ATIS STANDARD

ATIS-0700007

ATIS Standard on -

IMPLEMENTATION GUIDELINES AND BEST PRACTICES FOR GSM/UMTS CELL BROADCAST SERVICE

ATIS-0700007, *Implementation Guidelines and Best Practices for GSM/UMTS Cell Broadcast Service*

Is an ATIS Standard developed by the **Mobile/Wireless GSM/3G System and Network (G3GSN)** Subcommittee under the **ATIS Wireless Technologies and Systems Committee (WTSC)**.

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ATIS Standard on

IMPLEMENTATION GUIDELINES AND BEST PRACTICES FOR GSM/UMTS CELL BROADCAST SERVICE

Alliance for Telecommunications Industry Solutions

Approved October 2009

Abstract

This standard describes implementation guidelines and best practices related to the GSM/UMTS Cell Broadcast Service regardless of the application using the Cell Broadcast Service.

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The Wireless Technologies and Systems Committee (WTSC) – formerly T1P1 -- develops and recommends standards and technical reports related to wireless and/or mobile services and systems, including service descriptions and wireless technologies. WTSC develops and recommends positions on related subjects under consideration in other North American, regional and international standards bodies.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, WTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

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ATIS Standard on –

Implementation Guidelines and Best Practices for GSM/UMTS Cell Broadcast Service

1 SCOPE, PURPOSE, & APPLICATION

1.1 Scope

The scope of this specification is to provide implementation guidelines and best practices for the support of the GSM/UMTS Cell Broadcast Service (CBS).

This specification is not intended to describe an end-to-end Cell Broadcast architecture, but includes clarifications to the existing 3GPP CBS standards (see Clause 2, *Normative References*), as well as "best practices" for implementation of the standards. These clarifications may be applicable to any application that uses CBS.

1.2 Purpose

The purpose of this specification is to describe implementation guidelines and best practices related to GSM/UMTS Cell Broadcast Service regardless of the application using CBS.

While some examples of specific uses of Cell Broadcast applications (e.g., Commercial Mobile Alert Service) are provided, the focus of the document is on the general Cell Broadcast capabilities which are not tied to any particular application.

1.3 Application

This specification is applicable to the Cell Broadcast Service which operates on GSM or UMTS networks.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this ATIS Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this ATIS Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

[Ref 1] 3GPP TS 23.041, *3rd Generation Partnership Project; Technical Specification Group Terminals; Technical realization of Cell Broadcast Service (CBS).*[1]

[Ref 2] 3GPP TS 25.419, *3rd Generation Partnership Project; Technical Specification Group RAN; UTRAN Iu-BC Interface: Service Area Broadcast Protocol (SABP).*[1]

[1] This document is available from the 3rd Generation Partnership Project (3GPP) < http://www.3gpp.org/ >.

[Ref 3] 3GPP TS 44.012, *3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; Short Message Service Cell Broadcast (SMSCB) support on the mobile radio interface.* [1]

[Ref 4] 3GPP TR 25.925, *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Radio interface for broadcast/multicast service.* [1]

[Ref 5] 3GPP TS 25.324, *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Broadcast/Multicast Control (BMC).* [1]

[Ref 6] 3GPP TS 25.212, *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Multiplexing and channel coding (FDD).* [1]

[Ref 7] 3GPP TS 25.222, *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Multiplexing and channel coding (TDD).* [1]

[Ref 8] 3GPP TS 25.402, *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Synchronization in UTRAN Stage 2.* [1]

[Ref 9] ATIS-0700006, *Commercial Mobile Alerts Service (CMAS) for GSM/UMTS Using Cell Broadcast Service.*[2]

[Ref 10] ATIS-0700008, *Cell Broadcast Entity (CBE) to Cell Broadcast Center (CBC) Interface Specification.*[2]

[Ref 11] 3GPP TS 48.058, *3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Base Station Controller - Base Transceiver Station (BSC - BTS) interface; Layer 3 specification.* [1]

3 Definitions, Acronyms, & Abbreviations

3.1 Definitions

3.1.1 Cell Broadcast Service. Cell Broadcast Service (CBS) 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.

3.1.2 Cell Broadcast Area. Cell Broadcast Area is the geographical area for the broadcast of the CBS message. Cell Broadcast Areas may be comprised of one or more cells or the entire wireless operator network. Individual CBS messages will be assigned their own Cell Broadcast Areas.

3.1.3 Cell Broadcast Service (CBS) Page. A Cell Broadcast Service (CBS) page comprises 82 octets, which, using the default character set, equates to 93 characters. Up to 15 of these pages may be concatenated to form a CBS message. Each page of such a CBS message will have the same message identifier and the same serial number.

3.2 Acronyms & Abbreviations

ATIS	Alliance for Telecommunications Industry Solutions
BMC	Broadcast/Multicast Control
BSC	Base Station Controller

[2] This document is currently awaiting publication by the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < https://www.atis.org/docstore/default.aspx >.

BTS	Base Transceiver System
CB	Cell Broadcast
CBC	Cell Broadcast Center
CBCH	Cell Broadcast Channel
CBE	Cell Broadcast Entity
CBS	Cell Broadcast Service
CMAS	Commercial Mobile Alert Service
CMSP	Commercial Mobile Service Provider
CTCH	Common Traffic Channel
DRX	Discontinuous Reception
RNC	Radio Node Controller
OA&M	Operations, Administration, & Maintenance
SMS	Short Message Service
XML	eXtensible Markup Language

4 Functional Architecture & Interfaces

This clause defines the functional architecture and interfaces for the Cell Broadcast Service as defined in 3GPP TS 23.041 [Ref 1].

The GSM Cell Broadcast architecture is as follows:

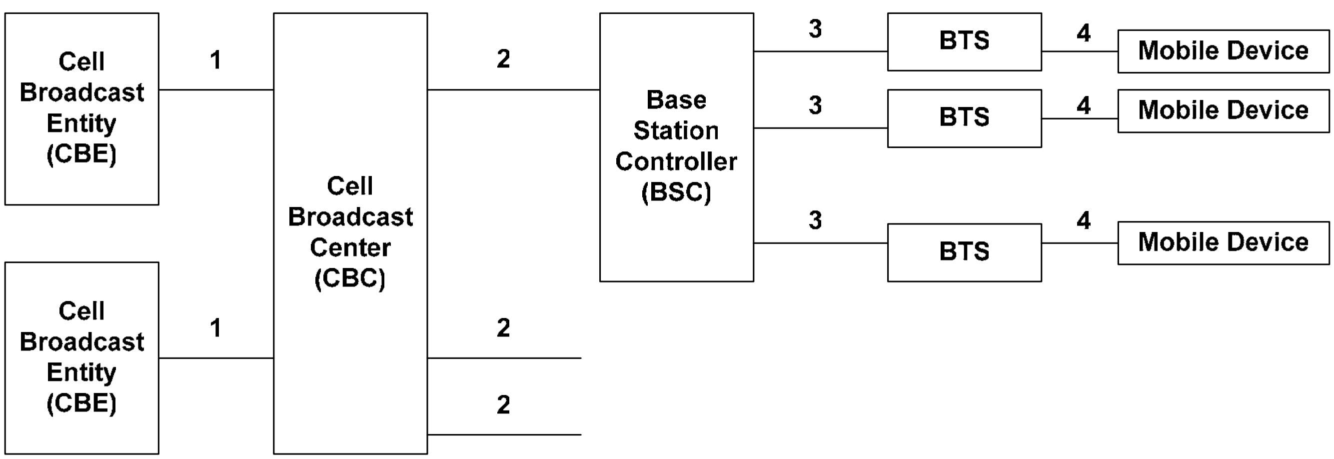

Figure 1: GSM Cell Broadcast Architecture

Similarly, the UMTS Cell Broadcast architecture is as follows:

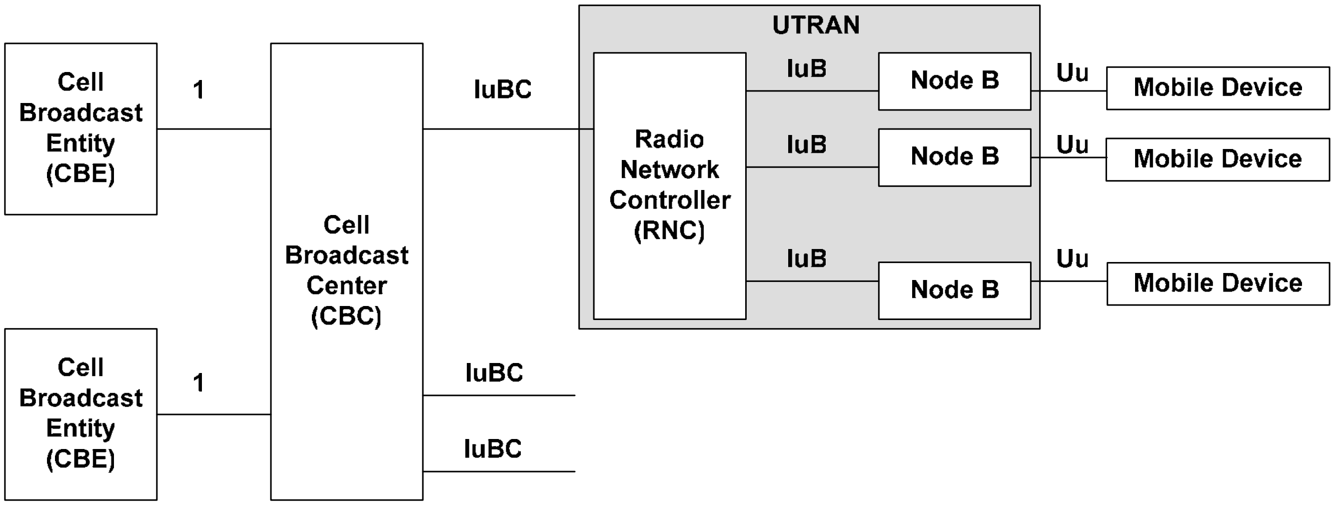

Figure 2: UMTS Cell Broadcast Architecture

In both the GSM and UMTS architectures for Cell Broadcast, the Cell Broadcast Entity (CBE) could be the CMSP Gateway, a commercial service entity, or an entity which performs both functions.

4.1 Cell Broadcast Entity (CBE)

The Cell Broadcast Entity (CBE) is the source of the Cell Broadcast message that is to be broadcast by the CBC. The CBE could be providing either a commercial information service or an emergency alert service such as CMAS.

The CBE provides the CBC with the geo-target information (e.g., geo-code, polygon, circle) associated with the Cell Broadcast message. The CBC converts this geo-target information into the associated set of cell sites.

The CBE provides the CBC with the frequency and duration attributes for the retransmission of the Cell Broadcast message. The frequency and duration of the retransmissions is based upon the criticality of the information and the length of its validity. For example, emergency alert messages may have a higher frequency than non-emergency information messages such as sports scores. Additionally, the duration for the retransmission of an emergency alert message could be the duration of the emergency event. However, traffic congestion alert information has a limit period of validity (e.g., traffic congestion information from the morning commute is not useful for the evening commute), and, therefore, this type of Cell Broadcast message would have a short duration for retransmission.

4.2 Cell Broadcast Center (CBC)

The functionality of the CBC is specified in 3GPP TS 23.041 [Ref 1]. Additional CBC requirements for the support of CMAS are provided in the CMAS via GSM/UMTS Cell Broadcast Specification [Ref 9].

The CBC determines the set of cells as defined in sections 5 and 9.3.5 of 3GPP TS 23.041 [Ref 1] (e.g., list of cell sites, location areas, service areas) based upon the geo-target information (e.g., geo-code, polygon, circle) provided to the CBC by the CBE. There are no requirements on the accuracy of geo-targeting. The determination of the set of cells and the accuracy of geo-targeting to the desired broadcast area is operator and implementation specific and may be subject to regulatory requirements.

The CBC in conjunction with the capabilities of the GSM and UMTS radio networks shall perform retransmissions of the Cell Broadcast message based upon the retransmission information provided by the CBE.

4.3 CBE to CBC Interface

According to section 3.1 of 3GPP TS 23.041 [Ref 1], the definition of the message transfer on link 1 between the CBE and the CBC is outside the scope of GSM specifications.

However, for CMAS, the interface between the CMSP Gateway type of CBE and the CBC for the support of CMAS will be an XML based protocol as defined in the CMAS via GSM/UMTS Cell Broadcast Specification [Ref 9].

4.4 CBC to BSC Interface

According to section 9.2 of 3GPP TS 23.041 [Ref 1], there is no mandatory protocol between the CBC and the BSC specified by GSM, and as such this interface is a vendor specific implementation. In order to implement CMAS and other services, CBCs should be able to interface to all BSCs deployed in the CMSP network via a TCP/IP interface using the primitives defined in 3GPP TS 23.041 [Ref 1] on physical and logical ports different from OA&M traffic, using the call flows in clause 6.1, *Cell Broadcast CMAS Call Flows,* of this document. In addition, the CBC to BSC protocol descriptions may be required by CMSPs, test equipment vendors, and monitoring equipment vendors.

4.5 CBC to RNC Interface

For the support of Cell Broadcast via UMTS, 3GPP has defined a mandatory protocol between the CBC and RNC in 3GPP TS 25.419 [Ref 2].

5 Battery Life Impact Analysis for CBS

The battery life impacts shown in this clause are based upon GSM technology and are illustrative only. The battery life impacts for UMTS technology should be similar. Actual battery life impacts may vary based upon factors such as CMSP configurations and mobile device implementations.

The impact of the standard Cell Broadcast Service on battery life is unacceptable for applications using the Cell Broadcast Service, such as the CMAS application. The guidelines provided in this technical report are based on the requirements identified in CMAS via GSM/UMTS Cell Broadcast Service [Ref 9] where it has been specified that Cell Broadcast Service with DRX mode of operation is mandatory for CMAS.

5.1 Description of Technology

Cell Broadcast (CB) is designed for simultaneous delivery of messages to multiple users in a specified area. Cell Broadcast is one-to-many geographically focused service. Cell Broadcast is defined within Phase 1 of the GSM standard in GSM 23.041 [Ref 1]. A Cell Broadcast message may be from 1 to 15 pages in length. Each page can be up to 93 alphanumeric characters or 82 octets of binary data in length.

5.2 CB Methods

- *CB*: The Cell Broadcast service is designed to minimize the battery usage requirements for a mobile device. A mobile device can read the first part of a CB message and then decide whether or not to read the rest of the message.
- *CB DRX*: The network may broadcast Schedule Messages, providing information in advance about the CB messages that will be sent immediately afterwards. The mobile device may use this scheduling information to restrict reception to those messages the customer is interested in receiving.

5.3 Battery Life Calculations when a CMAS Alert is not active

5.3.1 Baseline in a typical case[3]

The broadcast of a message includes the transmission of 4 bursts over the air. In idle mode, a mobile device that receives 5 System Information (SI) messages and 30 paging messages in a 30 second time interval will have about 0.269% of activity. This is calculated as shown below:

$$\frac{[(SI + Pages) * Radio\ Bursts\ per\ message * Radio\ Burst\ Duration]}{[Time\ Interval]}$$

$$((N_{SI} + N_{pages}) * N_{radio\_bursts} * T_{frame}) / T_{interval} \qquad \textbf{\{Formula-1\}}$$

Where:

N_{SI} = **5** (number of SI messages)

N_{pages} = **30** (number of paging messages)

N_{radio_bursts} = **4** (number of radio bursts per message)

T_{frame} = **577 µsec** (time duration of 1 time-slot or 1 radio burst)

$T_{interval}$ = **30 sec** (total time considered)

Applying the values to the **{Formula-1},** we will get:

(5 + 30) * 4 * 0.000577 / 30 = 0.00269 or 0.269%

This 0.269% of the mobile device activity in idle mode is used as the baseline in all of the remaining battery life evaluations described in this clause.

[3] Assumption: Page DRX about 1s. No Neighbor cell activity included.

5.3.2 Cell Broadcast[4]

The broadcast of a Cell Broadcast message takes 4 consecutive CBCH blocks transmitted within the {8 * 51} TDMA multi-frame. The broadcast of each CBCH block requires the transmission of 4 bursts over the radio. The mobile device operating in a non-DRX mode will have to receive at least one CBCH block once every {8 * 51} TDMA multi-frame which in turn will increase the idle mode activity of a mobile device by about 45%. The additional activity to receive one CBCH block once every {8 * 51} TDMA multi-frame is calculated as shown below:

$$\frac{\text{[CBCH Blocks * Radio Bursts per CBCH Block]}}{\text{[Time-slots in a \{8*51\} TDMA multi-frame]}}$$

$$N_{CBCH\_blocks} * N_{radio\_bursts} / N_{multi\text{-}frames} * N_{tdma\_frames} * N_{timeslots} \qquad \text{\{Formula-2\}}$$

Where:

N_{CBCH_blocks} = **1** (one CBCH block is read in non-DRX mode)

N_{radio_bursts} = **4** (each CBCH block is transmitted in 4 radio bursts over the air)

$N_{multi\text{-}frames}$ = **8** (each of the 8 CBCH Blocks repeat once every 8 multi-frames)

N_{tdma_frames} = **51** (each multi-frame consists of 51 TDMA frames)

$N_{time\text{-}slots}$ = **8** (each TDMA frame consists of 8 time-slots)

Applying the values to the **{Formula-2}**, we will get

(1 * 4) / (8 * 51 * 8) = 4 / 3264 = 0.0012 or 0.12%

The additional 0.12% of activity would increase the idle mode activity by about **45%** (derived from 0.12/0.269 = 0.45).

5.3.3 Cell Broadcast with DRX

With DRX mode of operation, the mobile device will have to receive at a minimum 1 CBCH block of Schedule Message once every Schedule Period. In an idle mode, the mobile device may just have to read one CBCH block of Schedule Message once every Schedule Period instead of reading at least one CBCH block once every {8 * 51} TDMA multi-frame.

The additional device activity in the idle mode to receive one CBCH block of Schedule Message once every Schedule Period will vary based on the duration of the Schedule Period. Therefore, what has been given here is an example. If a Schedule Period consists of 32 {8 * 51} TDMA multi-frames (also

[4] Mobile device reads the first out of four CBCH blocks and decides whether or not to read the rest of the message

known as 32 Message Slots), then the additional idle mode mobile device activity to receive one Schedule Message once every 32 Message Slots would be about 0.0038% and is determined as shown below:

$$\frac{\text{[CBCH Blocks * Radio Bursts per CBCH Block]}}{\text{[Time-slots in a \{8*51\} TDMA multi-frame * Schedule Period]}}$$

$$N_{CBCH\_blocks} * N_{radio\_bursts} / N_{time\text{-}slots\_multi\text{-}frame} * N_{Schedule\_Period} \quad \text{\{Formula-3\}}$$

Where:

N_{CBCH_blocks} = **1** (one CBCH block of Schedule Message)

N_{radio_bursts} = **4** (each of CBCH block of a Schedule Message is broadcast using 4 radio bursts).

$N_{time\text{-}slots\_multi\text{-}frame}$ = **3264** (Number of total time-slots in a 8 * 51 TDMA multi-frame)

$N_{Schedule\_Period}$ = **32** (Number of Message Slots in a Schedule Period)

Applying the values to the **{Formula-3}**, we get:

1 * 4 / 3264 * 32 = 0.0000383 or 0.0038%

This 0.0038% of additional activity would increase the mobile device idle mode activity by about 1.4% (derived from 0.0038/0.269 = 1.4%). Note that the smaller the Schedule Period is the larger will be the additional device activity in the idle mode.

If the operator has multiple CBS services active (CMAS alerts and commercial broadcast services), CMAS would not introduce any additional power consumption because the mobile device would be receiving these other services and detecting the CBS scheduling info only, not additional messages because of the CMAS message.

5.4 Battery Life Calculations when a CMAS Alert is active

If a CBS message is received in every {8 * 51} TDMA multi-frame, then it would contribute about 0.49% of the mobile device activity or about 182% increase to the idle mode activity of the mobile device. As noted earlier, each CBS message is transmitted over 4 consecutive CBCH blocks within an {8 * 51} TDMA multi-frame. This is calculated as shown below:

CBCH Blocks * Radio Bursts per CBCH Block] ________________________________ **[Time-slots in a {8*51} TDMA multi-frame]**

$$N_{CBCH\_blocks} * N_{radio\_bursts} / N_{multi\text{-}frames} * N_{tdma\_frames} * N_{timeslots}$$ **{Formula-4}**

Where:

N_{CBCH_blocks} = **4** (each CMAS alert message has 4 CBCH blocks)

N_{radio_bursts} = **4** (each CBCH block is transmitted in 4 radio bursts over the air)

$N_{multi\text{-}frames}$ = **8** (each of the 4 CBCH Blocks repeat once every 8 multi-frames)

N_{tdma_frames} = **51** (each multi-frame consists of 51 TDMA frames)

$N_{time\text{-}slots}$ = **8** (each TDMA frame consists of 8 time-slots)

Applying the values to the **{Formula-4}**, we get:

(4 * 4) / (8 * 51 * 8) = 16/3264 = 0.0049 or 0.49%

The additional 0.49% of activity would increase the idle mode activity by **182%** (derived from 0.49/0.269 = 1.82).

5.4.1 CMAS Message with DRX

The **{Formula-3}** indicated that the mobile device activity in idle mode would have increased by about 1.4% if the device has to receive 1 CBCH block of a Schedule Message once within a Schedule Period of 32 Message Slots. This can be generalized to say that the device activity would increase by about 1.4% to receive one 1CBCH block once every 32 Message Slots.

Therefore, to receive a CMAS alert message with a repetition period that consists of 32 Message Slots, the device activity would increase by 7%. This can be calculated as shown below:

(CBCH Blocks * Activity per CBCH Block) + Activity per CBCH Block of Schedule Message)

$$N_{CBCH\_Blocks} * A_{One\text{-}CBCH\_Block} + A_{Schedule\_1CBCH}$$ **{Formula-5}**

Where:

N_{CBCH_Blocks} = **4** (four CBCH Blocks of the CMAS alert message)

$A_{One\text{-}CBCH\_Block}$ = **1.4%** (Activity increase to receive 1 CBCH Block)

$A_{Schedule\_1CBCH}$ = **1.4%** (Activity increase for 1 CBCH Block of Schedule Message)

Applying the values to **{Formula-5}**, we get:

4 * 1.4% + 1.4% = 7%.

5.4.2 CBS Message with non-DRX

Based on the logic used in the DRX mode calculations, the device activity would increase by about 1.4% to receive 1 CBCH Block in 32 Message Slots. When the CBS message is broadcast in a non-DRX mode with a repetition period of 32 Message Slots, the mobile device would receive the 4 CBCH blocks of CBS message in one Message Slot and then receive 1 CBCH block in every Message Slot of the remaining 31 Message Slots. This process would increase the mobile device activity by about 49%. This can be calculated as shown below:

(CBCH Blocks * Message Slots + Other (CBCH Blocks * Message Slots)) * Activity per CBCH Block

$(N_{CBS\_Blocks} * N_{CBS\_slots} + N_{other\_slots} * N_{other\_Blocks}) * A_{One\_Block}$ **{Formula-6}**

Where:

N_{CBS_Blocks} = **4** (four CBCH Blocks of the CBS message)

N_{CBS_slots} = **1** (CBS message in 1 Message Slot)

N_{other_slots} = **31** (the remaining Message Slots within the Repetition Period)

N_{other_Blocks} = **1** (1 CBCH block in the remaining Message Slots within the Repetition Period)

A_{One_Block} = **1.4%** (Activity increase to receive 1 CBCH Block)

Applying the values to **{Formula-6}**, we get:

(**4 * 1 + 31 * 1) * 1.4 = 0.49 or 49%**.

Basically, the above calculations indicate that the mobile device activity would increase by about 49% to receive a CMAS alert message with non-DRX mode operation but would only require a mobile device activity of about **7%** to receive the same message with DRX mode of operation.

5.5 Latency Comparison

- *CB baseline latency*: CB message can be repeated every 8th 51-multi-frame. The average air interface latency is 0.94 seconds and worst case 1.88 seconds.

- *CB DRX with 30 seconds duty cycle*: The average air interface latency would be 15 seconds and worst case 30 seconds.

5.6 Network & Handset Impacts

The table below summarizes the findings of the previous clauses. Note that the baseline is assuming a very modern implementation, thus it may not apply to some of the older handsets currently in the market. Secondly, the baseline is assuming static conditions -- i.e., no neighbor cell related activity in idle state. Including dynamic conditions (crossing cell boundaries) would increase the baseline activity.

Table 1: Comparison of Impacts of Potential Battery Life Improvement Options

CELL BROADCAST IMPACT ON MOBILE DEVICE ACTIVITY IN IDLE MODE	WITHOUT DRX		WITH DRX (SCHEDULE PERIOD = 32)	
	ACTIVITY	INCREASE	ACTIVITY	INCREASE
Baseline Typical Case	0.269%	N/A	0.269%	N/A
Cell Broadcast Support	0.389%	45%	0.273%	1.4%
CMAS Alert Message (Repetition Period = 32)	0.401%	49%	0.288%	7%
CMAS Alert Message in every Message Slot	0.759%	182%	0.759%	182%

The basic Cell Broadcast seems to increase the idle mode activity by 45%. As shown, when DRX mode of operation is used to broadcast the Cell Broadcast messages, the idle mode increased activity is as short as 1.4% (off course, this varies according to the Schedule Period). Therefore, for CMAS application the DRX mode of operation is made mandatory.

It is recommended the CB with DRX -- currently an optional feature in the CBS standard -- be made a requirement for Cell Broadcast applications including CMAS.

Basic CB, even the power optimized version, seems to introduce an unacceptable activity increase of 45%.

6 SINGLE PAGE CELL BROADCAST MESSAGE WITH DRX

This clause describes the call flows and processing associated with a single page Cell Broadcast message using the DRX capabilities. CMAS is an example of an application which uses a single page Cell Broadcast message with DRX capabilities and CMAS is referenced in these flows only as an example application using these capabilities.

6.1 Cell Broadcast Call Flows

This clause provides example call flows for the support of Cell Broadcast messages via Cell Broadcast. The call flows in this clause are illustrative of 3GPP 23.041 [Ref 1], 3GPP TS 44.012 [Ref 3], and 3GPP TS 25.419 [Ref 2]. It is not the intent of this specification to modify or enhance those 3GPP specifications. The following call flows are included in this clause:

- Call flow for new Cell Broadcast message on GSM with DRX via SMS Broadcast Command.
- Call flow for new Cell Broadcast message on GSM with DRX via SMS Broadcast Request.

- Call flow for new Cell Broadcast message on UMTS.
- Call flow for cancellation of Cell Broadcast message on GSM and UMTS.

6.1.1 Call Flow for New Broadcast Message on GSM with DRX via SMS Broadcast Command

The following is an illustrative call flow for a new Cell Broadcast message on a GSM system with DRX via the SMS Broadcast Command.

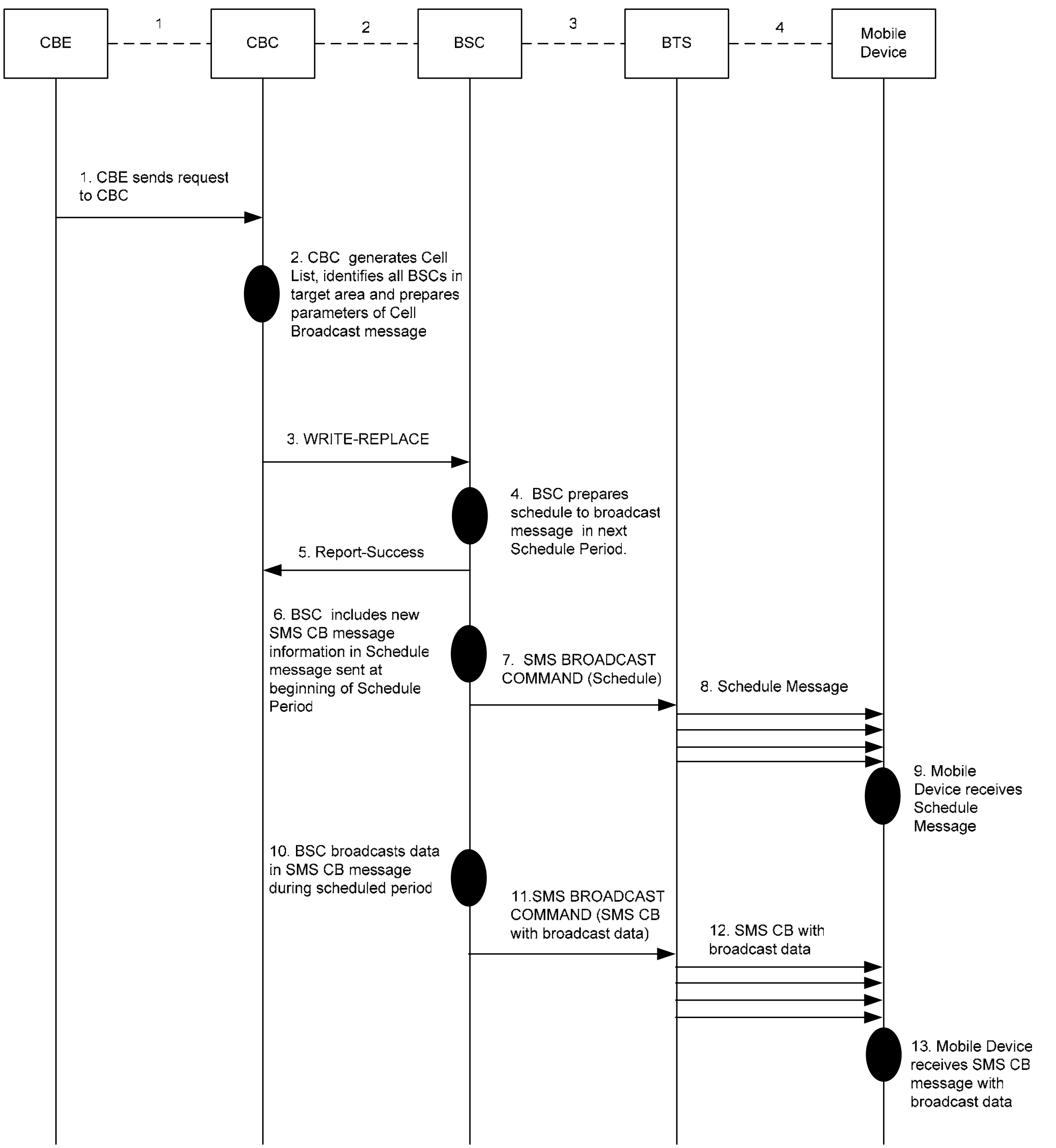

Figure 3: Call Flow for New Broadcast Message on GSM with DRX via SMS Broadcast Command

1. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request to the CBC. This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
2. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.
3. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to each Base Station Controller (BSC) that controls cell sites within the target area (as identified in the cell list).
4. Each BSC receives the WRITE-REPLACE indication from the CBC, validates the message, and prepares a schedule to broadcast the message to all the BTSs in the affected area (i.e., in the cell list).
5. Upon receiving the WRITE-REPLACE primitive, the BSC returns a REPORT primitive to the CBC indicating successful reception of the Cell Broadcast message.
6. At the beginning of the next Schedule Period, BSC includes the new SMS CB message indication within the Schedule Message.
7. BSC broadcasts the Schedule Message using the SMS BROADCAST COMMAND message to all BTSs in the affected area.
8. BTS breaks the Schedule Message contained within the SMS BROADCAST message into four 22 octet blocks and broadcasts those four blocks over the air to the mobile devices on the 4 consecutive CBCH blocks.
9. The mobile device receives the Schedule Message and using the information in the Schedule Message, identifies there is a new Cell Broadcast message to be transmitted within the identified schedule period. The mobile device identifies the parameters required to receive the Cell Broadcast message from the Schedule Message.
10. During the scheduled period, the BSC broadcasts the new SMS CB message containing the broadcast data.
11. BSC formats an SMS BROADCAST COMMAND message containing the message information page of Cell Broadcast message information. The SMS BROADCAST COMMAND is sent to each Base Transceiver System (BTS) that controls cell sites within the target area. The 3GPP TS 23.041 [Ref 1] specifies that "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 [Ref 3]) and transmits the four resulting blocks on the air."
12. Each BTS breaks each page of the Cell Broadcast message into four blocks for broadcast to the mobile devices in the associated broadcast area. At the appropriate time within the schedule period, the BTS broadcasts those four blocks over the radio interface to the mobile devices.
13. The mobile devices within the broadcast area receive the message information page of the Cell Broadcast message.

6.1.2 Call Flow for New Broadcast Message on GSM with DRX Call Flow via SMS Broadcast Request

The following is an illustrative call flow that shows the use of SMS BROADCAST REQUEST between the BSC and the BTS in broadcasting the Cell Broadcast Message on a GSM network that adopts the DRX operational mode.

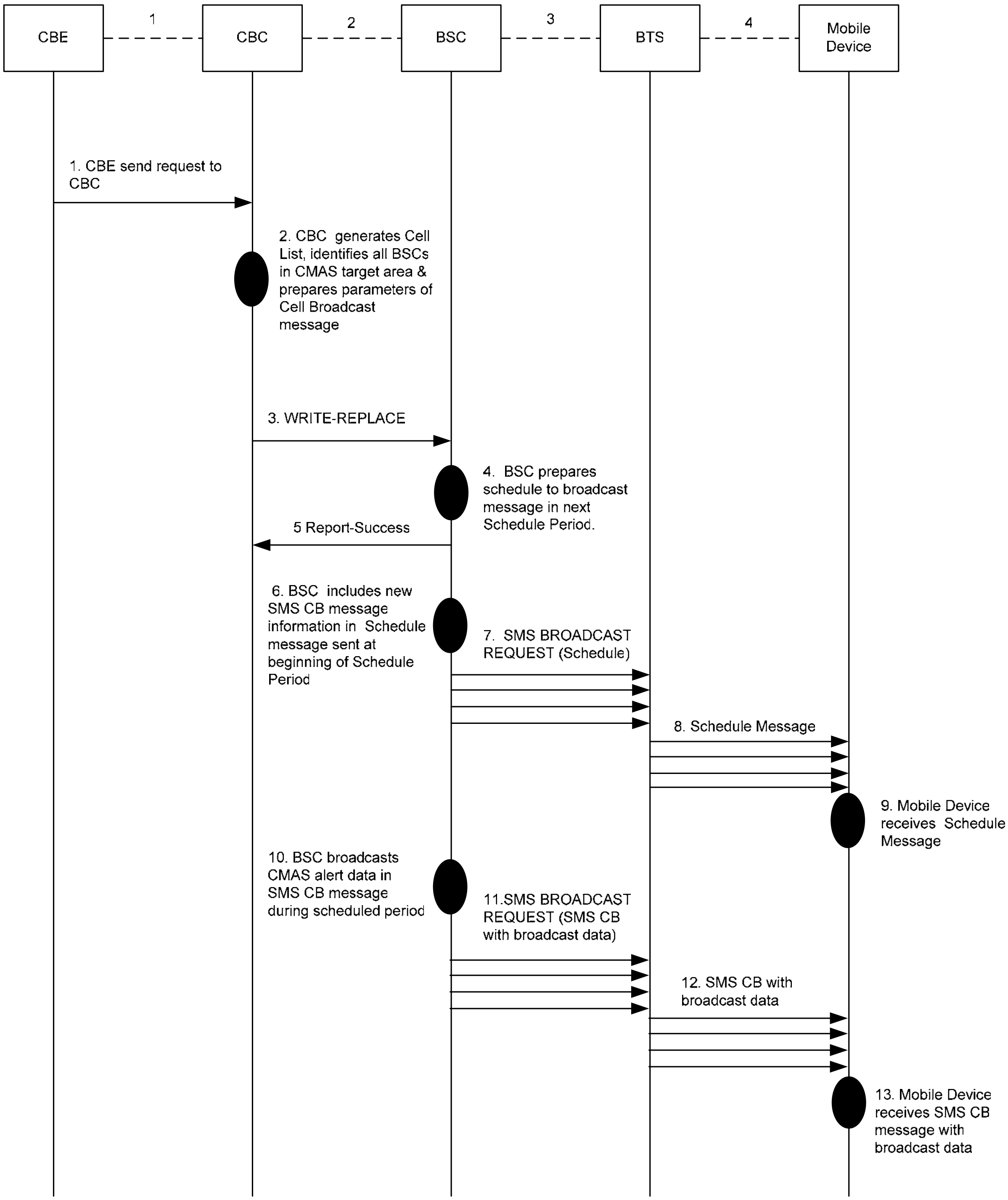

Figure 4: Call Flow for New Broadcast Message on GSM with DRX via SMS Broadcast Request

1. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request to the CBC. This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
2. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.
3. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area (as identified in the cell list).
4. Each BSC receives the WRITE-REPLACE indication from the CBC, validates the message and prepares a schedule to broadcast the message to all the BTSs in the affected area (i.e., in the cell list).
5. BSC returns a REPORT primitive to the CBC indicating successful reception of the Cell Broadcast message.
6. At the beginning of the next Schedule Period, BSC includes the new SMS CB message indication within the Schedule Message.
7. BSC sends the Schedule Message to all the BTSs in the affected area using four SMS BROADCAST REQUEST messages.
8. BTS upon receiving all four of the SMS BROADCAST REQUEST messages broadcasts the Schedule Message contained within the SMS BROADCAST REQUEST messages over the air to the mobile devices on the 4 consecutive CBCH blocks.
9. Mobile device receives the Schedule Message blocks and understands the schedule and prepares itself to receive the SMS CB message carrying the broadcast data during the scheduled message slot.
10. During the scheduled period, the BSC broadcasts the new SMS CB message containing the broadcast data.
11. The BSC sends the SMS CB message containing the broadcast data using four SMS BROADCAST REQUEST messages to each BTS controlling the cell sites in the affected area.
12. BTS, upon receiving all four of the SMS BROADCAST REQUEST messages and at the appropriate time within the schedule period, broadcasts the SMS CB message contained in those four SMS BROADCAST REQUEST messages over the radio interface to the mobile devices using 4 consecutive CBCH blocks.
13. Mobile device receives the message information page of the SMS CB message in 4 blocks.

6.1.3 Call Flow for New Broadcast Message on UMTS

The following is an illustrative call flow for a new Cell Broadcast message on a UMTS system:

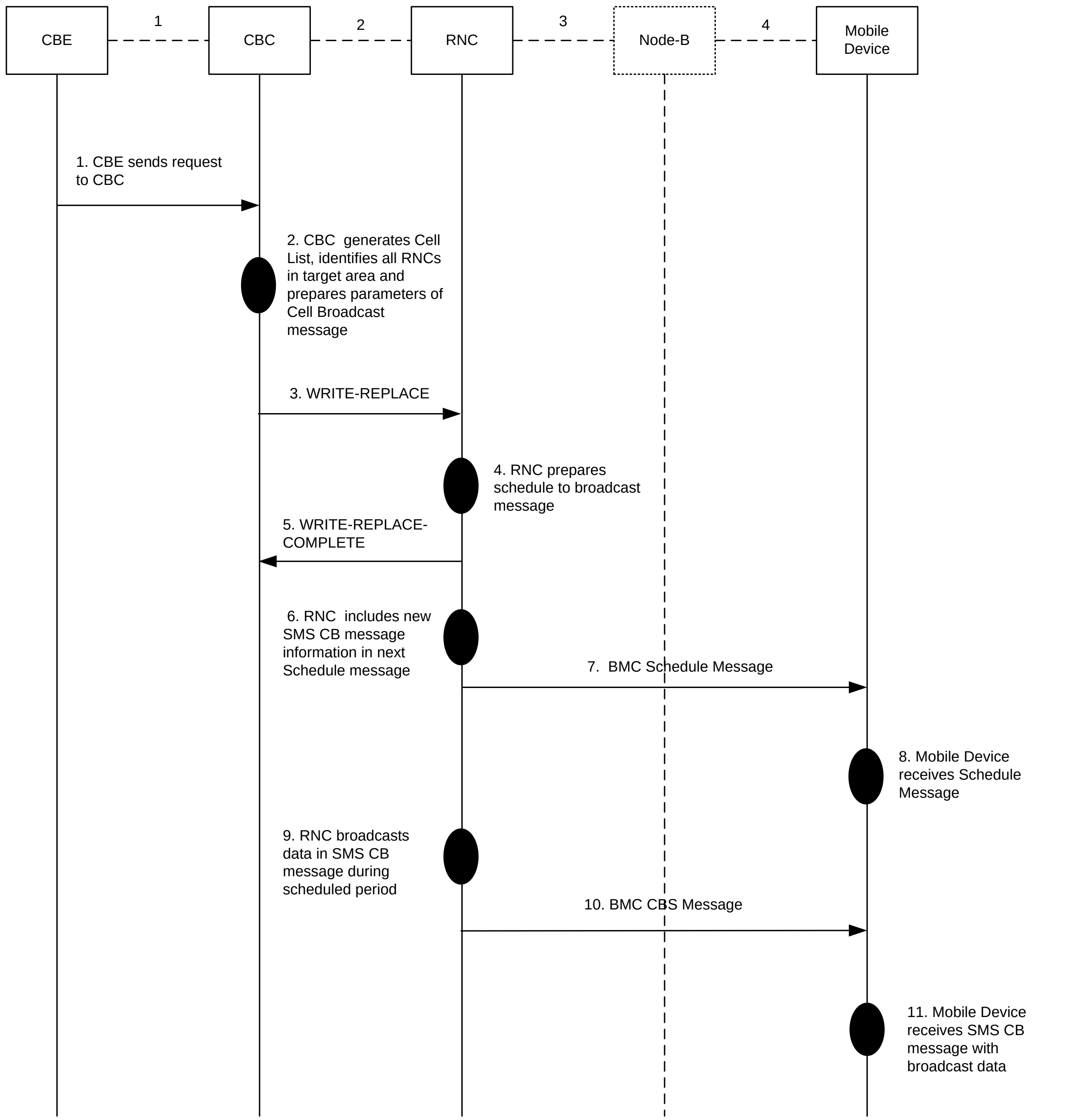

Figure 5: Call Flow for New Broadcast Message on UMTS

1. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request to the CBC. This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
2. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

3. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to each Radio Network Controller (RNC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).
4. Each RNC receives the WRITE-REPLACE indication from the CBC, validates the message, and places the Cell Broadcast message on the schedule.
5. RNC returns WRITE-REPLACE-COMPLETE primitive to the CBC indicating successful reception of the broadcast.
6. RNC includes the new SMS CB message indication in the Schedule Message sent in the next Schedule Period.
7. The RNC sends the Schedule Message using the BMC Schedule Message to the mobile device.
8. Mobile device receives the Schedule Message and identifies there is a new message to be broadcast in the next schedule period. The mobile device initiates monitoring of the broadcast channel at the appropriate time to receive the broadcast.
9. During the scheduled period, the RNC broadcasts the new SMS CB message.
10. The RNC formats a BMC CBS message containing the message information page of the Cell Broadcast message. The BMC CBS message is broadcast to cell sites within the target area of the Cell Broadcast message.
11. The mobile devices within the broadcast area receive the message information page of the broadcast.

6.1.4 Call Flow for Cancellation of Broadcast Message on GSM and UMTS

The following is an illustrative call flow for a cancellation of a broadcast on a GSM and UMTS system.

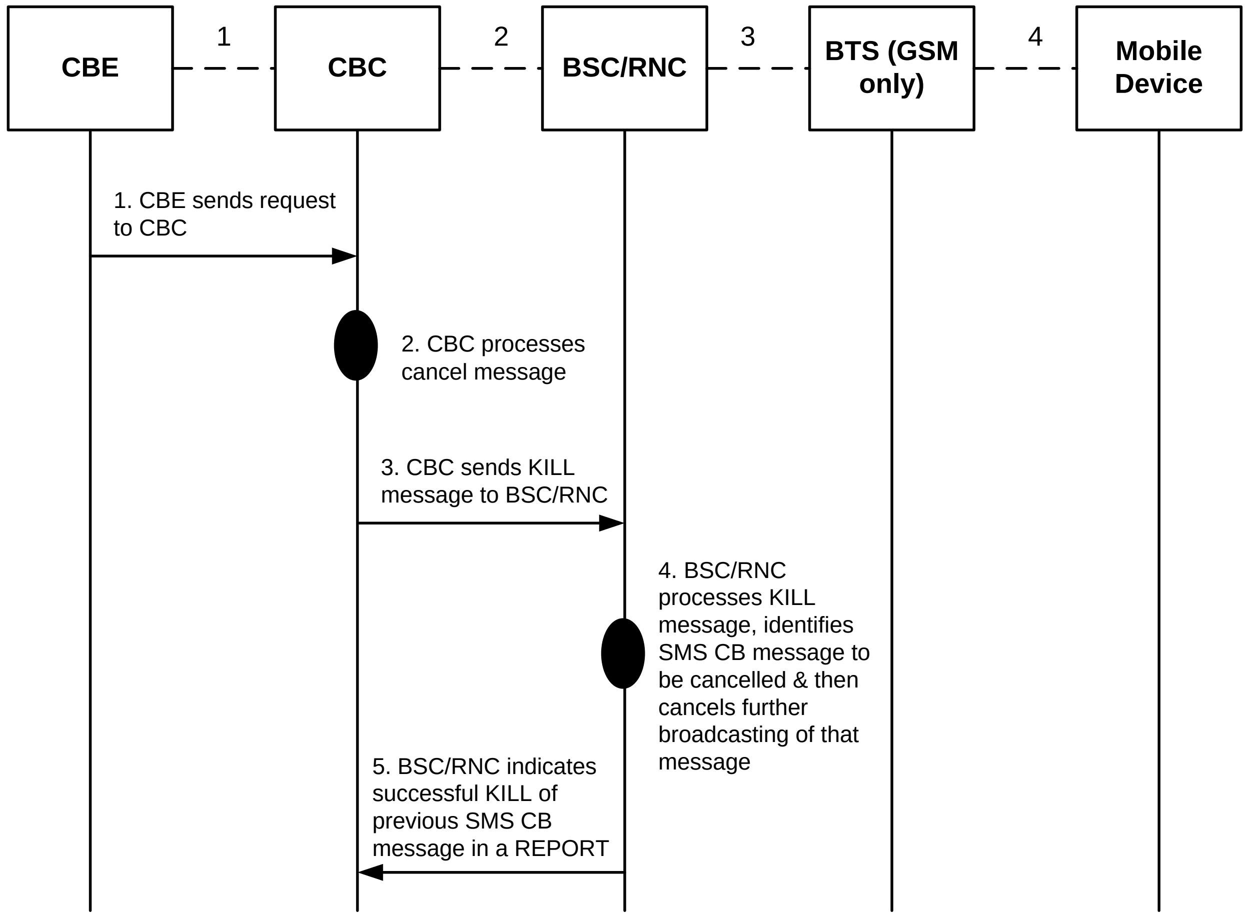

Figure 6: Call flow for Cancellation of Broadcast Message on GSM and UMTS

1. The CBE (e.g., CMSP Gateway) sends a cancel Cell Broadcast request to the CBC. This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
2. The CBC receives the broadcast cancellation request and associates the request with a currently active Cell Broadcast message that is being broadcast. The CBC uses the cell list from the original Cell Broadcast message as the cell list for the cancellation.
3. The CBC generates a Cell Broadcast KILL primitive and sends this message to each Base Station Controller (BSC) and/or Radio Network Controller (RNC) that controls cell sites within the target area of the original Cell Broadcast message broadcast. Each BSC and/or RNC receives the KILL indication from the CBC and validates the message
4. The BSCs and/or RNCs processes the KILL primitive, and terminates broadcasting of the original Cell Broadcast message associated with the cancellation request, and clears all information regarding the original Cell Broadcast message.
5. The BSC/RNC returns a REPORT primitive to the CBC indicating successful receipt and processing of the KILL primitive indicating the broadcast of the Cell Broadcast message associated with the cancellation request has been suspended.

6.2 DRX Mode in GSM Networks

This clause contains call flows for GSM networks that illustrate the activation of DRX mode of operation along with the broadcasting of periodic Schedule Messages and then the broadcasting of a new SMS CB messages with various repetition periods. The call flows in this clause are illustrative of 3GPP TS 23.041 [Ref 1], 3GPP TS 44.012 [Ref 3], and 3GPP TS 48.058 [Ref 11]. It is not the intent of this specification to modify or enhance those 3GPP specifications. The following call flows are included in this clause:

- Activation of DRX mode and broadcasting of periodic schedule message with SMS Broadcast Request and SMS Broadcast Command messages.
- New SMS CB Message with a Repetition Period less than the Schedule period with SMS Broadcast Request and SMS Broadcast Command messages.
- New SMS CB Message with a Repetition Period same as the Schedule period with SMS Broadcast Request and SMS Broadcast Command messages.
- New SMS CB Message with a Repetition Period greater than the Schedule period with SMS Broadcast Request and SMS Broadcast Command messages.

In all the call flows, it is assumed that the Schedule Period consists of 31 message slots. In other words, up to 31 SMS CB message pages can be broadcast within one Schedule Period plus the periodic Schedule Message sent at the beginning of every Schedule Period.

6.2.1 Activation of DRX Mode of Operation and Broadcasting of Periodic Schedule Message

When the BSC receives a message (Set DRX Mode) from the CBC to activate the DRX mode of operation, BSC starts broadcasting of the Schedule Message periodically as per the Schedule Period indicated within the Set DRX Mode message.

6.2.1.1 GSM Network Using SMS Broadcast Request Messages

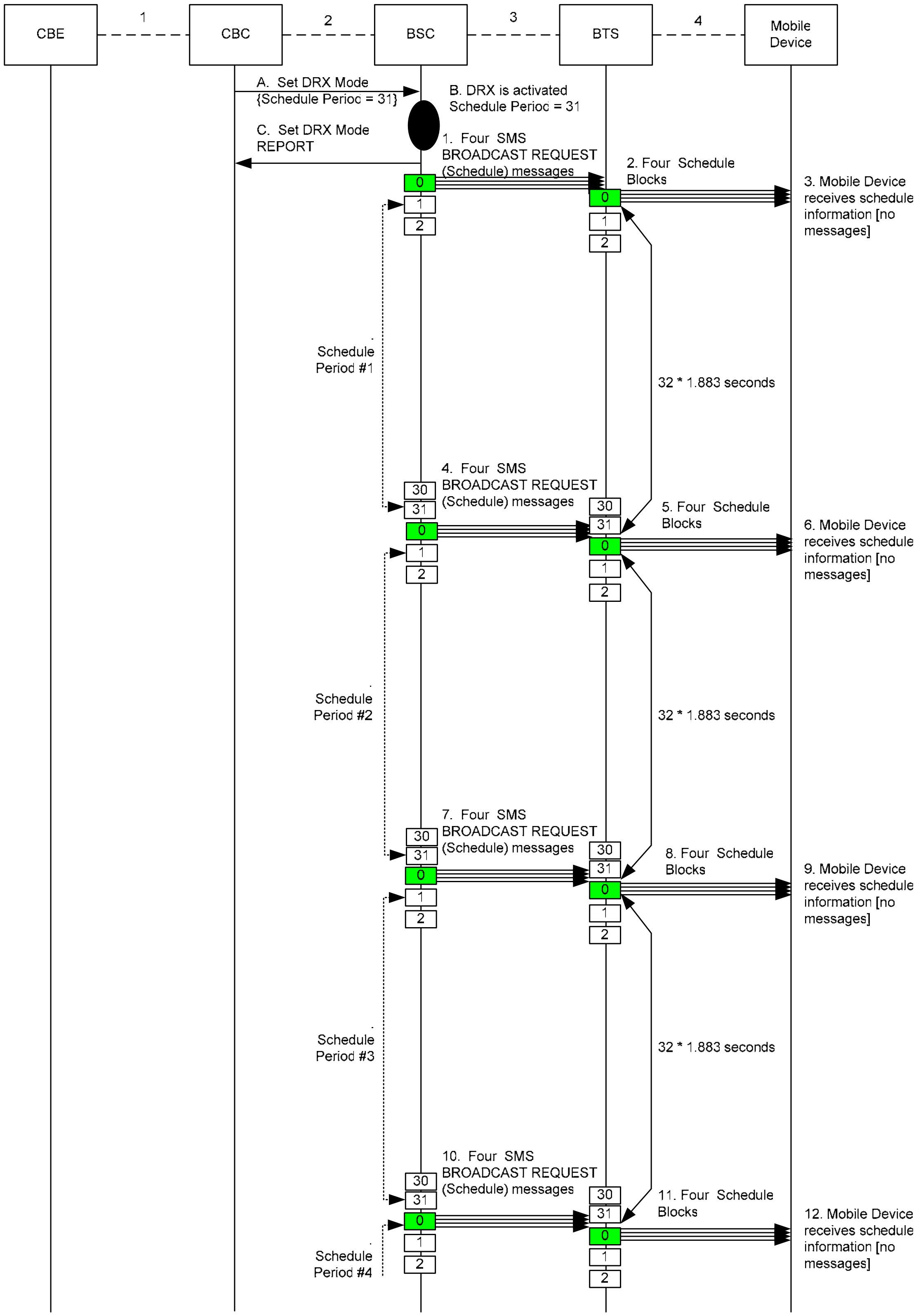

Figure 7: Schedule Message (GSM with SMS Broadcast Request)

Activation of DRX Mode

As an alternative mechanism, the DRX mode might be activated within the BSC using the OAM&P interface similar to the methods described in 3GPP TR 25.925 [Ref 4] for the RNC. In this case, steps A, B, and C do not apply. The following methods are described in 3GPP TS 23.041 [Ref 1].

CBC activates the DRX mode by sending the Set DRX Mode message to the BSC. Within the message, the CBC indicates the Schedule Period (in this example flow, the chosen schedule period is 31 message slots).

BSC receives the Set DRX Mode message and activates the DRX mode of operation. Periodically, broadcasts the Schedule Messages at the beginning of every Schedule Period. The Schedule Message would indicate 1 as the Begin Slot Number and 31 as the End Slot number.

BSC acknowledges the reception of Set DRX Mode message using the Set DRX Mode Report message.

Schedule Period and Schedule Messages

First Schedule Period (no messages):

1. BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS, after receiving all 4 of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving a complete (i.e., 4 blocks of) Schedule Message enter the DRX mode of operation. NULL messages have no impact on the mobile devices. In other words, the mobile devices operating in a DRX mode may not even look at those free slots in which the NULL messages were broadcast.

Second Schedule Period (no messages):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots.
6. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

Third Schedule Period (no messages):

7. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
8. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots.
9. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

Fourth Schedule Period (no messages):

10. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
11. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots.
12. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

6.2.1.2 GSM Network Using SMS Broadcast Command Messages

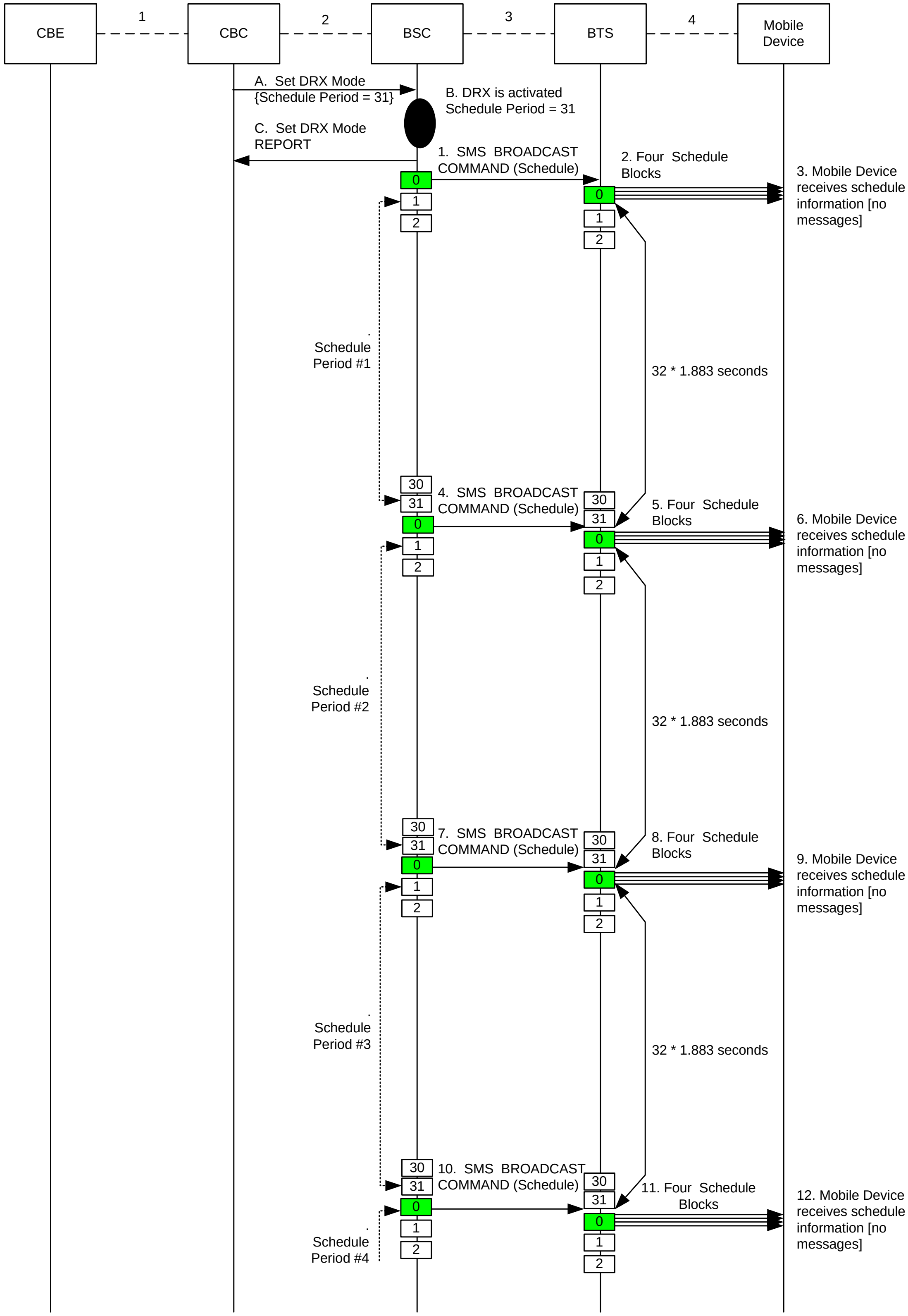

Figure 8: Schedule Message (GSM with SMS Broadcast Command)

Activation of DRX Mode

As an alternative mechanism, the DRX mode might be activated within the BSC using the OAM&P interface similar to the methods described in 3GPP TS 25.324 [Ref 5] for the RNC. In this case, steps A, B, and C do not apply. The following methods are described in 3GPP TS 23.041 [Ref 1].

A. CBC activates the DRX mode by sending the Set DRX Mode message to the BSC. Within the message, the CBC indicates the Schedule Period (in this example flow, the chosen schedule period is 31 message slots).

B. BSC receives the Set DRX Mode message and activates the DRX mode of operation. Periodically, broadcasts the Schedule Messages at the beginning of every Schedule Period. The Schedule Message would indicate that 1 as the Begin Slot Number and 31 as the End Slot number.

C. BSC acknowledges the reception of Set DRX Mode message using the Set DRX Mode Report message.

Schedule Period and Schedule Messages

First Schedule Period (no messages):

1. BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving a complete (i.e., 4 blocks of) Schedule Message enter the DRX mode of operation. NULL messages have no impact on the mobile devices. In other words, the mobile devices operating in a DRX mode may not even look at those free slots in which the NULL messages were broadcast.

Second Schedule Period (no messages):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
5. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
6. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not

read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

Third Schedule Period (no messages):

7. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
8. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
9. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

Fourth Schedule Period (no messages):

10. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
11. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
12. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

6.2.2 New SMS CB Message with Repetition Period less than Schedule period

In these examples, the repetition period happens to be less than the Schedule Period. As a result, the SMS CB message will have to be broadcast more than once within the Schedule Period. The flows assume a repetition period of 16 message slots (i.e., approximately about 30 seconds) and hence, the SMS CB message broadcast twice within a Schedule Period.

6.2.2.1 GSM Network Using SMS Broadcast Request Messages

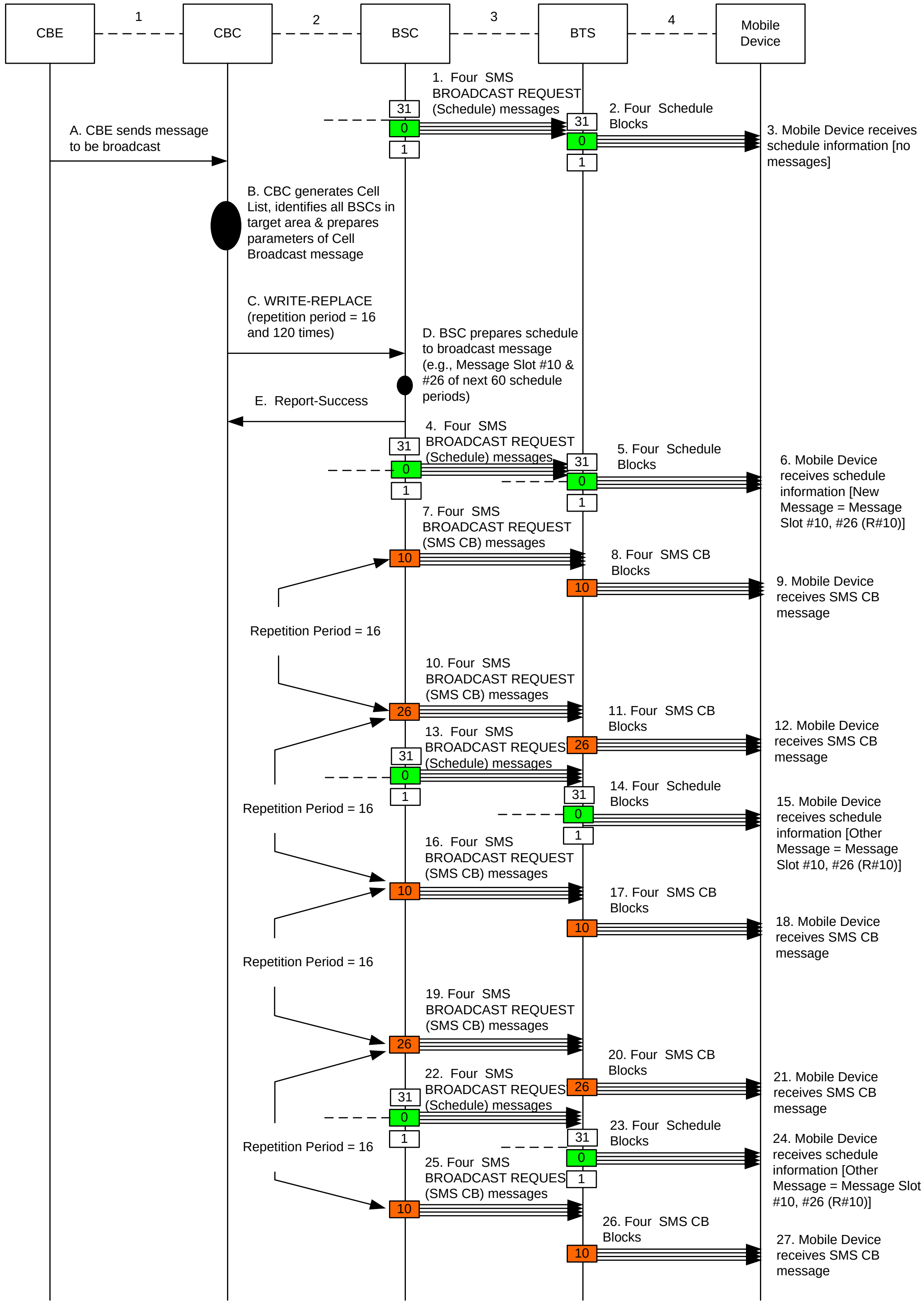

Figure 9: New SMS CB Message (GSM with SMS Broadcast Request) with Short Repetition Periods

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message, continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

A new Cell Broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 16 slots (approximately 30 seconds) and the number of broadcasts to be performed is 60 (i.e., approximately for a duration of 30 minutes). The BSC prepares the schedules in such a way that the SMS CB message is broadcast in Message Slots 10 and 26 in every Schedule Period for the next 60 Schedule Periods.

E. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Broadcasting of new SMS CB message over the air interface in a DRX mode

First Schedule Period (New Message on Message Slot #10 and repeated on Message Slot #26):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 26 contain new messages with a further indication implying that the new message in Message Slot 26 is a repeated message from message slot number 10.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 26.
6. Mobile devices receive the Schedule Message and understand that Message Slots 10 and 26 have new SMS CB messages and the Message Slot 26 has the repeated Message from Message Slot 10. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10 and may read the message on the Message Slot 26.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
8. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.
10. When the time that corresponds to the Message Slot 26 occurs (which may occur much before the time delay of 26*1.883 seconds from the previously sent scheduled Schedule Message due to a previously received CBCH Load Indication (underflow) message or may be a case of immediate sending when a new CBCH Load Indication (underflow) is received from the BTS), the BSC sends the SMS CB message carrying the Cell Broadcast message to the BTS using 4 SMS BROADCAST REQUEST messages.
11. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 26 (i.e., 26 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
12. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Second Schedule Period (Other Message on Message Slot #10 and repeated on Message Slot #26):

13. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that there are no new messages, but the Message Slots 10 and 26 contain the old messages (i.e., Other Messages) with a further indication implying that the old message in Message Slot 26 is a repeated message from message slot number 10.
14. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 26.
15. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 26 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 26.
16. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
17. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the broadcast message.
19. When the time that corresponds to the Message Slot 26 occurs (which may occur much before the time delay of 26*1.883 seconds from the previously sent scheduled Schedule Message due to a previously received CBCH Load Indication (underflow) message or may be a case of immediate sending when a new CBCH Load Indication (underflow) is received from the BTS), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
20. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 26 (i.e., 26 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

21. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Third Schedule Period (Other Message on Message Slot #10 and repeated on Message Slot #26):

22. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that there are no new messages, but the Message Slots 10 and 26 contain the old messages (i.e., Other Messages) with a further indication implying that the old message in Message Slot 26 is a repeated message from message slot number 10.
23. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages on the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 26.
24. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 26 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 26.
25. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
26. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
27. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

6.2.2.2 GSM Network Using SMS Broadcast Command Messages

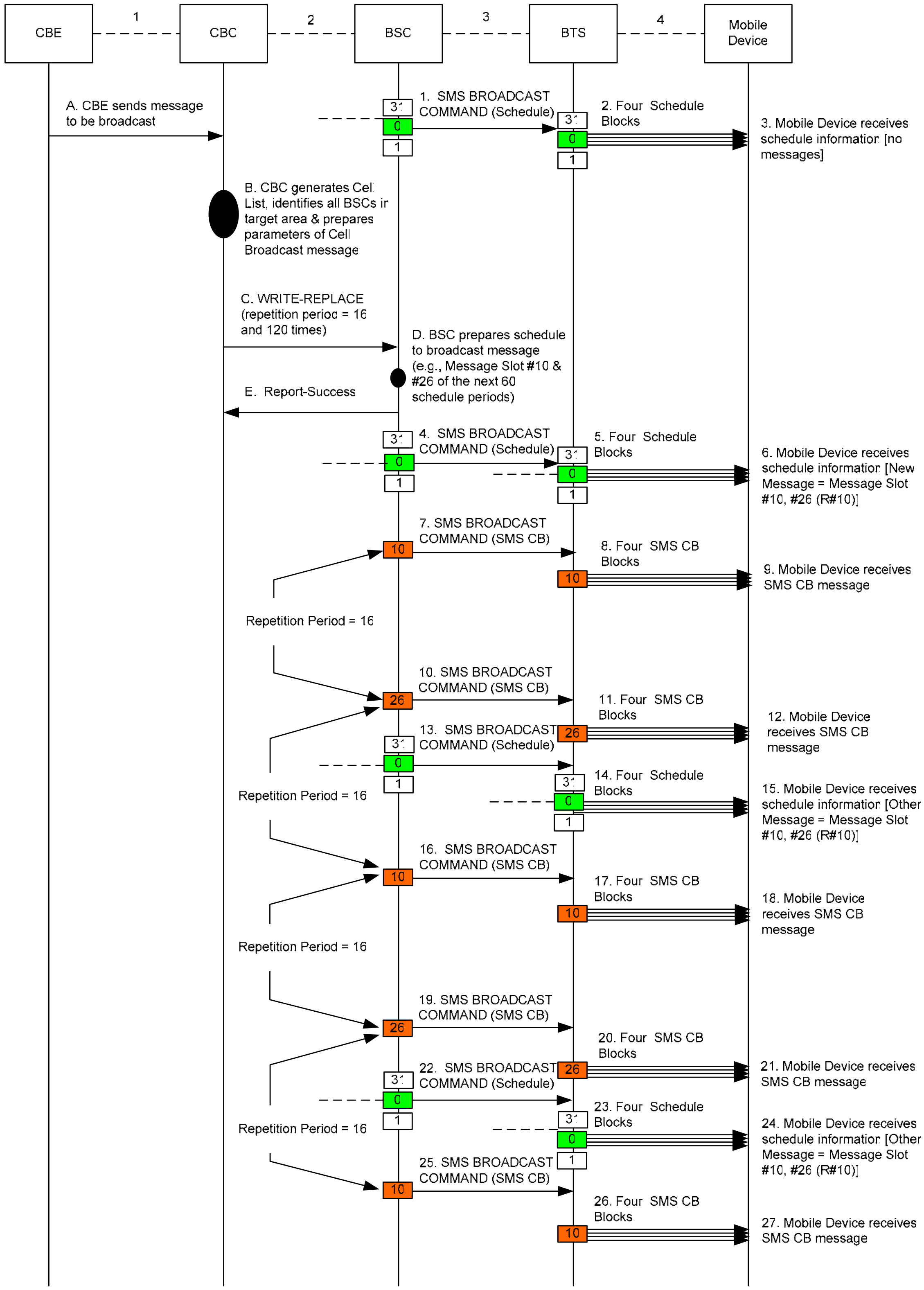

Figure 10: New SMS CB Message (GSM with SMS Broadcast Command) with Short Repetition Periods

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 16 slots (approximately 30 seconds) and the number of broadcasts to be performed is 60 (i.e., approximately for a duration of 30 minutes). The BSC prepares the schedules in such a way that the SMS CB message is broadcast in message slots 10 and 26 in every Schedule Period for the next 60 Schedule Periods.

E. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

<u>Broadcasting of new SMS CB message over the air interface in a DRX mode</u>

First Schedule Period (New Message on Message Slot #10 and repeated on Message Slot #26):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 26 contain new messages with a further indication implying that the new message in Message Slot 26 is a repeated message from message slot number 10.
5. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with “underflow” as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slots 10 and 26.
6. Mobile devices receive the Schedule Message and understand that Message Slots 10 and 26 have new SMS CB messages and the Message Slot 26 has the repeated Message from Message Slot 10. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10 and may read the message on the Message Slot 26.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
8. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.
10. When the time that corresponds to the Message Slot 26 occurs (which may occur much before the time delay of 26*1.883 seconds from the previously sent scheduled Schedule Message due to a previously received CBCH Load Indication (underflow) message or may be a case of immediate sending when a new CBCH Load Indication (underflow) is received from the BTS), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
11. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 26 (i.e., 26 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
12. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Second Schedule Period (Other Message on Message Slot #10 and repeated on Message Slot #26):

13. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND messages to the BTS. In this Schedule Message, the BSC would indicate that there are no new messages, but the Message Slots 10 and 26 contain the old messages (i.e., Other Messages) with a further indication implying that the old message in Message Slot 26 is a repeated message from message slot number 10.
14. BTS receives the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slots 10 and 26.
15. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 26 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 26.
16. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
17. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.
19. When the time that corresponds to the Message Slot 26 occurs (which may occur much before the time delay of 26*1.883 seconds from the previously sent scheduled Schedule Message due to a previously received CBCH Load Indication (underflow) message or may be a case of immediate sending when a new CBCH Load Indication (underflow) is received from the BTS), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
20. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 26 (i.e., 26 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
21. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Third Schedule Period (Other Message on Message Slot #10 and repeated on Message Slot #26):

22. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND messages to the BTS. In this Schedule Message, the BSC would indicate that there are no new messages, but the Message Slots 10 and 26 contain the old messages (i.e., Other Messages) with a further indication implying that the old message in Message Slot 26 is a repeated message from message slot number 10.
23. BTS receives the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slots 10 and 26.
24. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 26 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 26.
25. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
26. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
27. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

6.2.3 New SMS CB Message with Repetition Period same as Schedule period

In these examples, the repetition period happens to be same as the Schedule Period. As a result, the SMS CB message will have to be broadcast once in every Schedule Period. The flows assume a repetition period of 32 message slots (i.e., approximately about 60 seconds).

6.2.3.1 GSM Network Using SMS Broadcast Request Messages

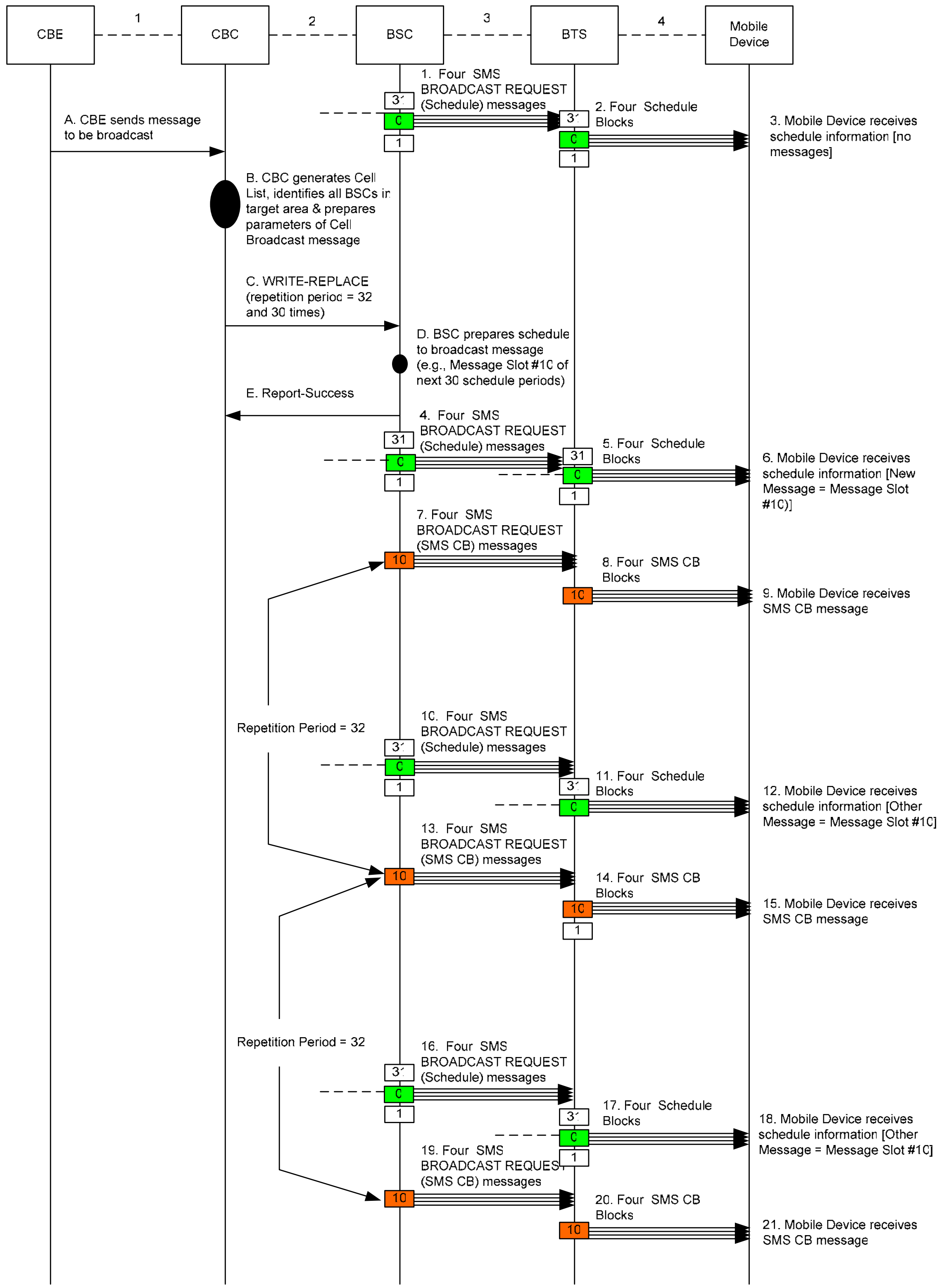

Figure 11: New SMS CB Message (GSM with SMS Broadcast Request) with Repetition Periods Same as Schedule Periods

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

A broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, on call flows repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 32 slots (approximately 1 minute) and the number of broadcasts to be performed is 30 (i.e., approximately for a duration of 30 minutes). The BSC prepares the schedules in such a way that the SMS CB message is broadcast in Message Slot 10 in every Schedule Period for the next 30 Schedule Periods.

E. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Broadcasting of new SMS CB message over the air interface in a DRX mode

First Schedule Period (New Message on Message Slot #10):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the new message.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
6. Mobile devices receive the Schedule Message and understand that Message Slot 10 has the new SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
8. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Second Schedule Period (Other Message on Message Slot #10):

10. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the old message (i.e., Other Messages).
11. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.

12. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slot 10 has the old SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB message in Message Slot 10.
13. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
14. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
15. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Third Schedule Period (Other Message on Message Slot #10):

16. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the old message (i.e., Other Messages).
17. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
18. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slot 10 has the old SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB message in Message Slot 10.
19. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
20. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds

after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

21. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

6.2.3.2 GSM Network Using SMS Broadcast Command Messages

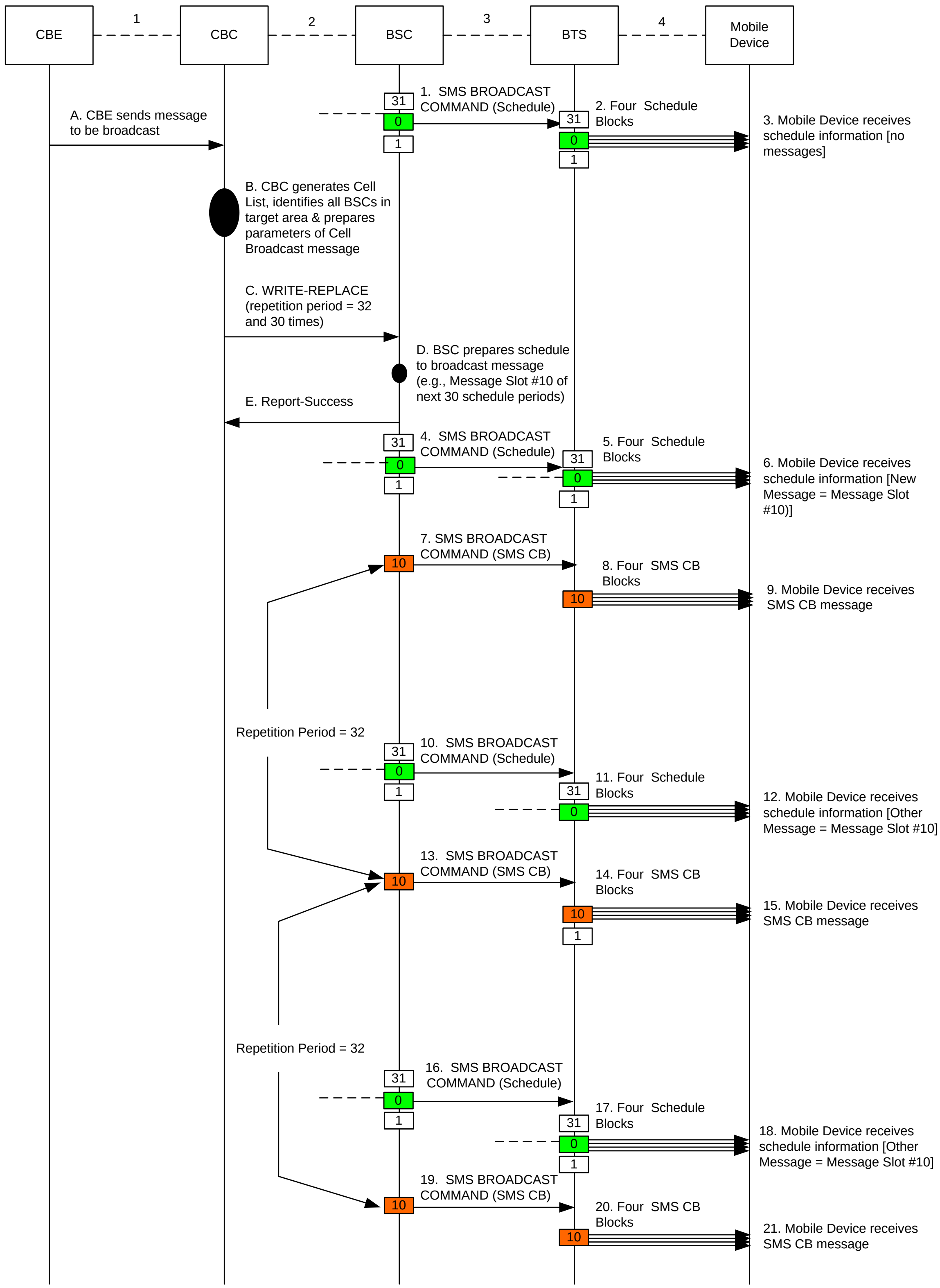

Figure 12: New SMS CB Message (GSM with SMS Broadcast Command) with Repetition Periods Same as Schedule Periods

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, on call flows repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 32 slots (approximately 1 minute) and the number of broadcasts to be performed is 30 (i.e., approximately for a duration of 30 minutes). The BSC prepares the schedules in such a way that the SMS CB message is broadcast in Message Slot 10 in every Schedule Period for the next 30 Schedule Periods.

E. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Broadcasting of new SMS CB message over the Air interface in a DRX mode

First Schedule Period (New Message on Message Slot #10):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the new message.
5. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
6. Mobile devices receive the Schedule Message and understand that Message Slot 10 has the new SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
8. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Second Schedule Period (Other Message on Message Slot #10):

10. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the old message (i.e., Other Messages).
11. BTS receives the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.

12. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slot 10 has the old SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB message in Message Slot 10.
13. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
14. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
15. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Third Schedule Period (Other Message on Message Slot #10):

16. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the old message (i.e., Other Messages).
17. BTS receives the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
18. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slot 10 has the old SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and may read the SMS CB message in Message Slot 10.
19. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
20. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of

the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

21. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

6.2.4 New SMS CB Message with Repetition Period greater than Schedule period

In these examples, the repetition period happens to be greater than the Schedule Period. As a result, the SMS CB message will not be broadcast in some of the Schedule Periods. The flows assume a repetition period of 64 message slots (i.e., approximately about 120 seconds) and hence the SMS CB message is broadcast in alternate Schedule Periods

6.2.4.1 GSM Network Using SMS Broadcast Request Messages

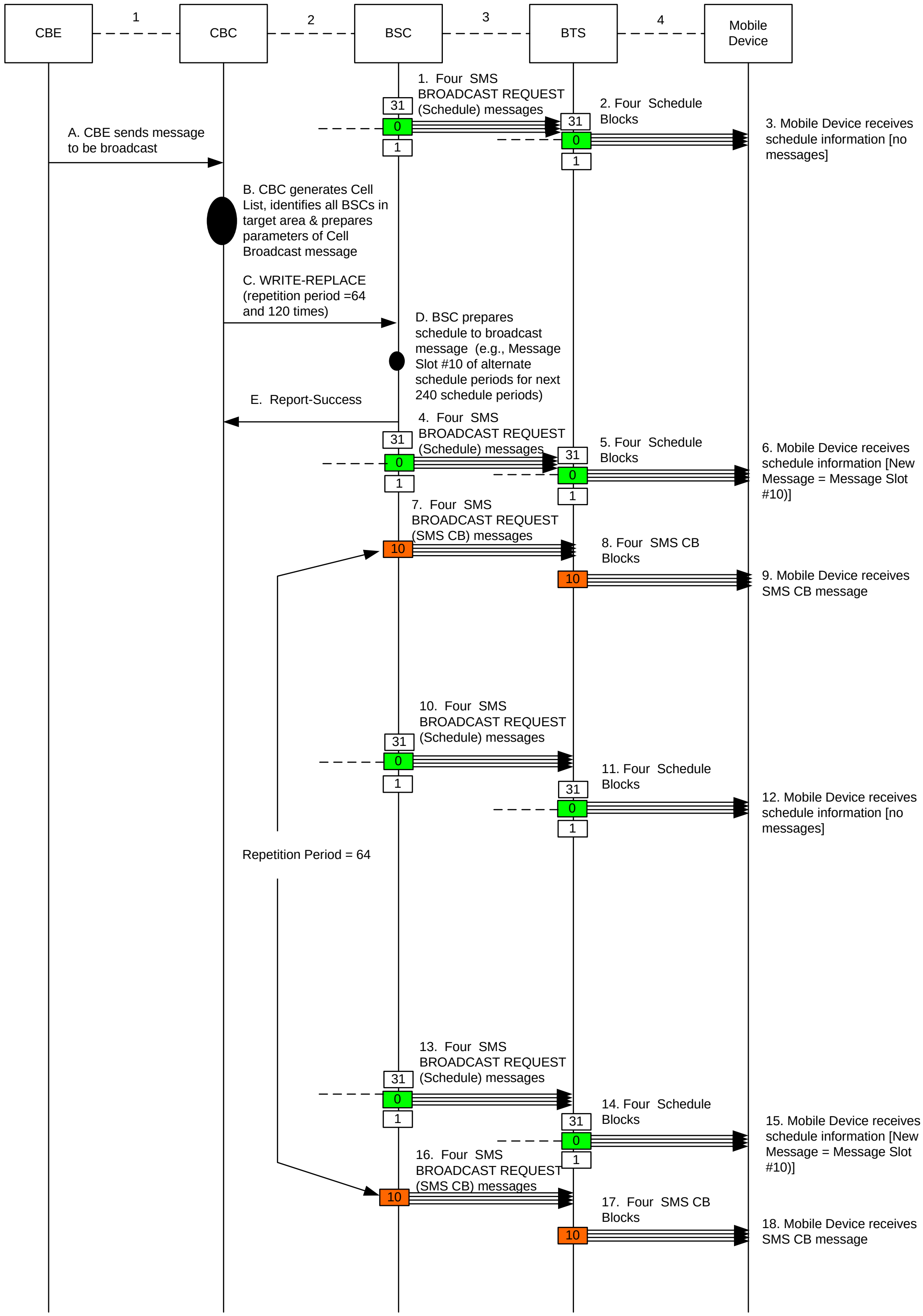

Figure 13: New SMS CB Message (GSM with SMS Broadcast Request) with Large Repetition Periods

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 64 slots (approximately 2 minutes) and the number of broadcasts to be performed is 120 (i.e., approximately for a duration of 4 hours). The BSC prepares the schedules in such a way that the SMS CB message is broadcast in Message Slot 10 in the alternate Schedule Period for the next 240 Schedule Periods.

E. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Broadcasting of new SMS CB message over the Air interface in a DRX mode

First Schedule Period (New Message on Message Slot #10):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the new message.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
6. Mobile devices receive the Schedule Message and understand that Message Slot 10 has the new SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
8. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Second Schedule Period (No Messages):

10. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that there are no messages in any of the Message Slots.
11. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
12. Mobile devices receive the Schedule Message and understand that no new SMS CB (or old SMS CB) messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode.

Third Schedule Period (New Message on Message Slot #10):

13. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the new message.
14. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
15. Mobile devices receive the Schedule Message and understand that Message Slot 10 has the new SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10.
16. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using 4 SMS BROADCAST REQUEST messages.
17. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

6.2.4.2 GSM Network Using SMS Broadcast Command Messages

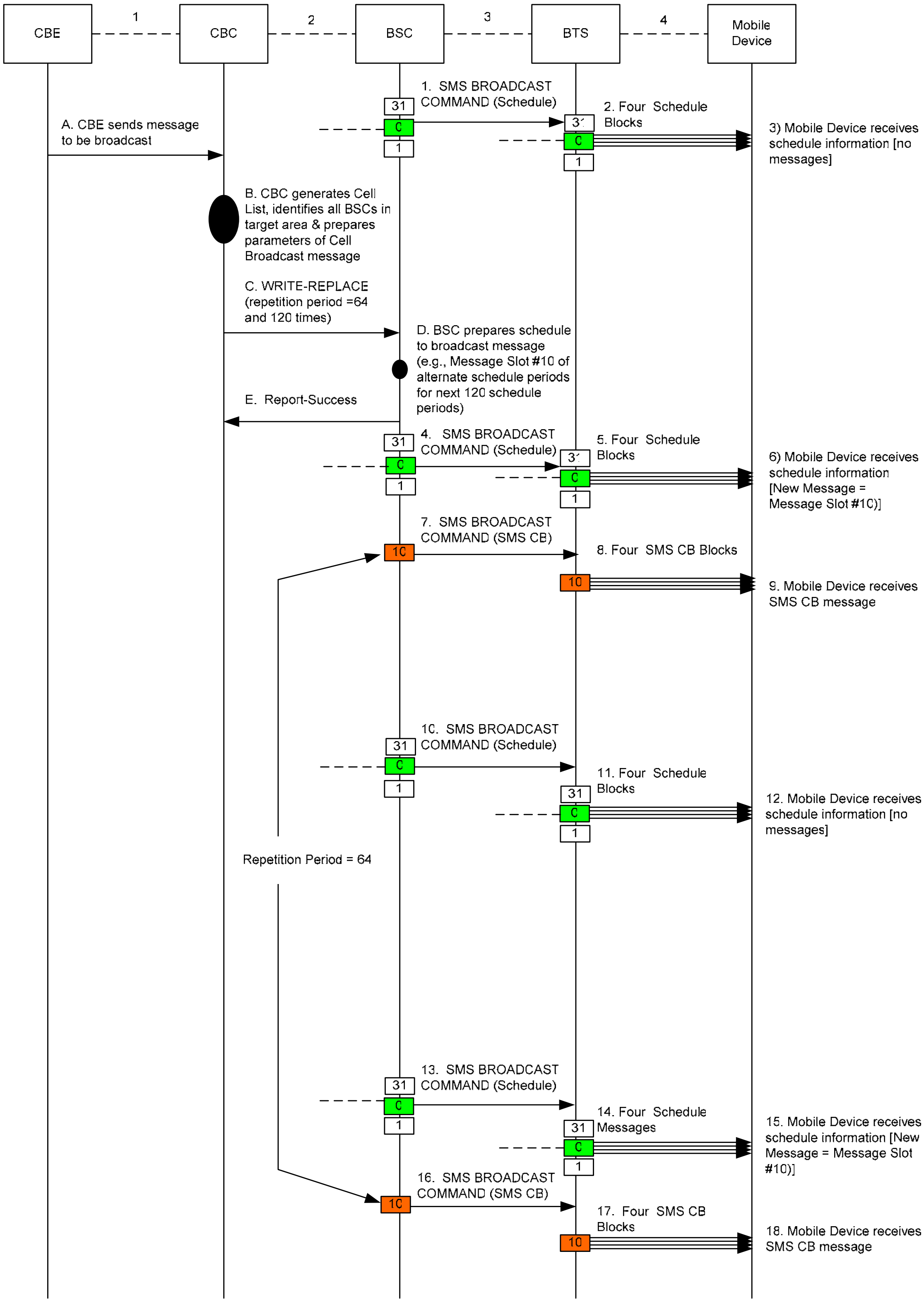

Figure 14: New SMS CB Message (GSM with SMS Broadcast Command) with Large Repetition Periods

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no new SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. CBC sends the constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 64 slots (approximately 2 minutes) and the number of broadcasts to be performed is 120 (i.e., approximately for a duration of 4 hours). The BSC prepares the schedules in such a way that the SMS CB message is broadcast in Message Slot 10 in the alternate Schedule Period for the next 240 Schedule Periods.

E. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Broadcasting of new SMS CB message over the Air interface in a DRX mode

First Schedule Period (New Message on Message Slot #10):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the new message.
5. BTS receives the SMS BROADCAST COMMAND message and broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
6. Mobile devices receive the Schedule Message and understand that Message Slot 10 has the new SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
8. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

Second Schedule Period (No Messages):

10. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND messages to the BTS. In this Schedule Message, the BSC would indicate that there are no messages in any of the Message Slots.
11. BTS receives the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
12. Mobile devices receive the Schedule Message and understand that no new SMS CB (or old SMS CB) messages are expected during the next 31 message slot period. The mobile devices, upon receiving the renewed Schedule Message continue to operate in the DRX mode.

Third Schedule Period (New Message on Message Slot #10):

13. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slot 10 contains the new message.
14. BTS receives the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the message available in order to broadcast the same over the air in Message Slot 10.
15. Mobile devices receive the Schedule Message and understand that Message Slot 10 has the new SMS CB message. The mobile devices, upon receiving this Schedule Message continue to operate in the DRX mode and would read the SMS CB message in Message Slot 10.
16. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the SMS CB message carrying the Cell Broadcast message data to the BTS using a SMS BROADCAST COMMAND message.
17. BTS receives the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive the complete SMS CB message containing the Cell Broadcast message.

6.3 DRX Mode in UMTS Networks

This clause contains call flows for UMTS networks that illustrate the activation of DRX mode of operation along with the broadcasting of periodic Schedule Messages and then the broadcasting of a new SMS CB messages with various repetition periods. The call flows in this clause are illustrative of 3GPP TS 23.041 [Ref 1], 3GPP TS 25.419 [Ref 2], and 3GPP TS 25.324[Ref 5]. It is not the intent of this specification to modify or enhance those 3GPP specifications. The following call flows are included in this clause:

- Activation of DRX mode and broadcasting of periodic schedule message.
- Cell Broadcast message repeated within schedule period.
- Repetition period half of repetition period of schedule message in idle mode.
- New SMS Cell Broadcast messages with large repetition periods.

Within an UMTS network, the logical channel used to transmit the Cell Broadcast messages is known as Common Traffic Channel (CTCH) and the consecutive radio frames in a time-interval associated to the CTCH is known as CTCH Block Set (CTCH BS) The CTCH BS is independently addressed within the network and the mobile device using the CTCH BS Index (range 1 to 256). The assignment of System Frames to CTCH Block Sets is done using the following algorithm:

- M_{TTI}: Number of radio frames in the TTI of the FACH used for CTCH.
- N: Period of CTCH allocation on S-CCPCH, integer number of radio frames.
  - o $M_{TTI} \leq N \leq MaxSFN - K$.
    - Where N is a multiple of M_{TTI} (see TS 25.212 [Ref 6] and 3GPP TS 25.222 [Ref 7]).
- MaxSFN: Maximum system frame number = 4096 (see 3GPP TS 25.402 [Ref 8]).
- K: CBS frame offset, integer number of radio frames $0 \leq K \leq N-1$.
    - Where K is a multiple of M_{TTI}.
- First System Frame Number (SFN) associated with a CTCH BS Index.
  $SFN_{FirstFrame} = K + mN$.
  - Where m = 0 to M.
  - Where M is an integer that is less than or equal to (MaxSFN – K)/N.

In the call flow examples illustrated in this clause, MaxSFN is equal to 4096, K = 0, N = 16. The following table illustrates the CTCH BS Index to SFN mapping:

Table 2: Example Mapping of CTCH BS Index to SFN

CTCH BS INDEX	SFN	CTCH BS INDEX	SFN	CTCH BS INDEX	SFN	CTCH BS INDEX	SFN
1	0, 1	2	16, 17	3	32, 33	4	48, 49
:	:	:	:	:	:	:	:
101	1600, 1601	102	1616, 1617	103	1632, 1633	104	1648, 1649
:	:	:	:	:	:	:	:
201	3200, 3201	202	3216, 3217	203	3232, 3233	204	3248, 3249
:	:	:	:	:	:	:	:
252	4032, 4033	254	4048, 4049	255	4064, 4065	256	4080, 4081

The values of K and N, referred to as DRX Level 1 information, are supplied to the mobile device in the System Level Information. This allows the mobile device to have its own mapping of SFNs to the CTCH BS Index values.

6.3.1 Activation of DRX Mode and Broadcasting of Periodic Schedule Message

Within an UMTS network, a schedule period can be as large as 40.96 seconds or as small as the time required to transmit a Schedule Message. Even with smaller schedule periods, the time-difference between two Schedule Messages can still be maintained at 40.96 seconds. The Schedule Message indicates where the next schedule period begins and how long the schedule period is. The Schedule Message can be sent any where within the Schedule Period. As and when new messages have to be broadcast, the schedule period can be adjusted so as to accommodate the broadcasting of those new messages.

The call flow example considered here assumes that Schedule Message is transmitted once in 32 seconds with a schedule period of 4 CTCH Block Sets.

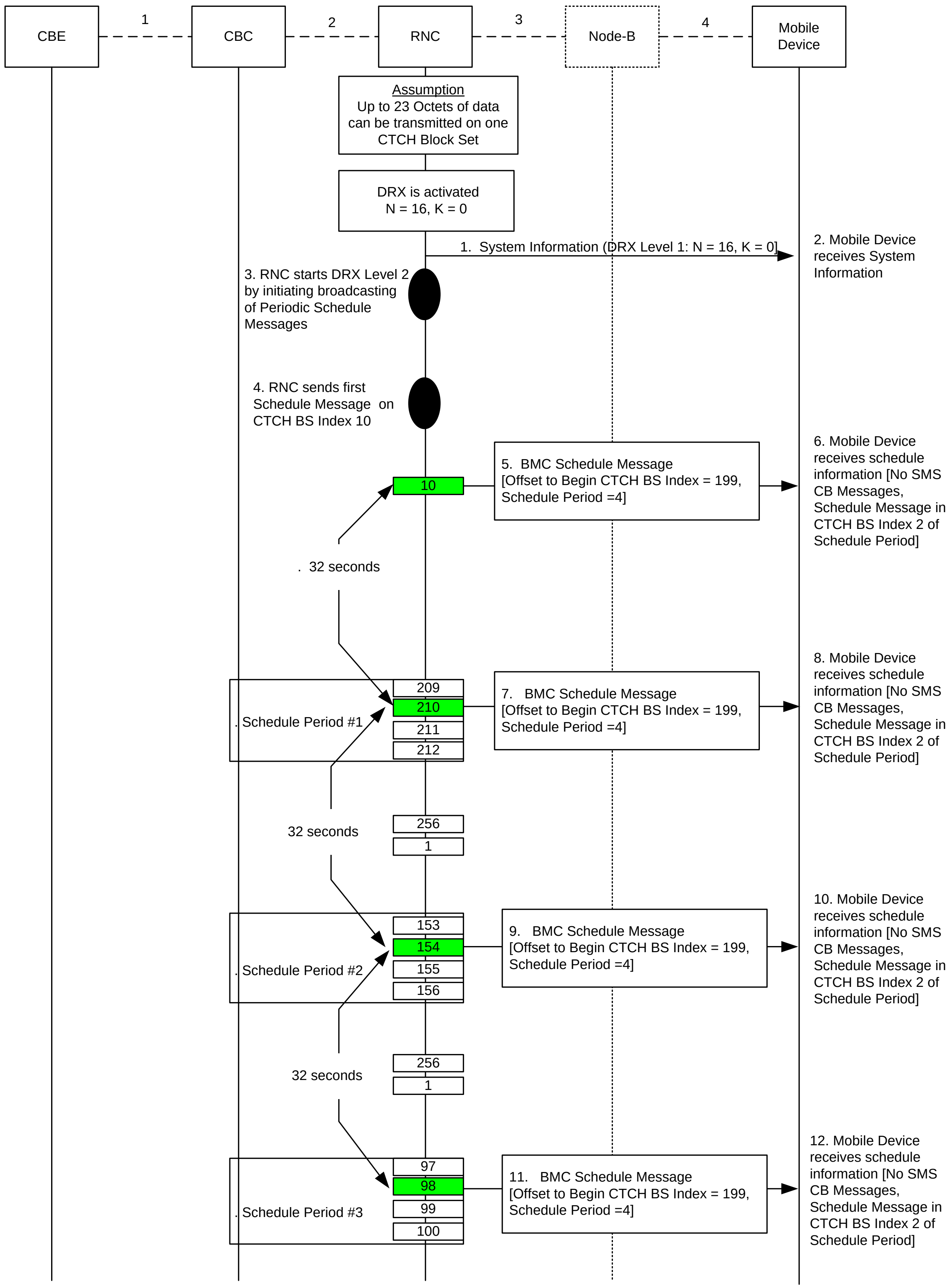

Figure 15: Broadcasting of Periodic Schedule Messages (UMTS)

The call flow assumes that the message transmitted in each of the CTCH Block Set is able to carry up to 23 octets of the data. This would mean that in order to transmit 90 octets of data (the approximate size of 1 page of a CBS message), 4 CTCH Block Sets are required. Also, the call flow assumes the following the DRX level 1 parameters: N = 16 and K = 0. The value of N = 16, means that the first SFN of the two consecutive CTCH Block Sets are separated by 16 radio frames (or 160 ms). So, for example, a 32 second of repetition period can be realized if the messages are transmitted on the CTCH Block Sets whose Index values are separated by 200.

In the example shown, a Schedule Message is repeated once every 200 CTCH Block Sets (or 32 seconds) and each Schedule Period consists of 4 CTCH Block Sets. Note that the index of a CTCH Block Set known to the RNC can be different from the index of the same CTCH Block Set known to the mobile device. The absolute CTCH Block Set Index values referenced below are from an RNC's perspective.

DRX Level 1 Information:

1. When the DRX mode of operation is activated, the RNC sends the DRX level 1 parameters (the values of N and K) to all mobile devices in the System Information message.
2. Mobile device receives the DRX level 1 parameters in the System Level Information message and understands the radio frames associated with the CTCH Block Sets.

DRX Level 2 Information (unscheduled Schedule Message):

3. The RNC starts the DRX level 2 by initiating the broadcasting of periodic Schedule Messages.
4. The RNC sends the first Schedule Message as an unscheduled message. In the example, the CTCH BS Index 10 is used to broadcast the first Schedule Message.
5. The RNC broadcasts the Schedule Message in the CTCH BS Index 10 using the BMC Schedule Message. In the example, the Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 10 + 199 (i.e., = 209). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. In the example, the CTCH BS Index values of the next Schedule Period would be (from an RNC's perspective): 209, 210, 211, and 212. The Schedule Message also indicates that there are no SMS messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 210 is used to send the next Schedule Message.
6. The mobile device which had not received any previous Schedule Messages is monitoring all the CTCH Block Sets and thus receives the BMC Schedule Message. Note that the RNC had sent the Schedule Message in CTCH BS Index 10, but the index value of the corresponding CTCH Block Set at the mobile device can be different from 10. The absolute CTCH BS Index used to send the current Schedule Message is not of important in a RNC-Mobile Device communication. The Schedule Message gives information about the next Schedule Period using the relative CTCH BS Index values. On receiving this Schedule Message, the mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which this particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC

at the relative CTCH BS Index 2 (i.e., the second CTCH Block Set) of the next Schedule Period. The mobile device thus stops reading all the remaining CTCH Block Sets and would read the second CTCH Block Set of the next Schedule Period.

First Schedule Period:

7. The RNC broadcasts the next Schedule Message in the CTCH BS Index 210 (i.e., second CTCH Block Set of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 210 + 199 (i.e., 153, derived from 409 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. In the example, the CTCH BS Index values of the next Schedule Period would be (from an RNC's perspective): 153, 154, 155, and 156. The Schedule Message also indicates that there are no SMS messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 154 is used to send the next Schedule Message.
8. The mobile device which was previously told that the next Schedule Message would be sent in the second CTCH Block Set of the next Schedule Period thus receives the BMC Schedule Message. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 (i.e., the second CTCH Block Set) of the next Schedule Period.

Second Schedule Period:

9. The RNC broadcasts the next Schedule Message in the CTCH BS Index 154 (i.e., second CTCH Block Set of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 154 + 199 (i.e., = 97, derived from 353 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. In the example, the CTCH BS Index values of the next Schedule Period would be (from an RNC's perspective): 97, 98, 99, and 100. The Schedule Message also indicates that there are no SMS messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 98 is used to send the next Schedule Message.
10. The mobile device which was previously told that the next Schedule Message would be sent in the second CTCH Block Set of the next Schedule Period thus receives the BMC Schedule Message. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message

would be sent by the RNC at the relative CTCH BS Index 2 (i.e., the second CTCH Block Set) of the next Schedule Period.

Third Schedule Period:

11. The RNC broadcasts the next Schedule Message in the CTCH BS Index 98 (i.e., second CTCH Block Set of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 98 + 199 (i.e., = 41, derived from 297 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. In the example, the CTCH BS Index values of the next Schedule Period would be (from an RNC's perspective): 41, 42, 43, and 44. The Schedule Message also indicates that there are no SMS messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 42 is used to send the next Schedule Message.
12. The mobile device which was previously told that the next Schedule Message would be sent in the second CTCH Block Set of the next Schedule Period thus receives the BMC Schedule Message. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 (i.e., the second CTCH Block Set) of the next Schedule Period.

6.3.2 CB Message Repeated Within Schedule Period

In this example, the repetition period is 8 seconds, and schedule period is about 10 seconds.

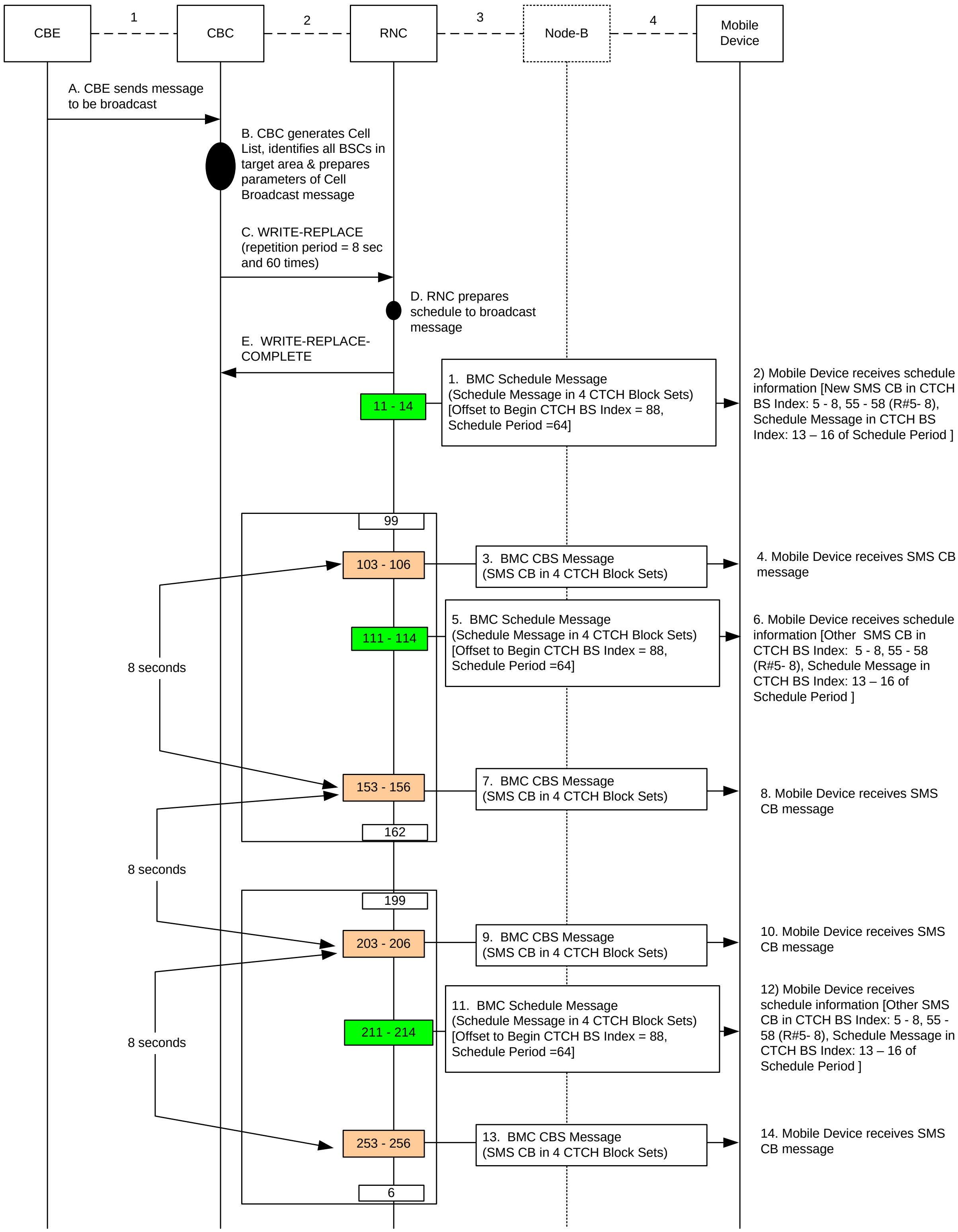

Figure 16: SMS CB Message Repeated Within Schedule Period

The call flow assumes that the message transmitted in each of the CTCH BS is able to carry up to 23 octets of the data. This would mean that in order to transmit 90 octets of data (the approximate size of 1 page of a CBS message), 4 CTCH Block Sets are required. Also, the call flow assumes the following the DRX level 1 parameters: N = 16 and K = 0. The value of N = 16, means that the first SFN of the two consecutive CTCH Block Sets are separated by 16 radio frames (or 160 ms). So, for example, an 8 second of repetition period can be realized if the messages are transmitted on the CTCH Block Sets whose Index values are separated by 50.

The example shown is a scenario where a Schedule Message is repeated once every 100 CTCH Block Sets (or 16 seconds) and each Schedule Period consists of 64 CTCH Block Sets (about 10 seconds). Since lot more octets (assumed to be around 90) are required to carry the information about the 64 CTCH Block Sets, the example assumes that 4 CTCH Block Sets are used to send one Schedule Message. The new SMS CB message carrying the Cell Broadcast message data is repeated once every 8 seconds which is less than the Schedule Period and hence, will have to be sent more than once within a Schedule Period. Note hat the index of a CTCH Block Set known to the RNC can be different from the index of the same CTCH Block Set known to the mobile device. The absolute CTCH BS Index values referenced below are from an RNC's perspective.

A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to each Radio Network Controller (RNC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 8 seconds and the number of broadcasts to be performed is 60 (i.e., approximately for a duration of 8 minutes).

E. RNC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Next Schedule Message (Mobile devices are notified of the new SMS CB message)

1. Based on a previously sent periodic Schedule Message, RNC sends the next Schedule Message on CTCH BS Index values 11 to 14 using the BMC Schedule Message. The Schedule Message

indicates that Offset to the Begin CTCH BS Index as 88 and the length of the Schedule Period as 64. The Offset to the Begin CTCH BS Index value of 88 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 11 + 88 (i.e., = 99). The Schedule Period of 64 would mean that the next Schedule Period would consist of 64 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 99 to 162. The Schedule Message also indicates that there is a new SMS CB message which would be sent at the relative CTCH BS Index 5 to 8 and 55 to 58 of the next Schedule Period, with a further indication implying that the new SMS CB message sent at the relative CTCH BS Index 55 to 58 would be a repetition of the new SMS CB message sent at the relative CTCH BS Index 5 to 8. From an RNC's perspective, this would mean that the new SMS CB message is sent in the CTCH BS Index 103 to 106 and repeated again in the CTCH BS Index 153 to 156 (note that the difference between 153 and 103 is 50 or 8 seconds). The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 13 to 16 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index values 111 to 114 are used to send the next Schedule Message.

2. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. Note that the RNC had sent the Schedule Message in CTCH BS Index 11 to 14, but the index values of the corresponding CTCH Block Sets at the mobile device can be different from 11 to 14. The absolute CTCH BS Index values used to send the current Schedule Message is not of important in a RNC-Mobile Device communication. The mobile device understands that the Offset to the Begin CTCH BS Index is 88 (i.e., the next Schedule Period begins at the CTCH BS Index 88 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 64 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 13 to 16 of the next Schedule Period. Furthermore, the mobile device understands that a new SMS CB message would be sent by the RNC at the relative CTCH BS Index values 5 to 8 and at 55 to 58 with a further indication that the SMS CB message sent at the relative CTCH BS Index 55 to 58 would be a repetition of the message sent at the relative CTCH BS Index 5 to 8.

<u>Subsequent Schedule Period 1(New SMS CB message broadcast twice)</u>

3. The RNC broadcasts the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective, in the CTCH BS Index 103 to 106) using the BMC CBS message.
4. The mobile device, which was previously given the schedule information, receives the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.
5. The RNC broadcasts the Schedule Message in the CTCH BS Index 111 to 114 (i.e., relative CTCH BS Index 13 to 16 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 88 and the length of the Schedule Period as 64. The Offset to the Begin CTCH BS Index value of 88 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 111 + 88 (i.e., = 199). The Schedule Period of 64 would mean that the next Schedule Period would consist of 64 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 199 to 6 (6 is derived from 262 modulo 256). The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS

CB messages would be sent (i.e., as Other SMS CB messages) at the relative CTCH BS Index 5 to 8 and 55 to 58 of the next Schedule Period, with a further indication implying that the Other SMS CB message sent at the relative CTCH BS Index 55 to 58 would be a repetition of the Other SMS CB message sent at the relative CTCH BS Index 5 to 8. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 203 to 206 and repeated again in the CTCH BS Index 253 to 256. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 13 to 16 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index values 211 to 214 are used to send the next Schedule Message.

6. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 88 (i.e., the next Schedule Period begins at the CTCH BS Index 88 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 64 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 13 to 16 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as Other SMS CB messages) would be sent by the RNC at the relative CTCH BS Index values 5 to 8 and at 55 to 58 with a further indication that the Other SMS CB message sent at the relative CTCH BS Index 55 to 58 would be a repetition of the Other SMS CB message sent at the relative CTCH BS Index 5 to 8.
7. The RNC repeats the broadcasting of the new SMS CB message (as repeated New SMS CB message) containing the Cell Broadcast message data in the relative CTCH BS Index 55 to 58 of the Schedule Period (i.e., from an RNC's perspective, in the CTCH BS Index 103 to 106) using the BMC CBS message.
8. The mobile device, which was previously given the schedule information, receives the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 55 to 58 of the Schedule Period.

<u>Subsequent Schedule Period 2 (Old SMS CB message broadcast twice as Other SMS CB messages)</u>

9. The RNC broadcasts the old SMS CB message (as Other SMS CB Message) containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective, in the CTCH BS Index 203 to 206) using the BMC CBS message.
10. The mobile device, which was previously given the schedule information, receives the Other SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.
11. The RNC broadcasts the Schedule Message in the CTCH BS Index 211 to 214 (i.e., relative CTCH BS Index 13 to 16 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 88 and the length of the Schedule Period as 64. The Offset to the Begin CTCH BS Index value of 88 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 211 + 88 (i.e., 43, derived from 299 modulo 256). The Schedule Period of 64 would mean that the next Schedule Period would consist of 64 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 43 to 106. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB messages would be sent (i.e., as Other SMS CB messages) at the relative CTCH BS Index 5 to 8 and 55 to 58 of the next Schedule Period, with a further indication implying that the Other

SMS CB message sent at the relative CTCH BS Index 55 to 58 would be a repetition of the Other SMS CB message sent at the relative CTCH BS Index 5 to 8. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 47 to 50 and repeated again in the CTCH BS Index 97 to 100. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 13 to 16 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index values 55 to 58 are used to send the next Schedule Message.

12. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 88 (i.e., the next Schedule Period begins at the CTCH BS Index 88 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 64 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 13 to 16 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as Other SMS CB messages) would be sent by the RNC at the relative CTCH BS Index values 5 to 8 and at 55 to 58 with a further indication that the Other SMS CB message sent at the relative CTCH BS Index 55 to 58 would be a repetition of the Other SMS CB message sent at the relative CTCH BS Index 5 to 8.
13. The RNC repeats the broadcasting of the old SMS CB message (as repeated Other SMS CB message) containing the Cell Broadcast message data in the relative CTCH BS Index 55 to 58 of the Schedule Period (i.e., from an RNC's perspective, in the CTCH BS Index 253 to 256) using the BMC CBS message.
14. The mobile device, which was previously given the schedule information, receives the repeated Other SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 55 to 58 of the Schedule Period.

6.3.3 Repetition Period Half of Repetition Period of Schedule Message in Idle Mode

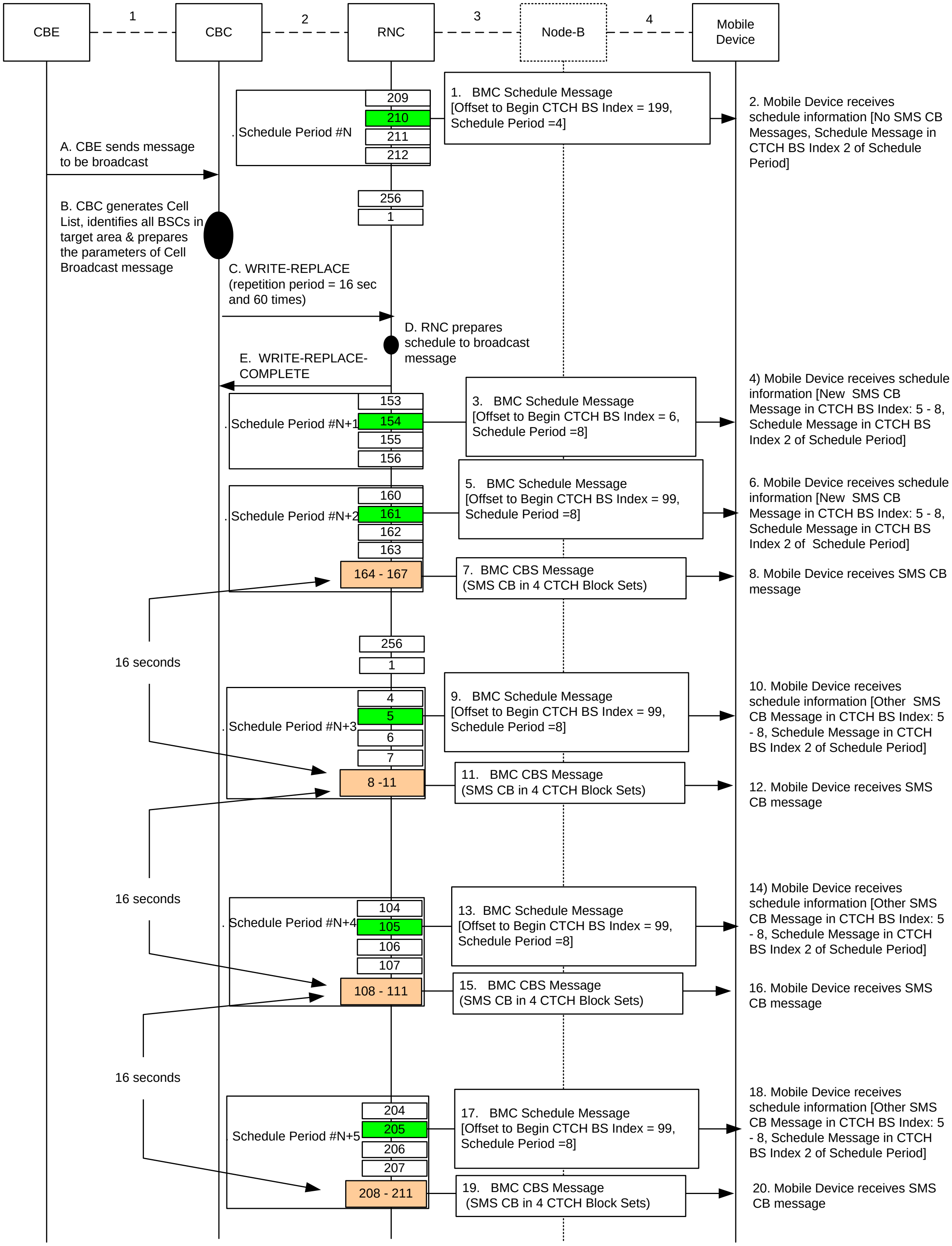

Figure 17: Repetition Period Half of Repetition Period of Schedule Message in Idle Mode

When a new SMS CB message is to be broadcast with a repetition period less than maximum allowable repetition period (in the examples considered here: 40.96 seconds), the RNC can modify the length of the Schedule Period and the beginning of the Schedule Period in such a way that the SMS CB message broadcast only once in a Schedule Period. For example, if the Schedule Message is repeated once every 32 seconds, then a SMS CB message with the repetition period of 32 seconds is required to be sent only once in every Schedule Period. If the repetition period of the SMS CB message is 16 seconds (as an example), then the repetition rate of the Schedule Message can be changed to 16 seconds so that the SMS CB message is sent only once in a Schedule Period. In an UMTS network, the beginning of the next Schedule Period can be modified and the Schedule Period can be modified. These capabilities provide various implementation alternatives. In the example shown below, the repetition period of the SMS CB message happens to be 16 seconds.

The call flow assumes that the message transmitted in each of the CTCH BS is able to carry up to 23 octets of the data. This would mean that in order to transmit 90 octets of data (the approximate size of 1 page of a CBS message), 4 CTCH Block Sets are required. Also, the call flow assumes the following the DRX level 1 parameters: N = 16 and K = 0. The value of N = 16, means that the first SFN of the two consecutive CTCH Block Sets are separated by 16 radio frames (or 160 ms). The index of a CTCH Block Set known to the RNC can be different from the index of the same CTCH Block Set known to the mobile device. The absolute CTCH Block Set Index values referenced below are from an RNC's perspective.

Periodic sending of Schedule Messages (Schedule Period #N)

1. In Schedule Period #N, RNC sends the Schedule Message on CTCH BS Index value 210 using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 210 + 199 (i.e., = 153, derived from 409 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 153, 154, 155, and 156. The Schedule Message indicates that there are no SMS CB messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 154 is used to send the next Schedule Message.
2. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of that Schedule Period. Furthermore, the mobile device understands that there are new SMS CB messages in the next Schedule Period.

<u>A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)</u>

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to each Radio Network Controller (RNC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 16 seconds and the number of broadcasts to be performed is 60 (i.e., approximately for a duration of 16 minutes).

E. RNC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

<u>Schedule Period #N+1 (Mobile device is notified about the new SMS CB message)</u>

In the example, the beginning of the next Schedule Period is adjusted so as to send the SMS CB message at the earliest possible time. As an alternative implementation, the RNC may continue to send the periodic Schedule Messages as it was sent before, and in that case, the sending of the SMS CB message would be delayed to the subsequent Schedule Period. For example, if the repetition period of the Schedule Message is 32 seconds, and when the WRITE-REPLACE primitive is received at the RNC, the RNC will have to include the new message information in the next Schedule Message (which may be up to 32 seconds away). But, the next Schedule Message can only tell when the new SMS CB message is sent in a subsequent Schedule Period which can be a further 32 seconds away. In the example illustrated below, the very first time, the beginning of the new Schedule Period is started earlier so as to send the new SMS CB message containing the Cell Broadcast message data at the earliest possible time.

3. Based on a previously sent periodic Schedule Message, RNC sends the Schedule Message on CTCH BS Index value 154 using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 6 and the length of the Schedule Period as 8 (alternatively, the RNC could have maintained the repetition period of the Schedule Message, and could have included the Offset to Begin CTCH BS Index as 199, which off course, would have delayed the sending of the SMS CB message, the very first time). The Offset to the Begin CTCH BS Index value of 6 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 154 + 6 (i.e., = 160). The Schedule Period of 8 would mean that the next Schedule Period would consist 8 consecutive CTCH Block Sets. From an

RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 160 to 167. The Schedule Message also indicates that there is a new SMS CB message which would be sent at the relative CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the new SMS CB message is sent in the CTCH BS Index 164 to 167. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 161 is used to send the next Schedule Message.

4. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 6 (i.e., the next Schedule Period begins at the CTCH BS Index 6 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 8 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of that Schedule Period. Furthermore, the mobile device understands that a new SMS CB message would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.

<u>Schedule Period #N+2 (New Message sent)</u>

5. The RNC broadcasts the Schedule Message in the CTCH BS Index 161 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 (note that the Offset to Begin CTCH BS Index could be set in a way to suit the repetition period of the SMS CB message, for example, it could be 199 if the repetition period was 32 seconds) and the length of the Schedule Period as 8. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 161 + 99 (i.e., = 4, derived from 260 modulo 256). The Schedule Period of 8 would mean that the next Schedule Period would consist of 8 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 4 to 11. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 8 to 11. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 5 is used to send the next Schedule Message.
6. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 8 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.

7. The RNC broadcasts the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 164 to 167) using the BMC CBS message.
8. The mobile device, which was previously given the schedule information, receives the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.

Schedule Period #N+3 (Old Message sent as Other Message)

9. The RNC broadcasts the Schedule Message in the CTCH BS Index 5 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 and the length of the Schedule Period as 8. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 5 + 99 (i.e., = 104). The Schedule Period of 8 would mean that the next Schedule Period would consist of 8 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 104 to 111. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 108 to 111. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 105 is used to send the next Schedule Message.
10. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 8 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as a Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.
11. The RNC broadcasts the old SMS CB message (as a Other SMS CB message) containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 8 to 11) using the BMC CBS message.
12. The mobile device, which was previously given the schedule information, receives the Other SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.

Schedule Period #N+4 (Old Message sent as Other Message)

13. The RNC broadcasts the Schedule Message in the CTCH BS Index 105 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 and the length of the Schedule Period as 8. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 105 + 99 (i.e., = 204).

The Schedule Period of 8 would mean that the next Schedule Period would consist of 8 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 204 to 211. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 208 to 211. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 205 is used to send the next Schedule Message.

14. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 8 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as a Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.
15. The RNC broadcasts the old SMS CB message (as Other SMS CB message) containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 108 to 111) using the BMC CBS message.
16. The mobile device, which was previously given the schedule information, receives the Other SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.

<u>Schedule Period #N+5 (Old Message sent as Other Message)</u>

17. The RNC broadcasts the Schedule Message in the CTCH BS Index 205 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 and the length of the Schedule Period as 8. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 205 + 99 (i.e., = 48, derived from 304 modulo 256). The Schedule Period of 8 would mean that the next Schedule Period would consist of 8 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 48 to 55. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 51 to 55. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 49 is used to send the next Schedule Message.
18. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile

device also understands that the next Schedule Period would consist of 8 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as a Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.

19. The RNC broadcasts the old SMS CB message (as Other SMS CB message) containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 208 to 211) using the BMC CBS message.
20. The mobile device, which was previously given the schedule information, receives the Other SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.

6.3.4 New SMS CB Messages with Large Repetition Periods

In this example, the repetition period is 64 seconds the SMS CB message is 64 seconds, and the repetition period of the schedule message is 32 seconds.

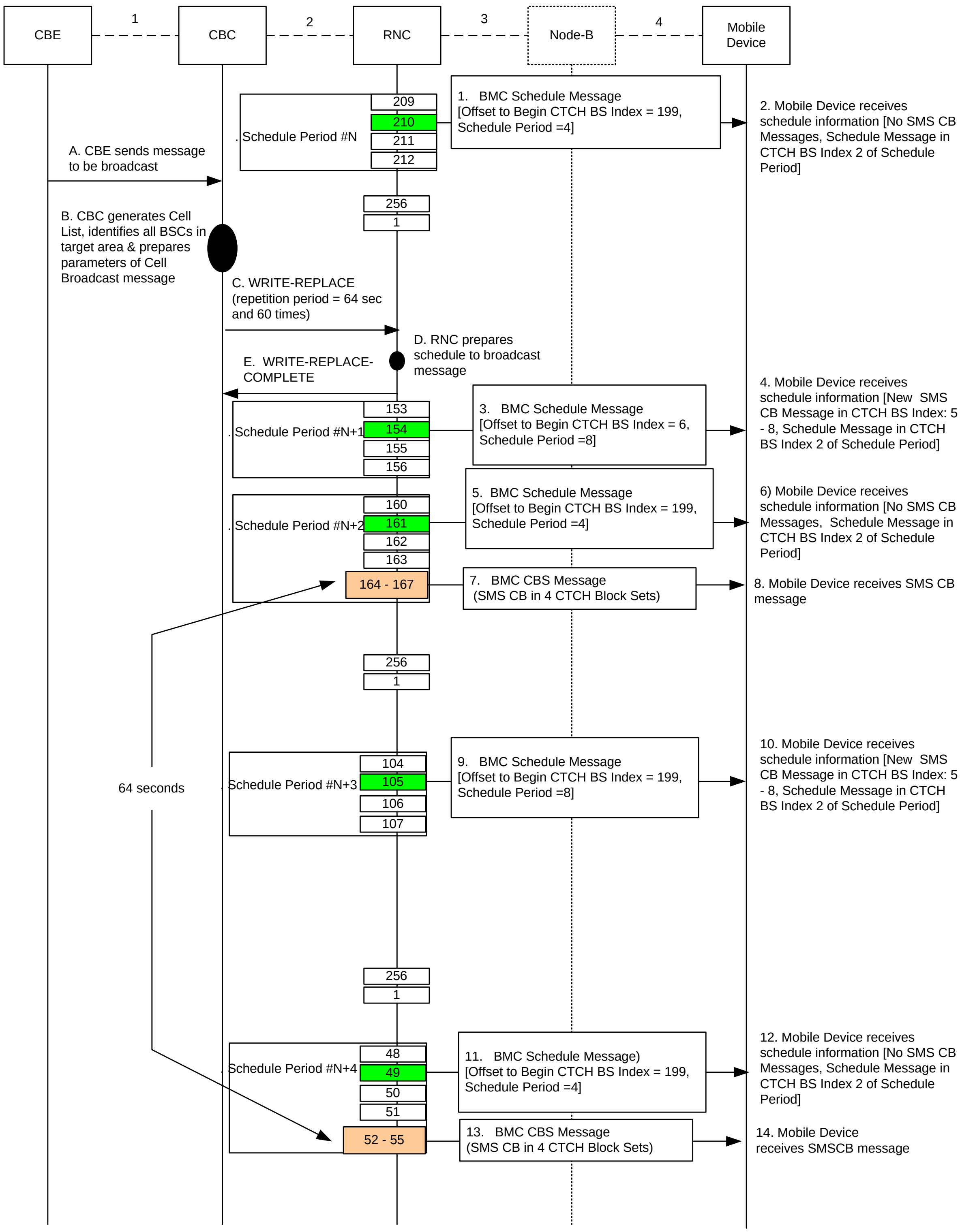

Figure 18: New SMS CB Messages with Large Repetition Periods

When a new SMS CB message is to be broadcast with a repetition period larger than the maximum allowable repetition period (in the examples considered here: 40.96 seconds), a scenario will result in where the SMS CB message is not sent in every Schedule Period. For example, if the Schedule Message is repeated once every 32 seconds, then a SMS CB message with the repetition period of 64 seconds is required to be sent in the alternate Schedule Periods.

The call flow shown here assumes that the message sent in each of the CTCH Block Set is able to carry up to 23 octets of the data. This means that in order to transmit a 90 octets of data (the approximate size of 1 page of a CBS message), 4 CTCH Block Sets are required. Also, the call flow assumes the following the DRX level 1 parameters: N = 16 and K = 0. The value of N = 16, means that the first SFN of the two consecutive CTCH Block Sets are separated by 16 radio frames (or 160 ms). The index of a CTCH Block Set known to the RNC can be different from the index of the same CTCH Block Set known to the mobile device. The absolute CTCH Block Set Index values referenced below are from an RNC's perspective.

<u>Periodic sending of Schedule Messages (Schedule Period #N)</u>

1. Based on a previously sent periodic Schedule Message, the RNC sends the Schedule Message on CTCH BS Index value 210 using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 210 + 199 (i.e., = 153, derived from 409 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 153, 154, 155, and 156. The Schedule Message indicates that there are no SMS CB messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 154 is used to send the next Schedule Message.
2. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets, and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no SMS CB messages in the next Schedule Period.

<u>A new broadcast message (steps A to E are same as the steps shown in clause 6.1, *Cell Broadcast Call Flows*, repeated here just for completeness)</u>

A. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).

B. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). The CBC also generates the required Cell Broadcast parameters including the Cell Broadcast channel, retransmission parameters including number of broadcasts requested (i.e., expiration time), the geographic scope of the Cell Broadcast message, and the serial number with the geographic scope indication.

C. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to each Radio Network Controller (RNC) that controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list).

D. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. In this example flow, the repetition period is 64 seconds and the number of broadcasts to be performed is 60 (i.e., approximately for a duration of 64 minutes).

E. RNC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

Schedule Period #N+1(Mobile device is notified about the new SMS CB message)

In the example, the beginning of the next Schedule Period is adjusted so as to send the SMS CB message at the earliest possible time. As an alternative implementation, the RNC may continue to send the periodic Schedule Messages as it was sent before, and in that case, the sending of the SMS CB message would be delayed to the subsequent Schedule Period. For example, if the repetition period of the Schedule Message is 32 seconds, and when the WRITE-REPLACE primitive is received at the RNC, the RNC will have to include the new message information in the next Schedule Message (which may be up to 32 seconds away). But, the next Schedule Message can only tell when the new SMS CB message is sent in a subsequent Schedule Period which can be a further 32 seconds away. In the example illustrated below, the very first time, the beginning of the new Schedule Period is started earlier so as to send the new SMS CB message containing the Cell Broadcast message data at the earliest possible time.

3. Based on a previously sent periodic Schedule Message, RNC sends the Schedule Message on CTCH BS Index 154 using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 6 and the length of the Schedule Period as 8 (alternatively, the RNC could have maintained the repetition period of the Schedule Message with the Offset to Begin CTCH BS Index as 199, which off course, would have delayed the sending of the SMS CB message, the very first time). The Offset to the Begin CTCH BS Index value of 6 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 154 + 6 (i.e., = 160). The Schedule Period of 8 would mean that the next Schedule Period would consist of 8 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 160 to 167. The Schedule Message also indicates that there is a new SMS CB message which would be sent at the relative CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the new SMS CB message is sent in the CTCH BS Index 164 to 167. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 161 is used to send the next Schedule Message.
4. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to

the Begin CTCH BS Index is 6 (i.e., the next Schedule Period begins at the CTCH BS Index 6 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 8 CTCH Block Sets, and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that a new SMS CB message would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.

Schedule Period #N+2 (New SMS CB message, but no message in the subsequent Schedule Period)

5. The RNC broadcasts the Schedule Message in the CTCH BS Index 161 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 161 + 199 (i.e., = 104, derived from 360 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 104 to 107. The Schedule Message also indicates that there are no SMS CB messages in the next Schedule Period. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 105 is used to send the next Schedule Message.
6. The mobile device receives the BMC Schedule Message in the CTCH Block Set as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no SMS CB messages in the next Schedule Period.
7. The RNC broadcasts the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 164 to 167) using the BMC CBS message.
8. The mobile device, which was previously given the schedule information, receives the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.

Schedule Period #N+3 (No message in this Schedule Period, but will be in the next)

9. The RNC broadcasts the Schedule Message in the CTCH BS Index 105 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 8. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 105 + 199 (i.e., = 48, derived from 304 modulo 256). The Schedule Period of 8 would mean that the next Schedule Period would consist of 8 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 48 to 55. The Schedule Message also indicates that there is a new SMS CB message which would be sent at the relative

CTCH BS Index 5 to 8 of the next Schedule Period. From an RNC's perspective, this would mean that the new SMS CB message is sent in the CTCH BS Index 52 to 55. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 49 is used to send the next Schedule Message.

10. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 8 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there is a new SMS CB message in the next Schedule Period which would be sent by the RNC at the relative CTCH BS Index values 5 to 8 of the next Schedule Period.

<u>Schedule Period #N+4 (Old SMS CB message as a New SMS CB message, but no message in the subsequent Schedule Period)</u>

11. The RNC broadcasts the Schedule Message in the CTCH BS Index 49 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 49 + 199 (i.e., = 248). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 248 to 251. The Schedule Message also indicates that there are no new SMS CB messages in next Schedule Period. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 249 is used to send the next Schedule Message.
12. The mobile device receives the BMC Schedule Message as was instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period.
13. The RNC broadcasts the old SMS CB message (as New SMS CB message) containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 52 to 55) using the BMC CBS message.
14. The mobile device, which was previously given the schedule information, receives the new SMS CB message containing the Cell Broadcast message data in the relative CTCH BS Index 5 to 8 of the Schedule Period.

6.4 Example Call Flows for GSM Cell Broadcast Failures

This clause contains two example call flows for Cell Broadcast failures in GSM networks. The call flows in this clause are illustrative of 3GPP TS 23.041 [Ref 1], 3GPP TS 44.012 [Ref 3], and 3GPP TS 48.058 [Ref 11]. It is not the intent of this specification to modify or enhance those 3GPP specifications.

This clause focuses on the interface between the CBC and the BSC in illustrating the failure situations in the broadcasting of Cell Broadcast message data. Furthermore, this clause uses the example where a BTS within the Cell Broadcast message target area is operationally down and hence, is not able to broadcast the message. The BSC upon detecting such an error condition would report the same to the CBC.

This clause does not go to the extent of explaining how a BSC would determine that a BTS is operationally down. As a matter of fact, the examples of failure conditions considered here are independent of Cell Broadcast requesting application. In other words, basically, the flows illustrate how the GSM networks would behave in handling the broadcasting of Cell Broadcast message data, when a failure condition independent of the Cell Broadcast requesting application occurs.

For the purpose of these examples, it is presumed that each BTS is associated to one cell. Also, note that other implementation alternatives are possible. For example, in the call flow in clause 6.4.2, *Example #2 Call Flow for GSM Cell Broadcast Failure Conditions*, the BSC could still make the CBC to send a new WRITE-REPLACE primitive with the proper indications. Either of the two approaches might be taken if the first BTS becomes operational while the broadcast of the cell broadcast message is still outstanding, in the second example.

6.4.1 Example #1 Call Flow for GSM Cell Broadcast Failure Conditions

The BSC detects that one of the BTSs goes operationally down. The BSC reports the failure condition to the CBC. The CBC withholds that impacted cell(s) from the list of cells to which the Cell Broadcast message has to be broadcast. When the BTS becomes operationally active again, the BSC upon detecting the same would report the situation to the CBC. The CBC would send a new WRITE-REPLACE primitive to initiate the broadcasting of the outstanding Cell Broadcast message to the cell(s) which is now operational.

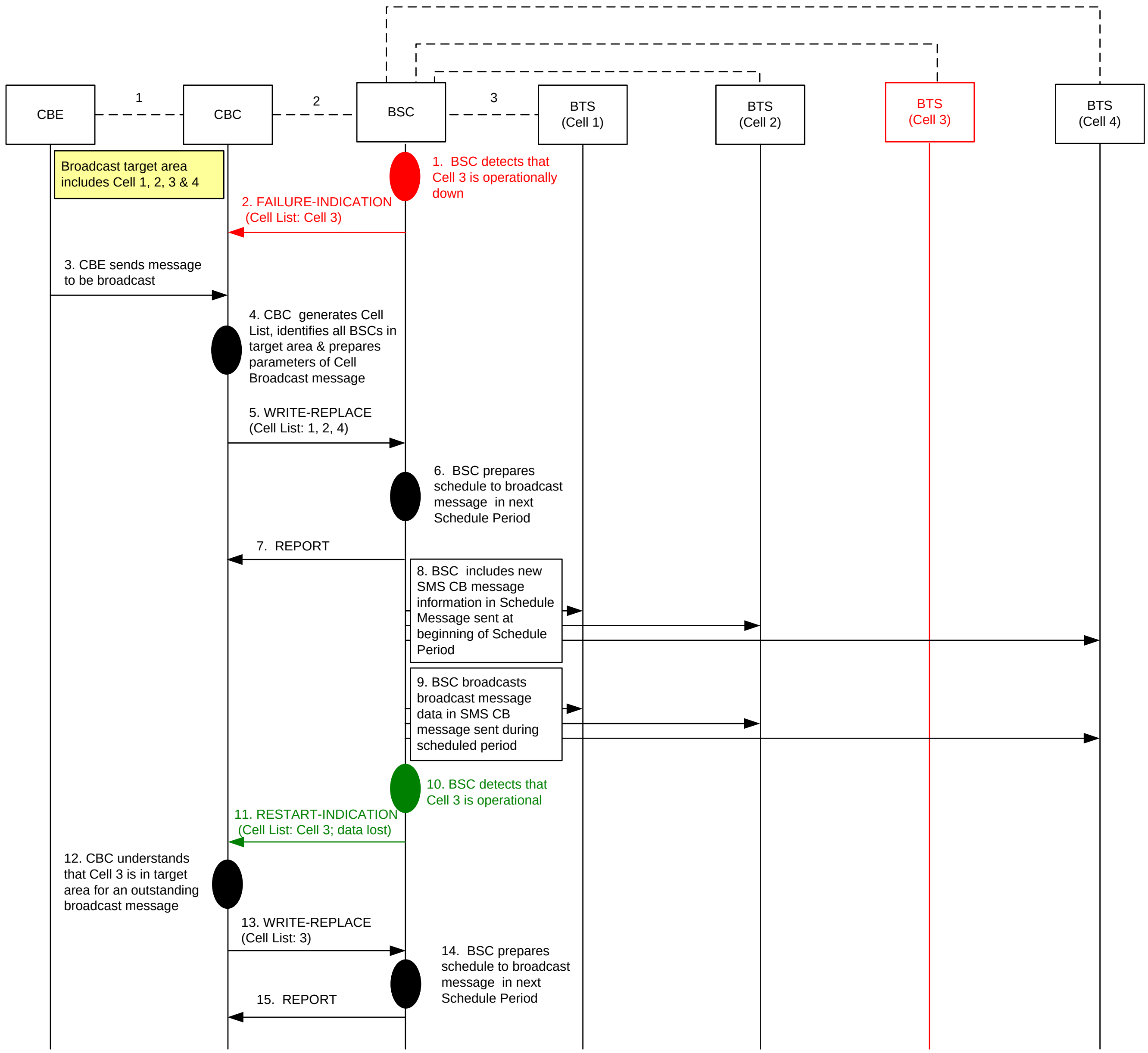

Figure 19: Example #1 Call Flow for GSM Cell Broadcast Failure Conditions

In this example flow, 4 BTSs are shown, all of which are served by the same BSC. For the purpose of this illustration, it is presumed that each BTS serves one cell. Also, for the purpose of this illustration, it is presumed that the Cell Broadcast message target area includes the 4 cells referred to as Cell 1, Cell 2, Cell 3, and Cell 4.

1. BSC detects that BTS that serves the Cell 3 operationally goes down.
2. BSC reports the Cell 3 failure indication to the CBC using the message FAILURE INDICATION with the Cell 3 information included within the Cell List. The handling of the message FAILURE INDICATION is a CBC implementation option. For example, the CBC could withhold the particular cell from the Cell List if and when a Cell Broadcast message covering that cell has to be broadcast. Or, the CBC could still include the cell within the Cell List if and when a Cell Broadcast message covering the cell has to be broadcast and thus expecting the BSC

to deal with the cell that is operationally down. This example flow assumes the former implementation option.

3. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
4. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells (Cell 1, Cell 2, Cell 3, and Cell 4) in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). As noted in step 2, the CBC would withhold the Cell 3 from the Cell List due to the prior knowledge on the operational status of the Cell 3.
5. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to the BSC which controls cell sites within the target area of the Cell Broadcast message (as identified in the cell list – Cell 1, Cell 2, Cell 4).
6. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message.
7. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.
8. When the new Schedule Message is sent in the next Schedule Period, the BSC includes the new SMS CB message information within the Schedule Message. The BSC would broadcast the Schedule Message to BTSs serving the Cell 1, Cell 2, and Cell 4 using either a SMS BROADCAST COMMAND or a SMS BROADCAST REQUEST message (depending on the implementation choice).
9. During the scheduled Message Slot of the Schedule Period, the BSC would broadcast the new SMS CB message containing the Cell Broadcast message data to the BTSs serving the Cell 1, Cell 2 and Cell 4 using either a SMS BROADCAST COMMAND or a SMS BROADCAST REQUEST message (depending on the implementation choice).
10. BSC detects that BTS that serves the Cell 3 operationally becomes active.
11. BSC reports the Cell 3 status to the CBC using the message RESTART INDICATION with the Cell 3 information included within the Cell List. The BSC would also indicate to the CBC that no SMS CB related information is available for the Cell 3.
12. Based on the previously known information, CBC understands that one of the outstanding Cell Broadcast messages includes Cell 3.
13. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to the BSC with Cell 3 as the Cell Id within the Cell List.
14. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message.
15. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

6.4.2 Example #2 Call Flow for GSM Cell Broadcast Failure Conditions

The BSC detects that one of the BTSs goes operationally down. The BSC reports the failure condition to the CBC. But, maybe due to race condition, the CBC does not withhold that the associated cell(s) from the list of the cells to which the Cell Broadcast message has to be broadcast. But the BSC upon receiving the WRITE-REPLACE primitive would indicate to the CBC that message cannot be broadcast to certain cell(s). The example illustrates a second BTS going down while the Cell Broadcast message data is being broadcast. Within the example, this second BTS becomes operationally active again, and the BSC upon detecting the same would report the situation to the CBC. But, now since the BSC knows that the Cell Broadcast message data should also be sent to the associated cell(s), the BSC would indicate the same to the CBC that it has the data. The CBC does not initiate any WRITE-REPLACE to that BSC. The BSC includes the new cell(s) while broadcasting the message, the next time.

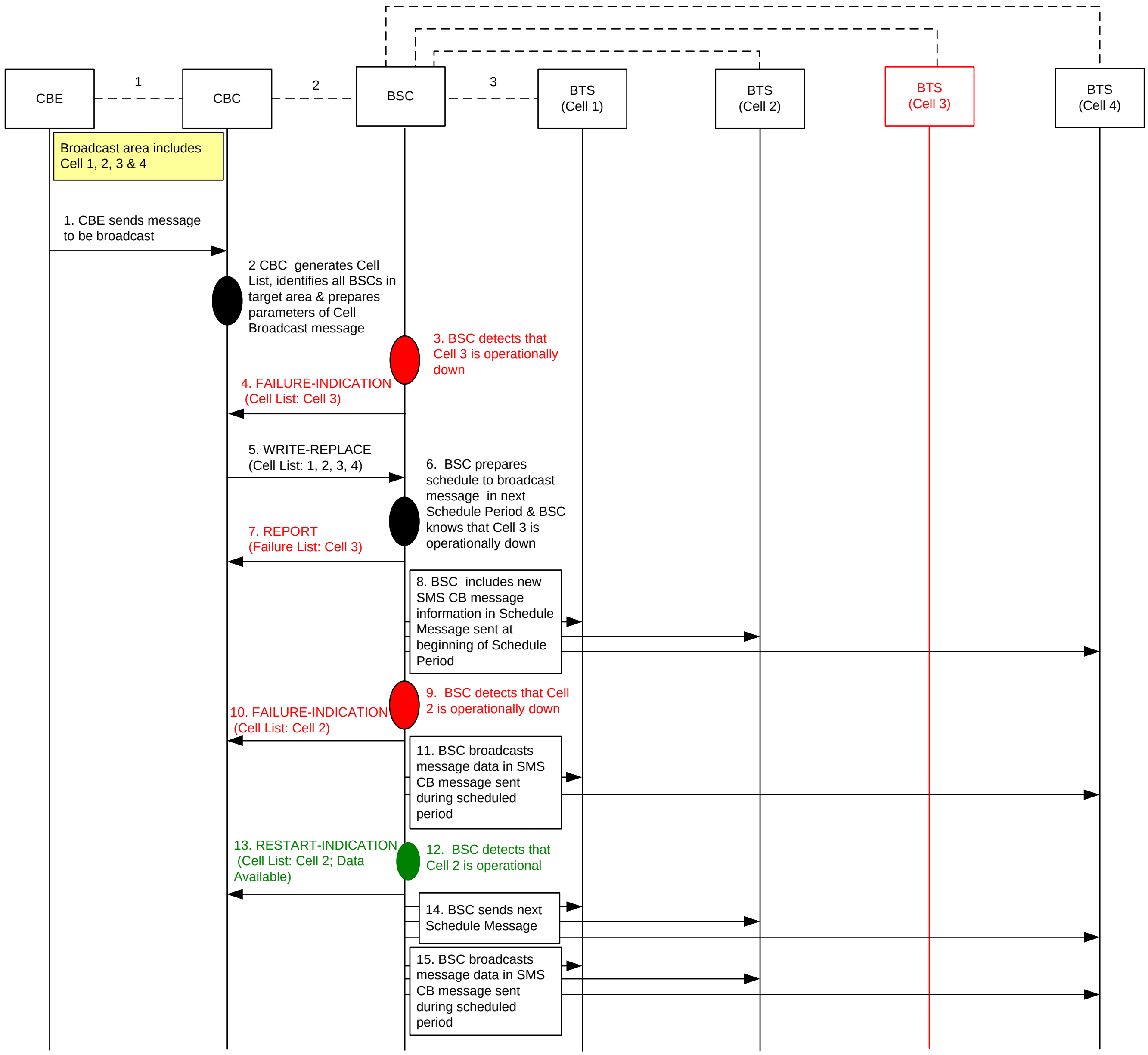

Figure 20: Example #2 Call Flow for GSM Cell Broadcast Failure Conditions

In this example flow, 4 BTSs are shown all of which are served by the same BSC. For the purpose of this illustration, it is presumed that each BTS serves one cell. Also, for the purpose of this illustration, it is presumed that the Cell Broadcast message target area includes the 4 cells referred to as Cell 1, Cell 2, Cell 3, and Cell 4.

1. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
2. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of cells (Cell 1, Cell 2, Cell 3 and Cell 4) in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]).
3. BSC detects that BTS that serves the Cell 3 operationally goes down.
4. BSC reports the Cell 3 failure indication to the CBC using the message FAILURE INDICATION with the Cell 3 information included within the Cell List.
5. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to the BSC which controls cell sites within the target area (as identified in the cell list – Cell 1, Cell 2, Cell 3, Cell 4).
6. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed and prepares a schedule to broadcast the message. The BSC is also aware of the fact that the Cell Broadcast message cannot be broadcast to Cell 3 due to the operational status of the BTS that serves Cell 3.
7. BSC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message with the exception to the Cell 3. The exception is reported with a failure indication within the REPORT primitive with Cell 3 being included within the Cell List.
8. When the new Schedule Message is sent in the next Schedule Period, the BSC includes the new SMS CB message information within the Schedule Message. The BSC would broadcast the Schedule Message to BTSs serving the Cell 1, Cell 2, and Cell 4 using either a SMS BROADCAST COMMAND or a SMS BROADCAST REQUEST message (depending on the implementation choice).
9. BSC detects that BTS that serves the Cell 2 operationally goes down.
10. BSC reports the Cell 2 failure indication to the CBC using the message FAILURE INDICATION with the Cell 2 information included within the Cell List.
11. During the scheduled Message Slot of the Schedule Period, the BSC would broadcast the new SMS CB message containing the Cell Broadcast message data to the BTSs serving the Cell 1 and Cell 4 using either a SMS BROADCAST COMMAND or a SMS BROADCAST REQUEST message (depending on the implementation choice). The BSC does not attempt to send the message to the BTS (serving the Cell 2) that is operationally down.
12. BSC detects that BTS that serves the Cell 2 operationally becomes active.
13. BSC reports the Cell 2 status to the CBC using the message RESTART INDICATION with the Cell 2 information included within the Cell List. The BSC would also indicate to the CBC that SMS CB related information is available for the Cell 2. Due to this indication, the CBC does not send any new WRITE-REPLACE primitives to the BSC.
14. When the new Schedule Message is sent in the next Schedule Period, the BSC would send the message to the BTS that serves the Cell 2 as well. Basically, the BSC would broadcast the Schedule Message to BTSs serving the Cell 1, Cell 2, and Cell 4 using either a SMS BROADCAST COMMAND or a SMS BROADCAST REQUEST message (depending on the implementation choice).
15. During the scheduled Message Slot of the Schedule Period, the BSC would broadcast the SMS CB message containing the Cell Broadcast message data to the BTSs serving the Cell 1, Cell 2,

and Cell 4 using either a SMS BROADCAST COMMAND or a SMS BROADCAST REQUEST message (depending on the implementation choice).

6.5 Example Call Flows for UMTS Cell Broadcast Failures

This clause contains two example call flows for Cell Broadcast failures in UMTS networks. The call flows in this clause are illustrative of 3GPP TS 23.041 [Ref 1], 3GPP TS 25.419 [Ref 2], and 3GPP TS 25.324 [Ref 3]. It is not the intent of this specification to modify or enhance those 3GPP specifications.

This clause focuses on the interface between the CBC and the RNC in illustrating the failure situations in the broadcasting of Cell Broadcast message data. Furthermore, this clause uses the example where a Node B within the target area is operationally down and hence, is not able to broadcast the message over the air. The RNC upon detecting such an error condition would report the same to the CBC.

This clause does not go to the extent of explaining how an RNC would determine that a Node B is operationally down. As a matter of fact, the examples of failure conditions considered here are independent of Cell Broadcast requesting application. In other words, basically, the flows illustrate how the UMTS networks would behave in handling the broadcasting of Cell Broadcast message data, when a failure condition independent of the Cell Broadcast requesting application occurs.

For the purpose of these examples, it is presumed that each Node B is associated to one Service Area. Also, note that other implementation alternatives are possible. For example, in the clause 6.5.2, *Example #2 Call Flow for UMTS Cell Broadcast Failure Conditions*, the RNC, with the proper indications, could still make the CBC to send a new WRITE-REPLACE primitive. Either of the two approaches might be taken if the first Node B becomes operational while the broadcast of the Cell Broadcast message is still outstanding, in the second example.

6.5.1 Example #1 Call Flow for UMTS Cell Broadcast Failure Conditions

The RNC detects that one of the Node Bs goes operationally down. The RNC reports the failure condition to the CBC. The CBC withholds that impacted Service Area from the list of Service Areas to which the Cell Broadcast message has to be broadcast. When the Node B becomes operationally active again, the RNC upon detecting the same would report the situation to the CBC. The CBC would send a new WRITE-REPLACE primitive to initiate the broadcasting of the outstanding Cell Broadcast message to the Service Area which is now operational.

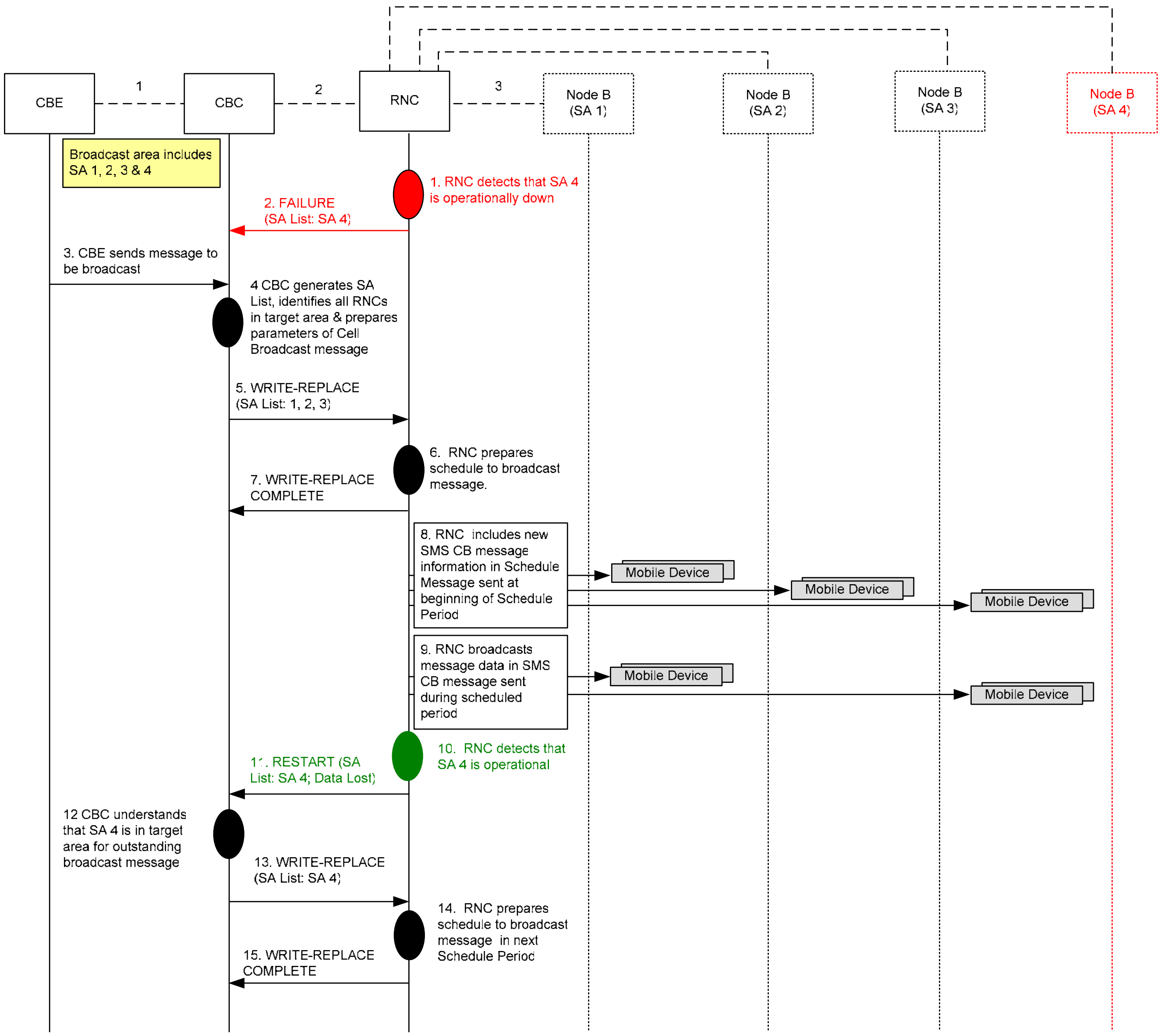

Figure 21: Example #1 Call Flow for UMTS Cell Broadcast Failure Conditions

In this example flow, 4 Node Bs are shown all of which are served by the same RNC. For the purpose of this illustration, it is presumed that each Node B serves one Service Area. Also, for the purpose of this illustration, it is presumed that the Cell Broadcast message target area includes the 4 Service Areas referred to as SA 1, SA 2, SA 3, and SA 4.

1. RNC detects that Node B that serves the SA 4 operationally goes down.
2. RNC reports the SA 4 failure indication to the CBC using the message FAILURE with the SA 4 information included within the SA List. The handling of the message FAILURE is a CBC implementation option. For example, the CBC could withhold the particular SA from the SA List if and when a Cell Broadcast message covering that SA has to be broadcast. Or, the CBC could still include the SA within the SA List if and when a Cell Broadcast message covering the SA has to be broadcast and thus expecting the RNC to deal with the SA that is operationally down. This example flow assumes the former implementation option.

3. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
4. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of Service Areas (SA 1, SA 2, SA 3, and SA 4) in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]). As noted in step 2, the CBC would withhold the SA 4 from the SA List due to the prior knowledge on the operational status of the SA 4.
5. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to the RNC which controls Service Areas within the target area (as identified in the SA List – SA 1, SA 2, and SA 3).
6. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed, and prepares a schedule to broadcast the message.
7. RNC returns a WRITE-REPLACE COMPLETE primitive to the CBC indicating successful processing of the Cell Broadcast message.
8. When the new Schedule Message is sent in the next Schedule Period, the RNC includes the new SMS CB message information within the Schedule Message. The RNC would broadcast the Schedule Message to mobile devices via the Node Bs serving the SA 1, SA2, and SA 3 using BMC Schedule Message.
9. During the scheduled time of the next Schedule Period, the RNC would broadcast the new SMS CB message containing the Cell Broadcast message data to the mobile devices via the Node Bs serving the SA1, SA2 and SA3 using the BMC CBS message.
10. RNC detects that Node B that serves the SA 4 operationally becomes active.
11. RNC reports the SA 4 status to the CBC using the message RESTART with the SA 4 information included within the SA List. The RNC would also indicate to the CBC that no SMS CB related information is available for the SA 4.
12. Based on the previously known information, CBC understands that one of the outstanding cell broadcast messages includes SA 4.
13. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to the RNC with SA 4 within the SA List.
14. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed, and prepares a schedule to broadcast the message.
15. RNC returns a WRITE-REPLACE COMPLETE primitive to the CBC indicating successful processing of the Cell Broadcast message.

6.5.2 Example #2 Call Flow for UMTS Cell Broadcast Failure Conditions

The RNC detects that one of the Node Bs goes operationally down. The RNC reports the failure condition to the CBC. But, maybe due to race condition, the CBC does not withhold that the associated Service Area from the list of the Service Areas to which the Cell Broadcast message has to be broadcast. But the RNC upon receiving the WRITE-REPLACE primitive would indicate to the CBC that message cannot be broadcast to certain Service Area. The example illustrates a second Node B going down while the Cell Broadcast message data is being broadcast. Within the example, this second Node B becomes operationally active again, and the RNC upon detecting the same would report the situation to the CBC. But, now since the RNC knows that the Cell Broadcast message data should also be sent to the associated Service Area, the RNC would indicate the same to the CBC that it has the data. The CBC does not initiate any WRITE-REPLACE to that RNC. The RNC includes the new Service Area while broadcasting the message, the next time.

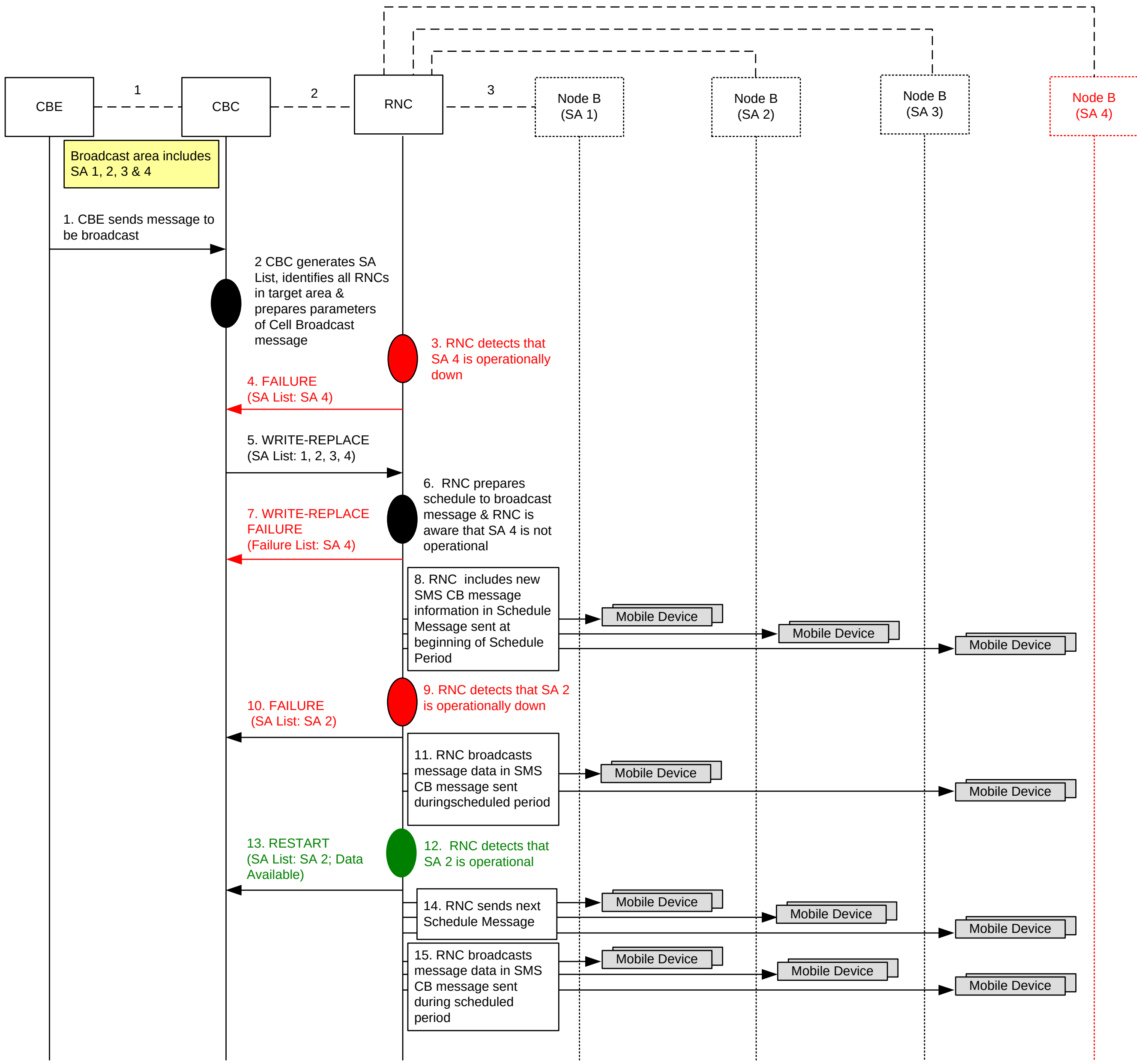

Figure 22: Example #2 Call Flow for UMTS Cell Broadcast Failure Conditions

In this example flow, 4 Node Bs are shown all of which are served by the same RNC. For the purpose of this illustration, it is presumed that each Node B serves one Service Area. Also, for the purpose of this illustration, it is presumed that the Cell Broadcast target area includes the 4 Service Areas referred to as SA 1, SA 2, SA 3, and SA 4.

1. The CBE (e.g., CMSP Gateway) sends a Cell Broadcast request over interface 1 to the Cell Broadcast Center (CBC). This interaction is outside the scope of this specification (see ATIS CBE to CBC Interface Specification [Ref 10]).
2. The CBC receives the Cell Broadcast request, constructs the SMS Cell Broadcast (SMS CB) message. The CBC uses the geo-targeting information to determine the set of Service Areas (SA 1, SA 2, SA 3, and SA 4) in the target area where the message is to be broadcast (see 3GPP TS 23.041 [Ref 1]).
3. RNC detects that Node B that serves the SA 4 operationally goes down.
4. RNC reports the SA 4 failure indication to the CBC using the message FAILURE with the SA 4 information included within the SA List.
5. The CBC generates a Cell Broadcast WRITE-REPLACE indication primitive and sends this message to the RNC which controls Service Areas within the target area (as identified in the SA List – SA 1, SA 2, SA 3, and SA 4).
6. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed, and prepares a schedule to broadcast the message. The RNC is also aware of the fact that the Cell Broadcast message cannot be broadcast to SA 4 due to the operational status of the Node B that serves SA 4.
7. RNC returns a WRITE-REPLACE FAILURE primitive to the CBC indicating a successful processing of the Cell Broadcast message for Service Areas with the exception of SA 4. The exception is reported with a failure indication within the WRITE-REPLACE FAILURE primitive with SA 4 being included within the SA List.
8. When the new Schedule Message is sent in the next Schedule Period, the RNC includes the new SMS CB message information within the Schedule Message. The RNC would broadcast the Schedule Message to mobile devices via the Node Bs serving the SA 1, SA 2, and SA 3 using BMC Schedule Message.
9. RNC detects that Node B that serves the SA 2 operationally goes down.
10. RNC reports the SA 2 failure indication to the CBC using the message FAILURE with the SA 2 information included within the SA List.
11. During the scheduled time of the next Schedule Period, the RNC would broadcast the new SMS CB message containing the Cell Broadcast message data to the mobile devices via the Node Bs serving the SA 1 and SA 3 using the BMC CBS message. The RNC does not attempt to send message to the mobile devices in SA 2 (because the Node B that serves SA 2 is operationally down).
12. RNC detects that Node B that serves the SA 2 operationally becomes active.
13. RNC reports the SA 2 status to the CBC using the message RESTART with the SA 2 information included within the SA List. The RNC would also indicate to the CBC that SMS CB related information is available for the SA 2. Due to this indication, the CBC does not send any new WRITE-REPLACE primitives to the RNC.
14. When the new Schedule Message is sent in the next Schedule Period, the RNC would send the message to the mobile devices in the SA 2 (via Node B) as well. Basically, the RNC would broadcast the Schedule Message to mobile devices via the Node Bs serving the SA1, SA2, and SA3 using BMC Schedule Message.
15. During the scheduled time of the next Schedule Period, the RNC would broadcast the SMS CB message containing the Cell Broadcast message data to the mobile devices via the Node Bs serving the SA 1, SA 2, and SA 3 using the BMC CBS message.

7 Single Page Cell Broadcast Message without DRX

This clause describes the illustrative call flows and processing associated with a single page Cell Broadcast message without using the DRX capabilities. It is not the intent of this specification to modify or enhance the 3GPP specifications.

7.1 Single Page Cell Broadcast using SMS Broadcast Request without DRX

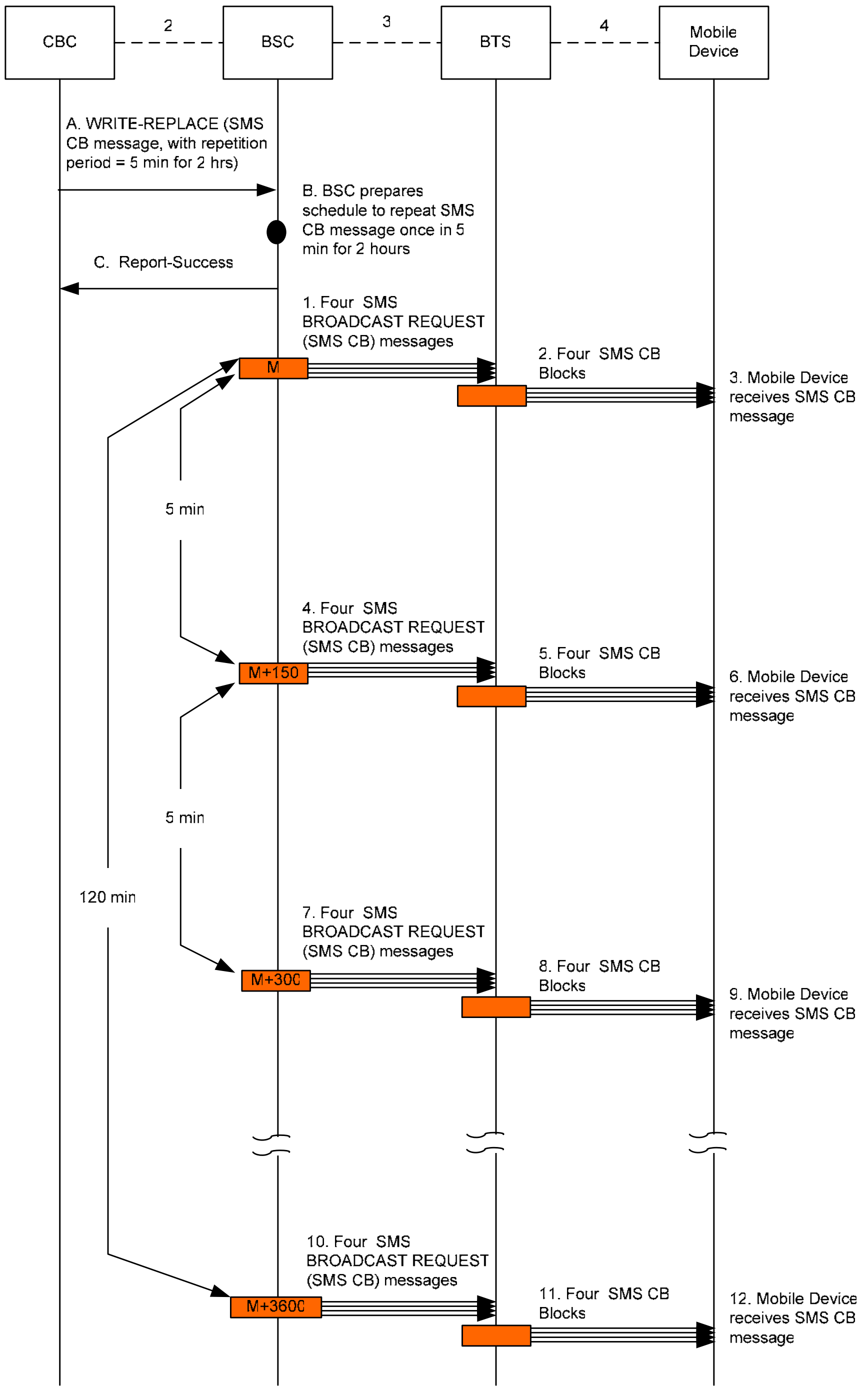

Figure 23: Single Page Cell Broadcast using SMS Broadcast Request without DRX

CBC sends the SMS CB message to BSC

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list).

B. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed, and prepares a schedule to broadcast the message. In this example flow, the repetition period is 150 Message Slots (approximately 5 minutes) and the number of broadcasts to be performed is 24 (i.e., approximately for a duration of 2 hours). The BSC prepares the schedules in such a way that the SMS CB message is broadcast once every 150 Message Slots.

C. BSC returns a REPORT primitive to the CBC indicating successful processing of the SMS CB message.

Broadcasting of new SMS CB message over the Air interface in a non-DRX mode

First Time:

1. In this example, it is assumed that BSC chooses the Message Slot M to broadcast the SMS CB message. When the time that corresponds to the Message Slot M occurs, the BSC sends the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages.
2. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
3. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

Second Time:

4. When the time that corresponds to the Message Slot M+150 occurs (which is approximately 5 minutes away from the Message Slot M, with the assumption that each Message Slot is separated by approximately 2 seconds (actually it 1.883 seconds), the BSC sends the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
6. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

Third Time:

7. When the time that corresponds to the Message Slot M+300 occurs (which is approximately 10 minutes away from the Message Slot M or 5 minutes away from M+150), the BSC sends the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages.
8. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile

devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

9. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

Last Time:

10. When the time that corresponds to the Message Slot M+3600 occurs (which is approximately 2 hours away from the Message Slot M), the BSC sends the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages.
11. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
12. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

7.2 Single Page Cell Broadcast using SMS Broadcast Command without DRX

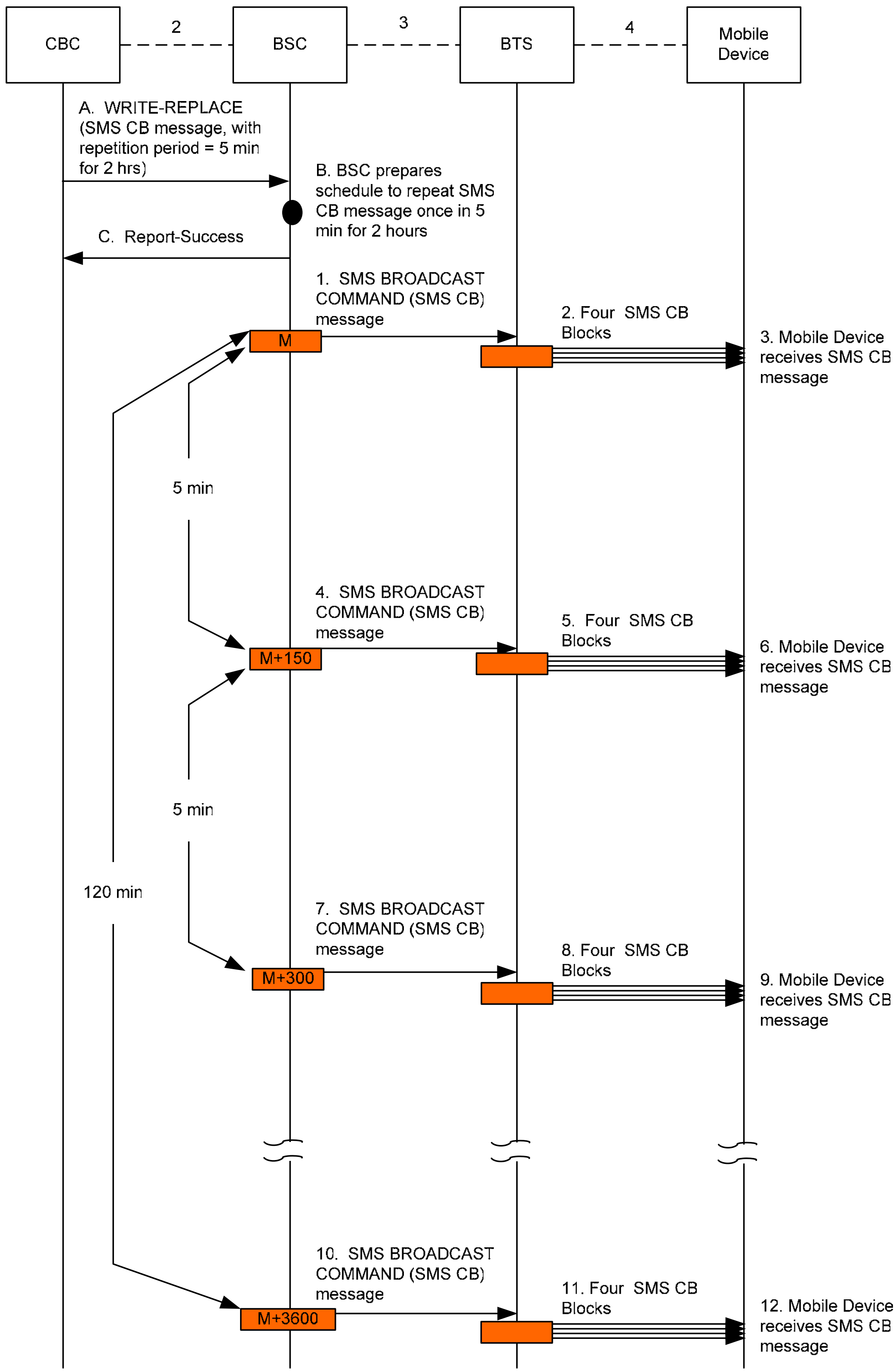

Figure 24: Single Page Cell Broadcast using SMS Broadcast Command without DRX

CBC sends the SMS CB message to BSC

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list).

B. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed, and prepares a schedule to broadcast the message. In this example flow, the repetition period is 150 Message Slots (approximately 5 minutes) and the number of broadcasts to be performed is 24 (i.e., approximately for a duration of 2 hours). The BSC prepares the schedules in such a way that the SMS CB message is broadcast once every 150 Message Slots.

C. BSC returns a REPORT primitive to the CBC indicating successful processing of the SMS CB message.

Broadcasting of new SMS CB message over the Air interface in a non-DRX mode

First Time:

1. In this example, it is assumed that BSC chooses the Message Slot M to broadcast the SMS CB message. When the time that corresponds to the Message Slot M occurs, the BSC sends the SMS CB message to the BTS using a SMS BROADCAST COMMAND message.
2. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, BTS broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
3. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

Second Time:

4. When the time that corresponds to the Message Slot M+150 occurs (which is approximately 5 minutes away from the Message Slot M, with the assumption that each Message Slot is separated by approximately 2 seconds (actually it 1.883 seconds), the BSC sends the SMS CB message to the BTS using a SMS BROADCAST COMMAND message.
5. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, BTS broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
6. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

Third Time:

7. When the time that corresponds to the Message Slot M+300 occurs (which is approximately 10 minutes away from the Message Slot M or 5 minutes away from M+150), the BSC sends the SMS CB message to the BTS using a SMS BROADCAST COMMAND message.

8. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, BTS broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

Last Time:

10. When the time that corresponds to the Message Slot M+3600 occurs (which is approximately 2 hours away from the Message Slot M), the BSC sends the SMS CB message to the BTS using a SMS BROADCAST COMMAND message.
11. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, BTS broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
12. Mobile devices would receive the complete SMS CB message and process the message as required by the application (e.g., display on the screen).

8 Multiple Page Cell Broadcast Message in GSM without DRX

This clause describes the illustrative call flows and processing associated with a multiple page Cell Broadcast message in GSM without the use of the DRX capabilities. It is not the intent of this specification to modify or enhance the 3GPP specifications.

The examples shown in this clause do not assume that the application drives the broadcasting of SMS CB messages with multiple pages. The following call flows are included in this clause:

- Call flow for 2 page Cell Broadcast message on GSM without DRX via SMS Broadcast Request.
- Call flow for 2 page Cell Broadcast message on GSM without DRX via SMS Broadcast Command.

The illustrated call flows apply to GSM networks that operate in a non-DRX mode, in the sense that messages are broadcast as and when the WRITE-REPLACE primitive is received by the BSC. The following are the contents of a WRITE-REPLACE primitive that determines whether a message will result in multiple pages:

- Number of pages
- CBS Message Information Page 1
- CBS Message Information Length 1
- ::::::
- ::::::
- CBS Message Information Page 15
- CBS Message Information Length 15

As indicated above, a CBS message may have a maximum of 15 pages. The information of each page can have a maximum of 82 octets. So, one of page of an SMS CB message broadcast over the air has the following contents:

- Serial Number: 2 octets
- Message Identifier: 2 octets
- Data Coding Scheme: 1 octet
- Page Parameter: 1 octet
- Cell Broadcast Contents: 82 octets

The first 6 octets are referred to as header. The page parameter has the following construct:

- Bits 0-3: Total Number of Pages (range in binary: 0001 to 1111)
- Bits 4-7: Page Number of this SMS CB message (range in binary: 0001 to 1111).

The 3GPP TS 23.041 [Ref 1] specification indicates that when either of the two nibbles is equal to [0000] in binary, then a value of [0001] in binary, shall be assumed for both the nibbles.

8.1 Multiple Page Cell Broadcast using SMS Broadcast Request without DRX

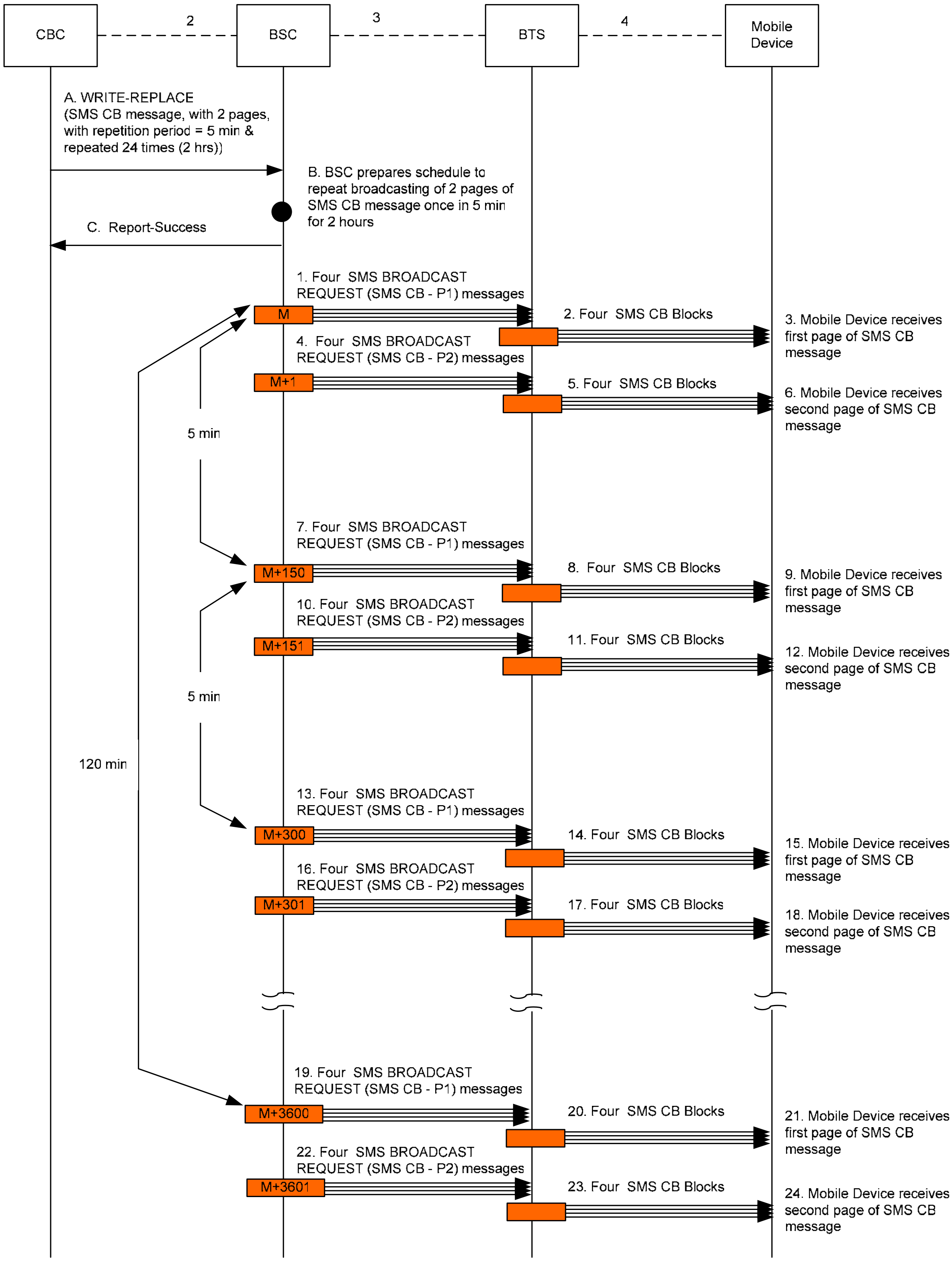

Figure 25: Call Flow for Multiple Page Cell Broadcast Message on GSM without DRX via SMS Broadcast Request

Descriptive Text

The example shows the broadcasting of a CBS message that has 2 pages. In this example, the 2 pages are broadcast in two consecutive message slots. The example also shows that the repetition period of the broadcasting is about 5 minutes and the broadcasting is done for about 2 hours (24 times). The timing between the broadcasting of the first page determines the repetition period.

CBC sends the SMS CB message to BSC

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list). The WRITE-REPLACE indicates that the SMS CB message has two pages.

B. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands that the message has two pages and further understands the repetition period and the number of broadcasts that has to be performed. BSC prepares a schedule to broadcast the two pages of the message. In this example flow, the repetition period is 150 Message Slots (approximately 5 minutes) and the number of broadcasts to be performed is 24 (i.e., approximately for a duration of 2 hours). The BSC prepares the schedules in such a way that the two pages of the SMS CB message are broadcast on the two consecutive Message Slots once every 150 Message Slots.

C. BSC returns a REPORT primitive to the CBC indicating successful processing of the SMS CB message.

Broadcasting of new SMS CB message in a non-DRX mode

First Time – Page 1:

1. In this example, it is assumed that BSC chooses the Message Slot M to broadcast the first page of the SMS CB message. When the time that corresponds to the Message Slot M occurs, the BSC sends the first page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
2. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
3. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

First Time – Page 2:

4. In this example, it is assumed that BSC chooses the Message Slot M+1 to broadcast the second page of the SMS CB message. When the time that corresponds to the Message Slot M+1 occurs, the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus header.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
6. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen).

Second Time – Page 1:

7. When the time that corresponds to the Message Slot M+150 occurs (which is approximately 5 minutes away from the Message Slot M, with the assumption that each Message Slot is separated by approximately 2 seconds (actually it 1.883 seconds)), the BSC sends the first page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
8. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

Second Time – Page 2:

10. When the time that corresponds to the Message Slot M+151 occurs, the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus header.
11. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile

devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

12. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 6, since this is not a new SMS CB message.

Third Time – Page 1:

13. When the time that corresponds to the Message Slot M+300 occurs (which is approximately 10 minutes away from the Message Slot M or 5 minutes away from M+150), the BSC sends the first page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
14. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
15. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

Third Time – Page 2:

16. When the time that corresponds to the Message Slot M+301 occurs, the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus header.
17. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 6, since this is not a new SMS CB message.

Last Time – Page 1:

19. When the time that corresponds to the Message Slot M+3600 occurs (which is approximately 2 hours away from the Message Slot M), the BSC sends the first page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
20. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
21. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

Last Time – Page 2:

22. When the time that corresponds to the Message Slot M+3601 occurs, the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus header.
23. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
24. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 6, since this is not a new SMS CB message.

8.2 Multiple Page Cell Broadcast using SMS Broadcast Command without DRX

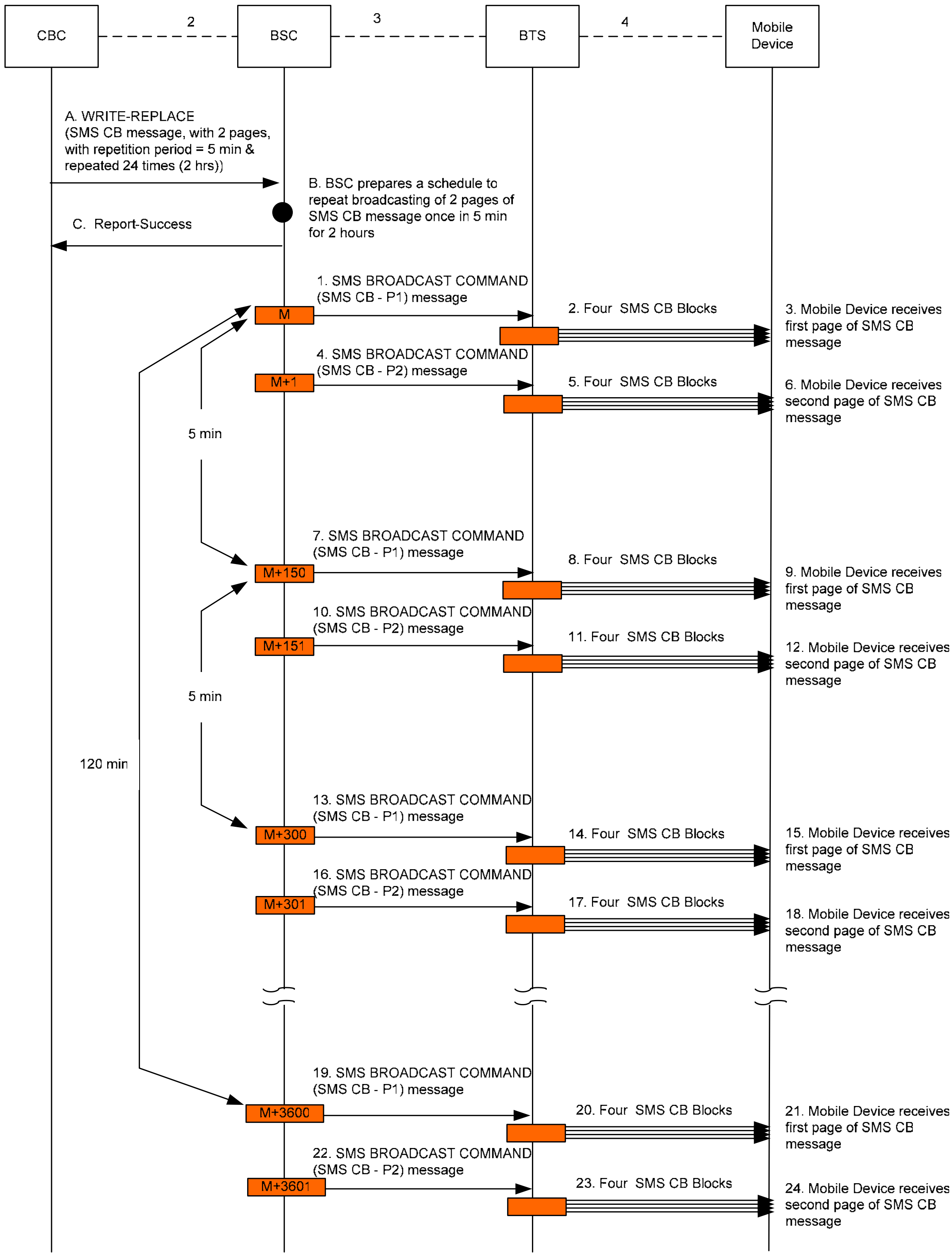

Figure 26: Call Flow for Multiple Page Cell Broadcast Message on GSM without DRX via SMS Broadcast Command

Descriptive Text

The example shows the broadcasting of a CBS message that has 2 pages. In this example, the 2 pages are broadcast in two consecutive message slots. The example also shows that the repetition period of the broadcasting is about 5 minutes and the broadcasting is done for about 2 hours (24 times). The timing between the broadcasting of the first page determines the repetition period.

CBC sends the SMS CB message to BSC

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list). The WRITE-REPLACE indicates that the SMS CB message has two pages.

B. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands that the message has two pages and further understands the repetition period and the number of broadcasts that has to be performed. BSC prepares a schedule to broadcast the two pages of the message. In this example flow, the repetition period is 150 Message Slots (approximately 5 minutes) and the number of broadcasts to be performed is 24 (i.e., approximately for a duration of 2 hours). The BSC prepares the schedules in such a way that the two pages of the SMS CB message are broadcast on the two consecutive Message Slots once every 150 Message Slots.

C. BSC returns a REPORT primitive to the CBC indicating successful processing of the SMS CB message.

Broadcasting of new SMS CB message in a non-DRX mode

First Time – Page 1:

1. In this example, it is assumed that BSC chooses the Message Slot M to broadcast the first page of the SMS CB message. When the time that corresponds to the Message Slot M occurs, the BSC sends the first page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
2. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, BTS broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
3. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

First Time – Page 2:

4. In this example, it is assumed that BSC chooses the Message Slot M+1 to broadcast the second page of the SMS CB message. When the time that corresponds to the Message Slot M+1 occurs, the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST

COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.

5. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
6. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen).

Second Time – Page 1:

7. When the time that corresponds to the Message Slot M+150 occurs (which is approximately 5 minutes away from the Message Slot M, with the assumption that each Message Slot is separated by approximately 2 seconds (actually it 1.883 seconds)), the BSC sends the first page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
8. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

Second Time – Page 2:

10. When the time that corresponds to the Message Slot M+151 occurs, the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
11. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
12. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 6, since this is not a new SMS CB message.

Third Time – Page 1:

13. When the time that corresponds to the Message Slot M+300 occurs (which is approximately 10 minutes away from the Message Slot M or 5 minutes away from M+150), the BSC sends the first page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
14. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
15. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

Third Time – Page 2:

16. When the time that corresponds to the Message Slot M+301 occurs, the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
17. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 6, since this is not a new SMS CB message.

Last Time – Page 1:

19. When the time that corresponds to the Message Slot M+3600 occurs (which is approximately 2 hours away from the Message Slot M), the BSC sends the first page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
20. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

21. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.

Last Time – Page 2:

22. When the time that corresponds to the Message Slot M+3601 occurs, the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
23. BTS receives the SMS BROADCAST COMMAND message and splits the 88 octets of SMS CB message into 4 blocks of 22 octets. When the time of the next Message Slot arrives, broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
24. Mobile devices would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (and the last) page. Thus, after receiving the page, the mobile devices would process the message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 6, since this is not a new SMS CB message.

9 MULTIPLE PAGE CELL BROADCAST MESSAGE IN GSM WITH DRX

This clause describes the call flows and processing associated with a multiple page Cell Broadcast message in GSM with the use of the DRX capabilities.

The examples shown do not assume that the application drives the broadcasting of SMS CB messages with multiple pages. The following call flows are included in this clause:

- Call flow for 2 page Cell Broadcast message on GSM with DRX via SMS Broadcast Request.
- Call flow for 2 page Cell Broadcast message on GSM with DRX via SMS Broadcast Command.

The illustrated call flows apply to GSM networks that operate in a DRX mode. The following are the contents of a WRITE-REPLACE primitive that determines whether a message will result in multiple pages:

- Number of pages
- CBS Message Information Page 1
- CBS Message Information Length 1
- ::::::
- ::::::
- CBS Message Information Page 15
- CBS Message Information Length 15

As indicated above, a CBS message may have a maximum of 15 pages. The information of each page can have a maximum of 82 octets. So, one of page of an SMS CB message broadcast over the air has the following contents:

- Serial Number: 2 octets
- Message Identifier: 2 octets
- Data Coding Scheme: 1 octet
- Page Parameter: 1 octet
- Cell Broadcast Contents: 82 octets

The first 6 octets are referred to as header. The page parameter has the following construct:

- Bits 0-3: Total Number of Pages (range in binary: 0001 to 1111).
- Bits 4-7: Page Number of this SMS CB message (range in binary: 0001 to 1111).

The 3GPP TS 23.041 [Ref 1] specification indicates that when either of the two nibbles is equal to [0000] in binary, then a value of [0001] in binary, shall be assumed for both the nibbles.

9.1 Multiple Page Cell Broadcast using SMS Broadcast Command with DRX

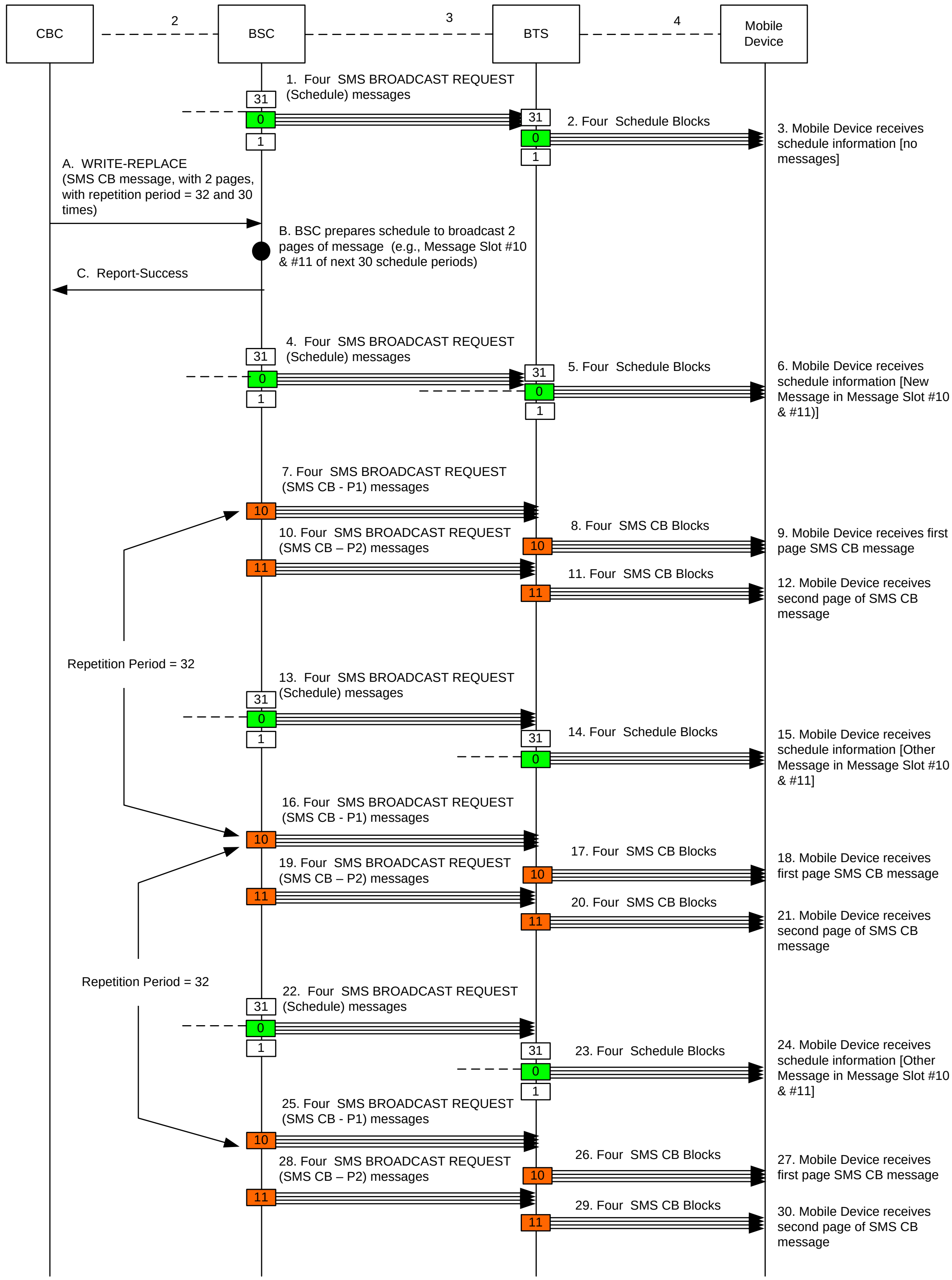

Figure 27: Call Flow for Multiple Page Cell Broadcast Message on GSM with DRX via SMS Broadcast Request

Descriptive Text

The example shows the broadcasting of a CBS message that has 2 pages. In this example, the 2 pages are broadcast in two consecutive message slots. The example also shows that the repetition period of the broadcasting is about 32 Message Slots (or approximately 1 minute) and the broadcasting is done for about 30 minutes (30 times). The timing between the broadcasting of the first page determines the repetition period.

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message, since the first block would indicate that there are no new messages.

CBC sends the SMS CB message to BSC

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list). The WRITE-REPLACE indicates that the SMS CB message has two pages.

B. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands that the message has two pages and further understands the repetition period and the number of broadcasts that has to be performed. In this example flow, the repetition period is 32 slots (approximately 1 minute) and the number of broadcasts to be performed is 30 (i.e., approximately for a duration of 30 minutes). The BSC prepares the schedules in such a way that the two pages of the SMS CB message are broadcast in Message Slot 10 and 11 in every Schedule Period for the next 30 Schedule Periods. Note that in a typical implementation, the BSC would choose the first two free Message Slots. Also note that those two Free Message Slots are not necessarily consecutive Message Slots. However, the BSC as an implementation option may choose the first two free consecutive Message Slots.

C. BSC returns a REPORT primitive to the CBC indicating successful processing of the SMS CB message.

Broadcasting of new SMS CB message in a DRX mode

First Schedule Period (New Message on Message Slots #10 & #11):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 11 contain the new messages.
5. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB messages in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 11.
6. Mobile devices receive the Schedule Message and understand that Message Slots 10 and 11 have the new SMS CB messages. The mobile devices, upon receiving this Schedule Message, continue to operate in the DRX mode and would read the SMS CB messages in Message Slots 10 and 11.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the first page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
8. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.
10. When the time that corresponds to the Message Slot 11 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 11 occurs much before the time delay of 11*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
11. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 11 (i.e., 11 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the

mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

12. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen).

Second Schedule Period (Other Message on Message Slots #10 and #11):

13. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 11 contain the old messages (i.e., Other Messages).
14. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 11.
15. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 11 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message, continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 11.
16. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the first page SMS CB message using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
17. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive. Also, since

this is not a new SMS CB message, processing of the message depends on the application that governs the use of CBS for the message broadcasting.

19. When the time that corresponds to the Message Slot 11 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 11 occurs much before the time delay of 11*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
20. BTS after receiving all 4 blocks of the SMS BROADCAST REQUEST messages, and when the time arrives to send the message corresponding to the Message Slot 11 (i.e., 11 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
21. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 12, since this is not a new SMS CB message.

Third Schedule Period (Other Message on Message Slots #10 & 11):

22. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using 4 SMS BROADCAST REQUEST messages to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 11 contain the old messages (i.e., Other Messages).
23. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 11.
24. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 11 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message, continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 11.

25. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the first page SMS CB message using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
26. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
27. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive. Also, since this is not a new SMS CB message, processing of the message depends on the application that governs the use of CBS for the message broadcasting.
28. When the time that corresponds to the Message Slot 11 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 11 occurs much before the time delay of 11*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the second page of the SMS CB message to the BTS using 4 SMS BROADCAST REQUEST messages. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}. The 88 octets are broadcast using four SMS BROADCAST REQUEST message each having 22 octets plus the header.
29. BTS, after receiving all 4 blocks of the SMS BROADCAST REQUEST messages and when the time arrives to send the message corresponding to the Message Slot 11 (i.e., 11 *1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
30. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 12, since this is not a new SMS CB message.

9.2 Multiple Page Cell Broadcast using SMS Broadcast Command with DRX

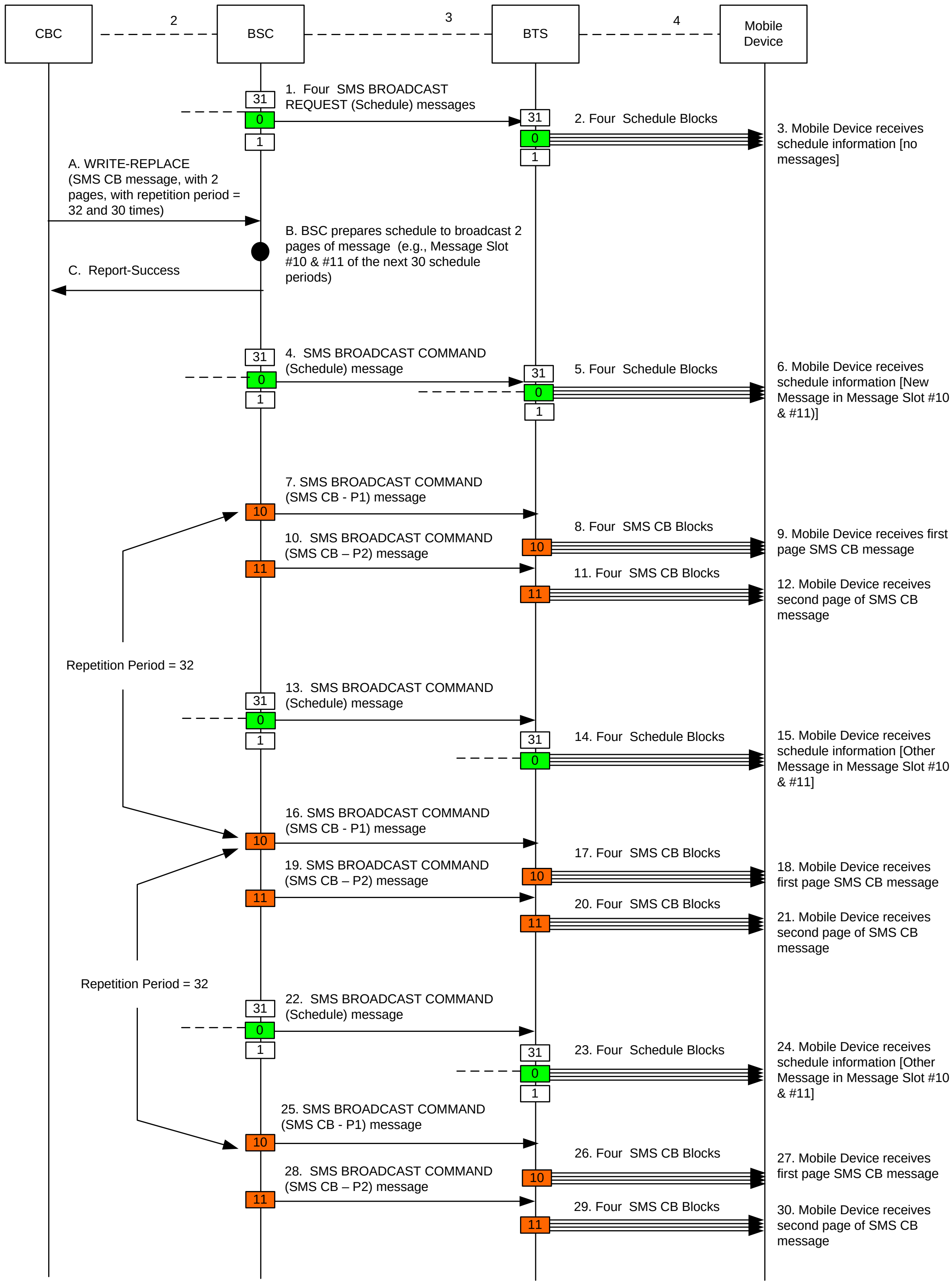

Figure 28: Call Flow for Multiple Page Cell Broadcast Message on GSM with DRX via SMS Broadcast Command

Descriptive Text

The example shows the broadcasting of a CBS message that has 2 pages. In this example, the 2 pages are broadcast in two consecutive message slots. The example also shows that the repetition period of the broadcasting is about 32 Message Slots (or approximately 1 minute) and the broadcasting is done for about 30 minutes (30 times). The timing between the broadcasting of the first page determines the repetition period.

Periodic sending of Schedule Messages

1. At the beginning of a Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC indicates that there are no SMS CB messages and hence, all the Message Slots are Free Message Slots.
2. BTS after receiving the SMS BROADCAST COMMAND message, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots.
3. Mobile devices receive the Schedule Message and understand that no SMS CB messages are expected during the next 31 message slot period. The mobile devices, upon receiving this renewed Schedule Message, continue to operate in the DRX mode. The mobile devices may not read all 4 blocks of the Schedule Message since the first block would indicate that there are no new messages.

CBC sends the SMS CB message to BSC

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Base Station Controller (BSC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list). The WRITE-REPLACE indicates that the SMS CB message has two pages.

B. BSC receives the SMS CB message within the WRITE-REPLACE primitive, understands that the message has two pages and further understands the repetition period and the number of broadcasts that has to be performed. In this example flow, the repetition period is 32 slots (approximately 1 minute) and the number of broadcasts to be performed is 30 (i.e., approximately for a duration of 30 minutes). The BSC prepares the schedules in such a way that the two pages of the SMS CB message are broadcast in Message Slot 10 and 11 in every Schedule Period for the next 30 Schedule Periods. Note that in a typical implementation, the BSC would choose the first two free Message Slots. Also note that those two Free Message Slots are not necessarily consecutive Message Slots. However, the BSC as an implementation option may choose the first two free consecutive Message Slots.

C. BSC returns a REPORT primitive to the CBC indicating successful processing of the SMS CB message.

<u>Broadcasting of new SMS CB message in a DRX mode</u>

First Schedule Period (New Message on Message Slots #10 & #11):

4. At the beginning of the next Schedule Period, BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 11 contain the new messages.
5. BTS, after receiving the SMS BROADCAST COMMAND message, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB messages in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 11.
6. Mobile devices receive the Schedule Message and understand that Message Slots 10 and 11 have the new SMS CB messages. The mobile devices, upon receiving this Schedule Message, continue to operate in the DRX mode and would read the SMS CB messages in Message Slots 10 and 11.
7. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the first page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
8. BTS, after receiving the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10*1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
9. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive.
10. When the time that corresponds to the Message Slot 11 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 11 occurs much before the time delay of 11*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
11. BTS, after receiving the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 11 (i.e., 11*1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
12. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (last) page.

Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen).

Second Schedule Period (Other Message on Message Slots #10 and #11):

13. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 11 contain the old messages (i.e., Other Messages).
14. BTS, after receiving the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 11.
15. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 11 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message, continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 11.
16. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the first page SMS CB message using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
17. BTS, after receiving the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10*1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
18. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive. Also, since this is not a new SMS CB message, processing of the message depends on the application that governs the use of CBS for the message broadcasting.
19. When the time that corresponds to the Message Slot 11 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 11 occurs much before the time delay of 11*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND

message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.

20. BTS, after receiving the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 11 (i.e., 11*1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
21. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 12, since this is not a new SMS CB message.

Third Schedule Period (Other Message on Message Slots #10 & 11):

22. When the time that corresponds to the beginning of next Schedule Period occurs (which may occur much before the typical time delay of 32*1.883 seconds between two scheduled Schedule Messages due to the case of receiving a CBCH Load Indication (underflow) message from the BTS), BSC prepares and sends a Schedule Message using a SMS BROADCAST COMMAND message to the BTS. In this Schedule Message, the BSC would indicate that the Message Slots 10 and 11 contain the old messages (i.e., Other Messages).
23. BTS, after receiving the SMS BROADCAST COMMAND message and when the time for the beginning of the next Schedule Period (i.e., 32 *1.883 seconds after the previously sent Schedule Message) arrives, broadcasts the Schedule Message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field. BTS also manages the CBCH timing and broadcasts the NULL messages during the Free Message Slots. BTS may also send a CBCH Load Indication (with "underflow" as the CBCH load type within the CBCH Load Information, 3GPP TS 48.058) message to the BSC to receive the SMS CB message in advance so that it has the messages available in order to broadcast the same over the air in Message Slots 10 and 11.
24. Mobile devices receive the Schedule Message and understand that there are no new messages, but the Message Slots 10 and 11 have the old SMS CB messages. The mobile devices, upon receiving this Schedule Message, continue to operate in the DRX mode and may read the SMS CB messages in Message Slots 10 and 11.
25. When the time that corresponds to the Message Slot 10 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 10 occurs much before the time delay of 10*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the first page SMS CB message using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00010010] indicating that this is the page 1 (0001B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
26. BTS, after receiving the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 10 (i.e., 10*1.883 seconds after broadcasting

of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.

27. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the first page. Thus, after receiving the page, the mobile devices would wait for the next page to arrive. Also, since this is not a new SMS CB message, processing of the message depends on the application that governs the use of CBS for the message broadcasting.
28. When the time that corresponds to the Message Slot 11 occurs (which may be a case of immediate sending when a CBCH Load Indication (underflow) is received from the BTS implying that the time that corresponds to the Message Slot 11 occurs much before the time delay of 11*1.883 seconds from the previously sent scheduled Schedule Message), the BSC sends the second page of the SMS CB message to the BTS using a SMS BROADCAST COMMAND message. The page parameter of the SMS CB header field will have the following binary value: [00100010] indicating that this is the page 2 (0010B) of the 2 pages (0010B). The SMS CB message has 88 octets of data {6 octets of header plus 82 octets of information}.
29. BTS, after receiving the SMS BROADCAST COMMAND message and when the time arrives to send the message corresponding to the Message Slot 11 (i.e., 11*1.883 seconds after broadcasting of the Schedule Message), broadcasts the SMS CB message over the air to the mobile devices in the 4 consecutive CBCH blocks. Each block consists of 22 octets of data plus the header field.
30. Mobile devices which were previously given the schedule information (thus operating in a DRX mode) would receive this page of the SMS CB message. The mobile devices understand through the page parameter that the message has two pages and this is the second (last) page. Thus, after receiving the page, the mobile devices would process the complete message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 12, since this is not a new SMS CB message.

10 MULTIPLE PAGE CELL BROADCAST MESSAGE IN UMTS

This clause describes the call flows and processing associated with a multiple page Cell Broadcast message in UMTS.

The example shown does not assume that the application drives the broadcasting of SMS CB messages with multiple pages.

The illustrated call flow applies to UMTS networks. The following are the contents of a WRITE-REPLACE primitive that determine whether message will result in multiple pages:

- Number of pages
- CBS Message Information Page 1
- CBS Message Information Length 1
- ::::::
- ::::::
- CBS Message Information Page 15
- CBS Message Information Length 15

As indicated above, a CBS message may have a maximum of 15 pages. The information of each page can have a maximum of 82 octets. In an UMTS network, all the pages are sent within one BMC CBS message as Cell Broadcast Data. The BMC CBS Message broadcast over the air has the following contents:

- Message Type: 1 octet
- Message Identifier: 2 octets
- Serial Number: 2 octets
- Data Coding Scheme: 1 octet
- Cell Broadcast Data: Variable {84 to 1246 octets}

Each page will have 83 octets and hence, the 15 pages will have a total of 1245 octets plus the octet that tells the number of pages. The following is the details of the Cell Broadcast Data field:

- Octet 1: Number of Pages
- Octet 2 – 83: The CBS Information Page 1
- Octet 84: The CBS Information Length 1
- Octet 85 – 166: The CBS Information Page 2
- Octet 167: The CBS Information Length 2
- :::::::
- :::::::
- Octet 1164 – 1245: The CBS Information Page 15
- Octet 1246: The CBS Information Length 15

Thus a CBS message can have a maximum of 1252 octets (1246 plus the 6 octets of header). When a given page has less than the 82 octets of data, the remainder of the 82 octets are padded.

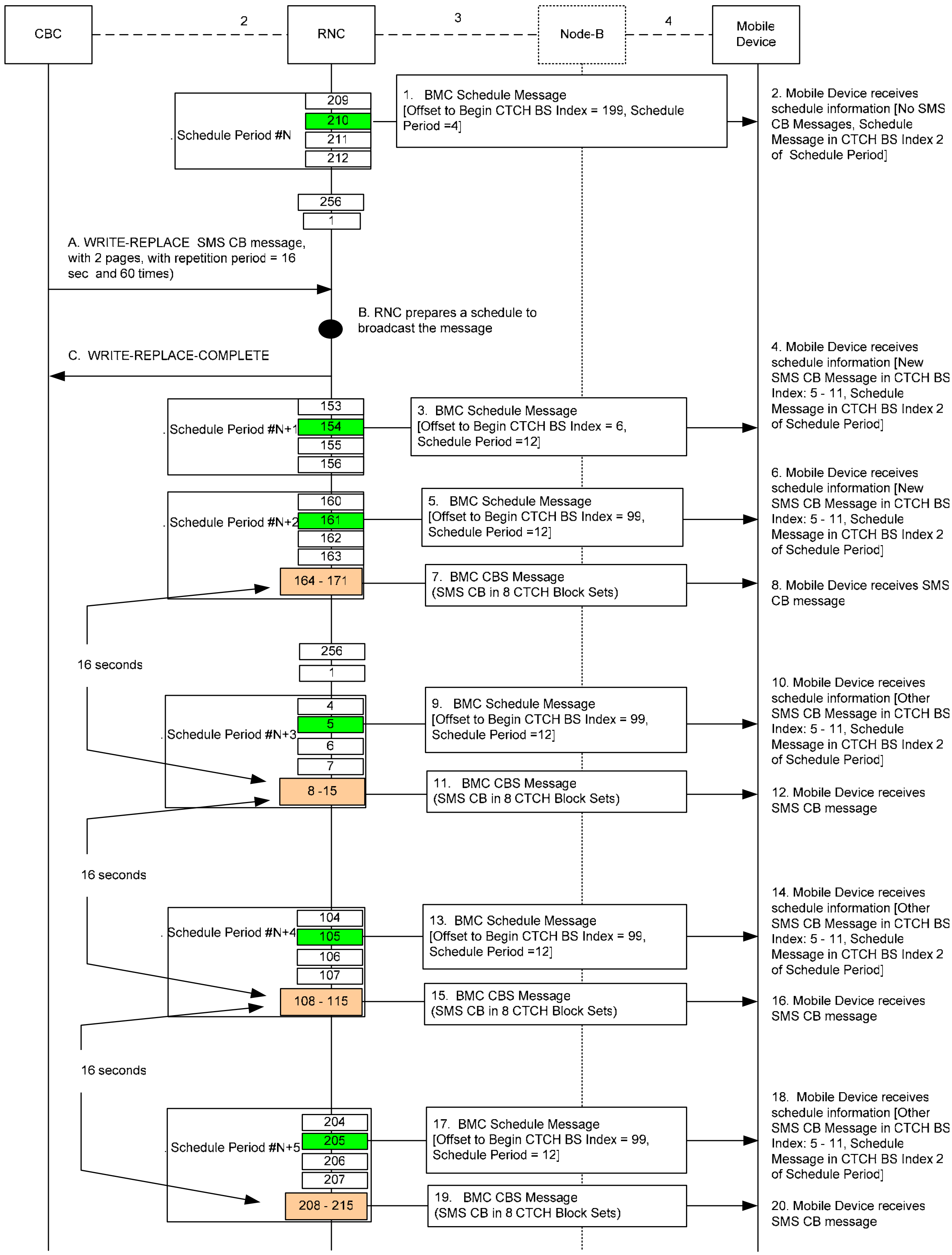

Figure 29: Call Flow for Multiple Page Cell Broadcast Message in UMTS

Descriptive Text

The example shows the broadcasting of a CBS message that has 2 pages. The example also shows that the repetition period of the broadcasting is about 16 seconds and the broadcasting is done for about 16 minutes (60 times).

The call flow assumes that the message transmitted in each of the CTCH BS is able to carry up to 23 octets of the data. A SMS CB message with 2 pages will have the following octets:

- Octets 1: Message Type
- Octet 2-3: Message Identifier
- Octet 4-5: Serial Number
- Octet 6: Data Coding Scheme
- Octet 7: 2 (Number of pages)
- Octet 8 – 89: CBS Information Page 1 (with padding, if necessary)
- Octet 90: CBS Information Length 1
- Octet 91 - 172: CBS Information Page 2 (with padding, if necessary)
- Octet 173: CBS Information Length 2

If a CBS information page has N (which is less than or equal to 82) octets of data, then the last [82 – N] octets are padded so as to maintain the octet-positions. With 23 octets of data per CTCH BS (as an example), in order to transmit 173 octets of data (the size of 2 pages of a CBS message), 8 CTCH Block Sets are required. Also, the call flow assumes the following the DRX level 1 parameters: N = 16 and K = 0. The value of N = 16, means that the first SFN of the two consecutive CTCH Block Sets are separated by 16 radio frames (or 160 ms). The index of a CTCH Block Set known to the RNC can be different from the index of the same CTCH Block Set known to the mobile device. The absolute CTCH Block Set Index values referenced below are from an RNC's perspective.

Periodic sending of Schedule Messages (Schedule Period #N)

1. In Schedule Period #N, RNC sends the Schedule Message on CTCH BS Index value 210 using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 199 and the length of the Schedule Period as 4. The Offset to the Begin CTCH BS Index value of 199 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 210 + 199 (i.e., = 153, derived from 409 modulo 256). The Schedule Period of 4 would mean that the next Schedule Period would consist of 4 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 153, 154, 155, and 156. The Schedule Message indicates that there are no SMS CB messages and the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 154 is used to send the next Schedule Message.
2. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 199 (i.e., the next Schedule Period begins at the CTCH BS Index 199 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile

device also understands that the next Schedule Period would consist of 4 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of that Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period.

<u>CBC sends the SMS CB message to RNC</u>

A. CBC sends a constructed SMS CB message within the WRITE-REPLACE indication primitive to each Radio Network Controller (RNC) that controls cell sites within the target area of the SMS CB message (as identified in the cell list). The WRITE-REPLACE indicates that the SMS CB message has two pages.

B. RNC receives the SMS CB message within the WRITE-REPLACE primitive, understands the repetition period and the number of broadcasts that has to be performed, and prepares a schedule to broadcast the message. In this example flow, the repetition period is 16 seconds and the number of broadcasts to be performed is 60 (i.e., approximately for a duration of 16 minutes). The two pages of SMS CB message are indicated within the WRITE-REPLACE primitive as shown below:

    a. Number of pages = 2

    b. CBS Message Information Page 1

    c. CBS Message Information Length 1

    d. CBS Message Information Page 2

    e. CBS Message Information Length 2

C. RNC returns a REPORT primitive to the CBC indicating successful processing of the Cell Broadcast message.

<u>Schedule Period #N+1 (Mobile device is notified about the new SMS CB message)</u>

In the example, the beginning of the next Schedule Period is adjusted so as to send the SMS CB message at the earliest possible time.

3. Based on a previously sent periodic Schedule Message, RNC sends the Schedule Message on CTCH BS Index value 154 using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 6 and the length of the Schedule Period as 12. The Offset to the Begin CTCH BS Index value of 6 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 154 + 6 (i.e., = 160). The Schedule Period of 12 would mean that the next Schedule Period would consist 12 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 160 to 171. The Schedule Message also indicates that there is a new SMS CB message which would be sent at the relative CTCH BS Index 5 to 12 of the next Schedule Period. From an RNC's perspective, this would mean that the new SMS CB message is sent in the CTCH BS Index 164 to 171. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 161 is used to send the next Schedule Message.

4. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 6 (i.e., the next Schedule Period begins at the CTCH BS Index 6 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 12 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of that Schedule Period. Furthermore, the mobile device understands that a new SMS CB message would be sent by the RNC at the relative CTCH BS Index values 5 to 12 of the next Schedule Period.

<u>Schedule Period #N+2 (New Message sent)</u>

5. The RNC broadcasts the Schedule Message in the CTCH BS Index 161 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 (note that the Offset to Begin CTCH BS Index could be set in a way to suit the repetition period of the SMS CB message, for example, it could be 199 if the repetition period was 32 seconds) and the length of the Schedule Period as 12. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 161 + 99 (i.e., = 4, derived from 260 modulo 256). The Schedule Period of 12 would mean that the next Schedule Period would consist of 12 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 4 to 15. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 12 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 8 to 15. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 5 is used to send the next Schedule Message.
6. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 12 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 12 of the next Schedule Period.
7. The RNC broadcasts the new SMS CB message in the relative CTCH BS Index 5 to 12 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 164 to 171) using the BMC CBS message.
8. The mobile device, which was previously given the schedule information, receives the new SMS CB message in the relative CTCH BS Index 5 to 12 of the Schedule Period and would process the message as required by the application (e.g., display on the screen).

Schedule Period #N+3 (Old Message sent as Other Message)

9. The RNC broadcasts the Schedule Message in the CTCH BS Index 5 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 and the length of the Schedule Period as 12. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 5 + 99 (i.e., = 104). The Schedule Period of 12 would mean that the next Schedule Period would consist of 12 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 104 to 115. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 12 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 108 to 115. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 105 is used to send the next Schedule Message.
10. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 12 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as a Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 12 of the next Schedule Period.
11. The RNC broadcasts the old SMS CB message (as an Other SMS CB message) in the relative CTCH BS Index 5 to 12 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 8 to 15) using the BMC CBS message.
12. The mobile device, which was previously given the schedule information, receives the Other SMS CB message in the relative CTCH BS Index 5 to 12 of the Schedule Period and processes the message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 8, since this is not a new SMS CB message.

Schedule Period #N+4 (Old Message sent as Other Message)

13. The RNC broadcasts the Schedule Message in the CTCH BS Index 105 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 and the length of the Schedule Period as 12. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 105 + 99 (i.e., = 204). The Schedule Period of 8 would mean that the next Schedule Period would consist of 12 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 204 to 215. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 12 of the next Schedule

Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 208 to 215. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 205 is used to send the next Schedule Message.

14. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 12 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS CB messages in the next Schedule Period, but the old messages (as a Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 12 of the next Schedule Period.
15. The RNC broadcasts the old SMS CB message (as Other SMS CB message) in the relative CTCH BS Index 5 to 12 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 108 to 115) using the BMC CBS message.
16. The mobile device, which was previously given the schedule information, receives the Other SMS CB message in the relative CTCH BS Index 5 to 12 of the Schedule Period and processes the message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 8, since this is not a new SMS CB message.

Schedule Period #N+5 (Old Message sent as Other Message)

17. The RNC broadcasts the Schedule Message in the CTCH BS Index 205 (i.e., relative CTCH BS Index 2 of the Schedule Period) using the BMC Schedule Message. The Schedule Message indicates that Offset to the Begin CTCH BS Index as 99 and the length of the Schedule Period as 12. The Offset to the Begin CTCH BS Index value of 99 would mean that (from an RNC's perspective) the next Schedule Period would begin at the CTCH BS Index 205 + 99 (i.e., = 48, derived from 304 modulo 256). The Schedule Period of 12 would mean that the next Schedule Period would consist of 12 consecutive CTCH Block Sets. From an RNC's perspective, this would mean that CTCH BS Index values of the next Schedule Period would be: 48 to 59. The Schedule Message also indicates that there are no new SMS CB messages, but the old SMS CB message would be sent (i.e., as a Other SMS CB message) at the relative CTCH BS Index 5 to 12 of the next Schedule Period. From an RNC's perspective, this would mean that the Other SMS CB message is sent in the CTCH BS Index 51 to 59. The Schedule Message also indicates that the next Schedule Message would be sent at the relative CTCH BS Index 2 of the next Schedule Period. From an RNC's perspective, this would imply the CTCH BS Index of 49 is used to send the next Schedule Message.
18. The mobile device receives the BMC Schedule Message as instructed within the Schedule Message sent in the previous Schedule Period. The mobile device understands that the Offset to the Begin CTCH BS Index is 99 (i.e., the next Schedule Period begins at the CTCH BS Index 99 plus the CTCH BS Index in which the particular Schedule Message was received). The mobile device also understands that the next Schedule Period would consist of 12 CTCH Block Sets and the next Schedule Message would be sent by the RNC at the relative CTCH BS Index 2 of the next Schedule Period. Furthermore, the mobile device understands that there are no new SMS

CB messages in the next Schedule Period, but the old messages (as a Other SMS CB message) would be sent by the RNC at the relative CTCH BS Index values 5 to 12 of the next Schedule Period.

19. The RNC broadcasts the old SMS CB message (as Other SMS CB message) in the relative CTCH BS Index 5 to 12 of the Schedule Period (i.e., from an RNC's perspective the CTCH BS Index 208 to 215) using the BMC CBS message.
20. The mobile device, which was previously given the schedule information, receives the Other SMS CB message in the relative CTCH BS Index 5 to 12 of the Schedule Period and processes the message as required by the application (e.g., display on the screen). Also, note that the mobile device behavior in processing this complete message might be different from the behavior noted in step 8, since this is not a new SMS CB message.