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Technical realization of Cell Broadcast Service (CBS)
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1 Scope

The present document describes the Cell Broadcast short message service (CBS) for GSM and UMTS.

For GSM it defines the primitives over the Cell Broadcast Centre - Base Station System (CBC-BSS) interface and the message formats over the Base Station System - Mobile Station (BSS-MS) interface for Teleservice 23 as specified in 3GPP TS 22.003 [2].

For UMTS it defines the interface requirements for the Cell Broadcast Centre – UMTS Radio Network System (RNS) interface and the radio interface requirements for UMTS Radio Access Networks to support CBS as specified in 3GPP TS 22.003 [2].

The present document also describes the Public Warning System (PWS) for GSM, UMTS, E-UTRAN, and NG-RAN, see 3GPP TS 22.268 [28].

1.1 References

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

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

- [1] Void
- [2] 3GPP TS 22.003: "Circuit Teleservices supported by a Public Land Mobile Network (PLMN)".
- [3] 3GPP TS 23.038: "Alphabets and language-specific information".
- [4] 3GPP TS 23.040: "Technical realization of the Short Message Service (SMS)".
- [5] Void.
- [6] 3GPP TR 03.49 Version 7.0.0: "Digital cellular telecommunication system (Phase 2+); Example protocol stacks for interconnecting Cell Broadcast Centre (CBC) and Base Station Controller (BSC)".
- [7] 3GPP TS 44.012: "Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface".
- [8] 3GPP TS 45.002: "Multiplexing and multiple access on the radio path".
- [9] Void.
- [10] 3GPP TS 48.052: "Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Interface principles".
- [11] 3GPP TS 48.058: "Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification".
- [12] ITU-T Recommendation X.210: "Information technology - Open systems interconnection - Basic Reference Model: Conventions for the definition of OSI services".
- [13] 3GPP TS 48.008: "Mobile-services Switching Centre - Base Station System (MSC-BSS) interface; Layer 3 specification".
- [14] 3GPP TS 23.042: "Compression algorithm for text messaging services".

- [15] 3GPP TS 23.048: "Security Mechanisms for the SIM application toolkit".
- [16] 3GPP TS 25.331: "Radio Resource Control (RRC); Protocol specification".
- [17] 3GPP TS 25.401: "UTRAN Overall Description".
- [18] 3GPP TS 31.102: "Characteristics of the USIM Application".
- [19] 3GPP TS 25.324: "Broadcast/Multicast Control BMC".
- [20] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [21] 3GPP TR 25.925: "Radio Interface for Broadcast/Multicast Services".
- [22] Void.
- [23] Void.
- [24] Void.
- [25] GSMA AD.26: "Coding of Cell Broadcast Functions".
- [26] 3GPP TS 44.018: "Mobile radio interface layer 3 specification; Radio Resource Control Protocol".
- [27] 3GPP TS 44.060: "General Packet Radio Service (GPRS); Mobile Station (MS) - Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol".
- [28] 3GPP TS 22.268: "Public Warning System (PWS) Requirements".
- [29] 3GPP TS 25.419: "UTRAN Iu-BC Interface: Service Area Broadcast Protocol (SABP)".
- [30] 3GPP TS 48.049: "Base Station Controller - Cell Broadcast Centre (BSC-CBC) Interface Specification; Cell Broadcast Service Protocol (CBSP)".
- [31] Void.
- [32] ETSI TS 102 900: "European Public Warning System (EU-ALERT) using the Cell Broadcast Service".
- [33] IETF RFC 4960: "Stream Control Transmission Protocol".
- [34] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".
- [35] 3GPP TS 29.168: "Cell Broadcast Centre interfaces with the Evolved Packet Core".
- [36] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".
- [37] Void.
- [38] 3GPP TS 23.007: "Restoration Procedures".
- [39] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".
- [40] 3GPP TS 38.413: "NG Radio Access Network (NG-RAN); NG Application Protocol (NGAP)".
- [41] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".
- [42] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".
- [43] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".
- [44] 3GPP TS 38.300: "NR; NR and NG-RAN Overall Description; Stage 2".
- [45] 3GPP TS 23.527: "5G System; Restoration Procedures; Stage 2".

- [46] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRAN); Overall description; Stage 2".
- [47] ATIS-0700041: "WEA 3.0: Device-Based Geo-Fencing".
- [48] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".
- [49] 3GPP TS 23.122: "Non-Access-Stratum functions related to Mobile Station (MS) in idle mode".

1.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [20] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [20].

5GS	5G System
5GCN	5G Core Network
EPC	Evolved Packet Core
ePWS	enhancements of Public Warning System
NR	New Radio
SNPN	Stand-alone Non-Public Network
WEA	Wireless Emergency Alert

1.3 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.501 [39] apply:

5G System
NG-RAN

For the purposes of the present document, the following terms and definitions given in 3GPP TS 38.300 [44] apply:

gNB
NG-RAN node
ng-eNB

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.122 [39] apply:

Subscribed SNPN

2 General description

The CBS service is analogous to the Teletex service offered on television, in that like Teletex, it permits a number of unacknowledged general CBS messages to be broadcast to all receivers within a particular region. CBS messages are broadcast to defined geographical areas known as cell broadcast areas. These areas may comprise of one or more cells, or may comprise the entire PLMN or SNPN. Individual CBS messages will be assigned their own geographical coverage areas by mutual agreement between the information provider and the PLMN or SNPN operator. CBS messages may originate from a number of Cell Broadcast Entities (CBEs), which are connected to the Cell Broadcast Centre. CBS messages are then sent from the CBC to the cells, in accordance with the CBS's coverage requirements.

A CBS page comprises of 82 octets, which, using the default character set, equates to 93 characters. Other Data Coding Schemes may also be used, as described in 3GPP TS 23.038 [3]. Up to 15 of these pages may be concatenated to form a CBS message. Each page of such CBS message will have the same message identifier (indicating the source of the message), and the same serial number. Using this information, the MS/UE is able to identify and ignore re-broadcasts of already received messages.

CBS messages are broadcast cyclically by the cell at a frequency and for a duration agreed with the information provider. The frequency at which CBS messages are repeatedly transmitted will be dependent on the information that they contain; for example, it is likely that dynamic information such as road traffic information, will require more frequent transmission than weather information. The repetition period will also be affected by the desire for CBS messages to be received by high speed mobiles which rapidly traverse cells. Reception of CBS messages for an MS/UE is not a requirement if it is connected in the CS domain. It should be possible for an MS/UE to receive messages if it is connected in the PS domain and no data is currently transmitted.

CS-Domain	CS-Connected	CS-Idle	CS-Idle
PS-Domain	-	PS-Idle	PS-Connected
Reception of CBS Message	Not possible	Possible	Depends on RRC mode

NOTE: In case the UE is in CS-Idle and PS-Connected Mode it depends on the Radio Resource Control State whether reception of CBS messages is possible. The relevant states are described in 3GPP TS 25.331 [16].

GSM only [CBS messages may be broadcast on two different cell broadcast channels, which are characterized by different QoS. A MS is always able to read the basic channel (see 3GPP TS 45.002 [8]). The reading of the extended channel may collide with other tasks of the MS. Therefore the probability of receiving a CBS message on the extended channel is smaller than on the basic channel. The reading of the extended channel for MSs is optional. The scheduling on the channels will be done independently].

To permit mobiles to selectively display only those CBS messages required by the MS/UE user, CBS messages are assigned a message class which categorises the type of information that they contain and the language (Data Coding Scheme) in which the CBS message has been compiled. Through the use of appropriate MMI, the user is then able to ignore message types that he does not wish to receive, e.g. advertising information or messages in an unfamiliar language.

A network may be able to remotely activate mobile terminals in order to enable them to receive CBS messages, according to regulatory requirements (see 3GPP TS 25.331 [16]).

PWS provides a service that allows the network to distribute warning messages on behalf of public authority. PWS enables the distribution of ETWS, CMAS (aka WEA), KPAS and EU-Alert warning messages in GSM, UMTS, E-UTRAN, and NG-RAN.

Some of the PWS warning message distribution mechanisms are access technology specific, but some CBS procedures and related message structures are common for GSM and UMTS, and some CBS procedures and related message structures are common for E-UTRAN and NG-RAN.

The language-independent content mapped to an event or a disaster can be included in a warning message that is transparently passed from CBC to UEs. UEs with user interface which support the ePWS language-independent content functionality can display the entire warning message that they receive.

UEs with no user interface which support the ePWS disaster characteristics functionality can derive the characteristics of a disaster from the message identifier of a received warning message.

3 Network Architecture

3.0 General

The chosen network architectures differ for GSM, UMTS, EPS, and 5GS. In clause 3.1 the GSM network architecture is described, in clause 3.2 the UMTS network architecture, in clause 3.3 the EPS network architecture, and in clause 3.4 the 5GS network architecture.

3.1 GSM Network Architecture

The basic network structure of CBS is depicted by figure 1.

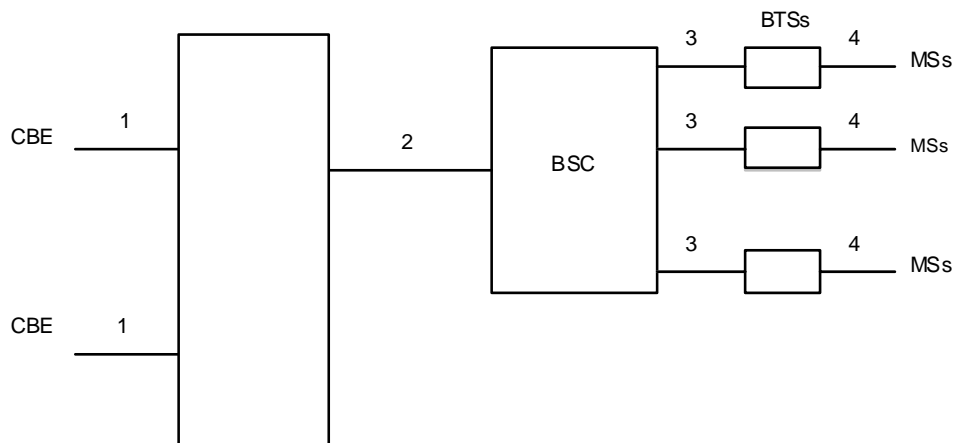


Figure 1

- message transfer on link 1 is outside the scope of 3GPP specifications;
- message transfer on link 2 is described in clause 9.1;
- message transfer on link 3 is described in 3GPP TS 48.058 [11];
- message transfer on link 4 is described in 3GPP TS 44.012 [7] and the timing of messages transferred on link 4 is described in 3GPP TS 45.002 [8].

3.2 UMTS Network Architecture

The basic network structure of CBS is depicted by figure 2.

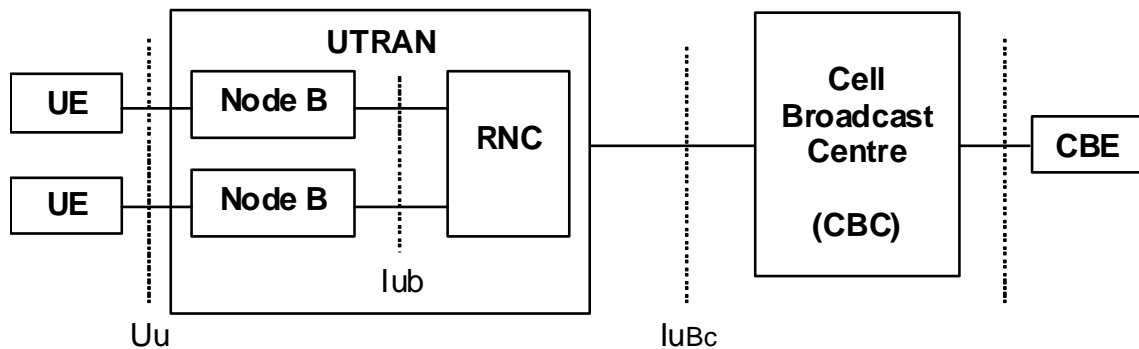


Figure 2

The basic network structure replaces the GSM BSS with the UTRAN containing the RNC and the Node B. The cell broadcast centre (CBC) is part of the core network and connected to a routing node e.g. a 3G SGSN via the Bc reference point. Thus the CBC can reach every RNC via the user plane of the Iu interface. On the logical interface between the CBC and the RNC protocol is described in 3GPP TS 25.419 [29]. The other UTRAN related interfaces are described in the according UTRAN specifications based on the 3GPP TR 25.925 [21]. Based on this architecture and the current requirements for cell broadcast the core network elements like MSC, VLR, HLR etc are not involved for the service delivery.

The CBE and the interface between CBE and CBC are out of scope of 3GPP specifications.

3.3 EPS Network Architecture

The basic network structure of PWS architecture in E-UTRAN is depicted by figure 3.3-1.

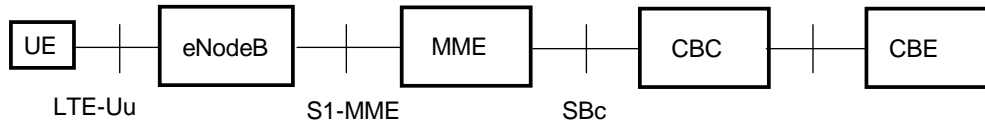


Figure 3.3-1: PWS architecture

The cell broadcast centre (CBC) is part of the core network and connected to the MME via the SBc reference point. The interface between the CBC and the MME is described in 3GPP TS 29.168 [35] and the interface between the MME and the eNodeB is described in 3GPP TS 36.413 [34].

The CBE and the interface between CBE and CBC are out of scope of 3GPP specifications.

3.4 5GS Network Architecture

Figures 3.4-1, 3.4-2 and 3.4-3 depict the basic network structure of 5GS PWS architecture.

Figure 3.4-1 depicts the 5GS PWS system architecture, using service-based interfaces between CBCF and AMF, showing how the network functions interact with each other. This option is further described in clauses 4 to 8. The service-based interfaces are further described in clause 9A.

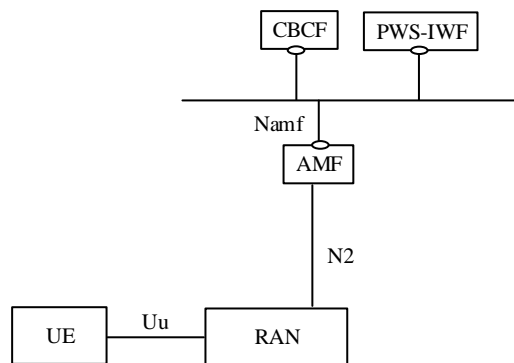


Figure 3.4-1: 5GS PWS architecture

NOTE: No services are provided by CBCF or PWS-IWF, thus no service-based interfaces are depicted for these NFs in the 5GS PWS architecture.

Figure 3.4-2 depicts the basic network structure of 5GS PWS architecture using the reference point representation showing how the network functions interact with each other when no PWS-IWF is used. This option is further described in clauses 4 to 8.

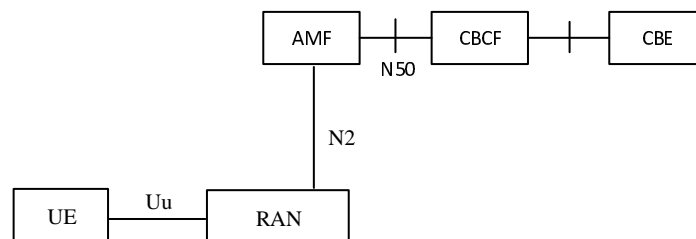


Figure 3.4-2: 5GS PWS architecture in reference point representation without PWS-IWF

Figure 3.4-3 depicts the basic network structure of 5GS PWS architecture using the reference point representation showing how the network functions interact with each other when PWS-IWF is used. This option is further described in Annex B.

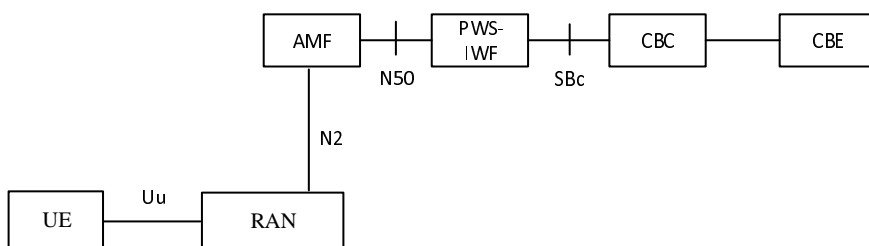


Figure 3.4-3: 5GS PWS architecture in reference point representation with PWS-IWF

The 5GS PWS architecture contains the following service-based interface:

Namf: Service-based interface exhibited by AMF.

The 5GS PWS architecture contains the following reference points:

N2: Reference point between the NG-RAN and the AMF.

NOTE 1: NG-RAN can be NR based or E-UTRA based (See 3GPP TS 23.501 [39], 3GPP TS 38.413 [40] and 3GPP TS 36.413 [34]).

N50: Reference point between the AMF and the CBCF or between the AMF and the PWS-IWF.

NOTE 2: N50 uses service-based interfaces, further described in clause 9A of the present document.

SBc: Reference point between the PWS-IWF and the CBC.

The CBE and the interface between CBE and CBC are out of scope of 3GPP specifications.

4 CBE Functionality

The functionality of the CBE is outside of the scope of 3GPP specifications; however it is assumed that the CBE is responsible for all aspects of formatting CBS messages, including the splitting of a CBS message into a number of pages.

5 CBC Functionality

In 3GPP the CBC is integrated as a node in the core network.

The CBC may be connected to several BSCs/RNCs/MMEs/PWS-IWFs. The CBC may be connected to several CBEs. The CBC shall be responsible for the management of CBS messages including:

- allocation of serial numbers;
- modifying or deleting CBS messages held by the BSC/RNC/eNodeB/NG-RAN node;
- initiating broadcast by sending fixed length CBS messages to a BSC/RNC/eNodeB/NG-RAN node for each language provided by the cell, and where necessary padding the pages to a length of 82 octets (see 3GPP TS 23.038 [3]);
- determining the set of cells to which a CBS message should be broadcast, and indicating within the Serial Number the geographical scope of each CBS message;

- determining the time at which a CBS message should commence being broadcast;
- determining the time at which a CBS message should cease being broadcast and subsequently instructing each BSC/RNC/eNodeB/NG-RAN node to cease broadcast of the CBS message;
- determining the period at which broadcast of the CBS message should be repeated;
- determining the cell broadcast channel in GSM, on which the CBS message should be broadcast.
- when CBS transmits emergency messages, allocation of "emergency indication" to differentiate it from normal CBS messages, including the "Cell ID/Service Area ID list", "warning type", "warning message". If "warning type" is of 'test', only UEs which are specially designed for testing purposes may display warning message.

To work efficiently on the interfaces, the BSC/RNC - which is normally controlling more than one cell of a broadcast area - should be used as a concentrator as far as CBS message handling is concerned. Hence, the CBC should work on lists of cells when issuing CB related requests towards the BSC/RNC.

5A CBCF Functionality

In 3GPP the CBCF is a network function in the 5G core network.

The CBCF may be connected to several AMFs. The CBCF may be connected to several CBEs. The CBCF shall be responsible for the management of CBS messages including:

- allocation of serial numbers;
- modifying or deleting CBS messages held by the NG-RAN node;
- initiating broadcast by sending fixed length CBS messages to a NG-RAN node for each language provided by the cell, and where necessary padding the pages to a length of 82 octets (see 3GPP TS 23.038 [3]);
- determining the set of cells to which a CBS message should be broadcast, and indicating within the Serial Number the geographical scope of each CBS message;
- determining the time at which a CBS message should commence being broadcast;
- determining the time at which a CBS message should cease being broadcast and subsequently instructing each NG-RAN node to cease broadcast of the CBS message;
- determining the period at which broadcast of the CBS message should be repeated;
- when CBS transmits emergency messages, allocation of "emergency indication" to differentiate it from normal CBS messages, including the "Cell ID/Service Area ID list", "warning type", "warning message". If "warning type" is of 'test', only UEs which are specially designed for testing purposes may display warning message.

The CBCF supports service based interface. The CBCF uses AMF communication services to forward warning messages to the NG-RAN and to subscribe to receive warning delivery related notifications.

6 BSC/RNC/MME/AMF Functionality

The BSC/RNC shall interface to only one CBC. A BSC may interface to several BTSs as indicated by 3GPP TS 48.052 [10]. An RNC may interface to several Node Bs.

The MME may interface to one CBC or multiple CBCs (i.e. the MME is allowed to have SCTP transport associations established with one or multiple CBCs). An MME may interface to several eNodeBs.

The AMF may interface to one CBCF or multiple CBCFs (i.e. the AMF is allowed to have HTTP/2 application layer associations with one or multiple CBCFs). An AMF may interface to several NG-RAN nodes.

The BSC/RNC/MME/AMF shall be responsible for:

BSC	RNC	MME	AMF
Interpretation of commands from the CBC.			
Storage of messages from the CBC.		Not applicable	
Scheduling of CBS messages on the CBCH.	Scheduling of CBS messages on the CBS related radio resources.	Not applicable	Not applicable
Providing an indication to the CBC when the desired repetition period cannot be achieved.		Not applicable	
Providing to the CBC acknowledgement of successful execution/forwarding of commands received from the CBC.			
Reporting to the CBC failure when a command received from the CBC is not understood or cannot be executed.			
Not applicable.	Not applicable.	Report the Broadcast Completed Area List, the Broadcast Cancelled Area List, PWS Restart Indication and the PWS Failure Indication received from eNB(s) to all CBCs that the MME interfaces with.	Report the Broadcast Completed Area List, the Broadcast Cancelled Area List, PWS Restart Indication and the PWS Failure Indication received from NG-RAN nodes to all CBCFs and PWS-IWFs that the AMF interfaces with.
Routing of CBS messages to the appropriate BTSs.	Routing of CBS messages to the appropriate Node Bs.	Routing of warning messages to the appropriate eNodeBs in the indicated Tracking Area.	Routing of warning messages to the appropriate NG-RAN nodes in the indicated Tracking Area.
Transferring CBS information to each appropriate BTS via a sequence of 4 SMS BROADCAST REQUEST messages or 1 SMS BROADCAST COMMAND message (see 3GPP TS 48.058 [11]), indicating the channel which shall be used.	The Node B has no functionality regarding CBS. This implies that CBS messages do not have to be transmitted explicitly to the Node Bs for further processing.	Not applicable.	Not applicable.
Optionally generating Schedule Messages, indicating the intended schedule of transmissions (see 3GPP TS 44.012 [7]).	Generating Schedule Messages, indicating the intended schedule of transmissions (see 3GPP TS 25.324 [19]). The conversion of GSM related CB DRX Information is a function of the RNC (3GPP TS 25.401 [17]).	Not applicable.	Not applicable.
Optionally receiving CBCH Load Indication messages and reacting by broadcasting a burst of scheduled CBS messages or by suspending the broadcast for a period indicated by BTS (see 3GPP TS 48.058 [11]).	Not applicable.	Not applicable.	Not applicable.
Broadcasting the ETWS Primary Notification message upon receipt of the WRITE-REPLACE message including the Paging-ETWS-Indicator. The ETWS Primary Notification message is broadcasted according to the Warning Period parameter.	Sending ETWS messages to mobile terminals upon receiving CBS transmission request from CBC including the Paging-ETWS-Indicator. Emergency indication can be included in the paging messages, based on the warning type information conveyed from CBC.	Sending the Write-Replace Warning Request message to the appropriate eNodeBs upon receiving warning message transmission request from CBC.	Sending the Write-Replace Warning Request message to the appropriate NG-RAN nodes upon receiving warning message transmission request from CBCF or PWS-IWFs.

To work efficiently on the interfaces, the BSC/RNC should forward CB related messages to the CBC using cell lists as far as applicable.

7 BTS Functionality

Only GSM [The BTS is responsible for conveying CBS information received via SMS BROADCAST REQUEST or SMS BROADCAST COMMAND messages over the radio path to the MS.

- optionally generating CBCH Load Indication messages, indicating an underflow or overflow situation on the CBCH (see 3GPP TS 48.058 [11]).]

8 MS/UE Functionality

8.1 General MS/UE Functionality

Only GSM [The MS is responsible for recombination of the blocks received via the radio path to reconstitute the CBS message.]

The precise method of display of CBS messages is outside the scope of 3GPP specifications, however it is assumed that an MS/UE will:

MS	UE
Discard sequences transferred via the radio path (see 3GPP TS 44.012 [7]) which do not consist of consecutive blocks.	Discard corrupt CBS messages received on the radio interface.
Have the ability to discard CBS information which is not in a suitable data coding scheme.	
Have the ability to discard a CBS message which has a message identifier indicating that it is of subject matter which is not of interest to the MS/UE.	
Have the ability to detect duplicate messages as specified in clause 8.2;	
Have the ability to transfer a CBS message to an external device, when supported ;	
Optionally enter CBS DRX mode based upon received Schedule Messages (see 3GPP TS 44.012 [7]);	Enter CBS DRX mode based upon received Schedule Messages (see 3GPP TS 25.324 [19]).
Optionally skip reception of the remaining block(s) of a CBS message which do(es) not contain cell broadcast information (see 3GPP TS 44.012 [7]);	Not applicable.
Optionally read the extended channel.	Not applicable for UMTS, E-UTRAN, and NG-RAN.
Enable the user to activate/deactivate CBS through MMI	
Enable the user to maintain a "search list" and receive CBS messages with a Message Identifier in the list while discarding CBS messages with a Message Identifier not in the list.	
Discard CBS messages in Message Identifier value range "A000hex-AFFFhex" unless received from HPLMN, EHPLMN, PLMN that is equivalent to HPLMN or EHPLMN, or a subscribed SNPN.	
Allow the user to enter the Message Identifier via MMI only for the 1 000 lowest codes.	
Be capable of receiving CBS messages consisting of up to 15 pages.	Be capable of receiving CBS messages consisting of up to 1230 octets in UTRAN or warning messages of up to 9600 octets in E-UTRAN, or NG-RAN.
When emergency indication is included in the received paging and/or CBS/warning message, behave as specified in 3GPP TS 22.268 [28]. If the emergency indication includes the value for "test", mobile terminals which are not used for testing purpose silently discard the paging message and do not receive the corresponding CBS/warning message.	

8.2 Duplication Detection Function

The MS/UE uses a common duplication detection function for all messages received in GSM, UMTS, E-UTRAN and NG-RAN.

In a PLMN, upon reception of a new message, the MS/UE shall perform duplication detection on the messages. Those messages that are received from the same PLMN in the certain time period specified by the duplication detection time are subject to duplication detection. The MS/UE shall not perform duplication detection on messages whose duplication detection time has elapsed. The value of the duplication detection time to be used by the MS/UE shall be derived from the MCC of the current PLMN as follows:

- If MCC = 440 or MCC = 441 (Japan), duplication detection time shall be 1 hour;
- For all other MCCs, duplication detection time shall be 24 hours.

In an SNPN, upon reception of a new message, the MS/UE shall perform duplication detection on the messages. Those messages that are received in the certain time period specified by the duplication detection time are subject to duplication detection. The MS/UE shall not perform duplication detection on messages whose duplication detection time has elapsed. The value of the duplication detection time to be used by the MS/UE shall be 24 hours.

The MS/UE shall check:

- 1) whether the Serial Number associated with the Message Identifier of the new message matches the Serial Number of any of those messages with the same Message Identifier that have been received and displayed to the subscriber and that are subject to the duplication detection.

Additionally, the MS/UE may check:

- 2) other criteria for detecting duplicates. An example of such a criterion is whether the actual contents of the two messages is the same.

If criterion 1 is fulfilled and any implemented additional checks (as described in criterion 2) are also met, then the MS/UE shall consider the new message as duplicated and shall ignore it. If the Geographical Scope is not PLMN/SNPN wide the validity of the Serial Number may be considered as described in clause 9.4.1.2.1.

For ETWS, duplicate message detection shall be performed independently for primary and secondary notifications.

8.3 ePWS functionality

The ePWS functionality consists of the ePWS language-independent content functionality and the ePWS disaster characteristics functionality as follows:

- 1) UEs with user interface which support the ePWS language-independent content functionality and which are capable of displaying text-based warning messages should be capable of displaying the language-independent content mapped to an event or a disaster (e.g. character such as Unicode based pictogram mapping to a disaster) that is part of user information contained in the content of a warning message transparently passed from CBC to UEs.

NOTE 1: Language-independent contents mapped to disasters need to be formatted to be suitable to be included in a warning message. It could be unicode symbol or symbol based on GSM 7 bit default alphabet. It is desirable that standardised symbols mapped to disasters are applied in all countries that provide warning messages for public safety. This will make it possible for foreigners to intuitively understand the meaning of language-independent contents displayed to their devices.

Editor's note [WI: ePWS, CR#202]: FFS on what character(s) such as Unicode based pictogram(s) are the language-independent content mapped to an event or a disaster.

- 2) UEs with user interface which support the ePWS language-independent content functionality and which are incapable of displaying text-based warning messages should be capable of mapping message identifiers of received warning messages to language-independent contents stored in those UEs. When a warning message is received, such a UE should be capable of displaying of a language-independent content stored in the UE mapped from the message identifier of the received warning message.

NOTE 2: This ePWS functionality is not applied for such UEs if they are not capable of storing any language-independent content.

- 3) UEs with no user interface which support the ePWS disaster characteristics functionality should be capable of identifying the characteristics of a disaster derived from the message identifier of a received warning message in order to take appropriate action.

9 Protocols and Protocol Architecture

9.1 Requirements on Core Network and Radio Access Network

9.1.1 GSM Radio Access Network

Commands interpreted by the BSC will result in a sequence of 4 SMS BROADCAST REQUEST messages or 1 SMS BROADCAST COMMAND message being sent to a BTS, which in turn result in a sequence of 4 blocks each 22 octets long being transferred via the BTS-MS interface (see 3GPP TS 44.012 [7]).

With the SMS BROADCAST REQUEST mode of operation, the 88 octet fixed length CBS page which is specified in clause 9.3 is split into four 22 octet blocks which are carried in SMS BROADCAST REQUEST messages as follows:

- octets 1-22 are transferred in the 1st SMS BROADCAST REQUEST
with a sequence number (see 3GPP TS 44.012 [7]) indicating first block;
- octets 23-44 are transferred in the 2nd SMS BROADCAST REQUEST
with a sequence number (see 3GPP TS 44.012 [7]) indicating second block;
- octets 45-66 are transferred in the 3rd SMS BROADCAST REQUEST
with a sequence number (see 3GPP TS 44.012 [7]) indicating third block;
- octets 67-88 are transferred in the 4th SMS BROADCAST REQUEST
with a sequence number (see 3GPP TS 44.012 [7]) indicating fourth block.

Figure 3 illustrates the protocol architecture and the scope of the various GSM Specifications for the SMS BROADCAST REQUEST mode of operation.

