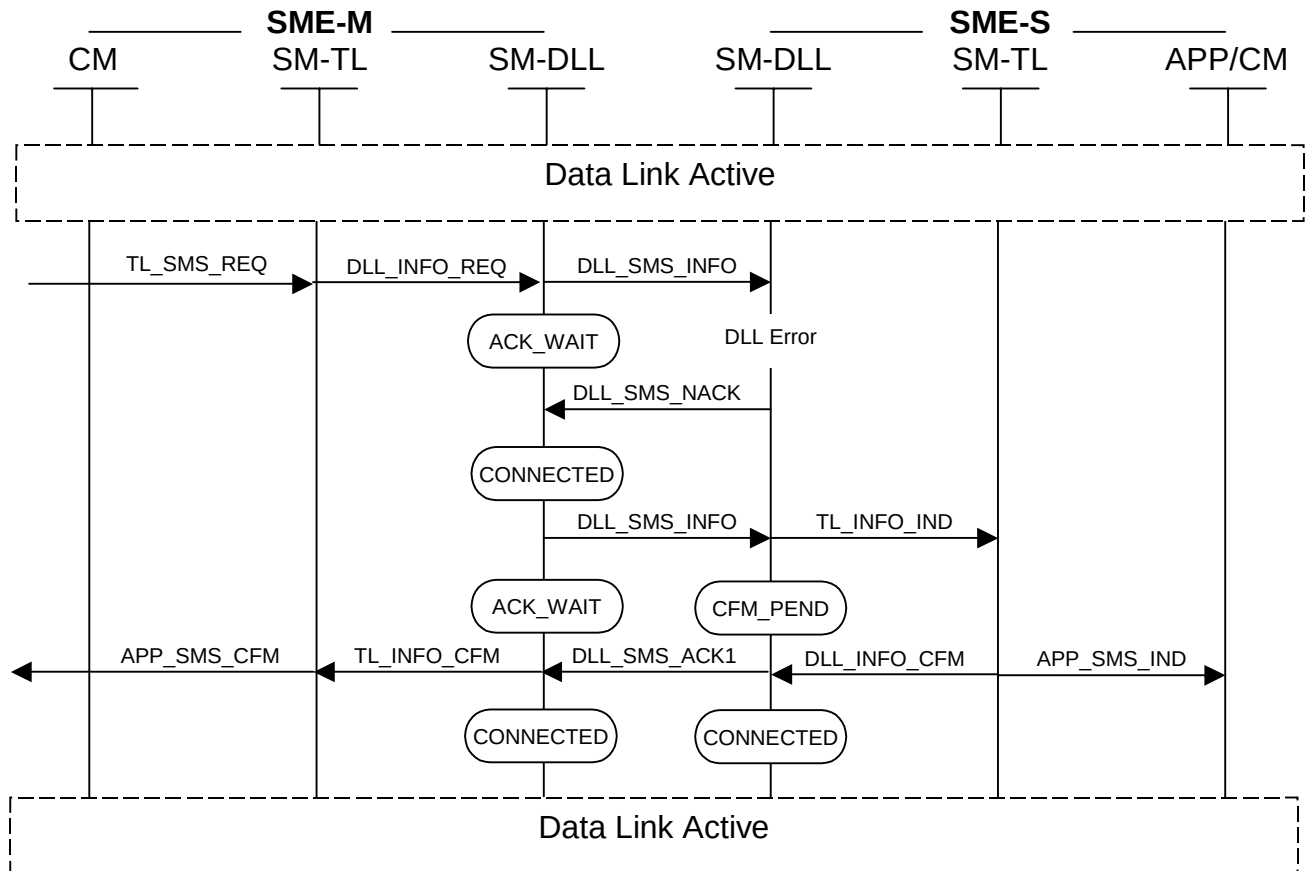


Figure B.1.3.5: Single segment, recoverable error in SME-S DLL, the SME-S confirms the SM before Tm6 expiry

B.1.3.6 Single segment, recoverable error in SME-M_SM-DLL, the SME-S confirms the SM before Tm6 expiry

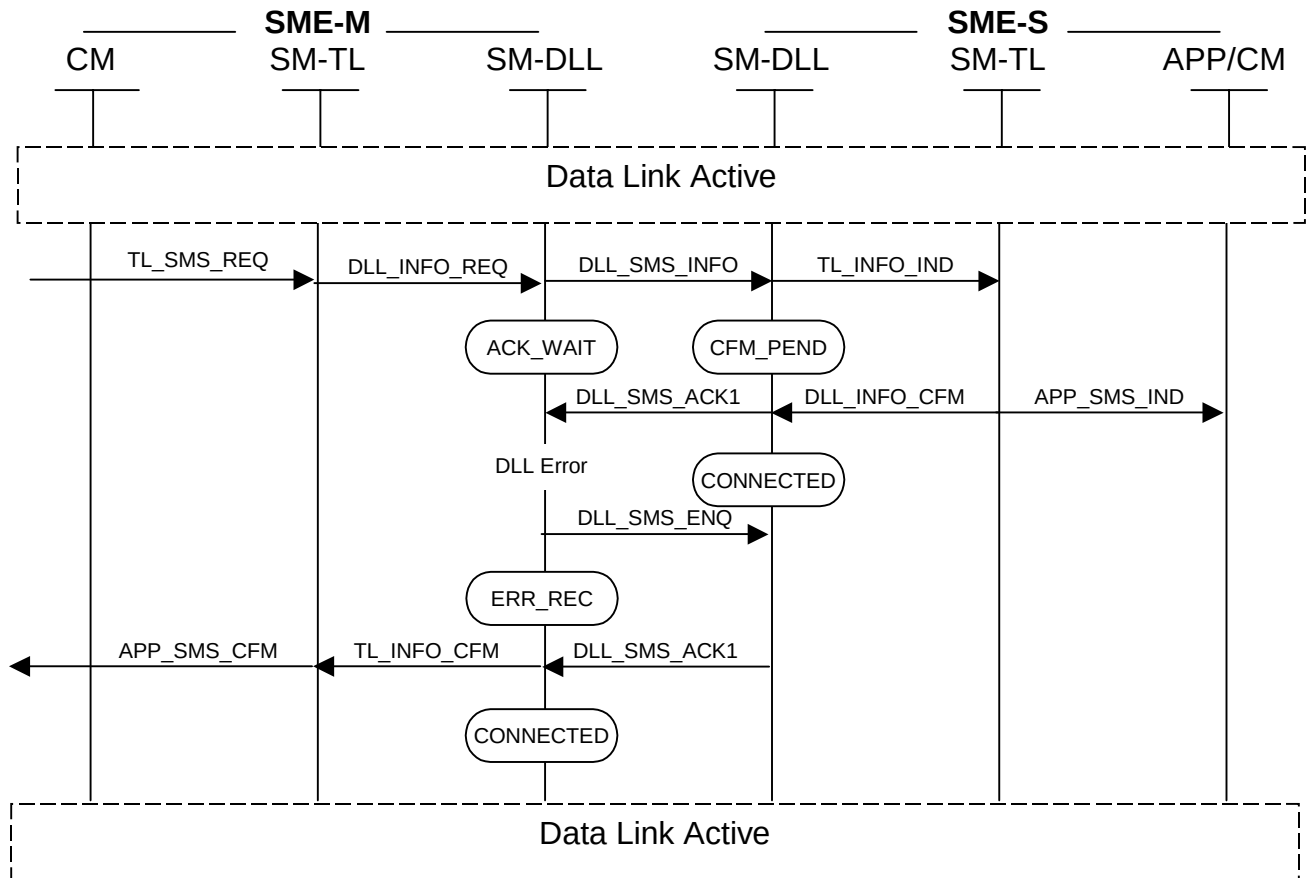


Figure B.1.3.6: Single segment, recoverable error in SME-M_SM-DLL, the SME-S confirms the SM before Tm6 expiry

B.1.3.7 Single segment, recoverable loss of frame in SME-S_SM-DLL, the SME-S confirms the SM before Tm6 expiry

