



A Deliverable by the NGMN Alliance

NGMN Broadcast and Multicast Support

next generation mobile networks



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Editor in Charge	Zhigang Yan (China Mobile)
Editing Team	Tin Lin Lee (China Mobile), Xiaodong Shen (China Mobile), Ronan Le Bras (Orange), Hans-Jürgen Dichter (T-Mobile), John Boggis (Vodafone)
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Abstract

Within NGMN, Project 7 Broadcast and Multicast Support looks into network operators' needs to support broadcast and multicast services. The key objective of Project 7 is to deliver the recommendations and requirements for broadcast and multicast services. These sets of recommendations and requirements will form the basis for equipment roadmap and evaluation criteria for NGMN broadcast and multicast systems.

Project 7 has identified a set of requirements for the support broadcast and multicast. Project 7 recognises that the support of broadcast service and/or multicast service cannot be deemed as mandatory within terminals or networks. However if the system supports broadcast and multicast, the design and implementation of broadcast and multicast shall conform to the requirements of this document. Furthermore Multicast is considered to be of equal significance to Broadcast.

The list of requirements for broadcast and multicast support is summarized below. Note that the initial high-level recommendations listed in NGMN white paper and NGMN Project 7 recommendations are used as inputs. It is aimed that the requirements for the support of broadcast and multicast should inherit most of NGMN's requirements.



Network requirements:

- Reuse physical layer components
- Support transmissions: Point to multipoint, Dedicated and mixed carrier; Single cell and multi-cell
- Spectral efficiency of 10 times or better than 3GPP Release 6 MBMS
- Ensure continuity of broadcast and multicast services for speeds higher than 120km/h
- Ensure phase synchronisation of sites in multi-cell single frequency network
- Support multi-operator sharing of broadcast and multicast infrastructure
- Have minimum additional interfaces due to broadcast and multicast support, and interfaces should be open and standardised
- Have architecture that is flexible and allows network expansion independent of the unicast network
- Support interaction and uplink feedback

UE requirements:

- Support reliable distribution of emergency information if unicast does not provide emergency support information which is an optional UE capability to fulfil local regulatory requirements.
- For single receiver UE, enable simultaneous reception of multiple streams of broadcast/multicast and unicast data on mixed carrier.



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1 INTRODUCTION

The NGMN Alliance [1] is an initiative by a group of leading mobile operators to provide a vision for technology evolution beyond 3G for the competitive delivery of broadband wireless services to increase further end-user benefits. The objective is to establish clear performance targets, fundamental recommendations and deployment scenarios for a future wide area mobile broadband network, and to make sure that its price/performance is competitive with alternative technologies.

Within NGMN, Project 7 Broadcast and Multicast Support looks into network operators' needs to support broadcast and multicast services. The key objective of Project 7 is to deliver the recommendations and requirements for broadcast and multicast services. These sets of recommendations and requirements will form the basis for equipment roadmap and evaluation criteria for NGMN broadcast and multicast systems.

In this document, the list of requirements for broadcast and multicast support is presented, taking the initial high-level recommendations listed in NGMN white paper [1] and NGMN Project 7 recommendations [2] as inputs. It is aimed that the requirements for the support of broadcast and multicast should inherit most of NGMN's requirements. In the following, we will focus on the requirements of broadcast and multicast network and user equipment.

Project 7 has identified a set of requirements for the support broadcast and multicast. Project 7 recognises that the support of broadcast service and/or multicast service cannot be deemed as mandatory within terminals or networks. However if the system supports broadcast and multicast, the design and implementation of broadcast and multicast shall conform to the requirements of this document. Furthermore Multicast is considered to be of equal significance to Broadcast.

2 RADIO NETWORK REQUIREMENTS

The NGMN broadcast and multicast system should be able to reuse most of NGMN's network requirements specified in other projects, for example, NGMN Project 5 on System Architecture. Any additional functionalities and requirements to support broadcast and multicast services should be clearly justified to avoid complicating the broadcast and multicast system. In this section, we will focus on these additional needs for broadcast and multicast services from network perspective.

2.1 PHYSICAL LAYER COMPONENT RE-USE

In order to reduce terminal complexity, as much as possible the same fundamental modulation, coding and multiple access approaches used for unicast operation should apply to broadcast and multicast, and the same UE bandwidth mode set supported for unicast operation should also be applicable to broadcast and multicast operations. Specific physical layer requirements for the support of broadcast and multicast should be minimised unless benefits are clearly demonstrated. For example, in 3GPP specification, a reduced sub-carrier spacing of 7.5 kHz for dedicated carrier is recommended to maximise efficiency.