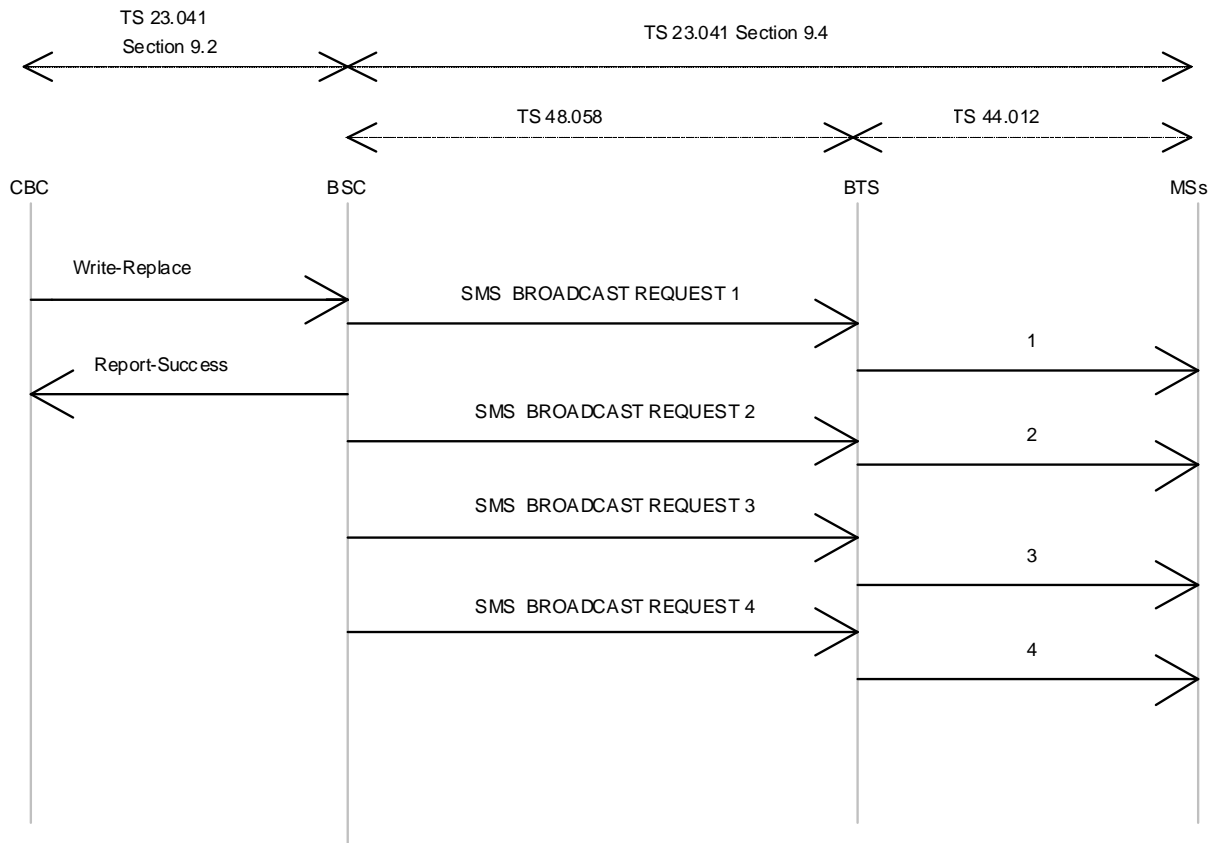


Figure 3

With the SMS BROADCAST COMMAND mode of operation, the BSC sends to the BTS in one single message the 88 octet fixed length CBS page. The BTS then splits the page into four 22 octet blocks, adds the sequence number (see 3GPP TS 44.012 [7]) and transmits the four resulting blocks on the air.

Figure 4 illustrates the protocol architecture and the scope of the various GSM Specifications for the SMS BROADCAST COMMAND mode of operation.

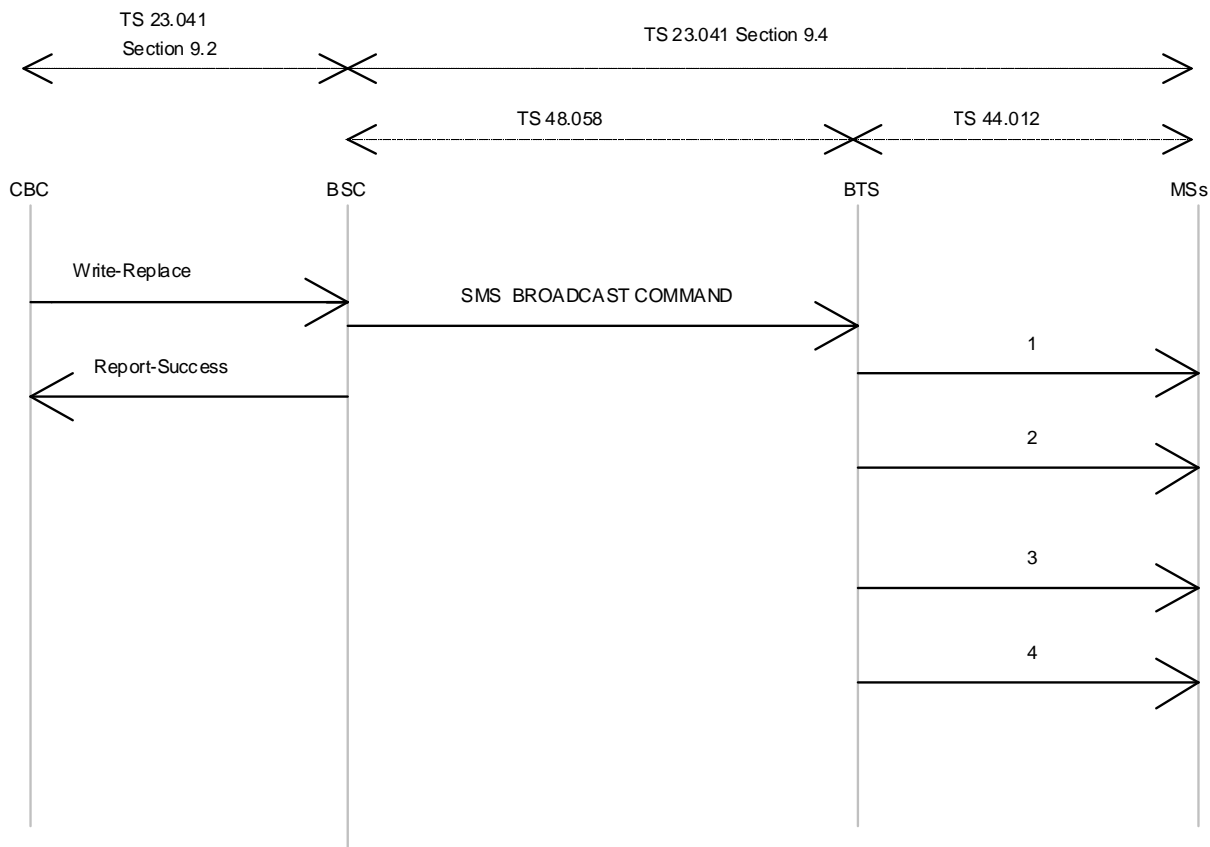


Figure 4

9.1.2 UMTS Radio Access Network

Commands interpreted by the RNC will result in one SMS BROADCAST COMMAND sent to the UE. The CBS messages are completely transparent to the Node B, i.e. no manipulation of the data like e.g. fragmentation is done at the Node B.

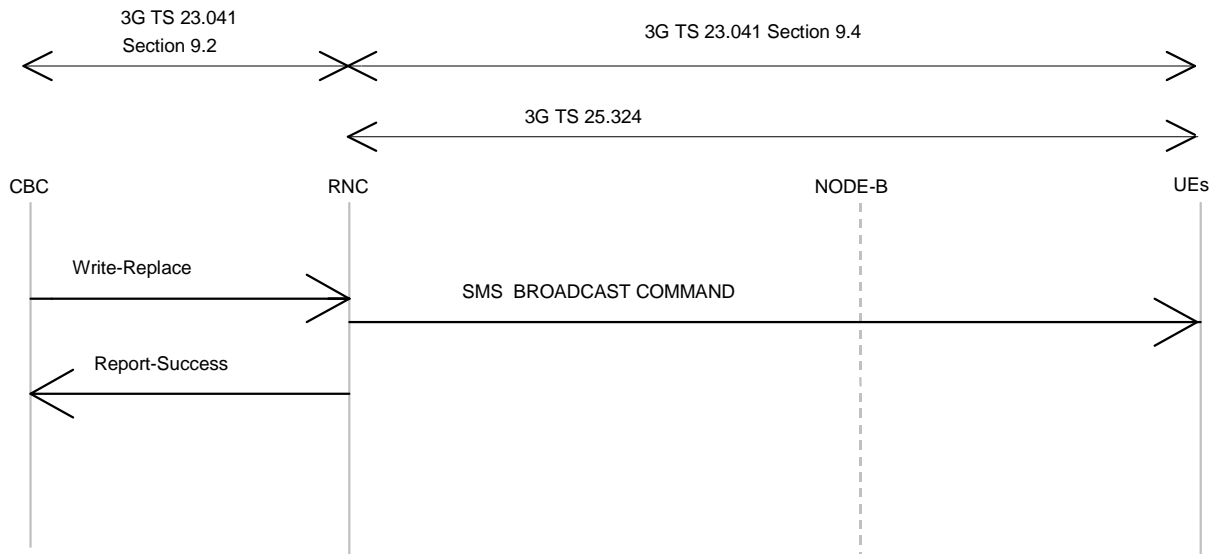


Figure 4a

9.1.3 Warning Message Delivery

9.1.3.1 General

In GSM and UMTS, the cell broadcast service can be used to transfer CBS messages related to public warning. This requires reception of CBS messages to be permanently activated in the mobile terminal.

Warning message delivery is similar to cell broadcast service. It permits a number of unacknowledged warning messages to be broadcast to MS/UEs within a particular area. Reception of warning messages is enabled as defined later on in this specification.

For warning messages received from a PLMN, 3GPP TS 31.102 [18] defines a USIM data file for configuration of warning messages reception. In case of a non-existing or empty USIM data file, the MS/UE accepts all warning messages on all PLMNs. As specified in 3GPP TS 31.102 [18], the MS/UE can be configured to ignore all warning messages received in its HPLMN or in a PLMN equivalent to it. As specified in 3GPP TS 31.102 [18], the MS/UE can be configured to ignore all warning messages received in a VPLMN or in a PLMN equivalent to it.

A UE in limited service state, and configured according to the USIM data file to display warning messages on that PLMN, shall display warning messages to the user.

For warning messages received from an SNPN:

- 3GPP TS 23.122 [49] defines configuration parameters in each entry of the "list of subscriber data" for configuration of warning message reception. In case the configuration parameters are not present in the selected entry of the "list of subscriber data", the UE accepts all warning messages on all SNPNS. As specified in 3GPP TS 23.122 [49], when using an entry of the "list of subscriber data" to access an SNPN, the UE can be configured to ignore all warning messages received in the subscribed SNPN of the selected entry of the "list of subscriber data". As specified in 3GPP TS 23.122 [49], when using an entry of the "list of subscriber data" to access an SNPN, the UE can be configured to ignore all warning messages received in an SNPN other than the subscribed SNPN of the selected entry of the "list of subscriber data"; and
- 3GPP TS 31.102 [18] defines a USIM data file for configuration of warning message reception when the UE accesses an SNPN using the PLMN subscription. In case of a non-existing or empty USIM data file, the UE accepts all warning messages on all SNPNS. As specified in 3GPP TS 31.102 [18], the UE can be configured to ignore all warning messages received in an SNPN.

In GSM, an ETWS capable MS uses the procedure as outlined in clause 9.1.3.2. See 3GPP TS 44.018 [26] and 3GPP TS 44.060 [27] for details on the radio interface.

In UMTS, an ETWS capable UE uses the procedure as outlined in clause 9.1.3.3. See 3GPP TS 25.331 [16] for details on the radio interface.

In E-UTRAN, an ETWS capable UE or a CMAS capable UE uses the procedures as outlined in clause 9.1.3.4. See 3GPP TS 36.331 [36] for details on the radio interface.

In NG-RAN, an ETWS capable UE or a CMAS capable UE uses the procedures as outlined in clause 9.1.3.5. See 3GPP TS 36.331 [36] and 3GPP TS 38.331 [48] for details on the radio interface.

9.1.3.2 Warning Message Delivery Procedure in GSM

When a warning message is sent in GERAN, the following message flow applies. The warning message request from the CBE will trigger a broadcast of an ETWS emergency message (containing the ETWS Primary Notification) and/or a CBS message (constituting a Secondary Notification) on the radio interface. The ETWS emergency message is conveyed by the paging message which can invoke mobile terminals to start receiving CBS messages without MMI. Mobile stations invoked to start receiving CBS messages this way may stop receiving CBS messages (without MMI) after a predefined period of time.

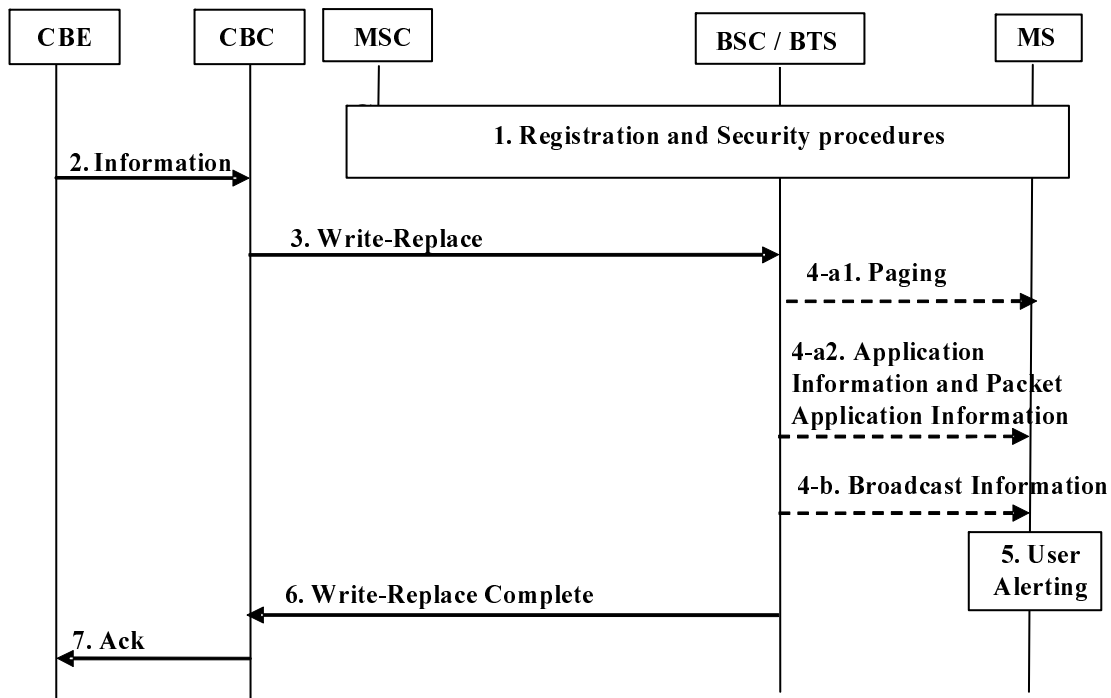


Figure 9.1.3.2-1: Warning message delivery procedure in GERAN

1. Network registration and security procedures are performed.

NOTE 1: This step is performed each time an MS is attached to a NW (e.g. after each power-on).

2. CBE (e.g. Information Source such as PSAP or Regulator) sends emergency information ("warning type", "warning message", "impacted area", and "time period") to the CBC. The CBC shall authenticate this request. The "warning type" takes one of the following values: earthquake, tsunami, earthquake and tsunami, test, or other.
3. Using the "impacted area information", the CBC identifies which BSCs need to be contacted and constructs the "Cell list" for the cells in which the information is to be broadcast.

The CBC shall send a WRITE-REPLACE message to all the identified BSCs. If the emergency information received from the CBE contains warning information to be sent both in an ETWS emergency message and in a CBS message, then the CBC need to send this information in separate WRITE-REPLACE messages to the identified BSCs accordingly:

- When containing an ETWS emergency message the WRITE-REPLACE message includes the "Paging ETWS Indicator" to differentiate it from a normal CBS message, as well as (among other parameters) the "Cell list", "warning type" (which constitutes a part of the ETWS Primary Notification message, see clause 9.4.1.3), and the "warning period" parameter.
- When containing a CBS message the WRITE-REPLACE message includes the "Channel Indicator" to differentiate it from an ETWS emergency message, as well as (among other parameters) the "Cell list", "Repetition Period", "No of Broadcasts Requested" and the "CBS Message Information" parameter(s).

The CBC shall not include the "digital signature" or "timestamp" information.

NOTE 2: Due to requirements in earlier versions of this document, it is possible for "digital signature" and "timestamp" information (included in the "Warning Security Information" parameter) to be transmitted within the WRITE-REPLACE message.

4. The BSCs use the "Cell list" information to identify in which cells the warning message needs to be broadcasted.
 - a) When the WRITE-REPLACE message contains an ETWS emergency message, the BSC/BTS:
 - 1) shall include the ETWS emergency message within the paging message and start sending the paging messages in all paging groups for the time duration requested by the CBC in the "warning period"

parameter. The paging message contains the "ETWS indicator", based on the "Paging ETWS Indicator" received in the WRITE-REPLACE message, and the ETWS Primary Notification message as defined in clause 9.4.1.3. When the "warning type" in the ETWS Primary Notification message is set to 'other', all of the warning information is included in the broadcasted CBS message.

- 2) may send the ETWS Primary Notification message in other messages (Application Information, see 3GPP TS 44.018 [26], and Packet Application Information, see 3GPP TS 44.060 [27]) in order to reach mobiles in connected mode.
- b) When the WRITE-REPLACE message contains a CBS message the BSC/BTS shall start to broadcast the CBS message on the Cell Broadcast channel according to the "Repetition Period" and "No of Broadcasts Requested" requested by the CBC.
5. Upon reception of the paging message containing the ETWS Primary Notification message, if the MS is configured to accept warnings on that PLMN (see 3GPP TS 31.102 [18]) the ETWS capable MS alerts the user immediately as indicated by the "warning type" value, and starts reading the Cell Broadcast channel in order to acquire a possible broadcasted CBS message containing the Secondary Notification message.

Upon reception of the CBS message containing the Secondary Notification message, the ETWS capable MS immediately indicates the contents of the Secondary Notification message to the user.

NOTE 3: If the MS receives the same ETWS Primary Notification message more than once it silently discards the last received Primary Notification message.

NOTE 4: When the "warning type" is set to 'test', the MS silently discards the ETWS Primary Notification message. The MS does not start reading the Cell Broadcast channel in this case. However, the MS specially designed for testing purposes can perform user alerting and proceed to the reception of the broadcasted CBS message as described above.

NOTE 5: If the MS is configured to ignore warnings on that PLMN (see 3GPP TS 31.102 [18]), the MS does not try to acquire the broadcasted CBS message described above.

The MS shall perform duplication detection of the received message as specified in clause 8.2.

The MS shall ignore the values of "digital signature" and "timestamp" if received in the "Warning Security Information" parameter.

NOTE 2: Due to requirements in earlier versions of this document, it is possible for "digital signature" and "timestamp" information (included in the "Warning Security Information" parameter) to be transmitted within the WRITE-REPLACE message.

6. The BSC sends a WRITE-REPLACE COMPLETE message to the CBC in response to the WRITE-REPLACE message.
7. CBC sends acknowledgement message to CBE.

9.1.3.3 Warning Message Delivery Procedure in UMTS

When a warning message is sent in UTRAN, the following message flow applies. In this case, the paging message with a new emergency indication can invoke mobile terminals to start receiving CBS messages without MMI. Mobile stations invoked to start receiving CBS messages this way may stop receiving CBS messages (without MMI) after a period of time, which should not be less than 30 minutes in case DRX-Level-2 is used, and 2 minutes in case DRX-Level-1 is used.

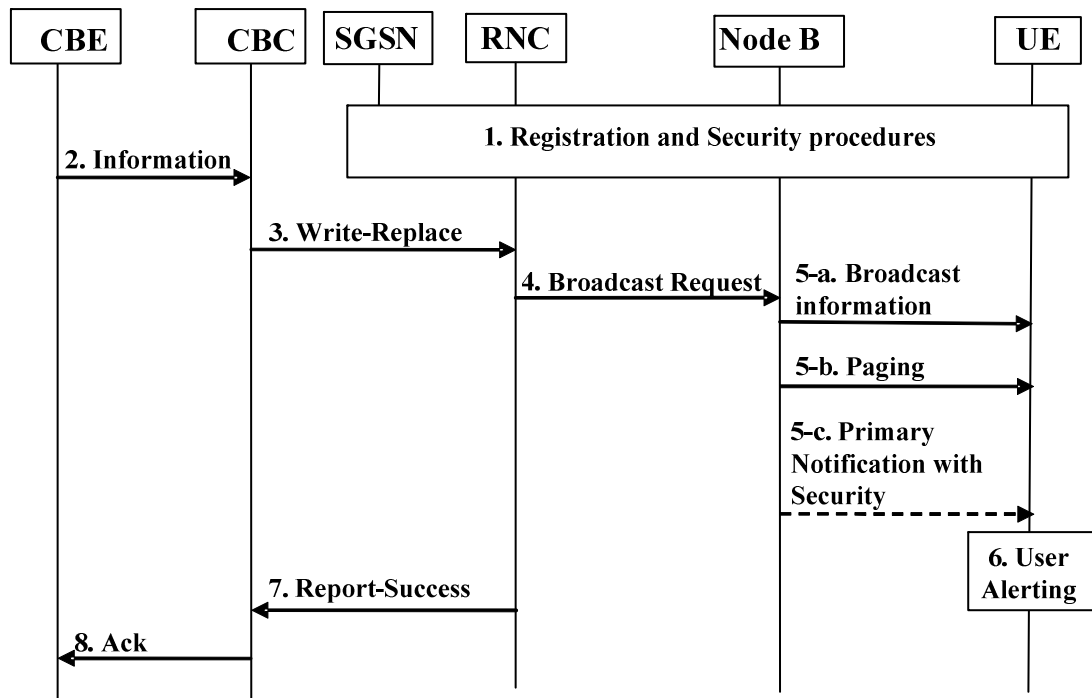


Figure 9.1.3.3-1: Warning message delivery procedure in UTRAN

1. Network registration and security (e.g. mutual authentication) procedures are performed.

NOTE 1: This step is performed each time a UE is attached to a network (e.g. after each power-on).

2. CBE (e.g. Information Source such as PSAP or Regulator) sends emergency information ("warning type", "warning message", "impacted area", and "time period") to the CBC. The CBC shall authenticate this request. The "warning type" takes one of the following values: earthquake, tsunami, earthquake and tsunami, test, or other.

3. Using the "impacted area information", the CBC identifies which RNCs need to be contacted and constructs the "Service Area ID list" for the cells in which the information is to be broadcast.

The CBC shall send a WRITE-REPLACE message to all the identified RNCs. The message shall include an "emergency indication" to differentiate it from normal Cell Broadcast information, as well as the "Service Area ID list", "warning type", "warning message".

The CBC shall not include the "digital signature" or "timestamp" information.

NOTE 2: Due to requirements in earlier versions of this document, it is possible for "digital signature" and "timestamp" information to be transmitted within "warning message".

4. The RNCs use the "Service Area ID list" information to identify which Node Bs they need to reach, and then, they relay information to them using the appropriate Iub interface message.
5. The Node B receives the Iub message containing the emergency indication. As parallel actions, the RNC/Node B:
 - a) shall start to broadcast the "warning message". This is broadcast by using a Cell Broadcast channel and modified System Information messages. This broadcast information is repeated continuously by the Node B for the "time period" requested by the CBE.
 - b) shall use paging messages in every paging group to alert idle mode mobiles to receive the broadcast warning message. Typically these paging messages are repeated in all paging groups for several DRX periods. The paging message contains the "ETWS indication" based on the "warning type" information. When the "warning type" is set to 'other', all of the warning information is included in the broadcast "warning message".

c) may send the "ETWS indication" in other messages (System Information Change Indication or ETWS Primary Notification With Security) in order to reach mobiles in connected mode. Inclusion of "ETWS indication" is the same as that of the paging message mentioned above.

6. If the UE is configured to accept warnings on that PLMN (see 3GPP TS 31.102 [18]) the UE alerts the user immediately, using "warning type" value upon the reception of the "ETWS Indication".

NOTE 3: If the UE received the "ETWS Indication" more than once it will silently discard the optional primary notification.

NOTE 4: When the "warning type" is 'test', the UE silently discards the "ETWS Indication" and does not perform the reception of the broadcast message described below. However, the UE specially designed for testing purposes can perform user alerting described above and proceed to the reception of the broadcast message described below

NOTE 5: If the UE is configured to ignore warnings on that PLMN (see 3GPP TS 31.102 [18]) the UE does not perform the reception of the broadcast message described below.

Upon the reception of the "ETWS Indication", the UE activates the reception of the broadcast messages containing the "warning message" as the secondary notification. The UE indicates the contents of the "warning message" to the user.

The UE shall perform duplication detection of the received message as specified in clause 8.2.

The UE shall ignore the values of "digital signature" and "timestamp" if received.

NOTE 6: The "digital signature" and "timestamp" can be received due to requirements in earlier versions of this document.

7. The RNC node sends a BMC REPORT-SUCCESS to the CBC in response to Write-Replace.

8. CBC sends acknowledgement message to CBE.

9.1.3.4 Warning Message Delivery Procedure in E-UTRAN

9.1.3.4.1 General

The maximum size of the warning message for E-UTRAN is different from that for UTRAN/GERAN.

When S1-flex is used, the eNodeB may receive duplicated warning messages. Duplicated messages can be detected by checking the message identifier and serial number fields and they shall not be transmitted on the radio interface.

E-UTRA connected to both EPC and 5GCN (see 3GPP TS 36.300 [46]) may receive warning messages from both EPC and 5GCN. Duplicated messages can be detected by checking the message identifier and serial number fields and duplicate messages shall not be transmitted on the radio interface.

9.1.3.4.2 Warning Message Delivery Procedure

The warning message to be broadcast is delivered via MMEs to multiple eNodeBs. The eNodeB(s) are responsible for scheduling the broadcast of the new message and the repetitions in each cell.

The overall warning message delivery procedure is presented in figure 9.1.3.4.2-1:

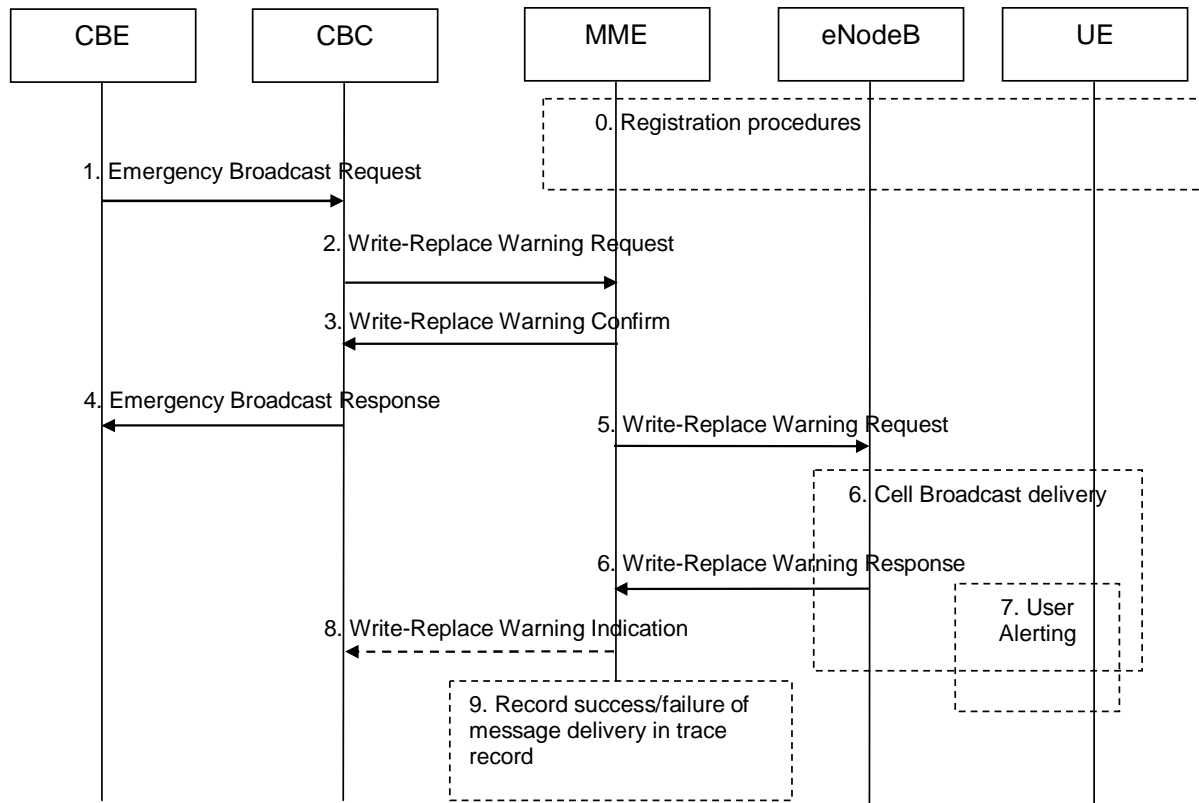


Figure 9.1.3.4.2-1: Warning message delivery procedure in E-UTRAN

0. Network registration and security (e.g. mutual authentication) procedures are performed.

NOTE 1: This step is performed each time a UE is attached to a network (e.g. after each power on).

1. CBE (e.g. Information Source such as PSAP or Regulator) sends emergency information (e.g. "warning type", "warning message", "impacted area", "time period") to the CBC. The CBC shall authenticate this request.

NOTE 2: A warning message can include a language-independent content mapped to an event or a disaster that is compatible with texts used to describe user information contained in the content of a CBS-Message-Information-Page transparently passed from CBC to UEs if the ePWS language-independent content functionality (see clause 8.3) is supported by CBE.

2. Using the "impacted area" information, the CBC identifies which MMEs need to be contacted and determines the information to be placed into the Warning Area List Information Element. The CBC sends a Write-Replace Warning Request message containing the warning message to be broadcast and the delivery attributes (Message identifier, Serial Number, list of TAIs, Warning Area List, OMC ID, CWM Indicator, Send Write-Replace-Warning-Indication, Global eNB ID, Warning Area Coordinates) to MMEs.

The warning messages use the coding scheme for CBS data specified in 3GPP TS 23.038 [3].

The list of TAIs is only used by the MME. The MME uses it for selecting which eNodeBs to forward the Write-Replace Warning Request message to.

If the Write-Replace Warning Request message is sent to reload cells served by an eNodeB, for which the CBC has previously received a Restart Indication (see clause 15A.1 of TS 23.007 [38]), the CBC shall include the Global eNB ID IE with the identity of this eNodeB in the Write-Replace Warning Request message.

The Warning Area List shall be a list of Cell IDs or a list of TAIs or one or more Emergency Area IDs. The Warning Area List is only used by the eNodeB. The eNodeB is configured with the TAI(s) and Cell ID(s) it serves and the Emergency Area ID(s) that it belongs to. The eNodeB checks for any match of the contents of the Warning Area List with these IDs to identify the cells where to distribute the warning message. The Warning Area List is an optional information element. If the Warning Area is absent, it shall be interpreted as "all cells on

the eNodeB". The number of cell IDs will be limited by the message size on SBC and S1-MME. An Emergency Area ID is unique within the PLMN.

The message may include an OMC ID. If present, it indicates the OMC to which the Trace record generated in step 9 is destined. Co-location of that OMC with the CBC is an operator option.

CBC shall set the Concurrent Warning Message (CWM) indicator in all Write-Replace Warning Request messages, if the PLMN supports concurrent warning message broadcasts.

The CBC shall not include the "digital signature" or "timestamp" information.

CBC shall set the Send Write-Replace-Warning Indication element in case the MME is requested to forward the Broadcast Scheduled Area List in a Write-Replace Warning Indication for the warning message.

NOTE 3: Due to requirements in earlier versions of the specification, it is possible that "digital signature" and "timestamp" information are transmitted within the "warning message".

CBC includes the Warning Area Coordinates in the Write-Replace-Warning Request message based on operator policy.

3. The MME sends a Write-Replace Warning Confirm message that indicates to the CBC that the MME has started to distribute the warning message to eNodeBs.

The Write-Replace Warning Confirm message may contain the *Unknown Tracking Area List* IE. The *Unknown Tracking Area List* IE identifies the Tracking Areas that are unknown to the MME and where the Request cannot be delivered.

If this message is not received by the CBC within an appropriate time period, the CBC can attempt to deliver the warning message via another MME in the same pool area.

