**3GPP TSG-RAN WG4 Meeting # 97-e R4-200XXXX**

**Electronic Meeting, 2 – 13 Nov., 2020**

**Agenda item:** 7.5.1

**Source:** Moderator (Ericsson)

**Title:** Email discussion summary for [97e][110] LTE\_NR\_DC\_CA\_enh\_RF

**Document for:** Information

# Introduction

This email discussion concerns three topics

1. Maintenance for 38.101-3 and 38.307 (EN-DC and NR-DC)
2. RAN2 LS on cell grouping for synchronous NR-DC
3. New UE capabilities (FG): ‘Only switched-UL’ capability for roaming UE and a modified FG [2-20]

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round:
	1. decide which of the CR to pursue
	2. agreement on a what to reply to RAN2
	3. decision on introduction of proposed UE capabilities
* 2nd round: TBA

# Topic #1: Maintenance for 38.101-3 and 38.307

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014958 | ZTE Corp. | CR to TS 38.101-3 on intra-band contiguous EN-DC BW class (Rel-16)CR 38.101-3 Cat-FSummary of change:1. Add intra-band contiguous EN-DC bandwidth class “AB” to Table 5.3B-1.
2. Editorial correction to table number of Table 5.3B-1.
3. Remove the note for uplink EN-DC configuration for DC\_(n)41AA and DC\_41A\_n41A in Table 5.3B.1.2-1.
 |
| R4-2015036 | ZTE Corp. | CR to TS 38.307 on the definition of the duplex-mode for the band configurationsCR 38.307 Cat-FSummary of change:By using the similar method of TS36.307, the NOTE for each ‘duplex-mode’ in the table is added. Also duplex mode of ‘FDD and TDD’ is added for PC3 inter-band ENDC. |
| R4-2015037 | ZTE Corp. | CR to TS 38.307 on the definition of the duplex-mode for the band configurationsCR 38.307 Cat-A |

## Open issues summary

No open issues listed, the CRs submitted are for ‘close-to-finalize Rel-16’ work.

### Sub-topic 1-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 1-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 1-2: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

Comments in the CRs in the next sub-clause.

|  |  |
| --- | --- |
| **Company** | **Comments** |
|  |  |

### CRs/TPs comments collection

*Major close-to-finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2014958TS 38.101-3 CR 382Rel-16 Cat-F |  T-Mobile USA: This CR made me notice that the text in 5.3B is hanging paragraphs, which are not allowed in the drafting rules. Since this clause is being fixed the text should be put under 5.3B.0 General. |
| ZTE2: Thanks for pointing out the issue of hanging paragraphs. The revision is as below.<https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_97_e/Inbox/Drafts/%5B97e%5D%5B110%5D%20LTE_NR_DC_CA_enh_RF/R4-2014958-r1.docx>ZTE3: In addition, does it also need to correct the issue of hanging paragraphs from Rel-15? If so, a new Tdoc number is needed? |
|  |
| R4-2015036TS 38.307 CR 37Rel-15 Cat-F | Company A |
| Company B |
| Intel: For intra-band cases, the note is not needed. There is no ambiguity.Huawei: This agenda and WI code “LTE\_NR\_DC\_CA\_enh-Core” is for Rel-16. However, this CR is for Rel-15 and it’s based on the current version “15.6.0”. Not sure whether this CR can be postponed based on the CR quality control announced by Chairman.The indication for duplex mode is unnecessary for the band combinations with mixing duplex mode, since RAN4 never discuss the requirements or capabilities based mixing duplex mode for the band combination. We may still lost the mixing duplex mode, such as “SDL and FDD” for inter-band CA. If so, there is no need to add these notes. |
| R4-2015037TS 38.307 CR 38Rel-16 Cat-A | Company A |
| Company B |
| Intel: For intra-band cases, the note is not needed. There is no ambiguity. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: RAN2 LS on cell grouping for synchronous NR-DC

RAN4 has received an LS from RAN2 on UE cell-grouping capability for synchronous NR-DC asking for RAN4 input. What to reply?

