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3RD GENERATION PARTNERSHIP PROJECT 2 "3GPP2"

Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems

Revision E

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FOREWORD AND SCOPE

(This foreword and scope is not part of this standard)

This Specification was prepared by Technical Specification Group C of the Third Generation Partnership Project 2 (3GPP2). This Specification contains the Layer 2 Link Access Control (LAC) layer of the IMT-2000 CDMA Multi-Carrier Mode, IMT-2000 CDMA MC, also known as cdma2000®[1]. It provides a specification for land mobile wireless systems based upon cellular principles. This Specification includes the capabilities of Telecommunications Industry Association Standard TIA/EIA-95-B.

This Specification provides the Layer 2 Link Access Control (LAC) signaling protocol architecture and functionality used to provide the transport and delivery of Layer 3 signaling messages over IMT-2000 CDMA MC air interface; however, other specifications are required to complete the air interface and the rest of the system. Some of these specifications are listed in the References section.

In this document, the term "Layer 2" is understood to mean the *signaling* Layer 2, in the sense that non-signaling traffic (e.g., circuit or packet data) may have a different Layer 2 not described here. In addition, some traditional ISO Layer 2 functionality may be placed in the MAC Layer, but such functionality is not signaling-specific and thus is outside the scope of this document.

This document has the following organization:

1. Definitions and Conceptual Model. This section defines the terms and numeric information used in this standard, and describes the architectural and functional model used to develop cdma2000 LAC signaling.

2. Mobile Station Requirements. This section describes the requirements for cdma2000 mobile stations. A mobile station complying with these requirements will be able to operate in the CDMA mode with cdma2000 base stations complying with this document.

3. Base Station Requirements. This section describes the requirements for cdma2000 base stations. A base station complying with these requirements will be able to operate in the CDMA mode with cdma2000 mobile stations complying with this document.

Annex A. Timers and Constants. This normative annex contains tables that give specific values for the constant identifiers found in Section 2 and Section 3.

This standard includes provisions for future expansion of system capabilities.

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[1] cdma2000® is the trademark for the technical nomenclature for certain specifications and standards of the Organizational Partners (OPs) of 3GPP2. Geographically (and as of the **date** of publication), cdma2000® is a registered trademark of the Telecommunications Industry Association (TIA-USA) in the United States.

NOTES

1. Compatibility, as used in connection with this specification, is understood to mean the following: any mobile station is able to place and receive calls from any base stations. In addition, all base stations are able to place and to receive calls for any mobile station.
2. This compatibility specification is based upon the specific spectrum allocations defined by various governmental administrations.
3. Each mobile station is assigned either a single unique 32-bit binary serial number (ESN) or a single unique 56-bit binary serial number (MEID), which cannot be changed by the subscriber without rendering the mobile station inoperative (see 2.3.2 of [5]).
4. This specification uses the following verbal forms: "Shall" and "shall not" identify requirements to be followed strictly to conform to the standard and from which no deviation is permitted. "Should" and "should not" indicate that one of several possibilities is recommended as particularly suitable, without mentioning or excluding others; that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is discouraged but not prohibited. "May" and "need not" indicate a course of action permissible within the limits of the standard. "Can" and "cannot" are used for statements of possibility and capability, whether material, physical, or causal.
5. Footnotes appear at various points in this specification to elaborate and further clarify items discussed in the body of the specification.
6. Unless indicated otherwise, this document presents numbers in decimal form. Binary numbers are distinguished in the text by the use of single quotation marks.
7. The following operators define mathematical operations:

   $\times$ indicates multiplication.

   $\lfloor x \rfloor$ indicates the largest integer less than or equal to x: $\lfloor 1.1 \rfloor = 1, \lfloor 1.0 \rfloor = 1$.

   $\lceil x \rceil$ indicates the smallest integer greater or equal to x: $\lceil 1.1 \rceil = 2, \lceil 2.0 \rceil = 2$.

   $|x|$ indicates the absolute value of x: $|-17| = 17, |17| = 17$.

   $\oplus$ indicates exclusive OR (modulo-2 addition).

   min (x, y) indicates the minimum of x and y.

   max (x, y) indicates the maximum of x and y.

   x mod y indicates the remainder after dividing x by y: $x \bmod y = x - (y \times \lfloor x/y \rfloor)$.
8. While communication between Layer 3 and Layer 2 and between the LAC Sublayer and the MAC Sublayer are specified, there is no requirement to implement layering.

REFERENCES

The following standards contain provisions that, through reference in this text, constitute provisions of this specification. All standards are subject to revision, and parties to agreements based upon this specification are encouraged to apply the most recent editions of the standards indicated below.

1. Reserved.
2. C.S0002-E, *Physical Layer Standard for cdma2000 Spread Spectrum Systems*.
3. C.S0003-E, *Medium Access Control (MAC) Standard for cdma2000 Spread Spectrum Systems*.
4. Reserved.
5. C.S0005-E, *Upper Layer (Layer 3) Signaling Standard for cdma2000 Spread Spectrum Systems*.
6. Reserved.
7. TIA/EIA/IS-735, *Enhancements to TIA/EIA-41-D & TIA/EIA-664 for Advanced Features in Wideband Spread Spectrum Systems*.
8. *Common Cryptographic Algorithms, Revision C*, 1997. An EAR-controlled document subject to restricted distribution. Contact the Telecommunications Industry Association, Arlington, VA, USA.
9. *Interface Specification for Common Cryptographic Algorithms, Revision C*, 1997. Contact the Telecommunications Industry Association, Arlington, VA, USA.
10. ITU-T Recommendation E.212, *Identification Plan For Land Mobile Stations,* 1998.
11. TIA/EIA-95-B, *Mobile Station-Base Station Compatibility Standard for Dual-Mode Spread Spectrum Systems*.
12. Reserved.
13. C.S0007-0, *Direct Spread Specification for Spread Spectrum Systems on ANSI-41 (DS-41) - Upper Layers Air Interface*.
14. C.S0008-0, *Multi-Carrier Specification for Spread Spectrum Systems on GSM MAP (MC-MAP) (Lower Layers Air Interface)*.
15. S.S0055-A v2.0, *Enhanced Cryptographic Algorithms*.
16. C.S0023-C, Removable User Identity Module (R-UIM) for cdma2000 Spread Spectrum Systems.

INFORMATIVE REFERENCES

IR1. C.R1001-G, *Administration of Parameter Value Assignments for cdma2000 Spread Spectrum Standards*.

1 DEFINITIONS AND CONCEPTUAL MODEL

1.1 Terms and Numeric Information

1.1.1 Terms

Access Attempt. The entire process of sending one r-csch PDU and receiving (or failing to receive) an acknowledgment for that PDU, consisting of one or more access sub-attempts. See also Access Probe, Access Probe Sequence, and Access Sub-attempt.

Access Probe. One r-csch transmission consisting of a preamble and a PDU or a header (see [3]) associated with that PDU. The transmission of the PDU is an integer number of frames in length and transmits one r-csch message. See also Access Probe Sequence, Access Sub-attempt, and Access Attempt.

Access Probe Sequence. A sequence of one or more access probes on the r-csch. When the PDU is transmitted, other than the reported pilot information, the same r-csch content is transmitted in every access probe of an access sub-attempt. See also Access Probe, Access Sub-attempt, and Access Attempt.

Access Sub-attempt. A sequence of one or more access probe sequences on the r-csch transmitted to one pilot, containing the same PDU content other than the reported pilot information. See also Access Probe, Access Probe Sequence, and Access Attempt.

AKA. Authentication and Key Agreement protocol.

ARQ. Automatic Repeat Request.

Assured Mode. Mode of delivery that guarantees that a PDU will be delivered to the peer. A PDU sent in assured mode is retransmitted by the LAC Sublayer, up to a maximum number of retransmissions, until the LAC entity at the sender receives an acknowledgement for the PDU. See also Confirmation of Delivery.

Authentication. A procedure used by a base station to validate a mobile station's identity.

Authentication Response (AUTHR). An 18-bit output of the authentication algorithm. It is used, for example, to validate mobile station registrations, originations and terminations.

Automatic Repeat Request (ARQ). Technique for providing reliable delivery of signals between communicating stations which involves autonomous retransmission of the signals and transmission of acknowledgments until implicit or explicit confirmation of delivery is received.

Base Station. A fixed station used for communicating with mobile stations. Depending upon the context, the term base station may refer to a cell, a sector within a cell, an MSC, or other part of the cellular system. See also MSC.

broadcast channel. When the channel name is written with lower case letters, it refers to the logical channel on which system overhead information or broadcast messages are transmitted by the base station. When system overhead information is transmitted, the logical "broadcast channel" can be mapped to the physical Paging Channel or to the physical primary Broadcast Control Channel. When broadcast messages are transmitted,

the logical “broadcast channel” can be mapped to the physical Paging Channel or to either the physical non-primary Broadcast Channel or the Forward Common Control Channel, as specified in [5].

Call History Parameter (COUNT). A modulo-64 event counter maintained by the mobile station and Authentication Center that is used for clone detection.

CDMA. See Code Division Multiple Access.

CK. Ciphering Key for the AKA security protocol, used for message encryption and decryption.

CMEA. Cellular Message Encryption Algorithm.

Code Division Multiple Access (CDMA). A technique for spread-spectrum multiple-access digital communications that creates channels through the use of unique code sequences.

Confirmation of Delivery. A notification sent by the LAC Sublayer to Layer 3 at the sender, when the LAC entity at the sender receives the acknowledgment for a specific PDU sent in assured mode.

Electronic Serial Number (ESN). A 32-bit number assigned by the mobile station manufacturer, uniquely identifying the mobile station equipment.

Emergency Call. A call placed by a mobile station user to request emergency assistance, typically to an emergency services or public safety provider. The method used by a mobile station to identify a call as an emergency call is outside the scope of this document.

ENC_KEY. A 4-entry array of keys used by Layer 3 for message encryption and decryption, indexed by the key identifier that ranges from ‘00’ to ‘11’. Keys indexed by the ‘00’ and the ‘01’ values of the key identifier are CMEA keys, while keys indexed by the ‘10’ and ‘11’ values of the key identifier are AKA CK keys.

Encapsulated PDU. A LAC PDU together with the associated length and CRC SAR parameters.

Encapsulated PDU Fragment. A portion of the encapsulated PDU which is limited in size to the available capacity of Lower Layer frames, and is transferred at the interface between the LAC SAR Sublayer and the MAC Sublayer.

EXT_SSEQ. Extended security sequence number. A 32-bit crypto-sync that is used for encryption, message integrity, or both.

ESN. See Electronic Serial Number.

f-csch. Forward common signaling logical channel (analogous to Paging and Sync Channels in [11]).

f-dsch. Forward dedicated signaling logical channel (analogous to Forward Traffic or Fundamental Channel in [11]).

F-PDCH. Forward packet data channel, capable of carrying both bearer traffic and signaling.

Full TMSI. The combination of TMSI_ZONE and TMSI_CODE. The full TMSI is a globally unique address for the mobile station.

IK. Integrity Key for the AKA security protocol, used for message integrity.

IMSI. See International Mobile Subscriber Identity.

IMSI_M. MIN-based IMSI using the lower 10 digits to store the MIN.

IMSI_O. Operational value of IMSI (either IMSI_M or IMSI_T) used by the mobile station for operation with the base station.

IMSI_S. A 10-digit number derived from the IMSI that is encoded as a 34-bit value (see 2.3.1 of [5]). IMSI_S generally corresponds to the last 10 digits of the IMSI.

IMSI_S1. A 24-bit value that corresponds to the last 7 digits of IMSI_S.

IMSI_T. True IMSI not associated with MIN. Could be 15 digits or fewer.

INT_KEY. A 4-entry array of keys used for message integrity calculations, indexed by the key identifier that ranges from '00' to '11'. Keys indexed by the '00' and the '01' values of the key identifier are CMEA keys, while keys indexed by the '10' and '11' values of the key identifier are AKA IK keys.

Interface Control Information. Data passed between adjacent layers in the protocol stack, together with the SDU, to assist a layer to properly encapsulate/decapsulate the SDU. An example of interface control information in this document is the MCSB.

International Mobile Subscriber Identity (IMSI). A method of identifying subscribers in the wireless service, based on [10].

Key Identifier. An index in the arrays INT_KEY[.], ENC_KEY[.], TX_EXT_SSEQ[0][.], TX_EXT_SSEQ[1][.], RX_EXT_SSEQ[0][.], and RX_EXT_SSEQ[1][.] that are "in use". '00' and '01' are used to index CMEA keys and the associated security sequence numbers. '10' and '11' are used to index AKA keys and the associated security sequence numbers.

L1. See Layer 1.

L2. See Layer 2.

L3. See Layer 3.

LAC PDU. LAC protocol data unit transferred between peer Utility Sublayers on the mobile station and the base station.

LAC Sublayer. See Link Access Control Sublayer.

Layering. A method of organization for communication protocols in which the transmitted or received information is transferred conceptually in pipeline fashion within each station, in well-defined encapsulated data units between coordinated processing entities ("layers"). A layer is defined in terms of its communication protocol to the peer layer in the other station and the services it offers to the next higher layer in its own station.

Layer 1 (L1). Layer 1 (Physical Layer) provides for the transmission and reception of radio signals between the base station and the mobile station.

Layer 2 (L2). Layer 2 provides for delivery of signaling messages generated by Layer 3 (see below). Layer 2 consists of two sublayers: the LAC Sublayer and the MAC Sublayer (see below). Layer 2 makes use of the services provided by Layer 1.

Layer 3 (L3). Layer 3 originates and terminates signaling messages according to the semantics and timing of the communication protocol between the base station and the mobile station. Layer 3 makes use of the services provided by Layer 2.

Link Access Control (LAC) Sublayer. The LAC Sublayer is the upper sublayer of Layer 2. It implements a data link protocol that provides for the correct transport and delivery of signaling messages generated by Layer 3. The LAC Sublayer makes use of the services provided by the Lower Layers (Layer 1 and the MAC Sublayer).

Logical Channel. A communication path between stations, described in terms of the intended use of, and access to, the transferred data, and direction of transfer. A logical channel can be "mapped" to and from one or more physical channels. In this document, channel names beginning with lowercase letters specify logical channels.

Lower Layers. In this document, layers below the LAC Sublayer (e.g., Layer 1 and the MAC Sublayer).

MAC Sublayer. See Medium Access Control Sublayer.

MAC-I. Message Authentication Code for message integrity. The 32-bit output of the message integrity algorithm that allows the receiver to authenticate the message.

MACI. A 32-bit LAC Layer field that carries either the MAC-I or the UMAC of a signaling message.

Mapping. In this context, the technique for forming associations between logical and physical channels.

MCC. See Mobile Country Code.

MCSB. See Message Control and Status Block.

Medium Access Control (MAC) Sublayer. The MAC Sublayer is the lower sublayer of Layer 2. It implements the medium access protocol and is responsible for transport of LAC protocol data units using the services provided by Layer 1.

MEID. See Mobile Equipment Identifier.

Message. Signaling data unit transferred between the base station and the mobile station. In this document, it should be interpreted as the Layer 3 PDU or the LAC SDU.

Message Control and Status Block (MCSB). In this document, a parameter block representing the interface control information transferred between Layer 3 and the LAC Sublayer. The MCSB is also used to carry relevant information within the LAC Sublayer.

MIN. See Mobile Identification Number.

Mini PDU. A PDU that carries a Layer 3 *mini* message. The total length of a mini PDU is 48 bits. A mini PDU may not be fragmented, and is carried in a 5 ms physical frame. See also Regular PDU.

MNC. See Mobile Network Code.

Mobile Country Code (MCC). A part of the E.212 IMSI identifying the home country. See [10].

Mobile Equipment Identifier (MEID). A 56-bit number assigned by the mobile station manufacturer, uniquely identifying the mobile station equipment.

Mobile Network Code (MNC). A part of the E.212 IMSI identifying the home network within the home country. See [10].

Mobile Identification Number (MIN). The 34-bit number that is a digital representation of the 10-digit number assigned to a mobile station.

Mobile Station. A station in the Public Cellular Radio Telecommunications Service intended to be used while in motion or during halts at unspecified points. Mobile stations include portable units (e.g., hand-held personal units) and units installed in vehicles.

Mobile Subscriber Identification Number (MSIN). A part of the E.212 IMSI identifying the mobile subscriber within the home network. See [10].

MSC. Mobile Switching Center.

MSIN. See Mobile Subscriber Identification Number.

Multiplex Layer. Protocol Layer situated between Layer 2 and Layer 1 on dedicated channels that is responsible for multiplexing Layer 2 SDUs from multiple sources (user traffic, such as voice or data packets, and signaling traffic) onto the same physical channel, according to priority and QoS criteria.

NAM. See Number Assignment Module.

National Mobile Subscriber Identity (NMSI). A part of the E.212 IMSI identifying the mobile subscriber within the home country. The NMSI consists of the MNC and the MSIN. See [10].

NMSI. See National Mobile Subscriber Identity.

Number Assignment Module (NAM). A set of MIN/IMSI-related parameters stored in the mobile station.

PACA. Priority Access and Channel Assignment. See PACA Call.

PACA Call. A priority mobile station originated call for which no traffic channel or voice channel was immediately available, and which has been queued for a priority r-csch assignment.

PDU. See Protocol Data Unit.

Physical Channel. A communication path between stations, described in terms of the radio characteristics such as coding, power control policies, etc. In this document, channel names beginning with uppercase letters specify physical channels.

Primitive. An atomic, well-defined conceptual method of transferring data and control information between two adjacent layers and sublayers. It is conventionally represented as a function invocation, with the data and control information passed as parameters.

Protocol Data Unit (PDU). Encapsulated data communicated between peer layers on the mobile station and the base station.

Protocol Stack. Conceptual model of the layered architecture for communication protocols (see Layering) in which layers within a station are represented in the order of their numeric designation and requiring that transferred data be processed sequentially by each layer, in the order of their representation. Graphically, the "stack" is drawn vertically, with the layer having the lowest numeric designation at the base.

QoS. Quality of Service.

Random Challenge (RANDC). A 32-bit value held in the mobile station. It is used, in conjunction with SSD_A and other parameters, to validate mobile station originations, terminations and registrations.

r-csch. Reverse common signaling logical channel (analogous to Access Channel in [11] and including the Enhanced Access Channel).

r-dsch. Reverse dedicated signaling logical channel (analogous to Reverse Traffic or Fundamental Channel in [11]).

Regular PDU. A PDU that carries a Layer 3 message other than a mini message. The length of a regular PDU is variable. A regular PDU may be fragmented, and fragments of a regular PDU are carried in 20 ms physical frames. See also Mini PDU.

Removable User Identity Module. A real "card" temporarily attached to the mobile station and containing all the information related to the user subscription for service.

Rescue Channel. A Fundamental Channel used for call rescue soft handoff. The Walsh Code is pre-allocated and advertised to the mobile station. In the event that the mobile station loses the Forward Traffic Channel or declares an acknowledgment failure, communication with a new base station can be established on the Rescue Channel.

R-PDCH. Reverse packet data channel, capable of carrying both bearer traffic and signaling.

R-UIM. See Removable User Identity Module.

RX_EXT_SSEQ[*i*][*j*]. An 8-entry array of 32-bit crypto-sync counters used by the receiver to decrypt messages and compute the message integrity related data, where $i = 0$ is for messages sent in unassured mode and $i = 1$ is for messages sent in assured mode, where j is the key identifier that ranges from '00' to '11'.

SAP. See Service Access Point.

SAR. Segmentation and Reassembly.

SDU. See Service Data Unit.

Service Access Point (SAP). Conceptual point at the interface between two adjacent layers where services are provided to the upper layer and data and protocol information is exchanged between layers.

Service Data Unit (SDU). Data transferred between adjacent layers in the protocol stack. Unless specified otherwise, in this document SDU refers to the Layer 3 service data unit transferred to or from the LAC Sublayer.

SID. See System Identification.

Sublayer. A protocol layer of finer granularity within another protocol layer or sublayer. The LAC Sublayer itself may be seen as having several sublayers.

System Identification (SID). A number uniquely identifying a wireless system.

Temporary Mobile Subscriber Identity (TMSI). A temporary mobile subscriber identification assigned by the base station.

TMSI. See Temporary Mobile Subscriber Identity.

TMSI Zone. The administrative zone that allows the TMSI to be reused. The TMSI_CODE has to be unique within a TMSI zone but may be reused in a different TMSI zone. The TMSI zone is identified by the field TMSI_ZONE.

TX_EXT_SSEQ[*i*][*j*]. An 8-entry array of 32-bit crypto-sync counters used by the transmitter to encrypt messages and compute the message integrity related data, where i = 0 is for messages sent in unassured mode and i = 1 is for messages sent in assured mode, where j is the key identifier that ranges from '00' to '11'.

UAK. UIM authentication key.

UIM. See User Identity Module.

UIM_ID. A 56-bit electronic identification (ID) number that is unique to the R-UIM. Currently only 32-bits are used. The mobile station uses UIM_ID in place of ESN when configured with a R-UIM which indicates that UIM_ID is to be used (see [16]).

UMAC. See User Message Authentication Code.

Unassured Mode. Mode of delivery that does not guarantee that a PDU will be delivered to the peer. The LAC entity at the receiver does not acknowledge a PDU sent in unassured mode.

Upper Layers. General reference to Layer 3 and the layers above it.

User Identity Module. A "card" (real or conceptual) permanently or temporarily attached to the mobile station and containing all the information related to the user subscription for service.

User Message Authentication Code. A 32-bit output of the UMAC algorithm computed by UIM, based on MAC-I.

1.1.2 Numeric Information

Numeric information is used to describe the operation of the mobile station. The following subscripts are used to clarify the use of the numeric information:

- "s" indicates a value stored in a mobile station's temporary memory.
- "sv" indicates a stored value that varies as a mobile station processes various tasks.
- "sl" indicates the stored limits on values that vary.
- "r" indicates a value received by a mobile station over a CDMA Forward Channel.
- "p" indicates a value set in a mobile station's permanent security and identification memory.

- "s-p" indicates a value stored in a mobile station's semi-permanent security and identification memory.

$ACCOLC_p$ – A four-bit number used to identify which overload class field controls access attempts.

$ACH\_ACC\_TMO_s$ – Access Channel acknowledgment timeout, in units of 80 ms.

ACH_FRAME_SIZE – The size of the frame used on the Access Channel (see [2]).

$ASSIGNING\_TMSI\_ZONE\_LEN_{s-p}$ – The 4-bit assigning TMSI zone length.

$ASSIGNING\_TMSI\_ZONE_{s-p}$ – The 8-octet assigning TMSI zone.

$AUTH_s$ – Current authentication mode.

$BCAST\_INDEX_s$ – Broadcast slot cycle index.

$COUNT_{s-p}$ – A modulo-64 count held in the mobile station. $COUNT_{s-p}$ is maintained during power-off.

$CURRENT\_ACTIVE\_PILOT_s$ – Identifies the current pilot in the Active Set during an access attempt.

$EACH\_ACC\_TMO_s$ – Enhanced Access Channel acknowledgment timeout, in units of 20 ms.

$EXT\_PREF\_MSID\_TYPE_s$ – Extended preferred mobile station identifier field type.

$FIRST\_ACTIVE\_PILOT_s$ – While the mobile station is in the *System Access State*, identifies the pilot to which the first access probe was transmitted, upon entering the *System Access State*.

$FPC\_PRI\_CHAN_s$ – Primary power control subchannel measured channel.

$IMSI\_11\_12_s$ – The 11th and 12th digits of the IMSI used for address matching.

$IMSI\_M\_S_p$ – The 34-bit IMSI_S derived from the mobile station's IMSI_M.

$IMSI\_M\_S1_p$ – The least significant 24 bits of $IMSI\_M\_S_p$.

$IMSI\_M\_S2_p$ – The most significant 10 bits of $IMSI\_M\_S_p$.

$IMSI\_O\_ADDR\_NUM_s$ – The number of digits in the NMSI of IMSI_O, minus four.

$IMSI\_O\_S_s$ – The 34-bit IMSI_S derived from the mobile station's IMSI_O.

$IMSI\_O\_11\_12_s$ – The 11th and 12th digits of IMSI_O.

KEY_ID_s – The key identifier.

$M\_MSG\_SEQ\_ACK_s$ – Next message sequence number for mini PDUs requiring acknowledgment.

$M\_MSG\_SEQ\_NOACK_s$ – Next message sequence number for mini PDUs not requiring acknowledgment.

$M\_MSG\_SEQ\_RCVD_s[i]$ – Received message indicator for a mini PDU with message sequence number i. Set to YES if a mini PDU with message sequence number i has been

received. Set to NO when a mini PDU with message sequence number (i+4) modulo 4 has been received.

MAX_CAP_SZ$_S$ – Maximum number of Access Channel frames in an Access Channel message capsule, less 3.

MAX_REQ_SEQ$_S$ – Maximum number of access probe sequences for an r-csch request.

MAX_RER_PILOT_LIST_SIZE$_S$ – Maximum number of pilots to be maintained in the radio environment report pilot list (see [5]).

MAX_RSP_SEQ$_S$ – Maximum number of access probe sequences for an r-csch response.

MAX_SLOT_CYCLE$_S$ – Maximum value of the slot cycle index allowed by the current base station.

MCC$_S$ – The Mobile Country Code used for address matching.

MCC_O$_S$ – The Mobile Country Code of IMSI_O.

MSG_PSIST$_S$ – Persistence modifier for r-csch message transmissions.

MSG_SEQ_ACK$_S$ – Next message sequence number for regular PDUs requiring acknowledgment.

MSG_SEQ_NOACK$_S$ – Next message sequence number for regular PDUs not requiring acknowledgment.

MSG_SEQ_RCVD$_S$[i] – Received message indicator for a regular PDU with message sequence number i. Set to YES if a regular PDU with message sequence number i has been received. Set to NO when a regular PDU with message sequence number (i+4) modulo 8 has been received.

NUM_STEP$_S$ – Number of access probes in a single access probe sequence.

P_REV_IN_USE$_S$ – Protocol revision level currently in use by a mobile station.

PAM_SZ$_S$ – Number of frames in the Access Channel preamble, less 1.

PILOT_PN_PHASE – Calculated Pilot Channel PN phase, in chips, including the PN sequence offset and the arrival time relative to the mobile station's time reference.

PILOT_REPORT$_S$ – Pilot reporting indicator.

PREF_MSID_TYPE$_S$ – Preferred mobile station identifier field type.

PROBE_BKOFF$_S$ – Access Channel probe backoff range, in slots.

PROBE_PN_RAN$_S$ – Range for hashing function selection of the delay prior to transmission of Access Channel probes. Value is $\log_2$(range + 1).

PSIST$_S$ – Persistence value for the mobile station's overload class.

PSIST_EMG$_S$ – Persistence value for emergency calls placed from mobile stations having an access overload control class (ACCOLC) value from 0 to 9.

RA – Random access channel number. The Access Channel number generated (pseudo-randomly) by the mobile station.

$RAND_S$ – Authentication random challenge value.

RANDC – The eight most-significant bits of the random challenge value used by the mobile station.

REG_PSIST_S – Persistence modifier for registration accesses (except ordered registrations).

$RESQ\_ENABLED_S$ – Rescue channel enabled indicator.

$RESQ\_NUM\_TOT\_TRANS\_20MS_S$ – Total number of unacknowledged transmissions of a regular PDU requiring acknowledgment after which the rescue operation can be triggered.

$RESQ\_NUM\_TOT\_TRANS\_5MS_S$ – Total number of unacknowledged transmissions of a mini PDU requiring acknowledgment after which the rescue operation can be triggered.

$RETRY\_COUNT_S$ – Message retransmission count. Counter used to determine when the maximum number of retransmissions has been exceeded for a given message.

SSD_A_{S-p} – The 64 most significant bits of the Shared Secret Data. SSD_A_{S-p} is used for support of the authentication procedures.

SSD_B_{S-p} – The 64 least significant bits of the Shared Secret Data. SSD_B_{S-p} is used for message encryption.

TA – Acknowledgment response timeout.

$TMSI\_CODE_{S-p}$ – The 4-octet TMSI code that uniquely identifies the mobile station within the assigning TMSI zone.

$TMSI\_ZONE_{S-p}$ – The TMSI zone number of the base station, from 1 to 8 octets in length.

$TMSI\_ZONE\_LEN_{S-p}$ – The number of octets in TMSI zone.

TX_EXT_SSEQ[*i*][*j*] – An array of 32-bit crypto-sync counters used by the transmitter to encrypt and compute the message integrity, where $i = 0$ is for unassured messages and $i = 1$ is for assured messages, where j is the key identifier that ranges from '00' to '11'.

USE_TMSI_S – Base station's preference of the use of TMSI.

USE_UAK_S – Indication of whether or not the mobile station uses the UMAC generated by the UIM for message integrity.

1.2 Conceptual Model for the LAC Sublayer

The layers, sublayers, SAPs, primitives and parameters are abstract modeling constructs, and thus should not be interpreted as implementation requirements. However, the observable behavior of base stations and mobile stations compliant with this specification should be consistent with the interactions described via the primitives and the other modeling constructs mentioned above.

LAC signaling for cdma2000 is modeled as follows:

- **Protocol Layers**. The LAC Sublayer provides services to Layer 3. SDUs are passed between Layer 3 and the LAC Sublayer. The LAC Sublayer provides the proper encapsulation of the SDUs into LAC PDUs, which are subject to segmentation and reassembly and are transferred as encapsulated PDU fragments to the MAC Sublayer.

- **Sublayers**. Processing within the LAC Sublayer is done sequentially, with processing entities passing the partially formed LAC PDU to each other in a well established order.
- **Logical Channels**. SDUs and PDUs are processed and transferred along functional paths, without the need for the Upper Layers to be aware of the radio characteristics of the physical channels. However, the Upper Layers could be aware of the characteristics of the physical channels and may direct Layer 2 to use certain physical channels for the transmission of certain PDUs.

1.2.1 General Architecture

The general architecture is presented in Figure 1.2.1-1.

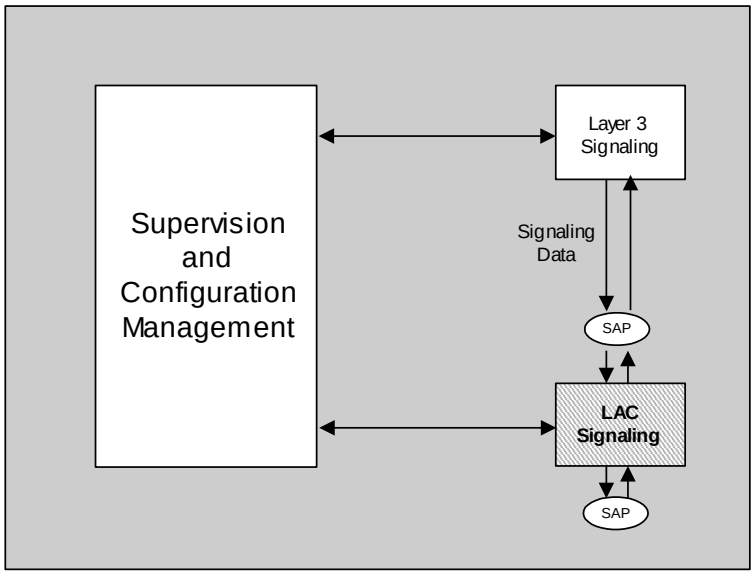

Figure 1.2.1-1. cdma2000 Signaling – General Architecture

1.2.2 Protocol Sublayers

As a generated or received data unit traverses the protocol stack, it is processed by various protocol sublayers in sequence. Each sublayer processes only specific fields of the data unit that are associated with the sublayer-defined functionality. For example, the ARQ Sublayer operates only on the acknowledgment-related fields, and carries out duplicate detection and retransmission functions.

The general processing of data units by the LAC Sublayer and its sublayers is shown in Figure 1.2.2-1.

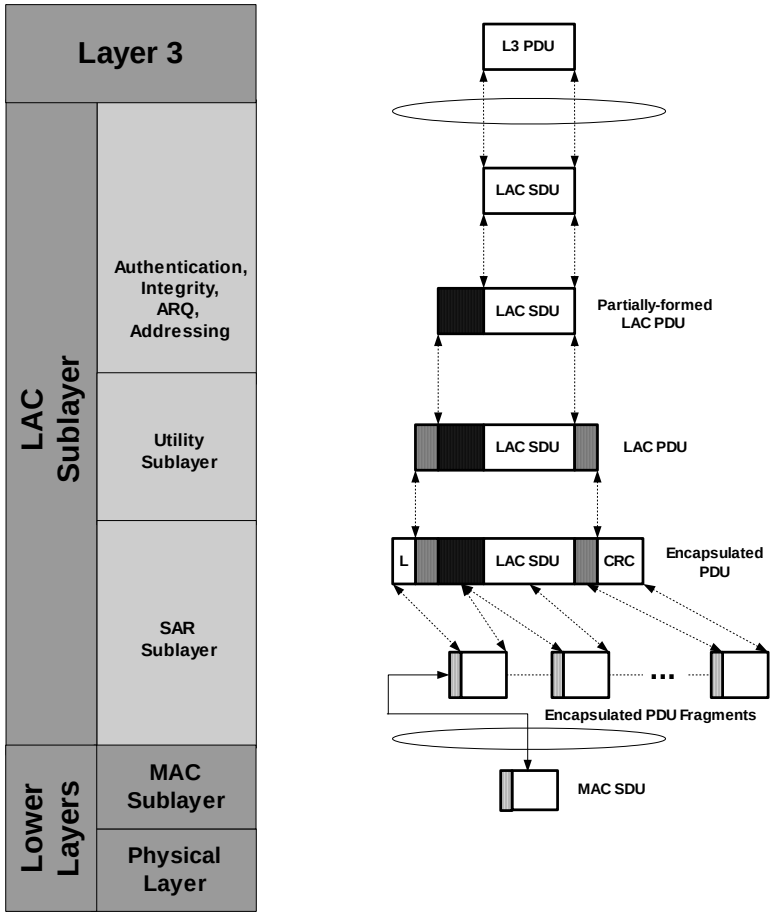

Figure 1.2.2-1. LAC Data Unit Processing

1.2.3 Logical Channels

Layer 3 and the LAC Sublayer send and receive signaling information on *logical channels*, thus avoiding the need to be sensitive to the radio characteristics of the physical channels used at Layer 1. A logical channel is generally characterized as unidirectional (either forward or reverse), but in many cases it may be functionally coupled or paired with a logical channel carrying related traffic in the opposite direction. cdma2000 systems use the following types of logical channel to carry signaling information:

- f-csch/r-csch (forward and reverse common signaling channel, respectively).
- f-dsch/r-dsch (forward and reverse dedicated signaling channel, respectively).

Logical channels are classified based upon whether they carry information for a single target only or for multiple targets, upon whether the information carried is signaling or user data, upon the direction of the transfer (forward or reverse) and upon other criteria. Logical channels are defined for the following purposes on cdma2000 systems:

- Synchronization.
- Broadcast.
- General signaling (includes paging).

- Access.
- Dedicated signaling.

Multiple instances of the same logical channel may be deployed.

Since the traffic on a logical channel is ultimately carried via one or more physical channels, there must be associations between logical channels and physical channels. Such associations are called *mappings*. A logical channel may have permanent and exclusive use of a physical channel (e.g., the synchronization channel), or may have temporary – but still exclusive – use of a physical channel (e.g., successive r-csch access probe sequences can be sent on different physical Access Channels), or may share the physical channel with other logical channels (requiring a multiplex function to perform the mapping, possibly on a PDU-by-PDU basis).

In certain cases, a logical channel can be mapped to another logical channel. The two (or more) channels are "fused" into one effective logical channel capable of carrying different traffic types (e.g., the broadcast channel and the general forward signaling channel are mapped to one common logical channel carrying signaling information). Since a logical channel can carry only one PDU at a time, there must be serialization at Layer 3 to ensure deterministic behavior.

Figures 1.2.3-1 and 1.2.3-2 show the cdma2000 logical channels (seen by the LAC Sublayer) on the forward and reverse links, respectively. Various types of mappings are present: Permanent and temporary logical-to-physical (e.g., the reverse access channel), multiplexed logical-to-physical (between dsch and dtch for both forward and reverse link) and logical-to-logical (broadcast channel and general signaling channel).

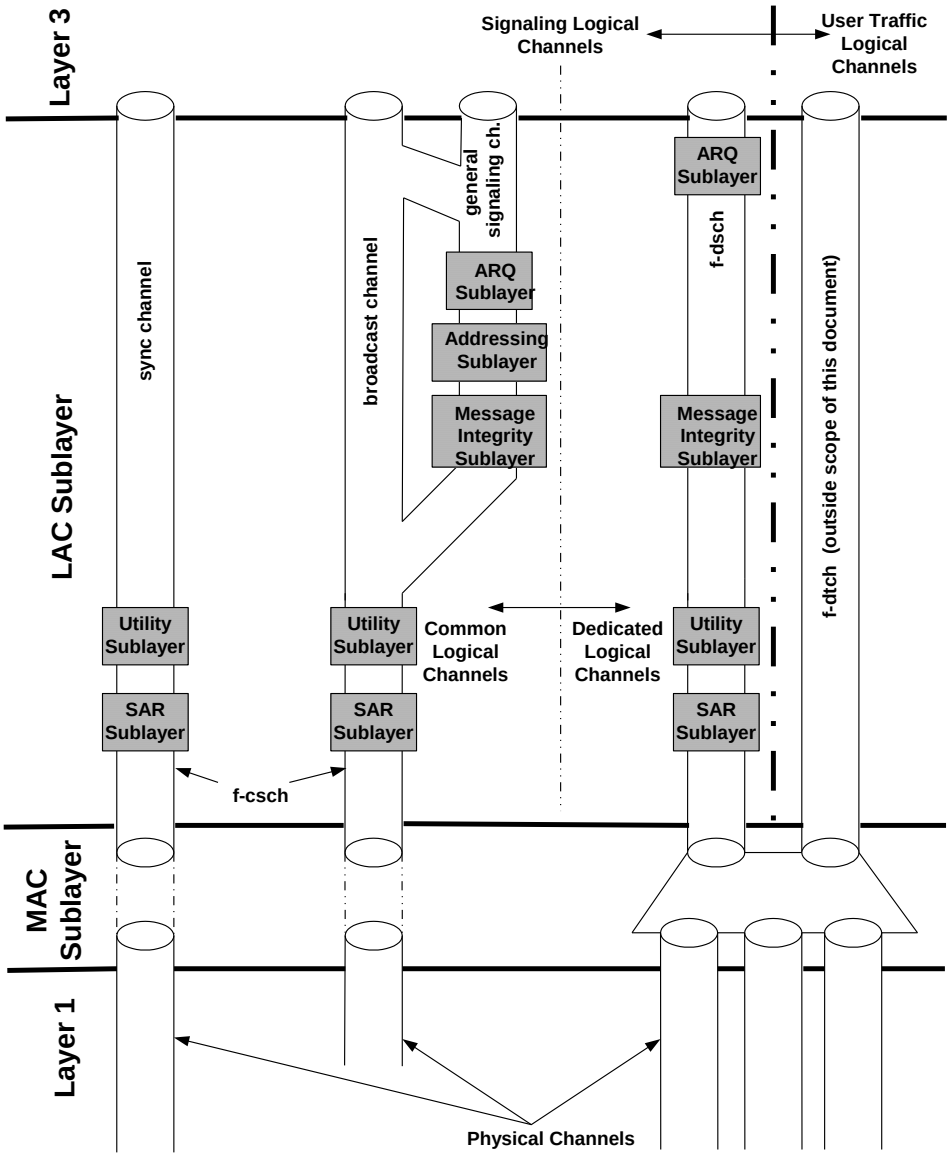

Figure 1.2.3-1. Architecture of the forward logical channels seen by the LAC Sublayer

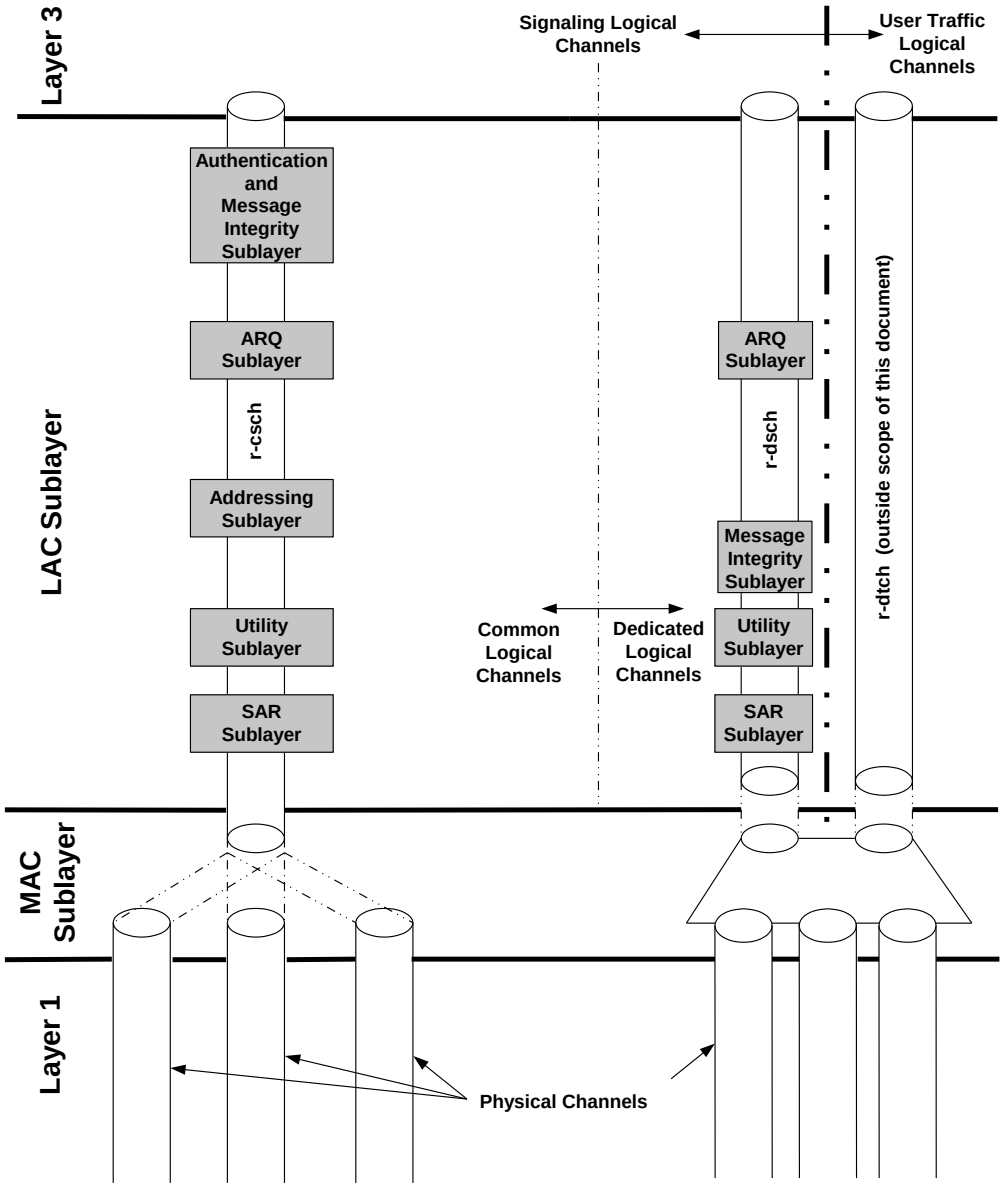

Figure 1.2.3-2. Architecture of the reverse logical channels seen by the LAC Sublayer

1.2.4 Interfaces

1.2.4.1 Interface to Layer 3

The interface between Layer 3 and Layer 2 is a Service Access Point (SAP). At the SAP, Layer 3 and Layer 2 exchange Service Data Units (SDUs) and interface control information in the form of Message Control and Status Blocks (MCSBs) using a set of primitives. The general format of a primitive invocation is:

L2-<*Primitive_Name*>.<*Primitive_Type*> (<*data_unit*>, MCSB)

The optional parameters data_unit and MCSB represent the SDU being exchanged and the message control and status block described in 1.2.4.1.1, respectively.

1.2.4.1.1 Message Control and Status Block (MCSB)

The MCSB is a parameter block for the defined primitives, containing relevant information about individual Layer 3 messages (SDU) as well as instructions on how the message may be handled or how it is to be (for transmission), or was (for reception), processed by the LAC Sublayer or the MAC Sublayer, or both. On transmission, the MCSB is received from Layer 3 and is discarded by the SAR Sublayer. On reception, the MCSB is generated by the SAR Sublayer and is passed up the stack to Layer 3. The MCSB is a conceptual construct and is not subject to detailed specification in this document; however, it is envisioned the MCSB would contain information such as:

- The MSG_TAG. If the message is generated in response to a previously received message, the MSG_TYPE of the previously received message is also stored.
- The length of the SDU.
- Page record length parameters, i.e., values of the SDU_INCLUDED field for a *Mobile Station-addressed* record in a *General Page Message*, the EXT_MS_SDU_LENGTH_INCL and EXT_MS_SDU_LENGTH fields for a *Mobile Station-addressed* record in a *Universal Page Message*, and the EXT_BCAST_SDU_LENGTH_IND and EXT_BCAST_SDU_LENGTH fields for an *Enhanced Broadcast* record sent in a *General Page Message* or a *Universal Page Message*.
- A unique instance identifier associated with the message, which enables identification of a message for notifications of delivery/non-delivery or recovery procedures.
- Whether the message should be acknowledged at the LAC Sublayer (i.e., delivered in assured mode or unassured mode).
- Whether notification of delivery is required.
- The identity of the addressee for the message.
- Whether the SDU being delivered to Layer 3 is a duplicate (in cases where the LAC Sublayer does not discard duplicates).

- Data needed by the authentication procedures (e.g., the CHARi fields of the *Origination Message*).
- Relevant SDU classification (e.g., registrations, originations), where processing at the LAC Sublayer is sensitive to the type of SDU being transferred.
- The encryption status of the logical channel, the encryption mode, encryption sequence number and the encrypted 8-bit CRC computed over the unencrypted SDU.
- CDMA System Time corresponding to the frame in which the first or last bit of a message was received.
- Transmission instructions for the LAC Sublayer, such as a *scheduling hint* indicating how to send a message with a certain relative priority (before, after, or by interrupting the transmission of other messages), an instruction regarding message supervision, and so on.
- Abnormal condition indications from the LAC Sublayer.
- An indication whether or not a received PDU requires Layer 2 acknowledgment.
- An indication that an acknowledgment to a received PDU has been sent and acknowledged.
- When a PDU is received on the f-csch, an indication whether or not an access attempt for a PDU being transmitted on the r-csch was terminated as a result of processing the ARQ fields of the received PDU.
- The physical channel on which the message is to be transmitted. The LAC uses this information to specify the *"channel_type"* parameter used by the MAC primitives.
- An emergency call indicator. When the mobile station determines the message is for an emergency call, the mobile station sets the emergency call indicator on.
- On transmission, an indication from Layer 3 whether or not the PDU is to be protected by message integrity.
- On transmission, if the PDU is to be protected by message integrity, a 32-bit or 24-bit crypto-sync supplied by Layer 3.
- On reception, an indication to Layer 3 whether or not the received PDU contains a valid MACI.
- On reception, either the 8-bit SDU_SSEQ or the 32-bit EXT_SSEQ.
- On reception, the SDU_KEY_ID field of the PDU.

1.2.4.1.2 Interface Primitives

The following primitives are defined for communication between Layer 2 and Layer 3:

Name: **L2-Data.Request**
Type: Request
Direction: Layer 3 to Layer 2
Parameters: SDU, MCSB
Action: The SDU is handed to Layer 2 for delivery across the radio interface.

Name: **L2-Data.Confirm**
Type: Confirm
Direction: Layer 2 to Layer 3
Parameters: MCSB
Action: Reception of the specified (in the MCSB) transmitted SDU was acknowledged at Layer 2 by the addressee.

Name: **L2-Data.Indication**
Type: Indication
Direction: Layer 2 to Layer 3
Parameters: SDU, MCSB
Action: The received SDU is handed to Layer 3.

Name: **L2-Condition.Notification**
Type: Indication
Direction: Layer 2 to Layer 3
Parameters: MCSB
Action: Layer 3 is notified of a relevant event (e.g., abnormal condition) detected at Layer 2. Details are indicated via the MCSB.

Name: **L2-Supervision.Request**
Type: Request
Direction: Layer 3 to Layer 2
Parameters: MCSB
Action: Layer 2 executes a control command as directed by Layer 3 (for example, an order to abandon retransmission of a message, or an order to reset the message sequence number, the acknowledgment sequence number, and the timers used for duplicate detection).

1.2.4.2 Interface to MAC Sublayer

The interface between the LAC Sublayer and the MAC Sublayer is a Service Access Point (SAP). At the SAP, the LAC Sublayer and the MAC Sublayer exchange LAC PDUs or encapsulated PDU fragments and interface control information in the form of a parameter list. The general format of a primitive invocation is:

MAC-<*Primitive_Name*>.<*Primitive_Type*> (<*parameter_list*>)

Transmission and reception by the MAC Sublayer do not guarantee delivery, uniqueness, or order. A LAC PDU or encapsulated PDU fragment submitted for transmission, or received, is transmitted or delivered immediately, one time only, by the MAC Sublayer, unless requested otherwise. The MAC Sublayer transmits and delivers LAC PDUs and encapsulated PDU fragments in the order of submission or reception, unless indicated

otherwise. Received LAC PDUs and encapsulated PDU fragments containing errors detected by the Lower Layers are not delivered.

1.2.4.2.1 Reserved

1.2.4.2.2 Interface Primitives

The following primitives are defined for communication between the LAC Sublayer and the MAC Sublayer:

Name: **MAC-SDUReady.Request (*channel_type, size, P, seqno, scheduling_hint*)**
Type: Request
Direction: LAC Sublayer to MAC Sublayer
Action: Invocations represent requests for a series of availability notifications for the fragments of an encapsulated PDU and may provide information necessary for scheduling the transmission of those fragments.

Name: **MAC-SDUReady Response (*access_mode*)**
Type: Response
Direction: MAC Sublayer to LAC Sublayer
Action: The LAC Sublayer is notified of the access mode to be used by the MAC Sublayer for the transmission of the PDU corresponding to the most recent MAC_SDUReady.Request.

Name: **MAC-Data.Request (*channel_type, data, size*)**
Type: Request
Direction: LAC Sublayer to MAC Sublayer
Action: The encapsulated PDU fragment is transmitted across the radio interface. Invocations without an encapsulated PDU fragment and with the size parameter set to zero indicate that the LAC Sublayer does not have any more data to be transferred.

Name: **MAC-Data.Indication (*channel_id, channel_type, data, size, system_time, physical_channel_id*)**
Type: Indication
Direction: MAC Sublayer to LAC Sublayer
Action: The received PDU is delivered to the LAC Sublayer. Invocation without an encapsulated PDU fragment can be used to signal reception errors.

Name: **MAC-Availability.Indication (*channel_type, max_size, system_time*)**
Type: Indication
Direction: MAC Sublayer to LAC Sublayer
Action: The LAC Sublayer is notified of the maximum size of the encapsulated PDU fragment that can be transferred in the next Lower Layer transfer unit (e.g., frame). Invocations can also be used to signal significant time boundaries (e.g., beginning or end of a time slot).

Name: **MAC-AccessFailure.Indication (*reason, acceptable_rate*)**
Type: Indication
Direction: MAC Sublayer to LAC Sublayer
Action: The LAC Sublayer is notified when the MAC Sublayer determines that a PDU cannot be transmitted on the r-csch.

Parameter definitions:

- *channel_type* is set to “5ms FCH/DCCH frame”, “20ms FCH/DCCH frame”, “F-PDCH frame”, “R-PDCH frame”, “F-CCCH frame”, “F-BCCH frame”, “R-CCCH frame”, “F-PCH frame”, “F-SYNC frame”, “R-ACH frame” or “ENHANCED ACCESS frame”.
- *size* is set to the number of bits in the encapsulated PDU or the fragment of the encapsulated PDU (if *data* parameter is present).
- *P* is the value used in the persistence tests on R-ACH, R-EACH and R-CCCH.
- *seqno* is the access probe count within the current access sub-attempt for R-ACH, R-EACH and R-CCCH.
- *scheduling-hint* is used to indicate to the multiplex sublayer of the MAC how to prioritize fragments of the encapsulated PDU versus other types of multiplexed traffic.
- *access_mode* is the access mode (Basic Access Mode or Reservation Access Mode) to be used by the MAC Sublayer for the transmission of a PDU.
- *data* is a fragment of the encapsulated PDU.
- *system_time* is the time at which the Physical Layer received the first bit of the Physical Layer frame containing the information bits or at which the frame will be transmitted.
- *physical_channel_id* is a unique identifier for the Physical Channel on which the data was received at the Physical Layer.
- *max_size* maximum acceptable value for the *size* parameter of the matching **MAC-Data.Request** primitive.
- *reason* is set equal to “Timer Expired”, “Loss of Channel” or “Insufficient Transmission Rate”.
- *acceptable_rate* is set to the maximum instantaneous transmission rate that can be used for the transfer, whenever *reason* is set to “Insufficient Transmission Rate”.

When the LAC Sublayer has a PDU to transmit, it invokes the **MAC-SDUReady.Request** primitive, passing the size of the encapsulated PDU, and other information about it such as type, sequence number, persistence threshold, or information needed for scheduling (e.g., priority). The MAC Sublayer uses this information to perform the transmission. If a subsequent **MAC-SDUReady.Request** primitive is received before the MAC Sublayer completes transmission of the PDU corresponding to the current **MAC-SDUReady.Request**,

the new invocation overrides the previous one, in the sense that transmission of the previous PDU is in general,[2] interrupted and replaced by transmission of the new PDU. For each subsequent available Physical Layer transfer unit (e.g., frame), the MAC Sublayer invokes the **MAC-Availability.Indication** primitive, advertising how many bits can be carried by the transfer unit. The LAC Sublayer responds immediately with the **MAC-Data.Request** primitive, carrying data of size less than or equal to the amount indicated in the matching **MAC-Availability.Indication**. If there is no more data to be transferred but the **MAC-Availability.Indication** primitive is received, the LAC Sublayer responds by invoking the **MAC-Data.Request** primitive with the size parameter set to zero. This signals the MAC Sublayer that the transfer of the PDU was completed.

On reception, the MAC Sublayer invokes the **MAC-Data.Indication** primitive every time there is a received encapsulated PDU fragment to be delivered.

1.2.5 Functional Description

The LAC Sublayer performs the following functions:

- Delivery of SDUs to the Layer 3 peer entity using ARQ techniques, when needed, to provide reliability. See ARQ Sublayer below.
- Assembling and validating well-formed PDUs, appropriate for carrying the SDUs. See Utility Sublayer below.
- Segmentation of encapsulated PDUs into encapsulated PDU fragments of sizes suitable for transfer by the MAC Sublayer. See SAR Sublayer below.
- Reassembly of encapsulated PDU fragments into encapsulated PDUs. See SAR Sublayer below.
- Access control through "global challenge" authentication[3], message integrity validation or both. Conceptually, some messages failing authentication or message integrity check on a common channel may not necessarily need to be delivered to the Upper Layers for processing. See Authentication Sublayer below.
- Address control to ensure delivery of PDUs based upon addresses that identify particular mobile stations. See Addressing Sublayer below.
- Internal signaling, by exchanging notifications and data with Layer 3 and the supervisory and configuration entities, resulting from the processing of LAC Sublayer level information.

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[2] The transmission of a mini-message may be punctured (i.e. overlapped) with the transmission of a regular message.

[3] Some authentication is a Layer 3 function while some resides in Layer 2. Specifically, the "global challenge" type of authentication is placed in Layer 2, because it can be viewed as related to access. Implementations are not constrained by this modeling consideration.

1.2.5.1 Operation on r-csch

Figure 1.2.5.1-1 shows an example structure of the LAC Sublayer for the r-csch logical channel:

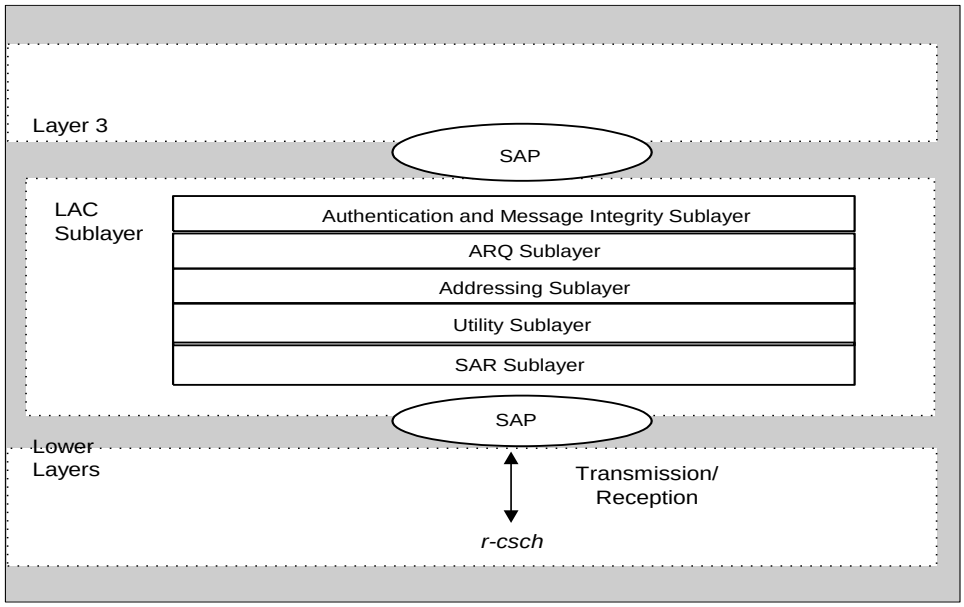

Figure 1.2.5.1-1. Protocol Architecture: r-csch

Message transmission by the mobile station on the r-csch operates as follows:

- At the SAP, Layer 3 invokes the **L2-Data.Request** primitive that carries the SDU and the associated MCSB to the LAC Sublayer.
- The SDU and the MCSB are presented to the Authentication and Message Integrity Sublayer, which sets the mobile station authentication fields and the message integrity fields and adds them to the SDU, producing the initial LAC Protocol Data Unit (PDU).
- The PDU and the MCSB are then presented to the ARQ Sublayer, which sets the mobile station acknowledgment fields accordingly, based upon information available in the MCSB. These fields are added to the PDU.
  - If the ARQ sublayer is required to send an acknowledgment for a received PDU and Layer 3 indicates that there is no Layer 3 response to the received PDU, the ARQ Sublayer sends an acknowledgment-only PDU to acknowledge the received PDU.
  - If the ARQ sublayer is required to send an acknowledgment for a received PDU and Layer 3 indicates that there is a Layer 3 response to the received PDU, the ARQ sublayer includes the acknowledgment in the PDU carrying the Layer 3 response.

