**3GPP TSG RAN WG1 #117 R1-24xxxxx**

**Fukuoka City, Fukuoka, Japan, May 20th – 24th, 2024**

**Agenda item:** 8.2.1

**Source:** Moderator (NTT DOCOMO, INC.)

**Title:** Summary of discussion on UE features for MBS

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes discussions regarding UE features for MBS.

At the RAN1#115 meeting, RAN1 made discussions on UE Capability of Multicast Reception in RRC\_INACTIVE triggered by RAN2 LS and the following agreements were made.

|  |
| --- |
| **Agreement**RAN1 confirms the RAN2 assumption that the UE in RRC\_INACTIVE state is not required to support FDMed multicast MCCH PDSCH or MTCH PDSCH with DL channels other than FDMed multicast MCCH PDSCH and PBCH in a slot in Pcell . Specifically, from RAN 1’ perspective, the UE in RRC\_INACTIVE state is not expected to support reception of* FDMed multicast MTCH PDSCH and PBCH
* FDMed multicast MCCH PDSCH and multicast MTCH PDSCH
* FDMed multiple multicast MTCH PDSCHs
* FDMed multicast MCCH/multicast MTCH PDSCH and SIB PDSCH
* FDMed multicast MCCH/multicast MTCH PDSCH and Paging PDSCH
* FDMed multicast MCCH/multicast MTCH and RAR PDSCH
* FDMed multicast MCCH/MTCH and broadcast MCCH/MTCH

**Agreement**FG 33-3-2 and FG 33-3-3 do not apply to the UE multicast reception in RRC INACTIVE state. **Agreement**From RAN1 perspective, * a new FG for the support of FDMed any combinations of unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state is not needed.
* whether a new FG for the support of intra-slot TDMed unicast/broadcast/ multicast PDSCHs in RRC\_INACTIVE state is introduced is up to RAN2.

LS to RAN2 is agreed in R1-2312641. |

At the RAN1#116bis meeting, RAN1 received LS from RAN2 regarding RAN2 agreement as below [1].

|  |
| --- |
| **1. Overall Description:**RAN2 would like to thank RAN1 for the replay LS on UE capability of multicast reception in RRC\_INACTIVE. RAN2 agreed to introduce a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state. **2. Actions:****To RAN1 group:** **ACTION:** RAN2 respectfully asks RAN1 to take the information above into consideration. |

# **New FG for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state**

Following inputs are provided in contributions for the RAN1#117 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | RAN1 discussed the intra-slot TDM PDSCH reception capability for RRC\_INACTIVE state UE and concluded it is up to RAN2 whether to introduce such capability reporting, assuming the FG33-3-3 defined for multicast in RRC\_CONNECTED state can be reused once RAN2 agreeing on it. Later on, RAN2 agreed to introduce a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state, which is informed to RAN1 by LS-in in the last meeting, which triggered the RAN1 discussion on the UE feature. If a simplified UE feature is preferred as proposed by the proponent in the last meeting, the new FGs also need to consider intra-slot TDM multicast and broadcast, in addition to TDM multicast and unicast. The reporting granularity should be per band. **Proposal 4: Introduce the following two FGs for multicast reception in RRC\_INACTIVE state as in Appendix 3.** * **Such FGs are included in the updated RAN1 UE feature list, so no need to inform RAN2 in a separate LS.**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 57-1 | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNTI for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support of one Multicast MCCH-RNTI and one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  |  |  | Per band |  |  |  |  |
| 57-2 | Intra-slot TDM-ed PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support of TDM between one PDSCH and one group-common PDSCH for multicast in a slot.2. For any two consecutive slots n and n+1, if there are more than 1 multicast/other PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/other PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | xx-y, 5-11 and/or 5-11a and/or 5-11b |  |  |  | Per band |  |  |  | Candidate value for component 2: require the minimum time separation time {yes, no} |

 |
| [3] | ZTE | For Rel-18 MBS, RAN2 agreed to introduce a new UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state. In RAN1#116bis, the related UE capability was discussed as below.

|  |  |  |  |
| --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNT for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |
|  | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.[2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz] | xx-y, 5-11 and/or 5-11a and/or 5-11b |

