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**Digital cellular telecommunications system (Phase 2+);
Voice Broadcast Service (VBS) - Stage 2
(GSM 03.69 version 5.1.1)**

ETSI

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Foreword

This draft European Telecommunication Standard (ETS) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI) and is now submitted for the Unified Approval Procedure phase of the ETSI approval procedure.

This ETS specifies the stage two description of the Voice Broadcast Service (VBS) within the digital cellular telecommunications system.

This ETS is a GSM Technical Specification version 5 and is part of the 1996 release of the GSM Technical Specifications.

The contents of this ETS is subject to continuing work within TC-SMG and may change following formal TC-SMG approval. Should TC-SMG modify the contents of this ETS, it will be resubmitted for UAP by ETSI with an identifying change of release date and an increase in version number as follows:

Version 5.x.y

where:

- y the third digit is incremented when editorial only changes have been incorporated in the specification;
- x the second digit is incremented for all other types of changes, i.e. technical enhancements, corrections, updates, etc.

Proposed transposition dates	
Date of latest announcement of this ETS (doa):	3 months after ETSI publication
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Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

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1 Scope

This European Telecommunication Standard (ETS) specifies the stage 2 description of the Voice Broadcast Service (VBS) which allows the distribution of speech (or other signals which can be transmitted via the speech codec), generated by a service subscriber, into a predefined geographical area to all or a group of service subscribers located in this area.

2 Normative references

This ETS incorporates by dated and undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETS only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

- [1] GSM 01.04 (ETR 350): "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".
- [2] GSM 02.09 (ETS 300 920): "Digital cellular telecommunications system; Security aspects".
- [3] GSM 02.69 (ETS 300 926): "Digital cellular telecommunications system (Phase 2+); Voice Broadcast Service (VBS) - Stage 1".
- [4] GSM 03.20 (ETS 300 929): "Digital cellular telecommunications system; Security related network functions".
- [5] GSM 03.22 (ETS 300 930): "Digital cellular telecommunications system; Functions related to Mobile Station (MS) in idle mode and group receive mode".
- [6] GSM 03.67 (ETS 300 932): "Digital cellular telecommunications system (Phase 2+); enhanced Multi-Level Precedence and Pre-emption service (eMLPP) - Stage 2".
- [7] GSM 04.08 (ETS 300 940): "Digital cellular telecommunications system (Phase 2+); Mobile radio interface layer 3 specification".
- [8] GSM 05.08 (ETS 300 911): "Digital cellular telecommunications system (Phase 2+); Radio subsystem link control".
- [9] GSM 08.08: "Digital cellular telecommunications system (Phase 2+); Mobile Switching Centre - Base Station System (MSC - BSS) interface Layer 3 specification".
- [10] CCITT Recommendation E.164: "Numbering plan for the ISDN era".

3 Definitions and abbreviations

3.1 Definitions

Definitions used in this ETS are also defined in GSM 02.69.

broadcast call attributes: Group call area, dispatcher identities and acknowledgement destinations applying to a voice broadcast call.

group call anchor MSC: The MSC responsible for managing and maintaining a particular voice broadcast call. The group call anchor MSC is determined as the one controlling the cells of the group call area. For voice broadcast services where the group call area exceeds an MSC area, the group call anchor MSC is predefined in the network.

Group Call Register (GCR): A functionality in the network containing the broadcast call attributes.

group call relay MSC: MSC controlling cells of a group call area which are not under control of the group call anchor MSC for those voice broadcast services where the group call area exceeds one MSC area.

group members: Service subscribers entitled to belong to a particular group classified by a certain group identification (group ID).

Notification Channel (NCH): Common control channel on which the notifications are sent by the network (equivalent to a paging channel).

notification: Notifications are given on common channels or dedicated channels in order to inform group members which are either in idle mode or in dedicated mode or participating in a voice group call or broadcast call on the existence of voice broadcast calls.

voice broadcast call member: Any group member or dispatcher participating in an on going voice broadcast call.

voice broadcast channel: Downlink to be allocated in each cell of the group call area for a particular voice broadcast call. All mobile stations of the destination subscriber being service subscribers in one cell shall listen to the common downlink.

3.2 Abbreviations

Abbreviations used in this ETS are also listed in GSM 01.04.

For the purposes of this ETS, the following abbreviations apply:

eMLPP	enhanced Multi-Level Precedence and Pre-emption
GCR:	Group Call Register
NCH:	Notification Channel
VBS:	Voice Broadcast Service
VGCS:	Voice Group Call Service

4 Main concepts

4.1 Group definition

Service subscribers can become group members on a PLMN wide basis to one or more groups pre-defined in the network by a corresponding group identification (group ID). The membership enables them to receive voice broadcast calls associated with that group ID. In addition, certain group members are entitled by their subscription to initiate voice broadcast calls. Certain dispatchers connected to external networks also require the capability to initiate or receive voice broadcast calls.

In addition to subscriber details in the HLR, it is necessary for the mobile station to be aware of its group membership by storing details on the SIM. This is required because it shall respond to notification messages which include only the group ID (i.e. no IMSI or TMSI details).

Having become a group member, each service subscriber can set to active state or deactive state the group ID or any one out of his several group IDs on the SIM. In active state the subscriber can initiate voice broadcast calls to that group ID. When in deactive state the subscriber can not make voice broadcast calls to the group and the mobile station ignores any notification for that group ID.

4.2 Broadcast process

4.2.1 Broadcast call initiation

4.2.1.1 Normal operation with successful outcome

A group call area can be restricted to a single MSC area or can exceed one MSC area (implementation option).

A voice broadcast call shall be initiated by a calling subscriber by a related MMI action for the service selection and the group ID dialled.

The MSC in which the voice broadcast call is initiated obtains (by requesting the Group Call Register (GCR, see clause 5) the group call attributes.

When a calling subscriber initiates a voice broadcast call, one voice broadcast channel shall be established in each cell of the group call area and notifications for that call shall be sent in each of these cells. As an alternative, voice broadcast channels may only be established in cells in reaction to responses received from mobile stations on the notifications. At the same time standard connections to dispatchers in the mobile network or in an external network shall be established.

The calling subscriber shall have an dedicated standard uplink/downlink. All mobile stations of the listening service subscribers in one cell shall only listen to the same common downlink (voice broadcast channel).

Only one voice broadcast channel shall be established in each cell for any given voice broadcast call, although there may be a number of simultaneous voice broadcast calls within the same cell.

Service subscribers shall be notified on the voice broadcast call in each cell. These voice broadcast call notification messages shall be broadcast on the notification channel (NCH).

The notification messages use the group ID rather than individual TMSIs/IMSI. Additionally, a group call area identity (group call area ID) shall be included in order to enable a resolution in the case of overlapping group call areas. A service subscriber's mobile station needs to be able to recognize notification messages for those group IDs subscribed to and presently activated.

As a network option, messages are also sent on appropriate voice broadcast channel SACCHs or FACCHs, in order to notify voice broadcast call members who may participate in other voice broadcast calls. In addition, also paging information messages for standard calls may be sent in order to inform voice broadcast call members on actually paged point-to-point calls.