4. Upon reception of the Write-Replace Confirm messages from the MMEs, the CBC may confirm to the CBE that it has started to distribute the warning message.
5. The MME forwards Write-Replace Warning Message Request to eNodeBs. The MME shall use the list of TAIs to determine the eNodeBs in the delivery area. If the list of TAIs is not included and no Global eNB ID has been received from the CBC, the message is forwarded to all eNodeBs that are connected to the MME. If a Global eNB ID has been received from the CBC, the MME shall forward the message only to the eNodeB indicated by the Global eNB ID IE.
6. When S1-flex is used the eNodeB may receive same message from multiple MMEs. The eNodeB detects duplicate messages by checking the message identifier and serial number fields within the warning message. If any redundant messages are detected only the first one received will be broadcasted by the cells. The eNodeB shall use the Warning Area List information to determine the cell(s) in which the message is to be broadcast. The eNodeBs return a Distribute Warning Message Response to the MME, even if it was a duplicate.

If there is a warning broadcast message already ongoing and the CWM Indicator is included in the Write-Replace Warning Message Request, the eNodeB does not stop existing broadcast message but start broadcasting the new message concurrently. Otherwise the eNodeB shall immediately replace the existing broadcast message with the newer one.

NOTE 4: If concurrent warning messages are not supported, this requires the CBE/CBC to take care that 'lower' priority warnings are not sent while a higher priority warning is still being sent.

The eNodeB broadcasts the message frequently according to the attributes set by the CBC that originated the warning message distribution.

7. If the UE has been configured to receive warning messages, and the UE is configured to accept warnings on that PLMN (see 3GPP TS 31.102 [18]), then the UE proceeds as follows:

The UE can use "warning type" values, 'earthquake', 'tsunami' or 'earthquake and tsunami', immediately to alert the user. When "warning type" is 'test', the UE silently discards the primary notification, but the UE specially designed for testing purposes may proceed with the following procedures.

The UE activates reception of the broadcast messages containing the "warning message".

If the Warning Area Coordinates are not present:

The UE indicates the contents of the "warning message" to the user.

If the Warning Area Coordinates are present, and if the UE is unable to determine its location:

The UE indicates the contents of the "warning message" to the user.

If the Warning Area Coordinates are present, and the UE determines it is inside the Warning Area Coordinates:

The UE indicates the contents of the "warning message" to the user.

If the Warning Area Coordinates are present, and the UE determines it is outside the Warning Area Coordinates:

The UE does not indicate the contents of the "warning message" to the user. The UE shall store the "warning message" in the list of "warning messages" to be checked for geo-fencing during a UE implementation specific time which shall not be greater than 24 hours. Upon expiration of the UE implementation specific time, the UE shall remove the stored "warning message" from the list of "warning messages" to be checked for geo-fencing.

If the "warning message" is a geo-fencing trigger message (see clause 9.4.1.2.2) then:

- if the list of "warning messages" to be checked for geo-fencing stored at the UE is not empty, the UE shall, for each "warning message" stored at the UE in the list of "warning messages" to be checked for geo-fencing, compare the Serial Number and Message Identifier combination of the stored "warning message" to the list of Serial Number and Message Identifier combinations included in the Warning Message Content IE (CB Data) of the geo-fencing trigger message and encoded as specified in ATIS-0700041 [47], and:
 - 1) if the Serial Number and Message Identifier combination of the stored "warning message" matches one of the Serial Number and Message Identifier combinations included in the geo-fencing trigger message, and:
 - a) the UE:
 - i) is able to determine its location and determines it is inside the Warning Area Coordinates of the stored "warning message"; or
 - ii) is unable to determine its location,

indicate the contents of the stored "warning message" to the user, remove the "warning message" from the list of "warning messages" to be checked for geo-fencing and then discard the geo-fencing trigger message; or
 - b) the UE is able to determine its location and determines it is outside the Warning Area Coordinates of the stored "warning message", discard the geo-fencing trigger message; or
 - 2) if none of Serial Number and Message Identifier combinations of the stored "warning message" matches any of the Serial Number and Message Identifier combinations included in the Warning Message Content IE (CB Data) of the geo-fencing trigger message, discard the geo-fencing trigger message; and
- if the list of "warning messages" to be checked for geo-fencing stored at the UE is empty, the UE shall discard the geo-fencing trigger message.

If a language-independent content mapped to an event or a disaster (e.g. character such as Unicode based pictogram mapping to a disaster) is included as part of user information contained in the content of a CBS-Message-Information-Page transparently passed from CBC to UEs:

- UEs with user interface which support the ePWS language-independent content functionality (see clause 8.3) and which are capable of displaying text-based warning messages should be capable of displaying the entire warning message that they receive.

Editor's note [WI: ePWS, CR#203]: FFS on what character(s) such as Unicode based pictogram(s) are the language-independent content mapped to an event or a disaster.

8. If the Send Warning-Message-Indication parameter was present in the Write-Replace Warning Request and it is configured in the MME based on operator policy, the MME shall forward the Broadcast Scheduled Area Lists in a Write-Replace Warning Indication(s) to the CBC. The Broadcast Scheduled Area List shall contain the Broadcast Completed Area List the MME has received from the eNodeB. The MME may aggregate Broadcast Completed Area Lists it receives from eNodeBs.

NOTE 5: Support for sending of Write-Replace Warning Indication(s) to the CBC is optional in the MME.

9. From the Write-Replace Warning Response messages returned by eNodeB's the MME determines the success or failure of the delivery and creates a trace record. Any OMC ID received in step 2 is written to the trace record to permit the O&M system to deliver them to the desired destination.

9.1.3.4.3 Warning Message Cancel Procedure

The cancel warning message delivery procedure takes place when CBE requests to stop the on-going broadcast of warning messages.

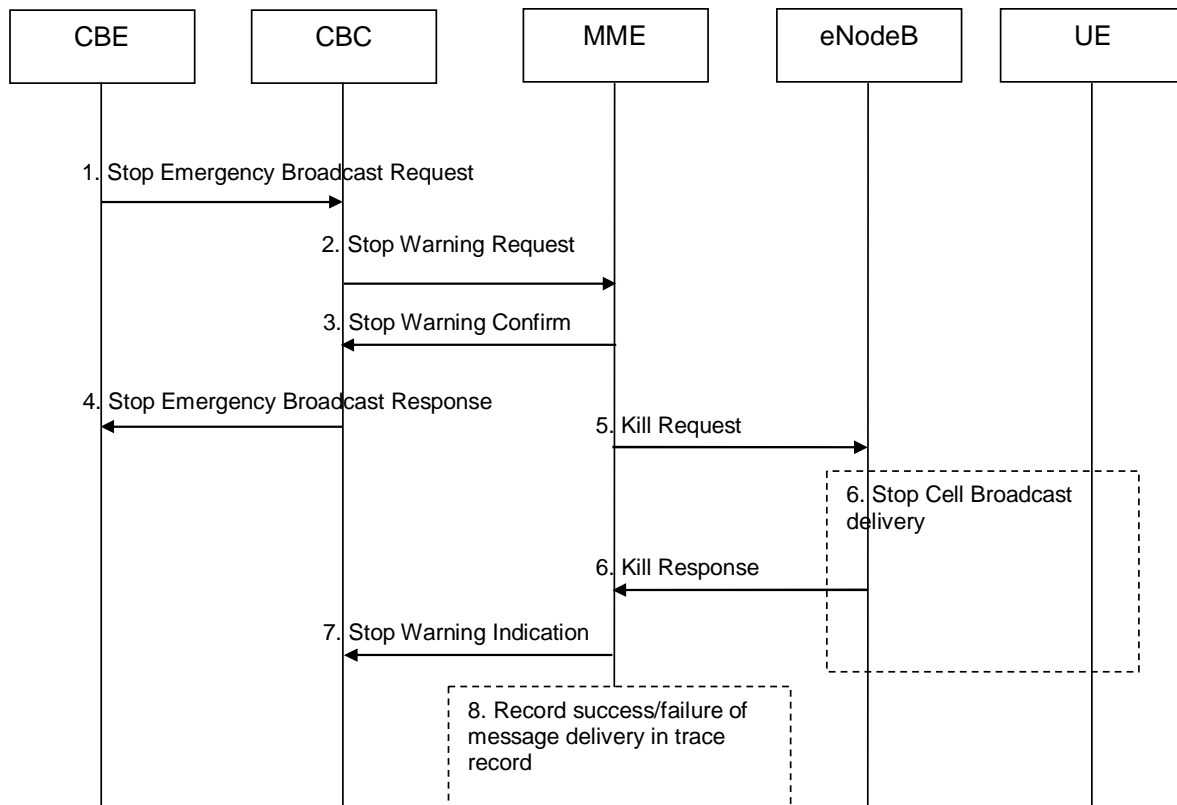


Figure 9.1.3.4.3-1: Warning message cancel procedure in E-UTRAN

1. CBE initiates procedure by sending Stop Emergency Broadcast Request (e.g. "Message Identifier and Serial Number"), to the CBC. The CBC shall authenticate this request.
2. The CBC identifies which MMEs need to be contacted and determines the information to be place into the Warning Area Information Element. The CBC sends a Stop Warning Request message (Message Identifier, Serial Number, Tracking Area ID list, Warning Area, OMC ID, Send Stop Warning Indication) to MMEs.

The message may include an OMC ID. If present, it indicates the OMC to which the Trace record generated in step 8 is destined. Co-location of that OMC with the CBC is an operator option.

The CBC sets the Send Stop Warning Indication element in case the MME is requested to forward the Broadcast Completed Area List in a Stop Warning Indication for the warning message.

3. The MME sends a Stop Warning Confirm message that indicates to the CBC that the MME has started to distribute the Kill Request message to eNodeBs.

If this message is not received by the CBC within an appropriate time period, the CBC can attempt to send Stop Warning Request via another MME in the same pool area.

4. Upon reception of the Stop Warning Confirm messages from the MMEs, the CBC may confirm to the CBE that it has initiated the Warning message cancel procedure.

5. The MME forwards the request from the CBC by Kill Request to eNodeB's. The MME shall use the Tracking Area ID list to determine the eNodeBs that may have warning message broadcast ongoing. In case the Tracking Area ID list is not included the Kill Request is forwarded to all eNodeBs that are connected to the MME.
6. The eNodeB shall stop broadcasting the warning message identified by the Message Identifier and Serial Number in the areas identified by Warning Area IDs. If the Warning Area is absent, it shall be interpreted as "all cells on the eNodeB").

When S1-Flex is used the eNodeB may receive same Kill Request from multiple MMEs, if any redundant Kill Requests are detected only the response to the first MME shall contain statistics related to the cancelled broadcast.

7. If the Send Stop Warning Indication parameter was present in the Stop Warning Request and it is configured in the MME based on operator policy, the MME forwards the Broadcast Cancelled Area List it has received from the eNodeB in a Stop Warning Indication(s) to the CBC. The MME may aggregate Broadcast Cancelled Area Lists it receives from eNodeBs.

If the CBC has requested the MME to send Stop Warning Indications, then the CBC releases the Serial Number of a message after it has stopped receiving the Stop Warning Indications for that message.

NOTE: Support for Stop Warning Indication(s) is optional in the MME.

8. From the Kill Response messages returned by eNodeB's the MME creates a trace record (e.g. number of times a particular message has been broadcasted in a given warning area) related to the cancelled message. Any OMC ID received in step 2 is written to the trace record to permit the O&M system to deliver them to the desired destination.

9.1.3.5 Warning Message Delivery Procedure in NG-RAN

9.1.3.5.1 General

The maximum size of the warning message for NG-RAN is the same as the maximum size defined for E-UTRAN.

When the CBCF sends warning messages to multiple AMFs for the same warning area, the gNodeB may receive duplicated warning messages. Duplicated messages can be detected by checking the message identifier and serial number fields and they shall not be transmitted on the radio interface.

The Warning Message Delivery procedure messages and the Warning Message Cancel procedure messages are transported with the NonUeN2MessageTransfer service operation between CBCF and AMF (see clause 9A) and via N2 between AMF and NG-RAN.

9.1.3.5.2 Warning Message Delivery Procedure

The warning message to be broadcast is delivered via AMFs to multiple NG-RAN nodes. The NG-RAN node(s) are responsible for scheduling the broadcast of the new message and the repetitions in each cell.

The overall warning message delivery procedure is presented in figure 9.1.3.5.2-1:

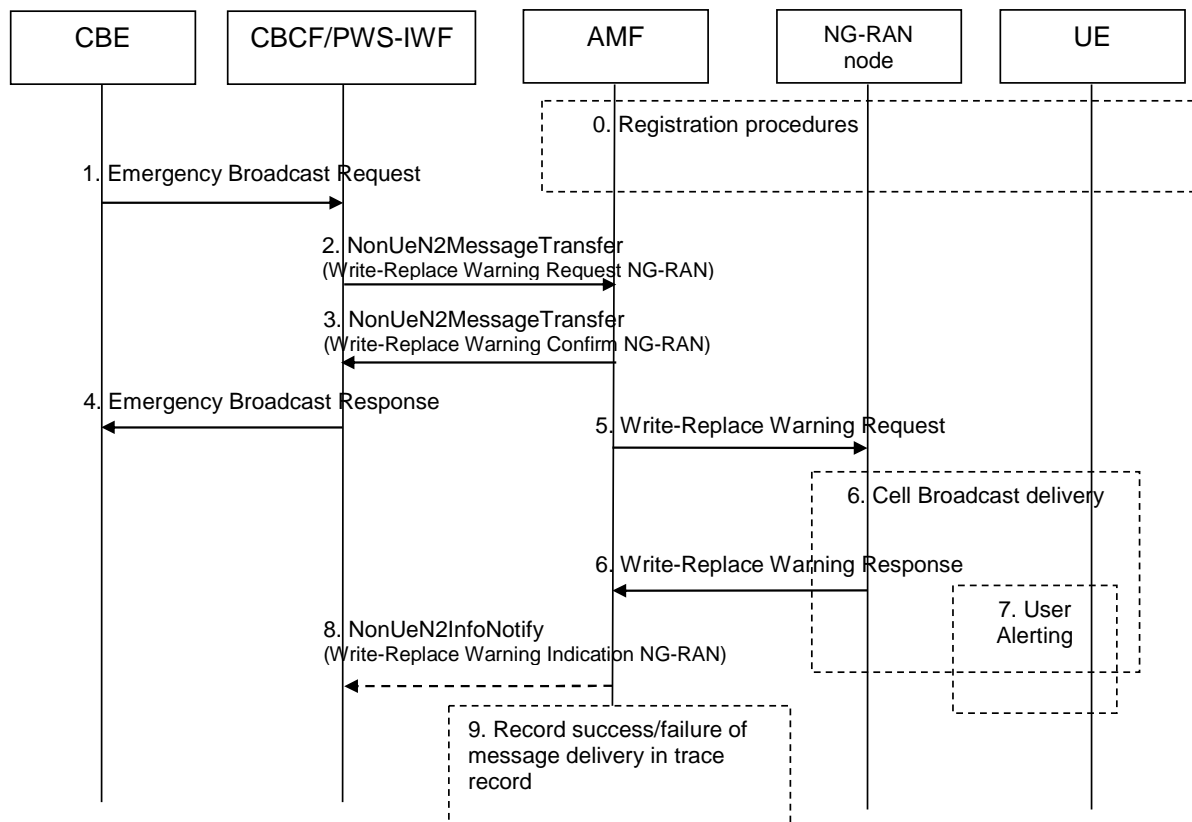


Figure 9.1.3.5.2-1: Warning message delivery procedure in NG-RAN

0. Network registration and security (e.g. mutual authentication) procedures are performed.

NOTE 1: This step is performed each time a UE is attached to a network (e.g. after each power on).

1. CBE (e.g. Information Source such as PSAP or Regulator) sends emergency information (e.g. "warning type", "warning message", "impacted area", "time period") to the CBC. The CBCF shall authenticate this request.

NOTE 2: A warning message can include a language-independent content mapped to an event or a disaster that is compatible with texts used to describe user information contained in the content of a CBS-Message-Information-Page transparently passed from CBC to UEs if the ePWS language-independent content functionality (see clause 8.3) is supported by CBE.

2. Using the "impacted area" information, the CBCF identifies which AMFs need to be contacted and determines the information to be placed into the Warning Area List NG-RAN Information Element. The CBCF sends a Write-Replace Warning Request NG-RAN message containing the warning message to be broadcast and the delivery attributes (Message Identifier, Serial Number, list of NG-RAN TAIs, Warning Area List NG-RAN, OMC ID, CWM Indicator, Send Write-Replace-Warning-Indication, Global RAN Node ID, Warning Area Coordinates) to AMFs.

The warning messages use the coding scheme for CBS data specified in 3GPP TS 23.038 [3].

The list of NG-RAN TAIs is only used by the AMF. The AMF uses it for selecting which NG-RAN node(s) to forward the Write-Replace Warning Request NG-RAN message to.

If the Write-Replace Warning Request NG-RAN message is sent to reload cells served by a NG-RAN node, for which the CBCF has previously received a Restart Indication (see clause 15A.1 of TS 23.007 [38]), the CBCF shall include the Global RAN Node ID IE with the identity of this NG-RAN node in the Write-Replace Warning Request NG-RAN message.

The Warning Area List NG-RAN shall be a list of Cell IDs or a list of NG-RAN TAIs or one or more Emergency Area IDs. The Warning Area List NG-RAN is only used by the NG-RAN node. The NG-RAN node

is configured with the NG-RAN TAI(s) and Cell ID(s) it serves and the Emergency Area ID(s) that it belongs to. The NG-RAN node checks for any match of the contents of the Warning Area List NG-RAN with these IDs to identify the cells where to distribute the warning message. The Warning Area List NG-RAN is an optional information element. If the Warning Area List NG-RAN is absent, it shall be interpreted as "all cells on the NG-RAN node". The number of cell IDs will be limited by the message size on N50 and N2. An Emergency Area ID is unique within the PLMN or SNPN.

The message may include an OMC ID. If present, it indicates the OMC to which the Trace record generated in step 9 is destined. Co-location of that OMC with the CBCF is an operator option.

The CBCF shall set the Concurrent Warning Message (CWM) indicator in all Write-Replace Warning Request NG-RAN messages, if the PLMN or SNPN supports concurrent warning message broadcasts.

The CBCF shall not include the "digital signature" or "timestamp" information.

The CBCF shall set the Send Write-Replace-Warning Indication element in case the AMF is requested to forward the Broadcast Scheduled Area List in a Write-Replace Warning Indication NG-RAN for the warning message.

The CBCF includes the Warning Area Coordinates in the Write-Replace-Warning-Request-NG-RAN message based on operator policy.

3. The AMF sends a Write-Replace Warning Confirm NG-RAN message that indicates to the CBCF that the AMF has started to distribute the warning message to NG-RAN nodes.

The Write-Replace Warning Confirm NG-RAN message may contain the *Unknown Tracking Area List* IE. The *Unknown Tracking Area List* IE identifies the Tracking Areas that are unknown to the AMF and where the Request cannot be delivered.

If this message is not received by the CBCF within an appropriate time period, the CBCF can attempt to deliver the warning message via another AMF in the same AMF region.

4. Upon reception of the Write-Replace Confirm NG-RAN messages from the AMFs, the CBCF may confirm to the CBE that it has started to distribute the warning message.
5. The AMF forwards Write-Replace Warning Message Request NG-RAN to NG-RAN nodes. The AMF shall use the list of NG-RAN TAIs to determine the NG-RAN nodes in the delivery area. If the list of NG-RAN TAIs is not included and no Global RAN Node ID has been received from the CBCF, the message is forwarded to all NG-RAN nodes that are connected to the AMF, subject to the RAT Selector NG-RAN. If a Global RAN Node ID has been received from the CBCF, the AMF shall forward the message only to the NG-RAN node indicated by the Global RAN Node ID IE.
6. When the CBCF sends warning messages to multiple AMFs for the same warning area, the NG-RAN node may receive the same message from multiple AMFs. The NG-RAN node detects duplicate messages by checking the message identifier and serial number fields within the warning message. If any redundant messages are detected only the first one received will be broadcasted by the cells. The NG-RAN node shall use the Warning Area List NG-RAN information to determine the cell(s) in which the message is to be broadcast. The NG-RAN nodes return a Write Replace Warning Message Response to the AMF, even if it was a duplicate.

If there is a warning broadcast message already ongoing and the CWM Indicator is included in the Write-Replace Warning Request NG-RAN message, the NG-RAN node does not stop the existing broadcast message but starts broadcasting the new message concurrently. Otherwise the NG-RAN node shall immediately replace the existing broadcast message with the newer one.

NOTE 3: If concurrent warning messages are not supported, this requires the CBE/CBCF to take care that 'lower' priority warnings are not sent while a higher priority warning is still being sent.

The NG-RAN node broadcasts the message frequently according to the attributes set by the CBCF that originated the warning message distribution.

7. If the UE has been configured to receive warning messages, and the UE is configured to accept warnings on that PLMN (see 3GPP TS 31.102 [18]) or SNPN (see 3GPP TS 23.122 [49]), then the UE proceeds as follows:

The UE can use "warning type" values, 'earthquake', 'tsunami' or 'earthquake and tsunami', immediately to alert the user. When "warning type" is 'test', the UE silently discards the primary notification, but the UE specially designed for testing purposes may proceed with the following procedures.

The UE activates reception of the broadcast messages containing the "warning message".

If the Warning Area Coordinates are not present:

The UE indicates the contents of the "warning message" to the user.

If the Warning Area Coordinates are present, and if the UE is unable to determine its location:

The UE indicates the contents of the "warning message" to the user.

If the Warning Area Coordinates are present, and the UE determines it is inside the Warning Area Coordinates:

The UE indicates the contents of the "warning message" to the user.

If the Warning Area Coordinates are present, and the UE determines it is outside the Warning Area Coordinates:

The UE does not indicate the contents of the "warning message" to the user. The UE shall store the "warning message" in the list of "warning messages" to be checked for geo-fencing during a UE implementation specific time which shall not be greater than 24 hours. Upon expiration of the UE implementation specific time, the UE shall remove the stored "warning message" from the list of "warning messages" to be checked for geo-fencing.

If the "warning message" is a geo-fencing trigger message (see clause 9.4.1.2.2) then:

- if the list of "warning messages" to be checked for geo-fencing stored at the UE is not empty, the UE shall, for each "warning message" stored at the UE in the list of "warning messages" to be checked for geo-fencing, compare the Serial Number and Message Identifier combination of the stored "warning message" to the list of Serial Number and Message Identifier combinations included in the Warning Message Content IE (CB Data) of the geo-fencing trigger message and encoded as specified in ATIS-0700041 [47], and:
 - 1) if the Serial Number and Message Identifier combination of the stored "warning message" matches one of the Serial Number and Message Identifier combinations included in the geo-fencing trigger message, and:
 - a) the UE:
 - i) is able to determine its location and determines it is inside the Warning Area Coordinates of the stored "warning message"; or
 - ii) is unable to determine its location,
indicate the contents of the stored "warning message" to the user, remove the "warning message" from the list of "warning messages" to be checked for geo-fencing and then discard the geo-fencing trigger message; or
 - b) the UE is able to determine its location and determines it is outside the Warning Area Coordinates of the stored "warning message", discard the geo-fencing trigger message; or
 - 2) if none of Serial Number and Message Identifier combinations of the stored "warning message" matches any of the Serial Number and Message Identifier combinations included in the Warning Message Content IE (CB Data) of the geo-fencing trigger message, discard the geo-fencing trigger message; and
- if the list of "warning messages" to be checked for geo-fencing stored at the UE is empty, the UE shall discard the geo-fencing trigger message.

If a language-independent content mapped to an event or a disaster (e.g. character such as Unicode based pictogram mapping to a disaster) is included as part of user information contained in the content of a CBS-Message-Information-Page transparently passed from CBC to UEs:

- UEs with user interface which support the ePWS language-independent content functionality (see clause 8.3) and which are capable of displaying text-based warning messages should be capable of displaying the entire warning message that they receive.

Editor's note [WI: ePWS, CR#203]: FFS on what character(s) such as Unicode based pictogram(s) are the language-independent content mapped to an event or a disaster.

8. If the Send Warning-Message-Indication parameter was present in the Write-Replace Warning Request NG-RAN and it is configured in the AMF based on operator policy, the AMF shall forward the Broadcast Scheduled Area Lists in a Write-Replace Warning Indication(s) NG-RAN to the CBCF. The Broadcast Scheduled Area List shall contain the Broadcast Completed Area List the AMF has received from the NG-RAN node. The MME may aggregate Broadcast Completed Area Lists it receives from NG-RAN nodes.

NOTE 4: Support for sending of Write-Replace Warning Indication(s) NG-RAN to the CBCF is optional in the AMF.

9. From the Write-Replace Warning Response messages returned by NG-RAN nodes the AMF determines the success or failure of the delivery and creates a trace record. Any OMC ID received in step 2 is written to the trace record to permit the O&M system to deliver them to the desired destination.

9.1.3.5.3 Warning Message Cancel Procedure

The cancel warning message delivery procedure takes place when CBE requests to stop the on-going broadcast of warning messages.

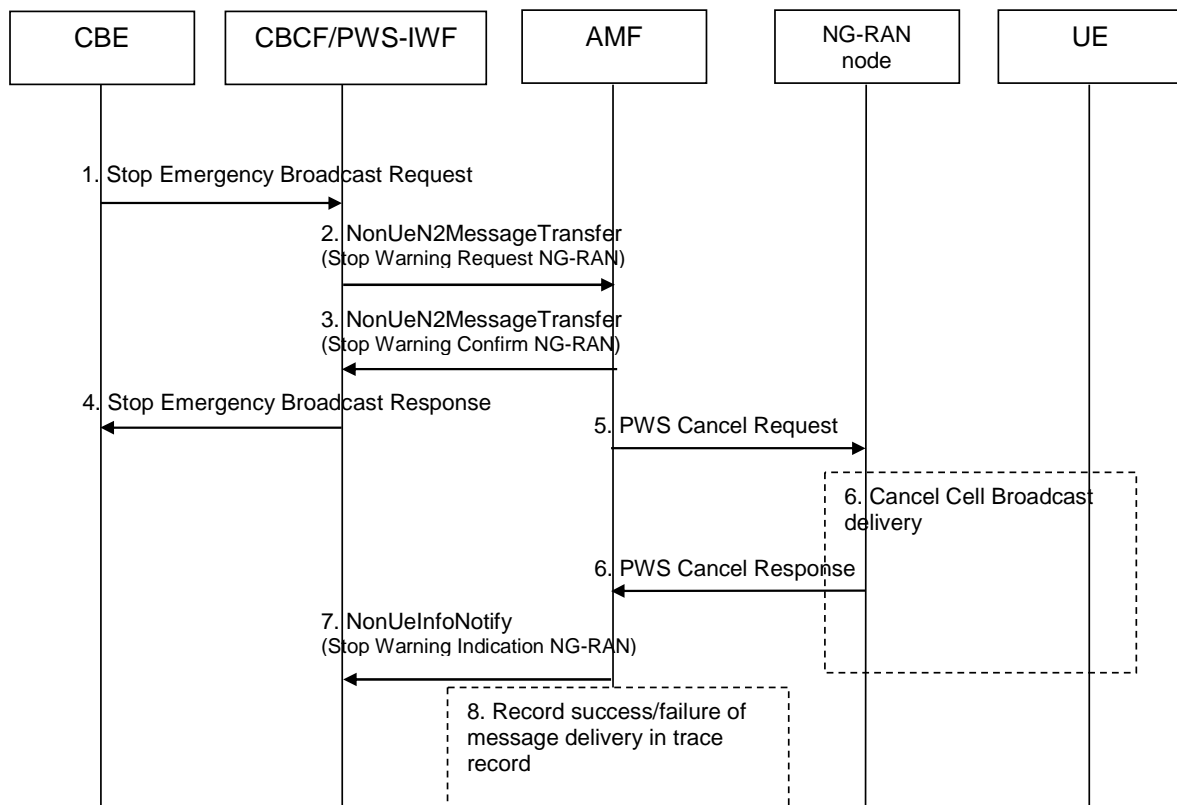


Figure 9.1.3.5.3-1: Warning message cancel procedure in NG-RAN

1. CBE initiates procedure by sending Stop Emergency Broadcast Request (e.g. "Message Identifier and Serial Number"), to the CBCF. The CBCF shall authenticate this request.
2. The CBCF identifies which AMFs need to be contacted and determines the information to be placed into the Warning Area Information Element. The CBC sends a Stop Warning Request NG-RAN message (Message Identifier, Serial Number, Tracking Area ID list, Warning Area, OMC ID, Send Stop Warning Indication) to AMFs.

The message may include an OMC ID. If present, it indicates the OMC to which the Trace record generated in step 8 is destined. Co-location of that OMC with the CBCF is an operator option.

The CBCF sets the Send Stop Warning Indication element in case the AMF is requested to forward the Broadcast Completed Area List in a Stop Warning Indication NG-RAN for the warning message.

3. The AMF sends a Stop Warning Confirm NG-RAN message that indicates to the CBCF that the AMF has started to distribute the Cancel Request message to NG-RAN nodes.

If this message is not received by the CBCF within an appropriate time period, the CBCF can attempt to send Stop Warning Request NG-RAN via another AMF in the same AMF region.

4. Upon reception of the Stop Warning Confirm NG-RAN messages from the AMFs, the CBCF may confirm to the CBE that it has initiated the Warning message cancel procedure.
5. The AMF forwards the request from the CBCF by a Cancel Request to NG-RAN nodes. The AMF shall use the Tracking Area ID list to determine the NG-RAN nodes that may have warning message broadcast ongoing. In case the Tracking Area ID list is not included the Cancel Request is forwarded to all NG-RAN nodes that are connected to the AMF, subject to the RAT Selector NG-RAN.
6. The NG-RAN node shall cancel broadcasting the warning message identified by the Message Identifier and Serial Number in the areas identified by Warning Area IDs. If the Warning Area is absent, it shall be interpreted as "all cells on the NG-RAN node".

When the CBCF sends cancel messages to multiple AMFs for the same warning area, the NG-RAN node may receive same Cancel Request from multiple AMFs, if any redundant Cancel Requests are detected only the response to the first AMF shall contain statistics related to the cancelled broadcast.

7. If the Send Stop Warning Indication parameter was present in the Stop Warning Request NG-RAN and it is configured in the AMF based on operator policy, the AMF forwards the Broadcast Cancelled Area List it has received from the NG-RAN node in a Stop Warning Indication(s) NG-RAN to the CBCF. The AMF may aggregate Broadcast Cancelled Area Lists it receives from NG-RAN nodes.

If the CBCF has requested the AMF to send Stop Warning Indications NG-RAN, then the CBCF releases the Serial Number of a message after it has stopped receiving the Stop Warning Indications NG-RAN for that message.

NOTE: Support for Stop Warning Indication(s) NG-RAN is optional in the AMF.

8. From the Cancel Response messages returned by NG-RAN nodes the AMF creates a trace record (e.g. number of times a particular message has been broadcasted in a given warning area) related to the cancelled message. Any OMC ID received in step 2 is written to the trace record to permit the O&M system to deliver them to the desired destination.

