

**3rd Generation Partnership Project (3GPP);
Technical Specification Group (TSG) RAN;
Working Group 2 (WG2);**

Radio Interface for Broadcast/Multicast Services

TSG-RAN



TSGRP-99473

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Reference

<Workitem> (<Shortfilename>.PDF)

Keywords

Digital cellular telecommunications system,
Universal Mobile Telecommunication System
(UMTS), UTRA, IMT-2000

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Foreword

This Technical Report has been produced by the 3GPP.

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- x the first digit:
 - 1 presented to TSG for information;
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 - 3 Indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification.

1 Scope

The present document shall provide a general overview on radio interface related aspects of broadcast/multicast services. Also in the scope of this report is the functional split between UTRAN nodes and the analysis of the potential impact on UTRAN related interfaces regarding broadcast/multicast services. This report covers stage 2 and stage 3 aspects.

This report is organized as follows: Chapter 4 gives an overview on the broadcast/multicast services and their requirements. Chapter 5 provides a common model and describes aspects common to all point-to-multipoint services. Chapters 6 - 10 are devoted to the different broadcast/multicast service categories. Each service specific chapter describes the requirements on the interfaces. In these subchapters the impacts on the interface functions and the protocol aspects are described. This TR covers only those items which are in the scope of 3GPP TSG RAN. Information from Technical Specifications or other documents are provided when it is necessary to understand the requirements described.

Table 1: Schedule of the broadcast/multicast services onto the UMTS phases and annual releases

Phase	(Annual) Release	Broadcast/multicast service
1	1999	SMS Cell Broadcast Service (GSM)
	2000	
	2001	

Note: A decision to map the services to phases/releases is required for all other broadcast/multicast services.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to a TS shall also be taken to refer to later versions published as an EN with the same number.

- [1] 3GPP TS 22.100 "UMTS Phase 1"
- [2] 3GPP TS 22.101 "UMTS Service Principle"
- [3] 3GPP TS 22.105 "Services and Service Capabilities"
- [4] 3GPP TS 25.301 "Radio Interface Protocol Architecture"
- [5] 3GPP TS 25.302 "Services provided by the Physical Layer"
- [6] 3GPP TS 25.303 "UE Functions and Interlayer Procedures in Connected Mode"
- [7] 3GPP TS 25.304 "UE Procedures in Idle Mode"
- [8] 3GPP TS 25.321 "MAC Protocol Specification"
- [9] 3GPP TS 25.322 "RLC Protocol Specification"
- [8] 3GPP TS 25.331 "RRC Protocol Specification"

- [9] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); Principles of telecommunication services supported by a GSM Public Land Mobile Network (PLMN)".
- [10] GSM 02.60: "GPRS Service description"
- [11] GSM 03.41: "Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)"
- [12] GSM 03.61: "Digital cellular telecommunications system (Phase 2+); Support of Mobile Number Portability (MNP); Service description; Stage 1"
- [13] 3GPP TS 23.110: "UMTS Access Stratum, Services and Functions"

3 Definitions and Abbreviations

3.1 Definitions

3.2 Abbreviations

BCCH	Broadcast Control Channel
BCH	Broadcast Channel
BMC	Broadcast/Multicast Control
CB	Cell Broadcast
CCCH	Common Control Channel
CTCH	Common Traffic Channel
FACH	Forward Access Channel
IP	Internet Protocol
IP-M	IP Multicast
MDS	Multimedia Distribution Service
PTM	Point-to-Multipoint
PTM-G	PTM Group Call
PTM-M	PTM Multicast
SMS	Short Message Service
SMS-CB	SMS Cell Broadcast
UE	User Equipment
UMTS	Universal Mobile Telecommunication System

TrCH Transport channel
UTRAN UMTS Terrestrial Radio Access Network

4 Overview of Point-to-multipoint Services and Requirements

It is agreed to have service continuity for GSM/GPRS point-to-multipoint services in UMTS ([1] and [2]). This means that the user gets the same service behaviour as he knows it from GSM or GPRS. The services are SMS Cell Broadcast [101] and Point-to-multipoint Multicast, Point-to-multipoint Group Call and IP Multicast [102].

Combined with the UMTS service classification given in [2] the service classification shown in Figure 1 could be used as a starting point. The figure contains the view in terms of Radio Access Bearer services and should not be applied for higher layers where other categories of services may exist. Future work may result in changes of Figure 1.

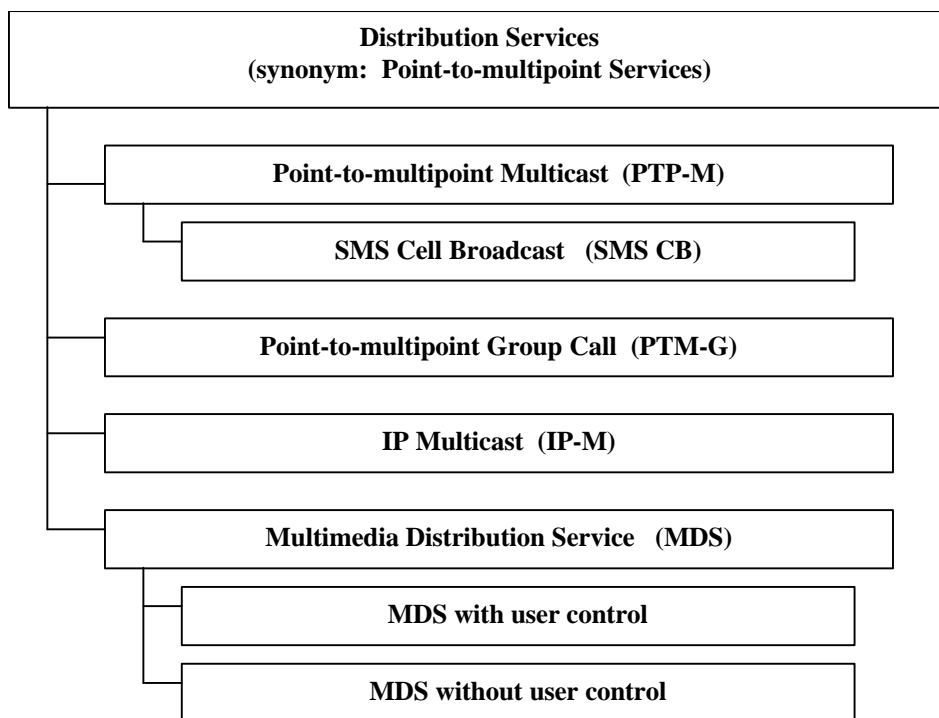


Figure 1: Structure of point-to-multipoint services

Tables 1 and 2 below summarise the service attributes defining the broadcast/multicast services. Table 3 allocates attributes of the Uu radio interface to the services. Table entries which are left empty, require further study.

