

[RAN93e-R18Prep-09] Evolution for broadcast and multicast services - Version 0.0.6

RAN

3GPP TSG RAN#93e
[RP-211659]

Electronic Meeting, September 13 - 17, 2021

Agenda Item: xx

Source: RAN Vice-Chair (Deutsche Telekom)

Title: Moderator's summary for discussion [RAN93e-R18Prep-09] Evolution for broadcast and multicast services

Document for: Information & Decision

The discussion in this thread covers the topic #9 [RWS-210659] “**Evolution for broadcast and multicast services** - Including both LTE based 5G broadcast and NR MBS (Multicast Broadcast Services)”

Deadline and NWM organization based on the guidelines provided by the RAN Chair in [RP-211639]

As per guidance of the RAN Chair [RWS-210659] the discussion in this thread should be based on the (RAN REL-18 workshop) RWS submissions !

The aim is to converge on a set of areas with a reasonable scope as a “high-level description” – where “high-level description” herein is not a “draft SID/WID” but is something like a single slide with a set of bullets. In other words, it can be viewed as a skeleton of the possible objectives with some high-level notes

Please avoid any input like “We support / we do not support” as this is no “number counting” driven discussion, but focus on tangible commercial interests (near & longer terms)

1 Initial Round

1.1 General high-level views

Moderator's note: The moderator asks companies to provide general views on the motivation of enhancing broadcast and multicast services and providing clear judgement for high-level areas. Also view and near and longer term commercial interests might be placed here.

Feedback Form 1: General high-level views

1 – VODAFONE Group Plc

We would prefer to see more significant market traction on 3GPP broadcast/multicast before spending more time on further specification work for it.

2 – Futurewei Technologies

Futurewei

- During Rel-17 NR MBS WID standardization, many basic and essential features have been developed to support multicast and broadcast services.
- We acknowledge further work is needed on NR MBS to meet different service requirements of high reliability, high rate, low latency with multiple concurrent service operations.

3 – Futurewei Technologies

- During Rel-17 NR MBS WID standardization, many basic and essential features have been developed to support multicast and broadcast services.
- We acknowledge further work is needed on NR MBS to meeting different service requirements of high reliability, high rate, low latency with multiple concurrent service operations.

4 – LG Uplus

We would like to see further evolution of NR MBS and like Futurewei said, it needs to consider more specific service requirements depending on use cases with high data rate and low latency where capacity is limited.

5 – Apple Computer Trading Co. Ltd

6 – vivo Mobile Communication Co.

We are ok to have 1) Multicast for Idle/Inactive UE reception and 2) CHO for MBS. However, we also agree other companies that we would like to see the real market requirement firstly.

7 – Samsung R&D Institute UK

We think certain broad areas for enhancing broadcast and multicast services in Rel-18 may include:

- Extending multicast service coverage for dense deployments and mission critical services
- Energy efficient operation for MBS reception

8 – ZTE Corporation

1. Since Rel-17 is not finished yet, we still have around 3 quarters to go to make Rel-17 NR MBS a truly deployable 3GPP technique.

2. There are features that reflect the real requirement, but lack sufficient online discussion due to time limit in Rel-17: RRC_INACTIVE/IDLE support for MBS especially Multicast services, power saving mechanisms, and MR-DC. Those features together with some features proposed by operators, we suggest, can be the focus of Rel-18.

9 – Deutsche Telekom AG

Broadcast and multicast services in many variants has been discussed and standardized for any 3GPP RAT since 20y.

The claim was always “market needs”, but no large scale commercial implementation happened.

We think that the large area broadcast Use Case can be addressed with the “5G LTE-based broadcast” which is part of Rel-17; from our point of view no further enhancements are needed at this stage.

For the Evolution of NR Multicast Broadcast Services (MBS) a selected set of missing features can be considered based on clear guidance of operators, broadcasters or MPRs (5GAA, 5G-MAG, TCCA, et al.).

10 – CATT

Many companies contributed to the discussions in which were summarized in RWS-210655.

From CATT point of view, NR MBS evolution is an important part of R18 work. In Rel-17 we only specify basic functionalities. In order to ensure deployment and commercial success we think some key enhancements need to be included. Besides the RAN discussions, SA2 (see for example report of SA#146e) is also discussing their R18 study and work scope. A good level of business and technical interests have been observed there as well.

11 – Lenovo (Beijing) Ltd

Rel-17 MBS is focused on the basic functionality. To meet different requirements on reliability, data rate, latency for multiple MBS services, we think further enhancement is needed in Rel-18.

12 – AT&T

- The needs in the public safety and operator communities are current and real.
- Additional MBS standards development in areas including group calling, resulting in cell admission limitations, resulting in unavoidable congestion, should be further addressed in Rel-18.

13 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon The general main goal for Rel-18 is to enable better deployment of MBS, such as improvement of spectrum efficiency/capacity/reliability based on Rel-17 MBS standards and to enable better support of broadcast services required by operators such as FTA and broadcast in wider areas (not limited to a single gNB).

14 – FirstNet

Broadcasting and multicasting are the key communication mediums in emergencies dealing with large groups. Emergency broadcasting plays a critical role in the rapid dissemination of information to the public and is a key element in helping save lives in the aftermath of natural disasters. Emergency Broadcasting will provide broadcasters, first responders and the public important information on how to prepare for natural disasters and their aftermath.

FirstNet thinks the enhancements for broadcast and multicast services in Rel-18 should include:

- o Extending multicast service coverage for dense deployments and mission critical services
- o Energy efficient operation for MBS reception
- o Group calling addressing that results in in cell admission limitations and congestion

15 – CBN

Rel-17 specifies fundamental NR MBS functionality, and continuous improvements are demanded based on strong market requirements for NR MBS deployment.

16 – OPPO

We would also like to have further evolution/enhancement on MBS in following release. Based on the current design in Rel-17 NR MBS, some further improvement can be considered, e.g. higher reliability, lower latency, larger coverage, deployment for different connection states.

17 – Ericsson LM

We need to specify a scalable MBS, both in RAN and SA WGs, but many discussions in Rel-17, especially in RAN3, do not take it into account. Once specified in the first MBS release, it will be difficult (or even impossible if MBS of Rel-17 gets commercial traction) to be addressed and correct these issues in Rel-18. It would therefore be very important to have such functionality specified already in Rel-17, otherwise this will have to be specified in Rel-18 with more difficulty. Minimizing signaling on all the interfaces, especially avoiding UE individual signaling, where not absolutely necessary, is part of our concern on current concepts. When NR MBS needs to serve a large numbers of UEs, this will prove a serious bottleneck.

18 – Intel Corporation (UK) Ltd

Rel-17 is the first release to introduce multicast and broadcast service in NR. There is huge interest in NR MBS work (e.g. as from the number of submitted contributions), while several topics were down prioritized due to lack of time. It is expected that Rel-18 NR MBS work can continue several deprioritized but important topics as well as introduce further enhancements to improve performance and power efficiency.

In high level directions, we think that there are separate tracks for terrestrial broadcast (as in LTE based 5G terrestrial broadcast) and mixed mode (as in NR MBS). They are targeted for different deployment scenarios, and we should avoid introducing overlapping features for the two tracks in Rel-18.

19 – BBC

We are interested in the distribution of media (e.g. TV, radio, on-demand and personalised content) over mobile networks. In particular, we seek:

- Universal access to BBC services;
- Broadcast-equivalent QoE (i.e. high quality and reliability);
- Complete and supportive standards-based ecosystem; and
- Widespread and consistent feature support in handsets.

We think that NR MBS and its relevant enhancements can help to address these.

20 – 5G MAG

5G-MAG supports work in 3GPP on distribution of media content (e.g., TV, radio, on demand, personalized, immersive, etc) over mobile broadband, terrestrial broadcast and satellite networks. From this point of view, we welcome improvements on the technologies and features on the two tracks below.

1.2 Evolution of 5G LTE based broadcast

Moderator's note: The moderator asks companies to provide views on areas or features for 5G LTE based broadcast evolution, which should be considered for Rel-18. Please avoid in this round to re-state the same areas or features other companies have included already, prioritisation of proposed topics will be handled in the later rounds.

Feedback Form 2: Evolution of 5G LTE based broadcast

<p>1 – Nokia France</p> <p>We doubt whether any evolution of this is needed in Release 18. It could be reassessed in a future release when the market situation becomes clear. Rel-18 seems too early to consider extensions.</p>
<p>2 – VODAFONE Group Plc</p> <p>Agree with Nokia.</p>
<p>3 – MediaTek Inc.</p> <p>We agree with Nokia and doubt the need to have any evolution of 5G LTE based broadcast in Release 18.</p>
<p>4 – Futurewei Technologies</p> <p>Futurewei</p> <p>So far we don't see a strong motivation to further enhance the 5G LTE based broadcast in Rel-18.</p>
<p>5 – Qualcomm Incorporated</p> <p>We have two main areas of interest for LTE broadcast:</p> <ol style="list-style-type: none">1) Connection to 5GC: This was already discussed as part of the Rel-16 package. Note that this item requires the corresponding work to be done in SA.2) Enabling simultaneous NR unicast and LTE broadcast: This item was discussed as a TEI proposal in RAN2 (see R2-2004535). As documented in discussion report by RAN2 chair in R2-2006106, while there was a strong support for this enhancement, it was considered large for agreeing as a TEI. This enhancement is important to allow the UE to use its available hardware resources to support simultaneous unicast and broadcast reception. <p>Since the main work here is connection to 5GC, we would support to start a small RAN3-led item with RAN2 as a secondary working group.</p>
<p>6 – China Mobile Com. Corporation</p> <p>Agree with above companies, we don't see the motivation to have evolution of 5G LTE based broadcast in Release 18</p>
<p>7 – LG Uplus</p> <p>At least we do not have any plan to consider 5G LTE based broadcast in near Future.</p>
<p>8 – Apple Computer Trading Co. Ltd</p>

9 – Spreadtrum Communications

We don't see a strong motivation to have evolution of 5G LTE based broadcast in Release 18.

10 – NEC Corporation

We agree 5G LTE based broadcast is market motivated and should be assessed before it becomes clearer.

11 – Samsung R&D Institute UK

We also concur with other companies, there is no real motivation to have evolution of 5G LTE based broadcast in Rel-18. Further, we recognize there is significant complexity with FeMBMS /HPHT approach on UE implementation especially PHY. Connecting LTE broadcast to 5GC may also have large architectural impacts and beyond RAN scope (e.g. SA group)

12 – Telia Company AB

There needs to be a clear market demand for 5G LTE based broadcast that it would make sense to include it into Release 18.

13 – Deutsche Telekom AG

We do not see any demand considering any Rel-18 extension for 5G LTE based broadcast

14 – CATT

We agree with some companies above that there seems to be no strong market requirement for this enhancement.

15 – Lenovo (Beijing) Ltd

Agree with above companies that there is no need to have evolution of 5G LTE based broadcast in Release 18.

16 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon No evolution is expected from our side on LTE based broadcast. We have not observed real market request from operators to enhance this technology direction.

17 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon general we would need to see what are the common directions indicated by companies. More in details, from our point of view it makes sense to work in Rel-18 on these:

- Inter gNB/DU SFN

Deploying SFN only within intra-DU cells as supported by Rel-17 would limit the number of cells configured for SFN and thus imposes severe restrictions on the expected gain of SFN, To support wide area services deployments, it is needed to extend the SFN transmission to inter gNB/DU scenario. Considering that the aggregated architecture is the most important RAN deployment in real networks, the Rel-18 SFN evolution should consider both aggregated architecture and disaggregated architecture in the system design, therefore inter-gNB scenario should be taken into account.

- Enhancements for better support of FTA deployment.

Needed to better support FTA for the UE which supports both unicast and FTA service reception

- MBS resources optimization in RAN sharing deployment

Useful to save some radio resources in MOCN deployment. In RAN sharing deployment, if the same Multicast/Broadcast service is provided by two (or more) operators separately, this service would be recognized as separate TMGIs resulting in duplicated PTM radio resources consumption in the same cell for transmission of the same content. It is expected that reduction of at least 50% of radio resources consumption can be achieved if the RAN can schedule the same content using the same resources for UEs subscribed to different operators in MOCN scenario.

· Multicast reception in RRC_INACTIVE/IDLE state

To enable Multicast reception in high load/congestion scenario. We understand that from the standard point of view the support in RRC_IDLE requires more changes than the support in RRC_INACTIVE, and for this reason we could look at the support in RRC_IDLE as second priority.

· Potential enhancement to Multicast reliability

To enhance high reliability for the services that require this, for example some use cases for V2X. This enhancements to reliability can be considered in Rel-18 if the solutions specified in Rel-17 cannot meet all the reliability requirements.

