**3GPP TSG RAN WG1 #106bis-e R1-210xxxx**

**e-Meeting, October 11th – 19th, 2021**

**Agenda item:** 8.17.15

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

**Title:** [draft] Summary on UE features for LTE based 5G terrestrial broadcast

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.17.15 regarding UE features for LTE based 5G terrestrial broadcast and captures the following email discussion.

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| [106bis-e-R17-UE-features-LTE-Bcast-01] Email discussion UE features for LTE based 5G terrestrial broadcast – Shinya (DOCOMO)   * 1st check point: October 14 * Final check point: October 19 |

In the preliminary RAN1 UE features list for Rel-17 LTE [1], there is following feature group for LTE based 5G terrestrial broadcast.

* 3-1 Support of new channel bandwidth for PMCH

Based on the discussions summarized in Section 2, following is the suggested list of issues to be discussed and priority order considering RAN2 impact especially for capability signaling design, which are tagged and colour coded with High priority, Medium priority, or Low priority.

**FL proposal of list of issues/proposals and priority:**

* **High priority issues (such as a certain FG is necessary or not):**
  + **Discuss** **whether separate FGs 3-1x are necessary for different bandwidths for PMCH**
* **Medium priority issues (such as components and type that have capability signaling impacts):**
  + **Discuss whether capability signaling is necessary for FG 3-1 (or 3-1x)**
  + **Discuss whether the type of FG 3-1 (or 3-1x) should be per band or not**
* **Low priority issues (such as components that do not have capability signaling impacts)**
  + **Discuss whether the sentence in “Consequence if the feature is not supported by the UE” should be revised**

In this round of the discussion, companies are requested to provide comments on the proposals and questions tagged FL4.

# **3-1: Support of new channel bandwidth for PMCH**

In [1], FG 3-1 is captured as below.

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the eNB to know if the feature is supported | [Need for the UE to know if the feature is supported (only for V2X WI, where the PC5-RRC capability signalling is delivered between the UEs)] | **Consequence if the feature is not supported by the UE** | **Type**  **(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Capability interpretation for mixture of FDD/TDD | Note | Mandatory/Optional |
| 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | [TBD: whether separate components are neded for different bandwidths] | Support of dedicated MBMS cells | N |  | UE cannot receive MBMS in the corresponding cell | [Per band] | N/A | N/A |  | [Optional with capability signaling] |

Following feedbacks are provided in contributions for the RAN1#106bis-e meeting.

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| [2] | ZTE | Based on our understanding, it is not necessary/impossible for UEs to report this UE capability for the MBMS dedicated cell. Thus, the following UE capability is reported for other cells transmitting unicast.  Based on the above understanding, we propose the following updates for this UE feature.  ***Proposal 1****: Update the Rel-17 UE features for LTE based 5G terrestrial broadcast as following.*   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | [TBD: whether separate components are neded for different bandwidths]  Indicate support of new PMCH bandwidth 6MHz (30RB), 7MHz (35RB) and 8MHz (40RB). | Support of dedicated MBMS cells | N |  | UE cannot receive MBMS in the corresponding cell | Per band | N/A | N/A |  | Optional with capability signaling | |
| [3] | Huawei, HiSilicon | It was noted in [3] regarding the basic components of the feature as follows:  *[TBD: whether separate components are needed for different bandwidths]*  The supported system bandwidth indicated in MIB is set to 5 MHz or 3 MHz, for which PMCH can be configured with 6/7/8 MHz. A single UE capability supporting flexible bandwidth of 6/7/8 MHz is sufficient. The component of the feature could be written to support the feature of flexible bandwidth for PMCH with system bandwidth limited to 5 or 3 MHz.  ***Proposal 1: The component of the feature can be written as:***   * ***Support flexible PMCH bandwidth (6/7/8 MHz) allocation for the system bandwidth indicated in MIB set to 5 MHz or 3 MHz.***   This is a feature regarding bandwidth of PMCH allocation for specific system bandwidths, hence the report should be per band.  ***Proposal 2: The capability of the feature is per band.***  On one hand, eNB doesn’t need to know whether the feature is supported by UE per [3]. On the other hand, such feature targets UE receiving broadcast on dedicated cells for all RRC states. Hence, for UE receiving broadcast especially for RRC\_IDLE state, such feature should be optional without capability signalling.  ***Proposal 3: The feature is optional without capability signaling.*** |
| [4] | Qualcomm | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | 1. Support of 6/7/8MHz for PMCH | Support of dedicated MBMS cells | N |  | UE cannot receive MBMS in the corresponding MBSFN area | Per band | N/A | N/A | Separate capability bit is introduced for 6, 7 and 8MHz (3 bits in total). | Optional with capability signaling | |
| [5] | Nokia, Nokia Shanghai Bell | * **3-1:**   Regarding TBD on listing separate components for different bandwidths, it should be noted that components cannot be individually supported/not supported. Moreover, from RAN1 point of view there is no reason for separate indication of bandwidths, and hence this FG should be a simple supported/not supported indication for all bandwidths. |

