**3GPP TSG RAN WG1 #100bis-e R1-20xxxxx**

e-Meeting, April 20th – 30th, 2020

Source: NTT DOCOMO, INC.

Title: Summary on Email discussion [100b-e-LTE-UEFeatures-eMTC-01]

Agenda Item: 6.2.5.1

**Document for:** **Discussion and Decision**

# **Introduction**

This contribution summarizes the following email discussion in AI 6.2.5.1 regarding UE features for additional MTC enhancements.

[100b-e-LTE-UEFeatures-eMTC-01] Email discussion/approval on feature group structure for both additional MTC enhancements and additional enhancements for NB-IoT (20th-24th April) – (DCM, Hiroki)

* Discuss whether FG[1-2] is a separate FG (i.e., remove bracket) or FG[1-2] is removed and added as a component in FG1-1
  + This issue is jointly discussed with FG[2-2]
* Discuss whether FG[1-7] is a separate FG (i.e., remove bracket) or FG[1-7] is removed and added as a component in FG1-3/1-4/1-5/1-6
  + This issue is jointly discussed with FG[2-4]
* Discuss whether FG1-9 is kept as a separate FG or FG1-9 is removed and added as a component in FG1-3/1-4/1-5/1-6
  + This issue is jointly discussed with FG2-5
* Discuss whether or not to introduce separate FGs for slot/symbol level resource reservation for FG1-23 to 1-26
  + This issue is jointly discussed with FG2-12 and 2-13

# **[1-2]: Group WUS with group resource alternation and [2-2]: UE-group WUS with group resource alternation**

In [1], FG1-2 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 1. LTE\_eMTC5 | [1-2] | Group WUS with group resource alternation | 1. Group WUS with group resource alternation | 1-1 | Yes | N/A | If UE does not support group resource alternation and the eNB enables group resource alternation, UE falls back to Rel-15 MWUS when Rel-15 MWUS is configured or no MWUS when Rel-15 MWUS is not configured. | Per UE | Yes | N/A | FFS: whether to keep this feature group 1-2 separately or put it as a component of FG 1-1 | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [3] | Qualcomm | We propose to make this a separate feature, mainly because of IODT (it is expected that this resource alternation will not be deployed initially). |
| [4] | Ericsson | **Proposal 1 Keep GWUS with/without group resource alternation as two separate FGs.** |
| [5] | Huawei, HiSilicon | Proposal 1: FG 1-2 (Group resource alternation) is a component in feature 1-1. |

In [1], FG2-2 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 2. NB\_IOTenh3 | [2-2] | UE-group WUS with a wake-up time before the first associated PO (with group resource alternation) |  | 2-1 | Yes | N/A | The network cannot wake-up a group of users with one wake-up signal | Per UE | FDD only | N/A | If UE does not support group resource alternation and the eNB enables group resource alternation, UE falls back to Rel-15 NWUS when Rel-15 NWUS is configured or no NWUS when Rel-15 NWUS is not configured.  FFS: whether to keep this feature group 2-2 separately or put it as a component of FG 2-1 | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [7] | Qualcomm | Remove brackets for FG2-2 and Keep FG2-1/2-2 as separate FGs. |
| [8] | Ericsson | **Proposal 1 Keep GWUS with/without group resource alternation as two separate FGs.** |
| [9] | Huawei, HiSilicon | Proposal 1: FG 2-2 (group resource alternation) is a component of FG 2-1. |

## 2.1 Discussion 1

**Companies are encouraged to provide views on whether the bracket for FG1-2/2-2 are removed or FG1-2/2-2 are removed.**

**Keeping the FG1-2/2-2 (removing brackets) supported by: Ericsson, Qualcomm**

**Objected (i.e., support removing FG1-2/2-2 and adding them as component of FG1-1/2-1) by:**

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Keep 1-2/2-2 (removing brackets). |
| Qualcomm | Keep 1-2/2-2 |
| ZTE,Sanechips | Keep 1-2/2-2 |
| Huawei, HiSilicon | support removing FG1-2/2-2 and adding them as component of FG1-1/2-1  The fairness between WUS resources is import for power consumption, therefore it should be mandatory for group WUS. |
| SONY | Agree with the view of Huawei, based on power consumption / fairness arguments. Hence:  support removing FG1-2/2-2 and adding them as component of FG1-1/2-1. FG1-1 would then have to be re-named as simply “Group WUS”. |