As a further network option, notification on the voice broadcast call shall be provided to service subscribers which have subscribed to the paged group ID and which are in dedicated mode.

The ability to react on these notification and paging information messages which are provided into on-going calls shall be a mobile station option. It shall be indicated to the mobile stations by the network if the notification and paging information on the voice broadcast channel SACCH or FACCH is provided.

The process of broadcasting messages on NCHs and appropriate SACCHs or FACCHs is to be carried out throughout the call in order to provide the "late entry" facility whereby group members entering the area can join the call.

On receiving details of a voice broadcast call a voice broadcast call member's mobile station which is in idle mode shall adjust to the nominated channel if this channel was received in the notification message and receive the information on the downlink. Whilst receiving, the mobile station shall not transmit on the uplink SACCH. This group receive mode is different to the normal idle mode or dedicated mode. If no channel description was provided in the notification message, the mobile station shall establish a dedicated connection in order to respond to the notification. The network may then provide the mobile station with a channel description for the voice broadcast call.

4.2.1.2 Exceptional procedures

Completion of links into congested cells where pre-emption did not occur is required.

If the cell in which the calling service subscriber is located will be reset, the voice broadcast call shall be released.

On receiving details of a voice broadcast call the user may choose to move to the notified call or the mobile station may automatically move to the notified call if the new call is of higher priority than the existing call and automatic acceptance applies for this priority level.

4.2.2 On-going broadcast calls

4.2.2.1 Normal operation with successful outcome

Within each voice broadcast call only the voice of the calling subscriber shall be transmitted on the voice broadcast downlink channel.

As an implementation option, information shall be broadcast on the voice broadcast channel SACCH concerning the voice broadcast call channel details in neighbour cells. Mobile stations in group receive mode use a version of the standard idle mode procedures to "camp-on" to the voice broadcast channel in a new cell. If this information on the neighbouring cells is not provided at all or only provided for cells in the same BSC area, the mobile station may find the voice broadcast channel details of a new cell on the related NCH.

A network may decide not to establish voice broadcast channels in all cells. Instead, notifications containing no channel description may be provided. If a mobile station moves to such a cell, it must respond to the notification in order to receive the voice broadcast call. The network may then establish a voice broadcast channel and inform the mobile station on the channel position.

NOTE: Concerning security aspects, whilst authentication and membership checking of mobile call originators can be carried out, it is not possible to authenticate service subscribers in group receive mode if they have not before established a dedicated connection to responded to a notification. No equivalent of a group "TMSI" is provided to protect the "identity" of established voice broadcast calls.

4.2.2.2 Exceptional procedures

If a mobile station in group receive mode indicates a failure due to radio link time-out, the mobile station shall behave as specified in GSM 05.08 and go back to idle mode, possibly in another cell, as determined by the cell re-selection algorithm. If a notification is received for the same cell, the mobile station shall try to reconnect.

4.2.3 Leaving of a broadcast call without termination

A destination subscriber being service subscriber can leave the voice broadcast call at any point by "deselecting" it via an MMI function. Having deselected the call the mobile station returns to idle mode and "ignores" any further notification messages related to that call.

[Remark: If a service subscriber does not wish to participate in calls to a particular group ID for long periods of time, the group ID shall be switched to deactive state by the subscriber.]

The service subscriber shall have the capability to reselect the voice broadcast call. The mobile station shall not ignore notification messages to that call any more.

The dispatcher shall be able to leave a voice broadcast call without terminating it.

4.2.4 Broadcast call termination

A voice broadcast call can be terminated by the calling subscriber or an entitled dispatcher.

The call must not be maintained if the calling subscriber leaves the group call area (e.g. if he moves into an MSC area where a group call area is no part of).

4.2.5 Acknowledgements

The acknowledgement is an application option.

For voice broadcast calls which are identified by an acknowledgement flag in the notification message mobile stations which have acknowledgement facilities are informed that they have to return an acknowledgement message with a predefined content in a predefined manner.

The flag is set on basis of the GCR data.

The acknowledgement shall be sent using an appropriate data service, to a predefined address or with a predefined short code stored on the SIM card. The network may apply geographical routing to a predefined acknowledgement service centre.

4.2.6 Transactions between the mobile station and the network

Mobile stations which are in broadcast receive mode shall not perform any transactions with the network while adjusted to the voice broadcast channel. They shall leave the group receive mode and act in a standard way to perform any transaction if necessary and return to the voice broadcast call afterwards.

5 General architecture

5.1 Group Call Register (GCR)

The general architecture of GSM is maintained. In addition, a network function is required which is used for registration of the broadcast call attributes, the Group Call Register (GCR).

The GCR function is mainly a database function, holding information about voice broadcast calls.

NOTE 1: The GCR implementation is not specified. It may be realized e.g. as a new network node, in a PABX directly attached to an MSC, inside an MSC or as an HLR. The interface between the GCR function and other functions is not specified in the GSM technical specifications. As a consequence, the functional split between MSC and GCR as developed in this specification is only indicative, and other functional splits can be implemented.

The GCR data for a specific voice broadcast call is set at the creation of the broadcast call attributes, and can be subsequently modified. No support for these functions is specified in the GSM technical specifications.

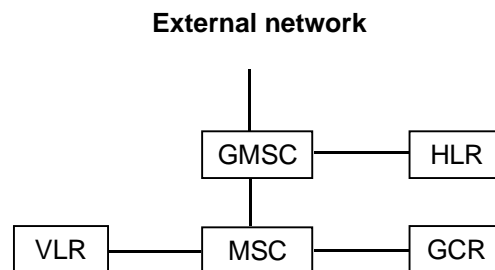


Figure 1: Functional architecture with a Group Call Register

The signalling between the entities shown in figure 1, for the two cases of service subscriber and dispatcher originated calls, shall be as defined in the following.

Service subscriber originated: The MSC containing the cell within which this voice broadcast call is initiated shall perform subscription checking against VLR records. It shall then consult its GCR to determine the broadcast call attributes related to its MSC area and whether it is the group call anchor MSC for that voice broadcast call. If it is not, the GCR shall provide with the broadcast call reference and the routing information identifying the group call anchor MSC to the originating MSC. The originating MSC shall then route the voice broadcast call to the anchor MSC. If the originating MSC is the group call anchor MSC, along with the broadcast call attributes, the GCR shall provide information on all group call relay MSCs to be involved.

The group call anchor MSC shall set up links to all group call relay MSCs. Each MSC involved in a voice broadcast call obtains its proper broadcast call attributes from the GCR related to the MSC.

Dispatcher originated: In the case of dispatchers calling from an external network, the call request, in the form of an ISDN number, shall be received at a GMSC. The number shall be passed to the appropriate HLR, which shall pass the corresponding MSRN back to the GMSC referring to the group call anchor MSC for the call. Alternatively, the voice broadcast request can be directly routed to the group call anchor MSC by the GMSC based on the called identity without requesting an HLR. The group call anchor MSC shall interrogate the GCR and obtain the broadcast call attributes. If an identical voice broadcast call is currently in progress, the dispatcher shall be connected to this call and no new call shall be initiated. When interrogating the GCR, the identity of the dispatcher is compared with the list of dispatchers to which a dedicated link is to be established. If the dispatcher is not in the list, or an identity is not provided, the network shall reject the call.

