[RAN95e-RAN4-R18Prep-03] - Version 0.0.6
RAN

3GPP TSG-RAN Meeting #95e RP-220021

Electronic Meeting, 17 – 23 March 2022

Agenda item: xxxx

Source: RAN4 Vice-Chair (Intel)

Title: Moderator's summary for discussion [RAN95e-RAN4-R18Prep-03] RRM Enhancements

Document for: Information

1 Introduction

This email thread is a part of RAN Rel-18 RAN4 Email Discussion (February 7th to 11th) with overall guidance and details provided in RP-220003.

This discussion covers a candidate Rel-18 RAN4 RRM Enhancements work area. The goals of this email discussion are to identify potential SI/WI(s), stabilize potential scope for each potential SI/WI including justification and objectives for them. The discussion is based on the conclusions reached duringpre-RAN #94e email discussions (RP-212682) for "Topic #10: RRM requirements enhancement" with the following key working

- **Topic #10: RRM requirements enhancement**
  - Working areas which seem stable
    - FR2 RRM enhancements
    - General RRM requirement enhancement and leftover
    - Measurement gap related enhancement and leftover

The plan of the email discussion is provided below:

- **Initial Round**
  - Discussion on possible SI/WIs structure for RRM enhancements work in Rel-18.
  - Discussion on the set of topics/objectives based on the outcome of pre-RAN#94e email discussion. The goal of discussion is to conclude on a converged set of topics/objectives.
- **Intermediate Round**

- Further discussion on a reduced set of converged topics/objectives for the potential projects (SI/WIs)

- **Final Round**
  - Discussion on initial drafts of SID/WID(s) justification and objectives

The email discussion commenting timelines are provided below for delegates convenience (see RP-220003 for details)

- Wednesday, 9th February 12:00h UTC: Deadline for comments on initial email discussion
- Thursday, 10th February 12:00h UTC: Deadline for comments on intermediate email discussion
- Friday, 11th February 12:00h UTC: Deadline for comments on final email discussion

Note:please observe the deadlines carefully. Comments received after the respective deadline will not be considered for the corresponding summary and discussion/conclusion (subject to up to 30 minutes grace period in consideration for potential 3GPP email server delays).

2 Initial round

2.1 General

Duringpre-RAN #94e email discussions (RP-212682) the following working areas for Topic #10 RRM requirements enhancements were identified

1. FR2 RRM enhancements
2. General RRM requirement enhancements and leftovers
3. MG related enhancements and leftover

This email discussion shall aim to identify potential WI or SI structure. In Rel-17 timeframe RAN4 has two projects covering RRM and MG enhancements: 1) Rel-17 Further RRM enhancements WI and 2) Rel-17 MG Enhancements WI. Given the set of identified working areas during pre-RAN #94 email discussion and a strong level of companies interest in further evolution of all three tracks, moderator recommends discussing if a similar project structure can be adopted for Rel-18 timeframe.

Proposal #1: Consider the following 2 WI as an output of email discussion

1. **Rel-18 NR [and MR-DC] RRM enhancement WI covering working areas #1 (FR2 RRM) and #2 (General RRM)**
2. **Rel-18 NR [and MR-DC]s MG enhancements WI covering working area #3 (MG enhancements)**

Companies are encouraged to share views on the potential Rel-18 SI and/or WIs structure for RRM enhancement work area based on moderator Proposal #1.

Feedback Form 1: Rel-18 SI and/or WIs structure for RRM enhancement work area

1 – Nokia Corporation

In general, we do not see a great benefit in combining FR2 RRM enhancements and General RRM requirement enhancements and leftovers. It is not clear the reason for combining while having them separate the scope of each would maybe be clearer. However, if the final package content fits better into one a combined Rel-18 NR RRM enhancement WI covering both areas, then it can be reconsidered.

2 – MediaTek Inc.

We are fine with proposal #1, which follows the Rel-17 arrangement (RRM enh + Gap enh). Nevertheless, we also do not see a problem to put FR2 RRM into a separate WI, e.g., to be considered together with some FR2 enhancement in [RAN95e-RAN4-R18Prep-02].

3 – Apple Poland Sp. z.o.o.

We support to have two WIs in R18 for RRM enh and MG enh respectively, following the R17 enhancement structure. In our understanding, the enhancement in FR2 RRM enhancement category is also part of RRM enhancement, and it makes more sense to have RRM enhancement WI to contain also FR2 enhancement.

4 – Guangdong OPPO Mobile Telecom.

Generally fine with proposal #1.

Two WIDs led by RAN4 RRM could be good and enough considering the balance between demands and workload, just like we did in Rel-17. If any FR2 RRM objectives were indentified, they can also be included in the same RRM enh WID or covered by other RF leading WID related to FR2.

5 – China Mobile Com. Corporation

We are OK with proposal 1, support to follow the similar project structure in Rel-17.

6 – Beijing Xiaomi Mobile Software

Support the Proposal#1, and we prefer to have two separate WIs in Rel-18 for RRM enhancement and MG enhancement respectively. And RRM enhancement WI could cover FR2 RRM enhancements and general RRM enhancement.

7 – QUALCOMM JAPAN LLC.

We believe we should first focus on what items to be approved and then decide how to group them in WIs. Also, the contents should be kept to a minimum given that the RRM room has been overloaded for many years.

8 – Huawei Technologies France Support proposal 1 to follow the R17 WI structure. If FR2 RRM Enh and General RRM Enh are to be combined to one WI, we suggest to extend some proposals in current working area FR2 to include FR1 also.
9 – Ericsson LM We are fine with proposal 1
10 – Intel We support this proposal.
11 – CATT Generally we are fine with proposal #1 which is aligned with R17 structure, but it is also OK for us to set up 3 RRM WIs if the package of widely supported objectives is large enough.
12 – ZTE Wistron Telecom AB We are fine with the proposal. The contents to be included should be clear and specific.
13 – vivo Mobile Communication (S) In general, the umbrella WIs for RRM enhancement should still be adopted in Rel-18. The objectives need to be identified firstly. Then objectives can be grouped into umbrella WIs from best of project management perspective. In our view what really matters is the number and scope of objectives.
14 – LG Electronics Inc. Support Proposal #1. Regarding RAN4 work load, objectives need to be decided. 2 objectives in FR2 RRM and 1 objective in General RRM are recommended (Total 3 objectives). And depending on work load, each objective need to consider 2 or 3 sub-objectives.
15 – China Telecommunications In general, we are fine with this proposal, and it also depends on which and how many items will be approved.
16 – NTT DOCOMO INC. In general, we support proposal #1, but if total number of RRM topic become large finally, it is better to separate General RRM and FR2 RRM.

2.2 Working area #1: FR2 RRM enhancements

Considering conclusions reached duringpre-RAN #94e email discussions (RP-212682) moderator suggests use an updated list of candidate topics as the basis for an initial round discussion. In the updated list additional clarifications on objectives scope were added based on companies comments in pre-RAN #94e email discussion (changes are underlined).

1. FR2 RRM enhancements

- 1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)
- 1.2 Define FR2-FR2 DAPS requirements
- 1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)
- 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)
- 1.5 RRM measurements for different Rx beam sets in FR2
- 1.6 Network-controlled gaps for UE Rx beam switching
- 1.7 FR2 delay reduction enhancements
- 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

Companies are invited to provide comments on candidate topics/objectives such as

- Justification including commercial interests (near & longer terms)
- Objective support & priority (note: it is not intended decisions will be taken based on number counting)
- Detailed scope & objectives
- Impact on other WGs
- Expected amount of RAN4 work efforts
- Additional candidate objectives (if any)
- *Note: Companies are strongly encouraged to provide both index and title of specific objectives in the comments to simplify tracking.*

Feedback Form 2: Comments on Working area #1: FR2 RRM enhancements

1 – Nokia Corporation

We suggest having a WI dedicated for FR RRM enhancements. For the potential objectives within a WI including FR2 RRM enhancements our views are as follows:

1.1 Enhancement to FR2 beam measurement requirements, (e.g., allow UE to measure a subset of the configured resources)

We do not see a need for this enhancement in Rel-18. Our understanding of the proposal is that the problem and reasoning behind the reasoning for enhancements can be addressed by proper a network configuration. We do not see this proposal as being bringing improvements in a well configured network. Hence, as the enhancements can be handled via network configuration, and considering the RAN4 workload, we believe this enhancement can be postponed. Low priority. Will have impact on other WG. Initially, we expect high workload.

1.2 Define FR2-FR2 DAPS requirements

We do not see a need for defining FR2-FR2 DAPS requirements in Rel-18. We suggest that RAN4 return to discuss requirements for FR2-FR2 DAPS feature in Rel-19 or beyond once RAN4 has defined requirements

for simultaneous independent multi-Rx beam DL reception in FR2. Having these requirements defined first will give clearer baseline for discussing FR2-FR2 DAPS requirements and the most complete set of requirements for the feature. In practise we only see a real use case for this feature for a UE capable of independent simultaneous Rx-Chain reception. Postpone for a later release.

1.3 SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

We support this objective. The current SCell activation delays in FR2 are in some scenarios relaxed which could have the side effect that network would avoid deactivating the FR2 SCell. This may have negative impact on the UE power consumption. RAN4 should discuss SCell activation latency reduction to identify and specify enhancements where feasible. At least RAN4 should discuss further the detailed conditions for known and unknown conditions as these are currently putting strict limitations on the expected latencies. High priority. There could be impact on other WGs. RAN4 has been working on activation delays in Rel-17 and we expect a continued work into latency reduction can be medium to high workload.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

We do not see a strong need FR2 BWP switching time enhancements in Rel-18. The topic of enhancing the type 2 BWP switch delay in FR2 has been discussed earlier in RAN4. during those discussions RAN4 could not reach consensus. As such a reduction on the BWP switch delay is likely beneficial but our preference is that any enhancement should be generic and apply for all UEs to reduce the network complexity.

If we should support this work in Rel-18 the objective shall also include BWP switch delay enhancements shall also include RRC based BWP switch delay. Conditional priority. This work could include RF aspects as well as other WGs. Workload could be medium.

1.5 RRM measurements for different Rx beam sets in FR2

The proposal provided is unclear concerning details and therefore we cannot support this work. However, we expect that this may address the same aspect also discussed within '2.3 Topic #14 Requirement for FR2 multi-Rx chain DL reception' proposal under enhanced RRM requirements. Hence, we suggest RAN4 to clarify the difference between this proposal and the work proposal in 'Topic #14 Requirement for FR2 multi-Rx chain DL reception'. Low priority as scope is not clear.

1.6 Network-controlled gaps for UE Rx beam switching

We do not see a need for a WI on this enhancement in Rel-18 timeframe. Currently, UE Rx beam switching is UE implementation specific and agnostic to the network. If network should be able to configure Rx beam switch gaps, the network would need to know the UE Rx beam switch implementation. Although, we have seen that some features may under some conditions have a negative impact in terms of dropped DL allocations due to UE autonomous Rx beam switch we also see that allocated RX beam switch gaps may have higher negative impact than not having RX switch gaps. Hence, if RAN4 is to progress on this, we prefer to first study the potential gain and loss from such solution and based on the SI outcome decide whether to progress with a WI. There would be impact on other WGs. We also expect that the workload could be very high as this relates to existing UE and network implementations.

1.7 FR2 delay reduction enhancements

We support this work. Enhancements to the FR2 delay requirements can potentially reduce some of the current FR2 delays which can benefit both UE and network. We believe this proposal can be merged with other proposals related to FR2 delay enhancements e.g. 'SCell activation enhancement in FR2'. High priority. We see that workload and WG impact is likely the same as SCell activation enhancement topic.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC))

We do not see a need for working on these leftovers in Rel-18. These leftovers could have low priority in RAN4 Rel-18 as we do not expect FR2-2 deployments or devices available in Rel-18 timeframe. Postpone to later release.

Based on this and the above discussion our preference is to define a WI targeted at FR2 RRM enhancements with the following objectives. We see that such WI with listed objectives could give overall system improvements and can provides benefits for both UE and network.:

FR2 RRM enhancements

The work item could include a number of the following objectives:

- High priority:

o FR2 delay reduction enhancements

o SCell activation enhancement in FR2

- Medium priority:

o TCI switching enhancement

o Fast and gapless Scell activation

o Fast RRC connection re-establishment

- Conditional

o [FR2 BWP switching time enhancements provided RRC based BWP switch delay is included]

The proposed objectives would need more details and could have impact on other WGs. Additionally, RAN4 has been working on activation delays in earlier releases and the work usually calls for detailed timing discussions. Hence, we expect work into latency reductions in FR2 can be medium to high workload.

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2 – MediaTek Inc.

1.1 Enhancement to FR2 beam measurement requirements

Not interested.

We do not see the need for this enhancement. The benefit is not clear to us. More discussions may be needed for justification.

1.2 Define FR2-FR2 DAPS requirements

Postpone.

This is an even advanced feature after UE can already support simultaneous multi-panel reception, which is still under discussion in RAN4/RANP. It is too early to have this objective in Rel-18.

1.3. SCell activation enhancements in FR2

Support.

Current FR2 SCell activation requirements are complicated and take a too long time, which is not good for the real deployment and also UE power consumption. It is desirable to see some enhancement here to fix the problem. Just a reminder that we may also need RAN1 or RAN2 involved to really come out with a solution which can really reduce the activation delay. A pure UE-based solution does not bring much benefit in our view.

1.4 FR2 BWP switching time enhancements

Support.

Current BWP switching time in FR2 takes 17 slots for 120KHz SCS, which provide s sufficient room for improvement. Especially that FR2 carriers usually have a very wide bandwidth, reducing the delay by even [2] slots means a lot of throughput. The final solution (e.g., a mandatory enhancement of Type 2 delay or defining a new UE capability) can be up to RAN4 discussion. We expect the discussion could be difficult, but the workload is low.

1.5 RRM measurements for different Rx beam sets in FR2

Not interested.

This should be left to UE implementation. We are not clear about the benefit to standardize this.

1.6 Network-controlled gaps for UE Rx beam switching

Postpone.

In last RAN4 meeting, there were some progress for NCSG in FR2. Companies are still working on this direction. We should wait for RAN4 to conclude the Rel-17 discussions before deciding any potential Rel-18 enhancement. We are not sure to put this objective here or in the gap enhancement WI.

1.7 FR2 delay reduction enhancement

Support.

As mentioned in previous candidate objectives, FR2 RRM requirements are in general too slow. We are fine to have some enhancement in this direction. However, the current objective is still very high-level and includes even 1.3 and 1.4. We suggest to list specific RRM requirements to be enhanced, e.g., L3 measurement delay, SCell activation, RRC re-establishment, BWP switch. TCI state switch ... . A more specific objective can help to improve RAN4 discussion efficiency a lot. This objective already demand a rather big to workload.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

Not interested.

We prefer to start the work only if there is a strong market need. Maybe some input from operator could be helpful.

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3 – Apple Poland Sp. z.o.o.

We propose to have certain principle to down-select the candidate topics for R18 WI since we have limited TU. The down-selection criteria should be:

(1)based on interests of majority companies,

(2)based on the commercial interests of operators,

(3)R17 leftover topics shall be prioritized for essential functionalities.

1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)

[Apple]: the gain of this enhancement might not be obvious, since this issue could be optimized by network configuration using the existing signaling and therefore at least it would not be an essential functionality enhancement. Due to the TU limitation, we propose to put it as medium priority.

1.2 Define FR2-FR2 DAPS requirements

[Apple]: this enhancement shall be led by RAN2. In the mobility enhancement WI discussion, this FR2-FR2 DAPS scenario has been precluded from R18 and we think it might not be an important scenario/deployment in R18 from operator perspective (also high UE complexity). We propose to put it as low priority.

1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

[Apple]: we are fine to have this scope in R18 enhancement. Since in R17 CA/DC enhancement WI we already had some enhancement for efficient CA activation, RAN4 needs to clearly capture the working

scope or possible direction of this SCell activation enhancements to avoid redundant work. We propose to put it as medium priority.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

[Apple]: we didn't see strong justification to have such FR2 BWP switching time enhancement. In the current spec, we already had both type 1 and type 2 BWP switching delay, and therefore the benefit to introduce another type of FR2 BWP switching delay is not clear to us. We propose to put it as low priority.

1.5 RRM measurements for different Rx beam sets in FR2

[Apple]: the Rx beam set is up to UE implementation and RAN4 is working on minimum requirement. We don't think it's necessary to specify the UE implementation of differentiating the different Rx beam sets used for different measurement targets. We propose to put it as low priority.

1.6 Network-controlled gaps for UE Rx beam switching

[Apple]: as commented for topic 1.5, the Rx beam switching is also up to UE implementations, and we don't see the necessity to specify it. Even though it somehow would bring some potential interruption reduction, it would cause big impact to UE flexibility of local Rx beam scheduling. We propose to put it as low priority.

1.7 FR2 delay reduction enhancements

[Apple]: we are supportive on this enhancements since the existing FR2 RRM cell identification/measurement delay is quite long and the mobility performance impact is not well protected in previous release. Such enhancement would both benefit UE and network since FR2 measurement with beam sweeping is the essential functionality anyway. We propose to put it as high priority.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

[Apple]: the current FR2-2 RRM is not fully concluded, and it's not very clear to us what the leftover is, e.g., we even don't have FR2+FR2 NR-DC RRM requirement, why do we need to firstly prioritize FR2-2 NR-DC. As this enhancement is scenario/deployment related, we need to hear views from operators about the importance of this deployment. We propose to put it as low priority.

In this FR2 enhancement category, we propose followings:

- High priority:

1.7 FR2 delay reduction enhancements

- Medium priority

1.1 Enhancement to FR2 beam measurement requirements

1.3 SCell activation enhancements in FR2

- Low priority

1.2 Define FR2-FR2 DAPS requirements

1.4 FR2 BWP switching time enhancements

1.5 RRM measurements for different Rx beam sets in FR2

1.6 Network-controlled gaps for UE Rx beam switching

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

4 – Guangdong OPPO Mobile Telecom.

We are open to 1.7 FR2 delay reduction enhancement.

Such a high-level objecvtive can cover all potential enhancement of FR2 delay reduction including 1.3 and 1.4. Specific RRM requirements to be enhanced can be futher indentified, e.g., SCell activation, RRC re-establishment, BWP switch, TCI state switch. But the workload should be taken into accout that the bullets with most interst and significant gain come first.

No strong interest in other items.

5 – China Mobile Com. Corporation

One general consideration, as suggested in Proposal 1, working areas #1 (FR2 RRM) and #2 (General RRM) will be covered by 1 WI (Rel-18 NR [and MR-DC] RRM enhancement WI), considering the RAN4 work efforts and available TU, the objectives cannot be too much and the overall load need to be controlled into a reasonable range, it is necessary to focus on the essential features.

For FR2 RRM enhancement, we are interested in following topics and suggested to be prioritized:

- **1.7 FR2 delay reduction enhancements**: Support. Currently, the FR2 delay requirements are too long, delay reduction benefits system performance.

For following topics, we have concerns and suggested to be deprioritized:

- **1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)**: Deprioritized. Reduction on BWP switching delay has been discussed in some WI of previous release (e.g. R16 power saving), but the discussion is controversial and no consensus is reached, we are wondering whether we will face the same situation. And we would like to know the details on how to perform the reduction.
- **1.6 Network-controlled gaps for UE Rx beam switching**: Deprioritized. UE Rx beam switching is up to UE implementation, not sure how network-controlled gaps work.
- **1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)**: Deprioritized. Since there is no commercial deployment on these scenarios, considering RAN4 workload, can be deprioritized.

6 – Beijing Xiaomi Mobile Software

1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)

[Xiaomi]: Not interested. The benefit is not clear. As mentioned by Apple, this optimization can be achieved by NW configuration.

1.2 Define FR2-FR2 DAPS requirements

[Xiaomi]: Not interested. We do not think FR2-FR2 DAPS is a typical and important scenario in mobility WI. And, from UE perspective, UE complexity would be increase significantly to support FR2-FR2 DAPS.

1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

[Xiaomi]: Support this objective. Current FR2 SCell activation delay requirements are extremely long and complicated. It is beneficial to further reduce the delay and simplify the procedure.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

[Xiaomi]: Postpone. More discussion and justification on introducing another type BWP switching delay in FR2 are needed, since the existing BWP switching delay requirements are complicated, e.g. type 1 and type 2 BWP switching delay which depends on UE capability. In addition, RAN4 is discussing whether BWP switching delay is reduced or not for only changing center frequency case in Rel-17 RedCap WI.

1.5 RRM measurements for different Rx beam sets in FR2

[Xiaomi]: Postpone. We do not think this is an urgent topic. Since the Rx beam set is up to UE implementation.

1.6 Network-controlled gaps for UE Rx beam switching

[Xiaomi]: Postpone, more justification is needed. Since UE Rx beam switching is up to UE implementation.

1.7 FR2 delay reduction enhancements

[Xiaomi]: Support, it is beneficial to enhance FR2 delay requirements to introduce the mobility performance. And the specific FR2 RRM requirement should be identified, and we propose to enhance the following requirement as a starting point:

1□ FR2 cell identification requirement in idle/inactive/connected mode

2□ FR2 measurement delay requirement in idle/inactive/connected mode

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

[Xiaomi]: Postpone, we would like to hear more views for operator if there is a strong market request.

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7 – QUALCOMM JAPAN LLC.

There are many proposals in this area, however, many of them are not clearly defined or it is not clear what problem they are actually addressing.

1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources):

What is exact problem that is being solved and what kind of performance gains are expected. In our understanding, the number of beams that UEs have to measure is adequate and the UE can already prioritize which beams to measure through implementation.

1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

RAN1 involvement would be needed to have a significant reduction for the case of unknown cells, is there a plan to involve RAN2. A more concrete proposal on which scenario is to be enhanced and how would be useful

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

We already have Type 1 and Type 2, we do not see the point of defining a Type 1.5 with requirements in the middle. UE vendors can directly implement Type 1 if Type 2 is too slow

1.7 FR2 delay reduction enhancements:

A concrete proposal on which delay reduction is the target is needed to discuss this further.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

This should based on some band combination requests.

8 – Huawei Technologies France

1.1 Enhancement to FR2 beam measurement requirements, (e.g., allow UE to measure a subset of the configured resources)

High priority, and if FR2 RRM Enh and General RRM Enh are to be combined to one WI based on P1 in section 2.1, we suggest to combine 1.1 with 2.5 as general BM enhancement without limiting to FR2.

From the field deployment, we do see the issue that limited UE capability for BM measurement causes frequent RRC reconfiguration of BM resources, which has clear negative impacts on power consumption, signaling overhead and report latency. The objective is to allow UE to measure a subset of the configured BM resource, similar as L3 CSI-RS measurement based on associated SSB.

The spec impact would be mainly on the applicability of the BM requirements, so the efforts in RAN4 would be small, and we do not expect impacts to other WGs.

1.2 Define FR2-FR2 DAPS requirements

This is a leftover from Rel-16 eMob WI, and the reason was that FR2-FR2 DAPS HO would require UE to simultaneously receive from 2 direction, which may not be feasible based on assumptions on UE Rx beam at that time. For now, we already have IBM framework for inter-band FR2 CA from Rel-16, so FR2-FR2 DAPS HO should be feasible in some scenarios, and we believe Rel-18 is the right time for RAN4 to define the requirements. We expect medium efforts in RAN4 and no impact to other WGs. Medium priority.

1.3 SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

High priority, and if FR2 RRM Enh and General RRM Enh are to be combined to one WI based on P1 in section 2.1, we suggest to combine 1.3, 1.7 and 2.14 without limiting the enhancement to FR2.

We expect the efforts in RAN4 would be medium given that SCell activation enhancement has been discussed quite extensively since Rel-15, and we expect some small impacts to other WGs.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

BWP switching delay requirements also impacts how fast UE can access the FR2 resources with large BW, thus impacts the user experience. Moreover, UE is not required to Tx/Rx data during the BWP switching delay so a longer delay would mean long interruption time.

In our view, the switching delay for type 2 UE (2.25ms in absolute time) is rather large, and we suggest to enhance the type 2 BWP switching delay requirement, e.g. by introducing a new UE capability in between type 1 and type 2. We expect the RAN4 efforts for this objective would be small, and impacts to other WG is very limited as so far we see only impacts to RAN2 due to new UE capability. High priority.

1.5 RRM measurements for different Rx beam sets in FR2

In Rel-15 RAN1 has concluded that it is up to UE to determine the Rx beam set for RRM measurement on different carriers, and so far we do not see clear issue based on this principle. Also, the proposed objective is not very clear, e.g. what are the expected impacts to the requirements. Considering that the issue and the enhancement are not clear for this objective, we consider it as low priority at this stage. Low priority.

1.6 Network-controlled gaps for UE Rx beam switching

This proposal was raised to reduce the performance degradation for CBM based FR2 inter-band CA in R17 and also was discussed in R17. Unlike UE measurement behavior, UE usually performs Rx beam switching due to TCI state change (network driven) or according to BM measurement results (UE autonomous). When to perform Rx beam switching is up to UE implementation. Besides, how to configure a proper gap pattern for UE Rx beam switching could be difficult for network to decide. Introducing network-controlled gaps means that the network needs to indicate TCI state change at an appropriate time so that UE can perform

Rx beam switching within the gap. It can be observed that network-controlled gap has the limitation on both network implementation and UE implementation. Low priority.

1.7 FR2 delay reduction enhancements

FFS priority due to unclear scope.

The scope of this objective with current wording is not very clear, e.g. for what procedures the delay reduction are considered. We suggest to focus on the SCell activation and BWP switching delay reduction as they have direct impacts on the user throughput. In this sense, this objective can be merged with 1.3 and 1.4.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC))

We do not see the urgency for these leftover scenarios in Rel-18 timeline (e.g.FR2-1 + FR2-2). Prefer to consider it in later releases. We suppose to put it as low priority.

In summary, in this FR2 enhancement category, we propose followings:

- High priority:

- **Combine** 1.3(SCell activation enhancements in FR2), 1.7 (FR2 delay reduction enhancements) and 2.14 (Fast Scell activation) to "SCell activation enhancement including FR1 and FR2";

- **Combine** 1.1(Enhancement to FR2 beam measurement requirements) with 2.5 (TCI switching enhancement) to "beam management enhancement without limiting the enhancement to FR2";

- 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2).

- Medium priority:

- 1.2 Define FR2-FR2 DAPS requirements.

- Low priority

1.5 RRM measurements for different Rx beam sets in FR2

1.6 Network-controlled gaps for UE Rx beam switching

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

9 – Ericsson LM

We support the following objectives as highest priority with objective 1.7 as the umbrella objective:

- **1.7 FR2 delay reduction enhancements:**
    - **1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)**

For other objectives, we do not see any urgent need not we see any substantial improvement based on the previous discussions in RAN4.

10 – Intel

Regarding FR2 RRM enhancements we propose to consider the below objectives in R18 work item. They are our priorities in consideration of industrial & commercial interests.

1.7. FR2 delay reduction enhancements

This objective consists of three sub-objectives to enhance FR2 performance in terms of RRM delay requirements. The detailed projected scope is presented below. This objective is projected as **medium workload** and **no cross group impact**.

FR2 delay reduction enhancements [RAN4]

· General measurement delay reduction by assuming reduced number of Rx beams for UE with simultaneous receptions

· SCell activation delay reduction in FR2 for unknown target SCell cases

· BWP switching delay reduction in FR2 for type 2 UE

1.6. Network controlled gaps for UE Rx beam switching

This is to introduce mechanism to allow dedicated gaps for UE RX beam switching under scenarios with high MRTD/MTTD to have a predictable impact on performance. This objective is projected as **minor workload** and **minor RAN2 impact**.

Network controlled gaps for UE Rx beam switching [RAN4, RAN2]

- Specify mechanisms to schedule gaps for UE Rx beam switching
- Specify scheduling restrictions within network controlled gaps based on Rx beam switching periodicity and duration
- Specify applicability on the scenarios where network controlled gaps are applied

1.8. Requirements for leftover Rel-17 FR2-2 deployment scenarios

This is to introduce include leftover scenarios / requirements for FR2-2 into Rel-18. This objective is projected as **medium workload** and **no cross group impact**.

Leftover deployment scenarios for FR2-2 [RAN4]

- Specify RRM requirements for FR2-1 + FR2-2 NR CA and NR-DC
- Specify RRM requirements for EN-DC with FR2-2
- Specify RRM requirements for NE-DC with FR2-2

For other FR2 topics, we would like to have general comments on:

1.1. Enhancement to FR2 beam measurement requirements

The scope needs further clarification. Is it correct understanding that this is mainly related to RAN2 design of configuration?

1.5. RRM measurements for different Rx beam sets in FR2

We do not support this objective since we believe UE Rx beam configuration and sets are totally implementation driven and we don't see the reason to further specify anything.

11 – CATT

For FR2 enhancement, we can support the following two objectives which can be combined

1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

1.7 FR2 delay reduction enhancements

And we think the following objectives can be deprioritized:

1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)

[CATT] We don't see the benefit of this enhancement. Firstly we have a similar view as Nokia that this can be addressed by NW configuration. Secondly, the enhancement approach is not clear, if UE doesn't measure the configured resources, how it can choose the subset and guarantee the performance.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

[CATT] We don't see the strong justification for this objective and it is unclear what principle can be used to reduce the delay.

1.6 Network-controlled gaps for UE Rx beam switching

[CATT] The benefit of this proposal is not clear. Since the Rx beam switching is up to UE implementation which is not known to the network, it is not practical for NW to configure gaps for all UEs to perform Rx beam switching.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

[CATT] This is not urgent need for deployment and can be postponed.

12 – vivo Mobile Communication (S)

1.1 Enhancement to FR2 beam measurement requirements, (e.g., allow UE to measure a subset of the configured resources)

We do not see necessity/gain of this enhancement. In our view the feature can already work with existing signaling under correct network configuration. Optimization can be made by UE implementation.

1.2 Define FR2-FR2 DAPS requirements

Not necessary to define requirements at least in Rel-18.

1.3 SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

In Rel-18, it is better focusing on general mechanism of reducing measurement delay in FR2, which can be main objective of 1.7. If the measurement delay in FR2, e.g., L1-RSRP measurement delay, can be reduced, then there is no strong motivation to reduce SCell activation delay in FR2 further.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

We are not interested in this enhancement since there is already 2 types of BWP switching time available.

1.5 RRM measurements for different Rx beam sets in FR2

In our understanding, it is up to UE implementation what RX beams are used for serving cell and neighbor cells measurement as long as UE can meet the minimum requirements. No issues have been identified so far.

1.6 Network-controlled gaps for UE Rx beam switching

UE Rx beam switching is up to UE implementation. UE should be allowed to switch Rx beam when it finds necessary.

1.7 FR2 delay reduction enhancements

We support this work with the objective of identifying feasible mechanism to reduce L3/L1 measurement delay in FR2 and specifying corresponding requirements. High priority.