# **[1-7] PUR serving cell RSRP TA validation and [2-4]: PUR with serving cell RSRP for TA validation**

In [1], FG1-7 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 1. LTE\_eMTC5 | [1-7] | PUR serving cell RSRP TA validation | 1. Serving cell RSRP for TA validation for PUR | 1-3 or 1-4 | Yes | N/A | PUR will not use serving cell RSRP for TA validation. | Per UE | Yes | N/A | TA validation mechanisms based on ‘Serving cell changes’ and ‘TA timer for idle mode’ (and ‘TA always valid’) are mandatory for PUR UEs.  FFS: whether to keep this feature group 1-7 separately or put it as a component of FG 1-3//1-4/1-5/1-6 | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [3] | Qualcomm | We propose to make it separate |
| [4] | Ericsson | **Proposal 4 Discuss whether there is enough reason from IODT point of view to keep PUR serving cell RSRP TA validation as a separate feature group.** |
| [5] | Huawei, HiSilicon | Proposal 2: FG 1-7 (Serving cell RSRP for TA validation) is a component of FG 1-3/1-4/1-5/1-6. |

In [1], FG2-4 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 2. NB\_IOTenh3 | [2-4] | PUR with serving cell RSRP for TA validation |  | 2-3 | Yes | N/A | PUR will not use serving cell RSRP for TA validation | Per UE | FDD only | N/A | RAN2 has agreed that PUR with UP and CP solutions have separate indications, but this is not captured in this RAN1 UE feature list.  TA validation mechanisms based on ‘Serving cell changes’, ‘TA timer for idle mode’ and ‘TA always valid’ are mandatory for PUR UEs  FFS: whether to keep this feature group 2-4 separately or put it as a component of FG 2-3 | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [7] | Qualcomm | Remove brackets for FG2-4 and Keep FG2-3/2-4 as separate FGs. |
| [8] | Ericsson | **Proposal 2 Discuss whether there is reason from IODT point of view to keep PUR with serving cell RSRP for TA validation as a separate feature group.** |
| [9] | Huawei, HiSilicon | Proposal 2: FG 2-4 (PUR with serving cell RSRP for TA validation) is a component to FG 2-3. |

## 3.1 Discussion 2

**Companies are encouraged to provide views on whether the bracket for FG1-7/2-4 are removed or FG1-7/2-4 are removed.**

**Keeping the FG1-7/2-4 (removing brackets) supported by: Ericsson, Qualcomm**

**Objected (i.e., support removing FG1-7/2-4 and adding them as component of FG1-3/4/5/6 and 2-3) by:**

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Keep 1-7/2-4 (removing brackets). |
| Qualcomm | Keep 1-7/2-4 |
| ZTE,Sanechips | Keep 1-7/2-4 |
| Huawei, HiSilicon | support removing FG1-7/2-4 and adding them as component of FG1-3/4/5/6 and 2-3  Without serving cell RSRP for TA validation, it would not be accurate enough for UE to validate TA. With the inaccurate TA, there will be uplink interference which result in waste of uplink resources and additional UE power consumption. |
| SONY | Agree with view of HW. Serving cell RSRP validation is required for TA validation and hence FG1-7 needs to be a component of FG1-3/4/5/6. Similarly for FG2-4 with respect to FG2-3. Hence:  support removing FG1-7/2-4 and adding them as component of FG1-3/4/5/6 and 2-3 |

# **1-9: PUR L1 ACK and 2-5: PUR with L1 ACK**

In [1], FG1-9 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 1. LTE\_eMTC5 | 1-9 | PUR L1 ACK | 1. L1 ACK for PUR | 1-3 or 1-4 | Yes | N/A | PUR will not use L1 ACK. | Per UE | Yes | N/A |  | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [5] | Huawei, HiSilicon | Proposal 3: FG 1-9 (L1 ACK) is a component of FG 1-3/1-4/1-5/1-6. |

In [1], FG2-5 is captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 2. NB\_IOTenh3 | 2-5 | PUR with L1 ACK |  | 2-3 | Yes | N/A | PUR will not use L1 ACK | Per UE | FDD only | N/A | RAN2 has agreed that PUR with UP and CP solutions have separate indications, but this is not captured in this RAN1 UE feature list. | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [9] | Huawei, HiSilicon | Proposal 3: FG 2-5 (PUR with L1 ACK) is a component of FG 2-3. |