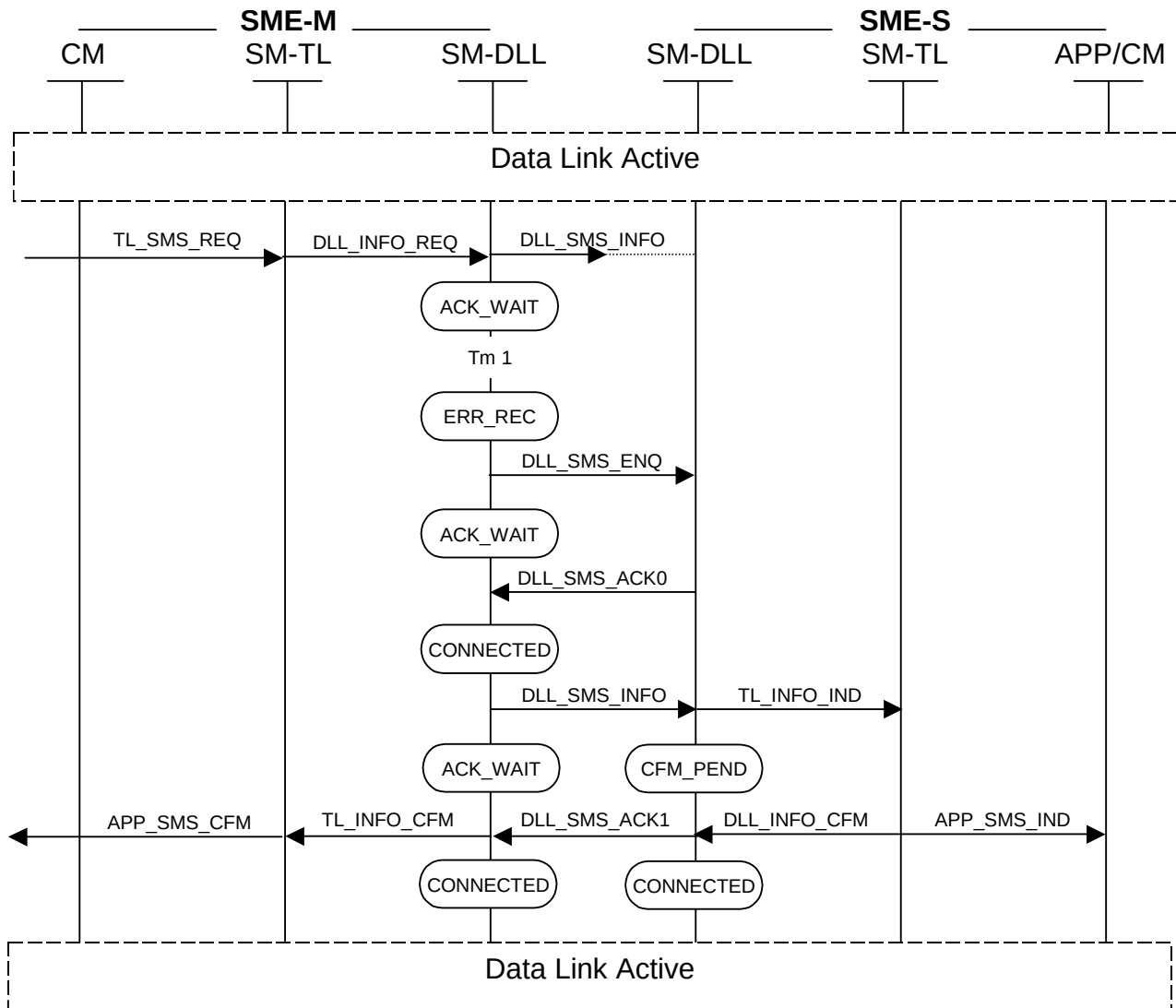


Figure B.1.3.7: Single segment, recoverable loss of frame in SME-S_SM-DLL, the SME-S confirms the SM before Tm6 expiry

B.1.3.8 Single segment, recoverable loss of frame in SME-M_SM-DLL, the SME-S confirms the SM before Tm6 expiry

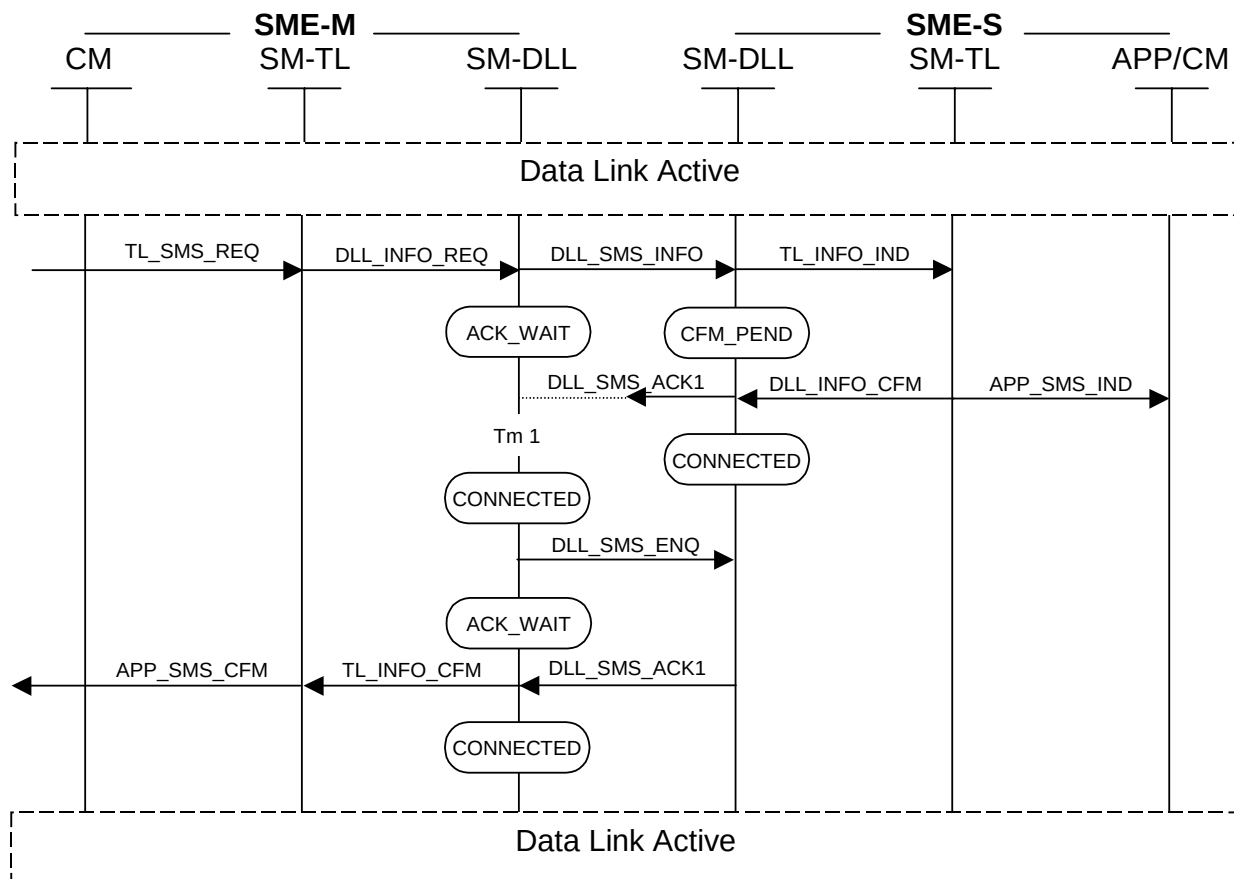


Figure B.1.3.8: Single segment, recoverable loss of frame in SME-M_SM-DLL, the SME-S confirms the SM before Tm6 expiry