18 – HUAWEI TECHNOLOGIES Co. Ltd.

{Huawei, HiSilicon} of course the above is a paste error, please ignore, it is referred to the section below in 1.3

19 – CBN

We do not see the market demand for 5G LTE based broadcast enhancement in Rel-18

20 – OPPO

We share the similar view with other companies that we do not observe much strong motivation in Rel-18 for the evolution of 5G LTE based broadcast.

21 – Ericsson LM

The UHF band definition for LTE broadcast is already an agreed WI. Otherwise, we do not see the need for further enhancements of LTE broadcast, neither for CN nor RAN; further work on broadcast-multicast should focus on NR only.

22 – Intel Corporation (UK) Ltd

We agree with other companies that there seems no strong market motivation for 5G LTE based broadcast enhancement in Rel-18.

23 – EBU

EBU supports the Qualcomm viewpoint and we believe that the amount of work in relation to this would be limited in RAN.

24 – 5G MAG

5G-MAG expressed the following priorities and topics of interest under the LTE-based 5G Terrestrial Broadcast track:

Priorities:

- Connection of EnTV RAN (FeMBMS) to 5G Core
- Optimization for simultaneous support of 5G Broadcast & NR Unicast

- Time Interleaving

Other topics of interest are (the order does not imply priority):

- Public Warning capability
- Efficiency enhancements, e.g., MIMO (existing antennas/RF stages in handsets), Overhead Reduction.

1.3 Evolution of NR Multicast Broadcast Services (MBS)

Moderator's note: The moderator asks companies to provide views on areas or features for NR Multicast Broadcast Services (MBS) evolution, which should be considered for Rel-18. Please avoid in this round to re-state the same areas or features other companies have included already, prioritisation of proposed topics will be handled in the later rounds.

Feedback Form 3: Evolution of NR Multicast Broadcast Services (MBS)

1 – Nokia France

For NR MBS, Rel-17 will already provide the most important functionality for broadcast/multicast services, e.g. for public safety. Across all the contributions in the workshop, a very diverse set of potential enhancements (>30) was suggested by different companies. If any enhancement work is to be done for broadcast/multicast in Rel-18, careful prioritisation and selection would be needed, to focus only on a small, genuinely useful set of enhancements.

Potential objectives (if any) could be:

- Multicast reception in RRC_Inactive
- Multicast reception in RRC_Idle
- Free-to-Air/Receive-only-Mode. (The impact of this in RAN is expected to be rather small, but it also needs the corresponding work to be agreed in SA.)

2 – VODAFONE Group Plc

We are not yet convinced of the need for any NR MBS work in Rel 18.

3 – MediaTek Inc.

Potential objectives for Rel-18 MBS can be:

- SFN support for inter-cell (e.g. inter-DU cases)
- Further reliability improvement for multicast (Rel-17 MBS continuation)
- study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)
- power saving aspects for UE reception of Broadcast/Multicast and/or Unicast

4 – Futurewei Technologies

Based on the outcome of Rel-18 workshop, we would like to prioritize the following possible Rel-18 MBS objectives for consideration:

- Standardization of SFN over multiple cells across gNB-DUs with no new SCS.
- Support/optimization of Free-to-Air/receive only mode for terrestrial broadcast.
- RLC based ARQ for PTM transmission.
- Reception of multicast services by inactive UEs.

5 – Qualcomm Incorporated

Considering a clear market demand, we support a WI for Rel-18 MBS focusing on small enhancements that were not completed or considered in Rel-17 due to lack of time, with the following main items included:

1) Power savings: [RAN2/RAN1]

- Specify support of multicast in RRC_INACTIVE
- Power saving techniques for multicast/broadcast monitoring, such as PEI and WUS for MBS, PDCCH monitoring control/SS set switching for MBS, etc.

2) Other leftovers from Rel-17 (to be evaluated closer to the end of the release), including enhancements to capacity and reliability (both in RAN1/RAN2). For instance, the following were considered in Rel-17 but down-prioritized, which should be completed in Rel-18:

- RV-level time-interleaving
- CSI feedback enhancement for multicast
- Optimizations for HARQ-ACK codebook with limited reception capabilities
- Support of L2-based retransmissions based on L2-feedback from the UE.

6 – China Mobile Com. Corporation

Release 17 NR MBS WI provides fundamental functions to support broadcast/multicast service in NR. However, due to limited TU in Release 17, there is uncertainty whether following techniques to enhance the spectrum efficiency and reliability for UEs in RRC_CONNECTED state can be specified, including: group scheduling mechanisms, e.g., beam management for multicast, especially for FR2, carrier aggregation, HARQ process management enhancement, reliability improvement schemes, e.g., CSI measurement/report enhancement, sub-slot based PUCCH for HARQ-ACK feedback, and ARQ in Layer 2 for PTM is also not supported.

For RRC_IDLE/INACTIVE UEs, multiple MCCHs for broadcast service are not supported in Release 17, and there is uncertainty whether multicast service can be supported in Release 17 as well.

In addition, some deployment scenarios are also not considered in Release 17 WI scope, e.g., standardised support of SFN over multiple cells, support of Free-to-Air/receive only mode, RAN sharing scenario.

Last but not least, some cross-field features also need to be considered for MBS, e.g., UE power saving.

Therefore, we think the following set of objectives can be specified in Rel-18 NR MBS:

1) Specify enhancement for broadcast/multicast service for UEs in RRC_CONNECTED state [RAN1, RAN2]:

- Specify group scheduling mechanism enhancement to further improve spectrum efficiency, e.g., beam management for multicast service, especially for FR2, carrier aggregation for multicast service, dynamic HARQ process management between broadcast/multicast service and unicast service [RAN1, RAN2];
- Specify reliability improvement enhancement, e.g., HARQ-ACK feedback enhancement, CSI measurement/report enhancement for multicast service, support of ARQ in Layer 2 for PTM [RAN1, RAN2];
- Other Rel-17 leftovers.

2) Specify enhancement for broadcast/multicast service for UEs in RRC_IDLE/INACTIVE states [RAN2, RAN1]:

- Support of multicast service for UEs in RRC_IDLE/INACTIVE states [RAN2, RAN1];
- Specify the multiple MCCHs for broadcast service per cell [RAN2]

3) Specify enhancement to expand deployment scenarios for broadcast/multicast service for UEs in RRC_IDLE/INACTIVE/CONNECTED states [RAN2, RAN1, RAN3]:

- Standardised support of SFN over multiple cells above gNB-DU level [RAN1, RAN2, RAN3];
- Support of Free-to-Air/receive only mode [RAN2];
- Support of RAN sharing scenario [RAN2].

4) Specify UE power saving and battery lifetime enhancement for UEs in RRC_IDLE/INACTIVE/CONNECTED states [RAN1, RAN2]:

- Specify power saving signal/channel in triggering UE adaptation to the DRX operation for broadcast/multicast service [RAN1, RAN2].

7 – LG Uplus

Based on the moderator's guidance, I do not want to re-state the same areas/features already covered from other companies. They are mentioned above.

8 – Apple Computer Trading Co. Ltd

9 – Spreadtrum Communications

The set of R18 MBS objectives can include:

- Support of ROM (receive only mode) for Objective B.
- Support of Inter DU SFN.
- Specify SN supported MBS in MR DC.
- Study the support for Multicast service reception in RRC_IDLE/INACTIVE mode.
- Study UE power saving for MBS reception in RRC_IDLE/INACTIVE/CONNECTED mode.

10 – NEC Corporation

We agree with the objectives put forward from MediaTek and Nokia, plus the following ones:

- Dual connectivity for MBS
 - o Inter-node RLC layer reliability enhancement.
 - o Inter-node MCCH/MTCH scheduling
- Inter-leg reliability enhancement
 - o PTM leg provides RLC UM mode DL transmission only, PTP leg re-transmit the un-received RLC PDU of PTM leg.
- Spectral efficiency and latency enhancement to support services with extreme requirements
- Dynamic group UEs according to some conditions.
- HARQ-ACK codebook enhancements
 - o Dynamic group UEs according to some conditions.
 - o HARQ-ACK codebook enhancements

11 – Samsung R&D Institute UK

We think Rel-18 can focus on enhancing and improvising upon Rel-17 MBS functionalities and capabilities, and potential objectives can include

1) Specify Multicast in RRC_IDLE / RRC_INACTIVE states

Multicast reception can be extended to RRC_IDLE and RRC_INACTIVE in order to enhance service coverage and power saving. Local dense deployment scenarios (e.g. PALS defined in SA1, like stadium, concert etc.) and public safety / mission critical can be potential use cases.

2) Specify energy efficient operation for MBS reception

Extension of wake-up signal (WUS) for MBS e.g. multicast reception in Connected mode including both PTM and PTP. Prolonged battery life for extensive use of MBS for video and data intensive applications is significant.

12 – ZTE Corporation

Potential Rel-18 feature list for NR MBS:

- MR-DC and multiple cell reception support (for better deployment flexibility of MBS services)
- RRC_IDLE/INACTIVE enhancement (e.g. better scalability, better spectrum efficiency, CFR configuration enhancements)
- MBSFN based transmission (with minimized network arch/interface impacts)
- Power saving enhancement (for both delivery mode 1 & 2)
- Advanced mobility support for MBS (CHO & DAPS) to better minimization of data loss
- FTA/ROM
- Rel-17 leftover features (e.g., HARQ process management, beam management, and other recognized features till the end of Rel-17)

13 – Deutsche Telekom AG

We support the use cases and demands coming from 5GAA [RWS-210360] for the MBS automotive use cases.

The set of objectives shall be very precise and comprehensive – only Rel-17 leftovers and really urgent additional features, which should be well justified.

14 – CATT

In our view the following potential objectives should be on the top of the list, and other aspects can be further discussed if time allows.

- a) Support for Multicast reception in RRC IDLE/INACTIVE state
- b) Necessary enhancements to support broadcast reception for FTA/ROM
- c) Enhanced support for SFN
- d) Improved reliability of PTM (i.e., mainly higher layer aspects based on R17 progress)
- e) Efficiency improvement for MBS in RAN sharing scenarios

In detail, among these, a) and b) are well understood requirements from service point of view, and they have been discussed in R17 but not completed due to time limitation. So it is clear that these are of high priorities. Then for c) our understanding is Rel-17 MBS only supports transparent SFN in given scenarios, e.g. intra-DU, and reuse legacy numerologies, but such SFN will be limited in cell size and/or inter-site distance. Therefore, to further improve performance and spectrum efficiency at cell edge, e.g. for public safety/TV services, it is necessary to study supporting SFN in a larger area in Rel-18. d) is leftover from R17, for which the benefits/motivations have been discussed extensively. For e) we observe interests from operators, so we can support it as part of R18.

15 – AT&T

AT&T Input:

- For the operator/public safety community, where group call is one of the main application, **it is essential that *RRCinactive and RRCidle over 5GMBS continue to be developed***. In certain cases, the maximum number of UEs in RRC_Connected state participating in a group call and admitted to a cell is limited to values below the actual need, and this situation can be solved by operating additional UEs in inactive or idle mode, as a way to mitigate congestion.

- Further development during Rel-18 of the *RRCinactive and RRCidle* will assist in easing this congestion issue.

- Other 5G MBS issues of importance to public safety which should be addressed in Rel-18 include:

- Relatively small Single Frequency Networks (**SFN**) with “follow-me” capabilities (e.g. extendable area), that can span the borders of the localized and limited SFN areas already possible in Rel-17.

- Increased flexibility and dynamicity of the management of RF resources, that would **enable rapid call setup, reconnection and reuse of RF resources** for PTT and video calls, to enable meeting KPIs requirements and first responders’ service expectations.

- Efficient and simultaneous delivery of **multiple services** (e.g. PTT and video) to the same UEs with proper QoS.

16 – Lenovo (Beijing) Ltd

Below areas are prioritized from our side: (1) Reliability improvement via HARQ; (2) UE power saving ; 3) Multicast reception in RRC_Inactive; 4)SFN support for inter-DUs; 5)Support of Free-to-Air/receive only mode.

17 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon general we would need to see what are the common directions indicated by companies. More in details, from our point of view it makes sense to work in Rel-18 on these:

- Inter gNB/DU SFN

Deploying SFN only within intra-DU cells as supported by Rel-17 would limit the number of cells configured for SFN and thus imposes severe restrictions on the expected gain of SFN, To support wide area services deployments, it is needed to extend the SFN transmission to inter gNB/DU scenario. Considering that the aggregated architecture is the most important RAN deployment in real networks, the Rel-18 SFN evolution should consider both aggregated architecture and disaggregated architecture in the system design, therefore inter-gNB scenario should be taken into account.

- Enhancements for better support of FTA deployment.