9.1.4 UMTS Protocol Overview

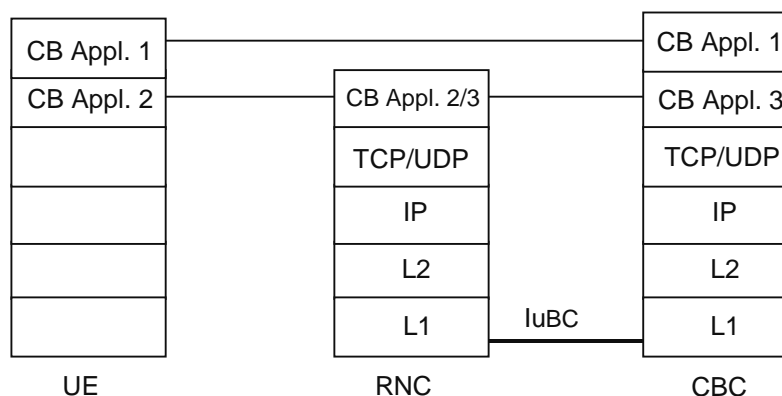
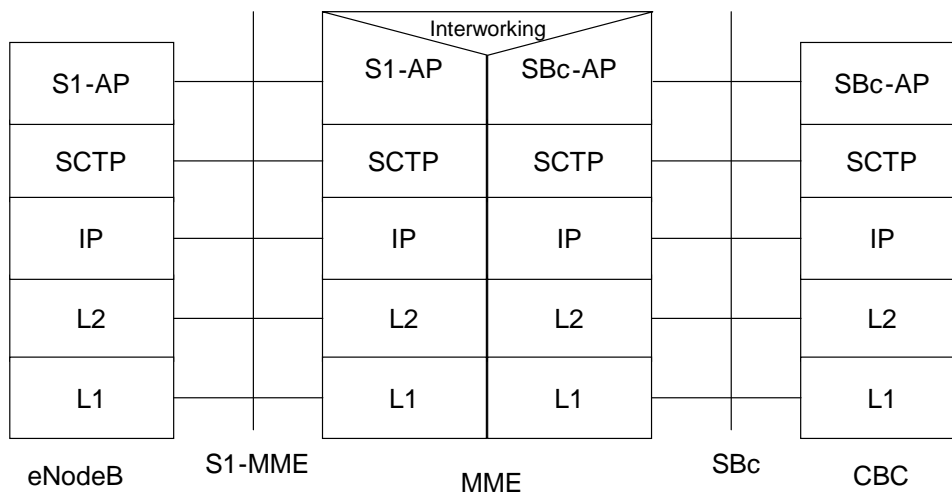


Figure 5

9.1.5 E-UTRAN Protocol Overview



Legend:

- SBc Application Protocol (SBc-AP): Application Layer Protocol between CBC and MME. This protocol supports transfer of warning messages.
- S1 Application Protocol (S1-AP): Application Layer Protocol between the eNodeB and the MME.
- SCTP for the control plane (SCTP): This protocol guarantees delivery of signalling messages between MME and eNodeB (S1). SCTP is defined in RFC 4960 [33].

Figure 9.1.5-1: CBC - eNodeB

9.1.6 NG-RAN Protocol Overview

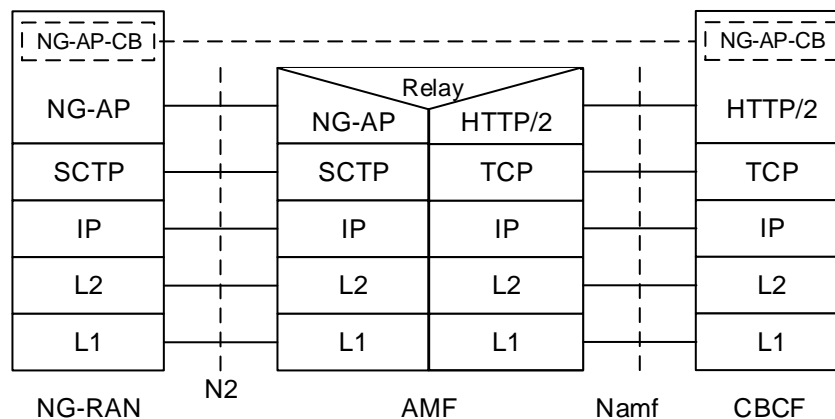


Figure 9.1.6-1: CBCF - NG-RAN

Legend:

- NG application protocol information for cell broadcast (NG-AP-CB): Subset of NG-AP information that the AMF relays between the AN and the CBCF. NG-AP-CB corresponds to a subset of NG-AP defined in 3GPP TS 38.413 [40].
- NG application protocol (NGAP): Application layer protocol between the NG-RAN node and the AMF. The NGAP protocol is defined in 3GPP TS 38.413 [40].
- SCTP for the control plane (SCTP): This protocol guarantees delivery of signalling messages between AMF and NG-RAN (N2). SCTP is defined in IETF RFC 4960 [33].
- HTTP/2: Application layer protocol for Service based interface between AMF and CBCF. HTTP/2 is defined in IETF RFC 7540 [42].

NOTE: NG-RAN protocol stack for the case where AMF and CBC inter-connects via PWS-IWF is described in annex B.3.

9.2 Requirements on the CBC-RAN, CBC-MME and CBCF-AMF interfaces

9.2.0 General

The requirements are described by primitives. The term primitive is used to indicate "an abstract, implementation independent interaction between a service user and a service provider" (see ITU-T Recommendation X.210 [12]). For the CBC-BSC/RNC/MME or CBCF-AMF interface, the service provider would be the protocol interconnecting the CBC and BSC/RNC/MME or the CBCF and AMF. A Primitive may therefore be viewed as an abstract, implementation independent request/indication or response/confirm interaction between the service user (CBC/CBCF or BSC/RNC/MME/AMF) and the service provider (protocol). A set of primitives for use between the CBC and BSC/RNC/MME and CBCF and AMF are specified appropriate to the functionality assigned to the CBC/CBCF and BSC/RNC/MME/AMF in clause 5 and clause 6. In order to allow future extensions to the primitives, where possible a primitive shall not be rejected because a parameter is not recognized; the recipient shall ignore the parameter in question and process the remainder of the primitive's parameters as usual.

NOTE: The primitives for the CBCF-AMF interface are also applicable to the PWS-IWF – AMF interface, and the primitives for the CBC-MME interface are also applicable to the CBC-PWS-IWF interface.

The following table gives an overview over the existing primitives:

Name	Originator	Type	Reference
WRITE-REPLACE	CBC	Request/Indication	9.2.2
KILL	CBC	Request/Indication	9.2.3
REPORT	BSC/RNC	Response/Confirm	9.2.4
STATUS-LOAD-QUERY	CBC	Request/Indication	9.2.5
STATUS-LOAD-QUERY	BSC/RNC	Response/Confirm	9.2.6
STATUS-MESSAGE-QUERY	CBC	Request/Indication	9.2.7
STATUS-MESSAGE-QUERY	BSC/RNC	Response/Confirm	9.2.8
REJECT	BSC/RNC	Response/Confirm	9.2.9
RESTART-INDICATION	BSC/RNC	Request/Indication	9.2.10
RESET	CBC	Request/Indication	9.2.11
FAILURE-INDICATION	BSC/RNC	Request/Indication	9.2.12
SET-DRX	CBC	Request/Indication	9.2.13
SET-DRX-REPORT	BSC	Response/Confirm	9.2.14
WRITE-REPLACE-WARNING-REQUEST	CBC	Request/Indication	9.2.16
WRITE-REPLACE-WARNING-CONFIRM	MME	Response/Confirm	9.2.17
STOP-WARNING-REQUEST	CBC	Request/Indication	9.2.18
STOP-WARNING-CONFIRM	MME	Response/Confirm	9.2.19
WRITE-REPLACE-WARNING-INDICATION	MME	Request/Indication	9.2.20
STOP-WARNING-INDICATION	MME	Request/Indication	9.2.21
RESTART-INDICATION-E-UTRAN	MME	Request/Indication	9.2.22
FAILURE-INDICATION-E-UTRAN	MME	Request/Indication	9.2.23
RESET-COMPLETE	BSC/RNC	Response/Confirm	9.2.24
RESET-FAILURE	BSC/RNC	Response/Confirm	9.2.25
WRITE-REPLACE-WARNING-REQUEST-NG-RAN	CBCF/PWS-IWF	Request/Indication	9.2.26
WRITE-REPLACE-WARNING-CONFIRM-NG-RAN	AMF	Response/Confirm	9.2.27
STOP-WARNING-REQUEST-NG-RAN	CBCF/PWS-IWF	Request/Indication	9.2.28
STOP-WARNING-CONFIRM-NG-RAN	AMF	Response/Confirm	9.2.29
WRITE-REPLACE-WARNING-INDICATION-NG-RAN	AMF	Request/Indication	9.2.30
STOP-WARNING-INDICATION-NG-RAN	AMF	Request/Indication	9.2.31
RESTART-INDICATION-NG-RAN	AMF	Request/Indication	9.2.32
FAILURE-INDICATION-NG-RAN	AMF	Request/Indication	9.2.33

In GSM the CBC is integrated into the Core Network. The protocol between the CBC and BSC is defined in 3GPP TS 48.049 [30].

In UMTS the CBC is integrated into the Core Network. The protocol between the CBC and RNC is defined in 3GPP TS 25.419 [29].

In E-UTRAN the CBC is integrated into the Core Network. The protocol between the CBC and MME is defined in 3GPP TS 29.168 [35].

In NG-RAN the CBCF/PWS-IWF is integrated into the Core Network. The protocol between the CBCF/PWS-IWF and AMF is defined in 3GPP TS 29.518 [41].

NOTE 1: The primitives used in NG-RAN are transported with the NonUeN2MessageTransfer and NonUeN2InfoNotify service operations between CBCF and the AMF (see clause 9A) and via N2 from AMF to NG-RAN.

NOTE 2: In the following definitions, M indicates "mandatory parameter", O indicates "optional parameter" and C indicates "conditional parameter".

9.2.1 Identification of a CBS message

In GSM within a CBC-BSC interface, a CBS message is uniquely identified by the quartet (Message Identifier, Serial Number, Cell Identifier, Channel Indicator).

In UMTS within the CBC-RNC interface, in E-UTRAN within the CBC-MME interface, and in NG-RAN within the CBCF-AMF interface and CBC – PWS-IWF interface, a CBS message is uniquely identified by the triplet (Message Identifier, Serial Number, Cell Identifier).

This means that even when two CBS messages have the same semantic contents (for example the same weather forecast) but in different languages or coding schemes, they are considered as different and must therefore be identified by a different quartet.

The Serial Number (Old-Serial-Number or New-Serial-Number) is managed cyclically and therefore this does not prevent the re-use of the same quartet for a different CBS message when the serial number have been incremented a sufficient number of times. How to manage the ambiguity is described subsequently.

This unique identification of a CBS message across the CBC-BSC interface is used in all the primitives defined hereafter. This means that the quartet/triplet will be implicitly or explicitly present in every interface primitive which applies to a given CBS message.

This unique quartet/triplet will be referred in the rest of the document as the "message reference".

9.2.2 WRITE-REPLACE Request/Indication

PARAMETER	REFERENCE	PRESENCE (UMTS/GSM)
Message-Identifier	9.3.1	M/M
Old-Serial-Number	9.3.2	O/O
New-Serial-Number	9.3.3	M/M
Cell-List	9.3.5.1	M/M
GSM only [Channel Indicator	9.3.6	O] (note 1)
Category	9.3.7	O/C (note 2)
Repetition-Period	9.3.8	M/C (note 2)
No-of-Broadcasts-Requested	9.3.9	M/C (note 2)
Number-of-Pages	9.3.4	M/C (note 2)
Data Coding Scheme	9.3.18	M/C (note 2)
CBS-Message-Information-Page 1	9.3.19	M/C (note 2)
CBS-Message-Information-Length 1	9.3.20	M/C (note 2)
CBS-Message-Information-Page 2	9.3.19	O/O
CBS-Message-Information-Length 2	9.3.20	O/O
:		:
CBS-Message-Information-Page n	9.3.19	O/O
CBS-Message-Information-Length n	9.3.20	O/O
Paging-ETWS-Indicator	9.3.23	O/O (note 1)
Warning-Type	9.3.24	O/C (note 3)
Warning-Security-Information	9.3.25	O/C (note 3)
GSM only [Warning Period	9.3.26	C] (note 3)
UMTS only [Broadcast Message Content	9.3.48	O] (note 4)
Validity Indicator		
NOTE 1: Only one of these two optional parameters may be simultaneously present in the primitive. The <i>Channel Indicator</i> parameter is included if the primitive contains a CBS message. The <i>Paging-ETWS-Indicator</i> parameter is included if the primitive contains an ETWS emergency message.		
NOTE 2: In GSM this parameter is included if the <i>Channel Indicator</i> parameter is present in the primitive.		
NOTE 3: In GSM this parameter is included if the <i>Paging-ETWS-Indicator</i> parameter is present in the primitive.		
NOTE 4: In UMTS this parameter is included if the <i>Broadcast Message Content IE</i> present in the primitive <i>does not contain any valid information</i> .		

This primitive is sent by the CBC to the BSC/RNC. As this primitive can be used either to broadcast a new CBS message or replace a CBS message already broadcast, the CBC will use the presence and content of the Old-Serial-Number and New-Serial-Number fields in this primitive to instruct the BSC/RNC as follows:

- a) Old-Serial-Number not present/New-Serial-Number present:

- This is a write request which will be interpreted by the BSC/RNC as an instruction to broadcast a new CBS message in all the cells of the Cell list.
- GSM only [The CBS message will be broadcasted on the channel derived by the Channel Indicator (see the clause on parameters that describes the implicit value of the Channel Indicator when not present in the CBS message)].

The following table identifies the BSC/RNC's behaviour:

Success/Failure of write request	BSC/RNC behaviour
Success	The BSC/RNC completes the following parameters to be returned in the Report PDU: - a '0' value is entered in the number of broadcasts completed list for the cell - no entry is made in the failure list for the cell
Failure	The BSC/RNC completes the following parameters to be returned in the Report PDU: - no entry is made in the number of broadcasts completed list for the cell - an entry is made in the failure list for the new CBS message identifying the failure cause for the cell

- The BSC/RNC will build as many message references as the number of cells in the list. These message references will be used in particular in the subsequent primitives.
- When a message reference is already known by the BSC/RNC for certain cells in the list (even if the Update field of the Serial-Number is different), the primitive will be rejected for those cells with the cause "message reference already used". The list of cells where the message reference is not valid will be provided in the failure list of the REPORT primitive. For these cells no entry will be made in the number of broadcasts completed parameter.

b) Old-Serial-Number present/New-Serial-Number present.

- This is a replace request which will be interpreted by the BSC/RNC as a kill request for the CBS message with the old serial number, followed by a write request for the CBS message with the new serial number. The handling of the new serial number in the write part of this request, is as described above in the write request where no Old-Serial-Number is supplied. These two kill and write requests are executed sequentially. If the kill request is unsuccessful, the BSC/RNC does not proceed to execute the write request. The kill request will stop broadcast of, and cause all information currently associated with the combination of message identifier, old serial number, GSM only [Channel Indicator] and the list of cells in the Cell list to be deleted from the cells in the BSC/RNC (i.e. for all cells provided in the Cell-List parameter). If the kill request is successful, the subsequent write request information conveyed in the primitive replaces the killed CBS message. The following table identifies the BSC/RNC's behaviour:

Success/Failure of kill request	BSC/RNC behaviour
Success	The BSC/RNC proceeds to execute the write request: - Write successful: the BSC/RNC completes the following parameters to be returned in the Report PDU: - An entry is made in the number of broadcasts completed list for the cell. - No entry is made in the failure list for the cell. - Write unsuccessful: the BSC/RNC completes the following parameters to be returned in the Report PDU: - An entry is made in the number of broadcasts completed list for the cell. - An entry is made in the failure list for the new CBS message identifying the failure cause for the cell.
Failure	The BSC/RNC does not proceed to execute the write request, and completes the following parameters to be returned in the Report PDU: - no entry is made in the number of completed broadcasts list. - an entry is made for the old CBS message in the failure list identifying the failure cause for the cell.

All cells which should perform the broadcasting are mentioned in the Cell-List parameter.

The broadcast of the referenced CBS message in the cells which are not mentioned in the Cell-List remains unaffected.

If no category is present, the default category is interpreted by the BSC/RNC, see the parameter clause.

This primitive is responded by a REPORT or REJECT primitive.

NOTE: GSM only [In the case of multipage CBS messages, the individual pages are considered as independent by the BSC scheduling algorithm].

9.2.3 KILL Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	M
Cell-List	9.3.5.1	M
GSM only [Channel Indicator	9.3.6	O]

This primitive is sent by the CBC to the BSC/RNC. The CBC will use this primitive to kill the message indicated by the combination of message identifier, serial number, GSM only [Channel Indicator] and the cells indicated in the Cell-List of this KILL request, i.e. the primitive will halt broadcast of the message in the indicated cells and remove any knowledge of the message from the BSC/RNC for these cells. The broadcast of the referenced message in the cells which are not mentioned in the Cell-List remains unaffected. This primitive is responded with a REPORT or REJECT primitive.

9.2.4 REPORT Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Serial-Number	9.3.2/9.3.3	M
GSM only [Channel Indicator	9.3.6	O]
No-of-Broadcasts-Completed-List	9.3.10	O
Failure-List	9.3.14	O

This primitive will be sent by the BSC/RNC to the CBC in response to WRITE-REPLACE and KILL primitives. The Serial-Number field will contain the old serial number if this primitive is sent in response to a KILL primitive, and the new serial number if the primitive is sent in response to a WRITE-REPLACE primitive.

The No-of-Broadcasts-Completed-List, if present, may contain for each cell the number of broadcasts of the (replaced or killed) CB message with the old message reference sent to this particular cell for broadcast. The serial number information element in the case of a WRITE-REPLACE does not refer to the message for which the number of broadcasts completed information is supplied. The Failure-List, if present, may contain those cells which were present in the related WRITE-REPLACE or KILL primitive and failed the requested operation.

9.2.5 STATUS-LOAD-QUERY Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.1	M
GSM only [Channel Indicator]	9.3.6	O

This primitive is sent by the CBC to the BSC/RNC in order to obtain the current loading of the CBCH/UTRAN Radio Resource of particular cells referenced in the Cell-List parameter. This primitive is responded by a STATUS-LOAD-QUERY Response/Confirm or a REJECT primitive.

9.2.6 STATUS-LOAD-QUERY Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Radio-Resource-Loading-List	9.3.15	O
Failure-List	9.3.14	O
GSM only [Channel Indicator]	9.3.6	O

This primitive will be sent by the BSC/RNC in response to the STATUS-LOAD-QUERY Request/Indication primitive.

The Radio-Resource-Loading-List, if present, may contain each cell which successfully performed the requested operation and for each of these cells the CBCH loading/ UTRAN Radio Resource loading of this particular cell.

NOTE: For cells with DRX the load caused by the schedule messages will be included in the load calculation.

The Radio-ResourceLoading-List will not be present if all cells indicated in the related STATUS-LOAD-QUERY Request/Indication failed the requested operation.

The Failure-List, if present, may contain all cells for which the requested operation failed (e.g. because the cells CBCH is not available in a BTS). The STATUS-LOAD-QUERY Response/Confirm will not contain the Failure-List parameter if none of the cells in the Cell-List of the related STATUS-LOAD-QUERY Request failed the requested operation.

9.2.7 STATUS-MESSAGE-QUERY Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	M
Cell-List	9.3.5.1	M
GSM only [Channel Indicator]	9.3.6	O

This primitive is sent by the CBC to the BSC/RNC in order to obtain the current status of a CB-message for the cells referenced in the Cell-List parameter. This primitive is responded by the STATUS-MESSAGE-QUERY Response/Confirm or by a REJECT Response/Confirm.

9.2.8 STATUS-MESSAGE-QUERY Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message-Identifier	9.3.1	M
Old-Serial-Number	9.3.2	M
No-of-Broadcasts-Completed-List	9.3.10	O
Failure-List	9.3.14	O
GSM only [Channel Indicator]	9.3.6	O

This primitive will be sent by the BSC/RNC to the CBC in response to a STATUS-MESSAGE-QUERY Request/Indication primitive.

The No-of-Broadcasts-Completed-List, if present, may contain each cell which successfully performed the requested operation and for each of these cells the number of times this CB message has been sent to this particular cell for broadcast (parameter Number-of-Broadcasts-Completed; this parameter is not included for the cell if the old message reference is not known to the BSC/RNC, and an entry is made in the failure list). The No-of-Broadcasts-Completed-List will not be present if all cells indicated in the related STATUS-MESSAGE-QUERY Request failed the requested operation.

The Failure-List may contain all cells for which the requested operation failed (e.g. because the broadcast of the requested message was never requested before or because the cells CBCH is not available). The STATUS-MESSAGE-QUERY Response/Confirm will not contain the Failure-List parameter if none of the cells in the Cell-List of the related STATUS-MESSAGE-QUERY Request failed the requested operation.

9.2.9 REJECT Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Cause	9.3.16	M
Diagnostic	9.3.17	O
Message-Identifier	9.3.1	O
Serial Number	9.3.2	O

This primitive is sent by the BSC/RNC to the CBC in response to any primitive which is not understood (e.g. invalid parameter or parameter value).

9.2.10 RESTART-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	M
Recovery Indication	9.3.21	O
GSM only [Broadcast Message Type]	9.3.27	O

The RESTART-INDICATION Request is used by the BSC/RNC to indicate to the CBC a CB related restart situation in one or more of its cells (e.g. when an existing or a new cell becomes operational during normal BSC/RNC operation or when the BSC/RNC initialises).

Any referenced cell are again in CB-operational state (have resumed CB operation). The parameter Recovery Indication, if present, indicates whether CB related data are lost for the cells referenced in the Cell-List and have to be re-loaded. If the Recovery Indication parameter is absent, the CBC shall interpret it as the Recovery Indication with the value data lost.

The CBC upon receiving a RESTART INDICATION indication, marks the cell as operational again. It will usually generate WRITE-REPLACE requests for this cell, according to the actual CB message loading at the moment of the restart.

NOTE: A RESTART-INDICATION can be triggered from the CBC by a RESET Request. This allows recovery from situations, where a PDU occasionally may be lost.

9.2.11 RESET Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.1	M

The RESET Request is used by the CBC to force one or more cells of one BSC/RNC into CB-idle state.

The RESET Request may also be used by the CBC to request the CB operational state of cells earlier indicated to have failed (polling CB operational state).

If a BSC/RNC receives a RESET Request, the indicated cells enter idle state (same state as after "power on"). All CB related information concerning earlier CB messages in a referenced cell is lost.

The BSC/RNC acknowledges the RESET Request for each cell by a RESET-COMPLETE response or, if not adequate, by a RESET-FAILURE response.

Several responses may be combined using a cell list in the RESET-COMPLETE or RESET-FAILURE response.

9.2.12 FAILURE-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	M
GSM only [Broadcast Message Type]	9.3.27	O

The FAILURE-INDICATION Request is used by the BSC/RNC to indicate to the CBC a CB related problem situation in one or more of its cells.

Any referenced cell enters CB-not-operational state. The status of the CBS messages is undefined until the Restart-Indication is sent. It remains in not-operational state until a RESTART-INDICATION request (see clause 9.1.10) indicates normal CB operation (again).

The CBC upon receiving a FAILURE-INDICATION, marks this cell as failed. It will generally not generate further WRITE-REPLACE requests for this cell, up to the point when the CBC is informed by a RESTART indication, that the cell has resumed CB operation.

The BSC/RNC refuses further WRITE-REPLACE requests from the CBC with the cause "cell-broadcast-not-operational" when any referenced cell is in the CB-not-operational state.

NOTE: A FAILURE-INDICATION can be triggered by a RESET Request. This allows recovery from situations, where a PDU occasionally may be lost.

9.2.13 SET-DRX Request/Indication

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.1	M
Schedule-Period	9.3.12	O
Reserved-Slots	9.3.13	O
GSM only [Channel Indicator]	9.3.6	O

This primitive is applicable in GSM only. In UMTS DRX is a mandatory feature in the RNC and no activation/deactivation function on CBS related radio resources controlled by the CBC is necessary.

The SET-DRX Request is used by the CBC to set DRX specific parameters i.e. the schedule period and the number of slots reserved for high priority CBS messages, see 3GPP TS 44.012 [7]. At least one of the Schedule-Period or Reserved-Slots parameters must be present in the primitive. If this primitive is not supported, the BSC may use default values.

If a BSC receives a SET-DRX Indication, the new DRX parameters will be taken into account starting from the next schedule period in each cell, see 3GPP TS 44.012 [7].

If a BSC receives a SET-DRX Indication, the new DRX parameters will be applied for all cells that do not handle any broadcast message (null loading).

9.2.14 SET-DRX- REPORT Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Cell-List	9.3.5.2	O
Failure-List	9.3.14	O
GSM only [Channel Indicator]	9.3.6	O

This primitive will be sent by the BSC to the CBC in response to a SET-DRX Request/Indication primitive.

The Failure-List will contain those cells which were present in the Request message and which failed the requested operation.

If the new schedule period parameters are not acceptable on a cell due to the load of the cell, the cause "bss-capacity-exceeded" is used in the Failure-list.

9.2.15 Void

9.2.16 WRITE-REPLACE-WARNING-REQUEST Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Repetition-Period E-UTRAN	9.3.36	M
No-of-Broadcasts-Requested	9.3.9	M
List of TAIs	9.3.29	O
Warning Area List	9.3.30	O
Extended Repetition-Period	9.3.37	O
Warning-Type	9.3.24	O
Warning-Security-Information	9.3.25	O
Data Coding Scheme	9.3.18	O (NOTE 1)
Warning Message Content E-UTRAN	9.3.35	O
OMC ID	9.3.31	O
Concurrent Warning Message Indicator	9.3.32	O
Send Write-Replace-Warning-Indication	9.3.39	O
Global eNB ID	9.3.46	O
List of NG-RAN TAIs	9.3.54	O
Warning Area List NG-RAN	9.3.55	O
Warning Message Content NG-RAN	9.3.51	O
Global RAN Node ID	9.3.53	O
RAT Selector NG-RAN	9.3.56	O
Warning Area Coordinates	9.3.63	O
Test Flag	9.3.64	O (NOTE 2)
NOTE1: The Data Coding Scheme IE is not required for ETWS primary notification but it is mandatory for ETWS secondary notification and CMAS warning messages when Warning Message Content E-UTRAN IE is present.		
NOTE 2: This IE may only be included if the CBC sends the request to a PWS-IWF.		

This primitive is sent by the CBC to the MME or to the PWS-IWF.

The WRITE-REPLACE-WARNING-REQUEST Request/Indication primitive is to request the MME and the AMF to start or overwrite a warning message broadcast. The response to this Request/Indication primitive is sent by the MME or the AMF in a corresponding WRITE-REPLACE-WARNING-CONFIRM primitive.

If the message is sent to the MME, then the *List of TAIs* IE, the *Warning Area List* IE, the *Warning Message Content E-UTRAN* IE and the *Global eNB ID* IE may be used and the *List of NG-RAN TAIs* IE, the *Warning Area List NG-RAN* IE, the *Warning Message Content NG-RAN* IE, the *Global RAN Node ID* IE and the *RAT Selector NG-RAN* IE shall not be used.

If the message is sent to the PWS-IWF, then the *List of NG-RAN TAIs* IE, the *Warning Area List NG-RAN* IE, the *Warning Message Content NG-RAN* IE, the *Global RAN Node ID* IE and the *RAT Selector NG-RAN* IE may be used and the *List of TAIs* IE, the *Warning Area List* IE, the *Repetition-Period E-UTRAN* IE, the *Extended Repetition Period* IE, the *Warning Message Content E-UTRAN* IE, and the *Global eNB ID* IE shall not be used. The WRITE-REPLACE-WARNING-REQUEST Request/Indication primitive shall then be forwarded to the AMF.

NOTE: For ETWS Primary Notification, the Repetition Period IE and the Number of Broadcasts Requested IE are ignored by eNB if included in WRITE-REPLACE-WARNING-REQUEST message (see 3GPP TS 36.413 [34]).

9.2.17 WRITE-REPLACE-WARNING-CONFIRM Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Cause E-UTRAN	9.3.33	M
Criticality Diagnostics	9.3.34	O
Unknown Tracking Area List	9.3.38	O
Cause NG-RAN	9.3.50	O
Unknown NG-RAN Tracking Area List	9.3.57	O

This primitive is sent by the MME or by the PWS-IWF to the CBC. The PWS-IWF receives this message from the AMF.

The WRITE-REPLACE-WARNING-CONFIRM Response/Confirm primitive is to acknowledge the start or overwrite of a WRITE-REPLACE-WARNING-REQUEST for a warning message.

If the message is received from an MME then the *Cause E-UTRAN* IE and the *Unknown Tracking Area* IE may be present. If the message is received from an AMF via a PWS-IWF then the *Cause NG-RAN* IE and the *Unknown NG-RAN Tracking Area List* may be present.

9.2.18 STOP-WARNING-REQUEST Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
List of TAIs	9.3.29	O
Warning Area List	9.3.30	O
OMC ID	9.3.31	O
Send Stop Warning Indication	9.3.41	O
Stop-All Indicator	9.3.43	O
List of NG-RAN TAIs	9.3.54	O
Warning Area List NG-RAN	9.3.55	O
RAT Selector NG-RAN	9.3.56	O

This primitive is sent by the CBC to the MME or to the PWS-IWF.

The STOP-WARNING-REQUEST Request/Indication primitive is sent to request to stop a warning message broadcast. The response to this Request/Indication primitive is sent by the MME or the AMF in a corresponding STOP-WARNING-CONFIRM primitive.

If the message is sent to an MME, then the *List of TAIs* IE and the *Warning Area List* IE may be used and the *List of NG-RAN TAIs* IE, the *Warning Area List NG-RAN* IE and the *RAT Selector NG-RAN* IE shall not be used.

If the message is sent to the PWS-IWF, then the *List of NG-RAN TAIs* IE, the *Warning Area List NG-RAN* IE and the *RAT Selector NG-RAN* IE may be used and the *List of TAIs* IE and the *Warning Area List* IE shall not be used. The STOP-WARNING-REQUEST Request/Indication primitive shall then be forwarded to the AMF.

9.2.19 STOP-WARNING-CONFIRM Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Cause E-UTRAN	9.3.33	M
Criticality Diagnostics	9.3.34	O
Unknown Tracking Area List	9.3.38	O
Cause NG-RAN	9.3.50	O
Unknown NG-RAN Tracking Area List	9.3.57	O

This primitive is sent by the MME or by the PWS-IWF to the CBC. The PWS-IWF receives this message from the AMF.

The STOP-WARNING-CONFIRM Response/Confirm primitive is to acknowledge the receipt of the STOP-WARNING-REQUEST primitive for a warning message.

If the message is received from an MME then the *Cause E-UTRAN* IE and the *Unknown Tracking Area* IE may be present. If the message is received from an AMF via the PWS-IWF then the *Cause NG-RAN* IE and the *Unknown NG-RAN Tracking Area List* may be present.

9.2.20 WRITE-REPLACE-WARNING-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Broadcast Scheduled Area List	9.3.40	O
Broadcast Scheduled Area List NG-RAN	9.3.58	O
Broadcast Empty Area List	9.3.44	O
Broadcast Empty Area List NG-RAN	9.3.60	O

This Indication is sent by the MME to report to the CBC the Broadcast Scheduled Area List(s) the MME has received from the eNodeB(s) as Broadcast Completed Area List. If the MME has received a WRITE REPLACE WARNING RESPONSE without a Broadcast Completed Area List, then the eNodeB ID shall be included in the Broadcast Empty Area List instead. Multiple responses from eNodeBs may be combined in a Broadcast Scheduled Area List.

This Indication is sent by an AMF via the PWS-IWF to report to the CBC the Broadcast Scheduled Area List(s) NG-RAN the AMF has received from the NG-RAN node(s) as Broadcast Completed Area List. If the AMF has received a WRITE-REPLACE WARNING RESPONSE without a Broadcast Completed Area List, then the gNodeB ID shall be included in the Broadcast Empty Area List NG-RAN instead. Multiple responses from NG-RAN nodes may be combined by the AMF in a Broadcast Scheduled Area List NG-RAN.

If the MME or the PWS-IWF interfaces with multiple CBCs (i.e. has active SCTP associations established with multiple CBCs), the MME or PWS-IWF shall forward the same WRITE-REPLACE-WARNING-INDICATION message to all CBCs.

The *Broadcast Scheduled Area List* IE or *Broadcast Scheduled Area List NG-RAN* IE is not included in the WRITE-REPLACE WARNING INDICATION when the broadcast is unsuccessful in all the cells within the eNodeBs or NG-RAN nodes.

If the message is received from an MME then the *Broadcast Scheduled Area List* IE may be present. If the message is received from an AMF via the PWS-IWF then the *Broadcast Scheduled Area List NG-RAN* IE may be present.

The *Broadcast Empty Area List* IE may be included in the WRITE-REPLACE-WARNING-INDICATION when the MME has received at least one WRITE REPLACE WARNING RESPONSE without *Broadcast Completed Area List* IE.

The *Broadcast Empty Area List NG-RAN* IE may be included in the WRITE-REPLACE-WARNING-INDICATION when the AMF has received at least one WRITE REPLACE WARNING RESPONSE without *Broadcast Completed Area List* IE.

9.2.21 STOP-WARNING-INDICATION Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Broadcast Cancelled Area List	9.3.42	O
Broadcast Empty Area List	9.3.44	O
Broadcast Cancelled Area List NG-RAN	9.3.59	O
Broadcast Empty Area List NG-RAN	9.3.60	O

This primitive is sent by the MME to the CBC.

The STOP-WARNING-INDICATION Request/Indication primitive is to report to the CBC the Broadcast Cancelled Area List the MME has received from the eNodeB in a KILL RESPONSE. If the MME has received a KILL RESPONSE without a *Broadcast Cancelled Area List* IE, then the eNodeB ID shall be included in the Broadcast Empty Area List instead. The MME may aggregate Broadcast Cancelled Area Lists it receives from eNodeBs.

If the MME interfaces with multiple CBCs (i.e. has active SCTP associations established with multiple CBCs), the MME shall forward the same STOP-WARNING-INDICATION primitive to all CBCs.

This primitive is sent by an AMF via the PWS-IWF to the CBC.

The STOP-WARNING-INDICATION Request/Indication primitive is to report to the CBC the Broadcast Cancelled Area List the AMF has received from the NG-RAN nodes in a PWS CANCEL RESPONSE. If the AMF has received a PWS CANCEL RESPONSE without a *Broadcast Cancelled Area List* IE, then the NG-RAN node ID shall be included in the Broadcast Empty Area List NG-RAN instead. The AMF may aggregate Broadcast Cancelled Area Lists it receives from NG-RAN nodes and send them to the CBC via the PWS-IWF.

If the message is received from an MME then the *Broadcast Cancelled Area List* IE may be present. If the message is received from an AMF via the PWS-IWF then the *Broadcast Cancelled Area List NG-RAN* IE may be present.

The *Broadcast Cancelled Area List* IE or *Broadcast Cancelled Area List NG-RAN* IE is included in the STOP-WARNING-INDICATION when stopping the broadcast was successful in at least one of the cells within the eNodeBs or NG-RAN nodes.

The *Broadcast Empty Area List* IE shall be included in the STOP-WARNING-INDICATION when the MME has received at least one KILL RESPONSE without *Broadcast Cancelled Area List* IE.

The *Broadcast Empty Area List NG-RAN* IE shall be included in the STOP-WARNING-INDICATION when the AMF has received at least one PWS CANCEL RESPONSE without *Broadcast Cancelled Area List* IE.

9.2.22 RESTART-INDICATION-E-UTRAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Restarted Cell List	9.3.45	M
Global eNB ID	9.3.46	M
List of TAs	9.3.29	M
Emergency Area ID List	9.3.47	O
Restarted Cell List NG-RAN	9.3.61	O
Global RAN Node ID	9.3.53	O
List of NG-RAN TAs	9.3.54	O

The RESTART-INDICATION-E-UTRAN message is sent by the MME to the CBC upon receipt of a PWS Restart Indication from an eNodeB, to indicate that the PWS service is restarted in one or more or all cells served by an

eNodeB, i.e. the service has become operational and no warning message data is available for these cell(s). Upon receipt of that message, the CBC shall reload the cells if required. See clause 15A.1 of 3GPP TS 23.007 [38].

If the MME interfaces with multiple CBCs (i.e. has active SCTP associations established with multiple CBCs), the MME shall forward the same RESTART-INDICATION-E-UTRAN message to all CBCs.

The RESTART-INDICATION-E-UTRAN primitive is sent by a PWS-IWF to the CBC, triggered by the AMF sending a RESTART-INDICATION-NG-RAN message to the PWS-IWF upon receipt of a PWS Restart Indication from a NG-RAN node. The RESTART-INDICATION-E-UTRAN message indicates to the CBC that the PWS service is restarted in one or more or all cells served by a NG-RAN node, i.e. the service has become operational and no warning message data is available for these cell(s). Upon receipt of that message, the CBC shall reload the cells if required.

If the indication is received from the PWS-IWF then the *Restarted Cell List NG-RAN* IE, the *Global RAN Node ID* IE and *List of NG-RAN TAIs* IE shall be present and the *Restarted Cell List* IE, the *Global eNB ID* IE and *List of TAIs* IE are populated with a dummy value (all zeros).

The List of TAIs or List of NG-RAN TAIs, and the Emergency Area ID List shall contain the Tracking Area IDs and Emergency Area IDs (if any) that are configured for the restarted cells listed in the Restarted Cell List, or in the Restarted Cell List NG-RAN.

Upon receiving a RESTART-INDICATION-E-UTRAN shortly after a preceding one, if:

- a) the same Restarted Cell List NG-RAN is included in both messages; or
- b) the same Restarted Cell List is included in both messages and the Restarted Cell List NG-RAN is absent in both messages;

the CBC shall consider the RESTART-INDICATION-E-UTRAN as a duplicate message and shall ignore it.

NOTE: The CBC can receive the same PWS Restart Indication message via two MMEs of the MME pool for redundancy reasons (see clause 15A.1 of 3GPP TS 23.007 [38]).

9.2.23 FAILURE-INDICATION-E-UTRAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Failed Cell List	9.3.49	M
Global eNB ID	9.3.46	M
Failed Cell List NG-RAN	9.3.62	O
Global RAN Node ID	9.3.53	O

The FAILURE-INDICATION-E-UTRAN message is sent by the MME to the CBC upon receipt of a PWS Failure Indication from an eNodeB, to indicate that ongoing PWS operation in one or more or all cells served by that eNodeB has failed.

If the MME interfaces with multiple CBCs (i.e. has active SCTP associations established with multiple CBCs), the MME shall forward the same FAILURE-INDICATION-E-UTRAN message to all CBCs.

The FAILURE-INDICATION-E-UTRAN message is sent by a PWS-IWF to the CBC, triggered by the AMF sending a FAILURE-INDICATION-NG-RAN message to the PWS-IWF upon receipt of a PWS Failure Indication from a NG-RAN node. The FAILURE-INDICATION-E-UTRAN message indicates to the CBC that ongoing PWS operation in one or more or all cells served by that NG-RAN node has failed.

If the indication is received from a PWS-IWF then the *Failed Cell List NG-RAN* IE and the *Global RAN Node ID* IE shall be present and the *Failed Cell List* IE and the *Global eNB ID* IE are populated with a dummy value (all zeros).

9.2.24 RESET-COMPLETE Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Cell List	9.3.5.2	M

This primitive will be sent by the BSC/RNC to the CBC in response to a RESET Request primitive if the RESET Request was successful in all the cells, which are indicated in the Cell List.

If the RESET Request was not successful in all the cells then the BSC/RNC shall respond with a RESET-FAILURE Response.

9.2.25 RESET-FAILURE Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Failed Cell List	9.3.5.2	M
Cell List	9.3.5.2	O

This primitive will be sent by the BSC/RNC to the CBC in response to a RESET Request/Indication primitive if the RESET Request was not successful in all the cells.

The cells where the RESET Request failed are indicated in the Failed Cell List and the Cell List contains the list of cells where the RESET was successful, if any.

9.2.26 WRITE-REPLACE-WARNING-REQUEST-NG-RAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Repetition-Period NG-RAN	9.3.52	M
No-of-Broadcasts-Requested	9.3.9	M
RAT Selector NG-RAN	9.3.56	M
List of NG-RAN TAIs	9.3.54	O
Warning Area List NG-RAN	9.3.55	O
Warning-Type	9.3.24	O
Warning-Security-Information	9.3.25	O
Data Coding Scheme	9.3.18	O (NOTE)
Warning Message Content NG-RAN	9.3.51	O
OMC ID	9.3.31	O
Concurrent Warning Message Indicator	9.3.32	O
Send Write-Replace-Warning-Indication	9.3.39	O
Global RAN Node ID	9.3.53	O
Warning Area Coordinates	9.3.63	O
Test Flag	9.3.64	O

NOTE: The Data Coding Scheme IE is not required for ETWS primary notification but it is mandatory for ETWS secondary notification and CMAS warning messages when Warning Message Content NG-RAN IE is present.

This primitive is sent by the CBCF to the AMF to request start or overwrite of a warning message broadcast and is responded to by the AMF in a WRITE-REPLACE-WARNING-CONFIRM-NG-RAN response.

NOTE: For ETWS Primary Notification, the Repetition Period IE and the Number of Broadcasts Requested IE are ignored by NG-RAN node if included in WRITE-REPLACE-WARNING-REQUEST-NG-RAN.

9.2.27 WRITE-REPLACE-WARNING-CONFIRM-NG-RAN Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Cause NG-RAN	9.3.50	M
Criticality Diagnostics	9.3.34	O
Unknown NG-RAN Tracking Area List	9.3.57	O

This primitive is sent by the AMF to the CBCF to acknowledge the CBCF on the start or overwrite of a WRITE-REPLACE-WARNING-REQUEST-NG-RAN for a warning message.

9.2.28 STOP-WARNING-REQUEST-NG-RAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
RAT Selector NG-RAN	9.3.56	M
List of NG-RAN TAIs	9.3.54	O
Warning Area List NG-RAN	9.3.55	O
OMC ID	9.3.31	O
Send Stop Warning Indication	9.3.41	O
Stop-All Indicator	9.3.43	O

This primitive is sent by the CBCF to the AMF to request to stop a warning message broadcast and is responded to by the AMF in a STOP-WARNING-CONFIRM-NG-RAN response.

9.2.29 STOP-WARNING-CONFIRM-NG-RAN Response/Confirm

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Cause NG-RAN	9.3.50	M
Criticality Diagnostics	9.3.34	O
Unknown NG-RAN Tracking Area List	9.3.57	O

This primitive is sent by the AMF to the CBCF to acknowledge the CBCF on receipt of the STOP-WARNING-REQUEST-NG-RAN for a warning message.

9.2.30 WRITE-REPLACE-WARNING-INDICATION-NG-RAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Broadcast Scheduled Area List NG-RAN	9.3.58	O
Broadcast Empty Area List NG-RAN	9.3.60	O

This Indication is sent by the AMF to report to the CBCF the Broadcast Scheduled Area List(s) the AMF has received from the NG-RAN node(s) as Broadcast Completed Area List. If the AMF has received a WRITE-REPLACE

WARNING RESPONSE without a Broadcast Completed Area List, then the gNodeB ID shall be included in the Broadcast Empty Area List NG-RAN instead. Multiple responses from NG-RAN nodes may be combined in a Broadcast Scheduled Area List.

If the AMF interfaces with multiple CBCFs, the AMF shall forward the same WRITE-REPLACE-WARNING-INDICATION-NG-RAN message to all CBCFs.

The *Broadcast Scheduled Area List* IE is not included in the WRITE-REPLACE WARNING INDICATION-NG-RAN when the broadcast is unsuccessful in all the cells within the NG-RAN nodes.

The *Broadcast Empty Area List NG-RAN* IE may be included in the WRITE-REPLACE-WARNING-INDICATION when the AMF has received at least one WRITE REPLACE WARNING RESPONSE without *Broadcast Completed Area List* IE.

9.2.31 STOP-WARNING-INDICATION-NG-RAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Message Identifier	9.3.1	M
Serial-Number	9.3.3	M
Broadcast Cancelled Area List NG-RAN	9.3.59	O
Broadcast Empty Area List NG-RAN	9.3.60	O

This message is sent by the AMF to report to the CBCF the Broadcast Cancelled Area List the AMF has received from the NG-RAN node in a CANCEL RESPONSE. If the AMF has received a CANCEL RESPONSE without a *Broadcast Cancelled Area List* IE, then the NG-RAN node ID shall be included in the Broadcast Empty Area List instead. The AMF may aggregate Broadcast Cancelled Area Lists it receives from NG-RAN nodes.

If the AMF interfaces with multiple CBCFs, the AMF shall forward the same STOP-WARNING-INDICATION-NG-RAN message to all CBCFs.

The *Broadcast Cancelled Area List* IE is included in the STOP-WARNING-INDICATION-NG-RAN when cancelling the broadcast was successful in at least one of the cells within the NG-RAN nodes.

The *Broadcast Empty Area List* IE shall be included in the STOP-WARNING-INDICATION-NG-RAN when the AMF has received at least one CANCEL RESPONSE without *Broadcast Cancelled Area List* IE.

9.2.32 RESTART-INDICATION-NG-RAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Restarted Cell List NG-RAN	9.3.61	M
Global RAN Node ID	9.3.53	M
List of NG-RAN TAIs	9.3.54	M
Emergency Area ID List	9.3.47	O

The RESTART-INDICATION-NG-RAN message is sent by the AMF to the CBCF upon receipt of a PWS Restart Indication from a NG-RAN node, to indicate that the PWS service is restarted in one or more or all cells served by an NG-RAN node, i.e. the service has become operational and no warning message data is available for these cell(s). Upon receipt of that message, the CBCF shall reload the cells if required. See 3GPP TS 23.527 [45].

If the AMF interfaces with multiple CBCFs, the AMF shall forward the same RESTART-INDICATION-NG-RAN message to all CBCFs.

The List of TAIs and the Emergency Area ID List shall contain the Tracking Area IDs and Emergency Area IDs (if any) that are configured for the restarted cells listed in the Restarted Cell List.

Upon receiving a RESTART-INDICATION-NG-RAN shortly after a preceding one, if the same Restarted Cell List NG-RAN is included in both messages, the CBCF shall consider the RESTART-INDICATION-NG-RAN as a duplicate message and shall ignore it.

NOTE: The CBCF can receive the same PWS Restart Indication message via two AMFs of the AMF region for redundancy reasons (see 3GPP TS 23.527 [45]).

9.2.33 FAILURE-INDICATION-NG-RAN Request/Indication

PARAMETER	REFERENCE	PRESENCE
Message Type	9.3.28	M
Failed Cell List NG-RAN	9.3.62	M
Global RAN Node ID	9.3.53	M

The FAILURE-INDICATION-NG-RAN message is sent by the AMF to the CBCF upon receipt of a PWS Failure Indication from a NG-RAN node, to indicate that ongoing PWS operation in one, more or all cells served by that NG-RAN node has failed.

If the AMF interfaces with multiple CBCFs, the AMF shall forward the same FAILURE-INDICATION-NG-RAN message to all CBCFs.

9.3 Parameters

9.3.1 Message-Identifier

This parameter identifies source/type of a CBS message and is passed transparently from the CBC to the MS/UE. Its format is defined in clause 9.4.1.2.2.

9.3.2 Old-Serial-Number

This parameter equates to the parameter - Serial Number sent between the BSC/RNC and the MS/UE. Its format is defined in clause 9.4.1.2.1.

This parameter enables a particular existing CBS message, from the source/type indicated by the message identifier, to be identified.

9.3.3 New-Serial-Number

This parameter equates to the parameter - Serial Number sent between the BSC/RNC and the MS/UE. Its format is defined in clause 9.4.1.2.1.

This parameter enables CBS message change to be indicated since it is altered every time the CBS message is changed. The serial number identifies a particular CBS message, which may be several pages in length, from the source indicated by the message identifier.

9.3.4 Number-of-Pages

This parameter enables the number of pages in the CBS message to be indicated.

9.3.5 Cell-List

The cell-list identifies a sequence of one or more cells to which the primitives apply.

The following applies for GSM only:

The cells in the list are described in 3GPP TS 48.008 [13] and can be identified by the CBC or BSC in LAC and CI format or CI format only.

In addition (see 3GPP TS 48.008 [13]) it is possible for the CBC to refer to all cells in a LAC or in a complete BSC. If supplied, the Cell-List parameter must refer to at least one cell.

The following applies for UMTS only:

- a) For CBS the cells are referred to as Service Areas. As described in 3GPP TS 25.401 [17] a Service Area Identifier (SAI) is used to uniquely identify an area consisting of one or more cells belonging to the same Location Area. Such an area is called a Service Area and can be used for indicating the location of a UE to the CN.
- b) The Service Area Code (SAC) together with the PLMN-Id and the LAC will constitute the Service Area Identifier.
- SAI = PLMN-Id + LAC + SAC.
- c) The SAC is defined by the operator, and set in the RNC via O&M.

NOTE: For CBS, a Service Area shall consist of only one Cell. The mapping of SAI onto cell is controlled by the RNC and managed by an O&M function. Given the above differences between cell identification in the two directions, a cell list sent from the CBC to the BSC/RNC has a different structure compared to a cell list sent from the BSC/RNC to the CBC. The different cell lists are described in clauses 9.3.5.1 and 9.3.5.2.

The following applies for E-UTRAN only:

- The cells in the list are described in 3GPP TS 36.413 [34].

The following applies for NG-RAN only:

- The cells in the list are described in 3GPP TS 38.413 [40].

9.3.5.1 Cell-List sent from CBC to BSC/RNC

The CBC to BSC/RNC Cell-List contains a length parameter identifying the number of cell-identifications present in the list, a Cell-Id-Discriminator, which is common for all cell-identifications in the list, and a sequence of cell-identifications.

Description of list elements:

PARAMETER	PRESENCE
Length	M
Cell-Id-Discriminator	M
Cell-Identification	M

The Cell-Id-Discriminator has one of the following formats:

Format	Description
LAC and CI in GSM;	3GPP TS 48.008 [13]
CI only;	3GPP TS 48.008 [13]
all cells in the BSC/RNC belonging to a certain Location Area;	Example in 3GPP TR 03.49 [6]
all cells in the BSC;	Example in 3GPP TR 03.49 [6]
SAI in UMTS	3GPP TS 25.401 [17]

The Cell-identification is repeated for each cell included in the list. The Cell-List must refer to at least one cell.

9.3.5.2 Cell-List sent from BSC/RNC to CBC

The BSC/RNC to CBC Cell-List contains a sequence of cell-identifiers as defined in clause 9.3.11. The Cell-List must contain at least one cell-identifier as defined in clause 9.3.11.

9.3.6 Channel Indicator

The following applies for GSM only:

This parameter indicates the CB channel, which shall be used for broadcasting the data:

- basic channel;

- extended channel (supporting such a channel by the network or MSs is optional);

9.3.7 Category

This indicates the priority of the message:

- High Priority: to be broadcast at the earliest opportunity.
- Background: to be broadcast when no CBS messages of category "High Priority" or "Normal" are broadcast. The repetition period defines the minimum broadcast requirement.
- Normal: to be broadcast according to the associated repetition period.

If the category is omitted, the default category implied is "Normal" message.

9.3.8 Repetition-Period

This indicates the period of time after which broadcast of the CBS message should be repeated. The minimum period with which a CBS message consisting of one page may be broadcast over the air interface is a period of 1.883 s in GERAN. The minimum period with which a CBS message may be broadcast over the air interface in UTRAN is a period of 1 s.

The value of "Repetition-Period" shall be in the range 1 to 4095 for GERAN and in the range of 1 to 4096 for UTRAN, where each unit will represent the value of one minimum period.

NOTE: In previous versions of the present specification the the maximum Repetition-Period was defined to be 1024.

In the event of a conflict where the BSS/RNS has more than one CBS message to send at the same time, the BSC/RNC shall decide the order of such CBS messages as an implementation matter.

NOTE: The time period 1.883 s approximately reflects one 8 x 51 multiframe sequence of the GSM radio interface. The higher capacity of the RNC enables the CBC to send more than one CBS message consisting of one page with the minimum repetition rate to a Node B.

9.3.9 No-of-Broadcasts-Requested

This specifies the number of times the CBS message is to be broadcast.

The parameter may take any value up to 65535 (this maximum allows the CBS message to be broadcast approximately every 1.883 s for more than 24 h). If the parameter is set to 0 then the CBS message will be broadcast indefinitely (i.e. until the BSC receives an appropriate Kill-Message Request/Indication primitive).

9.3.10 No-of-Broadcasts-Completed-List

This parameter is a list indicating the number of times that the CBS message (i.e. all pages of the CBS message) has been sent to each cell in the Cell-List for broadcast over the air interface.

The cells in the list are described as per clause 9.3.11.

Description of list elements:

PARAMETER	PRESENCE
Cell Identifier	M
No-of-Broadcasts-completed	M
No-of-Broadcasts-Compl-Info	O

The information above is repeated for the number of cells in the list.

To each cell in the list the information element No-of-Broadcasts-completed is associated. This information element is related to the particular referenced cell in the list and contains the number of times a CBS message (i.e. all pages of a

CBS message) has been sent to this cell for broadcast. The No-of-Broadcasts-completed information element represents the number of full broadcasts made of a CBS message, and that the CBS message is being (or had been) broadcast.

The optional No-of-Broadcasts-Compl-Info information element may be supplied to indicate to the CBC one of the following cases:

- overflow;

the count of the number of full broadcasts made of a CBS message has overflowed, and that the CBS message is being (or had been) broadcast. The actual number of broadcasts completed is greater than the value indicated in the No-of-Broadcasts-completed information element;

- unknown;

indicates that there is no information regarding the number of broadcasts completed in the BSC/RNC for the CBS message with the old serial number. The value indicated in the No-of-Broadcasts-completed information element is undefined in this case.

The No-of-Broadcasts-Completed-List must contain at least one cell.

9.3.11 Cell-Identifier

The cell-identifier consists of a cell-id-discriminator and cell-identification pair.

Description of list elements:

PARAMETER	PRESENCE
Cell-Id-Discriminator	M
Cell-Identification	M

The Cell-Id-Discriminator has one of the following formats:

Format	Description
LAC and CI in GSM	3GPP TS 48.008 [13]
CI only	3GPP TS 48.008 [13]
SAI in UMTS	3GPP TS 25.401 [17]

The BSC can use the 'LAC and CI' format for a cell identifier in any response to the CBC. The BSC may also use the 'CI only' format for a cell identifier when responding to a CBC primitive that had contained a cell with 'CI only' format for a cell identifier. The RNC uses the SAI format for a cell identifier in any response to the CBC.

9.3.12 Schedule-Period

The following applies for GSM only:Indicates the DRX schedule period length, see 3GPP TS 44.012 [7].

The following values should be coded:

- no DRX;
- length of the schedule period.

If a schedule period length greater than 40 is used, the schedule message cannot be built entirely if more than 40 CBS messages have to be described in the period. Therefore, schedule period length shall be reduced to 40.

9.3.13 Reserved-Slots

The following applies for GSM only:Indicates the number of slots marked as "free slots reading advised" in the schedule message and considered as reserved in a DRX schedule period for incoming high priority CBS messages, not scheduled in the current schedule period, see 3GPP TS 44.012 [7].

The spacing of the reserved slots is implementation dependent.

Reserved slots shall receive a 40 value at maximum, taking into account the constraint for schedule period length.

9.3.14 Failure-List

This identifies the list of cells for which the BSC/RNC could not complete the request. The failure cause for each cell is indicated.

The cells in the list are described as per clause 9.3.11.

Description of list elements:

PARAMETER	PRESENCE
Cell Identifier	M
Cause	M
Diagnostic	O

The information above is repeated for the number of cells that failed.

To each cell in the list the information elements Cause and, as an implementation option, Diagnostic are associated. These are related to the particular referenced cell in the list.

The Failure-List must contain at least one cell.

9.3.15 Radio-Resource-Loading-List

A list of the predicted short term load of each cell in the list expressed as a percentage. The calculation of this percentage is an implementation matter. The load should reflect the number of used slots, and schedule messages and reserved slots must be taken into account. The cells in the list are described as per clause 9.3.11.

Description of list elements:

PARAMETER	PRESENCE
Cell Identifier	M
Radio-Resource-Loading	M

The information above is repeated for the number of cells in the list.

To each cell in the list the information element Radio-Resource-Loading is associated. This information element is related to the particular referenced cell in the list and contains the cells load.

Note that for cells with DRX the load caused by the schedule messages will be included in the Radio-Resource load.

The Radio-Resource-Loading-List must contain at least one cell.

9.3.16 Cause

Indicates reason why the BSC/RNC was not able to interpret or execute the received primitive. The causes are given in table 1.

Table 1

Cause	Reason
Parameter-not-recognized	Sent when the recipient (CBC or BSC/RNC) was unable to act upon the primitive received due to an unrecognized parameter. A primitive should not be rejected only because a parameter is not recognized as this would prevent extensions to the service
parameter-value-invalid	Sent when a failure occurred due to the value of a parameter being invalid, e.g. out of range, or in Write-Replace, the parameter "no of pages" does not equal the number of pages received
valid-CBS-message-not-identified	Sent when the BSC/RNC does not recognize the CBS message reference
cell-identity-not-valid	Sent when the BSC/RNC does not recognize a cell Identity
unrecognized-primitive	Sent when the BSC/RNC did not recognize the primitive at all
missing-mandatory-element	Sent when a mandatory element is missing from the primitive
bss-capacity-exceeded	Sent when a write-replace fails because the BSC/RNC cannot meet the requested repetition period or when the set-drx parameters cannot be applied because of the cell loading
GSM only [cell-memory-exceeded]	Sent when the local cell memory has been exceeded
bss-memory-exceeded	Sent when the BSS/RNS is unable to store a CBS message as the BSS/RNS memory has been exceeded
cell-broadcast-not-supported	Sent when the CBCH/CBS related Radio Resource is not configured for a cell
cell-broadcast-not-operational	Sent when the CBCH/CBS related radio resource is not available because of error conditions or due to maintenance activities
incompatible-DRX-parameter	Sent when the DRX parameter(s) cannot be applied.
GSM only [Extended-channel-not-supported]	Sent when a write-replace fails because the extended channel is not configured for a cell]
message-reference-already-used	Sent when the recipient (BSC/RNC) was unable to act upon the write_replace received due to a previous write_replace received with the same message_reference.
unspecified-error	Sent when none of the above cause values apply

9.3.17 Diagnostic

Provides additional information associated with Cause parameter and may contain parameter which could not be interpreted/executed.

9.3.18 Data Coding Scheme

This parameter identifies the alphabet or coding employed for the message characters and message handling at the MS/UE and is passed transparently from the CBC to the MS/UE. This parameter is defined in 3GPP TS 23.038 [3].

9.3.19 CBS-Message-Information-Page n

This parameter is of a fixed length of 82 octets and carries up to and including 82 octets of user information. Where the user information is less than 82 octets, the remaining octets must be filled with padding (see 3GPP TS 23.038 [3]).

The content of a CBS-Message-Information-Page is passed transparently from the CBC to the MS/UE.

In GSM the CBS-Message-Information-Page n becomes the 'Content of Message' parameter at the MS.

In UMTS and E-UTRAN, the CBS-Message-Information-Pages together with the associated CBS-Message-Information-Length parameter are broadcasted as a single unit over the radio interface, and are part of 'CB Data' parameter at the UE.

In the case where the user information is GSM 7 bit default alphabet encoded, the appropriate padding characters and bit-fill are added to the end of the user information to complete the CBS-Message-Information-Page (see 3GPP TS 23.038 [3]).

In the case where the user information is 8 bit encoded, the appropriate padding octets are added to the end of the user information to complete the CBS-Message-Information-Page (see 3GPP TS 23.038 [3]).

9.3.19.1 Identification of a directory number within a CBS-Message-Information-Page

For information relating to this feature see 3GPP TS 23.040 [4].

9.3.20 CBS-Message-Information-Length n

This parameter gives the number of octets of the CBS-Message-Information-Page n containing user information. The remaining octets of the CBS-Message-Information-Page n contain only padding information and are not included in this parameter.

In the case where the user information is encoded using the GSM 7 bit default alphabet and the last character terminates at an octet boundary, this parameter indicates the number of octets of user information. In the case where the last character does not terminate at an octet boundary, this parameter indicates the number of octets up to the octet boundary immediately following the last GSM 7 bit default alphabet character of user information.

In UMTS and E-UTRAN, the CBS-Message-Information-Pages together with the associated CBS-Message-Information-Length parameter are broadcasted as a single unit over the radio interface, and are part of 'CB Data' parameter at the UE.

9.3.21 Recovery-Indication

Indicates whether the CBS related data was lost or is still available.

The following values should be coded:

- Data-available;
- Data-lost.

9.3.22 Void

9.3.23 Paging-ETWS-Indicator

This parameter indicates that emergency information shall be sent over the paging message.

In UMTS the parameter remotely activates the UE to receive CBS messages.

In GSM the parameter indicates that an ETWS emergency message is included in the WRITE-REPLACE primitive.

9.3.24 Warning-Type

This parameter is set when ETWS is used. It has three fields in order to contain warning type value, emergency user alert and popup indications.

The warning type value field indicates the following 5 warning types as its values; earthquake, tsunami, earthquake and tsunami, test, and other. Also, other warning types can be defined in the future if it is required.

The values for this parameter are expressed in 7-bit string. The following table shows the values and their corresponding warning types.

Warning typeValue	Warning type
0000000	Earthquake
0000001	Tsunami
0000010	Earthquake and Tsunami
0000011	Test
0000100	Other
0000101-1111111	Reserved for future use

The fields for emergency user alert and popup indications are type binary. They are used to command mobile terminals to activate emergency user alert and message popup in order to alert the users upon the reception of ETWS primary notification (e.g. paging message). The codings for the fields are shown below:

Field	Emergency User Alert		Popup	
Value	0	1	0	1
Instruction to Terminal	No instruction as to emergency alert.	Activate emergency user alert.	No instruction as to popup.	Activate popup on the display.

NOTE: Emergency user alert includes alerting tone and other user alerting means such as vibration, according to the UE's capability. The types of alert (e.g. the kind of tone, vibration, etc) are implementation dependent and may be subject to regulatory requirements.

The encoding of the Warning-Type parameter is as shown below. The warning type value shall be mutually exclusive and binary encoded.

Octet 1								Octet 2							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Warning Type Value							Emergency User Alert	Popup	Padding						

The values of this parameter are sent to the mobile terminals (e.g. over the paging message which remotely activates the UE to receive CBS messages).

9.3.25 Warning-Security-Information

This parameter is only set when ETWS primary notification is sent with security. This parameter is 50 bytes in length and contains 7 byte timestamp and 43 byte digital signature.

8	7	6	5	4	3	2	1	
Year								octet 1
Month								octet 2
Day								octet 3
Hour								octet 4
Minute								octet 5
Second								octet 6
Time zone								octet 7
Digital Signature								octet 8 - octet 50

Year (octet 1, bits 1-8): This field uses the same format as the Year field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Month (octet 2, bits 1-8): This field uses the same format as the Month field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Day (octet 3, bits 1-8): This field uses the same format as the Day field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Hour (octet 4, bits 1-8): This field uses the same format as the Hour field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Minute (octet 5, bits 1-8): This field uses the same format as the Minute field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Second (octet 6, bits 1-8): This field uses the same format as the Second field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Time Zone (octet 7, bits 1-8): This field uses the same format as the Time Zone field used in the TP-Service-Centre-Time-Stamp, which is defined in 3GPP TS 23.040 [4].

Digital Signature (octet 8 - 50, bits 1-8): This field contains the 43 byte digital signature.

9.3.26 Warning Period

This parameter indicates the length of the period during which the ETWS emergency message is to be broadcasted in the BSC. This parameter is applicable for GSM only.

9.3.27 Broadcast Message Type

This parameter is applicable for GSM only.

It indicates if the primitive including this parameter is referring to:

- CBS message broadcasting; or
- ETWS emergency message broadcasting.

9.3.28 Message Type

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Message Type* IE uniquely identifies the message being sent; see 3GPP TS 29.168 [35] for E-UTRAN and 3GPP TS 29.518 [41] for NG-RAN.

9.3.29 List of TAIs

This parameter is applicable for E-UTRAN only.

The *Tracking Area ID List* IE is used to uniquely identify a Tracking Area; see 3GPP TS 36.413 [36] for E-UTRAN.

9.3.30 Warning Area List

This parameter is applicable for E-UTRAN only.

