3GPP TSG-RAN WG1 Meeting #101-e R1-20xxxxx

e-Meeting, May 25th – June 5th, 2020

Agenda Item: 6.2.1.4

Source: Moderator (Ericsson)

Title: Feature lead summary for NR coexistence performance improvements for LTE-MTC

Document for: Discussion, Decision

# Introduction

This document provides a summary of the issues raised in contributions [1][2][3].

# Issue #1: Resource reservation in special subframes

According to 36.211 clauses 6.4.1 and 6.8B.5, the UE shall not expect PDSCH or MPDCCH in a subframe if it is not a BL/CE DL subframe. Furthermore, according to the 36.213 CR endorsed by RAN1#100bis-e in [4], the set of BL/CE DL subframes only includes downlink subframes, not special subframes for TDD. As a result, PDSCH and MPDCCH can no longer be transmitted in a special subframe even if it is unreserved and thus potentially available for transmission of MPDCCH or PDSCH.

ZTE/Sanechips contribution [1] provides the following 36.213 TP which considers that special subframe may not be available for transmission in all special subframe configurations. For more detailed discussion, see [1].

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| 7.1 UE procedure for receiving the physical downlink shared channel  **<Unchanged parts are omitted>**  For BL/CE UEs, the set of BL/CE DL subframes is indicated as follows  - If higher layer parameter *ce-reserved-resource-DL-freq* or *ce-reserved-resource-DL-time* is configured,  - for PDSCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space including PDSCH transmission without a corresponding MPDCCH,  - if the Resource reservation field in the DCI is set to 0, then the set of BL/CE DL subframes corresponds to all downlink subframes or special subframes during the PDSCH transmission;  - if the Resource reservation field in the DCI is set to 1, then the set of BL/CE DL subframes corresponds to all downlink subframes or special subframes that are not fully reserved according to higher layer parameters (a subframe is considered fully reserved if and only if all OFDM symbols of all PRBs of the PDSCH transmission are reserved in the subframe);  - for MPDCCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,  - the set of BL/CE DL subframes corresponds to all downlink subframes or available special subframes that are not fully reserved according to higher layer parameters (a subframe is considered fully reserved if and only if all OFDM symbols of all PRBs of the MPDCCH transmission are reserved in the subframe).  - In all other cases, the set of BL/CE DL subframes is indicated by the higher layers according to *fdd-DownlinkOrTddSubframeBitmapBR* [11].  **<Unchanged parts are omitted>** |

1. Consider the above 36.213 TP on resource reservation in special subframes.

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| **Company** | **Comments on Proposal 1** |
| ZTE | We think there is a need to clarify special subframe case for BL/CE DL subframe definition. |
| Ericsson | We are fine to treat this issue in the email discussion. |
| Nokia, NSB | We are fine to discuss this issue |
| Qualcomm | We are fine to discuss this issue in the email discussion |
| Huawei, HiSilicon | We are fine to discuss this issue. |
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# Issue #2: References to higher-layer parameters

Huawei/HiSilicon contribution [2] points out that the references in 36.211/212/213 to higher-layer parameters for resource reservation are not aligned with how these parameters are captured in 36.331. In the latest endorsed 36.331 CR [5], the framework of resource reservation has been captured as below.