## **Discussion**

**[FL1] High priority question 2-1:**

* **Companies are encouraged to provide views on whether** **separate FGs 3-1x are necessary for different bandwidths for PMCH, e.g.,**
  + **FG 3-1a: Support of new channel bandwidth of 6 MHz for PMCH**
  + **FG 3-1b: Support of new channel bandwidth of 7 MHz for PMCH**
  + **FG 3-1c: Support of new channel bandwidth of 8 MHz for PMCH**
  + **Note that components in an FG cannot be individually supported/not supported as pointed out by [5]**

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| Company | Comment |
| Qualcomm | We think it is necessary to differentiate the support of different bandwidths. 6/7/8MHz target different geographies (with different spectrum holdings), and it may be the case that in initial deployments there is no IODT opportunity for all the possible bandwidths. |
| ZTE | Our preference is a joint UE capability for 6/7/8MHz PMCH bandwidth.  All these three bandwidths are between 5MHz and 10MHz, UE may apply the same/similar design to fulfill them from our perspective. It seems unnecessary to have separate UE capabilities for 6/7/8MHz from functionality perspective. |
| Huawei, HiSilicon | From the perspective of the UE implementing capability, single UE capability supporting flexible bandwidth of 6/7/8MHz is sufficient. However, we can also live with Qualcomm’s suggestion. |
| Nokia, NSB | No need for separate capabilities for separate bandwidths. From RAN1 point of view there is no functional difference. Any differentiation should be done at RAN4 level. |
| NTT DOCOMO | We prefer to have a single capability for 6/7/8MHz PMCH bandwidth. We agree with ZTE/HW/Nokia that there would be no functional difference among 6/7/8MHz PMCH bandwidth support from RAN1 perspective. On the other hand, IODT perspective mentioned by QCM is also understandable. We can accept separate FGs if it is really necessary for some companies. |
| FL2 | According to the comments provided so far, companies have different view on whether/how to separate the capabilities from FG 3-1.  Therefore, following proposal is made 1) to confirm FG 3-1 is kept as “Support of new channel bandwidth for PMCH” and 2) keep TBD part in the Components.  **[FL2] High priority proposal 2-1:**   * **FG 3-1 is kept as “Support of new channel bandwidth for PMCH” as follows**  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | [TBD: whether separate components are neded for different bandwidths] | Support of dedicated MBMS cells | N |  | UE cannot receive MBMS in the corresponding cell | [Per band] | N/A | N/A |  | [Optional with capability signaling] |   Note that any contents highlighted in yellow mean FFS and to be discussed further. |
| NTT DOCOMO | We are fine with FL proposal 2-1 at this stage. |
| Nokia, NSB | Support |
| FL3 | Since no concerns/objections have been received so far (more than 24 hours from FL2), the same proposal is set for email endorsement at 1st check point (Oct 14th).  **High priority proposal 2-1:**   * **FG 3-1 is kept as “Support of new channel bandwidth for PMCH” as follows**  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | [TBD: whether separate components are neded for different bandwidths] | Support of dedicated MBMS cells | N |  | UE cannot receive MBMS in the corresponding cell | [Per band] | N/A | N/A |  | [Optional with capability signaling] |   Note that any contents highlighted in yellow mean FFS and to be discussed further. |
| FL4 | Following was agreed at the 1st check point (October 14)  **High priority proposal 2-1:**   * **FG 3-1 is kept as “Support of new channel bandwidth for PMCH” as follows**  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 3. LTE\_terr\_bcast\_bands\_part1 | 3-1 | Support of new channel bandwidth for PMCH | [TBD: whether separate components are neded for different bandwidths] | Support of dedicated MBMS cells | N |  | UE cannot receive MBMS in the corresponding cell | [Per band] | N/A | N/A |  | [Optional with capability signaling] |   Let’s further discuss the contents highlighted in yellow in the next step.  The remaining FFS is whether separate capabilities are needed for different bandwidths. Following is the latest situation   * Option 1: Separate capabilities are needed: Qualcomm   + Can live with Option 1: Huawei, HiSilicon, DOCOMO * Option 2: Separate capabilities are not needed: ZTE, Huawei, HiSilicon, Nokia, NSB, DOCOMO   + Can live with Option 2:   Therefore, no additional proposal is made, but companies are encouraged to check the comments provided so far and indicate if their position is changed. |
| Qualcomm | We would like to highlight again the importance of having separate capabilities for different bandwidths.  If we have a common capability, then a UE that is targeting a single region shall implement the bandwidths for the other regions (with the corresponding potential different RF requirements). |
| ZTE | One question for clarification from our perspective, since this is a per-band UE capability, if different band has different bandwidth requirements, will RAN4 define different bandwidth for different bands? For example, only 6MHz is applicable to band X and only 8MHz is applicable to Band Y, something like this. If RAN4 will finally define such requirements, then it seems one joint capability for 6/7/8MHz is enough. |
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**[FL1] Medium priority question 2-2:**

* **Companies are encouraged to provide views on whether capability signaling is necessary for FG 3-1 (or 3-1x), i.e, whether to support as optional with capability signaling or optional without capability signaling**