## 4.1 Discussion 3

**Companies are encouraged to provide views on whether FG1-9/2-5 are kept or FG1-9/2-5 are removed.**

**Keeping the FG1-9/2-5 supported by: Ericsson, Qualcomm**

**Objected (i.e., support removing FG1-9/2-5 and adding them as component of FG1-3/4/5/6 and 2-3) by:**

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Keep 1-9/2-5 (removing brackets). |
| Qualcomm | Keep 1-9/2-5 |
| ZTE,Sanechips | FG 2-5 is a component of FG 2-3 |
| Huawei, HiSilicon | support removing FG1-9/2-5 and adding them as component of FG1-3/4/5/6 and 2-3 |
|  |  |

# **1-23 to 1-26: Subframe/slot/symbol-level resource reservation and 2-12 and 2-13: Subframe/slot/symbol-level resource reservation**

In [1], FG1-23 to FG1-26 are captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 1. LTE\_eMTC5 | 1-23 | Resource reservation for DL in CemodeA | 1. Subframe/slot/symbol-level time-domain resource reservation in DL in CemodeA  2. RBG-level frequency-domain resource reservation in DL in CemodeA | CemodeA | Yes | N/A | Whole DL subframe(s) may need to be configured as invalid in order to avoid NR collision. | Per UE | Yes | N/A | FFS: Whether to have separate indications for subframe/slot/symbol levels | Optional with capability signalling |
| 1-24 | Resource reservation for DL in CemodeB | 1. Subframe/slot/symbol-level time-domain resource reservation in DL in CemodeB  2. RBG-level frequency-domain resource reservation in DL in CemodeB | CemodeB | Yes | N/A | Whole DL subframe(s) may need to be configured as invalid in order to avoid NR collision. | Per UE | Yes | N/A | FFS: Whether to have separate indications for subframe/slot/symbol levels | Optional with capability signalling |
| 1-25 | Resource reservation for UL in CemodeA | 1. Subframe/slot/symbol-level time-domain resource reservation in UL in CemodeA | CemodeA | Yes | N/A | Whole UL subframe(s) may need to be configured as invalid in order to avoid NR collision. | Per UE | Yes | N/A | FFS: Whether to have separate indications for subframe/slot/symbol levels | Optional with capability signalling |
| 1-26 | Resource reservation for UL in CemodeB | 1. Subframe/slot/symbol-level time-domain resource reservation in UL in CemodeB | CemodeB | Yes | N/A | Whole UL subframe(s) may need to be configured as invalid in order to avoid NR collision. | Per UE | Yes | N/A | FFS: Whether to have separate indications for subframe/slot/symbol levels | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [2] | ZTE | ***Proposal 2: The capability signalling can be used to indicate support for slot/symbol level granularity in Rel-16 MTC enhancement. For subframe level, legacy indication can be used.*** |
| [4] | Ericsson | **Proposal 7 Introduce two separate indications for DL resource reservation in CE mode A with subframe-level and slot-/symbol-level granularity, respectively.**  **Proposal 8 Introduce two separate indications for DL resource reservation in CE mode B with subframe-level and slot-/symbol-level granularity, respectively.**  **Proposal 9 Introduce two separate indications for UL resource reservation in CE mode A with subframe-level and slot-/symbol-level granularity, respectively.**  **Proposal 10 Introduce two separate indications for UL resource reservation in CE mode B with subframe-level and slot-/symbol-level granularity, respectively.** |
| [5] | Huawei, HiSilicon | **Proposal 5：Separate indication to slot/symbol level resource reservation in feature groups from 1-23 to 1-26 is not supported.** |
| [3] | Qualcomm | We propose to have separate indication (for 1-23 to 26) |

In [1], FG12 and FG2-13 are captured as below.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 2. NB\_IOTenh3 | 2-12 | Resource reservation  DL resource reservation with subframe-level, slot-level and symbol-level granularity of NB-IoT non-anchor carriers. |  |  | Yes | N/A | NB-IoT transmission may collide with NR transmission | Per UE | Yes | N/A | FFS: Whether to introduce separate indications for subframe/slot/symbol levels | Optional with capability signalling |
| 2-13 | Resource reservation  UL resource reservation with subframe-level, slot-level and symbol(s)-level granularity of NB-IoT non-anchor carriers. |  |  | Yes | N/A | NB-IoT transmission may collide with NR transmission | Per UE | Yes | N/A | FFS: Whether to introduce separate indications for subframe/slot/symbol levels | Optional with capability signalling |

Following feedbacks are provided in contributions for the RAN1#100bis-e meeting.

|  |  |  |
| --- | --- | --- |
| [6] | ZTE | ***Proposal 2: For Rel-16 NB-IoT enhancement, one indication for symbol-level/slot level and another separate indication for subframe level should be used for DL/UL resource reservation.*** |
| [7] | Qualcomm | We would like to have separate indications for all resource reservation FG. |
| [8] | Ericsson | **Proposal 3 Introduce two separate indications for DL resource reservation with subframe-level and slot-/symbol-level granularity, respectively.**  **Proposal 4 Introduce two separate indications for UL resource reservation with subframe-level and slot-/symbol-level granularity, respectively.** |
| [9] | Huawei, HiSilicon | **Proposal 4：Separate indication to slot/symbol level resource reservation is not supported in feature groups 2-12 and 2-13.** |

## 5.1 Discussion 4

**Companies are encouraged to provide views on whether or not to introduce separate FGs for slot/symbol level resource reservation for FG1-23 to 1-26 and FG2-12/13.**

**Introducing separate FGs supported by: Ericsson, Qualcomm**

**Objected (i.e., not introducing separate FGs) by:**

|  |  |
| --- | --- |
| Company | Comment |
| Ericsson | Introduce separate FGs for subframe level and slot/symbol level (but keep the same FG for slot level and symbol level). |
| Qualcomm | We would like to have separate FG for slot/symbol/subframe, but we could accept Ericsson’s proposal as a compromise. |
| ZTE,Sanechips | Same FG for slot level and symbol level. For subframe level, legacy indication signaling can be used. |
| Ericsson 2 | Regarding the ZTE/Sanechips comment above, probably “legacy indication signaling” refers to the Rel-13 valid/invalid subframe configuration, but it should be noted that although there are similarities, the Rel-13 valid/invalid subframe configuration and the Rel-16 subframe resource reservation are different features with different configuration parameters, so it cannot be assumed that a UE that implements one of them correctly also implements the other one correctly. |
| Qualcomm 2 | To add to Ericsson’s comment, we don’t think legacy subframe-level reservation has any capability (so, essentially if we follow ZTE’s proposal, this feature would be mandatory without capability signaling, which is not desirable) |
| Huawei, HiSilicon | We support to have one FG for subframe/slot/symbol.  We can accept to have one single separate FG for slot/symbol, while the subframe FG is the prerequisite FG. |
| SONY | We are OK with separate FGs for subframe level and slot / symbol level (as per Ericsson), or the even more granular proposal from Qualcomm.  Taking the Ericsson approach and using FG1-23 as an example, we understand that Ericsson propose to have:   |  |  |  | | --- | --- | --- | | 1-23a | Subframe level resource reservation for DL in CEmodeA | 1. Subframe-level time-domain resource reservation in DL in CEmodeA  2. RBG-level frequency-domain resource reservation in DL in CEmodeA | | 1-23b | Slot/symbol level resource reservation for DL in CEmodeA | 1. Slot/symbol-level time-domain resource reservation in DL in CEmodeA  2. RBG-level frequency-domain resource reservation in DL in CEmodeA |   If the above is not Ericsson’s proposal, could they please clarify? |
| Ericsson 3 | Regarding the Sony comment above: Yes, the example reflects our proposal well. |

# **Conclusion**

TBD

# **References**

[1] R1-2001485 RAN1 UE features list for Rel-16 LTE after RAN1#100-E Moderator (AT&T, NTT DOCOMO, INC.)

[2] R1-2001857 Discussion on UE features for additional MTC enhancements ZTE

[3] R1-2002181 UE features for eMTC Qualcomm Incorporated

[4] R1-2002510 On the RAN1 UE feature list for Rel-16 LTE-MTC Ericsson

[5] R1-2002604 Rel-16 UE features for LTE-MTC Huawei, HiSilicon

[6] R1-2001858 Discussion on UE features for additional enhancements for NB-IoT ZTE

[7] R1-2002182 UE features for NB-IoT　 Qualcomm Incorporated

[8] R1-2002511 On the RAN1 UE feature list for Rel-16 NB-IoT　 Ericsson

[9] R1-2002605 Rel-16 UE features for NB-IoT　 Huawei, HiSilicon