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** |
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# Issue #2: References to higher-layer parameters

In 36.331, the framework of resource reservation has been captured as below:

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| -- ASN1START  NR-ResourceReservationConfig-r16 ::= SEQUENCE {  periodicity-r16 ENUMERATED {ms10, ms20, ms40, ms80, ms160} OPTIONAL,  startPosition-r16 INTEGER (0..15) OPTIONAL,  resourceReservationFreq-r16 CHOICE {  rbg-bw1dot4MHz BIT STRING (SIZE (6)),  rbg-bw3MHz BIT STRING (SIZE (8)),  rbg-bw5MHz BIT STRING (SIZE (13)),  rbg-bw10MHz BIT STRING (SIZE (17)),  rbg-bw15MHz BIT STRING (SIZE (19)),  rbg-bw20MHz BIT STRING (SIZE (25))  } OPTIONAL, -- Cond DL  slotConfig-r16 SEQUENCE {  slotBitmap-r16 CHOICE {  slotPattern10ms BIT STRING (SIZE (20)),  slotPattern40ms BIT STRING (SIZE (80))  } OPTIONAL, -- Cond FDD-OR-TDD-DL  symbolBitmap1-r16 BIT STRING (SIZE (7)) OPTIONAL,  symbolBitmap2-r16 BIT STRING (SIZE (7)) OPTIONAL  } OPTIONAL,  ...  }  -- ASN1STOP   | Conditional presence | Explanation | | --- | --- | | *DL* | The field is mandatory present if *NR-ResourceReservationConfig* configures downlink parameters; otherwise the field is not present. | | *FDD-OR-TDD-DL* | The field is mandatory present for FDD and mandatory present for TDD downlink; otherwise the field is not present. | |

The references in 36.211/212/213 to higher-layer parameters are not aligned with the above, and therefore Huawei/HiSilicon contribution [2] provides the following text proposals to remove any potential ambiguity.

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| ==============================Start of text proposal to 36.211=======================  6.4.1 Physical downlink shared channel for BL/CE UEs  **<Unchanged parts are omitted>**  For BL/CE UEs, if the PDSCH is not carrying SIB1-BR the PRB resources for PDSCH transmission in the first subframe are obtained from the DCI as described in clauses 5.3.3.1.12, 5.3.3.1.13, and 5.5.1.3.14 in [3], or provided by higher layers. Each of the PDSCH codewords is transmitted with  repetitions, where is the number of transport blocks defined in clause 7.1.11 of 3GPP TS 36.213 [4]. The PDSCH transmission spans consecutive subframes, including subframes that are not BL/CE DL subframes where the the PDSCH transmission is postponed.   * If higher layer parameter *resourceReservationFreq* 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,   - In a subframe that is fully reserved as defined in clause 7.1 in [4], the PDSCH transmission is postponed until the next BL/CE downlink subframe that is not fully reserved.  - In a subframe that is partially reserved, the reserved resource elements shall be counted in the PDSCH mapping but not used for transmission of the PDSCH.  **<Unchanged parts are omitted>**  6.8B.5 Mapping to resource elements  **<Unchanged parts are omitted>**   * - The narrowband  for MPDCCH transmission in the first subframe of MPDCCH search space is provided by higher layers. Starting subframe configuration of a search space where UE monitors an MPDCCH is also provided by higher layers. The MPDCCH search space uses  subframes, spanning  consecutive subframes, including subframes that are not BL/CE DL subframes where the MPDCCH transmission is postponed.   - If higher layer parameter *resourceReservationFreq* is configured, then in case of MPDCCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,  - In a subframe that is fully reserved as defined in clause 7.1 in [4], the MPDCCH transmission is postponed until the next BL/CE downlink subframe that is not fully reserved.  - In a subframe that is partially reserved, the reserved resource elements shall be counted in the MPDCCH mapping but not used for transmission of the MPDCCH.  **<Unchanged parts are omitted>**  6.10.3A.2 Mapping to resource elements  **<Unchanged parts are omitted>**  For BL/CE UEs, if higher layer parameter *resourceReservationFreq* is configured, then in case of MPDCCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,   * - If all OFDM symbols in a PRB are reserved, the demodulation reference signal transmission in that PRB is dropped.   ==============================End of text proposal to 36.211=======================  ==============================Start of text proposal to 36.212======================= 5.3.3.1.12 Format 6-1A **<Unchanged parts are omitted>**  - Resource reservation – 1 bit as defined in clause 7.1 of [3]. This field is only present if higher layer parameter *resourceReservationFreq* is configured and the DCI is mapped onto the UE-specific search space given by C-RNTI as defined in [3].  **<Unchanged parts are omitted>**  5.3.3.1.13 Format 6-1B  **<Unchanged parts are omitted>**  - Resource reservation – 1 bit as defined in clause 7.1 of [3]. This field is only present if higher layer parameter *resourceReservationFreq* is configured and the DCI is mapped onto the UE-specific search space given by C-RNTI as defined in [3].  ==============================End of text proposal to 36.212=======================  ==============================End of text proposal to 36.213=======================  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 *resourceReservationFreq* is configured,  - for PDSCH transmission associated with C-RNTI or SPS C-RNTI using UE-specific MPDCCH search space,  - 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 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 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 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].  ==============================End of text proposal to 36.213======================= |

It seems somewhat unclear from the earlier RAN1 agreements [5] and the L1 parameter list [6] which one of the frequency-domain configuration and the time-domain configuration that is the more fundamental one, but apparently RAN2 has chosen to make the frequency-domain configuration (resourceReservationFreq) mandatory present and the time-domain configuration (slotConfig) optionally present in the parameter structure (NR-ResourceReservationConfig).

1. Discuss whether the frequency-domain or the time-domain configuration ought to be the one that is mandatory present in the resource reservation configuration.

* If the answer is that the frequency-domain configuration should be mandatory present, RAN1 should consider the above 36.211/212/213 TPs.
* If the answer is that the time-domain configuration should be mandatory present, RAN1 should consider requesting RAN2 to moves the ‘Cond DL’ condition tag from ‘resourceReservationFreq’ to ‘slotConfig’, and RAN1 should also consider correspondingly modified versions of the above 36.211/212/213 TPs.

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| **Company** | **Comments on Proposal 2** |
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# 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 [7]. 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** |
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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. [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”