2.2 TRANSMISSIONS MODES

Radio network supporting broadcast and multicast is required to support point-to-multi-point transmission mode. Both multi-cell and single cell broadcast and multicast transmissions should be supported.

On top of that, transmissions will be required to be carried out on either a dedicated carrier or a carrier multiplexed with unicast traffic. Dedicated and mixed carrier transmissions have different uplink feedback requirements, resource sharing with unicast network and deployment approaches, hence, different strategies to increase the efficiency for the delivery of broadcast and multicast services should be available to the network operators.

2.2.1 QUALITY OF SERVICE REQUIREMENTS

For multicast services, operators are able to configure the quality of service for each service and for each user class to provide for differentiated flow charging.

When broadcast and multicast traffic is multiplexed with unicast traffic, the network is required to adapt the broadcast and multicast data transmissions to different radio network capabilities or availability of radio resources.

2.2.2 SPECTRUM EFFICIENCY

In deployment scenario where a carrier is mixed among broadcast/multicast and unicast traffic, the spectrum efficiency target at cell edge for the broadcast and multicast traffic should be in line with the existing target performance in the unicast traffic.

In deployment scenario where a dedicated carrier is used for broadcast and multicast, when operating with the same content for all cells or for a group of cells, for example in single frequency network (SFN), the target spectrum efficiency level should be at least 10 times better than MBMS Rel.6 which is already achievable in LTE MBMS [4].

In broadcast mode, the spectrum efficiency of better than 1 bit/s/Hz is required in 90% of the broadcast area. This is equivalent to the support of at least 16 mobile TV channels at around 300 kbps per channel in a 5 MHz carrier in an urban or suburban environment.

2.2.3 SERVICE CONTINUITY AND SEAMLESS MOBILITY

The user of broadcast and multicast services shall be able to continue to receive the services throughout the broadcast and multicast area. Seamless mobility (for mobile speeds of more than 120km/h has been defined in NGMN Access Terminal Requirements [3]) within the same transmission area is required. End users should not be aware of handover between cells within the transmission area and handover should be as good as streaming services in the unicast system.

Mobility between different transmission areas should also be supported if the same service is provided in both areas. For example, a user using a broadcast/multicast service is moving out of single cell into multi-cell transmission area, this user should support the change of transmission modes and should be able to continue to use the same service in the new transmission area.

The two networks (UEs) should support seamless handover between broadcast/multicast and unicast service where the same data is being transmitted over the two networks, in order to improve/extend overall coverage. This will allow economic roll out of the broadcast/multicast network

2.2.4 NETWORK SYNCHRONISATION

To provide multi-cell broadcast and multicast services, there is a clear gain with tight inter-cell phase synchronisation as this allows for an efficient and low-complexity combining of multiple cells. In the case of allocating a dedicated carrier for broadcast and multicast, fewer sites can be used and only those sites which are part of the single frequency network of broadcast and multicast transmissions need to be phase synchronised. It is required that the cells within a single frequency network, transmitting broadcast and multicast contents, are phase synchronised within a fraction of prefix length. This phase synchronization shall be provided to the cells via the transport network.

2.2.5 INTERRUPTION TIME REQUIREMENT

The system shall allow the network operator to configure the system to provide an interruption time when changing between two broadcast streams received in the same cell and interruption time when changing between two broadcast streams received on different carriers should be less than 1 second.

2.3 OVERALL NETWORK REQUIREMENTS

It is mandatory that the broadcast and multicast network expansion should be kept independent of unicast network. Both broadcast/multicast and unicast are independently scalable.

Broadcast and multicast system architecture needs to be flexible to allow the network operators to efficiently manage the development of broadcast and multicast system.

2.3.1 NETWORK SHARING

The use of broadcast and multicast services provided by one operator should be available to roaming users from the other mobile operators, in particular in the dedicated carrier deployment scenario. Moreover, options to share core or radio networks for broadcast and multicast purposes should be available to the operator.

Operators should be able to share broadcast/multicast infrastructure independent if unicast infrastructure is already shared.