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| Company | Comment |
| Qualcomm | We think it would be good to add the capability signaling, as we did in Rel-14 and Rel-16, but we also acknowledge that the system may work without the explicit signaling. |
| Huawei, HiSilicon | I just wonder how the capability is reported for the case of receive only mode. |
| Nokia, NSB | Yes, capability signaling is needed as the network needs to know if there are UEs supporting the feature. |
| NTT DOCOMO | We think capability signaling can be defined. |
| FL2 | According to the comments provided so far, most of companies are fine to define capability signaling.  Therefore, following proposal is made:  **[FL2] Medium priority proposal 2-2:**   * **FG 3-1 is supported as optional with capability signaling**   + **The column of “Need for the eNB to know if the feature is supported” in FG 3-1 is “Yes”** |
| NTT DOCOMO | We are fine with FL proposal 2-2. |
| Nokia, NSB | Support |
| FL3 | Since no concerns/objections have been received so far (more than 24 hours from FL2), the same proposal is set for email endorsement at 1st check point (Oct 14th).  **Medium priority proposal 2-2:**   * **FG 3-1 is supported as optional with capability signaling**   + **The column of “Need for the eNB to know if the feature is supported” in FG 3-1 is “Yes”** |
| FL4 | Following was agreed at the 1st check point (October 14)  **Medium priority proposal 2-2:**   * **FG 3-1 is supported as optional with capability signaling**   + **The column of “Need for the eNB to know if the feature is supported” in FG 3-1 is “Yes”** |

**[FL1] Medium priority question 2-3:**

* **Companies are encouraged to provide views on whether the type of FG 3-1 (or 3-1x) should be per band or not**

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| Company | Comment |
| Qualcomm | This feature may only apply to a limited set of bands (to be defined in RAN4 next year). Also, different countries may have different bands (due to different regulatory requirements). Thus, we think it is beneficial to have the signaling (or capability) per band. |
| ZTE | OK to keep it as per-band. |
| Huawei, HiSilicon | Should be per band. |
| Nokia, NSB | “Per UE” should be sufficient, but given the limited number of bands where it applies, that option can be considered as well. |
| NTT DOCOMO | We are fine with “per band”. |
| FL2 | According to the comments provided so far, all companies are fine to keep the type of FG 3-1 as per band.  Therefore, following proposal is made:  **[FL2] Medium priority proposal 2-3:**   * **Type of FG 3-1 is per band** |
| NTT DOCOMO | We are fine with FL proposal 2-3. |
| Nokia, NSB | Support |
| FL3 | Since no concerns/objections have been received so far (more than 24 hours from FL2), the same proposal is set for email endorsement at 1st check point (Oct 14th).  **Medium priority proposal 2-3:**   * **Type of FG 3-1 is per band** |
| FL4 | Following was agreed at the 1st check point (October 14)  **Medium priority proposal 2-3:**   * **Type of FG 3-1 is per band** |

**[FL1] Low priority question 2-4:**

* **Companies are encouraged to provide views on whether the sentence in “Consequence if the feature is not supported by the UE” should be revised as “UE cannot receive MBMS in the corresponding ~~cell~~ MBSFN area”**

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| Company | Comment |
| Qualcomm | OK with change |
| ZTE | OK with the change. |
| Huawei, HiSilicon | Ok with the change. |
| Nokia, NSB | OK |
| NTT DOCOMO | We are fine with the proposed change. |
| FL2 | According to the comments provided so far, all companies are fine to revise sentence in “Consequence if the feature is not supported by the UE” in FG 3-1 .  Therefore, following proposal is made.  **[FL2] Low priority proposal 2-4:**   * **The sentence in “Consequence if the feature is not supported by the UE” in FG 3-1 is revised as “UE cannot receive MBMS in the corresponding ~~cell~~ MBSFN area”** |
| NTT DOCOMO | We are fine with FL proposal 2-4. |
| Nokia, NSB | Support |
| FL3 | Since no concerns/objections have been received so far (more than 24 hours from FL2), the same proposal is set for email endorsement at 1st check point (Oct 14th).  **Low priority proposal 2-4:**   * **The sentence in “Consequence if the feature is not supported by the UE” in FG 3-1 is revised as “UE cannot receive MBMS in the corresponding ~~cell~~ MBSFN area”** |
| FL4 | Following was agreed at the 1st check point (October 14)  **Low priority proposal 2-4:**   * **The sentence in “Consequence if the feature is not supported by the UE” in FG 3-1 is revised as “UE cannot receive MBMS in the corresponding ~~cell~~ MBSFN area”** |

# **Conclusions**

TBD

# **References**

[1] R1-2108678 Preliminary RAN1 UE features list for Rel-17 LTE Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2108862 Discussion on Rel-17 UE features for LTE based 5G terrestrial broadcast ZTE

[3] R1-2109157 Rel-17 UE features for LTE-based 5G terrestrial broadcast Huawei, HiSilicon

[4] R1-2110233 UE features for LTE-based 5G terrestrial broadcast Qualcomm Incorporated

[5] R1-2110277 On UE features for LTE based 5G terrestrial broadcast Nokia, Nokia Shanghai Bell