Table 1: Bearer Service attributes ([3])

Attributes		Values
Information transfer attributes	1. Connection mode attribute	Connection oriented: CO (Circuit Switched base)
		Connectionless: CL (Packet Switched)
	2. Transfer type attribute	Constant bit rate
		Variable bit rate
		Available bit rate
		Unspecified bit rate
	3. Symmetry attribute	Unidirectional
		Bi-directional symmetric
		Bi-directional asymmetric
	4. Communication configuration attribute	Point-to-point
		Point-to-multipoint
	5. Information transfer rate attributes	(Continuous range of values is possible)
		High bit rate
		Medium bit rate
		Low bit rate
	Information quality attributes	1. Maximum transfer delay attribute
Delay sensitive		
Delay insensitive		
2. Delay variation attribute		(Continuous range of values is possible)
		Constant
		Variable
3. Bit error ratio attribute		(Continuous range of values is possible)
		Loss sensitive
		Loss insensitive
4. Error characteristics attribute		Uniform
		Bursty

Table 2: Overview of Broadcast/Multicast Services (Part 1)

Attributes	SMS-CB	PTM Multicast (medium rate)	PTM Multicast (high rate)	PTM Group call	IP-multicast (Medium rate)	IP-multicast (Low rate)
Information transfer attributes						
1. Connection mode attribute	CL	CL	CL	CO	CL	CL
2. Transfer type attribute	Constant	Variable	Variable	Variable	Available	Available
3. Symmetry attribute	UNI	UNI	UNI	UNI BI ASYM MULTI	MULTI (UNI)	MULTI (UNI)
4. Communication configuration attribute	PTM	PTM	PTM	PTM	PTM	PTM
5. Information transfer rate attributes	Low	Medium	High	Low	Medium	Low
Information quality attributes						
1. Maximum transfer delay attribute	Delay insensitive	Delay insensitive	Delay sensitive	Delay sensitive	Delay insensitive	Delay insensitive
2. Delay variation attribute						
3. Bit error ratio attribute	Loss insensitive	Loss insensitive	Loss insensitive	Loss insensitive	Loss sensitive	Loss sensitive
4. Error characteristics attribute						
Defined in	GSM	GPRS	GPRS	GPRS	GPRS	GPRS

(Editor's note: Value MULTI is not defined in [3] yet. It is specified in [10])

Table 2: Overview of Broadcast/Multicast Services (Part 2)

Attributes	MDS without user control (high rate)	MDS without user control (medium rate)	MDS with user control (high rate)	MDS with user control (medium rate)	Messaging service (high rate)	Messaging service (medium rate)
Information transfer attributes						
1. Connection mode attribute						
2. Transfer type attribute						

3. Symmetry attribute						
4. Communication configuration attribute	PTM	PTM	PTM	PTM	PTM	PTM
5. Information transfer rate attributes	High	Medium	High	Medium	High	Medium
Information quality attributes						
1. Maximum transfer delay attribute						
2. Delay variation attribute						
3. Bit error ratio attribute						
4. Error characteristics attribute						
Defined in	UMTS	UMTS	UMTS	UMTS	UMTS	UMTS

Table 3: Radio Interface related attributes of broadcast/multicast services (part 1) [10]

Attributes	SMS-CB	PTM Multicast (medium rate)	PTM Multicast (high rate)	PTM Group call	IP-multicast (Medium rate)	IP-multicast (Low rate)
UE modes (ffs.)	(ffs.)					
Logical Channels	CTCH	CTCH	CTCH	CTCH	CTCH	CTCH
Necessity of separate control channel	Yes BCCH					
Transport Channels	FACH					
Physical Channels	Secondary CCPCH					
DRX Mode	Yes	Yes	Yes	No	Yes	Yes
Primary addressing	GEO area	Subscriber group	Subscriber group	Subscriber group	Subscriber group	Subscriber group
Secondary addressing	---	GEO area	GEO area	GEO area	---	---
Present subscribers known	No	No	No	Yes	Yes	Yes
Ciphering	No	No	No	Yes	Yes	Yes
Reliable delivery	No	No	No	Optional	Yes	Yes

Table 3: Radio Interface related attributes of broadcast/multicast services (part 2)

Attributes	MDS without user control (high rate)	MDS without user control (medium rate)	MDS with user control (high rate)	MDS with user control (medium rate)	Messaging service (high rate)	Messaging service (medium rate)
UE modes (ffs.)						
Logical Channels						
Necessity of separate control channel						
Transport Channels						
Physical Channels						
DRX Mode						
Primary addressing						

Secondary addressing						
Present subscribers known						
Ciphering						
Reliable delivery						

5 Common Model

The common Traffic Channel (CTCH) [4] is provided by the MAC sublayer for support of broadcast/multicast services. It is presently assumed that the CTCH can be used for all categories of broadcast/multicast services.

The present assumption (ffs.) for SMS-CB service is that the CTCH is mapped to a FACH transport channel. The FACH is also a candidate to be used for other multicast services. This possibility will be further investigated in this report.

6 SMS Cell Broadcast Service (GSM)

This chapter contains the requirements derived from GSM specifications of SMS Cell Broadcast Teleservice and the analysis of the impact on the radio interface Uu.

The main requirements for Release 99 are:

- service continuity (i.e. no degradation of the GSM SMS CB service as seen by users)
- the restrictions which are given in GSM does not remain any longer:
- this report should be a basis for future broadcast/multicast service developments
- minimising the power consumption by use of intelligent scheduling schemes for SMS CB messages (GSM SMS CB message discontinuous reception CB-DRX should become mandatory).

The analysis of 3G SMS CB service integration is done top-down. It starts with the network architecture and follows with protocol architectures applicable on each interface.

In chapter 6.1 the impact on UTRAN functions is described. This chapter provides all information on the network level needed to derive the requirements for each interface involved and its services, functions and procedures. In general two network architecture are possible:

Case 1 which takes the existing GSM network architecture where the Cell Broadcast Center CBC exists as an external node and

Case 2 which integrates the CBC into the 3G Core Network.

Chapter 6.2 discusses the requirements on the radio interface. The main requirement is to find a radio interface architecture which is independent from the chosen network architecture Case1 or Case 2. Three options are discussed in this report:

Option 1 introduces a new Layer 3 sublayer, the Broadcast/Multicast Control (BMC) to the user plane,

Option 2 integrates the storage and scheduling of SMS CB messages into RRC and

Option 3 splits this main function between RRC and MAC.

Pros and cons of these possible protocol architecture options are discussed.

Further special radio requirements are listed in subchapters related to each radio link interface layer.

The functions related to the CBC-RNC-interface are not in the scope of RAN WG2.

6.1 Impact on UTRAN functions

6.1.1 Network Architecture (Case 1 and Case 2)

Two cases will be discussed:

Case 1: The existing GSM network architecture remains. This means that the Cell Broadcast Center CBC (i.e. node where SMS CB messages are managed) is not part of the 3G core network and there exists an external interface Ibm' connecting RNC and CBC. This interface is described in GSM 03.41 but is not mandatory. Different implementations exist on the market.

Note 1: SA2 is requiring that interface Ibm' becomes mandatory within 3GPP (see S2-99440)

Note 2: Whether the specification of the interface between RNC and CBC is out of scope of 3GPP is left in SA WG2.

Note 3: SA2 discusses Case 1 to be used in Phase 1 Release 1999. (S2-99440)

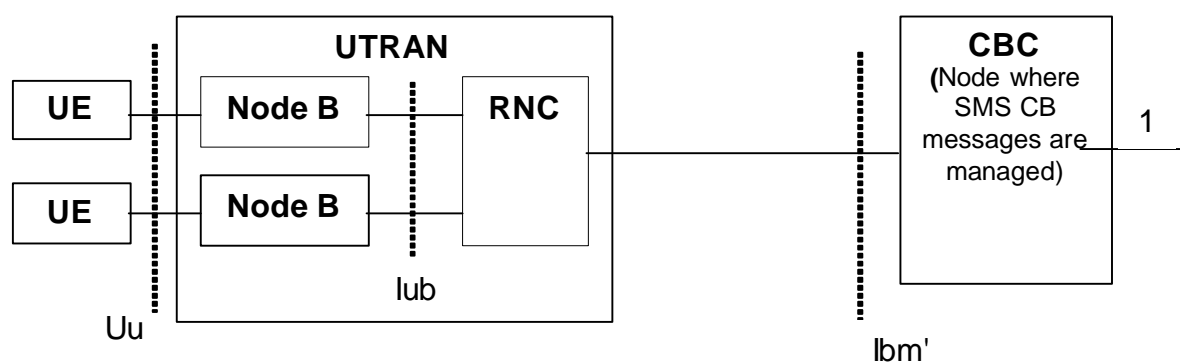


Figure 6.1: Architecture for SMS Cell Broadcast in UMTS for Case 1

Case 2: The SMS CB managing node is integrated into the 3G core network CN. Thus the SMS CB messages are delivered over the Iu interface to the RNC and there exists another interface Ibm between the AN/CN and the CBC.

