**3GPP TSG-RAN WG2 Meeting #1010-e *draft*R2-2005829**

**Online, 1st  - 12th June 2020**

**Agenda Item: 7.1.5**

**Source: Huawei, HiSilicon**

**Title: draft Report from [Offline-409] RAN1 feature list and UE capabilities issues for eMTC**

**Document for: Discussion and Decision**

# Introduction

This document discusses remaining eMTC Capabilities opens issues, based on [1]

# Discussion

In this section we collect company opinions on the proposals made in [1], except for proposal 10-2 which is covered in Offline-201.

## RAN2 open issues:

**Proposal 1:** Move the four PUR capabilities to general capabilities in the eMTC RRC correction CR.

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | Yes but | The capabilities should be grouped in PUR-Paramters because PUR capabilities affect multiple layers e.g. RRC, MAC, Phy. This should be handled in running CR, see eMTC RRC CR. |
| Huawei | Yes | OK to create a new PUR parameters group (and new subsection in 36.306) |
| Ericcson | Yes | Fine to create a new group as there are multiple new capabilities.  |
| BlackBerry | Yes |  |

**Proposal 2:** Change the group Wake Up Signal capabilities names in the eMTC correction CR so the names align with NB-IoT and Rel-15 capabilities names.

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | Yes | Generally eMTC capabilities have FDD/TDD differentiation in the name but for WUS R15 this general rule was not followed. To avoid confusion to the reader, ok to follow R15 scheme for FDD/TDD differentiation for group WUS. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 3:** Align the naming of ce mode A/B specific capabilities to align to those in Rel-15 (e.g. similar to ce-PDSCH-FlexibleStartPRB-CE-ModeA-r15)

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | Not really | For example, there is no need to repeat “ce” twice in the same field name. Therefore, prefer to stick to what is already in the eMTC RRC CR, i.e., ce-ModeA-PDSCH-MultiTB-r16. It is more compact. |
| Huawei | Yes | It seems better to be consistent across releases |
| Ericsson | Yes | First it was like in Rel-15, then we changed, and now the proposal is to change it back. We need to decide.We prefer the proposal as it is 1) aligned with e.g. Rel-15 flexible TBS, thus more consistent and 2) this format results in better sorting of the capability names, i.e. sorting would be per feature and not listing all ce-ModeA-\*\*\* first then ce-ModeB-\*\*\* and so on.  |
| BlackBerry | Yes |  |

## RAN1 Feature List Impact:

### PUR

**Proposal 4-1:** For eMTC, introduce a new general capability *pur-PUSCH-NB-MaxTBS-r16*, conditional to support of (*pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-*

*r16* and/or *pur-CP-EPC-r16)* and *ce-PUSCH-NB-MaxTBS.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | No | The pre-requisite should be on ce-PUSCH-NB-MaxTBS-r15 and at least one of the pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16 and pur-UP-5GC-r16 for full PRB CE mode A. See proposal 4-2.  |
| Huawei | Yes |  |
| Ericsson | Yes | Currently pur-XX-YYY-r16 are all dependent on CE Mode A.  |
| BlackBerry | Yes |  |

**Proposal 4-2:** For eMTC, introduce a new general capability *pur-CE-ModeB-r16*, conditional to support of *pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | maybe | We prefer to have separate capability (i.e., pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16, pur-UP-5GC-r16) for both CE mode A and CE mode B for full PRB.Otherwise, for example following option would not be possible* Support of pur-CP-EPC-r16 in CE mode A/B but pur-UP-EPC-r16 only in CE mode A.

It can be handled in running CR. |
| Huawei | yes | Not clear why the support of CE Mode B would be different depending on CN type but open to discuss. |
| Ericsson | Yes but | Agree with QC that we should have separate capabilities for CE Mode A and B. |

**Proposal 4-3:** For eMTC, introduce a new physical layer capability *pur-Sub-PRB-CE-ModeA-r16*, conditional to support of (*pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16)* and *ce-PUSCH-SubPRB-Allocation-r15.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm |  | It is as per RAN1 UE feature list. As per RAN1 UE feature list, UE capabilities are captured in eMTC RRC running CR. Similarly, the UE capabilities and dependency can be captured in 36.306 running CR. Therefore, it can be handled in the running CR. |
| Huawei | yes | The proposal is as per RAN1 feature list |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 4-4:** For eMTC, introduce a new physical layer capability *pur-Sub-PRB-CE-ModeB-r16*, conditional to support of (*pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16)* and *pur-CE-ModeB-r16* and *ce-PUSCH-SubPRB-Allocation-r15.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm |  | The pre-requisite should be the support of at least one of the pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16 and pur-UP-5GC-r16 for CE mode B and ce-PUSCH-SubPRB-Allocation-r15 |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 4-5:** For eMTC, introduce a new physical layer capability *pur-FrequencyHopping-r16*, conditional to support of *pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | Pre-requisite should be support of at least one of the pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16, pur-UP-5GC-r16 for full PRB CE mode A (not applicable to CE mode B). |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

### MultiTB scheduling

**Proposal 5-1:** For eMTC, introduce a new physical layer capability *ce-MultiTB-Interleaving-r16*, conditional to support of *ce-ModeA-PUSCH-MultiTB-r16* and/or *ce-ModeB-PUSCH-MultiTB-r16* and/or *ce-ModeA-PDSCH-MultiTB-r16* and/or *ce-ModeB-PDSCH-MultiTB-r16.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | It is as per RAN1 UE feature list. As per RAN1 UE feature list, UE capabilities are captured in eMTC RRC running CR. Similarly, the UE capabilities and their dependency can be captured in 36.306 running CR. Therefore, there is no need to discuss and agree each UE capability. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 5-2:** For eMTC, introduce a new physical layer capability *ce-MultiTB-HARQ-Bundling-r16*, conditional to support of *ce-ModeA-PDSCH-MultiTB-r16.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 5-3:** For eMTC, introduce a new physical layer capability *ce-MultiTB-Sub-PRB-r16*, conditional to support of (*ce-ModeA-PUSCH-MultiTB-r16* and/or *ce-ModeB-PUSCH-MultiTB-r16)* and *ce-PUSCH-SubPRB-Allocation-r15.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 5-4:** For eMTC, introduce a new physical layer capability *ce-MultiTB-EarlyTermination-r16*, conditional to support of *ce-ModeA-PUSCH-MultiTB-r16* and/or *ce-ModeB-PUSCH-MultiTB-r16.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 5-5:** For eMTC, introduce a new physical layer capability *ce-MultiTB-64QAM-r16*, conditional to support of *ce-ModeA-PDSCH-MultiTB-r16* and *ce-PDSCH-64QAM-r15.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 5-6:** For eMTC, introduce a new physical layer capability *ce-MultiTB-FrequencyHopping-r16*, conditional to support of *ce-ModeA-PUSCH-MultiTB-r16* and/or *ce-ModeB-PUSCH-MultiTB-r16* and/or *ce-ModeA-PDSCH-MultiTB-r16* and/or *ce-ModeB-PDSCH-MultiTB-r16.*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 5-7:** For eMTC, introduce a new capability without radio access capability signaling for Multi-TB SC-MTCH in CE-modeB.

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm |  | This is optional capability without signalling so it can be captured together for CE mode A and B. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

### Resource reservation for NR

**Proposal 6-1:** Rename the four already defined capabilities to *ce-SubframeResourceResvUL-CE-ModeA-r16, ce-SubframeResourceResvUL-CE-ModeA-r16, ce-SubframeResourceResvDL-CE-ModeA-r16, ce-SubframeResourceResvDL-CE-ModeB-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | no | There is no need to repeat “ce” as our reponse to Proposal 3. Prefer the following naming:*ce-ModeA-SubframeResourceResvUL-r16, ce-ModeA-SubframeResourceResvDL-r16, ce-ModeB-SubframeResourceResvDL-r16, ce-ModeB-SubframeResourceResvDL-r16.*This can be handled in running CR. |
| Huawei | Yes | The proposal aligns to earlier release convention |
| Ericsson | Yes |  |

**Proposal 6-2:** Introduce four new physical layer capabilities *ce-SlotSymbolResourceResvUL-CE-ModeA-r16, ce-SlotSymbolResourceResvUL-CE-ModeB-r16, ce-SlotSymbolResourceResvDL-CE-ModeA-r16, ce-SlotSymbolResourceResvDL-CE-ModeB-r16* to support of slot/symbol level granularity.

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | There is no need to repeat “ce” in the naming, see proposal 6-1.  |
| Huawei | Yes |  |
| Ericsson | Yes |  |

### MPDCCH Performance Improvement

**Proposal 7-1:** Rename existing capability to *ce-CRS-ChannelEstMPDCCH-CE-ModeA-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | no | As per response to Proposal 3, prefer the following: *ce-ModeA-CRS-ChannelEstMPDCCH-r16.* It can be handled in running CR. |
| Huawei | Yes |  |
| Ericssn | Yes |  |
|  |  |  |

**Proposal 7-2:** Introduce a new physical layer capability *ce-CRS-ChannelEstMPDCCH-CE-ModeB-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm |  | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 7-3:** Introduce a new physical layer capability *ce-CRS-ChannelEstMPDCCH-CSI-CE-ModeB-r16* conditional to support of *ce-CRS-ChannelEstMPDCCH-CE-ModeA-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm |  | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

**Proposal 7-4:** Introduce a new physical layer capability *ce-CRS-ChannelEstMPDCCH-reciprocity-TDD-r16* conditional to support of *ce-CRS-ChannelEstMPDCCH-CE-ModeA-r16* and/or *ce-CRS-ChannelEstMPDCCH-CE-ModeB-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes |  |
| BlackBerry | Yes |  |

### CSI-RS Feedback

**Proposal 8-1:** Introduce a new physical layer capability *ce-ModeA-CodebookRestriction-CSI-RS-Feedback-r16* conditional to support of *ce-ModeA-CSI-RS-Feedback-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | To be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes but | Pre-requisite should be *tm9-CE-ModeA-r13* per RAN1 feature list |

### LTE Control Channel use

**Proposal 9-1:** Rename existing capability to *ce-MPDCCH-RxInLTE-ControlRegion-CE-ModeA-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | no | As per our response to Proposal 3, prefer the following: *ce-ModeA-MPDCCH-RxInLTE-ControlRegion-r16* |
| Huawei | Yes |  |
| Ericsson | Yes |  |

**Proposal 9-2:** Introduce 3 new capabilities *ce-PDCCH-RxInLTE-ControlRegion-CE-ModeB-r16, ce-PDSCH-RxInLTE-ControlRegion-CE-ModeA-r16, ce-PDSCH-RxInLTE-ControlRegion-CE-ModeB-r16*

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | No | See proposal 9-1 for naming. The new UE capabilities should be handled in running CR. |
| Huawei | Yes |  |
| Ericsson | Yes but | There is no "MPDSCH", it should be "PDSCH" in the capability names.  |

### Other

**Proposal 10-1:** Introduce UE-EUTRA-CapabilityAddXDD-Mode container for all of the newly introduced Release-16 physical layer capabilities.

**Company views (to be completed during the meeting)**

|  |  |  |
| --- | --- | --- |
| **Company** | **Do you agree (yes/no)** | **Comments (including whether there is anything missing from the list)** |
| Qualcomm | yes | Yes for the capabilities that need FDD/TDD differentiation. |
| Huawei | Yes |  |
| Ericsson | Yes | Yes when TDD/FDD differentiation is needed. |

# 3 Summary

4 companies responded to the discussion, and for most of the proposals all are aligned with the original proposals, with the following exceptions:

**-**

**Proposal 1:** Move the four PUR capabilities to general capabilities in the eMTC RRC correction CR.

All companies are fine to create a new capabilities group PUR-Paramters which would mean a new subclause in 36.306 4.3.x. This impacts NB-IoT also.

**Proposal 1’:** For eMTC and NB-IoT,Move the four PUR capabilities to a new capability group “PUR-Parameters” and create a new subclause in 36.306 4.3.x.

**-**

**Proposal 3:** Align the naming of ce mode A/B specific capabilities to align to those in Rel-15 (e.g. similar to ce-PDSCH-FlexibleStartPRB-CE-ModeA-r15)

1 company does not agree, and 3 companies agree. It is therefore proposed to go with the majority view and keep the proposal.

**-**

**Proposal 4-2:** For eMTC, introduce a new general capability *pur-CE-ModeB-r16*, conditional to support of *pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16.*

Two companies prefer to introduce separate capabilities for CE-Mode A and B For each of the 4 capabilities pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16, pur-UP-5GC-r16. One company indicated flexibility. Since the existing 4 capabilities are already defined common for CE Mode A and NB-IoT, it is not proposed to rename those, but just to replace proposal 4-2 to introduce 4 new capabilities for CE Mode B.

**Proposal 4-2’:** For eMTC, introduce a 4 new capabilities *pur-CP-EPC-CE-ModeB-r16, pur-CP-5GC-CE-ModeB-r16*, *pur-UP-EPC CE-ModeB-r16*, *pur-CP-EPC-CE-ModeB-r16*, conditional to support of the corresponding capabilities for CE Mode A (*pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16,* *pur-CP-EPC-r16*).

-

**Proposal 4-4:** For eMTC, introduce a new physical layer capability *pur-Sub-PRB-CE-ModeB-r16*, conditional to support of (*pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16)* and *pur-CE-ModeB-r16* and *ce-PUSCH-SubPRB-Allocation-r15.*

The proposal has to be updated according to the changes to proposal 4-2.

**Proposal 4-4’:** For eMTC, introduce a new physical layer capability *pur-Sub-PRB-CE-ModeB-r16*, conditional to support of (*pur-CP-EPC-CE-ModeB-r16*and/or *pur-CP-5GC-CE-ModeB-r16* and/or *pur-UP-EPC-CE-ModeB-r16* and/or *pur-CP-EPC-CE-ModeB-r16)* and *ce-PUSCH-SubPRB-Allocation-r15.*

-

A number of small editorial errors were noticed, which are taken into account in the updated set of proposals provided in the conclusion. In addition the name changes of capability dependencies is taken account of in the updated set of proposals, according to proposal 3.

-

Finally, it can be noted that any final fine tuning can be done as part of CR implementation, as usual.

# 4 Conclusion

In this document, we have discussed miscellaneous UE capability open issues and made the following proposals:

**RAN2 open issues:**

**Proposal 1’:** For eMTC and NB-IoT,Move the four PUR capabilities to a new capability group “PUR-Parameters” and create a new subclause in 36.306 4.3.x.

**Proposal 2:** Change the group Wake Up Signal capabilities names in the eMTC correction CR so the names align with NB-IoT and Rel-15 capabilities names.

**Proposal 3:** Align the naming of ce mode A/B specific capabilities to align to those in Rel-15 (e.g. similar to *ce-PDSCH-FlexibleStartPRB-CE-ModeA-r15*)

**RAN1 Feature List Impact:**

**PUR**

**Proposal 4-1:** For eMTC, introduce a new general capability *pur-PUSCH-NB-MaxTBS-r16*, conditional to support of (*pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16)* and *ce-PUSCH-NB-MaxTBS.*

**Proposal 4-2’:** For eMTC, introduce a 4 new capabilities *pur-CP-EPC-CE-ModeB-r16, pur-CP-5GC-CE-ModeB-r16*, *pur-UP-EPC CE-ModeB-r16*, *pur-CP-EPC-CE-ModeB-r16*, conditional to support of the corresponding capabilities for CE Mode A (*pur-CP-EPC-r16, pur-CP-5GC-r16, pur-UP-EPC-r16,* *pur-CP-EPC-r16*).

**Proposal 4-3:** For eMTC, introduce a new physical layer capability *pur-Sub-PRB-CE-ModeA-r16*, conditional to support of (*pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16)* and *ce-PUSCH-SubPRB-Allocation-r15.*

**Proposal 4-4’:** For eMTC, introduce a new physical layer capability *pur-Sub-PRB-CE-ModeB-r16*, conditional to support of (*pur-CP-EPC-CE-ModeB-r16*and/or *pur-CP-5GC-CE-ModeB-r16* and/or *pur-UP-EPC-CE-ModeB-r16* and/or *pur-CP-EPC-CE-ModeB-r16)* and *ce-PUSCH-SubPRB-Allocation-r15.*

**Proposal 4-5:** For eMTC, introduce a new physical layer capability *pur-FrequencyHopping-r16*, conditional to support of *pur-CP-EPC-r16* and/or *pur-CP-5GC-r16* and/or *pur-UP-EPC-r16* and/or *pur-CP-EPC-r16.*

**MultiTB scheduling**

**Proposal 5-1’:** For eMTC, introduce a new physical layer capability *ce-MultiTB-Interleaving-r16*, conditional to support of *ce-PUSCH-MultiTB-CE-ModeA*-*r16* and/or *ce-PUSCH-MultiTB-CE-ModeB*-*r16* and/or *ce-PDSCH-MultiTB-CE-ModeA*-*r16* and/or *ce-PDSCH-MultiTB-CE-ModeB*-*r16.*

**Proposal 5-2’:** For eMTC, introduce a new physical layer capability *ce-MultiTB-HARQ-Bundling-r16*, conditional to support of *ce-PDSCH-MultiTB-CE-ModeA*-*r16.*

**Proposal 5-3’:** For eMTC, introduce a new physical layer capability *ce-MultiTB-Sub-PRB-r16*, conditional to support of (*ce-PUSCH-MultiTB-CE-ModeA*-*r16* and/or *ce-PUSCH-MultiTB-CE-ModeB*-*r16)* and *ce-PUSCH-SubPRB-Allocation-r15.*

**Proposal 5-4’:** For eMTC, introduce a new physical layer capability *ce-MultiTB-EarlyTermination-r16*, conditional to support of *ce-PUSCH-MultiTB-CE-ModeA*-*r16* and/or *ce-PUSCH-MultiTB-CE-ModeB*-*r16.*

**Proposal 5-5’:** For eMTC, introduce a new physical layer capability *ce-MultiTB-64QAM-r16*, conditional to support of *ce-PDSCH-MultiTB-CE-ModeA*-*r16* and *ce-PDSCH-64QAM-r15.*

**Proposal 5-6’:** For eMTC, introduce a new physical layer capability *ce-MultiTB-FrequencyHopping-r16*, conditional to support of *ce-PUSCH-MultiTB-CE-ModeA*-*r16* and/or *ce-PUSCH-MultiTB-CE-ModeB*-*r16* and/or *ce-PDSCH-MultiTB-CE-ModeA*-*r16* and/or *ce-PDSCH-MultiTB-CE-ModeB*-*r16.*

**Proposal 5-7:** For eMTC, introduce a new capability without radio access capability signaling for Multi-TB SC-MTCH in CE-modeB.

**Resource reservation for NR**

**Proposal 6-1’:** For eMTC, rename the four already defined capabilities to *ce-SubframeResourceResvUL-CE-ModeA-r16, ce-SubframeResourceResvUL-CE-ModeA-r16, ce-SubframeResourceResvDL-CE-ModeA-r16, ce-SubframeResourceResvDL-CE-ModeB-r16*

**Proposal 6-2’:** For eMTC, introduce four new physical layer capabilities *ce-SlotSymbolResourceResvUL-CE-ModeA-r16, ce-SlotSymbolResourceResvUL-CE-ModeB-r16, ce-SlotSymbolResourceResvDL-CE-ModeA-r16, ce-SlotSymbolResourceResvDL-CE-ModeB-r16* to support of slot/symbol level granularity.

**MPDCCH Performance Improvement**

**Proposal 7-1:** Rename existing capability to *ce-CRS-ChannelEstMPDCCH-CE-ModeA-r16*

**Proposal 7-2:** Introduce a new physical layer capability *ce-CRS-ChannelEstMPDCCH-CE-ModeB-r16*

**Proposal 7-3:** Introduce a new physical layer capability *ce-CRS-ChannelEstMPDCCH-CSI-CE-ModeB-r16* conditional to support of *ce-CRS-ChannelEstMPDCCH-CE-ModeA-r16*

**Proposal 7-4:** Introduce a new physical layer capability *ce-CRS-ChannelEstMPDCCH-reciprocity-TDD-r16* conditional to support of *ce-CRS-ChannelEstMPDCCH-CE-ModeA-r16* and/or *ce-CRS-ChannelEstMPDCCH-CE-ModeB-r16*

**CSI-RS Feedback**

**Proposal 8-1’:** Introduce a new physical layer capability *ce-ModeA-CodebookRestriction-CSI-RS-Feedback-r16* conditional to support of *ce-CSI-RS-Feedback-CE-ModeA-r16*

**LTE Control Channel use**

**Proposal 9-1:** Rename existing capability to *ce-MPDCCH-RxInLTE-ControlRegion-CE-ModeA-r16*

**Proposal 9-2’:** Introduce 3 new capabilities *ce-PDCCH-RxInLTE-ControlRegion-CE-ModeB-r16, ce-PDSCH-RxInLTE-ControlRegion-CE-ModeA-r16, ce-PDSCH-RxInLTE-ControlRegion-CE-ModeB-r16*

**Other**

**Proposal 10-1:** Introduce UE-EUTRA-CapabilityAddXDD-Mode container for all of the newly introduced Release-16 physical layer capabilities.

# 4 References

1. [R2-2005085](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_110-e/Docs/R2-2005085.zip) “RAN1 feature list and UE capabilities issues for eMTC”, Huawei, HiSilicon