In RRC\_INACTIVE, the UE can only receive the unicast data over radio bearers configured for SDT. Therefore, unicast PDSCH in the component 1 is the PDSCH for SDT. Since there is no layer 1 feature group for SDT, the prerequisite should be only the FG of MBS reception in RRC\_INACTIVE, i.e., xx-y. The FG 5-11 should be removed since they are for PDSCH reception in RRC\_CONNECTED. ***Proposal 3:*** *The prerequisite of FG for intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state should be only the basic FG for MBS in RRC\_INACTIVE.* |
| [4] | vivo | In RAN1#115, RAN1 made discussions on UE Capability of Multicast Reception in RRC\_INACTIVE triggered by RAN2 LS and the following agreements were made[4].

|  |
| --- |
| Agreement:RAN1 confirms the RAN2 assumption that the UE in RRC\_INACTIVE state is not required to support FDMed multicast MCCH PDSCH or MTCH PDSCH with DL channels other than FDMed multicast MCCH PDSCH and PBCH in a slot in Pcell. Specifically, from RAN 1’ perspective, the UE in RRC\_INACTIVE state is not expected to support reception of* FDMed multicast MTCH PDSCH and PBCH
* FDMed multicast MCCH PDSCH and multicast MTCH PDSCH
* FDMed multiple multicast MTCH PDSCHs
* FDMed multicast MCCH/multicast MTCH PDSCH and SIB PDSCH
* FDMed multicast MCCH/multicast MTCH PDSCH and Paging PDSCH
* FDMed multicast MCCH/multicast MTCH and RAR PDSCH
* FDMed multicast MCCH/MTCH and broadcast MCCH/MTCH

Agreement:FG 33-3-2 and FG 33-3-3 do not apply to the UE multicast reception in RRC INACTIVE state. Agreement:From RAN1 perspective, * a new FG for the support of FDMed any combinations of unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state is not needed.
* whether a new FG for the support of intra-slot TDMed unicast/broadcast/ multicast PDSCHs in RRC\_INACTIVE state is introduced is up to RAN2.

LS to RAN2 is approved in:[**R1-2312641**](file:///D%3A%5Cdocument%5C%E6%8F%90%E6%A1%88%E6%92%B0%E5%86%99%5C2024%5CDocs%5CR1-2312641.zip) **Reply LS on UE Capability of Multicast Reception in RRC\_INACTIVE RAN1, vivo** |

In Rel-17, for multicast reception in RRC\_CONNECTED state, feature group of 33-3-2 and 33-3-3 are introduced to support FDMed and intra-slot TDMed PDSCHs between unicast PDSCH and group-common PDSCHs. RAN1 agreed that FG 33-3-2 and FG 33-3-3 do not apply to the UE multicast reception in RRC INACTIVE state and whether a new FG for the support of intra-slot TDMed unicast/broadcast/ multicast PDSCHs in RRC\_INACTIVE state is introduced is up to RAN2. In the LS [5][5], RAN2 agreed to introduce a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs. Thus, a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs needs to be defined.When defining the FG for the support of intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state, the following options are identified.* Option 1: Support TDM between one group-common PDSCH for multicast and one unicast PDSCH in a slot
* Option 2: Support TDM between one group-common PDSCH for multicast and one group-common PDSCH for broadcast or one unicast PDSCH in a slot
* Option 3: Define the feature group similar as that of 33-3-3 for UEs in RRC\_CONNECTED state so that {2,4,7} TDMed PDSCHs in a slot can be supported based on UE capability. For the FG for the support of intra-slot TDM-ed unicast/broadcast/ multicast PDSCHs in RRC\_INACTIVE state, the components include:
1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.
2. Support TDM between M (M>1) TDMed unicast PDSCHs and one group-common PDSCH for multicast in a slot per CC
3. Support TDM among N (N>1) group-common PDSCHs in a slot per CC
4. Support TDM between K (K>1) TDMed unicast PDSCHs and L (L>1) TDMed group-common PDSCHs in a slot per CC
5. The UE maximum number of TDMed PDSCH receptions capability in a slot per CC is kept as for Rel-15/Rel-16, i.e., {2/4/7} based on UE FG5-11/5-11a/5-11b
* Note:  Group-common PDSCH(s) are counted as unicast PDSCH(s).
* Note: The max number of (M+1), N, (K+L) are determined based on the numbers reported by FG5-11 and/or FG5-11a and/or FG5-11b.
1. up to one broadcast PDSCH is supported in a slot.
2. For any two consecutive slots n and n+1, if there are more than 1 broadcast/multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two broadcast/multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz

It is obvious that option 1 is the simplest one, and is aligned with RAN2’s main motivation to support intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state, i.e., intra-slot TDM between unicast PDSCH and multicast PDSCH is beneficial for UE with both small data transmission and multicast transmission. Option 2 supports TDM between multicast PDSCH and broadcast PDSCH besides TDM between multicast PDSCH and unicast PDSCH. If UE supports TDM between multicast PDSCH and unicast PDSCH, and UE supports broadcast reception, there is no difference between reception of unicast PDSCH and reception of broadcast PDSCH, so UE can also support TDM between multicast PDSCH and broadcast PDSCH. For option 3, it reuses the intra-slot TDM capability for UE in RRC\_CONNECTED state. It looks straightforward, but it is very complicated. Note that more than one TDMed unicast PDSCHs in one slot is also supported in this option which is different from legacy. Rel-18 MBS is enhancements for MBS multicast in RRC\_INACTIVE state, enhancements for unicast PDSCH may be out of scope and should not be pursued especially at the later stage. Thus, we think both option 1 and option 2 can be considered, and option 1 is preferred for simplicity.In addition, to define a new FG for intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state, a basic layer L1 FG for multicast reception in RRC\_INACTIVE state is needed, which can be based on *multicastInactive-r18* defined in RAN2. In addition, for SDT in RRC\_INACTIVE state, RAN1 does not introuduce new capability. Here, 38-x is used for placeholder. ***Proposal 9: The following new UE FGs should be introduced for multicast reception in RRC\_INACTIVE state with intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state.***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNT for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  | *BandNR* |  | N/A | N/A |  | Optional with capability signalling |
|  | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | xx-y, [38-x] |  | *BandNR* | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

 |
| [5] | CATT, CICTCI, CBN | During RAN2 meeting#125, RAN2 agreed to introduce a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state in the incoming LS [2]. In RAN1#116bis meeting, the issue of intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state was discussed, but didn’t achieve consensus.If a UE is in RRC\_INACTIVE, besides the unicast PDSCH reception that CRC scrambled by SI-RNTI/P-RNTI/TC-RNTI/RA-RNTI, the following group-common PDSCH can be received by a UE supporting dynamic scheduling for multicast in RRC\_INACTIVE state: * PDSCH with CRC scrambled by MCCH-RNTI for multicast transmission.
* PDSCH with CRC scrambled by G-RNTI for multicast transmission.
* PDSCH with CRC scrambled by G-RNTI for broadcast transmission.

If the capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state is introduced, the following PDSCHs reception combinations should be considered:* Intra-slot TDM-ed one unicast PDSCH and one group-common PDSCH for multicast
* Intra-slot TDM-ed one group-common PDSCH for multicast and one group-common PDSCH for multicast
* Intra-slot TDM-ed one group-common PDSCH for broadcast and one group-common PDSCH for multicast

It is noted that there is no different for unicast/broadcast/multicast PDSCHs in case of counting the number of PDSCH reception. Thus, the any combination between two PDSCH receptions should be considered, and it will not lead to additional complexity for UE.***Proposal 4: The UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state should include following PDSCHs reception combinations:**** ***Intra-slot TDM-ed one unicast PDSCH and one group-common PDSCH for multicast***
* ***Intra-slot TDM-ed one group-common PDSCH for multicast and one group-common PDSCH for multicast***
* ***Intra-slot TDM-ed one group-common PDSCH for broadcast and one group-common PDSCH for multicast***
 |
| [6] | Nokia | RAN1#116bis left the following MBS FGs to be discussed further in RAN1#117 and to be liaised to RAN2:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNT for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  | Per band | N/A | N/A |  | Optional with capability signalling |
|  | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.[2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz] | xx-y, 5-11 and/or 5-11a and/or 5-11b |  | Per band | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