NOTE 2: Optionally dispatchers may also be user of the GSM network in which the VBS service is provided or may directly be connected to a PABX containing the GCR. Dispatcher which are registered for a certain voice broadcast call and which have also a subscription for VBS with the same group ID as the voice broadcast call for which they are dispatcher shall deactivate this group ID when they are located in the corresponding group call area in order to avoid conflicts between paging for the dispatcher and notifications for the group ID.

5.2 Voice broadcast call responsibility

The MSC responsible for the voice broadcast call is the one nominated within the GCR or the one to which the call is routed from the GMSC in the case of a dispatcher originated call. This MSC is termed the group call anchor MSC.

If the group call area extends beyond one MSC area then any MSCs controlling cells in the area outside of the group call anchor MSC are referred to as group call relay MSCs.

6 Compatibility issues

VBS can not be used with standard Phase 1 or Phase 2 mobile stations. A dedicated mobile station with VBS capability is required.

A mobile station with VBS capability shall also provide the complete functionality in order to allow the use of phase 2 services.

Standard Phase 1 and Phase 2 mobile stations in a network shall not be impacted by the presence of VBS services in that network due to VBS signalling, also if the mobile station is operated with a SIM of a VBS service subscriber.

7 Transmission

7.1 Transmission architecture

A distribution function, is required to distribute the voice broadcast call to the nominated cells and dispatchers, respectively. The distribution function is to be located within the group call anchor MSC. The group call anchor MSC is responsible for setting up all connections, both to the nominated cells (voice broadcast channels) in the group call anchor MSC and in any related group call relay MSC, and to the dispatchers. There shall be one link for every cell within the group call relay MSC which is involved in the voice broadcast call, i.e. there shall be no secondary distribution functions in BSCs or group call relay MSCs.

NOTE: As GSM Phase 2+ evolves, distribution functions may be realized in the BSC or in the group call relay MSC which allow a more efficient use of the network resources.

7.2 Radio channels

In each cell of the group call area one voice broadcast channel may be established consisting of a downlink received by all service subscriber's mobile stations.

The calling subscriber's mobile station shall use a dedicated standard uplink/downlink which is connected as input to the distribution function.

A listening subscriber's mobile station which responds to a notification because no description of the voice broadcast channel was provided in the notification may be assigned a dedicated standard link which is connected to the distribution function up to the instant where the network decides that the mobile station shall join the voice broadcast channel and the dedicated connection is released.

Voice broadcast channels shall be standard full rate or half rate speech channels. A specific voice broadcast call can have cells in the group call area where the voice broadcast channels are either only half rate speech or only full rate speech or there are cells with half rate speech and cells with full rate speech. Those implementations are optional for the network operator.

Full standard duplex channels shall be provided to all dispatchers listed in the GCR as for normal calls and connected to the distribution function although their speech shall not be added to the speech of the calling subscriber in the distribution function if they are destination subscribers. The links may be provided either via GSM, or via an external network.

Simplex downlink radio channels are to be provided to all destination service subscribers, with one common downlink per cell.

A separate standard duplex channel is to be provided to the calling service subscriber.

7.3 Data confidentiality

Data confidentiality on the radio link can be provided as a network option.

If data confidentiality is provided, the downlink of the voice broadcast channels in each cell of the group call area shall be ciphered using the same group key.

The group key is related to the group ID. For each group ID, there is a number of group keys stored on the SIM which are identified by a group key number. The group key number identifying the group key to be used for a particular voice broadcast call is provided with the notification to the mobile stations. Mobile stations which have responded to a notification shall be informed of the group key number before they join the voice broadcast channel.

The distribution of the group keys to the related SIMs shall be done off-line.

NOTE: The distribution of group keys shall be done by the service provider when editing the SIM. Distribution of group keys via the air interface may be possible with future features as the SIM-toolkit. Those distribution schemes are for further study.

Details on data confidentiality for voice broadcast calls are provided in GSM 02.09 and GSM 03.20.

8 Information storage

8.1 Information stored in the GCR

8.1.1 Information used for routing of service subscriber originated voice broadcast calls

The GCR shall hold for a related MSC area for each group ID and cell from which voice broadcast calls can be established by service subscribers the broadcast call reference to be used for a voice broadcast call to be established and an indication whether the originating MSC is the group call anchor MSC.

If the originating MSC is the group call anchor MSC, the GCR shall provide the broadcast call attributes related to that broadcast call reference as defined in subclause 8.1.2 to the originating MSC and the originating MSC shall establish the voice broadcast call.

If the originating MSC is not the anchor MSC, the GCR shall provide the broadcast call reference plus the routing information identifying the anchor MSC to the originating MSC and the originating MSC shall route the voice broadcast call to the anchor MSC.

NOTE: In case the GCR function is distributed over different physical entities, each may hold only the information needed to treat requests coming from the MSCs connected to the physical GCR entity.

8.1.2 Broadcast call attributes

Each MSC involved in a voice broadcast call requests its proper broadcast call attributes from its related GCR. For any broadcast call reference the GCR shall provide the corresponding broadcast call attributes to the requesting MSC. These lists shall be programmed by the service provider at registration of the network specific service configuration.

The contents of each list related to requests of the group call anchor MSC is as follows:

- a list of cells inside the MSC area of the group call anchor MSC into which the call is to be sent (part of the group call area), see subclause 8.1.2.1;
- a list of group call relay MSCs into which the call is to be sent;
- information on the cipher algorithm and the group key to be used for this voice broadcast call;
- information on the codecs allowed for this voice broadcast call;
- a list of identities of dispatchers to which a dedicated link is to be established, see subclause 8.1.2.2;
- a list of identities of dispatchers which are allowed to initiate the voice broadcast call, see subclause 8.1.2.2;
- a list of identities of dispatchers which are allowed to terminate the voice broadcast call, see subclause 8.1.2.2;
- the default priority level related to that voice broadcast call if eMLPP applies, see subclause 8.1.2.3;
- a status flag indicating if a voice broadcast call with the related group call reference is on-going, see subclause 11.3.1.1.1;
- a flag indicating if acknowledgements are required for this voice broadcast call.

The contents of each list related to requests of a group call relay MSC is as follows:

- A list of cells inside the MSC area of the requesting MSC into which the call is to be sent (part of the group call area), see subclause 8.1.2.1;

8.1.2.1 Group call area

The group call area is defined as a list of cells inside the network. The cells shall be defined by their cell identification consisting of the Location Area Code and the Cell Identity as defined in GSM 08.08 and are therefore uniquely identified in the network.

In the case the group call area extends over several MSCs, only the cells belonging to the requesting MSC are included in the broadcast call attributes.

