3GPP TSG-RAN WG2 Meeting #117-e R2-22xxxxx

Electronic, February 21 – March 03, 2022

Agenda item: 8.24.1

Source: Apple

Title: Summary of [AT117-e][058][NR17] FR2 UL Gap (Apple)

Document for: Discussion

# 1 Introduction

Discussions with Deadline **Schedule 1**:

A **first round** with **Deadline for comments W1 Thur Feb 24th 1200 UTC** to settle scope what is agreeable etc

A Final round with **Final deadline W2 Wed March 2nd 1200 UTC** to settle details / agree CRs etc.

Additional deadlines check points etc if needed are defined by the Rapporteur of each discussion respectively. In case some parts of an email discussion need more time, doesn’t converge, need not yet planned on-line treatment, then Rapporteur please contact chair.

This is the summary of following email discussion.

* [AT117-e][058][NR17] FR2 UL Gap (Apple)

Scope: Treat R2-2202155, R2-2202156, R2-2202508, R2-2202918, R2-2202510, R2-2202511, R2-2202507, R2-2202509. Ph1 Determine agreeable parts and converge on discussion points if any, Ph2 agree CRs (and Reply LS only if needed).

Intended outcome: Report, Agreed CRs, endorsed UE cap CRs (38306, 38331) for Merge.

Deadline: Schedule 1

[1] R2-2202155 Reply LS to RAN2 on UL gap in FR2 RF enhancement (R4-2202419; contact: Apple) RAN4 LS in Rel-17 To:RAN2

[2] R2-2202156 LS to RAN2 on UL gap in FR2 RF enhancement (R4-2202420; contact: Apple) RAN4 LS in Rel-17 To:RAN2

[3] R2-2202506 RAN2 impact from FR2 UL gap Apple discussion Rel-17 NR\_RF\_FR2\_req\_enh2

[4] R2-2202918 Introduction of FR2 UL gap Apple R&D CR Rel-17 37.340 16.8.0 0295 - B NR\_RF\_FR2\_req\_enh2

[5] R2-2202507 Introduction of FR2 UL gap Apple CR Rel-17 38.331 16.7.0 2893 - B NR\_RF\_FR2\_req\_enh2

[6] R2-2202509 Introduction of FR2 UL gap Apple CR Rel-17 38.321 16.7.0 1191 - B NR\_RF\_FR2\_req\_enh2

[7] R2-2202510 Introduction of FR2 UL gap UE capability Apple draftCR Rel-17 38.331 16.7.0 B NR\_RF\_FR2\_req\_enh2

[8] R2-2202511 Introduction of FR2 UL gap UE capability Apple draftCR Rel-17 38.306 16.7.0 B 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 Discussion on two RAN4 LS(s)

Regarding the two RAN4 LS(s) [1] [2], the rapporteur thinks they can be noted without immediate actions. We can further discuss if any reply LS is required after detailed questions are addressed.

**Question 1: Do companies agree that the two LS(s) [1][2] can be noted for now?**

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

**Issue 1: NR-DC with FR1 MCG + FR2 (+FR1) SCG**

In RAN4 LS [1], it is mentioned that the timing reference for FR2 UL gap is based on SFN/subframe of FR2 serving cell.

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| **Q3:** For FR2 UL gap timing reference configuration, whether the SFN/subframe of a FR2 serving cell or a FR1 serving cell (e.g., PCell, PSCell) can be used as timing reference for FR2 UL gap?  **A3:** Timing reference for FR2 UL gap is based on the SFN/subframe of FR2 serving cell. |

[3] pointed out that this leads to conflict between the RAN2 agreement and RAN4 agreement.