- The PDU and the MCSB are then presented to the Addressing Sublayer, which sets the mobile station address fields to proper values and adds them to the PDU.
- The PDU and the MCSB are then presented to the Utility Sublayer, which maps the MSG_TAG in the MCSB to the MSG_TYPE field of the PDU. The Utility Sublayer further assembles the mobile station pilot measurement report fields and adds them to the PDU. For each retransmission, the old set of pilot measurement report fields may be replaced by a new set of pilot measurement report fields. Then, the PDU is padded so its length is an integral number of octets plus two bits by appending 0-7 bits of '0', as necessary. The Utility Sublayer then further computes the value for the message authentication code field and adds the message authentication code field to the padded PDU, if the PDU is to be integrity protected. This operation completes the construction of the PDU. If an error occurs, the LAC Sublayer can inform Layer 3 by using the **L2-Condition.Notification** primitive.
- The PDU and the MCSB are then presented to the SAR Sublayer, which computes the length, if not already computed at the Utility Sublayer[4], and the CRC parameters for the PDU. The PDU is logically encapsulated between the prepended length parameter and the appended CRC parameter.
- By means of a one-time invocation of the **MAC-SDUReady.Request** primitive, the SAR Sublayer indicates to the MAC Sublayer that there is a PDU ready for transmission on the r-csch. If the base station allows r-csch signaling only on the Access Channel, the PDU is submitted to the MAC sublayer for transmission on the Access Channel. If the base station allows r-csch signaling on the Enhanced Access Channel, the PDU is submitted to the MAC sublayer on the Enhanced Access Channel. The information sent via this invocation of the primitive may be used by the MAC Sublayer to decide whether to invoke the **MAC-Availability.Indication** primitive (and if so, how many times). The LAC sublayer can also receive the **MAC-AccessFailure.Indication** primitive to indicate to the LAC sublayer that specific conditions or events that prevented a successful transmission have occurred.
- The SAR Sublayer waits for each reception of the **MAC-Availability.Indication** primitive from the MAC Sublayer, indicating the availability, transmission time, and capacity of the physical channel frame that can carry the contents of the LAC PDU. On each reception of the primitive, the SAR Sublayer assembles an encapsulated PDU fragment to be transmitted using the next untransmitted bits of the PDU (up to the specified available capacity), and invokes the **MAC-Data.Request** primitive. If the SAR Sublayer has nothing (more) to transmit but continues to receive the **MAC-Availability.Indication** primitive, it replies by invoking the **MAC-Data.Request** primitive with the length indicator set to zero.

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[4]The computation of the message authentication code is performed over the message length, which means that if message integrity is required, the message length has to be computed at the Utility Sublayer and just passed down into the MCSB to the SAR Sublayer.

Message reception by the base station on the r-csch operates as follows:

- Within an r-csch time slot, the SAR Sublayer receives each encapsulated PDU fragment and the associated parameter list from the MAC Sublayer via the **MAC-Data.Indication** primitive.[5] Upon receiving a first fragment, the PDU capsule length is determined. All of the subsequently received fragments are concatenated according to the expected length or until the r-csch time slot expires, whichever occurs first. If the CRC matches, a copy of the entire received encapsulated PDU is kept to be used for message integrity computations, if necessary, and then the length and CRC parameters are discarded[6] and the PDU is presented to the Utility Sublayer. If the CRC does not match, the PDU and the SAR parameters are discarded.
- The MCSB is generated.
- The Utility Sublayer maps the MSG_TYPE to a MSG_TAG suitable for Layer 3. • The PDU and the MCSB are presented to the Addressing Sublayer, which recognizes and processes the address of the mobile station that generated the message. An address-specific instance is created in the ARQ Sublayer and Authentication and Message Integrity Sublayer for the mobile station. The address fields are removed from the PDU.
- The PDU and the MCSB are presented to the ARQ Sublayer, for the addressed mobile. If message integrity validation is not required the ARQ fields are processed and the internal ARQ variables are updated immediately. The ARQ fields are removed from the PDU. A unique identifier is created containing the identity of the mobile station, the MSG_TAG, and an instance specification and is associated with the message in the MCSB. If message integrity validation is required, the completion of the processing of the ARQ fields is postponed until the result of the message integrity validation is known. ARQ processing will not be performed for a message that fails the message integrity check, unless the base station makes an explicit decision to proceed despite the security failure (e.g. in case of an emergency call).

[5] If the MAC Sublayer detects that a frame was received in error, the MAC Sublayer may notify the SAR Sublayer (via the **MAC-Data.Indication** primitive) or may stop sending the contents of that frame and subsequent ones (to the end of the r-csch time slot), or both.

[6] The length of the PDU is first recorded in the MCSB.

- The Authentication and Message Integrity Sublayer selects, stores in the MCSB and removes from the PDU the mobile station authentication fields, the message integrity fields, and the message authentication code, if present. It then initiates their processing. If message integrity is supported, the crypto-sync value is validated, if necessary, and if valid, the message authentication code is computed over the copy of the received encapsulated PDU and is compared with the message authentication code from the received PDU[7]. The copy of the encapsulated PDU is discarded, as it is no longer needed. The PDU is then returned to the ARQ sublayer to complete processing and then comes back to the Authentication and Message Integrity Sublayer. The authentication then proceeds. If the authentication or message integrity check fail, the PDU will be delivered to the Upper Layers with a notification of failed integrity check, failed authentication or both[8]. In some cases it may be desirable to perform the authentication function in parallel with the Upper Layer functions invoked by the message carried in the PDU. If the authentication or the message integrity check fail, the Authentication and Integrity Sublayer can generate an **L2-Condition.Notification** primitive to Layer 3 specifying the unique message identifier of the message that was not properly authenticated or that failed the message integrity check.
- The remaining Layer 3 SDU and the associated MCSB are then presented to Layer 3 at the SAP via the **L2-Data.Indication** primitive.

1.2.5.2 Operation on f-csch

Figure 1.2.5.2-1 shows an example structure of the LAC Sublayer for the f-csch logical channel:

[7] The message integrity check is considered to have failed if message integrity fields were expected (see [5]) but missing from the received message, if the crypto-sync value was not deemed valid, if the crypto-sync value was an invalid duplicate, or if the computed and the received values of the message authentication codes were not identical.

[8] It is up to the base station to decide when authentication is performed on a message that failed the message integrity check.

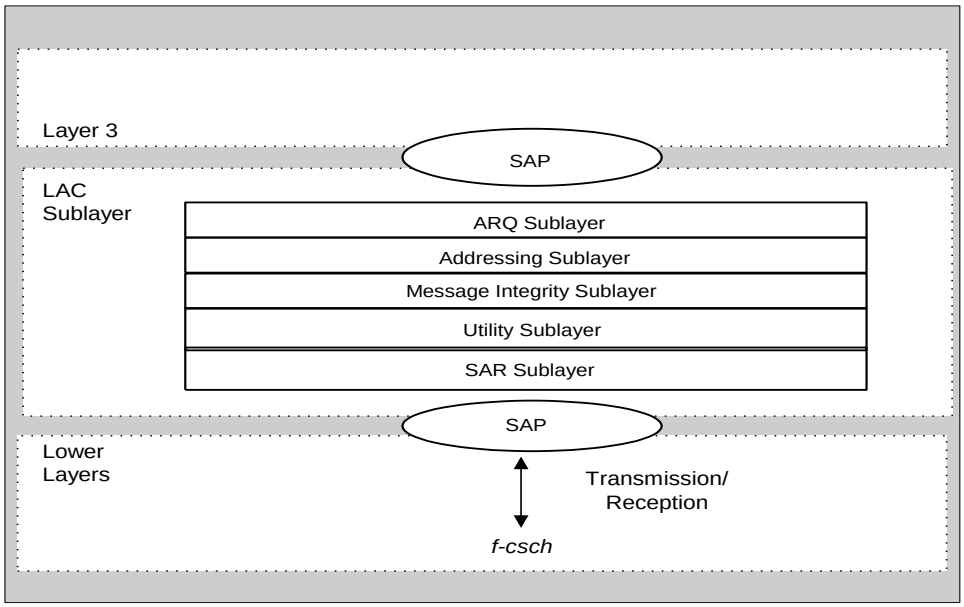

Figure 1.2.5.2-1. Protocol Architecture: f-csch

Message transmission by the base station on the f-csch operates as follows:

- The Layer 3 message (LAC SDU) and the associated MCSB are presented to the LAC Sublayer via the **L2-Data.Request** primitive. The associated MCSB indicates the proper f-csch logical channel (sync, broadcast, or general signaling) to be used for the LAC SDU and the physical channel that the logical channel maps to (the Paging Channel or the Broadcast Channel for the broadcast channel, and the Paging Channel or the Forward Common Control Channel for the general signaling channel). The MCSB may indicate that a message needs to be transmitted on multiple physical channels.
- For messages sent on the sync and broadcast logical channels and those messages sent on the general signaling channel that are addressed to a single mobile station, the LAC Sublayer encapsulates each SDU in a PDU. The corresponding PDU is assembled as follows:
  - If the PDU is sent on the general signaling channel, the ARQ Sublayer adds the relevant acknowledgment fields to the PDU carrying the message. The PDU and the MCSB are passed to the Addressing Sublayer.
  - If the PDU is sent on the general signaling channel, the Addressing Sublayer adds the relevant mobile station address parameters to the PDU carrying the message. The PDU and the MCSB are passed to the Message Integrity Sublayer.
  - If the PDU is sent on the general signaling channel, the Message Integrity Sublayer adds the message integrity information fields to the PDU carrying the message. The PDU and the MCSB are passed to the Utility Sublayer.

- The Utility Sublayer completes assembly of the PDU (selecting the appropriate PDU format according to the protocol) and maps the MSG_TAG to MSG_TYPE. Then, the PDU is padded by appending 0-7 bits of '0', as necessary, for the subsequent transfer of an integral number of octets plus two bits to the SAR Sublayer. Then, the Utility Sublayer adds the message authentication code field to the padded PDU, if the PDU is to be integrity protected. The PDU and the MCSB are passed to the SAR Sublayer.

• For messages addressed to multiple mobile stations other than the *Universal Page Message* and which do not contain the Extended Encryption Fields (e.g., the *Order Message*, the *Channel Assignment Message*, the *Extended Channel Assignment Message*, the *General Page Message*), the LAC sublayer encapsulates one or more SDUs of the same type in a single PDU. If the base station uses the *Extended Encryption Fields* or the *Message Integrity Fields* and encapsulates multiple SDUs in a single PDU, the base station can send only the *Extended Channel Assignment Message* (i.e., the base station may not send the *Channel Assignment Message* or the *Order Message*). The corresponding PDU is assembled as follows:

  - Layer 3 presents each of the LAC SDUs (records) to be included in a PDU, one at a time, and indicates to the LAC Sublayer when it has sent all records to be included in a single PDU. For the *General Page Message*:

    + Layer 3 sends a record of non-zero length for each mobile station-addressed page record, if any, and a record of zero length for each broadcast page record, if any.

    + When Layer 3 indicates to the LAC Sublayer that it has sent all records, if any, to be included in a single message, it sends the GPM Common Fields to the LAC Sublayer. The Message Integrity Sublayer adds the relevant message integrity information fields to the record, if the record is to be integrity protected. The ARQ Sublayer adds the relevant acknowledgment fields to the record. The record and the MCSB are passed to the Addressing Sublayer.

  - The Addressing Sublayer adds the relevant mobile station address parameters to the record. The record and the MCSB are passed to the Message Integrity Sublayer.

  - The Message Integrity Sublayer adds the message integrity information fields to the record. The record and the MCSB are passed to the Utility Sublayer.

- The Utility Sublayer appends a MACI field to each record that needs message integrity protection and then collects the records to be included in a single PDU. When it receives an indication from Layer 3, it encapsulates all records of the type indicated by Layer 3 in a single PDU, selects the appropriate PDU format according to the protocol, and maps the MSG_TAG to MSG_TYPE. The Utility Sublayer includes records in a PDU in the same order as they were received from Layer 3. If the PDU corresponds to a *General Page Message*, the Utility Sublayer creates a header for the message using the GPM Common Fields. Then, the PDU is padded by appending 0-7 bits of '0', as necessary, for the subsequent transfer of an integral number of octets plus two bits to the SAR Sublayer. The Utility Sublayer then adds the message authentication code field, if the PDU is to be integrity protected. The PDU and the MCSB are passed to the SAR Sublayer.

- For the *Universal Page Message* (which may be addressed to multiple mobile stations), the LAC Sublayer encapsulates one or more SDUs of the same type into one or more PDUs. The PDUs are assembled as follows:
  - Layer 3 presents each of the LAC SDUs (records) to be included in the message, one at a time, and indicates to the LAC Sublayer when it has sent all records to be included in the message. Layer 3 sends a record of non-zero length for each mobile station-addressed page record. Layer 3 sends a record of non-zero length for each enhanced broadcast page record. Layer 3 sends a record of zero length for each mobile station-directed message announcement. When Layer 3 indicates to the LAC Sublayer that it has sent all records to be included in the message, it also sends the UPM Common Fields to the LAC Sublayer. Layer 3 may send only the UPM Common Fields and not send any records.
  - The ARQ Sublayer adds the relevant acknowledgment fields to the record. The record and the MCSB are passed to the Addressing Sublayer.
  - The Addressing Sublayer adds the relevant mobile station address parameters to the record. The record and the MCSB are passed to the Utility Sublayer.
  - The Utility Sublayer collects records to be included in the message. When an indication is received from Layer 3, all records of the type indicated by Layer 3 are encapsulated in a preliminary structure called the *Universal Page Block* that includes the UPM Common Fields. The Utility Sublayer then includes the *Universal Page Block* in a single PDU, or optionally segments the *Universal Page Block* into multiple PDUs. For each PDU, the Utility Sublayer then selects the appropriate PDU format according to the protocol and maps the MSG_TAG to MSG_TYPE. Then each PDU is padded by appending 0-7 bits of '0', as necessary, for the subsequent transfer of an appropriate number of bits to the SAR Sublayer. The PDU and the MCSB are passed to the SAR Sublayer.
- The SAR Sublayer computes the length and the CRC parameters for the PDU. The PDU is logically encapsulated between the prepended length parameter and the appended CRC parameter.

- By means of a one-time invocation of the **MAC-SDUReady.Request** primitive for each channel (Paging Channel, Broadcast Channel, or Forward Common Control Channel) on which the PDU is to be transmitted, the SAR Sublayer indicates to the MAC Sublayer that there is a PDU ready for transmission on that channel. The information sent via this invocation of the primitive may be used by the MAC Sublayer to decide whether to invoke the **MAC-Availability.Indication** primitive (and if so, how many times).
- The SAR Sublayer waits to receive the **MAC-Availability.Indication** primitive from the MAC Sublayer (on each frame for the sync channel, each half-frame for the Paging Channel, or each partial-frame for the Forward Common Control Channel or the Broadcast Channel), indicating the availability, transmission time, and capacity of the physical channel frame that can carry the contents of the PDU. On each reception of the primitive,[9] the SAR Sublayer assembles the encapsulated PDU fragment to be transmitted using the next untransmitted bits of the PDU (up to one or two bits less than the specified available capacity). The SAR Sublayer then adds the Start of Message (SOM) bit for the sync channel, or the Synchronized Capsule Indicator (SCI) bit for the Paging Channel and the Broadcast Channel, or the Segmentation Indicator (SI) field for the Forward Common Control Channel, indicating the fragment's position in the encapsulated PDU (first or subsequent), and invokes the **MAC-Data.Request** primitive.
  - On the sync channel, if at the reception of the **MAC-Availability.Indication** primitives there are fewer information bits to transfer than the specified capacity of the frame, enough padding bits (set to '0') to fill the specified capacity of the frame are appended to the information bits and the padded data is transferred via the **MAC-Data.Request** primitive. Following each of the subsequent receptions of the **MAC-Availability.Indication** primitive corresponding to frames within the current sync channel superframe (if any), only padding bits (set to '0') are transferred to fill each sync channel frame to the specified capacity.

[9] On the sync channel, the transfer of a new encapsulated PDU begins only in the first frame of a superframe.

- On the Paging Channel, if at the reception of the **MAC-Availability.Indication** primitives there are fewer information bits to transfer than the specified capacity of the half-frame, enough padding bits (set to '0') to fill the specified capacity of the half-frame may be appended to the information bits and the padded data may be transferred via the **MAC-Data.Request** primitive. Alternatively, if there are at least eight bits of extra capacity left in the half-frame, enough (to fill the half-frame) beginning bits of the next encapsulated PDU (and possibly extending further to subsequent encapsulated PDUs) to be transmitted are appended to the untransmitted information bits of the last encapsulated PDU and transferred. If no other encapsulated PDUs are available to transfer, encapsulated PDUs corresponding to the Null Message are transferred continuously.
- On the Broadcast Channel or the Forward Common Control Channel, if at the reception of the **MAC-Availability.Indication** primitives there are fewer information bits to transfer than the specified capacity of the partial-frame, enough padding bits (set to '0') to fill the specified capacity of the partial-frame may be appended to the information bits and the padded data may be transferred via the **MAC-Data.Request** primitive. Alternatively, if there are enough bits of extra capacity left in the partial-frame, to include at least the entire message length fields of the next encapsulated PDU (and possibly extending further to subsequent encapsulated PDUs) to be transmitted, enough bits (to fill the partial-frame) of the PDU are appended to the untransmitted information bits of the last encapsulated PDU and transferred.

Message reception by the mobile station on the f-csch operates as follows:

- The SAR Sublayer receives information bits containing the encapsulated PDU fragment and the parameter list from the MAC Sublayer via the **MAC-Data.Indication** primitive. The MCSB is generated.
- The first encapsulated PDU fragment is identified (via the SOM bit for the sync channel, or via the SCI bit or SI field for any other f-csch logical channel) and the PDU capsule length is determined. For f-csch logical channels other than the sync channel, a first fragment of an encapsulated PDU may start immediately after the last bit of a preceding PDU capsule, if it is immediately followed by eight or more information bits transferred via the same **MAC-Data.Indication** primitive and if the aforementioned eight bits binary encode an unsigned integer greater than or equal to five.
- For the assembly of each PDU, all subsequently received encapsulated PDU fragments are concatenated, either up to the expected length or until a new first fragment is received (which restarts the reassembly procedure). The SOM/SCI/SI bits are discarded. The CRC is checked against the received data and if the check fails, all of the received data (encapsulated PDU fragments and the associated SAR parameters) are discarded; otherwise, only the length and CRC parameters are discarded, and the remaining PDU is presented to the Utility Sublayer.

- At the Utility Sublayer, the Message Type fields are mapped to the corresponding MSG_TAG. For the *Universal Page Message*, the Utility Sublayer may perform reassembly of the *Universal Page Message* from multiple received PDUs.
- For messages received on the sync channel or the broadcast channel, the LAC SDU (from the received PDU) and the associated MCSB are presented to Layer 3 through the SAP via the **L2-Data.Indication** primitive.
- For messages received on the general signaling channel that are addressed to a single mobile station:
  - The SAR Sublayer assembles the message and checks its CRC. The length of the message is passed up to the Utility Sublayer.
  - The Utility Sublayer strips the MACI field and saves a copy of the message for MACI validation.
  - The Message Integrity Sublayer triggers the integrity checks (crypto-sync and MACI validation) procedure and the result determines how to handle the PDU further. Then the PDU passes to the Addressing Sublayer.
  - The Addressing Sublayer converts the address fields in the PDU according to the protocol and processes them for address matching. If the destination of the PDU does not match the identity of the mobile station, the PDU and the MCSB are discarded; otherwise, the address fields are removed from the PDU, and the remainder of the PDU and the MCSB are sent to the ARQ Sublayer.
  - The PDU and the MCSB are then passed to the ARQ Sublayer where the ARQ fields are processed and then removed from the PDU. If the received PDU has passed the message integrity checks and requires an acknowledgment, the ARQ Sublayer includes an indication for this requirement in the MCSB. If an access attempt is in progress and the received PDU does not contain an acknowledgment for the PDU being transmitted, the ARQ Sublayer includes an indication for this condition in the MCSB.
  - The LAC SDU (from the received PDU) and the associated MCSB are then presented to Layer 3 through the SAP via the **L2-Data.Indication** primitive, together with an indication of wether or not the message integrity has succeeded.If the received PDU includes an acknowledgment to a previously transmitted PDU containing an acknowledgment, the LAC Sublayer sends an indication to Layer 3 via the **L2-Condition.Notification** primitive.
- For messages received on the general signaling channel that are addressed to multiple mobile stations:
  - If the message is a *General Page Message*, the Utility Sublayer removes the GPM Common Fields from the PDU and puts them in the MCSB.
  - If the message is a *Universal Page Message*, the Utility Sublayer removes the UPM Common Fields from the PDU and puts them in the MCSB.

- The Utility Sublayer separates the individual records, strips the respective MACI fields, bypasses the Message Integrity Sublayer and passes the records to the Addressing Sublayer.
- The Addressing Sublayer converts the address fields in each record of the PDU according to the protocol and processes them for address matching. If the destination of the record does not match the identity of the mobile station, the record is discarded; otherwise, the address fields are removed from the record, and the remainder of the record and the MCSB are sent to the Message Integrity Sublayer.
- The Message Integrity Sublayer stores the message integrity fields and validates the crypto-sync. The message integrity check (MACI validation) procedure is triggered and its result determines how to handle the PDU further. If the received record is deemed valid, the record and the MCSB are passed to the ARQ Sublayer where the ARQ fields are processed and then removed from the record.
- If the received record requires an acknowledgment, the ARQ Sublayer includes an indication for this requirement in the MCSB. If an access attempt is in progress and the received PDU does not contain an acknowledgment for the PDU being transmitted, the ARQ Sublayer includes an indication for this condition in the MCSB.
- The LAC SDU (from the record of the received PDU) and the associated MCSB are then presented to Layer 3 through the SAP via the **L2-Data.Indication** primitive, with an indication of whether or not the message integrity check has succeeded. For the *General Page Message* and the *Universal Page Message*, the MCSB (containing the GPM Common Fields or the UPM Common Fields, respectively) is presented to Layer 3 even if there is no record addressed to the mobile station.
- If the received PDU includes an acknowledgment to a previously transmitted PDU containing an acknowledgment, the LAC Sublayer sends an indication to Layer 3 via the **L2-Condition.Notification** primitive.

1.2.5.3 Operation on r-dsch and f-dsch

Figure 1.2.5.3-1 shows an example structure of the LAC Sublayer for the f-dsch and r-dsch logical channels:

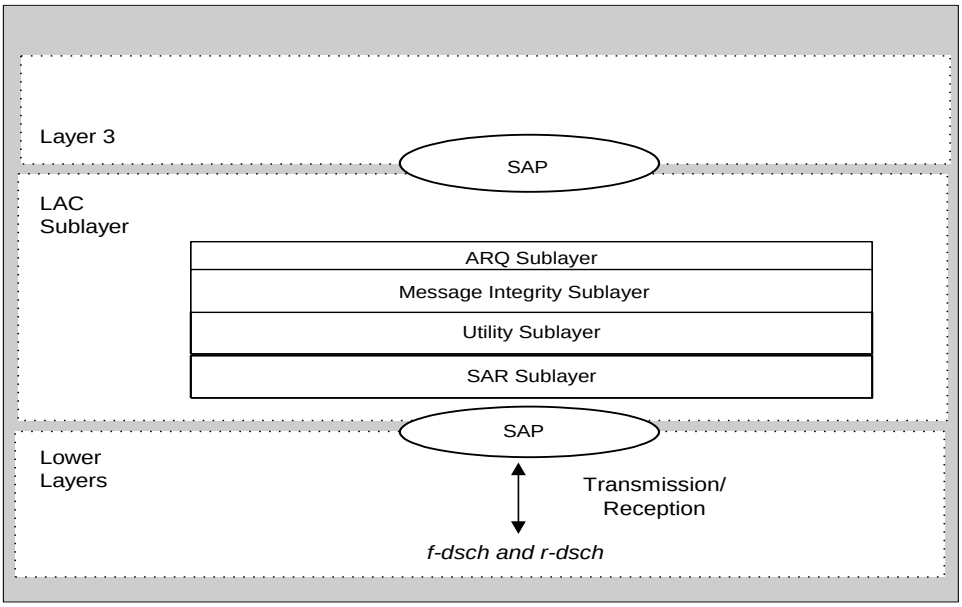

Figure 1.2.5.3-1. Protocol Architecture: f-dsch and r-dsch

Message transmission by the base station and the mobile station on the logical dedicated signaling channels operates as follows:

- The Layer 2 SDU and the associated MCSB are presented to the LAC Sublayer via the SAP, using the **L2-Data.Request** primitive.
- The ARQ Sublayer processes and adds acknowledgement-related fields to the PDU, and presents the PDU and the MCSB to the Message Integrity Sublayer.
- The Message Integrity Sublayer processes and adds message integrity-related fields to the PDU, and presents the PDU and the MCSB to the Utility Sublayer.
- The Utility Sublayer maps the MSG_TAG to the MSG_TYPE field of the PDU. For a regular PDU, the Utility Sublayer adds the ENCRYPTION field (identifying the status of encryption on the channel), and padding bits (set to '0') are added as needed to extend the PDU's length to an integral number of octets. If necessary, the value for the MACI field is computed and the MACI field is added to the PDU. The PDU and the MCSB are passed to the SAR Sublayer.
- For a regular PDU, the SAR Sublayer computes the length[10] and the CRC parameter for the PDU. The PDU is logically encapsulated between the prepended length parameter and the appended CRC parameter.

[10] Since the message length is needed to compute the value of the MACI field, the message length may be computed at the Utility Sublayer, after the PDU is built, and passed in the MCSB to the SAR Sublayer.

- Via a one-time invocation of the **MAC-SDUReady.Request** primitive, the SAR Sublayer may indicate to the MAC Sublayer that there is a pending PDU for transmission. The information sent via this invocation of the primitive may be used by the MAC Sublayer to decide whether to invoke the **MAC-Availability.Indication** primitive (and if so, how many times).
- The SAR Sublayer waits for each notification from the MAC Sublayer indicating the availability, transmission time, and capacity of the frame that can carry the contents of the PDU. For transmission on logical dedicated channels mapped to Fundamental Channels or Dedicated Control Channels, the MAC Sublayer invokes the **MAC-Availability.Indication** primitive on 20 ms boundaries, at least until the "payload" requested via the **MAC-SDUReady.Request** primitive has been processed, and, optionally, on 5 ms boundaries, indicating availability of mini frames. For transmission on F-PDCH, the MAC Sublayer invokes the **MAC-Availability.Indication** primitive every time when transmission capacity is available via a F-PDCH frame.
  - If a mini PDU is available for transmission at the time of the reception of the **MAC-Availability.Indication** primitive that indicates available capacity for a mini frame, the SAR Sublayer invokes the **MAC-Data.Request** primitive containing a mini PDU.
  - If a regular PDU is available for transmission at the time of the reception of the **MAC-Availability.Indication** primitive that indicates available capacity for a frame, the SAR Sublayer assembles the encapsulated PDU fragment to be transmitted using the next untransmitted bits of the encapsulated PDU (up to one bit less than the specified available capacity). It then adds the SOM bit, as appropriate, indicating the fragment position (first or subsequent) in the PDU, and invokes the **MAC-Data.Request** primitive containing the assembled encapsulated PDU fragment. The SAR Sublayer does not send fragments of another regular PDU to the MAC Sublayer for transmission before all fragments of the current regular PDU have been sent to the MAC Sublayer.
- If the SAR Sublayer has nothing (more) to transmit but continues to receive the **MAC-Availability.Indication** primitive, it replies by invoking the **MAC-Data.Request** primitive with the length indicator set to zero.

Reception procedures are similar on both the f-dsch and r-dsch. Reception on the f-dsch by the mobile station is explained here, as an example.

- The SAR Sublayer receives the encapsulated PDU fragment and the parameter list from the MAC Sublayer via the **MAC-Data.Indication** primitive, with information which identifies it as a mini PDU or a fragment of a regular PDU. Each encapsulated PDU fragment is timestamped with the system time corresponding to the frame that carried it. The MCSB is generated.

  - For encapsulated PDU fragments of a regular PDU, the first fragment is identified (via the SOM bit) and the PDU capsule length is determined. All subsequently received fragments are concatenated up to the expected length or until a new first fragment (corresponding to a regular PDU or mini PDU) is received and restarts the reassembly procedure. The SOM bit is discarded. The CRC is checked against the received data and if the check fails, all of the received data (encapsulated PDU fragments and the associated SAR parameters) are discarded; otherwise, only the length and CRC parameters are discarded and the remaining PDU is presented to the Utility Sublayer.
  - An encapsulated PDU fragment corresponding to a mini PDU is presented to the Utility Sublayer without additional processing.

- The Utility Sublayer maps the MSG_TYPE to a MSG_TAG. The PDU and the MCSB are forwarded to the Message Integrity Sublayer.
- The Message Integrity Sublayer processes the message integrity fields, including checking for valid crypto-sync values. If the PDU requires message integrity, the PDU would be returned to the Utility Sublayer to strip the MACI off the PDU and the message integrity check (MACI validation) procedure is triggered. Its result determines how to handle the PDU further. If the received record is deemed valid, it is moved directly to the ARQ Sublayer for processing.
- The ARQ fields are removed from the PDU. If the received PDU requires an acknowledgment, the ARQ Sublayer will include an indication for this requirement in the MCSB, to be processed further.
- The resulting SDU is then sent to Layer 3 via the SAP with the corresponding MCSB, using the **L2-Data.Indication** primitive, together with an indication of whether the message integrity check has succeeded or not.

1.2.6 ARQ Model

Within both the base station and the mobile station, the ARQ Sublayer for each logical channel is viewed as split between a transmitter side and a receiver side (see Figure 1.2.6-1). The two sides signal one another, with the receiver side typically notifying the transmitter side of the reception of an acknowledgment or of a PDU requiring acknowledgment. In addition to the PDUs transported between sublayers, the two sides can transport signaling with other sublayers and with supervisory and configuration management entities.

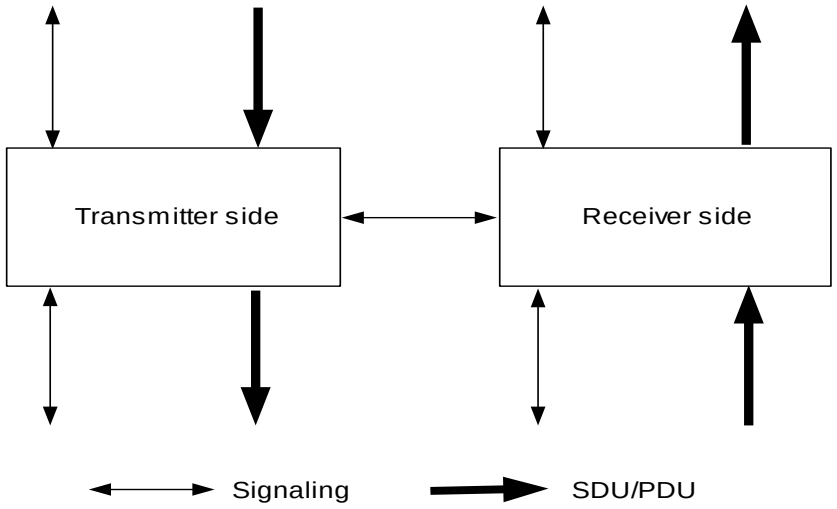

Figure 1.2.6-1. ARQ Model

With respect to ARQ, the LAC Sublayer provides two major types of service to Layer 3:

- Assured Delivery Service. PDUs sent in assured mode on a logical channel are repeated autonomously several times at fixed intervals until an acknowledgement from the LAC Sublayer of the receiving station is received by the LAC Sublayer of the transmitting station. If no such acknowledgement is received after a specific number of retransmissions, the logical channel is dropped. When requesting a PDU transfer in assured mode, Layer 3 may also request a *confirmation of delivery* from the LAC Sublayer. In such cases, the LAC Sublayer in the transmitting station notifies Layer 3 immediately (for example, by using the **L2-Data.Confirm** primitive) upon receiving the LAC acknowledgment from the receiving station LAC Sublayer. Such notifications can be used by Layer 3 to order and serialize the delivery of messages.
- Unassured Delivery Service. PDUs sent in unassured mode are not acknowledged by the LAC Sublayer of the receiving station, and thus there is no guarantee that they were actually received. When requesting a PDU transfer in unassured mode, Layer 3 may also request the LAC Sublayer to increase the probability of delivery of the PDU (for example, by having the PDU sent multiple times in rapid succession and relying on the duplicate detection capabilities of the receiver to achieve unique delivery).

When requesting transmission of a Layer 3 PDU, Layer 3 typically specifies whether the transfer is to be performed in assured mode (with or without confirmation of delivery) or in unassured mode (for example, by setting the proper parameters in the MCSB argument of the **L2-Data.Request** primitive).

Layer 3 can also request the LAC Sublayer to perform a reset of the LAC ARQ procedures (for example, by using the **L2-Supervision.Request** primitive).

2 MOBILE STATION REQUIREMENTS

When operating on common channels, the mobile station shall meet the requirements specified in 2.1. When operating on dedicated channels the mobile station shall meet the requirements specified in 2.2.

2.1 Common Channel Operation

The mobile station shall meet the requirements specified in 2.1.1 for operation on the r-csch and in 2.1.2 for operation on the f-csch.

2.1.1 Transmission on r-csch

The mobile station shall meet the requirements specified in 2.1.1.1.2, 2.1.1.2.2, 2.1.1.3.2, 2.1.1.4.2 and 2.1.1.5.2.

2.1.1.1 Authentication and Message Integrity Sublayer

2.1.1.1.1 Parameters

The mobile station shall use the authentication and message integrity fields defined in 2.1.1.1.1.1 for PDUs transmitted on the r-csch. The mobile station shall set the authentication fields according to the requirements specified in 2.1.1.1.1.2. The mobile station shall set the message integrity fields according to the requirements specified in 2.1.1.1.1.3.

If the PDU is retransmitted, the mobile station shall not modify the authentication parameters or the message integrity parameters[11] included in this PDU.

2.1.1.1.1.1 Definition of the Authentication and Message Integrity Fields

The Authentication Fields[12] are AUTH_INCL, AUTHR, RANDC and COUNT. The Message Integrity Fields are MACI_INCL, RANDC[13], SDU_KEY_ID, SDU_INTEGRITY_ALGO,

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[11] The message integrity parameters are EXT_SSEQ, SDU_KEY_ID and INT_KEY[SDU_KEY_ID] that were used in the first transmission of the PDU.

[12] In previous releases, the PDU showed a 2 bit long Authentication Field called AUTH_MODE, having the values '00' and '01' in use, and all other values reserved. For P_REV_IN_USE greater than or equal to nine, the AUTH_MODE is conceptually replaced by (or split into) two 1-bit long fields: MACI_INCL and AUTH_INCL. The change is backwards compatible with previous versions of the standard.

[13] RANDC is both an Authentication Field and a Message Integrity Field and is present only in PDUs sent on r-csch.

SDU_SSEQ_OR_SSEQH, SDU_SSEQ and SDU_SSEQ_H[14]. The authentication fields for PDUs transmitted on the r-csch have the following format:

Field	**Length (bits)**
MACI_INCL	1
AUTH_INCL	1
AUTHR	0 or 18
RANDC	0 or 8
COUNT	0 or 6
SDU_KEY_ID	0 or 2
SDU_INTEGRITY_ALGO	0 or 3
SDU_SSEQ_OR_SSEQH	0 or 1
SDU_SSEQ	0 or 8
SDU_SSEQ_H	0 or 24

MACI_INCL – Message integrity fields included indicator.

Presence indicator for the message integrity fields, set to '1' if the message integrity fields are present and to '0', otherwise.

AUTH_INCL – Authentication fields included indicator.

This field indicates whether other authentication fields are present in the PDU. The field is set to '0' if no other authentication fields are present, or to '1' if the authentication fields below are included in the PDU.

AUTHR – Authentication Response.

If AUTH_INCL is '1', this field is the response output of the authentication algorithm. It is used, for example, to validate mobile station registrations, originations, and terminations. If AUTH_INCL is '0', the field is omitted.

RANDC – Random challenge value.

[14] For practical purposes, the MACI field is handled at the Utility Sublayer, separately from the Message Integrity Fields.

If AUTH_INCL is '1' or if MACI_INCL is '1', this field is set to the eight most significant bits of the 32-bit Random Challenge (RAND) held in the mobile station. RAND is used, in conjunction with SSD_A and other parameters, to validate mobile station originations, terminations and registrations and for message integrity. If AUTH_INCL is '0'and if MACI_INCL is '0', the field is omitted.

COUNT – Call history parameter.

If AUTH_INCL is '1', this field is set to the Call History Parameter, a modulo-64 event counter maintained by the mobile station and Authentication Center that is used for clone detection. If AUTH_INCL is '0', the field is omitted.

SDU_KEY_ID – The key id of the integrity key that is used to compute the MAC-I value for this PDU. If MACI_INCL is '0', the field is omitted.

SDU_INTEGRITY_ALGO – The identity of the message integrity algorithm that is used for the SDU carried by this PDU. If MACI_INCL is '0', the field is omitted.

SDU_SSEQ_OR_SSEQH – Security sequence number format indicator. If MACI_INCL is '0', the field is omitted.

SDU_SSEQ – The 8 least significant bits of the 32-bit security sequence number that is used to compute the MAC-I value for this PDU. If MACI_INCL is equal to '0' or if SDU_SSEQ_OR_SSEQH is equal to '1', the field is omitted.

SDU_SSEQ_H – The 24 most significant bits of the 32-bit security sequence number that is used to compute the MAC-I value for this PDU. If MACI_INCL is equal to '0' or if SDU_SSEQ_OR_SSEQH is equal to '0', the field is omitted.

2.1.1.1.1.2 Requirements for Setting the Authentication Fields

The mobile station shall set the authentication fields as follows:

- If the PDU carries an *Order Message*, *Authentication Challenge Response Message*, *Status Response Message* or an *Extended Status Response Message*, the mobile station shall set the AUTH_INCL to '0' and shall not include the other authentication fields in the PDU, except for the RANDC field, which is further subject to requirements in 2.1.1.1.1.3.
- If the PDU carries any other message:
  - If authentication information is not available, or if the base station has indicated that authentication is not required ($AUTH_S$ is set to '00'), the mobile station shall set AUTH_INCL to '0' and shall not include the other authentication fields in the PDU.
  - Otherwise, the mobile station shall:
    + Set AUTH_INCL to '1'.

+ Set AUTHR to the output value of the Auth_Signature procedure executed as specified in 2.1.1.1.2.2.
+ Set RANDC to the eight most significant bits of the stored value of RAND.
+ Set COUNT to the current value $COUNT_{s\text{-}p}$.

2.1.1.1.1.3 Requirements for Setting the Message Integrity Fields

The Message Integrity Fields shall be set as follows:

- If the PDU carries any message that requires message integrity (as indicated by Layer 3, see [5]) or the PDU is a Layer 2 acknowledgment PDU required to be integrity-protected (see [5]), and if INT_KEY[*key_id*] is not equal to NULL, where *key_id* is the index of the key to be used for message integrity[15] for the PDU, then[16]:
  - Set MACI_INCL to '1'.
  - Set RANDC, if present in the PDU, to the eight most significant bits of the stored value of RAND.
  - Set SDU_KEY_ID to *key_id*.
  - Set SDU_INTEGRITY_ALGO to the id of the integrity algorithm[17] to be used for message integrity for the PDU.
  - Either:
    + set SDU_SSEQ_OR_SSEQH to '0', omit SDU_SSEQ_H, include the SDU_SSEQ field and set it to the 8 least significant bits of the EXT_SSEQ (see 2.1.1.1.2.5 for computation of EXT_SSEQ) used to compute the value MAC-I for this PDU; or
    + set SDU_SSEQ_OR_SSEQH to '1', omit SDU_SSEQ, include the SDU_SSEQ_H field and set it to the 24 most significant bits of the EXT_SSEQ (see 2.1.1.1.2.5 for computation of EXT_SSEQ) used to compute the value MAC-I for this PDU.
- Otherwise, set the MACI_INCL to '0' and omit the SDU_KEY_ID, SDU_INTEGRITY_ALGO, SDU_SSEQ_OR_SSEQH, SDU_SSEQ, and SDU_SSEQ_H fields. The RANDC field shall be omitted unless further requirements in 2.1.1.1.1.2 specify otherwise.

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[15] For a mobile station transmitting, this index is KEY_ID_S.

[16] That may be the case when the protocol revision is ten or higher.

[17] For a mobile station transmitting, this id is $INTEGRITY\_ALGO_S$.

2.1.1.1.2 Procedures

2.1.1.1.2.1 Overview of Authentication Procedures

Authentication is the process by which information is exchanged between a mobile station and a base station for the purpose of confirming the identity of the mobile station. A successful outcome of the authentication process occurs only when it can be demonstrated that the mobile station and base station possess identical sets of shared secret data.

The authentication algorithms are described in [8]. The interface (input and output parameters) for the algorithms is described in [9].

The mobile station provides the base station with the response to the authentication algorithm, the 8 most significant bits of the stored RAND variable and the stored Call History Parameter. The response to the authentication algorithm is generated by executing the Auth_Signature procedure using the same input parameters, as in Figure 2.1.1.1.2.1-1.

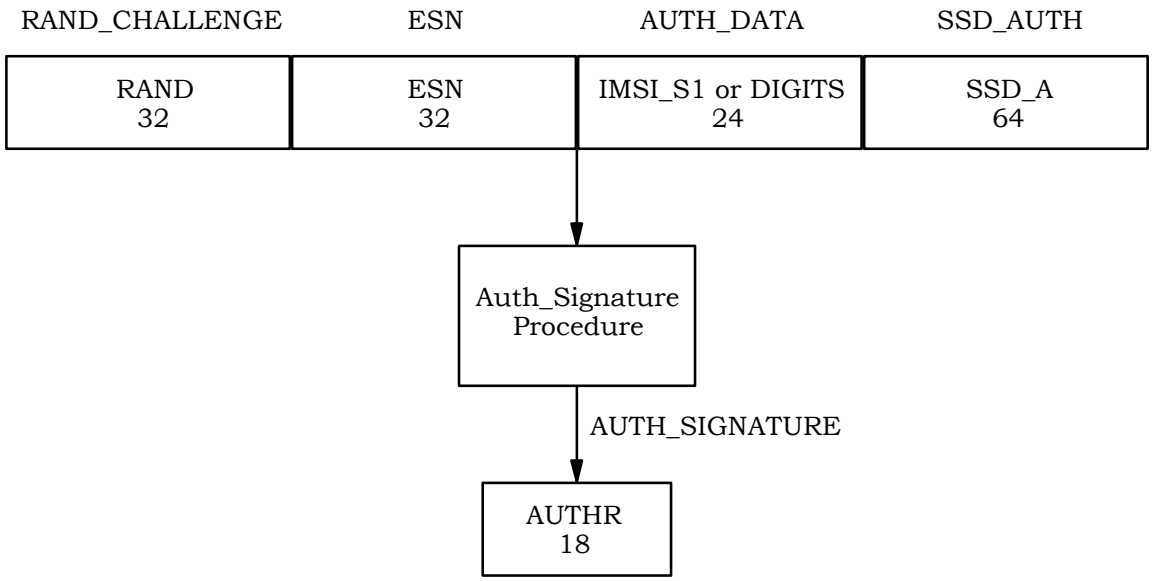

Figure 2.1.1.1.2.1–1. Computation of AUTHR for Mobile Station Authentication

The stored values for the random challenge (RAND), electronic serial number (ESN), and shared secret data (SSD_A) are used for all PDUs. The setting for the AUTH_DATA field (IMSI_S1 or DIGITS) depends upon the nature of the SDU being carried by the PDU. Layer 3 provides an indication of the value to be used, as shown in Table 2.1.1.1.2.1-1.

Table 2.1.1.1.2.1-1. Auth_Signature Input Parameters

Message Name	AUTH_DATA	SAVE_ REGISTERS
Registration Message	IMSI_S1	See below
Origination Message	Digits	TRUE
Page Response Message	IMSI_S1	TRUE
Reconnect Message	IMSI_S1	FALSE
Call Recovery Request Message	IMSI_S1	FALSE
Data Burst Message	Digits	FALSE
TMSI Assignment Completion Message	IMSI_S1	FALSE
PACA Cancel Message	IMSI_S1	FALSE
Device Information Message	IMSI_S1	FALSE
Security Mode Request Message	IMSI_S1	FALSE

2.1.1.1.2.2 Requirements for Authentication Procedures

The mobile station shall perform the Auth_Signature authentication procedures when $AUTH_S$ is set to '01'.

For authentication purposes, the mobile station shall use IMSI_M if it is so programmed; otherwise, the mobile station shall use IMSI_T.[18]

The mobile station shall set the input parameters of the Auth_Signature procedure (see Section 2.3 of [9]) as illustrated in Figure 2.1.1.1.2.1–1:

- RAND_CHALLENGE shall be set to the 32-bit stored value of RAND.
- ESN shall be set to the 32-bit electronic serial number of the mobile station.
- SSD_AUTH shall be set to the 64-bit current value of SSD_A.
- AUTH_DATA and SAVE_REGISTERS shall be set as follows:

[18] The base station uses the IMSI selected according to the same criteria.

- If the PDU carries a *TMSI Assignment Completion Message*, *PACA Cancel Message*, *Device Information Message, Security Mode Request Message*, *Call Recovery Request Message,* or a *Reconnect Message* (see Table 2.1.1.1.2.1-1), the mobile station shall set AUTH_DATA to the 24-bit IMSI_S1 and shall set the SAVE_REGISTERS input parameter to FALSE.

- If the PDU carries a *Registration Message*, the mobile station shall set AUTH_DATA to the 24-bit IMSI_S1. If $P\_REV\_IN\_USE_S$ is less than or equal to 6, the mobile station shall set the SAVE_REGISTERS input parameter to FALSE; otherwise, the mobile station shall set the SAVE_REGISTERS input parameter to TRUE.

- If the PDU carries an *Origination Message* (see Table 2.1.1.1.2.1-1), the mobile station shall set AUTH_DATA to the 24-bit quantity based upon the dialed digits as follows: the AUTH_DATA input parameter shall include the last six digits contained in the CHARi fields of the *Origination Message*, encoded as follows: If a CHARi field represents one of the digits 0-9, *, or #, the digit shall be encoded according to Table 2.1.1.1.2.2-1. If the CHARi field represents any other character, the CHARi field shall be converted to its decimal equivalent (treated as an unsigned binary number), and the digit shall be the least significant decimal digit of the decimal equivalent, encoded according to Table 2.1.1.1.2.2-1. If fewer than six digits are included in the *Origination Message*, the most significant bits of IMSI_S1 shall be used to replace the missing digits. The exact procedure is that IMSI_S1 is used to initially fill the AUTH_DATA input parameter, and then the last dialed digits included in the *Origination Message* are used to replace all or part of this initial value. If a full 6 digits are dialed and included in the *Origination Message*, the first digit of the 6 that were included is used as the most significant 4 bits of AUTH_DATA, the second digit is the next less-significant 4 bits of AUTH_DATA, and so forth. If fewer than 6 digits are included in the *Origination Message*, then the least significant 4 bits of AUTH_DATA are the last included dialed digit, the second-last dialed digit becomes the next more-significant 4 bits of AUTH_DATA, and so on up to the first of the dialed digits. The mobile station shall set the SAVE_REGISTERS input parameter to TRUE.

- If the PDU carries a *Page Response Message* (see Table 2.1.1.1.2.1-1), the mobile station shall set AUTH_DATA to the 24-bit IMSI_S1 and shall set the SAVE_REGISTERS input parameter to TRUE.

- If the PDU carries a *Data Burst Message* (see Table 2.1.1.1.2.1-1), the mobile station shall set AUTH_DATA to the 24-bit quantity as follows: The AUTH_DATA input is generated by first filling the AUTH_DATA parameter with the 24 bits of IMSI_S1 and then replacing part or all of the pre-filled value with up to six 4-bit hexadecimal digits that are provided by the procedure (according to BURST_TYPE) requesting the *Data Burst Message*. Specifically, the mobile station shall generate the AUTH_DATA input as follows:

  1. Let AUTH_DATA = IMSI_S1.

2. The requesting procedure shall supply a sequence of 0 to 6 4-bit hexadecimal digits.

3. The least significant 4-bit hexadecimal digit in the sequence shall replace the least significant four bits of AUTH_DATA, the next-least significant 4-bit hexadecimal digit in the sequence shall replace the next-least significant four bits of AUTH_DATA, and so on, until all of the supplied 4-bit hexadecimal digits in the sequence have been incorporated into the value of AUTH_DATA.

The mobile station shall set the SAVE_REGISTERS input parameter to FALSE.

The mobile station shall set the Authentication fields of the PDU to be transmitted as specified in 2.1.1.1.1.2.

Table 2.1.1.1.2.2-1. Representation of Digits

Digit	Code (binary)	Digit	Code (binary)
1	0001	7	0111
2	0010	8	1000
3	0011	9	1001
4	0100	0	1010
5	0101	*	1011
6	0110	#	1100
All other codes are reserved.			

2.1.1.1.2.3 Overview of the Integrity Procedures

Message integrity ensures the integrity and authenticity of the messages by attaching to the message a Message Authentication Code for integrity (MAC-I) or a UIM Authentication Code (UMAC). The MAC-I is computed based on the integrity key established by either the AUTHR based authentication (CMEA) or Authentication and Key Agreement (AKA) procedures over the message length field of the encapsulated PDU and the non-encapsulated LAC PDU, up to and including the PDU_PADDING field.

Only a subset of Layer 3 messages is specified to be integrity-protected (see [5]). For each integrity-protected message, Layer 3 passes the Layer 3 PDU (or the encrypted Layer 3 PDU if encryption is turned on) to the LAC Layer to perform message integrity. Layer 3 also indicates for each message, whether a 32-bit crypto-sync or a 24-bit crypto-sync is provided by Layer 3. At the Utility Sublayer, the LAC Layer then computes the MAC-I as specified in 2.1.1.1.2.5. Furthermore, if UIM Authentication Key (UAK) is supported and enabled (i.e. USE_UAK_S is set to '1'), the mobile station converts the MAC-I to a UMAC by using the UAK as described in 2.1.1.1.2.6. The LAC Layer then sets the MACI field to the value MAC-I or UMAC.

The LAC Layer then forms a LAC PDU by assembling the SDU_KEY_ID, SDU_INTEGRITY_ALGO, SDU_SSEQ or SDU_SSEQ_H, and MACI fields with the Layer 3 PDU (or the encrypted Layer 3 PDU if encryption is turned on).

2.1.1.1.2.4 Requirements for Message Integrity Procedures on r-csch

Mobile stations with MOB_P_REV greater than or equal to ten shall support message integrity on r-csch.

The mobile station shall set *channel_specific_buffer* to the 34 bits corresponding to "$RAND_S$[31:0] | ACK_REQ |'1'", where ACK_REQ is set to '0', if the message is to be sent in unassured mode or to '1', if the message is to be sent in assured mode, where the most significant bit of the *channel_specific_buffer* corresponds to the most significant bit of $RAND_S$.

When the mobile station executes the procedure for setting up the MACI field (see 2.1.1.4.2), the *channel_specific_buffer* shall be passed as input parameter to that procedure.

2.1.1.1.2.5 Procedure for computing the MAC-I value

In addition to the arrays that contain the correct keys and contain information allowing the computation of the correct crypto-sync values, this procedure receives as input parameters the *channel_specific_buffer*, the *msg_length* of the encapsulated PDU and the *message* to be protected. Typically, the *message* to be protected is the entire non-encapsulated PDU (which contains both the ACK_REQ and the SDU_KEY_ID fields considered set properly), including the PDU_PADDING bits, but excluding the MACI field. In case of information records addressed to individual mobile stations, the *message* to be protected is the record itself, up to and excluding its MACI field. Any of the input parameters of this procedure can have a length of 0, which, in practice, means that there are no bits coming from that parameter to participate in the computation of the MAC-I. The output of the procedure is the MAC-I value associated with the message and its transmission.

For each message and Layer 2 acknowledgment PDU required to be message integrity protected (see [5]):

- if the PDU is being transmitted and Layer 3 provides a 32-bit crypto-sync, the EXT_SSEQ shall be set to the 32-bit crypto-sync; otherwise,
- if the PDU is being transmitted and Layer 3 provides a 24-bit crypto-sync, the EXT_SSEQ shall be set to 256 multiplied by the 24-bit crypto-sync; otherwise,
- if the PDU is being transmitted, the EXT_SSEQ shall be set to TX_EXT_SSEQ[ACK_REQ][SDU_KEY_ID] and then TX_EXT_SSEQ[ACK_REQ][SDU_KEY_ID] shall be incremented by one, where ACK_REQ is used as the first index in the TX_EXT_SSEQ array and is set to '0', if the PDU is to be sent in unassured mode or to '1', if the PDU is to be sent in assured mode; otherwise,
- if the PDU is being received and this procedure is invoked for the computation of the MAC-I value for the received PDU, EXT_SSEQ shall be set as specified in 3.1.1.1.3.

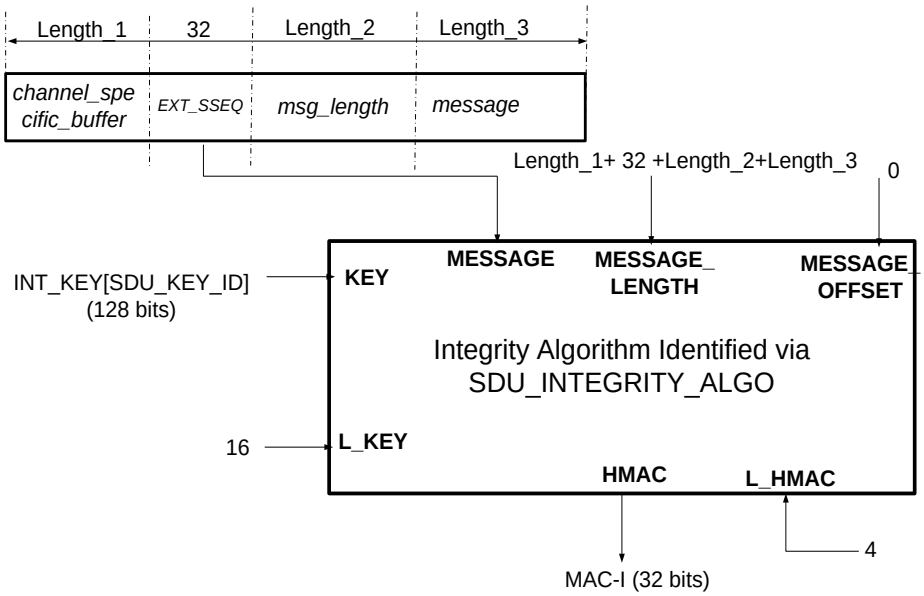

Figure 2.1.1.1.2.5-1. Function used for calculation of MAC-I

The input parameters of the EHMACSHA (see [15]) procedure shall be set as follows:

- The KEY parameter of EHMACSHA (see [15]) shall be set INT_KEY[SDU_KEY_ID].
- The L_KEY parameter of EHMACSHA (see [15]) shall be set to 16.
- An input working buffer of sufficient size shall be loaded, in order, from the most significant bit to the least significant bit, with the *channel_specific_buffer*, immediately followed by EXT_SSEQ[31:0], immediately followed by *msg_length*, immediately followed by the *message* parameter.
- The MESSAGE parameter of EHMACSHA (see [15]) shall be set to the pointer to the most significant bit of the input working buffer.
- The MESSAGE_OFFSET parameter of EHMACSHA (see [15]) shall be set to 0.
- The MESSAGE_LENGTH parameter of EHMACSHA (see [15]) shall be set to the number of bits of data in the input working buffer
- The HMAC parameter of EHMACSHA (see [15]) shall be set to the pointer to the most significant bit of the output buffer that will contain the computed MAC-I value.
- The L_HMAC parameter of EHMACSHA (see [15]) shall be set to 4.

The integrity algorithm identified by the SDU_INTEGRITY_ALGO field of the message being integrity-protected shall then be executed and the resultant MAC-I value shall be returned to the entity that invoked the procedure.

2.1.1.1.2.6 Procedure for computing the UMAC value

If UAK is supported and enabled, the MAC-I value is converted to UMAC using this procedure. The procedure is not used by a transmitting base station and by a receiving mobile station, since the UMAC is not used on the forward channels.

In addition to the 128-bit long UAK, the procedure receives MAC-I as input parameter and returns UMAC as output parameter.