There may be impact to other WGs depending on feasible mechanism identified during WI phase.

RAN4 work efforts could be high.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC))

It can be postponed to future release.

So, for working area #1 for FR2 enhancement, we propose **1.7 (FR2 delay reduction enhancements)** as high priority. Other objectives are considered as low priority.

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13 – ZTE Wistron Telecom AB

1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)

Low priority. It would be good that Proponent provides more details on why a proper network configuration cannot address the target issues.

1.2 Define FR2-FR2 DAPS requirements

Low priority. We don't see any urgent demand for this.

1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

High priority.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

Low priority. The benefits and needs of introducing a delay between Type 1 and 2 are not sufficiently justified.

1.5 RRM measurements for different Rx beam sets in FR2

Low priority.

1.6 Network-controlled gaps for UE Rx beam switching

Low priority, can be addressed as an implementation issue.

1.7 FR2 delay reduction enhancements

The initiative is fine, but it seems too general, needs to be more specific and it should not be too broad that it may become an ”umbrella”.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

Low priority. Lack of sufficient and immediate commercial demands.

In addition, TCI switching enhancement can be included as one of the objectives in the general RRM WI.

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14 – LG Electronics Inc.

1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)

– High priority. We expect impacts are not big to other WGs.

1.2 Define FR2-FR2 DAPS requirements

– Low priority. It can be discussed after simultaneous independent multi-Rx beam reception, and it is not urgent issue.

1.3 SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

– Medium priority. Clear work scopes are needed. If needed, 1.3 can be combined with 1.7.

1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

– Medium priority. If needed, 1.4 can be combined with 1.7.

1.5 RRM measurements for different Rx beam sets in FR2

– High priority. We think there can be gain difference due to different Rx beam sets which are used in UE in real field. It can impact mobility performance. We expect small workload and impact on other WGs are not big. 1.5 can be combined with 1.1.

1.6 Network-controlled gaps for UE Rx beam switching

– Low priority

1.7 FR2 delay reduction enhancements

– High priority. 1.7 can merge 1.3 and/or 1.4, however workload needs to be considered.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

– Low priority. At first, operator’s request is needed, and we prefer to focus on enhancement of FR2-1.

In summary, we suggest 2 objectives with sub-objectives as follow

- FR2 beam measurement enhancement

: 1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)

: 1.5 RRM measurements for different Rx beam sets in FR2

- FR2 delay reduction enhancement

: 1.3 SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)

: 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

: 1.7 FR2 delay reduction enhancements

15 – TELECOM ITALIA S.p.A.

There are clearly too many topics in this proposal, and only a small subset should be adopted to keep the workload manageable.

We strongly recommend not to spend time and resources on FR2-2 related activities.

High priority: FR2 delay reduction enhancement

16 – China Telecommunications

We support the following topics with more obvious gain and in more common scenarios:

- FR2 delay reduction enhancements
- SCell activation enhancements in FR2

17 – NTT DOCOMO INC.

1.1 Enhancement to FR2 beam measurement requirements

Low priority: The objective issue can be resolved by appropriate network configuration and the obtained gain may be not so large. In addition, signalling may become complex and some part may depend on UE implementation.

1.2 Define FR2-FR2 DAPS requirements

Low priority: Considering real deployment scenario, basically FR2 cell assumes add-on cell, i.e. the gain provided by FR2-FR2 DAPS HO mey be small.

1.3. SCell activation enhancements in FR2

High priority: The current FR2 SCell activation delay requirement is too long in some cases, e.g. unknown SCell case and FR2 basically assumes intra-band CA to achieve high throughput. Therefore SCell activation enhancement may have large gain.

1.4 FR2 BWP switching time enhancements

Low priority: The necessity of intermediate type between Type 1 and Type 2 is doubtful.

1.5 RRM measurements for different Rx beam sets in FR2

Low priority: Same view as 1.2, basically FR2 cell assumes add-on cell so the performance gain may be small. In addition, UE Rx beam for measurement is now up to UE implementation, then it may be difficult to specify the requirement.

1.6 Network-controlled gaps for UE Rx beam switching

Low priority: The expected gain is unclear and operation considering this function for diverse UEs may be complex.

1.7 FR2 delay reduction enhancements

High priority: Same reason as 1.3 but objective should be clearly defined.

1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

Low priority: FR2-2 related issue should be postponed.

18 – Samsung Electronics Co.

Based on the previous discussion, it is better to clarify the exsiting 1.7 (even though the title itself is high level) is referring to further reduce the cell identificaiton as well as measurement delay requirements. With this, 1.7 is not included 1.3 and 1.4 in our understanding. By saying that, we think the existing 1.7, i.e., further reduce the FR2 cell identification and measurement delay requirements, shall be one of high priority objectives in RRM enhancement WI.

2.3 Working area #2: General RRM enhancement and leftovers

Considering conclusions reached duringpre-RAN #94e email discussions (RP-212682) moderator suggests use an updated list of candidate topics as the basis for initial round discussion. In the updated list additional clarifications on objectives scope were added based on companies comments in pre-RAN #94e email discussion (changes are underlined). In addition, relevant topics listed under "Other" areas in RP-212682 were added to this list (starting from objective 2.8).

2. General RRM enhancement and leftovers

- 2.1 UL frame boundary offset reporting
- 2.2 FR1-FR1 NR-DC RRM requirements
- 2.3 Enhancements for CSI-RS based L3 measurement
- 2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)
- 2.5 TCI switching enhancement
- 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
- 2.7 RLM enhancements
- 2.8 HST RRM enhancement
- 2.9 CGI reading requirement for NR-U cell

- 2.10 Harmonized RLM/BM
- 2.11 RRM enhancement for large CC number
- 2.12 allowInterruption mechanism for deactivated SCell measurements
- 2.13 CSI-RS based CFRA in RRM requirement
- 2.14 Fast and gapless Scell activation
- 2.15 Fast RRC connection re-establishment
- 2.16 RRM enhancement for NR-U

Companies are invited to provide comments on candidate topics/objectives such as

- Justification including commercial interests (near & longer terms)
- Objective support & priority (note: it is not intended decisions will be taken based on number counting)
- Detailed scope & objectives
- Impact on other WGs
- Expected amount of RAN4 work efforts
- Additional candidate objectives
- *Note: Companies are strongly encouraged to provide both index and title of specific objectives in the comments to simplify tracking.*

Feedback Form 3: Comments on Working area #2: General RRM enhancement and leftovers

1 – Nokia Corporation

2.1 UL frame boundary offset reporting

Our view is that the actual proposal and gain was not clear. As the proposal provided was not clear concerning the objectives, we cannot support the WI without further clarifications. This proposal can be postponed to a later release.

2.2 FR1-FR1 NR DC RRM requirements

We see a clear commercial request for defining these requirements including demand based on deployments. High priority. There should be no impact on other WGs as the signalling is already in place and only RAN4 requirements are missing. We do not expect this topic will lead to more than medium workload (likely low workload). High priority

2.3 Enhancements for CSI-RS based L3 measurement

RAN4 has defined requirements such that the UE requirements apply only under limited network configuration and the CSI-RS L3 measurement window is in practice in place. Additionally, the current Rel-17 status is, that from network perspective, there are no UE accuracy requirements defined concerning the reported measurement results when considering field deployments. Reliable UE accuracy requirements in

field deployments are important for the network in order to use the UE reported measurement results and the CSI-RS L3 measurement feature. This topic can be postponed to a later release.

2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

We support this work. It has earlier proposed to support the missing scenarios in HO with PSCell where we supported the work, and we continue to support developing UE requirements covering these missing scenarios. From RAN2 specification, all these scenarios are supported, hence we see no impact to other WGs. Workload should be limited as RAN4 already have a requirements framework defined. High priority.

2.5 TCI switching enhancement

Initially, we see this more as a latency reduction enhancement and if included in Rel-18 we propose this work to be merged together with a possible WI addressing general latency reduction enhancements in FR2 RRM enhancements. However, the achievable gain is not clear. It should be clarified which enhancements types are considered and how they potentially benefit the network and UE. It is difficult to evaluate impact on other WGs as well as the possible RAN4 workload. Medium priority and medium workload but it would depend on the scope.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

Same feedback as 2.3. This topic can be postponed to a later release.

2.7 RLM enhancements

RAN4 has earlier discussed introduction of the 2nd level BLER during Rel-15. During that time, we supported such introduction as it has benefits having a 2nd level BLER for some services like Voice. During Rel-15 it was dropped due to the tight Rel-15 schedule. We are positive towards introducing the 2nd BLER level.

The proposal was lacking details. Concerning unified RLM and BFD we see that this can have significant impact on both network and UE. From network perspective there are plenty of existing deployments which are based on the current operation of RLM and BFD. The related system parameters, UE configurations and deployments are based on current Rel-15 RLM and BFD operations. Changing the basic Rel-15 RLM and BFD operations will have significant impact on existing deployments. We believe this work would be RAN1 work.

Support introduction of 2nd level BLER. There would be no impact on other WG as the signalling is already in place from Rel-15. Workload could medium. Other parts of the RLM enhancements needs thorough investigation and taking the RAN4 workload into account it should be postponed to a later release.

2.8 HST RRM enhancement

Based on the proposal we see that it would be covered by other proposals related to FR2 HST enhancement and/or FR1 HST improvements discussed in other topics. We suggest either merge this proposal to 'FR2 HST enhancement' and/or 'FR1 HST improvements' and stop the detailed discussion here. (Potential WI and objectives should only be discussed in one place.)

2.9 CGI reading requirement for NR-U cell

Currently we do not see a need for in Rel-18. The proposal and the need for the feature seems not to be very urgent compared to other topics being discussed as part of the Rel-18 RAN4 package. Postpone to a later release.

2.10 Harmonized RLM/BFD

Changing existing RLM and BFD may lead to increased system complexity. Concerning unified RLM and BFD we see that this can have significant impact on both network and UE behaviour in the field. From network perspective there are existing deployments which are based on the current operation of RLM and

BFD. The related system parameters, UE configurations and deployments are based on current Rel-15 RLM and BFD operations. Changing the basic Rel-15 RLM and BFD operations may have significant impact on existing deployments. Additionally, this may introduce two distinct UE behaviours in the field. This would require RAN1 work – if not being a RAN1 WI. To be postponed and needs further discussion.

2.11 RRM enhancement for large CC number

We support this work. It is our understanding that RF is still discussing the actual number of aggregated CC's for FR2 based on operator request. No agreement has been reached yet. However, if RF agreement is reached to support increased number CC aggregation in FR2 (beyond the current 8) we believe RAN4 should also define related RRM requirements. there could be impact on other WGs. Workload in RAN4 should be no more than medium. High priority.

2.12 Allow interruption mechanism for deactivated SCell measurements

We do not see a need for this work. The current agreement came from LTE and current requirement was made as a reasonable compromise between UE power saving and allowed drop of data when UE performs measurements on a deactivated SCell. Reducing the DRX cycle to a lower limit will of course impact the potential packet drop when having one or more deactivated SCells. Increasing the packet drop could reduce the gain from having SCell deactivated. This can be postponed to a later release.

2.13 CSI-RS based CFRA in RRM requirement

We do not see a need for this work in Rel-18. Our understanding of this proposal is that it is a latency reduction proposal for handover and PSCell addition. Hence, it may be discussed whether to merge the proposal to the general WI addressing FR2 latency enhancement of handover and PSCell addition with CSI-RS. However, we expect the gain from other latency reductions proposals to be higher as they may happen more often. This work will likely impact other WGs. Low priority.

2.14 Fast and gapless Scell activation

We see this proposal as a latency enhancement proposal which could be included as one objective in a general discussion about having a WI focusing on latency enhancements. If agreed, we propose including this in the discussions related to FR2 RRM enhancements. This may impact other WGs. We do not expect this topic to be more than medium workload. Medium priority.

2.15 Fast RRC connection re-establishment

We see this proposal as a latency enhancement proposal which could be included as one objective in a general discussion about having a WI focusing on latency enhancements. If agreed, we propose including this in the discussions related to FR2 RRM enhancements. This may impact other WGs. We do not expect this topic to be more than medium workload. Medium priority.

2.16 RRM enhancement for NR-U

In general, we see that there are RAN4 topics and improvements proposals which would provide more broad and generic enhancement. Hence, we do not see any urgent needs for RAN4 to work on RRM enhancements for NR-U in Rel-18. Our preference is to focus on proposals with more direct benefits or interest in Rel-18 timeframe. This proposal can be postponed to a later release.

The above discussion lists our preferences related to a WI targeted at General RRM enhancements and leftovers. We propose that such WI with following listed objectives would be defined - accounting the RAN4 workload, the overall system improvements and benefits for both UE and network:

General RRM enhancement and leftovers

The work item could include a number of the following objectives:

- High priority:

o FR1-FR1 NR DC RRM requirements

o HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

o RRM enhancement for large CC number

2 – MediaTek Inc.

2.1 UL frame boundary offset reporting

Support.

The intention of this reporting is to resolve the issue we encountered in the interruption discussions, e.g., DL interruption due to Tx switching, symbol-level interruption of SRS antenna switching and the UL slot immediately after measurement gap. The common problem of above issue is that network has no knowledge about UE's accumulated absolute TA. So that we always need to allow additional margin for interruption or leave it to UE implementation, which reduce the network efficiency. We may need RAN2 involved to set up a reporting mechanism.

2.2 FR1-FR1 NR-DC RRM requirements

Support.

This is the missing requirement for some real deployments.

2.3 Enhancements for CSI-RS based L3 measurement

Not interested.

We do not see the urgency to have this enhancement.

2.4 HO with PSCell requirements for new scenarios

Support.

This is the missing requirement for some real deployments.

2.5 TCI switching enhancement

Not clear.

We see 3 different directions for this objective: 1) FR2 delay reduction, which may need UE to use 2 panels simultaneously. 2) Temporary RS, which reduce the time for L1-RSRP and timing sync. 3) clarification on UE behavior during transient period of the switch. We need a bit more delay to proceed the discussion.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

Not interested.

The issue has been resolved in Rel-16. We do not see the urgency to have this enhancement.

2.7 RLM enhancements

Not interested.

This issue has been raised for several releases, but the interest/urgency level is still low.

2.8 HST RRM enhancement

Neutral.

2.9 CGI reading requirement for NR-U cell

Neutral.

2.10 Harmonized RLM/BM

Not interested.

In our understanding, RAN1/2 created BFD mechanism under existing RLM in Rel-15. If any changes to the mechanism is needed, it should be triggered by RAN1/2, instead of RAN4.

2.11 RRM enhancement for large CC number

Not interested.

Following current RAN4 requirements, the anchor CC is always having the highest priority in L3 measurement, i.e., a dedicated searcher. Other SCC will share the other searcher. We do not see much benefit for reduce the measurement delay for non-anchor CCs. Maybe more justification is needed.

2.12 allow Interruption mechanism for deactivated SCell measurements

Neutral.

The workload seems small.

2.13 CSI-RS based CFRA in RRM requirement

Not interested.

We do not see the urgency of introducing this requirement.

2.14 Fast and gapless Scell activation

Not clear.

This issue seems to overlap with one of the candidate objective of FR2 enhancement. Clarification is needed.

2.15 Fast RRC connection re-establishment

Not clear.

This issue seems to overlap with one of the candidate objective of FR2 enhancement. Clarification is needed.

2.16 RRM enhancement for NR-U

Not interested.

We do not see the urgency of introducing this requirement.

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3 – Apple Poland Sp. z.o.o.

We propose to have certain principle to down-select the candidate topics for R18 WI since we have limited TU. The down-selection criteria should be:

(1)based on interests of majority companies,

(2)based on the commercial interests of operators,

(3)R17 leftover topics shall be prioritized for essential functionalities.

2.1 UL frame boundary offset reporting

[Apple]: it's not very clear to us about benefit vs. complexity, as well as how to make such reporting timely reflect the real condition at UE when network would like to explore such benefit by fast scheduling. More justification is needed. We propose to put it as low priority.

2.2 FR1-FR1 NR-DC RRM requirements

[Apple]: this is a baseline scenario missing in RRM spec from R16. We are supportive on this topic and we propose to put it as high priority

2.3 Enhancements for CSI-RS based L3 measurement

[Apple]: we understand there were some missing parts in current CSI-RS L3 measurement requirement (measurement/scheduling restriction when L3 CSI-RS colliding with L1) even though the whole functionality can still work without such parts. Technically we are fine to enhance the CSI-RS L3 measurement, however, due to the limited TU, there are other more essential topics in the list and therefore we propose to put it as medium priority.

2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

[Apple]: we are supportive to complete this HO with PSCell functionality by specifying the missing scenarios in R18. We propose to put it as high priority.

2.5 TCI switching enhancement

[Apple]: This issue has been discussed even in R15/16 TCI switching delay. In order to shorten the TCI switching delay, it's obviously beneficial to further discuss if UE behavior can be enhanced to receive DL data during the time gap of Tfirst-SSB in Rel-18 or if any other reference signal could be used to speed up the switching delay. We propose to put it as high priority.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement

[Apple]: So far the timing limitation for CSI-RS L3 measurement is specified as a requirement applicability in RAN4, but it's not a real systematic solution for network and UE to configure and perform L3 CSI-RS measurement, respectively. So it's desirable to introduce clear timing window for L3 CSI-RS measurement, like SMTC for SSB based L3 measurement. Considering the limited TUs, we propose to put it as medium priority.

2.7 RLM enhancements

[Apple]: the 2nd pair of BLER has been discussed from R15 and we don't think it's an essential enhancement to operator since no any enhancement is motivated from R15 to R17. We propose to put it as low priority.

2.8 HST RRM enhancement

[Apple]: we have other HST related enhancement on-going (FR1 and FR2 HST), and not sure if this one would be necessary to further enhanced in R18 unless the justification is completely clarified. We propose to put it as low priority.

2.9 CGI reading requirement for NR-U cell

[Apple]: we think CGI reading feature is an important functionality especially on unlicensed carrier, and it would be worth-while to discuss the corresponding CGI reading requirement with CCA in REL-18. However, due to the limited TU, we can compromise to put it as medium priority.

2.10 Harmonized RLM/BM

[Apple]: There are lots of commonality between RLM and BM, and in order to simplify the link evaluation procedure and reduce the UE complexity and procedure delay, RAN4 may investigate and introduce a harmonized link monitoring/recovery mechanism to unify the RLM and BFD/CBD within single UE procedure. We propose to put it as high priority.

2.11 RRM enhancement for large CC number

[Apple]: In Rel-15, Rel-16 and Rel-17, the serving CC number for RRM is specified as below, however in TS38.101-1/2/3 the allowed serving cell could be more than RRM requirement, e.g.,10 NR CCs. With larger number of serving CC, it would result into huge long measurement/detection delay to degrade mobility performance based on CSSF factor without MG. It would be desirable to investigate and introduce a RRM enhancement mechanism for the measurement delay when large number of serving CCs are used. However, due to the limited TU, we can compromise to put it as medium priority.

2.12 allowInterruption mechanism for deactivated SCell measurements

[Apple]: we think it's beneficial if RAN4 could investigate and introduce allowInterruption mechanism for the NR deactivated SCell measurement to save UE power consumption when measCycleSCell<640ms. This mechanism is missing in NR but it has been used in LTE from old release. However, due to the limited TU, we can compromise to put it as medium priority.

2.13 CSI-RS based CFRA in RRM requirement

[Apple]: The CSI-RS based CFRA is a fundamental functionality from R15 but its requirement is missing for handover and PSCell addition requirement in RRM. We propose RAN4 to investigate and specify additional RRM requirement when CSI-RS based CFRA is used:for handover and for PSCell addition. However, due to the limited TU, we can compromise to put it as medium priority.

2.14 Fast and gapless Scell activation

[Apple]:Not sure if this topic is somewhat relevant to topic 1.3. Some of the enhancement scopes are similar to the efficient SCell activation in R17 CA/DC enhancement WI. The scope may need to be further clarified. It's also not very clear to us what the 'gapless' mean in this topic, and if it tends to reduce the interruption, it might be considered together with issue 2.12. We propose to put it as medium priority.

2.15 Fast RRC connection re-establishment

[Apple]: if this topic is also relevant to FR2 delay reduction enhancement, we are supportive to consider it in FR2 delay reduction as a package. For FR1, the benefit of delay reduction is not obvious to us, at least no any simulation results has provided to prove such gain. We propose to put it as medium priority.

2.16 RRM enhancement for NR-U

[Apple]: the NR-U enhancement scope would be very big since it has lots of leftover from R16 (e.g., all CSI-RS based NR-U requirement was missing) and also it might be combined with other R16/R17 features (e.g., NR-U + RedCap). Unless operator has strong interests on it, we propose to put it as low priority and may be discussed in future release.

3.3 Inter-RAT NR measurement without gaps

[Apple]: we moved this topic 3.3 under the category of '2.3 General RRM enhancement and leftovers' since this topic was identified in R17 discussion and it's more like a measurement enhancement rather than a MG enhancement. We are supportive to this topic and propose to put it as high priority.

In this 'General RRM enhancement and leftover' category, we proposed followings:

- **High priority:**

2.2 FR1-FR1 NR-DC RRM requirements

2.4 HO with PSCell requirements for new scenarios

2.5 TCI switching enhancement

2.10 Harmonized RLM/BM

3.3 Inter-RAT NR measurement without gaps (moved from MG enh)

- **Medium priority**

2.3 Enhancements for CSI-RS based L3 measurement

2.6 CMTC

2.9 CGI reading requirement for NR-U cell

2.11 RRM enhancement for large CC number

2.12 allowInterruption mechanism for deactivated SCell measurements

2.13 CSI-RS based CFRA in RRM requirement

2.14 Fast and gapless Scell activation

2.15 Fast RRC connection re-establishment

- **Low priority**

2.1 UL frame boundary offset reporting

2.7 RLM enhancements

2.8 HST RRM enhancement

2.16 RRM enhancement for NR-U

Since some of the topics may have quite limited scope, e.g., "HO with PSCell requirements for new scenarios", **we propose to re-group the topics from FR2 enhancement and general RRM enhancement as following**:

- **Beam management enhancement:**
  - including, e.g., TCI switching enhancement, FR2 delay reduction enhancement, Harmonized RLM/BM
- **Extension for R17 features to new scenarios:**
  - including, e.g., FR1+FR1 NR-DC RRM, HO with PSCell for new scenarios

- **Essential enhancements to legacy release:**
    - including, e.g., Inter-RAT NR/LTE measurement without gaps

4 – Guangdong OPPO Mobile Telecom.

In general, we suggest 3-4 items to be included in one WID considering the balance of the workload and necessity.

We support the following objectives with real demands:

- 2.2 FR1-FR1 NR-DC RRM requirements
- 2.4 HO with PSCell requirements for new scenarios

We are open to the further enhancements as optimization, which could have not much workload.

- 2.5 TCI switching enhancement
- 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

For other items, we are Not interested. Do not see the significant gain from them, and extra impact on both UE and network in the field could be not small.

- 2.7 RLM enhancements
- 2.8 HST RRM enhancement
- 2.9 CGI reading requirement for NR-U cell
- 2.10 Harmonized RLM/BM
- 2.11 RRM enhancement for large CC number
- 2.12 allow Interruption mechanism for deactivated SCell measurements
- 2.13 CSI-RS based CFRA in RRM requirement
- 2.14 Fast and gapless Scell activation
- 2.15 Fast RRC connection re-establishment
- 2.16 RRM enhancement for NR-U

5 – China Mobile Com. Corporation

One general consideration, as suggested in Proposal 1, working areas #1 (FR2 RRM) and #2 (General RRM) will be covered by 1 WI (Rel-18 NR [and MR-DC] RRM enhancement WI), considering the RAN4 work efforts and available TU, the objectives cannot be too much and the overall load need to be controlled into a reasonable range, it is necessary to focus on the essential features.

For general RRM enhancement and leftovers, from CMCC's point of view, following topics are considered as high priority:

- **2.2 FR1-FR1 NR-DC RRM requirements**: Support. This is fundamental scenario, and the requirements are missing, which need to be fixed.
- **2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)**: Support. All these new scenarios are practical deployment, and RAN4 work effort on specifying the related requirements are small.

For following topics, we have concerns and suggested to be deprioritized:

- **2.7 RLM enhancements**: Deprioritized. No issues observed with current mechanism, another consideration is that how to decide the 2nd level BLER may be a very controversial discussion, considering RAN4 work load, suggest to be de-prioritized.
- **2.9 CGI reading requirement for NR-U cell**: Deprioritized. Since there is no commercial deployment on NR-U, considering RAN4 workload, can be deprioritized.
- **2.16 RRM enhancement for NR-U**: Deprioritized. Since there is no commercial deployment on NR-U, considering RAN4 workload, can be deprioritized.

6 – Beijing Xiaomi Mobile Software

2.1 UL frame boundary offset reporting

[Xiaomi]: Postpone, more discussion and justification are needed.

2.2 FR1-FR1 NR-DC RRM requirements

[Xiaomi]: Support, this is an essential RRM requirement.

2.3 Enhancements for CSI-RS based L3 measurement

[Xiaomi]: Not interested. CSI-RS L3 measurement has been supported since Rel-16. And we do not see the necessity for this enhancement.

2.4 HO with PSCell requirements for new scenarios

[Xiaomi]: Support.

2.5 TCI switching enhancement

[Xiaomi]: Postpone, more discussion and justification are needed.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

[Xiaomi]: Postpone, the timing window for CSI-RS resources has been resolved in Rel-16 CSI-RS L3 measurement WI. We do not see the urgency to introduce CMTC in Rel-18.

2.7 RLM enhancements

[Xiaomi]: Neutral, we see the benefit to introduce the 2nd BLER for certain service, e.g. VoNR. But the potential impact on the existing RLM and BFD should be considered.

2.8 HST RRM enhancement

[Xiaomi]: Postpone, more discussion and justification are needed.

2.9 CGI reading requirement for NR-U cell

[Xiaomi]: Neutral

2.10 Harmonized RLM/BM

[Xiaomi]: Not interested, since the harmonized RLM/BM may impact the existing RAN1/2 RLM/BM procesure, and it should be triggered by RAN1/2.

2.11 RRM enhancement for large CC number

[Xiaomi]: Postpone, more discussion and justification are needed.

2.12 allow Interruption mechanism for deactivated SCell measurements

[Xiaomi]: Neutral

2.13 CSI-RS based CFRA in RRM requirement

[Xiaomi]: Not interested. We do not see the urgency to introduce this requirement in Rel-18.

2.14 Fast and gapless Scell activation

[Xiaomi]: Postpone, more discussion and justification are needed.

2.15 Fast RRC connection re-establishment

[Xiaomi]: Postpone, more discussion and justification are needed.

2.16 RRM enhancement for NR-U

[Xiaomi]: Not interested. We do not see the urgency to introduce this requirement in Rel-18.

7 – QUALCOMM JAPAN LLC.

We are only interested in 2.2 FR1-FR1 NR-DC RRM requirements and HO with PSCell requirements for new scenarios.

All other proposal are small enhancements that would not bring any significant benefits in the network.

2.15 would also require RAN2 involvement and it should be RAN2 led since the most significant reduction can only be obtained from RRC processing improvements.

8 – Huawei Technologies France

2.1 UL frame boundary offset reporting

The definition of UL frame boundary offset needs to be clarified. Does it refer to the UL frame boundary offset between different CCs? More details are needed. Low priority.

2.2 FR1-FR1 NR DC RRM requirements

In R-17, there are no requirements for FR1-FR1 NR-DC RRM requirements. However no issues are identified to support the scenario in practical. Low priority.

2.3 Enhancements for CSI-RS based L3 measurement

The remaining work for R16 CSI-RS L3 measurement are not small, although the functionality is essential. Medium priority.

2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

The scenarios with higher priority considered in Rel-17 are more typical in practical. The left over scenarios are suggested as low priority.

2.5 TCI switching enhancement

Interested in using AP RS to speed up the TCI switching. As the enhancement of TCI and 1.1 FR2 beam management (e.g., allow UE to measure a subset of the configured resources) belong to beam management enhancement, we propose to put 1.1 and 2.5 together to ”beam management enhancement including both FR1 and FR2”.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

A clear timing window for CSI-RS based L3 measurement would provide benefit for UE. Medium priority.

2.7 RLM enhancements

The 2nd pair of BLER has been ever discussed from R15. Due to lack of sufficient input from RAN1, the discussion is paused in R15. The work load of the proposal is huge. Moreover the benefit of the 2nd pair of RLM is not clear.

2.8 HST RRM enhancement

We have other HST related enhancement on-going in R18. We suggest to merge this to other separate HST WI.

2.9 CGI reading requirement for NR-U cell

We do not see the urgency for working on enhancement of requirements for NR-U. We suppose to put it as low priority.

2.10 Harmonized RLM/BFD

The proposal focus on BM procedure changes and it shall be first discussed/ triggered by RAN1 and RAN2. Low priority.

2.11 RRM enhancement for large CC number

If the solution is to increase searcher numbers, we don't think the proposal is feasible. As currently in R17 gap enhancement, co-current gaps have already increased searcher numbers. It means that the UE capability and complexity have been increased largely. Further enhancement on UE capability are not expected. Low priority.

2.12 Allow interruption mechanism for deactivated SCell measurements

Allow interruption when measCycleSCell<640ms would mean frequent interruption from network perspective. The performance degradation would be observed. Low priority.

2.13 CSI-RS based CFRA in RRM requirement

Prefer to keep the legacy assumptions for HO and PSCell addition requirements, and do not see urgency for working on CSI-RS based CFRA requirements. Low priority

2.14 Fast and gapless Scell activation

As commented for objective 1.3, we suggest to combine 1.3, 1.7 and 2.14 without limiting the enhancement to FR2. High priority.

Technically, we are interested in the SCell activation delay enhancement for both FR1 and FR2. For the interruption reduction, we understand it is addressing specific scenarios for multiple SCell activation, and this is **not** essential enhancement in our view.

2.15 Fast RRC connection re-establishment

Not clear how could UE re-establish to the cell without searching and measurement. If the motivation is to shorten the cell search time by making sure the target cell is a known cell, then it is already supported currently by L3 measurement and report. Clarification is needed. Low priority.

2.16 RRM enhancement for NR-U

We do not see the urgency for working on enhancement of requirements for NR-U. Low priority.