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| – *ResourceReservationConfig* The IE *ResourceReservationConfig* is used to specify the resource reservation, e.g. for coexistence with NR.  *ResourceReservationConfig* information element  -- ASN1START  ResourceReservationConfigDL-r16 ::= SEQUENCE {  periodicityStartPos-r16 PeriodicityStartPos-r16,  resourceReservationFreq-r16 CHOICE {  rbg-Bitmap1dot4 BIT STRING (SIZE (6)),  rbg-Bitmap3 BIT STRING (SIZE (8)),  rbg-Bitmap5 BIT STRING (SIZE (13)),  rbg-Bitmap10 BIT STRING (SIZE (17)),  rbg-Bitmap15 BIT STRING (SIZE (19)),  rbg-Bitmap20 BIT STRING (SIZE (25))  },  slotBitmap-r16 CHOICE {  slotPattern10ms BIT STRING (SIZE (20)),  slotPattern40ms BIT STRING (SIZE (80))  },  symbolBitmap1-r16 BIT STRING (SIZE (7)) OPTIONAL, -- Cond Bitmap1  symbolBitmap2-r16 BIT STRING (SIZE (7)) OPTIONAL, -- Cond Bitmap2  ...  }  ResourceReservationConfigUL-r16 ::= SEQUENCE {  periodicityStartPos-r16 PeriodicityStartPos-r16,  slotBitmap-r16 CHOICE {  slotPattern10ms BIT STRING (SIZE (20)),  slotPattern40ms BIT STRING (SIZE (80))  } OPTIONAL, -- Cond FDDandTDDnoDL  symbolBitmap1-r16 BIT STRING (SIZE (7)) OPTIONAL, -- Cond Bitmap1  symbolBitmap2-r16 BIT STRING (SIZE (7)) OPTIONAL, -- Cond Bitmap2  ...  }  PeriodicityStartPos-r16 ::= CHOICE {  periodicity10ms NULL,  periodicity20ms INTEGER(0..1),  periodicity40ms INTEGER(0..3),  periodicity80ms INTEGER(0..7),  periodicity160ms INTEGER(0..15),  spare3 NULL, spare2 NULL, spare1 NULL  }  -- ASN1STOP     | *ResourceReservationConfig* field descriptions | | --- | | ***periodicityStartPos***  Indicates periodicity and start offset of of the reserved resources. Value set to *periodicity10ms* corresponds to periodicity 10 milliseconds and corresponding start position is 0, value set to *periodicity20ms* corresponds to periodicity 20 milliseconds and corresponding start position in milliseconds = indicated value \* 10ms, and so on. | | ***resourceReservationFreq***  Downlink frequency domain resource reservation bitmap where each bit corresponds to a resource block group (RBG), see TS 36.213 [23]. Value *rbg-Bitmap1dot4* corresponds to 1.4 MHz system bandwidth, value *rbg-Bitmap3* corresponds to 3 MHz system bandwidth, and so on. | | ***slotBitmap***  Slot-level resource reservation configuration. Value *slotPattern10ms* corresponds to 10ms slot pattern and *slotPattern40ms* corresponds to 40ms slot pattern, see TS 36.213 [23] for DL and TS 36.211 [21] for UL.  The first/leftmost 2-bits corresponds to the subframe #0 of the radio frame satisfying SFN mod periodicity = start position, as indicated by *periopdicityStartPos*. Two bits for each subframe coded as:  00: both slots are not reserved  01: the first slot is not reserved, the second slot is reserved  10: the first slot is reserved, the second slot is not reserved  11: both slots are reserved.  If the field is not included in UL configuration, the value of the field from DL configuration applies. | | ***symbolBitmap1, symbolBitmap2***  Provides the symbol-level resource reservation for one subframe. If *symbolBitmap1* is absent, value '01' in the *slotBitmap* corresponds to the whole 2nd slot being reserved. If *symbolBitmap2* is absent, value '10' in the *slotBitmap* corresponds to the whole 1st slot being reserved. |      | Conditional presence | Explanation | | | --- | --- | --- | | *Bitmap1* | The field is optionally present, need OR, if value of *slotBitmap* corresponding to at least one subrame is '01'; otherwise the field is not present. | | *Bitmap2* | The field is optionally present, need OR, if value of *slotBitmap* corresponding to at least one subrame is '10'; otherwise the field is not present. | | *FDDandTDDnoDL* | The field is mandatory present for TDD when resource reservation for DL is not configured, and for FDD; otherwise the field is optionally present, need OP. | |

It is the feature lead’s understanding that RAN1’s intention has been that it should be possible to configure the frequency-domain resource reservation without the time-domain parameters and vice versa, but it is seems to be some unclear from the earlier RAN1 agreements [6] and the L1 parameter list [7], and apparently RAN2 has chosen to make both the frequency-domain configuration (resourceReservationFreq) and the time-domain configuration (slotConfig) mandatory present in the parameter structure (NR-ResourceReservationConfig).

1. Discuss whether one or both of the parameters for frequency-domain and time-domain resource reservation ought to be optionally present rather than mandatory present.

* If the answer is yes, RAN1 may need to send a LS to RAN2 to request that one or both parameters are changed from mandatory present to optionally present.
* In any case, corrections of the references in 36.211/212/213 may be needed, where the TPs in [2] can be used as a starting point.

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| **Company** | **Comments on Proposal 2** |
| ZTE | From our understanding, both of the frequency-domain parameters and time-domain parameters ought to be mandatory if DL resource reservation is configured.  Regarding the corrections of the parameter name, since other topics also have parameter name misalignment issues, we are not sure if such issues would be resolved case by case, or they can be handled together. |
| Ericsson | We are fine to treat this issue in the email discussion.  Our understanding has been that it should be possible to configure the time-domain and frequency-domain resource reservation separately. In the RAN1 UE feature list, they are listed as separate components of a feature group. So, if there are no issues, we would prefer to ensure that at least the frequency-domain resource reservation parameter is optionally present, while the time-domain resource reservation parameter can either be mandatory or optionally present. Then the time-domain resource reservation can be configured without having to provide the frequency-domain bitmap if it is not needed. |
| Nokia, NSB | We are fine to discuss this issue  We share similar view as Ericsson that frequency domain resource reservation is optionally present as in some cases it is not needed. |
| Qualcomm | We are fine to discuss this issue in the email discussion.  Per our understanding, time domain resource reservation can be separately configured for UL and DL. Therefore, the time domain resource reservation parameter is optionally present, at least in one of the directions. Similarly, frequency domain resource reservation is also optional. |
| Huawei, HiSilicon | We are fine to discuss this issue regarding misalignment between RAN1/2 specs. However, which one is optional/mandatory and what UE should consider if one is not present is the signaling optimization issue to us, which has been resolved in last meeting LS to RAN2. To not be involved in RAN2 signaling design, RAN1 can use higher layer parameters ResourceReservationConfigDL or ResourceReservationConfigUL instead of specific parameters within them. |
| FUTUREWEI | RAN2 took what we gave and came up with what seems to be reasonable signaling, as they are supposed to do. This does not appear to be a critical issue, and not worth taking our time or troubling RAN2 given we are all so busy. If everyone else is keen to spend time discussing then you can include it, but it should be rewritten to see if there is a *critical* issue with current RAN2 signaling where both freq and time are mandatory present. |