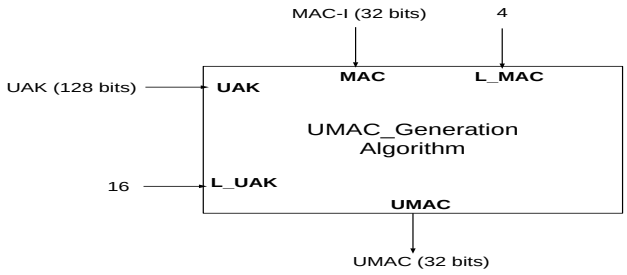

Figure 2.1.1.1.2.6-1. Function used for calculation of UMAC

For each MAC-I received:

- The UAK parameter of UMAC_Generation (see [15]) shall be set to the UAK associated with the user who is sending the message or to whom the message is being sent.
- The L_UAK parameter of UMAC_Generation (see [15]) shall be set to 16.
- The MAC parameter of UMAC_Generation (see [15]) shall be set to the pointer to the most significant bit of the buffer containing MAC-I.
- The L_MAC parameter of UMAC_Generation (see [15]) shall be set to 4.
- The UMAC parameter of UMAC_Generation (see [15]) shall be set to the pointer to the most significant bit of the output buffer that will contain the computed UMAC value.

The UMAC_Generation (see [15]) procedure shall then be executed and the resultant UMAC value shall be returned to the entity that invoked the procedure.

2.1.1.2 ARQ Sublayer

2.1.1.2.1 Parameters

The mobile station shall use the ARQ fields defined in 2.1.1.2.1.1 for PDUs transmitted on the r-csch. The mobile station shall set the ARQ fields according to the requirements specified in 2.1.1.2.1.2.

2.1.1.2.1.1 Definition of the ARQ Fields

The ARQ fields for PDUs transmitted on the r-csch have the following format:

Field	Length (bits)
ACK_SEQ	3
MSG_SEQ	3
ACK_REQ	1
VALID_ACK	1
ACK_TYPE	3
EXT_ACK_TYPE	0 or 3

ACK_SEQ - Acknowledgment sequence number.

This field contains the value of the MSG_SEQ field of a PDU received on the f-csch that is being acknowledged on the r-csch.

MSG_SEQ - Message sequence number.

This field contains the message sequence number for the PDU to be sent on the r-csch.

ACK_REQ - Acknowledgment required indicator.

This field indicates whether the PDU being sent on the r-csch requires an acknowledgment from the base station. The ACK_REQ field is set to '1', for PDUs requiring acknowledgment, or to '0', for PDUs sent in unassured mode[19].

VALID_ACK - Valid acknowledgment indicator.

This field is set to '1' when the PDU being sent on the r-csch includes an acknowledgement for a PDU received on the f-csch; otherwise, the field is set to '0'.

ACK_TYPE - Acknowledgment address type.

This field is set as described in 2.1.1.2.1.2

EXT_ACK_TYPE - Extended Acknowledgment address type.

This field is set as described in 2.1.1.2.1.2

[19] Whether a PDU is sent in assured or unassured mode is controlled entirely by the Upper Layers (see [5]). For $P\_REV\_IN\_USE_S$ less than 11, the ACK_REQ field is always set to '1', since all the PDUs transmitted on r-csch are sent in assured mode. The direct channel assignment capability (introduced in Release D) specifies that the *Page Response Message* and the *Reconnect Message* with ORIG_IND equal to '0' are to be sent in unassured mode. Sending of a PDU in unassured mode on r-csch is allowed only when explicitly specified in the Upper Layers.

2.1.1.2.1.2 Requirements for Setting the ARQ Fields

If the PDU is sent in assured mode the mobile station shall set the ACK_REQ field to '1'; otherwise, the mobile station shall set the ACK_REQ field to '0'.

The mobile station shall set the MSG_SEQ field according to the following procedure. The mobile station shall generate a set of MSG_SEQ numbers for PDUs sent in assured mode and a separate set of MSG_SEQ numbers for PDUs sent in unassured mode. The mobile station shall set the MSG_SEQ field to '000' in the first PDU sent in assured mode and in the first PDU sent in unassured mode after powering up. The mobile station may set the MSG_SEQ field to '000' in the first PDU sent in assured mode and in the first PDU sent in unassured mode after a transition from another CDMA band class. If the ARQ Sublayer supports supervisory control (see 2.1.1.2.2) and receives a supervisory directive to perform a reset operation, the mobile station may set the MSG_SEQ field to '000' in the first PDU sent in assured mode and in the first PDU sent in unassured mode after the execution of the reset operation. The mobile station shall increment assured MSG_SEQ, modulo 8, for each new access attempt (see 2.1.1.2.2.1) and shall increment unassured MSG_SEQ, modulo 8, for each new unassured access attempt (see 2.1.1.2.2.1), regardless of the content of the new PDU. When sending a PDU that includes an acknowledgment for a PDU other than a *General Page Message* or a *Universal Page Message*:

- The mobile station shall set the VALID_ACK field to '1',
- The mobile station shall set the ACK_SEQ field to the MSG_SEQ field of the PDU received on the f-csch and being acknowledged, and
- The mobile station shall set the ACK_TYPE field to the ADDR_TYPE field of the PDU received on the f-csch and being acknowledged.
- If ACK_TYPE is set to a value other than '100', then the mobile station shall omit the EXT_ACK_TYPE field; otherwise, the mobile station shall include this field and set it to the EXT_ADDR_TYPE field of the PDU received on the f-csch and being acknowledged.

When sending a PDU that includes an acknowledgment of a *General Page Message* or a *Universal Page Message*:

- The mobile station shall set the VALID_ACK field to '1',
- The mobile station shall set the ACK_SEQ field equal to the MSG_SEQ field of the record addressed to the mobile station, and
- The mobile station shall set the ACK_TYPE field according to the PAGE_CLASS field of the record addressed to the mobile station as follows:
  - If the PAGE_CLASS is equal to '00' or '01', the mobile station shall set the ACK_TYPE field to '010'.
  - If the PAGE_CLASS is equal to '10', the mobile station shall set the ACK_TYPE field to '011'.

When sending a PDU that does not include an acknowledgment:

- The mobile station shall set the VALID_ACK field to '0', and

- The mobile station shall set the ACK_TYPE, EXT_ACK_TYPE and ACK_SEQ fields as follows:
  - If the last PDU received on the f-csch addressing the mobile station and requiring acknowledgment was not a *General Page Message* or a *Universal Page Message*, the mobile station shall set the ACK_TYPE and ACK_SEQ fields equal to the ADDR_TYPE and MSG_SEQ fields, respectively, of that PDU. If ACK_TYPE is set to a value other than '100', then the mobile station shall omit the EXT_ACK_TYPE field; otherwise, the mobile station shall include this field and set it to the EXT_ADDR_TYPE field of the received PDU.
  - If the last PDU received on the f-csch addressing the mobile station and requiring acknowledgment was a *General Page Message* or a *Universal Page Message*, the mobile station shall:
    + Set the ACK_SEQ field equal to the MSG_SEQ field of the record of the *General Page Message* or the *Universal Page Message* addressed to the mobile station, and
    + Set the ACK_TYPE field according to the PAGE_CLASS field of the record of the *General Page Message* or the *Universal Page Message* addressed to the mobile station as follows:
      - If the PAGE_CLASS is equal to '00' or '01', the mobile station shall set the ACK_TYPE field to '010'.
      - If the PAGE_CLASS is equal to '10', the mobile station shall set the ACK_TYPE field to '011'.
  - If no PDU has been received addressing the mobile station and requiring acknowledgment since the mobile station last started monitoring the f-csch, the mobile station shall set the ACK_TYPE field to '000' and shall set the ACK_SEQ field to '111'.

2.1.1.2.2 Procedures

2.1.1.2.2.1 Overview of Transmission and Retransmission Procedures

The entire process of attempting to send (or actually sending) one PDU on the r-csch and receiving (or failing to receive) an indication that an acknowledgment for that PDU was received on the f-csch is called an assured access attempt. The entire process of attempting to send (or actually sending) one PDU on the r-csch that does not require an acknowledgment for that PDU to be received on the f-csch is called an unassured access attempt. In general, an assured access attempt may consist of one transmission and several retransmissions of the same PDU, while an unassured access attempt consists of only one transmission of the PDU. If the Access Channel or the Enhanced Access Channel operating in Basic Access Mode (see [3]) is used, each transmission is called an access probe and contains the PDU being transmitted (or retransmitted). If the Enhanced Access Channel operating in Reservation Access Mode (see [3]) is used, each transmission on the Enhanced Access Channel is called an access probe and contains just overhead

information ("header", see [3]) associated with the PDU to be transmitted; in this case, the PDU itself is transmitted on the Reverse Common Control Channel.

When the mobile station stops transmitting access probes of an access attempt to one base station and begins transmitting access probes of the same access attempt to another base station, the mobile station is said to perform an access probe handoff. The portion of an access attempt that begins when the mobile station starts transmitting the first access probe to one base station and ends when the mobile station either performs an access probe handoff or terminates the access attempt is called an access sub-attempt. One access attempt consists of one or more access sub-attempts. For unassured transmissions or in the absence of an access probe handoff, an access attempt has only one sub-attempt. Within an access sub-attempt, access probes are grouped into access probe sequences. Each assured access probe sequence consists of up to 1 + NUM_STEP_S access probes, while each unassured access probe sequence consists of only one access probe. With each transmission and retransmission request to the layers below, the LAC Sublayer provides the sequence number of the current access probe within the current access sub-attempt.

The ARQ Sublayer is notified after each access probe handoff to start a new access sub-attempt, if necessary.

The ARQ Sublayer receives information from Layer 3 on the general type of the SDU ("response", "request", "registration", etc.). Based upon this information and the access information for the current base station, the ARQ Sublayer computes a threshold value P which is to be used by the MAC Sublayer to introduce a persistence delay before each access probe sequence in the sub-attempt (see [3]).

The exact timing of the start of each access probe may be subject to delays introduced under supervisory control. The exact timing between access probes of an access probe sequence is determined at the MAC Sublayer. An indication is provided by the SAR Sublayer to the ARQ Sublayer immediately after each transmission of the last encapsulated PDU fragment. For an unassured transmission, this indication ends the access attempt. For an assured transmission, after each such indication, the ARQ Sublayer waits a specified period, TA = (2 + $ACH\_ACC\_TMO_S$) × 80 ms (when operating on the Access Channel),[20] or TA = (1 + $EACH\_ACC\_TMO_S$) × 20 ms (when operating on the Enhanced Access Channel),[21] to get an indication that an acknowledgment from the base station was received on the f-csch. If such an acknowledgment is received, the access attempt ends. The access attempt may also end if supervisory control is supported and the ARQ Sublayer is explicitly directed by Layer 3 to cancel the access attempt or to reset.

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[20] Based upon the possible values for $ACH\_ACC\_TMO_S$, TA can be valued between 160 ms and 1360 ms.

[21] Based upon the possible values for $EACH\_ACC\_TMO_S$, TA can be valued between 20 ms and 1280 ms.

The mobile station ARQ Sublayer on the transmitter side interacts with the layers above it in the protocol stack, the layers below it in the protocol stack, the mobile station ARQ Sublayer on the receiver side, and with entities that may exercise supervisory control.

When interacting with the Upper Layers in the protocol stack, the ARQ Sublayer may receive the following:

- A request-type SDU to be transmitted and its subtype (e.g., registration). In such cases, the ARQ Sublayer does not include an acknowledgment within the PDU to be transmitted.
- A response-type SDU to be transmitted, its subtype (e.g., page response), identifying information to allow the pairing of the message to be transmitted with the received message to which it is replying, and possible information on how the ACK_TYPE should be set in the reply PDU. In such cases, the ARQ Sublayer on the transmitter side includes an acknowledgment in the PDU, if the ARQ Sublayer on the receiver side indicates that an acknowledgment is required.
- An indication that no response SDU is outstanding. In such cases, the ARQ Sublayer on the transmitter side may generate an acknowledgment-only PDU,[22] if the ARQ Sublayer on the receiver side indicates that an acknowledgment is required.

When an SDU is received from the Upper Layers for transmission, the Upper Layers may request a confirmation of delivery. This request, together with the MSG_SEQ assigned to the PDU carrying the SDU, is passed to the ARQ Sublayer on the receiver side.

When interacting with the Upper Layers in the protocol stack, the ARQ Sublayer sends the following:

- The SDU carried by a PDU received from the base station, together with:
  - an indication whether or not the PDU requires acknowledgment, and
  - an indication whether or not an access attempt for a PDU being transmitted on the r-csch was terminated as a result of processing the ARQ fields of the received PDU.
- An indication that an acknowledgment to a message has been sent and acknowledged.

When interacting with the MAC Sublayer, the ARQ Sublayer sends one or more of the following:

- An indication that a PDU is ready for transmission.
- The PDU for transmission and the sequence number of the access probe within the access sub-attempt.

[22] In [11], this acknowledgment-only PDU is referred to as the *Mobile Station Acknowledgement Order*.

When interacting with the MAC Sublayer, the ARQ Sublayer may receive one or more of the following:

- An indication that the LAC Sublayer can send to the MAC Sublayer the PDU to be transmitted.
- An indication specifying the access mode to be used (Basic Access Mode or Reservation Access Mode), if the access is on the Enhanced Access Channel.
- An indication that the overhead information ("header", see [3]) corresponding to the PDU was not acknowledged by the base station within the required time interval.
- An indication that that the transmission of a PDU was aborted.

When interacting with the SAR Sublayer, the ARQ Sublayer may receive a completion indication immediately after each PDU is transmitted.

When interacting with the mobile station ARQ Sublayer on the receiver side, the mobile station ARQ Sublayer on the transmitter side is provided with:

- An indication of whether an acknowledgment is required.
- Identifying information necessary for including the acknowledgment in the response PDU.
- The values the MSG_SEQ and ADDR_TYPE fields (if available) of the PDU being acknowledged, or of the most recently received PDU requiring acknowledgment.
- An indication when an acknowledgment for a transmitted PDU is received.

If an acknowledgment is required, the mobile station ARQ Sublayer on the transmitter side includes the acknowledgment in the proper PDU as determined through the interaction with Upper Layers on the protocol stack.

The ARQ Sublayer on the transmitter side provides the ARQ Sublayer on the receiver side with an indication of whether an access probe is still in progress after processing an indication from the ARQ Sublayer on the receiver side that an acknowledgment for a transmitted PDU was received.

When interacting with entities that exercise supervisory control:

- The ARQ Sublayer raises a *TA expired* indication when the TA timer expires, after sending each access probe, to allow access probe handoffs in case of insufficiency of the forward link channels[23] being monitored (see 2.6.3.1.3.3 of [5]).
- If the ARQ Sublayer is directed to perform a *reset* operation, the ARQ Sublayer immediately cancels the transmissions of access probes and resets the pool of values for the MSG_SEQ (see 2.1.1.2.1.2).

[23] Paging Channel, Forward Common Control Channel or Common Power Control Sub-Channel, as applicable.

- If the ARQ Sublayer is directed to perform a *cancel* operation (see 2.6.3.1.4 of [5]), the ARQ Sublayer immediately terminates the access attempt. More than one temporary loss of a monitored control channel during an access attempt, as well as a determination that the PDU may not be suitable after an access probe handoff (e.g., too large for the new transmission capsule size), could cause a cancellation.
- If the ARQ Sublayer is directed to perform a *suspend* operation (see 2.6.3.1.3.3 and 2.6.3.1.8 of [5]), the ARQ Sublayer stops transmitting access probes, until instructed to resume the transmissions, or until directed to perform a cancel or reset operation. The reasons for suspending transmission may be a temporary loss of a monitored control channel or an access probe handoff, which may result in the mobile station having to wait for overhead messages on the new base station.
- If the ARQ Sublayer is directed to perform a *resume* operation after being suspended (see 2.6.3.1.8 of [5]), the ARQ Sublayer does not continue the interrupted access probe sequence if one was in progress at the time of the suspension. Instead, it restarts the interrupted access probe sequence from the beginning (i.e., with the first access probe in the sequence).
- If the ARQ Sublayer is directed to perform a *restart* operation after being suspended (see 2.6.3.1.3.3 of [5]), the ARQ Sublayer does not continue the interrupted access probe sequence if one was in progress at the time of the suspension. Instead, it starts a new access sub-attempt at the beginning of the first access probe sequence in the access sub-attempt, using the most current values of stored variables (e.g., NUM_STEP_S, $MAX\_REQ\_SEQ_S$, $MAX\_RSP\_SEQ_S$, $ACH\_ACC\_TMO_S$, $EACH\_ACC\_TMO_S$, $PROBE\_PN\_RAN_S$).

The ARQ Sublayer signals an access attempt failure to the Upper Layers (or to the entities exercising supervisory control) if an assured access attempt concludes after sending all of the required access probes but a PDU acknowledgment indication is not received.

2.1.1.2.2.2 Requirements for Transmission and Retransmission Procedures

For PDUs requiring acknowledgment received on the Paging Channel, the mobile station shall send the acknowledgment(s) on the Access Channel. For PDUs requiring acknowledgment received on the Forward Common Control Channel, the mobile station shall send the acknowledgment(s) on the Enhanced Access Channel or the Reverse Common Control Channel.

The mobile station shall compute the persistence variable P:

- If the type of the SDU is a response, P shall be set to '1'.
- If the type of the SDU is a request and a registration, P shall be computed by

$$P = \begin{cases} 2^{-PSIST_s/4} \times 2^{-REG\_PSIST_s} & \text{if } PSIST_s \neq 63 \\ 0 & \text{otherwise} \end{cases} \qquad ACCOLC_p = 0, 1, \ldots, 9$$

$$P = \begin{cases} 2^{-PSIST_s} \times 2^{-REG\_PSIST_s} & \text{if } PSIST_s \neq 7 \\ 0 & \text{otherwise} \end{cases} \qquad ACCOLC_p = 10, 11, ..., 15$$

- If the type of the SDU is a request and a message transmission, except in the case of an emergency message transmission from a mobile station having an $ACCOLC_p$ value between 0 and 9 inclusive, P shall be computed by

$$P = \begin{cases} 2^{-PSIST_s/4} \times 2^{-MSG\_PSIST_s} & \text{if } PSIST_s \neq 63 \\ 0 & \text{otherwise} \end{cases} \qquad ACCOLC_p = 0, 1, ..., 9$$

$$P = \begin{cases} 2^{-PSIST_s} \times 2^{-MSG\_PSIST_s} & \text{if } PSIST_s \neq 7 \\ 0 & \text{otherwise} \end{cases} \qquad ACCOLC_p = 10, 11, ..., 15$$

- If the type of the SDU is a request for an emergency call or for an emergency message transmission, and the mobile station has an $ACCOLC_p$ value between 0 and 9 inclusive, P shall be computed by

$$P = \begin{cases} 2^{-PSIST\_EMG_s} & \text{if } PSIST\_EMG_s \neq 7 \\ 0 & \text{otherwise} \end{cases} \quad ACCOLC_p = 0, 1, ..., 9$$

- If the type of the SDU is a request other than a registration or a message transmission, and the SDU is not for an emergency call or emergency message transmission, P shall be computed by

$$P = \begin{cases} 2^{-PSIST_s/4} & \text{if } PSIST_s \neq 63 \\ 0 & \text{otherwise} \end{cases} \qquad ACCOLC_p = 0, 1, ..., 9$$

$$P = \begin{cases} 2^{-PSIST_s} & \text{if } PSIST_s \neq 7 \\ 0 & \text{otherwise} \end{cases} \qquad ACCOLC_p = 10, 11, ..., 15$$

If P is equal to 0, the mobile station shall end the access attempt, shall declare an access attempt failure, and send an indication to Layer 3 that the system access is denied. Otherwise, the mobile station shall transmit the access probe. Details on access probe transmission are given in [3].

For an unassured transmission, an access sub-attempt shall consist of a single access probe[24]. For an assured transmission, the maximum number of access probes shall be determined as follows:

[24] An unassured access attempt is actually a single access probe, but can be seen as containing a single sub-attempt, which in turn contains a single access probe sequence, which in turn contains a single access probe.

When the mobile station performs an assured access sub-attempt, the LAC Sublayer shall send one or more indications to the MAC Sublayer that a PDU is ready for transmission. If the assured access sub-attempt is a request, the LAC Sublayer shall send no more than $(NUM\_STEP_S + 1) \times MAX\_REQ\_SEQ_S$ indications to the MAC Sublayer that a PDU is ready for transmission, except that:

- When an assured access sub-attempt resumes, following a temporary loss of the forward link channels being monitored, the number of PDU-ready-for-transmission indications considered to have been sent to the MAC Sublayer since the beginning of the sub-attempt shall be adjusted down to the closest integer multiple of $(NUM\_STEP_S + 1)$.
- When an assured access sub-attempt resumes on the Enhanced Access Channel operating in Reservation Access Mode, following a failure to receive an acknowledgment within TA seconds since the transmission of the PDU, the number of PDU-ready-for-transmission indications considered to have been sent to the MAC Sublayer since the beginning of the sub-attempt shall be adjusted up to the closest integer multiple of $(NUM\_STEP_S + 1)$.

If the assured access sub-attempt is a response, the LAC Sublayer shall send no more than $(NUM\_STEP_S + 1) \times MAX\_RSP\_SEQ_S$ indications to the MAC Sublayer that a PDU is ready for transmission, except that:

- When an assured access sub-attempt resumes, following a temporary loss of the forward link channels being monitored, the number of PDU-ready-for-transmission indications considered to have been sent to the MAC Sublayer since the beginning of the sub-attempt shall be adjusted down to the closest integer multiple of $(NUM\_STEP_S + 1)$.
- When an assured access sub-attempt resumes on the Enhanced Access Channel operating in Reservation Access Mode, following a failure to receive an acknowledgment within TA seconds since the transmission of the PDU, the number of PDU–ready-for-transmission indications considered to have been sent to the MAC Sublayer since the beginning of the sub-attempt shall be adjusted up to the closest integer multiple of $(NUM\_STEP_S + 1)$.

At any time during an assured access attempt, the mobile station may stop the current sub-attempt and start another sub-attempt to a new pilot (i.e. perform access probe handoff), subject to the restrictions and specifications in [5].

The mobile station may terminate an access attempt at any time.

During each sub-attempt, the mobile station shall proceed as follows (or equivalent):

After sending an indication that a PDU is ready for transmission, if the Enhanced Access Channel is used, the LAC Sublayer shall consider the access mode (Basic Access Mode or Reservation Access Mode, see [3]) determined as specified by the indication received from the MAC Sublayer.

If the Access Channel or the Enhanced Access Channel operating in Basic Access Mode is used, the mobile station shall perform the following:

- If, after sending an indication that a PDU is ready for transmission, the LAC Sublayer receives an indication from the MAC Sublayer to transmit the PDU, the LAC Sublayer shall transmit the PDU.
- If the PDU was transmitted in unassured mode the mobile station shall terminate the access attempt;
- Otherwise, immediately upon completing transmission of the PDU, the mobile station shall start a timer TA = (2 + $ACH\_ACC\_TMO_S$) × 80 ms (if the access was on the Access Channel) or TA = (1 + $EACH\_ACC\_TMO_S$) × 20 ms (if the access was on the Enhanced Access Channel). If a valid acknowledgment[25] is received for the PDU being transmitted before the TA timer expires, the mobile station shall stop the TA timer and shall terminate the access attempt; otherwise, when the TA timer expires, the mobile station shall perform the following:
  - If fewer than the maximum allowed (for the type of the sub-attempt) number of access probes have been transmitted in the current access sub-attempt, the mobile station shall transmit another access probe within the current sub-attempt; otherwise, the LAC Sublayer shall terminate the access sub-attempt and shall send an access failure indication to Layer 3.

If the Enhanced Access Channel operating in Reservation Access Mode is used, the mobile station shall perform the following:

- If, after sending an indication that a PDU is ready for transmission, the LAC Sublayer receives an indication from the MAC Sublayer that the overhead information ("header", see [3]) corresponding to the PDU was not acknowledged by the base station within the required time interval, the mobile station shall perform the following:
  - If fewer than the maximum allowed (for the type of the sub-attempt) number of access probes have been transmitted in the current access sub-attempt, the LAC Sublayer shall send another indication to the MAC Sublayer that a PDU is ready for transmission; otherwise, the LAC Sublayer shall terminate the access sub-attempt and shall send an access failure indication to Layer 3.
- If the LAC Sublayer receives an indication from the MAC Sublayer to transmit the PDU, the LAC Sublayer shall transmit the PDU.
- If the PDU was transmitted in unassured mode the mobile station shall terminate the access attempt;

[25] An acknowledgment is valid if it is not required to be message integrity protected (see [5]) or if it passes the message integrity checks (see 3.1.1.1.3).

- Otherwise, immediately upon completing transmission of the PDU the mobile station shall start a timer TA = (1 + EACH_ACC_TMO$_S$) × 20 ms. If a valid acknowledgment[26] is received for the PDU being transmitted before the TA timer expires, the mobile station shall stop the TA timer and shall terminate the access attempt; otherwise, when the TA timer expires, the mobile station shall perform the following:
  - The mobile station shall consider the number of PDU ready for transmission indications sent to the MAC Sublayer in the current sub-attempt to be the next higher multiple of (NUM_STEP$_S$ + 1). If this number is less than the maximum allowed, the mobile station shell send to the MAC Sublayer an indication that the PDU is ready for transmission and resume the sub-attempt; otherwise, the LAC Sublayer shall terminate the access sub-attempt and shall send an access failure indication to Layer 3.

If the mobile station terminates an assured access attempt without having received an acknowledgment for the PDU, the mobile station shall declare an access attempt failure, and send an indication to Layer 3 that the system is lost, except when the access attempt termination was due to supervisory action.

The mobile station shall not acknowledge received PDUs on the f-csch, unless requested. When requested (see 2.1.2.1.2.1), the mobile station shall acknowledge PDUs received on the f-csch by performing access attempts on the r-csch to send PDUs containing acknowledgments. The mobile station shall set the acknowledgment fields (see 2.1.1.2.1.1) of the PDUs transmitted on the r-csch as described in 2.1.1.2.1.2.

If the transmission of an acknowledgment for a received PDU is requested:

- If the mobile station either has or receives an indication that the Upper Layer message carried by the received PDU does not have an Upper Layer response, the mobile station shall generate a PDU carrying an SDU which has the following format (to be sent as an *Order Message*):[27]

Field	**Length (bits)**
ORDER = '010000'	6
ADD_RECORD_LEN = '000'	3

  and shall include the acknowledgment in the generated PDU.

[26] An acknowledgment is valid if it is not required to be message integrity protected (see [5]) or if it passes the message integrity checks (see 3.1.1.1.3).

[27] In [11], this acknowledgment-only PDU is referred to as the *Mobile Station Acknowledgement Order*.

- Otherwise, the mobile station shall include the acknowledgment in the PDU carrying the Upper Layers' reply to the Upper Layer message carried by the received PDU.

After a PDU carrying an acknowledgment has been sent (i.e., transmitted and possibly retransmitted as part of the same assured access attempt), the mobile station shall not send an acknowledgment in any subsequent transmitted PDUs until requested again.

The mobile station shall not begin a new access attempt until the previous access attempt has ended.

2.1.1.2.2.3 Accumulated Statistics for r-csch

The mobile station shall maintain the counters shown in Table 2.1.1.2.2.3-1.[28]

The mobile station shall initialize each counter described in Table 2.1.1.2.2-3-1 to zero upon powering on; the mobile station shall not re-initialize those counters at any other time except upon command from the base station. Each counter shall be 16 bits long and shall be maintained modulo 2^{16}.

The mobile station shall increment the ACC_1 counter for each Access Channel "request" type SDU transmitted. The mobile station shall increment the ACC_2 counter for each Access Channel "response" type SDU transmitted. The mobile station shall increment the ACC_i counter during the i minus one transmission on the Access Channel of an access probe in the access attempt, for i equals three to seven. The mobile station shall increment the ACC_8 counter if the access attempt on the Access Channel is unsuccessful due to the transmission of the maximum allowed number of probes.

The mobile station shall increment the EACH_BA_1 counter for each "request" type SDU transmitted on the Enhanced Access Channel in Basic Access mode. The mobile station shall increment the EACH_BA_2 counter for each "response" type SDU transmitted on the Enhanced Access Channel in Basic Access mode. The mobile station shall increment the EACH_BA_i counter during the i minus one transmission on the Enhanced Access Channel in Basic Access mode of an access probe in the access attempt, for i equals three to seven. The mobile station shall increment the EACH_BA_8 counter if the access attempt on the Enhanced Access Channel in Basic Access mode is unsuccessful due to the transmission of the maximum allowed number of probes.

The mobile station shall increment the EACH_RA_i counter during the i minus one transmission on the Enhanced Access Channel in Reservation Access mode of an access probe, as part of an access attempt, for i equals three to seven. The mobile station shall increment the EACH_RA_8 counter if the access attempt on the Enhanced Access Channel

[28] From a modeling point of view, the information necessary to update the counters for the Enhanced Access Channel and the Reverse Common Control Channel reside at the MAC sublayer rather than at the LAC sublayer. The exchange of information between the two sublayers, as modeled by the set of primitives and their associated parameters, allows the maintenance of the counters to be done at the LAC sublayer, which is the solution shown here.

in Reservation Access mode is unsuccessful due to the transmission of the maximum allowed number of probes.

The mobile station shall increment the RCCCH_1 counter for each Reverse Common Control Channel "request" type SDU transmitted. The mobile station shall increment the RCCCH_2 counter for each Reverse Common Control Channel "response" type SDU transmitted. The mobile station shall increment the RCCCH_i counter during the i minus one transmission on the Reverse Common Control Channel of an SDU, for i equals three to seven. The mobile station shall increment the RCCCH_8 counter if the transmission on the Reverse Common Control Channel is unsuccessful (i.e., no acknowledgment was received on the Forward Common Control Channel). The mobile station shall increment the RCCCH_9 counter when the transmission on the Reverse Common Control Channel is abandoned due to loss of power control feed-back on the forward link.

Table 2.1.1.2.2.3-1. Accumulated Statistics for the Access Channel

Counter Identifier	Description
ACC_1	Number of "request" type SDUs transmitted on the Access Channel.
ACC_2	Number of "response" type SDUs transmitted on the Access Channel.
ACC_3	Number of times that an access probe was transmitted at least twice on the Access Channel.
ACC_4	Number of times that an access probe was transmitted at least three times on the Access Channel.
ACC_5	Number of times that an access probe was transmitted at least four times on the Access Channel.
ACC_6	Number of times that an access probe was transmitted at least five times on the Access Channel.
ACC_7	Number of times that an access probe was transmitted at least six times on the Access Channel.
ACC_8	Number of unsuccessful access attempts on the Access Channel.

Table 2.1.1.2.2.3-2. Accumulated Statistics for the Enhanced Access Channel in Basic Access Mode

Counter Identifier	Description
EACH_BA_1	Number of “request” type SDUs transmitted on the Enhanced Access Channel in Basic Access mode.
EACH_BA_2	Number of “response” type SDUs transmitted on the Enhanced Access Channel in Basic Access mode.
EACH_BA_3	Number of times that an access probe was transmitted at least twice on the Enhanced Access Channel in Basic Access mode.
EACH_BA_4	Number of times that an access probe was transmitted at least three times on the Enhanced Access Channel in Basic Access mode.
EACH_BA_5	Number of times that an access probe was transmitted at least four times on the Enhanced Access Channel in Basic Access mode.
EACH_BA_6	Number of times that an access probe was transmitted at least five times on the Enhanced Access Channel in Basic Access mode.
EACH_BA_7	Number of times that an access probe was transmitted at least six times on the Enhanced Access Channel in Basic Access mode.
EACH_BA_8	Number of unsuccessful access attempts on the Enhanced Access Channel in Basic Access mode.

Table 2.1.1.2.2.3-3. Accumulated Statistics for the Enhanced Access Channel in Reservation Access Mode

Counter Identifier	Description
EACH_RA_3	Number of times that an access probe was transmitted at least twice on the Enhanced Access Channel in Reservation Access mode.
EACH_RA_4	Number of times that an access probe was transmitted at least three times on the Enhanced Access Channel in Reservation Access mode.
EACH_RA_5	Number of times that an access probe was transmitted at least four times on the Enhanced Access Channel in Reservation Access mode.
EACH_RA_6	Number of times that an access probe was transmitted at least five times on the Enhanced Access Channel in Reservation Access mode.
EACH_RA_7	Number of times that an access probe was transmitted at least six times on the Enhanced Access Channel in Reservation Access mode.
EACH_RA_8	Number of unsuccessful access attempts on the Enhanced Access Channel in Reservation Access mode.

Table 2.1.1.2.2.3-4. Accumulated Statistics for the Reverse Common Control Channel

Counter Identifier	Description
RCCCH_1	Number of “request” type SDUs transmitted on the Reverse Common Control Channel.
RCCCH_2	Number of “response” type SDUs transmitted on the Reverse Common Control Channel.
RCCCH_3	Number of times that an SDU was transmitted at least twice on the Reverse Common Control Channel.
RCCCH_4	Number of times that an SDU was transmitted at least three times on the Reverse Common Control Channel.
RCCCH_5	Number of times that an SDU was transmitted at least four times on the Reverse Common Control Channel.
RCCCH_6	Number of times that an SDU was transmitted at least five times on the Reverse Common Control Channel.
RCCCH_7	Number of times that an SDU was transmitted at least six times on the Reverse Common Control Channel.
RCCCH_8	Number of unsuccessful transmissions on the Reverse Common Control Channel in which an acknowledgment was not received on the Forward Common Control Channel.
RCCCH_9	Number of unsuccessful transmissions on the Reverse Common Control Channel in which transmission was abandoned due to loss of power control feedback on the forward link.

2.1.1.3 Addressing Sublayer

2.1.1.3.1 Parameters

The mobile station shall use the addressing fields defined in 2.1.1.3.1.1 for PDUs transmitted on the r-csch. The mobile station shall set the addressing fields according to the requirements specified in 2.1.1.3.1.2 and 2.1.1.3.1.3.

2.1.1.3.1.1 Definition of Addressing Fields

Addressing fields of PDUs transmitted on the r-csch are given by the mobile station identifier type. Mobile station identifier types are defined in Table 2.1.1.3.1.1-1 and Table 2.1.1.3.1.1-1a.

The addressing fields for PDUs transmitted on the r-csch have the following format:

Field	**Length (bits)**
MSID_TYPE	3
EXT_MSID_TYPE	0 or 3
MSID_LEN	4
MSID	8 × MSID_LEN

MSID_TYPE – Mobile station identifier field type.

The mobile station sets this field to the value shown in Table 2.1.1.3.1.1-1 corresponding to the address type used by the mobile station.

Table 2.1.1.3.1.1-1. Address Types

Description	**MSID_TYPE (binary)**	**MSID_LEN (octets)**
IMSI_S and ESN (Band Class 0 only)	000	9
ESN	001	4
IMSI	010	5 to 7
IMSI and ESN	011	9 to 11
Extended MSID	100	see Table 2.1.1.3.1.1-1a
TMSI	101	2 to 12
Reserved (for MC-MAP)	110	2 to 12
Reserved (for MC-MAP)	111	5 to 10

EXT_MSID_TYPE – Extended Mobile station identifier field type.

If MSID_TYPE is set to a value other than ‘100’, the mobile station shall omit this field; otherwise, the mobile station shall include this field and set it to a value shown in Table 2.1.1.3.1.1-1a corresponding to the extended address type used by the mobile station.

Table 2.1.1.3.1.1-1a. Extended Address Types

Description	EXT_MSID_TYPE (binary)	MSID_LEN (octets)
MEID	000	7
IMSI and MEID	001	12 to 14
IMSI, ESN and MEID	010	0 to 2 (see Note)
Reserved	All other values	–
Note: The range of values from 0 to 2 in the MSID_LEN field corresponds to an actual range of values of 16 to 18 octets for the length of the MSID field.		

MSID_LEN – Mobile station identifier field length.

If MSID_TYPE is not set to '100', or if EXT_MSID_TYPE is included and is set to '000' or '001', the mobile station sets this field to the number of octets included in the MSID field, as shown in Table 2.1.1.3.1.1-1 and Table 2.1.1.3.1.1-1a; otherwise, if MSID_TYPE is set to '100' and if EXT_MSID_TYPE is included and is set to '010', the mobile station sets this field to 16 less than the number of octets included in the MSID field, as shown in Table 2.1.1.3.1.1-1a.

MSID – Mobile station identifier.

The mobile station sets this field to the mobile station identifier, using the identifier type specified in the MSID_TYPE field.

If MSID_TYPE is equal to '000', the MSID field consists of the following subfields:

Subfield	Length (bits)
IMSI_M_S1	24
IMSI_M_S2	10
ESN	32
RESERVED	6

If MSID_TYPE is equal to '001', the MSID field consists of the following subfield:

Subfield	Length (bits)
ESN	32

If MSID_TYPE is equal to '010', the MSID field consists of the following subfields:

Subfield	Length (bits)
IMSI_CLASS	1
IMSI class-specific subfields	7 + 8 × (MSID_LEN - 1)

If MSID_TYPE is equal to '011', the MSID field consists of the following subfields:

Subfield	Length (bits)
ESN	32
IMSI_CLASS	1
IMSI class-specific subfields	7 + 8 × (MSID_LEN - 5)

If MSID_TYPE is equal to '100' and EXT_MSID_TYPE is equal to '000', the MSID field consists of the following subfields:

Subfield	Length (bits)
MEID	56

If MSID_TYPE is equal to '100' and EXT_MSID_TYPE is equal to '001', the MSID field consists of the following subfields:

Subfield	Length (bits)
MEID	56
IMSI_CLASS	1
IMSI class-specific subfields	7 + 8 × (MSID_LEN - 8)

If MSID_TYPE is equal to '100' and EXT_MSID_TYPE is equal to '010', the MSID field consists of the following subfields:

Subfield	Length (bits)
ESN	32
MEID	56
IMSI_CLASS	1
IMSI class-specific subfields	7 + 8 × (MSID_LEN + 16 - 12)

If MSID_TYPE is equal to '101', the MSID field consists of the following subfields:

Subfield	Length (bits)
TMSI_ZONE	If MSID_LEN is greater than four, 8 × (MSID_LEN - 4); otherwise, 0.
TMSI_CODE_ADDR	If MSID_LEN is greater than four, 32; otherwise, 8 × MSID_LEN.

IMSI_M_S1 – First part (least significant 24 bits) of the mobile station's IMSI_M_S $_p$ (see 2.3.1 of [5]).

IMSI_M_S_2 – Second part (most significant 10 bits) of the mobile station's IMSI_M_S $_p$ (see 2.3.1 of [5]).

ESN – Mobile station's electronic serial number.

MEID – Mobile Equipment Identifier.

RESERVED – Reserved bits.

IMSI_CLASS – Class of the IMSI (0 or 1).

TMSI_ZONE – TMSI zone.

TMSI_CODE_ADDR – Temporary mobile station identity code address.

Additional addressing parameters are represented in Tables 2.1.1.3.1.1-2 and 2.1.1.3.1.1-3, IMSI Class 0 Types and IMSI Class 1 Types, respectively. The parameters IMSI_CLASS and IMSI class-specific subfields are defined when MSID_TYPE is equal to '010', '011' or '100' (EXT_MSID_TYPE equal to '001' or '010'). Requirements on how the mobile station sets these fields are given in 2.1.1.3.1.3.

If IMSI_CLASS is equal to '0', the mobile station includes the following fields in the IMSI class-specific subfields:

IMSI_CLASS_0_TYPE – The mobile station sets this field as described in 2.1.1.3.1.3 (see Table 2.1.1.3.1.1-2).

Table 2.1.1.3.1.1-2. IMSI Class 0 Types

Description	IMSI_CLASS_0_TYPE (binary)	Length of IMSI Class 0 Type-specific Subfields (bits)
IMSI_S included	00	37
IMSI_S and IMSI_11_12 included	01	45
IMSI_S and MCC included	10	45
IMSI_S, IMSI_11_12, and MCC included	11	53

IMSI class 0 type specific subfields – IMSI class 0 type-specific subfields.

The mobile station sets the IMSI class 0 type-specific subfields as described below:

If IMSI_CLASS_0_TYPE is equal to '00', then IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-specific Subfield	Length (bits)
RESERVED	3
IMSI_S	34

If IMSI_CLASS_0_TYPE is equal to '01', then IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-specific Subfield	Length (bits)
RESERVED	4
IMSI_11_12	7
IMSI_S	34

If IMSI_CLASS_0_TYPE is equal to '10', then IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-specific Subfield	Length (bits)
RESERVED	1
MCC	10
IMSI_S	34

If IMSI_CLASS_0_TYPE is equal to '11', then IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-specific Subfield	Length (bits)
RESERVED	2
MCC	10
IMSI_11_12	7
IMSI_S	34

If IMSI_CLASS is equal to '1', the mobile station includes the following fields in the IMSI class-specific subfields:

IMSI_CLASS_1_TYPE – The mobile station is to set this field as described in 2.1.1.3.1.3 (see Table 2.1.1.3.1.1-3).

Table 2.1.1.3.1.1-3. IMSI Class 1 Types

Description	IMSI_CLASS_1_TYPE (binary)	Length of IMSI Class 1 Type Specific Subfields (bits)
IMSI_S and IMSI_11_12 included	0	46
IMSI_S, IMSI_11_12, and MCC included	1	54

IMSI class 1 type specific subfields – IMSI class 1 type-specific subfields.

The mobile station sets the IMSI class 1 type-specific subfields as described below:

If IMSI_CLASS_1_TYPE is equal to '0', then IMSI class 1 type-specific subfields consist of:

IMSI Class 1 Type-specific Subfield	**Length (bits)**
RESERVED	2
IMSI_ADDR_NUM	3
IMSI_11_12	7
IMSI_S	34

If IMSI_CLASS_1_TYPE is equal to '1', then IMSI class 1 type-specific subfields consist of:

IMSI Class 1 Type-specific Subfield	**Length (bits)**
IMSI_ADDR_NUM	3
MCC	10
IMSI_11_12	7
IMSI_S	34

RESERVED – Reserved bits.

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).

MCC – Mobile Country Code (see 2.3.1 of [5]).

IMSI_ADDR_NUM – Number of digits in the NMSI minus four (see 2.3.1 of [5]).

2.1.1.3.1.2 Requirements for Setting the Addressing Fields

The mobile station shall determine and set the type of address to use as follows:

- The mobile station shall set MSID_TYPE equal to '000' and shall use IMSI_O_S_S (equal to IMSI_M_S_P) and the ESN as the mobile station identifier if the following conditions are met:
  - PREF_MSID_$TYPE_S$ is equal to '00';
  - USE_TMSI_S is equal to '0' or all of the bits of $TMSI\_CODE_{S-P}$ are equal to '1', and
  - $P\_REV\_IN\_USE_S$ is less than 11.

  The mobile station shall include the following subfields in the MSID field:

IMSI_M_S1 – The mobile station shall set this field to $IMSI\_M\_S1_p$.

IMSI_M_S2 – The mobile station shall set this field to $IMSI\_M\_S2_p$.

ESN – The mobile station shall set this field to its electronic serial number.

RESERVED – Reserved bits.

The mobile station shall set this field to '000000'.

- The mobile station shall set MSID_TYPE equal to '001' and shall use the ESN as the mobile station identifier if the following conditions are met:
  - Neither IMSI_M nor IMSI_T has been assigned to the mobile station; and
  - Any of the following conditions is met:
    + $P\_REV\_IN\_USE_s$ is less than 11;
    + The mobile station has a R-UIM which indicates that UIM_ID is to be used (see [16]).

  The mobile station shall include the following subfield in the MSID field:

  ESN – The mobile station shall set this field to its electronic serial number.

- The mobile station shall set MSID_TYPE to '100', EXT_MSID_TYPE to '000' and shall use the MEID as the mobile station identifier if the following conditions are met:
  - Neither IMSI_M nor IMSI_T has been assigned to the mobile station;
  - $P\_REV\_IN\_USE_s$ is greater than or equal to 11; and
  - The mobile station does not have a R-UIM which indicates that UIM_ID is to be used (see [16]).

  The mobile station shall include the following subfield in the MSID field:

  MEID – The mobile station shall set this field to $MEID_p$.

- The mobile station shall set MSID_TYPE to '010' and shall use the IMSI_O as the mobile station identifier if all of the following conditions are met:
  - The mobile station has been assigned either an IMSI_T, or an IMSI_M, or both;
  - $PREF\_MSID\_TYPE_s$ is equal to '10';
  - USE_TMSI_s is equal to '0' or all of the bits of $TMSI\_CODE_{s\text{-}p}$ are equal to '1'; and
  - Any of the following conditions is met:
    + $P\_REV\_IN\_USE_s$ is less than 11;
    + $MEID\_REQD_s$ is set to '0';
    + The mobile station does not have a R-UIM which indicates that UIM_ID is to be used (see [16]);
    + The PDU does not contain a *Registration Message*, nor an *Origination Message*, nor a *Page Response Message*.

The mobile station shall include the following subfields in the MSID field:

IMSI_CLASS – The mobile station shall set this field as specified in 2.1.1.3.1.3.

IMSI class-specific subfields – IMSI class-specific subfields. The mobile station shall set these fields as specified in 2.1.1.3.1.3.

- The mobile station shall set MSID_TYPE to '011' and shall use both the IMSI_O and the ESN as the mobile station identifier if all of the following conditions are met:
  - The mobile station has been assigned either an IMSI_T, or an IMSI_M, or both;
  - USE_TMSI_s is equal to '0' or all of the bits of $TMSI\_CODE_{s\text{-}p}$ are equal to '1';
  - Any of the following conditions is met:
    + $P\_REV\_IN\_USE_s$ is less than 11 and $PREF\_MSID\_TYPE_s$ is equal to '11';
    + $P\_REV\_IN\_USE_s$ is greater than or equal to 11, $PREF\_MSID\_TYPE_s$ is equal to either '11' or '00' and $EXT\_PREF\_MSID\_TYPE_s$ is equal to '00';
    + $P\_REV\_IN\_USE_s$ is greater than or equal to 11, $PREF\_MSID\_TYPE_s$ is equal to either '11' or '00', $EXT\_PREF\_MSID\_TYPE_s$ is equal to '01' and the mobile station has a R-UIM which indicates that UIM_ID is to be used (see [16]).

    ; and
  - Any of the following conditions is met:
    + $P\_REV\_IN\_USE_s$ is less than 11;
    + $MEID\_REQD_s$ is set to '0';
    + The mobile station does not have a R-UIM which indicates that UIM_ID is to be used (see [16]);
    + The PDU does not contain a *Registration Message*, nor an *Origination Message*, nor a *Page Response Message*.

  The mobile station shall include the following subfields in the MSID field:

  ESN – The mobile station shall set this field to its electronic serial number.

  IMSI_CLASS – The mobile station shall set this field as specified in 2.1.1.3.1.3.

  IMSI class-specific subfields – IMSI class-specific subfields. The mobile station shall set these fields as specified in 2.1.1.3.1.3.

- The mobile station shall set MSID_TYPE to '100', EXT_MSID_TYPE to '001' and shall use IMSI_O and the MEID as the mobile station identifier if all of the following conditions are met:
  - The mobile station has been assigned either an IMSI_T, or an IMSI_M, or both;

- USE_TMSI_s is equal to '0' or all of the bits of $TMSI\_CODE_{s-p}$ are equal to '1';
- $P\_REV\_IN\_USE_s$ is greater than or equal to 11; and
- Any of the following conditions is met:
  - All of the following conditions are met:
    - $PREF\_MSID\_TYPE_s$ is equal to '00' or '11';
    - $EXT\_PREF\_MSID\_TYPE_s$ is equal to '01', or $EXT\_PREF\_MSID\_TYPE_s$ is equal to '11'; and
    - The mobile station does not have a R-UIM which indicates that UIM_ID is to be used (see [16]).
  - All of the following conditions are met:
    - $PREF\_MSID\_TYPE_s$ is equal to '10';
    - $EXT\_PREF\_MSID\_TYPE_s$ is equal to '00', or $EXT\_PREF\_MSID\_TYPE_s$ is equal to '01', or $EXT\_PREF\_MSID\_TYPE_s$ is equal to '11';
    - $MEID\_REQD_s$ is set to '1'
    - The mobile station has a R-UIM which indicates that UIM_ID is to be used (see [16]); and
    - The PDU contains a *Registration Message*, or an *Origination Message*, or a *Page Response Message*.

The mobile station shall include the following subfields in the MSID field:

MEID – The mobile station shall set this field to $MEID_p$.

IMSI_CLASS – The mobile station shall set this field as specified in 2.1.1.3.1.3.

IMSI class-specific subfields – IMSI class-specific subfields. The mobile station shall set these fields as specified in 2.1.1.3.1.3.

- The mobile station shall set MSID_TYPE to '100', EXT_MSID_TYPE to '010' and shall use IMSI_O, ESN and the MEID as the mobile station identifier if all of the following conditions are met:
  - The mobile station has been assigned either an IMSI_T, or an IMSI_M, or both;
  - USE_TMSI_s is equal to '0' or all of the bits of $TMSI\_CODE_{s-p}$ are equal to '1';
  - $P\_REV\_IN\_USE_s$ is greater than or equal to 11; and
  - Any of the following conditions is met:
    - All of the following conditions are met:
      - $PREF\_MSID\_TYPE_s$ is equal to '00' or '11'; and
      - $EXT\_PREF\_MSID\_TYPE_s$ is equal to '11' and the mobile station has a R-UIM which indicates that UIM_ID is to be used (see [16]).

+ All of the following conditions are met:
  - o PREF_MSID_TYPE$_s$ is equal to '00' or '11';
  - o EXT_PREF_MSID_TYPE$_s$ is equal to '00', or EXT_PREF_MSID_TYPE$_s$ is equal to '01';
  - o MEID_REQD$_s$ is set to '1'
  - o The mobile station has a R-UIM which indicates that UIM_ID is to be used (see [16]);
  - o The PDU contains a *Registration Message*, or an *Origination Message*, or a *Page Response Message*.

The mobile station shall include the following subfields in the MSID field:

ESN – The mobile station shall set this field to its electronic serial number.

MEID – The mobile station shall set this field to MEID$_p$.

IMSI_CLASS – The mobile station shall set this field as specified in 2.1.1.3.1.3.

IMSI class-specific subfields – IMSI class-specific subfields. The mobile station shall set these fields as specified in 2.1.1.3.1.3.

• The mobile station shall set MSID_TYPE to '101' and shall use the TMSI as the mobile station identifier if all of the following conditions are met:
  - – The mobile station has been assigned either an IMSI_T, or an IMSI_M, or both;
  - – The bits of TMSI_CODE$_{s\text{-}p}$ are not all equal to '1';
  - – PREF_MSID_TYPE$_s$ is equal to '10' or '11'; and
  - – USE_TMSI$_s$ is equal to '1'.

The mobile station shall determine the value of the MSID_LEN field according to the procedure described in 2.1.1.3.1.2.1, and then the mobile station shall include the following subfields in the MSID subfields:

TMSI_ZONE – If MSID_LEN is greater than four, the mobile station shall set this field to the ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ most significant octets of ASSIGNING_TMSI_ZONE$_{s\text{-}p}$, the assigning TMSI zone. If MSID_LEN is less than or is equal to four, the mobile station shall omit this field.

TMSI_CODE_ADDR – If TMSI_ZONE is included in the address, the mobile station shall set this field to the 32-bit TMSI code assigned to the mobile station.

If TMSI_ZONE is not included in the address, the mobile station shall set this field as follows:

1. If the most significant octet of the TMSI_CODE assigned to the mobile station is equal to '00000000' and the second most significant octet of the TMSI_CODE assigned to the mobile station is not equal to '00000000', the mobile station shall set TMSI_CODE_ADDR to the 24 least significant bits of the TMSI_CODE assigned to the mobile station.
2. If the two most significant octets of the TMSI_CODE assigned to the mobile station are both equal to '00000000', the mobile station shall set TMSI_CODE_ADDR to the 16 least significant bits of the TMSI_CODE assigned to the mobile station.
3. In all other cases, the mobile station shall set TMSI_CODE_ADDR to the TMSI_CODE assigned to the mobile station.

2.1.1.3.1.2.1 Value of the MSID_LEN Field

If MSID_TYPE is set to '100' and if EXT_MSID_TYPE is set to '010', the mobile station shall set the MSID_LEN field to 16 less than the number of octets included in the MSID field (see Table 2.1.1.3.1.1-1a).

Otherwise, if MSID_TYPE is not equal to '101' the mobile station shall set MSID_LEN to the number of octets included in MSID (see Table 2.1.1.3.1.1-1 and Table 2.1.1.3.1.1-1a).

Otherwise, if MSID_TYPE is equal to '101' the mobile station shall set MSID_LEN as follows:

1. The mobile station shall set MSID_LEN to 4 (TMSI_CODE_ADDR is to include all four octets of $TMSI\_CODE_{s\text{-}p}$) if all of the following conditions are met:
   - $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
   - The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$, and
   - The most significant octet of $TMSI\_CODE_{s\text{-}p}$ is not equal to '00000000'.
2. The mobile station shall set MSID_LEN to 3 (TMSI_CODE_ADDR is to include the three least significant octets of $TMSI\_CODE_{s\text{-}p}$) if all of the following conditions are met:
   - $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
   - The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$,
   - The most significant octet of $TMSI\_CODE_{s\text{-}p}$ is equal to '00000000', and
   - The next most significant octet of $TMSI\_CODE_{s\text{-}p}$ is not equal to '00000000'.
3. The mobile station shall set MSID_LEN to 2 (TMSI_CODE_ADDR is to include the two least significant octets of $TMSI\_CODE_{s\text{-}p}$) if all of the following conditions are met:

- ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ is equal to TMSI_ZONE_LEN$_s$,
- The least significant ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ octets of ASSIGNING_TMSI_ZONE$_{s\text{-}p}$ are equal to TMSI_ZONE$_s$, and
- The two most significant octets of TMSI_CODE$_{s\text{-}p}$ are both equal to '00000000'.

4. The mobile station shall set MSID_LEN to 4 + ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ (TMSI_ZONE is to include the ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ least significant octets of ASSIGNING_TMSI_ZONE$_{s\text{-}p}$ while TMSI_CODE_ADDR is to include all four octets of TMSI_CODE$_{s\text{-}p}$) if the following condition is met:
   - ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ is not equal to TMSI_ZONE_LEN$_s$, or
   - The least significant ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ octets of ASSIGNING_TMSI_ZONE$_{s\text{-}p}$ are not equal to TMSI_ZONE$_s$.

2.1.1.3.1.3 Requirements for Setting IMSI Class and IMSI Class-specific Subfield Parameters

When the IMSI_O is used in the MSID field of a PDU (see 2.1.1.3.1.2), the mobile station shall use the following procedures to set the values for the IMSI_CLASS and the IMSI class-specific subfields:

- The mobile station shall set IMSI_CLASS to '0' and IMSI_CLASS_0_TYPE to '00' if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - IMSI_O_11_12$_s$ is equal to IMSI_11_12$_s$, and
  - MCC_O$_s$ is equal to MCC$_s$.

  The mobile station shall include the following fields in IMSI class 0 type-specific subfields:

  RESERVED – The mobile station shall set these bits to '000'.

  IMSI_S – The mobile station shall set this field to IMSI_O_S$_s$.

- The mobile station shall set IMSI_CLASS to '0' and IMSI_CLASS_0_TYPE to '01' if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - IMSI_O_11_12$_s$ is not equal to IMSI_11_12$_s$, and
  - MCC_O$_s$ is equal to MCC$_s$.

  The mobile station shall include the following fields in IMSI class 0 type-specific subfields:

  RESERVED – The mobile station shall set these bits to '0000'.

  IMSI_11_12 – The mobile station shall set this field to IMSI_O_11_12$_s$.

  IMSI_S – The mobile station shall set this field to IMSI_O_S$_s$.

- The mobile station shall set IMSI_CLASS to '0' and IMSI_CLASS_0_TYPE to '10' if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - $IMSI\_O\_11\_12_S$ is equal to $IMSI\_11\_12_S$, and
  - MCC_O_S is not equal to MCC_S.

  The mobile station shall include the following fields in IMSI class 0 type-specific subfields:

  RESERVED – The mobile station shall set this bit to '0'.
  MCC – The mobile station shall set this field to the MCC_O_S.
  IMSI_S – The mobile station shall set this field to $IMSI\_O\_S_S$.

- The mobile station shall set IMSI_CLASS to '0' and IMSI_CLASS_0_TYPE to '11' if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - $IMSI\_O\_11\_12_S$ is not equal to $IMSI\_11\_12_S$, and
  - MCC_O_S is not equal to MCC_S

  The mobile station shall include the following fields in IMSI class 0 type-specific subfields:

  RESERVED – The mobile station shall set these bits to '00'.
  MCC – The mobile station shall set this field to the MCC_O_S.
  IMSI_11_12 – The mobile station shall set this field to $IMSI\_O\_11\_12_S$.
  IMSI_S – The mobile station shall set this field to $IMSI\_O\_S_S$.

- The mobile station shall set IMSI_CLASS to '1' and IMSI_CLASS_1_TYPE to '0' if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 1 IMSI, and
  - MCC_O_S is equal to MCC_S.

  The mobile station shall include the following fields in IMSI class 1 type-specific subfields:

  RESERVED – The mobile station shall set these bits to '00'.
  IMSI_ADDR_NUM – The mobile station shall set this field to the number of digits in the NMSI minus four.
  IMSI_11_12 – The mobile station shall set this field to $IMSI\_O\_11\_12_S$.
  IMSI_S – The mobile station shall set this field to $IMSI\_O\_S_S$.

- The mobile station shall set IMSI_CLASS to '1' and IMSI_CLASS_1_TYPE to '1' if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 1 IMSI, and

– MCC_O_S is not equal to MCC_S.

The mobile station shall include the following fields in IMSI class 1 type-specific subfields:

IMSI_ADDR_NUM – The mobile station shall set this field to the number of digits in the NMSI minus four.

MCC – The mobile station shall set this field to the MCC_O_S.

IMSI_11_12 – The mobile station shall set this field to IMSI_O_11_12$_S$.

IMSI_S – The mobile station shall set this field to IMSI_O_S_S.