The *Warning Area List* IE indicates the areas where the warning message needs to be broadcast. The *Warning Area List* consists of a Cell ID list (see clause 9.3.5) or a TAI list (see clause 9.3.29) or an Emergency Area ID list; see clause 9.3.47.

9.3.31 OMC ID

This parameter is applicable for E-UTRAN and NG-RAN only.

The *OMC ID IE* indicates the identity of an Operation and Maintenance Centre to which Trace Records shall be sent. This element consists of a string of maximum 20 octets; see 3GPP TS 29.168 [35] for E-UTRAN and 3GPP TS 29.518 [41] for NG-RAN.

9.3.32 Concurrent Warning Message Indicator

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Concurrent Warning Message Indicator IE* indicates to eNB that the received warning message is a new message to be scheduled for concurrent broadcast with any other ongoing broadcast of warning messages. This element is an enumerated type; see 3GPP TS 36.413 [36] for E-UTRAN and 3GPP TS 38.413 [40] for NG-RAN.

NOTE: The Concurrent Warning Message Indicator IE is always present for non-ETWS (eg. CMAS) messages. The Concurrent Warning Message Indicator is not applicable for ETWS.

9.3.33 Cause-E-UTRAN

This parameter is applicable for E-UTRAN only.

The purpose of the *Cause E-UTRAN IE* is to indicate the reason for a particular event for the SBc-AP protocol. This element is an integer; see 3GPP TS 29.168 [35].

9.3.34 Criticality Diagnostics

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Criticality Diagnostics IE* is sent by the MME/AMF when parts of a received message have not been comprehended or were missing, or if the message contained logical errors. When applicable, it contains information about which IEs were not comprehended or were missing; see 3GPP TS 29.168 [35] for E-UTRAN and 3GPP TS 29.518 [41] for NG-RAN.

9.3.35 Warning Message Content E-UTRAN

This parameter is applicable for E-UTRAN only.

The *Warning Message Content E-UTRAN IE* contains user information, e.g., the message with warning contents, and will be broadcast over the radio interface. This element is a string of maximum 9600 octets; see 3GPP TS 36.413 [36].

NOTE: If the ePWS language-independent content functionality (see clause 8.3) is supported by CBE, a user information can include a language-independent content mapped to an event or a disaster that is compatible with texts used to describe user information contained in the content of a CBS-Message-Information-Page transparently passed from CBC to UEs.

The content of *Warning Message Content E-UTRAN IE* consists of the following parameters:

PARAMETER	REFERENCE	PRESENCE
Number-of-Pages	9.3.4	M
CBS-Message-Information-Page 1	9.3.19	M
CBS-Message-Information-Length 1	9.3.20	M
CBS-Message-Information-Page 2	9.3.19	O
CBS-Message-Information-Length 2	9.3.20	O
...		:
CBS-Message-Information-Page n	9.3.19	O
CBS-Message-Information-Length n	9.3.20	O
NOTE: n equal to or less than 15		

9.3.36 Repetition-Period E-UTRAN

This parameter is applicable for E-UTRAN only.

The *Repetition Period E-UTRAN* IE indicates the periodicity in seconds of the warning message to be broadcast. This element is an integer with a value between 0 and 4095; see 3GPP TS 36.413 [36].

9.3.37 Extended Repetition-Period

This parameter is applicable for E-UTRAN only.

The *Extended Repetition-Period* IE indicates the periodicity in seconds of the warning message to be broadcast. This IE is used if the Repetition Period has a value larger than 4095 and is an integer between 4096 and $(2^{17}-1)$; see 3GPP TS 36.413 [36] for E-UTRAN.

9.3.38 Unknown Tracking Area List

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Unknown Tracking Area List* IE identifies the Tracking Areas that are unknown to the MME/AMF and where the Request cannot be delivered. This IE is of type List of TAI (see clause 9.3.29).

This IE shall not be included if the Cause IE indicates *Tracking area not valid*. The Cause IE indicating *Tracking area not valid* is used when all Tracking Areas in the Request are invalid.

9.3.39 Send Write-Replace-Warning-Indication

This parameter is applicable for E-UTRAN and NG-RAN only.

For E-UTRAN:

The *Send Write-Replace-Warning-Indication* IE indicates to the MME that the MME shall send the WRITE-REPLACE WARNING INDICATION to the CBC for the warning message. This element is an enumerated type; see 3GPP TS 29.168 [35].

For NG-RAN:

The *Send Write-Replace-Warning-Indication* IE indicates to the AMF that the AMF shall send the WRITE-REPLACE WARNING INDICATION-NG-RAN to the CBCF for the warning message. This element is an enumerated type; see 3GPP TS 29.518 [41].

9.3.40 Broadcast Scheduled Area List

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Broadcast Scheduled Area List* IE indicates the areas where initiation of a broadcast was performed successfully. A Broadcast Scheduled Area List is received by the MME/AMF from an eNodeB/NG-RAN node as Broadcast Completed Area List; see 3GPP TS 36.413 [36] for E-UTRAN and 3GPP TS 38.413 [40] for NG-RAN.

9.3.41 Send Stop Warning Indication

This parameter is applicable for E-UTRAN and NG-RAN only.

For E-UTRAN:

The *Send Stop Warning Indication* IE is an indication for the MME to send the STOP-WARNING-INDICATION to the CBC for the warning message. This element is an enumerated type; see 3GPP TS 29.168 [35].

For NG-RAN:

The *Send Stop Warning Indication* IE is an indication for the AMF to send the STOP-WARNING-INDICATION-NG-RAN to the CBCF for the warning message. This element is an enumerated type; see 3GPP TS 29.518 [41].

9.3.42 Broadcast Cancelled Area List

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Broadcast Cancelled Area List* IE indicates the areas where broadcast was stopped successfully; see 3GPP TS 36.413 [36] for E-UTRAN and 3GPP TS 38.413 [40] for NG-RAN.

9.3.43 Stop-All Indicator

This parameter is applicable for E-UTRAN and NG-RAN only.

For E-UTRAN:

The *Stop-All Indicator* IE in the STOP-WARNING-REQUEST is sent by the MME to the eNodeB in the Kill Request (see 3GPP TS 36.413 [36]). This is to indicate to the eNB that the *Message Identifier* IE and the *Serial Number* IE in the Kill Request shall be ignored and the request applies to all messages in the Warning Area.

NOTE 1: The CBC may use the *Message Identifier* IE and/or the *Serial Number* IE to associate the STOP-WARNING-INDICATION and the STOP-WARNING-RESPONSE with the STOP-WARNING-REQUEST.

The *Stop-All Indicator* IE is an enumerated type; see 3GPP TS 29.168 [35].

For NG-RAN:

The *Stop-All Indicator* IE in the STOP-WARNING-REQUEST-NG-RAN is sent by the AMF to the NG-RAN node in the Cancel Request (see 3GPP TS 38.413 [40]). This is to indicate to the NG-RAN node that the *Message Identifier* IE and the *Serial Number* IE in the Cancel Request shall be ignored and the request applies to all messages in the Warning Area.

NOTE 2: The CBCF may use the *Message Identifier* IE and/or the *Serial Number* IE to associate the STOP-WARNING-INDICATION-NG-RAN and the STOP-WARNING-RESPONSE-NG-RAN with the STOP-WARNING-REQUEST-NG-RAN.

The *Stop-All Indicator* IE is an enumerated type; see 3GPP TS 29.518 [41].

9.3.44 Broadcast Empty Area List

This parameter is applicable for E-UTRAN and NG-RAN only.

For E-UTRAN:

The *Broadcast Empty Area List* IE contains a list of the eNodeB IDs (see clause 9.3.46) of eNodeBs that have responded to the the MME with a

- WRITE-REPLACE WARNING RESPONSE message in which the *Broadcast Completed Area List* IE was not included (see 3GPP TS 36.413 [34]), or
- KILL RESPONSE message in which the *Broadcast Cancelled Area List* IE was not included (see 3GPP TS 36.413 [34]).

The MME may aggregate eNodeB IDs into the Broadcast Empty Area List.

For NG-RAN:

The *Broadcast Empty Area List* IE contains a list of the RAN Node IDs (see clause 9.3.53) of NG-RAN nodes that have responded to the the AMF with a

- WRITE-REPLACE WARNING RESPONSE message in which the *Broadcast Completed Area List* IE was not included (see 3GPP TS 38.413 [40]), or
- PWS CANCEL RESPONSE message in which the *Broadcast Cancelled Area List* IE was not included (see 3GPP TS 38.413 [40]).

The AMF may aggregate NG-RAN node IDs into the Broadcast Empty Area List.

9.3.45 Restarted-Cell-List

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Restarted-Cell-List* IE lists the cells which have restarted and where warning messages have been stopped if any were ongoing. See 3GPP TS 36.413 [36] for E-UTRAN and 3GPP TS 38.413 [40] for NG-RAN.

9.3.46 Global eNB ID

This parameter is applicable for E-UTRAN only.

The *Global eNB ID* IE is used to globally identify an eNB. See 3GPP TS 36.413 [36].

9.3.47 Emergency Area ID List

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Emergency Area ID List* IE is used to indicate the area which has the emergency impact; see 3GPP TS 36.413 [36] for E-UTRAN and 3GPP TS 38.413 [40] for NG-RAN.

9.3.48 Broadcast Message Content Validity Indicator

This parameter is applicable for UMTS only.

The *Broadcast Message Content Validity Indicator* IE if included in the WRITE-REPLACE message indicates that the Broadcast Message Content IE does not contain any valid information and is to be ignored. This element is an enumerated type; see 3GPP TS 25.419 [29].

9.3.49 Failed-Cell-List

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Failed-Cell-List* IE lists the cells where ongoing PWS operation has failed. See 3GPP TS 36.413 [36] for E-UTRAN and 3GPP TS 38.413 [40] for NG-RAN.

9.3.50 Cause-NG-RAN

This parameter is applicable for NG-RAN only.

The purpose of the *Cause-NG-RAN* IE is to indicate the reason for a particular event for the N50 protocol. This element is an integer; see 3GPP TS 29.518 [41].

9.3.51 Warning Message Content NG-RAN

This parameter is applicable for NG-RAN only.

The *Warning Message Content NG-RAN* IE contains user information, e.g., the message with warning contents, and will be broadcast over the radio interface. This element is a string of maximum 9600 octets; see 3GPP TS 38.413 [40].

NOTE: If the ePWS language-independent content functionality (clause 8.3) is supported by CBE, a user information can include a language-independent content mapped to an event or a disaster that is compatible with texts used to describe user information contained in the content of a CBS-Message-Information-Page transparently passed from CBC to UEs.

The content of *Warning Message Content NG-RAN* IE consists of the following parameters:

PARAMETER	REFERENCE	PRESENCE
Number-of-Pages	9.3.4	M
CBS-Message-Information-Page 1	9.3.19	M
CBS-Message-Information-Length 1	9.3.20	M
CBS-Message-Information-Page 2	9.3.19	O
CBS-Message-Information-Length 2	9.3.20	O
...		:
CBS-Message-Information-Page n	9.3.19	O
CBS-Message-Information-Length n	9.3.20	O
NOTE: n equal to or less than 15		

9.3.52 Repetition-Period NG-RAN

This parameter is applicable for NG-RAN only.

The *Repetition Period NG-RAN* IE indicates the periodicity in seconds of the warning message to be broadcast. This element is an integer with a value between 0 and $2^{17}-1$; see 3GPP TS 38.413 [40].

9.3.53 Global RAN Node ID

This parameter is applicable for NG-RAN only.

The *Global RAN Node ID* IE is used to globally identify a NG-RAN node (i.e. a Global gNB ID or a Global ng-eNB ID). See 3GPP TS 38.413 [40].

9.3.54 List of NG-RAN TAIs

This parameter is applicable for NG-RAN only.

The *List of NG-RAN TAIs* IE is used to uniquely identify NG-RAN Tracking Areas; see 3GPP TS 38.413 [40].

9.3.55 Warning Area List NG-RAN

This parameter is applicable for NG-RAN only.

The *Warning Area List NG-RAN* IE indicates the areas where the warning message needs to be broadcast. The *Warning Area List NG-RAN* consists of a Cell ID list (see clause 9.3.5) or a NG-RAN TAI list (see clause 9.3.54) or an Emergency Area ID list; see clause 9.3.47.

9.3.56 RAT Selector NG-RAN

This parameter is applicable for NG-RAN only.

The *RAT Selector NG-RAN* IE shall be present to indicate to the AMF if the request shall be distributed to attached ng-eNBs or to gNBs. See 3GPP TS 29.518 [41].

NOTE: The CBC and the AMF do not support handling of concurrent responses from ng-eNBs and gNBs for the same request.

9.3.57 Unknown NG-RAN Tracking Area List

This parameter is applicable for NG-RAN only.

The *Unknown NG-RAN Tracking Area List* IE identifies the Tracking Areas that are unknown to the AMF and where the request cannot be delivered. This IE is of type List of NG-RAN TAIs (see clause 9.3.54).

This IE shall not be included if the Cause IE indicates *Tracking area not valid*. The Cause IE indicating *Tracking area not valid* is used when all Tracking Areas in the request are invalid.

9.3.58 Broadcast Scheduled Area List NG-RAN

This parameter is applicable for NG-RAN only.

The *Broadcast Scheduled Area List NG-RAN* IE indicates the areas where initiation of a broadcast was performed successfully. A Broadcast Scheduled Area List is received by the AMF from an NG-RAN Node as Broadcast Completed Area List. See 3GPP TS 38.413 [40].

9.3.59 Broadcast Cancelled Area List NG-RAN

This parameter is applicable for NG-RAN only.

The *Broadcast Cancelled Area List NG-RAN* IE indicates the areas where broadcast was stopped successfully; see 3GPP TS 38.413 [40].

9.3.60 Broadcast Empty Area List NG-RAN

This parameter is applicable for NG-RAN only.

The *Broadcast Empty Area List NG-RAN* IE contains a list of the Global RAN Node IDs (see clause 9.3.53) of NG-RAN Nodes that have responded to the the AMF with a

- WRITE-REPLACE WARNING RESPONSE message in which the *Broadcast Completed Area List* IE was not included (see 3GPP TS 38.413 [40]), or
- PWS CANCEL RESPONSE message in which the *Broadcast Cancelled Area List* IE was not included (see 3GPP TS 38.413 [40]).

The AMF may aggregate NG-RAN Node IDs into the Broadcast Empty Area List NG-RAN.

9.3.61 Restarted Cell List NG-RAN

This parameter is applicable for NG-RAN only.

The *Restarted Cell List NG-RAN* IE lists the cells which have restarted and where warning messages have been stopped if any were ongoing. See 3GPP TS 38.413 [40].

9.3.62 Failed Cell List NG-RAN

This parameter is applicable for NG-RAN only.

The *Failed Cell List NG-RAN* IE lists the cells where ongoing PWS operation has failed. See 3GPP TS 38.413 [40].

9.3.63 Warning Area Coordinates

This parameter is applicable for E-UTRAN and NG-RAN only.

The *Warning Area Coordinates* IE indicates alert area coordinates of a warning message. The eNB and NG-RAN node pass this information to the UE. The UE uses this information to conditionally display (see clause 9.1.3.4.2 and clause 9.1.3.5.2) the warning message contents.

The *Warning Area Coordinates* IE is encoded as specified in ATIS-0700041 [47].

9.3.64 Test Flag

The Test Flag IE may be included to indicate to the NG-RAN node that the request is to be processed and responded to normally, but shall not result in broadcast over the air and shall not allocate any resources (i.e. the request cannot be cancelled).

9.4 Message Format on the Radio Network – MS/UE Interface

9.4.1 GSM

The CBS messages which are transmitted by the BTS for the MS include the CBS Message (information for the user) and Schedule Message (schedule of CBS messages).

The use and the formatting of the CBS messages, which contain information for the MS user, is described in this clause.

The Schedule Message is broadcast to support CBS DRX mode for Mobile Stations. The Schedule Message is helpful in minimizing battery usage for Cell Broadcast in the Mobile Station, because it allows the MS to ignore transmissions of CBS messages the customer is not interested in. The use and formatting of the Schedule Message is described in 3GPP TS 44.012 [7].

The handling of the GSM only applicable ETWS Primary Notification messages differ from what is stated in this clause and is instead described in clause 9.4.1.3.

9.4.1.1 General Description

Each page of a CBS Message sent to the MS by the BTS is a fixed block of 88 octets as coded in 3GPP TS 44.012 [7]. This is sent on the channel allocated as CBCH by 3GPP TS 45.002 [8]. The 88 octets of the CBS Message are formatted as described in clause 9.3.2.

9.4.1.2 Message Parameter

Octet Number(s)	Field
1-2	Serial Number
3-4	Message Identifier
5	Data Coding Scheme
6	Page Parameter
7-88	Content of Message

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

9.4.1.2.1 Serial Number

This parameter is a 16-bit integer which identifies a particular CBS message (which may be one to fifteen pages in length) from the source and type indicated by the Message Identifier and is altered every time the CBS message with a given Message Identifier is changed.

The two octets of the Serial Number field are divided into a 2-bit Geographical Scope (GS) indicator, a 10-bit Message Code and a 4-bit Update Number as shown below:

Octet 1								Octet 2							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
GS		Message Code										Update Number			

The most significant bit of the update number is octet 2 bit 3. The most significant bit of the Message Code is octet 1 bit 5 and the least significant bit of the Message Code is octet 2 bit 4. The most significant bit of the Geographical Scope is octet 1 bit 7.

Message Code:

The Message Code differentiates between CBS messages from the same source and type (i.e. with the same Message Identifier). Message Codes are for allocation by PLMN or SNPN operators.

The Message Code identifies different message themes. For example, let the value for the Message Identifier be "Automotive Association" (= source), "Traffic Reports" (= type). Then "Crash on A1 J5" could be one value for the message code, "Cow on A32 J4" could be another, and "Slow vehicle on M3 J3" yet another.

In the case of transmitting CBS messages for ETWS, i.e. the Message Identifier has a value for ETWS (see clause 9.4.1.2.2), a part of Message Code can be used to command mobile terminals to activate emergency user alert and message popup in order to alert the users. Message Code format for this purpose is as follows:

5	4	3	2	1	0	7	6	5	4
Emergency User Alert	Popup								

NOTE 1: The exact behaviour of the UE is specified in 3GPP TS 22.268 [28]. Whether the UE setting is overridden is subject to regulatory requirements.

NOTE 2: Emergency user alert includes alerting tone and other user alerting means such as vibration, according to the UE's capability. The types of alert (e.g. the kind of tone, vibration, etc) are implementation dependent and may be subject to regulatory requirements.

NOTE 3: The popup indication shall take precedence over the setting of the DCS Message class (see 3GPP TS 23.038 [3]), and the Geographical Scope with regard to Display Mode 'immediate'.

The codings of the Emergency User Alert and Popup fields are shown below:

Field	Code	Instruction to Terminal
Emergency User Alert	0	No instruction as to emergency user alert.
	1	Activate emergency user alert.
Popup	0	No instruction as to popup.
	1	Activate popup on the display.

Geographical Scope:

The Geographical Scope (GS) indicates the geographical area over which the Message Code is unique, and the display mode. The CBS message is not necessarily broadcast by all cells within the geographical area. When two CBS messages are received with identical Serial Numbers/Message Identifiers in two different cells, the Geographical Scope may be used to determine if the CBS messages are indeed identical.

In particular, the Geographical Scope tells the mobile if the CBS message is:

- only cell wide (which means that if a message is displayed it is desirable that the message is removed from the screen when the UE selects the next cell and if any CBS message is received in the next cell it is to be regarded as "new"), or
- PLMN/SNPN wide (which means that the Message Code and/or Update Number must change in the next cell, of the PLMN or SNPN, for the CBS message to be "new". The CBS message is only relevant to the PLMN or SNPN in which it is broadcast, so any change of PLMN (including a change to another PLMN which is an ePLMN) or SNPN means the CBS message is "new"), or
- Location Area wide (in GSM) (which means that a CBS message with the same Message Code and Update Number may or may not be "new" in the next cell according to whether the next cell is in the same Location Area as the current cell), or
- Service Area wide (in UMTS) (which means that a CBS message with the same Message Code and Update Number may or may not be "new" in the next cell according to whether the next cell is in the same Service Area as the current cell), or

NOTE 4: According to 3GPP TS 23.003 [2] a Service Area consists of one cell only.

- Tracking Area wide (in E-UTRAN) (which means that a warning message with the same Message Code and Update Number may but need not be "new" in the next cell according to whether the next cell is in the same Tracking Area as the current cell), or
- Tracking Area wide (in NG-RAN) (which means that a warning message with the same Message Code and Update Number may but need not be "new" in the next cell according to whether the next cell is in the same Tracking Area as the current cell).

The display mode indicates whether the CBS message is supposed to be on the display all the time ("immediate") or only when the user wants to see it ("normal"). In either case, the CBS message will be displayed only if its Message Identifier is contained within the "search list" of the mobile (see clause 9.3.2). These display modes are indicative of intended use, without indicating a mandatory requirement or constraining the detailed implementation by mobile manufacturers. The user may be able to select activation of these different modes.

The coding of the Geographical Scope field is shown below:

GS Code	Display Mode	Geographical Scope
00	Immediate	Cell wide
01	Normal	PLMN/SNPN wide
10	Normal	Location Area wide in GSM, Service Area wide in UMTS, Tracking Area wide in E-UTRAN, Tracking Area wide in NG-RAN
11	Normal	Cell wide

Immediate = default direct display.

Normal = default display under user interaction.

Code 00 is intended for use by the network operators for base station IDs but this code can also be used for other applications. Use of GS=00 takes precedence over the setting of the DCS Message class (see 3GPP TS 23.038 [3])

Update Number:

The Update Number indicates a change of the message content of the same CBS message, i.e. the CBS message with the same Message Identifier, Geographical Scope, and Message Code.

In other words, the Update Number will differentiate between older and newer versions of the same CBS message, within the indicated geographical area. A new CBS message may have Update Number 0000; however this number will increment by 1 for each update.

9.4.1.2.2 Message Identifier

This parameter identifies the source and type of the CBS message. For example, "Automotive Association" (= source), "Traffic Reports" (= type) could correspond to one value. A number of CBS messages may originate from the same source and/or be of the same type. These will be distinguished by the Serial Number. The Message Identifier is coded in binary.

The ME shall attempt to receive the CBS messages whose Message Identifiers are in the "search list". This "search list" shall contain the Message Identifiers stored in the EF_{CBMI}, EF_{CBMID} and EF_{CBMIR} files on the SIM (see 3GPP TS 11.11) and any Message Identifiers stored in the ME in a "list of CBS messages to be received". If the ME has restricted capabilities with respect to the number of Message Identifiers it can search for, the Message Identifiers stored in the SIM shall take priority over any stored in the ME.

The use/application of the Message Identifier is shown in the following table, with octet 3 of the Message Identifier in hex shown first, followed by octet 4. Thus "1234" (hex) represents octet 3 = 0001 0010 and octet 4 = 0011 0100.

In a PLMN, the MS shall discard a CBS message in Message Identifier value range "A000hex-AFFFhex" unless it is received from:

- HPLMN;

- EHPLMN; or
- PLMN that is equivalent to either HPLMN or EHPLMN.

In an SNPN, the MS shall discard a CBS message in Message Identifier value range "A000hex-AFFFhex" unless it is received from a subscribed SNPN.

Networks shall only use Message Identifiers from the range 4352 – 6399 (1100 hex – 18FF hex) for Public Warning System as defined in 3GPP TS 22.268 [28]. If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message. Processing of different language codes is specified in clause 9.4.1.2.3 and clause 9.4.2.2.4.

Decimal	Hex	Meaning
0 – 999	0000 – 03E7	To be allocated by GSMA(see GSMA AD.26 [25]). If a Message Identifier from this range is in the "search list", the ME shall attempt to receive such CBS message. This version of this document does not prohibit networks from using Message Identifiers in the range 0000 - 03E7 (hex) for Cell Broadcast Data Download to the SIM.
1000	03E8	LCS CBS Message Identifier for E-OTD Assistance Data message.
1001	03E9	LCS CBS Message Identifier for DGPS Correction Data message.
1002	03EA	LCS CBS Message Identifier for GPS Ephemeris and Clock Correction Data message.
1003	03EB	LCS CBS Message Identifier for GPS Almanac and Other Data message.
1004 - 4095	03EC – 0FFF	Intended for standardization in future versions of this document. These values shall not be transmitted by networks that are compliant to this version of this document. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.
4096 - 4223	1000 – 107F	Networks shall only use Message Identifiers from this range for Cell Broadcast Data Download in "clear" (i.e. unsecured) to the SIM (see 3GPP TS 11.14). If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message. Not settable by MMI
4224 - 4351	1080 – 10FF	Networks shall only use Message Identifiers from this range for Cell Broadcast Data Download secured according to 3GPP TS 23.048 [15] to the SIM (see 3GPP TS 11.14). If a message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message. Not settable by MMI
4352	1100	ETWS CBS Message Identifier for earthquake warning message.
4353	1101	ETWS CBS Message Identifier for tsunami warning message.
4354	1102	ETWS CBS Message Identifier for earthquake and tsunami combined warning message.
4355	1103	ETWS CBS Message Identifier for test message.

		The UE silently discards this message. A UE specially designed for testing purposes may display its contents.
4356	1104	ETWS CBS Message Identifier for messages related to other emergency types.
4357 - 4359	1105 - 1107	ETWS CBS Message Identifier for future extension.
4360 - 4369	1108 - 1111	Intended for standardization in future versions of this document. These values shall not be transmitted by networks that are compliant to this version this document. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.
4370	1112	CMAS CBS Message Identifier for CMAS Presidential Level Alerts. EU-Alert Level 1 Message Identifier for the local language as defined in ETSI TS 102 900 [32]. Korean Public Alert System (KPAS) Class 0 Message Identifier for Extreme Emergency alerts in Korean language. Not settable by MMI.
4371	1113	CMAS CBS Message Identifier for CMAS Extreme Alerts with Severity of Extreme, Urgency of Immediate, and Certainty of Observed. EU-Alert Level 2 Message Identifier for the local language as defined in ETSI TS 102 900 [32]. Korean Public Alert System (KPAS) Class 1 Message Identifier for Emergency alerts in Korean language. Settable by MMI For subscriber opt-out requirements, see 3GPP TS 22.268 [28].
4372	1114	CMAS CBS Message Identifier for CMAS Extreme Alerts with Severity of Extreme, Urgency of Immediate, and Certainty of Likely. EU-Alert Level 2 Message Identifier for the local language as defined in ETSI TS 102 900 [32]. Korean Public Alert System (KPAS) Class 1 Message Identifier for Public Safety alerts in Korean language. Settable by MMI For subscriber opt-out requirements, see 3GPP TS 22.268 [28].
4373	1115	CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Extreme, Urgency of Expected, and Certainty of Observed. EU-Alert Level 3 Message Identifier for the local language as defined in ETSI TS 102 900 [32]. Korean Public Alert System (KPAS) Class 1 Message Identifier. Settable by MMI

		For subscriber opt-out requirements, see 3GPP TS 22.268 [28].
4374	1116	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Extreme, Urgency of Expected, and Certainty of Likely.</p> <p>EU-Alert Level 3 Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier.</p> <p>Settable by MMI</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4375	1117	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Severe, Urgency of Immediate, and Certainty of Observed.</p> <p>EU-Alert Level 3 Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier.</p> <p>Settable by MMI</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4376	1118	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Severe, Urgency of Immediate, and Certainty of Likely.</p> <p>EU-Alert Level 3 Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier.</p> <p>Settable by MMI</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4377	1119	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Severe, Urgency of Expected, and Certainty of Observed.</p> <p>EU-Alert Level 3 Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier.</p> <p>Settable by MMI</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4378	111A	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Severe, Urgency of Expected, and Certainty of Likely.</p> <p>EU-Alert Level 3 Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier.</p> <p>Settable by MMI</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>

4379	111B	<p>CMAS CBS Message Identifier for Child Abduction Emergency (or Amber Alert).</p> <p>EU-Amber Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for Amber alerts in Korean language.</p> <p>Settable by MMI</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4380	111C	<p>CMAS CBS Message Identifier for the Required Monthly Test.</p> <p>According to CMAS requirements (see 3GPP TS 22.268 [28]), if this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message.</p>
4381	111D	<p>CMAS CBS Message Identifier for CMAS Exercise.</p> <p>According to CMAS requirements (see 3GPP TS 22.268 [28]), if this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message.</p>
4382	111E	<p>CMAS CBS Message Identifier for operator defined use.</p> <p>According to CMAS requirements (see 3GPP TS 22.268 [28]), if this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message.</p>
4383	111F	<p>CMAS CBS Message Identifier for CMAS Presidential Level Alerts for additional languages.</p> <p>EU-Alert Level 1 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 0 Message Identifier for Extreme Emergency alerts in additional languages.</p> <p>Not settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p>
4384	1120	<p>CMAS CBS Message Identifier for CMAS Extreme Alerts with Severity of Extreme, Urgency of Immediate, and Certainty of Observed for additional languages.</p> <p>EU-Alert Level 2 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for Emergency alerts in additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>

4385	1121	<p>CMAS CBS Message Identifier for CMAS Extreme Alerts with Severity of Extreme, Urgency of Immediate, and Certainty of Likely for additional languages.</p> <p>EU-Alert Level 2 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for Public Safety alerts in additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4386	1122	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Extreme, Urgency of Expected, and Certainty of Observed for additional languages.</p> <p>EU-Alert Level 3 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4387	1123	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Extreme, Urgency of Expected, and Certainty of Likely for additional languages.</p> <p>EU-Alert Level 3 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4388	1124	<p>CMAS CBS Message for CMAS Severe Alerts with Severity of Severe, Urgency of Immediate, and Certainty of Observed for additional languages.</p> <p>EU-Alert Level 3 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for additional languages.</p> <p>Settable by MMI.</p>

		<p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4389	1125	<p>CMAS CBS Message for CMAS Severe Alerts with Severity of Severe, Urgency of Immediate, and Certainty of Likely for additional languages.</p> <p>EU-Alert Level 3 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4390	1126	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Severe, Urgency of Expected, and Certainty of Observed for additional languages.</p> <p>EU-Alert Level 3 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4391	1127	<p>CMAS CBS Message Identifier for CMAS Severe Alerts with Severity of Severe, Urgency of Expected, and Certainty of Likely for additional languages.</p> <p>EU-Alert Level 3 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Korean Public Alert System (KPAS) Class 1 Message Identifier for additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4392	1128	<p>CMAS CBS Message Identifier for Child Abduction Emergency (or Amber Alert) for additional languages.</p> <p>EU-Amber Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p>

		<p>Korean Public Alert System (KPAS) Class 1 Message Identifier for Amber alerts in additional languages.</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4393	1129	<p>CMAS CBS Message Identifier for the Required Monthly Test for additional languages.</p> <p>According to CMAS requirements (see 3GPP TS 22.268 [28]), if this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p>
4394	112A	<p>CMAS CBS Message Identifier for CMAS Exercise for additional languages.</p> <p>According to CMAS requirements (see 3GPP TS 22.268 [28]), if this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p>
4395	112B	<p>CMAS CBS Message Identifier for operator defined use for additional languages.</p> <p>According to CMAS requirements (see 3GPP TS 22.268 [28]), if this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p>
4396	112C	<p>CMAS CBS Message Identifier for CMAS Public Safety Alerts.</p> <p>EU-Alert Level 4 Message Identifier for the local language as defined in ETSI TS 102 900 [32].</p> <p>Settable by MMI.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4397	112D	<p>CMAS CBS Message Identifier for CMAS Public Safety Alerts for additional languages.</p> <p>EU-Alert Level 4 Message Identifier for additional languages as defined in ETSI TS 102 900 [32].</p> <p>Settable by MMI.</p> <p>The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME.</p> <p>For subscriber opt-out requirements, see 3GPP TS 22.268 [28].</p>
4398	112E	<p>CMAS CBS Message Identifier for CMAS State/Local WEA Test.</p> <p>Settable by MMI.</p>

		For subscriber opt-out requirements, see 3GPP TS 22.268 [28].
4399	112F	CMAS CBS Message Identifier for CMAS State/Local WEA Test for additional languages. Settable by MMI. The ME shall receive the messages dependent on the language indicated in the CBS message and the language indicator settings in the ME. For subscriber opt-out requirements, see 3GPP TS 22.268 [28].
4400	1130	CMAS CBS Message Identifier for geo-fencing trigger messages. EU-Alert Message Identifier for geo-fencing trigger messages.
4401	1131	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality. Not applicable for US WEA
4402	1132	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when an earthquake occurs. Not applicable for US WEA
4403	1133	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a volcanic eruption occurs. Not applicable for US WEA
4404	1134	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is water (e.g. flood, typhoon, hurricane or tsunami) occurs. Not applicable for US WEA
4405	1135	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is fire (e.g. forest fire or building fire) occurs. Not applicable for US WEA
4406	1136	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is pressure (e.g. landslide or avalanche) occurs. Not applicable for US WEA
4407	1137	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is wind (e.g. tornado or gale) occurs. Not applicable for US WEA
4408	1138	Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS

		<p>functionality when a disaster whose characteristic is dust (e.g. yellow dust or sandstorm) occurs.</p> <p>Not applicable for US WEA</p>
4409	1139	<p>Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is chemical hazard (e.g. radiation leak or toxic substance leak) occurs.</p> <p>Not applicable for US WEA</p>
4410	113A	<p>Non-ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when an epidemic occurs.</p> <p>Not applicable for US WEA</p>
4411	113B	<p>Non-ETWS CBS Message Identifier for test message dedicated to UEs with no user interface and with ePWS functionality.</p> <p>Not applicable for US WEA</p>
4412	113C	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality.</p> <p>Not applicable for Japan ETWS</p>
4413	113D	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when an earthquake occurs.</p> <p>Not applicable for Japan ETWS</p>
4414	113E	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a volcanic eruption occurs.</p> <p>Not applicable for Japan ETWS</p>
4415	113F	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is water (e.g. flood, typhoon, hurricane or tsunami) occurs.</p> <p>Not applicable for Japan ETWS</p>
4416	1140	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is fire (e.g. forest fire or building fire) occurs.</p> <p>Not applicable for Japan ETWS</p>
4417	1141	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is pressure (e.g. landslide or avalanche) occurs.</p> <p>Not applicable for Japan ETWS</p>
4418	1142	<p>ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is wind (e.g. tornado or gale) occurs.</p>

		Not applicable for Japan ETWS
4419	1143	ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is dust (e.g. yellow dust or sandstorm) occurs. Not applicable for Japan ETWS
4420	1144	ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when a disaster whose characteristic is chemical hazard (e.g. radiation leak or toxic substance leak) occurs. Not applicable for Japan ETWS
4421	1145	ETWS CBS Message Identifier for warning message dedicated to UEs with no user interface and with ePWS functionality when an epidemic occurs. Not applicable for Japan ETWS
4422	1146	ETWS CBS Message Identifier for test message dedicated to UEs with no user interface and with ePWS functionality. Not applicable for Japan ETWS
4423 - 6399	1147 – 18FF	Intended as PWS range in future versions of the present document. These values shall not be transmitted by networks that are compliant to this version of this document. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.
6400	1900	EU-Info Message Identifier for the local language as defined in ETSI TS 102 900 [32].
6401 – 40959	1901 – 9FFF	Intended for standardization in future versions of this document . These values shall not be transmitted by networks that are compliant to this version of this document. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message.
40960 - 45055	A000 - AFFF	PLMN/SNP operator specific range. The type of information provided by PLMN or SNP operators using these Message Identifiers is not guaranteed to be the same across different PLMNs or SNPs. If a Message Identifier from this range is in the "search list", the ME shall attempt to receive this CBS message. In a PLMN, the MS shall discard messages in this MI value range unless received from HPLMN, EHPLMN or PLMN that is equivalent to HPLMN or EHPLMN. In an SNP, the MS shall discard messages in this MI value range unless received from a subscribed SNP.
45056 - 61439	B000 - EFFF	Intended as PLMN/SNP operator specific range in future versions of this document. These values shall not be transmitted by networks that are compliant to this version of this document. If a Message Identifier from this range is in the "search list", then the ME shall attempt to receive this CBS message.
61440 - 65534	F000 - FFFE	Intended as PLMN/SNP operator specific range in future versions of this document. These values shall not be transmitted by networks that are compliant to this version of this document. If

		a Message Identifier from this range is in the "search list", then the ME shall attempt to receive this CBS message. Not settable by MMI.
65535	FFFF	Reserved, and should not be used for new services, as this value is used on the SIM to indicate that no Message Identifier is stored in those two octets of the SIM. If this Message Identifier is in the "search list", the ME shall attempt to receive this CBS message. Not settable by MMI.