Discussion in RAN1#116bis revealed that when the RRC\_CONNECTED UE capability for intra-slot TDM-ed unicast and multicast PDSCHs is a fairly central piece of MBS operation, whereas the same capability in RRC\_INACTIVE is less central combination as the only unicast PDSCH transmission in RRC\_INACTIVE relate to Small Data Transmission. Nevertheless, RAN2 has agreed to introduce the FG, and the combination of MBS an SDT is a valid one, but it does raise a few points:1. FGs 5-11/11a/11b are needed for the UE to indicate support for 2/7/4 unicast PDSCHs per slot respectively, and they are not needed for multiplexing one unicast and one multicast PDSCH
2. Should the new FG mention that the unicast PDSCH is e.g. a small data transmission PDSCH

**Proposal 3: Agree to the table below with the revisions of the table discussied in RAN1#116bis shown, and liaise it to RAN2.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNT for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  | Per band | N/A | N/A |  | Optional with capability signalling |
| xx-z | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH (e.g. Small Data Transmission PDSCH) and one group-common PDSCH for multicast in a slot.~~[~~2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz~~]~~ | xx-y~~, 5-11 and/or 5-11a and/or 5-11b~~ |  | Per band | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

 |
| [7] | Ericsson | In R1-2401941, RAN1 was informed that RAN2 plans to introduce a separate capability for TDM of group common PDSCH and unicast/broadcast for RRC inactive:

|  |
| --- |
| *R1-2401941***1. Overall Description:**RAN2 would like to thank RAN1 for the replay LS on UE capability of multicast reception in RRC\_INACTIVE. RAN2 agreed to introduce a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state. **2. Actions:****To RAN1 group:** **ACTION:** RAN2 respectfully asks RAN1 to take the information above into consideration. |

RAN1 already communicated in the previous LS that the capabilities for multicast PDSCH were intended for RRC connected state, i.e. FG 33-3-2 and FG 33-3-3 do not apply to the UE multicast reception in RRC INACTIVE state. The capability for TDM in MBS Rel-17 is currently not mentioning the RRC state, and it may be good to clarify that the capability is intended for RRC\_CONNECTED. However, this can be directly handled by RAN2 directly in 38.306. 1. FG 33-3-3 is not currently limited to RRC CONNECTED state.
2. For MBS, RAN1 should suggest RAN2 to update the capabilities for FG-33-3-3 in 38.306 to reflect that the scope is limited to RRC\_CONNECTED.

Regarding the content of the capability for TDM in RRC inactive, two candidate FGs were discussed in RAN1#116b:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNTI for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  | Per band | N/A | N/A |  | Optional with capability signalling |
|  | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.[2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz] | xx-y, 5-11 and/or 5-11a and/or 5-11b |  | Per band | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

There was a discussion regarding whether component 2 in the second FG was required. We think that to be consistent with the unicast and multicast capabilities, this component is required. If a UE requires to have a gap between TDM transmissions for unicast and multicast in the same slot in connected mode, it will most likely need that feature too in inactive state. In addition, we think broadcast should also be added, otherwise, the support of TDMed broadcast/unicast is not clear. 1. For MBS, support the FGs proposed in RAN1#116b for TDM of group common and unicast PDSCH, including the component on whether a time separation of 4 symbols between starting times is required.
2. For MBS, support component 1 in the FG for intra slot TDM in inactive state to include broadcast.
 |
| [8] | Qualcomm Incorporated | In last RAN1 meeting, RAN1 has discussed how to introduce intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE states triggered by RAN2 LS R1-2401941, but there is no consensus yet. Based on the previous FL’s proposal in [2], we suggest to simply the new UE capability FG xx-z as follows, where the minimum time gap between consecutieve slots is needed for UE to process more than one multicast/unicast PDSCH in RRA\_INACTIVE state in either slot.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by MulticastMCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.2. Support of CFR configuration for multicast.3. Support of CORESET and common search space configuration for multicast.4. Support of DCI format 4\_0 with CRC scrambled with MulticastMCCH-RNT for multicast MCCH.5. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.6. Support one G-RNTI for multicast reception.5. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  | Per band | N/A | N/A |  | Optional with capability signalling |
| xx-z | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.~~[~~2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in RRC\_INACTIVE state in either slot, ~~whether to~~ require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz~~]~~ | xx-y, 5-11 and/or 5-11a and/or 5-11b |  | Per band | N/A | N/A | ~~Candidate value for component 2: require the minimum time separation time {yes, no}~~ | Optional with capability signalling |