B.1.3.9 Single segment, unrecoverable error in SME-S_SM-DLL

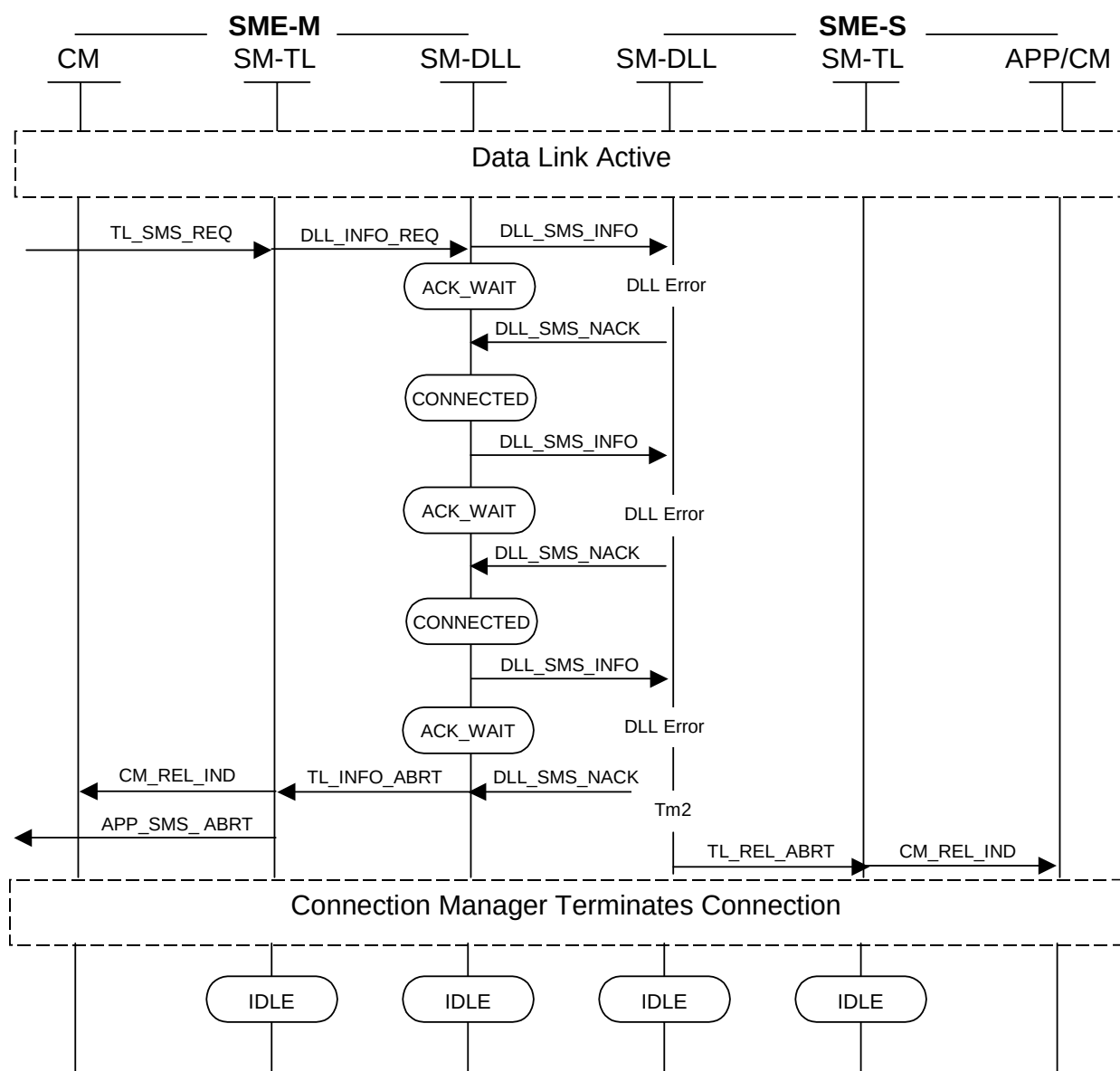


Figure B.1.3.9: Single segment, unrecoverable error in SME-S_SM-DLL

[illegible]

Figure B.1.3.10: Single segment, unrecoverable loss of frame in SME-M_SM-DLL

B.1.3.11 Single segment, unrecoverable loss of frame in SME-S_SM-DLL

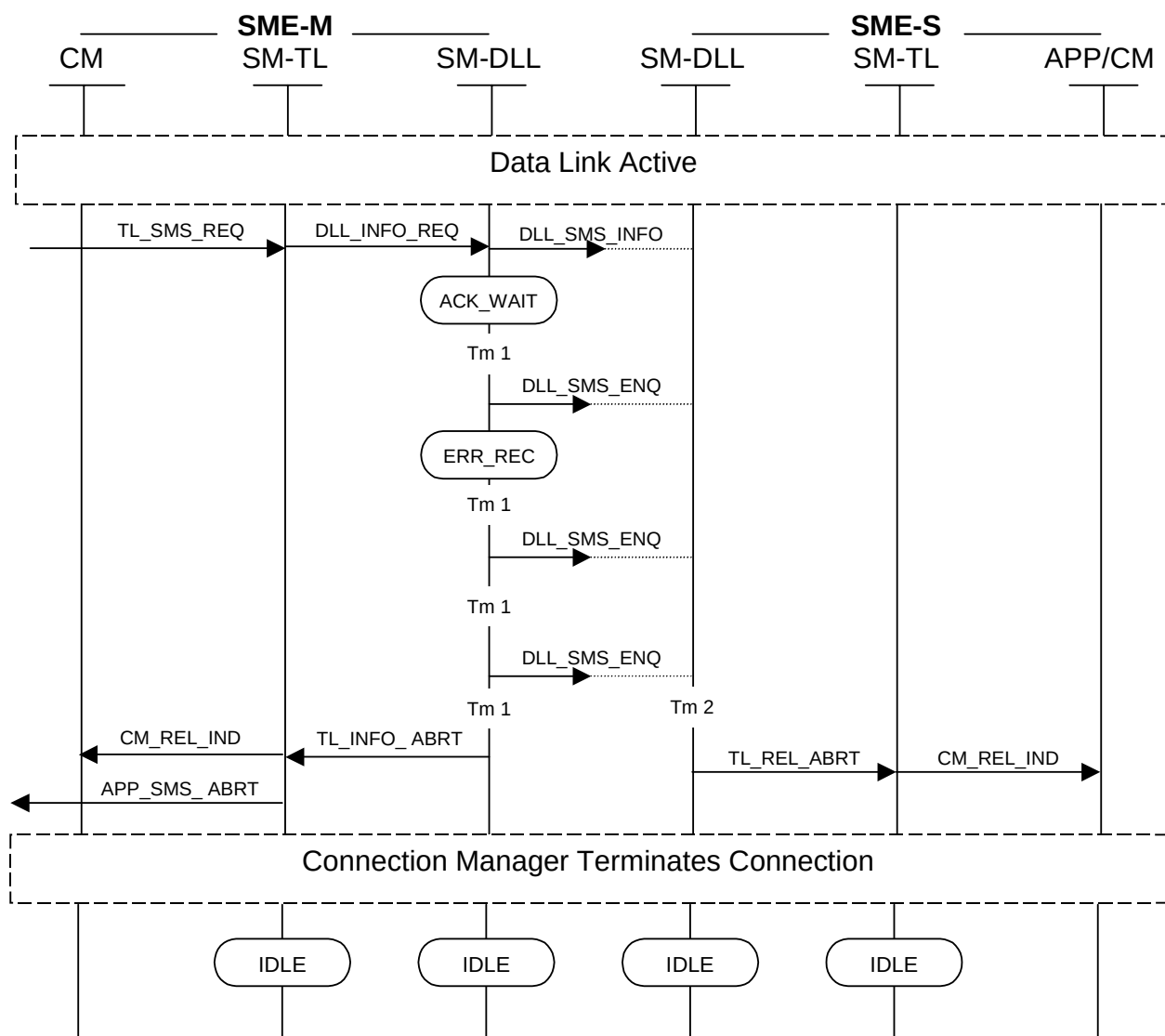


Figure B.1.3.11: Single segment, unrecoverable loss of frame in SME-S_SM-DLL

B.1.4 Connection Release

B.1.4.1 Normal Case

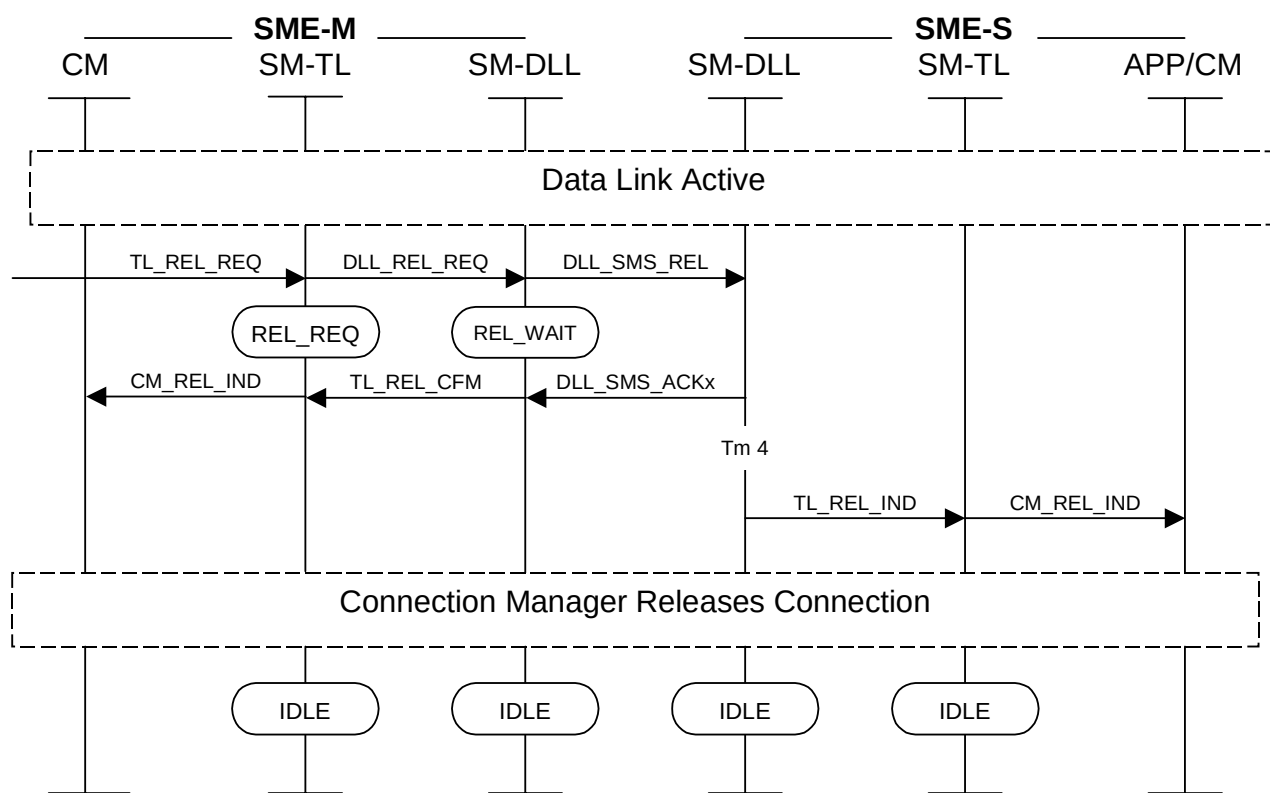


Figure B.1.4.1: Normal Case

B.1.4.2 Recoverable Error in SME-S_SM-DLL

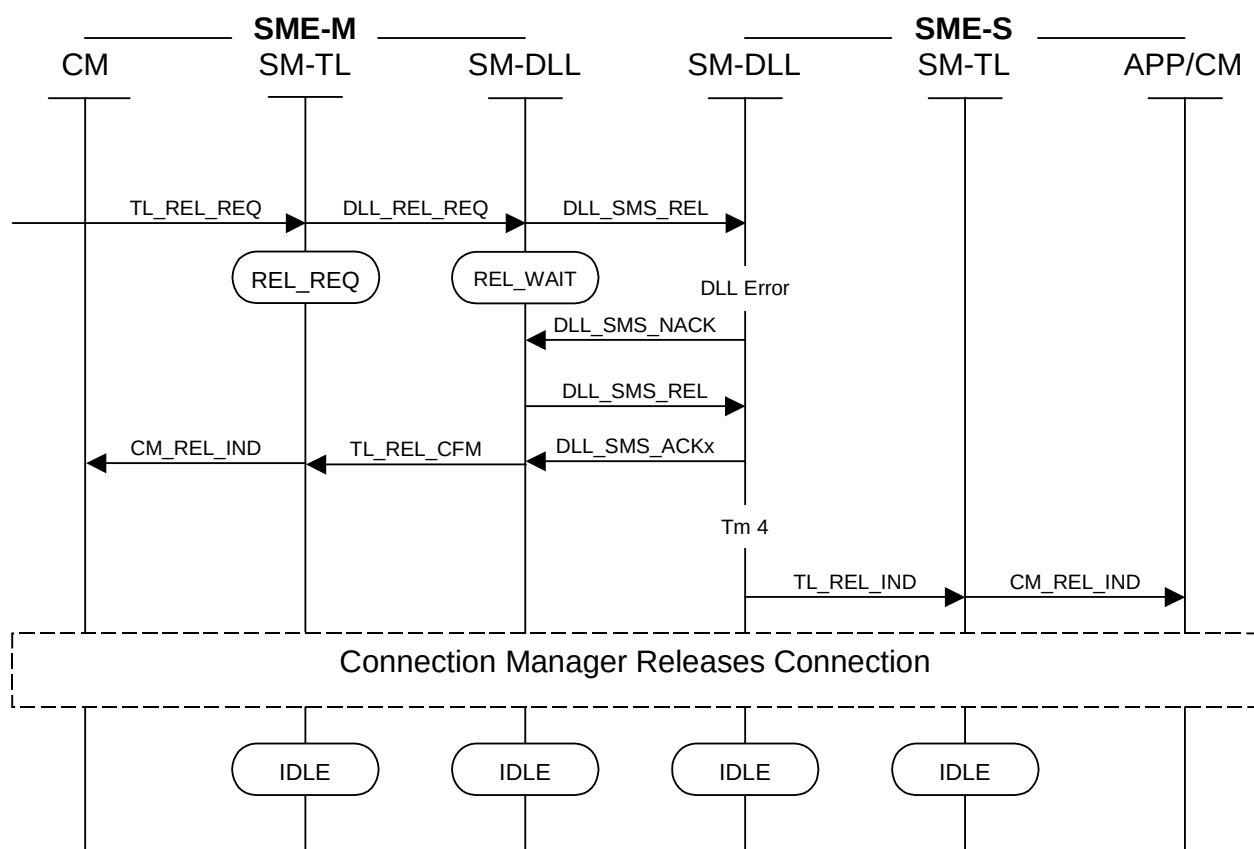


Figure B.1.4.2: Recoverable Error in SME-S_SM-DLL

B.1.4.3 Recoverable Error in SME-M_SM-DLL

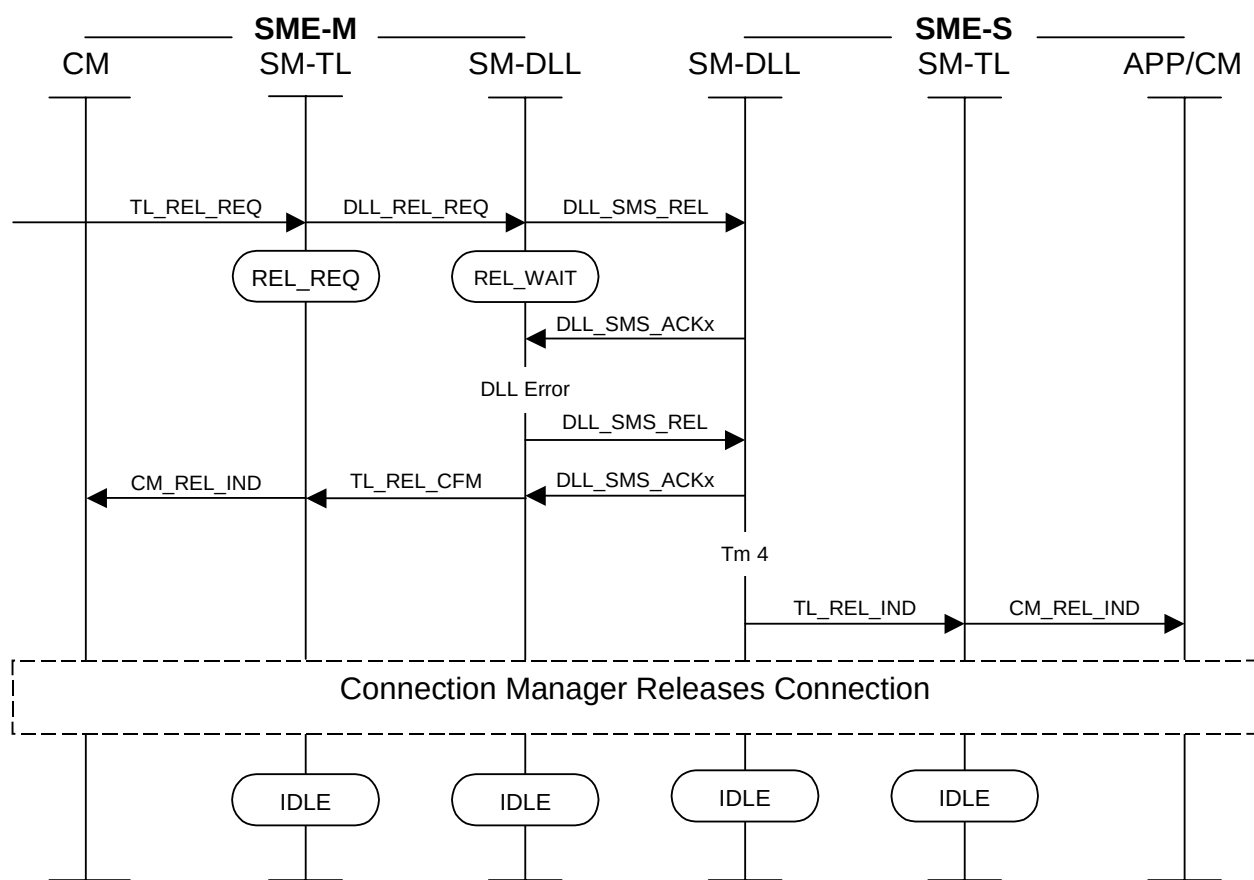