2.3.2 CELL SELECTION CHARACTERISTICS

End user might be receiving broadcast and multicast services from a cell different from the camped cell, especially in dedicated carrier scenario. Cell reselection process is required to include reselection for broadcast/multicast and unicast services separately. Wherever possible, cell reselection for broadcast and multicast transmissions is required to be kept separate from unicast. Hence, both information regarding unicast and broadcast/multicast should be made available regardless if the UE is in idle or active mode. It is important to note that in event of conflict, unicast shall have priority over broadcast and multicast.

In order to facilitate broadcast and multicast mobility, it is required that network operators supporting broadcast and multicast services are able to provide service announcements for broadcast/multicast services within the transmission area defined for the service.

Some mobility scenarios may be eased for Dual receiver UEs that are constantly connected to both unicast and MBMS (if they are provided on a separate carrier).

2.3.3 OPEN AND STANDARDISED INTERFACES

Additional interfaces due to the support for broadcast and multicast shall be kept minimum. Moreover, any additional interfaces are required to be open and standardised. This requirement entails that the interfaces to unicast and other legacy systems should be open and specified.

In addition to supporting the network's own broadcast services, network operator may be required to support broadcast services from third parties. However, the interfaces of these third party service providers are required to be standardised and specified. For example, interfaces of external sources to the broadcast/multicast service centre BM-SC should be standardised.

2.3.4 UNIFIED NETWORK MANAGEMENT

Broadcast and multicast is required to operate under the same network management system. It should not require a separate operational and management system.

Mobile operator shall be able to provision one or more broadcast or multicast services within the network. Moreover, mobile operator should be able to configure the broadcast and multicast areas individually for each service.

Functionalities to enable network operators to configure and manage multicast user groups dynamically are required. Functionalities for effective file and stream distribution are also required.

2.3.5 SUPPORT FOR INTERACTION AND UPLINK MESSAGING

Means for user interaction and sending of uplink messages are required for some scenarios. Mobile operators may wish to know how the users use the broadcast and multicast services and the take up of certain services, in order to effectively manage the resources. Techniques to efficiently support user interaction and uplink messaging should be developed for broadcast and multicast system.

3 UE REQUIREMENTS

Besides the NGMN terminal requirements [3], specific requirements for UE for the support of broadcast and multicast services are discussed in this section. In general, UE does not need to be in RRC active mode to receive broadcast and multicast services. Furthermore, UE should allow users to activate and/or deactivate the support of broadcast and multicast.

This section describes the other UE requirements for the support of broadcast and multicast services.

3.1 SUPPORT FOR EMERGENCY INFORMATION

Unless the unicast system is not able to provide emergency information, broadcast may not be the primary and sole source of providing emergency information, but will aim to provide complimentary emergency information, where local regulatory requirements exist.

3.2 SIMULTANEOUS RECEPTION

For single receiver UE, in mixed carrier transmissions, broadcast and multicast services will share one carrier resources with unicast services, hence, it is required that the UE should be capable of receiving unicast and broadcast/multicast services simultaneously. Single receiver UE in dedicated carrier transmissions should also support broadcast and multicast.

For dual receiver UE, the UE should be capable of receiving unicast and broadcast/multicast data simultaneously. Simultaneous reception of more than one broadcast and multicast service is required for dual receiver UE. Therefore, while receiving one or more broadcast and multicast services, it shall be possible for the user to be informed about incoming voice calls or the availability of other broadcast and multicast services.

3.3 SUPPORT FOR LOCATION DETERMINATION

The user equipment is able to discover the broadcast and multicast services available at the current location and its vicinity. The UE should be equipped with ability to decide when/who/where to send personal location information or data depending on its location. The network should be able to use the user reported location information to optimise the allocated services and resources. Note that the features for location determination are optional and are not mandatory UE functions and could be handled at the application level.

4 SUMMARISED KEY REQUIREMENTS

Network requirements:

- Reuse physical layer components
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- For single receiver UE, enable simultaneous reception of multiple streams of broadcast/multicast and unicast data on mixed carrier.



5 REFERENCES

- [1] H. Akhavan, V. Badrinath, T. Geitner, H. Lennertz, Y. Sha, T. Utano, B. West, "Next Generation Mobile Networks Beyond HSPA", White Paper V.3.0, December 2006
- [2] NGMN Project 7, "Broadcast and Multicast Support – M2 Recommendations", Version 1.0, July 2007
- [3] NGMN Project 8, "NGMN Radio Access Terminal Requirements", Version 2.3, July 2007
- [4] Qualcomm, "Summary of MBSFN evaluation", 3GPP TSG RAN1#49, R1072536, Kobe, Japan, May 2007