2.1.1.3.2 Procedures

The mobile station shall set the addressing fields of the PDU as specified in 2.1.1.3.1.2.

2.1.1.4 Utility Sublayer

2.1.1.4.1 Parameters

2.1.1.4.1.1 Message Type Fields

The mobile station shall use the fields defined in 2.1.1.4.1.1.1 to support message type identification for PDUs transmitted on the r-csch. The mobile station shall set the fields according to the requirements in 2.1.1.4.1.1.2.

2.1.1.4.1.1.1 Definition of Message Type Fields

The message type fields of PDUs transmitted on the r-csch have the following format:

Field	**Length (bits)**
PD	2
MSG_ID	6

PD - Protocol Discriminator.

MSG_ID - Message Identifier.

2.1.1.4.1.1.2 Requirements for Setting Message Type Fields

If P_REV_IN_USE$_S$ is less than six, the mobile station shall set the PD field to '00'. If P_REV_IN_USE$_S$ is equal to six, the mobile station shall set the PD field to '01'. If P_REV_IN_USE$_S$ is greater than or equal to seven, the mobile station shall set the PD field to '10'.

The mobile station shall set the MSG_ID field as shown in Table 2.1.1.4.1.1.2-1.

Table 2.1.1.4.1.1.2-1. MSG_ID values on r-csch (part 1 of 2)

Message Name	MSG_TAG	MSG_ID (binary)
Registration Message	RGM	000001
Order Message	ORDM	000010
Data Burst Message	DBM	000011
Origination Message	ORM	000100
Page Response Message	PRM	000101
Authentication Challenge Response Message	AUCRM	000110
Status Response Message	STRPM	000111
TMSI Assignment Completion Message	TACM	001000
PACA Cancel Message	PACNM	001001
Extended Status Response Message	ESTRPM	001010
Reserved	N/A	001011
Reserved	N/A	001100
Device Information Message	DIM	001101
Security Mode Request Message	SMRM	001110
Data Burst Response Message (DS-41 only, see [13])	DBRM	001111
RR-level Registration Message (MC-MAP only, see [14])	RRLRM	010000
MC-MAP Initial L3 Message (MC-MAP only, see [14])	MAPIL3M	010001
MC-MAP L3 Message (MC-MAP only, see [14])	MAPL3M	010010
MC-MAP RRC Connection Request Message (MC-MAP only, see [14])	MAPCRM	010011
R-TMSI Assignment Completion Message (MC-MAP only, see [14])	RTACM	010100
Authentication Response Message	AURSPM	010101

Table 2.1.1.4.1.1.2-1. MSG_ID values on r-csch (part 2 of 2)

Message Name	MSG_TAG	MSG_ID (binary)
Authentication Resynchronization Message	AURSYNM	010110
Reconnect Message	RCNM	010111
Radio Environment Message	REM	011000
Call Recovery Request Message	CRRM	011001
General Extension Message	GEM	111111

2.1.1.4.1.2 LAC Length Field

The mobile station shall use the field defined in 2.1.1.4.1.2.1 for PDUs transmitted on the r-csch. The mobile station shall set this field according to the requirements in 2.1.1.4.1.2.2.

2.1.1.4.1.2.1 Definition of LAC Length Field

The LAC Length field for PDUs transmitted on the r-csch has the following format:

Field	Length (bits)
LAC_LENGTH	5

LAC_LENGTH – Length of the LAC fields.

2.1.1.4.1.2.2 Requirements for Setting LAC Length Field

The mobile station shall set the LAC_LENGTH field to the combined length in octets of the LAC_LENGTH field, the Authentication fields (see 2.1.1.1.1.1), the ARQ fields (see 2.1.1.2.1.1), the Addressing fields (see 2.1.1.3.1.1) and the LAC Padding field (see 2.1.1.4.1.4).

2.1.1.4.1.3 Extended-Encryption Fields

The mobile station shall use the fields defined in 2.1.1.4.1.3.1 to support Extended-Encryption for PDUs transmitted on the r-csch. The mobile station shall set the fields according to the requirements in 2.1.1.4.1.3.2.

2.1.1.4.1.3.1 Definition of Extended-Encryption Fields

The Extended-Encryption Fields for PDUs transmitted on the r-csch have the following format:

Field	Length (bits)
ENC_FIELDS_INCL	0 or 1
SDU_ENCRYPT_MODE	0 or 3
ENC_SEQ	0 or 8

ENC_FIELDS_INCL – Extended-Encryption Fields included indicator.

SDU_ENCRYPT_MODE – Signaling encryption mode in use for the SDU carried by this PDU.

ENC_SEQ – Eight least significant bits of the encryption sequence number used to construct a cryptographic synchronization crypto-sync (see 2.3.12.4 of [5]) for the encryption algorithm.

2.1.1.4.1.3.2 Requirements for Setting Extended-Encryption Fields

The mobile station shall set the Extended-Encryption Fields as follows:

- If $P\_REV\_IN\_USE_S$ is greater than or equal to seven, the mobile station shall include the ENC_FIELDS_INCL field in the PDU; otherwise, the mobile station shall omit all the Extended-Encryption Fields from the PDU.
- If the ENC_FIELDS_INCL field is present in the PDU, the mobile station shall set the ENC_FIELDS_INCL field to '1' if the SDU_ENCRYPT_MODE field is included in this PDU; otherwise, the mobile station shall set the ENC_FIELDS_INCL field to '0'.[29]
- If the SDU_ENCRYPT_MODE field is included in the PDU, the mobile station shall set it to the signaling encryption mode that is used for the SDU carried by this PDU and is provided by Layer 3.
- If the SDU_ENCRYPT_MODE field is included and is equal to '001' or '010' and if the MACI_INCL field is not present in the PDU or it is present, but it is equal to '0', the mobile station shall include the ENC_SEQ field and shall set it to the eight least significant bits of the 32-bit EXT_SSEQ value provided by Layer 3; otherwise, the mobile station shall omit the ENC_SEQ field.

If the PDU is retransmitted, the mobile station shall not change either the value of the Extended-Encryption Fields or the encryption state of the SDU carried by the PDU.

2.1.1.4.1.4 LAC Padding Field

The mobile station shall use the field defined in 2.1.1.4.1.4.1 to extend the combined length of the LAC Length field, the Authentication fields, the ARQ fields, and the Addressing fields to the closest integer number of octets, so as to ensure an octet boundary alignment for

[29] Some messages sent on the r-csch are not meant to be encrypted (see 2.3.12.4.1 of [5]). For such messages, the mobile station sets the ENC_FIELDS_INCL to '0'.

subsequent fields in the PDU. The mobile station shall set this field according to the requirements in 2.1.1.4.1.4.2.

2.1.1.4.1.4.1 Definition of LAC Padding Field

The LAC Padding field for PDUs transmitted on the r-csch has the following format:

Field	Length (bits)
LAC_PADDING	0-7

LAC_PADDING – Padding bits.

2.1.1.4.1.4.2 Requirements for Setting LAC Padding Field

The mobile station shall set the LAC Padding field to contain the minimum number of bits needed to extend the combined length of the LAC_LENGTH field, the Authentication fields, the ARQ fields, and the Addressing fields to an integer number of octets. The mobile station shall set these bits to '0'.

2.1.1.4.1.5 Radio Environment Report Fields

The mobile station shall use the fields defined in 2.1.1.4.1.5.1 to support time-sensitive radio environment reporting for PDUs transmitted on the r-csch. The mobile station shall set the fields according to the requirements in 2.1.1.4.1.5.2.

2.1.1.4.1.5.1 Definition of Radio Environment Report Fields

The time-sensitive radio environment report fields for PDUs transmitted on the r-csch have the following format:

Field	Length (bits)
ACTIVE_PILOT_STRENGTH	0 or 6
FIRST_IS_ACTIVE	0 or 1
FIRST_IS_PTA	0 or 1
NUM_ADD_PILOTS	0 or 3

NUM_ADD_PILOTS occurrences of the following record:

PILOT_PN_PHASE	15
PILOT_STRENGTH	6
ACCESS_HO_EN	1
ACCESS_ATTEMPTED	1
NUM_AUX_PILOTS	0 or 3

Field	Length (bits)
NUM_AUX_PILOTS occurrences of the following record:	
PILOT_PN_PHASE	15
PILOT_STRENGTH	6
PILOT_REC_TYPE	3
RECORD_LEN	3
Type-specific fields	8 × RECORD_LEN

ACTIVE_PILOT_-STRENGTH – Pilot strength of the pilot in the Active Set.

FIRST_IS_ACTIVE – Indicates when the pilot in the Active Set corresponds to the first base station to which the mobile station transmitted an access probe after entering the *System Access State* (see 2.6.3.1.3 of [5]).

FIRST_IS_PTA – Indicates when the first base station to which the mobile station transmitted an access probe after entering the *System Access State* is the base station used in the access sub-attempt immediately prior to the current access sub-attempt within the current access attempt.

NUM_ADD_PILOTS – Number of additional (to the pilot in the Active Set) reported common pilots.

The mobile station includes NUM_ADD_PILOTS occurrences of the following four-field record (one occurrence for each additional common pilot being reported):

PILOT_PN_PHASE – Pilot measured phase.

PILOT_STRENGTH – Pilot strength.

ACCESS_HO_EN – Access handoff enable.

ACCESS_ATTEMPTED – Access attempted flag.

NUM_AUX_PILOTS – Number of reported auxiliary pilots.

The mobile station includes NUM_AUX_PILOTS occurrences of the following five-field record (one occurrence for each auxiliary pilot being reported):

PILOT_PN_PHASE – Pilot measured phase.

PILOT_STRENGTH – Pilot strength.

PILOT_REC_TYPE – Pilot record type.

RECORD_LEN – Length in octets of the pilot record type-specific fields.

Type-specific fields – Type-specific fields.

If PILOT_REC_TYPE is equal to '000', the mobile station includes the following fields as the type-specific fields:

Field	Length (bits)
QOF	2
WALSH_LENGTH	3
PILOT_WALSH	WALSH_LENGTH + 6
RESERVED	0-7 (as needed)

QOF – Index of the Quasi-orthogonal function corresponding to the auxiliary pilot being reported.

WALSH_LENGTH – Length of the Walsh code for the auxiliary pilot being reported.

PILOT_WALSH – Walsh code corresponding to the auxiliary pilot being reported.

RESERVED – Reserved bits.

2.1.1.4.1.5.2 Requirements for Setting Radio Environment Report Fields

If $P\_REV\_IN\_USE_S$ is greater than or equal to four, the mobile station shall include the radio environment report fields; otherwise, the mobile station shall omit the radio environment report fields.

When the mobile station includes time-sensitive radio environment report fields in the PDU being transmitted, the mobile station shall set the time-sensitive radio environment report fields as follows:

ACTIVE_PILOT_-STRENGTH – The mobile station shall set this field to

$$\min (\max (\lfloor -2 \times 10 \log_{10} PS \rfloor, 0), 64)$$

where PS is the strength of the pilot in the Active Set (see 2.6.3.1.7 of [5]).

FIRST_IS_ACTIVE – The mobile station shall set this field to '1' if $FIRST\_ACTIVE\_PILOT_S$ is equal to $CURRENT\_ACTIVE\_PILOT_S$ (see 2.6.3.1.3 of [5]); otherwise, the mobile station shall set this field to '0'.

FIRST_IS_PTA – The mobile station shall set this field to '1' if $FIRST\_ACTIVE\_PILOT_S$ is equal to $PREVIOUS\_ACTIVE\_PILOT_S$ (see 2.6.3.1.3 of [5]); otherwise, the mobile station shall set this field to '0'.

NUM_ADD_PILOTS – If $PILOT\_REPORT_s$ is equal to '0' and the PDU corresponds to a message other than the *Fast Call Setup Order*, *Origination Message, Radio Environment Message, Reconnect Message, Call Recovery Request Message,* or the *Page Response Message*, the mobile station shall set this field to '000'; otherwise, the mobile station shall set this field as follows:

The mobile station shall set this field to the sum of the number of common pilots being reported from the ACCESS_HO_LIST (see 2.6.3.1.7 of [5]), other than the pilot in the Active Set, and the number of common pilots being reported from the OTHER_REPORTED_LIST.

The mobile station shall include NUM_ADD_PILOTS occurrences of the following record, with each occurrence corresponding to a different common pilot:

PILOT_PN_PHASE – The mobile station shall set this field to the phase of the common pilot PN sequence (see 2.6.3.1.7 of [5]).

PILOT_STRENGTH – The mobile station shall set this field to

$$\min (\max (\lfloor -2 \times 10 \log_{10} PS \rfloor, 0), 64)$$

where PS is the strength of this common pilot (see 2.6.3.1.7 of [5]).

ACCESS_HO_EN – If the common pilot is in ACCESS_HO_LIST, the mobile station shall set this field to '1'; otherwise, the mobile station shall set this field to '0'.

ACCESS_ATTEMPTED – The mobile station shall set this field to '1' if an access probe has been transmitted to the base station corresponding to this common pilot within the current access attempt; otherwise, the mobile station shall set this field to '0' (see 2.6.3.1.3.3 of [5]).

NUM_AUX_PILOTS – If $P\_REV\_IN\_USE_s$ is less than seven, the mobile station shall omit this field; otherwise the mobile station shall include this field and set it as follows:

If $PILOT\_REPORT_s$ is equal to '0' and the PDU corresponds to a message other than the *Fast Call Setup Order*, *Origination Message, Radio Environment Message, Reconnect Message, Call Recovery Request Message,* or the *Page Response Message* the mobile station shall set this field to '000'; otherwise, the mobile station shall set this field to the number of auxiliary pilots being reported from the OTHER_REPORTED_LIST (see 2.6.3.1.7 of [5]).

The mobile station shall include NUM_AUX_PILOTS occurrences of the following record, with each occurrence corresponding to a different auxiliary pilot:

PILOT_PN_PHASE – The mobile station shall set this field to the phase of the auxiliary pilot PN sequence (see 2.6.3.1.7 of [5]).

PILOT_STRENGTH – The mobile station shall set this field to

$$\min (\max (\lfloor -2 \times 10 \log_{10} PS \rfloor, 0), 64)$$

where PS is the strength of this auxiliary pilot (see 2.6.3.1.7 of [5]).

PILOT_REC_TYPE – The mobile station shall set this field to the pilot record type as specified in Table 3.7.2.3.2.34-1 of [5].

RECORD_LEN – The mobile station shall set this field to the number of octets in the type-specific fields.

If PILOT_REC_TYPE is equal to '000', the mobile station shall include the following fields as the type-specific fields:

QOF – The mobile station shall set this field to the index of the Quasi-orthogonal function of the corresponding auxiliary pilot.

WALSH_LENGTH – The mobile station shall set this field to the WALSH_LENGTH value shown in Table 2.7.2.3.2.34-2 of [5] corresponding to the length of the Walsh code for the auxiliary pilot being reported.

PILOT_WALSH – The mobile station shall set this field to the Walsh code corresponding to the auxiliary pilot reported.

RESERVED – The mobile station shall include the minimum number of bits required to make the length of the type-specific fields an integer number of octets. The mobile station shall set each of these bits to '0'.

The mobile station shall select the NUM_ADD_PILOTS and NUM_AUX_PILOTS pilots to be reported from among the pilots monitored in the ACCESS_HO_LIST and OTHER_REPORTED_LIST (see 2.6.3.1.7 of [5]), and shall include the respective records in the PDU, as a list with NUM_ADD_PILOTS and NUM_AUX_PILOTS entries, according to the following procedure (or equivalent):

- The list shall be empty initially and new records shall be added consecutively from the start of the list, without duplicates, until the list contains NUM_ADD_PILOTS plus NUM_AUX_PILOTS records.
- No record corresponding to the pilot in the Active Set shall be part of the list.
- If FIRST_IS_ACTIVE is equal to '0', a record corresponding to the common pilot identified by $\text{FIRST\_ACTIVE\_PILOT}_S$ (see 2.6.3.1.3 of [5]) shall be added to the list.
- If $\text{PREVIOUS\_ACTIVE\_PILOT}_S$ (see 2.6.3.1.3 of [5]) is not NULL, a record corresponding to the pilot identified by $\text{PREVIOUS\_ACTIVE\_PILOT}_S$ shall be added to the list, unless already present in the list.
- Records corresponding to pilots in the ACCESS_HO_LIST (see 2.6.3.1.7 of [5]) shall be added to the list without the encapsulated PDU exceeding *max_msg_size* for the channel on which the PDU will be sent (see 2.1.1.4.2).

- After including records corresponding to the pilots in the ACCESS_HO_LIST, records corresponding to the pilots having the highest pilot strength relative to other pilots in the OTHER_REPORTED_LIST (see 2.6.3.1.7 of [5]) shall be added to the list. As many pilots as possible from the OTHER_REPORTED_LIST shall be included in the list without the encapsulated PDU exceeding *max_msg_size* for the channel on which the PDU will be sent (see 2.1.1.4.2).

If the PDU corresponds to a *Fast Call Setup Order* or *Radio Environment Message*, and RER_MODE_ENABLED (see [5]) is set to YES, the mobile station shall generate a new RER_PILOT_LIST (see [5]), to contain only the pilot in the Active Set and the min(MAX_RER_PILOT_LIST_SIZE$_S$-1, NUM_ADD_PILOTS + NUM_AUX_PILOTS) additional pilots with records included in the PDU in the order of strongest pilot strength.

If the PDU corresponds to a *Fast Call Setup Order*, the mobile station supports radio environment reporting mode, and RER_MODE_ENABLED is set to NO, the mobile station shall generate a new RER_PILOT_LIST (see [5]), to contain only the pilot in the Active Set and the NUM_ADD_PILOTS + NUM_AUX_PILOTS additional pilots with records included in the PDU in the order of strongest pilot strength.

2.1.1.4.1.6 PDU Padding Field

The mobile station shall use the field defined in 2.1.1.4.1.6.1 to pad PDUs transmitted on the r-csch. The mobile station shall set this field according to the requirements in 2.1.1.4.1.6.2.

2.1.1.4.1.6.1 Definition of PDU Padding Field

The PDU Padding field for PDUs transmitted on the r-csch has the following format:

Field	**Length (bits)**
PDU_PADDING	0 - 7

PDU_PADDING – Padding bits.

2.1.1.4.1.6.2 Requirements for Setting PDU Padding Field

The mobile station shall set the PDU Padding field to contain the minimum number of bits needed to make the length of the PDU 8k+2 bits, where k is an integer ($k \geq 0$). The mobile station shall set these bits to '0'.

2.1.1.4.1.7 MACI Field

The mobile station shall include the field defined in 2.1.1.4.1.7.1 to provide message integrity, if and only if the MACI_INCL field in the PDU transmitted on the r-csch is included and is equal to '1'; otherwise, the mobile station shall omit the MACI field. If the MACI field is included, the mobile station shall set this field according to the requirements in 2.1.1.4.1.7.2.

2.1.1.4.1.7.1 Definition of MACI field

The MACI field for PDUs transmitted on the r-csch has the following format:

Field	Length (bits)
MACI	0 or 32

MACI – Message Authentication Code for Integrity.

2.1.1.4.1.7.2 Requirements for Setting MACI Field

The mobile station shall execute the procedure described in 2.1.1.4.2. If USE_UAK_S is equal to '0', the mobile station shall set the MACI field to MAC-I. Otherwise, the mobile station shall set the MACI field to the UMAC value.

2.1.1.4.2 Procedures

The mobile station shall set the parameters defined in 2.1.1.4.1 according to their corresponding requirements. When required, the mobile station shall update the time-sensitive radio environment report fields for each transmission or retransmission of a PDU.

The format of the PDU sent to the MAC Sublayer for transmission on the r-csch depends upon the protocol capabilities of both the mobile station and base station.

If $P\_REV\_IN\_USE_S$ is less than four, the mobile station shall assemble the PDU as shown in Table 2.1.1.4.2-1.

Table 2.1.1.4.2-1. PDU Format on r-csch for P_REV_IN_USE < 4

Parameter	Reference
Message Type Fields	Section 2.1.1.4.1.1
ARQ Fields	Section 2.1.1.2.1
Addressing Fields	Section 2.1.1.3.1
Authentication Fields	Section 2.1.1.1.1
SDU	[5]
PDU Padding Field	Section 2.1.1.4.1.6

If $P\_REV\_IN\_USE_S$ is equal to four or $P\_REV\_IN\_USE_S$ is equal to five, the mobile station shall assemble the PDU as shown in Table 2.1.1.4.2-2.

Table 2.1.1.4.2-2. PDU Format on r-csch for P_REV_IN_USE = 4 or 5

Parameter	Reference
Message Type Fields	Section 2.1.1.4.1.1
ARQ Fields	Section 2.1.1.2.1
Addressing Fields	Section 2.1.1.3.1
Authentication Fields	Section 2.1.1.1.1
SDU	[5]
Radio Environment Report Fields	Section 2.1.1.4.1.5
PDU Padding Field	Section 2.1.1.4.1.6

If $P\_REV\_IN\_USE_S$ is equal to six, the mobile station shall assemble the PDU as shown in Table 2.1.1.4.2-3.

Table 2.1.1.4.2-3. PDU Format on r-csch for P_REV_IN_USE = 6

Parameter	Reference
Message Type Fields	Section 2.1.1.4.1.1
LAC Length Field	Section 2.1.1.4.1.2
ARQ Fields	Section 2.1.1.2.1
Addressing Fields	Section 2.1.1.3.1
Authentication Fields	Section 2.1.1.1.1
LAC Padding Field	Section 2.1.1.4.1.4
Radio Environment Report Fields	Section 2.1.1.4.1.5
SDU	[5]
PDU Padding Field	Section 2.1.1.4.1.6

If $P\_REV\_IN\_USE_S$ is equal to seven or $P\_REV\_IN\_USE_S$ is equal to eight, the mobile station shall assemble the PDU as shown in Table 2.1.1.4.2-4.

Table 2.1.1.4.2-4. PDU Format on r-csch for P_REV_IN_USE = 7 or 8

Parameter	Reference
Message Type Fields	Section 2.1.1.4.1.1
ARQ Fields	Section 2.1.1.2.1
Addressing Fields	Section 2.1.1.3.1
Authentication Fields	Section 2.1.1.1.1
Extended-Encryption Fields	Section 2.1.1.4.1.3

Parameter	Reference
Radio Environment Report Fields	Section 2.1.1.4.1.5
SDU	[5]
PDU Padding Field	Section 2.1.1.4.1.6

If $P\_REV\_IN\_USE_S$ is greater than or equal to nine, the mobile station shall assemble the PDU as shown in Table 2.1.1.4.2-5.

Table 2.1.1.4.2-5. PDU Format on r-csch for P_REV_IN_USE ≥ 9

Parameter	Reference
Message Type Fields	Section 2.1.1.4.1.1
ARQ Fields	Section 2.1.1.2.1
Addressing Fields	Section 2.1.1.3.1
Authentication and Message Integrity Fields	Section 2.1.1.1.1
Extended-Encryption Fields	Section 2.1.1.4.1.3
Radio Environment Report Fields	Section 2.1.1.4.1.5
SDU	[5]
PDU Padding Field	Section 2.1.1.4.1.6
Message Authentication Code for Integrity (MACI)	Section 2.1.1.4.1.7

If the MACI field is included in the PDU, the mobile station shall proceed as follows:

- The mobile station shall compute EXT_MSG_LENGTH and MSG_LENGTH as described 2.1.1.5.1.2.
- If EXT_MSG_LENGTH is included in the encapsulated PDU, as described in 2.1.1.5.1.2, the mobile station shall set *msg_length* to a bit configuration corresponding to EXT_MSG_LENGTH immediately followed by MSG_LENGTH; otherwise, the mobile station shall set *msg_length* to MSG_LENGTH.
- If EXT_MSG_LENGTH is included in the encapsulated PDU and is equal to '1', as described in 2.1.1.5.1.2, the mobile station shall consider the length of the *msg_length* parameter to be 16 bits; otherwise the mobile station shall consider the length of the *msg_length* parameter to be 8 bits.
- The mobile station shall set *channel_specific_buffer* as described in 2.1.1.1.2.4 and shall invoke the procedure for computing the MAC-I value described in 2.1.1.1.2.5 with the *channel_specific_buffer*, *msg_length* and the non-encapsulated PDU without the MACI field, as parameters.

- If USE_UAK_S is equal to '1', the mobile station shall invoke the procedure for computing the UMAC value described in 2.1.1.1.2.6, with the computed MAC-I as input parameter.
- The mobile station shall use the values MAC-I or UMAC, if computed, to set the MACI field as described in 2.1.1.4.1.7.2.

The mobile station shall not transmit PDUs larger than *max_msg_size* = $(3 + MAX\_CAP\_SZ_S) \times ACH\_FRAME\_SIZE$ - 38 bits on the Access Channel.[30]

When using the Enhanced Access Channel, the mobile station shall not transmit PDUs larger than *max_msg_size*, where:

max_msg_size = max ((*max_BA_duration* × *max_BA_rate*), (*max_RA_duration* × *max_RA_rate*)),

max_BA_duration = maximum of $MODE\_SELECTION_S$[i].MAX_DURATION such that $MODE\_SELECTION_S$[i].ACCESS_MODE is Basic Access mode,

max_BA_rate = maximum transmission rate for Basic Access mode that can be supported by both the mobile station and the base station (determined from $EACH\_BA\_RATES\_SUPPORTED_S$ for the base station and implementation-specific for the mobile station),

max_RA_duration = maximum of $MODE\_SELECTION_S$[i].MAX_DURATION such that $MODE\_SELECTION_S$[i].ACCESS_MODE is Reservation Access mode,

max_RA_rate = maximum transmission rate for Reservation Access mode that can be supported by both the mobile station and the base station (determined from $RCCCH\_RATES\_SUPPORTED_S$ for the base station and implementation-specific for the mobile station).

2.1.1.5 Segmentation and Reassembly Sublayer

2.1.1.5.1 Parameters

The mobile station shall use the SAR parameters defined in 2.1.1.5.1.1 for PDUs transmitted on the r-csch. The mobile station shall set the SAR parameters according to the requirements specified in 2.1.1.5.1.2.

2.1.1.5.1.1 Definition of SAR Parameters

The SAR parameters for PDUs transmitted on the r-csch have the following format:

[30] Consistent with a maximum MAX_CAP_SZ of 7 and ACH_FRAME_SIZE of 88, the maximum PDU size can be 842 bits, which translates into a MSG_LENGTH parameter valued between 5 and 110.

Field	Length (bits)
EXT_MSG_LENGTH	0 or 1

EXT_MSG_LENGTH – Extended message length.

Field	Length (bits)
MSG_LENGTH	7, 8 or 15

MSG_LENGTH – Length of the PDU in octets.

Field	Length (bits)
CRC	30

CRC – Cyclic Redundancy Check for the PDU.

Field	Length (bits)
SI	2

SI – Segmentation Indicator.

2.1.1.5.1.2 Requirements for Setting SAR Parameters

For PDUs that are sent on the Reverse Common Control Channel or on the Enhanced Access Channel, the EXT_MSG_LENGTH parameter shall be included. For PDUs that are sent on the Access Channel, the EXT_MSG_LENGTH parameter shall be omitted.

For PDUs that are sent on the Reverse Common Control Channel or on the Enhanced Access Channel:

- If the size of the LAC PDU is less than or equal to 978 bits:
  - The EXT_MSG_LENGTH shall be set to '0'.
  - The MSG_LENGTH field shall be seven bits long and shall be set to (size of LAC PDU in bits + 38) / 8.
- If the size of the LAC PDU is greater than 978 bits:
  - The EXT_MSG_LENGTH shall be set to '1'.
  - The MSG_LENGTH field shall be fifteen bits long and shall be set to (size of LAC PDU in bits + 46) / 8.

For PDUs that are sent on the Access Channel, the MSG_LENGTH parameter shall be eight bits long and shall be set to (size of LAC PDU in bits + 38) / 8.

The 30-bit value of the CRC shall be computed over the EXT_MSG_LENGTH parameter (if included), the MSG_LENGTH parameter and the LAC PDU, in this order. The generator polynomial for the CRC shall be as follows:

$$g(x) = x^{30} + x^{29} + x^{21} + x^{20} + x^{15} + x^{13} + x^{12} + x^{11} + x^{8} + x^{7} + x^{6} + x^{2} + x + 1.$$

The following procedure and the logic shown in Figure 2.1.1.5.1.2-1 shall be used to compute the CRC:

- All shift register elements shall be initialized to logical one.[31]
- The switches shall be set in the up position.
- If the EXT_MSG_LENGTH parameter is included and is equal to '1', the information bit count k shall be defined as 16 plus the size of the LAC PDU in bits; otherwise, the information bit count shall be defined as eight plus the size of the LAC PDU.
- The register shall be clocked k times for the k information bits.
- The switches shall be set in the down position so that the output is a modulo-2 addition with a '1' and the successive shift register inputs are '0'.
- The register shall be clocked an additional 30 times.
- The 30 additional output bits shall be the CRC value.

The CRC parameter shall be set to the CRC value in such a way that its bits are transmitted in the order in which they appeared at the output of the CRC encoder.

[31] Initialization of the register to ones causes the CRC for all-zero data to be non-zero.

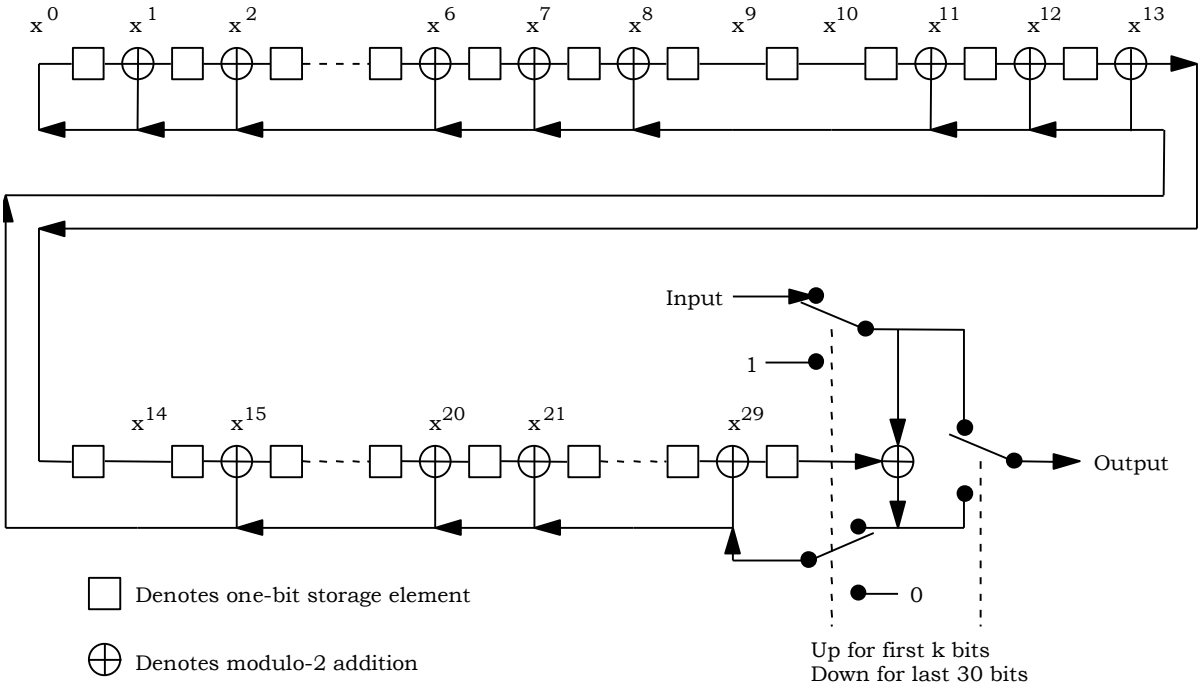

Figure 2.1.1.5.1.2-1. The 30-bit CRC Calculation

For encapsulated PDU fragments that are sent on the Reverse Common Control Channel or on the Enhanced Access Channel, the SI parameter shall be included and shall be set to '00'. For PDUs that are sent on the Access Channel, the SI parameter shall be omitted.

2.1.1.5.2 Procedures

The mobile station shall set the SAR parameters as specified in 2.1.1.5.1.2. The mobile station shall assemble an encapsulated PDU from the SAR parameters and the PDU by concatenating them in the following order:

- For PDUs that are sent on the Reverse Common Control Channel or on the Enhanced Access Channel, the EXT_MSG_LENGTH parameter.
- The MSG_LENGTH parameter, starting with the most significant bit.
- The PDU, starting with the most significant bit of PD of the Message Type Fields.
- The CRC parameter, starting with the bit that appeared first at the output of the CRC encoder.

The mobile station shall segment the encapsulated PDU into fragments. The mobile station shall transmit consecutive fragments of the encapsulated PDU in consecutive r-csch frames. For transmission on the Reverse Access Channel (R-ACH) all frames shall be within an R-ACH slot (see [3]). If the mobile station transmits an encapsulated PDU fragment on the Reverse Common Control Channel or on the Enhanced Access Channel, it shall

transmit the SI parameter associated with the encapsulated PDU fragment before transmitting the fragment.

2.1.2 Reception on f-csch

The mobile station shall meet the requirements specified in 2.1.2.5.2, 2.1.2.1.2.2, 2.1.2.2.2, 2.1.2.3.2 and 2.1.2.4.2.

If a received PDU is not expected to be message integrity protected (see [5]), but contains a MACI_INCL field equal to '1', the mobile station shall ignore the Message Integrity Fields and the MACI field in the received PDU.

2.1.2.1 ARQ Sublayer

2.1.2.1.1 Parameters

The mobile station shall use the ARQ fields defined in 3.1.2.1.1.1 for PDUs received on the f-csch.

2.1.2.1.2 Procedures

2.1.2.1.2.1 Overview of Reception Procedures

The ARQ Sublayer removes the ARQ fields from the PDU received on the f-csch and passes the remainder of the PDU (which generally includes the SDU) to the Upper Layers. The timestamp indicating when the message was received is also passed to the Upper Layers to assist these layers with duplicate detection, in the event that duplicate detection is not performed by the ARQ Sublayer.

The Upper Layers may provide the ARQ Sublayer with a *dedicated channel assignment* indication (see 2.6.3.3 and 2.6.3.5 of [5]), which is used to control the ARQ processing.

When the ARQ Sublayer on the receiver side receives a PDU with the VALID_ACK field set to '1' and the received PDU includes an acknowledgment for a PDU being transmitted, the ARQ Sublayer on the receiver side provides an indication to the ARQ Sublayer on the transmitter side (see 2.1.1.2.2.1) that the access probe has been acknowledged. If the ACK_REQ field of the received PDU is set to '1', the ARQ Sublayer on the receiver side provides an indication to the ARQ Sublayer on the transmitter side that an acknowledgment needs to be sent for the received PDU, together with the MSG_SEQ field of the received PDU.

When the ARQ Sublayer on the receiver side receives a *dedicated channel assignment* indication from the Upper Layers for a received PDU, then the ARQ Sublayer on the receiver side provides an indication to the ARQ Sublayer on the transmitter side to terminate the access attempt in progress, if any. If the ACK_REQ field of the received PDU is set to '1', the ARQ Sublayer on the receiver side provides an indication to the ARQ Sublayer on the transmitter side that an acknowledgment needs to be sent for the received PDU, together with the MSG_SEQ field of the received PDU. If the received PDU does not include an acknowledgment for the PDU currently being transmitted, the ARQ Sublayer signals the Upper Layers to update the registration variables.

When the ARQ Sublayer on the receiver side receives a PDU that has the VALID_ACK field set to '0' or that does not include an acknowledgment for a PDU being transmitted, the ARQ Sublayer on the receiver side ignores the ACK_REQ field even if it is set to '1' (i.e., no acknowledgement is sent for the received PDU).

The ARQ Sublayer performs duplicate detection by using the MSG_SEQ field of the received PDUs, information (provided by the MAC Sublayer) on which physical channel (corresponding to the f-csch) the PDUs were received, and on the relative time of the receptions. The identity of the physical channel on which a PDU is received is determined by the Lower Layers and is made available to the ARQ Sublayer (see the **MAC-Data.Indication** primitive; see also [3] for a description of how physical channels are identified) to assist with duplicate detection.

In cases when the ARQ Sublayer does not perform duplicate detection, the same information is made available to the Upper Layers to assist these layers in duplicate detection. The ARQ Sublayer discards received PDUs considered to be duplicate.

2.1.2.1.2.2 Requirements for Reception Procedures

When receiving a PDU on the f-csch:

- Except for PDUs associated with emergency calls, the mobile station should not process the ARQ fields and ARQ variables if the received PDU is expected to be message integrity protected (see [5]), but the Message Integrity Fields and the MACI field are either not included or fail the message integrity check (see 3.1.1.1.3);
- Otherwise, if the VALID_ACK field is set to '1' and the ACK_SEQ field is set to the value of the MSG_SEQ field of a PDU currently being sent (via an access attempt in progress):
  - The mobile station shall consider the PDU being sent as acknowledged (see 2.1.1.2.2.2 for requirements on the processing of a PDU after being acknowledged).
  - If the ACK_REQ field of the received PDU is set to '1', the mobile station shall recognize it as a request for acknowledgment.
- Otherwise:
  - If a *dedicated channel assignment* indication is received (see 2.6.3.3 and 2.6.3.5 of [5]):
    + The mobile station shall terminate any access attempt in progress.
    + If the ACK_REQ field of the received PDU is set to '1', the mobile station shall recognize it as a request for acknowledgment.
  - Otherwise, if the ACK_REQ field of the received PDU is set to '1', the mobile station shall ignore the ACK_REQ field (i.e., no acknowledgment is sent by the mobile station).

The mobile station shall detect duplicate received PDUs according to the following rules.

The mobile station shall consider two PDUs or records (except records in the *General Page Message* or in the *Universal Page Message*) addressed to the mobile station to be duplicates if all of the following are true:

- The PDUs (records) were received on the same physical channel corresponding to the f-csch (see [3] for a description of how physical channels are identified);
- The PDUs (records) contain the same values in the ADDR_TYPE, MSG_SEQ and ACK_REQ fields;
- The PDUs (records) were received within T_{4m} seconds of each other (see Figure 2.1.2.1.2.2-1);
- The PDUs do not have ADDR_TYPE equal to '101' (broadcast address); and
- An address match was declared (see 2.1.2.2.2.3) for both PDUs (records).

The mobile station shall consider two page records (as contained in the *General Page Message* or in the *Universal Page Message*) to be duplicates if all of the following are true:

- The records were received on the same physical channel corresponding to the f-csch (see [3] for a description of how physical channels are identified);
- The records contain the same values in the MSG_SEQ field;
- The records were received within T_{4m} seconds of each other (see Figure 2.1.2.1.2.2-1) or in the same message; and
- A page match was declared (see 2.1.2.2.2.1) for both records.

The mobile station shall then discard, without further processing, PDUs or records considered duplicate.

The LAC Sublayer shall make available to Layer 3 all the broadcast pages and broadcast messages addressed to the mobile station, for further processing (including duplicate detection, to be performed at the Upper Layers, as specified in [5]).

The mobile station shall consider PDUs and records to be different if they are not duplicates according to the rules given above. The mobile station shall process all PDUs and records that are considered to be different.

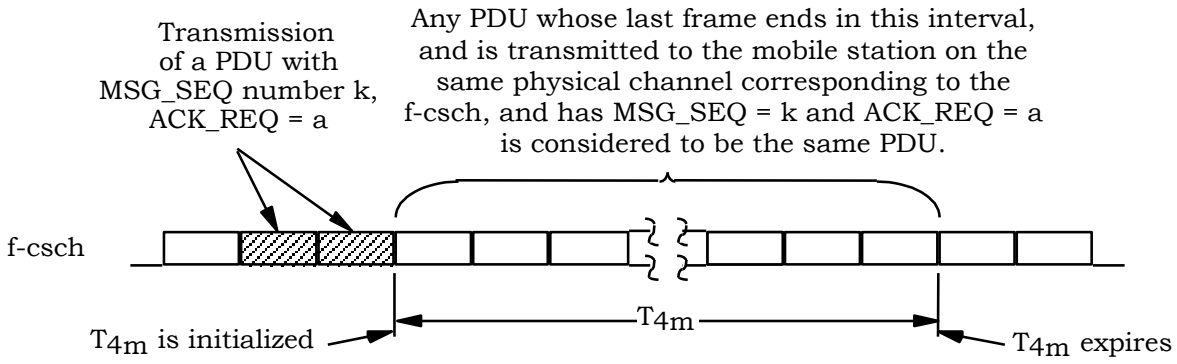

Figure 2.1.2.1.2.2-1. Time Interval for Duplicate Message Detection

2.1.2.2 Addressing Sublayer

2.1.2.2.1 Parameters

The mobile station shall use the addressing fields defined in 3.1.2.2.1.1 for PDUs carrying the *General Page Message*. The mobile station shall use the addressing fields defined in 3.1.2.2.1.2 for PDUs carrying the *Universal Page Message*. The mobile station shall use the addressing fields defined in 3.1.2.2.1.3 for PDUs carrying messages other than the *General Page Message* or the *Universal Page Message*.

2.1.2.2.2 Procedures

2.1.2.2.2.1 Page Match Procedure for the *General Page Message*

The mobile station shall use the addressing fields of the received PDU (see 3.1.2.2.1.1) to determine a page match.

The mobile station shall process the records in the *General Page Message* in the order they occur using the following procedures:

- The mobile station shall ignore all remaining bits in a page record that has:
  - PAGE_CLASS equal to '11' and PAGE_SUBCLASS equal to '01', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_SUBCLASS_EXT equal to '00', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_SUBCLASS_EXT equal to '01', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_SUBCLASS_EXT equal to '10', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11' and PAGE_SUBCLASS_EXT equal to '01', or

- PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11' and PAGE_SUBCLASS_EXT equal to '10'.

- The mobile station shall ignore all remaining bits in the message if a page record has:
  - PAGE_CLASS equal to '01' and PAGE_SUBCLASS equal to '10' or '11', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_CLASS_EXT equal to '11', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11' and PAGE_SUBCLASS_EXT equals '11'.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '00', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - $IMSI\_O\_S_S$ is equal to the IMSI_S received in the page record,
  - $IMSI\_O\_11\_12_S$ is equal to $IMSI\_11\_12_S$, and
  - MCC_O_S is equal to MCC_S.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '01', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - $IMSI\_O\_S_S$ is equal to the IMSI_S received in the page record,
  - $IMSI\_O\_11\_12_S$ is equal to the IMSI_11_12 received in the page record, and
  - MCC_O_S is equal to MCC_S.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '10', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - $IMSI\_O\_S_S$ is equal to the IMSI_S received in the page record,
  - $IMSI\_O\_11\_12_S$ is equal to $IMSI\_11\_12_S$, and
  - MCC_O_S is equal to the MCC received in the page record.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '11', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - $IMSI\_O\_S_S$ is equal to the IMSI_S received in the page record,
  - $IMSI\_O\_11\_12_S$ is equal to the IMSI_11_12 received in the page record, and
  - MCC_O_S is equal to the MCC received in the page record.
- If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '00', the mobile station shall declare a page match if all of the following conditions are met:

- The mobile station's IMSI_O is a class 1 IMSI (see 2.3.1 of [5]),
- $IMSI\_O\_S_s$ is equal to the IMSI_S received in the page record,
- $IMSI\_O\_11\_12_s$ is equal to the IMSI_11_12 received in the page record,
- MCC_O_s is equal to MCC_s, and
- $IMSI\_O\_ADDR\_NUM_s$ is equal to the IMSI_ADDR_NUM received in the page record.

• If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '01', the mobile station shall declare a page match if all of the following conditions are met:

- The mobile station's IMSI_O is a class 1 IMSI,
- $IMSI\_O\_S_s$ is equal to the IMSI_S received in the page record,
- $IMSI\_O\_11\_12_s$ is equal to the IMSI_11_12 received in the page record,
- MCC_O_s is equal to the MCC received in the page record, and
- $IMSI\_O\_ADDR\_NUM_s$ is equal to the IMSI_ADDR_NUM received in the page record.

• If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '00', the mobile station shall declare a page match if all of the following conditions are met:

- The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
- $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
- The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$, and
- $TMSI\_CODE_{s\text{-}p}$ is equal to the TMSI_CODE_ADDR received in the page record.

• If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '01', the mobile station shall declare a page match if all of the following conditions are met:

- The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
- $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
- The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$,
- The most significant octet of $TMSI\_CODE_{s\text{-}p}$ is equal to '00000000', and
- The least significant 24 bits of $TMSI\_CODE_{s\text{-}p}$ are equal to the TMSI_CODE_ADDR received in the page record.

• If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '10', the mobile station shall declare a page match if all of the following conditions are met:

- The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
- $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,

- The least significant ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ octets of ASSIGNING_TMSI_ZONE$_{s\text{-}p}$ are equal to TMSI_ZONE$_s$,
- The two most significant octets of TMSI_CODE$_{s\text{-}p}$ are both equal to '00000000', and
- The least significant 16 bits of TMSI_CODE$_{s\text{-}p}$ are equal to the TMSI_CODE_ADDR received in the page record.

- If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '11', the mobile station and shall declare a page match if the following conditions are met:
  - The bits of TMSI_CODE$_{s\text{-}p}$ are not all equal to '1',
  - ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ is equal to the TMSI_ZONE_LEN received in the page record,
  - The least significant ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ octets of ASSIGNING_TMSI_ZONE$_{s\text{-}p}$ are equal to the TMSI_ZONE received in the page record, and
  - TMSI_CODE$_{s\text{-}p}$ is equal to the TMSI_CODE_ADDR received in the page record.
- If the mobile station is configured to receive broadcast messages, then for each record of the page message with PAGE_CLASS equal to '11' and PAGE_SUBCLASS equal to '00', the mobile station shall compare the BURST_TYPE and BC_ADDR fields to the burst types and broadcast addresses that the mobile station has been configured to receive. The mobile station shall determine if the record type contains a burst type and broadcast address that the mobile station has been configured to receive.

  The mobile station shall not declare a page match for a page record with PAGE_CLASS equal to '11' and PAGE_SUBCLASS equal to '00'.
- If the mobile station is configured to receive broadcast messages, then for each record of the page message with PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equal to '00', the mobile station shall compare the BURST_TYPE and BC_ADDR fields to the burst types and broadcast addresses that the mobile station has been configured to receive. The mobile station shall determine if the record type contains a burst type and broadcast address that the mobile station has been configured to receive, and if so, the LAC Sublayer shall make the Record-specific fields (see 3.1.2.3.1.7) available to Layer 3 for further processing.

  The mobile station shall not declare a page match for a page record with PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equal to '00'.

2.1.2.2.2.2 Page Match Procedure for the *Universal Page Message*

The mobile station shall use the addressing fields of the received *Universal Page Message* (see 3.1.2.2.1.2) to determine a page match.

The mobile station shall process the page records in the *Universal Page Message* in the order they occur using the following procedures:

- The mobile station shall ignore all remaining bits in a page record that has:
  - PAGE_CLASS equal to '11' and PAGE_SUBCLASS equal to '00', or
  - PAGE_CLASS equal to '11' and PAGE_SUBCLASS equal to '01', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_SUBCLASS_EXT equal to '00', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_SUBCLASS_EXT equal to '01', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_SUBCLASS_EXT equal to '10', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11' and PAGE_SUBCLASS_EXT equal to '01', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11' and PAGE_SUBCLASS_EXT equal to '10'.
- The mobile station shall ignore all remaining bits in the record, except the RESERVED_LEN field, if a page record has:
  - PAGE_CLASS equal to '01' and PAGE_SUBCLASS equal to '10' or '11', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '10' and PAGE_CLASS_EXT equal to '11', or
  - PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11' and PAGE_SUBCLASS_EXT equals '11'.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '00', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - The most significant 18 bits of $IMSI\_O\_S_S$ are equal to the IMSI_S_33_16 received in the page record,
  - The least significant 16 bits of $IMSI\_O\_S_S$ are equal to the 16 IMSI_S bits of the Interleaved Address Fields that are associated with the received page record,
  - $IMSI\_O\_11\_12_S$ is equal to $IMSI\_11\_12_S$, and
  - MCC_O_S is equal to MCC_S.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '01', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - The most significant 18 bits of $IMSI\_O\_S_S$ are equal to the IMSI_S_33_16 received in the page record,

- The least significant 16 bits of IMSI_O_S_S are equal to the 16 IMSI_S bits of the Interleaved Address Fields that are associated with the received page record,
- IMSI_O_11_12_S is equal to the IMSI_11_12 received in the page record, and
- MCC_O_S is equal to MCC_S.

- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '10', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - The most significant 18 bits of IMSI_O_S_S are equal to the IMSI_S_33_16 received in the page record,
  - The least significant 16 bits of IMSI_O_S_S are equal to the 16 IMSI_S bits of the Interleaved Address Fields that are associated with the received page record,
  - IMSI_O_11_12_S is equal to IMSI_11_12_S, and
  - MCC_O_S is equal to the MCC received in the page record.
- If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '11', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - The most significant 18 bits of IMSI_O_S_S are equal to the IMSI_S_33_16 received in the page record,
  - The least significant 16 bits of IMSI_O_S_S are equal to the 16 IMSI_S bits of the Interleaved Address Fields that are associated with the received page record,
  - IMSI_O_11_12_S is equal to the IMSI_11_12 received in the page record, and
  - MCC_O_S is equal to the MCC received in the page record.
- If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '00', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 1 IMSI (see 2.3.1 of [5]),
  - The most significant 18 bits of IMSI_O_S_S are equal to the IMSI_S_33_16 received in the page record,
  - The least significant 16 bits of IMSI_O_S_S are equal to the 16 IMSI_S bits of the Interleaved Address Fields that are associated with the received page record,
  - IMSI_O_11_12_S is equal to the IMSI_11_12 received in the page record,
  - MCC_O_S is equal to MCC_S, and
  - IMSI_O_ADDR_NUM_S is equal to the IMSI_ADDR_NUM received in the page record.
- If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '01', the mobile station shall declare a page match if all of the following conditions are met:
  - The mobile station's IMSI_O is a class 1 IMSI,

- The most significant 18 bits of $IMSI\_O\_S_s$ are equal to the IMSI_S_33_16 received in the page record,
- The least significant 16 bits of $IMSI\_O\_S_s$ are equal to the 16 IMSI_S bits of the Interleaved Address Fields that are associated with the received page record,
- $IMSI\_O\_11\_12_s$ is equal to the IMSI_11_12 received in the page record,
- MCC_O_s is equal to the MCC received in the page record, and
- $IMSI\_O\_ADDR\_NUM_s$ is equal to the IMSI_ADDR_NUM received in the page record.

• If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '00', the mobile station shall declare a page match if all of the following conditions are met:

- The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
- $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
- The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$,
- The most significant two octets of $TMSI\_CODE_{s\text{-}p}$ are equal to the TMSI_CODE_ADDR_31_16 received in the page record, and
- The least significant 16 bits of $TMSI\_CODE_{s\text{-}p}$ are equal to the 16 TMSI_CODE_ADDR bits of the Interleaved Address Fields that are associated with the received page record.

• If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '01', the mobile station shall declare a page match if all of the following conditions are met:

- The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
- $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
- The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$,
- The most significant octet of $TMSI\_CODE_{s\text{-}p}$ is equal to '00000000',
- The next to most significant octet of $TMSI\_CODE_{s\text{-}p}$ is equal to the TMSI_CODE_ADDR_23_16 received in the page record, and
- The least significant 16 bits of $TMSI\_CODE_{s\text{-}p}$ are equal to the 16 TMSI_CODE_ADDR bits of the Interleaved Address Fields that are associated with the received page record.

• If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '10', the mobile station shall declare a page match if all of the following conditions are met:

- The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
- $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_s$,
- The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to $TMSI\_ZONE_s$,

- The two most significant octets of $TMSI\_CODE_{s\text{-}p}$ are both equal to '00000000', and
- The least significant 16 bits of $TMSI\_CODE_{s\text{-}p}$ are equal to the 16 TMSI_CODE_ADDR bits of the Interleaved Address Fields that are associated with the received page record.

- If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '11', the mobile station and shall declare a page match if the following conditions are met:
  - The bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1',
  - $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ is equal to the TMSI_ZONE_LEN received in the page record,
  - The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{s\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{s\text{-}p}$ are equal to the TMSI_ZONE received in the page record,
  - The most significant two octets of $TMSI\_CODE_{s\text{-}p}$ are equal to the TMSI_CODE_ADDR_31_16 received in the page record, and
  - The least significant 16 bits of $TMSI\_CODE_{s\text{-}p}$ are equal to the 16 TMSI_CODE_ADDR bits of the Interleaved Address Fields that are associated with the received page record.
- If the mobile station is configured to receive broadcast messages, then for each record of the page message with PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equal to '00', the mobile station shall compare the received broadcast address (specified by the BC_ADDR_REMAINDER from the page record and the BC_ADDR_PA from the Interleaved Address Fields) and the received BURST_TYPE (from the Interleaved Address Fields) to the broadcast addresses and corresponding burst types that the mobile station has been configured to receive. The mobile station shall determine if it is a burst type and broadcast address that the mobile station has been configured to receive, and if so, the LAC Sublayer shall make the Record-specific fields (see 3.1.2.3.1.7) available to Layer 3 for further processing.

  The mobile station shall not declare a page match for a page record with PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equal to '00'.

2.1.2.2.2.3 Address Recognition Procedure for Messages Other than the *General Page Message* and the *Universal Page Message*

The mobile station shall use the addressing fields of the received PDU (see 3.1.2.2.1.3) to determine an address match.

If the ADDR_TYPE is equal to '000' (the address is an IMSI_S address), the mobile station shall declare an address match if the mobile station's IMSI_O is set to IMSI_M, and $IMSI\_M\_S1_p$ is equal to the value of the IMSI_M_S1 subfield received in the ADDRESS field

(see 3.1.2.2.1.3.1) and IMSI_M_S2$_p$ is equal to the value of the IMSI_M_S2 subfield received in the ADDRESS field (see 3.1.2.2.1.3.1).

If the ADDR_TYPE is equal to '001' (the address is an ESN address), the mobile station shall declare an address match if the addressed ESN is equal to the mobile station's ESN.

If the ADDR_TYPE is equal to '010' (the address is an IMSI address), the mobile station shall use the following procedures:

- If IMSI_CLASS is equal to '0' and IMSI_CLASS_0_TYPE is equal to '00', the mobile station shall declare an address match if the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI (see 2.1.1.3.1.1),
  - IMSI_O_11_12$_s$ is equal to IMSI_11_12$_s$,
  - IMSI_O_S$_s$ is equal to the IMSI_S received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1), and
  - MCC_O$_s$ is equal to MCC$_s$.
- If IMSI_CLASS is equal to '0' and IMSI_CLASS_0_TYPE is equal to '01', the mobile station shall declare an address match if the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - IMSI_O_S$_s$ is equal to the IMSI_S received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1),
  - IMSI_O_11_12$_s$ is equal to the IMSI_11_12 received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1), and
  - The MCC_O$_s$ is equal to MCC$_s$.
- If IMSI_CLASS is equal to '0' and IMSI_CLASS_0_TYPE is equal to '10', the mobile station shall declare an address match if the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - IMSI_O_S$_s$ is equal to the IMSI_S received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1),
  - IMSI_O_11_12$_s$ is equal to IMSI_11_12$_s$, and
  - MCC_O$_s$ is equal to the MCC received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1).
- If IMSI_CLASS is equal to '0' and IMSI_CLASS_0_TYPE is equal to '11', the mobile station shall declare an address match if the following conditions are met:
  - The mobile station's IMSI_O is a class 0 IMSI,
  - IMSI_O_S$_s$ is equal to the IMSI_S received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1),
  - IMSI_O_11_12$_s$ is equal to the IMSI_11_12 received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1), and

- MCC_O_S is equal to the MCC received in the IMSI class 0 type-specific subfield (see 3.1.2.2.1.1).

- If IMSI_CLASS is equal to '1' and IMSI_CLASS_1_TYPE is equal to '0', the mobile station shall declare an address match if the following conditions are met:
  - The mobile station's IMSI_O is a class 1 IMSI (see 2.1.1.3.2.1),
  - $IMSI\_O\_S_S$ is equal to the IMSI_S received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1)**,**
  - $IMSI\_O\_11\_12_S$ is equal to the IMSI_11_12 received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1),
  - MCC_O_S is equal to MCC_S, and
  - The $IMSI\_O\_ADDR\_NUM_S$ is equal to IMSI_ADDR_NUM received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1).

- If IMSI_CLASS is equal to '1' and IMSI_CLASS_1_TYPE is equal to '1', the mobile station shall declare an address match if the following conditions are met:
  - The mobile station's IMSI_O is a class 1 IMSI,
  - $IMSI\_O\_S_S$ is equal to the IMSI_S received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1),
  - $IMSI\_O\_11\_12_S$ is equal to the IMSI_11_12 received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1),
  - MCC_O_S is equal to the MCC received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1), and
  - The $IMSI\_O\_ADDR\_NUM_S$ is equal to IMSI_ADDR_NUM received in the IMSI class 1 type-specific subfield (see 3.1.2.2.1.1).

If the ADDR_TYPE is equal to '011' (the address is a TMSI address), the mobile station shall declare an address match if the following conditions are met:

- The bits of $TMSI\_CODE_{S\text{-}p}$ are not all equal to '1' and the received ADDR_LEN is less than or equal to four:
  - $ASSIGNING\_TMSI\_ZONE\_LEN_{S\text{-}p}$ is equal to $TMSI\_ZONE\_LEN_S$,
  - The least significant $ASSIGNING\_TMSI\_ZONE\_LEN_{S\text{-}p}$ octets of $ASSIGNING\_TMSI\_ZONE_{S\text{-}p}$ are equal to $TMSI\_ZONE_S$,
  - The received ADDRESS (TMSI_CODE_ADDR) is equal to the ADDR_LEN least significant octets of $TMSI\_CODE_{S\text{-}p}$, and
  - Each of the four minus ADDR_LEN most significant octets of $TMSI\_CODE_{S\text{-}p}$ are equal to '00000000'.

- The bits of $TMSI\_CODE_{S\text{-}p}$ are not all equal to '1' and the received ADDR_LEN is greater than four:

- The ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ most significant octets of the received ADDRESS (TMSI_ZONE) are equal to the least significant ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$ octets of TMSI_ZONE$_{s\text{-}p}$,
- ADDR_LEN minus four is equal to ASSIGNING_TMSI_ZONE_LEN$_{s\text{-}p}$, and
- The least significant four octets of ADDRESS (TMSI_CODE_ADDR) are equal to TMSI_CODE$_{s\text{-}p}$.

If the ADDR_TYPE field is equal to '100' and the EXT_ADDR_TYPE field is equal to '000' (the address is an MEID address), the mobile station shall declare an address match if the mobile station has a MEID$_p$ and the addressed MEID is equal to the mobile station's MEID$_p$.

If the ADDR_TYPE is equal to '101' (the address is a broadcast address), the mobile station shall declare an address match if the following conditions are met:

- The mobile station is configured to receive broadcast addresses;
- The SDU carried by the PDU is identified as a *Data Burst Message* (see 2.1.2.3.2);
- The ADDRESS field of the PDU is equal to a broadcast address that the mobile station is configured to receive.

2.1.2.2.2.4 Determination of Address Mismatch

In order to assist Layer 3 in determining when the mobile station may stop monitoring the Paging Channel or the Forward Common Control Channel for the sake of power conservation (see 2.6.2.1.1.1.1.1 and 2.6.2.1.1.1.1.2 of [5]), the LAC Sublayer performs procedures which determine whether or not a further page or mobile station-directed message for the mobile station will be included in a slot. The LAC Sublayer examines the addressing fields to determine if there is an address mismatch. When the LAC Sublayer determines that no further pages or mobile station-directed messages for the mobile station will be included in a Paging Channel slot or a Forward Common Control Channel slot, the LAC Sublayer sends an address mismatch indication to Layer 3.

2.1.2.2.2.4.1 Determination of Address Mismatch for the *General Page Message*

The *General Page Message* common fields (see 3.1.2.3.1.2) can be used to determine if there is an address mismatch.

- A mobile station that has a class 0 IMSI address type assigned, and does not have a TMSI assigned, can determine that there is an address mismatch if the CLASS_0_DONE field of the *General Page Message* is set to '1'.
- A mobile station that has a class 1 IMSI address type assigned, and does not have a TMSI assigned, can determine that there is an address mismatch if the CLASS_1_DONE field of the *General Page Message* is set to '1'.
- A mobile station that has a class 0 IMSI address type assigned, and has a TMSI assigned, can determine that there is an address mismatch if the CLASS_0_DONE and the TMSI_DONE fields of the *General Page Message* are both set to '1'.

- A mobile station that has a class 1 IMSI address type assigned, and has a TMSI assigned, can determine that there is an address mismatch if the CLASS_1_DONE and the TMSI_DONE fields of the *General Page Message* are both set to '1'.
- A mobile station that has a class 0 IMSI address type assigned, and has a TMSI assigned, can determine that there is an address mismatch if the CLASS_0_DONE and the ORDERED_TMSIS fields of the *General Page Message* are both set to '1', and the mobile station processes a page record with a TMSI_CODE value of higher numerical value than TMSI_CODE $_{s\text{-}p}$.
- A mobile station that has a class 1 IMSI address type assigned, and has a TMSI assigned, can determine that there is an address mismatch if the CLASS_1_DONE and the ORDERED_TMSIS fields of the *General Page Message* are both set to '1', and the mobile station processes a page record with a TMSI_CODE value of higher numerical value than TMSI_CODE $_{s\text{-}p}$.

A mobile station that is configured to receive broadcast addresses can determine that there is a broadcast address mismatch if any of the above conditions is true and the BROADCAST_DONE field of the received *General Page Message* is set to '1'.

2.1.2.2.2.4.1.1 Requirements for Determination of Address Mismatch for the *General Page Message*

When the mobile station receives a *General Page Message*, the LAC Sublayer shall send an address mismatch indication to Layer 3 if any of the following conditions is satisfied:

- The mobile station has a class 0 IMSI assigned, all the bits of TMSI_CODE$_{s\text{-}p}$ are equal to '1', and the CLASS_0_DONE field of the *General Page Message* is set to '1'; or
- The mobile station has a class 1 IMSI assigned, all the bits of TMSI_CODE$_{s\text{-}p}$ are equal to '1', and the CLASS_1_DONE field of the *General Page Message* is set to '1'; or
- The mobile station has a class 0 IMSI assigned, the bits of TMSI_CODE$_{s\text{-}p}$ are not all equal to '1', and the CLASS_0_DONE and TMSI_DONE fields of the *General Page Message* are both set to '1'; or
- The mobile station has a class 1 IMSI assigned, the bits of TMSI_CODE$_{s\text{-}p}$ are not all equal to '1', and the CLASS_1_DONE and TMSI_DONE fields of the *General Page Message* are both set to '1'; or
- The mobile station has a class 0 IMSI assigned, the bits of TMSI_CODE$_{s\text{-}p}$ are not all equal to '1', the CLASS_0_DONE and ORDERED_TMSIS fields of the *General Page Message* are both set to '1', and the *General Page Message* contains a record with TMSI_CODE value greater than TMSI_CODE$_{s\text{-}p}$; or
- The mobile station has a class 1 IMSI assigned, the bits of TMSI_CODE$_{s\text{-}p}$ are not all equal to '1', the CLASS_1_DONE and ORDERED_TMSIS fields of the *General Page Message* are both set to '1', and the *General Page Message* contains a record with TMSI_CODE value greater than TMSI_CODE$_{s\text{-}p}$.

The LAC Sublayer shall send a broadcast address mismatch indication to Layer 3 if any of the above conditions is satisfied and the BROADCAST_DONE bit of the received *General Page Message* is set to '1'.

2.1.2.2.2.4.2 Determination of Address Mismatch for the *Universal Page Message*

The address information from the Interleaved Address Fields (see 3.1.2.1.1.2.1) can be used to determine if there is an address mismatch. If a portion of, but not all of the Interleaved Address Fields, has been received due to segmentation of the *Universal Page Message* (see 3.1.2.3.2.4.2.2.2), the mobile station can determine whether or not there is an address mismatch based upon the portion received. If the mobile station has not yet determined there to be an address mismatch, when a subsequent segment of the *Universal Page Message* is received (see 2.1.2.3.2.2.1), the mobile station can again determine whether or not there is an address mismatch based upon the portion of the Interleaved Address Fields so far received. If the mobile station has not yet determined there to be an address mismatch based on the complete Interleaved Address Fields, the mobile station shall continue the process of determining whether or not there is an address mismatch, based on the remaining portion of the complete address.

A mobile station that has an IMSI address type assigned, and does not have a TMSI assigned can determine that there is an address mismatch if any of the following conditions are met:

- IMSI_INCLUDED is equal to '0', or
- a comparison of the portion of each IMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's IMSI yields no matches.

A mobile station that has an IMSI address type assigned, and has a TMSI assigned can determine that there is an address mismatch if any of the following conditions are met:

- IMSI_INCLUDED is equal to '0' and TMSI_INCLUDED is equal to '0', or
- IMSI_INCLUDED is equal to '0' and a comparison of the portion of each TMSI address in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's TMSI yields no matches, or
- TMSI_INCLUDED is equal to '0' and a comparison of the portion of each IMSI address in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's IMSI yields no matches.

A mobile station that has an IMSI address type assigned, and has a TMSI assigned can determine that there is an address mismatch if a comparison of the portion of each IMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's IMSI yields no matches, and if a comparison of the portion of each TMSI address in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's TMSI yields no matches.

A mobile station that is configured to receive broadcast addresses can determine that there is a broadcast address mismatch if any of the following conditions is satisfied:

- BCAST_INCLUDED is equal to '0', or
- The mobile station has one or more broadcast addresses assigned, the received portion of the Interleaved Address Fields contains at least one BCAST_ADDR_BIT bit for each broadcast page, and a comparison of the portion of each broadcast address included in the received portion of the Interleaved Address Fields with the corresponding bits of the broadcast addresses that the mobile station is configured to receive, yields no matches.

If a mobile station has not yet determined to have an address mismatch based on the complete Interleaved Address Fields, the mobile station shall continue the process of determining whether or not there is an address mismatch, based on the remaining portion of the complete address.

2.1.2.2.2.4.2.1 Requirements for Determination of Address Mismatch for the *Universal Page Message*

Each time a segment of the *Universal Page Message* is received (see 2.1.2.3.2.2.1), the mobile station shall determine whether or not there is an address mismatch. The LAC Sublayer shall send an address mismatch indication to Layer 3 if any of the following conditions is satisfied:

- The mobile station has an IMSI assigned, all the bits of $TMSI\_CODE_{s\text{-}p}$ are equal to '1', and IMSI_INCLUDED is equal to '0'; or
- The mobile station has an IMSI assigned, all the bits of $TMSI\_CODE_{s\text{-}p}$ are equal to '1', the received portion of the Interleaved Address Fields contains at least one IMSI_S bit for each mobile station with an IMSI address type being paged, and a comparison of the portion of each IMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's IMSI yields no matches or matches, but a comparison of the remaining IMSI address included in the page record with the corresponding bits of the mobile station's IMSI yields no matches (unless a Mobile Station-directed Message Announcement Record is included in the message); or
- The mobile station has an IMSI assigned, the bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1', and IMSI_INCLUDED is equal to '0' and TMSI_INCLUDED is equal to '0'; or
- The mobile station has an IMSI assigned, the bits of $TMSI\_CODE_{s\text{-}p}$ are not all equal to '1', IMSI_INCLUDED is equal to '0', the received portion of the Interleaved Address Fields contains at least one TMSI address bit for each mobile station with a TMSI address type being paged, and a comparison of the portion of each TMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's TMSI yields no matches or matches, but a comparison of the remaining TMSI address included in the page record with the corresponding bits of the mobile station's TMSI yields no matches (unless a Mobile Station-directed Message Announcement Record is included in the message); or

- The mobile station has an IMSI assigned, the bits of $TMSI\_CODE_{s-p}$ are not all equal to '1', TMSI_INCLUDED is equal to '0', the received portion of the Interleaved Address Fields contains at least one IMSI_S bit for each mobile station with an IMSI address type being paged, and a comparison of the portion of each IMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's IMSI yields no matches, or matches but a comparison of the remaining IMSI address included in the page record with the corresponding bits of the mobile station's IMSI yields no matches (unless a Mobile Station-directed Message Announcement Record is included in the message); or
- The mobile station has an IMSI assigned, the bits of $TMSI\_CODE_{s-p}$ are not all equal to '1', the received portion of the Interleaved Address Fields contains at least one IMSI_S bit for each mobile station with an IMSI address type being paged and contains at least one TMSI address bit for each mobile station with a TMSI address type being paged, a comparison of the portion of each IMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's IMSI yields no matches, or matches but a comparison of the remaining IMSI address included in the page record with the corresponding bits of the mobile station's IMSI yields no matches (unless a Mobile Station-directed Message Announcement Record is included in the message), and a comparison of the portion of each TMSI address included in the received portion of the Interleaved Address Fields with the corresponding bits of the mobile station's TMSI yields no matches or matches, but a comparison of the remaining TMSI address included in the page record with the corresponding bits of the mobile station's TMSI yields no matches (unless a Mobile Station-directed Message Announcement Record is included in the message).

Each time a segment of the *Universal Page Message* is received (see 2.1.2.3.2.2.1), the mobile station shall determine whether or not there is a broadcast address mismatch. The LAC Sublayer shall send a broadcast address mismatch indication to Layer 3 if any of the following conditions is satisfied:

- BCAST_INCLUDED is equal to '0'; or
- The mobile station has one or more broadcast addresses assigned, the received portion of the Interleaved Address Fields contains at least one BCAST_ADDR_BIT bit for each broadcast page, and a comparison of the portion of each broadcast address included in the received portion of the Interleaved Address Fields with the corresponding bits of the broadcast addresses the mobile station is configured to receive yields no matches, or matches but a comparison of the remaining BC_ADDR_REMAINDER address included in the page record with the corresponding bits of the mobile station's BC_ADDR, yields no matches.

2.1.2.2.3 Accumulated Addressing Statistics for f-csch

The mobile station shall maintain the 16-bit counters shown in Table 2.1.2.2.3-1.

Table 2.1.2.2.3-1. Accumulated Addressing Statistics for f-csch

Counter Identifier	Description
PAG_3	Number of Paging Channel messages or records received by the mobile station that were addressed to it
FCCCH_3	Number of Forward Common Control Channel messages or records received by the mobile station that were addressed to it

The mobile station shall initialize each counter in Table 2.1.2.2.3-1 to zero upon power-up. The mobile station shall not re-initialize any of the counters at any other time except upon command from the base station. Each counter shall be maintained modulo 2^{16}.

The mobile station shall increment the counter PAG_3 for each record or message that it receives on the Paging Channel addressed to the mobile station. The PAG_3 counter shall not be incremented for messages detected as duplicates or for acknowledgments. The mobile station shall increment the counter FCCCH_3 for each record or message that it receives on the Forward Common Control Channel addressed to the mobile station. The FCCCH_3 counter shall not be incremented for messages detected as duplicates or for acknowledgments.

2.1.2.3 Utility Sublayer

2.1.2.3.1 Parameters

The mobile station shall use the fields defined in 3.1.2.3.1 for PDUs received on the f-csch.

2.1.2.3.2 Procedures

The mobile station shall identify a PDU having a length of 2 bits, with the bits equal to '0', as a *Null PDU*. The mobile station shall discard a *Null PDU*, if one is received. The mobile station shall identify the SDU carried by the received PDU based upon the MSG_TYPE field as shown in Table 3.1.2.3.1.1.2-1. If such identification is not possible, the mobile station shall discard the PDU. Whenever the mobile station receives a valid PDU on the f-csch, it shall raise an indication to the Upper Layers that a valid PDU has been received.[32]

If the mobile station receives a valid PDU, the mobile station shall do the following:

- If the ENC_FIELDS_INCL field of the received PDU is equal to '1', the LAC Sublayer shall make the SDU included in the PDU available to Layer 3, together with the Extended-Encryption Fields (see 3.1.2.3.1.3.1).

[32] These indications are used by the Upper Layers to maintain the timers used for f-csch monitoring (T_{21m}, T_{30m}, T_{40m}, and T_{72m}).

- If the ENC_FIELDS_INCL field of the received PDU is equal to '0', the LAC Sublayer shall make the SDU included in the PDU available to Layer 3, together with SDU_ENCRYPT_MODE set to '000'.

2.1.2.3.2.1 Procedures for Processing of the *General Page Message*

If the received PDU corresponds to a *General Page Message*, the mobile station shall remove the GPM Common fields (see 3.1.2.3.1.2.1) from the PDU. These fields are made available to the Addressing Sublayer and Layer 3 for further processing.

2.1.2.3.2.2 Procedures for Processing of the *Universal Page Message*

If the received PDU is a *UPM First Segment PDU* or an *Unsegmented UPM PDU* (see 3.1.2.3.2.4.2.2), the mobile station shall remove the UPM Common fields (see 3.1.2.3.1.5.1) from the PDU. These fields are made available to Layer 3 for further processing.

2.1.2.3.2.2.1 Procedures for Reassembly of the *Universal Page Block*

The mobile station shall assemble the *Universal Page Block* from received PDUs using the following procedure, or equivalent:

- A reassembly buffer large enough to accommodate the maximum size *Universal Page Block* shall be available. The reassembly buffer shall be emptied at the beginning of every Forward Common Control Channel slot and every time the mobile station receives a PDU other than a *UPM First Segment PDU*, a *UPM Middle Segment PDU*, or a *UPM Final Segment PDU*.
- If the received PDU is a *UPM First Segment PDU*, the mobile station shall perform the following:
  - The mobile station shall empty the reassembly buffer, and
  - The mobile station shall place the First Segment of the *Universal Page Block* from the *UPM First Segment PDU* at the beginning of the reassembly buffer.
- If the received PDU is a *UPM Middle Segment PDU*, the mobile station shall perform the following:
  - If the reassembly buffer is empty the mobile station shall discard the received PDU; otherwise,
  - If the value of the UPM_SEGMENT_SEQ is greater than '00' and the mobile station has not received any *UPM Middle Segment PDU* from which the buffer has been filled , the mobile station shall empty the reassembly buffer and shall discard the received PDU; otherwise,
  - If the value of the UPM_SEGMENT_SEQ is greater than '00' and is not equal to one plus the UPM_SEGMENT_SEQ of the most recently received PDU from which the buffer has been filled, the mobile station shall empty the reassembly buffer and shall discard the received PDU; otherwise,
  - The mobile station shall append the Middle Segment of the *Universal Page Block* from the *UPM Middle Segment PDU* to the contents of the reassembly buffer.

- If the received PDU is a *UPM Final Segment PDU*, the mobile station shall perform the following:
  - If the reassembly buffer is empty the mobile station shall discard the received PDU; otherwise,
  - If the value of the UPM_SEGMENT_SEQ is greater than '00' and the mobile station has not received any *UPM Middle Segment PDU* from which the buffer has been filled , the mobile station shall empty the reassembly buffer and shall discard the received PDU; otherwise,
  - If the value of the UPM_SEGMENT_SEQ is greater than '00' and is not equal to one plus the UPM_SEGMENT_SEQ of the most recently received PDU from which the buffer has been filled, the mobile station shall empty the reassembly buffer and shall discard the received PDU; otherwise,
  - The mobile station shall append the Final Segment of the *Universal Page Block* from the *UPM Final Segment PDU* to the contents of the reassembly buffer. The mobile station shall then forward the content of the reassembly buffer to the Addressing Sublayer in order to enable the Page Match Procedure for the Universal Page Message (see 2.1.2.2.2.2). The mobile station shall then empty the reassembly buffer.

When content from a PDU is introduced into the reassembly buffer, the Utility Sublayer shall forward the portion of the *Universal Page Block* reassembled so far to the Addressing Sublayer in order to enable partial address comparison (see 2.1.2.2.2.4).

2.1.2.4 Segmentation and Reassembly (SAR) Sublayer

2.1.2.4.1 Parameters

The mobile station shall use the parameters defined in 3.1.2.4.1.1 for operation on the f-csch.

2.1.2.4.2 Procedures

The mobile station shall maintain the counters described in Section 2.1.2.4.3.

The mobile station shall assemble PDUs from encapsulated PDU fragments received on the sync channel using the following procedure:

- A reassembly buffer large enough to accommodate the largest encapsulated PDU shall be available. The reassembly buffer shall be empty initially and shall be emptied at the end of each sync channel superframe.
- When an encapsulated PDU fragment is received:
  - If the SOM parameter is equal to '1':
    + The current contents of the reassembly buffer, if any, shall be discarded (the reassembly buffer becomes empty).

- + The encapsulated PDU fragment (which corresponds to the beginning of a PDU) shall be placed in the buffer (without the SOM parameter). The first eight bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than five, the reassembly buffer shall be emptied.
- – If the SOM parameter is equal to '0':
  - + If the reassembly buffer is empty, the encapsulated PDU fragment shall be discarded.
  - + If the reassembly buffer is not empty, the encapsulated PDU fragment (which corresponds to a subsequent part of the PDU being received) shall be appended to the contents of the reassembly buffer (without the SOM parameter).
- – If the reassembly buffer is not empty and if there are at least MSG_LENGTH octets in the buffer, the data representing the first MSG_LENGTH × 8 - 30 bits in the buffer shall be run through the 30-bit CRC computation specified in 2.1.1.5.1.2. The result of the computation shall be compared with the 30-bits located in the reassembly buffer after the first MSG_LENGTH × 8 - 30 bits and the following actions shall be taken:
  - + If the computed CRC is equal to the received CRC, the PDU is considered to have been correctly received and reassembled. The contents of the reassembly buffer, starting with the ninth bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
  - + If the computed CRC is not equal to the received CRC, the content of the reassembly buffer shall be discarded (the buffer becomes empty).

The mobile station shall assemble PDUs from encapsulated PDU fragments received on f-csch logical channels other than the sync channel using the following procedure:

- A reassembly buffer large enough to accommodate all of the bits in all of the f-csch partial-frames (half-frames for the Paging Channel) necessary to transfer the largest possible encapsulated PDU shall be available. The reassembly buffer shall be empty initially. The reassembly buffer should be emptied when the mobile station stops monitoring the physical channel(s) which carry the f-csch traffic.
- When an encapsulated PDU fragment is received:
  - – If the encapsulated PDU fragment is received on a Paging Channel:
    - + If the SCI parameter is equal to '1':
      - o The current contents of the reassembly buffer, if any, shall be discarded (the reassembly buffer becomes empty).

- The encapsulated PDU fragment (which corresponds to the beginning of a PDU) shall be placed in the buffer (without the SCI parameter). The first eight bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than five, the reassembly buffer shall be emptied.

+ If the SCI parameter is equal to '0':

- If the reassembly buffer is empty, the encapsulated PDU fragment shall be discarded.

- If the reassembly buffer is not empty, the encapsulated PDU fragment (which corresponds to a subsequent part of the PDU being received) shall be appended to the contents of the reassembly buffer (without the SCI parameter).

– If the encapsulated PDU fragment is received on the Broadcast Channel:

+ If the SCI parameter is equal to '1':

- The current contents of the reassembly buffer, if any, shall be discarded (the reassembly buffer becomes empty).

- The encapsulated PDU fragment (which corresponds to the beginning of a PDU) shall be placed in the buffer (without the SCI parameter). The first bit shall be interpreted as the EXT_MSG_LENGTH parameter.

◊ If EXT_MSG_LENGTH is equal to '0', the next seven bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than six, the reassembly buffer shall be emptied.

◊ If EXT_MSG_LENGTH is equal to '1', the next 15 bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than 128, the reassembly buffer shall be emptied.

+ If the SCI parameter is equal to '0':

- If the reassembly buffer is empty, the encapsulated PDU fragment shall be discarded.

- If the reassembly buffer is not empty, the encapsulated PDU fragment (which corresponds to a subsequent part of the PDU being received) shall be appended to the contents of the reassembly buffer (without the SCI parameter).

– If the encapsulated PDU fragment is received on the Forward Common Control Channel:

+ If the SI parameter is equal to '01':

- The current contents of the reassembly buffer, if any, shall be discarded (the reassembly buffer becomes empty).

- The encapsulated PDU fragment (which corresponds to the beginning of a PDU) shall be placed in the buffer (without the SI parameter). The first bit shall be interpreted as the EXT_MSG_LENGTH parameter.
  - If EXT_MSG_LENGTH is equal to '0', the next seven bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than six, the reassembly buffer shall be emptied.
  - If EXT_MSG_LENGTH is equal to '1', the next 15 bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than 128, the reassembly buffer shall be emptied.

+ If the SI parameter is equal to '00':
  - If the reassembly buffer is empty, the encapsulated PDU fragment shall be discarded.
  - If the reassembly buffer is not empty, the encapsulated PDU fragment (which corresponds to a subsequent part of the PDU being received) shall be appended to the contents of the reassembly buffer (without the SI parameter).
+ If the SI parameter is equal to '10' or '11', the encapsulated PDU fragment and the current contents of the reassembly buffer, if any, shall be discarded (the reassembly buffer becomes empty).

– If the reassembly buffer is not empty and if there are at least MSG_LENGTH octets in the buffer, the data representing the first MSG_LENGTH × 8 - 30 bits in the buffer shall be run through the 30-bit CRC computation specified in 2.1.1.5.1.2. The result of the computation shall be compared with the 30 bits located in the reassembly buffer after the first MSG_LENGTH × 8 - 30 bits and the following actions shall be taken:

+ If the computed CRC is equal to the received CRC, the PDU is considered to have been correctly received and reassembled. Then:
  - If the PDU is received on a Paging Channel:
    - The contents of the reassembly buffer, starting with the ninth bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
    - The first MSG_LENGTH × 8 bits in the reassembly buffer shall be shifted out and discarded in such a way that the remaining bits, if any, are stored at the beginning of the buffer.

- ◊ If there are at least eight bits left in the reassembly buffer and the first eight bits from the beginning of the reassembly buffer binary encode an unsigned integer greater than or equal to five, then the eight bits shall be interpreted as the MSG_LENGTH parameter for a new PDU and the process shall continue; otherwise, the reassembly buffer shall be emptied.

o If the PDU is received on the Forward Common Control Channel or Broadcast Channel:

- ◊ If EXT_MSG_LENGTH is equal to '0', the contents of the reassembly buffer, starting with the 9th bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
- ◊ If EXT_MSG_LENGTH is equal to '1', the contents of the reassembly buffer, starting with the 17th bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
- ◊ The first MSG_LENGTH × 8 bits in the reassembly buffer shall be shifted out and discarded in such a way that the remaining bits, if any, are stored at the beginning of the buffer.
- ◊ The remaining bits in the reassembly buffer shall be discarded except for the following cases:
  - > If there are at least sixteen bits left in the reassembly buffer with the first bit equal to '1' and the next 15 bits binary encoding an unsigned integer greater than or equal to 128, then the 15 bits shall be interpreted as the MSG_LENGTH parameter for a new PDU and the process shall continue.
  - > Otherwise, if there are at least eight bits left in the reassembly buffer with the first bit equal to '0' and the next seven bits binary encoding an unsigned integer greater than or equal to six, then the seven bits shall be interpreted as the MSG_LENGTH parameter for a new PDU and the process shall continue.

+ If the computed CRC is not equal to the received CRC, the contents of the reassembly buffer shall be discarded (the buffer becomes empty).

2.1.2.4.3 Accumulated Statistics for f-csch

The mobile station shall maintain the 24-bit counters shown in Table 2.1.2.4.3-1.

Table 2.1.2.4.3-1. Accumulated Statistics for f-csch

Counter Identifier	Description
PAG_1	Number of Paging Channel encapsulated PDUs the mobile station attempted to receive
PAG_2	Number of Paging Channel encapsulated PDUs received by the mobile station with a CRC that does not match
PAG_4	Number of Paging Channel half-frames received by the mobile station
PAG_5	Number of Paging Channel half-frames that contain any part of a message with a CRC that matches
BCCH_1	Number of Broadcast Channel encapsulated PDUs the mobile station attempted to receive
BCCH_2	Number of Broadcast Channel encapsulated PDUs received by the mobile station with a CRC that does not match
BCCH_3	Number of Broadcast Channel partial-frames received by the mobile station
BCCH_4	Number of Broadcast Channel partial-frames received by the mobile station with a CRC that matches
FCCCH_1	Number of Forward Common Control Channel encapsulated PDUs the mobile station attempted to receive
FCCCH_2	Number of Forward Common Control Channel encapsulated PDUs received by the mobile station with a CRC that does not match

The mobile station shall initialize each counter in Table 2.1.2.4.3-1 to zero upon power-up. The mobile station shall not re-initialize any of the counters at any other time except upon command from the base station. Each counter shall be maintained modulo 2^{24}.

The mobile station shall increment the counter PAG_1 for each CRC that it tests for an encapsulated PDU received on a Paging Channel. The mobile station shall increment the counter PAG_2 for each invalid Paging Channel encapsulated PDU. The mobile station shall increment the counter PAG_4 for each Paging Channel half-frame that it receives. The mobile station shall increment the counter PAG_5 for each Paging Channel half-frame that contains any part of a valid encapsulated PDU.

The mobile station shall increment the counter BCCH_1 for each CRC that it tests for an encapsulated PDU received on the Broadcast Channel. The mobile station shall increment the counter BCCH_2 for each invalid Broadcast Channel encapsulated PDU. The mobile station shall increment the counter BCCH_3 for each Broadcast Channel frame that it

receives. The mobile station shall increment the counter BCCH_4 for each Broadcast Channel frame that contains any part of a valid encapsulated PDU.

The mobile station shall increment the counter FCCCH_1 for each CRC that it tests for an encapsulated PDU received on the Forward Common Control Channel. The mobile station shall increment the counter FCCCH_2 for each invalid Forward Common Control Channel encapsulated PDU.

2.1.2.5 Message Integrity Sublayer

The mobile station shall process the Message Integrity Fields and the MACI field of PDUs received on f-csch as specified in 2.1.2.5.1 and 2.1.2.5.2.

2.1.2.5.1 Parameters

The mobile station uses and interprets the Message Integrity Fields defined in 2.1.1.1.1.1 and the MACI field for PDUs received on the f-csch[33].

2.1.2.5.2 Procedures

If the received PDU contains Message Integrity Fields and the MACI field and the mobile station operates at a protocol revision equal to ten or higher, the mobile station shall perform the procedures[34] specified in 3.1.1.1.3.

2.2 Dedicated Channel Operation

The mobile station shall meet the requirements specified in 2.2.1 for operation on the r-dsch and in 2.2.2 for operation on the f-dsch.

2.2.1 Transmission on r-dsch

The mobile station shall meet the requirements specified in 2.2.1.1.2.2, 2.2.1.2.2 and 2.2.1.3.2.

2.2.1.1 ARQ Sublayer

2.2.1.1.1 Parameters

To support the ARQ mechanism on the dedicated channels, the mobile station shall use the ARQ fields defined in 2.2.1.1.1.1 for PDUs transmitted on the r-dsch. The mobile station shall set the ARQ fields according to the requirements in 2.2.1.1.1.2.

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[33] When receiving on the f-csch, the mobile station uses the same Message Integrity Fields as when transmitting on r-csch.

[34] When receiving on the f-csch, the mobile station uses the same message integrity procedures as the base station does when receiving on r-csch.

2.2.1.1.1.1 Definition of ARQ Fields

The ARQ fields for PDUs transmitted on the r-dsch have the following format:

Field	Length (bits)
ACK_SEQ	2 or 3
MSG_SEQ	2 or 3
ACK_REQ	1

ACK_SEQ - Acknowledgment sequence number.

This field contains the value of the MSG_SEQ field of a regular PDU (3 bits) or a mini PDU (2 bits) received on the f-dsch and acknowledged on the r-dsch. If no PDU requiring acknowledgment has been received, all bits of the field are set to '1'.

MSG_SEQ - Message sequence number.

This field contains the message sequence number for the regular PDU (3 bits) or the mini PDU (2 bits) to be sent on the r-dsch.

ACK_REQ - Acknowledgment required indicator.

This field indicates whether the PDU being sent on the r-dsch requires an acknowledgment from the base station. The ACK_REQ field is set to '1' to request an acknowledgment and to '0' otherwise.

2.2.1.1.1.2 Requirements for Setting ARQ Fields

The mobile station shall set the ACK_REQ field of PDUs transmitted on the r-dsch to:

- '1' to request an acknowledgment from the base station, or
- '0' to indicate to the base station that an acknowledgment is not requested.

The mobile station shall set the MSG_SEQ field of the PDU being transmitted on the r-dsch according to the following procedures:

- For PDUs requiring acknowledgment, the mobile station uses the message sequence number variables $MSG\_SEQ\_ACK_S$ for regular PDUs and uses $M\_MSG\_SEQ\_ACK_S$ for mini PDUs. When the mobile station prepares a new regular PDU or mini PDU requiring acknowledgment for transmission on the r-dsch, the mobile station shall set the MSG_SEQ field of the PDU to $MSG\_SEQ\_ACK_S$ or $M\_MSG\_SEQ\_ACK_S$, respectively. In subsequent retransmissions of the PDU, the mobile station shall set the MSG_SEQ field to the same value used for the initial transmission of that PDU.

- For PDUs not requiring acknowledgment, the mobile station uses the message sequence number variables $MSG\_SEQ\_NOACK_S$ for regular PDUs and uses $M\_MSG\_SEQ\_NOACK_S$ for mini PDUs. When the mobile station prepares a new regular PDU or mini PDU not requiring acknowledgment for transmission on the r-dsch, the mobile station shall set the MSG_SEQ field of the PDU to $MSG\_SEQ\_NOACK_S$ or $M\_MSG\_SEQ\_NOACK_S$, respectively.

The mobile station shall set the ACK_SEQ field of regular PDUs and mini PDUs transmitted on the r-dsch to the MSG_SEQ field of a regular PDU or mini PDU, respectively, previously received on the f-dsch and being acknowledged. If no PDU requiring acknowledgment has been received since r-dsch was acquired, the mobile station shall set all bits of the ACK_SEQ field to '1'.

2.2.1.1.2 Procedures

2.2.1.1.2.1 Overview of Transmission and Retransmission Procedures

Both PDUs requiring acknowledgment and those not requiring acknowledgment are sent on the r-dsch. The order of delivery of either type of PDU is not guaranteed. The procedure for PDUs requiring acknowledgment is a selective repeat scheme in which a PDU is retransmitted only if an acknowledgment for the PDU is not received before the expiration of a timer. PDUs not requiring acknowledgment are not retransmitted.

The LAC Sublayer is notified as soon as a PDU is actually transmitted by the MAC Sublayer. At this time, for a PDU requiring acknowledgment, the ARQ Sublayer on the transmitter side stores the PDU and starts a timer. If the ARQ Sublayer on the transmitter side receives an indication from the ARQ Sublayer on the receiver side that an acknowledgment for the transmitted PDU was received on the f-dsch, the ARQ Sublayer on the transmitter side stops the timer and discards the copy of the transmitted PDU; otherwise, if the timer expires before the ARQ Sublayer on the transmitter side receives an indication of acknowledgment for the transmitted PDU, the ARQ Sublayer resubmits the stored PDU and, upon notification of retransmission, restarts the timer. The procedure is repeated until each PDU requiring acknowledgment is either acknowledged or is transmitted a total of N_{1m} times for regular PDUs or N_{15m} times for mini PDUs.

If the ARQ Sublayer on the transmitter side receives an indication from the ARQ Sublayer on the receiver side that a PDU requiring acknowledgment has to be acknowledged, the ARQ Sublayer on the transmitter side issues an acknowledgment within T_{2m} seconds for regular PDUs or within T_{76m} seconds for mini PDUs (either by setting the ACK_SEQ field in a PDU pending transmission, or by generating an "acknowledgment-specific" PDU[35]).

The ARQ Sublayer may receive a reset disposition from the controlling management function (for both regular and mini PDUs), from Layer 3 (for both regular and mini PDUs), or from the ARQ Sublayer on the receiver side upon the reception of a *Reset PDU* (for mini

[35] In [11], this "acknowledgment-specific" PDU is referred to as the *Mobile Station Acknowledgement Order*.

PDUs only). The ARQ Sublayer is reset simultaneously on the transmitter and the receiver sides. In such cases the message sequence number variables for PDUs both requiring and not requiring acknowledgments are set to '0', the acknowledgment timers are reset and the repetition counters for all PDUs are set to '0'. Since the reset operation results in pending acknowledgments being discarded, all bits of the ACK_SEQ field are set to '1' for PDUs sent immediately after a reset operation.

2.2.1.1.2.2 Requirements for Transmission and Retransmission Procedures

When assembling PDUs for transmission, the mobile station shall set the ARQ fields as specified in 2.2.1.1.1.2. The mobile station shall maintain the ARQ statistics as specified in 2.2.1.1.3.

The mobile station shall store a message sequence number variable $MSG\_SEQ\_ACK_S$ for regular PDUs requiring acknowledgment and $M\_MSG\_SEQ\_ACK_S$ for mini PDUs requiring acknowledgment. After sending a PDU requiring acknowledgment, the mobile station shall increment $MSG\_SEQ\_ACK_S$ modulo 8 for regular PDUs or shall increment $M\_MSG\_SEQ\_ACK_S$ modulo 4 for mini PDUs. For PDUs not requiring acknowledgment, the mobile station shall store different message sequence number variables $MSG\_SEQ\_NOACK_S$ for regular PDUs and $M\_MSG\_SEQ\_NOACK_S$ for mini PDUs. After sending a PDU not requiring acknowledgment, the mobile station shall increment $MSG\_SEQ\_NOACK_S$ modulo 8 for regular PDUs or shall increment $M\_MSG\_SEQ\_NOACK_S$ modulo 4 for mini PDUs.

The mobile station may transmit up to four regular PDUs before receiving an indication that one of the transmitted regular PDUs was acknowledged. The mobile station may transmit up to two mini PDUs before receiving an indication that one of the transmitted mini PDUs was acknowledged. If a transmitted (regular or mini) PDU of a given type requiring acknowledgment and having the MSG_SEQ field equal to ($MSG\_SEQ\_ACK_S$ + 4) modulo 8 for regular PDUs or equal to ($M\_MSG\_SEQ\_ACK_S$ + 2) modulo 4 for mini PDUs is awaiting acknowledgment, the mobile station shall not send a new PDU of the same type requiring acknowledgment until it receives an indication that the transmitted PDU was acknowledged.

The mobile station shall not retransmit PDUs not requiring acknowledgment or previously acknowledged. If the mobile station has not received a valid acknowledgment[36] indication within T_{1m} seconds for regular PDUs or within *retransmission_timer* seconds for mini PDUs after sending a PDU requiring acknowledgment, the mobile station shall retransmit the PDU (see Figure 2.2.1.1.1.2-1; only T_{1m} is shown). The value of *retransmission_timer* is equal to:

- T_{75m}, for the first N_{14m} (re)transmissions of the mini PDU,
- T_{1m}, for the next (N_{15m} - N_{14m}) retransmissions of the mini PDU.

[36] An acknowledgment is valid if it is not required to be message integrity protected (see [5]) or if it passes the message integrity checks (see 3.1.1.1.3).

If the mobile station retransmits a PDU, the mobile station shall use the same MSG_SEQ number for the retransmission. The mobile station shall not retransmit a PDU sooner than T_{1m} seconds for regular PDUs or *retransmission_timer* seconds (as defined above) for mini PDUs after the previous (re)transmission of the same PDU. The mobile station shall (re)transmit a PDU requiring acknowledgment until the mobile station receives an indication that the PDU was acknowledged, but no more than N_{1m} times for regular PDUs or N_{15m} times for mini PDUs. The mobile station shall declare an acknowledgment failure and may provide an indication to the Upper Layers, to the entities exercising supervisory control, or to both, if any of the following conditions hold:

- If a PDU requiring acknowledgment is not acknowledged after N_{1m} transmissions for a regular PDU or N_{15m} transmissions for a mini PDU, or
- If $RESQ\_ENABLED_s$ is equal to '1', $FPC\_PRI\_CHAN_s$ is equal to '0'and a PDU requiring acknowledgment is not acknowledged after $RESQ\_NUM\_TOT\_TRANS\_20MS_s$ transmissions for a regular PDU or $RESQ\_NUM\_TOT\_TRANS\_5MS_s$ transmissions for a mini PDU.

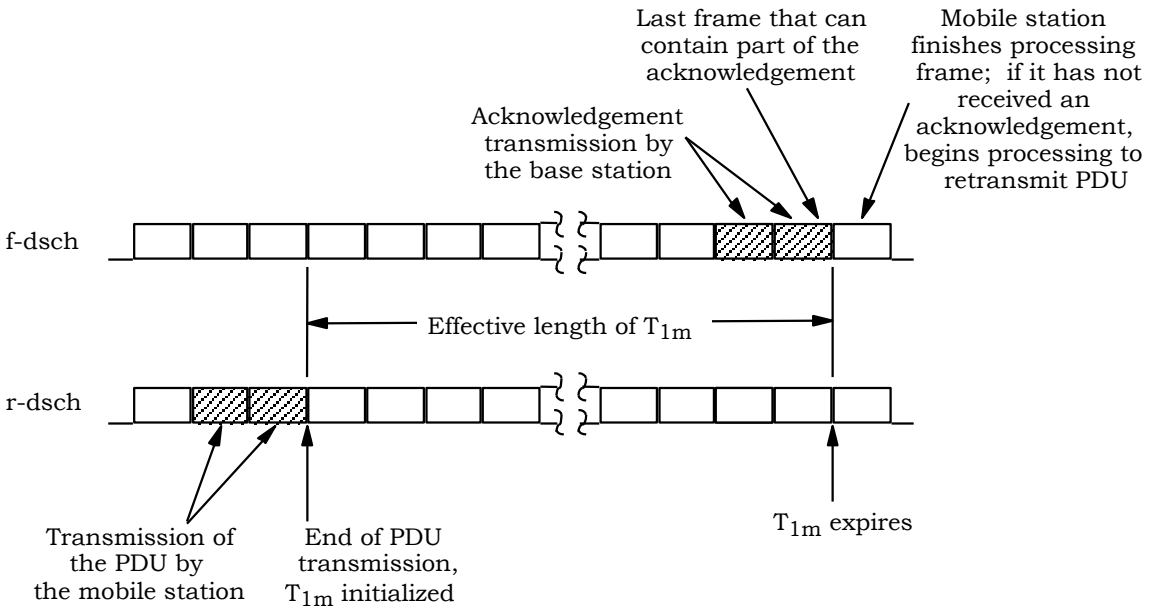

Figure 2.2.1.1.2.2-1. Time Limit for Retransmission of PDUs on r-dsch

If the mobile station receives an indication that the transmission of an acknowledgment for a received PDU is requested, the mobile station shall issue an acknowledgment within T_{2m} seconds for regular PDUs or within T_{76m} seconds for mini PDUs (see Figure 2.2.1.1.2.2-2; only T_{2m} is shown), as follows:

- The mobile station shall acknowledge a regular PDU requiring acknowledgment by transmitting a regular PDU. The mobile station shall acknowledge a mini PDU requiring acknowledgment by transmitting a mini PDU.
- If the mobile station needs to acknowledge a regular PDU and either has or receives an indication that no regular SDUs are to be transmitted within T_{2m} seconds of receiving the PDU being acknowledged, the mobile station shall generate and transmit a regular PDU carrying an SDU which has the following format (to be sent as an *Order Message*):[37]

Field	Length (bits)
ORDER = '010000'	6
ADD_RECORD_LEN = '000'	3

The mobile station shall set the ACK_REQ field in the generated PDU to '0' and shall set the ACK_SEQ field in the generated PDU as specified in 2.2.1.1.1.2.

- If the mobile station needs to acknowledge a mini PDU and either has or receives an indication that no mini SDUs are to be transmitted within T_{76m} seconds of receiving the PDU being acknowledged, the mobile station shall generate and transmit a mini PDU carrying an SDU which has the following format (to be sent as an *Acknowledgment PDU*):

Field	Length (bits)
RESERVED = '0000000000000'	13

The mobile station shall set the ACK_SEQ field in the generated PDU as specified in 2.2.1.1.1.2.

- Otherwise, the mobile station shall either generate and transmit a PDU with its fields set as described above or shall use an existing PDU carrying an Upper Layer SDU as the PDU to be transmitted and shall set the ACK_SEQ field as specified in 2.2.1.1.1.2.

[37] In [11], this "acknowledgment-specific" PDU is referred to as the *Mobile Station Acknowledgement Order*.

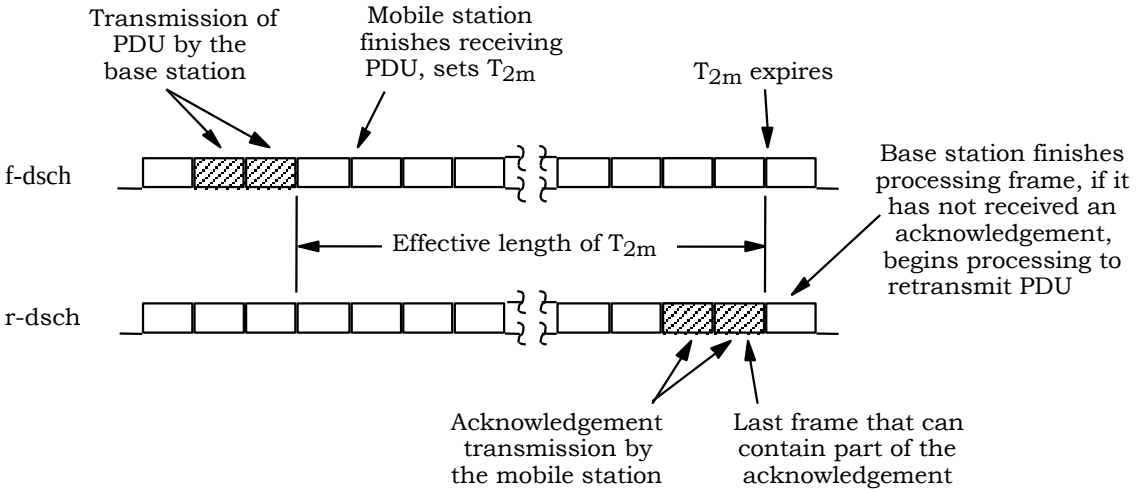

Figure 2.2.1.1.2.2-2. Time Limit for Acknowledgment of PDUs on f-dsch

The mobile station may send an order to reset the ARQ parameters on the base station side via a mini PDU carrying an SDU which has the following format (to be sent as a *Reset PDU*):

Field	Length (bits)
RESERVED = '0000000000000'	13

If the mobile station is instructed to perform a reset for both regular and mini PDUs, the mobile station shall:

- Reset its retransmission count for each PDU that is awaiting acknowledgment.
- Set $MSG\_SEQ\_ACK_S$, $M\_MSG\_SEQ\_ACK_S$, $MSG\_SEQ\_NOACK_S$ and $M\_MSG\_SEQ\_NOACK_S$ to '0'.
- Discard each of the pending requests for acknowledgment for PDUs received on the f-dsch.

If the mobile station is instructed to perform a reset for mini PDUs only, the mobile station shall:

- Reset its retransmission count for each mini PDU that is awaiting acknowledgment.
- Set $M\_MSG\_SEQ\_ACK_S$ and $M\_MSG\_SEQ\_NOACK_S$ to '0'.
- Discard each of the pending requests for acknowledgment for mini PDUs received on the f-dsch.

After completing the reset for the specified type of PDUs, the mobile station should resume normal operation, starting with the transmission of the PDUs of the specified type that were awaiting acknowledgment at the time the reset disposition was received. Further requirements for the processing of a reset request by the mobile station are given in 2.2.2.1.2.2.

2.2.1.1.3 Accumulated ARQ Statistics

The mobile station shall maintain the counters shown in Table 2.2.1.1.3-1 and Table 2.2.1.1.3-2. Each counter shall be 16 bits long. The mobile station shall initialize each counter described herein to zero upon power-up; the mobile station shall not re-initialize any counter described herein at any other time except upon command from the base station. Each counter shall be maintained modulo 2^{16}.

When the mobile station transmits a regular PDU or a mini PDU on the r-dsch requiring an acknowledgment for the i^{th} time, for i equals one to three, it shall increment the counter LAYER2_RTCi or the counter MM_RTCi, respectively.

The mobile station shall increment the counter LAYER2_RTC4 or the counter MM_RTC4 each time it aborts using the r-dsch because the timeout expired after the $N_{1m}{}^{th}$ transmission of a regular PDU or the $N_{15m}{}^{th}$ transmission of a mini PDU, respectively, requiring an acknowledgment.

The mobile station shall increment the counter LAYER2_RTC5 or the counter MM_RTC5 for each transmission of a regular PDU or a mini PDU, respectively, not requiring an acknowledgment on the r-dsch. This count shall include all transmissions, including those that were repeated multiple times or those carrying an identical SDU.

Table 2.2.1.1.3-1. Accumulated ARQ Statistics for Regular PDUs

Counter Identifier	Description
LAYER2_RTC1	Number of regular PDUs requiring acknowledgment that were transmitted at least once on the r-dsch
LAYER2_RTC2	Number of regular PDUs requiring acknowledgment that were transmitted at least twice on the r-dsch
LAYER2_RTC3	Number of regular PDUs requiring acknowledgment that were transmitted at least three times on the r-dsch
LAYER2_RTC4	Number of times that the mobile station dropped the r-dsch as a result of the timeout expiring after the $N_{1m}{}^{th}$ transmission of a regular PDU requiring acknowledgment
LAYER2_RTC5	Number of times a regular PDU not requiring an acknowledgment was sent on the r-dsch

Table 2.2.1.1.3-2. Accumulated ARQ Statistics for Mini PDUs

Counter Identifier	Description
MM_RTC1	Number of mini PDUs requiring acknowledgment that were transmitted at least once on the r-dsch
MM_RTC2	Number of mini PDUs requiring acknowledgment that were transmitted at least twice on the r-dsch
MM_RTC3	Number of mini PDUs requiring acknowledgment that were transmitted at least three times on the r-dsch
MM_RTC4	Number of times that the mobile station dropped the r-dsch as a result of the timeout expiring after the N_{15m}^{th} transmission of a mini PDU requiring acknowledgment
MM_RTC5	Number of times a mini PDU not requiring an acknowledgment was sent on the r-dsch

2.2.1.2 Utility Sublayer

2.2.1.2.1 Parameters

The mobile station shall use the fields defined in 2.2.1.2.1.1 to support message type identification parameters, encryption parameters, and padding for PDUs transmitted on the r-dsch. The mobile station shall set these fields according to the requirements in 2.2.1.2.1.2.

2.2.1.2.1.1 Definition of Utility Sublayer Fields

The message type field for PDUs transmitted on the r-dsch has the following format:

Field	Length (bits)
MSG_TYPE	3, 6 or 8

MSG_TYPE - Message type indicator.

This field contains the message type indicator for regular PDUs (8 bits) or mini PDUs (3 or 6 bits) sent on the r-dsch.

A regular PDU transmitted on the r-dsch includes the Encryption field and may include the Extended-Encryption Fields, based upon $P\_REV\_IN\_USE_s$ and the current encryption mode (see 2.2.1.2.1.2).

The Encryption field for regular PDUs transmitted on the r-dsch has the following format:

Field	Length (bits)
ENCRYPTION	2

ENCRYPTION – Message encryption indicator.

The Extended-Encryption Fields for regular PDUs transmitted on the r-dsch have the following format:

Field	Length (bits)
SDU_ENCRYPT_MODE	0 or 3
ENC_SEQ	0 or 8

SDU_ENCRYPT_MODE – Signaling encryption mode in use for the SDU carried by this PDU.

ENC_SEQ – The eight least significant bits of the encryption sequence number used to construct a cryptographic synchronization crypto-sync (see [5]) for the encryption algorithm.

The PDU padding field for PDUs transmitted on the r-dsch has the following format:

Field	Length (bits)
PDU_PADDING	0 - 7

PDU_PADDING – Padding bits.

The MACI field for PDUs transmitted on the r-dsch has the following format:

Field	Length (bits)
MACI	0 or 32

MACI – Message Authentication Code for Integrity.

2.2.1.2.1.2 Requirements for Setting Utility Sublayer Fields

The mobile station shall set the MSG_TYPE field of regular PDUs as shown in Table 2.2.1.2.1.2-1.

Table 2.2.1.2.1.2-1. MSG_TYPE Values for Regular PDUs on r-dsch (part 1 of 2)

Message Name	MSG_TAG	MSG_TYPE (binary)
Order Message	ORDM	00000001
Authentication Challenge Response Message	AUCRM	00000010
Flash With Information	FWIM	00000011
Data Burst Message	DBM	00000100
Pilot Strength Measurement Message	PSMM	00000101
Power Measurement Report Message	PMRM	00000110
Send Burst DTMF Message	BDTMFM	00000111
Status Message	STM	00001000
Origination Continuation Message	ORCM	00001001
Handoff Completion Message	HOCM	00001010
Parameters Response Message	PRSM	00001011
Service Request Message	SRQM	00001100
Service Response Message	SRPM	00001101
Service Connect Completion Message	SCCM	00001110
Service Option Control Message	SOCM	00001111
Status Response Message	STRPM	00010000
TMSI Assignment Completion Message	TACM	00010001
Supplemental Channel Request Message	SCRM	00010010
Candidate Frequency Search Response Message	CFSRSM	00010011
Candidate Frequency Search Report Message	CFSRPM	00010100
Periodic Pilot Strength Measurement Message	PPSMM	00010101
Outer Loop Report Message	OLRM	00010110
Resource Request Message	RRM	00010111
Extended Release Response Message	ERRM	00011000
Reserved	N/A	00011001

Table 2.2.1.2.1.2-1. MSG_TYPE Values for Regular PDUs on r-dsch (part 2 of 2)

Message Name	MSG_TAG	MSG_TYPE (binary)
Enhanced Origination Message	EOM	00011010
Extended Flash With Information Message	EFWIM	00011011
Extended Pilot Strength Measurement Message	EPSMM	00011100
Extended Handoff Completion Message	EHOCM	00011101
Resource Release Request Message	RRRM	00011110
Security Mode Request Message	SMRM	00011111
Data Burst Response Message (DS-41 only, see [13])	DBRM	00100000
DS-41 Inter-system Transfer Message (DS-41 only, see [13])	D41ISTM	00100001
User Zone Update Request Message	UZURM	00100010
Call Cancel Message	CLCM	00100011
Device Information Message	DIM	00100100
MC-MAP Initial L3 Message (MC-MAP only, see [14])	MAPIL3M	00100101
MC-MAP L3 Message (MC-MAP only, see [14])	MAPL3M	00100110
R-TMSI Assignment Completion Message (MC-MAP only, see [14])	RTACM	00100111
Base Station Status Request Message	BSSREQM	00101000
CDMA Offtime Report Message	COTRM	00101001
Authentication Resynchronization Message	AURSYNM	00101010
Authentication Response Message	AURSPM	00101011
ITBSPM Request Message	ITBSPMRM	00101100
Handoff Supplementary Information Notification Message	HOSINM	00101101
General Extension Message	GEM	11111111

The mobile station shall set the MSG_TYPE field of mini PDUs as shown in Tables 2.2.1.2.1.2-2 and 2.2.1.2.1.2-3.

Table 2.2.1.2.1.2-2. MSG_TYPE Values (3 bits) for Mini PDUs on r-dsch

Message Name	MSG_TAG	MSG_TYPE (binary)
Pilot Strength Measurement Mini Message	PSMMM	000
Supplemental Channel Request Mini Message	SCRMM	001
Reserved	N/A	010

Table 2.2.1.2.1.2-3. MSG_TYPE Values (6 bits) for Mini PDUs on r-dsch

Message Name	MSG_TAG	MSG_TYPE (binary)
Acknowledgment PDU	ACK	111000
Reset PDU	RESET	111001
Resource Request Mini Message	RRMM	111010
Extended Release Response Mini Message	ERRMM	111011
Resource Release Request Mini Message	RRRMM	111100

The mobile station shall set the ENCRYPTION field to the current encryption mode for regular PDUs to be transmitted on the r-dsch (see [5]). The mobile station shall not change the value of this field and the encryption state of the SDU carried by the PDU if the PDU is retransmitted.

If $P\_REV\_IN\_USE_S$ is greater than or equal to seven and the ENCRYPTION field is set to '11', the mobile station shall include the Extended-Encryption Fields; otherwise, these fields shall be omitted.

If the Extended-Encryption Fields are included, the mobile station shall set the Extended-Encryption Fields as follows:

- The mobile station shall set the SDU_ENCRYPT_MODE field to the signaling encryption mode that is used for the SDU carried by this PDU and is provided by Layer 3.
- If the SDU_ENCRYPT_MODE field is set to '001' or '010' and if the MACI_INCL field is not present in the PDU or it is present, but it is equal to '0', the mobile station shall include the ENC_SEQ field and shall set it to the value provided by Layer 3; otherwise, the mobile station shall omit the ENC_SEQ field.

The mobile station shall not change the value of the Extended-Encryption Fields and the encryption state of the SDU carried by the PDU if the PDU is retransmitted.

The mobile station shall set the PDU_PADDING field to contain the minimum number of bits needed to make the length of the PDU, in bits, an integral multiple of eight. The mobile station shall set these bits to '0'.

The mobile station shall include the MACI field, if and only if the MACI_INCL field in the transmitted PDU is included and is equal to '1'; otherwise, the mobile station shall omit the MACI field. If the MACI field is included, the mobile station shall set this field as follows: the mobile station shall execute the procedure described in 2.2.1.2.2. If USE_UAK_S is equal to '0', the mobile station shall set the MACI field to MAC-I. Otherwise, the mobile station shall set the MACI field to the UMAC value.

The mobile station shall not change the values of the MACI field and the Message Integrity Fields of the PDU, if the PDU is retransmitted.

2.2.1.2.2 Procedures

When sending regular PDUs on the r-dsch, the mobile station shall set the parameters defined in 2.2.1.2.1.1 according to the requirements specified in 2.2.1.2.1.2.

The format of a regular PDU sent to the MAC Sublayer for transmission on the r-dsch depends upon the protocol capabilities of both the mobile station and the base station, as well as on the value of the ENCRYPTION field (see 2.2.1.2.1.2).

If $P\_REV\_IN\_USE_S$ is less than nine, the mobile station shall assemble regular PDUs for the r-dsch using the following format:

Parameter	**Reference**
Message Type Field	Section 2.2.1.2.1.1
ARQ Fields	Section 2.2.1.1.1.1
Encryption Field	Section 2.2.1.2.1.1
Extended-Encryption Fields	Section 2.2.1.2.1.1
SDU	[5]
PDU Padding Field	Section 2.2.1.2.1.1

If $P\_REV\_IN\_USE_S$ is greater than or equal to nine, the mobile station shall assemble regular PDUs for the r-dsch using the following format:

Parameter	Reference
Message Type Field	Section 2.2.1.2.1.1
ARQ Fields	Section 2.2.1.1.1.1
Encryption Field	Section 2.2.1.2.1.1
Message Integrity Fields[38]	Section 2.1.1.1.1.1
Extended-Encryption Fields	Section 2.2.1.2.1.1
SDU	[5]
PDU Padding Field	Section 2.2.1.2.1.1
Message Authentication Code for Integrity (MACI) Field	Section 2.2.1.2.1.1

If the MACI field is included in the PDU, the mobile station shall proceed as follows:

- The mobile station shall compute MSG_LENGTH as described 2.1.1.3.1.2.
- The mobile station shall set *msg_length* to MSG_LENGTH and shall consider the length of the *msg_length* parameter to be 8 bits.
- The mobile station shall set *channel_specific_buffer* as described in 2.2.1.4.2 and shall invoke the procedure for computing the MAC-I value described in 2.1.1.1.2.5, with the *channel_specific_buffer*, *msg_length* and the non-encapsulated PDU without the MACI field, as parameters.
- If USE_UAK_S is equal to '1', the mobile station shall invoke the procedure for computing the UMAC value described in 2.1.1.1.2.6, with the computed MAC-I as input parameter.
- The mobile station shall use the values MAC-I or UMAC, if computed, to set the MACI field as described in 2.2.1.2.1.2.

When sending mini PDUs on the r-dsch, the mobile station shall assemble the mini PDU using the following format:

Parameter	Reference
ARQ Fields	Section 2.2.1.1.1.1
Message Type Field	Section 2.2.1.2.1.1
SDU	[5]
PDU Padding Field	Section 2.2.1.2.1.1

[38] The Message Integrity Fields are MACI_INCL, SDU_KEY_ID, SDU_INTEGRITY_ALGO, SDU_SSEQ_OR_SSEQH, SDU_SSEQ and SDU_SSEQ_H.

The mobile station shall not assemble and transmit regular PDUs larger than 2016 bits. The mobile station shall not assemble and transmit mini PDUs larger than 24 bits.

2.2.1.3 Segmentation and Reassembly (SAR) Sublayer

2.2.1.3.1 Parameters

The mobile station shall use the SAR parameters defined in 2.2.1.3.1.1 for PDUs transmitted on the r-dsch. The mobile station shall set the SAR parameters according to the requirements specified in 2.2.1.3.1.2.

2.2.1.3.1.1 Definition of SAR Parameters

The SAR parameters for regular PDUs transmitted on the r-dsch have the following format:

Field	Length (bits)
MSG_LENGTH	8

MSG_LENGTH – Length of the PDU in octets.

Field	Length (bits)
CRC	16

CRC - Cyclic Redundancy Check for the PDU.

A regular PDU transmitted on the r-dsch includes SOM field .

Field	Length (bits)
SOM	1

SOM - Start of Message indicator, for each encapsulated PDU fragment.

There are no SAR parameters defined for mini PDUs.

2.2.1.3.1.2 Requirements for Setting SAR Parameters

If the LAC PDU is a regular PDU, the MSG_LENGTH field shall be eight bits long and shall be set to (size of LAC PDU in bits + 24) / 8.

The 16-bit value of the CRC shall be computed over the MSG_LENGTH parameter and the LAC PDU, in this order. The generator polynomial for the CRC shall be as follows:

$$g(x) = x^{16} + x^{12} + x^5 + 1.$$

The following procedure and the logic shown in Figure 2.1.1.3.1.2-1 shall be used to compute the CRC:

- All shift register elements shall be initialized to logical one.[39]
- The switches shall be set in the up position.
- The information bit count k shall be defined as eight plus the size of the LAC PDU in bits.
- The register shall be clocked k times for the k information bits.
- The switches shall be set in the down position so that the output is a modulo-2 addition with a '1' and the successive shift register inputs are '0'.
- The register shall be clocked an additional 16 times.
- The 16 additional output bits shall be the CRC value.

The CRC parameter shall be set to the CRC value in such a way that its bits are transmitted in the order in which they appeared at the output of the CRC encoder.

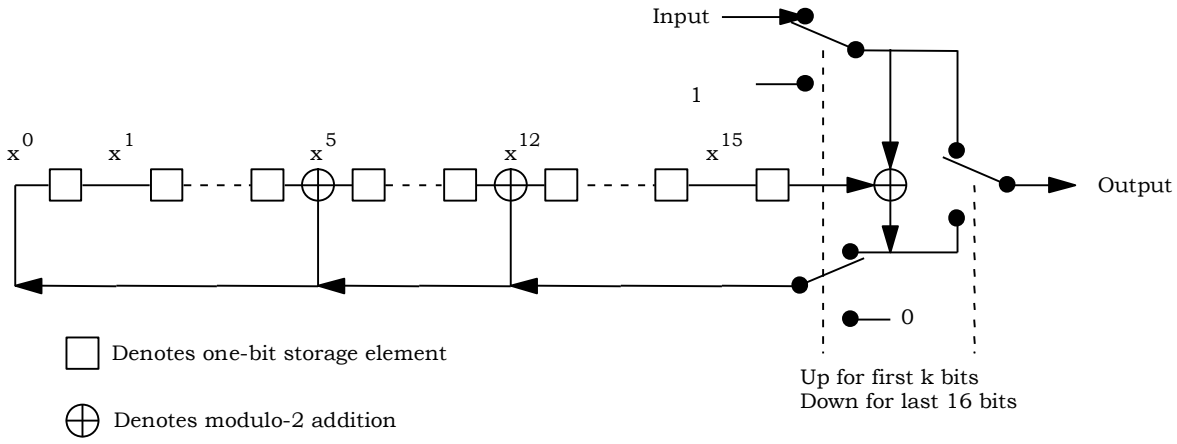

Figure 2.2.1.3.1.2-1. The 16-bit CRC Calculation

The mobile station shall set the SOM field as follows:

- The SOM field shall be set to '1' in the frame carrying the first encapsulated PDU fragment (corresponding to the MSG_LENGTH parameter and the beginning of the PDU).

[39] Initialization of the register to ones causes the CRC for all-zero data to be non-zero.

- The SOM field shall be set to '0' in all subsequent frames that carry encapsulated PDU fragments.

2.2.1.3.2 Procedures

The mobile station shall set the SAR parameters as specified in 2.2.1.3.1.2. The mobile station shall assemble an encapsulated PDU from the SAR parameters and the PDU by concatenating them in the following order:

- If the PDU is a regular PDU, the MSG_LENGTH parameter, starting with the most significant bit.
- The PDU, starting with the most significant bit of the MSG_TYPE field.
- The CRC parameter (for regular PDUs only), starting with the bit that appeared first at the output of the CRC encoder.

The mobile station shall segment the encapsulated regular PDU into fragments of maximum available size necessary to fit in a Lower Layer transport unit, except for the last fragment, which may be shorter. The mobile station shall transmit the encapsulated PDU fragments in order. Before transmitting an encapsulated PDU fragment of an encapsulated regular PDU, the mobile station shall transmit the SOM parameter associated with it.

Unless transmission of an encapsulated PDU is to be canceled, the mobile station shall not transmit encapsulated PDU fragments from a new encapsulated regular PDU until all fragments of the previous encapsulated regular PDU have been transmitted (i.e., interleaving fragments from different regular PDUs is not permitted). Encapsulated PDU fragments of a regular PDU may be interleaved with mini PDUs.

2.2.1.4 Message Integrity Sublayer

2.2.1.4.1 Parameters

The mobile station shall use and set the Message Integrity Fields[40] specified in 2.1.1.1.1.1 according to the procedures in 2.2.1.4.2 and 2.1.1.1.1.3.

2.2.1.4.2 Procedures

Mobile stations with MOB_P_REV greater than or equal to ten shall support message integrity on r-dsch.

The mobile station shall set *channel_specific_buffer* to the 2 bits corresponding to "ACK_REQ |'1'", where ACK_REQ is set to '0', if the message is to be sent in unassured mode or to '1', if the message is to be sent in assured mode, where the most significant bit of the *channel_specific_buffer* corresponds to the ACK_REQ bit.

---

[40] Except where explicitly specified otherwise (see 2.2.1.4.2), for regular PDUs transmitted on r-dsch, the mobile station uses the same Message Integrity Fields and the same procedures for inclusion and setting of values for these fields as it does when transmitting PDUs on r-csch.

When the mobile station executes the procedure for setting up the MACI field (see 2.2.1.2.2), the *channel_specific_buffer* shall be passed as input parameter to that procedure.

2.2.2 Reception on f-dsch

The mobile station shall meet the requirements specified in 2.2.2.3.2, 2.2.2.4.2, 2.2.2.2.2 and 2.2.2.1.2.2.

If a received PDU is not expected to be message integrity protected (see [5]), but contains a MACI_INCL field equal to '1', the mobile station shall ignore the Message Integrity Fields and the MACI field in the received PDU.

2.2.2.1 ARQ Sublayer

2.2.2.1.1 Parameters

To support the ARQ mechanism on the dedicated channels, the mobile station interprets the ARQ fields defined in 3.2.2.1.1.1 for PDUs received on the f-dsch.

2.2.2.1.2 Procedures

2.2.2.1.2.1 Overview of Reception Procedures

The mobile station removes the ARQ fields from PDUs received on the f-dsch and passes the remainder of the PDU (which generally includes the SDU) to the Upper Layers.

When the ARQ Sublayer on the receiver side receives a PDU, it provides an indication to the ARQ Sublayer on the transmitter side (see 2.2.1.1.2.1) of the acknowledgment of a previously transmitted PDU with the MSG_SEQ field equal to the ACK_SEQ field of the received PDU.

The ARQ Sublayer performs duplicate detection for received PDUs that require acknowledgment as well as for PDUs that do not require acknowledgment, using slightly different mechanisms. For PDUs requiring acknowledgment, the ARQ Sublayer uses received status indicators. For PDUs not requiring acknowledgment, the ARQ Sublayer uses a timer to delineate the interval during which PDUs with the same MSG_SEQ fields are considered duplicates. Duplicates of PDUs requiring acknowledgment are acknowledged (see below) and then discarded. Duplicates of PDU not requiring acknowledgment are discarded.

When the ARQ Sublayer on the receiver side receives a PDU with the ACK_REQ field set to '1', it provides an indication to the ARQ Sublayer on the transmitter side, amounting to a request for the transmission of an acknowledgment. The MSG_SEQ field of the received PDU and the time of reception are also provided to the ARQ Sublayer on the transmitter side (see 2.2.1.1.2.1).

Following the reception of an *acquiring dedicated channel* indication from Layer 3 (see 2.6.4.2 of [5]), the ARQ Sublayer considers the reception of the first valid PDU on the f-dsch as a signal that the dedicated signaling channel was properly established and further signaling can proceed. When that happens, the ARQ Sublayer sends a *forward dedicated*

channel acquired indication to Layer 3 (see 2.6.4.2 of [5]) signaling that the connection with the base station was established.

The ARQ Sublayer for dedicated channels can be reset locally, under dispositions from Layer 3 or the managing entity in the control plane, and can also be reset upon the reception of a *Reset PDU* by the LAC Sublayer (for mini PDUs only, see Table 3.2.2.2.1.2-3).

The ARQ Sublayer is reset simultaneously on the receiver and the transmitter sides. In such cases, the information needed to perform duplicate detection and the pending requests for acknowledgment are discarded.

2.2.2.1.2.2 Requirements for Reception Procedures

The mobile station shall process PDUs received on the f-dsch.

Except for PDUs associated with emergency calls, the mobile station should not process the ARQ fields and ARQ variables if the received PDU is expected to be message integrity protected (see [5]), but the Message Integrity Fields and the MACI field are either not included or fail the message integrity check (see 3.1.1.1.3). Otherwise:

When a PDU is received on the f-dsch with the ACK_REQ field set to '1', the mobile station shall recognize it as a request for acknowledgment. See 2.2.1.1.1.2 for requirements on the processing of requests for acknowledgment.

When a PDU is received on the f-dsch, the mobile station shall recognize it as including an acknowledgment for a previously transmitted PDU if the ACK_SEQ field of the received PDU matches the MSG_SEQ field of a previously transmitted PDU. See 2.2.1.1.1.2 for requirements on the processing of a PDU after being acknowledged.

The mobile station may ignore received acknowledgments for PDUs that were not sent or are not awaiting acknowledgment, except immediately after the reception of an *acquiring dedicated channel* indication from Layer 3. After receiving an *acquiring dedicated channel* indication, the mobile station shall consider the reception of the first valid PDU as a signal that the dedicated channel was successfully acquired, and shall send a *forward dedicated channel acquired* indication to Layer 3.

For the detection of duplicate PDUs requiring acknowledgment, the mobile station shall store a received status indicator for each possible value of the regular PDU MSG_SEQ field (MSG_SEQ_RCVD[n], for n equal to 0 through 7) and the mini PDU MSG_SEQ field (M_MSG_SEQ_RCVD[n], for n equal to 0 through 3). Duplicate detection is performed independently for regular PDUs and for mini PDUs.[41] The mobile station shall perform the following procedures:

[41] A regular PDU and a mini PDU cannot be duplicates of one another.

- When a PDU requiring acknowledgment is received having the message sequence number field MSG_SEQ, and MSG_SEQ_RCVD[MSG_SEQ] (for a regular PDU) or M_MSG_SEQ_RCVD[MSG_SEQ] (for a mini PDU) is equal to NO, the mobile station shall process the PDU as a new PDU. The mobile station shall then set MSG_SEQ_RCVD[MSG_SEQ] (for a regular PDU) or M_MSG_SEQ_RCVD[MSG_SEQ] (for a mini PDU) to YES, and shall set MSG_SEQ_RCVD[(MSG_SEQ + 4) modulo 8] (for a regular PDU) or M_MSG_SEQ_RCVD[(MSG_SEQ + 2) modulo 4] (for a mini PDU) to NO.
- When a PDU requiring acknowledgment is received having the message sequence number field MSG_SEQ, and MSG_SEQ_RCVD[MSG_SEQ] (for a regular PDU) or M_MSG_SEQ_RCVD[MSG_SEQ] (for a mini PDU) is equal to YES, the mobile station shall acknowledge the PDU and then discard it.

For the detection of duplicate PDUs not requiring acknowledgment, the mobile station shall consider all PDUs having the same MSG_SEQ field received within an interval of T_{3m} seconds for regular PDUs or within an interval of T_{77m} seconds for mini PDUs to be duplicates (see Figure 2.2.2.1.2.2-1; only T_{3m} is shown). If the mobile station receives multiple copies of the same PDU, it shall discard the duplicate copies.

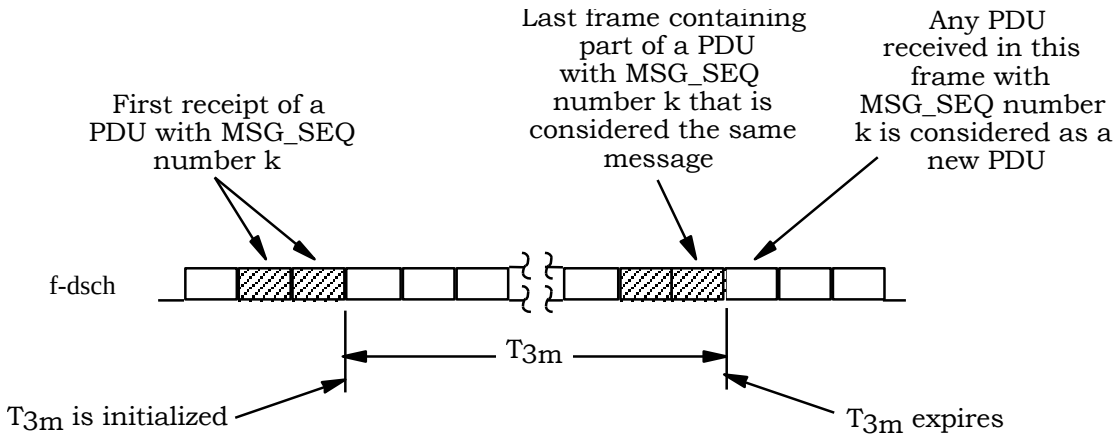

Figure 2.2.2.1.2.2-1. Time Window for Detecting Duplicate Messages not Requiring Acknowledgment

When processing a reset request for both regular PDUs and mini PDUs, the mobile station shall set MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 7 and shall set M_MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 3. When processing a reset request for mini PDUs only, the mobile station shall set M_MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 3. Further requirements for the processing of a reset request by the mobile station are given in 2.2.1.1.1.2.

2.2.2.2 Utility Sublayer

2.2.2.2.1 Parameters

The mobile station shall use the fields defined in 3.2.2.2.1.1 for PDUs received on the f-dsch.

2.2.2.2.2 Procedures

The mobile station shall identify the SDU carried by the received PDU as shown in Table 3.2.2.2.1.2-1 for regular PDUs or in Table 3.2.2.2.1.2-2 or 3.2.2.2.1.2-3 for mini PDUs received on the f-dsch. If identification is not possible, the mobile station shall discard the PDU without further processing.

If the mobile station receives a valid PDU, the LAC Sublayer shall make the SDU included in the PDU available to Layer 3, together with the Encryption field and the Extended-Encryption Fields, if any (see 3.1.2.3.1.3.1).

2.2.2.3 Segmentation and Reassembly (SAR) Sublayer

2.2.2.3.1 Parameters

The mobile station shall use the parameters defined in 3.2.2.3.1.1 for PDUs received on the f-dsch.

2.2.2.3.2 Procedures

The mobile station shall assemble regular PDUs[42] from encapsulated PDU fragments received on the f-dsch using the following procedure:

- A reassembly buffer large enough to accommodate the largest possible encapsulated PDU shall be available. The reassembly buffer shall be emptied whenever a *reset* indication is received.
- When an encapsulated PDU fragment is received:
  - If the SOM parameter is equal to '1':
    + The current contents of the reassembly buffer, if any, shall be discarded (the reassembly buffer becomes empty).
    + The encapsulated PDU fragment (which corresponds to the beginning of a PDU) shall be placed in the buffer (without the SOM parameter). The first eight bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than three, the reassembly buffer shall be emptied.

[42] Since mini PDUs are not fragmented, no reassembly procedures are defined for mini PDUs.

- If the SOM parameter is equal to '0':
  - + If the reassembly buffer is empty, the encapsulated PDU fragment shall be discarded.
  - + If the reassembly buffer is not empty, the encapsulated PDU fragment (which corresponds to a subsequent part of the PDU being received) shall be appended to the contents of the reassembly buffer (without the SOM parameter).
- – If the reassembly buffer is not empty and if there are at least MSG_LENGTH octets in the buffer, the data representing the first (MSG_LENGTH – 2) octets in the buffer shall be run through the 16-bit CRC computation specified in 3.2.2.3.1.2. The result of the computation shall be compared with the 16-bits located in the reassembly buffer after the first (MSG_LENGTH - 2) octets and the following actions shall be taken:
  - + If the computed CRC is equal to the received CRC, the PDU is considered to have been correctly received and reassembled.
  - + If the computed CRC is not equal to the received CRC, the contents of the reassembly buffer shall be discarded (the buffer becomes empty).

2.2.2.4 Message Integrity Sublayer

If the mobile station supports message integrity (MSG_INTEGRITY_SUP$_S$ is equal to '1'), the mobile station shall process the Message Integrity Fields and the MACI field of regular PDUs received on f-dsch as specified in 2.2.2.4.1 and 2.2.2.4.2.

2.2.2.4.1 Parameters

The mobile station uses and interprets the Message Integrity Fields defined in 2.1.1.1.1.1 and the MACI field for regular PDUs received on the f-dsch[43].

2.2.2.4.2 Procedures

If the received regular PDU contains Message Integrity Fields and the MACI field and the mobile station operates at a protocol revision equal to ten or higher, the mobile station shall perform the procedures[44] specified in 3.1.1.1.3.

[43] When receiving on the f-dsch, the mobile station uses the same Message Integrity Fields as when transmitting on r-csch.

[44] When receiving on the f-dsch, the mobile station uses the same message integrity procedures as the base station does when receiving on r-csch.

3 BASE STATION REQUIREMENTS

When operating on common channels, the base station shall meet the requirements specified in 3.1. When operating on dedicated channels the base station shall meet the requirements specified in 3.2.

3.1 Common Channel Operation

The base station shall meet the requirements specified in 3.1.1 for operation on the r-csch and in 3.1.2 for operation on the f-csch.

3.1.1 Reception on r-csch

The base station shall meet the requirements specified in 3.1.1.5.2, 3.1.1.4.2, 3.1.1.3.2, 3.1.1.2.2.2, 3.1.1.1.3, and 3.1.1.1.2.

If a received PDU is not expected to be message integrity protected (see [5]), but contains a MACI_INCL field equal to '1', the base station shall ignore the Message Integrity Fields and the MACI field in the received PDU.

3.1.1.1 Authentication and Message Integrity Sublayer

3.1.1.1.1 Parameters

The base station uses and interprets the authentication and message integrity fields defined in 2.1.1.1.1.1 for PDUs received on the r-csch.

3.1.1.1.2 Authentication Procedures

If the base station supports message integrity and the received PDU carries message integrity fields, the base station shall execute the procedures defined in 3.1.1.1.3.

The base station may be equipped with a database that includes unique mobile station authentication keys, shared secret data, or both, for each registered mobile station in the system. This database is used for authentication of mobile stations that are equipped for authentication operation.

If the base station supports mobile station authentication:

- The base station may compare the COUNT field of the received PDU with its internally stored value associated with the mobile station as identified by IMSI or TMSI.
- The base station shall compare the RANDC field of the PDU to the most significant eight bits of its internally stored value of RAND. If the comparison results in a match:
  - The base station shall perform authentication calculations using IMSI_M if it is programmed for the mobile station; otherwise the base station shall use IMSI_T.

– The base station shall compute the value AUTHR in the same manner that the mobile station does (see 2.1.1.1.2.2), but using its internal stored value SSD_A. The base station shall compare the computed value of AUTHR with the AUTHR field of the received PDU.

- If all of the performed comparisons result in matches, the base station may grant access or service. If any one comparison fails, the base station may deny access or service or may execute other security procedures.

3.1.1.1.3 Message Integrity Procedures

If the received PDU requires message integrity protection (see [5] for information on which PDUs are required to contain the MACI field) and message integrity is supported, the following procedures for the validation of the MACI field included in the PDU shall be performed:

- If the MACI_INCL field is not included or is included but is set to '0', the Layer 3 SDU should be forwarded to Layer 3 with a *message integrity failed* indication, the ARQ fields shall be processed appropriately for this condition (see specifications in the ARQ Sublayer for the channel on which the PDU is received) and the rest of the procedures in this section shall not be performed.
- If the SDU_SSEQ field is included in the received PDU, then:
  - If the ACK_REQ field is set to '0', let $N = 8$; otherwise, let $N = 4$. Let V be the 8 least significant bits of RX_EXT_SSEQ[ACK_REQ][SDU_KEY_ID]. The duplicate and out-of-range detection procedure specified in 3.1.1.1.4 shall be performed using N, V and SDU_SSEQ as parameters, before proceeding further.
  - If the received PDU is considered to contain a duplicate or an out-of-range SDU_SSEQ, based on the result of the procedure described in 3.1.1.1.4, the Layer 3 SDU should be forwarded to Layer 3 with a *message integrity failed* indication, the ARQ fields shall be processed appropriately for this condition (see specifications in the ARQ Sublayer for the channel on which the PDU is received) and the rest of the procedures in this section shall not be performed; otherwise,
  - If (SDU_SSEQ - V) mod 256 is less than 128, EXT_SSEQ shall be set to (RX_EXT_SSEQ[ACK_REQ][SDU_KEY_ID] + (SDU_SSEQ - V) mod 256) mod 2^{32};
  - otherwise, EXT_SSEQ shall be set to (RX_EXT_SSEQ[ACK_REQ][SDU_KEY_ID] - (V – SDU_SSEQ) mod 256) mod 2^{32}.
- Otherwise, if the SDU_SSEQ_H field is included in the received PDU, EXT_SSEQ shall be set[45] to SDU_SSEQ_H * 256.

[45] Crypto-sync duplicate detection is not performed when SDU_SSEQ_H is used.

- The receiver shall set the *channel_specific buffer* and *msg_length* parameters associated with the received PDU and the channel it was received on, in the same manner that the transmitter was required to do when it set those values for the procedures (see specifications in the Integrity Sublayer for the channel on which the received PDU was transmitted) used in the computation of the value for the MACI field. Using also the computed value of EXT_SSEQ and the received non-encapsulated PDU, the receiver shall compute the value for the MACI field (see 2.1.1.1.2.5 and 2.1.1.1.2.6), that it would have associated with the PDU on the respective channel, had it been the transmitter.
- If the computed value for the MACI field is not equal to the value in the MACI field of the received PDU, the Layer 3 SDU should be forwarded to Layer 3 with a *message integrity failed* indication, the ARQ fields shall be processed appropriately for this condition (see specifications in the ARQ Sublayer for the channel on which the PDU is received) and the rest of the procedures in this section shall not be performed; otherwise,
- The Layer 3 SDU may be forwarded to Layer 3 with a *message integrity succeeded* indication and the ARQ fields shall be processed appropriately for this condition (see specifications in the ARQ Sublayer for the channel on which the PDU is received). In addition:
  - If the ENC_FIELDS_INCL field is not included in the received PDU or is included but is equal to '0', and if the SDU_SSEQ field was included in the received PDU, and if ((SDU_SSEQ - *V*) mod 256) is less than 128, the receiver shall set RX_EXT_SSEQ[ACK_REQ][SDU_KEY_ID] to EXT_SSEQ constructed above; otherwise,
  - if the ENC_FIELDS_INCL field is included in the received PDU and is equal to '1', the EXT_SSEQ constructed above and the SDU_ENCRYPT_MODE shall be passed to Layer 3[46].

3.1.1.1.4 Security Sequence Number Duplicate and Out-of-Range Detection (refer also to 2.3.12.4.1.5 in [5])

This procedure is invoked only if message integrity is supported by the receiver and the received PDU specifies the value of the crypto-sync via the SDU_SSEQ field. The procedure accepts as input parameters SDU_SSEQ and the variables *V* and *N* (set as specified in 3.1.1.1.3). The procedure returns an indication of whether or not the value SDU_SSEQ is considered valid.

Given the value of the latest sequence number previously received and accepted, *V*, and the window size, *N*, the 8-bit security sequence number space at the receiver can be divided into the following three segments as shown in Figure 3.1.1.1.4-1:

[46] Layer 3 will also update the RX_EXT_SSEQ array, if necessary (see [5]).

- Segment #1 - sequence numbers from ((*V* - *N* + 1) mod 256) to *V* inclusive (the anti-replay window)
- Segment #2 - sequence numbers from ((*V* + 1) mod 256) to ((*V* + 127) mod 256) inclusive (future sequence numbers)
- Segment #3 - sequence numbers from ((*V* + 128) mod 256) to ((*V* - *N*) mod 256) inclusive (past sequence numbers)

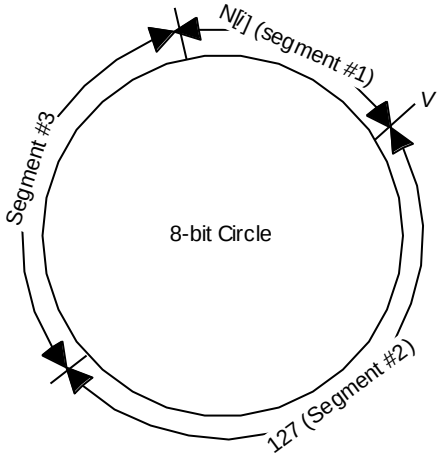

Figure 3.1.1.1.4-1 The 8-bit security sequence number space divided into 3 segments

If the received sequence number, SDU_SSEQ, belongs to segment #1, the receiver shall check whether a PDU having the same SDU_SSEQ has already been received successfully during the most recent time interval that SDU_SSEQ has been part of segment #1. If the SDU_SSEQ corresponds to a value that is considered to have been received already, the SDU_SSEQ shall be considered a duplicate.

If the received sequence number, SDU_SSEQ, belongs to segment #2, the SDU_SSEQ shall be considered valid and the value of SDU_SSEQ shall be considered as “already received and accepted”, to be used for duplicate detection at further invocations of the procedure.

If the received sequence number, SDU_SSEQ, belongs to segment #3 the SDU_SSEQ shall be considered out-of-range.

3.1.1.2 ARQ Sublayer

3.1.1.2.1 Parameters

The base station interprets the ARQ fields defined in 2.1.1.2.1.1 for PDUs received on the r-csch.

3.1.1.2.2 Procedures

3.1.1.2.2.1 Overview of Reception Procedures

The ARQ Sublayer removes the ARQ fields in the PDUs received on the r-csch and passes the remainder of the PDU (which generally includes the SDU) to the Upper Layers.

When the ARQ Sublayer on the receiver side receives a PDU with the ACK_REQ field set to '1', it provides an indication to the ARQ Sublayer on the transmitter side. The MSG_SEQ field of the received PDU and the time of reception are also provided to the ARQ Sublayer on the transmitter side (see 3.1.2.1.2.1).

When the ARQ Sublayer on the receiver side receives a PDU with the VALID_ACK field set to '1', it provides an indication to the ARQ Sublayer on the transmitter side (see 3.1.2.1.2.1) together with the ACK_SEQ and ACK_TYPE fields of the received PDU.

When the ARQ Sublayer receives a *mobile station inactive on common channel* indication from Layer 3 (see 3.6.3 of [5]), it considers the mobile station to be no longer active on the r-csch. The ARQ Sublayer uses this information to process PDUs (see 3.1.1.2.2.2).

The ARQ Sublayer performs duplicate detection by using the MSG_SEQ field of the received PDUs. In the case where a duplicate is detected the ARQ Sublayer processes the PDU like any other, but raises an indication to the Upper Layers specifying that the PDU is a duplicate (see 3.1.1.2.2.2).

3.1.1.2.2.2 Requirements for the Reception Procedures

Except for PDUs associated with emergency calls, the base station should not process the ARQ fields and ARQ variables if the received PDU is expected to be message integrity protected (see [5]), but the Message Integrity Fields and the MACI field are either not included or fail the message integrity check (see 3.1.1.1.3). Otherwise:

When receiving a PDU on the r-csch with the ACK_REQ field set to '1', the base station shall recognize it as a request for acknowledgment. See 3.1.2.1.2.2 for requirements on the processing of a request for acknowledgment.

When receiving a PDU on the r-csch with the VALID_ACK field set to '1', the base station shall use the ACK_TYPE and ACK_SEQ fields of the received PDU to identify the PDU being acknowledged. See 3.1.2.1.2.2 for requirements on the processing of a PDU after being acknowledged. If the base station receives an acknowledgment for a PDU that was transmitted on more than one channel (e.g., the Paging Channel and the Forward Common Control Channel), the base station shall consider the PDU to have been acknowledged for all the channels on which the PDU was transmitted.

If the base station performs duplicate detection using r-csch message sequence numbers, it should use the following procedures: The base station should store, for each mobile station that is active on the r-csch, a received status indicator for each possible value of the r-csch PDU MSG_SEQ field for assured mode (MSG_SEQ_RCVD[n], where n has a value from 0 to 7).

The base station should consider a mobile station active on the r-csch when it receives an r-csch PDU from the mobile station. The base station should consider the mobile station inactive on the r-csch if either of the following conditions exists:

- It has received no PDU from the mobile station within a time period to be selected by the base station manufacturer; or
- The ARQ Sublayer receives a *mobile station inactive on common channel* indication from Layer 3.

When the base station receives a PDU on the r-csch from an inactive mobile station, the base station should set MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 7. The base station should then consider the mobile station active on the r-csch.

For each active mobile station, the base station should perform the following procedures:

- When a PDU requiring acknowledgment is received (including a PDU received while the mobile station was inactive) having the message sequence number MSG_SEQ, and MSG_SEQ_RCVD[MSG_SEQ] is equal to NO, the base station should process the PDU as a new PDU. The base station should set MSG_SEQ_RCVD[MSG_SEQ] to YES and should set MSG_SEQ_RCVD[(MSG_SEQ + 4) modulo 8] to NO.
- When a PDU requiring acknowledgment is received having the message sequence number MSG_SEQ, and MSG_SEQ_RCVD[MSG_SEQ] is equal to YES, the base station shall acknowledge the PDU as specified in 3.1.2.1.2.2 but should treat the PDU as a duplicate. Requirements for the processing of SDUs that are part of PDUs received in duplicate are given in [5].

3.1.1.3 Addressing Sublayer

3.1.1.3.1 Parameters

The base station interprets the addressing fields defined in 2.1.1.3.1 for PDUs received on the r-csch.

3.1.1.3.2 Procedures

The base station should identify the mobile station based upon the addressing fields in the received PDU and further process the PDU in the context of the identified mobile station.

3.1.1.4 Utility Sublayer

3.1.1.4.1 Parameters

The base station interprets the fields defined in 2.1.1.4.1 for PDUs received on the r-csch.

3.1.1.4.2 Procedures

The value of the PD field identifies the format of the PDU (see 2.1.1.4.1.1.2 and 2.1.1.4.2). The base station should identify the SDU carried by the received PDU based upon the

MSG_ID field as shown in Table 2.1.1.4.1.1.2-1. If the MSG_ID field cannot be mapped to MSG_TAG, the PDU should be discarded.[47]

Except for PDUs associated with emergency calls, the base station should not update its record of the Radio Environment Reports associated with the mobile station, if the received PDU is expected to be message integrity protected (see [5]), but the Message Integrity Fields and the MACI field are either missing or fail the message integrity check (see 3.1.1.1.3). If the base station further communicates with the mobile station via channels selected based on the Radio Environment Reports, the base station should select those channels based on both the Radio Environment Reports of the received PDU and on the most recent Radio Environments Reports that did not fail the message integrity check.

If the base station receives a valid PDU, the base station shall do the following:

- If the ENC_FIELDS_INCL field is present in the received PDU and is equal to '1', the LAC Sublayer shall make the SDU included in the PDU available to Layer 3, together with the Extended-Encryption Fields (see 3.1.2.3.1.3.1).
- If the ENC_FIELDS_INCL field is not present in the received PDU or is equal to '0', the LAC Sublayer shall make the SDU included in the PDU available to Layer 3, together with SDU_ENCRYPT_MODE set to '000'.

3.1.1.5 Segmentation and Reassembly (SAR) Sublayer

3.1.1.5.1 Parameters

The base station shall use the parameters defined in 2.1.1.5.1.1 for operation on the r-csch.

3.1.1.5.2 Procedures

The base station shall assemble PDUs from encapsulated PDU fragments received on the r-csch, using the following procedure:

- A reassembly buffer large enough to accommodate the largest encapsulated PDU shall be available. The buffer shall be empty initially and shall be emptied immediately after each completion of the reassembly procedure or at the end of the mobile station's access probe, whichever comes first, regardless of whether a PDU was successfully reassembled or not.
- When an encapsulated PDU fragment is received:
  - If the encapsulated PDU fragment is received on the Access Channel:
    + The encapsulated PDU fragment shall be placed in the reassembly buffer immediately after the previous encapsulated PDU fragment.

[47] The base station may choose to discard the message only after acknowledging it, if possible, to try to prevent the mobile station from monopolizing the access channel with retransmissions of the same erroneous message in successive access probes.

- + The first eight bits in the reassembly buffer shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than six, the reassembly buffer shall be emptied.

- If the encapsulated PDU fragment is received on the Reverse Common Control Channel or on the Enhanced Access Channel:
  - + The SI parameter shall be removed from the fragment.
  - + The encapsulated PDU fragment shall be placed in the reassembly buffer immediately after the previous encapsulated PDU fragment.
  - + The first bit of the reassembly buffer shall be interpreted as the EXT_MSG_LENGTH parameter.
    - o If EXT_MSG_LENGTH is equal to '0', the next seven bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than six, the reassembly buffer shall be emptied.
    - o If EXT_MSG_LENGTH is equal to '1', the next 15 bits shall be interpreted as the MSG_LENGTH parameter associated with the PDU. If MSG_LENGTH is less than 128, the reassembly buffer shall be emptied.

- If the reassembly buffer is not empty and there are at least MSG_LENGTH octets in the reassembly buffer, or at the end of the r-csch time slot, whichever comes first, the base station shall run the first MSG_LENGTH × 8 - 30 bits in the reassembly buffer through the 30-bit CRC computation procedure described in 2.1.1.5.1.2. The result of the computation shall be compared with the 30 bits located in the reassembly buffer after the first MSG_LENGTH × 8 - 30 bits and the following actions shall be taken:
  - + If the computed CRC is equal to the received CRC, the PDU is considered to have been correctly received and reassembled. Then:
    - o If the PDU is received on the Access Channel, the contents of the reassembly buffer, starting with the 9^{th} bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
    - o If the PDU is received on the Reverse Common Control Channel or on the Enhanced Access Channel:
      - ◊ If EXT_MSG_LENGTH is equal to '0', the contents of the reassembly buffer, starting with the 9^{th} bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
      - ◊ If EXT_MSG_LENGTH is equal to '1', the contents of the reassembly buffer, starting with the 17^{th} bit and ending with the bit having the ordinal MSG_LENGTH × 8 - 30, are treated as a valid PDU and shall be passed up the protocol stack.
    - o The reassembly procedure shall be considered complete at this point.

+ If the computed CRC is not equal to the received CRC, the procedure completes by emptying the reassembly buffer and discarding its contents.

3.1.2 Transmission on f-csch

The base station shall meet the requirements specified in 3.1.2.1.1.2, 3.1.2.2.2, 3.1.2.3.2 and 3.1.2.4.2 when transmitting on the general signaling channel. The base station shall meet the requirements specified in 3.1.2.3.2 and 3.1.2.4.2 when transmitting on the sync or on the broadcast logical channels.

3.1.2.1 ARQ Sublayer

3.1.2.1.1 Parameters

The base station shall use the ARQ fields defined in 3.1.2.1.1.1 for PDUs transmitted on the f-csch. The base station shall set the ARQ fields according to the requirements specified in 3.1.2.1.1.2.

3.1.2.1.1.1 Definition of ARQ Fields

For PDUs carrying the *General Page Message* and for PDUs carrying the *Universal Page Message*, the ARQ fields have the following format:

Field	**Length (bits)**
MSG_SEQ	3

For all other PDUs, the ARQ fields have the following format:

Field	**Length (bits)**
ACK_SEQ	3
MSG_SEQ	3
ACK_REQ	1
VALID_ACK	1

ACK_SEQ – Acknowledgment sequence number.

If VALID_ACK is set to '1', this field contains the value of the MSG_SEQ field of a PDU received on the r-csch that is being acknowledged on the f-csch; otherwise, this field may contain any value.

MSG_SEQ – Message sequence number.

This field contains the message sequence number for the PDU being sent on the f-csch.

ACK_REQ – Acknowledgment required indicator.

This field indicates whether the PDU being sent on the f-csch requires an acknowledgment from the mobile station. The ACK_REQ field is set to '1' if an acknowledgment is required; otherwise, the field is set to '0'.

VALID_ACK – Valid acknowledgment indicator.

This field is set to '1' when the PDU being sent on the f-csch includes an acknowledgement for a PDU received on the r-csch; otherwise, the field is set to '0'.

3.1.2.1.1.2 Requirements for Setting ARQ Fields

The base station shall set the ACK_REQ field to '1' to request an acknowledgment from the mobile station for a PDU sent on the f-csch; otherwise, the base station shall set the ACK_REQ field to '0'. When sending a PDU that has the ADDR_TYPE field set to '101' [see 3.1.2.2.1.3], indicating a broadcast address, the base station should set the ACK_REQ field to '0'.

The base station shall set the MSG_SEQ field according to the following procedure:

The base station shall maintain independent message numbering sequences (MSG_SEQ) on the f-csch for each message address type (i.e., for each value of the ADDR_TYPE field that is used) and for each address. The address type is determined by the Addressing Sublayer (see 3.1.2.2) or is provided by Layer 3, together with the SDU to be transmitted. For each message address type, separate message numbering sequences shall be maintained for messages requiring acknowledgment and for messages not requiring acknowledgment. Each base station may maintain the sequence numbers independently of other base stations. For each new message sent to a message address, the base station shall increment the appropriate MSG_SEQ value, modulo 8.

When sending a PDU that includes an acknowledgment:

- The base station shall set the VALID_ACK field to '1'
- The base station shall set the ACK_SEQ field to the MSG_SEQ field of the PDU received on the r-csch and being acknowledged.

When sending a PDU that does not include an acknowledgment:

- The base station shall set the VALID_ACK field to '0'
- The base station may set the ACK_SEQ field to any value.

3.1.2.1.2 Procedures

3.1.2.1.2.1 Overview of Transmission and Retransmission Procedures

The ARQ Sublayer controls the transmission and retransmission of PDUs on the f-csch.

The ARQ Sublayer receives an SDU from the Upper Layers, as well as an indication of whether an acknowledgment for that SDU should be required from the mobile station, a repetition counter indicating how many times the PDU containing the SDU should be repeated (to increase the probability of delivery), and an indication of the addressing type

for the PDU (the Upper Layers may provide an explicit address type or an indication to use the default value appropriate for the mobile station being addressed). Based upon this information, the ARQ Sublayer sets the value of the ACK_REQ field and assigns a MSG_SEQ value to the PDU, as described in 3.1.2.1.1.2. If the PDU is retransmitted, all of the transmissions occur within a T_{4m} seconds interval, starting with the first transmission. During the T_{4m} seconds interval following the last transmission of the PDU, the same value for MSG_SEQ cannot be used in transmissions to the same destination and address type.

The ARQ Sublayer on the transmitter side may get an indication from the ARQ Sublayer on the receiver side that a PDU received on the r-csch needs to be acknowledged on the f-csch. In such cases, the MSG_SEQ of the received PDU and the time of the reception of the PDU by the base station are also made available. Within ACH_ACC_TMO × 80 ms (if the PDU was received on the Access Channel) or within EACH_ACC_TMO × 20 ms (if the PDU was received on the Enhanced Access Channel or the Reverse Common Control Channel) since the indicated time of reception, the ARQ Sublayer on the transmitter side transmits a PDU that includes an acknowledgment for the received PDU. The transmitted PDU may be carrying an SDU from the Upper Layers or may be generated locally by the ARQ Sublayer. The acknowledgment for the received PDU may be included in several PDUs transmitted on the f-csch.

The ARQ Sublayer on the transmitter side may get an indication from the ARQ Sublayer on the receiver side that an acknowledgment for a PDU sent on the f-csch and requiring acknowledgment was received on the r-csch. The values of the ACK_SEQ and ACK_TYPE fields in the received PDU are also provided to the ARQ Sublayer on the transmitter side, and are used to identify the PDU with the same value in the MSG_SEQ field and awaiting retransmission. The retransmission of the identified PDU is terminated.

3.1.2.1.2.2 Requirements for Transmission and Retransmission Procedures

For PDUs requiring acknowledgment received on the Access Channel, the base station shall send the acknowledgment(s) on the Paging Channel. For PDUs requiring acknowledgment received on the Enhanced Access Channel or the Reverse Common Control Channel, the base station shall send the acknowledgment(s) on the Forward Common Control Channel. The base station shall wait at least T_{4m} seconds after transmitting a MSG_SEQ number in a PDU sent to an address before using the same MSG_SEQ number in a different PDU (see Figure 3.1.2.1.2.2-1).

The base station may send the same PDU several times to increase the probability of reception. The base station shall complete all retransmissions of the same PDU within T_{4m} seconds after the first transmission, as shown in Figure 3.1.2.1.2.2-1.

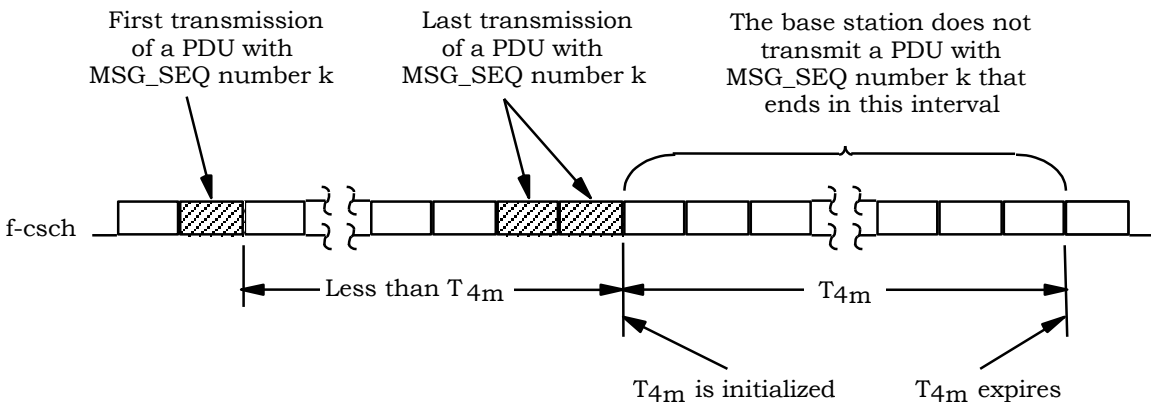

Figure 3.1.2.1.2.2-1. MSG_SEQ Reuse

The base station should not retransmit a PDU requiring acknowledgment after the transmitted PDU was acknowledged (see 3.1.1.2.2.2) via a valid acknowledgment[48].

When requested (see 3.1.1.2.2.2), the base station shall acknowledge PDUs received on the r-csch by including acknowledgments in PDUs sent on the f-csch to the same mobile station. The acknowledgment shall be transmitted within ACH_ACC_TMO × 80 ms (if the PDU was received on the Access Channel) or within EACH_ACC_TMO × 20 ms (if the PDU was received on the Enhanced Access Channel or the Reverse Common Control Channel), after receiving an indication of a PDU from the mobile station that requires acknowledgment, where:

- ACH_ACC_TMO is the value sent in the ACC_TMO field of the *Access Parameters Message* on the mobile station's assigned f-csch;
- EACH_ACC_TMO is the value sent in the ACC_TMO field of the *Enhanced Access Parameters Message* on the mobile station's assigned f-csch.

The base station may include the acknowledgment in an existing PDU carrying an SDU or in a generated PDU carrying an SDU which has the following format (to be sent as an *Order Message*):[49]

[48] An acknowledgment is valid if it is not required to be message integrity protected (see [5]) or if it passes the message integrity checks (see 3.1.1.1.3).

[49] In [11], this "acknowledgment-specific" PDU is referred to as the *Base Station Acknowledgement Order*.

Field	Length (bits)
ORDER = '010000'	6
ADD_RECORD_LEN = '000'	3

To include an acknowledgment for a received PDU, the base station shall set the VALID_ACK field to '1' and shall set the ACK_SEQ field in subsequent f-csch PDUs directed to that mobile station to the MSG_SEQ field specified in the received PDU. The VALID_ACK field shall be set to '1' for the first transmission of the PDU with this value of ACK_SEQ sent to the mobile station on the f-csch. For all f-csch transmissions of the PDUs after the first, directed to the same mobile station and containing the same ACK_SEQ field value:

- The base station may set the VALID_ACK field to '1' if the PDU is sent within T_{4m} seconds after the first transmission (see Figure 3.1.2.1.2.2-1).
- The base station shall set the VALID_ACK field to '0' if the PDU is sent more than T_{4m} seconds after the first transmission.

3.1.2.2 Addressing Sublayer

3.1.2.2.1 Parameters

The addressing fields of page records included in a *General Page Message* are described in 3.1.2.2.1.1. The addressing fields of page records included in a *Universal Page Message* are described in 3.1.2.2.1.2. The addressing fields of all other PDUs are described in 3.1.2.2.1.3.

3.1.2.2.1.1 Addressing Fields of Page Records in a *General Page Message*

3.1.2.2.1.1.1 Page Class Fields of a *General Page Message*

The base station shall use the fields defined in 3.1.2.2.1.1.1.1 for each record included in a *General Page Message.* The base station shall set these fields according to the requirements in 3.1.2.2.1.1.1.2.

3.1.2.2.1.1.1.1 Definition of Page Class Fields of a *General Page Message*

The page class fields have the following format:

Field	Length (bits)
PAGE_CLASS	2
PAGE_SUBCLASS	2
PAGE_SUBCLASS_EXT	0 or 2

PAGE_CLASS – Class of the page record included in the message.

PAGE_SUBCLASS – Subclass of the page record included in the message.

PAGE_SUBCLASS_EXT – Subclass extension of the page record included in the message.

The base station uses the PAGE_CLASS, PAGE_SUBCLASS and PAGE_SUBCLASS_EXT fields to identify the type of the page record included in the message. Page records with PAGE_CLASS set to '00' are used to page mobile stations that have registered with a class 0 IMSI. Page records with PAGE_CLASS set to '01' are used to page mobile stations that have registered with a class 1 IMSI. Page records with PAGE_CLASS set to '10' are used to page mobile stations using a TMSI. Page records with PAGE_CLASS set to '11' and PAGE_SUBCLASS set to '00' are used to announce broadcast messages sent on the Paging Channel. Page records with PAGE_CLASS set to '11', PAGE_SUBCLASS set to '11', and PAGE_SUBCLASS_EXT set to '00' are used to announce broadcast messages sent on the Broadcast Control Channel.

3.1.2.2.1.1.1.2 Requirements for Setting Page Class Fields of a *General Page Message*

The base station shall set the PAGE_CLASS, PAGE_SUBCLASS and PAGE_SUBCLASS_EXT (if included) fields of each page record included in a *General Page Message*, as specified in Table 3.1.2.2.1.1.1.2-1, to identify the type of the page record.

Table 3.1.2.2.1.1.1.2-1. Page Record Formats (part 1 of 2)

Description	PAGE-_CLASS (binary)	PAGE-_SUBCLASS (binary)	PAGE-_SUBCLASS-_EXT (binary)	Page Record Format Number
Class 0, IMSI_S included	00	00	–	0
Class 0, IMSI_S and IMSI_11_12 included	00	01	–	1
Class 0, IMSI_S and MCC included	00	10	–	2
Class 0, IMSI_S, IMSI_11_12, and MCC included	00	11	–	3
Class 1, IMSI_S and IMSI_11_12 included	01	00	–	4
Class 1, IMSI_S, IMSI_11_12, and MCC included	01	01	–	5
Reserved	01	10	–	6
Reserved	01	11	–	7
Class 2 with 32-bit TMSI_CODE_ADDR (TMSI_ZONE not included)	10	00	–	8
Class 2 with 24-bit TMSI_CODE_ADDR (TMSI_ZONE not included)	10	01	–	9
Class 2 with 16-bit TMSI_CODE_ADDR (TMSI_ZONE not included)	10	10	–	10
Class 2 with 32-bit TMSI_CODE_ADDR (TMSI_ZONE included)	10	11	–	11
Class 3, Broadcast (Paging Channel only)	11	00	–	12

Table 3.1.2.2.1.1.1.2-1. Page Record Formats (part 2 of 2)

Description	PAGE-_CLASS (binary)	PAGE-_SUBCLASS (binary)	PAGE-_SUBCLASS-_EXT (binary)	Page Record Format Number
Class 3a (Reserved for MC-MAP)	11	01	00	13.0
Class 3a (Reserved for MC-MAP)	11	01	01	13.1
Class 3a (Reserved for MC-MAP)	11	01	10	13.2
Class 3a (Reserved for MC-MAP)	11	01	11	13.3
Class 3b (Reserved for MC-MAP)	11	10	00	14.0
Class 3b (Reserved for MC-MAP)	11	10	01	14.1
Class 3b (Reserved for MC-MAP)	11	10	10	14.2
Reserved	11	10	11	14.3
Class 3c, Enhanced Broadcast (Forward Common Control Channel only)	11	11	00	15.0
Class 3c, Partial IMSI (*Universal Page Message* only)	11	11	01	15.1
Class 3c, Partial TMSI (*Universal Page Message* only)	11	11	10	15.2
Reserved	11	11	11	15.3

The base station shall use the following procedure to select the class of each page record:

- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '00' if all of the following conditions are met:
  - The mobile station's IMSI is a class 0 IMSI,
  - The IMSI_11_12 sent by the base station in overhead messages is set to '1111111' or is equal to IMSI_11_12 assigned to the mobile station,

  - The MCC sent by the base station in overhead messages is set to '1111111111' or is equal to the MCC assigned to the mobile station.

- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '01' if all of the following conditions are met:
  - The mobile station's IMSI is a class 0 IMSI,
  - The MCC assigned to the mobile station is equal to the MCC sent by the base station in overhead messages.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '10' if all of the following conditions are met:
  - The mobile station's IMSI is a class 0 IMSI,
  - The IMSI_11_12 assigned to the mobile station is equal to the IMSI_11_12 sent by the base station in overhead messages.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '11' if the mobile station's IMSI is a class 0 IMSI.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '01' and PAGE_SUBCLASS equal to '00' if all of the following conditions are met:
  - The mobile station's IMSI is a class 1 IMSI,
  - The MCC assigned to the mobile station is equal to the MCC sent by the base station in overhead messages.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '01' and PAGE_SUBCLASS equal to '01' if the mobile station's IMSI is a class 1 IMSI.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '00' if the mobile station has been assigned a TMSI within the same TMSI zone as the base station.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '01' if the following conditions are met:
  - The mobile station has been assigned a TMSI within the same TMSI zone as the base station, and
  - The most significant octet of TMSI_CODE is equal to '00000000'.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '10' if the following conditions are met:

  - The mobile station has been assigned a TMSI within the same TMSI zone as the base station, and
  - The two most significant octets of TMSI_CODE are both equal to '00000000'.
- If the base station pages the mobile station using the TMSI assigned to the mobile station and the TMSI was assigned in a different TMSI zone than that being sent by the base station in overhead messages, the base station shall use a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '11'.
- On the Paging Channel, the base station may page using a broadcast address with PAGE_CLASS equal to '11' and PAGE_SUBCLASS equal to '00'.
- On the Forward Common Control Channel, the base station may page using a broadcast address with PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equals '00'.

3.1.2.2.1.1.2 Page Type-specific Fields of a *General Page Message*

The base station shall use the fields defined in 3.1.2.2.1.1.2.1 for each record included in a *General Page Message.* The base station shall set these fields according to the requirements in 3.1.2.2.1.1.2.2.

3.1.2.2.1.1.2.1 Definition of Page Type-specific Fields of a *General Page Message*

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 0), the page type-specific fields have the following format:

Field	**Length (bits)**
IMSI_S	34

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '01' (page record format is equal to 1), the page type-specific fields have the following format:

Field	**Length (bits)**
IMSI_11_12	7
IMSI_S	34

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '10' (page record format is equal to 2), the page type-specific fields have the following format:

Field	Length (bits)
MCC	10
IMSI_S	34

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '11' (page record format is equal to 3), the page type-specific fields have the following format:

Field	Length (bits)
MCC	10
IMSI_11_12	7
IMSI_S	34

If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 4), the page type-specific fields have the following format:

Field	Length (bits)
IMSI_ADDR_NUM	3
IMSI_11_12	7
IMSI_S	34

If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '01' (page record format is equal to 5), the page type-specific fields have the following format:

Field	Length (bits)
IMSI_ADDR_NUM	3
MCC	10
IMSI_11_12	7
IMSI_S	34

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 8), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_CODE_ADDR	32

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '01' (page record format is equal to 9), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_CODE_ADDR	24

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '10' (page record format is equal to 10), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_CODE_ADDR	16

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '11' (page record format is equal to 11), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_ZONE_LEN	4
TMSI_ZONE	8 × TMSI_ZONE_LEN
TMSI_CODE_ADDR	32

If PAGE_CLASS is equal to '11' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 12), the page type-specific fields have the following format:

Field	Length (bits)
BURST_TYPE	6
ADDR_LEN	4
BC_ADDR	8 × ADDR_LEN

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '00' (page record format is equal to 13.0), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	32

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '01' (page record format is equal to 13.1), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	24

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '10' (page record format is equal to 13.2), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	16

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '11' (page record format is equal to 13.3), the page type-specific fields have the following format:

Field	Length (bits)
LENGTH	4
RESERVED	8 × LENGTH + 32

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '10', and if PAGE_SUBCLASS_EXT = '00' (page record format is equal to 14.0), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	32

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '10', and if PAGE_SUBCLASS_EXT = '01' (page record format is equal to 14.1), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	68

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '10', and if PAGE_SUBCLASS_EXT = '10' (page record format is equal to 14.2), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	76

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '11', and if PAGE_SUBCLASS_EXT = '00' (page record format is equal to 15.0), the page type-specific fields have the following format:

Field	Length (bits)
BURST_TYPE	6
ADDR_LEN	4
BC_ADDR	8 × ADDR_LEN

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).
IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).
MCC – Mobile Country Code (see 2.3.1 of [5]).
IMSI_ADDR_NUM – Number of digits in the NMSI minus four (see 2.3.1 of [5]).
TMSI_CODE_ADDR – Temporary mobile station identity code address.
TMSI_ZONE_LEN – TMSI zone length.
TMSI_ZONE – TMSI zone.
BURST_TYPE – Burst type.
ADDR_LEN – Address field length.
BC_ADDR – Broadcast address.
LENGTH – Length parameter.
RESERVED – Reserved bits.

3.1.2.2.1.1.2.2 Requirements for Setting Page Type-specific Fields of a *General Page Message*

The base station shall set the page type-specific fields of each page record included in the *General Page Message* according to the page record format number defined in Table 3.1.2.2.1.1.1.2-1.

The base station shall use only the page record format equal to nine if the most significant octet of the TMSI code assigned to the specified mobile station is '00000000'.

The base station shall only use the page record format equal to ten if the two most significant octets of the TMSI code assigned to the specified mobile station are '00000000'.

The base station shall set the page type-specific fields as follows:

- If IMSI_S is included in the page type-specific fields, the base station shall set this field to IMSI_S.
- If IMSI_11_12 is included in the page type-specific fields, the base station shall set this field to IMSI_11_12.
- If MCC is included in the page type-specific fields, the base station shall set this field to the MCC.
- If IMSI_ADDR_NUM is included in the page type-specific fields, the base station shall set this field according to the number of digits in the NMSI minus four.
- If TMSI_CODE_ADDR is included in the page type-specific fields, the base station shall set this field to the TMSI code assigned to the addressed mobile station of the length corresponding to the page record format (see Table 3.1.2.2.1.1.1.2-1).
- If TMSI_ZONE_LEN included in the page type-specific fields, the base station shall set this field to the number of octets included in the TMSI_ZONE. The base station shall set this field to a value in the range 1 to 8 inclusive.

- If TMSI_ZONE is included in the page type-specific fields, the base station shall set this field to the TMSI zone number associated with the assigned TMSI.
- If BURST_TYPE is included in the page type-specific fields, the base station shall set this field to the value shown in [IR1], for the type of the broadcast address.
- If ADDR_LEN is included in the page type-specific fields, the base station shall set this field to the number of octets in the BC_ADDR field.
- If BC_ADDR is included in the page type-specific fields, the base station shall set this field according to the requirements applicable to the burst type of the broadcast address.