Figure B.1.4.3: Recoverable Error in SME-M_SM-DLL

B.1.4.4 Unrecoverable Error in SME-S_SM-DLL

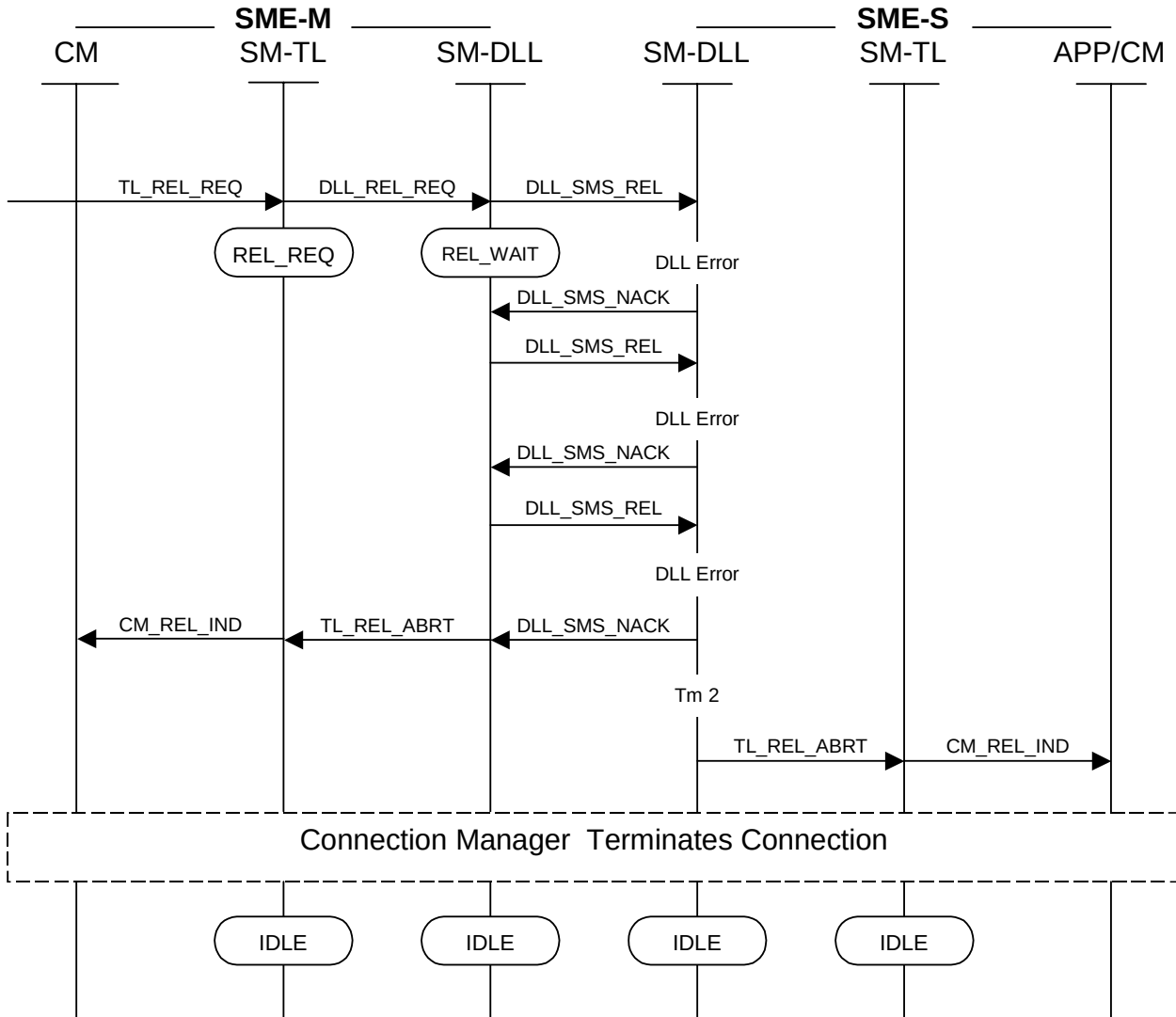


Figure B.1.4.4: Unrecoverable Error in SME-S_SM-DLL

B.1.4.7 No Message to send from SME-M_SM-TL before Tm7 expiry

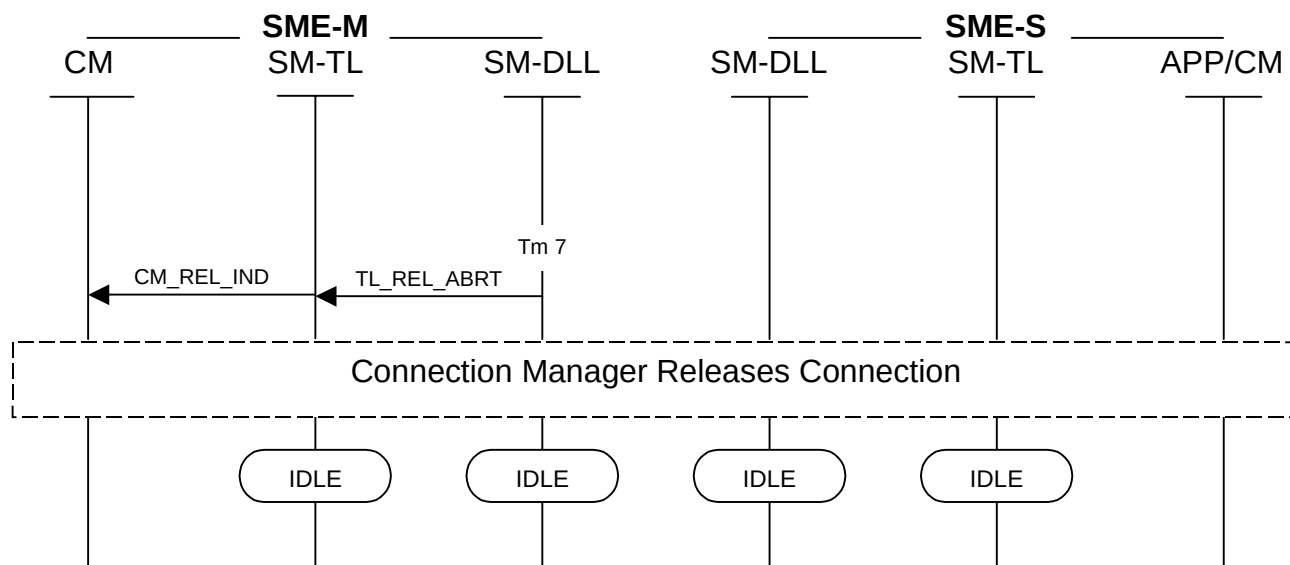


Figure B.1.4.7: No Message to send from SME-M_SM-TL before Tm7 expiry

B.2 Transfer Layer Messages and Parameters formats

B.2.1 TL Messages

B.2.1.1 SMS_SUBMIT Message Format

The message, in case the "Media Identifier" parameter assumes the value "SMS", contains the following parameters in the following order:

Table B.2.1

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Mandatory
Called Line identity	Clause: Called Line Identity Parameter format.	Mandatory
Called Terminal Identity	Clause Called Terminal Identity Parameter format.	Mandatory
Notify	Clause: Notify Parameter format.	Mandatory
Public Key	Clause: Public Key Parameter format.	Optional
Replace Short Message Type	Clause: Replace Short Message Type Parameter format.	Optional
Validity-Period	Clause: Validity-Period Parameter format.	Optional

The message, in case the "Media Identifier" parameter assumes the value "VOICE", contains the following parameters in the following order:

Table B.2.2

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Mandatory
Called Line identity	Clause: Called Line Identity Parameter format.	Mandatory
Called Terminal Identity	Clause: Called Terminal Identity Parameter format.	Mandatory
Notify	Clause: Notify Parameter format.	Mandatory
Public Key	Clause: Public Key Parameter format.	Optional
Replace Short Message Type	Clause: Replace Short Message Type Parameter format.	Optional
Validity-Period	Clause: Validity-Period Parameter format.	Optional

The message, in case the "Media Identifier" parameter assumes the value "conventional MAIL" or "TELEGRAM", contains the following parameters in the following order:

Table B.2.3

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Mandatory
Mail Address	Clause: Mail Address Parameter format.	Mandatory
Notify	Clause: Notify Parameter format.	Mandatory
Validity-Period	Clause: Validity-Period Parameter format.	Optional

The "Notify" parameter shall assume the value: "Status report not required".

The message, in case the "Media Identifier" parameter assumes the value "Fax", contains the following parameters in the following order:

Table B.2.4

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Mandatory
Called Line identity	Clause: Called Line identity Parameter format.	Mandatory
Fax Recipient Name	Clause: Fax recipient name Parameter format.	Mandatory
Notify	Clause: Notify Parameter format.	Mandatory
Validity-Period	Clause: Validity-Period Parameter format.	Optional

The "Notify" parameter shall assume the value: "Status report via SMS required".

The message, in case the "Media Identifier" parameter assumes the value "E-mail", contains the following parameters in the following order:

Table B.2.5

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Mandatory
Mail Address	Clause: Mail Address Parameter format.	Mandatory
Notify	Clause: Notify Parameter format.	Mandatory
Validity-Period	Clause: Validity-Period Parameter format.	Optional

The "Notify" parameter shall assume the value: "Status report not required".

The message, in case the "Media Identifier" parameter assumes the value "DATA", contains the following parameters in the following order:

Table B.2.6

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Data Information	Clause: Data Information Parameter format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Mandatory
Called Line identity	Clause: Called Line Identity Parameter format.	Mandatory
Called Terminal Identity	Clause: Called Terminal Identity Parameter format.	Mandatory
Notify	Clause: Notify Parameter format.	Mandatory
Public Key	Clause: Public Key Parameter format.	Optional
Replace Short Message Type	Clause: Replace Short Message Type Parameter format.	Optional
Validity-Period	Clause: Validity-Period Parameter format.	Optional

B.2.1.2 SMS_DELIVERY Message Format

The message contains the following parameters in the following order:

Table B.2.7: Media Identifier Parameter set to "SMS"

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Date and Time	Clause: Date and Time Parameter format.	Mandatory
Calling Line Identity (CLI)	Clause: Calling Line Identity (CLI) Parameter format.	Mandatory
Or Reason for Absence of CLI	Clause: Reason for Absence of CLI Parameter format.	
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Optional
Public Key	Clause: Public Key Parameter format.	Optional
Replace Short Message Type	Clause: Replace Short Message Type Parameter format.	Optional

Table B.2.8: Media Identifier Parameter set to "E-mail"

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Display Information	Clause: Display Information Parameter format.	Mandatory
Date and Time	Clause: Date and Time Parameter format.	Mandatory
Mail Address	Clause: Mail Address Parameter format.	Mandatory

Table B.2.9: Media Identifier Parameter set to "DATA"

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter format.	Mandatory
Data Information	Clause: Data Information Parameter format.	Mandatory
Date and Time	Clause: Date and Time Parameter format.	Mandatory
Calling Line Identity (CLI)	Clause: Calling Line Identity (CLI) Parameter format.	Mandatory
Or Reason for Absence of CLI	Clause: Reason for Absence of CLI Parameter format.	
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter format.	Optional
Public Key	Clause: Public Key Parameter format.	Optional
Replace Short Message Type	Clause: Replace Short Message Type Parameter format.	Optional

B.2.1.3 SMS_STATUS_REP Message Format

The message contains the following parameters in the following order:

Table B.2.10

Parameter name	Reference	Type
Media Identifier	Clause: Media Identifier Parameter Format.	Mandatory
Firmware Version	Clause: Firmware Version Parameter Format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter Format.	Mandatory
Display Information	Clause: Display Information Parameter Format.	Mandatory
Date and Time	Clause: Date and Time Parameter Format.	Mandatory
Calling Line Identity (CLI)	Clause: Calling Line Identity (CLI) Parameter Format.	Mandatory
Or Reason for Absence of CLI	Clause: Reason for Absence of CLI Parameter Format.	
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter Format.	Optional
Notify	Clause: Notify Parameter format.	Mandatory

The Calling Line Identity parameter shall contain the destination phone number of the message which the status report refers to.

B.2.1.4 SMS_SUBMIT_REP Message Format

The message contains the following parameter:

Table B.2.11

Parameter name	Reference	Type
Response Type	Clause: Response Type Parameter Format.	Mandatory

B.2.1.5 SMS_DELIVERY_REP Message Format

The message contains the following parameter:

Table B.2.12

Parameter name	Reference	Type
Response Type	Clause: Response Type Parameter Format.	Mandatory

B.2.1.6 SM-TE_STATUS Message Format

The message contains the following parameters in the following order:

Table B.2.13

Parameter name	Reference	Type
Firmware Version	Clause: Firmware Version Parameter Format.	Mandatory
SMS Provider Identifier	Clause: SMS Provider Identifier Parameter Format.	Mandatory
Calling Terminal Identity	Clause: Calling Terminal Identity Parameter Format.	Mandatory
SM-TE Resources	Clause: SM-TE Resources Parameter Format.	Mandatory

B.2.1.7 SM_TE_CAPABILITY Message Format

The message contains the following parameter:

Table B.2.14

Parameter name	Reference	Type
Bearer Capability	Clause: Bearer Capability Parameter Format.	Mandatory

B.2.2 Parameters

B.2.2.1 Media Identifier Parameter Format

Table B.2.15: The Media Identifier parameter Format

Octet number	Contents
1	0001 0000 (10h): parameter name
2	0000 0001 (01h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	xxxx xxxx (xxh): code; it shall assume one of the following values: 0000 0000 (00h): SMS 0000 0001 (01h): FAX 0000 0010 (02h): E-Mail 0000 0011 (03h): conventional MAIL (through post office) 0000 0100 (04h): TELEGRAM 0000 0101 (05h): VOICE (through text-to-speech) 0000 0110 (06h): DATA

B.2.2.2 Firmware Version Parameter Format

Table B.2.16: The Firmware Version parameter Format

Octet number	Contents
1	0001 0001 (11h): parameter name
2	0000 0110 (06h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	aah: firmware/software revision - major digit
5	bbh: firmware/software revision - 1 ST middle digit
6	cch: firmware/software revision - 2 ND middle digit
7	ddh: firmware/software revision - minor digit
8	xxh: product code
9	xxh: manufacturer code

NOTE 1: The octets 4 to 7 indicate the firmware version of the SM-TE in the SMS_SUBMIT or SM-TE_STATUS TL messages, and the software release of the SM-SC in case of SMS_DELIVERY or SMS_STATUS_REP TL messages.