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2014229 | Apple | On cell-grouping UE capability for synchronous NR-DC**Observation 1: it is beneficial to introduce cell grouping UE capability for synchronous NR-DC.****Observation 2: having differentiation between MCG and SCG for cell grouping UE capability can give UE more flexibility.****Proposal 1: To reply RAN2 that RAN4 sees benefit to introduce cell grouping UE capability for synchronous NR-DC, and the need of differentiation between MCG and SCG.** |
| R4-2014230 | Apple | Draft Reply LSOverall description:RAN4 has discussed this issue in RAN4#97e and determined the following:* Inter-band NR-DC configurations with three or more bands, including at least one FR2 band, are already defined in the Rel-16 version of TS38.101-3, with more configurations requested as part of the Rel-17 work item “Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 3 bands DL with 2 bands UL” [RP-201541]
* Configurations for inter-band NR-DC with three or more bands, where all bands are within FR1, are also requested as part of the Rel-17 work item “Rel-17 NR Inter-band Carrier Aggregation/Dual Connectivity for 3 bands DL with 2 bands UL” [RP-201541]
* RAN4 considers cell grouping UE capability signaling for synchronous NR-DC beneficial in these scenarios
* RAN4 further considers that differentiation between MCG and SCG is also beneficial in the related signaling design
 |
| R4-2014486 | Qualcomm Inc. | Draft Reply LSOverall description:From the point of view of RAN4 requirements, the RF requirements are the same irrespective of how the cells are grouped. All the CCs in a cell group have to be a valid CA combination with at least one UL CC. This information should already be available at the gNB through UE CA capability signalling. |
| R4-2016151 | Ericsson | Draft Reply LSOverall description:RAN4 has discussed the reasons above and is of the opinion that it is beneficial to define cell-grouping UE capability also for synchronous NR-DC not to limit support of deployment options. However, RAN4 recognises the concern on signalling overhead should LTE style cell grouping be adopted and that this approach would increase signalling overhead significantly. RAN4 is hoping that methods for limiting the signalling overhead used for other features could be employed also for cell grouping. |

## Open issues summary

### Sub-topic 2-1 RAN4 Reply LS on cell-grouping UE capability for synchronous NR-DC

*Sub-topic description: RAN4 Reply LS.*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: Reply to RAN2**

* Proposals
	+ Option 1: in accordance with R4-2014230, “cell grouping UE capability signaling for synchronous NR-DC beneficial, […] differentiation between MCG and SCG is also beneficial in the related signaling design”,
	+ Option 2: in accordance with R4-2014486, “information should already be available at the gNB through UE CA capability signalling”
	+ Option 3: in accordance with R4-2016151, “beneficial to define cell-grouping UE capability, […] methods for limiting the signalling overhead used”
	+ Option 4: other option (specify which)
* Recommended WF
	+ TBA

### Sub-topic 2-2

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: TBA**

* Proposals
	+ Option 1: TBA
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 2-1: We are fine with a reply saying that signaling for cell grouping is beneficial so a reply based on the Ericsson or Apple’s proposals is good. We noted in our LS that other aspects such as testing is not discussed in RAN4 but considering it, signaling is very useful. |
| MTK | **Issue 2-1: Reply to RAN2**Support Option 1 and Option 3.We also think it is beneficial, especially from UE’s point of view to introduce this cell grouping to enhance the communication to network.  |
| Huawei | Support Option 1 and Option 3. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: ‘Only switched-UL’ capability and a modified FG [2-20]

A continued discussion on “only switched-UL” capability and a modified version of the tentative FG 2-20.

Note: this is also discussed under agenda 8

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2015556 | Huawei, HiSilicon | Discussion on how to support EN-DC bandcombinations for Roaming UE**Observation 1: In order to meet the global 5G roaming function, UE vendors have to implement lots of EN-DC band combinations due to the lack of global unified ENDC band combinations.****Observation 2: UE vendor or IMT industry have to pay an expensive price to the roaming experience, if UE implements all the EN-DC band combinations with dual UL Tx that is only used in the roaming scenario.****Proposal 1: UE is allowed to indicate "only single switched UL" for any EN-DC band combinations when roaming.** |
| R4-2016487 | Huawei, HiSilicon | On UE capability for distinguishing EN-DC implementation capable for different deployment scenarios***Proposal: It is proposed to introduce new UE capability for UE supporting FDD-FDD inter-band EN-DC with overlapping DL spectrum.*** |

## Open issues summary

### Sub-topic 2-1 UE capability ‘only switched-UL’ for roaming UE

*Sub-topic description: two new UE capabilities (FG)*

*Open issues and candidate options before e-meeting:*

**Issue 2-1: ‘only switched-UL’ for roaming UE**

* Proposals
	+ Option 1: allow UE indication of "only single switched UL" for any EN-DC band combinations when roaming.
	+ Option 2: do not allow this
	+ Option 3: other (specify which)
* Recommended WF
	+ TBA

### Sub-topic 2-2 UE capability ‘FDD-FDD inter-band EN-DC with overlapping DL spectrum’ (modified FG 2-20)

*Sub-topic description*

*Open issues and candidate options before e-meeting:*

**Issue 2-2: modified version of FG 2-20 ‘FDD-FDD inter-band EN-DC with overlapping DL spectrum’**

Proposals

* + Option 1: introduce capability (FG) as proposed in R4-2015556
	+ Option 2: do not introduce the proposed FG
	+ Option 2: other (specify which)
* Recommended WF
	+ TBA

### Sub-topic 2-3 UE capability ‘support co-located scenario only for inter-band EN-DC’ (now FG [2-19])

*Sub-topic description; following the RAN4 GTW November 3rd the following FG should be discussed further (previously FG [2-20])*

Further discussion will take place in email thread #110, together with the new case of overlapping DL bands.