Proposal 2:**Send LS to RAN2 to inform RAN1’s preferred FG details on intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-z | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in RRC\_INACTIVE state in either slot, require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | xx-y, 5-11 and/or 5-11a and/or 5-11b |  | Per band | N/A | N/A |  | Optional with capability signalling |

 |

## **Discussion**

### **Proposal 2-1:**

* **Send LS to RAN2 to inform RAN1’s preferred FG details on intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx-y | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by Multicast MCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.3. Support of CFR configuration for multicast.4. Support of CORESET and common search space configuration for multicast.5. Support of DCI format 4\_0 with CRC scrambled with Multicast MCCH-RNT for multicast MCCH.6. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.7. Support one G-RNTI for multicast reception.8. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  |  | N/A | N/A |  | Optional with capability signalling |
|  | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one PDSCH and one group-common PDSCH for multicast in a slot.2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | xx-y |  |  | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | **Summary of companies’ view:*** General
	+ Two FGs are included in RAN1 UE features list: Huawei/HiSilicon
	+ RAN1’s preferred FG details are informed to RAN2: Nokia, Qualcomm
* FG for Dynamic scheduling for multicast in RRC\_INACTIVE state
	+ Reporting type
		- Per band: Huawei/HiSilicon, vivo, Nokia, Qualcomm
* FG for Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state
	+ Component 1
		- Support of TDM between one PDSCH and one group-common PDSCH for multicast in a slot: Huawei/HiSilicon, CATT/CICTCI/CBN, Ericsson
		- Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot: vivo, Qualcomm
		- Support TDM between one unicast PDSCH (e.g., Small Data Transmission PDSCH) and one group-common PDSCH for multicast in a slot: Nokia
	+ Component 2
		- For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz: Huawei/HiSilicon, vivo, Nokia, Ericsson
		- For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in RRC\_INACTIVE state in either slot, require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz: Qualcomm
	+ Prerequisite FG
		- Only xx-y (basic FG of MBS in RRC\_INACTIVE): ZTE, Nokia
		- xx-y, 5-11 and/or 5-11a and/or 5-11b: Huawei/HiSilicon, Qualcomm
		- xx-y, [38-x]: vivo
	+ Reporting type
		- Per band: Huawei/HiSilicon, vivo, Nokia, Qualcomm
	+ Note
		- Keep “Candidate value for component 2: require the minimum time separation time {yes, no}”: Huawei/HiSilicon, vivo, Nokia
		- Remove “Candidate value for component 2: require the minimum time separation time {yes, no}”: Qualcomm
 |
| Huawei, HiSilicon | Since these two FGs are defined in RAN1, it is better to include them in the RAN1 UE feature list with FG number added. The updated UE feature list will be sent to RAN2 anyway, no need to have a separate LS to RAN2.  |
| vivo | We think it is slightly better to have a separate LS to inform RAN2 and RAN2 can update their spec accordingly.Regarding Component 1, the first version ‘TDM between one PDSCH and one group-common PDSCH for multicast in a slot’ is not clear to us. Is two TDMed PDSCH for multicast also included by in this sentence? According to RAN2 discussion, the main motivation for TDMed multicast PDSCH and other PDSCHs is for SDT. For TDMed broadcast and multicast or TDMed multicast PDSCHs, we don’t see clear motivations. Nokia’s version and vivo’s version are the same considering the perquisite FG should include that for SDT. Regarding Component 2, agree with other company, keep consistent with that in RRC connected.Regarding the Prerequisite FG, we think only FGs for multicast in inactive and SDT in inactive are needed. But for SDT, RAN1 does not introduce any new FG. Our intention to use [38-x] is remind the editor TS38.306 that SDT in inactive should be the prerequisite FG when capturing this FG, e.g. TS306 may capture this FG in the following way: the UE indicating support of this feature shall also support multicastInactive-r18 and any of ra-SDT-r17, ra-SDT-NTN-r17, cg-SDT-r17, mt-SDT-r18, mt-SDT-NTN-R18 or mt-CG-SDT-r18. If we only put FG for multicast in inactive here, we are afraid that the capability for SDT will be missed. |
| Qualcomm | The FG can be introduced in RAN1. Anyway, RAN1 will send summary of UE feature updates every meeting.For Component 1, we think first option is lack of motivation as explained by vivo. For Component 2 and the note, we think {yes, no} may be enhancement for flexible scheduling at gNB side but not essential for RRC\_INACTIVE UEs anymore. Also it could be simpler to reduce the FG reporting bits for RRC\_INACTIVE UEs.  |
| Nokia | We’d be OK with the proposal. We could also accept the following modifications, but do not insist on them* Introducing these to RAN1 FG list would be also acceptable, but in that case we’d prefer a separate LS informing RAN2 about this to make sure the information is not lost
* Adding SDT FG prerequisite for the 2nd FG would be OK. This is in our view not strictly necessary though, and our intent was just to provide easy explanation to the reader that this FG, at least of today, is only relevant with SDT, rather than making SDT formally a pre-requisite.
* Removal of 2nd FG component 2: We’d be OK to make the non-requirement of the it mandatory part of the gap as mandatory part of the FG, but suspect this would not be agreeable.
 |
| Moderator | Thank you very much for the inputs.Based on the inputs, it seems companies would be ok to add two FGs into RAN1 UE features list and in the LS on updated RAN1 UE features list we can mention about these added new FGs for Rel-18 MBS according to the LS from RAN2.The updated proposal based on other feedbacks as well is shown below.**Updated Proposal 2-1:*** **Add following new FGs into RAN1 UE features list and inform RAN2 that added new FGs are based on RAN2 LS in R1-2401941.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 57-1 | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by Multicast MCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.3. Support of CFR configuration for multicast.4. Support of CORESET and common search space configuration for multicast.5. Support of DCI format 4\_0 with CRC scrambled with Multicast MCCH-RNT for multicast MCCH.6. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.7. Support one G-RNTI for multicast reception.8. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  | Per band | N/A | N/A |  | Optional with capability signalling |
| 57-2 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH and one group-common PDSCH for multicast in a slot.2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | 57-1the UE indicating support of this feature shall also support multicastInactive-r18 and any of ra-SDT-r17, ra-SDT-NTN-r17, cg-SDT-r17, mt-SDT-r18, mt-SDT-NTN-R18 or mt-CG-SDT-r18 |  | Per band | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