NOTE 2: In the SM submission case, the SM-TE may use the default values "0000 0000" (00h) for the firmware/software revision octets. The product code octet and manufacturer code octet may be given by the SMS or network provider or alternatively set to the default value "0000 0000" (00h).

NOTE 3: In the SM delivery case, all the values are set by the SMS provider.

NOTE 4: The coding of the firmware/software digits shall be the same as for the Display Information parameter.

B.2.2.3 SMS_Provider_Identifier Parameter Format

Table B.2.17: The SMS Provider Identifier parameter Format

Octet number	Contents
1	0001 0010 (12h): parameter name
2	0000 0011 (03h): parameter length less significant octet (3)
3	0000 0000 (00h): parameter length most significant octet
4	xxxx xxxx (xxh): first byte of the SM Service Provider code
5	xxxx xxxx (xxh): second byte of the SM Service Provider code
6	xxxx xxxx (xxh): third byte of the SM Service Provider code

NOTE: The octets 4 to 6 indicate the SM Service Provider code in both SM submission and SM delivery case. Both SM-TE and SM-SC may use the default value "0000 0000" (00h) for each octet. Alternatively, the SM Service Provider code may be given by the SMS or network provider.

B.2.2.4 Display Information Parameter Format

Table B.2.18: The Display Information parameter Format

Octet number	Contents
1	0001 0011 (13h): parameter name
2	xxxx xxxx (xxh): parameter length less significant octet
3	xxxx xxxx (xxh): parameter length most significant octet
4	0xxx xxxx: first character
n+3	0xxx xxxx: n-th character

The maximum parameter length is 65 535.

The character coding shall be the 7 bit GSM coding (apart from the character of column "20" and row "4", corresponding to the hexadecimal number 24) illustrated in the following tables:

Table B.2.19

	00	10	20	30	40	50	60	70
00	@	Δ	SP	0	i	P	¿	p
01	£		!	1	A	Q	a	q
02	\$	Φ	"	2	B	R	b	r
03	¥	Γ	#	3	C	S	c	s
04	è	Λ	€	4	D	T	d	t
05	é	Ω	%	5	E	U	e	u
06	ù	Π	&	6	F	V	f	v
07	ì	Ψ	'	7	G	W	g	w
08	ò	Σ	(	8	H	X	h	x
09	Ç	Θ	)	9	I	Y	i	y
0A	LF	Ξ	*	:	J	Z	j	z
0B	Ø	l)	+	;	K	Ä	k	ä
0C	ø	Æ	,	<	L	Ö	l	ö
0D	CR	æ	-	=	M	Ñ	m	ñ
0E	Å	ß	.	>	N	Ü	n	ü
0F	å	É	/	?	O	Š	o	à

NOTE: SP is the character "Space".

NOTE 1: If the SM-TE receives a character not supported, it shall insert a space or another character with the meaning of unknown character or convert to a character similar to the one not displayable (e.g. a character without accent instead of a character with accent).

NOTE 2: If an SM-TE implements the optional extension table (see table B.2.20), the character code 24h in the basic table above (table B.2.19) has the same meaning as in GSM table (i.e. character "□"). In this case the SM-TE shall not send this code to the SM-SC.

- 1) This code is an escape to an extension of the 7-bit default alphabet table. A receiving entity which does not understand the meaning of this escape mechanism may display it as a space.

Table B.2.20: Optional 7bit alphabet extension table

	00	10	20	30	40	50	60	70
00								
01								
02								
03								
04		^						
05							€	
06								
07								
08			{					
09			}					
0A	2)							
0B		1)						
0C				[				
0D				~				
0E				]				
0F			\					

In the event that a SM entity receives a code where a symbol is not represented in table B.2.20 then it shall display the character shown in the main default 7-bit alphabet table:

- 1) This code value is reserved for the extension to another extension table. On receipt of this code, a receiving entity shall display a space until another extension table is defined.
- 2) This code is defined as a Page Break character. Any SM entity which does not understand the 7-bit alphabet table extension mechanism will treat this character as Line Feed.

B.2.2.5 Date and Time Parameter Format

Table B.2.21: The Date and Time parameter Format

Octet number	Contents
1	0001 0100 (14h): parameter name
2	0000 1000 (08h): parameter length less significant octet (8)
3	0000 0000 (00h): parameter length most significant octet
4	Octet with the most significant digit of the month
5	Octet with the less significant digit of the month
6	Octet with the most significant digit of the day
7	Octet with the less significant digit of the day
8	Octet with the most significant digit of the hour
9	Octet with the less significant digit of the hour
10	Octet with the most significant digit of the minute
11	Octet with the less significant digit of the minute

The value for the month shall be between 01 (January) and 12 (December); the value for the day shall be between 01 and 31; the value for the hour shall be between 00 (midnight) and 23; the value for the minutes shall be between 00 and 59.

The digit coding shall be the same as for the Display Information parameter.

B.2.2.6 Calling Line Identity Parameter Format

Table B.2.22: The Calling Line Identity parameter Format

Octet number	Contents
1	0001 0101 (15h): parameter name
2	000x xxxx: parameter length less significant octet (max 20 decimal)
3	0000 0000 (00h): parameter length most significant octet
4	Calling line first digit
n+3	Calling line n-th digit

The Calling Line Identity digits shall be between 0 and 9, also the "*" and "#" characters shall be possible. The digit coding shall be the same as for the Display Information parameter.

B.2.2.7 Reason for Absence of CLI Parameter Format

Table B.2.23: The Reason for Absence of CLI parameter Format

Octet number	Contents
1	0001 0110 (16h): parameter name
2	0000 0001 (01h): parameter length less significant octet (1)
3	0000 0000 (00h): parameter length most significant octet
4	0100 1111 (4Fh): not available 0101 0000 (50h): private

B.2.2.8 Calling Terminal Identity Parameter Format

Table B.2.24: The Calling Terminal Identity parameter Format

Octet number	Contents
1	0001 0111 (17h): parameter name
2	0000 0001 (01h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	000x xxxx (0xh): Terminal Equipment Identity; value between 01h and 09h When requesting the CLI privacy, the bit 4 is set to 1

B.2.2.9 Called Line Identity Parameter Format

Table B.2.25: The Called Line Identity parameter Format

Octet number	Contents
1	0001 1000 (18h): parameter name
2	000x xxxx: parameter length less significant octet (max 20 decimal)
3	0000 0000 (00h): parameter length most significant octet
4	Called line first digit
n+3	Called line n-th digit

The Called Line Identity digits shall be between 0 and 9, also the "*" and "#" characters shall be possible. The digit coding shall be the same as for the Display Information parameter.

B.2.2.10 Fax Recipient Name Parameter Format

Table B.2.26: The Fax Recipient Name parameter Format

Octet number	Contents
1	0001 1001 (19h): parameter name
2	xxxx xxxx (xxh): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4 + i - 1	xxxx xxxx (xxh): destination name i-th character

The character coding shall be the same as for the Display Information parameter.

B.2.2.11 Mail Address Parameter Format

Table B.2.27: The Mail Address parameter Format

Octet number	Contents
1	0001 1010 (1Ah): parameter name
2	xxxx xxxx (xxh): parameter length less significant octet
3	0000 000x (0xh): parameter length most significant octet
4 + i - 1	xxxx xxxx (xxh): address i-th character

In case this parameters contains more than one field (e.g. more than one email address), they should be separated using a semicolon (";").

The maximum parameter length is 256.

The character coding shall be the same as for the Display Information parameter.

B.2.2.12 Called Terminal Identity Parameter Format

Table B.2.28: The Called Terminal Identity parameter Format

Octet number	Contents
1	0001 1011 (1Bh): parameter name
2	0000 0001 (01h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	0000 xxxx (0xh): Terminal Equipment Identity; value between 01h and 09h

B.2.2.13 Notify Parameter Format

Table B.2.29: The Notify parameter Format

Octet number	Contents
1	0001 1100 (1Ch): parameter name
2	0000 0011 (03h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	0000 00xx (0xh): in the SMS_SUBMIT Message xx: 00 - status report not required 01 - status report via SMS required in the SMS_STATUS_REP Message xx: 00 - successfully delivered message notification 11 - unsuccessfully delivered message notification
5	xxxx xxxx (xxh): notification number less significant octet
6	000x xxxx (xxh): notification number most significant octet

The notification number is assigned by the terminal equipment to a message sent to the Service Centre and is used by the Service Centre to identify the message which the notify refers to; the notification number is generated progressively modulo-8192.

In case of notification not required the progressive number shall be 0000h.

B.2.2.14 Public Key Parameter Format

Table B.2.30: The Public Key parameter Format

Octet number	Contents
1	0001 1101 (1Dh): parameter Format
2	0000 0xxx (0xh): parameter length less significant octet between 01h and 05h
3	0000 0000 (00h): parameter length most significant octet
4	xxxx xxxx (xxh): Public Key first character
4 + N - 1	xxxx xxxx (xxh): Public Key n-th character

The Public Key characters can be alphanumeric. The character coding shall be the same as for the Display Information parameter, but should be preferably limited on the characters [0 to 9, A to Z, a to z].

B.2.2.15 SM-TE Resources Parameter Format

Table B.2.31: The SM-TE Resources Parameter Format

Octet number	Contents
1	0001 1110 (1Eh): parameter name
2	0xxx xxxx (xxh): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	xxxx xxxx (xxh): Terminal Equipment status code bit 0 - Memory availability: xxxx xxx1: messages memory resources are not available xxxx xxx0: message memory resources are available bits 1 to 7: reserved for future implementations
5 - 67	reserved for future implementations

B.2.2.16 Response Type Parameter Format

Table B.2.32: The Response Type parameter Format

Octet number	Contents
1	0001 1111 (1Fh): parameter name
2	0000 0001 (01h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	xxxx xxxx (xxh): code used to notify the confirmation or rejection, with cause, of the received Transfer Layer message. It shall assume one of the following values: 0000 0000 (00h): CONFIRM: generic confirmation 1000 0000 (80h): REJECT (Generic): reject of the message for generic transfer layer error 1000 0001 (81h): REJECT (Memory): rejection of the message for lack of resources: device memory full (used only in the SMS DELIVERY REP) 1000 0010 (82h): REJECT (Key): rejection of the message for unknown Key (used only in the SMS DELIVERY REP) 1000 0011 (83h): REJECT (E-mail address): rejection of the message for syntax error in the E-mail address (used only in the SMS SUBMIT REP) 1000 0100 (84h): REJECT (Message too long): rejection of the message for overrun 1000 0101 (85h): REJECT (wrong parameter): rejection of the message for wrong parameter contents 1000 0110 (86h): REJECT (unwanted or missing parameter): rejection of the message for unwanted or missing parameter 1000 0111 (87h): REJECT (feature not available): rejection of the message for required feature not available at the Service Centre (used only in the SMS SUBMIT REP) 1000 1000 (88h): REJECT (feature not active): rejection of the message for required feature not active at the Service Centre (used only in the SMS SUBMIT REP) 1000 1001 (89h): REJECT (destination SMS terminal equipment missing): rejection of the message or destination SMS terminal equipment missing (used only in the SMS SUBMIT REP)

Generally, the values between 00h and 7Fh shall be used to confirm a message, the values between 80h and FDh shall be used to reject a message.

B.2.2.17 Bearer Capability Parameter Format

Table B.2.33: The Bearer Capability parameter Format

Octet number	Contents
1	0010 0000 (20h): parameter name
2	000x xxxx: parameter length less significant octet (max 20 decimal)
3	0000 0000 (00h): parameter length most significant octet
4	Services Field xxxx xxx1: SM Replace Service implemented xxxx xxx0: SM Replace Service not implemented xxxx xx1x: More Messages Receiving in one connection implemented xxxx xx0x: More Messages Receiving in one connection not implemented xxxx x1xx: Display Code Set Extension implemented xxxx x0xx: Display Code Set Extension not implemented xxxx 1xxx: E-Mail media implemented xxxx 0xxx: E-Mail media not implemented xxx1 xxxx: Data media implemented xxx0 xxxx: Data media not implemented bit 5 to bit 7 TBD
5-6	Display or Data Information Length Field xxxx xxxx: Max Display or Data Information parameter length implemented (less significant octet) xxxx xxxx: Max Display or Data Information parameter length implemented (most significant octet)
7-8	Available TE Memory Field xxxx xxxx: number of memory blocks available to store incoming SM (less significant octet) xxxx xxxx: number of memory blocks available blocks to store incoming SM (most significant octet) (each block consists of 16 bytes) (see note)
9-10	TE Language Field xxxx xxxx: Language Code (1st char) xxxx xxxx: Language Code (2nd Char) The Language is coded according to ISO 3166-1 [11] (as referenced in RFC 3066 [12])
11-23	Fields Reserved for Future Features xxxx xxxx: TBD

NOTE: In case the TE does not support this feature the two octets shall assume the reserved value FFh.

Only the TE can use the "Bearer Capability" parameter to inform the SM_SC about its capabilities.

If a field is omitted, the following ones shall be omitted too.

In case the SM-TE CAPABILITY message containing the "Bearer Capability" parameter is not used by the SM-TE to communicate its capabilities to the SM-SC, the SM-SC will assume the following default capabilities:

- SM Replace Service not implemented;
- More Messages Receiving during the same call not implemented;
- Display Code Set Extension not implemented;
- Max Display length implemented is 640 bytes;
- no information about available TE memory to store incoming SMs;
- the TE Language enabled is the language of the country in which the SM-SC is located;
- e-mail media not implemented;
- data media not implemented.

B.2.2.18 Replace Short Message Type Parameter Format

Table B.2.34: The Replace Short Message Type parameter format

Octet number	Contents
1	0010 0001 (21h): parameter format
2	0000 0001(01h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	0000 0000: Short Message Type 0 (Overwrite not required) 0000 0001: Replace Short Message Type 1 (Overwrite required) 0000 0010: Replace Short Message Type 2 (Overwrite required) 0000 0011: Replace Short Message Type 3 (Overwrite required) 0000 0100: Replace Short Message Type 4 (Overwrite required) 0000 0101: Replace Short Message Type 5 (Overwrite required) 0000 0110: Replace Short Message Type 6 (Overwrite required) 0000 0111: Replace Short Message Type 7 (Overwrite required)

B.2.2.19 Validity Period Parameter Format

Table B.2.35: The Validity Period parameter format

Octet number	Contents
1	0010 0010 (22h): parameter name
2	0000 0001(01h): parameter length less significant octet
3	0000 0000 (00h): parameter length most significant octet
4	xxxx xxxx: Validity Period 0 to 143 (VP + 1) x 5 minutes (i.e. 5 minutes intervals up to 12 hours) 144 to 167 12 hours + ((VP -143) x 30 minutes) 168 to 196 (VP - 166) x 1 day 197 to 255 (VP - 192) x 1 week

The SC shall assume 24h if there is no "Validity Period" parameter present in the SMS_SUBMIT message.

B.2.2.20 Data Information Parameter Format

Table B.2.36: The Data Information parameter format

Octet number	Contents
1	0010 0011 (23h): parameter name
2	xxxx xxxx (xxh): parameter length less significant octet
3	xxxx xxxx (xxh): parameter length most significant octet
4	xxxx xxxx: first byte
n+3	xxxx xxxx: n-th byte

The maximum parameter length is 65 535.

Annex C (informative): Bibliography

ETSI ES 201 986: "Services and Protocols for Advanced Networks (SPAN); Short Message Service (SMS) for PSTN/ISDN; Service Description".

3GPP TS 24.007: "3rd Generation Partnership Project; Technical Specification Group Core Network; Mobile radio interface signalling layer 3; General aspects (Release 5)".

ETSI ES 200 778-1: "Access and Terminals (AT); Analogue access to the Public Switched Telephone Network (PSTN); Protocol over the local loop for display and related services; Terminal Equipment requirements; Part 1: On-hook data transmission".

History

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