Generally, the MMI for entering any Message in the ME is left to the manufacturers' discretion. However, the codes allowed to be set by MMI in the table above shall be capable of being specified via their decimal representation i.e.:

```

Octet 3   Octet 4.
0000 00000000 0000(decimal '000').
0000 00000000 0001(decimal '001').
0000 00000000 0010(decimal '002').
0000 00000000 0011(decimal '003').
:   :   :
0000 11111111 1111(decimal '4095').

0001 00010000 0000(decimal '4352').
:   :   :
0001 00010001 0001(decimal '4369').

0001 00010001 0011(decimal '4371').
:   :   :
0001 00010001 1110(decimal '4382').

0001 00010010 0000(decimal '4384').
:   :   :
1110 11111111 1111(decimal '61439').

```

9.4.1.2.3 Data Coding Scheme

This parameter indicates the intended handling of the CBS message at the MS, the alphabet/coding, and the language (when applicable). This is defined in 3GPP TS 23.038 [3].

When the SIM indicates one or more language preferences, the ME shall, by default, use the language(s) stored in the SIM (in the EF_{PL} file) to set any language filter mechanisms provided by the ME.

Optionally, when allowed by language code processing specified below, the user can select the language(s) required by using an MMI, to determine whether a particular CBS message should be displayed.

Where the message relates to a public warning system, the Message Identifier values 4370 through 4382, 4396 and 4398 relate to warning messages delivered in languages which are mandatory to receive. The ME shall not use any language filter mechanisms or use the language(s) selected through the MMI to determine whether a particular CBS message should be displayed for these Message Identifier values. This does not affect the ability to set a particular message identifier by MMI.

Where the message relates to a public warning system, the Message Identifier values 4383 through 4395, 4397 and 4399 relate to warning messages delivered in languages which are optional to receive. For these values, the ME can use language filter mechanisms and the MS may use the language(s) selected through the MMI to determine whether a particular CBS message should be displayed. Even if the Message Identifier is not settable by MMI, the message shall still be discarded if the language is not set to be displayed.

9.4.1.2.4 Page Parameter

This parameter is coded as two 4-bit fields. The first field (bits 0-3) indicates the binary value of the total number of pages in the CBS message and the second field (bits 4-7) indicates binary the page number within that sequence. The coding starts at 0001, with 0000 reserved. If a mobile receives the code 0000 in either the first field or the second field then it shall treat the CBS message exactly the same as a CBS message with page parameter 0001 0001 (i.e. a single page message).

9.4.1.2.5 Content of Message

This parameter is a copy of the 'CBS-Message-Information-Page' as sent from the CBC to the BSC.

9.4.1.3 ETWS Primary Notification message

9.4.1.3.1 General Description

The ETWS Primary Notification message is transmitted to a MS in idle mode and dedicated mode as described in 3GPP TS 44.018 [26], and to a MS in packet transfer mode as described in 3GPP TS 44.060 [27]. The ETWS Primary Notification message is structured as in the table in clause 9.4.1.3.2.

This message is only applicable in GSM.

9.4.1.3.2 Message Parameter

Octet Number(s)	Field
1-2	Serial Number
3-4	Message Identifier
5-6	Warning Type
7-56	Warning Security Information

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

9.4.1.3.3 Serial Number

This parameter identifies a particular ETWS Primary Notification message from the source and type indicated by the Message Identifier and is altered every time the ETWS Primary Notification message with a given Message Identifier is changed. The coding of this parameter is same as that defined in clause 9.4.1.2.1.

9.4.1.3.4 Message Identifier

This parameter identifies the source and type of the ETWS Primary Notification message. The coding of this parameter is same as that defined in clause 9.4.1.2.2.

9.4.1.3.5 Warning Type

This parameter identifies the warning type of the ETWS Primary Notification message. It is identical with the Warning Type described in clause 9.3.24 with respect to its structure and possible value range.

9.4.1.3.6 Warning Security Information

This parameter identifies the warning security information of the ETWS Primary Notification message. The coding of this parameter is same as that defined in clause 9.3.25. The UE shall ignore this parameter.

NOTE: The Warning Security Information parameter is included due to requirements in earlier versions of this document.

9.4.2 UMTS

The CBS messages which are transmitted by the RNS to the UE include two types of messages: CBS Message (user information) and Schedule Message (schedule of CBS messages).

The format of the CBS Message containing user information is described in this clause and in 3GPP TS 25.324 [19].

The format of the Schedule Message is described in 3GPP TS 25.324 [19].

9.4.2.1 General Description

The CBS message is transmitted as one unit over the radio interface. On layer two of the UMTS radio interface the logical channel CTCH is used.

9.4.2.2 Message Parameter

Octet Number(s)	Parameter
1	Message Type
2 – 3	Message ID
4 – 5	Serial Number
6	Data Coding Scheme
7 – N	CB Data

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

For ETWS, the transmission order of the parameter is only applicable to the secondary notification.

For value N in the above table see 3GPP TS 25.324 [19].

9.4.2.2.1 Message Type

This parameter indicates the type of a message, either a CBS message or a Schedule Message. The Coding of the Message Type is described in 3GPP TS 25.324 [19].

9.4.2.2.2 Message ID

This parameter identifies the source and type of the CBS Message (see also 3GPP TS 25.324 [19]). It is identical with the Message Identifier described in clause 9.4.1.2.2 with respect to its structure and possible value range. Within a multi technology network of one operator, e.g. GSM combined with UMTS, the values identifying a given topic shall be identical for both the Message ID and the Message Identifier described in clause 9.4.1.2.2.

The UE shall attempt to receive the CBS messages whose Message ID's are in the "search list". This "search list" shall contain the Message IDs stored in the EF_{CBMI}, EF_{CBMID} and EF_{CBMIR} files on the USIM (see 3GPP TS 31.102 [18]) and any Message Identifiers stored in the UE in a "list of CBS messages to be received". If the UE has restricted capabilities with respect to the number of Message ID's it can search for, the IDs stored in the USIM shall take priority over any stored in the UE.

The MS shall discard a CBS message in Message Identifier value range "A000hex-AFFFhex" unless it is received from:

- HPLMN;
- EHPLMN; or
- PLMN that is equivalent to either HPLMN or EHPLMN.

9.4.2.2.3 Serial Number

This parameter identifies a particular CBS Message from the source and type indicated by the Message ID (see also 3GPP TS 25.324 [19]). It is identical with the Serial Number described in clause 9.4.1.2.1 with respect to its structure and possible value range.

9.4.2.2.4 Data Coding Scheme

This parameter identifies the the alphabet/coding and the language applied to a CBS Message as defined in 3GPP TS 23.038 [3].

When the USIM indicates one or more language preferences, the UE shall, by default, use the language(s) stored in the USIM (in the EF_{PL} file) to set any language filter mechanisms provided by the UE.

Optionally, when allowed by language code processing specified below, the user can select the language(s) required by using an MMI, to determine whether a particular CBS message should be displayed.

Where the message relates to a public warning system, the Message Identifier values 4370 through 4382, 4396 and 4398, relate to warning messages delivered in languages which are mandatory to receive. The ME shall not use any language filter mechanisms or use the language(s) selected through the MMI to determine whether a particular CBS message should be displayed for these Message Identifier values. This does not affect the ability to set a particular message identifier by MMI.

Where the message relates to a public warning system, the Message Identifier values 4383 through 4395, 4397 and 4399, relate to warning messages delivered in languages which are optional to receive. For these values, the ME can use language filter mechanisms and the MS/UE may use the language(s) selected through the MMI to determine whether a particular CBS message should be displayed. Even if the Message Identifier is not settable by MMI, the message shall still be discarded if the language is filtered or is not set to be displayed.

9.4.2.2.5 CB Data

This parameter consists of the following WRITE-REPLACE primitive parameters as received from the CBC (see clause 9.2.2):

- Number-of-Pages;
- CBS-Message-Information-Page;
- CBS-Message-Information-Length.

Octet Number(s)	Parameter
1	Number-of-Pages
2 – 83	CBS-Message-Information-Page 1
84	CBS-Message-Information-Length 1
...	...
	CBS-Message-Information-Page n
	CBS-Message-Information-Length n
NOTE: n equal to or less than 15	

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

9.4.3 E-UTRAN

9.4.3.1 General Description

The warning message may be segmented within E-UTRAN for transmission over radio interface.

9.4.3.2 Message Parameter

Parameter
Message Identifier
Serial Number
CB Data {Warning Message Content E-UTRAN},
Data Coding Scheme
Warning Area Coordinates (O)

The table gives a high-level description of the warning message content. The format of the warning message is described in 3GPP TS 36.331 [36].

For ETWS, the description of the warning message content is only applicable for the secondary notification. Description of the ETWS Primary Notification message is specified in clause 9.4.3.3.

9.4.3.2.1 Message Identifier

This parameter identifies the source and type of the warning message. The contents of the parameter are specified in clause 9.4.1.2.2 with respect to its structure and possible value range.

9.4.3.2.2 Serial Number

This parameter identifies a particular warning message from the source and type indicated by the Message Identifier. The contents of the parameter are specified in clause 9.4.1.2.1 with respect to its structure and possible value range.

9.4.3.2.3 Data Coding Scheme

This parameter identifies the alphabet/coding and the language applied to the warning message as defined in 3GPP TS 23.038 [3]. The contents of the parameter are specified in clause 9.4.2.2.4 with respect to its structure and possible value range.

9.4.3.2.4 CB Data

This parameter contains the content of the warning message and is contained in the *Warning Message Content E-UTRAN* IE (see clause 9.3.35) of the WRITE-REPLACE-WARNING-REQUEST Request message received from the CBC (see clause 9.2.16). It is encoded as specified in clause 9.4.2.2.5.

9.4.3.2.5 Warning Area Coordinates

This parameter contains the coordinates of the warning area and is contained in the Warning Area Coordinates IE (see clause 9.3.63) of the WRITE-REPLACE-WARNING-REQUEST Request message received from the CBC (see clause 9.2.16) or WRITE-REPLACE-WARNING-REQUEST-NG-RAN request message received from the CBCF (see clause 9.2.26).

9.4.3.3 ETWS Primary Notification message

9.4.3.3.1 General Description

The ETWS Primary Notification message for E-UTRAN radio interface is described in 3GPP TS 36.331 [36]. The ETWS Primary Notification message is structured as in the table in clause 9.4.3.3.2.

9.4.3.3.2 Message Parameter

Octet Number(s)	Parameter
1-2	Message Identifier
3-4	Serial Number
5-6	Warning Type
7-56	dummy

The octets in the above table are transmitted in order, starting with octet 1. The bits within these octets are numbered 0 to 7; bit 0 is the low order bit and is transmitted first.

9.4.3.3.3 Message Identifier

This parameter identifies the source and type of the ETWS Primary Notification message. The contents of the parameter are specified in clause 9.4.1.2.2 with respect to its structure and possible value range.

9.4.3.3.4 Serial Number

This parameter identifies a particular ETWS Primary Notification message from the source and type indicated by the Message Identifier and is altered every time the ETWS Primary Notification message with a given Message Identifier is changed. The contents of the parameter are specified in clause 9.4.1.2.1 with respect to its structure and possible value range.

9.4.3.3.5 Warning Type

This parameter identifies the warning type of the ETWS Primary Notification message. It is identical with the Warning Type described in clause 9.3.24 with respect to its structure and possible value range.

9.4.3.3.6 Dummy

This parameter is not used in the specification. The UE shall ignore this parameter.

9.4.4 NG-RAN

The format of the CBS Message for NG-RAN is same as format of the CBS Message defined for E-UTRAN as described in clause 9.4.3.2 and 3GPP TS 36.331 [36].

The format of the ETWS Primary Notification message is same as format of the ETWS Primary Notification message defined for E-UTRAN as described in clause 9.4.3.3 and 3GPP TS 36.331 [36].

9.5 CBS Compression

Cell Broadcast messages may be compressed in accordance with the compression algorithm described in 3GPP TS 23.042 [14].

The Data Coding Scheme parameter (see clause 9.4.1.2.3) indicates whether or not a CBS Message is compressed.

Compression and decompression may take place between a CBE and an MS/UE or between a CBC and an MS/UE.

The compression applies only to user information sent between the CBC and the MS/UE i.e. excludes any padding octets.

Padding in the case of CBS compression is defined as an integral number of octets where each padding octet has a value FF hexadecimal. The insertion of padding for different scenarios is described in the paragraphs below.

The compression footer (see 3GPP TS 23.042 [14]) delimits the compressed user information bit stream at an octet boundary. The remainder of the 'CBS-Message-Information-Page' sent between the CBC and the BSC contains padding octets. The parameter 'CBS-Message-Information-Length' identifies the sum of the compressed octets, the compression header, and the compression footer (see 3GPP TS 23.042 [14]), but not any padding.

Compression may apply to a single 'CBS-Message-Information-Page' or across multiple 'CBS-Message-Information-Page's.

In the case where Compression applies only to a single 'CBS-Message-Information-Page', the compression header shall be the first octet in that 'CBS-Message-Information-Page' and the compression footer shall immediately follow the compressed data stream. Any remaining octets after the compression footer shall contain padding up to and including the 82nd octet position. However, if the 82nd octet position contains the compression footer then there is no padding.

In the case where compression applies across multiple 'CBS-Message-Information-Page's, the compression header shall be present only in the first octet position of the first 'CBS-Message-Information-Page'. The compression footer shall immediately follow the compressed data stream which will terminate within the last 'CBS-Message-Information-Page'. Any remaining octets after the compression footer in the last 'CBS-Message-Information-Page' shall contain padding up to and including the 82nd octet position in the last 'CBS-Message-Information-Page'. However, if the 82nd octet position of the last 'CBS-Message-Information-Page' contains the compression footer then there is no padding.

If it is required to convey different blocks of information which are to be treated by the MS/UE as though they were physically independent pages rather than concatenated information then page break characters (see 3GPP TS 23.038 [3]) may be inserted in the character stream prior to compression. The boundaries created by the page

breaks will not normally align with the boundaries set by the page number parameters and so the page number parameters cannot be used to identify physically separate blocks of meaningful information.

The decoding at the MS/UE may be achieved by first locating the compression footer octet by working back from the 82nd octet in the last 'CBS-Message-Information-Page'. If padding is present, the MS/UE must skip backwards over the padding until a non padding octet is found. By definition this octet must be the compression footer. The compression footer has a pre-defined bit combination which can never replicate a padding octet. If padding is not present in the 82nd octet position of the last 'CBS-Message-Information-Page', by definition the 82nd octet must be the compression footer.

The compression footer defined in 3GPP TS 23.042 [14] indicates whether there are any compressed data bits contained within the compression footer octet and, if not, how many compressed data bits are contained within the octet immediately preceding the compression footer. In order to prevent possible replication of the padding octet value in the compression footer octet value, the compression mechanism must ensure that when bits 0, 1, 2 in the compression footer are all ones all other bits in the compression footer octet are set to 0.

9A Service Based Interface for 5G System

9A.1 Introduction

Within the 5GCN, the AMF offers services to the CBCF via the Namf service-based interface (see 3GPP TS 23.501 [39] and 3GPP TS 23.502 [43]).

Figure 9A.1-1 depicts the 5GS PWS system architecture, using the service-based interface representation showing how the network functions interact with each other.

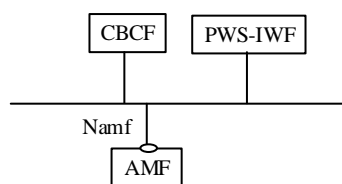


Figure 9A.1-1: 5GS PWS system architecture – CBCF/PWS-IWF - AMF

Service-based interface to support 5GS PWS:

Namf: Service-based interface exhibited by AMF.

NOTE: No services are provided by CBCF or PWS-IWF, thus no service-based interfaces are depicted for these NFs in the 5GS PWS system architecture.

The table 9A.1-1 shows the AMF Service and Service Operations specific for PWS:

Table 9A.1-1 AMF Service for PWS

Service Name	Service Operations	Operation Semantics	Consumer
Namf_Communication	NonUeN2MessageTransfer	Request/Response	CBCF, PWS-IWF
	NonUeN2InfoSubscribe	Subscribe/Notify	CBCF, PWS-IWF
	NonUeN2InfoUnSubscribe	Subscribe/Notify	CBCF, PWS-IWF
	NonUeN2InfoNotify	Subscribe/Notify	CBCF, PWS-IWF

9A.2 Namf_Communication Service

9A.2.1 Service Description

The Namf_Communication service is specified in 3GPP TS 23.502 [43] clause 5.2.2.2.

9A.2.2 Service Operations

9A.2.2.1 Namf_Communication_NonUeN2MessageTransfer service operation

The Namf_Communication_NonUeN2MessageTransfer service operation is specified in 3GPP TS 23.502 [43] clause 5.2.2.2.17.

The NonUeN2MessageTransfer service operation shall be invoked by the NF Service Consumer (e.g. CBCF or PWS-IWF) to initiate or stop broadcast in one or more cells as indicated in the *Warning Area* IE. The AMF shall accept the request and respond to the NF Service Consumer immediately.

When NonUeN2MessageTransfer service operation is used for PWS services:

- a) PWS Write-Replace-Warning Request message (see clause 9.2. 26) or the Stop-Warning Request message (see clause 9.2. 28) are transferred in an N2 Message Container via the NonUeN2MessageTransfer request operation (along with a number of IEs);

The N2 Message Container contains all the available elements from the Write-Replace-Warning Request message or the Stop-Warning Request message with the exception of the *List of TAIs* IE and the *Send Write-Replace-Warning Indication* IE or the *Send Stop-Warning Indication* IE. The PWS message in the N2 Message Container is sent by the AMF via N2 to NG-RAN.

- b) Write-Replace-Warning Confirm message (see clause 9.2.27) or the Stop-Warning Confirm message (see clause 9.2.29) returned to the NF Service Consumer via the NonUeN2MessageTransfer response operation;
- c) the *List of TAIs* IE shall be used by the AMF to determine to which NG-RAN nodes the N2 Message Container needs to be forwarded to. The *List of TAIs* IE is not included in the N2 Message Container. If the *List of TAIs* IE is not present then the message shall be forwarded to all NG-RAN nodes served by the AMF, subject to the RAT Selector NG-RAN;
- d) each NonUeN2MessageTransfer message is uniquely identified by the *Message Identifier* IE, the *Serial Number* IE and the *Message Type* IE. These IEs are also included in the N2 Message Container;
- e) if the *Send Write-Replace-Warning-Indication* IE is present in the Write-Replace-Warning Request message then the AMF shall send the associated Write-Replace-Warning Indication message(s) to the NF Service Consumer as specified in clause 9A.2.2.3. The *Send Write-Replace-Warning-Indication* IE is not included in the N2 Message Container, and
- f) if the *Send Stop-Warning-Indication* IE is present in the Stop-Warning Request message then the AMF shall send the associated Stop-Warning Indication message(s) to the NF Service Consumer as specified in clause 9A.2.2.3. The *Send Stop-Warning-Indication* IE is not included in the N2 Message Container.

9A.2.2.2 Namf_Communication_NonUeN2InfoSubscribe service operation

The Namf_Communication_NonUeN2InfoSubscribe service operation is specified in 3GPP TS 23.502 [43] clause 5.2.2.2.18.

The NonUeN2InfoSubscribe service operation shall be invoked by the NF Service Consumer (e.g. CBCF or PWS-IWF) to subscribe to the delivery of non-UE specific PWS information from the NG-RAN node, e.g. for PWS events, sent via N2 to the AMF.

When NonUeN2InfoSubscribe service operation is used for PWS services:

- a) The NF Service Consumer ID is an identifier which is configured in the CBCF or PWS-IWF;
- b) The N2 information types are:
 - WarningIndications;
 - RestartFailure;
- c) if the N2 information type is WarningIndications then the NF Service Consumer subscribes to receiving Write-Replace-Warning Indication messages (see clause 9.2.30) and Stop-Warning Indication messages (see clause 9.2.31) from the AMF, and

NOTE: If the Indication messages are actually sent to the NF Service Consumer depends on the presence of the *Send Write-Replace-Warning Indication IE* or the *Send Stop-Warning Indication IE*; see clause 9A.2.2.1.

d) if the N2 information type is RestartFailure then the NF Service Consumer subscribes to receiving Restart Indications (see clause 9.2. 32) and Failure Indications (see clause 9.2. 33) from the NG-RAN node.

9A.2.2.2A Namf_Communication_NonUeN2InfoUnSubscribe service operation

The Namf_Communication_NonUeN2InfoUnSubscribe service operation is specified in 3GPP TS 23.502 [43] clause 5.2.2.2.19.

The NonUeN2InfoUnSubscribe service operation shall be invoked by the NF Service Consumer (e.g. CBCF or PWS-IWF) to unsubscribe to stop notifying non-UE specific N2 information from the NG-RAN node, e.g. for PWS events.

9A.2.2.3 Namf_Communication_NonUeN2InfoNotify service operation

The Namf_Communication_NonUeN2InfoNotify service operation is specified in 3GPP TS 23.502 [43] clause 5.2.2.2.20.

The NonUeN2InfoNotify service operation is used by AMF to notify a particular PWS event towards the NF Service Consumer (e.g. CBCF or PWS-IWF) that has subscribed for the specific information. The AMF receives messages for such PWS events from NG-RAN via N2.

When NonUeN2InfoNotify service operation is used for PWS services, the N2 information consists of all (mandatory and optionally) available information provided via N2 in the Write-Replace Warning Indication (see clause 9.2.30), a Stop Warning Indication (see clause 9.2.31), a PWS Restart Indication (see clause 9.2.32) or a PWS Failure Indication (see clause 9.2.33).

9A.2.3 Service operation message flows

9A.2.3.1 Service flow for message transfer

Write-Replace-Warning Request messages and Stop-Warning-Request messages are transported with the NonUeMessageTransfer service operation. The procedure is shown in figure 9A.2.3-1.

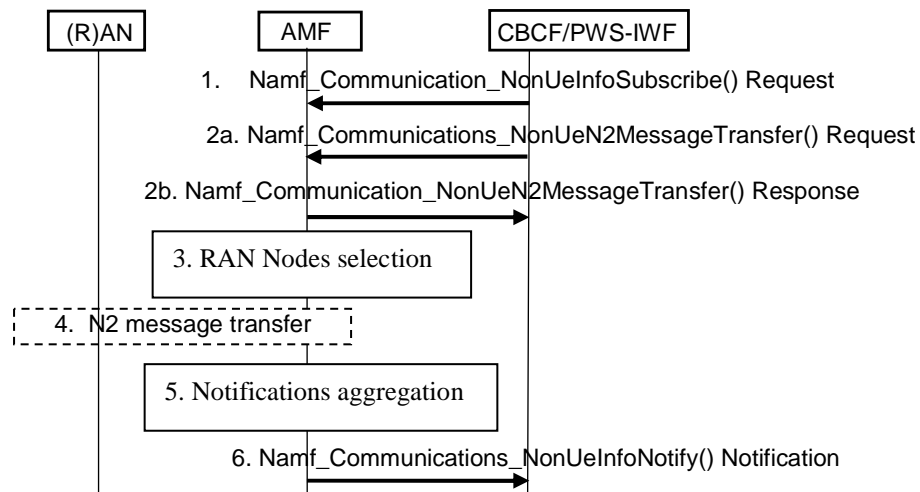


Figure 9A.2.3.1-1: Message transfer procedure

- 1) If the CBCF supports reception of Write-Replace-Warning Notifications and Stop-Warning Notifications then the CBCF uses the Namf_Communication_NonUeInfoSubscribe service operation to subscribe to these notifications.
- 2a) The CBCF sends a Write-Replace-Warning Request message or a Stop-Warning-Request message to the AMF using the Namf_Communication_NonUeN2MessageTransfer service operation.

- 2b) The AMF returns a `Namf_Communication_NonUeN2MessageTransfer` response message.
- 3) The AMF determines from the List of TAIs IE to the NG-RAN nodes the N2 Message Container shall be forwarded to.
- 4) The AMF forwards the messages included in the N2 Message Container to the selected NG-RAN nodes via N2 and receives a response from the NG-RAN nodes.
- 5) The AMF may aggregate the responses it has received from the NG-RAN nodes.
- 6) The AMF forwards the (aggregated) response(s) as Write-Replace-Warning Notification(s) or Stop-Warning Notifications to the CBCF using the `Namf_Communication_NonUeNotify` service operation if the CBCF has subscribed to receiving these notifications in step 1.

9A.2.3.2 Service flow for Restart and Failure Indication messages

Restart and Failure Indications are sent by NG-RAN nodes and are forwarded to the CBCF by the AMF if the CBCF has subscribed to receiving such indications. The procedure is shown in figure 9A.2.4-1.

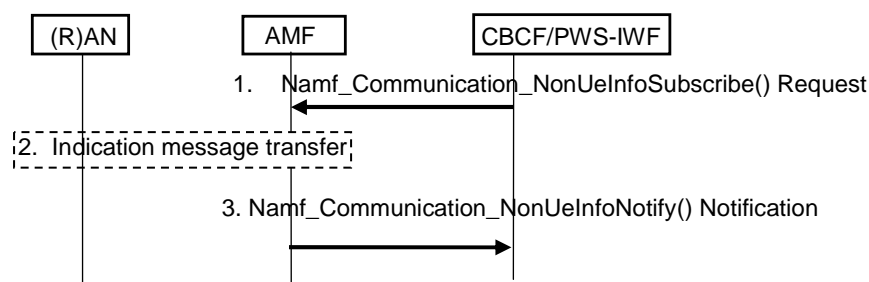


Figure 9A.2.3.2-1: Indication message transfer procedure

- 1 If the CBCF supports reception of Restart Indication messages and Failure Indication messages then the CBCF uses the `Namf_Communication_NonUeInfoSubscribe` service operation to subscribe to these notifications.
- 2 A RAN Node sends a Restart Indication or a Failure Indication to the AMF.
- 3 The AMF forwards the Restart Indication or a Failure Indication to the CBCF using the `Namf_Communication_NonUeInfoNotify` service operation.

10 CBS Index

An index structure is defined in this clause. Index can be used by the operator to inform the end user about the type of CBS services available. Index has the structure of a tree. It can thus have sub parts which are called subindexes. A subindex can be embedded in the same index message as its parent ("embedded subindex") or it can physically be in a separate index message ("child subindex"). Every index message has a unique message identifier. They are always of the same type. Message Code 1010101010b shall be used to indicate this type. The root of the index structure shall be the index message with message identifier 0. Other index messages are linked to the root index with links. Definition of their message identifiers is left to the operator.

A format ("enhanced format") for the index messages is described in this clause. If this enhanced format is used in the index message the MS/UE can present the index messages in its preferred format.

Available CBS services are introduced in the index. This means that their message identifier and name are stated. Enhanced format includes a mechanism for separating a normal service introduction from embedded subindex introduction and child subindex introduction. The introduction of an embedded subindex specifies the "subindex-id" used for identifying services that belong to this subindex. Embedded subindexes can have subindexes embedded in them etc. If these "second level embedded subindexes" are introduced their subindex-id shall begin with the subindex-id of their parent. Same principle applies for subindexes in third, fourth etc. level. An example of an index structure is given in figure 6.

