3GPP TSG-RAN WG2 Meeting #116bis-e R2-22xxxxx

Electronic, January 17 – January 25, 2022

Agenda item: 8.24.1

Source: Apple

Title: Summary of [AT116bis-e][038][NR17] FR2 UL Gap (Apple)

Document for: Discussion

# 1 Introduction

This is the summary of following email discussion.

* [AT116bis-e][038][NR17] FR2 UL Gap (Apple)

 Scope: Treat R2-2200122, R2-2201105. Aim to clarify what is needed in R2, determine agreeable parts, open points, pave the way for online disc.

 Intended outcome: Report

 Deadline: CB online Mon W2.

[1] R2-2200122 LS on UL gap in FR2 RF enhancement (R4-2120058; contact: Apple) RAN4 LS in Rel-17 NR\_RF\_FR2\_req\_enh2-Core To:RAN2

[2] R2-2201105 RAN2 impact from UL gap in FR2 RF enhancement Apple discussion NR\_RF\_FR2\_req\_enh2

# 2 Contact info

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| Company Name | Contact Person | Email Address |
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# 3 Phase 1 Discussion

## 3.1 FR2 UL gap configuration in SA deployment scenario

For timing reference of FR2 UL gap, [2] presents the following, which follows legacy FR2 gap design.

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| **Proposal 3: In SA deployment scenario, for synchronous FR2 CA configuration, the SFN and subframe of any FR2 serving cell can be used in the gap calculation.****Proposal 4: In SA deployment scenario, for asynchronous FR2 CA configuration, the SFN and subframe of the serving cell on FR2 frequency indicated by the *refFR2ServCellAsyncCA* is used in the gap calculation.** |

**Question 1: In SA deployment, for timing reference in synchronous FR2 CA configuration, do companies agree that the SFN and subframe of any FR2 serving cell can be used in the gap calculation?**

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| Company | Yes/No | Comments |
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**Question 2: In SA deployment, for timing reference in asynchronous FR2 CA configuration, do companies agree to introduce *refFR2ServCellAsyncCA* in FR2 UL gap configuration?**

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| Company | Yes/No | Comments |
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## 3.2 FR2 UL gap handling in MR-DC scenario

Before RAN2 receives RAN4 reply, the moderator would like to discuss the NR-DC scenarios with and without FR2-FR2 BC separately in parallel. For NR-DC, the potential agreements yet to conclude in Section 3.2.1 and 3.2.2 are exclusive to each other. RAN2 can adopt one set of agreements once receiving RAN4 feedback.

### 3.2.1 Support on EN-DC, NE-DC, NR-DC without FR2-FR2 BC scenarios

**Topic 1: Responsible network entity on FR2 UL gap configuration**

[2] presents the following proposals. For EN-DC and NE-DC, they follow legacy FR2 gap configuration design while for NR-DC it deviates a little from legacy FR2 gap design.

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| **Proposal 8: The activated UL gap applies to all FR2 cells inside the CG with FR2 bands, thus:*** **EN-DC: FR2 UL gap is configured by SN to UE.**
* **NE-DC: FR2 UL gap is configured by MN to UE.**
* **NR-DC without FR2-FR2: Either MN or SN can configure UL gap to UE, depending on which CG is configured with FR2 bands.**
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**Question 3: Do companies agree with the responsible network entity on FR2 UL gap configuration listed below.**

**- EN-DC: SN**

**- NE-DC: MN**

**- NR-DC: The network entity whichever configures UE with FR2 bands**

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**Topic 2: MN/SN coordination on FR2 UL gap**

[2] presents the following proposal with the reason that the FR2 UL gap is restricted in one CG.

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| **Proposal 9: In EN-DC, NE-DC and NR-DC without FR2-FR2 BC, there is no need to coordinate UL gap configuration between MN and SN.** |

**Question 4: Do companies agree that in EN-DC, NE-DC and NR-DC without FR2-FR2 BC, there is no need to coordinate UL gap configuration between MN and SN?**

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| Company | Yes/No | Comments |
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**Topic 3: Timing reference of FR2 UL gap**

[2] presents the following proposal.

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| **Proposal 10: In EN-DC, NE-DC and NR-DC without FR2-FR2 BC, use FR2 serving cell inside the CG with FR2 band as timing reference for the SFN and subframe calculation in FR2 UL gap calculation.** |

**Question 5: Do companies agree that in EN-DC, NE-DC and NR-DC without FR2-FR2 BC, use FR2 serving cell inside the CG with FR2 band as timing reference for the SFN and subframe calculation in FR2 UL gap calculation?**

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### 3.2.2 Support on NR-DC with FR2-FR2 BC scenarios

**Topic 1: Responsible network entity on FR2 UL gap configuration**

[2] has the following proposal, which aligns with legacy FR2 gap configuration.

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| **Proposal 11: In NR-DC with FR2-FR2 BC, FR2 UL gap is configured by MN.** |

**Question 6: Do companies agree that in NR-DC with FR2-FR2 BC, MN is responsible for FR2 UL gap configuration?**

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**Topic 2: MN/SN coordination on FR2 UL gap**

[2] explains that MN is aware of the FR2 bands configured by SN to UE from selectedBandCombination in CG-Config, thus MN has a good knowledge whether FR2 UL gap is required by SN or not. It is then proposed in [2] that in NR-DC with FR2-FR2 BC, MN informs SN the gap pattern for FR2 UL gap. But SN does not need to indicate gap request to MN.