Needed to better support FTA for the UE which supports both unicast and FTA service reception

- MBS resources optimization in RAN sharing deployment

Useful to save some radio resources in MOCN deployment. In RAN sharing deployment, if the same Multicast/Broadcast service is provided by two (or more) operators separately, this service would be recognized as separate TMGIs resulting in duplicated PTM radio resources consumption in the same cell for transmission of the same content. It is expected that reduction of at least 50% of radio resources consumption can be achieved if the RAN can schedule the same content using the same resources for UEs subscribed to different operators in MOCN scenario.

- Multicast reception in RRC_INACTIVE/IDLE state

To enable Multicast reception in high load/congestion scenario. We understand that from the standard point of view the support in RRCIDLE *requires more changes than the support in RRCINACTIVE*, and for this reason we could look at the support in RRC_IDLE as second priority.

- Potential enhancement to Multicast reliability

To enhance high reliability for the services that require this, for example some use cases for V2X. This enhancements to reliability can be considered in Rel-18 if the solutions specified in Rel-17 cannot meet all the reliability requirements.

18 – CBN

We think the following work should be carried out for NR MBS enhancement in Rel-18

- Further enhancement to the support of FTA
- Support of multicast in RRC_INACTIVE/IDLE state
- Extended the SFN transmission to inter gNB/DU scenario to support wide area services deployments
- Improved MBS transmission efficiency in RAN sharing scenario

19 – OPPO

Based on our view, the following contents can be considered/supported for further enhancement in Rel-18 MBS:

- SFN for inter-gNB/DU scenario
- Free-to-Air (FTA) with specifying MBS receive-only mode.
- Multicast reception for RRC_INACTIVE state UEs
- MBS-specific BWP
- Multiple MCCHs for different MBS QoS services.
- Configured grant group-common PDSCH transmissions/repetitions
- Enhancement of simultaneous reception of unicast/multicast

20 – BBC

From our perspective, we believe relevant enhancements to be:

- Specify MBS Receive-only Mode to support free-to-air broadcast service
- Study Broadcast/Multicast and Unicast Superposition Transmission (BMUST)
- Specify MBS Physical Layer Time Interleaving
- Complete potential leftovers from MBS work under Rel-17

In all cases, any new techniques should prioritise transparency to UE hardware.

21 – Intel Corporation (UK) Ltd

We propose to include the following enhancements in Rel-18 work:

- **Support of multicast in RRC INACTIVE:** the topic was actually supported by many companies during RAN2 Rel-17 discussion and was deprioritized due to lack of time. This topic gains very wide support for Rel-18. One discussion point for Rel-18 is whether to support multicast in RRC IDLE as well, which needs the input from SA2.
- **Reliability and radio efficiency enhancements in L2 and physical layer.**
- **Power saving enhancements:** the exact scope might depend on outcome of Rel-17 discussion.

22 – Ericsson LM

We see mainly the following areas of evolution:

- Enhanced SFN support via Extended CP (ECP) for SCS 15 kHz
- Multicast reception in RRC Inactive/Idle for enhanced support of use cases with scalability issues (if not already achieved in Rel-17, which would be preferable)
- Maximum commonality between NR multicast and NR broadcast for RRC Idle UEs, ideally with no difference (if not already achieved in Rel-17, which would be preferable)
- Support for NR broadcast/SDL band(s) within 470-694/698 MHz UHF
- Support for NR within 450-470 MHz (currently defined for LTE)

23 – EBU

EBU welcomes work on relevant enhancements to MBS such as the support for universal access (e.g. free-to-air broadcast services), improvements in spectral efficiency and robustness, etc. EBU would like to emphasise that the adoption of new techniques should prioritise transparency to UE hardware.

24 – 5G MAG

5G-MAG expressed the following priorities and topics of interest under the MBS track:

Priorities:

- Receive only mode/Free to air for MBS
- Multicast reception in RRC_INACTIVE state
- Potential leftovers from MBS Rel 17

Other topics of interest are (the order does not imply priority):

- Considerations on UE handset backwards compatibility are essential
- MBS SFN support for inter gNB /DU scenarios
- MBS resource optimization for RAN sharing deployment
- MBS Physical Layer Time Interleaving
- Broadcast/Multicast and Unicast Superposition Transmission (BMUST)

1.4 Other comments for this topic [which do not fit into the two area bullets 2) & 3)]

Moderator's note: The moderator asks companies to provide comments which do not fit in the previous 2 sections. Please avoid repetition of comments already provided by others or yourself in the forms above ! Obviously these comments should support creating a reasonable, agreeable set of objectives for creation of Rel-18 WID.

Feedback Form 4: Other comments for this topic

1.5 Moderator summary and recommendation from Initial Round

26 companies participated in the discussion consisting of mobile operators (AT&T, China Mobile, Deutsche Telekom, LGU+, Telia, Vodafone), public safety operators (FirstNet), Broadcasters (BBC, CBN, EBU) and network and UE vendors (Apple, CATT, Ericsson, Futurewei, Huawei/HiSilicon, INTEL, Lenovo, MediaTek, NEC, Nokia, OPPO, Qualcomm, Samsung, Spreadtrum, vivo, ZTE)

The topic was organized in 4 discussion areas:

1.1 General high-level views

In the general section participants provided the view that more significant market traction on 3GPP broadcast/multicast needs to be seen (Vodafone, Apple) and on NR MBS it was commented that the basic functionalities are defined in Rel-17 and a further evolution to high data rate and low latency use cases might be considered. Other companies provided the view that 5G LTE-based broadcast does not need Rel-18 evolution and NR MBS should be selectively enhanced based on clear guidance of operators, broadcasters or MPRs (5GAA, 5G-MAG, TCCA, et al.).

1.2 Evolution of 5G LTE based broadcast

No further evolution: Nokia, Vodafone, MediaTek, Futurewei, China Mobile, LGU+ ?, Apple, Spreadtrum, Samsung, Deutsche Telekom, CATT, Lenovo, Huawei/HiSilicon, CBN, OPPO, Ericsson, Intel

Further market assessment: NEC, Telia

Evolution proposals (Qualcomm, EBU):

- Connection to 5GC
- Enabling simultaneous NR unicast and LTE broadcast

Proposed conclusion: Given the demand to evolve 5G LTE based broadcast is limited to 2 companies while 17 companies (+ 2 pointing to further market assessment/development) do not think that there is a need to evolve 5G LTE based broadcast it is proposed by the moderator to concentrate this tread on NR MBS evolution and assume 5G LTE based broadcast will not be enhanced as part of the Rel-18 package.

1.3 Evolution of NR Multicast Broadcast Services (MBS)

No further evolution: Vodafone

Restricted further evolution with clear market requirement as provided by 5GAA: Deutsche Telekom

Potential evolution features proposed – no order, but those mentioned multiple times (partly different wording in bold), 2nd indention topics grouped to main topic, but finetuning needed once higher-level features agreed to be supported:

- **Multicast for Idle/Inactive UE** reception; deployment for different connection states
- **HO for MBS; Advanced mobility support for MBS** (CHO & DAPS) to better minimization of data loss
- **SFN support** for inter-cell (e.g. inter-DU cases); Standardization of SFN over multiple cells across gNB-DUs with no new SCS; standardised support of SFN over multiple cells; enable better support of broadcast services required by operators such as FTA and broadcast in wider areas (not limited to a single gNB); Support of Inter DU SFN; MBSFN based transmission (with minimized network arch/interface impacts); Relatively small Single Frequency Networks (SFN) with “follow-me” capabilities
 - Enhanced SFN support via Extended CP (ECP) for SCS 15 kHz
- Extending multicast service coverage for dense deployments and mission critical services
- **Energy efficient operation for MBS reception; power saving mechanisms**; Energy efficient operation for MBS reception
 - Power saving techniques for multicast/broadcast monitoring, such as PEI and WUS for MBS, PDCCH monitoring control/SS set switching for MBS, etc.
 - Specify power saving signal/channel in triggering UE adaptation to the DRX operation for broadcast/multicast service

- Efficient and simultaneous delivery of multiple services (e.g. PTT and video) to the same UEs with proper QoS.
- MR-DC; carrier aggregation
 - Specify SN supported MBS in MR DC
 - Inter-node RLC layer reliability enhancement
 - Inter-node MCCH/MTCH scheduling
 - Inter-leg reliability enhancement
- Minimizing signaling on all the interfaces, especially avoiding UE individual signaling;
- **Higher reliability, lower latency, larger coverage; improvement of spectrum efficiency/capacity/reliability** (based on Rel-17 MBS standards)
 - RLC based ARQ for PTM transmission
 - RV-level time-interleaving
 - CSI feedback enhancement for multicast
 - Optimizations for HARQ-ACK codebook with limited reception capabilities
 - Support of L2-based retransmissions based on L2-feedback from the UE
 - group scheduling mechanisms
 - beam management for multicast especially for FR2
 - HARQ process management enhancement; HARQ-ACK codebook enhancements
 - Reliability improvement schemes, e.g.,
 - CSI measurement/report enhancement,
 - sub-slot based PUCCH for HARQ-ACK feedback, and
 - ARQ in Layer 2 for PTM
 - Dynamic group UEs according to some conditions
 - Specify MBS Physical Layer Time Interleaving
- specify a scalable MBS
- MBS-specific BWP
- RAN sharing scenarios; Efficiency improvement for MBS in RAN sharing scenarios
- **Free-to-Air/receive only mode** (for terrestrial broadcast); support of Free-to-Air/receive only mode
- **(public safety focused:) enhancements** including group calling, resulting in cell admission limitations, resulting in unavoidable congestion; Extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, to enable meeting KPIs requirements and first responders' service expectations
- Multiple MCCHs for different MBS QoS services;
- Enhancement of simultaneous reception of unicast/multicast
- Separate tracks for terrestrial broadcast (as in LTE based 5G terrestrial broadcast) and mixed mode (as in NR MBS)
- Definition of MBS frequency band support:

- Support for NR broadcast/SDL band(s) within 470-694/698 MHz UHF
- Support for NR within 450-470 MHz (currently defined for LTE)

undefined **Multicast for Idle/Inactive UE** reception; deployment for different connection states

- **HO for MBS; Advanced mobility support for MBS** (CHO & DAPS) to better minimization of data loss
- **SFN support** for inter-cell (e.g. inter-DU cases); Standardization of SFN over multiple cells across gNB-DUs with no new SCS; standardised support of SFN over multiple cells; enable better support of broadcast services required by operators such as FTA and broadcast in wider areas (not limited to a single gNB); Support of Inter DU SFN; MBSFN based transmission (with minimized network arch/interface impacts); Relatively small Single Frequency Networks (SFN) with “follow-me” capabilities
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 - Support for NR broadcast/SDL band(s) within 470-694/698 MHz UHF
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- **Multicast for Idle/Inactive UE** reception; deployment for different connection states
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 - Specify power saving signal/channel in triggering UE adaptation to the DRX operation for broadcast/multicast service
 - Efficient and simultaneous delivery of multiple services (e.g. PTT and video) to the same UEs with proper QoS.

- MR-DC; carrier aggregation
 - Specify SN supported MBS in MR DC
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 - Inter-leg reliability enhancement
- Minimizing signaling on all the interfaces, especially avoiding UE individual signaling;
- **Higher reliability, lower latency, larger coverage; improvement of spectrum efficiency/capacity/reliability** (based on Rel-17 MBS standards)
 - RLC based ARQ for PTM transmission
 - RV-level time-interleaving
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 - Support of L2-based retransmissions based on L2-feedback from the UE
 - group scheduling mechanisms
 - beam management for multicast especially for FR2
 - HARQ process management enhancement; HARQ-ACK codebook enhancements
 - Reliability improvement schemes, e.g.,
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- Definition of MBS frequency band support:
 - Support for NR broadcast/SDL band(s) within 470-694/698 MHz UHF
 - Support for NR within 450-470 MHz (currently defined for LTE)

A bit more high-level feedback was provided by BBC – partly covered in the above proposals:

- distribution of media
 - Universal access to BBC services;
 - Broadcast-equivalent QoE (i.e. high quality and reliability);
 - Complete and supportive standards-based ecosystem; and
 - Widespread and consistent feature support in handsets.

A study was proposed by two companies (MediaTek and BBC):

- study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)

General advice on coordination and HW aspects provided:

- Coordination with SA groups suggested for NR MBS evolution (multiple companies) and
- adoption of new techniques should priorities transparency to UE hardware (EBU).

Proposed conclusion: Based on the inputs provided the grouping of individual companies' comments to the above list should be the basis for the discussion in the Intermediate Round. It is proposed to focus the discussion on an agreeable set of potential objectives for a potential NR MBS Rel-18 Work Item. As per guidance of the chair the group should come up with a high-level description which can fit on a single slide.

It is proposed to agree the following focus evolution objectives:

- **Support of MBS in IDLE and INACTIVE state**
- **Advanced mobility support for MBS reception, incl. SFN support**
- **Improve Energy efficient operation/power saving mechanisms for MBS reception**
- **Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS**
- **Support of Free-to-Air/receive only mode**
- **Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)**

1.4 Other comments for this topic

No input to this point.

2 Intermediate Round

The initiation of the Intermediate Round will provide a list of proposed "objectives" for eventual guidance to a WI. As per Chair guidance at this time the outcome of the discussion should be a list which might fit on a single powerpoint slide.

2.1 Evolution of 5G LTE based broadcast

~~Based on the Initial Round discussion, there will not be any work on Evolution of 5G LTE based broadcast in Rel-18~~

Feedback Form 5: No work on Evolution of 5G LTE based broadcast

1 – Verizon UK Ltd

We were deprived of the chance to speak up in the first round by NWM and our time zone - but we agree with this moderator proposal.

2 – MediaTek Inc.

We agree with the proposal as suggested by moderator

3 – Qualcomm Incorporated

We are a bit confused by the moderator's summary. Per Chairman's guidance, the objective of this discussion is "to potentially further refine the areas for each of the topics using the set of topics endorsed in RWS-210659, with NO intention to update the set and the organization of the topics as endorsed in RWS-210659" (from tdoc 1639). In this sense, we think that the input from the 1st round already describes a very small set of enhancements that should be the focus, the main one being the connection to 5G core. We would also like to note that 5G-MAG represents many companies in the broadcast arena, which should make it clear that this enhancement is important for those companies.

4 – Deutsche Telekom AG

(as Moderator) Thanks Qualcomm of bringing this up ! I must admit that for whatever reason, the 5G-MAG input (which was posted at (12:58 UTC) 2 minutes before the extended deadline (13:00 UTC) was not contained in the version I used to create the summary ! Apologies for this !!!

I now have rewritten the summary of the Initial Round and propose an update for the Intermediate Round as follows:

Objectives for a WI would be:

- Connection to 5GC
- Enabling simultaneous NR unicast and LTE broadcast
- Time Interleaving

And with lower priority:

- Public Warning capability
- Efficiency enhancements, e.g., MIMO (existing antennas/RF stages in handsets), Overhead Reduction.

I will close now this form and create a new one for the remaining discussion time,

UPDATED after realising there were relevant inputs 1 minute before the deadline which did not show up while I created the Initial report - sorry for this inconvenience !!!

Based on the Initial Round discussion, there is some support for creation of a WI with the following pot. Objectives:

Objectives for a WI would be:

- Connection to 5GC
- Enabling simultaneous NR unicast and LTE broadcast
- Time Interleaving

And with lower priority:

- Public Warning capability
- Efficiency enhancements, e.g., MIMO (existing antennas/RF stages in handsets), Overhead Reduction.

Please provide your views if this is a list of agreeable objectives for a pot. WI

Feedback Form 6: Pot. objectives of a "Evolution of 5G LTE based broadcast" WI

1 – Deutsche Telekom AG

< (as moderator) ... please continue here with the discussion >

2 – Samsung R&D Institute UK

We have same opinion that there is no real motivation for evolution of 5G LTE based broadcast in Rel-18. There is significant complexity with FeMBMS /HPHT approach on UE implementation especially PHY. Connecting LTE broadcast to 5GC may also have large architectural impacts and beyond RAN scope (e.g. SA group). We prefer not to define any objective for Evolution of 5G LTE based broadcast in Rel-18.

3 – EBU

We are supportive for very focused improvements to LTE-based 5G Terrestrial Broadcast in aspects which may consume small amount of time resources in Rel-18. In line with the priorities expressed in the 5G-MAG input and the contribution from Qualcomm we suggest prioritizing the simultaneous reception of NR unicast and LTE-based 5G Terrestrial Broadcast (previously discussed as a TEI), the introduction of HARQ-based time interleaving (also previously discussed as a TEI) and the connection of EnTV to 5GC (as a small WI under RAN3).

The motivation for such enhancements is based on the findings from previous work conducted in 3GPP (in particular Rel-16) with regards to improved robustness and diversity gains (TI), the use of UE hardware resources for the simultaneous reception of unicast and broadcast as well as the interoperability of EnTV with 5GC.

4 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon Similarly to Samsung and to many other companies opinion in the first round, we do not see the point of an evolution in this area. We have to look at where is the mobile operators request and what is the opinion of the traditional manufacturer of the telecommunication industry (chipset, devices, network).

5 – Intel Corporation (UK) Ltd

Regarding “connecting LTE terrestrial broadcast to 5GC”, given that RAN and SA architectures are tightly coupled for both LTE MBSFN and NR MBS, it might be better to wait for SA conclusion (e.g. regarding architecture aspects) before starting work in RAN WGs.

6 – Ericsson LM

We do not see the commercial use case for widespread LTE broadcast deployment.

Adding time interleaving in Rel-18 may enhance technical performance for the mobile use cases where LTE broadcast might be used. This would however render Rel-16 LTE broadcast obsolete, since Rel-16 UEs could then either not receive Rel-18 LTE broadcast (with time interleaving) at all, or would only do so with degraded performance compared to Rel-16. Our preference is therefore not to perform any further standardization activity with respect to LTE broadcast, but if this is anyway done, it needs to be limited to enhancements that can be achieved in a backwards-compatible way.

7 – Nokia France

As already indicated in the first round, we do not see that further evolution in this area is justified at the current time. This was also the overwhelming view of companies in the initial round. We suggest to focus on stronger market needs.

8 – CBN

We can see that most companies hold the same view from the first round. We think that 5G LTE based broadcast does not need evolution.

2.2 Objectives for Evolution of NR Multicast Broadcast Services (MBS)

It is proposed to agree the following focus evolution objectives:

- Support of MBS in IDLE and INACTIVE state
- Advanced mobility support for MBS reception, incl. SFN support
- Improve Energy efficient operation/power saving mechanisms for MBS reception
- Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS
- Support of Free-to-Air/receive only mode
- Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)

Moderator's note: Please provide views if this is an acceptable list of high-level objectives - please keep in mind that we are not yet developing a WID ! If you do not agree, please provide a reasonable argumentation, why this list should be extended by an additional topic submitted to the initial round (i.e. the list in the moderators report of the initial round which are NOT in bold in that list. Remember that this list has been created based on the indicative level of support. Please avoid discussing at this stage lower-level details for each of the objectives (those with further indentation in the list in the moderator summary). Please also avoid stating "my proposal has not been considered" -> instead provide additional convincing argumentation why this is an objective which urgently needs to be addressed. If we scope that list out, we might even have already reached any available TU capacity to realistically fit this work into Rel-18 ...

Feedback Form 7: Comments on the list of proposed potential objectives

1 – Futurewei Technologies

We are in general fine with the objectives proposed by the rapporteur, but not sure about mobility part of the second objective. We don't see the need of DAPS enhancement for MBS in advanced mobility support. CHO with MBS was proposed in Rel-17 and it may or may not be a R17 left-over. We support FSN as an objective.

Based on current Rel-17 MBS status and the uncertainty about left-overs. Consider to have a separate objective placeholder for Rel-17 left-overs.

2 – Verizon UK Ltd

Verizon order of priority:

- **4-** Support of MBS in IDLE and INACTIVE state
- **2-** Advanced mobility support for MBS reception, incl. SFN support
- **3-** Improve Energy efficient operation/power saving mechanisms for MBS reception
- **1-** Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS
- **6-** Support of Free-to-Air/receive only mode
- **5-** Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)

3 – MediaTek Inc.

(1) We suggest to decouple the SFN support from Advanced mobility support for MBS reception and list SFN support as an independent item. "Advanced mobility support for MBS reception" actually applies to non-SFN cases also. E.g. CHO can be considered in general scenario.

(2) The last objective "Public safety focused enhancements" has a too broad area with "including ...", we may need to indicate our focus for Rel-18

(3) We can also list the "study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)" within the objectives, as suggested by multiple companies

4 – TELECOM ITALIA S.p.A.

The list looks too large to fit in a reasonable Work Item in Rel 18. Considering the small uptake of MBS features, we strongly suggest to reduce it by using MRP inputs as a priority.

5 – OPPO

We are generally OK with the objectives proposed by moderator, but the description of the proposed objectives above may potentially include many technical features/aspects under each bullet/objective. Maybe some further details for each objective can help to make it clear. Besides, the following two aspects can be clarified:

- First bullet: Rel-17 MBS already supported MBS for RRCIDLE/RRCINACTIVE state UEs. The intention of this bullet maybe “Support of multicast reception in IDLE and INACTIVE state” or “Further enhancement of MBS in IDLE and INACTIVE state”.
- Second bullet: We also support the standardization of SFN over multiple cells above gNB-DU level, but we are not sure that supporting SFN should be considered under advanced mobility.

6 – Qualcomm Incorporated

As indicated in our input for the 1st round, our view for Rel-18 MBS WI is it should focus on small enhancements instead of a very big project. Therefore, we will provide our comments referring to each of the “focus evolution objectives” by the moderator below.

Regarding the first item (Support of MBS in IDLE and INACTIVE state), we think this should be specific to multicast in INACTIVE: “– Support of multicast in RRC-INACTIVE state”. Note that MBS includes both multicast and broadcast. As discussed during the Rel-18 WS also, broadcast is already supported in RRC-IDLE and RRC-INACTIVE in Rel-17, so no need to repeat “broadcast” here again. Further, it is still unclear to us why multicast should be supported in RRC-IDLE (given that broadcast in RRC-IDLE is already supported in Rel17 and multicast is more intended for reliable services and only for UEs which have joined a multicast session). According to SA2 system design, RRC-IDLE UEs are in NAS-CM-IDLE, which cannot support multicast (only supported in NAS CM-CONNECTED). The amount of additional work in SA2 and RAN groups to support multicast in RRC-IDLE is too much with no clear use case/benefit.

Regarding the second item, it should be clarified that SFN support would be using existing numerologies, i.e. “– Advanced mobility support for MBS reception, incl. SFN support using existing numerologies”. We don’t see the necessity of introducing ECP for small area SFN scenarios (which seems to be most common interest among other companies), and we do have concern on its negative impact on the device and specification complexity.

Regarding Public safety focused enhancements, although we agree that the listed use cases are important, it would be necessary to scope out the necessary changes to support those use cases.

We are fine with other focus area objectives listed by the moderator, specifically we support:

- Improve Energy efficient operation/power saving mechanisms for MBS reception
- Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

We also agree that, at this stage, it may be unclear what are “Rel-17 leftovers”, we may need to reconsider in Q4.

7 – Apple Computer Trading Co. Ltd

Item-1> Support of MBS multicast in IDLE and INACTIVE state

[Apple comment] “MBS” should be ”multicast”, since we have support the broadcast in IDLE/INACTIVE state in R17, and in R18 we should focus on multicast.

Item-2> Advanced mobility support for MBS reception, ~~incl.~~ and SFN support.

[Apple comment] If the advanced mobility includes the MBS reception during CHO and DAPS HO, it should be decoupled from the SFN support. For the MBS reception during CHO and DAPS HO, it should be the R17 leftover issues and discussed together with other leftover issues in Item-4 for the next step down scoping.

Item-4> Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

[Apple comment] We have several questions for clarification as follow, and would like to make this item description clear accordingly.

Q1) Does this item cover all the R17 leftover issues for further down scoping?

Q2) Is all the enhancements only for CONNECTED state?

Q3) For the large coverage part, what’s the difference between the large coverage and the SFN in item-2?

8 – vivo Mobile Communication Co.

1 We agree with multicast in idle and inactive state and some mobility enhancement with CHO.

2 about SFN, something is the network implementation, it is transparent to the UE. what else can we do, e.g., counting?

3 about “Improve Energy efficient operation/power saving mechanisms for MBS reception”

In R17, DRX mechanism for broadcast and multicast have been introduced. We are wondering what the scope of this objective, is it for MBS WUS or anything else?

4 about “Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS”

In R17, we introduce two legs architecture for multicast of RRC_CONNECTED UE, e.g. PTP leg and PTM leg, where PDCP duplication and RLC AM PTP are feasible. We are wondering whether there is further requirement and mechanism for higher reliability and lower latency from the higher layer perspective. From our point of view, L2 feedback enhancement, e.g. RLC AM for PTM and enhanced PDCP feedback mechanisms, will have high complexity in specification and implementation point of view and no obvious benefit is proven.

5 about “Support of Free-to-Air/receive only mode”

It can be transparent from UE in RAN, because we have support broadcast in RAN. Or clarification is needed about the enhancement part in RAN.

6 about “Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)”

We are wondering what is the difference between the above coverage improvements. Furthermore, it is not clear what is public safety enhancements, e.g. group calling addressing that results in cell admission

limitations and congestion, enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls since there is no discussion paper for that requirements and technical descriptions.

9 – China Mobile Com. Corporation

We are generally fine the list objectives, but have some comments as the following:

- Support of MBS in IDLE and INACTIVE state

As some companies commented above, we think it should be “multicast” not “MBS”. Regarding whether multicast can be supported in RRC_IDLE state, the agreement of support of multicast in CM-CONNECTED by SA2 is only about Rel-17.

From our perspective, there is no conflict issue with SA2 because we are discussing Rel-18 not Rel-17, whether to support both IDLE and INACTIVE or INACTIVE-only can be discussed in Rel-18 both in SA and RAN, and it is not needed to jump into a conclusion now.

- Advanced mobility support for MBS reception, incl. SFN support

We also think the SFN should be decoupled from mobility enhancement. The motivation of SFN is providing coverage enhancement for large-scale activity broadcast service in huge venue, e.g., sports competition in a stadium, international exhibition. But the target of mobility enhancement such as CHO is providing losses handover of multicast service.

In addition, regarding the numerology issue of SFN, our interested SFN scenario is small area multi cells SFN to serve some large-scale activity broadcast service but not HPHT scenario, and these normal cells are also used for unicast service, therefore, we prefer not introducing new numerology/CP to avoid coexistence issue.

- Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/-capacity/reliability for NR MBS

We also think support of multiple MCCBs for broadcast service per cell should also be included which can give network more flexibility in broadcast service configuration and scheduling.

- Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)

We are fine to study some public safety enhancements, but the current definition seems not objectives but some use cases or motivations which should be clarified.

Regarding “extending multicast service coverage for dense deployments and mission critical services”, we already have the similar scope of “Enable Higher reliability, lower latency, larger coverage”, it is not necessary to duplicate it in public safety since the coverage enhancement is a general technology approach which can be used for all MBS services, of course public safety has been included.

Regarding “Group calling addressing that results in in cell admission limitations and congestion” does it mean the introduction of UAC of MBS service to differentiate from unicast-only UEs?

Regarding “enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls,” we are not clear about what RAN needs to do, a detailed clarification are appreciated.

10 – Lenovo (Beijing) Ltd

We are generally fine with these objectives.

11 – Samsung R&D Institute UK

(To moderator: For clarity, please replace ”MBS” by ”Multicast” in first objective as - Support of Multicast in IDLE and INACTIVE state)

We support following objectives for Rel-18 MBS enhancements:

– Support of Multicast in IDLE and INACTIVE state

We consider multicast can be supported for both IDLE and INACTIVE in Rel18. There are significant scalability benefits and we need not limit to any specific state.

– Improve Energy efficient operation/power saving mechanisms for MBS reception

We consider prolonged UE battery life is an important objective for operating MBS services.

Further, we have following opinion on other objectives:

- Public safety focused enhancements (including...)

- We consider that Public safety focused enhancements e.g. extending multicast service coverage for dense deployments and mission critical services can be natural outcome or use case of the objective ”Support of Multicast in IDLE and INACTIVE state”.
- We need more clarity on other enhancements listed under ”Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls,”. These seem pertain to MBS specific UAC, which may or may not be addressed in Rel-17.

– Advanced mobility support for MBS reception, incl. SFN support

- In our opinion, advanced mobility support for MBS reception should only include CHO. DAPS for MBS may bring undesired UE implementation complexity to support up to 4 reception paths.
- To support SFN, the resources should be coordinated between base stations and synchronization is needed. This may have architecture impact. If lossless can be supported in Rel-17, we are not sure what’s the benefits to have SFN.

– Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

- For L2 based ARQ for PTM, we did not agree in Rel17 with already PTP path providing enhanced reliability. We do not see any change of requirements for Rel-18 MBS
- For L1 related enhancements, we would like to hear the detailed motivations and technical advantages for RV-level time interleaving and CSI feedback. We think, in some issues, the features developed for unicast can be just reused for MBS like, HARQ-ACK codebook, HARQ process management, reliability enhancement, sub-slot based PUCCH. Overall, we need to discuss further with motivations and candidate solutions from the proponents, not just with the list of topics.

12 – CATT

Our comments to the listed bullets are as the following.

- On the 1st bullet: we agree with some previous comments that the wording 'MBS' should better change to multicast. And we currently do not see why idle state should be excluded.
- On the 2nd bullet: we agree with some previous comments that SFN can be discussed separately than mobility part. Then, as stated in 1st round we are positive about SFN in Rel-18, for the sake of cell edge performance improvements, and detailed requirements/work can be further discussed. For mobility enhancement in general we believe the issue/motivation need to be better understood.
- On the 3rd bullet: currently we do not see strong requirement or urgency to enhance on this area for NR MBS.
- On the 5th bullet: we do see this an important aspect for R18. And it is worth mentioning that our estimation is that the standardization effort of this one can be quite low compared with some of the other ones in this list.
- Bullet 4 and 6 seem quite general. Different companies may have different understandings regarding what are included in these bullets. Perhaps some further discussions here are helpful. Among the aspects that the two bullets may try to cover, we think "Improved reliability of PTM" and "Efficiency improvement for MBS in RAN sharing scenarios" should be considered as important aspects for further discussions. We had provided some reasonings in the 1st round.

Then overall we think R18 NR MBS work scope should be reasonable taking into account both commercial interests/urgency as well as work load/TU budget. It seems not possible to address all in the list so far. This can be discussed in a later stage.

13 – CBN

We generally agree with moderator's proposed list of potential objectives, and there are two suggestions as follows:

- Second bullet: We think SFN support should be listed separately. SFN is more about solving the coverage problem, reducing inter cell interference and improving spectrum utilization. It seems inappropriate to put it together with "Advanced mobility support for MBS reception".
- Fourth bullet: This bullet seems quite broad. Our suggestion is to explicitly include efficiency improvement for RAN sharing scenario in the list. RAN sharing scenario is a real and important use case in practical deployment from operator point of view, so it is highly desirable to improve NR MBS in this area.

14 – Deutsche Telekom AG

(as moderator)

I will **change MBS to "multicast" for IDLE/INTERACTIVE state**

Mobility and SFN will be separate objectives (sorry for the confusion, based on my assumption that with SFN mobility comes naturally)

15 – LG Uplus

Thank to moderator for summarizing huge contents and suggestion. We are fine to the proposed high level areas. Like other companies said, it seems a bit large areas as now they are gathered together in moderator's summary where we will discuss during more rounds of course. So from our perspective, if more downscoping is required, more preferred areas among the proposal are following :

-Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/-capacity/reliability for NR MBS

: This is for supporting general media service more efficiently and also for providing even higher quality media services or data download (for updating SW/3D map) services with more stringent requirements.

-Improve Energy efficient operation/power saving mechanisms for MBS reception

: Energy saving mechanism should be taken into account as its importance is becoming bigger to operators and over worldwide.

16 – ZTE Corporation

thanks to moderator for the summary work especially with a not so stable NWM. our views on the summary:

- a separate bullet for leftover for Rel-17 might be needed
- Support of Multicast in IDLE and INACTIVE state (although we believe whether Multicast can be supported in RRC_IDLE shall be confirmed by SA2)
- SFN as improvements in L1, thus decoupled from advanced mobility
- SFN above gNG-DU level shall only be supported with clear/accessed scenarios/use case, otherwise the impacts to network interface will be huge. In our view, SFN is a technique in air interface only as the benefits is clear with coverage enhancement at cell edge. While whether to have across network nodes SFN shall be carefully accessed before we make the final decision.
- we are also confused by the reliability enhancement, if we are talking about RLC AM for PTM, RAN2 dicussion and the conclusion about its complexity still applies, and we don't think we should have it in future releases either.
- MRDC and cell-aggregation for Multicast can be considered for better flexibility in deployment, however, if this can already be done in Rel-17, then it is not necessary to discussion about it here. If not, MRDC can be included in the separate bullet: Rel-17 leftover.

17 – AT&T

AT&T

High Priority -

- Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls.
- Support of MBS in IDLE and INACTIVE state
- Enable higher reliability lower latency, larger coverage including improvement of spectrum efficiency/capacity/reliability for NR MBS

Medium Priority

- Advanced mobility support for MBS reception, including SFN support
- Improve Energy efficient operation/power saving mechanisms for MBS reception

Low Priority

- Support of Free-to-Air/receive only mode

18 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon We think that several clarifications are needed to better understand the proposed objectives.

Therefore we propose the following changes:

- Support of MBS multicast in IDLE and INACTIVE state

[Huawei: this is only for multicast, so now it should be clear. We also acknowledge that the specification impact for IDLE is higher than the one for INACTIVE. This is one of the main reasons why more companies support INACTIVE vs. IDLE. From our perspective we are fine to keep both for the time being.]

- ~~Advanced mobility support~~ Enhanced spectrum efficiency for MBS reception, incl. SFN support, and Efficiency improvement for MBS in RAN sharing scenarios.

[Huawei: we propose to gather spectrum efficiency related enhancements in one bullet. This is not for advanced mobility, which might be CHO related enhancement for MBS. Also “Efficiency improvement for MBS in RAN sharing scenarios” was proposed by several companies and has clear requirements from operator and thus deserves to be discussed under this objective, but at this stage we would be fine to not explicitly list it in the higher level objectives, if there is no consensus (tdb)]

- Improve Energy efficient operation/power saving mechanisms for MBS reception

[Huawei: we do not have a special interest in this area. We acknowledge that about a third of the companies expressed interest in this, so fine to leave it for now. We might get to the point where something needs to be de-prioritized, and this might be one area to be de-prioritized, based on the amount of support]

- Enable Higher reliability, ~~lower latency, larger coverage incl. improvement of spectrum efficiency/-capacity/reliability~~ for NR MBS

[Huawei: as spectrum efficiency and reliability have separate bullets we can remove them from this bullet, which then becomes more clear. Before it was not clear what was in the bullet]

- Enhanced Support of Free-to-Air/receive only mode

[Huawei: Most companies think FTA can be supported by Rel-17 broadcast already, this bullet is to further improve the support of FTA. Receive only mode is not the service requirement and it is the LTE solution name to provide FTA, we think it is better to discuss the solution in WI stage]

- Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)

[Huawei: we think most, if not all, the RAN requirements from Public Safety have been addressed by the bullets above, and something is a little bit unclear, for example:

extending multicast service coverage for dense deployments and mission critical services;

=>covered by SFN?

Group calling addressing that results in cell admission limitations and congestion

=>addressed by Support of MBS multicast in IDLE and INACTIVE state?

enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls

=> it is a little bit unclear what is the real problem and possible enhancements, especially in the RAN side. So perhaps it would be better to mention clearly Public safety in the Justification part of the WID and make sure that nothing that is technically needed is missing from the list of high level objectives. Other than this....we do not need this to be a stand alone objective]

19 – LG Electronics Deutschland

We're generally fine with discussing the objectives the rapporteur suggested. However, the scope of items looks too large to be covered in Rel-18. If we need to focus on some of them, we think that following two items can be deprioritized because DRX is already introduced in Rel-17 and HARQ and PTM/PTP switching is used for reliability in Rel-17.

- Improve Energy efficient operation/power saving mechanisms for MBS reception
- Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

20 – Ericsson LM

We agree with some companies that Rel-18 MBS should not be too large, so some further prioritization may be needed. Here are some specific comments on the Moderator's proposal.

- (High prio) We think the Support of MBS in IDLE and INACTIVE states is crucial for scalability reasons, so MBS needs to support this latest in Rel-18, although preferably already in Rel-17. This is the most prioritized objective in our view. We agree with Qualcomm that "MBS" should be clarified to mean "multicast", since broadcast is already supported in all RRC states in Rel-17.
- (High prio) We also agree with Mediatek comment that mobility and SFN should be separated, although both could be prioritized objectives. For SFN we do not foresee any need in Rel-18 to standardize network synchronization/coordination – this can still be left to proprietary solutions. However, any missing element in the Uu interface to support inter-DU SFN should be standardized in Rel-18. In the Uu interface we currently only foresee a need to support extended CP (with no change of SCS), but a closer analysis may reveal additional topics. Possibly, the standardization effort can be very limited.
- (Low prio) Improved power saving for MBS reception, we do not see as a prioritized objective.
- (Low prio) Regarding support of FTA/ROM, we do not see this as a prioritized objective, although at the same time we do not see that the standardization effort would be very significant. Is there anything at all for the RAN?
- (Medium prio) We think Public Safety/Mission Critical use cases are the main drivers for NR MBS, so think "Public safety focused enhancements" could be a prioritized objective, although further analysis will be needed to clarify which aspects should be addressed. The final list needs to be focused/limited.
- (Study) Some companies have also proposed to include "Study Broadcast/Multicast and Unicast Superposition Transmission (BMUST)" within the objectives, which we can support, if limited to "Study" in Rel-18. This would then not have any standardization impact in Rel-18, but could clarify whether Rel-19 needs to include such functionality.
- (Medium-Low prio) We agree with Futurewei to have separate category "Rel-17 leftovers" (to be clarified later). Priority depends on the specific leftovers.

21 – Nokia France

Overall, the scope proposed is much too large to be realistic. It is important to be realistic about the workload, and also to ensure stability of the new Rel-17 MBS feature.

If an MBS item were to be adopted in Rel-18, the top priority from our perspective would be support of multicast in IDLE and INACTIVE.

We also consider that support of Free-to-Air/receive only mode could be included, as the expected RAN impact is very small.

We believe that some companies have misunderstandings regarding SFN support, which is already available in Rel-17 transparently to the UE. Benefits of explicit or non-transparent SFN support have not been made clear. Further, introducing non-transparent SFN support that results in UE impact will most likely suffer the same fate in the market as previous attempts at MBMS in 3GPP, and we do not therefore see it worthwhile to pursue.

We support the needs of public safety. However, the RAN specification impacts of the sixth bullet would need further clarification.

22 – Intel Corporation (UK) Ltd

We are fine with the list in general, with comments on several objectives below:

- Regarding SFN support, so far NR already supports intra-DU SFN, and we prefer that SFN support should use existing numerologies.
- Regarding “Support of Free-to-Air/receive only mode”, Rel-17 NR MBS already supports broadcast service, and by SA2 definition (as in TS 23.757), all UEs in the broadcast coverage area are authorized to receive the data. It is not clear what additional RAN impacts are expected to support free-to-air/receive only mode, on top of existing support of broadcast service.
- For public safety focused enhancements, we agree with other companies that current scope might be too broad and we need to have focused areas within this objective.
- We support other objectives. Regarding “Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS”, we prefer to consider two sub-areas: 1) RLC-AM support for PTM; 2) UL Feedback for Reliability for RRC_IDLE/INACTIVE UEs.

23 – BBC

We would like to thank the moderator for compiling the high level list of objectives based on all the inputs to this discussion.

We think the high level objectives list is a good starting point for further discussion and potential down scoping based on companies’ interests/priorities.

We think that the study on of “*Broadcast/Multicast and Unicast Superposition Transmission (BMUST)*” that was put in the moderator summary as an independent item, can be considered as a potential item of the high level objective on “*Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS*”. Please note that BMUST has been mentioned by MediaTek, BBC, EBU (tdoc submitted to REL-18 WS) and 5G-MAG.

Thank you.

2.3 Moderator summary and recommendation from Intermediate Round

22 companies participated in the discussion consisting of mobile operators (AT&T, China Mobile, LGU+, Telecom Italia, Verizon), Broadcasters (BBC, CBN, EBU) and network and UE vendors (Apple, CATT, Ericsson, Futurewei, Huawei/HiSilicon, INTEL, LGE, MediaTek, Nokia, OPPO, Qualcomm, Samsung, vivo, ZTE)

The topic was organized in 2 discussion areas:

2.1 Evolution of 5G LTE based broadcast

Disclaimer and Apologies from the Moderator: In the initial round comments from 5G-MAG were not taken into account by the moderator while creating the summary and conclusion of the initial round due to the submission 1 minute before the extended deadline was passed. The NWM version used for the creation of the summaries did not contain that input for some reason.

Therefore, the proposal for “Evolution of 5G LTE based broadcast” was updated to this:

Based on the Initial Round discussion, there is some support for creation of a WI with the following pot. Objectives:

Objectives for a WI would be:

- Connection to 5GC
- Enabling simultaneous NR unicast and LTE broadcast
- Time Interleaving

And with lower priority:

- Public Warning capability
- Efficiency enhancements, e.g., MIMO (existing antennas/RF stages in handsets), Overhead Reduction

Proposed conclusion: Given the demand to evolve 5G LTE based broadcast is limited to 2 companies while 7 companies do not think that there is a need to evolve 5G LTE based broadcast it is proposed by the moderator report to the plenary that a pot. dedicated WI on “Evolution of 5G LTE based broadcast” would include the follow objectives (supported by more than one company in the discussion), but the decision if this work is perused (seeing the multiple companies which do not see a need going ahead with this) is left to RAN#93e

Objectives for a WI would be:

- **Connection to 5GC**
- **Enabling simultaneous NR unicast and LTE broadcast**

2.2 Objectives for Evolution of NR Multicast Broadcast Services (MBS)

The following potential objectives have been proposed by the moderator for the Intermediate Round

- Support of MBS in IDLE and INACTIVE state
- Advanced mobility support for MBS reception, incl. SFN support

- Improve Energy efficient operation/power saving mechanisms for MBS reception
- Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS
- Support of Free-to-Air/receive only mode
- Public safety focused enhancements (including extending multicast service coverage for dense deployments and mission critical services; Group calling addressing that results in in cell admission limitations and congestion; enable rapid call setup, reconnection and reuse of RF resources for PTT and video calls, ..)

The discussion largely supported that set of proposed objectives, with updates on the IDLE and Inactive state (change MBS to Multicast) and decoupling of Mobility and SFN – which has been confirmed by the moderator already during the discussion. Many companies commented that the objectives are still to large to fit into a realistic Rel-18 WI and thus further prioritization would be needed (with some companies proposing a prioritization already). On BMUST some companies proposed to pursue this as a Study Item has this topic has been mentioned by MediaTek, BBC, EBU (tdoc submitted to REL-18 WS) and 5G-MAG

Proposed conclusion: Use the list of the Intermediate Round (with correction and clarifications as proposed during the Intermediate Round) as starting point for further refinement and potential prioritization in the Final Round

3 Final Round

3.1 Evolution of 5G LTE based broadcast

Given that during the discussion in the Intermediate Round still some support for a WI initiation was expressed, a pot. WI for Evolution of 5G LTE based broadcast would have the following objectives:

Objectives for a WI would be:

- **Connection to 5GC**
- **Enabling simultaneous NR unicast and LTE broadcast**

Feedback Form 8: Is it agreeable to report these objectives to RAN#93e for further discussion, if such a dedicated WI should be persued during the further consolidation ?

<p>1 – MediaTek Inc.</p> <p>No. We are not convinced for the further evolution of LTE based broadcast.</p>
<p>2 – AT&T</p> <p>Do not Support</p>
<p>3 – Futurewei Technologies</p> <p>No. We maintain our position in the first round that we don't see a strong motivation supporting further</p>

evolution on LTE MBS. Since clear majority of the companies indicated their position of no further effort on LTE MBS, we would prefer to make decision in this email discussion to avoid the need of further debate/SOH in plenary.

4 – China Unicom

We think it is no need to support the further evolution of LTE MBS.

5 – Apple Computer Trading Co. Ltd

6 – CATT

As stated previously we do not see strong motivation for this in Rel-18.

7 – Deutsche Telekom AG

We think given the discussion it should be only reported that there was no agreement on creation of a WI given the clear majority no in favor of establishing such work for Rel-18.

8 – China Mobile Com. Corporation

We don't see the motivation of evolution of LTE based broadcast.

9 – Qualcomm Incorporated

We agree with the proposed summary as the focus area for Rel-18.

10 – Nokia France

As already indicated twice, we do not see that further evolution in this area is justified at the current time.

11 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon We do not support

12 – OPPO

Keeping the same view with the initial round discussion that we do not observe much strong motivation in Rel-18 for the evolution of 5G LTE based broadcast.

13 – CBN

Do not support

14 – Ericsson LM

Although Ericsson does not support such a potential WI, and we don't foresee the market need for such objectives, it is OK to report to RAN#93e.

15 – Samsung R&D Institute UK

We do not support further evolution of 5G LTE based broadcast

16 – Intel Corporation (UK) Ltd

As in our comments in Initial round, there seems no strong market motivation for 5G LTE based broadcast enhancement in Rel-18. Also as in our comments in Intermediate round, regarding “connection to 5GC”, given that RAN and SA architectures are tightly coupled for both LTE MBSFN and NR MBS, it might be better to wait for SA conclusion (e.g. regarding architecture aspects) before starting work in RAN WGs.

17 – EBU

We agree with the proposed objectives for a WI

3.2 Objectives for Evolution of NR Multicast Broadcast Services (MBS)

The following potential objectives are proposed by the moderator for agreement / further consolidation in the Final Round

1. Rel-17 left-overs

- Advanced mobility support for MBS reception (CHO) (DAPS)

2. Support of Multicast in IDLE and INACTIVE state

3. SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

4. Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

- Incl. RAN Sharing

5. Improve Energy efficient operation/power saving mechanisms for MBS reception

Instruction by the moderator: The form below allows you to indicate support for each objective and pot. next level of detail. Please avoid listing next level details which have been listed by a previous post in this form. This exercise is to agree on the set of 1st level objectives and list for each one the 2nd level objectives, selection of 2nd level objectives will be done in a later stage (Final Round or WID drafting phase) !

Feedback Form 9: Please provide for each bullet point if you support it (yes/no) and what would be your next level detail (please list)

1 – Deutsche Telekom AG

EXAMPLE INPUT

1. support

- xxx
- yyy
- zzz

2. not support

3. support

- xxx
- yyy
- zzz

(...)

2 – MediaTek Inc.

We support all of the objectives (1/2/3/4/5) as listed by moderator for NR MBS evolution at Rel-18

3 – AT&T

1. Support

- **Rel-17 left-overs [HI Priority]**
- o Advanced mobility support for MBS reception (CHO) (DAPS) [**Medium Priority**]
- **Support of Multicast in IDLE and INACTIVE state [Medium Priority]**
- **SFN support for MBS reception (above gNB-DU level)
(using existing numerologies) [Medium Priority]**
- **Enable Higher reliability, lower latency, larger coverage incl. improvement
of spectrum efficiency/capacity/reliability for NR MBS [HI Priority]**
- o Incl. RAN Sharing
- **Improve Energy efficient operation/power saving mechanisms for MBS reception [Low Priority]**

4 – Futurewei Technologies

1. Support: Rel-17 left-overs (subject to the outcome of Rel-17)

~~Advanced mobility support for MBS reception (CHO)(DAPS)~~

[Comment: No need to have any sub-item this time. The exact sub-item should be added after the completion of Rel-17.]

2. Support: Support of Multicast in INACTIVE state

3. Support: SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

4. Support: Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

o RLC based ARQ for PTM transmission.

5. Not support: Improve Energy efficient operation/power saving mechanisms for MBS reception

5 – Verizon UK Ltd

- **Support** - Better mobility for MBS reception (further optimization based on R17, CHP/DAPS)
- **TBD** - Support of Multicast in IDLE and INACTIVE state
- **Support** - SFN support for MBS reception (above gNB-DU level) (using existing numerologies)
- **Support** - Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, RAN Sharing
- **Support** - Improve Energy efficient operation/power saving mechanisms for MBS reception

6 – China Unicom

Support:

1. Support of Free-to-Air/receive only mode
2. Enable higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, RAN Sharing

7 – Apple Computer Trading Co. Ltd

8 – Deutsche Telekom AG

We support all 5 objectives and leave the details to further discussion.

We support to include network sharing as aspect in 4.

9 – China Mobile Com. Corporation

1. Support: Rel-17 left-overs

Not support: Advanced mobility support for MBS reception (CHO) (DAPS)

2. Support: Support of Multicast in IDLE and INACTIVE state

3. Support: SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

4. Support: Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

Support: Incl. RAN Sharing

5. Support: Improve Energy efficient operation/power saving mechanisms for MBS reception

10 – CATT

- **support**

Support of Multicast in IDLE and INACTIVE state

SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/-capacity/reliability for NR MBS

Incl. RAN Sharing

Some comments: Generally we support this as a starting point for next step discussion. But like said in previous round this bullet is still a bit too broad, and it may overlap with other bullet e.g., R17 leftover, or

SFN, etc..So we actually suggested to make it clear that this is mainly about "Improved reliability of PTM" and "Efficiency improvement for MBS in RAN sharing scenarios", others FFS if needed. This is of course a suggestion we made in previous round, hopefully this can be taken into account.

Enhancements for better support of FTA deployment

We suggest to include this also as high priority. We see good reasoning, and the required effort is relatively low compared with many other potential directions.

- **needs discussion**

Rel-17 left-overs

Advanced mobility support for MBS reception (CHO) (DAPS)

We think R17 left-over is a rather big hat and there are aspects that may be covered, e.g., reliability enh.. So before agreeing on this we need some better understanding regarding what is in it.