8.1.2.2 Dispatcher identities

Dispatcher identities shall be ISDN numbers or MSISDN numbers with the structure according to CCITT Recommendation E.164. They shall correspond both to the number to be used to establish a call toward the dispatcher and the number provided as calling line identification when the call is originated by a dispatcher.

The list of dispatcher identities to which a dedicated link is to be established shall be passed to the MSC so that the distribution function can be set up.

The list of dispatcher identities which are allowed to initiate voice broadcast calls is used by the anchor MSC for verification for a voice broadcast call establishment by a dispatcher.

The list of dispatcher identities which are allowed to terminate voice broadcast calls is used by the anchor MSC for verification for a voice broadcast call release by a dispatcher.

8.1.2.3 Priorities

If the eMLPP supplementary service is applied to a voice broadcast call, the priority level shall be stored in the GCR.

For further details see GSM 03.67.

8.2 Information managed per subscriber

8.2.1 Stored in the HLR

The following additional information shall be stored in the HLR:

- the subscription option for voice broadcast calls which can be made in the HPLMN only or also in case of roaming;
- a list of all the group IDs for which a service subscriber has a subscription;
- an indication whether the subscriber is entitled to establish a voice broadcast call to one or more group IDs of his subscription.

The group IDs are defined in subclause 9.1.

A service subscriber shall not be provided with more than 50 group IDs.

8.2.2 Stored in the VLR

The list of all the group IDs a service subscriber is entitled to use and the entitlement to establish a voice broadcast call to a group ID shall be brought forward to a VLR at the same time as other subscriber information is copied, and VLR entries shall be modified when corresponding HLR records are changed.

8.2.3 Stored in the SIM

The information detailed in subclause 8.2.1 also needs to be stored on the SIM. The service subscriber shall be able to deactivate or reactivate a group ID by MMI interaction so that the mobile station does ignore notification messages to this group ID.

For each group ID where data confidentiality may be applied, the SIM needs to store the cipher algorithm to be used and the possible group keys.

8.3 Information used for routing of dispatcher originated broadcast calls

Routing of dispatcher originated calls shall be performed on the MSISDN number received at a GMSC in the Initial_Address_Message.

The GMSC may use one of the two alternative information to route the call request to the corresponding group call anchor MSC:

- The routing information may be provided by an HLR as for normal mobile terminated calls. The called party MSISDN number shall be passed to the appropriate HLR which shall pass the corresponding MSRN back to the GMSC referring to the group call anchor MSC for the call. The related IMSI shall include the broadcast call reference as defined in subclause 9.2.

NOTE: Alternatively, the MSRN may be predefined in the HLR and in the group call anchor MSC with a fixed relation to a broadcast call reference.

- The routing information may be provided in the routing table of the GMSC which directly routes the call request to the group call anchor MSC without requesting an HLR. In this case, the broadcast call reference shall be included in the called MSISDN number as defined in subclause 9.2 d).

9 Identities

9.1 Elementary identities for broadcast calls

a) Group ID

The group ID shall be a binary number with a maximum value depending on the composition of the broadcast call reference defined under c).

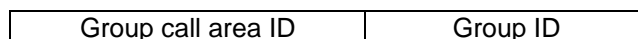
VBS shall also be provided in case of roaming. If this applies, certain group IDs shall be defined as supra-PLMN group IDs which have to be co-ordinated between the network operators and which shall be known in the networks and in the SIM.

b) Group call area ID

The group call area ID shall be a binary number uniquely assigned to a group call area in one network and with a maximum value depending on the composition of the broadcast call reference defined under c).

c) Broadcast call reference

Each voice broadcast call in one network is uniquely identified by its broadcast call reference. The broadcast call reference is composed of the group ID and the group call area ID. In the case where the routing of dispatcher originated calls is performed without the HLR (see subclause 8.3), the broadcast call reference shall have a maximum length of 8 digits. The composition of the group call area ID and the group ID can be specific for each network operator.



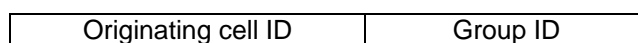
9.2 Use of identities in the network

For each voice broadcast call the identifications as defined in the following shall be used within the network for the related purpose mentioned.

For voice broadcast services which are to operate in more than one PLMN, group identities have to be co-ordinated between the network operators involved.

a) Identities used for GCR requests for service subscriber originated voice broadcast calls

In case of a service subscriber originated call, the identity of the call used by the MSC in which the call is originated to interrogate the GCR shall consist of the originating serving cell identity as defined in GSM 08.08 and the group ID as defined in subclause 9.1.



A service subscriber initiating a voice broadcast call has to call the wanted group ID. The MSC in which the call is originated shall accumulate from the BSS the called group ID and the originating cell ID.

If the group call area exceeds one MSC area, the identity used to interrogate the GCR by an MSC in which the call was not originated shall consist of the broadcast call reference as defined in subclause 9.1.

b) Identities used for GCR requests for dispatcher originated voice broadcast calls

In case of dispatcher originated call the identity used by the MSC to interrogate the GCR shall consist of the broadcast call references defined in subclause 9.1.

c) Identities used for notifications

Identities used for notification messages shall consist of the broadcast call reference as defined in subclause 9.

d) Identities used by dispatchers for voice broadcast call establishment

For dispatcher originated calls an MSISDN is dialled. The Country Code (CC) and National Destination Code (NDC) are used as normal for routing purposes. The numbering scheme is according to CCITT Recommendation E.164. The Subscriber Number (SN) is used to indicate:

- the request of a broadcast call by use of a prefix. The length of the prefix shall be 1 to 2 digits [tbc];
- the wanted broadcast call reference as defined in subclause 9.1 if the routing is performed by the GMSC without requesting an HLR.

CC	NDC	Prefix	Broadcast call reference
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If the routing is performed by requesting an HLR, the MSISDN shall be translated within the HLR to an IMSI where the Mobile Country Code (MCC) and Mobile Network Code (MNC) are set as for normal GSM calls and the Mobile Subscriber Identification Number (MSIN) contains the prefix plus the broadcast call reference.

MCC	MNC	Prefix	Broadcast call reference
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e) Identities used for VLR requests for service subscriber originated broadcast calls

The group ID shall be used on the B-Interface for VLR requests.

10 Operation and maintenance aspects

NOTE: A list and short description of the operation and maintenance aspects will be given. This includes the options and parameters which can be set by the operator:

- handling of timers;
- registration aspects etc.

11 Function and information flows

11.1 Broadcast function management

The broadcast call attributes, as given in subclause 8.1 shall be entered and modified by the service provider. A list providing information on necessary Operation and Maintenance actions is given in clause 10.

11.2 Group membership management

Once the membership is established, the individual membership of the group can be placed in an active or deactive state on the SIM by the user. If a subscriber has a group ID in an active state, the subscriber is able to establish voice broadcast calls corresponding to that group ID if he is entitled for it.

In a deactive state the mobile station prevents the service subscriber from establishing calls using the group ID and the corresponding notifications need to be "ignored" by the mobile station.

The active state and deactive state entries may be password protected as an implementation option.

Group IDs are listed in the subscription data within the network and on the SIM. The SIM must be returned to the network operator or service provider for updating if the subscription is to be changed.

NOTE: Updating of subscription data over the air interface is not considered. However, this shall not preclude future applications if corresponding mechanisms may be implemented.

Users can interrogate their mobile stations to determine to which groups they are members and which subscriptions are currently in an active state.

11.3 Call management

11.3.1 Call establishment

A voice broadcast call can be established by either a service subscriber or by a dispatcher.

11.3.1.1 Service subscriber call establishment

11.3.1.1.1 Initial stage

In the initial stages (between the MS and the MSC), service subscriber originated voice broadcast call establishment shall proceed as for a standard call. The initial signalling from the originator informs the network that a voice broadcast call is required and details the group ID. No information relative to the group call area is given by the caller.

The network shall perform a number of checks in order to determine how to handle the call:

- check of the ability of the subscriber to establish the call;
- check whether the call can be initiated from the cell;
- check of the existence of an on-going call of the same broadcast call reference.

The MSC shall check the VLR records for the ability of the subscriber to start the call. If the service subscriber has no subscription for the voice broadcast service with the indicated group ID, the call shall be released. In addition, the VLR shall return barring and identity presentation restriction checks to the MSC.

The MSC shall then request information from the GCR by giving the group ID and the originating cell ID as defined in subclause 9.2. The GCR first derives the group call area ID from the group ID and the originating cell ID. If no group call area ID is related to the group ID and originating cell ID, the call shall be released. If a group call area ID is related to the group ID and originating cell ID, the GCR shall transfer the corresponding broadcast call attributes to the MSC. From that moment until the MSC indicates the contrary, the call shall be considered as on-going by the GCR.

If the MSC is not the group call anchor MSC for the voice broadcast call as indicated in the GCR, then the voice broadcast call request shall be passed to the group call anchor MSC.

It is possible that two service subscribers or a service subscriber and a dispatcher or two dispatchers may attempt to establish a call using the same group ID and corresponding to the same group call area ID. If the two voice broadcast calls are established with the same group ID but for different group call areas, then separate voice broadcast calls shall be established. If the group call areas overlap, it is up to receiving mobile station to determine which call to participate in. If more than one call is made to identical group ID and group call area, the network shall reject all but one of the call attempts.

If the GCR receives a new interrogation related to a broadcast call reference where the call is indicated as on-going in the GCR, the GCR shall provide the on-going status together with the broadcast call reference back to the MSC. The MSC shall then release the call with cause user busy in case of a service subscriber originated call request. The mobile station of the service subscriber shall then look for notifications of the respective group ID on the NCH and join the voice broadcast call. In case of a dispatcher originated voice broadcast call request, the MSC shall join the dispatcher to the distribution function of the voice broadcast call.

A service subscriber which is entitled by his subscription to establish voice broadcast calls while roaming shall only be able to use supra-PLMN group IDs as defined in subclause 9.1 in case of roaming. In case of roaming, the mobile station shall only react on notifications for supra-PLMN group IDs.

Because of the possibility of overlapping group call areas, each call requires a unique reference, assigned by the group call anchor MSC at the point of call initiation. The broadcast call reference shall be composed of the group ID and a group call area ID (see clause 9).

Authentication of the calling subscriber can be performed by the network as for normal calls.

11.3.1.1.2 Establishment of the transmission means

A voice broadcast call channel shall be established in all the cells throughout the identified group call area using physical channels selected by the BSCs as appropriate. The downlink channels shall be established without any return signalling from mobile stations. Whilst the downlink channel is being established, the MSC shall form a distribution function containing the appropriate channels on all BTSs in the group call area. The MSC is responsible for adding dispatchers to the distribution function.

Alternatively, the network may establish voice broadcast channels in a cell on demand, i.e. if mobile stations respond to the notifications as defined in subclause 4.2.2.1.

In parallel, a dedicated suitable channel is allocated to the caller if not already the case. Once this is done, and at least one downlink channel is established, the MSC shall signal to the calling subscriber that this has occurred so that he knows when to start speaking.

The mobile station shall indicate connection to the subscriber. If channels could not be established in particular cells because of congestion, channels are allocated to these cells as soon as possible.

11.3.1.1.3 Release of the dedicated transmission means of mobile stations responding to a notification

Mobile stations which respond to a notification for which no description of the voice broadcast channel was given in the notification message may be given a dedicated connection up to the time where the network requests the mobile station to join the voice broadcast channel by use of a channel release procedure.

11.3.1.2 Dispatcher call establishment

In the case of dispatchers originated calls the call request, in the form of an MSISDN number, shall be received at a GMSC. Such a call can be treated by the GMSC as a normal mobile terminated call. In this case, the GMSC shall interrogate an HLR, determined on the basis of the MSISDN number. The HLR in turn may either interrogate the appropriate MSC/VLR to obtain an MSRN, or may supply an MSRN predefined in the HLR and related to the respective broadcast call reference in the MSC/VLR. If the HLR interrogates the MSC/VLR for the MSRN, the HLR shall provide this MSC/VLR with the related IMSI including the broadcast call reference as defined in clause 9.

Alternatively, the call request can be forwarded directly to the related group call anchor MSC on basis of the GMSC's internal routing table. In this case, the broadcast call reference shall already be included in the requested MSISDN number as defined in clause 9.

When interrogated by the group call anchor MSC, the GCR shall check if the calling line identity is within the list of dispatcher identities allowed to establish the voice broadcast call. If not the case, the call shall be rejected.

After reception of the call request, the group call anchor MSC checks whether an on-going call of the same broadcast call reference exists, in which case the group call anchor MSC shall add the dispatcher to the call.

At the point at which notification messages are sent to mobile stations, a tone is relayed to the dispatcher to inform him that he can commence his message.

11.3.1.3 Notification procedures

Different notification procedures shall be applied in relation to the mode of the mobile station as presented in table 1 and defined in the following clauses.

Table 1: Overview on different information messages for new or on-going calls

call type:	new broadcast call	on-going broadcast call	new point-to-point call
MS states:			
Idle mode	Initial Notification NCH (section a)	Subsequent Notification NCH (section a)	(standard paging)
group receive mode	Initial Notification FACCH (section b)	Subsequent Notification SACCH (section b)	Paging info SACCH/FACCH (section d)
dedicated mode	Initial Notification FACCH (section c)	Subsequent Notification SACCH (section c)	(standard Call Waiting)

a) Notification for mobile stations in idle mode

Once the voice broadcast channel has been established in a cell or the network is waiting to receive notification responses to establish a voice broadcast channel, notifications shall be broadcast on the NCH in that cell.

The position of the NCH shall be derived from the system information of the BCCH.

The notification messages shall include the broadcast call reference and possibly the description of the voice broadcast channel, the call priority if eMLPP is applied, an indication whether acknowledgements are required for this call and the group cipher key number.

A notification message can contain no, one or more notifications.

The notification process needs to continue throughout the duration of the broadcast call, in order to permit the "late entry" of other mobile stations. Mobile stations moving into the group call area which are in idle

mode shall be directed to the voice broadcast channel by the notification messages, possibly by means of the notification response procedure.

The scheduling of the notification messages in a cell shall be managed by the BSS. Information can be added in the messages to limit the required reception of NCH messages. The following constraints shall be met:

- Initial notifications (i.e. the first for a given broadcast call) shall have priority over subsequent notifications (i.e. the messages for an on-going broadcast call) and must be sent as soon as possible;
- After the initial notification, two other notifications for the call shall be sent to limit the probability of the notification not being received due to bad propagation.

NOTE: In addition initial notification messages for calls with or above an operator defined priority level can be sent on all possible paging or access grant channels to reduce the delay for those mobile stations which are not using DRX.

- Afterwards, an on-going broadcast call in the cell shall be periodically notified on the NCH.

Since the information for the establishment of a voice broadcast call is sent onto the NCH rather than on the PCH as for normal point-to-point calls, the mobile station must listen to the PCH as well as to the NCH. A "reduced NCH monitoring" mechanism can be used to save power in the mobile station when listening to the NCH.

A mobile station able to receive voice broadcast calls either, depending on the implementation:

- can use the "reduced NCH monitoring" mechanism. When entering a cell, the mobile station shall listen to the NCH to get the notifications of the voice broadcast calls on-going in the cell. Afterwards, the mobile station needs to listen to the NCH only if it is informed on the availability of a notification for a new voice broadcast call. This shall be based on the NCH status information provided, as indicated in GSM 04.08. In situations where conflicts due to other idle mode tasks occur, the mobile station shall fulfil those idle mode tasks with priority in multiframes which do not correspond to the own paging subgroup;
- do not apply the "reduced NCH monitoring" mechanism and read all possible paging or access grant channels.

b) Notification into on-going voice broadcast and group calls

Notifications into on-going voice broadcast and group calls may be provided as an implementation option.

In addition to sending initial notification messages on the NCH for the voice broadcast call, the BSS can provide initial notification into on-going voice broadcast and group calls informing mobile stations partaking in these calls of new voice broadcast calls that are being set-up in the cell.

In order to do this the BSS sends initial notification messages on FACCH to all on-going voice broadcast and group calls in the cell. The initial notification message on FACCH shall contain the broadcast call reference, the priority level if eMLPP applies and possibly the TCH description which allows the mobile station to connect directly to the new call without reading the NCH.

To provide a late entry facility, the BSS can provide subsequent notification on the SACCH into on-going voice broadcast or group calls informing late arrivals of the existence of the calls. The subsequent notification message on SACCH shall contain the group ID and the priority. The mobile station can decide, using this data, that there is a call of a higher priority and then look to the NCH in order to connect to the call.

The subsequent notification on SACCH needs to continue throughout the duration of the voice broadcast call allowing a late entry of mobile stations that missed the initial notification.

As an option the BSS may reduce the number of initial or subsequent notifications sent by using the priority field if the service is provisioned.

c) Notification into on-going point-to-point calls

Notification into on-going point-to-point calls shall be provided as an implementation option.

In addition to establishing the links for the voice broadcast call, the BSS can provide initial and subsequent notification onto on-going point-to-point calls informing mobile stations partaking in point-to-point calls of new and on-going voice broadcast calls.

The BSS shall only perform this procedure for those mobile stations whose classmark indicates that voice broadcast call is provisioned. The mobile station shall set the classmark if the mobile station supports voice broadcast calls and the SIM has a subscription to voice broadcast calls and at least one group ID is in active state on the SIM.

In order to perform initial notification the BSS shall send an initial notification message on the FACCH to the MS. The initial notification message shall contain the broadcast call reference, the priority level if eMLPP applies and possibly the channel description which allows the mobile station to connect directly to the new call without reading the NCH.

To provide a late entry facility, the BSS can provide subsequent notification on SACCH indicating on-going voice broadcast calls. The subsequent notification message on SACCH shall contain the group ID and possibly the priority. The mobile station can decide, using these data, whether there is a call of a higher priority and then look to the NCH in order to connect to the call.

The subsequent notification shall continue throughout the duration of the voice broadcast call allowing late entry of mobile stations. That is mobile stations that either ignored the initial notification or have subsequently moved into the group call area.

As an option the BSS may reduce the number of the initial or subsequent notifications sent by using the priority field if the service is provisioned.

d) Paging into on-going voice broadcast calls

Paging into on-going voice broadcast calls shall be provided as an implementation option.

In addition to establishing the links for the voice broadcast call, the network can provide paging information into on-going voice broadcast calls informing mobile stations partaking in a voice broadcast call of new incoming point-to-point calls.

For this, the MSC shall initiate paging sending the BSS an indication as to whether the paged mobile station has a subscription to voice broadcast calls. The BSS detecting that paging is to be initiated for a mobile station which has a subscription for voice broadcast calls shall send a SACCH/FACCH paging information message on the voice broadcast channels in the cells in which the paging is required.

Two different paging information mechanisms may be applied as a network option as defined in the following:

1) Paging of mobile subscriber identity:

The BSS shall provide paging messages for new calls with the related mobile subscriber identity on the SACCH/FACCH of the voice broadcast channel downlink.

2) Information on the availability of new paging messages on the PCH:

The paging information message shall contain an indication of the paging group to which the mobile station is being paged. A BSS shall ensure that the paging is repeated on the PCH in order to allow enough time for the mobile stations involved in voice broadcast calls to go to the PCH and read the paging message.

Those mobile stations which receive a paging information on the SACCH/FACCH which match their paging group shall look to their PCH paging subgroup (derived from the BCCH data) in order to search for the paging message.

In the event of a re-organization of the PCH the BSS shall inform the mobile stations via the SACCH/FACCH that paging re-organization has occurred. A mobile station receiving this indication shall decode the BCCH in order to obtain the new paging configuration.

As an option the BSS may reduce the number of paging information sent by using the priority field if the service is provisioned.

11.3.1.4 Destination subscribers

Mobile stations of destination subscribers which are in idle mode shall listen to notification messages on the NCH and move to the voice broadcast channel or respond to the notification.

Mobile stations which are busy shall either pre-empt the current call (if eMLPP is applied and the new call is of a sufficient priority, or shall provide the service subscriber with an indication similar to call waiting, when applicable.

11.3.1.5 Called dispatchers

Dispatchers are connected into the voice broadcast call as a standard point-to-point call.

11.3.2 Call release

The voice broadcast call can be terminated by the calling subscriber clearing it down, or by any dispatcher nominated in the GCR allowed to terminate the call.

If this occurs a call release message shall be sent on the FACCH of all cells in the group call area and then all resources are freed.

11.3.3 Leaving of a dispatcher

A dispatcher can disconnect from the call at any time without terminating the call. In order to terminate the call a dispatcher who is entitled to do this must use explicit signalling (e.g. DTMF).

NOTE: This signalling is currently not specified in the GSM technical specifications and left for operator specific solutions.

11.3.4 Leaving and returning to a voice broadcast call of a service subscriber

A destination service subscriber shall automatically disconnect from the call when leaving the group call area.

If the calling subscriber leaves the group call area or enters a BSC area not belonging to the service area, this may be detected by the network during the cell change procedure and the call may be terminated.

A destination subscriber's mobile station shall leave the voice broadcast call by no longer listening to the voice broadcast channel downlink and returning to idle mode. A broadcast call is returned to by listening to the periodic notification messages for that call, and reacting on them appropriately.

11.3.5 Cell change

11.3.5.1 Listening subscriber

In all cases change of cell shall be initiated and performed by the service subscriber's mobile station. In order for the service subscribers changing from one cell to another within the group call area to know which channel to listen to in adjacent cells, the channels used in each surrounding cell within the same BSC area, and if applicable, optionally in other BSC areas, are periodically broadcast on the downlink SACCH of the voice broadcast call as a network option. In this case, mobile stations entering a new cell shall perform cell change according to the algorithm C2, see GSM 05.08 and GSM 03.22.

Mobile stations which want to enter a cell for which they have received no channel information need to listen in addition to the BCCH to the NCH to determine which channel they shall retune to so that they can continue with the voice broadcast call if available in that cell.

Mobile stations entering a new location area shall perform location updating as normal.

11.3.5.2 Calling subscriber

Standard mobile station assisted handover shall be used for the cell change of the calling subscriber.

11.3.5.3 Dispatcher

Dispatchers which are mobile subscribers shall change the cell by standard handover procedures.

11.3.6 New calls

Any service subscriber originated new voice broadcast calls which have identical group ID and group call area to on-going voice broadcast calls shall be rejected by the network with cause busy. The mobile station shall then read the notifications for the corresponding group ID on the NCH.

For any dispatcher originated new voice broadcast calls which are identical to on-going voice broadcast calls as described above the network shall include the dispatcher in the on-going call.

Otherwise, new calls are treated as detailed in subclause 11.3.8. In the case of congestion, voice broadcast calls are treated according to their priority with each BSC treating each downlink depending on the situation in each cell to which the call is sent. Therefore, it is possible that a voice broadcast call might be established only in a subset of the required cells.

In the case where there are no distribution function free, and pre-emption is not performed, then the call request shall be rejected.

In the case of group members involved in voice broadcast or point-to-point calls who have been informed of a new voice broadcast call, the mobile station shall make a decision as to which to monitor as if both the on-going call and new call were point-to-point calls, and follow the procedure defined in GSM 03.67.

11.3.7 Uplink transmission management

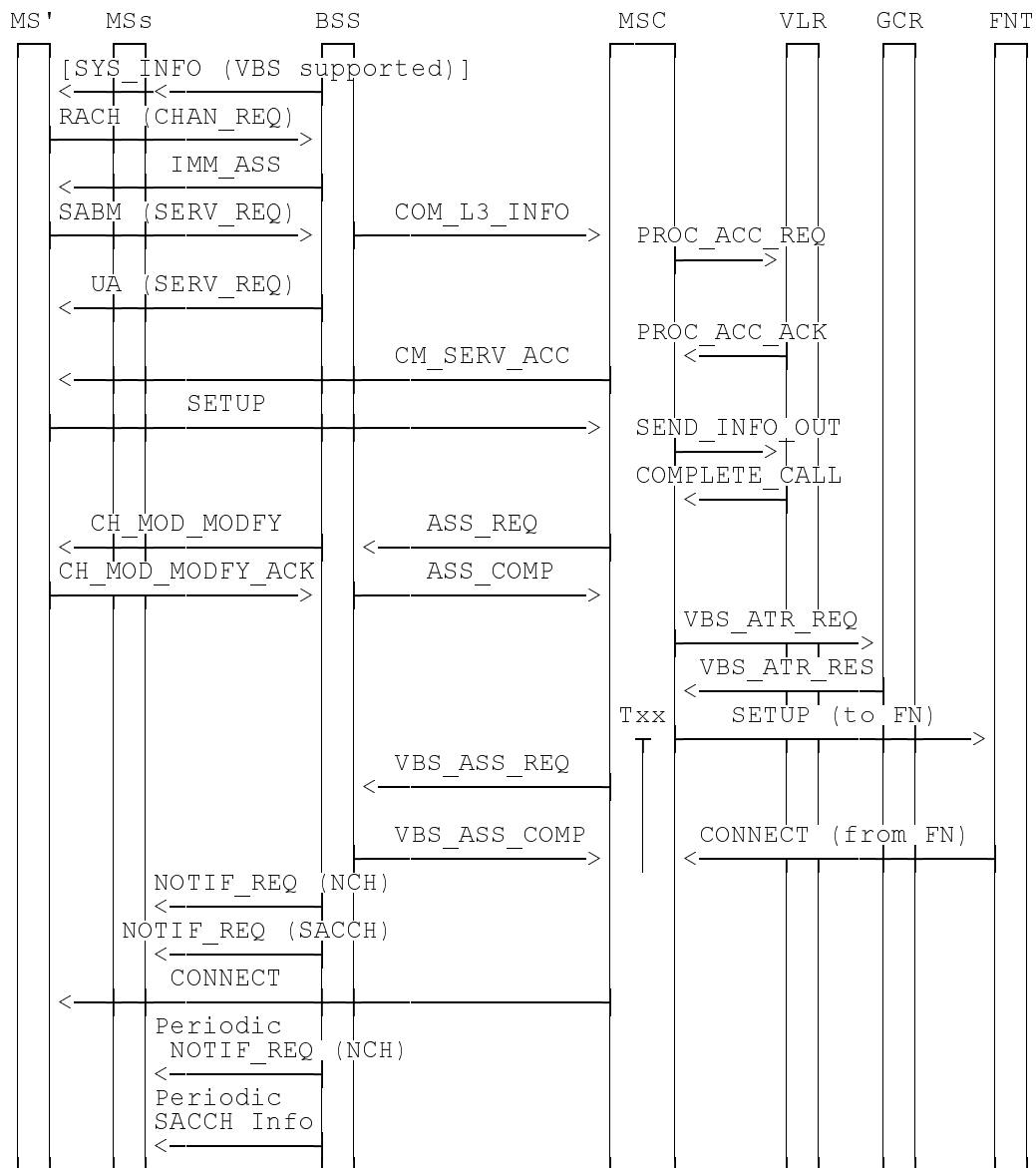
The uplink related to the voice broadcast channel downlink is not used. No UPLINK_BUSY information is required.

11.3.8 Overview of signalling

In this overview, the messages required to implement the specified concept are identified, and brief details are given of each message.

A diagrammatic representation of the voice broadcast call message structure proposed and actions required is given in figures 2 to 3.

NOTE: For VBS implementations where the group call area exceeds an MSC area, the MSC in figure 2 to 4 is the anchor MSC except for the VLR requests in figure 2.



NOTE: MS' = calling subscriber mobile station;
 MSs = destination subscriber mobile stations
 FNT = fixed network user terminal

Figure 2: Signalling information required for establishing voice broadcast calls by a service subscriber

SYS_INFO (VBS supported): Message used to indicate if the VBS establishment is supported in the cell and if voice broadcast channels and the corresponding paging/notification is supported in the cell.

Initial RACH CHAN_REQ: Standard message.

IMM_ASS: Standard message send on the PCH.

SERV_REQ (broadcast call): Modified form of the current call request message L3-MM CM SERVICE REQUEST sent on the allocated channel. Teleservice voice broadcast call is indicated.

UA (SERV_REQ): This message is used to acknowledge the layer 2 link and provide contention resolution of the service request.

COM_L3_INFO: The MSC is provided with initial information about the voice broadcast call.

NOTE 1: Messages flows for authentication and ciphering are not represented although performed as normal.

PROC_ACC_REQ: The MAP_PROCESS_ACCESS_REQUEST message is sent to the VLR to check the requested VBS teleservice against the subscription data.

PROC_ACC_ACK: The MAP_PROCESS_ACCESS_REQUEST ack message acknowledges the requested service.

CM_SERV_ACC: The service request is acknowledged. Acknowledgement of the service request can also be performed by invocation of ciphering mode setting.

SETUP: The MSC is provided with details about the voice broadcast call.

NOTE 2: Alternatively, an IMMEDIATE_SETUP may have been send as the initial message including all details of the voice broadcast call. In this case no SETUP message must be sent.

SEND_INFO_OUT: The requested group ID is transferred to the VLR in the MAP_SEND_INFO_FOR_OUTGOING_CALL message.

COMPLETE_CALL: The VLR returns the MAP_COMPLETE_CALL confirming the use of the requested group ID.

ASSIGNMENT_REQUEST: Standard message.

CHAN_MOD_MODIFY: Standard message to modify the channel mode in case of very early assignment.

CHAN_MOD_MODIFY_ACK: Standard message to acknowledge the modification of the channel mode.

ASSIGNMENT_COMPLETE: Standard message.

NOTE 3: Alternatively, early assignment or OACSU procedures might be applied with the corresponding assignment messages not presented in figure 2.

VBS_ATR_REQ: The broadcast attributes are requested from the GCR.

VBS_ATR_RES: The requested information is returned from the GCR.

VBS_ASSIGNMENT_REQ: This message is sent from the MSC to all affected BSCs, [one dedicated message for every requested channel in a cell] including the broadcast call reference, the channel type and possibly the call priority and details on the ciphering.

NOTE 4: As an operator option the voice broadcast channels, the links to them and optionally also the links to dispatchers can already be established and permanently reserved in order to speed up the call set-up for emergency voice broadcast calls.

VBS_ASSIGNMENT_COMPLETE: Acknowledgement message from the affected BSC in answer to the assignment request. If the assignment is not successful, a VGCS_ASSIGNMENT_FAILURE message shall be sent instead.

SETUP to fixed network users: Based on the information determined about the users of external networks to be involved in the call, the MSC shall initiate calls to these users in the normal manner, depending on their mode of connection into the MSC, and shall connect them to the distribution function. Alternatively normal calls to GSM subscribers may be established for dispatchers being GSM subscribers which is not presented in the diagram.

Txx: Timer implemented in the MSC which is started with the incoming VBS SETUP message and stops with the outgoing paging message. If the timer expires before the MSC receives all of the expected CHAN_REQ_ACK from the BSCs and the CONNECT messages from the external networks, the VBS shall be established by the MSC to all available parts of the group call area.

NOTIF_REQ (NCH): Messages for notification which contain the broadcast call reference, the priority of the call if eMLPP is applied, the acknowledgement flag and possibly the channel description of the voice broadcast channel to which the mobile stations shall listen and the number of the group key used for ciphering.

NOTIF_REQ (SACCH): Message for notification sent on the SACCH or FACCH to the mobile stations currently involved in other calls. The notification on the SACCH can include only the broadcast call reference, the acknowledgement flag and the priority level. The notification on the FACCH may include also the channel description and the group ciphering key numbers.

or also the channel description [and the group ciphering key numbers] as optional element[s].

Periodic NOTIF_REQ (NCH): The notifications are sent periodically so that mobile stations moving into the area can join the voice broadcast call.

Periodic SACCH Info: Periodic messages sent on the downlink of the SACCH or on the FACCH informing mobile stations of:

- optional details of surrounding cells which may include the channel description of the BCCH and the voice broadcast channel in each surrounding cell of the group call area or of the group call area and inside the same BSC area and other information used for cell reselection;
- notifications or paging information messages on other calls in the cell.

CONNECT: Information to the mobile station of the calling subscriber that the VBS is established with the related broadcast call reference as the connected number.

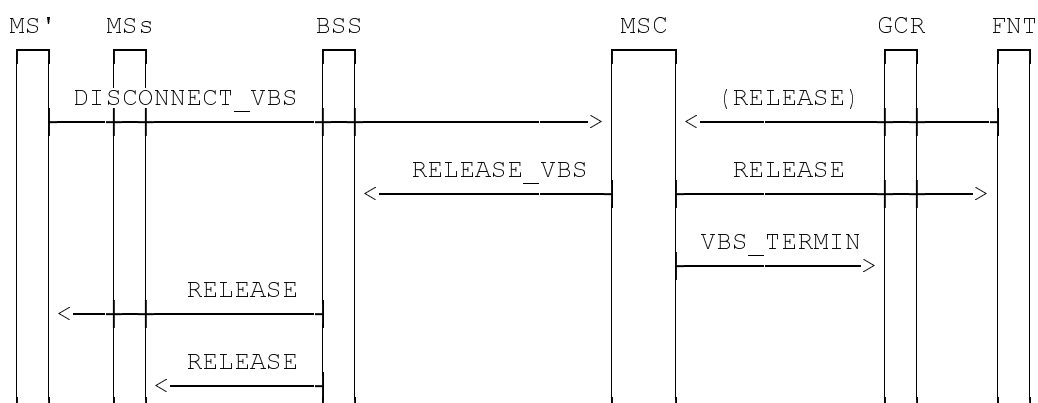


Figure 3: Signalling required to disconnect the voice broadcast call

DISCONNECT_VSB: The calling subscriber's mobile station can send a DISCONNECT message to clear down the entire voice broadcast call. Alternatively an authorized dispatcher can terminate the voice broadcast call in which case a RELEASE message is received from the external network.

RELEASE_VBS: This message is sent from the MSC to all related BSC to disconnect calls from the distribution function and stop all periodic notifications for the voice broadcast call to be released.

VBS_TERMIN: The MSC informs the GCR that the voice broadcast call with the related broadcast call reference is terminated.

RELEASE: RELEASE messages are sent to the calling subscriber and on all downlink FACCH to the service subscribers. The RELEASE messages shall be repeated for a predefined period in order to provide a high probability that the listening mobile stations receive the message.

In addition, RELEASE messages are sent to all related dispatchers.

History

Document history			
December 1996	Unified Approval Procedure	UAP 61:	1996-12-16 to 1997-04-11