RAN1-107-e-NWM-NR-R17-RedCap-02 - Version 0.0.2
RAN1

3GPP TSG-RAN WG1 Meeting #107 **R1-2112600**

e-Meeting, 11th – 19th November 2021

Agenda Item: **8.6.1.2**

Title: **FL summary #2 on other aspects for RedCap**

Source: **Moderator (Qualcomm Inc.)**

Document for: **Discussion, Decision**

1 Introduction

This feature lead (FL) summary (FLS) concerns the Rel-17 work item (WI) for support of reduced capability (RedCap) NR devices [1]. Earlier RAN1 agreements for this WI are summarized in [2].

This document summarizes contributions [3] – [27] submitted to agenda item 8.6.1.2 and captures this email discussion on other aspects operation for RedCap:

Table 1:

/This one is to use NWM – please use ***RAN1-107-e-NWM-NR-R17-RedCap-02*** as the document name [107-e-NR-R17-RedCap-02] Email discussion regarding other aspects of UE complexity reduction – Chao (Qualcomm) – 1st check point: November 15 – Final check point: November 19

The issues in this document are tagged and color coded with High Priority or Medium Priority. The issues that are in the focus of this round of discussion in this meeting are furthermore tagged FL2.

2 Remaining issues for HD-FDD operation

2.1 Case 5: Configured SSB vs. dynamically scheduled UL transmission

RAN1#106-e reached the following agreements [2].

Table 2:

Agreements:

- For Case 5 of SSB overlaps with in configured UL transmission, re-use the existing collision handling principles of Rel-15/16 for NR TDD that SSB is prioritized over configured UL transmission The configured UL transmission includes CG-PUSCH, or SRS FFS: Confirm that PUCCH is included

Agreements:

- For Case 5 of SSB overlaps with configured UL transmission, the configured UL transmission includes PUCCH transmission configured by higher layers
- Note: The UL transmission indicated by DCI is supposed to be dynamic UL transmission

Agreements:

- For Case 5 of dynamically scheduled UL transmission vs. SSB, one or both of the following options to be determined till next meeting:
  - Option 1: Dynamically scheduled UL transmission is prioritized over SSB
  - Option 2: Reuse the existing collision handling principles of Rel-15/16 for NR TDD that SSB is prioritized over dynamically scheduled UL transmission

The remaining issue in Case 5 is collision handling for the case of SSB overlapping with dynamically scheduled UL transmission. According to RAN1#106-e agreement, one or both of the following two options should be determined.

Table 2.1-1 summarizes companies' views on the two options.

Table 2.1-1: Views on collision handling for SSB overlapping with dynamically scheduled UL transmission

Table 3:

Index	Description	Companies	# of Companies
Option 1	Dynamically scheduled UL transmission is prioritized over SSB	Huawei, Ericsson, vivo, China Telecom, CMCC, Nokia, WILUS	7
Option 2	SSB is prioritized over dynamic scheduled UL transmission	Spreadtrum, OPPO, Xiaomi, Samsung, Intel, [DoCoMo], LG, Apple, Panasonic, Qualcomm, MTK, NordicSemi, CMCC (2nd)	12

Specific comments regarding benefits, advantages, drawbacks, concerns and impacts for each of the two options are summarized below.

Option 1: dynamically scheduled UL transmission is prioritized over SSB

Justifications/benefits/advantages:

- gNB can transmit and receive simultaneously on paired spectrum
- More flexibility and consistent with principle of dynamic scheduling
- Same handling as Case 2 by treating SSB as semi-static DL reception

Drawbacks/concerns/impacts:

- UE is not able to monitor SSB periodically depending on the gNB scheduling of the UL transmission
- RAN4 RRM requirement may be violated if SSB measurement is constantly cancelled by dynamic UL scheduling
- Rules for determining the available slots for Rel-17 PUSCH repetition will be different for CG- and DG-PUSCH for HD-FDD making the UE behaviour unnecessarily complicated

Option 2: SSB is prioritized over dynamically scheduled UL transmission

Justifications/benefits/advantages:

- A unified solution for dynamic and semi-static UL transmission
- Same UE implementation for SSB measurement
- Optimization for UL throughput and/or latency is not in scope of this WID
- gNB has full control on the timing of dynamically scheduled UL channel/signal to avoid collision

Drawbacks/concerns/impacts:

- Increased scheduling complexity for FDD gNB
- Lack of flexibility and resource utilization is sacrificed

In addition, some contributions also express view on the possibility to consider both options for the case of SSB overlapping with dynamically scheduled UL transmission.

- Support both options based on UE's capability if down-selection is difficult [vivo04]
- Option 1 is preferred for Msg3 (re)transmission and PUCCH for Msg4 and for other dynamically scheduled UL transmission two options can be supported based on UE capability report [ZTE05, Apple15]
- Option 1 for Msg3 (re)transmission and PUCCH for Msg4 and Option 2 for other dynamically scheduled UL transmission in connected mode [IDCC17]

In addition, contribution [CATT08] proposes to jointly consider collision handling of SSB vs. dynamic UL and counting based on available slot for Type A PUSCH repetition.

Contribution [Ericsson03] indicates that PRACH triggered by PDCCH order which is considered as dynamically scheduled UL in view of the previous agreement for Case 2 should be prioritized over SSB if Option 1 is supported.

Moderator observation/suggestion:

- Companies' positions have not changed as compared to last RAN1 meeting. Some companies also show serious concern on supporting both options based on UE capability signalling.
- Compared to last RAN1 meeting, two more companies express views to support Option 1 for Msg3 (re) transmission and PUCCH for Msg4. One company indicates that UE typically would not perform SSB-based measurement during initial access phase.
- Since it is last RAN1 meeting of the WI, if RAN1 cannot reach consensus then the overlapping between SSB and dynamically scheduled UL transmission will be treated as error case, which may not be desirable.
- Considering more technical concerns on Option 1 for the impact on UE implementation and the potential benefits for Option 2 mainly on optimization of UL throughput and/or latency, the moderator suggestions is to support Option 2 at least for dynamically scheduled UL transmission other than Msg3 (re)transmission and PUCCH for Msg4.

FL1 High Priority Proposal 2.1-1:

For Case 5 of dynamically scheduled UL transmission vs. SSB, support Option 2 at least for dynamically scheduled UL transmission other than Msg3 (re)transmission and PUCCH for Msg4

- Option 2: Reuse the existing collision handling principles of Rel-15/16 for NR TDD that SSB is prioritized over dynamically scheduled UL transmission

Feedback Form 1: Please indicate below whether FL1 Proposal 2.1-1 is accepted or not?

1 – vivo Communication Technology We would like to understand what is the essential difference between "error case" and "option 2". In our understanding, NW will not schedule DG-PUSCH colliding with SSB which is the same result as "error case".
2 – Nordic Semiconductor ASA We support FL proposal
3 – Ericsson LM We can accept the proposal for the sake of progress (although we prefer Option 1).

4 – Nokia We prefer Option 1 but we can accept the majority view for the sake of progress.
5 – QUALCOMM JAPAN LLC. We can accept the FL proposal and support Option 2.
6 – Intel Belgium SA/NV We can accept the FL proposal and support Option 2.
7 – Apple Poland Sp. z.o.o. We support the FL proposal and support Opt.2.
8 – SHARP Corporation **we are fine with FL's proposal**
9 – ZTE Corporation We are OK with this proposal for progress.
10 – Samsung Electronics Co. We support the FL proposal.
11 – NTT DOCOMO INC. We support FL proposal
12 – LG Electronics Inc. We are okay with the FL proposal. A question for clarification. Can you share the plan, if you have any, for the collision with the Msg3 (re)transmission and PUCCH for Msg4?
13 – Spreadtrum Communications We can accept the FL proposal and support Option 2.
14 – Panasonic Corporation We support the FL proposal.
15 – Xiaomi Communications We support FL's proposal
16 – CATT OK for the sake of progress.

17 – China Mobile Com. Corporation We support FL proposal.
18 – China Telecommunications China Telecom We are fine to accept FL proposal for the sake of progress.
19 – HUAWEI Technologies Japan K.K. We think it can be left to UE implemenation, if option 1 is not explicitly supported
20 – Guangdong OPPO Mobile Telecom. We are fine

2.2 Case 8: Dynamic or semi-static DL vs. valid RO

For Case 8, the same collision handling was agreed in RAN1#106-e and RAN1#106bis-e [2] for all sub-cases, i.e., to leave it to UE implementation whether to receive DL or transmit PRACH.

Table 4:

Agreements:

- For Type-A HD-FDD UEs, all ROs applicable to RedCap UEs are valid, and for the case of SSB overlapping with valid RO from cell specific point of view, leave it to UE implementation whether to receive SSB or transmit PRACH
- No support of differentiating of ROs for Type-A HD-FDD Redcap UEs and FD FDD RedCap UEs

Agreements:

- For Case 8 of valid RO overlapping with PDCCH in Type 0/0A/1/2 CSS set, leave it to UE implementation whether to receive configured PDCCH or transmit PRACH
- Note: For valid RO intended for PRACH triggered by PDCCH order, it has been covered in Case 2

Agreements:

- For Case 8 of valid RO overlapping with UE-dedicated configured DL reception (e.g. PDCCH in USS, SPS PDSCH, CSI-RS or DL PRS), leave it to UE implementation whether to receive the DL or transmit PRACH
- Note: For valid RO intended for PRACH triggered by PDCCH order, it has been covered in Case 2

Agreements:

- For Case 8 of valid RO overlapping with dynamically scheduled DL reception, leave it to UE implementation whether to receive the dynamically scheduled DL or transmit PRACH

FFS: whether or not the set of symbols overlapping with dynamic DL reception includes also N_{gap}

symbols before the valid RO and whether the same value for N_{gap} in current spec is reused for HD-FDD

- In contribution [Ericsson03], it is indicated that Case 9 can cover also the scenario where PRACH immediately follows DL reception and if there is a clear UE behavior defined, there is no need to include N_{gap} symbols before the valid PRACH occasion as part of the collision.
- Contributions [vivo04, Intel11, CMCC13] express similar view that there is no need to include the Ngap symbols before the valid RO for determining the set of symbols overlapping with semi-static or dynamic DL reception. It is also proposed in contribution [Intel11] to consider a unified solution for handling the gap for Tx-Rx or Rx-Tx switching time.
- Contributions [Nokia11] indicate that it is okay to follow the majority view to reuse the same TDD rule that the set of symbols overlapping with DL reception includes N_{gap} symbols before the valid RO.
- In contribution [Samsung15], it is proposed that N_{gap} symbols can be specified for HD-FDD as in TDD and in case of N_{gap} equals to 0, the Tx/Rx switching time is considered.
- Contribution [LG19] indicates that the Rx-to-Tx switching time before the valid RO needs to be accounted for HD-FDD and N_{gap} symbol can be included before the valid RO for all the subcases of Case 8.

Moderator observation/suggestion:

- From the above, a majority view is that there is no need to include the N_{gap} symbols before the valid RO and how to handle the gap for the Rx-to-Tx switching before the valid RO can be discussed under Case 9.

FL1 High Priority Proposed Conclusion 2.2-1:

- For Case 8, the set of symbols overlapping with DL reception does not include N_{gap} symbols before the valid RO. For the collision with switching time, i.e., PRACH immediately follows DL reception without sufficient time gap, it can be further discussed under Case 9 (non-overlapping UL/DL without sufficient time gap)

Feedback Form 2: Please indicate below whether FL1 Proposal 2.2-1 is accepted or not?

1 – vivo Communication Technology OK
2 – Nordic Semiconductor ASA OK
3 – Ericsson LM OK

4 – Nokia OK
5 – QUALCOMM JAPAN LLC. Agree
6 – Intel Belgium SA/NV OK
7 – Apple Poland Sp. z.o.o. Ok.
8 – SHARP Corporation ok
9 – ZTE Corporation OK
10 – Samsung Electronics Co. Before taking the FL proposal, we suggest to first conclude how to handle the gap for the Rx-to-Tx switching before the valid RO under Case 9. If clear UE behavior for the Rx-to-Tx switching can be defined under Case 9, we are fine to not include Ngap.
11 – NTT DOCOMO INC. OK
12 – LG Electronics Inc. Okay
13 – Spreadtrum Communications OK
14 – Panasonic Corporation OK
15 – Xiaomi Communications Support FL's proposal
16 – CATT OK with the proposal

17 – China Telecommunications China Telecom Support.
18 – China Mobile Com. Corporation OK
19 – HUAWEI Technologies Japan K.K. OK
20 – Guangdong OPPO Mobile Telecom. No Ngap for HD-FDD is acceptable to us

FFS: Whether or not the same principle is applied to PUSCH occasion of MsgA in 2-step RACH, if supported

Contributions [Ericsson03, CATT08] express view that PUSCH occasion of MsgA in the 2-step RACH can be treated in the same way as either configured PUSCH or valid RO.

Contributions [vivo04, Nokia07, CMCC13, Huawei16] express view that same collision handling as valid RO is preferred that is to leave it to UE implementation whether to receive the DL or transmit MsgA when collision happens.

In contribution [Intel11], it is proposed that the different handling rules can be considered for semi-statically configured DL reception and dynamically scheduled DL reception. When a MsgA PUSCH is overlapped with a dynamically scheduled DL reception, the MsgA PUSCH is cancelled if the cancellation time for MsgA PUSCH is met (follow the handling of Case 1); and when a MsgA PUSCH is overlapped with a configured DL reception, the MsgA PUSCH is cancelled.

Moderator observation/suggestion:

- From the above, a majority view is that the same collision handling as valid RO can be applied to MsgA PUSCH while only one company expresses a different view to deprioritize MsgA PUSCH when overlapping with configured DL or dynamic scheduled DL
- In moderator view, depritoitization of MsgA PUSCH is not necessary in some cases, e.g., when UE is not required monitor PDCCH. Therefore, it is desirable to leave it to UE implementation whether to transmit MsgA PUSCH or receive the DL when collisoin happens.

FL1 High Priority Proposal 2.2-2:

- For MsgA PUSCH occasion overlapping with dynamic or semi-static DL reception, leave it to UE implementation to prioritize the DL recepption or MsgA PUSCH transmission

Feedback Form 3: Please indicate below whether FL1 Proposal 2.2-2 is accepted or not?

1 – vivo Communication Technology OK
2 – Nordic Semiconductor ASA Agree, same behavior as for PRACH part
3 – Ericsson LM OK
4 – Nokia OK
5 – QUALCOMM JAPAN LLC. Support the proposal of FL
6 – Intel Belgium SA/NV for sake of progress, we are fine with FL proposal
7 – Apple Poland Sp. z.o.o. Support FL proposal.
8 – SHARP Corporation ok
9 – ZTE Corporation OK
10 – Samsung Electronics Co. OK
11 – NTT DOCOMO INC. We are fine with FL proposal
12 – LG Electronics Inc. Okay
13 – Spreadtrum Communications OK

14 – Panasonic Corporation We support the FL proposal.
15 – China Telecommunications China Telecom We are fine with FL proposal.
16 – China Mobile Com. Corporation OK
17 – CATT Support
18 – HUAWEI Technologies Japan K.K. OK
19 – Guangdong OPPO Mobile Telecom. OK

2.3 Case 9: Collision due to direction switching

RAN1#106bis-e reached the following agreement with a working assumption [2]

Table 5:

Agreements:

- For HD-FDD, reuse the same principle as Rel-15/16 UE not capable of full-duplex communication
  - A HD-FDD UE is not expected to transmit in the uplink earlier than $N_{RX\text{-}TX}\ T_c$ after the end of the last received downlink symbol in the same cell
  - A HD-FDD UE is not expected to receive in the downlink earlier than $N_{TX\text{-}RX}\ T_c$ after the end of the last transmitted uplink symbol in the same cell
  - $N_{RX\text{-}TX}\ T_c$ and $N_{TX\text{-}RX}\ T_c$ are the same as the transition time for FR1 in Table 4.3.2-3, TS 38.211 for a UE not capable of full-duplex communication
- (Working Assumption) The "back-to-back" non-overlapping UL/DL without sufficient gap between RRC configured UL and DL may happen, i.e., are allowed for HD-FDD UEs.
  - RRC configured DL/UL includes at least cell specific higher layer parameters configured DL/UL
  - Discuss further whether to specify a clear UE behavior, or leave it to UE implementation to ensure that the switching time is satisfied
  - Note: This does not mean a HD-FDD UE is required to support the back-to-back UL/DL switching without sufficient gap

The further question is the working assumption concerning the *back-to-back* non-overlapping DL/UL

scenarios.