Enhanced format includes a mechanism which allows the terminals to identify that the format of the index message is enhanced. The index-id -field and the above mentioned Message Code (1010101010b) constitute this mechanism:

```

message-format = index-id index-element-intro+.
index-id = "EI" version crlf.
version = number+.
number = "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9" | "0".
index-element-intro = subindex-intro | service-intro.
subindex-intro = subindex-id " " subindex-name crlf.
subindex-id = subindex-character+.
subindex-character = "a" | "b" | ... | "z" | "A" | "B" | ... | "Z".
subindex-name = name-character+.
name-character = <gsm03.38character excluding <CR> and <LF> >.
crlf= <CR> <LF>.
service-intro = subindex-id message-id delimiter service-name crlf.
message-id = number+.
delimiter = "." | " ".
service-name = name-character+.

```

Current version used is 1.

The use of "." as delimiter means that this service is a child subindex of the index structure.

Delimiter " " is used in all other cases.

Subindex-id shall not be used if the service introduced is in the first level of the index. Subindex-id:s are used in alphabetical order within an index message. They can be re-used in a child subindex.

0 Index:
(MsgId=0, Message Code = 1010101010b)

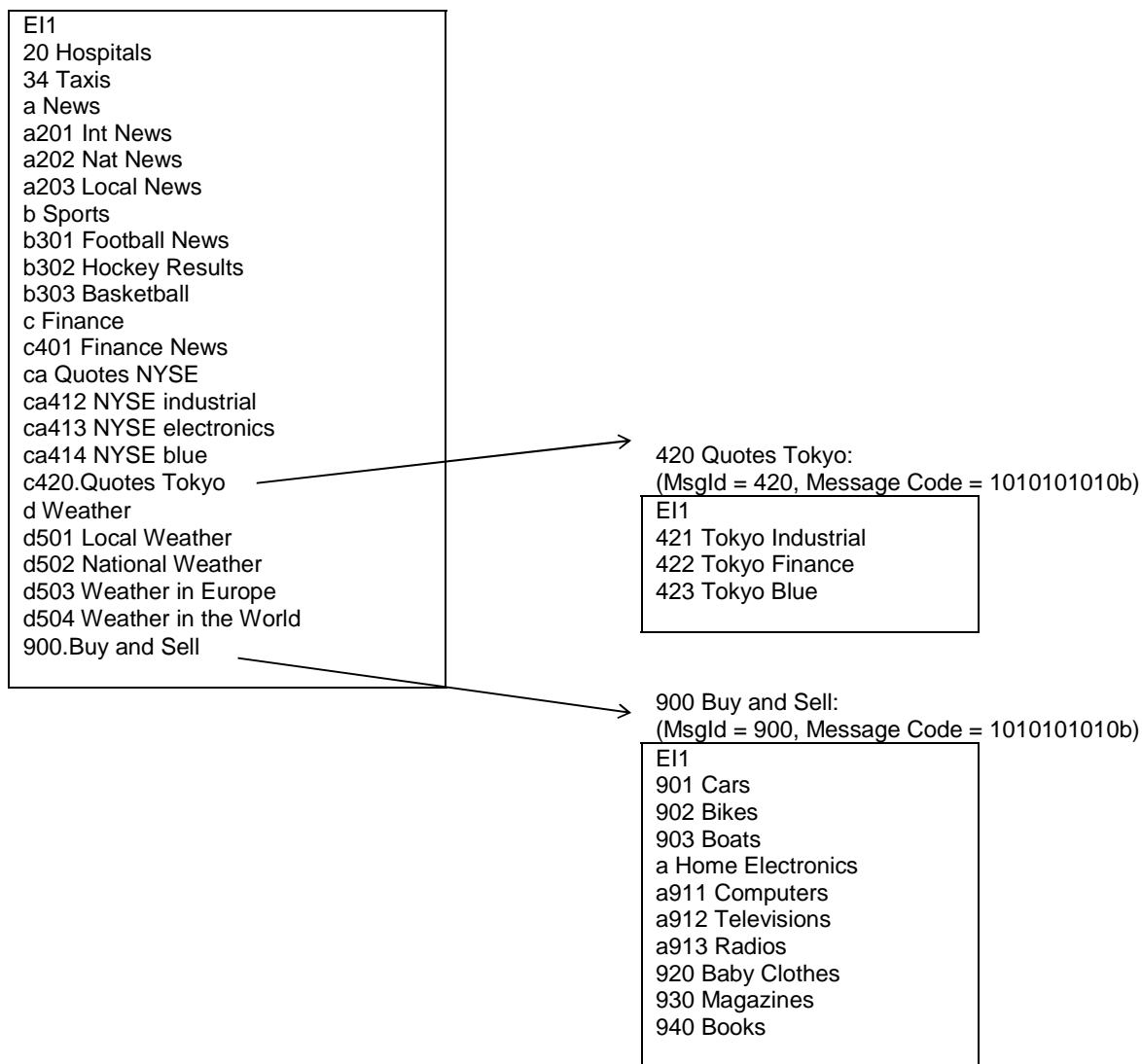


Figure 6

Annex A (informative):
Void

Annex B (normative): 5GS Network Architecture, AMF to CBC inter-connection via PWS-IWF

B.1 5GS PWS architecture with PWS-IWF

Figure B.1-1 depicts the optional deployment network structure of PWS architecture in 5GS with AMF to CBC inter-connection via PWS-IWF using the reference point representation showing how the network functions interact with each other. In this option the PWS-IWF implements functionality to transfer messages between N50 and SBc reference points, and vice versa.

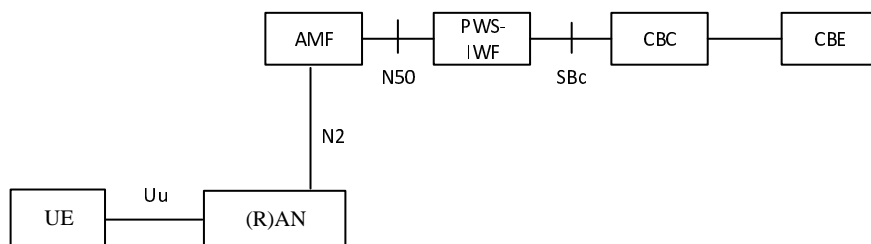


Figure B.1-1: 5GS PWS architecture with PWS-IWF

The PWS architecture using PWS-IWF contains the following reference points:

N2: Reference point between the NG-RAN and the AMF.

NOTE 1: NG-RAN can be NR based or E-UTRA based (See 3GPP TS 23.501 [39] and 3GPP TS 38.413 [40]).

SBc: Reference point between the PWS-IWF and the CBC.

NOTE 2: The requirements for SBc in this deployment option corresponds to the requirements for SBc in the EPS network architecture as (see 3GPP TS 29.168 [35]).

N50: Reference point between the AMF and the PWS-IWF.

NOTE 2: N50 uses service-based interfaces, further described in clause 9A of the present document.

The CBE and the interface between CBE and CBC are out of scope of 3GPP specifications.

The present document describes logical functional entities, and how these are realized in actual deployments is an implementation and deployment issue. It can however be foreseen that the PWS-IWF functionality may be co-located with the AMF, with the CBC, or deployed as a stand-alone network function. At AMF/PWS-IWF co-location, the AMF/PWS-IWF entity interacts with the CBC via SBc. At CBC/PWS-IWF co-location, the CBC/PWS-IWF interacts with the AMF via N50. At stand-alone PWS-IWF, the PWS-IWF interacts with the AMF via N50 and with the CBC via SBc.

A PWS-IWF co-located with AMF or a stand-alone PWS-IWF may interface to one CBC or multiple CBCs (i.e. the PWS-IWF is allowed to have SCTP transport associations established with one or multiple CBCs). A stand-alone PWS-IWF or a PWS-IWF co-located with the CBC may interface to several AMFs.

B.2 CBE Functionality

See clause 4 of the present document.

B.3 CBC Functionality

See clause 5 of the present document.

B.4 PWS-IWF Functionality

B.4.1 PWS-IWF generic functionality

The PWS-IWF is a logical function which functionality is to translate from N50 to SBc.

If the Write-Replace-Warning-Indication and Stop-Warning-Indication or the Restart-Indication-E-UTRAN and Failure-Indication-E-UTRAN are supported on SBc then the PWS-IWF shall manage the subscriptions for the corresponding notifications that may be received over N50.

The PWS-IWF may interface to one or multiple AMFs. The PWS-IWF may interface to one or multiple CBCs. Exceptions from straightforward mapping by the PWS-IWF from SBc based messages and parameters to SBI based messages and parameters are described in the following clauses.

B.4.2 Mapping of Repetition-Period

If the PWS-IWF receives a Write-Replace-Warning Request message from the CBC which contains the *Extended Repetition-Period* IE then the PWS-IWF shall map the *Extended Repetition-Period* IE onto the *Repetition-Period NG-RAN* IE in the Write-Replace-Warning Request message towards the AMF and shall ignore the *Repetition-Period* IE that is received from the CBC.

B.5 AMF Functionality

See clause 6 of the present document.

B.6 UE Functionality

See clause 8 of the present document.

B.7 Protocol stack when AMF and CBC inter-connects via PWS-IWF

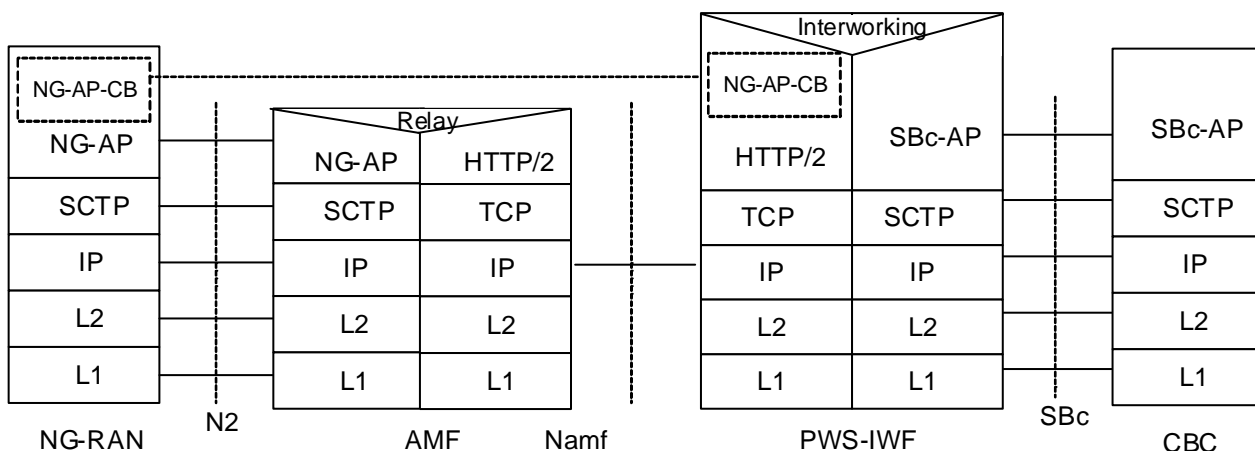


Figure B.7-1: CBC - NG-RAN with PWS-IWF

Legend:

- NG Application Protocol information for Cell Broadcast (NG-AP-CB): Subset of NG-AP information that the AMF transparently relays between the NG-RAN and the PWS-IWF. NG-AP-CB corresponds to a subset of NG-AP defined in TS 38.413 [40].
- NG Application Protocol (NGAP): Application Layer Protocol between the NG-RAN node and the AMF. The NGAP protocol is defined in 3GPP TS 38.413 [40].
- SBc Application Protocol (SBc-AP): Application Layer Protocol between PWS-IWF and CBC. This protocol supports transfer of warning messages.
- SCTP for the control plane (SCTP): This protocol guarantees delivery of signalling messages between AMF and NG-RAN (N2), and between PWS-IWF and CBC (SBc). SCTP is defined in IETF RFC 4960 [33].
- HTTP/2: Application layer protocol for Service based interface between AMF and CBCF. HTTP/2 is defined in IETF RFC 7540 [42].

Annex C (informative): Change history

TSG	TSG Tdoc	T2-Tdoc	CR	REL	VERS	NEW VERS	SUBJECT
T#5	TP-99179		New	R99	2.0.0	3.0.0	Transfer of GSM 03.41 v7.1.0 to 3GPP
T#6	TP-99237	T2-991064	001	R99	3.0.0	3.1.0	Adaptation of the scope of TS 23.041 from "GSM only" to "GSM and UMTS"
T#6	TP-99237	T2-991062	002	R99	3.0.0	3.1.0	LCS Utilization of CBS
T#7	TP-000024	T2-000134	003	R99	3.1.0	3.2.0	Addition of LCS message identifier to support GPS Navigation message
T#7	TP-000024	T2-000130	004	R99	3.1.0	3.2.0	Adaptation of the scope from "GSM only" to "GSM and UMTS" - Part II
T#9	TP-000143	T2-000553	005	R99	3.2.0	3.3.0	Defining Assisted GPS Broadcast Identifiers
T#11	-	-	-	Rel-4	3.3.0	4.0.0	Upgrade to Rel-4
T#12	TP-010128	T2-010532	007	Rel-4	4.0.0	4.1.0	Clarification of Geographical Scope
T#14	TP-010280	T2-011024	008	Rel-4	4.1.0	4.2.0	Clarification on the use of Message IDs in multi-technology networks
T#16	TP-020104	T2-020509	010	Rel-4	4.2.0	4.3.0	Update of references
T#16	-	-	-		4.3.0	5.0.0	Upgrade to Rel-5
T#17	TP-020252	-	011 rev1	Rel-6	5.0.0	6.0.0	Identification of a directory number in a CBS-Message-Information-Page
T#19	TP-030038	T2-030088	014	Rel-6	6.0.0	6.1.0	CB Data length
T#22	TP-030267	T2-030575	016	Rel-6	6.1.0	6.2.0	CB Data structure
CT#31	CP-060126	C1-060128	017r1	Rel-7	6.2.0	7.0.0	CBS – Reference correction
CT#41					7.0.0	8.0.0	Upgrade to Rel-8
CT#41	CP-080535	C1-083618	0019r4	Rel-8	7.0.0	8.0.0	Additions to the protocol aspects of CBS for the realisation of ETWS
CT#41	CP-080535	C1-083620	0018r5	Rel-8	7.0.0	8.0.0	Changes to CBS for the realisation of ETWS
CT#41	CP-080535	C1-083621	0020r5	Rel-8	7.0.0	8.0.0	Changes to the radio message format aspect of CBS for the realisation of ETWS
CT#42	CP-080836	C1-085355	0021r3	Rel-8	8.0.0	8.1.0	Clarification on EPS architecture and ETWS Instruction to terminal
CT#42	CP-080836	C1-085354	0022r1	Rel-8	8.0.0	8.1.0	Addition of Warning Security Information
CT#42	CP-080873	C1-085129	0023	Rel-8	8.0.0	8.1.0	CBS Message ID table
CT#43	CP-090149	C1-091099	0026r2	Rel-8	8.1.0	8.2.0	ETWS Duplication Detection
CT#43	CP-090159	C1-090442	0025r1	Rel-8	8.1.0	8.2.0	Clarification of non settable Message ID's through MMI
CT#43					8.1.0	8.2.0	Editorial cleanup by MCC
CT#44	CP-090320		0027r2	Rel-8	8.2.0	8.3.0	Definition of ETWS Primary Notification message format

CT#44	CP-090434	C1-092257	0028r 2	Rel-9	8.3.0	9.0.0	Message IDs for the U.S. Commercial Mobile Alert System (CMAS)
CT#45	CP-090686	C1-092466	0029	Rel-9	9.0.0	9.1.0	Message Identifiers for PWS
CT#45	CP-090670	C1-093124	0031r 1	Rel-9	9.0.0	9.1.0	CBS activation time for ETWS information
CT#45	CP-090682	C1-093812	0032r 1	Rel-9	9.0.0	9.1.0	Cell wide Geographical Scope (GS) code 00
CT#45	CP-090682	C1-093249	0033	Rel-9	9.0.0	9.1.0	Updates on references
CT#45	CP-090682	C1-093813	0034r 1	Rel-9	9.0.0	9.1.0	Resolution of editor's note
CT#45	CP-090682	C1-093251	0035	Rel-9	9.0.0	9.1.0	Fixes for typographical errors
CT#45	CP-090682	C1-093252	0036r 1	Rel-9	9.0.0	9.1.0	Clarification on duplicate use of "immediate display"
CT#45	CP-090686	C1-093531	0037	Rel-9	9.0.0	9.1.0	Updating of references to stage 1 document
CT#46	CP-090912	C1-094929	0039	Rel-9	9.1.0	9.2.0	Additional ETWS requirements for the BSC - CBC Cell Broadcast protocol
CT#46	CP-090912	C1-095394	0041r 1	Rel-9	9.1.0	9.2.0	Clarification on ETWS secondary notification
CT#46	CP-090912	C1-095396	0043r 1	Rel-9	9.1.0	9.2.0	Correction of duplicate detection in the UE
CT#47	CP-100152	C1-101202	0044r 1	Rel-9	9.2.0	9.3.0	Corrections to the Cell Broadcast Service (CBS) for ETWS
CT#47	CP-100135	C1-100625	0045	Rel-9	9.2.0	9.3.0	Correction of figure 4b
CT#47	CP-100152	C1-101263	0046r 1	Rel-9	9.2.0	9.3.0	Addition of Broadcast Message Type
CT#48	CP-100345	C1-101950	0050r 1	Rel-9	9.3.0	9.4.0	PLMN handling for ETWS duplicate detection
CT#48	CP-100345	C1-101551	0052	Rel-9	9.3.0	9.4.0	Removal of editor's note for ETWS
CT#49	CP-100501	C1-102734	0053r 1	Rel-9	9.4.0	9.5.0	Clarification of precedence for immediate display
CT#49	CP-100504	C1-102216	0055	Rel-9	9.4.0	9.5.0	Removal of CMAS reference to a ETWS capability
CT#49	CP-100520	C1-102735	0054r 1	Rel-10	9.5.0	10.0.0	Clarification of Scope for CB in LTE
CT#49	CP-100520	C1-103152	0057	Rel-10	9.5.0	10.0.0	Clarification of definition of "PLMN Wide" in Geographical Scope (GS) indicator
CT#50	CP-100744	C1-105127	0058r 2	Rel-10	10.0.0	10.1.0	Correction to CMAS Alert levels
CT#50	CP-100768	C1-104243	0056r 3	Rel-11	10.1.0	11.0.0	Message Identifiers for EU-Alert
CT#50	CP-100768	C1-104483	0057	Rel-11	10.1.0	11.0.0	Message Identifier for EU-Info
CT#51	CP-110876	C1-114785	0065r 3	Rel-11	11.0.0	11.1.0	Correction on Message Identifier for Korean Public Alert System
CT#51	CP-110882	C1-114427	0066r 2	Rel-11	11.0.0	11.1.0	Coding of Geographical Scope parameter for E-UTRAN/LTE operation.
CT#51	CP-110853	C1-115046	0070r 3	Rel-11	11.0.0	11.1.0	Correction to UE warning message indication with regards to "digital signature" and "timestamp"

CT#51	CP-110882	C1-115255	0071r 2	Rel-11	11.0.0	11.1.0	Additional Message Identifiers for CMAS/EU-Alerts
CT#51	CP-110882	C1-114923	0072r 1	Rel-11	11.0.0	11.1.0	Update Number Processing
CT#51	CP-110882	C1-114975	0073r 1	Rel-11	11.0.0	11.1.0	Multiple languages used in CBS
CT#55	CP-120125	C1-120857	0083r 3	Rel-11	11.1.0	11.2.0	Sorting out inconsistency problem in ETWS/PWS specification
CT#55	CP-120125	C1-120285	0084	Rel-11	11.1.0	11.2.0	Correction of binary coding in clause 9.4.1.2.2
CT#55	CP-120091	C1-120804	0077r 2	Rel-11	11.1.0	11.2.0	Redocumentation and alignment of the public warning system
CT#56	CP-120309	C1-122384	0081r 4	Rel-11	11.2.0	11.3.0	Alignment of clause 9 for PWS
CT#56	CP-120309	C1-121379	0091r 1	Rel-11	11.2.0	11.3.0	Correction to the duplication detection mechanism
CT#56	CP-120285	C1-121245	0092	Rel-11	11.2.0	11.3.0	Removal of security for ETWS/PWS over E-UTRAN
CT#56	CP-120285	C1-122295	0088r 3	Rel-11	11.2.0	11.3.0	Alignment and correction of aspects for public warning system for GERAN
CT#57	CP-120573	C1-123198	0094r 3	Rel-11	11.3.0	11.4.0	Correction to Figure 3.3-1
CT#57	CP-120567	C1-123186	0103r 1	Rel-11	11.3.0	11.4.0	Correction of Warning Message Delivery Procedure in GSM
CT#57	CP-120492	-	0098r 1	Rel-11	11.3.0	11.4.0	Correction of reference to GSMA document "Coding of Cell Broadcast Functions"
CT#58	CP-120794	C1-123955	0095r 2	Rel-11	11.4.0	11.5.0	Correction for Repetition Rates
CT#58	CP-120794	C1-123956	0107r 1	Rel-11	11.4.0	11.5.0	Correction of reference in Restart Indication Request
CT#58	CP-120774	C1-123875	0111r 1	Rel-11	11.4.0	11.5.0	Correcting handling of unused security parameters for warning messages
CT#58	CP-120794	C1-124990	0116r 2	Rel-11	11.4.0	11.5.0	Message IDs for Operator specific services
CT#58	CP-120794	C1-125024	0117r 2	Rel-11	11.4.0	11.5.0	USIM file usage for PWS message reception
CT#58	CP-120819	C1-124972	0097r 5	Rel-12	11.5.0	12.0.0	Report from MME on Warning Message Delivery
CT#58	CP-120819	C1-124971	0099r 4	Rel-12	11.5.0	12.0.0	Failure List in WRITE-REPLACE-WARNING-CONFIRM and STOP-WARNING-CONFIRM
CT#59	CP-130115	C1-130829	0120r 2	Rel-12	12.0.0	12.1.0	Correction for Warning Area List
CT#59	CP-130129	C1-130831	0123r 2	Rel-12	12.0.0	12.1.0	Clause 9.4.3 for E-UTRAN
CT#59	CP-130115	C1-130837	0124r 2	Rel-12	12.0.0	12.1.0	Warning message reception in Limited Service
CT#60	CP-130264	C1-132520	0125r 3	Rel-12	12.1.0	12.2.0	CB Message parameter format on the eUTRAN Radio Network – UE interface
CT#60	CP-130264	C1-131445	0127r 1	Rel-12	12.1.0	12.2.0	CBS message parameter references correction
CT#60	CP-130264	C1-131446	0128r 1	Rel-12	12.1.0	12.2.0	Failure Indication and Restart Indication handling

CT#60	CP-130264	C1-131725	0129r 2	Rel-12	12.1.0	12.2.0	Clarification to data coding scheme usage for primary vs secondary notification
CT#61	CP-130503	C1-133320	0118r 3	Rel-12	12.2.0	12.3.0	Stop-all broadcasting of warning messages and report from MME on Stop Warning Messages in E-UTRAN
CT#61	CP-130510	C1-133206	0132r 1	Rel-12	12.2.0	12.3.0	CellID in E-UTRAN
CT#61	CP-130510	C1-133207	0133r 1	Rel-12	12.2.0	12.3.0	Clarification on Duplication Detection
CT#61	CP-130510	C1-133646	0134r 1	Rel-12	12.2.0	12.3.0	Clarification on PWS CB Data for the eUTRAN Radio interface
Post CT#61				Rel-12	12.3.0	12.3.1	Correction of typos
CT#62	CP-130750	C1-134137	0137r 2	Rel-12	12.3.1	12.4.0	eNodeB ID in Stop-Warning Indication
CT#62	CP-130762	C1-134530	0139	Rel-12	12.3.1	12.4.0	Removal of cells=all feature from RNC
CT#62	CP-130751	C1-134930	0140r 1	Rel-12	12.3.1	12.4.0	Stop all indicator clarification
CT#63	CP-140140	C1-140609	0135r 5	Rel-12	12.4.0	12.5.0	Restart Indication
CT#63	CP-140144	C1-140440	0141r 1	Rel-12	12.4.0	12.5.0	Capacity Indication Request not implemented
CT#64	CP-140331	C1-141098	0142	Rel-12	12.5.0	12.6.0	Available-Capacity not implemented
CT#64	CP-140327	C1-141642	0143r 1	Rel-12	12.5.0	12.6.0	Support of category indication for prioritization of emergency alerts
CT#66	CP-140836	C1-144414	0146	Rel-12	12.6.0	12.7.0	Removal of CAPACITY-INDICATION reference
CT#66	CP-140858	C1-144827	0147r 1	Rel-13	12.7.0	13.0.0	Missing Broadcast Message Content Validity Indicator IE
CT#68	CP-150310	C1-150914	0149	Rel-13	13.0.0	13.1.0	Correction for List of TAIs
CT#68	CP-150310	C1-151465	0151r 1	Rel-13	13.0.0	13.1.0	Clarification on CBC Geo-redundancy support in LTE
CT#68	CP-150329	C1-151463	0152r 1	Rel-13	13.0.0	13.1.0	Serial Number handling for WRITE-REPLACE Request/Indication primitive
CT#68	CP-150310	C1-151830	0154	Rel-13	13.0.0	13.1.0	Warning message indication delivery for PWS reporting enhancement
CT#68	CP-150329	C1-151831	0155	Rel-13	13.0.0	13.1.0	ETWS Primary Notification message at E-UTRAN interface
CT#68	CP-150329	C1-152386	0156r 1	Rel-13	13.0.0	13.1.0	Reference corrections and editorial updates
CT#70	CP-150700	C1-154874	0157r 4	Rel-13	13.1.0	13.2.0	Failure Indication
CT#71	CP-160086	C1-160316	0159	Rel-13	13.2.0	13.3.0	Failed cell list parameter content correction

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2016-09	CP-73	CP-160519	0160	2	F	RESET COMPLETE and RESET FAILURE Response messages missing	14.0.0
2017-06	CP-76	CP-171092	0161	2	C	Addition of new Message Identifiers for FCC mandated Wireless Emergency Alert (WEA, aka CMAS) enhancements	14.1.0
2017-12	CP-78	CP-173067	0165	1	F	Correction to the Data Coding Scheme clause in support of NA regulatory requirement	14.2.0
2017-12	CP-78	CP-173069	0166	3	B	Support of PWS in 5GS	15.0.0
2018-03	CP-79	CP-180077	0167	2	B	PWS message format for NG-RAN in 5G	15.1.0
2018-03	CP-79	CP-180077	0168	3	B	AMF to CBC inter-connectivity solution option with and without IWF	15.1.0
2018-03	CP-79	CP-180077	0169	2	B	PWS in NR – clause 9.1.3.5	15.1.0
2018-03	CP-79	CP-180077	0170	2	B	PWS in NR – clause 9.2.0	15.1.0
2018-03	CP-79	CP-180077	0171	1	B	PWS in NR – clause 9.2.x	15.1.0
2018-03	CP-79	CP-180077	0172	3	B	PWS in NR – clause 9.3.x	15.1.0
2018-03	CP-79	CP-180077	0173	1	B	AMF, CBC and CBCF functionalities for PWS in 5G	15.1.0
2018-03	CP-79	CP-180077	0174		B	Service Based Interface for 5G System	15.1.0
2018-06	CP-80	CP-181057	0175	1	F	Corrections to table 6 and consistent use of terminology	15.2.0
2018-06	CP-80	CP-181057	0176		F	Addition of reference to TS 23.502	15.2.0
2018-06	CP-80	CP-181057	0177	1	B	Addition of entity functionality clauses in annex B	15.2.0
2018-06	CP-80	CP-181057	0178	1	F	Correction for the use of NG-RAN node and other general corrections	15.2.0
2018-06	CP-80	CP-181057	0180	3	F	Addition of reference point between AMF and CBCF	15.2.0
2018-06	CP-80	CP-181057	0181		F	Removal of Extended Repetition-Period IE for NG-RAN	15.2.0
2018-06	CP-80	CP-181057	0182		F	Correction Warning message content and removal of editor's	15.2.0
2018-06	CP-80	CP-181058	0183	2	F	Clarification on no use of container for PWS messages via N2	15.2.0
2018-09	CP-81	CP-182128	0184	1	B	Modifications needed to address NG-RAN over SBc	15.3.0
2018-09	CP-81	CP-182128	0185	1	F	Corrections to IE names for NG-RAN	15.3.0
2018-09	CP-81	CP-182128	0186	1	F	Solving Editor's notes for PWS	15.3.0
2018-09	CP-81	CP-182158	0189	6	B	Warning Area Coordinates in WRITE-REPLACE WARNING REQUEST	15.3.0
2018-12	CP-82	CP-183030	0192	1	F	Duplicate detection for EUTRA connected to both EPC and 5GCN	15.4.0
2018-12	CP-82	CP-183030	0193		F	Resolving the EN for the PWS restoration procedure for NG-RAN	15.4.0
2019-03	CP-83	CP-190100	0194	4	F	Additional Message Identifier to direct UEs to perform geo-fencing of CMAS messages	15.5.0
2019-03	CP-83	CP-190082	0195	1	F	Corrections on Warning Area List and TAIs for NG-RAN	15.5.0
2019-03	CP-83	CP-190082	0198	1	F	Correction on applicability of List of TAIs	15.5.0
2019-03	CP-83	CP-190064	0200		F	Incorrect reference	16.0.0
2019-09	CP-85	CP-192071	0201		F	Missing references and some editorial cleanup	16.1.0
2019-12	CP-86	CP-193105	0202	3	B	Addition of the support of ePWS functionality via E-UTRAN and NG-RAN	16.2.0
2019-12	CP-86	CP-193105	0203	3	B	Support of language-independent content mapped to a disaster in a warning message	16.2.0
2020-03	CP-87e	CP-200128	0204		F	Misalignment of 23.041 with 23.007 and 23.527	16.3.0
2020-03	CP-87e	CP-200110	0205		F	Procedures for an ETWS/CMAS-capable UE in NG-RAN	16.3.0
2020-03	CP-87e	CP-200118	0208	2	B	Addition of message identifiers for UEs with no user interface	16.3.0
2020-03	CP-87e	CP-200118	0209	1	B	Support of a stored language-independent content referenced by a warning message	16.3.0
2020-06	CP-88e	CP-201100	0207	2	F	Removal of Duplicate Service Operation Details	16.4.0
2020-06	CP-88e	CP-201100	0212		F	Correction to figure	16.4.0
2020-06	CP-88e	CP-201100	0213		F	Corrections to references	16.4.0
2020-06	CP-88e	CP-201100	0214	1	F	Subscription management in PWS-IWF	16.4.0
2020-06	CP-88e	CP-201131	0217	1	F	Handling of Concurrent Warning Message Indicator	16.4.0
2020-06	CP-88e	CP-201115	0218		F	Deletion of Editor's note in the clause 9.3.24 Warning-Type for ETWS	16.4.0
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2021-06	CP-92e	CP-211150	0222		F	Geo-fencing check for none of stored "warning message" matched to geo-fencing trigger	17.1.0
2021-06	CP-92e	CP-211150	0221	1	C	Broadcast Empty Area List for Write-Replace-Warning Request	17.1.0
2021-09	CP-93e	CP-212153	0215	3	F	Addition of Test Flag	17.2.0
2021-09	CP-93e	CP-212140	0224	-	F	Assign MI values for EU-Alert Level 4	17.2.0
2021-09	CP-93e	CP-212124	0225	1	B	Adding support for PWS in SNPNs	17.2.0
2021-09	CP-93e	CP-212153	0226	-	F	Correction on PWS 5GS architecture depiction	17.2.0
2022-03	CP-95e	CP-220236	0228	1	C	UE configuration for warning message reception in SNPNs	17.3.0
2022-06	CP-96e	CP-221203	0232	1	F	Removal of Editor's note on USIM data file for configuration of warning message reception when the UE accesses an SNPN using the PLMN subscription	17.4.0
2022-06	CP-96e	CP-221328	0231	2	F	Device based geo-fencing for EU-alert	18.0.0
2022-12	CP-98e	CP-223144	0233	2	B	CBS Message Identifiers for additional KPAS services	18.1.0

History

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