In this 'General RRM enhancement and leftover' category, we proposed followings:

- **High priority:**

- **Combine** 1.3(SCell activation enhancements in FR2), 1.7 (FR2 delay reduction enhancements) and 2.14 (Fast Scell activation) to "SCell activation enhancement including FR1 and FR2";

- **Combine** 1.1(FR2 delay reduction enhancements) with 2.5 (TCI switching enhancement) to "beam management enhancement without limiting the enhancement to FR2";

- **Medium priority**

- 2.3 Enhancements for CSI-RS based L3 measurement
- 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

- **Low priority**

- 2.1 UL frame boundary offset reporting
- 2.2 FR1-FR1 NR-DC RRM requirements
- 2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)
- 2.7 RLM enhancements
- 2.8 HST RRM enhancement
- 2.9 CGI reading requirement for NR-U cell
- 2.10 Harmonized RLM/BM - 2.11 RRM enhancement for large CC number
- 2.12 allowInterruption mechanism for deactivated SCell measurements
- 2.13 CSI-RS based CFRA in RRM requirement
- 2.15 Fast RRC connection re-establishment
- 2.16 RRM enhancement for NR-U

9 – Ericsson LM

We support the following objective:

- **2.5 TCI switching enhancement**
    - This should cover at least simultaneous TCI state switching requirement over multiple carriers. In case of FR2 this can be limited for IBM case.
- In addition leftovers (if any) from Rel-17 RRM enhancement WI should be prioritized.

Other objectives are low priority for us.

10 – Intel

Regarding general RRM enhancements we propose to consider the below objectives in R18 work item. Similar to FR2 objectives they are also out of interests from industry.

2.2. FR1-FR1 NR-DC RRM requirements

RRM requirements are missing and may be a bottleneck for deployments. This objective is projected as minor workload and no cross group impact.

Specify FR1 + FR1 NR-DC RRM requirements [RAN4]

· Number of serving carriers requirement

· PSCell addition and release delay requirement

· PSCell change and conditional PSCell change delay requirements

· Scheduling availability of UE during RLM and BFD

· CSSF for NR-DC

2.5. TCI switching enhancement

This is to reduce TCI switching delay and interruptions. Assume UE can use the old TCI state before switching completes. Applicable to Rel-15/16/17 TCI state switching methods. This objective is projected as **minor workload** and **no cross group impact**.

TCI state switch enhancement [RAN4]

· Enhancement in RRM requirements to maintain the UE reception and transmission during the period (or part of period) of MAC CE based TCI switching

· Enhancement in RRM requirements to maintain the UE reception and transmission during the period (or part of period) of RRC based TCI switching

2.6. CMTC (i.e., timing window for L3 CSI-RS measurement)

CMTC is analog to SMTC for CSI-RS based L3 measurements. Group consensus is that CMTC is beneficial to both UE and network in terms of efficient measurement configuration for UE mobility. This objective is projected as **medium workload** and **minor RAN2 impact**.

Specify CMTC configurations and RRM requirements [RAN4, RAN2]

- General CMTC configurations: CMTC lengths, periodicities, and offsets
- Multiple concurrent CMTC configurations
- CSI-RS measurement requirement updates with CMTC

For other topics we would like to provide general comments as below:

2.1. UL frame boundary offset reporting

Please proponent clarify on the exact scope and content of this objective.

2.3. Enhancements for CSI-RS based L3 measurement

What are the enhancements considered?

2.4. HO with PSCell requirements for new scenarios

We are fine to have this objective, but we need to consider the capacity of this work item.

2.7. RLM enhancements

We also support RLM enhancements with second BLER pair, but we need to consider the capacity of this work item.

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11 – CATT

We support the following objectives as high priority:

2.2 FR1-FR1 NR-DC RRM requirements

2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

2.3 Enhancements for CSI-RS based L3 measurement

[CATT] The CSI-RS requirements defined in R16 are only applied for certain configurations and scenarios which are limited. Some enhancements should be considered in Rel-18.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

[CATT] Support and can be part of 2.3.

(new) 2.17 PUCCH SCell activation delay requirements with multiple downlink SCells.

[CATT] This is the basic requirement but maybe leftover in R17 RRM enhancement WI due to timeline. This can depend on the discussion in February RAN4 meeting and it should be considered in R18 if not concluded in this meeting.

The following objectives can be medium priority

2.7 RLM enhancements

2.5 TCI switching enhancement

Other objectives are low priority for us.

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12 – vivo Mobile Communication (S)

2.1 UL frame boundary offset reporting

The intension of the objective is not very clear. If it is to define symbol level interruption requirements, we don't think it is urgent in Rel-18.

2.2 FR1-FR1 NR DC RRM requirements

We support this work. High priority

Justification:

• Band combinations for FR1+FR1 NR-DC are already introduced in TS 38.101-1 in Rel-16.

• MRTD/MTTD RRM requirements for both synchronous and asynchronous FR1+FR1 NR-DC are already specified in TS 38.133 in Rel-16.

• RRM requirements for PScell addition and CCSF are missing in TS38.133 in Rel-16, from which the FR1+FR1 NR-DC was introduced.

No impact to other working groups.

RAN4 work efforts is medium.

2.3 Enhancements for CSI-RS based L3 measurement

Current requirements for CSI-RS based L3 measurement are already enough for the feature to meet commercial needs. We don't see any necessity of enhancing the RRM requirements for CSI-RS based L3 measurement further.

2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

We are supportive this work. High priority.

In our view, the Rel-17 requirements for HO with PSCell for other scenarios can be reused largely. Commercial needs can be guaranteed with less standardization efforts.

No impact to other working groups.

RAN4 work efforts is low.

2.5 TCI switching enhancement

We support this work. High priority.

Justification:

For MAC-CE based and RRC based TCI state switch, and active TCI state list update, one SSB is needed under certain conditions which will result in long switch delay. TCI switching is delay sensitive in terms of system performance.

Temporary RS was introduced for fast SCell activation in Rel-17 and it can be used for timing/frequency tracking. For TCI state switching, one SSB is needed for timing/frequency tracking. So, temporary RS can serve the purpose of timing/frequency tracking and reduce TCI state switching delay significantly.

RAN1/2 involvement is needed to define procedures/signaling for temporary RS for TCI state switching.

RAN4 work efforts is medium.

RAN1 work efforts is low. RAN2 work efforts is low if any.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

Same view as 2.3.

2.7 RLM enhancements

This can be low priority. Justification is not clear.

2.8 HST RRM enhancement

2.9 CGI reading requirement for NR-U cell

This can be part of RRM enhancement for NR-U.

2.10 Harmonized RLM/BFD

It has impact not only to RAN4 requirements, but also to RAN1/2 procedures in our view. The impact to system is not clear. Given the limited TU in Rel-18, it can be low priority.

2.11 RRM enhancement for large CC number

This is not urgent. The deployment of large number of CCs is not typical. There are also ways of reducing measurement delay by implementation, e.g., only one CC in a band is configured for measurement.

2.12 Allow interruption mechanism for deactivated SCell measurements

We are neutral.

2.13 CSI-RS based CFRA in RRM requirement

Considering limited TU, it can be low priority.

2.14 Fast and gapless Scell activation

The objective is not clear. Fast SCell activation is already supported in Rel-17.

2.15 Fast RRC connection re-establishment

The objective is not clear. Not sure if it is related to FR2 measurement delay reduction.

2.16 RRM enhancement for NR-U

We support this work. High priority.

Justification:

New features introduced in Rel-16/17 should be applicable to NR operations on both licensed band and unlicensed band. However, requirements for Rel-16/17 features are only defined for NR operations on licensed band. This could have big impact to NR-U deployment. Considering the limited TU, the objectives can be focusing on features that has obvious benefit for NR-U operation. In our understanding, typical NR operations on unlicensed band would be LAA like, i.e., as a NR SCell or a NR PSCell. So, RRM enhancement can be considered for following features that can bring significant gain for NR-U operation.

Direct SCell activation

Multiple SCell activation

SCell dormancy

BWP switching on multiple CCs

TCI state switching (Rel-17 unified TCI framework)

HO with PSCell

We also see NR-U related requirements for RedCap UE is necessary. Considering workload and TU budget, it can be low priority in Rel-18.

No impact to other working groups.

RAN4 work efforts is medium if NR-U for RedCap UE is not considered.

2.17 Additional candidate objectives

2.17.1 Support NCD-SSB in IDLE mode for RedCap UE

We support this work. High priority.

Justification:

In RAN#94-e meeting, following agreements were made as below as in RP-213689:

1. Scheme 1 (i.e. UE in IDLE and INACTIVE monitors paging in an initial BWP associated with CD-SSB) is adopted for further work in Rel-17. Scheme 2 (i.e. UE in IDLE and INACTIVE monitors paging in an initial BWP associated with NCD-SSB) is not considered further in Rel-17

2. RAN2 should work on the assumption that the cell reselection measurements and cell ranking are performed based on measurements on the CD-SSB. This applies for intra- and inter-frequency measurements, and for IDLE and INACTIVE states.

Thus, in Rel-17 NCD-SSB is supported in RRC-CONNECTED state only. RRM measurement is based on NCD-SSB in RRC-CONNECTED state. Therefore, NCD-SSB should always be transmitted by NW.

Then, for a Rel-17 RedCap UE in IDLE and INACTIVE state, it can only monitor paging in an initial BWP associated with CD-SSB and perform RRM measurement based on CD-SSB. There could be capacity issues if there are larger number of UEs with traffic. It is desired that RedCap UE can be offloaded to an initial BWP associated with NCD-SSB for paging reception and RRM measurements are performed on NCD-SSB either in IDLE/INACTIVE state. Since NCD-SSB is always transmitted, it is feasible to offload RedCap UE in IDLE/INACTIVE state to a separate initial BWP associated with NCD-SSB and in the last RAN4 meeting the feasibility is confirmed from RAN4 perspective.

Objectives:

Specify RRM measurement requirements based on NCD-SSB in IDLE/INACTIVE state [RAN4]

Specify necessary signaling/procedures for enabling NCD-SSB in IDLE/INACTIVE state [RAN2]

RAN2 involvement is necessary. RAN1 involvement may be needed.

RAN4 work efforts is medium.

RAN2 work efforts is medium.

So, for working area #2 for general RRM enhancement,

High priority:

2.16 RRM enhancement for NR-U

2.5 TCI switching enhancement

2.2 FR1-FR1 NR DC RRM requirements

2.17.1 Support NCD-SSB in IDLE mode for RedCap UE

2.4 HO with PSCell requirements for new scenarios (e.g., HO from NR SA to EN-DC, from NR SA to NR-DC, from to ENDC)

Other topics is proposed to be low priority in Rel-18.

13 – LG Electronics Inc.

Regarding workload, 2.2 (FR1-FR1 NR DC RRM requirements) is recommended with high priority compared to others.

14 – China Telecommunications

We are interested in HO with PSCell requirements for new scenarios.

15 – TELECOM ITALIA S.p.A.

Due to workload the numbers of topics to be included should be carefully selected and limited.

The two topics (2.2 and 2.4) highlighted by CMCC are ok for us.

We have no interest to work on RRM enhancements for NR-U and recommend to keep RRM en for NR-U enhancements out of Rel 18

16 – NTT DOCOMO INC.

2.1 UL frame boundary offset reporting

Low priority: The expected gain may be small and objective is unclear.

2.2 FR1-FR1 NR-DC RRM requirements

High priority: FR1-FR1 NR-DC is basic scenario. The requirement should be specified.

2.3 Enhancements for CSI-RS based L3 measurement

Low priority: The expected gain and applicability for commercial environment is unclear because CSI-RS based L3 measurement is optional feature.

2.4 HO with PSCell requirements for new scenarios

High priority: The cell setup delay reduction after HO may have large gain. We understood that remaining scenarios were deprioritized because of the lack of TU in Rel-17, they are not the corner cases.

2.5 TCI switching enhancement

High priority: The DL throughput point of view, this may have large amount of gain in some cases, especially for FR2.

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

Low priority: Same view as 2.3

2.7 RLM enhancements

Middle priority: 2nd BLER level may have certain gain for specific scenario, e.g. VoNR.

2.8 HST RRM enhancement

Low priority: HST RRM requirement covered by Rel-17 is sufficient for current network and the gain by further enhancement is unclear.

2.9 CGI reading requirement for NR-U cell

Low priority: NR-U related issue should be postponed.

2.10 Harmonized RLM/BM

Low priority: The gain obtained from this harmonization is unclear. We understood the different mechanisms and requirements between RLF and BF come from the impact difference between them. RLM requirement should be strict than BM.

2.11 RRM enhancement for large CC number

Meddle priority: This should be considered for further throughput enhancement and may have small or no impact for other WG.

2.12 allowInterruption mechanism for deactivated SCell measurements

Low priority: The expected gain is unclear.

2.13 CSI-RS based CFRA in RRM requirement

Low priority: Low priority: The expected gain and applicability for commercial environment is unclear.

2.14 Fast and gapless Scell activation

Low priority: The objective is unclear.

2.15 Fast RRC connection re-establishment

Low priority: The objective and RAN2 impact are unclear.

2.16 RRM enhancement for NR-U

Low priority: NR-U related issue should be postponed.

17 – Deutsche Telekom AG

Similar to Telecom Italia and NTT DOCOMO we also think that the objectives should be carefully selected and for us NR-U focussed enhancements are of no interest for Rel-18 and should be skipped.

18 – ZTE Wistron Telecom AB

In general, 3 objectives should be enough for this WI.

In our views, the following items have a higher priority:

2.5 TCI switching enhancement

2.7 RLM enhancements and merged with 2.10 Harmonized RLM/BM

2.14 Fast and gapless Scell activation

And the following items are fine if workload allowed:

2.2 FR1-FR1 NR-DC RRM requirements

2.4 HO with PSCell requirements for new scenarios

And the following items have a lower priority requiring more clarifications and justifications:

2.1 UL frame boundary offset reporting

2.3 Enhancements for CSI-RS based L3 measurement

2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)

2.9 CGI reading requirement for NR-U cell

2.11 RRM enhancement for large CC number

2.12 allow Interruption mechanism for deactivated SCell measurements

2.13 CSI-RS based CFRA in RRM requirement

2.15 Fast RRC connection re-establishment

2.16 RRM enhancement for NR-U

And ”2.8 HST RRM enhancement” should be included in HST WI.

2.4 Working area #3: MG related enhancements and leftovers

Considering conclusions reached duringpre-RAN #94e email discussions (RP-212682) moderator suggests use an updated list of candidate topics as the basis for initial round discussion. In the updated list additional clarifications on objectives scope were added based on companies comments in pre-RAN #94e email discussion (changes are underlined). In addition, relevant topics listed under “Other” areas in RP-212682 were added to this list (starting from objective 3.4).

3. MG related enhancements and leftovers

- 3.1 NeedForGap requirements
- 3.2 Per-FR gap capability indication enhancements
- 3.3 Inter-RAT NR measurement without gaps
- 3.4 MG sharing enhancement
- 3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG (~~Joint requirements for pre-configured MG, Con-current MG and NCSG)~~
- 3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)
- 3.7 RRM requirements and New MG patterns for MUSIM
- 3.8 Dynamic activation and switching of the MG pattern for different applications

Companies are invited to provide comments on candidate topics/objectives such as

- Justification including commercial interests (near & longer terms)
- Objective support & priority (note: it is not intended decisions will be taken based on number counting)

- Detailed scope & objectives
- Impact on other WGs
- Expected amount of RAN4 work efforts
- Additional candidate objectives
- *Note: Companies are strongly encouraged to provide both index and title of specific objectives in the comments to simplify tracking.*

Feedback Form 4: Comments on Working area #3: MG related enhancements

1 – Nokia Corporation

3.1 NeedForGap requirements

We understand that there are some gain potentials by enhancing the needForGaps to cover more scenarios. If the work can improve such that unnecessary gaps being allocated this can help improving the overall system performance. However, RAN4 also needs to consider the ongoing NCSG discussion in Rel-17 measurement gap enhancements work. This will likely impact other WG (RAN2). Workload in RAN4 could be high as measurement gap related work usually is high load work. Medium/low Priority.

3.2 Per-FR gap capability indication enhancements

Our preference is that RAN4 work is focused on features showing gain and our current view is that the benefit from this proposal is unclear. We propose at most to study the possible gains first. Our initial impression is that this may lead to increased signalling if the UE indicates per-FR gap support per BC. This will yield additional latency. Low priority (but could be SI). This will likely impact other WG (RAN2). Workload in RAN4 could be high as measurement gap related work usually is high load work.

3.3 Inter-RAT NR measurement without gaps

For this topic, we do see gain in terms of reducing the need for measurements gaps for performing the inter-RAT measurements under certain conditions. Hence, there can be gain both for UE and network for capable devices and therefore we support this proposal. Medium priority. This may impact RAN2. Workload in RAN4 could be high as measurement gap related work usually is high load work.

3.4 Measurement gap sharing enhancement

We do not see a need for this work in Rel-18. Our understanding is that the current granularity for MG sharing ratio is sufficient and there is no gain increasing the granularity. This work can be postponed to a later release.

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

RAN4 already have the Rel17 WI on this topic and hence we see it natural that RAN4 prioritise continuation and finalization of this work. High priority.

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

RAN4 already have the Rel17 WI on this topic and hence we see it natural that RAN4 prioritise continuation and finalization of this work. High priority.

3.7 RRM requirements and New MG patterns for MUSIM

It seems not to be realistic for RAN4 to agree on too many gap related objectives. Measurement gap related work is usually workload heavy and time consuming. Hence, this work can be postponed to a later release. Workload in RAN4 would be very high as measurement gap related work usually is high load work.

3.8 Dynamic activation and switching of the MG pattern for different applications

We do not see this work as being essential for Rel-18 package and propose to postpone this work to a later release.

In general, we see that there are simply too many proposals related to measurements gaps and gap related enhancements. Hence, RAN4 has to perform a rather tough down selection among the proposals. We suggest prioritizing continuation and finalization of the already ongoing Rel17 WI. Hence, we suggest following:

MG related enhancements and leftovers

- High priority:

o Continuation of Rel-17 measurement gap enhancement work

§ Joint requirements for pre-configured MG, concurrent MG and NCSG

§ Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

- Medium:

o Inter-RAT NR measurement without gaps (may require needForGaps)

2 – MediaTek Inc.

3.1 NeedForGap requirements

Not interested.

NCSG (requirement ready in Rel-17) can already fully support the mechanism of Needforgap (requirement ready in Rel-18, if agreed). Furthermore, NCSG also resolved the ambiguity of Needforgap:

- 1) Whether the interruption is allowed. This has been resolved in NCSG by defining a new UE capability report (no-gap-no-ncsg, ncsg, gap)

- 2) When the interruptions are expected (if allowed). This has been resolved in NCSG by defining the NCSG pattern (VIL1-ML-VIL2)

Therefore, we do not see a very strong motivation to go back to discussion the requirements of NeedforGap at this moment.

3.2 Per-FR gap capability indication enhancements

Neutral.

The workload seems very small.

3.3 Inter-RAT NR measurement without gaps

Support

We see some real deployment need for this objective, especially for an LTE SA UE to measure FR2 NR frequency layers.

3.4 MG sharing enhancement

No interested.

This issue has been discussed for several releases but the interest level is always low. We do not see the urgency to work on this objective in Rel-18.

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

Support.

In Rel-17, RAN4 has no time to work on the joint requirements for the 3 objectives in gap enhancement. It is an important leftover to maximize the benefit of these Rel-17 features. Specifically, we would like to prioritize {concurrent MG + NCSG}, which helps further reduce the interruptions when UE can only do NCSG on particular band but still need legacy gap on other bands. The workload of this objective is large. We expect some complicated discussions.

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

Postpone after next RAN4 meeting.

This is still an open issue in current RAN4 discussion. We should wait for RAN4 to conclude before making decision on this direction.

3.7 RRM requirements and New MG patterns for MUSIM

Neutral

This issue should be coupled with the concurrent gaps. The discussion is expected to be complicated because up to 5 gaps may need to be considered. It will take a long time for RAN4 to conclude the requirement

3.8 Dynamic activation and switching of the MG pattern for different applications

Not interested.

We do not see the benefit of having this dynamic MG pattern changing.

In addition to above candidates, we would like the group also to consider the following enhancement of NCSG: Currently UE's NCSG capability reports is based on it configured serving cells. However, not all configured serving cells are active. If one serving cell is current deactivated, it is believed that this serving cell will not occupy a dedicated RF chain and that the UE is still able to use the idle RF chain for NCSG-assisted measurement. This differentiation between activated and deactivated cells can be further investigated in Rel-18 to increase the benefit of NCSG. Therefore, we suggest to investigate and introduce a mechanism and requirements to **allow UE to report NCSG capability based on its active serving cells**.

3 – Apple GmbH

3.1 NeedForGap requirements

This becomes less attractive as R17 NCSG becomes stable. In our view, functionality of NeedForGap will be covered by NCSG. It was agreed in RAN4 that for NCSG UE would indicate 'no-gap-no-ncsg', 'ncsg' and 'gap'. The interruption and scheduling restriction will be clearly defined in R17. From UE implementation point of view, support of NeedForGap and NCSG are quite similar. From standardization perspective, no need to spend effort to develop a different set of requirements in R18 given that the purpose of the requirements have already been achieved in R17 NCSG.

3.2 Per-FR gap capability indication enhancements

Considering the limited TU left for RAN4 work item in R18, we suggest RAN4 to focus on enhancements which show attractive gain and supported by most companies. However, attractive gain is not observed

for enhancement 3.2. Besides, per-BC indication would result in high signaling overhead. Therefore, we consider 3.2 low priority.

3.3 Inter-RAT NR measurement without gaps

We support this enhancement. However, in our view, working area #2 is a better place to discuss enhancement 3.3, since there is no any impact on gap design.

3.4 Measurement gap sharing enhancement

We support this enhancement. The potential enhancement is more about extension of use case, rather finer granularity. For instance, a specific gap sharing for inter-RAT measurement can be considered, so that operators can prioritize/deprioritize inter-RAT measurement depending on deployment.

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

We support this enhancement. These are left over from R17 MG enhancement. Note that RAN2 will support this in R17 design. It is important for RAN4 to complete the requirements to guarantee the performance.

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

We support this enhancement. In R17 positioning, such dynamic activation/deactivation of gap for PRS measurement has already been supported. It is beneficial to extend it to other RRM measurement. This can be covered by 3.9 below.

3.7 RRM requirements and New MG patterns for MUSIM

Some of the new MG patterns have already been agreed in last RAN4 meeting. Therefore, additional new patterns become less attractive.

3.8 Dynamic activation and switching of the MG pattern for different applications

The scope and use case are unclear to us.

(new) 3.9 Further enhancement on Pre-MG, NCSG and concurrent gaps

This is not on the list. However, we consider this high priority since most of them have discussed in R17 MG enhancement but postponed due to limited time in R17. Such as:

· Pre-MG:

o Pre-MG in MR-DC

o Fast Pre-MG activation/deactivation (MAC-CE or DCI based), similar with 3.6

o Pre-MG in CA based on BWP switching on multiple CCs.

· Concurrent gaps:

o Concurrent gaps in in MR-DC

o Requirement for FO, FPO (subject to R17 progress).

o Gap sharing in case of overlapping (subject to R17 progress).

· NCSG:

o NCSG in MR-DC

o NCSG for CSI-RS based inter-freq measurement (subject to R17 progress).

o deriveSSB-IndexFromCell-inter extension to cover 1) diff SCS; 2) multiple CCs and/or multiple MOs (subject to R17 progress).

(new) 3.10 MG enhancement for other R17 features

This is not on the list. However, we do see benefit to extend Pre-MG, concurrent gaps and NCSG for other R17 features. For instance, extend NCSG to MUSIM operation, if UE has a spare RF chain for NW B measurement/SI reception/paging reception, NW A doesn't need to configure a long gap for MUSIM. Instead, NCSG based MUSIM gap can achieve same purpose without introducing long interruption. Similar extension can be considered for NTN, Positioning and even RedCap.

In general, there are too many candidate objectives on the table. Some prioritizations need to be considered. We propose:

MG related enhancements and leftovers

- High priority:

3.5: Joint requirements for pre-configured MG, concurrent MG and NCSG

3.9: Further enhancement on Pre-MG, NCSG and concurrent gaps

3.10: MG enhancement for other R17 features

- Medium priority:

3.4: Measurement gap sharing enhancement

3.3: Inter-RAT NR measurement without gaps (shall be moved to working area #2)

- Low priority:

Others.

4 – Guangdong OPPO Mobile Telecom.

In general, we suggest 3-4 items to be included in one WID considering the balance of the workload and necessity.

We support the following objectives which have shown the majority companies' interest.

- 3.2 Per-FR gap capability indication enhancements
- 3.5 Joint requirements for Pre_MG, concurrent MG and NCSG

We are open to the followings.

- 3.3 Inter-RAT NR measurement without gaps
- 3.4 Measurement gap sharing enhancement
- 3.6 Enhancements for pre-configured MG (e.g., Pre_MG, triggered by other than BWP switch)
- 3.7 RRM requirements and New MG patterns for MUSIM

We do not see the urgency to define requirement for the following two items. RAN4 also needs to consider the ongoing NCSG discussion in Rel-17. NCSG may fully support the mechanism of Needforgap. We also do not see the benefit of having this dynamic MG pattern changing.

- 3.1 NeedForGap requirements
- 3.8 Dynamic activation and switching of the MG pattern for different applications

5 – China Mobile Com. Corporation

We are interested into following topics:

- **3.1 NeedForGap requirements**: Support. This feature is introduced in Rel-16 already, which is a very useful to reduce the throughput loss. In our view, NeedForGap is different from NCSG: NeedForGap means no gap no interruption, but NCSG allows interruption. Currently, NeedForGap is only considered for intra-frequency measurement, but it is missing for inter-frequency measurement. The impact on spec is small and will not take too much RAN4 effort. Support to specify the requirements.
- **3.3 Inter-RAT NR measurement without gaps**: Support. Inter frequency without gap is already supported in Rel-17, extension to inter-RAT is straightforward.
- **3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG**: Support. Leftover in Rel-17, we see the benefits to have joint combination of pre-configured MG, concurrent MG and NCSG, positive to specify the requirements.
- **3.6 Enhancements for pre-configured MG**: pending on the discussion in Rel-17, if it is not supported by autonomous mechanism in Rel-17, it is necessary to consider it in Rel-18 to guarantee the system performance.
- **3.7 RRM requirements and New MG patterns for MUSIM**: Support for RRM requirements. New MG patterns may be not necessary since RAN4 have already have agreements on the new MG patterns in last RAN4 meeting. But we see the necessity to specify the RRM requirements for MUSIM, which are not considered in Rel-17 due to limited timeline. In order to guarantee the performance in both network A and network B, support to specify the requirements.

For following topics, we have concerns and suggested to be deprioritized:

- **3.8 Dynamic activation and switching of the MG pattern for different applications**: Deprioritized. Not clear about the use case and benefits.

6 – Beijing Xiaomi Mobile Software

3.1 NeedForGap requirements

[Xiaomi]: Not interested.

3.2 Per-FR gap capability indication enhancements

[Xiaomi]: Neutral.

3.3 Inter-RAT NR measurement without gaps

[Xiaomi]: Support, inter-frequency measurement without gap has been supported in Rel-16, it is beneficial to introduce inter-RAT NR measurement without gaps.

3.4 MG sharing enhancement

[Xiaomi]: Support, the use case for MG sharing should be extended, e.g. gap sharing among carriers to be measured including inter-frequency carriers and inter-RAT carriers.

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

[Xiaomi]: Support, this is the leftover work in Rel-17 MG enhancement WI.

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

[Xiaomi]: Postpone, this is under discussion in Rel-17 MG enhancement WI.

3.7 RRM requirements and New MG patterns for MUSIM

[Xiaomi]: Not interested, the gap pattern has been introduced in Rel-17.

3.8 Dynamic activation and switching of the MG pattern for different applications

[Xiaomi]: Postpone, it is not urgency of introducing this objective in Rel-18.

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7 – QUALCOMM JAPAN LLC.

We think the number of items should be kept to a minimum given that the work in this area has proven itself to consume a lot of RAN4 time in the past.

3.1 NeedForGap requirements

This is a hole in the specs that clearly needs filling so we are supportive of this item

3.2 Per-FR gap capability indication enhancements

This is already being discussed in Rel.17 capabilities, there is no need for a dedicated item. It was already pointed out that there is no RAN4 work needed for this, only a new capability.

3.3 Inter-RAT NR measurement without gaps

We are interested in this item as this is also a hole in the spec as some other gapless measurements are already possible. The benefits are clear as gaps reduce throughput significantly.

3.7 RRM requirements and New MG patterns for MUSIM

This is a leftover that definitely should be addressed with higher priority compared to other items

All other items are just small enhancements not expected to bring much gains so they can be left out of Rel.18

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8 – Huawei Technologies France

3.1 NeedForGap requirements

We understand Rel-17 NCSG has provided a comprehensive framework to reduce the interruption due to MG. Functionality wise it is a superset of Rel-16 NeedForGaps, and performance wise there is clear requirement defined. Given the situation, we do not see clear need to define requirement for Rel-16 NeedForGap in Rel-18. Low priority.

3.2 Per-FR gap capability indication enhancements

High priority, if not concluded in Rel-17 feature list discussion.

The objective has been discussed since Rel-16, and detailed analysis can be found in our earlier paper R4-2110367. In short, it can enable use of per-FR gap in more scenarios. With Rel-15 per-FR gap capability indication, UE can indicate support of per-FR gap only when it supports per-FR gap for all supported band combinations. This means a UE supporting per-FR gap with most but not all band combinations cannot indicate support of per-FR gap.

We expect the RAN4 efforts to be very small since what is needed is only the clarification regarding the condition under UE is considered to support per-FR gap. The impact to other WG is also limited and we see only impacts to RAN2 due to new UE capability.

3.3 Inter-RAT NR measurement without gaps

We understand inter-RAT NR measurement can be configured when UE is in LTE SA or in EN-DC.

- When UE is in LTE SA, NeedForGap signaling has been introduced in Rel-16. The question is whether to define requirements for NeedForGap for this scenario.

- When UE is in EN-DC, RAN4/2 has discussed whether to support NCSG for MR-DC, and the conclusion was that NR SA is prioritised in Rel-17. The question is whether to define requirements for NCSG for this scenario.

We see both scenarios as medium priority.

3.4 Measurement gap sharing enhancement

MG sharing was already discussed in Rel-15, and different sharing schemes were defined depending on deployment scenarios (EN-DC, SA, NE-DC, NR-DC). We do not see clear need to introduce further enhancements to the MG sharing schemes. Low priority.

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

This is a leftover from Rel-17 MG Enh WI. To us, some joint working scenarios are of high interests, e.g. concurrent MG + NCSG and concurrent MG + pre-MG. High priority.

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

MAC CE based (de)activation has been supported for positioning measurement in Rel-17, so it is meaningful to consider applying the same mechanism to pre-MG for RRM measurements. Medium priority.

3.7 RRM requirements and New MG patterns for MUSIM

We do not see clear need to define new gap patterns for MUSIM given in Rel-17 we already introduced some new gap patterns for MUSIM. Low priority.

3.8 Dynamic activation and switching of the MG pattern for different applications

FFS priority.

The scope of this objective is unclear. Can it be merged with 3.6?

In summary, in MG related enhancements and leftovers category, we proposed followings:

- **High priority:**

3.2 Per-FR gap capability indication enhancements

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

- **Medium priority**

3.3 Inter-RAT NR measurement without gaps

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

- **Low priority**

3.1 NeedForGap requirements

3.4 Measurement gap sharing enhancement

3.7 RRM requirements and New MG patterns for MUSIM

9 – Ericsson LM

We support the following objectives with objective 3.1 as the highest priority:

- **3.1 NeedForGap requirements**
- **3.3 Inter-RAT NR measurement without gaps**
- **3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG**

Objectives 3.1 and 3.3 are related to missing core requirements and needforgap already exists since R16.

Objectives 3.1 and 3.3 can under the same umbrella objective (as shown below). Furthermore we suggest to also cover inter-RAT LTE measurement without gaps since UE with spare chain can also do LTE measurement w/o gaps and will give more overall benefits.

Measurement requirements without gaps:

- **3.1 NeedForGap requirements**
  - **NR intra-frequency and NR inter-frequency measurements without gaps**
- **3.3 Inter-RAT NR measurement without gaps**
- **Inter-RAT LTE measurement without gaps**

Other objectives are of low priority for us.

10 – Intel

Measurement gaps are key to the NR system performance in terms of Radio Resource Managements. As NR networks roll out around the globe, operators and vendors in the industry are together exploring continuously in the field of optimizing RRM performance. By a series of enhancements introduced in Rel-17, NR networks benefit from an advanced portfolio of measurement gap technologies. In Rel-18, further enhancements for measurement gaps are also expected to be beneficial in many aspects: in the aspect of further boosting RRM performance, in the aspect of achieving balance between extreme data throughput and efficient measurements, in the aspect of further developing network versatility, and in the aspect of completion to what we have introduced in Rel-17.

Regarding measurement gap enhancements we propose to consider the below objectives in R18 work item.

3.1. NeedForGap requirements

This objective is projected as **minor workload** and **no cross group impact**.

NeedForGapInfoNR requirements [RAN4]

· Specify RRM interruption requirements due to retuning the vacant chain [RAN4]

· Study and specify if needed RRM measurement requirements with gaps [RAN4]

· CSSF

· Measurement period

· Scheduling restrictions

· Study and specify if needed release independency of the feature from Rel-16 [RAN4]

3.5. Joint requirements for pre-configured MG, concurrent MG and NCSG

This is to specify requirements for RRM measurements when pre-configured MG is configured as one of concurrent gaps. This objective is projected as **medium workload** and **minor RAN2 impact**.

Joint requirements for pre-configured MG, concurrent MG and NCSG [RAN4, RAN2]

· Joint requirements among pre-configured measurement gaps, multiple concurrent gaps and network controlled short gaps

3.2. Per-FR gap capability indication enhancements

In Rel-16 RAN4 discussed enhancements in indicating UE per-FR gap capabilities. Per-BC indication of per-FR gap capabilities was proposed by several companies. This objective is projected as **medium workload** and **minor RAN2 impact**.

Per-FR gap indication enhancement [RAN4, RAN2]

· Study Per-BC indication of per-FR gap capabilities impacts on RRM requirements [RAN4]

· All DL interruptions involving FR1+FR2 BC

· Delay at activation of multiple DL SCells

· Delay at all kinds of BWP switch on multiple CCs

· Additional delay of measurement reporting upon SRS carrier switch

· Autonomous gaps

· Enhance indication of UE per-FR gap capabilities [RAN2]

For other topics we would like to provide our general comments:

3.4. MG sharing enhancement

We also support this objective and would like to see if this one also fits into this item.

3.7. RRM requirements and New MG patterns for MUSIM

We think this objective is a part of R18 MUSIM work item so we do not include it in MG item.

3.8. Dynamic activation and switching of the MG pattern for different applications

This objective needs further clarification. It seems like RAN1 work.

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11 – Charter Communications

3.1 NeedForGap requirements:

Supporting, we see a benefit of adding this for inter-frequency measurement as well.

3.7 RRM requirements and New MG patterns for MUSIM

RRM requirements is not address at all for MUSIM in Rel-17, and there is a need to confirm which existing requirements are applicable for MUSIM. We support working on RRM requirements for MUSIM. We agree with CMCC that *New MG patterns may be not necessary since RAN4 have already have agreements on the new MG patterns in last RAN4 meeting.*

12 – CATT

We support the following objectives as high priority:

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

[CATT] This is the enhancement of R17 gap WI and it has been informed to RAN2 that the signaling support for joint requirements should be considered in R17, so the corresponding requirements can be considered in the following release.

3.3 Inter-RAT NR measurement without gaps

[CATT] Support this objective but it seems this should be part of RRM enhancement rather than gap enhancement.

3.1 NeedForGap requirements

[CATT] Similar to 3.3, we support this enhancement but it seems this should be RRM enhancement rather than gap-related.

The following objectives can be medium priority:

3.2 Per-FR gap capability indication enhancements

[CATT] we are open to study the enhancements and the workload is small.

3.4 MG sharing enhancement

[CATT] We are open to study the MG sharing enhancement considering more and more gaps introduced. But it is not very urgent.

Other objectives are low priority for us.

13 – vivo Mobile Communication (S)

3.1 NeedForGap requirements

We are supportive of this work. High priority.

Justification:

The existing requirements for the UE capabilities NeedForGaps are only specified for intra frequency SSB based measurements without gaps, which is incomplete itself.

Complete RRM requirements are needed for intra frequency and inter frequency measurement for UE supporting NeedForGaps.

This feature can bring significant gains for system throughput and/or mobility performance as no gaps are needed under certain conditions.

No impact to other working groups.

RAN4 work efforts is medium.

3.2 Per-FR gap capability indication enhancements

Neutral

3.3 Inter-RAT NR measurement without gaps

The objective needs to be clarified. It may be categorized into NeedforGap requirements.

RAN2 involvement is needed.

RAN4 work efforts is medium.

3.4 Measurement gap sharing enhancement

We don't see enough justification for gap sharing enhancement.

3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

We are supportive of this work. High priority.

It was down selected in the last RAN plenary meeting due to lack of time in Rel-17. To make new gap mechanisms introduced in Rel-17 more useful, joint requirements is necessary. The scope can be further discussed and limited if necessary.

RAN2 involvement may be needed.

RAN4 work efforts is high.

3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

We are supportive of this work. Medium priority.

In our view, the enhancement should focus on multi-carrier scenarios so that pre-configured MG can be used in typical deployment.

RAN2 involvement may be needed.

RAN4 work efforts is medium.

3.7 RRM requirements and New MG patterns for MUSIM

We support this work. High priority.

According to endorsed propose 2 in RP-213622, the RRM requirements for MUSIM gaps should be specified in Rel-18.

Postpone all the discussion on RRM requirements related to MUSIM gaps to Rel-18. Whether this aspect will be covered under the R18 MUSIM WI or another RAN4 WI can be discussed as part of the Rel-18 RAN4 package.

The discussion should focus on whether the work should be covered under the R18 MUSIM WI or another RAN4 WI, e.g., MG enhancement WI in Rel-18.

In our view, it would be better being covered in RAN4 WI so that all gap related requirements are specified by taking all use cases into account. We are also fine if majority view is to cover it in Rel-18 MUSIM WI.

There may be impact to RAN2 depending on progress.
RAN4 work efforts is medium.

3.8 Dynamic activation and switching of the MG pattern for different applications
It may be considered in future releases.

So, for working area #3 for MG enhancement,
High priority:
3.7 RRM requirements and New MG patterns for MUSIM
3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
3.1 NeedForGap requirements

Medium priority:
3.6 Enhancements for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)

Other topics is proposed to be low priority in Rel-18.

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14 – LG Electronics Inc.

3.1 NeedForGap requirements
– Medium priority
3.2 Per-FR gap capability identification enhancement
– Not interested. Regarding of limited work scope, it could be low priority.
3.3 Inter-RAT NR measurement without gaps
– Neutral.
3.4 MG sharing enhancement
– Low priority
3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
– High priority. This work should be continued in Rel-18
3.6 Enhancement for pre-configured MG (e.g., pre-configured MG, triggered by other than BWP switch)
– Not interested.
3.7 RRM requirements and New MG patterns for MUSIM
– Not interested.
3.8 Dynamic activation and switching of the MG pattern for different application
– Neutral.
(new) 3.x Concurrent gap for DC

– This was proposed in RAN#94e. If concurrent MG is available, separated MG configuration for PCell and PSCell in DC mode could be used in the same frequency range. So, efficient measurements without MG sharing could be conducted. The work load would not be high.

In summary, we suggest

- 3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
- (new) 3.x Concurrent gap for DC

15 – China Telecommunications

We are interested in the following topics:

- NeedForGap requirements
- Inter-RAT NR measurement without gaps
- Joint requirements for pre-configured MG, concurrent MG and NC
- RRM requirements for MUSIM: agree with CMCC comment that we need to define RRM requirements but not new gap patterns.

16 – ZTE Wistron Telecom AB

In general, 2 objectives should be enough for this WI.

In our views, 3.4 (MG sharing enhancement) and 3.1 (NeedForGap) may have a higher priority.

3.3 Inter-RAT NR measurement without gaps

This item is intended for a gapless measurement, sounds not suitable for a gap-enhancement oriented WI.

3.7 RRM requirements and New MG patterns for MUSIM

This item could be included in MUSIM WI.

2.5 Summary of initial round

2.5.1 General

16 companies provided comments on moderator proposals with a majority (12) supporting moderator proposal to structure the work in two different work items. Several companies mentioned that focus shall be on topic identification and WI structure can be discussed at a later stage. From moderator point of view a high-level understanding on the candidate work items can be helpful to structure the discussion and facilitate WID preparation in the final round. With such clarifications moderator recommends proceeding with 2 candidate work items as baseline and the structure can be reconsidered in case the objectives (e.g., large number of topics, etc.).

2.5.2 Working area #1: FR2 RRM enhancements

18 companies provided comments on candidate objectives

- **Objectives 1.7 "FR2 delay reduction enhancements" and 1.3 "SCell activation enhancements in FR2" have received a strong level of support and interest from companies. Objective 1.4 "FR2 BWP switching time enhancements" has got a medium level of interest.** Moderator recommends to further discuss detailed objectives and justification for these 3 topics in the intermediate round. Given that many companies mentioned that discussions on 1.3, 1.4 and 1.7 are very much coupled, moderator recommends to combine the discussion on various FR2 delay reduction enhancements and focus on identifying a reasonable sub-set of possible directions.
- Other objectives have received a lower level of support/interest and moderator does not recommend further discussion in the intermediate round
    - 1.1 Enhancement to FR2 beam measurement requirements
    - 1.2 Define FR2-FR2 DAPS requirements
    - 1.5 RRM measurements for different Rx beam sets in FR2
    - 1.6 Network-controlled gaps for UE Rx beam switching
    - 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios
- Comments on specific objectives
    - 1.1 Enhancement to FR2 beam measurement requirements
        - Majority of companies did not show the interest and have questioned possible gains. Some companies mentioned that it can be resolved via network implementations.
        - One company proposed to combine 1.1 with 2.5 as general BM enhancement without limiting to FR2.
    - 1.2 Define FR2-FR2 DAPS requirements
        - Very limited interest/support for FR2-FR2 DAPS requirements.
        - Some companies mentioned that FR2 DAPS is not a typical scenarios and other mentioned that FR2 DAPS requires support of simultaneous multi-panel reception, which is currently under discussion in the other thread.
    - 1.3 SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)
        - The objective has a strong level of support and companies mentioned very long and complicated existing FR2 SCell activation delay requirements.
        - Possible RAN1/RAN2 involvement was mentioned.
        - Several companies commented that the objective is relevant to 1.7 and joint discussion on possible FR2 delay reduction enhancements is needed.
    - 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)

        - The objective has received a medium level of support.
        - One company mentioned that RRC-based BWP switching needs improvement.
    - 1.5 RRM measurements for different Rx beam sets in FR2
        - Small level of support/interest
    - 1.6 Network-controlled gaps for UE Rx beam switching
        - Small level of support/interest
    - 1.7 FR2 delay reduction enhancements
        - The objective has a strong level of support.
        - Many companies mentioned that the objective is relevant to 1.3 and 1.4 and a joint discussion on possible FR2 delay reduction enhancements is needed.
        - Several companies asked for additional clarifications on the objective scope. Several companies sharted an interpretation that FR2 delay reduction enhancements shall be focused on Cell identification and L3 measurement delay reduction enhancements.
    - 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)
        - Small level of support/interest

2.5.3 Working area #2: General RRM enhancement and leftovers

18 companies provided comments on candidate objectives

- **The following objectives/directions get a strong level of support and interest. Moderator recommends to further discuss detailed objectives and justification for these topics in the intermediate round.**
    - **2.2 FR1-FR1 NR-DC RRM requirements**
    - **2.4 HO with PSCell requirements for new scenarios**
    - **2.5 TCI switching enhancement**
- Other objectives get a lower level of support and interest and moderator does not recommended further discussion in the intermediate round
    - 2.1 UL frame boundary offset reporting
    - 2.3 Enhancements for CSI-RS based L3 measurement
    - 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
    - 2.7 RLM enhancements

- 2.8 HST RRM enhancement
- 2.9 CGI reading requirement for NR-U cell
- 2.10 Harmonized RLM/BM
- 2.11 RRM enhancement for large CC number
- 2.12 allowInterruption mechanism for deactivated SCell measurements
- 2.13 CSI-RS based CFRA in RRM requirement
- 2.14 Fast and gapless Scell activation
- 2.15 Fast RRC connection re-establishment
- 2.16 RRM enhancement for NR-U

- Several new objectives were proposed by companies and additional views collection is recommended in the intermediate round
  - 2.17 (new) PUCCH SCell activation delay requirements with multiple DL Scells (CATT)
  - 2.18 (new) Support NCD-SSB in IDLE mode for RedCap UE (vivo)

- Comments on specific objectives
  - 2.2 FR1-FR1 NR-DC RRM requirements
    - This topic has got a strong level of support/interest from companies. Companies mentioned relatively low workload and several operators mentioned that the scenarios are relevant to practical deployments.
  - 2.4 HO with PSCell requirements for new scenarios
    - This topic has got a strong level of support/interest from companies. Companies mentioned relatively low workload and several operators mentioned that the scenarios are relevant to practical deployments. Moderator recommends further discussion on detailed objectives and justification in the intermediate round.
  - 2.5 TCI switching enhancement
    - This topic has got a relatively good level of support/interest from companies observing the need to improve the TCI switching performance in terms of associated delays and enabling additional use cases.
    - Same time moderator observed that there is no convergence on the detailed proposed enhancements and further discussion in the intermediate round is needed to identify the most prominent directions. Moderator recommends to further discuss detailed objectives and justification.
    - One company proposed to “put 1.1 and 2.5 together to ”beam management enhancement including both FR1 and FR2””. Moderator’s view is that 1.1 topic does not get a strong support and recommend focusing further discussion on 2.5.

- 2.8 HST RRM enhancement
    - Limited interest from companies. Several companies recommended to discuss it as a part of HST enhancements item.
- 2.14 Fast and gapless Scell activation
    - Limited interest from companies. The scope of objective was not clear to some companies and additional questions were asked. One company proposed to combine 1.3, 1.7 and 2.14 without limiting the enhancement to FR2. Moderator suggestion is to further discuss it as a part of area #1 discussion and check if companies are fine to extend the same framework to FR1 as well.

2.5.4 Working area #3: MG related enhancements and leftovers

16 companies provided comments on candidate objectives

- **The following objectives/directions get a strong level of support and interest. Moderator recommends to further discuss detailed objectives and justification for these topics in the intermediate round.**
    - **3.5. Joint requirements for pre-configured MG, concurrent MG and NCSG**
    - **3.1. NeedForGap requirements**
    - **3.3. Inter-RAT NR measurement without gaps**
- Other objectives get a lower level of support and interest and moderator does not recommended further discussion in the intermediate round
    - 3.2. Per-FR gap capability indication enhancements
    - 3.4. MG sharing enhancement
    - 3.6. Enhancements for pre-configured MG
    - 3.8. Dynamic activation and switching of the MG pattern for different applications
- Several new objectives were proposed by companies and additional views collection is recommended in the intermediate round
    - 3.9 allow UE to report NCSG capability based on its active serving cells (MTK)
    - 3.10 Further enhancement on Pre-MG, NCSG and concurrent gaps (Apple)
    - 3.11 MG enhancement for other R17 features (Apple)
    - 3.12 Concurrent gap for DC (LGE)
- Comments on specific objectives
    - 3.5. Joint requirements for pre-configured MG, concurrent MG and NCSG

    - This topic has received the strongest level of support/interest. Multiple companies mentioned importance of defining joint requirements to extract full benefits of features introduced in Rel-17. Some companies proposed to make additional prioritization of possible scenarios. In addition, several companies suggested to consider additional objectives on enhancements for pre-configured MG, concurrent MG and NCSG in the context of 3.5.

  - 3.1. NeedForGap requirements

    - This topic has got a strong level of support/interest. Several companies mentioned that NCSG requirements already cover NeedForGap mechanism and can be considered as a superset of NeedForGap mechanism. Meanwhile many companies think that this is a separate feature and new requirements are needed disregards NCSG requirements. Several companies proposed to cover both inter-frequency measurement requirements under clarification that current specs already cover intra-frequency measurements. Several companies mentioned possible RAN2 impacts.

    - One company proposed to combine 3.1 ad 3.3 under "Measurement requirements without gaps" umbrella and include inter-RAT LTE measurements w/o gaps. Moderator thinks it is a good suggestion and further classification can be performed at a later stage once the scope of each individual objective becomes clear.

  - 3.3 Inter-RAT NR measurement without gaps

    - This topic has got a strong level of support/interest. Three companies mentioned that the topic should be discussed under working area #2. Some companies mentioned that the objective can be relevant to NCSG and NeedForGap requirements. Some companies mentioned possible RAN2 impacts. One company mentioned LTE measurements as well.

  - 3.2. Per-FR gap capability indication enhancements

    - Limited level of interest with several companies mentioning that there are ongoing discussions in Rel-17 UE feature list on the respective capability.

  - 3.4. MG sharing enhancement

    - Limited level of interest with several companies mentioning that benefits and gains are unclear.

  - 3.6. Enhancements for pre-configured MG

    - Medium level of interest for the objective. Several companies mentioned that this is relevant to the ongoing Rel-17 MG Enhancement WI discussions. Moderator recommends to postpone the discussion till RAN #95e once the final conclusions on Rel-17 work are ready.

  - 3.7. RRM requirements and New MG patterns for MUSIM

    - The topic got a medium level of support/interest. Several companies mentioned that they do not see clear need to define new gap patterns for MUSIM given that new MGs are defined in Rel-17. Meantime, RRM requirements were deprioritized in Rel-17 and companies prefer to complete the relevant work in Rel-18 timeframe in the scope of MG enhancements or MUSIM WI. Given no strong companies views and a medium level of support, moderator recommends discussing the MUSIM RRM requirements in the scope of Rel-18 MUSIM work item.

3 Intermediate round

For the intermediate round moderator recommends **focusing the discussion on the objectives, which got a strong level of support during the initial round**. The goal is to further clarify the scope/justification/objective for these items. Given that number of objectives is still quite large moderator expects that **additional prioritization shall take place at a later stage once the scope and workload associated with detailed objectives becomes clear**. Based on initial round comments some objectives may be related to Rel-17 progress and additional discussion in RAN #95e can be required.

3.1 General

An updated moderator proposal on WI structure is provided below taking into account the comments that final structure needs further check based on agreed set of objectives.

Proposal #1 (updated): Split the objectives into the following 2 WIs as an output of email discussion

1. **Rel-18 [NR and MR-DC] RRM enhancement WI covering working areas #1 (FR2 RRM) and #2 (General RRM)**
2. **Rel-18 [NR and MR-DC] MG enhancements WI covering working area #3 (MG enhancements)**

Note: the set of WIs can be reconsidered at a later stage subject to further set of objectives

Feedback Form 5: Rel-18 SI and/or WIs structure for RRM enhancement work area

1 – Apple Poland Sp. z.o.o. Support the objectives splitting into 2 separated WIs as proposal 1.
2 – Huawei Technologies France Support proposal #1 (updated).
3 – China Telecommunications OK with proposal 1.
4 – QUALCOMM JAPAN LLC. As we commented already, we should first see how many items overall can be approved and then decide on the grouping. Deciding the grouping first could lead to the expectation that more proposals are to be agreed.
5 – China Mobile Com. Corporation We support moderator's proposal #1.

6 – vivo Mobile Communication (S) We are fine with updated proposal #1.
7 – ZTE Wistron Telecom AB Moderator's proposal is fine for us.
8 – Guangdong OPPO Mobile Telecom. Support proposal #1 (updated).
9 – LG Electronics Inc. We support moderator's proposal.
10 – CATT Fine with proposal #1 (updated)
11 – Beijing Xiaomi Mobile Software We support proposal #1 (updated)
12 – Intel We support the updated proposal.
13 – NTT DOCOMO INC. We are fine with updated proposal.
14 – Nokia Corporation We can support the moderator proposal#1. However, in the end it may depend on the overall amount of topics agreed.

3.2 Working area #1: FR2 RRM enhancements

3.2.1 Prioritization

Based on the outcome of the initial round discussion moderator proposes to deprioritize a sub-set of topics and not consider them in Rel-18.

Proposal #2 (working area #1): De-prioritize the following Working area #1 objectives in Rel-18

- 1.1 Enhancement to FR2 beam measurement requirements (e.g., allow UE to measure a subset of the configured resources)
- 1.2 Define FR2-FR2 DAPS requirements
- 1.5 RRM measurements for different Rx beam sets in FR2
- 1.6 Network-controlled gaps for UE Rx beam switching

- 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios (e.g., FR2-2 NR-DC and FR2-1-FR2-2 NR CA/DC)

Companies are encouraged to share views on Proposal #2 on working area #1 topic prioritization.

Feedback Form 6: Comments on Working area #1 objectives de-prioritization

1 – Ericsson LM We support moderator's proposal # 2 to down prioritize all these items: 1.1, 1.2, 1.5. 1.6 and 1.8
2 – Apple Poland Sp. z.o.o. We think topic 1.4 FR2 BWP switching time enhancements shall also be deprioritized, since we already had both type 1 and type 2 BWP switching delay, and the benefit to introduce another type of FR2 BWP switching delay is very limited but it could need more complexity for UE implementation. The RRC related BWP switching is not a dynamic BWP switching behavior and the gain to shorten the current requirement is either not obvious. For others deprioritized topics, we support proposal 2.
3 – Huawei Technologies France Although we think item 1.1 is important, we can compromise support Proposal #2 (working area #1).
4 – Beijing Xiaomi Mobile Software We support moderator's proposal # 2 to deprioritize all these item.
5 – MediaTek Inc. We support Moderator's proposal to deprioritize these working area
6 – China Telecommunications ok with proposal 2.
7 – QUALCOMM JAPAN LLC. We support this deprioritazation
8 – TELECOM ITALIA S.p.A. ok
9 – China Mobile Com. Corporation We support moderator's proposal #2, considering RAN4 work load and focusing on the essential features.
10 – vivo Mobile Communication (S) We support moderator's porposal #2.

11 – Samsung Electronics Co. We support Moderator proposal.
12 – ZTE Wistron Telecom AB Moderator's proposal is fine for us
13 – Guangdong OPPO Mobile Telecom. We support Moderator's proposal.
14 – LG Electronics Inc. The moderator's proposal is fine for us.
15 – CATT Support proposal #2.
16 – Intel We are ok to the proposal.
17 – NTT DOCOMO INC. We support the moderator's proposal.
18 – Nokia Corporation We support the moderator proposal#2.

3.2.2 Topic #1.7 FR2 delay reduction enhancements (combined 1.3, 1.4 and 1.7)

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #1.7 FR2 delay reduction enhancements, #1.3 SCell activation enhancements in FR2 and #1.4 FR2 BWP switching time enhancements. The candidate justification and objectives are provided below.

- Justification:
    - TBA (after set of objectives is stabilized). [It is observed that some of the FR2 RRM requirements allow excessively long delay for UE in certain RRM operations. It is also observed that there is feasible way to enhance specific requirements to guarantee fair performance in the field for FR2 networks. For this objective RAN4 consolidates several sub-objectives to form an umbrella to facilitate a general enhancement in FR2 delay requirements.]

undefined

- Candidate objectives
    - #1.7 Study and if needed define FR2 RRM requirements delay reduction enhancements [RAN4, RAN1/2?]

- 1.7A Cell identification and L3 measurement delay reduction [RAN4]
  - Identify cases where FR2 cell identification and L3 measurement delay can be reduced (e.g., cases with reduced number of assumed Rx beams), and specify reduced delay requirements for such cases in IDLE/INACTIVE/CONNECTED modes
- 1.7B FR2 SCell activation delay reduction [RAN4, RAN1/2?]
  - Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]
  - [Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN1, RAN2]]
- 1.7C [FR2 BWP switching time enhancements] [RAN4]
  - Specify, if feasible, reduced FR2 BWP switching delay requirements including [DCI/Timer/RRC] based BWP switching.
- Other?

The list of objectives includes 3 key directions of FR2 delay reduction mentioned by companies. Further prioritization may be required to ensure a reasonable overall work scope. Companies are encouraged to share views on the following:

- #1: General views
- #2: Justification
- #3: Objectives (including prioritization between 1.7A, 1.7B, 1.7C)
- #4: Other WG impacts

Feedback Form 7: Comments on Topic #1.7 FR2 delay reduction enhancements

1 – Ericsson LM

We support combining the three items.

In terms of priority, for us item 1.7B is of highest priority and item 1.7A is of medium priority. For item 1.7C, we are not sure if there will be sufficient improvement. But we can accept if there is strong preference for this objective as well.

2 – Apple Poland Sp. z.o.o.

We are fine with the justification drafted by moderator. Regarding the objectives, we have concern to include the enhancement of the BWP switching delay in FR2 in this WI (the reasons have provided to form 6). We agree some of the topics may needs RAN1/2 involvements. We propose the following objectives (add one sub-bullet to 1.7A and remove 1.7C):

1.7 Study and if needed define FR2 RRM requirements delay reduction enhancements [RAN4, RAN1,

RAN2]

1.7A Cell identification and L3/L1 measurement delay reduction [RAN4, RAN2]

- Identify cases where FR2 cell identification and L3 measurement delay can be reduced (e.g., cases with reduced number of assumed Rx beams), and specify reduced delay requirements for such cases in IDLE/INACTIVE/CONNECTED modes. [RAN4]
- **Identify cases where measurement/evaluation time of FR2 L1-RSRP and/or CBD and/or BFD can be reduced, and specify reduced delay requirements for such cases.[RAN4]**
- Specify if needed, UE/network enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN2]

1.7B FR2 SCell activation delay reduction [RAN4, RAN1, RAN2]

- Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]
- Specify if needed, **UE/network** enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [**RAN1, RAN2, RAN4**]

~~1.7C [FR2 BWP switching time enhancements] [RAN4]~~

~~Specify, if feasible, reduced FR2 BWP switching delay requirements including [DCI/Timer/RRC] based BWP switching.~~

3 – Huawei Technologies France

Item 1.7B and 1.7C are high priority for us.

1.7B (FR2 SCell activation delay reduction) can also be extended to cover FR1 as current FR1 SCell activation requirements are very similar as FR2. For example, the scheme of minimize or eliminate the time needed for TCI indication and/or for L1-RSRP measurement/reporting can also be applicable to FR1. **We suggest to add a note under 1.7B: the enhancement can be extended to FR1 when applicable.**

We expect the efforts in RAN4 would be medium given that SCell activation enhancement has been discussed quite extensively since Rel-15, and we expect some small impacts to other WGs.

1.7C [FR2 BWP switching time enhancements]: the switching delay for type 2 UE (2.25ms in absolute time) is rather large, and we suggest to enhance the type 2 BWP switching delay requirement, e.g. by introducing a new UE capability in between type 1 and type 2. We expect the RAN4 efforts for this objective would be small, and impacts to other WG is very limited as so far we see only impacts to RAN2 due to new UE capability

4 – Beijing Xiaomi Mobile Software

We support item 1.7A and 1.7B with high priority, for item 1.7C, we are not sure whether there is sufficient room for further enhancement, since RAN4 already have 2 set of requirements with different UE capabilities.

5 – MediaTek Inc.

Item 1.7B and 1.7C are high priority to us.

1.7A: We suggest to first work on CONNECTED mode in this release. We have some concern on the enhancement in IDLE mode which may lead to higher UE power consumption which is very critical for IDLE case.

1.7B: We share similar view with Apple to add both network and UE enhancement into consideration and also add RAN1/RAN2 as the responsible companies. But to avoid duplicated discussion, we want to add a further note saying that **RAN1/RAN2 works are only triggered by RAN4 LS**.

1.7C: the worklaod is low.

Assuming that we will have only 1 RRM enh WI, the # of sub- objectives to be included should be jointly considered with the discussion in 3.3.

6 – China Telecommunications

First priority: 1.7B, and second priority: 1.7C.

For 1.7B, we support Huawei's suggestion to add a note saying: **the enhancement can be extended to FR1 when applicable.** In our view, the solutions, if generic, should not be restricted to be applied to FR2 only.

7 – QUALCOMM JAPAN LLC.

1.7A: so far we have not seen any data to justify the need for delay reduction. Is there any analysis showing that current requirements are not enough? these were agree after a long discussion in Rel.15, we should avoid another long discussion without any clear justification.

1.7B: we do not think any significant improvements can be achieved without RAN1 involvement. If there is a plan to reduce delay for unknown cell by introducing some reference signals, we would be supportive.

1.7C: same question as before, what is the point of having yet another requirement that is between TYpe 1 and TYpe 2?at the time these were introduced, infra vendors commented that it is difficult to handle different UEs at the base station, this will become even more complicated with another set of requirements. If someone really wants to build a low latency device, Type 1 is already available.

Priority among these 3 items would be 1.7B but only if RAN1 scope is introduced

8 – China Mobile Com. Corporation

In general, we support to use 1.7 as umbrella to cover the detailed enhanced direction. One consideration is that as proposed in Proposal 1, #1 (FR2 RRM) and #2 (General RRM) will be covered by the single WI, we think it is not necessary to limit the latency reduction to FR2, FR1 can also be considered if it is applicable.

For these three sub-objectives, 1.7A is our first priority, 1.7B is of medium priority. As for 1.7C, as we mentioned in initial round, there is similar discussion in previous release, the discussion is controversial and no consensus is reached, we are wondering whether we will face the same situation. But if there is strong support on this topic, we are also fine.

9 – China Unicom

We support to include Item 1.7B and 1.7C in Rel-18 work.

1.7B: We support to extend the enhancements of SCell activation delay reduction to FR1 where applicable.

1.7C: We support to specify reduced FR2 BWP switching delay requirements for FR2, as the current delay for type-2 UE is rather large. We think it's reasonable to introduce BWP switch enhancement with a new UE capability.

10 – Guangdong OPPO Mobile Telecom.

We are open to 1.7B. Potential impact on RAN1 should also be considered to reduce delay for unknown cell, which could be also discussed and clarified in this objective. The verision from Apple seems fine to us.

- 1.7B FR2 SCell activation delay reduction [RAN4, RAN1, RAN2]
    - Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]
    - Specify if needed, **UE/network** enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [**RAN1, RAN2, RAN4**]

For 1.7A and 1.7C, we think the existing requirements can work well and do not seen any strong motivation for delay reduction from UE perspective.

11 – LG Electronics Inc.

Generally, we are fine with the objectives. If the overall RAN4 workload needs to be reduced, 17.A and 1.7B could be higher priority than 1.7C.

12 – CATT

We support 1.7B as high priority and 1.7A as medium priority. For 1.7C, we think it can be deprioritized.

For objective 1.7B, we think the impact on RAN1/2 is not identified now and need not be included. And it can proceed through sending LS to RAN2 if the impact is identified during WI stage. The approach suggested by MediaTek to add a note saying that RAN1/RAN2 works are only triggered by RAN4 LS is also fine for us.

13 – Intel

We support 1.7A and 1.7B objectives.

Regarding 1.7C, one of the clarifications needed is whether a new capability is introduced to have another type in terms of BWP switch delay or directly reduce the delay for type 2 UE. Plus the scope applies to all DCI, Timer and RRC based BWP switching.

14 – vivo Mobile Communication (S)

We support the high level FR2 delay reduction enhancements.

For 1.7A, we support Apple's update to add L1 measurement enhancement and would like to provide more update to identify possible solutions during WI phase.

1.7A Cell identification and L3/L1 measurement delay reduction [RAN4]

- Identify cases where FR2 cell identification and L3 measurement delay can be reduced ~~(e.g., cases with reduced number of assumed Rx beams)~~, and specify reduced delay requirements for such cases in IDLE/INACTIVE/CONNECTED modes. [RAN4]
- **Identify cases where measurement/evaluation time of FR2 L1-RSRP and/or CBD and/or BFD can be reduced, and specify reduced delay requirements for such cases.[RAN4]**

  Note: L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception is covered in other WI.

In addition, Topic #14 [Requirement for FR2 multi-Rx chain DL reception] for FR2 RF evolution also discussed L3/L1 measurement enhancement for UE supporting multi Rx chain reception. RAN4 should avoid duplicated objectives in different WIs. So, a note would be helpful in our view.

If no other solution is forseen than reducing Rx beam sweeping factor by UE supporting multi Rx chain reception, then this objective can be dropped.

1.7B should be focused on other potential aspects than L1-RSRP measurement delay reduction, which can be covered by 1.7A. This may need to be clarified if both 1.7A and 1.7B are supported. For enhancement on other aspects, other working group involvement is needed in our view.

we don't see enough justification for 1.7C.

15 – NTT DOCOMO INC.

We are fine with moderator's proposed justification. About objectives, as we mentioned during initial round, 1.7C is low priority. Apple's modification seems fine.

16 – ZTE Wistron Telecom AB

We may need to focus on the currently identified schemes. Further down-selection might be required for the workload control. In this case 1.7B has a higher priority in our views.

Having "Others?" in the objectives is distractive, thus it should be removed.

17 – Nokia Corporation

We support this proposal of combing the proposals into defining FR2 RRM requirements delay reduction enhancements.

For the objectives we are in general fine with the proposed wording.

However, for 1.7B and the proposed changes from Apple we not agree on listing 'network enhancements' in the objectives. Firstly, because RAN4 defines UE requirements and secondly it is not clear which network enhancements are considered. We can agree listing 'signalling enhancements' as proposed by moderator.

Additionally, we do not see BFD discussion as being part of 1.7A.

We believe 1.7A and 1.7B are having higher priority than 1.7C.

3.3 Working area #2: General RRM enhancement and leftovers

3.3.1 Prioritization

Based on the outcome of the initial round discussion moderator proposes to deprioritize a sub-set of topics and not consider them in Rel-18.

Proposal #3 (working area #2): De-prioritize the following Working area #2 objectives in Rel-18

- 2.1 UL frame boundary offset reporting
- 2.3 Enhancements for CSI-RS based L3 measurement
- 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
- 2.7 RLM enhancements
- 2.8 HST RRM enhancement
- 2.9 CGI reading requirement for NR-U cell
- 2.10 Harmonized RLM/BM
- 2.11 RRM enhancement for large CC number
- 2.12 allowInterruption mechanism for deactivated SCell measurements
- 2.13 CSI-RS based CFRA in RRM requirement
- 2.14 Fast and gapless Scell activation
- 2.15 Fast RRC connection re-establishment
- 2.16 RRM enhancement for NR-U

Companies are encouraged to share views on Proposal #3 on working area #2 topic prioritization.

Feedback Form 8: Comments on Working area #2 objectives de-prioritization

1 – Ericsson LM We support moderator's proposal 3 to down prioritize all these items.
2 – Apple Poland Sp. z.o.o. We would like to have one more try to discuss the topic 2.10 Harmonized RLM/BM, since we observed lots of commonalities between RLM and BFD/CBD from R15. It would be much beneficial to both UE and network sides if we could configure same RS resource and share the same procedure to harmonize those two functionalities. And also the RLF would be triggered timely if UE cannot find qualified candidate beam in CBD after BFD which is more efficient from using legacy RLM to triggering RLF. For other deprioritized topics, we support proposal 3.
3 – Huawei Technologies France We are fine with Proposal #3 (working area #2)

4 – Beijing Xiaomi Mobile Software We support moderator's proposal # 3 to de-prioritize all these item.
5 – MediaTek Inc. To proceed, we are fine with moderator's proposal.
6 – China Telecommunications ok with proposal 3.
7 – QUALCOMM JAPAN LLC. We support this deprioritization
8 – TELECOM ITALIA S.p.A. ok
9 – China Mobile Com. Corporation We support moderator's proposal #3, considering RAN4 work load and focusing on the essential features.
10 – Samsung Electronics Co. we support moderator proposal
11 – Guangdong OPPO Mobile Telecom. We are fine with moderator's proposal.
12 – LG Electronics Inc. We support the moderator's proposal.
13 – CATT Fine with proposal #3.
14 – Intel We are OK with the proposal.
15 – NTT DOCOMO INC. We are OK with moderator's proposal.

16 – vivo Mobile Communication (S) We are fine with proposal #3 to move forward. One thing we would like to point out that for Rel-18 features, the requirements should be specified for NR operations on licensed band only, unless it is clearly stated in the WID that RRM requirements are to be specified for NR operations on unlicensed band. We should avoid the situation of debating whether NR-U is in the scope of WID or not, which is waste of precious online time. This comment is related to topic NR-U ehancement and we think a general guidance from RAN plenary is very necessary.
17 – ZTE Wistron Telecom AB Moderator's proposal is fine for us.
18 – Nokia Corporation We support the moderator proposal #3.

3.3.2 Topic #2.2 FR1-FR1 NR-DC RRM requirements

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #2.2 FR1-FR1 NR-DC RRM requirements.

- Justification:
  - *FR1 + FR1 NR-DC band combinations have been introduced since Rel-16 and the relevant deployment scenarios are expected to be used globally. However, the RRM requirements for FR1 + FR1 NR-DC are missing, which may negatively affect the overall performance in NR-DC scenarios and shall be specified. The missing requirements are identified initially as number of serving carrier requirement, PSCell addition and release delay, PSCell change and conditional PSCell change delay, scheduling availability of UE during RLM and BFD, and CSSF for NR-DC.*
- Candidate objectives
  - *Define RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]*

Companies are encouraged to share views on the following:

- #1: General views
- #2: Justification
- #3: Objectives
- #4: WG impacts

Feedback Form 9: Comments on Topic #2.2 FR1-FR1 NR-DC RRM requirements

1 – Apple Poland Sp. z.o.o.

We support moderator's summary of justification and objectives for this topic.

2 – Beijing Xiaomi Mobile Software

We support the candidate objective.

3 – Huawei Technologies France

As 2.2 and 2.4 are all the scenario extension, Apple's comments in initial round is reasonable to us: merge 2.2 and 2.4 to "extension for R17 features to new scenarios"

- Extension for R17 features to new scenarios including, e.g., FR1+FR1 NR-DC RRM, HO with PSCell for new scenarios.

For the scenario extension, RAN4 work load would be small.

4 – MediaTek Inc.

We are fine with the justifications.

Regarding the objective, we need a 2nd level of detail to set a clear scope for RAN4 discussion. The examples provided in the justification can be a good starting point.

5 – QUALCOMM JAPAN LLC.

We support this work to enable this deployment scenario

6 – China Mobile Com. Corporation

We support the justifications and objectives on topic #2.2 FR1-FR1 NR-DC RRM requirements. This topic is our first priority, considering this is fundamental scenario and the requirements need to be specified.

7 – Guangdong OPPO Mobile Telecom.

We are fine with moderator's proposal. This objective could be made clear based on the following justification.

The missing requirements are identified initially as number of serving carrier requirement, PSCell addition and release delay, PSCell change and conditional PSCell change delay, scheduling availability of UE during RLM and BFD, and CSSF for NR-DC.

8 – LG Electronics Inc.

We support the justification and candidate objectives.

9 – Intel

We support this objective.

10 – CATT

Support the objective. But we think the current objective may be too broad and we would like to suggest adding the identified requirements as sub-objectives e.g.

Define RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]

–number of serving carrier requirement, –PSCell addition/release delay requirement, –PSCell change and conditional PSCell change delay, –scheduling availability –CSSF for NR-DC
11 – vivo Mobile Communication (S) We support moderator's summary of justification and candidate objectives.
12 – NTT DOCOMO INC. We are fine with moderator's proposal.
13 – ZTE Wistron Telecom AB We support to complete the missing piece in Rel-18.
14 – Nokia Corporation We support the proposal and the justification in general.

3.3.3 Topic #2.4 HO with PSCell requirements for new scenarios

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #2.4 HO with PSCell requirements for new scenarios.

- Justification:
  - *Requirements for HO with PSCell were defined in the scope of Rel-17 NR and MR-DC further RRM enhancements WI, while the work on several scenarios was deprioritized. Practical deployment interest was identified for a number of new scenarios and additional RRM requirements are needed to enable handover with PSCell in additional scenarios including HO from NR SA to NE-DC, from NR SA to NR-DC and from LTE SA to EN-DC.*

- Candidate objectives
  - *Define HO with PSCell requirements for the following scenarios [RAN4]*
    - *HO from NR SA to NE-DC*
    - *HO from NR SA to NR-DC*
    - *HO from LTE SA to EN-DC*
    - *HO from NR SA to NE-DC*

Companies are encouraged to share views on the following:

- #1: General views
- #2: Justification
- #3: Objectives
- #4: Other WG impacts

Feedback Form 10: Comments on Topic #2.4 HO with PSCell requirements for new scenarios

1 – Apple Poland Sp. z.o.o.

We support moderator's summary of justification. The objective shall only contain three bullets (the last one seems like a typo).

Define HO with PSCell requirements for the following scenarios [RAN4]

- *HO from NR SA to NE-DC*
- *HO from NR SA to NR-DC*
- *HO from LTE SA to EN-DC*
- ~~*HO from NR SA to NE-DC*~~

2 – Huawei Technologies France

Same comments as on topic #2.2.

3 – MediaTek Inc.

OK with Apples's revision.

4 – QUALCOMM JAPAN LLC.

We support this proposal

5 – China Telecommunications

We support this objective.

6 – China Mobile Com. Corporation

We support the justifications and objectives on topic #2.4 HO with PSCell requirements for new scenarios. This topic is our first priority, all these new scenarios are practical deployment, and RAN4 work effort on specifying the related requirements expected to be small.

Just one minor comment, for the detailed scenarios, the 1st bullet and the last bullet are the same, one of them can be deleted.

7 – Intel Corporation (UK) Ltd

Moderator: Thank you for pointing out a typo. The last bullet is redundant and can be removed

8 – Guangdong OPPO Mobile Telecom. OK with Apples's revision.
9 – Beijing Xiaomi Mobile Software Support with Apples's revision.
10 – Intel We support this objective in general. Only one comment is whether the fourth subbullet in the objectives is a redundant.
11 – CATT Support the objective.
12 – vivo Mobile Communication (S) We support moderator's summary of justification and objectives by removing the last sub-bullet.
13 – NTT DOCOMO INC. We support the Apple's revision.
14 – ZTE Wistron Telecom AB We are fine with Apple's revision.
15 – Nokia Corporation We support the moderator proposal and the justification in general. Apple update seems fine.

3.3.4 Topic #2.5 TCI switching enhancements

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #2.5 TCI switching enhancement.

- Justification
  - *TBA (after set of objectives is stabilized)*
- Candidate objectives
  - 2.5 Define TCI switching enhancement [RAN4]
    - [2.5A Define simultaneous TCI state switching requirements over multiple carriers]
    - [2.5B Allow UE to receive DL data after TCI state switch command and before TCI state switch starts]
    - [2.5C Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements]

- Other?

The list of objectives includes 3 key directions of FR2 delay reduction mentioned by companies. Further prioritization may be required to ensure a reasonable overall work scope. Companies are encouraged to share views on the following: Companies are encouraged to share views on the following:

- #1: General views
- #2: Justification
- #3: Objectives (including prioritization of candidate objectives 2.5A/B/C)
- #4: Other WG impacts

Feedback Form 11: Comments on Topic #2.5 TCI switching enhancement

1 – Ericsson LM

We support this objective on TCI switching enhancement. Objective 2.5A is of highest priority for us. We are also fine with objective 2.5B (medium).

2 – Apple Poland Sp. z.o.o.

We support moderator's summary on objectives 2.5A/B/C. The 2.5B shall be revised to followings, since existing spec (using old TCI) covered the time gap from TCI state switching command to command decoding complete:

2.5B Allow UE to receive DL data after TCI state switch command **decoding** and before TCI state switch starts

We propose justification as:

Active TCI switching has been introduced since Rel-15. However, the TCI switching on multiple carriers are missing in the current requirement, and it could be a practical scenario for network to activate or switch multiple TCIs on multiple serving carriers simultaneously. In existing TCI switching requirement, UE is not required to receive PDCCH after MAC CE decoding until the end of the TCI switching delay, which would cause big throughput loss in case the TCI switching takes long period. In order to improve the throughput performance and speed up the TCI switching, it's desirable to consider to enhance UE behavior during TCI switching procedure and/or introduce temporary RS for fast measurement.

3 – Beijing Xiaomi Mobile Software

We are fine with the objective on TCI switching enhancement, and support 2.5A with high priority.

4 – Huawei Technologies France

We support the objective and our priority is 2.5C. Without waiting for SMTC/SSB, using temporary RS can efficiently reduce the TCI switching delay and interruption.

5 – MediaTek Inc.

2.5A: Need clarification. This seems already supported in Rel-17 feMIMO. And the RAN4 discussion is ongoing. We are not clear about what the additional enhancement to be done here.

2.5B: Need clarification. Current spec does not specify the UE requirement during the transition, which means UE is still allowed (but not mandated) to continue data reception. We still fail to see the need to specify anything here.

2.5C: This one is fine to us.

6 – MediaTek Inc.

(Cont'd) On 2.5C, RAN1 or RAN2 may need to be added as responsible WG, depending on whether new Temp RS triggering mechanism is needed.

7 – QUALCOMM JAPAN LLC.

Objective 2.5C is of highest priority and could offer the best improvements. all others are lower priority for us

8 – China Mobile Com. Corporation

For topic #2.5 TCI switching enhancement, our main consideration is about the RAN4 work load. If there is room, we are fine to consider this topic in REL-18 but the scope is not expected to be too large.

9 – Guangdong OPPO Mobile Telecom.

We support 2.5C with high priority. And RAN1 or RAN2 may be impacted as well.

10 – Intel

We support 2.5B.

Regarding 2.5A, clarification is needed on simultaneous switching, does it mean that the UE needs to switch TCI states on all the active carriers at the same time? Or alternatively the UE is allowed to switch on each carrier one by one.

Regarding 2.5C, we don't have strong view so we are open to look into this aspect in R18.

11 – CATT

Support objective 2.5B and also fine with objective 2.5A if the scope is enough.

12 – ZTE Wistron Telecom AB

We support the objective for TCI switching enhancement. And 2.5C has a higher priority.

13 – vivo Mobile Communication (S)

We support objective 2.5C as high priority and justifications are provided as follows.

- For MAC CE based and RRC based TCI state switch, and active TCI state list update, one SSB is needed for timing/frequency tracking if target TCI state is not in the active TCI state list for PDSCH, which will result in very long TCI switch delay due to waiting for the SSB.
- Temporary RS has been introduced for fast SCell activation in Rel-17 and has been identified that it can serve the purpose of timing/frequency tracking.

RAN1/2 need to be added as responsible WG, in case Temporary RS design for fast SCell activation cannot be reused directly.

For 2.5B, we think it is not needed further if temporary RS is used for TCI state switching, which can elimilate the uncertain period of which TCI to be used.

For 2.5A, it would be more appropriate to be discussed and covered by [Topic #14 Requirement for FR2 multi-Rx chain DL reception] WI where dual TCI is assumed.

14 – NTT DOCOMO INC.

We support the moderator's proposal and 2.5C can be highly prioritized considering the clarity and expected gain.

15 – Nokia Corporation

We support the moderator proposal and the justification in general. We agree with MTK comments related to 2.5B that UE is already allowed to continue reception. However, currently network will likely assume worst case UE behaviour

3.3.5 New objectives from the initial round

Several new objectives were proposed by companies in the initial round and additional views collection is recommended in the intermediate round

- 2.17 (new) PUCCH SCell activation delay requirements with multiple DL Scells (CATT)
- 2.18 (new) Support NCD-SSB in IDLE mode for RedCap UE (vivo)

Companies are encouraged to provide views on newly proposed objectives 2.17 and 2.18.

Feedback Form 12: Comments on Working area #2 new objectives

1 – Ericsson LM

On Objective 2.17:

- Our understanding is that objective 2.17 is part of R17 RRM enhancement WI and should be completed in R17 or under maintenance.

On Objective 2.18:

- This is related to R17 RedCap WI. It is better to wait and see the outcome in R17. Another issue is that this requires RAN2 agreements. In case any RedCap related item cannot be completed can possibly be included in R18 RedCap WI.

In summary both objectives should not be part of R18 RRM enhancement WI

2 – Apple Poland Sp. z.o.o.

We need to understand the scope of topic 2.17, does it mean PUCCH SCell is activated in parallel with other DL SCells? If Yes, we agree with topic 2.17.

We think topic 2.18 shall be discussed in RAN1/2 rather than RAN4, and since RAN1 didn't have such topic in R18 RedCap enhancement, we may deprioritize topic 2.18 for R18 RAN4 WI.

3 – Beijing Xiaomi Mobile Software

On Objective 2.17:

This Objective can be done under Rel-17 maintenance.

On Objective 2.18:

This Objective should be triggered by RAN1/2 instead of RAN4.

4 – Huawei Technologies France

2.17 (new) PUCCH SCell activation delay requirements with multiple DL Scells

The objective is relative to the ongoing Rel-17 FeRRM. We suggest to postpone the discussion until the work in Rel-17 is concluded.

2.18 (new) Support NCD-SSB in IDLE mode for RedCap UE

This has been discussed in RAN#94, as some issues are identified for using NCD-SSB in idle mode. The conclusion is that RedCap UE in IDLE and INACTIVE monitors paging in an initial BWP associated with CD-SSB in Rel-17, and idle/inactive mobility is only based on measurements on the CD-SSB. We don't fully understand the benefit to restart discussion on the NCD-SSB supported scheme in idle mode.

5 – QUALCOMM JAPAN LLC.

We support 2.18, however, it has to be checked what would be the impact in other WGs and whether this should be RAN2 led or RAN4 led. It can also be added to RedCap enhancements.

6 – China Mobile Com. Corporation

In our view, both topics are pending on the on-going Rel-17 discussion, and can be discussed after there is conclusion on Rel-17 work.

7 – Guangdong OPPO Mobile Telecom.

We are interested in 2.18. However, it may be not led by RAN4 but RAN1/2.

8 – Intel

Regarding 2.17 we have the similar concern as commented in the above issue. Whether the intention is to require UE to simultaneously switch on all the carriers is not clear.

Regarding 2.18, we wonder what are the expected requirements and spec impact? We wonder if we could still discuss this in Rel-17 if the expected scope is clear enough.

9 – CATT

For objective 2.17, our understanding is that PUCCH Scell is activated in parallel with multiple DL Scells and it can be revisited after February meeting discussion since it depends on the R17 process.

10 – Nokia Corporation

2.17: RAN4 should wait the Rel-17 work on PUCCH SCell is concluded. We don't think extensive leftover work should be done in maintenance phase.

2.18: This should be discussed under RedCap.

11 – vivo Mobile Communication (S)

For 2.18, we would like to share some background to address comments that it is under discussion in Rel-17.

In the RAN#94, the following conlusion was made.

conclusion: slide 2 of RP-213689 is endorsed

Slide 2 of RP-213689 is copied as follows.

1.Scheme 1 (i.e. UE in IDLE and INACTIVE monitors paging in an initial BWP associated with CD-SSB) is adopted for further work in Rel-17. Scheme 2 (i.e. UE in IDLE and INACTIVE monitors paging in an initial BWP associated with NCD-SSB) is not considered further in Rel-17

2.RAN2 should work on the assumption that the cell reselection measurements and cell ranking are performed based on measurements on the CD-SSB. This applies for intra- and inter-frequency measurements, and for IDLE and INACTIVE states.

So, RRM measurements are perfromed on the CD-SSB in IDLE and INACTIVE mode for Rel-17 RedCap UE according to RAN plenary agreements. Our understanding is then there is NO further work in RAN4 on IDLE mode RRM measurements based on NCD-SSB in Rel-17.

The conclusion in RP-213689 was made due to concerns on RAN2 and RAN4 workload. There is no issue for supporting separated initial BWP associated with NCD-SSB. In the last RAN4 meeting, RAN4 reached agreement that it is feasible according to approved WF R4-2202774.

Agreement: Capture the following agreements in reply LS

For working assumption "If it is configured for paging, RedCap UE expects it to contain NCD-SSB for serving cell but not CORESET#0/SIB from RAN1 perspective", from RAN4's view it is feasible.

Therefore, NCD-SSB is feasible to be supported in IDLE and INACTIVE mode and no requirements will be specifed in Rel-17. That's why we propose to define corresponding requirements in Rel-18 with further justifications as provided in initial round.

We agree RAN2 work is necessary. We think this work can also be RAN4 lead if there is no other appropriate WIs to do the work. In Rel-18, there is only one RedCap SI. This work cannot fit into a SI.

We are open to hear views on how this work can be done in Rel-18.

3.4 Working area #3: MG related enhancements and leftovers

3.4.1 Prioritization

Based on the outcome of the initial round discussion moderator proposes to deprioritize a sub-set of topics and not consider them in Rel-18.

Proposal #4 (working area #3): De-prioritize the following Working area #3 objectives in Rel-18

- 3.2. Per-FR gap capability indication enhancements
- 3.4. MG sharing enhancement
- 3.6. Enhancements for pre-configured MG
- 3.8. Dynamic activation and switching of the MG pattern for different applications

Companies are encouraged to share views on Proposal #4 on working area #3 topic prioritization.

Feedback Form 13: Comments on Working area #3 objectives de-prioritization

1 – Ericsson LM We support moderator's proposal 4 to down prioritize all the 4 objectives.
2 – Apple GmbH We are fine with proposal 4.
3 – Beijing Xiaomi Mobile Software We support moderator's proposal # 4 to de-prioritize all these item.
4 – Huawei Technologies France We have some concerns on de-prioritizing 3.2 (Per-FR gap capability indication enhancements). We understand that the topic is being discussed in Rel-17 feature list discussion, so we are fine to not further discuss it during this email discussion, but we suggest to keep it open before we get conclusion from Rel-17 feature list discussion.

5 – MediaTek Inc. We support Moderator's proposal.
6 – QUALCOMM JAPAN LLC. We are fine with the proposal
7 – China Telecommunications OK with Proposal #4.
8 – TELECOM ITALIA S.p.A. ok
9 – China Mobile Com. Corporation We support moderator's proposal #4, considering RAN4 work load and focusing on the essential features.
10 – Samsung Electronics Co. We support moderator proposal
11 – ZTE Wistron Telecom AB Though we have strong interests in 3.4 MG sharing enhancement, we can compromise to Moderator's proposal.
12 – LG Electronics Inc. We support the moderator's proposal.
13 – Intel We support this proposal.
14 – CATT Support proposal #4.
15 – Nokia Corporation We do see some benefits in 3.6. The enhancements would make sense together with topic 3.5. However, to progress and down select we can support the moderator proposal #4.
16 – vivo Mobile Communication (S) We support moderator's proposal #4.

3.4.2 Topic #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG.

Justification:

- *The baseline functionality of pre-configured MG, concurrent MG and NCSG was introduced in Rel-17 NR and MR-DC Measurement gap enhancements WI. Meanwhile, the work on requirements for the joint configuration of pre-configured MG, concurrent MG and NCSG was deprioritized. Support of respective joint requirements will improve network configuration flexibility and allow addressing additional use cases via a combination of pre-configured MG, concurrent MG and NCSG mechanisms.*

Candidate objectives

Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG

- *Define RRM requirements for UEs configured with a combination of with pre-configured MGs, multiple concurrent MGs and NCSG [RAN4]*

Companies are encouraged to share views on the following:

- #1: General comments
- #2: Justification
- #3: Objectives (e.g. whether any prioritization of scenarios is needed)
- #4: Other WG impacts

Feedback Form 14: Comments on Topic #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG

1 – Ericsson LM We support this objective.
2 – Apple GmbH We support this objective. The most attractive objectives to us include Pre-MG + concurrent gaps and NCSG + concurrent gaps. However, we would like to keep all other combinations in the scope for now.
3 – Beijing Xiaomi Mobile Software We support the candidate objective.
4 – Huawei Technologies France We support the objective, but suggest to add the following bullet - Prioritization among possible combinations of pre-configured MG, concurrent MG and NCSG can be discussed in WI phase

5 – MediaTek Inc.

We are fine with t he justification.

To control the workload, we prefer to have some prioritization among different combinations, e.g., focus on 1 or 2, because we may need to consider some other objectives in the same WI. It would be even better if the prioritization can be done in RP level, instead of RAN4. We suggest to at least prioritize NCSG + concurrent gaps.

6 – QUALCOMM JAPAN LLC.

We support this but it is lower priority compared to 3.1 and 3.3

7 – China Telecommunications

We support this objective. Prioritization among possible combinations can be discussed in RAN #95e or in WG level.

8 – China Mobile Com. Corporation

We support the justification and objectives.

9 – Guangdong OPPO Mobile Telecom.

We support the objective with all possible combinations of Pre_MG, concurrent MG and NCSG at this moment. The prioritization can be discussed in WI phase.

10 – ZTE Wistron Telecom AB

In general, we are fine with the objective with a clarification on ”combination” since there are three elements (Pre + Concurrent + NCSG) involved. The intention is to check all possible combinations even only two of them combined, therefore, the objective may be revised as:

Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG

· Define RRM requirements for UEs configured with a combination of ***~~with~~*** *pre-configured MGs,* ***and/or*** *multiple concurrent MGs* ***and/or*** *NCSG [RAN4]*

11 – LG Electronics Inc.

We support the justification and candidate objectives.

12 – Intel

We support this objective.

13 – CATT

Support the objective.

14 – vivo Mobile Communication (S)

We support the moderator's summary of justification.

For the objective, we think down-scope can be done at this phase. It is not clear how pre-MG + NCSG could work since NCSG would be dynamic configuration based on current CA/DC configuration for the UE. So, we propose following two combinations.

Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG

○ Define RRM requirements for UEs configured with a combination of with pre-configured MGs and multiple concurrent MGs and NCSG [RAN4]

○ Define RRM requirements for UEs configured with a combination of with multiple concurrent MGs and NCSG [RAN4]

15 – Nokia Corporation

In general, we support the moderator proposal. It is not clear whether this would need any prioritization.

3.4.3 Topic #3.1 NeedForGap requirements

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #3.1 NeedForGap requirements.

Justification

- *The existing RRM requirements for UEs supporting NeedForGaps feature are specified for intra-frequency SSB based measurements without gaps, while requirements for inter-frequency measurements without gaps are missing. This feature can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.*

Candidate objectives

- *Define measurement requirements without gaps*
    - *Define requirements for NR inter-frequency measurements without gaps for UEs reporting NeedForGapsInfoNR IE for inter-frequency measurements [RAN4]*

Companies are encouraged to share views on the following:

- #1: General comments
- #2: Justification
- #3: Objectives (e.g., shall reference to UE capability or signalling be added; type of RRM requirements to be defined; relation to NCSG)
- #4: Other WG impacts

Feedback Form 15: Comments on Topic #3.1 NeedForGap requirements

1 – Ericsson LM

We support this objective. It is of highest priority for us under the MG enhancement WI.

One comment on the objective. Some work may also be needed for intra-frequency measurement without gaps e.g. interruption. So we suggest to also include intra-frequency measurements without gaps

2 – Beijing Xiaomi Mobile Software

We support the candidate objective.

3 – Huawei Technologies France

We suggest to merge 3.1 (NeedForGap requirements) with 3.3 (Inter-RAT NR measurement without gaps) as one objective.

As we commented in initial round discussion, we do not see clear need to define requirements for NeedForGaps in Rel-18 given we already have requirements for NCSG in Rel-17. The only missing part after Rel-17 are inter-RAT NR measurements when UE is in LTE SA or EN-DC without MG, and we are fine to define requirements for them in Rel-18, which is addressed by 3.3.

4 – Apple GmbH

We consider this low priority since the functionality has already been covered by NCSG. If majority still want to spend effort on that, we are open for further discussion.

However, some clarification may be needed to align understanding from companies. For instance:

1) does "*gap-less*" here means there is no any interruption (similar with no-gap-no-ncsg in NCSG reporting) or some short glitch is allowed (similar with VIL)? Or potentially some new UE capability will be introduced to indicate whether interruption is needed? Note that no matter what the answer is, this has already been supported by NCSG.

2) does "gap-less" means there is no any scheduling restriction? or scheduling restriction shall still be there? In our view, the answer has impact on the procedure and signaling design. Note that no matter what the answer is, this has already been supported by NCSG.

3) what is the relationship between NeedForGap and NCSG? if UE supports both, do we need to harmonize the capability reporting for the same target band?

5 – MediaTek Inc.

As commented in initial round, all the functionalities of NeedforGap (even include no gap) has covered by NCSG already. Therefore, we have difficulty to see a good justification to work on this objective. We also have similar questions as raised by Apple (the Email moderator of NCSG in RAN4). If in the end the group still want to work on NeedforGap, we need to clearly specify the detail issues to be discussed, e.g., whether interruption and scheduling restriction is allowed as well as its relation to NCSG.

6 – QUALCOMM JAPAN LLC.

We support to have requirements for this case. If some requirements are already covered then it should be straightforward to finalize it and discuss in the future some other items if RAN4 time permits.

7 – China Telecommunications

We support the objective as an leftover from R16.

8 – China Mobile Com. Corporation

We support the justification and objectives. Topic #3.1 NeedForGap requirements is our high priority. As we mentioned in 1st round, in our view, NeedForGap means no gap no interruption, which is different from NCSG. The inter-frequency measurement requirements for UE indicating 'no-gap' via interFreq-needForGap need to be specified, which is not covered by NCSG framework. To be noted, this case is different from the case specified in 9.3.9 in TS38.133, the latter one requires the limitation that SSB is completely contained in the active BWP, but for NeedForGap, there is no need to have the limitation of within BWP.

9 – Guangdong OPPO Mobile Telecom.

As commented in initial round, we consider this as low priority. If NeedForGap means no gap no interruption, the requirements has already been covered by NCSG with "no-gap-no-ncsg", which could be quite straightforward.

If the majority still supported , we are open to capture it. But the exact definition/scope of NeedForGap requiremetns (e.g., no gap no interruption) should be clearly justifed in the objective, in order to avoid too much time for debating on the definition.

10 – Intel

We support this objective. We need to fix the spec for inter-frequency measurements for UE with capability of measurement without gaps. It is decoupled from NCSG since we allow the UE implementation of not supporting NCSG but supporting NeedforGap.

11 – CATT

Support the objective and we think it is independent with NCSG feature. On the one hand, the NCSG indication is possibly independent with NeedforGap which means the requirements for NeedforGap should be independent with NCSG support. E.g. there may be some UE not supporting NCSG indicating no-gap through NeedForGap. On the other hand, in our understanding, this objective is to define the requirements for the measurement without gap and without NCSG.

12 – ZTE Wistron Telecom AB

We support to complete the missing piece in Rel-18.

13 – vivo Mobile Communication (S)

We think the objectives need further discussion. During previous RAN4 discussions, following potential objectives were identified according to R4-2018039.

•Limited to SSB based measurements configured via measurement objects

•Study whether the additional interruption is allowed when UE reporting 'no gap'

•Further define the interruption length, occasion and ratio, if the interruption is allowed

•Study the related requirements, such as CSSF, measurement period, scheduling restriction etc.

If no interruption is needed for UE supporting NeedForGap, then it would be a much better feature than NCSG.

As relation to NCSG, we think it can different UE capabilities. UE should have flexibility to choose which feature to implement.

We are not expecting impat to other working groups unless inter-RAT measurement without gaps in considered in this topic.

3.4.4 Topic #3.3 Inter-RAT NR measurement without gaps

Based on the outcome of the initial round discussion moderator recommends further discussion on justification and objectives for topic #3.3 Inter-RAT NR measurements without gaps.

- Justification:
  - *Inter-frequency measurements without gaps are already supported in Rel-17. Support of gap-less inter-RAT NR [and LTE] measurements can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.*
- Candidate objectives
  - *Define measurement requirements without gaps*
    - *Inter-RAT NR measurement without gaps [RAN4]*
    - *[Inter-RAT LTE measurement without gaps [RAN4]]*

Companies are encouraged to share views on the following:

- #1: General comments
- #2: Justification
- #3: Objectives (e.g., whether inter-RAT LTE measurements shall be included; relation to NCSG and NeedForGap)
- #4: Other WG impacts
- #5: Views on whether the objective shall be a part of area #2 or area #3.

Feedback Form 16: Comments on Topic #3.3 Inter-RAT NR measurement without gaps

1 – Ericsson LM

We support this objective including both inter-RAT NR and inter-RAT LTE measurements without gaps. The reason is that if inter-RAT LTE measurement needs gaps then network will have to configure the measurement gaps.

Needforgap and inter-RAT NR/LTE measurements without gaps broadly falls under the same type of work.

2 – Beijing Xiaomi Mobile Software

We support the candidate objective.

3 – Huawei Technologies France

As commented above, we suggest to merge 3.1 (NeedForGap requirements) with 3.3 (Inter-RAT NR measurement without gaps) as one objective.

In Rel-17, inter-RAT LTE measurement is supported in NCSG already, so we do not see the need to include Inter-RAT LTE measurement without MG for Rel-18 enhancement.

4 – Apple GmbH

We support this objective. Even though IRAT LTE measurement can be covered by NCSG, this objective allows UE to support this gap-less measurement w/o supporting NCSG. this is different from relation between NeedForGap and NCSG. Those two are extremely similar from implementation and procedure perspective.

We believe area #2 would be the better place for this objective. Since there is no impact on gap design. Furthermore, IRAT NR measurement seems more like an enhancement on LTE side. The new requirements are expected to be implemented into LTE spec such as RAN4 requirements, RRC design and UE capability. All of these have nothing to do with NR measurement gap.

5 – MediaTek Inc.

We are fine with this objective.

We share the same view as Huawei/Apple that the inter-RAT LTE measurement is not needed.

Similar to NCSG discussion, RAN4 also need to discuss whether no-gap means without interruption or with interruption.

RAN2 may need to be added as one of the responsible WG, depending on the conclusion of discussions in RAN4

6 – QUALCOMM JAPAN LLC.

We support this item. We believe inter-RAT NR should be the priority

7 – China Telecommunications

#3 - Objectives: support to include inter-RAT LTE measurements.

8 – China Mobile Com. Corporation We support the candidate objectives. Inter-RAT NR measurement without gaps is our high priority. If there is room, we also support to consider Inter-RAT LTE measurement without gaps. For the detailed work, in our view, both the case without interruption and the case with short interruption need to be considered.
9 – Guangdong OPPO Mobile Telecom. We support this objectives . We agree that inter-RAT NR should be the priority.
10 – Intel We support this objective in general. To clarify on the scenario, we understand that this objective is for the cases where a UE is served by NR serving cell and configured inter-RAT measurements on LTE target cell. If the UE active BWP contains the target CRS, the UE maybe able to measure on the LTE target cell without gap. It is not clear to us why proponent go with two separate bullets.
11 – ZTE Wistron Telecom AB The objective is fine for us, however as commented in the initial round, it looks a bit strange that a ”gap-less” objective is included in a ”gap-oriented” WI. RRM enhancement WI may be a better place.
12 – CATT Support this objective and we are fine to include LTE measurement. On the other hand, we also think this is independent of NeedForGap and should be part of RRM enhancement (i.e. area#2).
13 – vivo Mobile Communication (S) It is better to be merged with 3.1 as one objective. For inter-RAT measurement without gaps, RAN2 involvement is necessary.
14 – Nokia Corporation We can support this proposal from the moderator. As mentioned in first round this work may require discussion related to needForGaps which would then increase the expected workload in RAN4.

3.4.5 New objectives from the initial round

Several new objectives were proposed by companies in the initial round and additional views collection is recommended in the intermediate round.

- 3.9. (new) Allow UE to report NCSG capability based on its active serving cells (MTK)
- 3.10. (new) Further enhancement on Pre-MG, NCSG and concurrent gaps (Apple)
- 3.11. (new) MG enhancement for other R17 features (Apple)
- 3.12. (new) Concurrent gap for DC (LGE)

Companies are encouraged to provide views on newly proposed objectives 3.9, 3.10, 3.11, and 3.12.

Feedback Form 17: Comments on Working area #3 new objectives

1 – Ericsson LM

These are enhancements of features which are being specified in R17. It is important to wait and see real field experience before doing further enhancements. Therefore our view we should wait for at least one more release for doing any such enhancement.

In summary all these should be down prioritized in R18.

2 – Beijing Xiaomi Mobile Software

All these objectives should be de-prioritized in Rel-18.

3 – Huawei Technologies France

We can support 3.10 (Further enhancement on Pre-MG, NCSG and concurrent gaps) among the new objectives. Of course, the details of the scope should be further discussed. From our side, we see enhancement to pre-configured MG as high priority.

4 – Apple GmbH

We support 3.10. We shall at least keep it open, rather than conclude it now to deprioritize it. There are several candidate enhancements discussed in R17 MG enhancement receive support from companies. However, they are still open and some of them are somehow deprioritized (e.g. due to limited time in R17). Such as:

1) general:

- Support of Pre-MG, NCSG and concurrent gaps in MR-DC

2) Pre-MG:

- Fast Pre-MG activation/deactivation w/o BWP switching. Note it has already been supported in R17 Positioning. We believe it is beneficial to extend it to cover legacy measurement.

- Pre-MG in CA based on BWP switching on multiple CCs.

3) concurrent gaps:

- Requirement for FO, FPO (subject to R17 progress)

- Gap sharing in case of overlapping

4) NCSG:

- NCSG for CSI-RS based inter-freq measurement (subject to R17 progress).

- deriveSSB-IndexFromCell-inter extension to cover 1) diff SCS; 2) multiple CCs and/or multiple MOs (subject to R17 progress).

Details scope can be further discussed after RAN4#102e.

5 – MediaTek Inc.

As 3.10 is pending on the ongoing RAN4 discussion, it is fine to keep it open till the next RP meeting.

6 – QUALCOMM JAPAN LLC.

There are small enhancements for which there is no clear need now, they can be discussed some time in the future

7 – China Mobile Com. Corporation

These topics are pending on the on-going Rel-17 discussion, and can be discussed after there is conclusion on Rel-17 work.

8 – Guangdong OPPO Mobile Telecom.

We are open to 3.10. But it may be pending on the ongoing RAN4 discussion.

9 – LG Electronics Inc.

We support 3.10 and 3.12. Some of the left over issues for MG enhancement should be continued under 3.10. And concurrent gap for DC would be less work load since this would be based on the principle of concurrent gap specified in Rel-17.

10 – Intel

Each of the objectives here needs further discussion. A clear scoping is much appreciated from the proponents. In the sense that the capacity in this work item is fully loaded, we suggest deprioritize the newly proposed objectives.

11 – ZTE Wistron Telecom AB

Current objectives discussed for the WI are already quite large, we propose to postpone these new objectives.

12 – CATT

We think these objectives are still under discussion in R17 and can be postponed.

13 – vivo Mobile Communication (S)

For 3.10, we see benifit of supporting pre-MG in CA case. So 3.10 can be kept open for now. Other objectives can be postponed.

14 – Nokia Corporation

Considering the RAN4 workload we believe these should be postponed/low priority.

3.5 Summary of intermediate round

3.5.1 General

14 companies provided comments. One company thinks it is premature to agree on a set of work items, while other companies support modified moderator proposals. Moderator would like to clarify that a new note was added in the intermediate round to address similar comments ("Note: the set of WIs can be reconsidered at a later stage subject to further set of objectives").

Given that majority supported the proposal, moderator recommends confirming the proposal and no further discussion is expected. Moderator will prepare drafts of two items for the final round. No further discussion is required in the final round and updated proposal #1 will be added to the email discussion summary document (section 5).

Proposal #1: Split the objectives into the following 2 WIs as an output of email discussion

1. **Rel-18 NR and MR-DC RRM enhancement WI covering working areas #1 (FR2 RRM) and #2 (General RRM)**
2. **Rel-18 NR and MR-DC MG enhancements WI covering working area #3 (MG enhancements)**

Note: the set of WIs can be reconsidered at a later stage subject to further set of objectives

3.5.2 Working area #1: FR2 RRM enhancements

3.5.2.1 Prioritization

18 companies provided comments. Majority of companies support moderator proposal on prioritization.

One company commented that topic 1.4 FR2 BWP switching time enhancements shall be deprioritized. Moderator acknowledges company view and would like to clarify that further prioritization is expected to balance the load and recommends to further discuss it. Further discussions on this issue are recommended to be done under topic #1.7.

For convenience moderator also suggests listing both prioritized / de-prioritized objectives to improve clarity without changing actual contents.

- **Proposal #2: Working Area #1 (FR2 RRM enhancements)**
  - **Prioritized objectives for further discussion**
    - 1.7 FR2 delay reduction enhancements
    - 1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)
    - 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)
    - ***Note: further prioritization of objectives can be required in RAN #95e***
  - **De-prioritized objectives**

        - 1.1 Enhancement to FR2 beam measurement requirements
        - 1.2 Define FR2-FR2 DAPS requirements
        - 1.5 RRM measurements for different Rx beam sets in FR2
        - 1.6 Network-controlled gaps for UE Rx beam switching
        - 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

3.5.2.2 Topic #1.7: FR2 delay reduction enhancements (combined 1.3, 1.4 and 1.7)

17 companies provided comments

- Overall companies are fine to consider a combined objective on FR2 delay reduction enhancements and shared views on possible further prioritization.
    - Objective 1.7B (FR2 SCell activation reduction) has a strong support
    - Objective 1.7A (Cell identification and measurement delay reduction) has a medium-to-strong level of support
    - Objective 1.7C (FR2 BWP switching time enhancements) has a relatively lower support
    - Given the received feedbacks moderator recommends confirming a stable interest for 1.7A and 1.7B, while additional decision on prioritization of 1.7C is needed in RAN #95e. 1.7C can be kept in [] for now.
- Justification:
    - Companies did not share many inputs on the justification part. Moderator recommends making further editorial updates shown below.
- Objectives refinement:
    - 1.7A: Cell identification and measurement delay reduction
        - Two companies proposed to include L1-RSRP, CBD, BFD measurements in the scope, while one company preferred to remove CBD/BFD.
        - One company proposed to limit the work to the CONNECTED mode.
        - One company commented that L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be covered in other WI.
        - One company proposed to add “Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements] [RAN2]”
    - 1.7B: FR2 SCell activation reduction
        - Several companies suggested to clarify that *UE/Network* enhancements can be considered, while one company suggested to remove network enhancements. Moderator recommends keeping the current text, which is general enough.

        - Several companies mentioned possible RAN1/2 involvement, while some companies shared a view that RAN1/RAN2 works can be triggered by RAN4 LS. Moderator recommends to discuss it in the final round.
        - One company suggested to add a note that the enhancement can be extended to FR1 when applicable. Moderator recommends to discuss it in the final round.
    - 1.7C: FR2 BWP switching time enhancements
        - Some companies clarified that the intention is to support values in between Type 1 and Type 2 and moderator suggest capturing such note in the objectives
        - No comments on DCI/Timer/RRC based switching were made and shall be further discussed.
    - Moderator proposes to discuss these aspects in the final round.

Updated justification / objectives are provided below and recommended to be discussed in the final round:

Justification:

- *It is observed that some of the FR2 RRM requirements allow excessively long delay for UE in certain RRM operations. It is also observed that there is feasible way to enhance specific requirements to guarantee fair performance in the field for FR2 networks. Candidate enhancements include 1) Cell identification and measurement delay reduction; 2) FR2 SCell activation delay reduction and 3) FR2 BWP switching time enhancements~~For this objective RAN4 consolidates several sub-objectives to form an umbrella to facilitate a general enhancement in FR2 delay requirements~~.*

Candidate objectives

- 1.7 Study and, if needed, define FR2 RRM requirements delay reduction enhancements ~~[RAN4, RAN1?, RAN2?]~~
    - 1.7A Cell identification and ~~L3~~ measurement delay reduction ~~[RAN4, RAN2?]~~
        - Identify cases where FR2 cell identification and L3 measurement delay can be reduced ~~(e.g., cases with reduced number of assumed Rx beams)~~, and specify reduced delay requirements for such cases in [IDLE/INACTIVE]/CONNECTED modes. [RAN4]
        - [Identify cases where measurement/evaluation time of FR2 L1-RSRP can be reduced, and specify reduced delay requirements for such cases] [RAN4]
        - [Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements] [RAN4, RAN2]
    - 1.7B FR2 SCell activation delay reduction ~~[RAN4, RAN1/2?]~~
        - Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]

- ~~[~~Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN1, RAN2]~~]~~
- Note: the technical solutions can be extended to FR1 when applicable

- 1.7C [FR2 BWP switching time enhancements] [RAN4]
  - Specify, if feasible, reduced FR2 BWP switching delay requirements ~~including~~ for [DCI/Timer/RRC] based BWP switching.
  - Note: enhancements shall aim to provide switching delay in between Rel-15 BWP switching type 1 and type 2 BWP switching delay for FR2
- Note: RAN1/RAN2 work can be triggered by RAN4 LS only
- ~~Other?~~

3.5.3 Working area #2: General RRM enhancement and leftovers

3.5.3.1 Prioritization

18 companies provided comments on topic prioritization. Majority of companies support moderator proposal on prioritization.

One company commented would like to further discuss topic 2.10 Harmonized RLM/BM. Based on the initial round the topic 2.10 got a limited support from the companies and moderator recommends not to discuss it further.

One company mentioned that the requirements should be specified for NR operations on licensed band only, unless it is clearly stated in the WID that RRM requirements are to be specified for NR operations on unlicensed band. Moderator thinks that relevant clarifications should be discussed as a part of WI objectives and can be added if there is a consensus to do so.

Moderator also would like to update proposal taking into account discussion on additional objectives. For convenience moderator also suggests listing both prioritized / de-prioritized objectives to improve clarity without changing actual contents.

- **Proposal #3: Working Area #2 (RRM enhancements and leftovers)**
  - **Prioritized objectives for further discussion**
    - #2.2 FR1-FR1 NR-DC RRM requirements
    - #2.4 HO with PSCell requirements for new scenarios
    - #2.5 TCI switching enhancements
    - ***Note: further prioritization of objectives can be required in RAN #95e***

- **De-prioritize the following objectives**
    - 2.1 UL frame boundary offset reporting
    - 2.3 Enhancements for CSI-RS based L3 measurement
    - 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
    - 2.7 RLM enhancements
    - 2.8 HST RRM enhancement
    - 2.9 CGI reading requirement for NR-U cell
    - 2.10 Harmonized RLM/BM
    - 2.11 RRM enhancement for large CC number
    - 2.12 allowInterruption mechanism for deactivated SCell measurements
    - 2.13 CSI-RS based CFRA in RRM requirement
    - 2.14 Fast and gapless Scell activation
    - 2.15 Fast RRC connection re-establishment
    - 2.16 RRM enhancement for NR-U
    - 2.17 PUCCH SCell activation delay requirements with multiple DL Scells
    - 2.18 Support NCD-SSB in IDLE mode for RedCap UE

3.5.3.2 Topic #2.2: FR1-FR1 NR-DC RRM requirements

14 companies provided comments

- All companies are supportive of the objective
- Objectives refinement:
    - One company commented to merge objectives 2.2 and 2.4 to ”extension for R17 features to new scenarios”. Moderator will capture the proposal in the final round revision.
    - Several companies proposed to introduce the 2nd level of details to set a clear scope for RAN4 discussion with the objectives listed in the justification part recommended to be used as baseline. Moderator will capture the proposal in the final round revision.

Updated justification / objectives are provided below and recommended to be discussed in the final round:

- Justification:

- *FR1 + FR1 NR-DC band combinations have been introduced since Rel-16 and the relevant deployment scenarios are expected to be used globally. However, the RRM requirements for FR1 + FR1 NR-DC are missing, which may negatively affect the overall performance in NR-DC scenarios and shall be specified. The missing requirements are identified initially as number of serving carrier requirement, PSCell addition and release delay, PSCell change and conditional PSCell change delay, scheduling availability of UE during RLM and BFD, and CSSF for NR-DC.*

- Candidate objectives
  - *Extension of requirmeents for existing features to new scenarios*
    - *Define RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]*
      - *RRM requirements include number of serving carriers, PSCell addition/release delay requirement, PSCell change and conditional PSCell change delay, scheduling availability, and CSSF. Other requirements are not precluded and are subject to WI stage discussion*

3.5.3.3 Topic #2.4: HO with PSCell requirements for new scenarios

15 companies provided comments

- All companies are supportive
- Companies noticed that the last bullet in objectives is redundant
- No further discussion is needed

Updated justification / objectives are provided below and recommended to be confirmed in the final round:

- Justification:
  - *Requirements for HO with PSCell were defined in the scope of Rel-17 NR and MR-DC further RRM enhancements WI, while the work on several scenarios was deprioritized. Practical deployment interest was identified for a number of new scenarios and additional RRM requirements are needed to enable handover with PSCell in additional scenarios including HO from NR SA to NE-DC, from NR SA to NR-DC and from LTE SA to EN-DC.*

- Candidate objectives
  - *Extension of requirements of existing features to new scenarios*
    - *Define HO with PSCell requirements for the following scenarios [RAN4]*
      - *HO from NR SA to NE-DC*
      - *HO from NR SA to NR-DC*
      - *HO from LTE SA to EN-DC*
      - ~~*HO from NR SA to NE-DC*~~

3.5.3.4 Topic #2.5: TCI switching enhancements

15 companies provided comments

- Prioritization
  - Objective 2.5C (Reduced TCI switch delay using temporary RS) has received larger support comparing to other objectives. Objectives 2.5A (simultaneous TCI state switching requirements over multiple carriers) and 2.5B (receive DL data after TCI state switch command) received almost same level of support and slightly less than 2.5C
  - Moderator proposed to confirm the work on 2.5C and further discuss the remaining objectives prioritization in RAN #95e. The remaining objectives can be kept in [] for now.
- Justification:
  - Companies provided inputs on justification. Moderator recommends to provide separate justification for 3 sub-objectives and updated version is provided for discussion in the final round.
  - Companies asked a number of questions on the technical justification of all objectives and proponents are kindly asked to provide feedbacks in the final round
- Objectives refinement:
  - 2.5A Define simultaneous TCI state switching requirements over multiple carriers
  - 2.5B Allow UE to receive DL data after TCI state switch command decoding and before TCI state switch starts
    - One company suggested to clarify that "2.5B Allow UE to receive DL data after TCI state switch command <u>decoding</u> and before TCI state switch starts"
  - 2.5C Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements
    - Several companies proposed to add RAN1/RAN2 as responsible WGs. Given the discussion for other objectives moderator recommends to add a similar not that RAN1/RAN2 work can be triggered by RAN4 LS to allow sufficient time for RAN4 discussion on candidate enhancements before triggering RAN1/2 work

Updated justification / objectives are provided below and recommended to be confirmed in the final round:

- Justification (justification text can be selected depending on the set of prioritized objectives):
  - *2.5A: Active TCI switching has been introduced since Rel-15. However, the requirements for TCI switching on multiple carriers are missing in the current specification, and it could be a practical scenario for network to activate or switch multiple TCIs on multiple serving carriers simultaneously. In order to improve the throughput performance and speed up the TCI switching, it's desirable to define requirements for such use case.*

- *2.5B: In the existing TCI switching requirements, UE is not required to receive PDCCH after MAC CE decoding until the end of the TCI switching delay, which would cause throughput loss in case the TCI switching takes a long period. In order to improve the throughput performance and speed up the TCI switching, it's desirable to consider enhancing UE behavior during TCI switching procedure.*
- *2.5C: For MAC CE based and RRC based TCI state switch, and active TCI state list update, one SSB is needed for timing/frequency tracking if target TCI state is not in the active TCI state list for PDSCH, which will result in a very long TCI switch delay due to waiting for the SSB. Temporary RS has been introduced for fast SCell activation in Rel-17 and has been identified that it can serve the purpose of timing/frequency tracking.*

- Candidate objectives
  - *2.5 Define TCI switching enhancements ~~[RAN4]~~*
    - *2.5C Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements [RAN4, RAN1, RAN2]*
      - *Note: RAN1/RAN2 work can be triggered by RAN4 LS*
    - *[2.5A Define simultaneous TCI state switching requirements over multiple carriers] [RAN4]*
    - *[2.5B Allow UE to receive DL data after TCI state switch command decoding and before TCI state switch starts] [RAN4]*
    - ~~Other?~~

3.5.3.5 New objectives from the initial round

11 companies provided comments

- 2.17 (new) PUCCH SCell activation delay requirements with multiple DL Scells (CATT)
  - Multiple companies mentioned that this objective is a part of Rel-17 or can be done under Rel-17 maintenance.
  - Some companies asked for clarification on the scope
- 2.18 (new) Support NCD-SSB in IDLE mode for RedCap UE (vivo)
  - Several companies mentioned that the objective is relevant to R17 RedCap WI and it is better to wait and see the outcome in R17. Some companies proposed to discuss in RAN1/2 rather than in RAN4
  - Several companies supported the work

Takin into account feedbacks received in the initial round for other objective moderator thinks that the new objectives have limited support comparing to previously prioritized objectives and recommends not to further discuss the new objectives. The Proposal #2 was updated accordingly. No further discussion expected in the final round on these objectives.

3.5.4 Working area #3: MG related enhancements and leftovers

Prioritization

16 companies provided comments. Majority of companies support moderator proposal on prioritization.

One company commented that has some concerns on de-prioritizing 3.2 (Per-FR gap capability indication enhancements). Based on the initial round comments it is moderator understanding that this topic has relatively limited interest from companies and does not see value in further discussion. Moderator would like to remind that a similar topic was discussed as a part of possible Rel-17 RRM scope extension earlier and was de-prioritized in Rel-17. Therefore, moderator recommends confirming the Proposal #4 and make an adjustment to address companies comments that some topics may require discussion in future subject to Rel-17 progress.

Moderator also would like to update proposal taking into account discussion on additional objectives. For convenience moderator also suggests listing both prioritized / de-prioritized objectives to improve clarity without changing actual contents.

- **Proposal #4: Working Area #3 (MG enhancements)**
  - **Prioritized objectives for further discussion**
    - #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
    - #3.1 NeedForGap requirements
    - #3.3 Inter-RAT NR measurement without gaps
    - *Note: further prioritization of objectives can be required in RAN #95e*
  - **De-prioritized objectives**
    - 3.2. Per-FR gap capability indication enhancements
    - 3.4. MG sharing enhancement
    - 3.6. Enhancements for pre-configured MG
    - 3.8. Dynamic activation and switching of the MG pattern for different applications
    - 3.9. Allow UE to report NCSG capability based on its active serving cells
    - 3.10. Further enhancement on Pre-MG, NCSG and concurrent gaps
    - 3.11. MG enhancement for other R17 features
    - 3.12. Concurrent gap for DC

3.5.4.1 Topic #3.5: Joint requirements for pre-configured MG, concurrent MG and NCSG

15 companies provided comments

- Several companies raised a question on prioritization of combination of scenarios
- Two companies proposed to make prioritization among possible combinations of pre-configured MG, concurrent MG and NCSG can be discussed in WI phase.
- Two companies suggested to prioritize Pre-MG + concurrent gaps and NCSG + concurrent gaps
- One company suggested to prioritize NCSG + concurrent gaps
- One company raised questions whether pre-MG + NCSG is a valid scenario
- One company proposed to add "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements] [RAN2]"
- One company proposed editorial modifications
- To address companies comments moderator recommends to list 2 prioritized scenarios and leave further prioritization to the WI stage discussion

Updated justification / objectives are provided below and recommended to be discussed in the final round:

Justification:

- *The baseline functionality of pre-configured MG, concurrent MG and NCSG was introduced in Rel-17 NR and MR-DC Measurement gap enhancements WI. Meanwhile, the work on requirements for the joint configuration of pre-configured MG, concurrent MG and NCSG was deprioritized. Support of respective joint requirements will improve network configuration flexibility and allow addressing additional use cases via a combination of pre-configured MG, concurrent MG and NCSG mechanisms.*

Candidate objectives

- *Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG*
  - *Define RRM requirements for UEs configured with a combination of ~~with~~ pre-configured MGs, and/or multiple concurrent MGs and/or NCSG [RAN4]*
    - *Prioritize at least joint requirements for UE configured with*
      - *Case 1: Pre-configured MGs and multiple concurrent MGs*
      - *Case 2: NCSG and multiple concurrent MGs*
    - *Note: Prioritization among other possible combinations of pre-configured MG, concurrent MG and NCSG can be discussed in WI phase*

3.5.4.2 Topic#3.1: NeedForGap requirements

13 companies provided comments

- Several companies commented that NCSG functionality is a super-set of NeedForGap functionality, while other companies commented that some UEs may support NeedForGap, while not support NCSG. Therefore, specification still need to support corresponding functionality. Moderator's understanding is that NCSG and NeedForGap are different features and the fact that RAN4 has defined requirements for NCSG does not preclude definition of NeedForGap requirements.
- Some questions were raised on whether NeedForGap measurements without gaps will cause any interruptions. Several companies commented that interruptions are allowed, and some companies commented that interruptions are not allowed. One company suggested more detailed objectives based on prior 3GPP discussions
    - *Study whether the additional interruption is allowed when UE reporting 'no gap'*
        - *Further define the interruption length, occasion and ratio, if the interruption is allowed*
    - *Study the related requirements, such as CSSF, measurement period, scheduling restriction etc.*

undefined Due to diverse set of views from companies moderator recommends that the discussion on interruptions need as well as relation to NCSG feature can be left up to RAN4. The objective can be kept generic and further details can be worked out in RAN4 directly.

- One company suggested to limit the discussion to limited to SSB based measurements configured via measurement objects. Moderator assumption is that this is a common understanding based on justification text and objective can be adjusted.
- One company proposed suggest to merge 3.1 (NeedForGap requirements) with 3.3 (Inter-RAT NR measurement without gaps) as one objective. From moderator perspective the proposal is not very clear and additional details of merged objective can be helpful.
- One company proposed to include intra-frequency measurements into the scope due to incomplete requirements (incl. interruption requirements). Moderator recommends further discussion in the final round on this use case.

Updated justification / objectives are provided below and recommended to be discussed in the final round:

- Justification:
    - *The existing RRM requirements for UEs supporting NeedForGaps feature are specified for intra-frequency SSB based measurements without gaps, while requirements for inter-frequency measurements without gaps are missing. Also, RRM requirements for intra-frequency SSB based measurements without gaps do not assume interruptions, which may be required. This feature can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.*
- Candidate objectives

- *Measurement requirements without gaps*
  - *Define requirements for NR inter-frequency and intra-frequencySSB-based measurements without gaps for UEs reporting NeedForGapsInfoNR IE ~~for inter-frequency measurements~~ [RAN4]*
    - *Study whether additional interruptions are allowed when UE is reporting 'no gap'. Further define the interruption length, occasion and ratio, if the interruption is allowed*
    - *Define related requirements, such as CSSF, measurement period, scheduling restriction etc.*

3.5.4.3 Topic #3.3: Inter-RAT NR measurement without gaps

14 companies provided comments

- Similar to topic 3.1 several companies commented that such functionality is already covered by NCSG
- Several companies commented that "area #2 would be the better place for this objective". Moderator recommends to keep the objective under working area 3 and an alternative approach could be to adjust the WID title to include "*measurements requirements without gaps*"
- One company proposed suggest to merge 3.1 (NeedForGap requirements) with 3.3 (Inter-RAT NR measurement without gaps) as one objective. From moderator perspective the proposal is not very clear and additional details of merged objective can be helpful.
- Diverse views on whether to include Inter-RAT LTE measurements with companies sharing different views. Companies are encouraged to share more views in the final round. It is moderator understanding that the following two scenarios are considered and further clarifications are welcome to make sure all proponents are on the same page
  - *Inter-RAT NR measurement without gaps:* UE is served by LTE serving cell and configured inter-RAT measurements on NR target cell
  - *Inter-RAT LTE measurement without gaps:* UE is served by NR serving cell and configured inter-RAT measurements on LTE target cell
- Moderator also recommends to list higher priority for NR measurements in the objectives.
- One company mentioned that RAN2 involvement is need. Moderator would like to ask for more details on RAN2 involvements, since details are unclear.