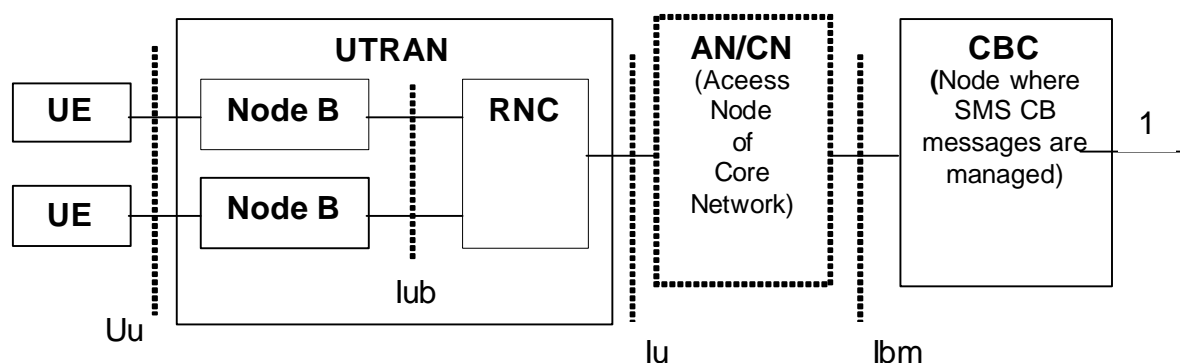


Figure 6.2: Architecture for SMS Cell Broadcast in UMTS for Case 2

Note: Case 2 is similar to the network architecture proposed for GPRS PTM Multicast.

6.1.2 Functions and Operations

An overview of the functions needed is given in Table 6.1.

Table 6.1: Allocation of SMS CB related functions to nodes

Node	Function	Chapter
CBC	Management of SMS CB Messages	6.1.2.1.1
	SMS CB DRX Management Function	6.1.2.1.2
	Mapping of geographical area onto cells	6.1.2.1.3
RNC	Storage of the SMS CB messages	6.1.2.2.1
	Scheduling of the SMS CB messages	6.1.2.2.2
	Configuration of SMS CB channels	6.1.2.2.3
	Transmission of SMS CB messages to UE	6.1.2.2.4
UE	Delivery of SMS CB messages to NAS	6.1.2.4.1
	Configuration of SMS CB DRX	6.1.2.4.2

6.1.2.1 Functions of CBC

6.1.2.1.1 Management of SMS CB Messages

The following parameters are associated with each SMS CB message:

SMS CB ID	SMS CB message identifier: Type of SMS CB message
Serial Number	Serial number: Each type of SMS CB message can vary. These variations are expressed by the serial number. The Serial Number consists of three information elements: Geographical scope (values: immediate cell wide, PLMN wide, LA wide, cell wide), Message Code , Update Number .
Data Coding Scheme	Data coding scheme used
Cell List	List of cells in which the SMS CB message should be broadcast. A cell list may contain only one cell. On interface Ibm' (Case 1) or Iu (Case 2) it contains only cells controlled by one RNC.
Category	Category of the SMS CB message: HIGH: SMS CB message should be broadcast at the earliest opportunity NORMAL: SMS CB message should be broadcast within the associated Repetition Period BACKGROUND: SMS CB message with lowest transmission priority
Repetition Period	Period of time after which broadcast of the SMS CB message should be repeated
Number Of Broadcast Requested	Number of times the SMS CB message is to be broadcast 0: infinitely 1..n: finite number of repetitions

The SMS CB information exchanged on CBC-RNC-interface (SDU on this interface) is shown in Table 6.2.

Table 6.2: SMS CB Information as it is sent to RNC for further management

SMS CB Message ID
old Serial Number (optional)
new Serial Number
Data Coding Scheme
Cell List
Category
Repetition Period
Number Of Broadcast Requested
SMS CB Message

6.1.2.1.2 SMS CB DRX Management Function.

Note: Whether this function should remain in CBC and how this function should be designed is ffs. The information given here is captured from the GSM specification.

Further cell related information regarding SMS CB discontinuous reception (CB-DRX) is managed. This CBC function is optional. The parameters used are:

DRX Schedule Period Indication of DRX schedule period length per cell. The values are:
 NODRX: DRX not required
 Length Of Schedule Period (unit: amount of CB slots where one and only one SMS CB message could be; the slots do not refer to PHY layer of the radio interface)

Reserved CB capacity Reserved capacity per cell for SMS CB Messages with Category=HIGH (unit: number of slots).

The number of slots remaining for SMS CB messages with Category=NORMAL or =BACKGROUND is equal to (DRX Schedule Period – Reserved CB Capacity)

The figure below describe the CB slot. Each CB slot can contain one and only one SMS CB message. A consecutive sequence of CB slots is defined as the scheduling period. Scheduling information is broadcast indicating which CB slots contains "new" SMS CB messages or "old" SMS CB. A scheduling information should be broadcast in time.

(SMS CB) Slot

	1	2	3	4	5	6	7	8	9	10
DRX Schedule Period = 10										
Reserved CB Capacity = 5										
(marked with "H" for SMS CB messages with Category = HIGH) New SMS CB messages are marked with "N", old with "O"	H	H	N	H	O	H	N	H	O	O

Figure 6.3: Example for SMS CB DRX scheme

The cell-related SMS CB DRX information exchanged on CBC-RNC-interface (SDU on this interface) is shown in Table 6.3.

Table 6.3: Cell related SMS CB DRX information as it is sent to RNC for further management

DRX Schedule Period
Reserved CB Capacity

6.1.2.1.3 Mapping of geographical area onto cells

Each SMS CB message is specified for a geographical area. This geographical area has to be mapped onto the cells of the radio network covering the geographical area. When the set of cells is determined, it is partitioned into the subsets controlled by one RNC. The output of this function is a set $R(SMS) = \{S(RNC1), \dots, S(RNCn)\}$ of sets of cells each consisting of cells controlled by one RNC.

Note 1: At the NAS-AS boundary SA2 has defined an primitive parameter "geographical area" sent from NAS to AS [13] (e.g. when requesting transmission of system information). This implies that the function "Mapping of geographical area onto cells" becomes a RNC function.

Note 2: The association to RNCs may be a function of the Access Nodes (2-step association) when applying Case 2.

6.1.2.1.4 Processing and transmission of SMS CB messages and control information

Following operations have to be supported by the interface between RNC and CBC. These operations are described in GSM 03.41 by the primitives to be used on this interface. This is applicable for both Cases 1 and 2.

WRITE (CN-side → RNC; req, ind)

A new SMS CB Message has to be sent the first time.

REPLACE (CN-side → RNC; req, ind)

A new revision of an already existing SMS CB Message should be sent (the new Serial Number replaces the old Serial Number).

KILL (CN-side → RNC; req, ind)

A existing SMS CB Message is deleted.

REPORT (RNC → CN-side; res, conf)

This is the response on WRITE, REQUEST or KILL.

STATUS-LOAD-QUERY (CN-side ↔ RNC; req, ind, res, conf)

With this operation the CN-side requests the actual CB load of indicated cells.