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| **Proposal 12: In NR-DC with FR2-FR2 BC, MN informs SN the gap pattern for FR2 UL gap.** |

**Question 7: Do companies agree that in NR-DC with FR2-FR2 BC, MN informs SN the gap pattern for FR2 UL gap?**

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**Topic 3: Timing reference of FR2 UL gap**

[2] proposed that to follow the legacy FR2 gap in NE-DC and NR-DC, where the *refServCellIndicator* is used to indicate PCell, PSCell, or MCG-FR2 cell to UE as timing reference. Thus, [2] has the following proposal.

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| **Proposal 13: In NR-DC with FR2-FR2 BC, introduce *refServCellIndicator* to indicate the reference serving cell. Meanwhile introduce the following notes in TS38.331.****NOTE 1: For *gapUL* configuration with synchrnonous CA, for the UE in NR-DC with FR-FR2 band combination configured, the SFN and subframe of the serving cell indicated by the *refServCellIndicator* in *gapUL* is used in the gap calculation. Otherwise, the SFN and subframe of a serving cell on FR2 frequency is used in the gap calculation.** **NOTE 2: For *gapUL* configuration with asynchronous CA, for the UE in NR-DC with FR2-FR2 band combination configured, the SFN and subframe of the serving cell indicated by the *refServCellIndicator and refFR2ServCellAsyncCA* in *gapUL* is used in the gap calculation. Otherwise, the SFN and subframe of a serving cell on FR2 frequency indicated by the *refFR2ServCellAsyncCA* in *gapUL* is used in the gap calculation.**  |

**Question 8: Do companies agree that in NR-DC with FR2-FR2 BC, *refServCellIndicator* is used to indicate the timing reference serving cell?**

**- For FR2 UL gapconfiguration with synchrnonous CA, for the UE in NR-DC with FR-FR2 band combination configured, the SFN and subframe of the serving cell indicated by the *refServCellIndicator* is used in the gap calculation.**

**- For FR2 UL gap configuration with asynchronous CA, for the UE in NR-DC with FR2-FR2 band combination configured, the SFN and subframe of the serving cell indicated by the *refServCellIndicator and refFR2ServCellAsyncCA* is used in the gap calculation.**

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## 3.3 UE indication on the need of UL gap activation/deactivation

Since RAN4 last time agreed in the WF that UE can explicitly indicate to NW on “need for UL gap” and “no need for UL gap”, [2] presents the following proposal.

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| **Proposal 7: In TS 38.331, capture that UE explicitly indicates the need of FR2 UL gap activation/deactivation using UAI message.** |

**Question 9: Do companies agree to confirm to support that UE explicitly indicates the need of FR2 UL gap activation/deactivation using UAI message.**

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## 3.4 FR2 UL gap activation/deactivation

RAN4 agreed that the configuration and deconfiguration of FR2 UL gaps at the same time activates and deactivates the FR2 UL gap.

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| On UL gap configuration and activation:* UL gaps are configured by the network using RRC configuration upon UE request.
* UL gaps are deconfigured by the network using RRC configuration.
* Related to activation and deactivation of UL gaps:
* The UL gaps can be activated when configured (using RRC signalling).
* FFS: The UL gaps can additionally and optionally be activated and deactivated using MAC command after UL gap is configured by RRC Signaling
* The UL gaps are deactivated when deconfigured (using RRC signalling).
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Besides, [2] proposes to also support MAC CE based FR2 UL gap activation/deactivation, which was discussed once in last RAN2 meeting. The main motivation mentioned in [2] is when the benefit of P-MPR reduction is limited, UL gap should be de-activated, to avoid overall throughput loss due to UL gap overhead.

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| **Proposal 5: Enable dynamic activation and de-activation of UL gap via MAC CE.****Proposal 6: MAC CE design should guarantee that the activation/deactivation on UL gap apply to all FR2 serving cells.**  |

**Question 10: Do companies agree to support MAC CE based FR2 UL gaps activation/deactivation?**

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## 3.5 UE capability on FR2 UL gap

[2] mentions that RAN4 has agreed that UE supporting UL gap should support MPE mandatorily. [2] also explains that all UL gap patterns are optional and UE reports UE capability which UL gap configurations are supported. The reported UL gap patterns also indicate FR2 UL gap is supported by UE.

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| **Proposal 14: UE supporting FR2 UL gap should also support R16 MPE reporting.****Proposal 15: All UL gap patterns are optional and UE reports the supported UL gap configurations through UE capability report to indicate that FR2 UL gap is supported.**  |

**Question 11: Do companies agree that UE supporting FR2 UL gap should also support R16 MPE reporting?**

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**Question 12: Do companies agree that all UL gap patterns are optional and UE reports the supported UL gap configurations through UE capability report to indicate that FR2 UL gap is supported?**

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## 3.6 Others

For any other issues not covered above, please feel free to indicate them into the following table.

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| Company | Discussion points | Comments |
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# 4 Phase 2 Discussion

[TBA]

# 5 Conclusion

Based on the discussion above, below are the proposals.