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| RAN2 agreed to follow legacy FR2 gap design to allow PCell, PSCell or MCG FR2 serving cell as SFN timing reference, while RAN4 agreed that only FR2 serving cell can be the SFN timing reference. |

[3] then presented an issue with using PCell as the SFN timing reference for FR2 UL gap timing determination in FR1 MCG + FR2 SCG, due to the large MRTD (maximum receiving timing difference) and proposes the following observations and proposals:

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| **Observation 1: In async DC deployment, the large MRTD between FR1 PCell and SCG FR2 serving cell leads to huge ambiguity on FR2 slot number determination in FR2 UL gap.**  **Proposal 3: Revert RAN2 agreement for NR-DC scenario and follow RAN4 conclusion to specify that only FR2 serving cell can be configured as SFN timing reference.** |

**Question 2: Do companies agree to follow with RAN4 agreement that “timing reference for FR2 UL gap is based on the SFN/subframe of FR2 serving cell”?**

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**Question 3: If the answer to Question 2 is Yes, do companies agree with the following proposals?**

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| **Proposal 4: SN to configure FR2 UL gap if FR2 bands are only configured in SCG.**  **Proposal 5: No need to support MN and SN coordination to enable FR2 UL gap in NR-NR DC without FR2-FR2.** |

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**Issue 2: Determination on support of NR-DC with FR2-FR2**

RAN4 indicated in [1] that there is no FR2-FR2 band combination specified for NR-DC in RAN4 and leaves it to RAN2 to decide whether to support it from signalling perspective.

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| **Q2:** Are MR-DC/NR-DC deployment scenarios included in this WI (NR\_RF\_FR2\_req\_enh2)? If NR-DC is supported, should the FR2-FR2 band combination be considered in the FR2 UL gap design?  **A2:** Per agreement in RAN#94e, MR-DC/NR-DC are part of this WI, where UL gap should apply. However, there is no FR2-FR2 band combination specified for NR-DC in RAN4 and it is up to RAN2 if FR2-FR2 NR-DC should be supported from signalling perspective. |

[3] has the following proposal:

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| **Proposal 6: RAN2 to discuss if FR2-FR2 DC should be supported. If RAN2 agrees to support it, FR2-FR2 NR-DC is limited to sync DC scenario.** |

**Question 4: About NR-DC with FR2-FR2 band combination, which option do companies prefer in RAN2 signalling design?**

**- Option 1: Support NR-DC with FR2-FR2**

**- Option 2: Do not support NR-DC with FR2-FR2**

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| Company | Support / No support | Comments |
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**Question 5: If the answer to Question 4 is “Support”, do companies agree with the following proposals in [3]?**

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| **Proposal 6: RAN2 to discuss if FR2-FR2 DC should be supported. If RAN2 agrees to support it, FR2-FR2 NR-DC is limited to sync DC scenario.**  **Proposal 7: For FR2-FR2 NR-DC, the MN and SN coordination should support SN requests MN for FR2 UL gap configuration.** |

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## 3.3 UL gap configuration

In RAN4 LS [1], the following parameters on UGL and UGRP are agreed.

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|  | UGL [ms] | UGRP [ms] |
| UL MGP #0 | 1.0 | 20 |
| UL MGP #1 | 1.0 | 40 |
| UL MGP #2 | 0.5 | 160 |
| UL MGP #3 | 0.125 when SCS of active UL BWP  =120kHz  0.25 when SCS of active UL BWP  =60kHz | 5 |

[3] has the following proposal to capture the agreed values in UL gap configuration.

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| **Proposal 1: In TS 38.331, for FR2 UL gap configuration, capture the values of *ugl* with {0.125ms, 0.25ms, 0.5ms, 1.0ms}, and the values of *ugrp* with {5ms, 20ms, 40ms, 160ms}.** |

**Question 6: Do companies agree with that “In TS 38.331, for FR2 UL gap configuration, capture the values of *ugl* with {0.125ms, 0.25ms, 0.5ms, 1.0ms}, and the values of *ugrp* with {5ms, 20ms, 40ms, 160ms}.”?**

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## 3.4 UE indication on the preferred UL gap patterns

RAN4 agreed on preferred UL gap patterns reporting [1], which was also discussed in RAN2 #116 meeting.

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| **Q5:** In RAN2 discussion, it has been brought up that from signalling point of view it is possible that UE provides its preferred FR2 UL gap patterns. Please RAN4 indicates whether it is beneficial for proper network configurations.  **A5**: In general, it is beneficial of UE to indicate the preferred FR2 UL gap patterns, which are not considered as UE capability. The eventual configured UL gap should be determined by the NW. |

[3] has the following proposal:

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| **Proposal 2: In TS 38.331, capture that UE indicates the preferred FR2 UL gap patterns using UAI message.** |

**Question 7: Do companies agree to capture that UE indicates the preferred FR2 UL gap patterns using UAI message in TS 38.331?**

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## 3.5 MAC impact

RAN4 agreed that all RACH procedures should be prioritized over FR2 UL gap as excerpted below [2].