STATUS-MESSAGE-QUERY (CN-side ↔ RNC; req, ind, res, conf)

With this operation the CN-side requests the actual SMS CB Message status regarding indicated cells.

REJECT (RNC → CN-side; res, conf)

In case of error situations this is responded with this operation.

RESTART-INDICATION (RNC → CN-side; req, ind)

Indication that a CB restart has taken place.

RESET (CN-side → RNC; req, ind)

RNC sets indicated cells into a CB-idle state.

FAILURE-INDICATION (RNC → CN-side; req, ind)
RNC indicates a failure situation.

SET-DRX (CN-side → RNC; req, ind, res, conf)
Activation or deactivation of CB discontinuous receptions.

These operations imply functions in CBC; AN/CN (if case 2)), and RNC.

6.1.2.2 Functions of RNC :

6.1.2.2.1 Storage of the SMS CB Messages

The RNC receives the SMS CB Messages with its associated schedule information and cell related information from CBC and stores it.

6.1.2.2.2 Scheduling of the SMS CB Messages

Note: Scheduling of SMS CB Messages is above the scheduling of individual SMS CB Messages on TrCH (MAC layer for the radio interface).

Each SMS CB Message has associated scheduling information which is used by the function as input to schedule (generate) SMS CB sequences per cell. If SMS CB DRX is applied the cell related CB DRX information has to be taken into account by this function.

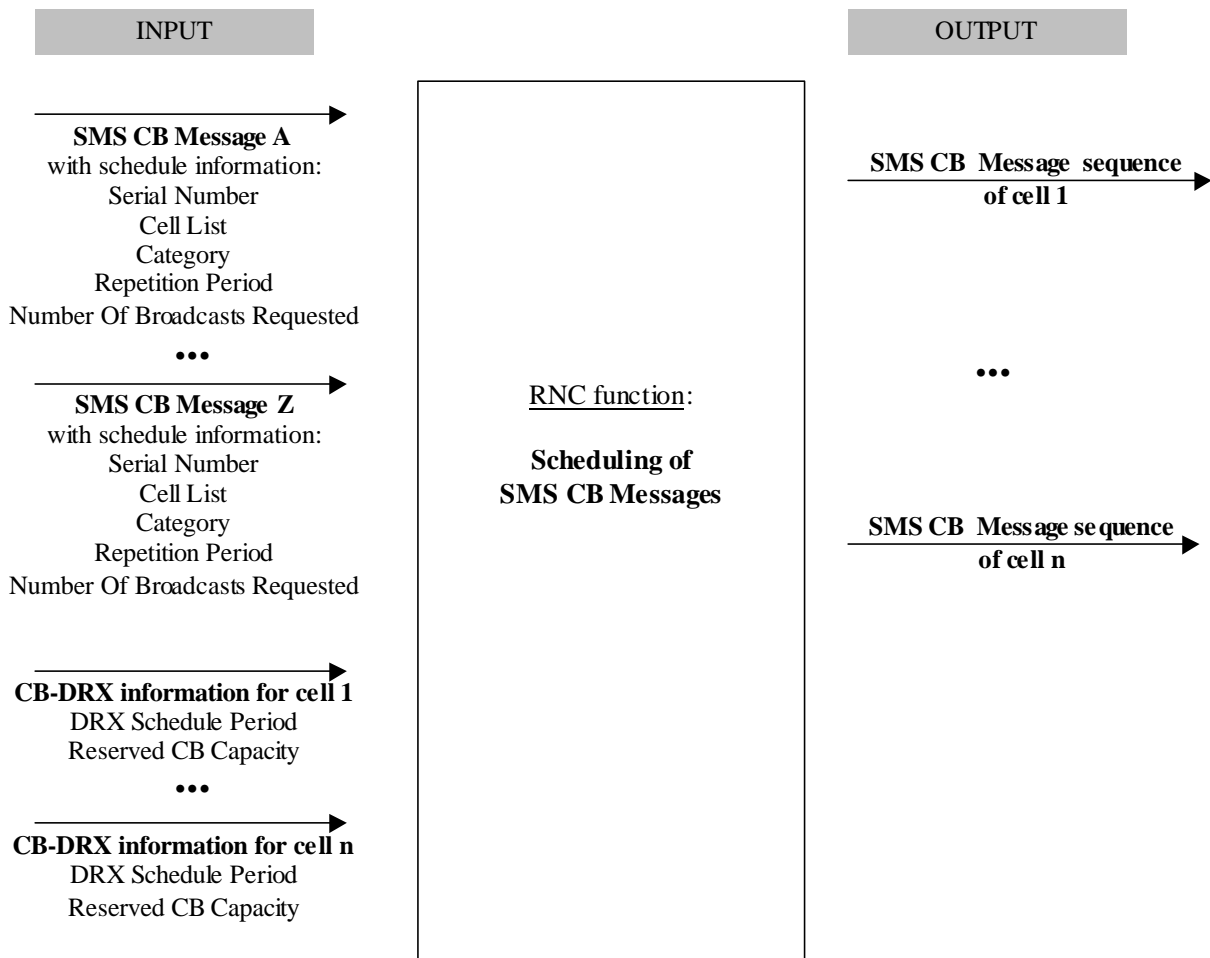


Figure 645: RNC-function: Schedule of SMS CB messages

An example is given in the figure below. SMS CB messages arrive from CBC (Case 1 is chosen). These messages contain a Cell List indicating the cell where the SMS CB message should be sent one time (Repetition Period is chosen to 1). The SMS CB message sequence is shown on the bottom of the RNC-box.

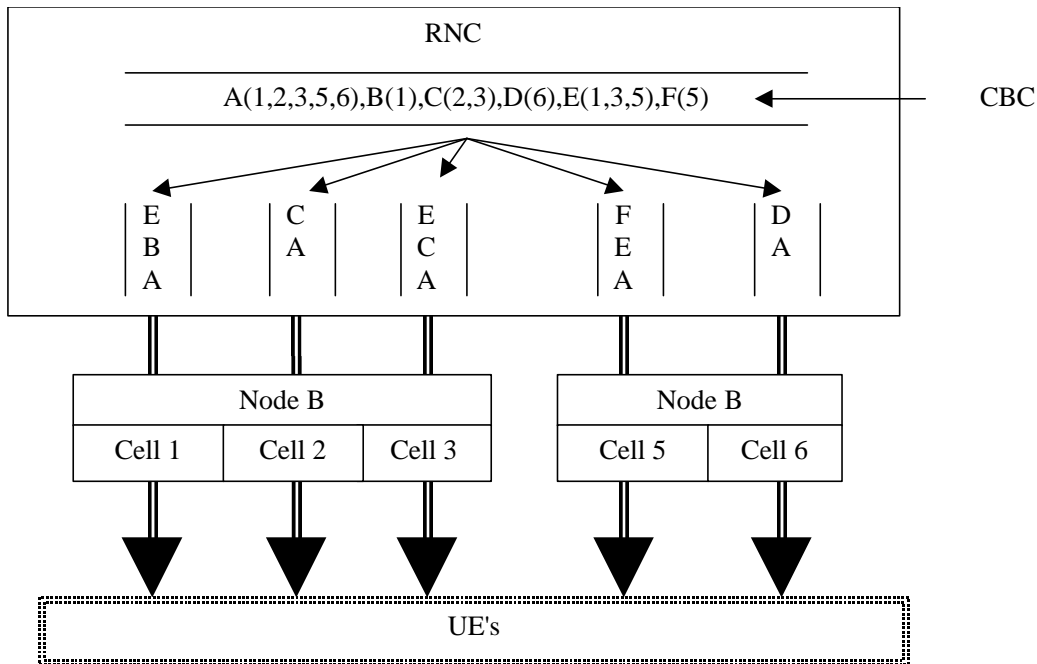


Figure 6.5: Example of SMS CB message sequences (Repetition Period = 1)

The SMS CB Message scheduling is implementation dependent. But the signalling of scheduling information has to be standardised.