*Open issues and candidate options before e-meeting (we continue the incorrect numbering):*

**Issue 2-3: FG [2-19] ‘support co-located scenario only for inter-band EN-DC’**

Proposals

* + Option 1: introduce capability FG [2-19]
	+ Option 2: do not introduce the proposed FG
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Sub topic 2-1: UE should be tested according to what it supports and it should conform to the requirements to those features, not what supports as secondary feature. Option 2 is our preference.Sub topic 2-2: Option 2, do not introduce this capability. The testable requirement description is missing. ….Others: |
| OPPO | **Issue 2-1: ‘only switched-UL’ for roaming UE**[OPPO] Prefer Option 1. It is understood that the high costs and testing burdens to support a large number of band combinations especially for global phone. In current RAN4 spec, the single switched UL is defined for problematic band combinations rather than from cost perspective. It make the normal band combinations be mandatory dual Tx. To reduce costs, one way is to not support certain band combination, the other might be the proposed solution, i.e. support single switched UL. Comparing the two approach, it seems interesting in the single switched UL at least it can makes higher possibility of supporting more band combinations. But the “roaming” may need more clarification on how to determine in conformance testing.**Issue 2-2: modified version of FG 2-20 ‘FDD-FDD inter-band EN-DC with overlapping DL spectrum’**[OPPO] Prefer Option 1, Feature 2-20 was discussed in last meeting but not agreed. At that time the FG is defined for whether UE supports collocated scenario. And many companies believe it is not needed. In this meeting the description changed to the way of UE to support overlapping FDD-FDD EN-DC, in this sense it might be helpful for the NW scheduling. However, it should be clear that no matter which kind of UE the current requirements both need to be met. |
| MTK | **Issue 2-2: modified version of FG 2-20 ‘FDD-FDD inter-band EN-DC with overlapping DL spectrum’**Support Option 1, which clearly indicates the scenario we are focusing (overlapped DL, e.g., in DC\_20\_n28). It is eventually up to UE’s implementation on how to support overlapped DL bands. Furthermore, introducing the capability will not add any scheduling limitation to network. Network can still try to schedule the separate-RF UE as common-RF UE. No performance degradation is expected. But with this capability signalled, it gives network additional flexibility for optimization w.r.t. separate-RF UEs. We also share the same view with OPPO that at least the current requirements can be applicable to both UEs.**Issue 2-3: FG [2-19] ‘support co-located scenario only for inter-band EN-DC’**Support Option 2.We are fine to withdraw 2-19, since 2-20 (in Issue 2-2) better addresses the issue. |
| Nokia | Sub topic 2-1: Not OK, this would mean additional functionality fron gNodeB becasue of roaming terminals as TDM patters would be needed and also gNodeB would need to track which terminal is roaming and which is not. Altenative UE do not advertise EN-DC when roaming. This is not really RAN4 issue but more RAN2/RANP matter. If UE vendor don’t want to support global EN-DC band combinations, they can omit support for those in UE capabilities when roaming – UE knows when it’s not in the HPLMN and can indicate capabilities accordingly. It’s that simple, no standardization effort or changes required.Sub topic 2-2: Option 2, do not introduce this capability. |
| Ericsson | Sub-topic 2-1: Option 2.Sub-topic 2-2: an interesting modification of the FG [2-19] (previously 2-20), now limited to EN-DC combinations with overlapping DL spectrum (bands) for which implementations with common RX branches for the CGs are viable despite their performance limitations. However, rather than imposing these limitations as general restrictions in the 38.101-3 specification for band combinations with overlapping DL bands, the proposal in R4-2016487 can be further modified to indicate UE support of non-collocated deployments for combinations like DC\_42-n77 (TDD-TDD) and DC\_20-n28 (FDD-FDD) for implementations supporting this.The proposed FG could be extended as follows:

|  |  |  |
| --- | --- | --- |
| 2-20 | [FDD-FDD or TDD-TDD inter-band EN-DC with overlapping or partially overlapping DL spectrum] | Supports FDD-FDD or TDD-TDD inter-band operation with overlapping or partially overlapping DL bands with an EN-DC MRTD according to clause 7.6 in 38.133 [i.e. MTRD < 33 us for synchronous EN-DC, the only option for TDD-TDD that is relevant here]If absent the UE supports FDD-FDD or TDD-TDD inter-band operations with overlapping or partially DL bands with MTRD < 3 us [and supports requirements for intra-band EN-DC requirements] |