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| On procedures to be prioritized over UL gap,  It was agreed that all the RACH procedure should be prioritized. FFS for other procedures. |

[3] then has the following proposal.

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| **Proposal 8: In TS 38.321, reflects that RACH procedure is prioritized over FR2 UL gap.** |

**Question 8: Do companies agree to reflect that RACH procedure is prioritized over FR2 UL gap in TS 38.321?**

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## 3.6 UE capability on FR2 UL gap

RAN4 agreed that the FR2 UL gap UE capability is per band [2].

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| On UE capability:  On UL gap for Tx power management UE capability, it was agreed the UL gap capability should be defined per band. |

[3] proposes the following:

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| **Proposal 10: UE indicates the FR2 UL gap support in per band UE capability and indicates the supported UL gap patterns in per UE capability.** |

The rapporteur feels RAN2 only needs to discuss the “per band UE capability” and waits for further progress from RAN4 on “supported UL gap patterns”.

**Question 9: Do companies agree to indicate the FR2 UL gap support in per band UE capability?**

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## 3.7 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.

# 6 Previous RAN2 agreements

Agreements from RAN2#116 meeting:

* At least the following three parameters are included in FR2 UL gap configuration.

a) gapOffset

b) ugl

c) ugrp

* Agree to use explicit configuration on *ugl* and *ugrp* for FR2 UL gap configuration (same as in NR meas gap configuration).
* Using UAI message to indicate the need of FR2 UL gap activation/deactivation, if RAN4 agrees with the need.
* Activate/deactivate FR2 UL gap by RRC (no agreement in RAN2 for MAC CE for now).
* Will send LS with questions (discuss details in ph2)

Agreements from RAN2#116bis meeting:

* In SA deployment:

- For timing reference in synchronous FR2 CA configuration, the SFN and subframe of any FR2 serving cell can be used in the gap calculation.

- For timing reference in asynchronous FR2 CA configuration, the SFN and subframe of the serving cell on FR2 frequency indicated by the *refFR2ServCellAsyncCA* (FFS on the field name) is used in the gap calculation.

* The following responsible network entity on FR2 UL gap configuration in different deployment scenario are agreed:

- EN-DC: SN

- NE-DC: MN

* For EN-DC/NE-DC, there is no need to coordinate FR2 UL gap configuration between MN and SN.
* In EN-DC and NE-DC, use FR2 serving cell inside the CG with FR2 band as timing reference for the SFN and subframe calculation in FR2 UL gap calculation.
* For NR-NR DC without FR2-FR2 BC considered, the responsible network entity on FR2 UL gap configuration is MN.
* For NR-NR DC without FR2-FR2 BC considered, FFS on the details on MN-SN coordination.

The Following three points are agreed under condition that R4 would agree to such scenario (otherwise they are N/A):

* 1: For NR-NR DC with FR2-FR2 BC considered (if RAN4 agrees to support), MN is responsible for FR2 UL gap configuration.
* 2: In NR-NR DC with FR2-FR2 BC considered, agree that MN informs SN about the FR2 UL gap pattern configured.
* 3: In NR-DC with FR2-FR2 BC considered, *refServCellIndicator* is used to indicate the timing reference serving cell:

- For FR2 UL gapconfiguration with synchronous 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.

* RAN2 to support that UE explicitly indicates the need of FR2 UL gap activation/deactivation using UAI message.
* From RAN2 perspective, MAC CE based FR2 UL gap activation/deactivation is not supported.
* UE supporting FR2 UL gap should also support R16 MPE reporting.
* Wait for RAN4 on the detailed UE capability reporting.

[4a, Alt2 is agreed]

* For NR-NR DC without FR2-FR2 BC, for timing reference for the SFN and subframe calculation in FR2 UL gap calculation: Follow legacy FR2 gap that the timing reference of FR2 UL gap can be PCell, PSCell or MCG FR2 serving cell, as indicated by *refServCellIndicator.* In asynchronous FR2 CA, *refFR2ServCellAsyncCA* is together used in the gap calculation.
* CRs to be provided for next meeting (Apple)