6.1.2.2.3 Configuration of SMS CB channels

When sending SMS CB messages to a cell for the first time appropriate capacity has to be allocated in the cell. The CTCH has to be configured and the used transport channel has to be indicated to all UEs via system information broadcasted on the BCH. The capacity allocated for SMS CB is cell specific and may vary over time to allow efficient use of the radio resources.

6.1.2.2.4 Transmission of SMS CB messages to UE

Transmission takes place in the downlink only. SMS CB messages are indicated as common traffic and should use the appropriate logical traffic channel CTCH. In release 99 only the transport channel FACH is mapped.

6.1.2.3 Functions of UE :

6.1.2.3.1 Delivery of SMS Cell Broadcast message to NAS

The SMS CB messages are delivered to the NAS in the sequence as received. Corrupted SMS CB messages may be discarded (UA service of RLC would become applicable).

6.1.2.3.2 Configuration of SMS CB DRX

When SMS CB DRX information is received the UE listen only to "new" SMS CB messages. The UE has to store the SMS CB header including the SMS CB ID and the serial number of received SMS CB MESSAGES. With this information the UE can select which of the SMS CB messages sent in the next DRX period shall be received. A SMS CB message is new if the SMS CB ID is unknown or the SMS CB ID is known but the serial number is greater than the stored one.

For example after switch on every SMS CB message is new.

6.2 Radio Interface Requirements

The transmission of SMS CB messages from RNC to UEs via Node B and the cells under its control is in the scope of RAN WG2.

6.2.1 Protocol architecture

It is aimed to define a radio interface protocol architecture that is independent of the network cases 1 and 2 (see chapter 6.1). Figure 6.3 describes this general view.

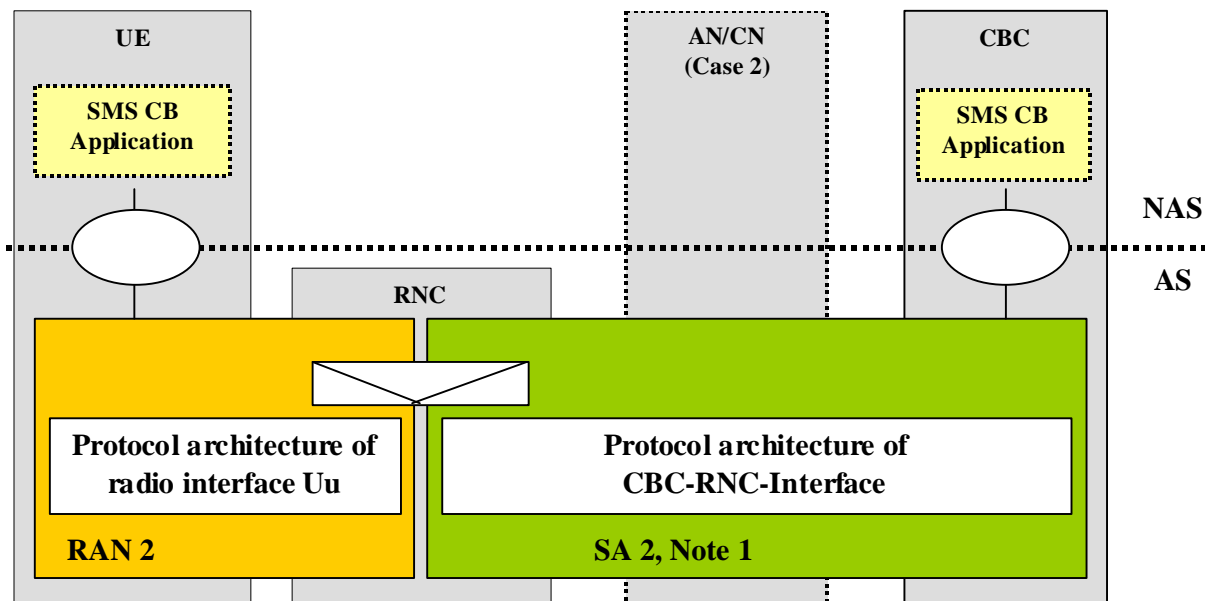


Figure 6.3: General Protocol Architecture applicable for Case 1 and Case 2

Note 1: SA WG2 is responsible for the protocol architecture. It is not yet clarified which TSG WG shall specify protocols on this interface.

A few options exist to locate the functions as described in chapter 6.1.

- Option 1: New L2 protocol BMC
A new L2 protocol called Broadcast/Multicast Control (BMC) is introduced located in the user plane.
- Option 2: RRC integrated solution
The existing protocol architecture remains and the main SMS CB functions are located in the RRC.
- Option 3: RRC/MAC integrated solution
A new MAC entity is introduced serving for the main SMS CB functions.

The mapping of the functions is given in the following table 6.4.

Table 6.4: Mapping of functions into protocol architecture

Function	Option 1	Option 2	Option 3
RNC			
Storage of the SMS CB messages	BMC	RRC	MAC
Scheduling of the SMS CB messages	RRC	RRC	MAC
Configuration of SMS CB channels	BMC, RRC	RRC	RRC
Transmission of SMS CB messages to UE	BMC, RLC, MAC	RRC, RLC, MAC	RLC, MAC
Segmentation/assembly of SMS CB messages	RLC	RLC	RLC
UE			
Delivery of the received SMS CB messages to NAS	BMC	RRC	MAC, RLC
Configuration of PHY regarding received SMS CB DRX information	RRC	RRC	MAC

In the succeeding subchapters the options are described.

6.2.1.1 Option 1

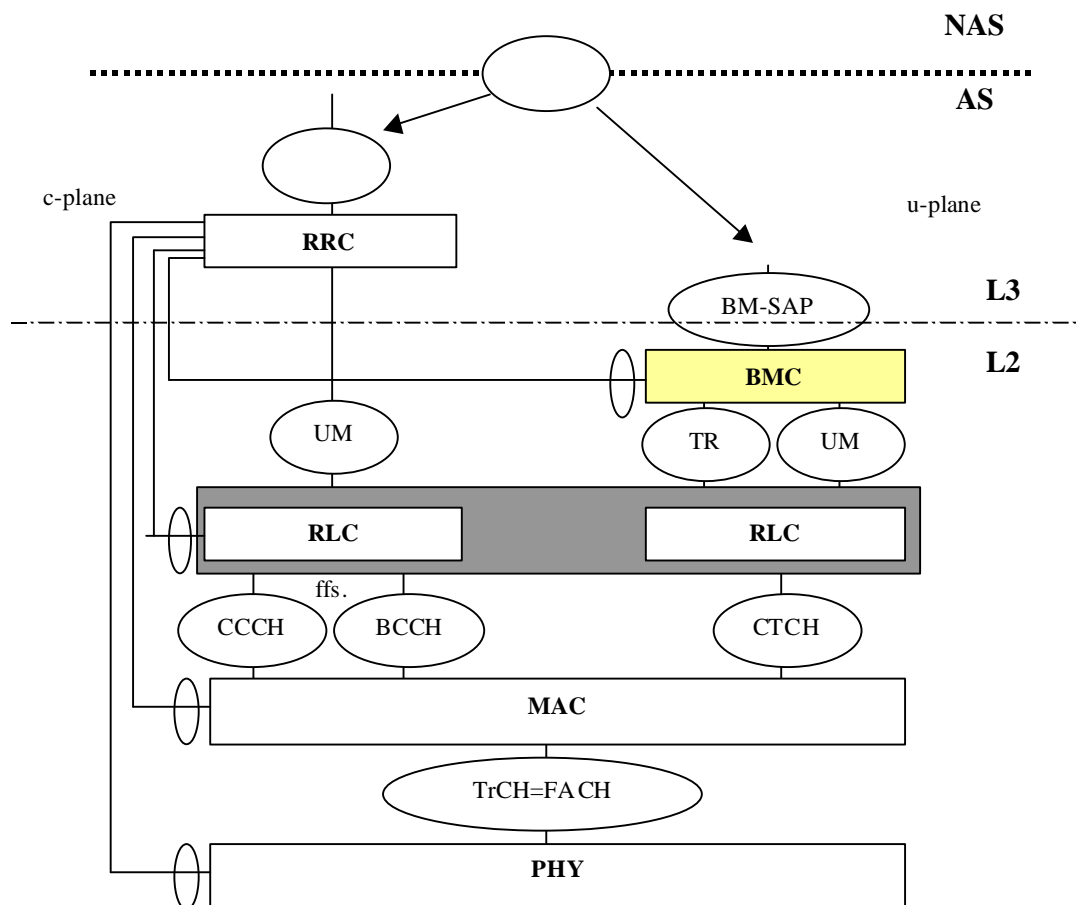


Figure 6.n: Detailed protocol architecture of option 1

- SMS CB messages are user data delivered in the user plane to BMC
Scheduling and SMS CB DRX information is delivered in the control plane to RRC
- Only cell related modelling is necessary because the transport channel FACH is chosen for transmission of SMS CB messages. BCH or FACH could be used for signalling.
- Common traffic radio bearer of a cell is established, maintained and released by RRC.
The event for establishment is the arrival of a first SMS CB message for this cell.
The event for release is the deletion of the last SMS CB message for this cell.
- The RRC(RNC) configures the SMS CB channels via the control SAPs and signals it to the peer RRC(UE) which itself configures its lower layer.
- The BMC(RNC) stores the SMS CB messages arriving over the CBC-RNC-interface and generates the SMS CB MESSAGE sequences
- Scheduling and DRX procedure when inband signalling is applied (Method 1)
The RRC(RNC) puts the scheduling information into a SCHEDULE MESSAGE which will be sent on CCCH or BCCH (ffs.). The receiving RRC(UE) detects and reads the SCHEDULE MESSAGE. Based on its stored schedule information the RRC(UE) can decide which SMS CB MESSAGE is new or old. The RRC(UE) can now instruct the PHY(UE) via C-PHY when it has to listen to the SMS CB channel(s).

- Scheduling and DRX procedure when outband signalling is applied (Method 2)
ffs

6.2.1.2 Option 2

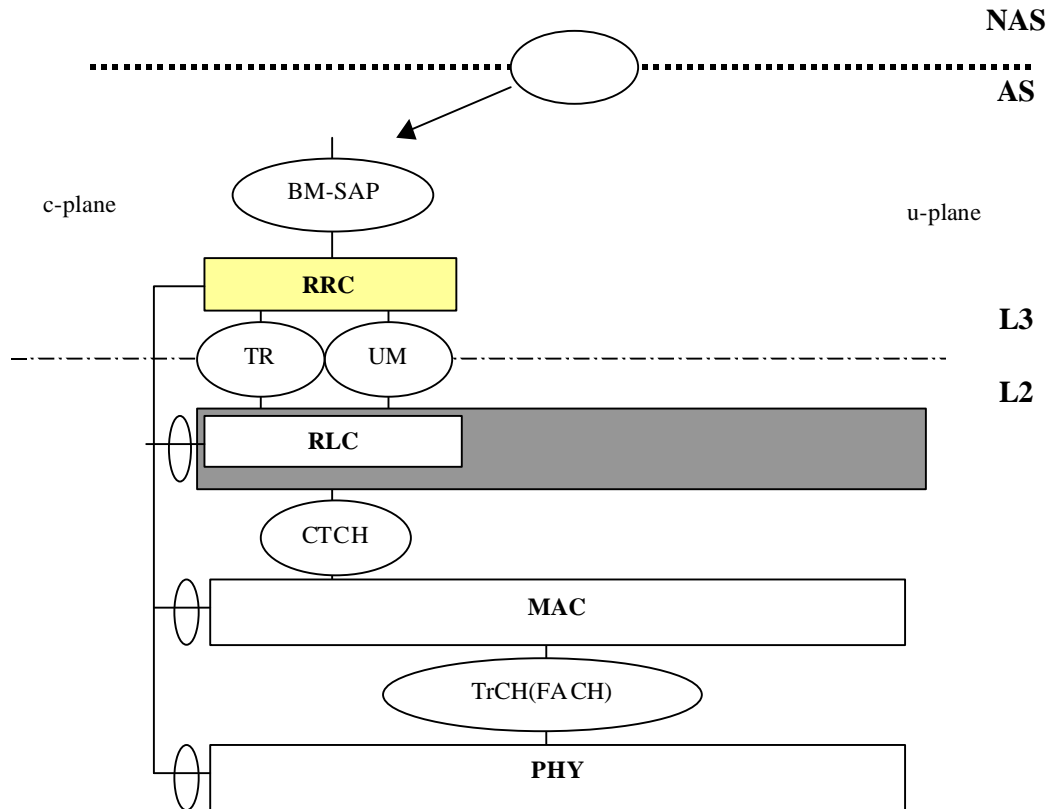


Figure 6.n: Detailed protocol architecture of option 2

- SMS CB messages and associated scheduling and SMS CB DRX information is delivered to RRC(RNC) in the control plane
- Only cell related modelling is necessary because the transport channel FACH is chosen for transmission of SMS CB messages. BCH or FACH could be used for signalling.
- Common traffic radio bearer of a cell is established, maintained and released by RRC. The event for establishment is the arrival of a first SMS CB message for this cell. The event for release is the deletion of the last SMS CB message for this cell.
- The RRC(RNC) configures the SMS CB channels via the control SAPs and signals it to the peer RRC(UE) which itself configures its lower layers.
- Cell related SMS CB messages arrive from the CBC-RNC-interface over BM-SAP at RRC(RNC) which stores the SMS CB messages and makes the scheduling
- Scheduling and DRX procedure when inband signalling is applied (Method 1)
The RRC(RNC) puts the scheduling information into a SCHEDULE MESSAGE which will be sent within the SMS CB MESSAGE stream. The receiving RRC(UE) detects and reads the SCHEDULE MESSAGE. Based on its stored schedule information the RRC(UE) can decide which SMS CB MESSAGE is new or old. The RRC(UE) can now instruct the PHY(UE) when it has to listen to the SMS CB channel(s).

- Scheduling and DRX procedure when outband signalling is applied (Method 2)
ffs

6.2.1.3 Option 3

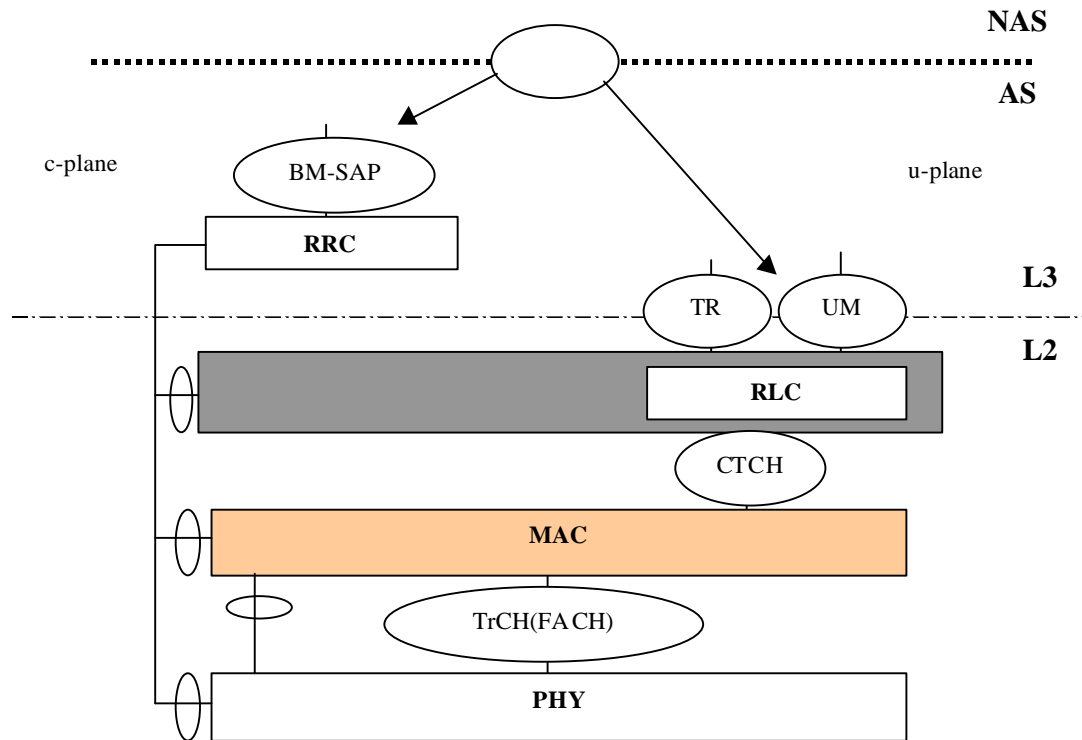


Figure 6.n: Detailed protocol architecture of option 3

- SMS CB messages are user data delivered in the user plane via RLC(RNC) to MAC(RNC). Scheduling and SMS CB DRX information is delivered in the control plane to RRC(RNC) which forward this information to MAC(RNC) via C-MAC.
- Only cell related modelling is necessary because the transport channel FACH is chosen for transmission of SMS CB messages. BCH or FACH could be used for signalling.
- Common traffic radio bearer of a cell is established, maintained and released by RRC. The event for establishment is the arrival of a first SMS CB message for this cell. The event for release is the deletion of the last SMS CB message for this cell.
- The MAC stores the received SMS CB messages and schedules the SMS CB MESSAGE sequences.
- The RRC(RNC) configures the SMS CB channels via the control SAPs and signals it to the peer RRC(UE) which itself configures its lower layers.
- Scheduling and DRX procedure when inband signalling is applied (Method 1)
The MAC(RNC) puts the scheduling information into a SCHEDULE MESSAGE which will be sent within the SMS CB MESSAGE stream. The receiving MAC(UE) detects and reads the SCHEDULE MESSAGE. Based on its stored schedule information the MAC(UE) can decide which SMS CB MESSAGE is new or old. The MAC(UE) can now instruct the PHY(UE) when it has to listen to the SMS CB channel(s).

- Scheduling and DRX procedure when outband signalling is applied (Method 2)
ffs

6.2.2 Comparison of Option 1, Option 2 and Option 3

All three options would be applicable with Case 1 and Case 2. The relay in RNC between the Uu Interface and the CBC-RNC-Interface is not part of the standardisation.

Table 6.5: Comparison of the options R1, R2 and R3

Criteria	Option 1	Option 2	Option3
Separation into c-plane and u-plane	BMC is located in the user plane where the SMS CB messages are stored RRC is the receiver of all control information	No separation into c- and u-plane on L3	The storage of the SMS CB messages is in the MAC defined common for control and user plane. Control information is delivered to RRC and MAC.
Usage of Radio Bearer concept	Yes.	Yes	Yes
Complexity	Simple architecture with a clear separation of control and user aspects.	Simple architecture but loosing the separation of control and user aspects	An additional control SAP between MAC and PHY is required to configure discontinuous reception.
Segmentation/assembly of SMS CB messages	RLC	RLC	RLC

6.2.3 When should the UE receive SMS CB messages ?

In which state the UE is capable of receiving SMS CB messages may depend on the UE class, the scheduling method chosen and the DRX implementation on the network side. The table 6.4 gives a first indication of the requirements:

Note:

In GSM the reception of SMS CB messages is restricted to CS domain Idle Mode. The terminal stays the most time (about 95 %) in this mode.

Table 6.4: UE reception capability in different RRC-modes

Mode of UE ([5])	Transport channel	Requirements
IDLE		The UE listen to the channels reserved for SMS Cell Broadcast service of the selected cell. DRX is applicable.
CONNECTING		(ffs)
CONNECTED: URA CONNECTED		The UE listen to the channels reserved for SMS Cell Broadcast of the selected cell. DRX is applicable.
CONNECTED: CELL CONNECTED	PCH	(ffs)
	RACH/FACH	(ffs)
	RACH/DSCH	Not applicable for Release 99.(ffs for future releases)
	DCH/DCH	(ffs)
	DCH/DCH+DSCH	(ffs)

Note: For further analysis.

6.2.4 RRC

6.2.4.1 SMS CB capacity configuration

The RRC is responsible for configuration of SMS CB capacity. Any request from upper layers or indication from lower layers have to be sent to RRC which decides whether more or less SMS CB capacity could be provided.

Which transport channels should be used ?

Only common transport channel in the downlink are applicable.

A minimum overall capacity about 20 kbps is required on the radio interface in Release 99. Higher bit rates are expected in the future when the text messages are combined with other media like audio and video.

Table 6. 5 : Comparison of Common TrCH regarding SMS CB service

Attribute	BCH	FACH	PCH	DSCH
Direction	DL	DL	DL	DL
Broadcast capability	Yes, required	Yes, possible (1)	Yes, required	Yes, possible (1)
Dynamic rate capability	No, fixed rate (16 kbps)	Yes, change every 10 ms possible	? (1)	? (1)
DRX	Possible	Possible	Possible	? (1)
Associated with	-	-	-	DCH or DSCH Control Channel, only combination (DSCH,DSCHCCH) makes sense
Slow power control	-	Possible	-	Possible
Type of data (1)	control data	control and user data	control data	user data
Open for future expansions	multiple BCH instances	dynamic configuration, one or more FACH instances	?	dynamic configuration,

Remarks :

(1) This attribute is not specified in S2.02 v0.3.0.

The TrCH type FACH is chosen for Release 1999. In future releases other TrCH may be good candidates to carry SMS CB messages.

6.2.4.2 SMS CB related system information

Whether SMS CB transmission capability is available or not and the configuration of the SMS CB resources should be broadcast as system information. The RRC of the UE configures its local resources upon the received SBS CB system information. How to transmit the SMS CB related system information depends on the chosen BCCH scheme.

6.2.5 RLC

The RLC gets the SMS CB message from higher layer as one piece and segments it if appropriate and delivers it to MAC via the CTCH SAP. The segmentation depends on the configured resources.

Note: SMS CB message is derived from GSM 03.41 section 9.3 Message Format on BTS-MS Interface.

The RLC SDU for SMS CB message has following format:

Serial Number	1 octet
	2
SMS CB Message ID	3
	4
Data Coding Scheme	5
SMS CB Message	7



Figure 6.12: SMS CB message format (RLC SDU)

6.2.6 MAC

6.2.6.1 MAC Scheduling

The MAC scheduling differs regarding the cases described in chapter 6.2.1. For Release 1999 only the FACH is chosen as TrCH. Thus the logical channel CTCH is mapped onto FACH only.

On the FACH four types of data can be sent: Common control data (CCCH), common traffic data (CTCH) such as SMS CB messages, dedicated control data (DCCH) and dedicated traffic data (DTCH).

Following cases should be discussed:

Case S1: A FACH instance is used exclusively for CTCH data.

Case S2: A FACH instance is used for CTCH and other control and/or traffic data.

6.2.6.2 Discontinuous Reception (DRX)

When applying SMS CB DRX it should be harmonised with other DRX schemes (for example: Paging DRX).

6.2.6.2.1 Method 1 (GSM adapted method, inband signalling)

With method 1 an inband DRX scheme is chosen.

With Tdoc R2-99427 a GSM-based method is proposed:

For allowing UE to receive the SMS cell broadcast in DRX mode, it is necessary to inform the UE when individual SMS CB messages are transmitted in a cell. For that purpose, we propose a Schedule message in similar way to GSM, which is changed slightly for UMTS radio interface. The complete reading of Schedule message allows the UE to enter DRX mode. When the UE reads the Schedule message, it can know which message is new and where it is during the schedule period. If there are new messages during the scheduled period and those SMS CB messages are of interest to the UE, UE reads those frames which are indicated by the Schedule message.

SMS CB transmission is shown in figure 1. Unscheduled schedule message has the information about message identifiers and the location of newly updated SMS CBs, and the location of next Schedule message.

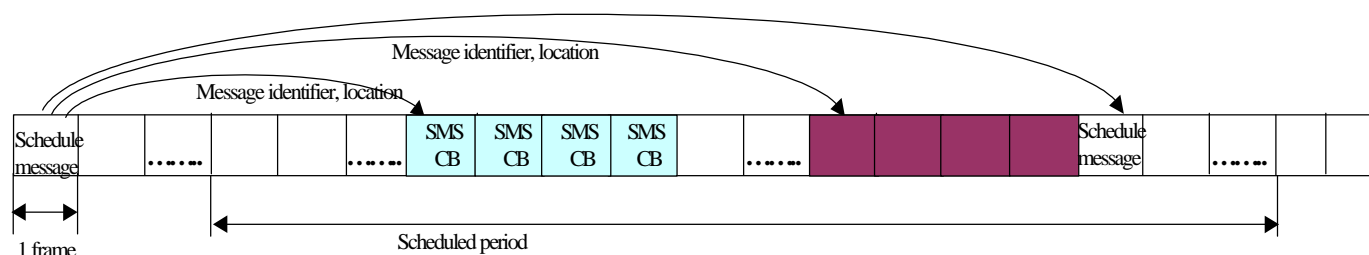


Figure 6.13 SMS CB transmission scenario

Length Indicator
Begin Frame of Schedule Period
End Frame of Schedule Period
New SMS CB Message Indicator (1)
...
New SMS CB Message Indicator (n)
Next SMS CB Schedule Message Indicator

Figure 6.14: SMS CB Schedule Message

Information Elements:

Length indicator	It indicates the length of the SMS CB Schedule message. By using it , SMS CB Schedule message can be extended in consecutive frames.
Begin Frame of Scheduled Period	It indicates the frame number of the start frame of schedule period.
End Frame of Scheduled Period	It indicates the frame number of the end frame of schedule period.
New SMS CB Message Indicator	It points to a new SMS CB message and consists of the SMS CB Message ID and the frame number where the SMS CB message starts.
Next SMS CB Schedule Message Indicator	It points to the next SMS CB Schedule message and consists the frame number where this message starts.

Note: The transmission of old SMS CB messages is left open. Thus more input is required to solve this problem.

6.2.6.3 Flow Control

<Note: Input required.>

7 PTM-Multicast Service (GPRS)

This chapter contains the requirements derived from GPRS specifications of Point-to-multipoint Multicast service and the analysis regarding the UMTS radio interface Uu.

Note:

The specification of the PTM-Multicast service is part of the work item “GPRS – Point-To-Multipoint Services” of GSM Phase 2+ Release 1999.

7.1 Impact on UTRAN Functions

7.2 Radio Interface Requirements

8 PTM-Group Call Service (GPRS)

This chapter contains the requirements derived from GPRS specifications of Point-to-multipoint Group Call service and the analysis regarding the UMTS radio interface Uu.

Note:

The specification of the PTM-Group Call service is part of the work item “GPRS – Point-To-Multipoint Services” of GSM Phase 2+ Release 1999.

8.1 Impact on UTRAN Functions

8.2 Radio Interface Requirements

9 IP Multicast Service (GPRS)

This chapter contains the requirements derived from GPRS specifications of IP Multicast service and the analysis regarding the UMTS radio interface Uu.

Note:

The specification of the IP-Multicast service is part of the work item “GPRS – Point-To-Multipoint Services” of GSM Phase 2+ Release 1999.

9.1 Impact on UTRAN Functions

9.2 Radio Interface Requirements

10 Multimedia Distribution Service (UMTS)

This chapter contains the requirements derived from UMTS Technical Specifications and the analysis regarding the radio interface Uu.

(Editor's Note:

RAN WG2 has sent a Liaison statement to SA WG1 and WG2 requesting stage 1 and stage 2 specification of UMTS multicast services and describing the relation to SMS services. A reply is expected. Information is needed about the questions: In which annual release the UMTS Multicast services will be part? What are the requirements for the UMTS system and the protocols?)

10.1 Impact on UTRAN Functions

10.2 Radio Interface Requirements

11 Annex A: Functions related to MDS (ffs.)

Previous WG2 Input documents:

R2-99075 (LGIC), R2-99076 (LGIC), R2-99218 (LGIC), R2-99219 (LGIC)

Input documents not presented yet:

R2-99077 (LGIC)

Related WG2 Output documents:

R2-99189 (TSG RAN WG2) LS to SA WG1 and SA WG2 on Multicast

(Editor's note: The following text is taken from R2-99075 and should give a first overview of functions which should be analysed for MDS. Already made decisions are incorporated.)

Functions which should be analysed are listed below:

RRC functions:

Variable Rate Support

Dynamic Code usage

Dynamic Scheduling

QoS Support (e.g. repetition time)

(LGIC, R2-99075, for information)

RLC functions:

Unacknowledged multicast data transfer

Multicast Delivery

(LGIC, R2-99075, for information)

MAC functions:

Support FO multiple CTCH

Mapping and multiplexing/demultiplexing between CTCH and transport channels

Scheduling among CTCH

Support of dynamic rate change using TFCS

(LGIC, R2-99075, for information)

New types of transport channels are not required.

L1 functions:

Transmission of messages containing multicast data to specific groups of UEs. This service includes provision of the location function necessary to deliver multicast messages to a mobile, which is in idle or slotted mode.

DTX (discontinuous transmission)

DRX (discontinuous reception)

Support of multicast data transmission with multitude

(LGIC, R2-99075, for information)

History

Document history		
Date	Version	Comment
May 1999	0.0.1	Skeleton without scope
June 1999	0.0.2	Inclusion of scope and document structure as agreed at TSG RAN WG2 meeting #4, Berlin, 25-28 May 1999, distributed for e-mail approval
June 1999	0.1.0	RAN WG 2 approved version with editorial changes and addition of subchapter x.2 (Impact on UTRAN Functions), x service specific chapters 6 to 10
June 1999	0.1.0	Noted by TSG-RAN
August 1999	0.1.1	Exchange of subchapters "Impact on UTRAN Functions" and "Radio Interface Requirements. Incorporation of chapter 6 "SMS CB Service".
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This document is written in Microsoft Word 97.		