3.1.2.2.1.2 Addressing Fields of Page Records in a *Universal Page Message*

3.1.2.2.1.2.1 Interleaved Address Fields

3.1.2.2.1.2.1.1 Definition of Interleaved Address Fields

Field	**Length (bits)**
BCAST_INCLUDED	1
NUM_BCAST	0 or 5
IMSI_INCLUDED	1
NUM_IMSI	0 or 6
TMSI_INCLUDED	1
NUM_TMSI	0 or 6
RESERVED_TYPE_INCLUDED	1
NUM_RESERVED_TYPE	0 or 6

If NUM_BCAST is included, NUM_BCAST plus one occurrences of the following field are included:

BURST_TYPE	6

16 occurrences of the following subrecord are included, one occurrence for each n^{th} least significant bit of the partial address that is included, where:

- n= 8…23, for BC_ADDR_BLOCK corresponding to BURST_TYPE equal to '000011';
- n= 0…15, for all other cases.

BC_ADDR_BLOCK	0 or NUM_BCAST + 1
IMSI_ADDR_BLOCK	0 or NUM_IMSI + 1
TMSI_ADDR_BLOCK	0 or NUM_TMSI + 1
RESERVED_ADDR_BLOCK	0 or NUM_RESERVED_TYPE + 1

3.1.2.2.1.2.1.1.1 Definition of BC_ADDR_BLOCK

Field	Length (bits)
If NUM_BCAST is included, NUM_BCAST plus one occurrences of the following field are included:	
BC_ADDRESS_BIT	1

3.1.2.2.1.2.1.1.2 Definition of IMSI_ADDR_BLOCK

Field	Length (bits)
If NUM_IMSI is included, NUM_IMSI plus one occurrences of the following field are included:	
IMSI_S_BIT	1

3.1.2.2.1.2.1.1.3 Definition of TMSI_ADDR_BLOCK

Field	Length (bits)
If NUM_TMSI is included, NUM_TMSI plus one occurrences of the following field are included:	
TMSI_CODE_ADDR_BIT	1

3.1.2.2.1.2.1.1.4 Definition of RESERVED_ADDR_BLOCK

Field	Length (bits)
If NUM_RESERVED_TYPE is included, NUM_RESERVED_TYPE plus one occurrences of the following field are included:	
RESERVED_BIT	1

3.1.2.2.1.2.1.2 Requirements for Setting Interleaved Address Fields

BCAST_INCLUDED – Pages addressed to broadcast addresses are included.

If pages addressed to broadcast addresses are included, the base station shall set this field to '1'; otherwise, the base station shall set this field to '0'.

NUM_BCAST – Number of pages addressed to broadcast addresses.

If BCAST_INCLUDED is set to '1', the base station shall include the field NUM_BCAST and shall set this field as described below; otherwise, the base station shall omit this field.

The base station shall set this field to the number of pages addressed to broadcast addresses included minus one.

IMSI_INCLUDED – Pages addressed to IMSI addresses are included.

If pages addressed to IMSI addresses are included, the base station shall set this field to '1'; otherwise, the base station shall set this field to '0'.

NUM_IMSI – Number of pages addressed to IMSI addresses.

If IMSI_INCLUDED is set to '1', the base station shall include the field NUM_IMSI and shall set this field as described below; otherwise, the base station shall omit this field.

The base station shall set this field to the number of pages addressed to IMSI addresses included minus one.

TMSI_INCLUDED – Pages addressed to TMSI addresses are included.

If pages addressed to TMSI addresses are included, the base station shall set this field to '1'; otherwise, the base station shall set this field to '0'.

NUM_TMSI – Number of pages addressed to TMSI addresses.

If TMSI_INCLUDED is set to '1', the base station shall include the field NUM_TMSI and shall set this field as described below; otherwise, the base station shall omit this field.

The base station shall set this field to the number of pages addressed to TMSI addresses included minus one.

RESERVED_TYPE_INCLUDED – Pages addressed to reserved address types are included.

If pages addressed to reserved addresses are included, the base station shall set this field to '1'; otherwise, the base station shall set this field to '0'.

NUM_RESERVED_TYPE – Number of pages addressed to reserved address types.

If RESERVED_TYPE_INCLUDED is set to '1', the base station shall include the field NUM_RESERVED_TYPE and shall set this field as described below; otherwise, the base station shall omit this field.

The base station shall set this field to the number of pages addressed to reserved address types included minus one.

BURST_TYPE – Data Burst Type.

The base station shall set this field to the value shown in [IR1] for the type of the broadcast address.

BC_ADDRESS_BIT – Bits of the broadcast address.

The base station shall include NUM_BCAST plus one occurrences of this field in the BC_ADDR_BLOCK fields, one occurrence for each page using a broadcast address type corresponding to Page Record Format Number 15.0 (see Table 3.1.2.2.1.1.1.2-1).

The base station shall use the same order for the BC_ADDRESS_BIT fields in this BC_ADDR_BLOCK field as is used for the BURST_TYPE fields in the Interleaved Page Fields which correspond to the same broadcast pages. Specifically, the i^{th} occurrence of the BC_ADDRESS_BIT field for this subrecord shall correspond the i^{th} occurrence of the BURST_TYPE field in the Interleaved Page Fields.

The base station shall also use the same order for the BC_ADDRESS_BIT fields in this BC_ADDR_BLOCK field as is used for all other BC_ADDR_BLOCK fields in the Interleaved Page Fields. Specifically, the i^{th} occurrence of the BC_ADDRESS_BIT field for this subrecord shall correspond the i^{th} occurrence of the BC_ADDRESS_BIT field for all other BC_ADDR_BLOCK fields in the Interleaved Page Fields.

IMSI_S_BIT – Bits of the last ten digits of the IMSI.

The base station shall include NUM_IMSI plus one occurrences of this field in the IMSI_ADDR_BLOCK field, one occurrence for each page using an IMSI address type corresponding to a Page Record Format Number of 0, 1, 2, 3, 4, 5, or 15.1 (see Table 3.1.2.2.1.1.1.2-1). See 2.3.1 of [5] for the encoding of IMSI_S. The base station shall use the same order for the IMSI_S_BIT fields in this IMSI_ADDR_BLOCK field as is used for all other IMSI_ADDR_BLOCK fields in the Interleaved Page Fields. Specifically, the i^{th} occurrence of the IMSI_S_BIT field for this subrecord shall correspond the i^{th} occurrence of the IMSI_S_BIT field for all other IMSI_ADDR_BLOCK fields in the Interleaved Page Fields.

TMSI_CODE_ADDR_BIT – Bit of the temporary mobile station identity code address.

If NUM_TMSI is included, the base station shall include NUM_TMSI plus one occurrences of this field in the TMSI_ADDR_BLOCK field, one occurrence for each partial address using a TMSI address type corresponding to a Page Record Format Number of 8, 9, 10, 11, or 15.2 (see Table 3.1.2.2.1.1.1.2-1). The base station shall use the same order for the TMSI_CODE_ADDR_BIT fields in this TMSI_ADDR_BLOCK field as is used for all other TMSI_ADDR_BLOCK fields in the Interleaved Page Fields. Specifically, the i^{th} occurrence of the TMSI_CODE_ADDR_BIT field for this subrecord shall correspond the i^{th} occurrence of the TMSI_ADDR_BLOCK fields in the Interleaved Page Fields.

RESERVED_BIT – Bit of a reserved address type.

The base station shall include NUM_RESERVED_TYPE plus one occurrences of this field in the RESERVED_ADDR_BLOCK field, one occurrence for each page using a reserved address type corresponding to a reserved Page Record Format (see Table 3.1.2.2.1.1.1.2-1). The base station shall use the same order for the RESERVED_BIT fields in this RESERVED_ADDR_BLOCK field as is used for all other RESERVED_ADDR_BLOCK fields in the Interleaved Page Fields. Specifically, the i^{th} occurrence of the RESERVED_BIT field for this subrecord shall correspond the i^{th} occurrence of the RESERVED_BIT field for all other RESERVED_ADDR_BLOCK fields in the Interleaved Page Fields.

3.1.2.2.1.2.2 Page Class Fields of a *Universal Page Message*

The base station shall use the fields defined in 3.1.2.2.1.2.2.1 for each record included in a *Universal Page Message*. The base station shall set these fields according to the requirements in 3.1.2.2.1.2.2.2.

3.1.2.2.1.2.2.1 Definition of Page Class Fields of a *Universal Page Message*

The page class fields have the following format:

Field	**Length (bits)**
PAGE_CLASS	2
PAGE_SUBCLASS	2
PAGE_SUBCLASS_EXT	0 or 2

PAGE_CLASS – Class of the page record included in the message.

PAGE_SUBCLASS – Subclass of the page record included in the message.

PAGE_SUBCLASS_EXT – Subclass extension of the page record included in the message.

The base station uses the PAGE_CLASS, PAGE_SUBCLASS, and PAGE_SUBCLASS_EXT fields to identify the type of the page record included in the message. Page records with PAGE_CLASS set to '00' are used to page mobile stations that have registered with a class 0 IMSI. Page records with PAGE_CLASS set to '01' are used to page mobile stations that have registered with a class 1 IMSI. Page records with PAGE_CLASS set to '10' are used to page mobile stations using a TMSI. Page records with PAGE_CLASS set to '11', PAGE_SUBCLASS set to '11', and PAGE_SUBCLASS_EXT set to '00' are used to page mobile stations using a broadcast address.

3.1.2.2.1.2.2.2 Requirements for Setting Page Class Fields of a *Universal Page Message*

The base station shall set the PAGE_CLASS, PAGE_SUBCLASS, and PAGE_SUBCLASS_EXT (if included) fields of each page record included in a *Universal Page Message*, as specified in Table 3.1.2.2.1.1.1.2-1, to identify the type of the page record.

The base station shall use the following procedure to select the class of each page record:

- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '00' if all of the following conditions are met:
  - The mobile station's IMSI is a class 0 IMSI,
  - The IMSI_11_12 sent by the base station in overhead messages is set to '1111111' or is equal to IMSI_11_12 assigned to the mobile station, and
  - The MCC sent by the base station in overhead messages is set to '1111111111' or is equal to the MCC assigned to the mobile station.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '01' if all of the following conditions are met:
  - The mobile station's IMSI is a class 0 IMSI, and
  - The MCC assigned to the mobile station is equal to the MCC sent by the base station in overhead messages.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '10' if all of the following conditions are met:
  - The mobile station's IMSI is a class 0 IMSI, and
  - The IMSI_11_12 assigned to the mobile station is equal to the IMSI_11_12 sent by the base station in overhead messages.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '00' and PAGE_SUBCLASS equal to '11' if the mobile station's IMSI is a class 0 IMSI.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '01' and PAGE_SUBCLASS equal to '00' if all of the following conditions are met:
  - The mobile station's IMSI is a class 1 IMSI, and
  - The MCC assigned to the mobile station is equal to the MCC sent by the base station in overhead messages.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '01' and PAGE_SUBCLASS equal to '01' if the mobile station's IMSI is a class 1 IMSI.

- The base station may page the mobile station using a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '00' if the mobile station has been assigned a TMSI within the same TMSI zone as the base station.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '01' if the following conditions are met:
  - The mobile station has been assigned a TMSI within the same TMSI zone as the base station, and
  - The most significant octet of TMSI_CODE is equal to '00000000'.
- The base station may page the mobile station using a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '10' if the following conditions are met:
  - The mobile station has been assigned a TMSI within the same TMSI zone as the base station, and
  - The two most significant octets of TMSI_CODE are both equal to '00000000'.
- If the base station pages the mobile station using the TMSI assigned to the mobile station and the TMSI was assigned in a different TMSI zone than that being sent by the base station in overhead messages, the base station shall use a page record with PAGE_CLASS equal to '10' and PAGE_SUBCLASS equal to '11'.
- The base station may send a mobile station-directed message announcement to a mobile station with an IMSI using a page record with PAGE_CLASS equal to '11, PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equal to '01'.
- The base station may send a mobile station-directed message announcement to a mobile station with a TMSI assigned using a page record with PAGE_CLASS equal to '11, PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equal to '10'.
- The base station may page using a broadcast address with PAGE_CLASS equal to '11', PAGE_SUBCLASS equal to '11', and PAGE_SUBCLASS_EXT equals '00'.

3.1.2.2.1.2.3 Page Type-specific Fields of a *Universal Page Message*

The base station shall use the fields defined in 3.1.2.2.1.2.3.1 for each record included in a *Universal Page Message.* The base station shall set these fields according to the requirements in 3.1.2.2.1.2.3.2.

3.1.2.2.1.2.3.1 Definition of Page Type-specific Fields of a *Universal Page Message*

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 0), the page type-specific fields have the following format:

Field	**Length (bits)**
IMSI_S_33_16	18

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '01' (page record format is equal to 1), the page type-specific fields have the following format:

Field	**Length (bits)**
IMSI_11_12	7
IMSI_S_33_16	18

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '10' (page record format is equal to 2), the page type-specific fields have the following format:

Field	**Length (bits)**
MCC	10
IMSI_S_33_16	18

If PAGE_CLASS is equal to '00' and PAGE_SUBCLASS is equal to '11' (page record format is equal to 3), the page type-specific fields have the following format:

Field	**Length (bits)**
MCC	10
IMSI_11_12	7
IMSI_S_33_16	18

If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 4), the page type-specific fields have the following format:

Field	Length (bits)
IMSI_ADDR_NUM	3
IMSI_11_12	7
IMSI_S_33_16	18

If PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '01' (page record format is equal to 5), the page type-specific fields have the following format:

Field	Length (bits)
IMSI_ADDR_NUM	3
MCC	10
IMSI_11_12	7
IMSI_S_33_16	18

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '00' (page record format is equal to 8), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_CODE_ADDR_31_16	16

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '01' (page record format is equal to 9), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_CODE_ADDR_23_16	8

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '10' (page record format is equal to 10), the page type-specific fields have the following format:

Field	Length (bits)
–	0

If PAGE_CLASS is equal to '10' and PAGE_SUBCLASS is equal to '11' (page record format is equal to 11), the page type-specific fields have the following format:

Field	Length (bits)
TMSI_ZONE_LEN	4
TMSI_ZONE	8 × TMSI_ZONE_LEN
TMSI_CODE_ADDR_31_16	16

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '00', (page record format is equal to 13.0), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	16

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '01', (page record format is equal to 13.1), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	8

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '10', (page record format is equal to 13.2), the page type-specific fields have the following format:

Field	Length (bits)
–	0

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '01', and if PAGE_SUBCLASS_EXT = '11', (page record format is equal to 13.3), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED_LEN	4
RESERVED	8 × RESERVED_LEN + 16

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '10', and if PAGE_SUBCLASS_EXT = '00', (page record format is equal to 14.0), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	16

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '10', and if PAGE_SUBCLASS_EXT = '01', (page record format is equal to 14.1), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	52

If PAGE_CLASS is equal to '11', and if PAGE_SUBCLASS is equal to '10', and if PAGE_SUBCLASS_EXT = '10', (page record format is equal to 14.2), the page type-specific fields have the following format:

Field	Length (bits)
RESERVED	60

If PAGE_CLASS is equal to '11', PAGE_SUBCLASS is equal to '11', and PAGE_SUBCLASS_EXT is equal to '00' (page record format is equal to 15.0), the page type-specific fields have the following format:

Field	Length (bits)
ADDR_LEN	4
BC_ADDR_REMAINDER	8 × (ADDR_LEN – 2)

If PAGE_CLASS is equal to '11', PAGE_SUBCLASS is equal to '11', and PAGE_SUBCLASS_EXT is equal to '01' (page record format is equal to 15.1), the page type-specific fields have the following format:

Field	Length (bits)
–	0

If PAGE_CLASS is equal to '11', PAGE_SUBCLASS is equal to '11', and PAGE_SUBCLASS_EXT is equal to '10' (page record format is equal to 15.2), the page type-specific fields have the following format:

Field	Length (bits)
–	0

For all of the following:

- PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '10',
- PAGE_CLASS is equal to '01' and PAGE_SUBCLASS is equal to '11',
- PAGE_CLASS is equal to '11', PAGE_SUBCLASS is equal to '10', and PAGE_SUBCLASS_EXT is equal to '11', and
- PAGE_CLASS is equal to '11', PAGE_SUBCLASS is equal to '11', and PAGE_SUBCLASS_EXT is equal to '11',

the page type-specific fields have the following format:

Field	Length (bits)
RESERVED_LEN	5
RESERVED	8 × RESERVED_LEN

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

IMSI_S_33_16 – The 18 most significant bits of the IMSI_S (see 2.3.1 of [5]).

IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).

MCC – Mobile Country Code (see 2.3.1 of [5]).

IMSI_ADDR_NUM – Number of digits in the NMSI minus four (see 2.3.1 of [5]).

TMSI_CODE_ADDR – Temporary mobile station identity code address.

TMSI_CODE_ADDR_23_16 – The next to most significant octet of TMSI_CODE_ADDR.

TMSI_CODE_ADDR_31_16 – The two most significant octets of TMSI_CODE_ADDR.

TMSI_ZONE_LEN – TMSI zone length.

TMSI_ZONE – TMSI zone.

ADDR_LEN – Length of the entire broadcast address including the least significant two octets.

BC_ADDR_REMAINDER – Broadcast Address remainder. For addresses of BURST_TYPE not equal to '000011', all but the least significant two octets of a broadcast address. For addresses of BURST_TYPE equal to '000011', the most significant two octets of the broadcast address followed by the least significant octet of the broadcast address.

RESERVED_LEN – Length parameter.

RESERVED – Reserved bits.

3.1.2.2.1.2.3.2 Requirements for Setting Page Type-specific Fields of a *Universal Page Message*

The base station shall set the page type-specific fields of each page record included in the *Universal Page Message* according to the page record format number defined in Table 3.1.2.2.1.1.1.2-1.

The base station shall only use the page record format equal to 9 if the most significant octet of the TMSI code assigned to the specified mobile station is '00000000'.

The base station shall only use the page record format equal to 10 if the two most significant octets of the TMSI code assigned to the specified mobile station are '00000000'.

The base station shall set the page type-specific fields as follows:

- If IMSI_S_33_16 is included in the page type-specific fields, the base station shall set this field to the most significant 18 bits of IMSI_S.
- If IMSI_11_12 is included in the page type-specific fields, the base station shall set this field to IMSI_11_12.
- If MCC is included in the page type-specific fields, the base station shall set this field to the MCC.
- If IMSI_ADDR_NUM is included in the page type-specific fields, the base station shall set this field according to the number of digits in the NMSI minus four.

- If TMSI_CODE_ADDR_31_16 is included in the page type-specific fields, the base station shall set this field to the most significant 16 bits of the TMSI code assigned to the addressed mobile station.
- If TMSI_CODE_ADDR_23_16 is included in the page type-specific fields, the base station shall set this field to the second most significant octet of the TMSI code assigned to the addressed mobile station.
- If TMSI_ZONE_LEN included in the page type-specific fields, the base station shall set this field to the number of octets included in the TMSI_ZONE. The base station shall set this field to a value in the range 1 to 8 inclusive.
- If TMSI_ZONE is included in the page type-specific fields, the base station shall set this field to the TMSI zone number associated with the assigned TMSI.

3.1.2.2.1.3 Addressing Fields of PDUs Carrying Messages Other than the *General Page Message* and the *Universal Page Message*

The base station shall use the addressing fields defined in 3.1.2.2.1.3.1 for PDUs carrying messages other than the *General Page Message* or the *Universal Page Message*. The base station shall set these fields according to the requirements in 3.1.2.2.1.3.2.

3.1.2.2.1.3.1 Definition of Addressing Fields

PDUs carrying a message other than the *General Page Message* or the *Universal Page Message* have the following addressing fields:

Field	**Length (bits)**
ADDR_TYPE	3
ADDR_LEN	4
EXT_ADDR_TYPE	0 or 3
RESERVED	0 or 5
ADDRESS	8 × ADDR_LEN or 8 × (ADDR_LEN-1)

ADDR_TYPE - Address field type.

This field is set to the value shown in Table 3.1.2.2.1.3.1-1 corresponding to the address type contained in the ADDRESS field.

Table 3.1.2.2.1.3.1-1. Address Types

Description	ADDR_TYPE (binary)	ADDR_LEN (octets)
IMSI_S	000	5
ESN	001	4
IMSI	010	5 to 7
TMSI	011	2 to 12
Extended Address	100	see Table 3.1.2.2.1.3.1-1a
BROADCAST	101	Variable
Reserved	110	–
Reserved	111	–

ADDR_LEN – Address field length.

This field is set to the total number of octets in the ADDRESS field and in the EXT_ADDR_TYPE and RESERVED fields, when the EXT_ADDR_TYPE and RESERVED fields are present.

EXT_ADDR_TYPE – Extended Address field type.

If ADDR_TYPE is set to a value other than '100', the base station shall omit this field; otherwise, the base station shall include this field and set it to a value shown in Table 3.1.2.2.1.3.1-1a corresponding to the extended address type contained in the ADDRESS field.

Table 3.1.2.2.1.3.1-1a. Extended Address Types

Description	EXT_ADDR_TYPE (binary)	ADDR_LEN (octets)
MEID	000	8
Reserved	001-111	–

RESERVED – Reserved field.

If ADDR_TYPE is set to a value other than '100', the base station shall omit this field; otherwise, the base station shall include this field and set it to '00000'.

ADDRESS – Mobile station address or broadcast address.

This field is set to the mobile station address or broadcast address using the address type specified in the ADDR_TYPE field, as follows:

If ADDR_TYPE is equal to '000', the ADDRESS field consists of the following subfields:

Subfield	Length (bits)
IMSI_M_S1	24
IMSI_M_S2	10
RESERVED	6

IMSI_M_S1 – First part (least significant 24 bits) of the mobile station's IMSI_M (see 2.3.1 of [5]).

IMSI_M_S2 – Second part (most significant 10 bits) of the mobile station's IMSI_M (see 2.3.1 of [5]).

RESERVED – Reserved bits.

If ADDR_TYPE is equal to '001', the ADDRESS field consists of the following subfields:

Subfield	Length (bits)
ESN	8 × ADDR_LEN

ESN – Mobile station's electronic serial number.

If ADDR_TYPE is equal to '010', the ADDRESS field consists of the following subfields:

Subfield	Length (bits)
IMSI_CLASS	1
IMSI class-specific subfields	7 + 8 × (ADDR_LEN – 1)

IMSI_CLASS – Class type (0 or 1) of the IMSI.

The field IMSI_CLASS is set to '0' if the IMSI used by the mobile station is of Class 0, and to '1' if the IMSI used by the mobile station is of Class 1.

If ADDR_TYPE is equal to '011', the ADDRESS field consists of the following subfields:

Subfield	Length (bits)
TMSI_ZONE	If ADDR_LEN is greater than four, 8 × (ADDR_LEN – 4); otherwise, 0.
TMSI_CODE_ADDR	If ADDR_LEN is greater than four, 32; otherwise, 8 × ADDR_LEN.

TMSI_ZONE – TMSI zone.

TMSI_CODE_ADDR – Temporary mobile station identity code address.

If ADDR_TYPE is equal to '100' and EXT_ADDR_TYPE is equal to '000', the ADDRESS field consists of the following subfields:

Subfield	Length (bits)
MEID	8 × (ADDR_LEN-1)

If ADDR_TYPE is equal to '101', the ADDRESS field consists of the following subfields:

Subfield	Length (bits)
BC_ADDR	8 × ADDR_LEN

BC_ADDR – Broadcast address.

For ADDR_TYPE '010', IMSI class-specific subfields are represented in Tables 3.1.2.2.1.3.1-2 and 3.1.2.2.1.3.1-3, IMSI Class 0 Types and IMSI Class 1 Types, respectively.

If the IMSI_CLASS field is equal to '0', the following fields are included in the IMSI class-specific subfields:

IMSI_CLASS_0_TYPE – IMSI Class 0 type.

This field is set as shown in Table 3.1.2.2.1.3.1-2.

Table 3.1.2.2.1.3.1-2. IMSI Class 0 Types

Description	IMSI_CLASS_0_TYPE (binary)	Length of IMSI Class 0 Type-Specific Subfields (bits)
IMSI_S included	00	37
IMSI_S and IMSI_11_12 included	01	45
IMSI_S and MCC included	10	45
IMSI_S, IMSI_11_12, and MCC included	11	53

IMSI class 0 type specific subfields – IMSI class 0 type-specific subfields.
These subfields are set as described below.

If the IMSI_CLASS field is equal to '1', the following fields are included in the IMSI class-specific subfields:

IMSI_CLASS_1_TYPE – IMSI Class 1 type.
This field is set as shown in Table 3.1.2.2.1.3.1-3.

Table 3.1.2.2.1.3.1-3. IMSI Class 1 Types

Description	IMSI_CLASS_1_TYPE (binary)	Length of IMSI Class 1 Type-Specific Subfields (bits)
IMSI_S and IMSI_11_12 included	0	46
IMSI_S, IMSI_11_12, and MCC included	1	54

IMSI class 1 type specific subfields – IMSI class 1 type-specific subfields.
These subfields are set as described below.

If the IMSI_CLASS field is equal to '0' and the IMSI_CLASS_0_TYPE field is equal to '00', then the IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-Specific Subfield	Length (bits)
RESERVED	3
IMSI_S	34

RESERVED – Reserved bits.

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

If the IMSI_CLASS field is equal to '0' and the IMSI_CLASS_0_TYPE field is equal to '01', then the IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-Specific Subfield	Length (bits)
RESERVED	4
IMSI_11_12	7
IMSI_S	34

RESERVED – Reserved bits.

IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

If the IMSI_CLASS field is equal to '0' and the IMSI_CLASS_0_TYPE field is equal to '10', then the IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-Specific Subfield	Length (bits)
RESERVED	1
MCC	10
IMSI_S	34

RESERVED – Reserved bit.

MCC – Mobile Country Code (see 2.3.1 of [5]).

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

If the IMSI_CLASS field is equal to '0' and the IMSI_CLASS_0_TYPE field is equal to '11', then the IMSI class 0 type-specific subfields consist of:

IMSI Class 0 Type-Specific Subfield	**Length (bits)**
RESERVED	2
MCC	10
IMSI_11_12	7
IMSI_S	34

RESERVED – Reserved bits.

MCC – Mobile Country Code (see 2.3.1 of [5]).

IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

If the IMSI_CLASS field is equal to '1' and the IMSI_CLASS_1_TYPE field is equal to '0', then the IMSI class 1 type-specific subfields consist of:

IMSI Class 1 Type-Specific Subfield	**Length (bits)**
RESERVED	2
IMSI_ADDR_NUM	3
IMSI_11_12	7
IMSI_S	34

RESERVED – Reserved bits.

IMSI_ADDR_NUM – Number of digits in the NMSI minus four (see 2.3.1 of [5]).

IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).

IMSI_S - Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

If the IMSI_CLASS field is equal to '1' and the IMSI_CLASS_1_TYPE field is equal to '1', then the IMSI class 1 type-specific subfields consist of:

IMSI Class 1 Type-Specific Subfield	Length (bits)
IMSI_ADDR_NUM	3
MCC	10
IMSI_11_12	7
IMSI_S	34

RESERVED – Reserved bits.

IMSI_ADDR_NUM – Number of digits in the NMSI minus four (see 2.3.1 of [5]).

MCC – Mobile Country Code (see 2.3.1 of [5]).

IMSI_11_12 – Two-digit number based upon the IMSI (see 2.3.1 of [5]).

IMSI_S – Ten-digit number based upon the IMSI (see 2.3.1 of [5]).

3.1.2.2.1.3.2 Requirements for Setting Addressing Fields

If the base station addresses a mobile station by IMSI_S, the base station shall set ADDR_TYPE to '000', shall set ADDR_LEN to five and shall set the ADDRESS field as follows:

- IMSI_M_S1 – First part (least significant 24 bits) of the mobile station's IMSI_M (see 2.3.1 of [5]).
- IMSI_M_S2 – Second part (most significant 10 bits) of the mobile station's IMSI_M (see 2.3.1 of [5]).
- RESERVED – '000000'.

If the base station addresses a mobile station by ESN, the base station shall set ADDR_TYPE to '001', shall include the electronic serial number of the mobile station in the ADDRESS field, and shall set ADDR_LEN to four.

If the base station addresses a mobile station by MEID, the base station shall set ADDR_TYPE to '100', EXT_ADDR_TYPE to '000', RESERVED to '00000', shall include the MEID of the mobile station in the ADDRESS field, and shall set ADDR_LEN to eight.

If the base station addresses a mobile station by IMSI, the base station shall set ADDR_TYPE to '010'. The base station shall include the IMSI_CLASS and IMSI class-specific subfields in the ADDRESS field. If the IMSI of the mobile station is of class 0, the base station shall set IMSI_CLASS to '0'; otherwise the base station shall set IMSI_CLASS to '1'. If IMSI_CLASS is '0', the base station shall set the IMSI class-specific subfields to IMSI_CLASS_0_TYPE and the corresponding IMSI class 0 type-specific subfields. If IMSI_CLASS is '1', the base station shall set the IMSI class-specific subfields to IMSI_CLASS_1_TYPE and the corresponding IMSI class 1 type-specific subfields. The base station shall set the IMSI class-specific subfields as specified in 3.1.2.2.1.3.3.

If the base station addresses a mobile station by TMSI, the base station shall set ADDR_TYPE to '011', and shall set the ADDRESS field as follows:

- If the base station includes the TMSI_ZONE in the ADDRESS field, the base station shall set the TMSI_ZONE field to the TMSI zone number associated with the assigned TMSI as specified in [7], and shall set the ADDR_LEN field to 4 + the length of the TMSI zone number in octets. The base station shall also include the TMSI_CODE_ADDR in the ADDRESS field, set to the 32-bit TMSI code assigned to the mobile station.
- If the base station does not include the TMSI_ZONE in the ADDRESS field, the base station shall include only the TMSI_CODE_ADDR in the ADDRESS field and shall set this field as follows:
  - If the most significant octet of the TMSI_CODE assigned to the mobile station is equal to '00000000', the base station may set TMSI_CODE_ADDR to the 24 least significant bits of the TMSI_CODE assigned to the mobile station and set ADDR_LEN to 3.
  - If the two most significant octets of the TMSI_CODE assigned to the mobile station are both equal to '00000000', the base station may set TMSI_CODE_ADDR to the 16 least significant bits of the TMSI_CODE assigned to the mobile station and set ADDR_LEN to two.
  - Otherwise, the base station shall set TMSI_CODE_ADDR to the TMSI_CODE assigned to the mobile station and set ADDR_LEN to four.

If the base station addresses a mobile station by a broadcast address, the base station shall set ADDR_TYPE to '101', shall include BC_ADDR in the ADDRESS field set according to the requirements applicable to the burst type of the *Data Burst Message* to be sent to the mobile station, and shall set ADDR_LEN to the length of the ADDRESS field in octets.

3.1.2.2.1.3.3 Requirements for Setting IMSI Class Subfields

If the IMSI_CLASS is equal to '0', the base station shall perform the following:

- The base station may set IMSI_CLASS_0_TYPE to '00' if both conditions shown below are true:
  - The IMSI_11_12 sent by the base station in overhead messages is set to '1111111' or is equal to the IMSI_11_12 assigned to the mobile station, and
  - The MCC sent by the base station in overhead messages is set to '1111111111' or is equal to the MCC assigned to the mobile station.

  If the base station sets IMSI_CLASS_0_TYPE to '00', it shall include the RESERVED field set to '000' and the IMSI_S field set to the last 10 digits of the IMSI in the IMSI class 0 type-specific subfields.
- The base station may set IMSI_CLASS_0_TYPE to '01' if the MCC sent by the base station in overhead messages is equal to the MCC assigned to the mobile station.

If the base station sets IMSI_CLASS_0_TYPE to '01', it shall include the RESERVED field set to '0000', the IMSI_11_12 field set to the 11th and 12th digits of the IMSI, and the IMSI_S field set to the last 10 digits of the IMSI in the IMSI class 0 type-specific subfields.

- The base station may set IMSI_CLASS_0_TYPE to '10' if the IMSI_11_12 sent by the base station in overhead messages is equal to the IMSI_11_12 assigned to the mobile station.

  If the base station sets IMSI_CLASS_0_TYPE to '10', it shall include the RESERVED field set to '0', the MCC field set to the Mobile Country Code, and the IMSI_S field set to the last 10 digits of the IMSI in the IMSI class 0 type-specific subfields.

- Otherwise, the base station may set IMSI_CLASS_0_TYPE equal to '11'.

  If the base station sets IMSI_CLASS_0_TYPE to '11', it shall include the RESERVED field set to '00', the MCC field set to the Mobile Country Code, the IMSI_11_12 field set to the 11th and 12th digits of the IMSI, and the IMSI_S field set to the last 10 digits of the IMSI in the IMSI class 0 type-specific subfields.

If the IMSI_CLASS is equal to '1', the base station shall perform the following:

- The base station may set IMSI_CLASS_1_TYPE to '0' if the MCC sent by the base station in overhead messages is equal to the MCC assigned to the mobile station.

  If the base station sets IMSI_CLASS_1_TYPE to '0', it shall include the RESERVED field set to '00', the IMSI_ADDR_NUM set to the number of digits in the NMSI minus four, the IMSI_11_12 field set to the 11th and 12th digits of the IMSI, and the IMSI_S field set to the last 10 digits of the IMSI in the IMSI class 1 type-specific subfields. See [5] for the definition of NMSI and the treatment of class 1 IMSI.

- Otherwise, the base station may set IMSI_CLASS_1_TYPE to '1'.

  If the base station sets IMSI_CLASS_1_TYPE to '1', it shall include the IMSI_ADDR_NUM set to the number of digits in the NMSI minus four, the MCC field set to the Mobile Country Code, the IMSI_11_12 field set to the 11th and 12th digits of the IMSI, and the IMSI_S field set to the last 10 digits of the IMSI in the IMSI class 1 type-specific subfields. See [5] for the definition of NMSI and the treatment of class 1 IMSI.

3.1.2.2.2 Procedures

When the base station sends PDUs directed to a specific mobile station, the base station shall address the mobile station using the ESN, the IMSI with which the mobile station registered last, or the TMSI. When the base station sends PDUs carrying *Data Burst Message*s to a group of mobile stations, the base station shall use a broadcast address for the group of mobile stations.

3.1.2.3 Utility Sublayer

3.1.2.3.1 Parameters

3.1.2.3.1.1 Message Type Fields

The base station shall use the fields defined in 3.1.2.3.1.1.1 for PDUs transmitted on the f-csch, and shall set these fields according to the requirements in 3.1.2.3.1.1.2.

3.1.2.3.1.1.1 Definition of Message Type Fields

The message type fields for PDUs transmitted on the f-csch have the following format:

Field	Length (bits)
PD	2
MSG_ID	6

PD – Protocol Discriminator.

MSG_ID – Message Identifier.

3.1.2.3.1.1.2 Requirements for Setting Message Type Fields

The base station shall set the PD field as follows:

- If the message is addressed to a mobile station with MOB_P_REV greater than or equal to nine and the message is sent on the Paging Channel, the Forward Common Control Channel or the non-primary Broadcast Channel and the message contains the Extended-Encryption Fields and the Message Integrity Fields[50], the base station shall set the PD field to '10'. The base station shall not send PDUs containing the Message Integrity Fields, but not the Extended-Encryption Fields.
- Otherwise, if the message is addressed to a mobile station with MOB_P_REV greater than or equal to seven and the message is sent on the Paging Channel and the message contains Extended-Encryption Fields, the base station shall set the PD field to '01'.
- Otherwise, the base station shall set the PD field to '00'.

The base station shall set the MSG_ID field in PDUs transmitted on the f-csch as shown in Table 3.1.2.3.1.1.2-1.

[50] If PD is '10', both the MACI_INCL and the ENC_FIELDS_INCL fields are present in the PDU.

Table 3.1.2.3.1.1.2-1. MSG_ID Values on f-csch (part 1 of 3)

Message Name	MSG_TAG	MSG_ID (binary)	Logical Channel
System Parameters Message	SPM	000001	broadcast
Access Parameters Message	APM	000010	broadcast
Neighbor List Message	NLM	000011	broadcast
CDMA Channel List Message	CCLM	000100	broadcast
Order Message	ORDM	000111	general signaling
Channel Assignment Message	CAM	001000	general signaling
Data Burst Message	DBM	001001	general signaling or broadcast
Authentication Challenge Message	AUCM	001010	general signaling
SSD Update Message	SSDUM	001011	general signaling
Feature Notification Message	FNM	001100	general signaling
Extended System Parameters Message	ESPM	001101	broadcast
Extended Neighbor List Message	ENLM	001110	broadcast
Status Request Message	STRQM	001111	general signaling
Service Redirection Message	SRDM	010000	general signaling
General Page Message	GPM	010001	general signaling
Global Service Redirection Message	GSRDM	010010	broadcast
TMSI Assignment Message	TASM	010011	general signaling
PACA Message	PACAM	010100	general signaling
Extended Channel Assignment Message	ECAM	010101	general signaling
General Neighbor List Message	GNLM	010110	broadcast
User Zone Identification Message	UZIM	010111	broadcast
Private Neighbor List Message	PNLM	011000	broadcast
Reserved	N/A	011001	N/A
Extended Global Service Redirection Message	EGSRDM	011010	broadcast
Extended CDMA Channel List Message	ECCLM	011011	broadcast
Sync Channel Message	SCHM	000001	sync

Table 3.1.2.3.1.1.2-1. MSG_ID Values on f-csch (part 2 of 3)

Message Name	MSG_TAG	MSG_ID (binary)	Logical Channel
User Zone Reject Message	UZRM	011100	general signaling
ANSI-41 System Parameters Message	A41SPM	011101	broadcast
MC-RR Parameters Message	MCRRPM	011110	broadcast
ANSI-41 RAND Message	A41RANDM	011111	broadcast
Enhanced Access Parameters Message	EAPM	100000	broadcast
Universal Neighbor List Message	UNLM	100001	broadcast
Security Mode Command Message	SMCM	100010	general signaling
Universal Page Message	UPM	100011 100100 100101 100110	general signaling
MC-MAP Sync Channel Message (MC-MAP only, see [14])	MAPSCHM	100111	sync
MC-MAP System Information Message (MC-MAP only, see [14])	MAPSIM	101000	broadcast
MC-MAP L3 Message (MC-MAP only, see [14])	MAPL3M	101001	general signaling
R-TMSI Assignment Message (MC-MAP only, see [14])	RTASM	101010	general signaling
MC-MAP Flow Release Message (MC-MAP only, see [14])	MAPFRM	101011	general signaling
Authentication Request Message	AUREQM	101100	general signaling
Broadcast Service Parameters Message	BSPM	101101	broadcast
MEID Extended Channel Assignment Message	MECAM	101110	general signaling
Alternative Technologies Information Message	ATIM	101111	broadcast
Access Point Identifier Message	APIDM	110000	broadcast
Access Point Identifier Text Message	APIDTM	110001	broadcast
Access Point Pilot Information Message	APPIM	110010	broadcast
General Overhead Information Message	GOIM	110011	broadcast

Table 3.1.2.3.1.1.2-1. MSG_ID Values on f-csch (part 3 of 3)

Message Name	MSG_TAG	MSG_ID (binary)	Logical Channel
Flex Duplex CDMA Channel List Message	FDCCLM	110100	Broadcast
General Extension Message	GEM	111111	general signaling
Freqeuent General Overhead Information Message	GOIM	110101	Broadcast

3.1.2.3.1.2 *General Page Message* Common Fields

The base station shall use the fields defined in 3.1.2.3.1.2.1 for a PDU corresponding to the *General Page Message* (see Table 3.1.2.3.1.1.2-1), and shall set these fields according to the requirements in 3.1.2.3.1.2.2.

3.1.2.3.1.2.1 Definition of *General Page Message* Common Fields

The GPM common fields for a PDU corresponding to the *General Page Message* have the following format:

Field	Length (bits)
CONFIG_MSG_SEQ	6
ACC_MSG_SEQ	6
CLASS_0_DONE	1
CLASS_1_DONE	1
TMSI_DONE	1
ORDERED_TMSIS	1
BROADCAST_DONE	1
RESERVED	4
ADD_LENGTH	3
ADD_PFIELD	8 × ADD_LENGTH

CONFIG_MSG_SEQ – Configuration message sequence number.

ACC_MSG_SEQ – Access parameters message sequence number.

CLASS_0_DONE – Class 0 pages are done.

CLASS_1_DONE – Class 1 pages are done.

TMSI_DONE – TMSI pages are done.

ORDERED_TMSIS – TMSIs sent in numerical order.

BROADCAST_DONE – Broadcast pages are done.

RESERVED – Reserved bits.

ADD_LENGTH – Number of octets in the page message specific fields.

ADD_PFIELD – Additional page message specific fields.

3.1.2.3.1.2.2 Requirements for Setting GPM Common Fields

The base station shall set the CONFIG_MSG_SEQ, ACC_MSG_SEQ, CLASS_0_DONE, CLASS_1_DONE, TMSI_DONE, ORDERED_TMSIS, BROADCAST_DONE, RESERVED, ADD_LENGTH and ADD_PFIELD fields to the values received from Layer 3 for these fields (see 3.7.2.3.2.17 of [5]).

3.1.2.3.1.3 Extended-Encryption Fields

When the base station uses the Extended-Encryption Fields defined in 3.1.2.3.1.3.1, the base station shall set these fields according to the requirements in 3.1.2.3.1.3.2.

3.1.2.3.1.3.1 Definition of Extended-Encryption Fields

The Extended-Encryption Fields for PDUs transmitted on the general signaling channel or the non-primary Broadcast Channel have the following format:

Field	**Length (bits)**
ENC_FIELDS_INCL	0 or 1
SDU_ENCRYPT_MODE	0 or 3
ENC_SEQ	0 or 8

ENC_FIELDS_INCL – Extended-Encryption Fields included indicator.

SDU_ENCRYPT_MODE – Signaling encryption mode in use for the SDU carried by this PDU.

ENC_SEQ – Eight least significant bits of the encryption sequence number used to construct a cryptographic synchronization crypto-sync (see [5]) for the encryption algorithm.

3.1.2.3.1.3.2 Requirements for Setting Extended-Encryption Fields

The base station shall set the Extended-Encryption Fields as follows:

- If the PDU is addressed to a mobile station of MOB_P_REV less than seven[51] or the PDU carries a *General Page Message* or a *Universal Page Message*, the base station shall omit all the Extended-Encryption Fields.
- Otherwise:
  - If the SDU included in the PDU is neither encrypted using Extended-Encryption nor message integrity protected and the PDU is sent on the Paging Channel, the base station may[52], at its choice:
    + omit all the Extended-Encryption Fields, in which case the base station shall use a PDU format with the PD field set to '00', or
    + include the ENC_FIELDS_INCL field, in which case the base station shall use a PDU format with the PD field set to either '01' or '10' (see 3.1.2.3.1.1.2).
  - Otherwise, the base station shall include the ENC_FIELDS_INCL field.
- If the ENC_FIELD_INCL field is included:
  - If the field SDU_ENCRYPT_MODE is also included in this PDU, the base station shall set the ENC_FIELDS_INCL field to '1';
  - Otherwise, the base station shall set the ENC_FIELDS_INCL field to '0'.• If the SDU_ENCRYPT_MODE field is included in the PDU, the base station shall set it to the signaling encryption mode that is used for the SDU carried by this PDU and is provided by Layer 3.
- If the SDU_ENCRYPT_MODE field is included and is equal to '001' or '010', and if the MACI_INCL field is not present in the PDU or it is present, but it is equal to '0', the base station shall include the ENC_SEQ field and shall set it to the value provided by Layer 3; otherwise, the base station shall omit the ENC_SEQ field.

The base station shall not change the value of the Extended-Encryption Fields and the encryption state of the SDU carried by the PDU if the PDU is retransmitted.

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[51] Such PDUs can be sent only on the Paging Channel.

[52] To properly interoperate with a base station meeting those requirements when sending messages on the Paging Channel:

- a mobile station of MOB_P_REV greater than or equal to seven has to be able to parse correctly both PDUs with the PD field set to '00' and PDUs with the PD field set to '01'.
- a mobile station of MOB_P_REV greater than or equal to nine has to be able to parse correctly PDUs with the PD field set to '00', PDUs with the PD field set to '01' and PDUs with the PD set to '10'.

3.1.2.3.1.4 PDU Padding Field

The base station shall use the field defined in 3.1.2.3.1.4.1 to pad PDUs transmitted on the f-csch. The base station shall set this field according to the requirements in 3.1.2.3.1.4.2.

3.1.2.3.1.4.1 Definition of PDU Padding Field

The PDU padding field for PDUs transmitted on the f-csch has the following format:

Field	Length (bits)
PDU_PADDING	0 - 7

PDU_PADDING – Padding bits.

3.1.2.3.1.4.2 Requirements for Setting PDU Padding Field

The base station shall set the PDU Padding field to contain the minimum number of bits needed to make the length of the PDU equal to 8k+2 bits, where k is an integer ($k \geq 0$). The base station shall set these bits to '0'.

3.1.2.3.1.5 *Universal Page Message* Common Fields

3.1.2.3.1.5.1 Definition of *Universal Page Message* Common Fields

The UPM common fields for a PDU corresponding to the *Universal Page Message* have the following format:

Field	Length (bits)
CONFIG_MSG_SEQ	6
ACC_MSG_SEQ	6
READ_NEXT_SLOT	1
READ_NEXT_SLOT_BCAST	1

CONFIG_MSG_SEQ – Configuration message sequence number.

ACC_MSG_SEQ – Access parameters message sequence number.

READ_NEXT_SLOT – Pages carried into next slot indicator.

READ_NEXT_SLOT_BCAST – Enhanced Broadcast Pages carried into next slot indicator.

3.1.2.3.1.5.2 Requirements for Setting UPM Common Fields

The base station shall set the CONFIG_MSG_SEQ, ACC_MSG_SEQ, READ_NEXT_SLOT and READ_NEXT_SLOT_BCAST fields to the values received from Layer 3 for these fields (see 3.7.2.3.2.35 of [5]).

3.1.2.3.1.6 UPM Segment Sequence Number Field

3.1.2.3.1.6.1 Definition of UPM Segment Sequence Number Field

The UPM common fields for a PDU corresponding to the *Universal Page Message* have the following format:

Field	Length (bits)
UPM_SEGMENT_SEQ	2

UPM_SEGMENT_SEQ – *Universal Page Message* segment sequence number.

3.1.2.3.1.6.2 Requirements for Setting UPM Segment Sequence Number Field

In the *UPM Middle Segment PDU* corresponding to the second, third, or fourth segment of a segmented *Universal Page Message*, the base station shall set UPM_SEGMENT_SEQ to '00', '01', or '10', respectively.

In the *UPM Final Segment PDU* corresponding to the second, third, fourth, or fifth segment of a segmented *Universal Page Message*, the base station shall set UPM_SEGMENT_SEQ to '00', '01', '10' or '11', respectively.

3.1.2.3.1.7 Record-specific Fields

The base station shall use the fields defined in 3.1.2.3.1.7.1 page records included in a *General Page Message* or a *Universal Page Record* (see Table 3.1.2.3.1.1.2-1), and shall set these fields according to the requirements in 3.1.2.3.1.7.2.

3.1.2.3.1.7.1 Definition of Record-specific Fields

The record-specific fields to be included in a page record depends on the type of page record.

If the record is a *Mobile Station-addressed* record sent in a *General Page Message* (see 3.1.2.3.2.2), the record-specific field has the following format:

Field	Length (bits)
SDU_INCLUDED	1

SDU_INCLUDED – SDU included indicator[53].

[53] In [11] this field is referred to as SPECIAL_SERVICE.

Indicates whether an SDU is included in the page record.

If the record is a *Mobile Station-addressed* record sent in a *Universal Page Message* (see 3.1.2.3.2.4.2.1), the record-specific field has the following format:

Field	Length (bits)
EXT_MS_SDU_LENGTH_INCL	1
EXT_MS_SDU_LENGTH	0 or 4

EXT_MS_SDU_LENGTH_INCL – Extended mobile station-addressed SDU length included indicator.

Indicates whether an extended SDU length field is included in the page.

EXT_MS_SDU_LENGTH – Extended mobile station-addressed SDU length.

Number of octets in the SDU included in the page record, minus two.

If the record is an *Enhanced Broadcast* record sent in a *General Page Message* or a *Universal Page Message* (see 3.1.2.3.2.4.1 and 3.1.2.3.2.4.2.1), the record-specific field has the following format:

Field	Length (bits)
EXT_BCAST_SDU_LENGTH_IND	2
EXT_BCAST_SDU_LENGTH	0 or 4

EXT_BCAST_SDU_LENGTH_IND – Extended broadcast SDU length indicator

EXT_BCAST_SDU_LENGTH – Extended broadcast SDU length.

The EXT_BCAST_SDU_LENGTH_IND and EXT_BCAST_SDU_LENGTH fields together determine the length of the SDU included in the page.

3.1.2.3.1.7.2 Requirements for Setting Record-specific Fields

For a *Mobile Station-addressed* record sent in a *General Page Message*, if Layer 3 sends an SDU to be included in the page record, the base station shall set the SDU_INCLUDED field to '1'; otherwise, the base station shall set this field to '0'. (If SDU_INCLUDED is set to '1', the length of the SDU included in the page record is two octets.)

For a *Mobile Station-addressed* record sent in a *Universal Page Message*, if Layer 3 sends an SDU to be included in the page record whose length is greater than two octets, the base station shall set the EXT_MS_SDU_LENGTH_INCL field to '1'; otherwise, the base station

shall set this field to '0'. If EXT_MS_SDU_LENGTH_INCL is set to '0', the base station shall omit the EXT_MS_SDU_LENGTH field; otherwise, the base station shall include the EXT_MS_SDU_LENGTH field and set it to the number of octets in the SDU included in the page record, minus two. (If EXT_MS_SDU_LENGTH_INCL is set to '0', the length of the SDU included in the page record is two octets). [54]

For an *Enhanced Broadcast* record sent in a *General Page Message* or a *Universal Page Message*, the base station shall set the EXT_BCAST_SDU_LENGTH_IND based on the length of the SDU, as shown in Table 3.1.2.3.1.7.2-1. The base station shall include or omit the EXT_BCAST_SDU_LENGTH field based on the length of the SDU, and shall set it as shown in Table 3.1.2.3.1.7.2 -1. [55]

Table 3.1.2.3.1.7.2-1. Values of EXT_BCAST_SDU_LENGTH_IND and EXT_BCAST_SDU_LENGTH Fields

Length of the SDU (bits)	EXT_ BCAST_SDU_- LENGTH_IND (binary)	EXT_- BCAST_SDU_- LENGTH field included?	EXT_- BCAST_SDU_- LENGTH (decimal)
13	00	No	N/A
18	01	No	N/A
13 + 8k, k > 0	10	Yes	k
18 + 8k, k > 0	11	Yes	k

3.1.2.3.1.8 MACI Field

If the base station supports message integrity for the PDU being transmitted, the base station shall use the field defined in 3.1.2.3.1.8.1 as Message Authentication Code for Integrity. The base station shall set this field according to the requirements in 3.1.2.3.1.8.2.

3.1.2.3.1.8.1 Definition of MACI Field

The MACI field for PDUs transmitted on the f-csch has the following format:

Field	Length (bits)
MACI	0 or 32

[54] The ADD_MS_RECORD field is defined in [5] for future expansion.

[55] The ADD_BCAST_RECORD field is defined in [5] for future expansion.

MACI – Message Authentication Code for Integrity.

3.1.2.3.1.8.2 Requirements for Setting MACI Field

The base station shall include the MACI field, if and only if the MACI_INCL field in the transmitted PDU is included and is equal to '1'; otherwise, the base station shall omit the MACI field. If the MACI field is included, the base station shall set this field as follows: the base station shall execute the procedure for setting the MACI field described in 3.1.2.3.2. The base station shall set the MACI field to MAC-I.

The base station shall not change the values of the MACI field and the Message Integrity fields of the PDU, if the PDU is retransmitted.

3.1.2.3.2 Procedures

The base station should set the fields defined in 3.1.2.3.1 according to their corresponding requirements.

When setting the MACI field for a PDU the base station shall proceed as follows:

- The base station shall compute EXT_MSG_LENGTH and MSG_LENGTH as described in 3.1.2.4.1.2.
- If EXT_MSG_LENGTH is included in the encapsulated PDU, as described in 3.1.2.4.1.2, the base station shall set *msg_length* to a bit configuration corresponding to EXT_MSG_LENGTH immediately followed by MSG_LENGTH; otherwise, the base station shall set *msg_length* to MSG_LENGTH.
- If EXT_MSG_LENGTH is included in the encapsulated PDU and is equal to '1', as described in 3.1.2.4.1.2, the base station shall consider the length of the *msg_length* parameter to be 16 bits; otherwise the base station shall consider the length of the *msg_length* parameter to be 8 bits.
- If the PDU is addressed to a single mobile station, the base station shall set *channel_specific_buffer* as described in 3.1.2.5.2 and shall invoke the procedure for computing the MAC-I value described in 2.1.1.1.2.5, with the *channel_specific_buffer*, *msg_length* and the non-encapsulated PDU without the MACI field, as parameters. The base station shall use the value MAC-I to set the MACI field as described in 3.1.2.3.1.8.2.
- Otherwise, if the PDU has several records addressed to different mobile stations with some records carrying each a MACI field, the base station shall proceed as follows: For each record that carries a MACI field and is addressed to an individual mobile, the base station shall set the individual *channel_specific_buffer* as described in 3.1.2.5.2 and shall invoke the procedure for computing the MAC-I value described in 2.1.1.1.2.5 with the *channel_specific_buffer*, *msg_length,* and the *message* parameter set to the concatenation, in order, of the PD field, the MSG_ID field and the record itself, up to and excluding the MACI field of the record. The mobile station shall use the value MAC-I to set the individual MACI field as described in 3.1.2.3.1.8.2.

3.1.2.3.2.1 PDU Assembly on the sync channel or on the primary Broadcast Control Channel

For PDUs transmitted on the sync channel or on the primary Broadcast Control Channel, the base station shall use the following format:

Field	**Reference**
Message Type Fields	Section 3.1.2.3.1.1.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

3.1.2.3.2.2 PDU Assembly on the Paging Channel when the PDU does not contain Extended-Encryption Fields

For PDUs transmitted on the Paging Channel which do not contain the Extended-Encryption Fields, the base station shall use the following formats:

- For PDUs carrying the *Order Message* or the *Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1):

Field	**Reference**
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying the *Extended Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1):

Field	Reference/Length
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
RESERVED_1	1-bit field set to '0'
ADD_RECORD_LEN	8-bit field set to the number of octets in the SDU
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying the *General Page Message* (see Table 3.1.2.3.1.1.2-1):

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
GPM Common Fields	Section 3.1.2.3.1.2.1
Zero or more occurrences of the *Page Record.*	
PDU_PADDING	Section 3.1.2.3.1.4.1

The *Page Record* can be a *Mobile Station-addressed* record, or a *Broadcast* record. The base station shall insert *Page Records* in the *General Page Message* in the same order as the corresponding SDUs are received from Layer 3.

– A *Mobile Station-addressed* record has the following format:

Field	Reference
Page Class Fields	Section 3.1.2.2.1.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Page Type-specific Fields	Section 3.1.2.2.1.1.2.1
Record-specific Fields	Section 3.1.2.3.1.7.1
SDU	[5]

– A *Broadcast* record has the following format:

Field	Reference
Page Class Fields	Section 3.1.2.2.1.1.1.1
Page Type-specific Fields	Section 3.1.2.2.1.1.2.1

- For the *Null PDU*:

Field	Reference
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying a broadcast channel message (see table 3.1.2.3.1.1.2-1), except *Data Burst Message*:

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- For any other PDU:

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

3.1.2.3.2.3 PDU Assembly on the Paging Channel when the PDU contains Extended-Encryption Fields

For PDUs transmitted on the Paging Channel when P_REV_IN_USE is greater than or equal to nine, the base station may include the Extended-Encryption Fields or both the Message Integrity Fields and the Extended-Encryption Fields[56]. For PDUs transmitted on the Paging Channel when P_REV_IN_USE is greater than or equal to seven, the base station may include the Extended-Encryption Fields. If the Extended-Encryption Fields are included, the base station shall use the following formats:

- For PDUs carrying the *Order Message* or *Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1), when the protocol discriminator field PD is equal to '01':

Field	**Reference**
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying the *Order Message* or *Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1), when the protocol discriminator field PD is equal to '10':

Field	**Reference**
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1
MACI	Section 3.1.2.3.1.8.1

[56] If only Extended-Encryption Fields are included, the protocol discriminator field, PD, is set to '01'. If both the Message Integrity fields and the Extended-Encryption Fields are included, the protocol discriminator field, PD, is set to '10'. See 3.1.2.3.1.1.2.

- For PDUs carrying the *Extended Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1), when the protocol discriminator field PD is equal to '01':

Field	**Reference/Length**
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
RESERVED_1	1-bit field set to '0'
ADD_RECORD_LEN	8-bit field set to the number of octets in the SDU
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying the *Extended Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1), when the protocol discriminator field PD is equal to '10':

Field	Reference/Length
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
RESERVED_1	1-bit field set to '0'
ADD_RECORD_LEN	8-bit field set to the number of octets in the SDU
SDU	[5]
MACI	Section 3.1.2.3.1.8.1
PDU_PADDING	Section 3.1.2.3.1.4.1

- For any other PDU except the *General Page Message* and the *Null Message*:

  - when the protocol discriminator field PD is equal to '01':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

  - when the protocol discriminator field PD is equal to '10':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1
MACI	Section 3.1.2.3.1.8.1

3.1.2.3.2.4 PDU Assembly on the Forward Common Control Channel

3.1.2.3.2.4.1 PDU Assembly for PDUs Carrying Messages Other than the *Universal Page Message*

For PDUs transmitted on the Forward Common Control Channel other than those carrying the *Universal Page Message*, the base station shall use the following formats:

- For PDUs carrying the *Order Message* (see Table 3.1.2.3.1.1.2-1):

  - for a non-encrypted SDU, when the protocol discriminator field PD is equal to '00':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

  - for a non-encrypted SDU without message integrity protection, when the protocol discriminator field PD is equal to '10':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- for an encrypted SDU without message integrity protection, when the protocol discriminator field PD is equal to ‘00’:

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- for an encrypted or non-encrypted SDU with message integrity protection, when the protocol discriminator field PD is equal to ‘10’:

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1
MACI	Section 3.1.2.3.1.8.1

- For PDUs carrying the *Extended Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1), when the protocol discriminator field PD is equal to '00':

Field	Reference/Length
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
RESERVED_1	1-bit field set to '0'
ADD_RECORD_LEN	8-bit field set to the number of octets in the SDU
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying the *Extended Channel Assignment Message* (see Table 3.1.2.3.1.1.2-1), when the protocol discriminator field PD is equal to '10':

Field	Reference/Length
Message Type Fields	Section 3.1.2.3.1.1.1
One or more occurrences of the following record:	
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
RESERVED_1	1-bit field set to '0'
ADD_RECORD_LEN	8-bit field set to the number of octets in the SDU
SDU	[5]
MACI	Section 3.1.2.3.1.8.1
PDU_PADDING	Section 3.1.2.3.1.4.1

- For PDUs carrying the *General Page Message* (see Table 3.1.2.3.1.1.2-1):

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
GPM Common Fields	Section 3.1.2.3.1.2.1
Zero or more occurrences of the *Page Record.*	
PDU_PADDING	Section 3.1.2.3.1.4.1

The *Page Record* can be a *Mobile Station-addressed* record, a *Broadcast* record, or an *Enhanced Broadcast* record. The base station shall insert *Page Records* in the *General Page Message* in the same order as the corresponding SDUs are received from Layer 3.

– A *Mobile Station-addressed* record has the following format:

Field	Reference
Page Class Fields	Section 3.1.2.2.1.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Page Type-specific Fields	Section 3.1.2.2.1.1.2.1
Record-specific Fields	Section 3.1.2.3.1.7.1
SDU	[5]

– A *Broadcast* record has the following format:

Field	Reference
Page Class Fields	Section 3.1.2.2.1.1.1.1
Page Type-specific Fields	Section 3.1.2.2.1.1.2.1

– An *Enhanced Broadcast* record has the following format:

Page Class Fields	Section 3.1.2.2.1.1.1.1
Page Type-specific Fields	Section 3.1.2.2.1.1.2.1
Record-specific Fields	Section 3.1.2.3.1.7.1
SDU	[5]

• For any other PDU

- when the protocol discriminator field PD is equal to '00':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

- when the protocol discriminator field PD is equal to '10':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1
MACI	Section 3.1.2.3.1.8.1

3.1.2.3.2.4.2 PDU Assembly for PDUs Carrying the *Universal Page Message*

3.1.2.3.2.4.2.1 Assembly of the *Universal Page Block*

When the base station assembles the PDU or PDUs for the *Universal Page Message*, it shall first form a *Universal Page Block* using the following format:

Field	Reference
UPM Common Fields	Section 3.1.2.3.1.5.1
Interleaved Address Fields	Section 3.1.2.2.1.2.1.1

Zero or more occurrences of the *Page Record*.

The *Page Record* can be a *Mobile Station-addressed* record, a *Mobile Station-directed Message Announcement* record, or an *Enhanced Broadcast* record. Mobile station-directed message announcement records are used to keep the mobile station monitoring the current slot, past the current message, to receive a message directed to the mobile station in the current slot.

The base station shall insert *Page Records* in the *Universal Page Block* in the same order as the corresponding address bits occur in the Interleaved Address Fields (see 3.1.2.2.1.2.1.2) as follows:

The base station shall include any page records with format 15.0 (see Table 3.1.2.2.1.1.1.2-1) first and shall include them in the same order as the occurrences of the BC_ADDRESS_BIT field of the partial address subrecord of the Interleaved Address Fields. Specifically, the i^{th} occurrence of the page record with format 15.0 shall correspond the i^{th} occurrence of the BC_ADDRESS_BIT field of the partial address subrecord of the Interleaved Address Fields.

The base station shall include any page records with formats from 0 to 5 (see Table 3.1.2.2.1.1.1.2-1) next and shall include them in the same order as the occurrences of the IMSI_S_BIT field of the partial address subrecord of the Interleaved Address Fields. Specifically, the i^{th} occurrence of the page record with format from 0 to 5 shall correspond the i^{th} occurrence of the IMSI_S_BIT field of the partial address subrecord of the Interleaved Address Fields.

The base station shall include any page records with formats from 8 to 11 (see Table 3.1.2.2.1.1.1.2-1) next and shall include them in the same order as the occurrences of the TMSI_CODE_ADDR_BIT field of the partial address subrecord of the Interleaved Address Fields. Specifically, the i^{th} occurrence of the page record with format from 8 to 11 shall correspond the i^{th} occurrence of the TMSI_CODE_ADDR_BIT field of the partial address subrecord of the Interleaved Address Fields.

– A *Mobile Station-addressed* record has the following format:

Page Class Fields	Section 3.1.2.2.1.2.2.1
ARQ Fields	Section 3.1.2.1.1.1
Page Type-specific Fields	Section 3.1.2.2.1.2.3.1
Record-specific Fields	Section 3.1.2.3.1.7.1
SDU	[5]

– A *Mobile Station-directed Message Announcement* record has the following format:

Page Class Fields	Section 3.1.2.2.1.2.2.1
Page Type-specific Fields	Section 3.1.2.2.1.2.3.1

– An *Enhanced Broadcast* record has the following format:

Page Class Fields	Section 3.1.2.2.1.2.2.1
Page Type-specific Fields	Section 3.1.2.2.1.2.3.1
Record-specific Fields	Section 3.1.2.3.1.7.1
SDU	[5]

3.1.2.3.2.4.2.2 PDU Assembly for PDUs Carrying the *Universal Page Message*

The base station can send the *Universal Page Message* using one PDU. The base station can also optionally segment the *Universal Page Message* into multiple PDUs in order to allow mobile stations operating in the slotted mode and monitoring the Forward Common Control Channel to quickly stop monitoring the Forward Common Control Channel for the sake of power conservation. For example, if a *Universal Page Message* would span multiple Forward Common Control Channel frames if included in a single PDU, the base station could segment the *Universal Page Message* into two PDUs. By including the first PDU within the first Forward Common Control Channel frame of a slot, the base station can give mobile stations operating in the slotted mode the ability to conserve power after the first frame.

3.1.2.3.2.4.2.2.1 PDU Assembly for an Unsegmented *Universal Page Message*

When transmitting a PDU on the Forward Common Control Channel carrying an unsegmented *Universal Page Message* (the PDU is called the *Unsegmented UPM PDU*), the base station shall use the following format:

Field	**Reference/Value**
PD	Section 3.1.2.3.1.1.2
MSG_ID	‘100011’
Universal Page Block	Section 3.1.2.3.2.4.2.1
PDU_PADDING	Section 3.1.2.3.1.4.1

3.1.2.3.2.4.2.2.2 PDU Assembly for a Segmented *Universal Page Message*

When the base station segments the *Universal Page Block* into multiple PDUs, the Utility Sublayer shall submit the PDUs to the SAR Sublayer in order, with the PDU corresponding to the most significant portion of the *Universal Page Block* first, followed by PDU(s) corresponding to less significant portions of the *Universal Page Block*.

The base station shall not transmit PDUs derived from the same *Universal Page Block* in different Forward Common Control Channel slots. The base station shall not transmit more than two *UPM First Segment PDU*s in the same Forward Common Control Channel slot.

When transmitting the first PDU on the Forward Common Control Channel of a segmented *Universal Page Message* (the PDU is called the *UPM First Segment PDU*), the base station shall use the following format:

Field	Reference/Value
PD	Section 3.1.2.3.1.1.2
MSG_ID	'100100'
First Segment of the Universal Page Block	Section 3.1.2.3.2.4.2.1

In the above PDU format,[57] for the First Segment of the Universal Page Block field, the base station shall include N bits of the *Universal Page Block*, starting with the most significant bit, where N is specified in Table 3.1.2.3.2.4.2.2.2-1.

Table 3.1.2.3.2.4.2.2.2-1 Number of bits for First Segment of UPM

F-CCCH frame duration [ms]	F-CCCH rate [bps]	Lower Layers "Payload" [bits]	Total size of SI fields [bits]	Total size of other SAR fields [bits]	MSG_LENGTH	N [bits]
20	9600	172	4	38	21	122
20	19200	360	8	38	44	306
20	38400	744	16	38	91	682
10	19200	172	4	38	21	122
10	38400	360	8	38	44	306
5	38400	172	4	38	21	122

When transmitting on the Forward Common Control Channel a PDU of a segmented *Universal Page Message* (the PDU is called the *UPM Middle Segment PDU*) which is later than the first PDU but earlier than the last PDU, the base station shall use the following format:

[57] This PDU format does not include PDU Padding.

Field	Reference/Value
PD	Section 3.1.2.3.1.1.2
MSG_ID	'100101'
UPM_SEGMENT_SEQ	Section 3.1.2.3.1.6.1
Middle Segment of the Universal Page Block	Section 3.1.2.3.2.4.2.1

In the above PDU format,[58] for the Middle Segment of the Universal Page Block field, the base station shall include M bits of the Universal Page Block, starting with the most significant bit not already included in a previous PDU, where M is specified in Table 3.1.2.3.2.4.2.2.2-2.

Table 3.1.2.3.2.4.2.2.2-2 Number of bits for Middle Segment of UPM

F-CCCH frame duration [ms]	F-CCCH rate [bps]	Lower Layers "Payload" [bits]	Total size of SI fields [bits]	Total size of other SAR fields [bits]	MSG_LENGTH	M [bits]
20	9600	172	4	38	21	120
20	19200	360	8	38	44	304
20	38400	744	16	38	91	680
10	19200	172	4	38	21	120
10	38400	360	8	38	44	304
5	38400	172	4	38	21	120

[58] This PDU format does not include PDU Padding.

When transmitting on the Forward Common Control Channel the final PDU of a segmented *Universal Page Message* (the PDU is called the *UPM Final Segment PDU*) the base station shall use the following format:

Field	**Reference**
PD	Section 3.1.2.3.1.1.2
MSG_ID	'100110'
UPM_SEGMENT_SEQ	Section 3.1.2.3.1.6.1
Final Segment of the Universal Page Block	Section 3.1.2.3.2.4.2.1
PDU_PADDING	Section 3.1.2.3.1.4.1

In the above PDU format, for the Final Segment of the Universal Page Block field, the base station shall include bits of the Universal Page Block, starting with the most significant bit not already included in a previous PDU.

3.1.2.3.2.5 PDU Assembly on the non-primary Broadcast Channel

For PDUs transmitted on the non-primary Broadcast Channel, the base station shall use the following format[59]:

- when the protocol discriminator field PD is equal to '00':

Field	**Reference**
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1

[59] The format used for broadcast messages on this channel is identical with the format used on the Forward Common Control Channel. Although among ARQ fields only the MSG_SEQ field is meaningful for a broadcast message, all the other ARQ fields are included. The addressing fields are of BROADCAST address type. Currently (see [5]), such messages are to be sent unencrypted and without message integrity protection, which means that the Extended-Encryption Fields consist solely of the ENC_FIELDS_INCL field set to '0', the Message Integrity Fields, if present, consist solely of the MACI_INCL field set to '0', while the MACI field is not included in the PDU.

- when the protocol discriminator field PD is equal to '10':

Field	Reference
Message Type Fields	Section 3.1.2.3.1.1.1
ARQ Fields	Section 3.1.2.1.1.1
Addressing Fields	Section 3.1.2.2.1.3.1
Message Integrity Fields	Section 3.1.2.5.1
Extended-Encryption Fields	Section 3.1.2.3.1.3.1
SDU	[5]
PDU_PADDING	Section 3.1.2.3.1.4.1
MACI	Section 3.1.2.3.1.8.1

3.1.2.4 Segmentation and Reassembly (SAR) Sublayer

3.1.2.4.1 Parameters

The base station shall use the SAR parameters defined in 3.1.2.4.1.1 for PDUs transmitted on the f-csch, and shall set the SAR parameters according to the requirements specified in 3.1.2.4.1.2.

3.1.2.4.1.1 Definition of SAR parameters

The SAR parameters for PDUs transmitted on the f-csch have the following format:

Field	Length (bits)
EXT_MSG_LENGTH	0 or 1

EXT_MSG_LENGTH – Extended message length.

Field	Length (bits)
MSG_LENGTH	7, 8 or 15

MSG_LENGTH – Length of the PDU in octets.

Field	Length (bits)
CRC	30

CRC – Cyclic Redundancy Check for the PDU.

Field	Length (bits)
SOM	1

SOM – Start of Message indicator, for each encapsulated PDU fragment sent on the sync channel.

Field	Length (bits)
SCI	1

SCI – Synchronized Capsule Indicator, for each encapsulated PDU fragment sent on the Paging Channel or Broadcast Channel.

Field	Length (bits)
SI	2

SI – Segmentation Indicator, for each encapsulated PDU fragment sent on the Forward Common Control Channel.

3.1.2.4.1.2 Requirements for Setting SAR Parameters

For PDUs that are sent on the Forward Common Control Channel or Broadcast Channel, the EXT_MSG_LENGTH parameter shall be included. For PDUs that are sent on a Paging Channel, the EXT_MSG_LENGTH parameter shall be omitted.

For PDUs that are sent on the Forward Common Control Channel or on the Broadcast Channel:

- If the size of the LAC PDU is less than or equal to 978 bits:
  - The EXT_MSG_LENGTH shall be set to '0'.
  - The MSG_LENGTH field shall be seven bits long and shall be set to (size of LAC PDU in bits + 38) / 8.
- If the size of the LAC PDU is greater than 978 bits:
  - The EXT_MSG_LENGTH shall be set to '1'.

- The MSG_LENGTH field shall be fifteen bits long and shall be set to (size of LAC PDU in bits + 46) / 8.

For PDUs that are sent on a Paging Channel, the MSG_LENGTH parameter shall be eight bits long and shall be set to (size of LAC PDU in bits + 38) / 8.

The base station shall set the CRC parameter as specified in 2.1.1.5.1.2.[60]

For transmission on the Sync Channel, the base station shall include the SOM parameter at the position in the information part of the frames indicated in Table 3.1.2.4.1.2-1. The SOM parameter shall be set to '1' for the first encapsulated PDU fragment of the encapsulated PDU and shall be set to '0' in all other cases.

For transmission on a Paging Channel or Broadcast Channel, the base station shall include the SCI parameter at the position in the information part of the frames indicated in Table 3.1.2.4.1.2-1. The SCI parameter shall be set to '1' for an encapsulated PDU fragment if the most significant bit of an encapsulated PDU immediately follows the SCI bit; otherwise, the SCI parameter shall be set to '0'.

For transmission on the Forward Common Control Channel, the base station shall include the SI parameter at the positions in the information part of the frames indicated in Table 3.1.2.4.1.2-1. If the most significant bit of an encapsulated PDU immediately follows the SI parameter, the SI parameter shall be set to '01'; otherwise, the SI parameter shall be set to '00'.

[60] When transmitting on the f-csch, the base station sets the EXT_MSG_LENGTH parameter (if included), the MSG_LENGTH parameter and CRC parameter in the same manner that the mobile station does when it is transmitting on the r-csch.

Table 3.1.2.4.1.2-1 Position of "always included" SAR parameters[61]

Channel type	Frame duration [ms]	Rate [bps]	Infor-mation bits	Name of the SAR field	Size of SAR field [bits]	Position in informati on part of frame
Sync	26.6666 6	1200	32/frame	SOM	1	1
Paging	20	4800	96/frame	SCI	1	1, 49
	20	9600	192/frame	SCI	1	1, 97
Broadcast	40	19200 9600 4800	744/slot[62]	SCI	1	1, 94, 187, 280, 373, 466, 559, 652
Forward Common Control	20	9600	172/frame	SI	2	1-2, 87-88
	20	19200	360/frame	SI	2	1-2, 91-92, 181-182, 271-272
	20	38400	744/frame	SI	2	1-2, 94-95, 187-188, 280-281, 373-374, 466-467, 559-560, 652-653
	10	19200	172/frame	SI	2	1-2, 87-88
	10	38400	360/frame	SI	2	1-2, 91-92, 181-182, 271-272
	5	38400	172/frame	SI	2	1-2, 87-88

3.1.2.4.2 Procedures

The base station shall set the SAR parameters as specified in 3.1.2.4.1.2.

[61] Bit 1 refers to the bit of the information part of the frame that is transmitted first.

[62] A BCCH slot consists of one 40 ms frame at the 19200 bps rate, or of two 40 ms frames at the 9600 bps rate, or of four 40 ms frames at the 4800 bps rate (see [2]).

The base station shall assemble an encapsulated PDU from the SAR parameters and the PDU by concatenating them in the following order:

- For PDUs that are sent on the Forward Common Control Channel or Broadcast Channel, the EXT_MSG_LENGTH parameter.
- The MSG_LENGTH parameter, starting with the most significant bit.
- The PDU, starting with the most significant bit of the PD field.
- The CRC parameter, starting with the bit that appeared first at the output of the CRC encoder.

The base station shall segment the encapsulated PDU into fragments of maximum available size (except for the last fragment which may be shorter) necessary to fit in a frame (for the sync channel), a half-frame (for the Paging Channel) or a partial-frame (for the Forward Common Control Channel or for the Broadcast Channel). The base station shall send encapsulated PDU fragments of an encapsulated PDU in consecutive frames (for the sync channel), consecutive half-frames (for the Paging Channel) or consecutive partial-frames (for the Forward Common Control Channel or for the Broadcast Channel).

For the sync logical channel, if the SOM parameter is equal to '1', the base station shall transmit the most significant bit of the encapsulated PDU immediately after the SOM bit.

For f-csch channels other than the sync channel, the base station shall proceed as follows:

- For PDUs that are sent on a Paging Channel:
  - The base station shall transmit the SCI parameter (set as described in 3.1.2.4.1.2).
  - If there are fewer than eight bits remaining in the half-frame after the end of the last bit of the encapsulated PDU, the base station shall set those remaining bits to '0'.
- For PDUs that are sent on the Broadcast Channel:
  - The base station shall transmit the SCI parameter (set as described in 3.1.2.4.1.2).
  - If there are fewer than eight bits remaining in the partial-frame after the end of the last bit of the encapsulated PDU, the base station shall set those remaining bits to '0'.
- For PDUs that are sent on the Forward Common Control Channel:
  - The base station shall transmit the SI parameter (set as described in 3.1.2.4.1.2).
  - If there are fewer than eight bits remaining in the partial-frame after the end of the last bit of the encapsulated PDU, the base station shall set those remaining bits to '0'.

- For PDUs that are sent on a Paging Channel, if there are eight or more bits remaining in the half-frame after the end of the last bit of the encapsulated PDU, or for PDUs that are sent on the Forward Common Control Channel or the Broadcast Channel, if there are sufficient bits remaining to fit the MSG_LENGTH and EXT_MSG_LENGTH parameters in the partial-frame after the end of the last bit of the encapsulated PDU, the base station shall perform one of the following:
  - The base station shall append sufficient number of padding bits (set to '0') to fill the remainder of the half-frame or partial-frame, or
  - The base station shall start transmission of the next encapsulated PDU by appending a sufficient number of bits from the beginning of that PDU to fill the remainder of the half-frame or partial-frame. If there are not enough bits available in the PDU to fill the half-frame or partial-frame, the transmission of the subsequent PDU can commence, and so on. The base station shall not select this option if it results in sending the first PDU in the f-csch time slot as an unsynchronized capsule.
- On the Paging Channel, if there are fewer than four bits remaining in the half-frame after the end of the last bit of the encapsulated PDU, and if the half-frame is the last one in the Paging Channel slot, and if the last 4 bits in the half-frame are not all '0', the base station shall set the SCI parameter and all of the bits in the following half-frame to '0'.

Unless transmission of a PDU is to be canceled, the base station shall not transmit encapsulated PDU fragments from a new encapsulated PDU until all fragments of the previous encapsulated PDU have been transmitted (i.e., interleaving fragments from different PDUs is not permitted).

3.1.2.5 Message Integrity Sublayer

3.1.2.5.1 Parameters

The base station shall use and set the Message Integrity Fields specified in 2.1.1.1.1.1[63] according to the procedures in 3.1.2.5.2 and 2.1.1.1.1.3.

3.1.2.5.2 Procedures

If message integrity is supported and enabled for a PDU transmitted on f-csch and addressed to a single mobile station, the base station shall set *channel_specific_buffer* to

[63] Except where explicitly specified otherwise (see 3.1.2.5.2), for regular PDUs transmitted on f-csch, the base station uses the same Message Integrity Fields (MACI_INCL, SDU_KEY_ID, SDU_INTEGRITY_ALGO, SDU_SSEQ_OR_SSEQH, SDU_SSEQ and SDU_SSEQ_H) and the same procedures for inclusion and setting of values for these fields as the mobile station does when transmitting PDUs on r-csch.

the 2 bits corresponding to "ACK_REQ |'0'", where ACK_REQ is set to '0', if the message is to be sent in unassured mode or to '1', if the message is to be sent in assured mode, where the most significant bit of the *channel_specific_buffer* corresponds to the ACK_REQ bit. If message integrity is supported and enabled for a PDU transmitted on f-csch, containing several records addressed to different mobile stations[64], but encapsulated in the same PDU, the base station shall generate as many *channel_specific_buffer*s as there are records in the PDU requiring message integrity protection, and set them to the 2 bits corresponding to "ACK_REQ |'0'", where the ACK_REQ field from each of the individual records is used in the corresponding *channel_specific_buffer*.

When the base station executes the procedure for setting up the MACI field (see 3.1.2.3.2), (or fields), the *channel_specific_buffer* (or the set of *channel specific_buffer*s) shall be passed as input parameter(s) to that procedure.

3.2 Dedicated Channel Operation

The base station shall meet the requirements specified in 3.2.1 for operation on the r-dsch and in 3.2.2 for operation on the f-dsch.

3.2.1 Reception on r-dsch

The base station shall meet the requirements stated in 3.2.1.4.2, 3.2.1.1.2.2, 3.2.1.2.2 and 3.2.1.3.2.

If a received PDU is not expected to be message integrity protected (see [5]), but contains a MACI_INCL field equal to '1', the base station shall ignore the Message Integrity Fields and the MACI field in the received PDU.

3.2.1.1 ARQ Sublayer

3.2.1.1.1 Parameters

To support the ARQ mechanism on the dedicated channels, the base station shall interpret the ARQ fields defined in 2.2.1.1.1.1 for PDUs received on the r-dsch.

3.2.1.1.2 Procedures

3.2.1.1.2.1 Overview of Reception Procedures

The ARQ Sublayer removes the ARQ fields from PDUs received on the r-dsch and passes the remainder of the PDU (which generally includes the SDU) to the Upper Layers.

When a PDU is received, the ARQ Sublayer on the receiver side provides an indication to the ARQ Sublayer on the transmitter side (see 3.2.2.1.2.1) of the acknowledgment of a previously transmitted PDU with the MSG_SEQ field equal to the ACK_SEQ field of the received PDU.

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[64] For example, PDUs carrying the *Extended Channel Assignment Message*.

The ARQ Sublayer performs duplicate detection for received PDUs that require acknowledgment by using the MSG_SEQ field of the received PDUs. Duplicates of PDUs requiring acknowledgment are acknowledged (see below) and then discarded.

When a PDU is received with the ACK_REQ field set to '1', the ARQ Sublayer on the receiver side provides an indication to the ARQ Sublayer on the transmitter side requesting the transmission of an acknowledgment. The MSG_SEQ field of the received PDU and the time of reception are also provided to the ARQ Sublayer on the transmitter side (see 3.2.2.1.2.1).

The ARQ Sublayer for dedicated channels can be reset locally via indications from Layer 3 or the managing entity in the control plane, or upon the reception of a *Reset PDU* (for mini PDUs only, see Table 2.2.1.2.1.2-3).

The ARQ Sublayer is reset simultaneously on the receiver and the transmitter sides. In such cases the information needed to perform duplicate detection and the pending requests for acknowledgment are discarded.

3.2.1.1.2.2 Requirements for Reception Procedures

The base station shall process PDUs received on the r-dsch.

Except for PDUs associated with emergency calls, the base station should not process the ARQ fields and ARQ variables if the received PDU is expected to be message integrity protected (see [5]), but the Message Integrity Fields and the MACI field are either not included or fail the message integrity check (see 3.1.1.1.3). Otherwise:

When a PDU is received with the ACK_REQ field set to '1', the base station shall recognize it as a request for acknowledgment (see 3.2.2.1.2.2). The base station shall recognize the received PDU as including an acknowledgment if the received ACK_SEQ fields match the MSG_SEQ field of a previously transmitted PDU (see 3.2.2.1.2.2). The base station should ignore received acknowledgments for PDUs that were not sent or are not awaiting acknowledgment.

For duplicate detection, the base station shall store a received status indicator for each possible value of the MSG_SEQ field (MSG_SEQ_RCVD[n] for all values of n from 0 to 7, for regular PDUs, and M_MSG_SEQ_RCVD[n] for all values of n from 0 to 3, for mini PDUs). Duplicate detection is performed independently for regular PDUs and for mini PDUs.[65] The base station shall perform the following procedures:

[65] A regular PDU and a mini PDU cannot be duplicates of one another.

- When a PDU requiring acknowledgment is received containing the message sequence number field MSG_SEQ, and MSG_SEQ_RCVD[MSG_SEQ] (for regular PDUs) or M_MSG_SEQ_RCVD[MSG_SEQ] (for mini PDUs) is equal to NO, the base station shall process the PDU as a new PDU. The base station shall then set MSG_SEQ_RCVD[MSG_SEQ] (for regular PDUs) or M_MSG_SEQ_RCVD[MSG_SEQ] (for mini PDUs) to YES, and shall set MSG_SEQ_RCVD[(MSG_SEQ + 4) modulo 8] (for regular PDUs) or M_MSG_SEQ_RCVD[(MSG_SEQ + 2) modulo 4] (for mini PDUs) to NO.
- When a PDU requiring acknowledgment is received containing the message sequence number field MSG_SEQ, and MSG_SEQ_RCVD[MSG_SEQ] (for regular PDUs) or M_MSG_SEQ_RCVD[MSG_SEQ] (for mini PDUs) is equal to YES, the base station shall acknowledge the PDU and then discard it.

When processing a reset request for both regular PDUs and mini PDUs, the base station shall set MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 7 and M_MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 3. When processing a reset request for mini PDUs only, the base station shall set M_MSG_SEQ_RCVD[n] to NO for all values of n from 0 to 3. Further requirements for the processing of a reset request by the base station are given in 3.2.2.1.2.2.

3.2.1.2 Utility Sublayer

3.2.1.2.1 Parameters

The base station shall interpret the MSG_TYPE field of a PDU received on the r-dsch as defined in 2.2.1.2.1.1.

3.2.1.2.2 Procedures

The base station should identify the SDU carried by the received PDU based upon the MSG_TYPE field as shown in Table 2.2.1.2.1.2-1 for regular PDUs and Table 2.2.1.2.1.2-2 and 2.2.1.2.1.2-3 for mini PDUs.

If the base station receives a valid PDU, the LAC Sublayer shall make the SDU included in the PDU available to Layer 3, together with the Encryption field and the Extended-Encryption Fields, if any (see 3.1.2.3.1.3.1).

3.2.1.3 Segmentation and Reassembly Sublayer

3.2.1.3.1 Parameters

The base station shall use the parameters defined in 2.2.1.3.1.1 for PDUs received on the r-dsch.

3.2.1.3.2 Procedures

The base station shall reassemble PDUs from encapsulated PDU fragments received on the r-dsch[66] (see 2.2.2.3.2).

3.2.1.4 Message Integrity Sublayer

If the base station supports message integrity, the base station shall process the Message Integrity Fields and the MACI field of regular PDUs received on r-dsch as specified in 3.2.1.4.1 and 3.2.1.4.2.

3.2.1.4.1 Parameters

The base station uses and interprets the Integrity Fields defined in 2.1.1.1.1.1 and the MACI field for PDUs received on the r-dsch[67].

3.2.1.4.2 Procedures

If the base station supports message integrity, the base station shall perform the procedures[68] specified in 3.1.1.1.3.

3.2.2 Transmission on f-dsch

The base station shall meet the requirements stated in 3.2.2.1.1.2, 3.2.2.2.2, 3.2.2.4.2 and 3.2.2.3.2.

3.2.2.1 ARQ Sublayer

3.2.2.1.1 Parameters

To support the ARQ mechanism on the f-dsch and r-dsch, the base station shall use the ARQ fields defined in 3.2.2.1.1.1 for PDUs transmitted on the f-dsch. The base station shall set the ARQ fields according to the requirements in 3.2.2.1.1.2.

3.2.2.1.1.1 Definition of ARQ Fields

The ARQ fields for PDUs transmitted on the f-dsch have the following format:

---

[66] When receiving on the r-dsch, the base station reassembles PDUs in the same manner that the mobile station does when it is receiving on the f-dsch.

[67] When receiving on the r-dsch, the base station uses the same Message Integrity Fields as the mobile station does when transmitting on r-csch.

[68] When receiving on the r-dsch, the base station uses the same message integrity procedures as when receiving on r-csch.

Field	Length (bits)
ACK_SEQ	2 or 3
MSG_SEQ	2 or 3
ACK_REQ	1

ACK_SEQ – Acknowledgment sequence number.

This field contains the value of the MSG_SEQ field of a regular PDU (3 bits) or a mini PDU (2 bits) received on the r-dsch and being acknowledged on the f-dsch.

MSG_SEQ – Message sequence number.

This field contains the message sequence number for the regular PDU (3 bits) or the mini PDU (2 bits) to be sent on the f-dsch.

ACK_REQ – Acknowledgment required indicator.

This field indicates whether the PDU being sent on the f-dsch requires an acknowledgment from the mobile station.

3.2.2.1.1.2 Requirements for Setting ARQ Fields

The base station shall set the ACK_REQ field of a PDU transmitted on the f-dsch to:

- '1' to request an acknowledgment from the mobile station, or
- '0' to indicate to the mobile station that an acknowledgment is not requested.

The base station shall set the MSG_SEQ field of a PDU transmitted on the f-dsch according to the following procedures:

- For PDUs requiring acknowledgment, the base station shall use the message sequence number variables MSG_SEQ_ACK for regular PDUs and shall use M_MSG_SEQ_ACK for mini PDUs. When the base station prepares a new PDU requiring acknowledgment, the base station shall set the MSG_SEQ field of the PDU to MSG_SEQ_ACK for regular PDUs or to M_MSG_SEQ_ACK for mini PDUs. In subsequent retransmissions of the PDU, the base station shall set the MSG_SEQ field to the same value used for the initial transmission of that PDU.
- For PDUs not requiring acknowledgment, the base station shall use the message sequence number variables MSG_SEQ_NOACK for regular PDUs and shall use M_MSG_SEQ_NOACK for mini PDUs. When the base station prepares a new PDU not requiring acknowledgment for transmission on the f-dsch, the base station shall set the MSG_SEQ field of the PDU to MSG_SEQ_NOACK for regular PDUs or to M_MSG_SEQ_NOACK for mini PDUs.

The base station shall set the ACK_SEQ field of regular PDUs and mini PDUs transmitted on the f-dsch to the MSG_SEQ field of a regular PDU or mini PDU, respectively, previously received on the r-dsch and being acknowledged. If no PDU requiring acknowledgment has

been received since f-dsch was acquired, the base station shall set all bits of the ACK_SEQ field to '1'.

3.2.2.1.2 Procedures

3.2.2.1.2.1 Overview of Transmission and Retransmission Procedures

Both PDUs requiring acknowledgment and PDUs not requiring acknowledgment are sent on the f-dsch. The order of delivery of either type of PDU is not guaranteed. The procedure for PDUs requiring acknowledgment is a selective repeat scheme in which a PDU is retransmitted only if an acknowledgment for it is not received. PDUs not requiring acknowledgment may be transmitted several times.

After transmitting a PDU requiring acknowledgment, the ARQ Sublayer on the transmitter side stores the PDU. The ARQ Sublayer may retransmit the PDU if no acknowledgment for it was received. If the ARQ Sublayer on the transmitter side receives an indication from the ARQ Sublayer on the receiver side that an acknowledgment for the transmitted PDU was received on the r-dsch, the ARQ Sublayer on the transmitter side discards the copy of the transmitted PDU; otherwise, the ARQ Sublayer retransmits the stored PDU. The procedure is repeated until each PDU requiring acknowledgment is either acknowledged or is transmitted a fixed number of times (implementation-specific).

If the ARQ Sublayer on the transmitter side receives an indication from the ARQ Sublayer on the receiver side that a PDU requiring acknowledgment must be acknowledged, the ARQ Sublayer on the transmitter side sends an acknowledgment within T_{1m} seconds for regular PDUs or within T_{75m} seconds for mini PDUs.

When the ARQ Sublayer operating on the f-dsch receives a *reverse dedicated channel acquired* indication from Layer 3 (see 3.6.4.2 of [5]) indicating that the dedicated signaling channels were properly established and further signaling can proceed, the ARQ Sublayer generates an acknowledgment PDU[69] and sends it to the mobile station on the f-dsch.

The ARQ Sublayer may receive a reset indication from the controlling management function, from Layer 3, or from the ARQ Sublayer on the receiver side upon the reception of a *Reset PDU* by the LAC Sublayer (for mini PDUs only, see Table 2.2.1.2.1.2-3). The ARQ Sublayer is reset simultaneously on the transmitter and the receiver sides. In such cases the message sequence number variables for PDUs both requiring and not requiring acknowledgments are set to '0', the acknowledgment timers are reset and the repetition counters for all PDUs are set to '0'. Since the reset disposition results in pending acknowledgments being discarded, all bits of the ACK_SEQ field are set to '1' for PDUs sent immediately after a reset operation.

[69] In [11], this "acknowledgment-specific" PDU is referred to as the *Base Station Acknowledgement Order*.

3.2.2.1.2.2 Requirements for Transmission and Retransmission Procedures

When assembling PDUs for transmission, the base station shall set the ARQ fields as specified in 3.2.2.1.1.2.

The base station shall store the message sequence number variables MSG_SEQ_ACK for regular PDUs and M_MSG_SEQ_ACK for mini PDUs. After sending a PDU requiring acknowledgment, the base station shall increment MSG_SEQ_ACK modulo 8 for regular PDUs or shall increment M_MSG_SEQ_ACK modulo 4 for mini PDUs. For PDUs not requiring acknowledgment, the base station shall store different message sequence number variables MSG_SEQ_NOACK for regular PDUs and M_MSG_SEQ_NOACK for mini PDUs. After sending a PDU not requiring acknowledgment, the base station shall increment MSG_SEQ_NOACK modulo 8 for regular PDUs or shall increment M_MSG_SEQ_NOACK modulo 4 for mini PDUs.

The base station may transmit up to four regular PDUs before receiving an indication that one of the transmitted regular PDUs was acknowledged. The base station may transmit up to two mini PDUs before receiving an indication that one of the transmitted mini PDUs was acknowledged. If a transmitted (regular or mini) PDU of a given type requiring acknowledgment and having the MSG_SEQ field equal to (MSG_SEQ_ACK + 4) modulo 8 for regular PDUs or equal to (M_MSG_SEQ_ACK + 2) modulo 4 for mini PDUs is awaiting acknowledgment, the base station shall not send a new PDU of the same type requiring acknowledgment until it receives an indication that the transmitted PDU was acknowledged.

If the base station transmits the same PDU not requiring acknowledgment more than once, it shall use the same MSG_SEQ number for all transmissions. The base station shall complete all retransmissions of the same PDU within T_{3m} seconds for regular PDUs or within T_{77m} seconds for mini PDUs after the first transmission (see Figure 3.2.2.1.2.2-1; only T_{3m} is shown). The base station shall wait at least T_{3m} seconds for regular PDUs or T_{77m} seconds for mini PDUs after the last transmission of a PDU not requiring acknowledgment before transmitting another PDU of the same type not requiring acknowledgment that has the same MSG_SEQ number[70] (see Figure 3.2.2.1.2.2-1; only T_{3m} is shown).

[70]This is necessary because it is possible that the mobile station receives only the last transmission.

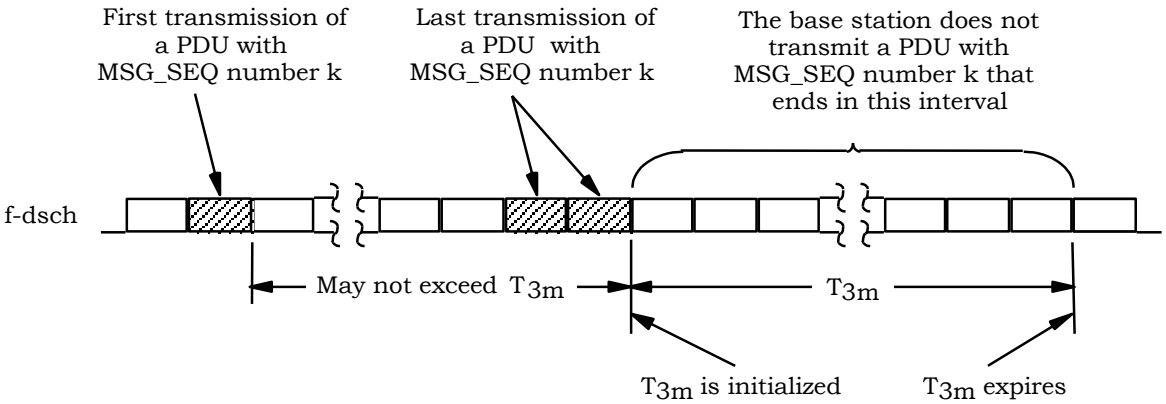

Figure 3.2.2.1.2.2-1. Time Requirement for the Base Station Not to Reuse a MSG_SEQ Number

The base station shall not retransmit PDUs requiring acknowledgments for which it has received an acknowledgment indication (see 3.1.1.2.2.2). If the base station has not received a valid acknowledgment[71] indication after transmitting a PDU requiring acknowledgment, the base station shall retransmit the PDU. If the base station retransmits a PDU, the base station shall use the same MSG_SEQ number for the retransmission. The base station shall retransmit a PDU only an implementer-defined maximum number of times; if the maximum number of retransmissions is to be exceeded, the base station shall declare an acknowledgment failure.

If the base station receives an indication that the transmission of an acknowledgment for a received PDU is requested (see 3.1.2.2.2), the base station shall transmit a PDU including an acknowledgment within T_{1m} seconds for regular PDUs or within T_{75m} seconds for mini PDUs, as follows:

- The base station shall acknowledge a regular PDU requiring acknowledgment by transmitting a regular PDU. The base station shall acknowledge a mini PDU requiring acknowledgment by transmitting a mini PDU.
- If the base station needs to acknowledge a regular PDU, and either has or receives an indication that no regular SDUs are to be transmitted within T_{1m} seconds, the base station shall generate and transmit a regular PDU carrying an SDU which has the following format (to be sent as an *Order Message*):[72]

[71] An acknowledgment is valid if it is not required to be message integrity protected (see [5]) or if it passes the message integrity checks (see 3.1.1.1.3).

[72] In [11], this "acknowledgment-specific" PDU is referred to as the *Base Station Acknowledgement Order*.

Field	Length (bits)
USE_TIME = '0'	1
ACTION_TIME = '000000'	6
ORDER = '010000'	6
ADD_RECORD_LEN = '000'	3

The base station shall set the ACK_REQ field in the generated PDU to '0', and shall set the ACK_SEQ field in the generated PDU as specified in 3.2.2.1.1.2.

- If the base station needs to acknowledge a mini PDU, and either has or receives an indication that no mini SDUs are to be transmitted within T_{75m} seconds, the base station shall generate and transmit a mini PDU carrying an SDU which has the following format (to be sent as an *Acknowledgment PDU*):

Field	Length (bits)
RESERVED = '0000000000000'	13

The base station shall set the ACK_SEQ field in the generated PDU as specified in 3.2.2.1.1.2.

- Otherwise, the base station shall either generate and transmit a PDU with fields defined as described above, or it shall use a PDU carrying an Upper Layer SDU as the PDU to be transmitted and shall set the ACK_SEQ field as specified in 3.2.2.1.1.2.

If the base station receives a *reverse dedicated channel acquired* indication from Layer 3, the base station shall immediately generate a PDU carrying an SDU which has the following format (to be sent as an *Order Message*):[73]

Field	Length (bits)
USE_TIME = '0'	1
ACTION_TIME = '000000'	6
ORDER = '010000'	6
ADD_RECORD_LEN = '000'	3

[73] In [11], this "acknowledgment-specific" PDU is referred to as the *Base Station Acknowledgement Order*.

The base station should set the ACK_REQ field to '1', should set the ACK_SEQ field in the generated PDU as specified in 3.2.2.1.1.2, and shall immediately transmit the PDU.

When sending mini PDUs, the base station may send an order to reset the ARQ parameters on the mobile station side via a PDU carrying an SDU which has the following format (to be sent as a *Reset PDU*):

Field	**Length (bits)**
RESERVED = '0000000000000'	13

If the base station receives a reset indication for both regular and mini PDUs, the base station shall:

- Reset its retransmission count for each PDU awaiting acknowledgment.
- Set MSG_SEQ_ACK, M_MSG_SEQ_ACK, MSG_SEQ_NOACK and M_MSG_SEQ_NOACK to '0'.
- Discard each pending request for acknowledgment for PDUs received on the r-dsch.

If the base station performs a reset for mini PDUs only, the base station shall:

- Reset its retransmission count for each mini PDU awaiting acknowledgment.
- Set M_MSG_SEQ_ACK and M_MSG_SEQ_NOACK to '0'.
- Discard each pending request for acknowledgment for mini PDUs received on the r-dsch.

After completing the reset for the specified type of PDUs, the base station should resume normal operation, starting with the transmission of the PDUs of the specified type that were awaiting acknowledgment at the time the reset disposition was received. Additional requirements for the processing of a reset request by the base station are given in 3.1.1.2.2.2.

3.2.2.2 Utility Sublayer

3.2.2.2.1 Parameters

The base station shall use the fields defined in 3.2.2.2.1.1 for PDUs transmitted on the f-dsch, and shall set these fields according to the requirements in 3.2.2.2.1.2.

3.2.2.2.1.1 Definition of Utility Sublayer Fields

The message type field for PDUs transmitted on the f-dsch has the following format:

Field	**Length (bits)**
MSG_TYPE	3, 6 or 8

MSG_TYPE – Message type indicator.

This field contains the message type indicator for regular PDUs (8 bits) or mini PDUs (3 or 6 bits) to be sent on the f-dsch.

A regular PDU transmitted on the f-dsch includes the Encryption field and may also include the Extended-Encryption Fields, based upon P_REV_IN_USE and the current encryption mode.

The Encryption field for regular PDUs transmitted on the f-dsch has the following format:

Field	Length (bits)
ENCRYPTION	2

ENCRYPTION – Message encryption indicator.

The Extended-Encryption Fields for regular PDUs transmitted on the f-dsch have the following format:

Field	Length (bits)
SDU_ENCRYPT_MODE	0 or 3
ENC_SEQ	0 or 8

SDU_ENCRYPT_MODE – Signaling encryption mode in use for the SDU carried by this PDU.

ENC_SEQ – The eight least significant bits of the encryption sequence number used to construct a cryptographic synchronization crypto-sync (see [5]) for the encryption algorithm.

The PDU padding field for PDUs transmitted on the f-dsch has the following format:

Field	Length (bits)
PDU_PADDING	0 - 7

PDU_PADDING – Padding bits.

The MACI field for PDUs transmitted on the f-dsch has the following format:

Field	Length (bits)
MACI	0 or 32

MACI – Message Authentication Code for Integrity.

3.2.2.2.1.2 Requirements for Setting Utility Sublayer Fields

The base station shall set the MSG_TYPE field of regular PDUs transmitted on the f-dsch as shown in Table 3.2.2.2.1.2-1.

Table 3.2.2.2.1.2-1. MSG_TYPE Values for Regular PDUs on f-dsch (Part 1 of 3)

Message Name	MSG_TAG	MSG_TYPE (binary)
Order Message	ORDRM	00000001
Authentication Challenge Message	AUCM	00000010
Alert With Information Message	AWIM	00000011
Data Burst Message	DBM	00000100
Reserved (Previously: Analog Handoff Direction Message)		00000110
In-Traffic System Parameters Message	ITSPM	00000111
Neighbor List Update Message	NLUM	00001000
Send Burst DTMF Message	BDTMFM	00001001
Power Control Parameters Message	PCNPM	00001010
Retrieve Parameters Message	RTPM	00001011
Set Parameters Message	STPM	00001100
SSD Update Message	SSDUM	00001101
Flash With Information Message	FWIM	00001110
Mobile Station Registered Message	MSRM	00001111
Status Request Message	STRQM	00010000
Extended Handoff Direction Message	EHDM	00010001
Service Request Message	SRQM	00010010
Service Response Message	SRPM	00010011
Service Connect Message	SCM	00010100
Service Option Control Message	SOCM	00010101
TMSI Assignment Message	TASM	00010110
Service Redirection Message	SRDM	00010111
Supplemental Channel Assignment Message	SCAM	00011000
Power Control Message	PCNM	00011001
Extended Neighbor List Update Message	ENLUM	00011010
Candidate Frequency Search Request Message	CFSRQM	00011011
Candidate Frequency Search Control Message	CFSCNM	00011100

Table 3.2.2.2.1.2-1. MSG_TYPE Values for Regular PDUs on f-dsch (Part 2 of 3)

Message Name	MSG_TAG	MSG_TYPE (binary)
Power Up Function Message	PUFM	00011101
Power Up Function Completion Message	PUFCM	00011110
General Handoff Direction Message	GHDM	00011111
Resource Allocation Message	RAM	00100000
Extended Release Message	ERM	00100001
Universal Handoff Direction Message	UHDM	00100010
Extended Supplemental Channel Assignment Message	ESCAM	00100011
Mobile Assisted Burst Operation Parameters Message	MABOPM	00100100
User Zone Reject Message	UZRM	00100101
User Zone Update Message	UZUM	00100110
Call Assignment Message	CLAM	00100111
Extended Alert With Information Message	EAWIM	00101000
DS-41 Inter-system Transfer Message (DS-41 only, see [13])	D41ISTM	00101001
Extended Flash With Information Message	EFWIM	00101010
Security Mode Command Message	SMCM	00101011
MC-MAP L3 Message (MC-MAP only, see [14])	MAPL3M	00101100
MC-MAP Inter-System Handover Command Message (MC-MAP only, see [14])	MAPISHCM	00101101
MC-MAP Dedicated Mode Paging Message (MC-MAP only, see [14])	MAPDMPM	00101110
R-TMSI Assignment Message (MC-MAP only, see [14])	RTASM	00101111
MC-MAP Flow Release Message (MC-MAP only, see [14])	MAPFRM	00110000
Base Station Status Response Message	BSSRSPM	00110001

Table 3.2.2.2.1.2-1. MSG_TYPE Values for Regular PDUs on f-dsch (Part 3 of 3)

Message Name	MSG_TAG	MSG_TYPE (binary)
Authentication Request Message	AUREQM	00110010
Rate Change Message	RATCHGM	00110011
In-Traffic Broadcast Service Parameters Message	ITBSPM	00110100
MEID Universal Handoff Direction Message	MUHDM	00110101
Radio Configuration Parameters Message	RCPM	00110110
Handoff Supplementary Information Solicit Message	HOSISM	00110111
General Extension Message	GEM	11111111
Alternate Technology Information Message	ATIM	00111000

The base station shall set the MSG_TYPE field of mini PDUs as shown in Tables 3.2.2.2.1.2-2 and 3.2.2.2.1.2-3.

Table 3.2.2.2.1.2-2. MSG_TYPE Values (3 bits) for Mini PDUs on f-dsch

Message Name	MSG_TAG	MSG_TYPE (binary)
Resource Allocation Mini Message	RAMM	000
Extended Release Mini Message	ERMM	001
Forward Supplemental Channel Assignment Mini Message	FSCAMM	010
Reverse Supplemental Channel Assignment Mini Message	RSCAMM	011

Table 3.2.2.2.1.2-3. MSG_TYPE Values (6 bits) for Mini PDUs on f-dsch

Message Name	MSG_TAG	MSG_TYPE (binary)
Acknowledgment PDU	ACK	111000
Reset PDU	RESET	111001

The base station shall set the ENCRYPTION field of regular PDUs sent on the f-dsch to the current encryption mode (see [5]). The base station shall not change the value of this field and the encryption state of the SDU carried by the PDU if the PDU is retransmitted.

If P_REV_IN_USE is greater than or equal to seven and the ENCRYPTION field is set to '11', the mobile station shall include the Extended-Encryption Fields; otherwise, these fields shall be omitted.

If the Extended-Encryption Fields are included, the base station shall set them as follows:

- The base station shall set the SDU_ENCRYPT_MODE field to the signaling encryption mode that is used for the SDU carried by this PDU and is provided by Layer 3.
- If the SDU_ENCRYPT_MODE field is set to '001' or '010' and if the MACI_INCL field is not present in the PDU or it is present, but it is equal to '0', the base station shall include the ENC_SEQ field and shall set it to the value provided by Layer 3; otherwise, the base station shall omit the ENC_SEQ field.

The base station shall not change the value of the Extended-Encryption Fields and the encryption state of the SDU carried by the PDU if the PDU is retransmitted.

The base station shall set the PDU_PADDING field to contain the minimum number of bits needed to make the length of the PDU, in bits, an integral multiple of eight. The base station shall set these bits to '0'.

The base station shall include the MACI field, if and only if the MACI_INCL field in the transmitted PDU is included and is equal to '1'; otherwise, the base station shall omit the MACI field. If the MACI field is included, the base station shall set this field as follows: the base station shall execute the procedure[74] for setting the MACI field described in 2.2.1.2.2. The base station shall set the MACI field to MAC-I.

The base station shall not change the values of the MACI field and the Message Integrity fields of the PDU, if the PDU is retransmitted.

3.2.2.2.2 Procedures

The base station shall set the parameters defined in 3.2.2.2.1.1 according to the requirements specified in 3.2.2.2.1.2.

If $P\_REV\_IN\_USE_S$ is less than nine, the base station shall use the following format to assemble regular PDUs for transmission on the f-dsch:

[74] With respect to the MACI field, when formatting a PDU for transmission on f-dsch, the base station uses the same procedures that the mobile station uses when formatting a PDU or transmission on r-dsch, except that the *channel_specific_buffer* is set differently, USE_UAK_S is not tested and the UMAC value is not computed or used.

Field	Reference
MSG_TYPE	Section 3.2.2.2.1.1
ARQ Fields	Section 3.2.2.1.1.1
ENCRYPTION	Section 3.2.2.2.1.1
Extended-Encryption Fields	Section 3.2.2.2.1.1
SDU	[5]
PDU_PADDING	Section 3.2.2.2.1.1

If $P\_REV\_IN\_USE_S$ is greater than or equal to nine, the base station shall assemble regular PDUs for transmission on the f-dsch using the following format:

Parameter	Reference
Message Type Field	Section 3.2.2.2.1.1
ARQ Fields	Section 3.2.2.1.1.1
Encryption Field	Section 3.2.2.2.1.1
Message Integrity Fields[75]	Section 2.1.1.1.1.1
Extended-Encryption Fields	Section 3.2.2.2.1.1
SDU	[5]
PDU Padding Field	Section 3.2.2.2.1.1
Message Authentication Code for Integrity (MACI) Field	Section 3.2.2.2.1.1

If the MACI field is included in the PDU, the base station shall proceed as follows:

- The base station shall compute MSG_LENGTH based on the requirements in 3.2.2.3.1.
- The mobile station shall set *msg_length* to MSG_LENGTH and shall consider the length of the *msg_length* parameter to be 8 bits.
- The mobile station shall set *channel_specific_buffer* as described in 2.2.1.4.2 and shall invoke the procedure for computing the MAC-I value described in 2.1.1.1.2.5, with the *channel_specific_buffer*, *msg_length* and the non-encapsulated PDU without the MACI field, as parameters.
- The mobile station shall use the value MAC-I to set the MACI field as described in 2.2.1.2.1.2.

[75] The Message Integrity Fields are MACI_INCL, SDU_KEY_ID, SDU_INTEGRITY_ALGO, SDU_SSEQ_OR_SSEQH, SDU_SSEQ and SDU_SSEQ_H.

The base station shall use the following format to assemble mini PDUs for transmission on the f-dsch:

Field	Reference
ARQ Fields	Section 3.2.2.1.1
MSG_TYPE	Section 3.2.2.2.1
SDU	[5]
PDU_PADDING	Section 3.2.2.2.1.1

The base station shall not assemble and transmit regular PDUs larger than 2016 bits. The base station shall not assemble and transmit mini PDUs larger than 24 bits.

3.2.2.3 Segmentation and Reassembly Sublayer

3.2.2.3.1 Parameters

3.2.2.3.1.1 Definition of SAR parameters

The SAR parameters for regular PDUs transmitted on the f-dsch have the same format as those for regular PDUs transmitted on the r-dsch (see 2.2.1.3.1.1).

There are no SAR parameters defined for mini PDUs.

3.2.2.3.1.2 Requirements for Setting SAR Parameters

For regular PDUs sent on the f-dsch, the base station shall set the SAR parameters as specified in 2.2.1.3.1.2.[76]

3.2.2.3.2 Procedures

The base station shall assemble and shall transmit encapsulated PDUs as specified in 2.2.1.3.2.[77]

3.2.2.4 Message Integrity Sublayer

3.2.2.4.1 Parameters

The base station shall use and set the Message Integrity Fields specified in 2.1.1.1.1.1[78] according to the procedures in 3.2.2.4.2. and 2.1.1.1.1.3.

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[76] When transmitting on the f-dsch, the base station sets the SAR parameters in the same manner that the mobile station does when transmitting on the r-dsch.

[77] When transmitting on the f-dsch, the base station assembles PDUs in the same manner that the mobile station does when transmitting on the r-dsch.

3.2.2.4.2 Procedures

If message integrity is supported and enabled for a regular PDU transmitted on f-dsch, the base station shall set *channel_specific_buffer* to the 2 bits corresponding to "ACK_REQ |'0'", where ACK_REQ is set to '0', if the message is to be sent in unassured mode or to '1', if the message is to be sent in assured mode, where the most significant bit of the *channel_specific_buffer* corresponds to the ACK_REQ bit.

When the base station executes the procedure for setting up the MACI field (see 3.2.2.2.2), the *channel_specific_buffer* shall be passed as input parameter to that procedure.

[78] Except where explicitly specified otherwise (see 3.2.2.4.2 and 3.2.2.2.2), for regular PDUs transmitted on f-dsch, the base station uses the same Message Integrity Fields and the same procedures for inclusion and setting of values for these fields as the mobile station does when transmitting PDUs on r-dsch.

ANNEX A TIMERS AND CONSTANTS

Annex A is a normative annex, which contains tables that give specific values for the constant identifiers. These identifiers take the forms such as T_{75m} and N_{15m}. The subscripted numbers vary to identify the particular constant. Typically the subscripted letter "m" refers to the mobile station and the subscripted letter "b" refers to the base station. The following tables provide values for identifiers given in the text:

Table A-1. Time Limits

Table A-2. Other Constants

Table A-1. Time Limits

Time Limit	Description	Value	References
T_{1m}	Maximum time the mobile station waits for an acknowledgment of a regular PDU. Maximum time the mobile station waits for an acknowledgment of a mini PDU after the first N_{14m} transmissions or retransmissions of the mini PDU.	0.4 s	2.2.1.1.2 3.2.2.1.2
T_{2m}	Maximum time allowed for the mobile station to send an acknowledgment of a regular PDU.	0.2 s	2.2.1.1.2
T_{3m}	Period in which two regular PDUs received by the mobile station on the f-dsch, not requiring an acknowledgment and carrying the same sequence numbers, are considered duplicates	0.32 s	2.2.2.1.2.2 3.2.2.1.2.2
T_{4m}	Period in which two PDUs received by the mobile station on the same physical channel corresponding to the f-csch, not requiring an acknowledgment and carrying the same sequence numbers, are considered duplicates	2.2 s	2.1.2.1.2.2 3.1.2.1.2.1 3.1.2.1.2.2
T_{75m}	Maximum time the mobile station waits for an acknowledgment of a mini PDU for the first N_{14m} transmissions or retransmissions of the mini PDU.	0.12 s	2.2.1.1.2 3.2.2.1.2
T_{76m}	Maximum time allowed for the mobile station to send an acknowledgment of a mini PDU.	0.06 s	2.2.1.1.2
T_{77m}	Period in which two mini PDUs received by the mobile station on the f-dsch, not requiring an acknowledgment and carrying the same sequence numbers, are considered duplicates	0.02 s	2.2.2.1.2.2 3.2.2.1.2.2

Table A-2. Other Constants

Constant	Description	Value	References
N_{1m}	Maximum number of times that a mobile station transmits or retransmits a regular PDU requiring acknowledgment on the r-dsch.	13	2.2.1.1.2 2.2.1.1.3
N_{14m}	Maximum number of times that a mobile station transmits or retransmits a mini PDU requiring acknowledgment on the r-dsch with *retransmission_timer* set to T_{75m}.	6	2.2.1.1.2 2.2.1.1.3
N_{15m}	Maximum number of times that a mobile station transmits or retransmits a mini PDU requiring acknowledgment on the r-dsch.	17	2.2.1.1.2