- **do not support**

Improve Energy efficient operation/power saving mechanisms for MBS reception

We do not see strong need for this. Considering the overall work load we think this is lower priority than others.

11 – LG Electronics Deutschland

1. support

- 1. Rel-17 left-overs

Rel-17 leftovers will be recognized at the end of Rel-17, then we can do down-selection based on their priorities. So, we think that there is no need to put advanced mobility support on the 2nd level list at this moment.

- 2. Support of Multicast in IDLE and INACTIVE state

2. not support

- 3. SFN support for MBS reception (above gNB-DU level) (using existing numerologies)
- 4. Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS
- 5. Improve Energy efficient operation/power saving mechanisms for MBS reception

12 – Qualcomm Incorporated

1. Rel-17 left-overs: Support in principle, but we think those belong to and are already under below objectives. Also need to revisit closer to end of R17.

2. - Support: Multicast in INACTIVE state, but according to some companies' comments, this can belong to the "improve energy efficient operation/power saving mechanisms" listed below.

- Not support: Multicast in IDLE state, considering it requires significant changes in SA2.

3. Neutral.

4. Support: Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS including:

- RV-level time-interleaving
- CSI feedback enhancement for multicast
- Optimizations for HARQ-ACK codebook with limited reception capabilities
- Support of L2-based retransmissions based on L2-feedback from the UE

5. Support: Improve Energy efficient operation/power saving mechanisms for MBS reception

- such as PEI and WUS for MBS, PDCCH monitoring control/SS set switching for MBS, etc.

13 – LG Uplus

We are supportive for the proposed bullets with higher priority for 3, 4 and 5

14 – Lenovo (Beijing) Ltd

We are supportive of all the five objectives listed by moderator.

15 – ZTE Corporation

1. Rel-17 left-overs

- **support.**
- some of the features are covered below, and some will be clearer as we are reaching the end of Rel-17 (e.g., MR-DC support, Advanced mobility support for MBS reception, HARQ process management, Beam management for multicast, CFR issues, e.g., more than one CFR per cell, relax numerology and location restriction between CFR and initial BWP).
- it all depends on how Rel-17 progresses, and let's have a place holder here for now but keep the contents it includes open.

2. Support of Multicast in IDLE and INACTIVE state

- **support.**
- IDLE support will be coordinated with SA2, and for inactive support, we can focus on following issues: PTM configuration for Multicast reception in INACTIVE; service continuity during RRC states transition and cell-reselection; Reliability enhancement, e.g., UL feedback for RRC_IDLE/INACTIVE UEs;

3. SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

- **partly support.**
- SFN support in which level/granularity can be open for now. if wide area SFN is needed, how wide is enough? in several cells or above gNB-DU level? We'd like to leave this open for now and decide based on the real scenarios/requirements.
- If SFN has to be supported, how to enable simultaneous reception of MBSFN and unicast will be on the feature list.

4. Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

- **support.**

- UL feedback for broadcast transmission in RRC_IDLE/INACTIVAT states; support CA for MBS reception in all RRC_states

5. Improve Energy efficient operation/power saving mechanisms for MBS reception

- **support.**

- we don't think current RAN WGs' progress on NR MBS prioritizes energy efficiency in some of the design. For example, for UE configured with split MRB, the PTM transmission monitoring and HARQ feedback continues with PDCP layer flooded with duplications, it is NOT power efficient. And for delivery mode 2, UE monitors MCCH modification in a per cell level, NOT power efficient either.

- all in all, we support the work on power saving mechanisms [with high priority] in Rel-18.

16 – OPPO

1. Support, high priority. The sub-bullet can be removed because it may lead to another interpretation that Rel-17 left-overs only indicates this one aspect.

2. Low priority.

3. Support, high priority. It can be updated to “SFN support for MBS reception over multiple cells (above gNB-DU level) (using existing numerologies)”.

4. Support, high priority.

5. Support, high priority.

17 – CBN

Support:

- **Support of Multicast in IDLE and INACTIVE state**

- **SFN support for MBS reception (above gNB-DU level) (using existing numerologies)**

We think it can support extended CP with existing SCS without changing the UE hardware. Extended CP has a great gain for large-scale merging scenarios.

- **Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS Incl. RAN Sharing [high priority for enhancements for RAN sharing scenario]**

As an operator, we think RAN sharing scenario is a real and important use case in practical deployment, so it is highly desirable to improve NR MBS in this area.

- **Further enhancement to the support of FTA**

We strongly recommend that this item be put as high priority. See our comments to the next question for details.

18 – Ericsson LM

General comment: Rel-18 should only address enhancements of Rel-17 use cases and not add new use cases.

1. **Support:** Rel-17 left-overs

2. **Support:** Support of Multicast in IDLE and INACTIVE state

- Only for enhancement of Rel-17 use cases (especially Public safety).

- Broadcast aligned with multicast for RRC Idle reception.

3. **Support:** SFN support for MBS reception (above gNB-DU level) (**using existing numerologies SCSs with ECP**)

- No standardization support of network synchronization/coordination.

4. **Support:** Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing.

5. **Not support:** Improve Energy efficient operation/power saving mechanisms for MBS reception.

- Not prioritized for Rel-18.

19 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon

1. support [medium priority] with changes below:

Rel-17 left-overs

- To be identified after completion of Rel-17 ~~Advanced mobility support for MBS reception (CHO) (DAPS)~~

[Huawei comment □ we can wait for the completion of Rle-17 to see what can be included, because some of the leftover seem to be already included in the other objectives, while on other there is no consensus to include them now, and they are supported by less than half of the companies. Already in December we should have a better visibility on this.]

2. support [INACTIVE as high priority, IDLE as medium priority]

[Huawei comment: the difference in priority has been explained by a few companies already, i.e. the impact especially in SA2 etc.]

3. support □ high priority □ with change and suggest sub bullets as below □

SFN support for MBS reception (above gNB-DU level) (using existing numerologiesSCS)

-Network synchronization, reuse SYNC protocol as baseline.

-Extended CP for 15K SCS

[Huawei comment □ 1. For network coordination and synchronization required by SFN, we understand the companies don't want to introduce too much complexity solutions in network side. So we think the possible simple solution would be to reuse SYNC protocol which is already used both by UMTS/LTE today and can be easily extended to NR, then no much extra effort is needed for the synchronization. For network coordination, we can leave the resources coordination in RAN side to implementation (OAM or other ways) to simplify the discussion.

2. Extended CP could bring significant benefit for SINR for medium and large SFN area and ECP with existing SCS will not lead to too much hardware impact to UE. For the standard efforts, since the framework for ECP has been supported when introducing ECP for 60KS SCS, we think the standard effort would be rather limited and thus can be included in the scope of SFN]

4. support [high priority for RAN sharing scenario]

[Huawei comment: We have to decide if the enhanced reliability part can be considered as Rel-17 leftover issues since the L2 feedback for reliability improvement is still under discussing in RAN2. For the other

techniques, we do not need to list them as there is no significant support for any of those options so far. Agree to include the RAN sharing scenario optimizations as commented before and by others.]

5. support [low priority]

[Huawei comment: this could be perhaps low priority, as it was originally - i.e. in phase one - supported by less than half of the companies]

20 – Samsung R&D Institute UK

1. TBD - Rel-17 left-overs

[Samsung Comment: Better to revisit in RAN#94]

2. Support - Support of Multicast in IDLE and INACTIVE state [High Priority]

3. Not support - SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

4. Not Support - Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

[Samsung Comment: The proposal is too abstract and generic, and it is unclear what should be enhanced from Rel-17 features. We are also concerned, in present form, it is likely to create a lot of confusion and a large number of varying opinions/proposals, leading to badly utilized time in WGs.]

5. Support - Improve Energy efficient operation/power saving mechanisms for MBS reception [High Priority]

21 – Nokia France

1. Rel-17 left-overs

- Advanced mobility support for MBS reception (CHO) (DAPS)

Don't support, especially not for DAPS

2. Support of Multicast in IDLE and INACTIVE state

Support

3. SFN support for MBS reception (above gNB-DU level) (using existing numerologies)

SFN is already supported in Rel-17. We don't support further specification work; the benefits have not been shown compared to Rel-17 SFN. At most, it should start with a study to assess the potential performance gains.

4. Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS

- **Incl. RAN Sharing**

RAN sharing enhancements can be studied, but if so, this should be a specifically, tightly-defined, dedicated objective, separate from the very wide and open-ended list in the main bullet, which we do not support.

5. Improve Energy efficient operation/power saving mechanisms for MBS reception

Don't support. There is no reason to think that the ongoing Rel-17 work is badly done and does not already consider those aspects.

22 – Intel Corporation (UK) Ltd

1. Support: Rel-17 left-overs

- Advanced mobility support for MBS reception (CHO) (DAPS)

2. Support: Support of Multicast in IDLE and INACTIVE state

3. **Neutral:** SFN support for MBS reception (above gNB-DU level) (using existing numerologies). We prefer related work to have no RAN1/RAN2 impacts.
4. **Support:** Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS
 - RLC-AM support for PTM
 - UL Feedback for Reliability for RRC_IDLE/INACTIVE UEs.
5. **Support:** Improve Energy efficient operation/power saving mechanisms for MBS reception.

23 – BBC

1. Rel-17 left-overs - support
2. Support of Multicast in IDLE and INACTIVE state - support
3. SFN support for MBS reception (above gNB-DU level) (using existing numerologies) - neutral
4. Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS - support

e.g. RV time interleaving. We also see potential to include study of BMUST benefits under this high-level objective
5. Improve Energy efficient operation/power saving mechanisms for MBS reception - support

24 – EBU

We support work on evolution of NR-MBS on the proposed areas, in particular those related to efficiency, robustness and coverage enhancements

And with lower priority or out:

1. Public safety focused enhancements
2. Support of Free-to-Air/receive only mode

Feedback Form 10: Please provide for each bullet point if you support it to be 2nd prio (yes/no)/higher prio and what would be your next level detail (please list)

1 – Deutsche Telekom AG

EXAMPLE INPUT

1. support
 - xxx
 - yyy
 - zzz
2. not support

2 – MediaTek Inc.

These two bullets can be out. By the way, Free-to-Air/receive only mode may run without RAN spec impact.

3 – AT&T

support

- **Public safety focused enhancements [HI Priority]**
- **Support of Free-to-Air/receive only mode [Low Priority]**

4 – Futurewei Technologies

1. Neutral: Public safety focused enhancements
2. Support: Support of Free-to-Air/receive only mode

5 – Verizon UK Ltd

- **Support** - Public safety focused enhancements
- **Low Priority/Not Supported** - Support of Free-to-Air/receive only mode

6 – Apple Computer Trading Co. Ltd

7 – Deutsche Telekom AG

1. Neutral: Public safety focused enhancements
2. No support: Support of Free-to-Air/receive only mode (as we understand this is broadcast only and should be possible already, as also other companies stated).

8 – China Mobile Com. Corporation

Not support: Public safety focused enhancements

Support: Support of Free-to-Air/receive only mode

This objective can be as the same priority with above five objectives.

9 – CATT

- **Support**

Enhancements for better support of FTA deployment

We suggest to include this also as high priority. We see good reasoning, and the required effort is relatively low compared with many other potential directions.

- **need discussions**

we are open to discuss public safety focused enhancements, especially it would be good to better understand what is the gap to serve related service type with all other enhancements (e.g., on cell edge performance, reliability, idle/inactive state enh, et.) done in R18. If there is clear gap we are happy to look into it.

10 – LG Electronics Deutschland

1. support

- 2. Support of Free-to-Air/receive only mode

FTA could be considered for Rel-18. As some companies mentioned, we also think that it can be supported with small RAN impact.

2. not support

- 1. Public safety focused enhancements

11 – Qualcomm Incorporated

For public safety related enhancements, we would need to scope out the related changes first. For FTA, we are neutral, although most of the work for this feature is to be done in SA, not in RAN.

12 – ZTE Corporation

Public safety focused enhancements

- let's figure out the specific requirements first (based on industrial inputs)
- evaluation can be taken to make further decision

Support of Free-to-Air/receive only mode

- we support this feature (with explicit operator/market demand, and it can be realized without much RAN efforts.)

13 – ZTE Corporation

Public safety focused enhancements

- 2nd priority
- let's figure out the specific requirements first (based on industrial inputs)
- evaluation can be taken to make further decision

Support of Free-to-Air/receive only mode

- higher priority
- we support this feature (with explicit operator/market demand, and it can be realized without much RAN efforts.)

// with some edit with moderator suggestions on priority indication

14 – OPPO

1. Public safety, Low priority/Out.
2. FTA/Receive only mode: Low priority.

15 – CBN

1. Support

“Public safety focused enhancements” may focus on Mission Critical services for NR MBS.

2. Support [high priority]

Free-to-air (FTA) broadcast is an essential feature to enable public services for NR MBS. Potential enhancements for better FTA Broadcast support include, e.g. to provide UE capabilities to aid configurations for simultaneous unicast and FTA broadcast reception. In the first two rounds of discussions, we can see that many companies support enhancement for better FTA support. We will deploy FTA services in the network, so we strongly suggest FTA should be put as high priority.

16 – Ericsson LM

1. **Support (High Priority):** Public safety focused enhancements

2. **Neutral (Low Priority, unclear whether any RAN work is needed?):** Support of Free-to-Air/receive only mode

17 – Samsung R&D Institute UK

1. Not Support - Public safety focused enhancements

[Samsung Comment: Public safety enhancements are already addressed use case by other objectives e.g. Multicast in Idle/Inactive state]

2. Not Support - Support of Free-to-Air/receive only mode

18 – HUAWEI TECHNOLOGIES Co. Ltd.

Huawei, HiSilicon

1. We suggest to add a note instead of another objective, as below:

“Other public safety focused enhancements not addressed by the above objectives could be considered, if they are found and deemed necessary”.

[Huawei comment: similar to almost all other companies, we think that all the RAN enhancements useful for public safety are in practice covered by the first 5 objectives in the previous section. Adding an extra objective for public safety will be not correct and cause confusion. We are suggestion to instead have a note and come back to this part in December, after the proponents companies have identified possible missing features]

2. Support [High priority]

[Huawei comment: we see many companies including operators support this enchantment and thus should be treated as high priority. In the phase one of the discussion about two thirds of the companies mentioned this, so there is clear interest in this area. Note that the Rel-17 NR MBS Broadcast solution provides the possibility that the UE receives broadcast service in a downlink only manner for FTA service. However ... in the typical use case for FTA, the UE is able to receive FTA service and access the network of same or another operator for unicast service. If the UE implements the FTA function and unicast function in the way that they are decoupled completely i.e. different hardware for different functions, there is no optimization requirement in standard. However ... as we learned from the Multi-SIM study, different receive/transmit modules in some UEs would have impact on each other due to constraint of cost, interference etc. For such UEs, there might be some functional coupling between the FTA reception hardware and unicast hardware, for example band combination restriction between FTA frequency band and frequency band for unicast, or

processing capability sharing between FTA module and unicast module. Therefore the unicast connection might impact the reception of FTA frequency for this kind of UEs. If the network could be aware of the UE capability and the carrier where it receives FTA service, better performance for FTA reception might be achieved. Therefore there are some simple standard impacts for this enhancement such UE capability report and FTA reception status report as what we do for LTE ROM. This has very little impact in RAN2, and should be done in the scope of Rel-18 as one of the objective. In fact it could be the smaller and easier of all.]

19 – Nokia France

1. Public safety focused enhancements

Detailed objectives are not clear beyond what is already provided in Rel-17 and in the previous section.

2. Support of Free-to-Air/receive only mode

Can be included, since the RAN impact should be very low; coordination with SA is needed.

20 – Intel Corporation (UK) Ltd

We agree that those two bullets can be out or low priority.

21 – BBC

Support of Free-to-Air/receive only mode - **Support - high priority**

We support the inclusion of this and also expect that RAN impact will be low. Coordination with SA is needed.

22 – EBU

We support Free-to-Air/receive only mode with high priority

Further a new Study has been proposed:

Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)

Feedback Form 11: Please provide feedback if such a Study should be part of Rel-18 NR MBS (tbd: either as part of the WI or seperrate)

1 – Deutsche Telekom AG

EXAMPLE INPUT

support / not support

2 – MediaTek Inc.

We support this study.

3 – AT&T

AT&T

[Not-Support]

· **Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)**

<p>4 – Futurewei Technologies</p> <p>Not support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>5 – LG Electronics France</p> <p>Not support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>6 – Apple Computer Trading Co. Ltd</p> <p>Not support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>7 – NEC Corporation</p> <p>Not support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>8 – Deutsche Telekom AG</p> <p>We do not support such a study due to the time budget limitation.</p>
<p>9 – China Mobile Com. Corporation</p> <p>Not support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>10 – CATT</p> <p>ot support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>11 – CATT</p> <p>sorry but plz skip the previous one, typo there....</p> <p>Not support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>12 – Qualcomm Incorporated</p> <p>Not support.</p>
<p>13 – Lenovo (Beijing) Ltd</p> <p>We don't support BMUST.</p>
<p>14 – OPPO</p> <p>Not support.</p>
<p>15 – Ericsson LM</p> <p>Support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>16 – Samsung R&D Institute UK</p> <p>Not support - Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>

<p>17 – HUAWEI TECHNOLOGIES Co. Ltd.</p> <p>Huawei, HiSilicon we are open to this ”study” and we support it, but we need to keep an eye on the overall workload, in other words we need to see if it can fit.</p>
<p>18 – Intel Corporation (UK) Ltd</p> <p>Support Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST).</p>
<p>19 – BBC</p> <p>Support: Study of Broadcast/Multicast and Unicast Superposition Transmission (BMUST)</p>
<p>20 – EBU</p> <p>We support to study BMUST as a potential efficiency enhancement in Rel-18</p>

This form provides the opportunity to submit additional comments which do not fit in the queries above

Feedback Form 12: Additional comments (not fitting above)

<p>1 – Deutsche Telekom AG</p> <p>In general we agree with many companies that the scope seems to be far too large – we are happy to see further reduction, e.g. Multicast only in INACTIVE, not IDLE, drop public safety aspects if still unclear, etc.</p>
<p>2 – Nokia France</p> <p>We agree with DT’s comment that there are still too many objectives on the table to be realistic.</p>

3.3 Moderator summary and recommendation from Intermediate Round

23 companies participated in the discussion consisting of mobile operators (AT&T, China Mobile, China Unicom, Deutsche Telekom, LGU+, Verizon), Broadcasters (BBC, CBN, EBU) and network and UE vendors (Apple, CATT, Ericsson, Futurewei, Huawei/HiSilicon, INTEL, Lenovo, LGE, MediaTek, Nokia, OPPO, Qualcomm, Samsung, ZTE)

The topic was organized in 2 discussion areas:

3.1 Evolution of 5G LTE based broadcast

Objectives for a WI were proposed to be:

- Connection to 5GC
- Enabling simultaneous NR unicast and LTE broadcast

The question was asked “Is it agreeable to report these objectives to RAN#93e for further discussion, if such a dedicated WI should be pursued during the further consolidation ?”

Table 1:

No	14 companies	Yes	3 companies
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Proposed conclusion: It will be reported to the RAN#93e meeting that there was a discussion on pot. objectives of a dedicated WI on Evolution of 5G LTE based broadcast, but a clear majority (14 companies in the last round) did not support the reporting of pot. objectives and do not support such a WI in Rel-18 at all. A majority of 2 companies supports the consideration of such a Rel-18 WI, 1 company was fine with the reporting of potential objectives, but does not support such a Rel-18 WI.

3.2 Objectives for Evolution of NR Multicast Broadcast Services (MBS)

Objectives for a WI were proposed to be:

- Rel-17 left-overs
 - Advanced mobility support for MBS reception (CHO) (DAPS)
- Support of Multicast in IDLE and INACTIVE state
- SFN support for MBS reception (above gNB-DU level) (using existing numerologies)
- Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS
 - Incl. RAN Sharing
- Improve Energy efficient operation/power saving mechanisms for MBS reception

Companies were invited to state whether or whether not they support the lifted high-level objectives. The feedback was quite mixed. Tendency could be seen that Rel-17 leftovers should be considered, SFN support got quite some attraction as well as Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, incl. RAN sharing; for Support of Multicast in IDLE and INACTIVE state there was clearly support for INACTIVE, partly lower for IDLE and Improve Energy efficient operation/power saving mechanisms for MBS reception was seen low prio by many companies

Proposed conclusion: It will be reported to the RAN#93e meeting that is an agreement of the following high-level objectives for a Rel-18 WID in priority order:

- **Rel-17 left-overs** (content to be identified and detailed at end of Rel-17)
- **SFN support for MBS reception (above gNB-DU level)**
- **Support of Multicast in IDLE and INACTIVE state**
- **Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing**
- **Improve Energy efficient operation/power saving mechanisms for MBS reception**

The discussion also revealed a number of 2nd level objectives for these main objectives which were not discussed in details, but shall be used as starting point for the phased of WID creation. These points contributed here in the discussion should be listed for each main objectives as a starting point for further discussion.

Based on the Intermediate Round tow topics were proposed to be of lower priority:

- **Public safety focused enhancements**
- **Support of Free-to-Air/receive only mode**

As expected, individual companies had different opinions on the priority from “both in” via “one in”, “the other one in” to “both out”. From the discussion is is clear that further discussion is needed in the objectives as such, i.e. for FTA what is possible with Rel.17 broadcast already and for public safety what is missing.

Proposed conclusion: It will be reported to the RAN#93e meeting that no agreement was possible to include these two objectives in the set of objectives for a WI. Especially for FTA it needs to be understood if this is already supported with Rel-17 and for Public safety focused enhancements details for evolution are missing.

Finally, the question was asked if a Study on BMUST should be initiated as part of Rel-18 MBS work (not discussed if separate or as study phase in the WI).

5 companies supported the initiation of such a Rel-18 study, while 0 companies did not support it

Proposed conclusion: It will be reported to the RAN#93e meeting that no agreement was possible if a study on BMUST should be initiated with 5 companies in favor and 10 companies against.

Final note to be reported to the RAN#93e meeting a number of companies indicated throughout the discussion that also the reduced list of objectives seems to be quite large for fitting into a realistic NR MBS evolution WI.

4 ****Revised** Conclusion (after final phase)**

*[Moderator comment: The Conclusion section has been updated to indicate controversial/non-controversial for each item discussed and the conclusion to progress on certain topics have been left open - this was necessary as I uploaded my report before the chair decided to not proceed with and extended round *** sorry for any inconvenience !!!]*

As the moderator of this discussion I like to thank all the participants for the fruitful discussion !

Based on the 3 rounds of discussions, I as the moderator like to draw the following conclusions:

4.1 Evolution of 5G LTE based broadcast

There was no agreement on the initiation of a 5G LTE based broadcast WI. While 2 (3) participating companies supported the creation of such a WI, the clear majority of companies did not support it.

The following potential objectives were discussed:

- **(controversial) Connection to 5GC**
- **(controversial) Enabling simultaneous NR unicast and LTE broadcast**

... and additional potential objectives supported by a single company (lower prio ?)

- **(controversial) Time Interleaving**
- **(controversial) Public Warning capability**
- **(controversial) Efficiency enhancements**

Proposed conclusion: ~~there will not be a WI on evolution of 5G LTE based broadcast~~ Further discussion needed in the process of Rel-18 packaging

4.2 Objectives for Evolution of NR Multicast Broadcast Services (MBS)

For the creation of a NR MBS WI the following objectives should be considered in this priority order:

- **(non-controversial) Rel-17 left-overs** (content to be identified and detailed at end of Rel-17)
- **(non-controversial) SFN support for MBS reception (above gNB-DU level)**
 - **(controversial) based on which numerology**
- **(non-controversial) Support of Multicast in INACTIVE state**
- **(controversial) Support of Multicast in IDLE state**
- **(non-controversial) Enable Higher reliability, lower latency, larger coverage incl. improvement of spectrum efficiency/capacity/reliability for NR MBS, Incl. RAN Sharing**
- **(controversial) Improve Energy efficient operation/power saving mechanisms for MBS reception**

The discussion also revealed a number of 2nd level objectives for these main objectives which were not discussed in details, but shall be used as starting point for the phased of WID creation. These points contributed into this discussion should be listed for each main objective as a starting point for further discussion once we start drafting a WID.

Proposed conclusion: Use these objectives in this priority order as starting point for development of the WID, consider contributed details for each objectives during the drafting of the potential WID.

4.2.1 Additional objectives for a WI

No agreement was possible to include the following two objectives in the set of objectives for a WI. Especially for FTA it needs to be understood if this is already supported with Rel-17 and for Public safety focused enhancements clear details for evolution are missing.

- **(controversial) Public safety focused enhancements**
- **(controversial) Support of Free-to-Air/receive only mode**

Proposed conclusion: Assess both topics as indicated in the Final Round Summary (3.3) to better understand if evolution work is needed. If work is needed it will be necessary to check, if these additional objections fit into a WI

4.2.2 Additional Study on BMUST

(controversial)

No agreement was possible if a study on BMUST should be initiated with 5 companies in favor and 10 companies against.

Proposed conclusion: A study on BMUST shall only be considered if TUs are available after agreeing on the status of the additional topics in 4.2.1, in other words: this additional study has lowest priority ~~or can be decided to be out of Rel-18~~