 |
| ZTE | For the component 1, we think the proposal is in line with the RAN2 agreement.For component 2 in FG 57-2, we can accept it for the sake of progress if this is majority view, even though we don’t think it is needed and this component is beyond RAN2 LS.  |
| MediaTek | For the component 1 in FG 57-2, we think it is better to make the wording “unicast PDSCH” clear since the discussion is in RRC\_INACTIVE state, e.g., adding “(e.g., small data transmission PDSCH)” after “unicast PDSCH”, which also align with RAN2’s discussion. |
| CATT | We think no different for unicast/broadcast/multicast PDSCHs in case of counting the number of PDSCH reception. If most of companies want to only introduce unicast PDSCH, we are ok to compromise to only introduce intra-slot between unicast and group-common PDSCH for multicast. One clarification issue is whether above unicast PDSCH includes SIBX PDSCH or not?  |
| Huawei, HiSilicon | Despite how RAN2 discussed it, the decision from the LS is as follows:RAN2 agreed to introduce a new optional UE capability for intra-slot TDMed unicast/broadcast/multicast PDSCHs in RRC\_INACTIVE state. It does not mention SDT related staff at all, rather the capability expected from RAN2 is intra-slot TDM for any combination of two from unicast, broadcast, or multicast. If Two Multicast TDM is the concern for some company, we can indicate there is no RAN1 consensus for this and RAN2 can then take it over. At least only defining the unicast and multicast intra-slot TDM is not consistent with what RAN2 expected per their agreement.  |
| Qualcomm | We support component 1. Per our understanding, the motivation to consider intra-slot TDM is to enable flexible configuration of unicast and multicast for a UE in INACTIVE state, rather than intra-slot broadcast in RRC\_INACTIVE.The issue is simple and no need to go back to RAN2. For component 2, it would be simpler not to add additional 1bit {yes,no}, especially for RRC\_INACTIVE UEs. But if we are the only company, it’s fine to go with the majority.  |
| Moderator | Thanks for further inputs.Although there are still different views on component 1 and 2 in 57-2, following is the proposal for online session based on the feedbacks so far.**Updated Proposal 2-1:*** **Add following new FGs into RAN1 UE features list and inform RAN2 that added new FGs are based on RAN2 LS in R1-2401941.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 57-1 | Dynamic scheduling for multicast in RRC\_INACTIVE state | 1. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by Multicast MCCH-RNTI.2. Support of group-common PDCCH/PDSCH for multicast with CRC scrambled by G-RNTI.3. Support of CFR configuration for multicast.4. Support of CORESET and common search space configuration for multicast.5. Support of DCI format 4\_0 with CRC scrambled with Multicast MCCH-RNT for multicast MCCH.6. Support of DCI format 4\_1 with CRC scrambled with G-RNTI for multicast MTCH.7. Support one G-RNTI for multicast reception.8. Support of inter-slot TDM between group-common PDSCH for multicast and other PDSCHs in different slots. |  |  | Per band | N/A | N/A |  | Optional with capability signalling |
| 57-2 | Intra-slot TDM-ed unicast PDSCH and group-common PDSCH for multicast in RRC\_INACTIVE state | 1. Support TDM between one unicast PDSCH (e.g., small data transmission PDSCH) and one group-common PDSCH for multicast in a slot.2. For any two consecutive slots n and n+1, if there are more than 1 multicast/unicast PDSCH in either slot, whether to require the minimum time separation between starting time of any two multicast/unicast PDSCHs within the duration of these slots is 4 OFDM symbol for 30kHz and 7 OFDM symbol for 60kHz | 57-1the UE indicating support of this feature shall also support multicastInactive-r18 and any of ra-SDT-r17, ra-SDT-NTN-r17, cg-SDT-r17, mt-SDT-r18, mt-SDT-NTN-R18 or mt-CG-SDT-r18 |  | Per band | N/A | N/A | Candidate value for component 2: require the minimum time separation time {yes, no} | Optional with capability signalling |