This would be backwards compatible since the present requirements for DC\_42-n77, DC\_20-n28 and similar assume MTRD < 3 us and a PSD difference less than [6] dB. Legacy UEs in the field would not indicate the new capability. We remark that it is impossible for a network to ensure a received PSD < 6 dB in the field. This can only be a condition for a performance requirement but would not necessarily imply that the UE is not functional for larger differences. Hence the requirements for UEs not indicating the above FG could still be based on the existing requirements for e.g. DC\_42-n77 or DC\_20-n28.We propose that the above capability could replace the FG [2-19].Sub-topic 2-3: Option 2 (do not introduce FG [2-19] as is). |
| ZTE | Sub-topic 2-1: Option 2. Seems for the same UE, the status needs to be switched when it is roaming the gNB needs to know the additional status for this UE. Also, UE may not be tested two status, as QC’s said, UE should be tested according to what it supports and compliance to the corresponding requirements. |
| T-Mobile USA | Issue 2-1: Option 2. Issue 2-2: Option 2. Issue 2-3: Option 2.  |
| Intel | Issue 2-2: We think Ericsson modification is better. But we want to add proximity DL spectrums as well.

|  |  |  |
| --- | --- | --- |
| 2-20 | [FDD-FDD or TDD-TDD inter-band EN-DC with overlapping or partially overlapping DL spectrum or proximity DL spectrums] | Supports FDD-FDD or TDD-TDD inter-band operation with overlapping or partially overlapping DL bands or proximity DL spectrums with an EN-DC MRTD according to clause 7.6 in 38.133 [i.e. MTRD < 33 us for synchronous EN-DC, the only option for TDD-TDD that is relevant here]If absent the UE supports FDD-FDD or TDD-TDD inter-band operations with overlapping or partially DL bands with MTRD < 3 us [and supports requirements for intra-band EN-DC requirements] |

 |
| NTT DOCOMO, INC | Issue 2-1: Option 2. We have concerns on relaxing the restriction of single UL for roaming UE from the UL performance perspective, as operator.In addition, in our understanding, so far eNB and gNB cannot know which UE(s) are roaming UE(s). In that case, when a UE sets single switched UL for certain EN-DC band combination which is not allowed to do single switched UL according to TS 38.101-3, we can not know whether it is correct behavior or not.  |
| Huawei | **Issue 2-1: ‘only switched-UL’ for roaming UE**There is no doubt that it’s beneficial for IMT industry to allow UE indication of "only single switched UL" for any EN-DC band combinations when UE roaming. At the beginning, RAN4 or companies need to identify or be aware of the issue raised in the discussion paper. Then we can further discuss how to justice the “roaming” or test the band combinations. It may have an impact on the other WGs. Anyway, we have to solve this issue to benefit IMT industry.To DCM: The bottleneck of UL is UL coverage instead of UL BW. Using single UL can improve the UL output power. It may have no impact on UL performance.**Issue 2-2: modified version of FG 2-20 ‘FDD-FDD inter-band EN-DC with overlapping DL spectrum’**1) we don't think that proximity DL spectrum should be considered here, as there is no criteria to determine what is proximity spectrum2) ok to consider TDD-TDD overlapping or partially overlapping DL spectrum as well3) The capability undertakes two aspects, one is a reference for network to decide whether to configure EN-DC based on UE implementation capability as well as the deployment scenario; the other one is for the measurement purpose, i.e. the requirements shall be met under certain conditions based on UE implementationsTherefore, two types of UE are appropriate to fulfil these two purposes. Some changes with taken suggestions from Ericsson:

|  |  |  |
| --- | --- | --- |
| 2-20 | [FDD-FDD or TDD-TDD inter-band EN-DC with overlapping or partially overlapping DL spectrum DL spectrum] | Indicates UE implementation architectures and the applicable requirements. candidate values set: {type1, type2}type 1 UE: common Rx chain, the minimum requirements apply for DL carriers with maximum power spectral density imbalance of [6] dB and MRTD=3us type 2 UE: separate Rx chains, the minimum requirements apply for DL carriers with MRTD=0.5 slot |

**Issue 2-3: FG [2-19] ‘support co-located scenario only for inter-band EN-DC’**This capability can be covered by modified version of FG 2-20 in issue 2-2. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary**  |
| **Sub-topic#1** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |