



RP-191019

*Proposal for standardization work in Rel-17:*

# Broadcast/Multicast over 5G for Mission Critical in RAN Rel-17

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# Intro & Background

- Currently 3GPP Mission Critical (MC) systems use eMBMS:
  - eMBMS, being point to multi-point, is a “natural fit” for key MC features such as group call and should be made available in 5G and beyond, over both eLTE and NR radio technologies.
- To-date eMBMS/5G has not been explicitly covered in 3GPP specifications:
  - Some work has been done in RAN1 (see TR 36.776), but **RAN2 and RAN3 work** is now needed.
- SA already has an approved 5G Rel-17 SI (S2-1906720, FS\_5MBS, due June 2020), for both “localized” (V2X, IoT, Public Safety) and wider area services (TV Video and Radio).
- RAN needs to start work on eMBMS/5G in Rel-17:
  - Work in RAN needs to be collaborative with and coordinated with work in SA.
  - **Mission Critical requirements need to be addressed and MC capabilities need to be designed into the system from the very beginning *and not as an afterthought addition.***

## Example of a potential new capability for eMBMS in 5G

- A unicast-broadcast/multicast “transparent mode” could be defined by RAN:
  - RAN would be able to *autonomously* decide (based on amount of traffic, number of served UEs, QoS, coverage, congestion, reported measurements, etc.) when to use unicast bearers and when to use multicast bearers and when to switch between them.
  - Such a capability would benefit all services, most of the time
  - In some cases, and especially for mission critical, there are situations when this “transparent mode” and/or the associated transitions between delivery mechanisms, may not be desirable, practical or optimal, so both autonomous RAN-controlled and explicit application-indicated selection, allocation, modification, releasing and toggling of bearers should be supported.

**Capabilities as this one should be studied by RAN in Rel-17 to determine suitability and optimal solution for inclusion in 5G.**

# Examples of MC reqs / capabilities for eMBMS/5G (1)

- 1. Rapid eMBMS bearers set-up and tear-down, to meet / exceed the MCPTT communications KPIs:**
  - Performance has to be humanly indistinguishable between unicast and eMBMS
  - Shortcomings and limitations in the current MC/eMBMS solution in terms of capacity and set up times need to be overcome as we move to 5G
- 2. Quick and lossless transitions and handovers between unicast and eMBMS bearers or between different eMBMS bearers:**
  - All transition combinations (unicast to eMBMS, eMBMS to unicast, eMBMS to (a different) eMBMS; inter-cell and intra-cell) need to be covered, while meeting the MC KPIs.
  - Human perceived quality of the communications during handover has to be very high, and at least as good as for commercial systems that may not be using (transitions to/from) eMBMS:
    - No dropped packets, no audio-gaps, no “audio clicks”
    - No perceived delay in the same voice stream when listening to two adjacent UEs, one served by eMBMS and the other by unicast

# Examples of MC reqs / capabilities for eMBMS/5G (2)

3. **Priority and pre-emption control** for both unicast and eMBMS bearers, with rapid dynamic adjustments of all bearers' QoS/bandwidth/priority
  - Features-wide parity between eMBMS and unicast is required
4. **Immediate notification** from the RAN to the MC application server (AS) when suspension (pre-emption) and/or automatic restoration of unicast and eMBMS bearers occur
  - The MC AS needs to find out fast which bearers are suspended, in order to mitigate by redirecting traffic and activating UE-to-Network relay functionality on certain UEs to temporarily provide service to UEs with suspended bearers via ProSe/sidelink.
5. **Uplink-only unicast GBR path:** UEs that transitioned from unicast to multicast and now receive downlink media on eMBMS bearer should have their downlink unicast GBR released in order to save downlink capacity, while maintaining the uplink-only unicast GBR path ready for instantaneous use, to enable them to meet the MCPTT transmission KPI when users key the PTT button and want to start transmitting voice in the uplink.
  - Feature also useful, independently of eMBMS or MC, for video modems in IoT devices consisting only of TV cameras that transmit video in the uplink

# Examples of MC reqs / capabilities for eMBMS/5G (3)

## 6. **Quick status and conditions reporting** to the mission critical application servers:

- Both the RAN (via network signaling) and the UE (via application level over the air signaling) should be available to provide the MC AS, on demand and via notification upon event detection, with up-to-date information: **rapidly produced reports** on traffic reception and/or received signal quality; or on specific in-cell/out-of-cell *up-to-date* location without having to use higher latency positioning technology
- RAN should provide *pre-notification of congestion build-up*, based on application defined levels, to give time to the AS to start application-specific mitigation (avoidance of full-blown congestion) before actual overload (and bearer suspension) occurs

## 7. **Enablement of dynamic control** by the mission critical application servers of allocations, modifications, quick traffic redirection and releasing of bearers

- The MC AS may be able to promptly predict and/or change the traffic patterns in ways that are not possible for the RAN, to optimize functionality and handle specific conditions: e.g. pre-starting eMBMS bearers in a incident area before most of the first responders arrive; or, switching to half rate vocoder transmission to reduce traffic and congestion in an area

# Conclusions and Proposal

1. It is essential to have a **mission critical friendly** broadcast/multicast system over 5G defined by 3GPP
2. Cooperation and coordination by RAN with the SA eMBMS SI work is essential, due to the end-to-end character of the project:
  - Events and conditions occur and are detected over-the-air [RAN2/RAN1], they can be signaled very **fast and reliably via the network** [RAN3, SA2, CTx], then reported and acted upon by the application server [SA6] which can then transmit orders on the same path in opposite direction.

**Proposal: RAN to start a Rel-17 SI asap focusing on eMBMS/5G, with the mission critical functional and performance requirements and features considered and included in the design from the beginning.**