 |
| Huawei, HiSilicon | After further offline discussion, we are ok with the latest FL’s proposal.  |

### **(Closed) Proposal 2-2:**

* **Send LS to RAN2 to suggest to update the capabilities for FG-33-3-3 in 38.306 to reflect that the scope is limited to RRC\_CONNECTED.**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | **Summary of companies’ view:*** Ericsson: RAN1 should suggest RAN2 to update the capabilities for FG-33-3-3 in 38.306 to reflect that the scope is limited to RRC\_CONNECTED.
 |
| Huawei, HiSilicon | We don’t think it is needed. RAN2 should be aware of that FG defined in R17 is for RRC\_CONNECTED which is even clearer when the new FGs will be defined for RRC\_INACTIVE. RAN2 specification maintenance is anyway up to RAN2.  |
| vivo | We don’t think it is needed. |
| Qualcomm | Agree with Huawei and vivo. |
| Nokia | This can be directly raised in RAN2 and RAN2 can then discuss if this is not obvious. No need for RAN1 to debate. |
| Moderator | Thank you very much for the inputs.We can conclude that this issue does not need to be discussed in RAN1 as this can be directly raised in RAN2. |

# **Conclusions**

To be updated

# **References**

[1] R1-2401941 Reply LS on UE Capability of Multicast Reception in RRC\_INACTIVE RAN2, vivo

[2] R1-2403918 UE features for other Rel-18 work items (Topics A) Huawei, HiSilicon

[3] R1-2404006 Discussion on UE feature topics A ZTE

[4] R1-2404163 Discussion on Rel-18 UE features topics A (Sidelink, MBS) vivo

[5] R1-2404382 Remaining issues on UE features for NR sidelink evolution and MBS CATT, CICTCI, CBN

[6] R1-2404484 UE Features for Other Topics A (SLenh, MCenh, MBS, Sub-5MHz) Nokia

[7] R1-2404523 Rel-18 UE features topics set A Ericsson

[8] R1-2405141 UE features for other Rel-18 work items (Topics A) Qualcomm Incorporated