Contributions [SPRD06, Nokia07, CT10] propose to confirm the working assumption.

Contributions [Ericsson03, Samsung14, LG19] express views that the case of “back-to-back” non-overlapping UL/DL without sufficient gap should be applied to all RRC configured UL/DL rather than only to the collision cases involving the cell-specifically configured UL/DL.

In contributions [vivo04, Xiaomi12, CMCC13], it is indicated that except for cell specific configured DL/UL, all other cases of “back-to-back” non-overlapping UL/DL without sufficient gap are treated as error cases.

Contribution [MTK23] proposes that the back-to-back scheduling of dedicated semi-statically configured reception and transmission should not be allowed consistently with the agreements on Case 3 collisions. The similar views are also expressed in contributions [Intel11, Apple15, Qualcomm22].

Contributions [Intel11, Apple15, Huawei16, DOCOMO21, MTK23] propose that the “back-to-back” non-overlapping UL/DL without sufficient gap should also include the cases of cell-specific configured UL and UE-dedicated configured DL (e.g., between valid RO and PDCCH in USS, SPS PDSCH, CSI-RS or DL PRS) and cell-specific configured DL and UE-dedicated configured UL (e.g., between SSB and CG-PUSCH).

In contributions [Huawei16, MTK23], it is further indicated that the “back-to-back” non-overlapping UL/DL without sufficient gap can include the case of dynamically scheduled DL/UL and RRC configured UL/DL.

Regarding whether to specify a clear UE behavior, or leave it to UE implementation to ensure that the switching time is satisfied, companies views are summarized below.

- Option 1a: A clear UE behavior is defined, e.g., prioritizing an earlier DL reception or UL transmission by puncturing or skipping the first symbol of the later UL transmission or DL reception
    - Ericsson, Sharp
- Option 1b: Reuse the collision handling rule defined for the corresponding overlapping UL/DL case [at least for the case of SSB and UE dedicated configured UL]
    - Apple, Huawei, LG, Qualcomm
- Option 2: Leave it to UE implementation to ensure that the switching time is satisfied [at least for the case of cell specific higher layer parameters configured DL/UL]
    - vivo, Spreadtrum, Nokia, CATT, OPPO, Intel, Xiaomi, CMCC, Panasonic, DOCOMO, Nordic

In contribution [Nokia07], it is further indicated that switching may not be needed in all cases and some cases can already be resolved via UE implementation and therefore leaving the switching time handling to UE implementation provides the most flexibility and avoids having to define specific rules for the different cases

Contributions [ZTE05] further discusses the collision with switching time after collision handling rules applied to Case 1, 5 and 8, and propose to define a clear UE behavior to ensure sufficient time gap for switching time.

Moderator observation/suggestion:

- Companies views are divergent regarding whether RRC configured UL/DL includes also UE-dedicated configured DL/UL.
    - 3 companies (vivo, Xiaomi,CMCC) say ”NO”
    - 8 companies (Ericsson, Samsung, LG, Intel, Apple, Huawei, DOCOMO, MTK) express view that at least the non-overlapping cases, i.e., between cell specific configured UL and dedicated configured DL, or between cell-specific configured DL (i.e. SSB) and dedicated configured UL should be included
- Companies (Huawei, MTK, ZTE) further propose the “back-to-back” non-overlapping UL/DL without sufficient gap can include the case of dynamically scheduled DL/UL and RRC configured UL/DL
- Regarding UE behavior for the non-overlapping case involving cell specific configured DL/UL, seems the majoirty is okay to leave it to UE implementation including proponents of Option 1B since the collision handling rule defined for the corresponding overlapping case (e.g., SSB or PDCCH in CSS vs. valid RO) is also up to UE implementation.

FL1 High Priority Proposal 2.3-1:

- For the case of the “back-to-back” non-overlapping UL/DL without sufficient gap between cell specific configured DL and cell-specific configured UL, e.g., SSB or PDCCH in CSS vs. valid RO, it is up to UE implementation to ensure that the switching time is satisfied

Feedback Form 4: Please indicate below whether FL1 Proposal 2.3-1 is accepted or not?

1 – vivo Communication Technology OK
2 – Nordic Semiconductor ASA OK
3 – Ericsson LM We can accept the proposal for the sake of progress (although we prefer Option 1a).
4 – Nokia OK
5 – QUALCOMM JAPAN LLC. We support the FL proposal
6 – Intel Belgium SA/NV OK

7 – Apple Poland Sp. z.o.o. OK
8 – SHARP Corporation OK for the sake of progress
9 – ZTE Corporation OK with the proposal. Additionally, for case 8 of SSB or PDCCH in CSS vs. valid RO, when the overlapping happens and there is no sufficient gap, similar solution should be used.
10 – NTT DOCOMO INC. We support FL proposal
11 – LG Electronics Inc. Okay
12 – Spreadtrum Communications OK
13 – Panasonic Corporation We support the FL proposal.
14 – China Telecommunications China Telecom We are fine with FL proposal.
15 – Xiaomi Communications Support
16 – China Mobile Com. Corporation OK
17 – CATT OK
18 – Samsung Electronics Co. OK
19 – HUAWEI Technologies Japan K.K. OK

20 – Guangdong OPPO Mobile Telecom.

OK

FL1 High Priority Question 2.3-2:

- Companies are invited to provide views on whether the following cases of the "back-to-back" non-overlapping UL/DL without sufficient gap should be also allowed for HD-FDD UEs
  - Between cell-specific configured DL and dedicated configured UL, e.g., SSB vs. CG PUSCH, PUCCH or SRS
  - Between dedicated configured DL and cell-specific configured UL, e.g., PDCCH in USS, SPS PDSCH, CSI-RS or DL PRS vs. valid RO
  - Between dedicated configured DL and dedicated configured UL, e.g., DL SPS or UL CG PUSCH

Feedback Form 5: Please indicate below whether FL1 Proposal 2.3-2 is accepted or not?

1 – vivo Communication Technology

At least the 3rd sub-case should not be allowed, as it should be avoided by NW configuration. For the 1st and 2nd sub-cases, we prefer not to allow them as well, but would be fine to accept if majority of companies would like to allow them.

2 – Nordic Semiconductor ASA

These cases should be an error case, and avoided by gNB

3 – Ericsson LM

In our view, all cases should be allowed. At least for the first two cases, the overlapping cases are already allowed. It is reasonable to allow also the back-to-back non-overlapping without sufficient gap. For the last case, it can be relevant for configurations with periodic occasions which may be difficult to avoid for all occasions.

4 – Nokia

We feel that all cases should be allowed to provide better flexibility in the configurations.

5 – QUALCOMM JAPAN LLC.

- For the 3rd case, we think it should NOT be allowed.
- For the 1st and 2nd cases, they should not be allowed as well, if the insufficient DL/UL switching gap happens **persistently/frequently**. When the DL/UL resources configured by dedicated RRC cannot be used by a HD-FDD UE, the loss in spectral efficiency is not desirable for either NW or UE.

6 – Intel Belgium SA/NV

In general, we prefer to reuse the priority rule agreed for overlapping case 1/2/3/4/5/8.

- the 3rd case is not allowed, since such combination is treated as error case in overlapping Case 3
- the first two cases can be allowed, with an exception of 'Cell-specifically configured Type-0/0A/1/2 CSS set + dedicated configured UL'. 'Cell-specifically configured Type-0/0A/1/2 CSS set + dedicated configured UL' should not be allowed since such combination is treated as error case in overlapping Case 3

7 – Apple Poland Sp. z.o.o.

The first two cases can be allowed to avoid performing suffer for non-Redcap FD-FDD UEs. On the 3rd case, it should not be allowed as anyhow gNB scheduler needs to avoid overlapping per agreement made for Case 3. There is no more efforts to additionally consider the switching time for collision avoidance here.

8 – SHARP Corporation

We support that all cases will be allowed

9 – ZTE Corporation

To avoid the restriction for gNB scheduling, the 1st case and 2nd case can be allowed. moreover, for the 1st case, it is suggested the SSB is prioritized and a clear UE behavior should be specified, i.e., puncture partial dedicated configured UL for switching time. and for the 2nd case, UE implementation can be used for providing switching time.

The 3rd case is similar as case3 and can be avoided by gNB scheduling. Therefore the 3rd case is not allowed. if happens, this case could be viewed as the error case.

@FL, For the above three cases, if overlapping happens and there is no sufficient switching time after collision handling rule, several companies have the different solution. It is worth to discuss it and make the corresponding conclusion in this meeting.

10 – Samsung Electronics Co.

We believe all cases should be allowed because relying on only gNB scheduling to avoid such cases may be very difficult and further impossible. But, we can accept the first two cases are allowed for the progress given the discussion.

11 – NTT DOCOMO INC.

We think at least 1st and 2nd cases should be allowed

12 – Spreadtrum Communications

According to the previous agreements, the first two cases can be allowed and:

- for the first case, SSB is prioritized
- for the second case, it is up to UE implementation to ensure the switching time.

The third case can be easily avoided by gNB, then, it should not be allowed.

13 – LG Electronics Inc.

We think all cases should be allowed.

Taking only the 3rd case as an error case would be an acceptable compromise to us.

14 – Panasonic Corporation

The 1st and 2nd cases should be allowed for the flexibility. The 3rd case should be the error case as it can be avoided by the scheduler.

15 – China Mobile Com. Corporation

We prefer to avoid three subcases by NW configuration. For progress, the first two subcases can be accepted.

16 – CATT

We think it is easy for a gNB to avoid the 3rd case. We can live with the first 2 cases for progress.

17 – Xiaomi Communications

We can't accept the 3rd Case. For the 1st case and 2nd case, we can live with them for progress

18 – HUAWEI Technologies Japan K.K.

We agree with Intel

19 – Guangdong OPPO Mobile Telecom.

The case 3 should not be allowed for gNB to configure.

The case 1/2 can also be avoided by configuration. At least one of the configuration is dedicated for the HD-FDD UE.

We have a general question on splitting question **Question 2.3-1/2/3:**

In the Rel-16, the configuration can be avoided totally for TDD UEs. Thus, our understanding for the Rel-16, 38.211 section 4 restrict that UE do not expect that happen for TDD UE. That means gNB is responsible to avoid that.

Now we split them into 3 sub-case and this may lead to different processing. Then, does that means we do not reuse Rel-16 text in 38.211, and we will define behaviors individually for 3 sub-cases?

FL1 High Priority Question 2.3-3:

- Companies are invited to provide views on whether the following cases of the "back-to-back" non-overlapping UL/DL without sufficient gap should be also allowed for HD-FDD UEs
  - Between dynamically scheduled DL and RRC configured UL, e.g., dynamic PDSCH or CSI-RS vs. CG PUSCH, PUCCH, SRS or valid RO
  - Between RRC configured DL and dynamically scheduled UL, e.g., SSB, PDCCH, SPS PDSCH, CSI-RS or DL PRS vs. dynamic PUSCH, PUCCH or SRS

Feedback Form 6: Please indicate below whether FL1 Proposal 2.3-3 is accepted or not?

1 – vivo Communication Technology

We do not see the need to extend the "back-to-back" non-overlapping UL/DL without sufficient gap case to the dynamic grant as it should be easily managed by gNB scheduler.

2 – Nordic Semiconductor ASA

These cases can can be handled by gNB scheduling

3 – Ericsson LM

For the cases involving dynamic scheduling, given that the overlapping cases are allowed (e.g., Cases 1 and 2), it is reasonable to allow also the back-to-back non-overlapping without sufficient gap. On the other hand, it can also be sufficient to leave it to scheduler to handle.

4 – Nokia

It should be up to gNB scheduling to manage this.

5 – QUALCOMM JAPAN LLC.

We think the insufficient switching gap involving dynamic scheduling can be avoided by NW. That is, a HD-FDD UE does not expect to receive a dynamic grant, which leads to insufficient DL/UL switching gap between dynamic scheduling and RRC configuration.

6 – Intel Belgium SA/NV

Such cases are not allowed, i.e. up to gNB implementation to avoid it

7 – Apple Poland Sp. z.o.o.

It should be handled by gNB scheduler and treated as error case if happens.

8 – SHARP Corporation

We can accept that gNB will manage this, and the gap size should be clearly defined to clarify gNB's behavior

9 – ZTE Corporation

For the first sub-bullet, it is similar as case 8. This back-to-back case can be allowed in the NW and similar solution is considered, i.e., UE implementation.

For the second subbullet, it is similar as case 2. It is allowed in the NW and also similar solution is considered, i.e., Dynamically UL is prioritized.

Additionally, for the above two cases, if overlapping happens and there is no sufficient switching time after collision handling rule, we think similar clarification is necessary and this issue should be resolved in this meeting.

10 – Samsung Electronics Co.

Our preference is to allow these cases as well. However, we are open to relying on only gNB scheduling for these cases.

11 – NTT DOCOMO INC. It should be up to gNB to avoid such cases
12 – Spreadtrum Communications Up to gNB implementation to avoid these two cases.
13 – LG Electronics Inc. Our preference has been to allow the two cases as well. But, for the case questioned by the FL, we can go for a majority view for the sake of progress.
14 – Panasonic Corporation These cases should be allowed and dynamic transmission should be prioritized. It aligns with the principle of the overlapping case 1 and 2. Whether to avoid such scheduling can be up to the scheduler.
15 – China Mobile Com. Corporation It is up to gNB to avoid such cases
16 – CATT This is even easier for gNB to avoid such case. No need to do special handling by spec.
17 – Xiaomi Communications NW can avoid this case easily and no standardization work is needed
18 – HUAWEI Technologies Japan K.K. They can be allowed as commented by Ericsson
19 – Guangdong OPPO Mobile Telecom. We think this should be avoided by gNB

2.4 Other issues

Additional UE behaviour for monitoring SFI

Currently, a FDD UE can optionally support SFI operation. The dynamic SFI provides a means for gNB to cancel the configured DL reception or UL transmission on flexible symbols in a slot. Contribution [Intel11] raises one issue on the order to check SFI and to apply overlap handling of a DL reception and a UL transmission when dynamic SFI is (optionally) supported for HD-FDD UEs. Therefore, it is proposed to jointly interpret the DL SFI and UL SFI for determining a slot pattern or define a rule on the order for SFI checking and collision handling.

FL1 Medium Priority Question 2.4-1:

- Companies are invited to comment whether or not additional UE behaviour is specified if dynamic SFI

can be optionally supported for HD-FDD UEs?

Feedback Form 7: Companies please share your views for the above question?

1 – vivo Communication Technology In general the use case of dynamic SFI for HD-FDD UE is not clear. But we are fine to allow optional support of SFI by RedCap UEs, without new UE behaviors.
2 – Nordic Semiconductor ASA No need to support SFI for RedCap UEs
3 – Ericsson LM We think this is not necessary. In our view, proper scheduling together with existing collision handling/prioritization rules should be able to achieve the same outcome. Resulting slot pattern from SFI can also lead to more restrictive scheduling in FDD carriers.
4 – Nokia We don't see the need to support SFI for HD-FDD RedCap UEs
5 – QUALCOMM JAPAN LLC. We agree with the comments of Nordic, Ericsson and Nokia. Considering semi-static DL/UL configurations (similar to NR TDD) is not supported in HD-FDD operation, we don't see a need to support SFI in HD-FDD.
6 – Intel Belgium SA/NV We prefer to keep legacy FDD design, i.e. SFI can be optional feature for HD-FDD
7 – Apple Poland Sp. z.o.o. Our view is to reuse the rule defined in TDD system and decouple the SFI detection and collision handling rule; Otherwise, tough discussion on processing time and ordering of SFI vs. scheduling DCI is needed since it involves some sequential behaviors, decoding SFI first and then determine the prioritization channel. In addition, our observation is that SFI has impacts on RRC-configured DL/UL channels, which is de-prioritized channels in case of DL/UL collision. As consequence, SFI may not have impact on the collision handling operation. In any case, we do not think SFI should be involved for collision handling of HD-FDD UEs.
8 – SHARP Corporation We don't support SFI for HD-FDD UEs
9 – ZTE Corporation No need to support dynamic SFI.

10 – Samsung Electronics Co. Unless there is special reason, it can be optionally supported by RedCap UE like FDD legacy UE. SFI can be used to cancel one of the directions between DL and UL if a collision between the DL and the UL happens.
11 – NTT DOCOMO INC. We are fine not to support SFI for HD-FDD UEs
12 – China Mobile Com. Corporation Fine to not support SFI for HD-FDD UEs.
13 – CATT Supporting SFI requries frequently monitoring SFI-DCI which is not friendly to a UE targeting complexing and power reduction, especially for a HD-FDD RedCap UE even prefer to implement a cheap switch rather than a duplexer. We do not see strong motivation to support SFI for HD-FDD UEs, which may bring additional spec effort.
14 – HUAWEI Technologies Japan K.K. Agree with CATT
15 – Guangdong OPPO Mobile Telecom. No SFI for HD-FDD

Reserved symbols for PDCCH monitoring

One contribution [Intel11] presents view on that a HD-FDD UE can be configured with a pattern of "Reserved (R)" symbols, such that a UE is not expected to monitor for PDCCH in such symbols

FL1 Medium Priority Question 2.4-2:

- Companies are invited to comment whether or not a pattern of "reserved" symbols can be configured for HD-FDD UEs to skip PDCCH monitoring in such symbols?

Feedback Form 8: Companies please share your views for the above question?

1 – vivo Communication Technology The current configuration of PDCCH monitoring seems quite flexible and sufficient, gNB can avoid configuring PDCCH monitoring for HD-FDD UEs on the symbols intended for UL.
2 – Ericsson LM We think this is not necessary as gNB can take into account when configuring search space to UE. Moreover, power saving is strictly speaking not in the scope for RAN1 work in Rel-17 RedCap.

3 – Nokia We don't see the need to support such reserved symbol. We don't expect significant power saving from this given that gNB can already configure quite flexible PDCCH monitoring for UE.
4 – QUALCOMM JAPAN LLC. For R17 RedCap, we think it might not be necessary to support "reserved symbols."
5 – Intel Belgium SA/NV In general, we think reducing UE power consumption is beneficial for RedCap UE. This is the reason we propose "reserved symbols.". In a worst case, if we remove both semi-static TDD configuration and dynamic SF, and don't agree with a similar concept of 'reserved symbols', gNB may be short of tools to UE power saving.
6 – Apple Poland Sp. z.o.o. The benefit of power saving is not clear for us given the NR PDCCH MO configuration is very flexible.
7 – ZTE Corporation We do not see the necessity.
8 – Samsung Electronics Co. We don't see a clear need.
9 – NTT DOCOMO INC. Rel-17 Power saving features such as SSSG switching would be enough
10 – LG Electronics Inc. We do not see it necessary for RedCap UEs. The benefit has not been studied, so we tend to think this proposal does not fit in the scope.
11 – CATT Do not see such need. A more natual choice is to configure a larger periodicity for PDCCH by gNB implementation.
12 – Xiaomi Communications We don't see the motivation
13 – HUAWEI Technologies Japan K.K. No addtional/special handling is necessary
14 – Guangdong OPPO Mobile Telecom. No symbol level definition.

FD-FDD UE fallback to HD-FDD operation

One contribution [Qualcomm22] indicates that if a FD-FDD UE indicating its support of HD-FDD operation on paired spectrum can be configured with a dedicated RRC configuration for the duplex mode for UE power saving and inter-cell interference mitigation.

FL1 Medium Priority Question 2.4-3:

- Companies are invited to comment whether a FD-FDD UE indicating its support of HD-FDD operation on paired spectrum can be configured with a dedicated RRC configuration for the duplex mode?

Feedback Form 9: Companies please share your views for the above question?

1 – vivo Communication Technology

In our view, the HD-FDD feature is more relevant to UE cost reduction, such benefit would disappear if a UE support both FD-FDD and HD-FDD for a given band.

For power saving, there are various differnt UE power saving features introduced in R15/16/17 which can be beneficial for HD-FDD UEs.

2 – Ericsson LM

In our view, the benefit is not clear. There would be no real cost saving when UE can support FD-FDD. From TR 38.875, there was no clear conclusion on the benefit on power saving from HD-FDD, i.e., "the impact on power consumption of HD-FDD depends on implementation and traffic characteristics". Moreover, power saving is strictly speaking not in the scope for RAN1 work in Rel-17 RedCap WI.

3 – Nokia

We don't see significant power saving benefit from this, so we do not support it.

4 – QUALCOMM JAPAN LLC.

We think a R17 RedCap UE can support both Type-A HD-FDD and FD-FDD, both of which are optional capabilties on FDD bands. As a result, a more flexibile tradeoff can be achieved between peak data rate and UE power saving.

Based on the RAN4 RF study for TX/RX requirements of HD-FDD UE,

- the LNA sensitivity of HD-FDD UE will improve due to lower insertion loss
- the PA efficiency of HD-FDD UE will improve due to lower PA output required

Therefore, a RedCap UE capable of FD-FDD and Type-A HD-FDD can switch between the two duplex modes based on RRC configurations. When the UE needs to support higher peak data rates on DL/UL, it can be configured as FD-FDD. When the traffic pattern changes, the UE can be configured as Type-A HD-FDD to support reduced throughput with reduced power consumption. It is not necessary to support dynamic switching between FD-FDD and HD-FDD.

5 – Intel Belgium SA/NV

We share similar views from vivo, Ericsson and Nokia.

6 – ZTE Corporation 1) gNB implementation can realize the HD-FDD operation 2)FDD has higher transmission efficiency. Therefore, HD-FDD operation does not mean it would bring the power saving compared with FD-FDD. 3)using HD-FDD operation to save the power consumption is out of our scope and does not have the corresponding evaluation in the TR. Therefore, considering the limited TU, this kind of enhancement is not considered.
7 – Samsung Electronics Co. We share a view with vivo, Ericsson and ZTE.
8 – NTT DOCOMO INC. We also share the view with other companies that such enhancement is not necessary
9 – LG Electronics Inc. Share the view with vivo, Ericsson, Nokia and many other companies.
10 – CATT HD-FDD is supported mainly because of its low cost, by replacing a duplexer with a switch. (1) From view of cost reduction, there is no motivation for a FD-FDD UE to pretend to be a HD-FDD UE. This will not reduce hardware cost. (2) From view of power consumption, remind that we did not reach consensus on whether HD-FDD is beneficial in power reduction during the SI. As captured in TR 38.875: 'The impact on power consumption of HD-FDD depends on implementation and traffic characteristics.' So we do not think this is well justified.
11 – HUAWEI Technologies Japan K.K. similar views from vivo, Ericsson, Nokia, Intel and ZTE, we don't see the benefit by supporting this.
12 – Guangdong OPPO Mobile Telecom. We don't support this bundling with power saving.

Switching gap for neighbour cell SSB measurement

Contribution [LG19] proposes to discuss the impact of switching gap in SSB-based measurement for a HD-FDD UE, e.g., whether the switching gap need to be considered for determining time duration for SSB reception for measurement within measurement gap.

FL1 Medium Priority Question 2.4-4:

- Companies are invited to comment whether the switching gap need to be considered for determining time duration for SSB reception for measurement within measurement gap?

Feedback Form 10: Companies please share your views for the above question?

1 – vivo Communication Technology We think this is an RAN4 topic.
2 – Ericsson LM This is better discussed in RAN4.
3 – Nokia This is RAN4 topic and should not be discussed here.
4 – Intel Belgium SA/NV This is better discussed in RAN4.
5 – Apple Poland Sp. z.o.o. This is more fit for RAN4 RRM session.
6 – ZTE Corporation OK to be discussed in RAN4.
7 – Samsung Electronics Co. OK with discussing it in RAN4.
8 – NTT DOCOMO INC. OK to be discussed in RAN4
9 – LG Electronics Inc. If all companies think this is clearly a RAN4 topic, then we are fine to not further discuss this in RAN1.
10 – China Mobile Com. Corporation OK to be discussed in RAN4.
11 – CATT Agree to leave it to RAN4.
12 – HUAWEI Technologies Japan K.K. OK to be discussed in RAN4. In our view, the measurement gap already includes the time for switching.
13 – Guangdong OPPO Mobile Telecom. RAN 4 topic

3 Other aspects of UE complexity reduction

In contribution [Qualcomm22], it is proposed that SRS transmissions outside of active UL BWP and frequency selective scheduling outside of active DL BWP are not supported by RedCap UEs. It is also proposed that the max BW specified for R17 RedCap UE (20 MHz in FR1, 100 MHz in FR2) applies to both BB and RF. The latter is indeed interpretation for the cost/complexity reduction feature of reduced max BW for RedCap UEs. However, if necessary, these details can be further discussed and confirmed as part of AI 8.6.1.1.

Contribution [Samsung14] proposes to consider configuration of separate PDCCH SS set for RedCap UEs to reduce PDCCH blocking in case of shared initial DL BWP between RedCap and non-RedCap UEs. However, contribution [Nokia07] proposes that mechanisms for PDCCH blocking reduction are not pursued further in Rel-17.

In contributions [Nokia07, CATT08], it is proposed that there is no need to optimize DCI size for RedCap UEs and the supported DCI formats and the length of each DCI field depend on the outcome of UE feature discussion.

Contribution [Nokia07] expresses view that there is no RAN1 specification impact for RedCap UE supporting 1 or 2 downlink MIMO layer. It is also indicated that the issue related to low-SE MCS table can be revisited as part of the capability discussion. Contribution [OPPO09] proposes that maximum number of DL MIMO layers and modulation orders do not need further discussion in RAN1.

4 Second round discussion

4.1 Case 5: Configured SSB vs. dynamically scheduled UL transmission

Summary of first round discussion:

- Majority is okay with or can accept the **FL1 High Priority Proposal 2.1-1** for the sake of progress.
- One company prefers to leave it to UE implementation if Option 1 is not accepted. Based on moderator understanding, the option for leaving it to UE implementation would have some issues with UCI multiplexing. Such UE behavior is not specified, it is not known to gNB whether UE will multiplex UCI on a PUSCH when both dynamic PUSCH and UCI are colliding with SSB. Also, the agreement in RAN1#106-e is to determine one or both of option 1 and 2 and no any other option will be considered. To follow the agreement in RAN1#106-e, it is not possible to consider the option of leaving it to UE implementation.
- One company would like to clarify the essential difference between “Option 2” and “error case”. In moderator’s view, there could be different UE behaviors when considering PUSCH repetitions with multiple slots. In case of “error case”, UE may ignore the DCI scheduling PUSCH repetition overlapping with SSB slot, but with “Option 2” UE can still transmit PUSCH in the slots not overlapping with SSB. Also, as commented by companies, Rel-17 PUSCH repetition may require UE to determine the available slots based on RRC configuration(s) in addition to TDRA in the DCI. With “Option 2”, the available slots for Rel-17 PUSCH repetition could be different by excluding SSB slots, but this is up to discussion in Rel-17 CE WI.

Based on the received response, moderator suggestion is to endorse the **FL1 High Priority Proposal 2.1-1** and discuss further the collision with Msg3 (re)transmission and PUCCH for Msg4. Based on moderator

understanding, UE typically would not perform SSB-based measurement during initial access and there could be some impact on initial access if SSB is prioritized over Msg3 (re)transmission and PUCCH for Msg4 since early indication of HD-FDD UE type is not supported

FL2 High Priority Question 4.1-1:

- For SSB overlapping with Msg3 (re)transmission and PUCCH for Msg4, which option is **preferred**, and which option is **acceptable** to you (or **not acceptable** to you)?
  - Option 1: Dynamically scheduled UL transmission is prioritized over SSB
  - Option 2: Reuse the existing collision handling principles of Rel-15/16 for NR TDD that SSB is prioritized over dynamically scheduled UL transmission

Feedback Form 11: Companies please share your views for the above question?

1 – vivo Communication Technology We can live with the proposal for sake of progress.
2 – ZTE Corporation Option 1 is preferred. Agree with FL's understanding that if SSB is prioritized during random access procedure the Msg3 (re)transmission and PUCCH for Msg4 will be interrupted if overlapping happens, and thus the UE has to restart a new random access procedure by sending a preamble in the next valid RO. It results in the extension of the latency of random access procedure. Furthermore, since early indication of HD-FDD UE type is not supported, in order to avoid the impact on the random access procedure mentioned above, gNB has to schedule the resources of Msg3 (re)transmission and PUCCH for Msg4 not overlapping with SSB in time domain no matter whether the UE is HD-FDD or not. Obviously, it will have impact on the scheduler strategy of Msg3 (re)transmission and PUCCH for Msg4 for FD-FDD RedCap UEs. Further, if early indication of RedCap is not configured, scheduling of the resources of Msg3 (re)transmission and PUCCH for Msg4 for legacy FDD NR UEs also would be affected. The impacts on FD-FDD RedCap UE and legacy NR FDD UE are not expected. Therefore, option 2 is not acceptable.
3 – CATT Can live with both options. For Option 1, it is a little strange if a HD-FDD UE is able to prioritize Msg3 and PUCCH for Msg4 than SSB, why not other PUSCH/PUCCH. But it will simplify gNB scheduler. For Option 2, unified handling is achieved. From gNB's point of view, conservative scheduling may be implemented in gNB for Msg3 and PUCCH for Msg4 (try best not to overlap with SSB), since gNB cannot distinguish a UE is HD or FD.
4 – Ericsson LM We prefer Option 1 for flexibility of scheduling UL transmission. However, if Option 2 was agreed for dynamically scheduled UL transmission other than Msg3 and PUCCH for Msg4, we can be open to accept it here in order to have a unified solution.

5 – Intel Belgium SA/NV We prefer Option 2 to have a unified solution for all cases. The latency reduction, if any, by prioritizing msg3/msg4 PUCCH is only a small part of full period for random access and the gain is limited to RedCap UE too, which may not be latency sensitive.
6 – Nokia We prefer Option 1 but can also accept Option 2 for the sake of progress (same view as for UL transmissions other than Msg3 and Msg4 PUCCH)
7 – Samsung Electronics Co. Support Option 2 and share a same view with Intel.
8 – Spreadtrum Communications Support Option 2□prefer to have a unified solution.
9 – NTT DOCOMO INC. We support Option 2 for unified solution
10 – Nordic Semiconductor ASA Since Msg3 (re)transmission and PUCCH for Msg4 have flexibility of scheduling, gNB should avoid overlap with SSB for HD-FDD UE. Option 2 is strongly preferred.

4.2 Case 8: Dynamic or semi-static DL vs. valid RO

Summary of first round discussion:

- For the **FL1 High Priority Proposal 2.2-1**, only one company does not support the proposal and would like to firstly conclude how to handle the gap for the Rx-to-Tx switching before valid RO under Case 9. Based on the moderator understanding, the **FL1 High Priority Proposal 2.3-1** will cover how to handle the Rx-to-Tx switching gap at least for SSB or PDCCH in CSS overlapping with valid RO. But it is okay to further check whether additional UE behaviors need to be defined to handle the Rx-to-Tx switching gap before valid RO for Case 8.
- For the **FL1 High Priority Proposal 2.2-2**, all the received responses support the FL proposal. Therefore, moderator suggestion is to endorse the **FL1 High Priority Proposal 2.2-2** to conclude the discussion

FL2 High Priority Question 4.2-1:

- For the case that PRACH immediately follows DL reception without sufficient time gap, whether or not additional UE behavior needs to be specified to handle the Rx-to-Tx switching in addition to **the FL1 High Priority Proposal 2.3-1 and [FL2 High Priority Proposal 4.3-1]**

Feedback Form 12: Companies please share your views for the above question?

1 – vivo Communication Technology

In our understanding, if the issue related to **the FL1 High Priority Proposal 2.3-1 and [FL2 High Priority Proposal 4.3-1]** are solved, there is no need to introduce additional UE behaviors.

2 – ZTE Corporation

The discussion of this proposal depends on the outcome of Proposal 2.3-1 and [FL2 High Priority Proposal 4.3-1]. We can further check after we have the conclusion.

3 – CATT

OK. Also fine to wait for the outcome in other related FL proposals.

4 – Ericsson LM

In our view, the discussion can be included in FL2 High Priority Proposal 4.3-1. It is perhaps important to emphasize the case of PRACH immediately follows dynamic DL without sufficient gap or vice versa. Although it is reasonable that gNB scheduler can avoid such dynamic scheduling, it should be noted that the case of overlapping between dynamic DL and valid RO is allowed and it is up to UE whether to receive DL or transmit PRACH. It can therefore be reasonable to not treat the back-to-back without sufficient gap as an error case, but rather define a UE behavior to handle it instead. Otherwise, it might lead to a strange scheduling restriction by the specification which in our view is unnecessary. See also our comment for FL2 Proposal 4.3-1.

5 – Intel Belgium SA/NV

Since a solution will be defined in Proposal 2.3-1 (already agreed) and [FL2 High Priority Proposal 4.3-1], we think there is no need to introduce additional UE behaviors

6 – Nokia

There is no need to specify additional UE behaviour

7 – Samsung Electronics Co.

If the issue is resolved in other related FL proposals, there is no need to have additional UE behavior.

8 – Spreadtrum Communications

We think this issue can be resolved in other related FL proposals, so, there is no need to specify additional UE behaviour.

9 – NTT DOCOMO INC.

Not necessary

10 – Nordic Semiconductor ASA

Maybe it would be good to understand what DL signals could be dropped and how severe would be consequences. Could paging be dropped e.g.? CSI-RS don't matter since in RACH UE takes QCL from PRACH onwards.

11 – China Mobile Com. Corporation
There is no need to specify additional UE behaviour

4.3 Case 9: Collision due to direction switching

Summary of first round discussion:

- For the **FL1 High Priority Proposal 2.3-1**, all the received responses support the FL proposal. Therefore, moderator suggestion is to endorse the **FL1 High Priority Proposal 2.3-1** to conclude the discussion**.**
- For **the FL1 High Priority Question 2.3-2 and 2.3-3** regarding whether additional cases of non-overlapping DL/UL without sufficient gap are allowed for HD-FDD, companies views are divergent.
    - Many companies have concern on the 3rd subcase in the **FL1 High Priority Question 2.3-2** since it is not aligned with the agreement for Case 3.
    - For the first and second subcases in the **FL1 High Priority Question 2.3-2,** they are supported by companies (Ericsson, Nokia, Intel, Apple, Sharp, ZTE, Samsung, DOCOMO, Spreadtrum, LG, Panasonic) and not support by companies (Nordic, Qualcomm), And also companies (vivo, CATT, Xiaomi) indicate the possibility to accept it for progress.
    - For the subcases in the **FL1 High Priority Question 2.3-3,** majority view is that they can be handled by gNB scheduling and should be treated as error case if happens

Based on the received response, in the moderator's view, a best tradeoff is to support the first and second subcases in the **FL1 High Priority Question 2.3-2** and treat other subcases of non-overlapping DL/UL without sufficient gap as error cases if happens

FL2 High Priority Proposal 4.3-1:

- The "back-to-back" non-overlapping UL/DL without sufficient gap between cell-specific configured DL and dedicated configured UL may happen, i.e., allowed for HD-FDD UEs
    - E.g., SSB vs. CG PUSCH, PUCCH or SRS
    - The first symbol of the later UL transmission is punctured to ensure that the switching time is satisfied (i.e., SSB is prioritized over configured UL)
- The "back-to-back" non-overlapping UL/DL without sufficient gap between dedicated configured DL and cell-specific configured UL may happen, i.e., allowed for HD-FDD UEs
    - E.g., PDCCH in USS, SPS PDSCH, CSI-RS or DL PRS vs. valid RO
    - Leave it to UE implementation to ensure that the switching time is satisfied
- Other cases of the "back-to-back" non-overlapping UL/DL without sufficient gap are not allowed for HD-FDD UEs and treated as error cases if happens
    - E.g., between dedicated configured DL and dedicated configured UL, between dynamically scheduled DL and RRC configured UL, or between RRC configured DL and dynamically scheduled UL

Feedback Form 13: Please indicate below whether FL2 Proposal 4.3-1 is accepted or not?

1 – vivo Communication Technology

For the cell-specific configured DL v.s. dedicated configured UL case, we do not support puncturing the UL transmisison, we prefer to allow UE to drop the corresponding configured UL transmission, to follow the principle of existing agreement of case 5 ”SSB overlaps with in configured UL transmission”

2 – vivo Communication Technology

For the case of ”dedicated configured DL v.s. cell-specific configured UL”, and FL1 High Priority Proposal 2.3-1 as well, we would like to clarify that ”Leave it to UE implementation to ensure that the switching time is satisfied” allows the UE implementation to drop either of the DL reception or the UL transmission.

3 – ZTE Corporation

For the case of cell-specific configured DL v.s. dedicated configured UL, for the second subbullet, with the following reasons,

- The number of punctured symbols may be larger than 1.
- The case, SSB follows dedicated configured UL, is missed. (The case dedicated configured UL follows SSB is captured in the proposal)

it is suggested to change as follows: ”**A set of starting symbols** of the later UL transmission or **a set of last symbols of the former UL transmission** is punctured to ensure that the switching time is satisfied (i.e., SSB is prioritized over configured UL)

The left part of this proposal is fine with us.

4 – CATT

In Rel-16, when the UE has to drop PUSCH or PUCCH, whether UE shall drop the entire PUSCH (baseline) or only partial PUSCH is up to UE capability (*partialCancellation*). Not sure we should consider ’dropping entire PUSCH or entire PUCCH’ as a baseline.

We are also OK to leave all theses cases up to UE implementation.

5 – Ericsson LM

Regarding which cases are allowed for the back-to-back non-overlapping UL/DL without sufficient gap:

In our view, at least all cases which have a handling rule defined for the overlapping scenarios in Cases 1-8 should be allowed. This includes also cases involving dynamic UL or DL. Otherwise, it would lead to unnecessary restriction in the specification as well as in gNB scheduling/configuration since the overlapping cases and non-overlapping cases with sufficient gap are already allowed. The non-overlapping with sufficient gap is clearly allowed. It is strange that only the back-to-back without sufficient gap is considered an error cases by specification.

Regarding overlapping scenarios which are considered as an error case, e.g., dedicated configured UL vs. dedicated configured DL (part of Case 3):

In our view, it can be viewed from either direction. Some may see that treating as an error case should be extended to apply to the back-to-back non-overlapping DL/UL without sufficient gap, while others may see

that the non-overlapping back-to-back DL/UL without sufficient gap is part of the non-overlapping scenarios in general and we only need to define a UE behavior to ensure sufficient switching time for HD-FDD rather than restricting it totally. We prefer the latter interpretation since it is less restriction but are open to accept a majority view here.

Regarding the UE behavior to ensure sufficient gap for cases which are allowed:

Although we prefer to have the same UE behavior for simplicity, it is can be acceptable for us to ”follow” the handling for Cases 1-8 to determine the prioritized channel/signal. However, instead of canceling/dropping the de-prioritized channel/signal completely, we prefer that UE can simply puncture/skip the last symbol(s) of the first transmission/reception or the first symbol(s) of the later transmission/reception. For the cases where it is up to UE to prioritize whether to receive DL or transmit UL when DL and UL are overlapping (e.g., Case 8), it can be up to UE to either puncture/skip the last symbol(s) of the first transmission/reception or the first symbol(s) of the later transmission/reception when DL and UL are non-overlapping without sufficient gap.

6 – Intel Belgium SA/NV

For the first bullet, i.e. cell-specific configured DL (SSB) and dedicated configured UL, we prefer to follow overlapping Case 5, i.e. SSB is prioritized. the current FL proposal require partial cancellation capability of UE and result in puncturing first DMRS symbol of UL transmission (if SSB is followed by UL)

we are fine with other bullets.

7 – Samsung Electronics Co.

We OK with ZTE suggestion to include the missing case where SSB follows dedicated configured UL for the first bullet. Also, we prefer partial dropping/skipping to entire dropping/skipping because we think the partial dropping/skipping can provide the benefits when such cases are allowed for RedCap UE and also gNB scheduling.

8 – NTT DOCOMO INC.

We support the revision from ZTE

9 – Nordic Semiconductor ASA

We still think that dedicated RRC can make sure not to overlap with cell-specific RRC. For sake of progress, we are fine to leave this collisions up to implementation or to prioritize cell-specific RRC

10 – China Mobile Com. Corporation

Fine with ZTE’s suggestion.

11 – vivo Communication Technology

We have concern on requiring UE to do puncture/partial cancellation for these cases which we even believe should not be allowed from the begining. We would be fine to compromise to allow such cases to happen if the UE behavior on how to ensure the sufficient switching gap is not specified, i.e. up to implementation.

Suggest revision:

-The “back-to-back” non-overlapping UL/DL without sufficient gap between cell-specific configured DL and dedicated configured UL may happen, i.e., allowed for HD-FDD UEs

- E.g., SSB vs. CG PUSCH, PUCCH or SRS

- ~~The first symbol of the later UL transmission is punctured to ensure that the switching time is satisfied (i.e.,~~ SSB is prioritized over configured UL and it is up to UE implementation how to ensure that swtiching time is satisfied

-The "back-to-back" non-overlapping UL/DL without sufficient gap between dedicated configured DL and cell-specific configured UL may happen, i.e., allowed for HD-FDD UEs

- E.g., PDCCH in USS, SPS PDSCH, CSI-RS or DL PRS vs. valid RO
- Leave it to UE implementation to ensure that the switching time is satisfied

4.4 Other issues

Summary of first round discussion:

- For **SFI monitoring** in **FL1 High Priority Question 2.4-1**, only two companies (Intel, Samsung) propose that SFI can be optional feature for HD-FDD like legacy FDD**, but** the majority view is that there is no need to support SFI for HD-FDD RedCap UEs. Since semi-static DL/UL configurations is not supported in HD-FDD operation, it would be straightforward not to SFI monitoring for HD-FDD UEs. With this, the moderator suggestion it to conclude that SFI is not supported for HD-FDD UEs in Rel-17 to close the discussion.
- For **Reserved symbols for PDCCH monitoring** in the **FL1 High Priority Question 2.4-2**, the majority view that this is not necessary and proper gNB implementation can achieve the same results. With this, the discussion for in the **FL1 High Priority Question 2.4-2** can be closed for now.
- For **FD-FDD fallback operation to HD-FDD** in the **FL1 High Priority Question 2.4-3**, the majority view that such enhancement is not necessary. With this, the discussion for in the **FL1 High Priority Question 2.4-3** can be closed for now.
- For **switching gap for neighboring cell SSB measurement** in the **FL1 High Priority Question 2.4-4**, the majority view that this is RAN4 topic. With this, the moderator suggestion is to leave it to RAN4 and no further discuss it in RAN1

FL2 High Priority Proposed Conclusion 4.4-1:

- SFI monitoring is not supported for HD-FDD UEs in Rel-17

Feedback Form 14: Please indicate below whether FL2 Proposal 4.4-1 is accepted or not?

1 – Samsung Electronics Co.

Given the discussion, we can accept majority view and then it can be concluded that additional behavior for DL/UL collision handling is not supported in Rel-17 if SFI monitoring is supported for RedCap UE. On the other hand, whether or not FG 3-6 (Dynamic SFI monitoring) can be supported for RedCap UE belongs to UE feature discussion and then can be further discussed in the UE feature agenda.

2 – vivo Communication Technology

Agree with Samsung's view above. We can conclude no special handling of SFI for HD-FDD UEs, but no

need to preclude a HD-FDD UE to support SFI monitoring from specification point of view.
3 – ZTE Corporation Support FL's proposal.
4 – CATT Support.
5 – Ericsson LM Agree with Samsung's and Vivo's comments.
6 – Intel Belgium SA/NV for sake of progress, we are fine to follow majority view
7 – Nokia OK with FL's proposal
8 – Spreadtrum Communications Support FL's proposal.
9 – NTT DOCOMO INC. Support FL proposal
10 – Nordic Semiconductor ASA Support
11 – Nordic Semiconductor ASA One more thing, since DCI format 2-0 has other fields than SFI, it should be clarified that this does not mean that DCI format 2_0 is not supported by REDCAP. At least NR-U RedCap can utilize DCI format 2-0
12 – China Mobile Com. Corporation support

5 References

Table 6:

[1]	RP-211574	Revised WID on support of reduced capability NR devices	Ericsson

[2]	R1-2110669	RAN1 agreements for Rel-17 NR RedCap	Rapporteur (Ericsson)
[3]	R1-2110770	Duplex operation for RedCap	Ericsson
[4]	R1-2111020	Remaining issues on RedCap half-duplex operation	vivo, Guangdong Genius
[5]	R1-2111067	HD-FDD for reduced capability NR devices	ZTE, Sanechips
[6]	R1-2111102	Discussion on other aspects for RedCap	Spreadtrum Communications
[7]	R1-2111130	Other UE Complexity Reduction Aspects	Nokia, Nokia Shanghai Bell
[8]	R1-2111263	Discussion on other aspects related to complexity reduction	CATT
[9]	R1-2111323	Other remaining issues for Reduced Capability NR Devices	OPPO
[10]	R1-2111432	Remaining issues on other aspects for RedCap	China Telecom
[11]	R1-2111502	On other aspects of complexity reduction for RedCap UEs	Intel Corporation
[12]	R1-2111579	Discussion on the remaining issues of HD-FDD for RedCap	Xiaomi
[13]	R1-2111614	Discussion on collision handling of HD-FDD operation	CMCC
[14]	R1-2111745	Other aspects for complexity reduction for RedCap Ues	Samsung
[15]	R1-2111881	Other UE complexity reduction aspects for RedCap	Apple

[16]	R1-2111922	Other complexity reduction aspects for RedCap UEs	Huawei, HiSilicon
[17]	R1-2111964	Duplex operation for RedCap UEs	InterDigital, Inc.
[18]	R1-2112016	Discussion on duplex operation for redcap UEs	Sharp
[19]	R1-2112057	Aspects related to the duplex operation of RedCap	LG Electronics
[20]	R1-2112086	Other aspects for UE complexity reduction for RedCap	Panasonic Corporation
[21]	R1-2112114	Discussion on other aspects for RedCap	NTT DOCOMO, INC.
[22]	R1-2112224	Other Aspects of RedCap UE Complexity Reduction	Qualcomm Incorporated
[23]	R1-2112284	On half duplex operation for RedCap UEs	MediaTek Inc.
[24]	R1-2112377	On aspects related to duplex operation	Nordic Semiconductor ASA
[25]	R1-2112388	Remining issue on duplex operation for RedCap UE	WILUS Inc