# Issue #3: Resource reservation for DL DMRS

RAN1#100bis-e discussed DL DMRS handling for Rel-16 LTE-MTC resource reservation in the email discussion “[100b-e-LTE-eMTC5-Coex-NR-01]”. For more background information, see “Issue #3” in the email discussion summary in [8]. Ericsson contribution [3] presents the following 36.211 TP.

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| ***Reason for change:*** | RAN1#99 made the following agreement for Rel-16 LTE-MTC which needs to be captured in the specification:   * In DL frequency-domain and DL time-domain resource reservation, DMRS REs can be reserved if and only if all other non-CRS REs in the same slot and PRB are also reserved. |
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| ***Summary of change:*** | The agreement is implemented in the specification. |
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| ***Consequences if not approved:*** | Resource reservation may be incorrectly implemented for DL DMRS. |
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| ***Clauses affected:*** | 6.10.3.2, 6.10.3A.2 |

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| 6.10.3.2 Mapping to resource elements  **<Unchanged parts are omitted>**  For BL/CE UEs, if higher layer parameter *ce-reserved-resource-DL-freq* or *ce-reserved-resource-DL-time* is configured, and the Resource reservation field in the DCI is set to 1, then in case of PDSCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,  - If and only if all OFDM symbols in a PRB are reserved, the demodulation reference signal transmission in that PRB is dropped.  **<Unchanged parts are omitted>**  6.10.3A.2 Mapping to resource elements  **<Unchanged parts are omitted>**  For BL/CE UEs, if higher layer parameter *ce-reserved-resource-DL-freq* or *ce-reserved-resource-DL-time* is configured, then in case of MPDCCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,  - If and only if all OFDM symbols in a PRB are reserved, the demodulation reference signal transmission in that PRB is dropped.  **<Unchanged parts are omitted>** |

1. Consider the above 36.211 TP on resource reservation for DL DMRS.

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| **Company** | **Comments on Proposal 3** |
| ZTE | We think this change is not necessary. But we are fine if other companies think it is beneficial. |
| Ericsson | We are fine to treat this issue in the email discussion. |
| Nokia, NSB | We are fine to discuss this issue |
| Qualcomm | We think it is needed to clarify on this. The current spec is not clear whether DMRS is reserved and dropped in a partially reserved subframe. We are fine to further discuss and optimize the TP. For example, instead of adding “and only if”, we can add “otherwise, UE does not assume the demodulation reference signal in that PRB is dropped” in the end of that sentence. |
| Huawei, HiSilicon | We don’t think the change is necessary. If there’s other place in the spec to drop the DMRS in the slot, it can be considered to be corrected. |
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# References

1. [R1-2003793](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2003793.zip), “Remaining issues on LTE-MTC resource reservation”, ZTE

1. [R1-2004165](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004165.zip), “Corrections on eMTC co-existence with NR”, Huawei, HiSilicon

1. [R1-2004657](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_101-e/Docs/R1-2004657.zip), “TP for 36.211 on DL DMRS handling for LTE-MTC resource reservation”, Ericsson

1. [R1-2003157](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2003157.zip), 36.213 CR1333 (Rel-16, F) “Corrections to Additional MTC Enhancements for LTE”

1. [R2-2003923](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109bis-e/Docs/R2-2003923.zip), 36.331 CR4239r1 (Rel-16, F) “Miscellaneous Rel-16 eMTC corrections”

1. [R1-1913594](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_99/Docs/R1-1913594.zip), “RAN1 agreements for Rel-16 Additional MTC Enhancements for LTE”

1. [R1-2003189](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2003189.zip), “Cleaned consolidated parameter list for Rel-16 LTE”

1. [R1-2002797](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002797.zip), “Feature lead summary #2 for NR coexistence performance improvements for LTE-MTC”