Updated justification / objectives are provided below and recommended to be discussed in the final round:

Justification:

- *Inter-frequency measurements without gaps are already supported in Rel-17. Support of gap-less inter-RAT NR [and LTE] measurements can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.*

Candidate objectives

- *Measurement requirements without gaps*
  - *Inter-RAT measurements without gaps [RAN4]*
    - *First priority: Inter-RAT NR measurements*
    - *Second priority: Inter-RAT LTE measurement*

undefined

3.5.4.4 New objectives from the initial round

14 companies provided comments on new objectives. Most companies commented that these objectives are related to the ongoing Rel-17 work status and either have low priority or can be discussed after Re17 discussion. Takin into account feedbacks received in the initial round for other objective moderator thinks that the new objectives have limited support comparing to previously prioritized objectives and recommends not to further discuss the new objectives in this email thread. The Proposal #3 was updated accordingly. No further discussion on these objectives is expected in the final round.

4 Final round

4.1 Draft WIDs

Moderator uploaded drafts of 2 WIDs to the Inbox based on the discussion in the initial and intermediate rounds.

- RP-22xxxx New WID: Even Further RRM enhancement for NR and MR-DC
  - https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_95e/Inbox/Drafts/%5BRAN95e-RAN4-R18Prep-03%5D/draft%20RP-22xxxx%20-%20New%20WID%20-%20NR%20RRM%20Enhancements%20v01.doc

- RP-22xxxx New WID: Further enhancements on NR and MR-DC Measurement Gaps and measurements requirements without gaps
  - https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_95e/Inbox/Drafts/%5BRAN95e-RAN4-R18Prep-03%5D/draft%20RP-22xxxx%20-%20New%20WID%20-%20NR%20MG%20Enhancements%20v01.doc

Note that objectives are planned to be further refined and justification part will be added after the final round.

Companies are encouraged to provide inputs on the general WID contents. **The comments on individual technical objectives shall be provided in the individual topics.**

Feedback Form 18: General comments on Draft WIDs

1 – Apple Poland Sp. z.o.o.

Those draft WIDs could be good baseline for further discussion. But details inside WIDs shall be concluded after finalizing the scope of each of following topics (some of them might be clear after next RAN4 group meeting, and some of them may need further discussion in RANP #95e).

2 – Apple Poland Sp. z.o.o.

one more comment:

Propose to add brackets for sub-bullets of FR2 BWP switching enh in draft WID:

o [FR2 BWP switching time enhancements] [RAN4]

§ **[**Specify, if feasible, reduced FR2 BWP switching delay requirements ~~including~~ for [DCI/Timer/RRC] based BWP switching.**]**

§ **[**Note: enhancements shall aim to provide switching delay in between Rel-15 BWP switching type 1 and type 2 BWP switching delay for FR2**]**

3 – Huawei Technologies France

WID shall be updated based the individual discussion as below.

4 – Intel Corporation (UK) Ltd

Moderator:

Thank you for the comments. Let me share a few clarifications to avoid misunderstanding.

The objectives in WID are based on intermediate round and planned to be further refined after the final round as well as justification part. Please provide comments on individual objectives below. I'll make updates after final round taking into account the comments.

Based on RAN Chair guidance (RP-220003) each email discussion will be documented with official tdoc#s:

1) One pre-allocated Tdoc from MCC for "Moderator's summary for discussion [RAN95e-RAN4-R18Prep-xx]"

2) As a by-product, new SID(s)/WID(s) (the set of SID(s)/WID(s) depend on each email thread)

It is moderator understanding that both documents will be used as inputs for further discussion in RAN #95e. Hope this clarifies the procedure.

5 – Nokia Corporation

RP-22xxxx New WID: Even Further RRM enhancement for NR and MR-DC: The proposed draft WID looks in general fine and work on the justification can continue. Comments for each Objective is made under each topic.

RP-22xxxx New WID: Further enhancements on NR and MR-DC Measurement Gaps and measurements requirements without gaps: In general, the WID looks good and agreeable. Further work on the justification can be done. Comments for each Objective is made under each topic.

4.2 Working area #1: FR2 RRM enhancements

4.2.1 Prioritization

Based on the outcome of the intermediate round discussion moderator proposes the following list of prioritized/ deprioritized. For convenience moderator also suggests listing both prioritized / de-prioritized objectives to improve clarity without changing actual contents.

- **Proposal #2: Working Area #1 (FR2 RRM enhancements)**
  - **Prioritized objectives for further discussion**
    - 1.7 FR2 delay reduction enhancements
    - 1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)
    - 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)
    - ***Note: further prioritization of objectives can be required in RAN #95e***
  - **De-prioritized objectives**
    - 1.1 Enhancement to FR2 beam measurement requirements
    - 1.2 Define FR2-FR2 DAPS requirements
    - 1.5 RRM measurements for different Rx beam sets in FR2
    - 1.6 Network-controlled gaps for UE Rx beam switching
    - 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

Feedback Form 19: Comments on Working area #1 objectives prioritization

1 – Apple Poland Sp. z.o.o.

Agree with proposal 2.

2 – Ericsson LM Agree with proposal 2.
3 – MediaTek Inc. Agree with proposal 2.
4 – Qualcomm Incorporated OK with proposal 2.
5 – Huawei Technologies France Agree with proposal #2.
6 – Beijing Xiaomi Mobile Software Agree with proposal #2.
7 – China Mobile Com. Corporation Support proposal #2
8 – vivo Mobile Communication (S) Agree with proposal #2.
9 – Guangdong OPPO Mobile Telecom. OK with proposal 2.
10 – CATT Fine with the proposal.
11 – China Telecommunications Agree with proposal 2.
12 – LG Electronics Inc. Agree with proposal 2
13 – Intel We support the proposal.
14 – ZTE Wistron Telecom AB Ok with the proposal.
15 – NTT DOCOMO INC. We agree with proposal #2.

16 – Nokia Corporation We can support proposal #2
17 – Samsung Electronics Co. In general, further downscoping for RRM enhancement including both FR2 RRM and general RRM shall be discussed to save RAN4 work load. For this FR2 RRM, we support moderator proposals by recognizing the notes indicating the further downscoping in coming RAN.

4.2.2 Topic #1.7: FR2 delay reduction enhancements (combined 1.3, 1.4 and 1.7)

Updated justification / objectives are provided below and recommended to be discussed in the final round:

- Justification:
  - It is observed that some of the FR2 RRM requirements allow excessively long delay for UE in certain RRM operations. It is also observed that there is feasible way to enhance specific requirements to guarantee fair performance in the field for FR2 networks. Candidate enhancements include 1) Cell identification and measurement delay reduction; 2) FR2 SCell activation delay reduction and 3) FR2 BWP switching time enhancements~~For this objective RAN4 consolidates several sub-objectives to form an umbrella to facilitate a general enhancement in FR2 delay requirements~~.
- Candidate objectives
  - 1.7 ~~Study and, if needed, define~~ FR2 RRM requirements delay reduction enhancements ~~[RAN4, RAN1?, RAN2?]~~
    - 1.7A Cell identification and ~~L3~~ measurement delay reduction ~~[RAN4, RAN2?]~~
      - Identify cases where FR2 cell identification and L3 measurement delay can be reduced ~~(e.g., cases with reduced number of assumed Rx beams)~~, and specify reduced delay requirements for such cases in [IDLE/INACTIVE]/CONNECTED modes. [RAN4]
      - [Identify cases where measurement/evaluation time of FR2 L1-RSRP can be reduced, and specify reduced delay requirements for such cases] [RAN4]
      - [Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements] [RAN4, RAN2]
    - 1.7B FR2 SCell activation delay reduction ~~[RAN4, RAN1/2?]~~
      - Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]
      - ~~[~~Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN1, RAN2]~~]~~
      - Note: the technical solutions can be extended to FR1 when applicable

- 1.7C [FR2 BWP switching time enhancements] [RAN4]
  - Specify, if feasible, reduced FR2 BWP switching delay requirements ~~including~~ for [DCI/Timer/RRC] based BWP switching.
  - Note: enhancements shall aim to provide switching delay in between Rel-15 BWP switching type 1 and type 2 BWP switching delay for FR2
- Note: RAN1/RAN2 work can be triggered by RAN4 LS only
- ~~Other?~~

Companies are encouraged to provide the views on adjusted objectives, address the questions from the intermediate round and share views on the following aspects:

- 1.7A: Cell identification and measurement delay reduction
  - Whether IDLE/INACTIVE mode needs to be considered
  - Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP
  - Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD
  - Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope
  - Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements"
- 1.7B: FR2 SCell activation reduction
  - Whether a note that "enhancement can be extended to FR1 when applicable." is acceptable
- 1.7C: FR2 BWP switching time enhancements
  - Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching
- Whether a note on RAN1/2 involvement is acceptable

Feedback Form 20: Comments on Topic #1.7 FR2 delay reduction enhancements

1 – Apple Poland Sp. z.o.o.

We agree with adjusted objectives

1.7A: Cell identification and measurement delay reduction

- 1.Whether IDLE/INACTIVE mode needs to be considered

  [Apple]: we support to consider IDLE/Inactive modes for such enhancements.
- Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

  [Apple]: we support to consider the enhancement for FR2 L1-RSRP measurement as well.

- Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

  [Apple]: CBD assumed to use beam sweeping for both SSB and CSI-RS based evaluation, and therefore we could compromise to only consider such FR2 enhancement for CBD but not for BFD.

- Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

  [Apple]: agree to preclude L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception from this WI.

- Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements

  [Apple]: support to add such object for studying possible enhancement solutions.

2.1.7B: FR2 SCell activation reduction

- Whether a note that "enhancement can be extended to FR1 when applicable. is acceptable

  [Apple]: prefer to focus on FR2 first as high priority. But we are also fine to have a note here as long as other companies want it.

4.1.7C: FR2 BWP switching time enhancements

- Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching

  [Apple]: we may need to decide whether or not to keep FR2 BWP switching enhancement in RANP #95e.

Whether a note on RAN1/2 involvement is acceptable

[Apple]: that's the normal way for RAN4 led WI like in R17 FeRRM. We are neutral on it as long as other companies are fine to keep it.

2 – Ericsson LM

We also support the adjusted objectives.

We also agree to remove L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception from the scope of RRM enhancement WI. The RRM enhancement WI is related to legacy/normal UE. But multi-Rx chain will be a new/separate UE capability.

3 – MediaTek Inc.

1.7A: Cell identification and measurement delay reduction

Whether IDLE/INACTIVE mode needs to be considered

As mentioned in the previous round. The power consumption in IDLE is very important. activating multiple panels for IDLE mode measurements does not seem to be a very attractive approach. If companies still have the interest, we suggest to put it in low priority.

Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

OK with this item

Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

OK to CBD. FFS on BFD.

CBD is triggered only if beam failure is detected. In this special case, we agree that it is important for UE to measure faster.

Regarding BFD, it may need some further discussion. A short evaluation period may lead to some down side like more frequent beam failure triggering.

Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

There are some parallel discussion [02] about RRM enhancement for multi-panel UE. We do not have a strong about which WI to handle this work, but just want to mention that it is important to also consider the discussions in the other Email thread.

Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements

It is fine to have this note in the WID. In the end whether signalling enhancement is needed is up to the conclusion of RAN4 discussion. We do not see the point to exclude this in the first place.

1.7B: FR2 SCell activation reduction

Whether a note that "enhancement can be extended to FR1 when applicable. is acceptable

Suggested modification: "**Enhancement focuses on FR2 only. Whether to extend to FR1 can be considered after the enhancement is concluded**. "

The RAN4 discussion should focus on FR2 only. We do not want to see the discussion get complicated when companies start to bring considerations from FR1. When the FR2 design is down. We are fine to have a separate discussion about whether to extend to FR1.

1.7C: FR2 BWP switching time enhancements

Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching

Yes.

We are fine to include DCI, Timer and RRC based BWP switch

Whether a note on RAN1/2 involvement is acceptable

Support the note.

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4 – Huawei Technologies France

1.7A: Cell identification and measurement delay reduction

Whether include reduction of L1 measurement delay and CBD and BFD and the applicability of RRC states need further discussion based on detailed solutions. These can continue to be discussed in RANP #95e.

L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope as this kind of enhancement shall be discussed in another WI.

1.7B: FR2 SCell activation reduction

Support to add the note to extend to FR1 when applicable. The current FR1 SCell activation requirements are very similar as FR2, for example, the time delay for TCI indication and for L1-RSRP measurement/reporting are also included in FR1 unknown case. In addition, based on the intermediate discussion, operators who have FR1 deployment are interested in FR1 SCell activation delay reduction as well.

1.7C: FR2 BWP switching time enhancements

1.7C is applicable to DCI/Timer/RRC based BWP switching

5 – Qualcomm Incorporated

Following the principle that RAN4 should prioritize objectives with commercialization impact, we think that for 1.7A there should be data to motivate the proposed objectives. The list of proposals is getting longer and RAN4 needs to prioritize. So far we remain negative about 1.7A.

We support 1.7B: FR2 SCell activation reduction. OK to add the note.

Objective 1.7C offers no clear benefits. We suggest to keep it in brackets for now (if not dropped) and discuss further during RAN plenary meeting.

6 – China Unicom

1.7B: FR2 SCell activation reduction

We think the feature of SCell activation reduction is beneficial to both FR2 and FR1 if applicable. So we support no add a note that "enhancement can be extended to FR1 when applicable."

7 – Beijing Xiaomi Mobile Software

1.7A: Cell identification and measurement delay reduction

Whether IDLE/INACTIVE mode needs to be considered

We support to consider IDLE/Inactive modes for such enhancements.

Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

We support to consider the enhancement for FR2 L1-RSRP measurement as well.

Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

We support to include reduction of measurement/evaluation time for FR2 CBD and BFD.

Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

Agree to exclude L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception from the scope.

Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements

Agree to add this objective.

1.7B: FR2 SCell activation reduction

Whether a note that "enhancement can be extended to FR1 when applicable. is acceptable

Fine to add this note.

1.7C: FR2 BWP switching time enhancements

Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching

Need to decide whether to introduce FR2 BWP switching enhancement in RANP #95e.

Whether a note on RAN1/2 involvement is acceptable

Fine to keep it

8 – China Mobile Com. Corporation

We support the adjusted objectives.

1.7A: Cell identification and measurement delay reduction

Whether IDLE/INACTIVE mode needs to be considered

We support to consider IDLE/INACTIVE mode, since IDLE/INACTIVE mode also has the long delay issue.

Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

We support to include L1-RSRP, since L1-RSRP also has the long delay issue.

Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

Support to include FR2 CBD and BFD.

Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

We are fine to remove L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception from this WID, if this topic is covered by other WI

Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements

OK with this objective.

1.7B: FR2 SCell activation reduction

Whether a note that "enhancement can be extended to FR1 when applicable. is acceptable

Support to add this note. FR1 face the similar problem, no need to limit to FR2.

1.7C: FR2 BWP switching time enhancements

Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching

We are fine to consider all these cases.

Whether a note on RAN1/2 involvement is acceptable

OK with this note

---

9 – vivo Mobile Communication (S)

We are okay with adjusted objectives, which is good balance considering different views from companies.

1.7A: Cell identification and measurement delay reduction

Whether IDLE/INACTIVE mode needs to be considered

We agree with MediaTek that power consumption is more important in IDLE/INACTIVE state. There should be some study on feasibilty of measurement delay reduction in IDLE/INACTIVE state by taking power consumption into consideration.

Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

We support to include FR2 L1-RSRP.

Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

we are fine to include CBD and BFD.

Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

The intension was to avoid duplicated objectives. As it is under discussion and may be included in other WI, it should be exluded from this WI explicitly. Or it can be further discussed in RAN#95-e as RAN4 RRM package.

Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements

Fine to keep it. Question would be if additional RAN2 TU is needed.

1.7B: FR2 SCell activation reduction

Whether a note that "enhancement can be extended to FR1 when applicable. is acceptable

It is fine with us.

1.7C: FR2 BWP switching time enhancements

Better to decide firstly whether it is essential enhancement in the next RAN plenary meeting.

Whether a note on RAN1/2 involvement is acceptable

Better to keep it to avoid potential different understandings in the future. Morover, with the note we think additional RAN2 TU will not be considered anymore.

10 – Guangdong OPPO Mobile Telecom.

We support 1.7B: FR2 SCell activation reduction. OK to add the note.

For 1.7A and 1.7C□suggest to keep FFS and decide whether to introduce in RANP #95e.

11 – CATT

1.7A: Cell identification and measurement delay reduction

o Whether IDLE/INACTIVE mode needs to be considered

[CATT] We think we can focus on the discussion in CONNECTED mode first and add a note that the enhancement can be extended to IDLE/INACTIVE mode when applicable.

o Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

[CATT] We are fine to include L1 measurement but suggest using L1 measurement generally rather than only including L1-RSRP.

o Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

[CATT] We think this can be also part of the L1 measurement enhancement.

o Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

[CATT] Support to remove it from this WI.

o Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements"

[CATT] Fine to include this objective.

1.7B: FR2 SCell activation reduction

o Whether a note that "enhancement can be extended to FR1 when applicable." is acceptable

[CATT] fine to include the note.

1.7C: FR2 BWP switching time enhancements

o Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching

[CATT] Need to decide whether to keep this objective first. And we think this is applicable for DCI/timer based BWP switching and not applicable for RRC based BWP switching. It should be noted that in current requirements for RRC based switching delay, T_*BWPswitchDelayRRC = 6ms is the time used by the UE to perform RRC based BWP switch which is not related to type 1 or type 2. T*_BWPswitchDelay is only used in DCI/timer based BWP switching.

o Whether a note on RAN1/2 involvement is acceptable

[CATT] Fine to add this note.

Besides a minor comments on the following sentence:

- FR2 RRM requirements for delay reduction enhancements

12 – China Telecommunications

1.7A: Cell identification and measurement delay reduction

We also agree to remove L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception from the scope of RRM enhancement WI.

1.7B: FR2 SCell activation reduction

We support the NOTE "enhancement can be extended to FR1 when applicable", without further update. The RAN4 discussion on any enhancement can be triggered by FR2, but not focus on FR2 only.

A note on RAN1/2 involvement is acceptable.

13 – Intel

Regarding 1.7A,

We prefer to include IDLE and INACTIVE mode since by looking at the existing requirements for IDLE, cell detection and measurements take too long time (e.g. 36 * 8 DRX cycles for 320ms DRX length);

We prefer not to include L1-RSRP reporting in the scope since it is not always configured;

We prefer not to include CBD and BFD considering the workload in general and those enhancements can be done in the future releases after we have solid conclusion for L3 measurements in R18;

It is OK to not include the mentioned objective if it is considered in the multi-Rx chain reception item;

It is OK to not include the objective since we don't expect any impact on other groups from L3 measurement enhancement while if L1 is also in the scope we are not sure about whether there is impact: so maybe proponent can clarify.

Regarding 1.7B,

It is acceptable to us to explore the feasibility of applying the enhancements also to FR1.

Regarding 1.7C,

All three kinds of BWP switching need to be involved if this objective goes into final version of WID.

Regarding other group impact,

We think only SCell enhancements have potential impact on other groups. We accept the note.

14 – LG Electronics Inc.

Generally fine with the objectives, and for the clarification, does FR2 mean FR2-1 only? If it is right understanding, the clarification needs to be added in WID.

For 1.7A, for multi-Rx chain DL reception, it would depend on the conclusion of FR2 RF discussion. In our understanding, multi-Rx chain DL reception issues are discussing making a separate WI in FR2 RF enhancement NWM. So, it could be precluded from this WI.

15 – NTT DOCOMO INC.

We support updated justification / objectives. Comments for each objective as follows.

1.7A: Cell identification and measurement delay reduction

L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception should be excluded from the scope.

1.7B: FR2 SCell activation reduction

The note "enhancement can be extended to FR1 when applicable." can be acceptable.

16 – ZTE Wistron Telecom AB

1.7A: Cell identification and measurement delay reduction

Whether IDLE/INACTIVE mode needs to be considered

We fully understand concerns on the power consumption from handset vendors in IDLE mode. The WID may prioritize CONNECTED mode if IDLE/INACTICE mode is included.

Whether to include reduction of measurement/evaluation time for FR2 L1-RSRP

Ok to include

Whether to include reduction of measurement/evaluation time for FR2 CBD and BFD

Ok to include.

Whether to L3/L1 measurement delay reduction by UE supporting multi-Rx chain DL reception shall be explicitly excluded from the scope

Ok to exclude.

Whether to add an objective to "Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements"

Ok to add the objective.

2.1.7B: FR2 SCell activation reduction

Whether a note that "enhancement can be extended to FR1 when applicable." is acceptable

Ok to add the note.

4.1.7C: FR2 BWP switching time enhancements

We can have further discussion.

Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching

We can have further discussion.

Whether a note on RAN1/2 involvement is acceptable

The note seems redundant since RAN1/2 is added as secondary responsibility group for the corresponding objectives.

17 – Nokia Corporation

1.7A:

- We are fine with the 1.7A objective and including **Idle/inactive** mode.

- We do not see a need to include FR2 **CBD and BFD** in the work. Such work is not directly related cell identification and measurement delay but more related to beam failure evaluation and detection (then followed by CBD). CBD can be addressed once cell identification and measurement delays have been addressed if time allows (hence, 2nd priority).

- Regarding the **multi-Rx chain** DL reception and cell identification and measurement delay, we think this is an important aspect to address in RAN4. Hence, if not included in other WI (multi-Rx chain WI) it should be included in this WI. Our understanding is that the other WI only addresses mTRP (single cell) and hence this WI need to include the multi-Rx reception for other scenarios including inter-cell operation.

- Concerning 'Whether to add an objective to "**Specify if needed**, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements"' we support to include such line to enable signalling support discussion – how signalling may help providing gain while also considering the signalling load.

1.7B:

- Concerning '**Whether a note** that "enhancement can be extended to FR1 when applicable." is acceptable'. If companies see that there can be benefits also in FR1 from some of the agreed enhancements, we are fine also discussing including such enhancement for FR1 (it will increase the workload).

1.7C:

- For the FR2 BWP switch time enhancement we believe RRC needs to be included in addition to DCI/timer based BWP switch. **RRC BWP switch is important** to include as the current RRC BWP switch has some inefficiency and causes unnecessary interrupts.

In general, it is acceptable to add a note on 'RAN1/2 involvement is acceptable'

4.3 Working area #2: General RRM enhancement and leftovers

4.3.1 Prioritization

Based on the outcome of the intermediate round discussion moderator proposes the following list of prioritized/ deprioritized. For convenience moderator also suggests listing both prioritized / de-prioritized objectives to improve clarity without changing actual contents.

- **Proposal #3: Working Area #2 (RRM enhancements and leftovers)**

- **Prioritized objectives for further discussion**
  - #2.2 FR1-FR1 NR-DC RRM requirements
  - #2.4 HO with PSCell requirements for new scenarios
  - #2.5 TCI switching enhancements
  - ***Note: further prioritization of objectives can be required in RAN #95e***
- **De-prioritize the following objectives**
  - 2.1 UL frame boundary offset reporting
  - 2.3 Enhancements for CSI-RS based L3 measurement
  - 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
  - 2.7 RLM enhancements
  - 2.8 HST RRM enhancement
  - 2.9 CGI reading requirement for NR-U cell
  - 2.10 Harmonized RLM/BM
  - 2.11 RRM enhancement for large CC number
  - 2.12 allowInterruption mechanism for deactivated SCell measurements
  - 2.13 CSI-RS based CFRA in RRM requirement
  - 2.14 Fast and gapless Scell activation
  - 2.15 Fast RRC connection re-establishment
  - 2.16 RRM enhancement for NR-U
  - 2.17 PUCCH SCell activation delay requirements with multiple DL Scells
  - 2.18 Support NCD-SSB in IDLE mode for RedCap UE

Feedback Form 21: Comments on Working area #2 objectives prioritization

1 – Apple Poland Sp. z.o.o. Agree with proposal 3.
2 – Ericsson LM We also support proposal 3
3 – Qualcomm Incorporated We support proposal 3.

4 – MediaTek Inc.

Fine with proposal 3.

5 – Huawei Technologies France

Agree with proposal #3.

6 – vivo Mobile Communication (S)

We are fine with proposal 3, except for 2.18.

For 2.18 support NCD-SSB in IDLE mode for RedCap UE, it involves RAN4 work and RAN2 work. Based on moderator's summary, it may not be as popular as prioritized topics in the 1st round. In the meantime, there are also several companies supporting the work. Our understanding is that there may be no room for this topic in the two RAN4 RRM WIs. However, since the topic involves both RAN4, RAN2 and maybe RAN1 work, it can be triggered by RAN1/2. The whole work should not be deprioritized from RRM aspects only. So, for 2.18, we think it can be futher discussed in RAN#95-e, including how to cover the work.

7 – Intel Corporation (UK) Ltd

Moderator:

@vivo - The moderator proposal is to de-prioritize 2.18 (and some other topics) is applicable to this email discussion and for the purpose of preparing the scope of the RRM and MG enhancements WIDs. In this email discussion I do not see a sufficient level of support to include these proposals in the scope. The argument "there are also several companies supporting the work" applies to quite some topics out of the full set of topics. So, these topics are recommended to be de-prioritized from the scope of this discussion. It is moderator understanding that it is not precluded for companies to make proposals in future to include the proposals in the scope of other items.

8 – Beijing Xiaomi Mobile Software

Agree with proposal #3.

9 – China Mobile Com. Corporation

We support Proposal #3

10 – Guangdong OPPO Mobile Telecom.

Agree with proposal #3.

11 – CATT

Fine with most content of the proposal except 2.17. Many companies commented in the intermediate round this is related to the R17 ongoing discussion. We would like to suggest to keep it open and revisit it after February meeting. E.g. We can add a note that "additional discussion can be required after Rel-17 RRM Enhancements WI completion on leftover issues" which is similar to MG enhancement part.

12 – China Telecommunications

Agree with proposal #3.

13 – Intel We support the proposal.
14 – LG Electronics Inc. Agree with proposal 3
15 – ZTE Wistron Telecom AB Ok with proposal 3.
16 – vivo Mobile Communication (S) Thanks @Moderator for the clarification. Proposal #3 should be fine for us with such clarification. Would it be fine to capture such clarification in the final summary so that companies can have same understanding on prioritization and de-prioritization of the objectives?
17 – NTT DOCOMO INC. We agree with proposal #3.
18 – Nokia Corporation We support proposal #3
19 – Samsung Electronics Co. We support moderator proposals by recognizing further downscoping shall be discussed in coming RAN

4.3.2 Topic #2.2: FR1-FR1 NR-DC RRM requirements

Updated justification / objectives are provided below and recommended to be discussed in the final round:

- Justification:
  - *FR1 + FR1 NR-DC band combinations have been introduced since Rel-16 and the relevant deployment scenarios are expected to be used globally. However, the RRM requirements for FR1 + FR1 NR-DC are missing, which may negatively affect the overall performance in NR-DC scenarios and shall be specified. The missing requirements are identified initially as number of serving carrier requirement, PSCell addition and release delay, PSCell change and conditional PSCell change delay, scheduling availability of UE during RLM and BFD, and CSSF for NR-DC.*
- Candidate objectives
  - *Extension of requirements for existing features to new scenarios*
    - *Define RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]*

- □ *RRM requirements include number of serving carriers, PSCell addition/release delay requirement, PSCell change and conditional PSCell change delay, scheduling availability, and CSSF. Other requirements are not precluded and are subject to WI stage discussion*

Companies are encouraged to provide the views on adjusted objectives.

Feedback Form 22: Comments on Topic #2.2: FR1-FR1 NR-DC RRM requirements

1 – Apple Poland Sp. z.o.o. Fine with adjusted objectives.
2 – Qualcomm Incorporated We're fine with the justification and with the adjusted objectives as the baseline for further discussion.
3 – Huawei Technologies France Fine with the adjusted objectives. We suggest to merge objectives 2.2 and 2.4 to "extension for R17 features to new scenarios" considering the similar story and small work load.
4 – MediaTek Inc. We are fine with the justification Regarding "*Other requirements are not precluded and are subject to WI stage discussion*", we would like to further suggest to prioritize Rel-15 functionalities/requirements (if identified) and put lower priority to other Rel-16/17 enhancements, e.g., NR-U, DAPS, HST. The intension is to help RAN4 focus on the baseline topics and avoid repeating same discussions meeting-by-meeting on whether a certain feature should be considered or not. The revision could be like: "*Other **missing Rel-15** requirements are not precluded and are subject to WI stage discussion*"
5 – Intel Corporation (UK) Ltd Moderator: 1) @Huawei, your proposal was already addressed in draft WID. Please check. 2) May I ask companies to checking if MediaTek proposal is acceptable
6 – Beijing Xiaomi Mobile Software Fine with the adjusted objectives.
7 – China Mobile Com. Corporation support the justification and objectives
8 – Guangdong OPPO Mobile Telecom. Fine with the adjusted objectives and MediaTek's proposal.

9 – CATT Support the justification and objectives provided by moderator.
10 – vivo Mobile Communication (S) We are fine with adjusted objectives in general. For other requirements, we think it needs to be clarified and limited. Firstly, it should be fine to be part of limited to baseline Rel-15 requirements in case there are items not being identified at this stage. Secondly, the issue was identified in topic HO with PSCell in Rel-17 eRRM WI. For scenario HO with PSCell from NR-DC to NR-DC, the requirements are to be sepcifed for FR1+FR2 NR-DC only. In addition, for measurement of deactivated SCG and CPAC in Rel-17 MR-DC enhacement WI, only FR1+FR2 NR-DC is supported due to lack of FR1+FR1 NR-DC baseline requirements support. In our view, RRM requirements should also be specifed for the Rel-16 feature HO with PSCell and for the Rel-17 feature deactivated one SCG measurement and CPAC, targeting FR1+FR1 NR-DC.
11 – Intel We support the objectives.
12 – LG Electronics Inc. We are fine with the objectives
13 – ZTE Wistron Telecom AB Ok with the objective.
14 – NTT DOCOMO INC. We are fine with updated justification / objectives.
15 – Nokia Corporation Current adjusted objectives look fine although it may be enough to list 'define the necessary RRM requirements for introduction of FR1-FR1 NR-DC scenarios' and leave out the detailed list (which now anyway is open ended 'other requirements are not precluded….').

4.3.3 Topic #2.4: HO with PSCell requirements for new scenarios

Updated justification / objectives are provided below and recommended to be confirmed in the final round:

- Justification:
    - *Requirements for HO with PSCell were defined in the scope of Rel-17 NR and MR-DC further RRM enhancements WI, while the work on several scenarios was deprioritized. Practical deployment interest was identified for a number of new scenarios and additional RRM requirements are needed to enable handover with PSCell in additional scenarios including HO from NR SA to NE-DC, from NR SA to NR-DC and from LTE SA to EN-DC.*

- Candidate objectives
    - *Extension of requirements for existing features to new scenarios*
        - *Define HO with PSCell requirements for the following scenarios [RAN4]*
            - *HO from NR SA to NE-DC*
            - *HO from NR SA to NR-DC*
            - *HO from LTE SA to EN-DC*
            - ~~*HO from NR SA to NE-DC*~~

No further discussion is expected in the final round and proposals is stable.

4.3.4 Topic #2.5: TCI switching enhancements

Updated justification / objectives are provided below and recommended to be confirmed in the final round:

- Justification (justification text can be selected depending on the set of prioritized objectives):
    - *2.5A: Active TCI switching has been introduced since Rel-15. However, the requirements for TCI switching on multiple carriers are missing in the current specification, and it could be a practical scenario for network to activate or switch multiple TCIs on multiple serving carriers simultaneously. In order to improve the throughput performance and speed up the TCI switching, it's desirable to define requirements for such use case.*
    - *2.5B: In the existing TCI switching requirements, UE is not required to receive PDCCH after MAC CE decoding until the end of the TCI switching delay, which would cause throughput loss in case the TCI switching takes a long period. In order to improve the throughput performance and speed up the TCI switching, it's desirable to consider enhancing UE behavior during TCI switching procedure.*
    - *2.5C: For MAC CE based and RRC based TCI state switch, and active TCI state list update, one SSB is needed for timing/frequency tracking if target TCI state is not in the active TCI state list for PDSCH, which will result in a very long TCI switch delay due to waiting for the SSB. Temporary RS has been introduced for fast SCell activation in Rel-17 and has been identified that it can serve the purpose of timing/frequency tracking.*
- Candidate objectives
    - *2.5 Define TCI switching enhancements* ~~*[RAN4]*~~
        - *2.5C Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements [RAN4, RAN1, RAN2]*
            - *Note: RAN1/RAN2 work can be triggered by RAN4 LS*
        - *[2.5A Define simultaneous TCI state switching requirements over multiple carriers] [RAN4]*

- *[2.5B Allow UE to receive DL data after TCI state switch command decoding and before TCI state switch starts] [RAN4]*
- ~~Other?~~

Companies are encouraged to provide the views on adjusted objectives and address questions raised during the intermediate round.

Feedback Form 23: Comments on Topic #2.5: TCI switching enhancements

1 – Apple Poland Sp. z.o.o. Agree with adjusted objectives. To feedback to the questions in intermediate round: We think 2.5B is needed, as such enhancement needs both network and UE has the same understanding that which TCI could be used for PDCCH/PDSCH before first SSB during the TCI switching. Leave it to UE implementation cannot help UE and network to use such gain completely (we need standardized assumption to align UE and network's expectation to use this gain). 2.5C and 2.5B are two alternatives for TCI switching enhancement, and we think if UE cannot support to use temporary RS to speed up measurement, it can still have chance to use 2.5B for TCI switching enhancement.
2 – Ericsson LM We are fine with the objective. But we suggest to remove the brackets around 2.5A and 2.5B.
3 – Qualcomm Incorporated We suggest to prioritize 2.5C. Since the other two objectives (2.5A and 2.5B) received less support, we agree that they should be subject to further discussion about prioritization. They should be kept in brackets for now.
4 – Huawei Technologies France Fine with the adjusted objectives on [2.5C]. Further discussion on 2.5A and 2.5B.
5 – MediaTek Inc. We support 2.5C. 2.5A and 2.5B should be treated as low priority, e.g., to be decided after considering other Objective in the same WI according to RAN4 workload.
6 – Beijing Xiaomi Mobile Software We are fine with the objective on 2.5C, and suggest to remove the bracket on 2.5A
7 – China Mobile Com. Corporation OK with the objectives

8 – Guangdong OPPO Mobile Telecom. Fine with the objectives, and ok to keep the brackets on 2.5A and 2.5B.
9 – CATT We support the objectives and suggest including 2.5A and 2.5B (i.e. removing the bracket).
10 – vivo Mobile Communication (S) We support prioritizing 2.5C. The candidate objectives with 2.5A and 2.5B in brackets proposed by moderator are fine with us.
11 – Intel We support the objectives 2.5B and 2.5C. regarding 2.5A, can we delete 'simultaneous'?
12 – ZTE Wistron Telecom AB We support to prioritize 2.5C and open to further discuss 2.5A and 2.5B.
13 – NTT DOCOMO INC. We support updated justification / objectives. Also we think 2.5C should be prioritized but we are OK to keep square brackets on 2.5A and 2.5B.
14 – Nokia Corporation The listed adjusted objectives look agreeable. We are fine working on 2.5C but also believe 2.5A and 2.5B are important as they can give important enhancements in terms of clear requirements and reduced switch time. At least we see 2.5B being a candidate which can improve system TP.

4.4 Working area #3: MG related enhancements and leftovers

4.4.1 Prioritization

Based on the outcome of the intermediate round discussion moderator proposes the following list of prioritized/ deprioritized. For convenience moderator also suggests listing both prioritized / de-prioritized objectives to improve clarity without changing actual contents.

- **Proposal #4: Working Area #3 (MG enhancements)**
  - **Prioritized objectives for further discussion**
    - #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
    - #3.1 NeedForGap requirements
    - #3.3 Inter-RAT NR measurement without gaps

- ***Note: further prioritization of objectives can be required in RAN #95e***

- **De-prioritized objectives**
  - 3.2. Per-FR gap capability indication enhancements
  - 3.4. MG sharing enhancement
  - 3.6. Enhancements for pre-configured MG
  - 3.8. Dynamic activation and switching of the MG pattern for different applications
  - 3.9. Allow UE to report NCSG capability based on its active serving cells
  - 3.10. Further enhancement on Pre-MG, NCSG and concurrent gaps
  - 3.11. MG enhancement for other R17 features
  - 3.12. Concurrent gap for DC

Feedback Form 24: Comments on Working area #3 objectives prioritization

1 – Ericsson LM We are generally fine with proposal 4. But as commented in the intermediate round, we prefer inter-RAT LTE without gaps is also included. Inter-frequency LTE w/o gaps exists in 36.133 and in principle this should not be too much work.
2 – Apple GmbH We are fine with most content of proposal 4. However we would like to remove 3.10 from deprioritized group. We shall at least keep it open rather than concluding it as low priority. This is based on the intermediate round discussion, 6 companies proposed to deprioritize it. however, 8 companies mentioned they would like to further discuss it, e.g. after R17 completion.
3 – Qualcomm Incorporated We're fine with the prioritization in proposal 4.
4 – Huawei Technologies France OK with proposal 4 based on moderator's clarification.
5 – MediaTek Inc. We are fine with moderator's suggestion
6 – Intel Corporation (UK) Ltd Moderator: 1) @Ericsson - yes inter-RAT LTE is under discussion and I'll update accordingly 2) @Apple - The moderator proposal is to de-prioritize topics is applicable to this email discussion and for the purpose of preparing the scope of the RRM and MG enhancements WIDs. In this email discussion I do

not see a sufficient level of support to include these proposals in the scope. Many companies mentioned it is relevant to the progress of the work item in Feb meeting and proposed to postpone the discussion. Let me add a note ”Note: additional discussion can be required after Rel-17 MG Enhancements WI completion on leftover issues”

7 – Beijing Xiaomi Mobile Software

Agree with proposal #4

8 – China Mobile Com. Corporation

We support Proposal #4

9 – Guangdong OPPO Mobile Telecom.

Fine with proposal #4

10 – CATT

Fine with the proposal based on moderator clarification.

11 – Apple GmbH

@Moderator, thanks for the clarification. With this we are fine with proposal #4

12 – China Telecommunications

OK with proposal 4.

13 – Intel

We support the proposal.

14 – vivo Mobile Communication (S)

We support proposal 4.

15 – LG Electronics Inc.

We are fine with the proposal 4.

16 – ZTE Wistron Telecom AB

Ok with Proposal 4.

17 – Nokia Corporation

We can support proposal #4

18 – Samsung Electronics Co.

We support moderator proposals by recognizing further downscoping shall be discussed in coming RAN

4.4.2 Topic #3.5: Joint requirements for pre-configured MG, concurrent MG and NCSG

Updated justification / objectives are provided below and recommended to be discussed in the final round:

Justification:

- *The baseline functionality of pre-configured MG, concurrent MG and NCSG was introduced in Rel-17 NR and MR-DC Measurement gap enhancements WI. Meanwhile, the work on requirements for the joint configuration of pre-configured MG, concurrent MG and NCSG was deprioritized. Support of respective joint requirements will improve network configuration flexibility and allow addressing additional use cases via a combination of pre-configured MG, concurrent MG and NCSG mechanisms.*

Candidate objectives

- *Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG*
  - *Define RRM requirements for UEs configured with a combination of ~~with~~ pre-configured MGs, and/or multiple concurrent MGs and/or NCSG [RAN4]*
    - *Prioritize at least joint requirements for UE configured with*
      - *Case 1: Pre-configured MGs and multiple concurrent MGs*
      - *Case 2: NCSG and multiple concurrent MGs*
    - *Note: Prioritization among other possible combinations of pre-configured MG, concurrent MG and NCSG can be discussed in WI phase*

Companies are encouraged to provide the views on adjusted objectives and address questions raised during the intermediate round.

Feedback Form 25: Comments on Topic #3.5: Joint requirements for pre-configured MG, concurrent MG and NCSG

1 – Ericsson LM

Multiple concurrent gaps for the same type (pre-configured or NCSG) is higher priority and more relevant.

Does case 1: means at least 2 concurrent NCSGs?

Does case 2; means at least 2 concurrent pre-configured MGs?

If so then it is better to state e.g.

Case 1: Multiple concurrent Pre-configured MGs

Case 2: Multiple concurrent NCSGs

Otherwise it may be interpreted as pre-configured MGs + concurrent gaps (2 or more legacy MGs)

2 – Apple GmbH

We are fine with the justification and candidate objectives.

Response to Ericsson: we prefer to keep existing wording. In our view, the updated case 1 and 2 are subset of existing case 1 and 2. For instance, *Pre-configured MGs and multiple concurrent MGs* also includes Pre-MG + legacy gap, which is very useful, e.g. UE is configured with multiple MOs and some of then are on the intra-band while others are on different inter-bands. Pre-MG can be used to handle the MOs on the intra-band while a legacy gap is needed to handle other MOs on different inter-bands. However, the updated case 1 precludes this from happening. Similar comments on the updated case 2.

3 – Qualcomm Incorporated

We agree with the justification. Regarding the two cases in the objectives, we suggest to refine the wording. e.g. Case 1: Concurrent MGs where (at least) one of the gaps is a pre-configured gap,

Case2: Concurrent MGs where (at least) one of the gaps is NCSG.

And we support keeping the note stating that other cases may be considered. The decision should be driven by real use cases.

4 – Huawei Technologies France

We are fine with the justification and the objective. On the wording for Case 1 and Case 2 in the objective, we prefer to keep the current wording and we share similar view as Apple on the use case.

5 – MediaTek Inc.

We are fine with the justification and objective.

Current wording is fine. In our understanding, we allow NCSG+legacy and NCSG+NCSG in the scope, for an example.

6 – Beijing Xiaomi Mobile Software

We are fine with the objective and keep the current wording for case 1 and case 2.

7 – China Mobile Com. Corporation

OK with the adjusted objectives

8 – CATT

Support the justification and objectives provided by moderator.

9 – Guangdong OPPO Mobile Telecom.

Fine with this objective. PreMG+concurrent MGs also includes Pre-MG + legacy gap, and multiple Pre_MG. Similar view for NCSG+ coucurren MGs.

10 – Intel

We support the objectives.

11 – LG Electronics Inc. We are fine the objectives
12 – vivo Mobile Communication (S) We support the justification and objectives proposed by moderator. Wording from Qualcomm is also fine if clarification is needed.
13 – ZTE Wistron Telecom AB Ok with the justification and the adjusted objectives.
14 – Nokia Corporation To have more focused work and reduce the workload we are fine with the proposed objectives and prioritisation. It would help the discussion if the Note is removed ('Note: Prioritization among other .....').
15 – Ericsson LM We are also fine to keep the original wording for case 1 and case 2 from moderator, since prioritization between different combinations can be discussed during the WI

4.4.3 Topic #3.1: NeedForGap requirements

Updated justification / objectives are provided below and recommended to be discussed in the final round:

- Justification:
  - *The existing RRM requirements for UEs supporting NeedForGaps feature are specified for intra-frequency SSB based measurements without gaps, while requirements for inter-frequency measurements without gaps are missing. Also, RRM requirements for intra-frequency SSB based measurements without gaps do not assume interruptions, which may be required. This feature can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.*
- Candidate objectives
  - *Measurement requirements without gaps*
    - *Define requirements for NR inter-frequency and intra-frequencySSB-based measurements without gaps for UEs reporting NeedForGapsInfoNR IE ~~for inter-frequency measurements~~ [RAN4]*
      - *Study whether the additional interruption is allowed when UE reporting 'no gap'. Further define the interruption length, occasion and ratio, if the interruption is allowed*
      - *Define related requirements, such as CSSF, measurement period, scheduling restriction etc.*

Companies are encouraged to provide the views on adjusted objectives and address questions raised during the intermediate round. Also, companies can share views on:

- Whether additional interruption is allowed when UE reporting 'no gap'
- Whether additional work for intra-frequency measurements is needed

Feedback Form 26: Comments on Topic #3.1: NeedForGap requirements

1 – Ericsson LM

We are fine with the objective.

In our view some discussion is needed about interruption and scheduling restriction. UE will use spare chain for measurement w/o gaps and without interruption it may have to keep it active all the time. Same applies for intra-frequency.

2 – Apple GmbH

"when UE reporting 'no gap'" is unclear to us. Does it mean we already agreed that there will be some additional UE capability indicating 'no gap'? This is subject to further technical discussion. To make it clear, we propose the following update:

Study whether the additional interruption is allowed when UE reporting ***'NeedForGapsInfoNR'*** *~~'no gap~~. Further define the interruption length, occasion and ratio, if the interruption is allowed*

3 – Qualcomm Incorporated

We support this objective. It will be beneficial to finalize and clarify the requirements associated with NeedForGaps.

4 – Huawei Technologies France

We still do not see a strong need to have this objective in Rel-18. Even the requirements are defined in Rel-18, they cannot apply to legacy Rel-16 and Rel-17 UEs. Also, we already have NCSG in Rel-17 which can serve the same purpose.

If this objective is to be included in Rel-18, we suggest to keep it open in the WID on whether interruption is allowed when UE reports 'no-gap' for both inter-frequency and intra-frequency, and make decisions during WI phase. To us this is technical discussion rather than scope discussion. There are pros and cons in each side, and we are not sure we can make decision now.

5 – MediaTek Inc.

We understand some companies' view that NeedforGap and NCSG are 2 different features. But we fail to see this as an efficient way to spend the precious RAN4 TU to work on a Rel-18 requirement which is just a subset of a Rel-17 requirement. No matter interruption is allowed or not, they are already a subset of

NCSG capability reporting. For example, no interruption is already reflected in the 'no-gap-no-ncsg' UE capability reporting.

If this objective will be included in the end, we suggest leaving technical discussions to RAN4 rather than making decision in RP, such as whether/how the interruption is allowed.

6 – Beijing Xiaomi Mobile Software

We are fine with the candidate objective.

7 – China Mobile Com. Corporation

We support the adjusted objectives.

- Whether additional interruption is allowed when UE reporting 'no gap

In our understanding, when UE indicating 'no-gap' via NeedForGapsInfoNR, it means no interruption.

- Whether additional work for intra-frequency measurements is needed

In our view, no additional work for intra-frequency measurement is needed. But we are also fine to have further study during the WI stage in case any potential impacts.

8 – CATT

Support the justification and objectives provided by moderator.

In our understanding, when UE report 'no gap', it means no interruption. But we are fine to leave the technical discussion to WI stage. Since this clarification for 'no gap' is also applied for intra-frequency measurement, we think it is OK to include intra-frequency measurement in the scope.

Besides we would like to suggest the following wording refinement on the objective (2) in draft WID, because we would generally say "measurement without gaps" rather than "measurement requirements without gaps"?

- **Define RRM ~~measurement~~ requirements for the measurement without gaps for the following cases**

Or we can just say "**Define RRM ~~measurement~~ requirements ~~for the measurement without gaps~~ for the following cases**" since it is already clarified in the sub-bullet that this objective is for the measurement without gaps. On the other hand, "measurement requirements" may be interpreted as "measurement period requirements" while "RRM requirements" can include other aspects e.g. interruption requirements in our understanding.

9 – Guangdong OPPO Mobile Telecom.

Fine with the candidate objective.

Firstly, we agree to further study whether the additional interruption is allowed when UE reporting 'no gap' and decide it during WI phase.

For the second sub-bullet, we suggest to define requirements based on further investigation and add 'if needed'.

Define related requirements, such as CSSF, measurement period, scheduling restriction etc, ***if needed****.*

10 – China Telecommunications

Ok with the adjusted objectives.

- Whether additional interruption is allowed when UE reporting 'no gap'

In our understanding, no interruption is needed.

11 – Intel

We could accept allowing interruption for incapable UE-s. If this is also group consensus, additional work is needed for intra-frequency measurements. In our understanding we could refer to the conclusions in NCSG discussions.

12 – vivo Mobile Communication (S)

We support the justification and objectives proposed by moderator.

13 – ZTE Wistron Telecom AB

In general we are fine with the adjusted objectives. One question is that if an interrupt is required, can UE is allowed to report "no-gap" capability to the network?

14 – Nokia Corporation

Our preference is that UEs indicating '**no gap**' also do not cause any gaps. This is legacy behaviour, and it should be kept. It can be discussed how needForGaps and NCSG can introduce enhancements. Hence, with our current understanding of the discussion 'additional interruption is allowed when UE reporting 'no gap'' shall not be part of the objectives.

Regarding '**additional work** for intra-frequency measurements is needed' is included or not – considering the RAN4 workload it will not help on the workload to include such open objective.

15 – Ericsson LM

It seems companies have different understanding whether 'no gap' means no interruption or some UEs may need interruption.

That is why we suggest to keep also intra-frequency scenarios in the objective and resolve it in RAN4

4.4.4 Topic #3.3: Inter-RAT NR measurement without gaps

Updated justification / objectives are provided below and recommended to be discussed in the final round:

- Justification:
  - *Inter-frequency measurements without gaps are already supported in Rel-17. Support of gap-less inter-RAT NR [and LTE] measurements can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.*

- Candidate objectives
    - *Measurement requirements without gaps*
        - *Inter-RAT measurements without gaps [RAN4]*
            - *First priority: Inter-RAT NR measurements*
            - *Second priority: Inter-RAT LTE measurement*

Companies are encouraged to provide further views on the objectives

Feedback Form 27: Comments on Topic #3.3: Inter-RAT NR measurement without gaps

1 – Ericsson LM We are fine with the objective
2 – Apple GmbH We are fine with the justification and candidate objectives.
3 – Qualcomm Incorporated We support this objective and with the proposed priority.
4 – Huawei Technologies France We suggest to keep "Inter-RAT LTE measurement" in []. As we commented in intermediate round, we understand it is already supported as part of Rel-17 NCSG, and we do not see the need to support it with a different approach in Rel-18.
5 – MediaTek Inc. We have similar view with Huawei about the inter-RAT LTE measurement. We would like to suggest a revision like "**Study if extra enhancement is needed on top of NCSG. Whether to introduce Inter-RAT LTE measurement without gap depends on the conclusion of the study**." Also, as a reminder, we may need RAN2 involved if some new signaling is needed. This can be triggered by RAN4 LS.
6 – Beijing Xiaomi Mobile Software We are fine with the candidate objective.
7 – China Mobile Com. Corporation Support the objectives.
8 – CATT Support the justification and objectives provided by moderator.

9 – Guangdong OPPO Mobile Telecom. Fine with the objectives.
10 – China Telecommunications OK with the objectives.
11 – Intel We need to clarify on the scenario: in our understanding, inter-RAT measurements without gap is for the cases where the UE active BWP contains target LTE CRS and the UE is able to measure on the target LTE CRS without gap. We don't see the need to consider other cases. So we suggest to go with the below objectives: § *Inter-RAT measurements without gaps [RAN4]* *Specify inter-RAT E-UTRA measurement requirements without gaps when the target CRS is contained in the UE active BWP in connected mode*
12 – vivo Mobile Communication (S) We see there are different understandings on inter-RAT measurement without gaps. One approach would be based on redundant UE hardware to measure like NCSG/NeedForGap. Another approach would be based on measurement within UE active BWP or UE channel BW. This needs to be clarified firstly. Our understanding is approach 1 and that is why we proposed to combine topic 3.1 and 3.3. After this part is clarified, justification part may be updated.
13 – ZTE Wistron Telecom AB Ok with the objectives.
14 – Nokia Corporation We are in general fine with the updated justification and objectives.

4.4.5 Topic #3.7 RRM requirements for MUSIM

// Moderator: this topic was missed in the intermediate round and recommend to check views in the final round.

The topic got a medium level of support. Several companies mentioned that they do not see clear need to define new gap patterns for MUSIM given that new MGs are defined in Rel-17. Meantime, RRM requirements were deprioritized in Rel-17 and companies prefer to complete the relevant work in Rel-18 timeframe in the scope of MG enhancements or MUSIM WI. Given no strong companies views and medium level of support, moderator recommends discussing the definition of MUSIM RRM requirements in the scope of Rel-18 MUSIM work item.

Proposal #4A: Further discuss inclusion of objectives on RRM requirements for Rel-17 MUSIM features in the scope of Rel-18 MUSIM WI in RAN #95e.

Companies are encouraged to provide views on moderator proposal.

Feedback Form 28: Comments on Topic #3.7 RRM requirements for MUSIM

1 – Ericsson LM

We are fine to consider Rel-17 MUSIM requirements (leftovers) in the RAN2 led Rel-18 MUSIM WI. But the decision is up to RAN and subject to TU availability.

2 – Apple GmbH

We support proposal #4A.

3 – Huawei Technologies France

We are fine with proposal 4A.

4 – vivo Mobile Communication (S)

Firstly, we would like to repeat our comments in the 1st round.

According to endorsed propose 2 in RP-213622 as below, the RRM requirements for Rel-17 MUSIM gaps will be specified in Rel-18 in our understanding.

Postpone all the discussion on RRM requirements related to MUSIM gaps to Rel-18. Whether this aspect will be covered under the R18 MUSIM WI or another RAN4 WI can be discussed as part of the Rel-18 RAN4 package.

So, if the topic is not covered by RAN4 WI, then it should be covered by Rel-18 MUSIM WI led by RAN2. It is not necessary to further discuss inlcusion of this topic in Rel-18 MUSIM WI as it had been discussed in RAN#94-e.

In the initial round discussion, there was concern on new gap of this topic. Now this topic only foucs on RRM requirements for Rel-17 MUSIM gaps. The concerns on new gap should be addressed.

Thus, would it be agreeable if proposal 4A is updated that RRM requirements for Rel-17 MUSIM features are covered by Rel-18 MUSIM WI?

5 – Qualcomm Incorporated

As indicated in our previous comments, we support specifying RRM requirements for MUSIM gaps in Rel-18. Once RAN4 agrees that this objective should be prioritized in Rel-18, then it can be further discussed if it can be included in the Rel-18 MUSIM WI or in a RAN4-led WI.

6 – MediaTek Inc.

We are fine to further discuss whether to include MUSIM requirements in the objectives of this WI in RP#95e. The discussions should consider the TU capacity of this WI.

7 – Intel Corporation (UK) Ltd

Moderator: The scope of current email discussion is whether to include certain objectives in the scope of RAN4-led items. Based on the initial round there was no strong support to include MUSIM requirements in the scope of RRM/MG enhancements items. Therefore, as a moderator I propose to consider this in

the scope of Rel-18 MUSIM WI. The intention of proposals is to give an indication that the topic needs to be treated in RAN #95e in the scope of MUSIM discussion. Whether to include these objectives in the MUSIM WI and which specific objectives can be included, shall be discussed in RAN #95e.

8 – Beijing Xiaomi Mobile Software

We support moderator's comments on MUSIM requirements, this objective can be considered in Rel-18 MUSIM WI.

9 – China Mobile Com. Corporation

We are fine to have further discussion for RRM requirements for Rel-17 MUSIM features. We see the necessity to specify the RRM requirements for MUSIM, which are not considered in Rel-17 due to limited timeline. The key point is to specify the requirements in order to guarantee the performance in both network A and network B. As for whether it is covered by Rel-18 MUSIM WI or other WI, we do not have strong view.

10 – Guangdong OPPO Mobile Telecom.

We are fine to have further discussion.

11 – CATT

Fine with the proposal.

12 – Intel

We are OK with this WF.

13 – ZTE Wistron Telecom AB

Ok with Moderator's proposal.

14 – Nokia Corporation

Accounting the workload situation in RAN4 we do not see it feasible to include RRM requirements for MUSIM in Rel-18 package. Although having such requirements would be very beneficial, we expect that defining such requirements will need a non-significant amount of RAN4 work. Hence, we prefer to postpone the work to a later release.

4.5 Final round summary

4.5.1 Draft WIDs

3 companies provided comments. Majority of companies commented that WIDs shall be updated based the individual discussion. Moderator would like to clarify that the objectives in WID are based on intermediate round.

Based on final round comments moderator prepared updated WIDs available in Inbox and will be uploaded as formal documents after the email discussion with both documents to be used as inputs for further discussion in RAN #95e.

- RP-22xxxx New WID: Even Further RRM enhancement for NR and MR-DC

- https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_95e/Inbox/Drafts/%5BRAN95e-RAN4-R18Prep-03%5D/draft%20RP-22xxxx%20-%20New%20WID%20-%20NR%20RRM%20Enhancements%20v02.doc

- RP-22xxxx New WID: Further enhancements on NR and MR-DC Measurement Gaps and measurements requirements without gaps
  - https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_95e/Inbox/Drafts/%5BRAN95e-RAN4-R18Prep-03%5D#:~:text=draft%20RP%2D22xxxx%20%2D%20New%20WID%20%2D%20NR%20MG%20Enhancem

4.5.2 Working area #1: FR2 RRM enhancements

4.5.2.1 Prioritization

17 companies provided comments. All companies supported moderator proposal on prioritization.

The final proposal will be added to the email discussion summary.

- **Proposal #2: Working Area #1 (FR2 RRM enhancements)**
  - Prioritized objectives for further discussion
    - 1.7 FR2 delay reduction enhancements
    - 1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)
    - 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)
      Note: further prioritization of objectives can be required in RAN #95e
  - De-prioritized objectives
    - 1.1 Enhancement to FR2 beam measurement requirements
    - 1.2 Define FR2-FR2 DAPS requirements
    - 1.5 RRM measurements for different Rx beam sets in FR2
    - 1.6 Network-controlled gaps for UE Rx beam switching
    - 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

4.5.2.2 Topic #1.7: FR2 delay reduction enhancements (combined 1.3, 1.4 and 1.7)

17 companies provided comments.

- Several companies commented that further prioritization between objectives is needed in RAN #95e. It is moderator understanding that further discussion on this can take place in RAN #95e, which is already captured in prioritization proposals.
- 1.7A: Cell identification and measurement delay reduction
  - Enhancements for IDLE/INACTIVE mode: inclusion of enhancements for IDLE/INACTIVE mode was proposed by multiples companies, while several companies suggested to focus on CONNECTED mode. Several companies indicated prioritization of CONNECTED mode work as one possible solution and moderator recommends capture this in the updated objectives.
  - Requirements for UE supporting multi-Rx chain DL reception: Majority of companies commented that the WI shall focus on UEs not supporting multi-RX chain DL simultaneous reception. Some companies commented that we need to take into account the scope of a possible separate item on FR2 multi-RX chain DL simultaneous reception. Therefore, moderator recommends adding a note that such devices can be excluded from the scope and further confirm it in RAN #95e when the scope of all items becomes clearer.
  - Reduction of measurement/evaluation time for FR2 L1-RSRP: Majority of companies are fine to include FR2 L1-RSRP into the scope and moderator will update objectives accordingly.
  - Reduction of measurement/evaluation time for FR2 CBD and BFD: Diverse views from companies. Some companies prefer to deprioritize both CBD/BFD of one of them. Several companies prefer to include CBD/BFD in the scope. Moderator recommends not to include CBD/BFD in the scope for now and additional discussion can take place in RAN #95e
  - Whether to add an objective to “Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements”: majority of companies support the proposal.
- 1.7B: FR2 SCell activation reduction
  - Whether a note that “enhancement can be extended to FR1 when applicable.” shall be kept: The note is supported by the majority of companies and moderator recommends keeping it.
- 1.7C: FR2 BWP switching time enhancements
  - Whether is 1.7C is applicable to [DCI/Timer/RRC] based BWP switching: Majority of companies commented that all 3 mechanisms shall be considered, and one company suggested additional discussion. Moderator recommends keeping all mechanisms in the scope.
- Whether a note on RAN1/2 involvement is acceptable: most companies are fine to keep a note
- One company suggested to clarify that the WI focus is on FR2-1. Moderator thinks that this is a new point and recommend further discussion in RAN #95e.

Updated justification / objectives are provided below and will be added to the draft WID:

- Justification:

- *It is observed that some of the FR2 RRM requirements allow excessively long delay for UE in certain RRM operations. It is also observed that there is feasible way to enhance specific requirements to guarantee fair performance in the field for FR2 networks. Candidate enhancements include 1) Cell identification and measurement delay reduction; 2) FR2 SCell activation delay reduction and 3) FR2 BWP switching time enhancements.*

- Candidate objectives
  - 1.7 FR2 RRM requirements delay reduction enhancements
    - 1.7A Cell identification and measurement delay reduction
      - Identify cases where FR2 cell identification and L3 measurement delay can be reduced and specify reduced delay requirements for such cases in ┤IDLE/INACTIVE├/CONNECTED modes [RAN4]┤Identify cases where measurement/evaluation time of FR2 L1-RSRP can be reduced, and specify reduced delay requirements for such cases├ [RAN4]
      - ┤Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements├ [RAN4, RAN2]
      - **Note: the work on CONNECTED mode enhancements shall be prioritized**
      - **[Note: delay reduction enhancements for UE supporting multi-Rx chain simultaneous DL reception are not in the scope]**
    - 1.7B FR2 SCell activation delay reduction
      - Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]
      - Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN1, RAN2]
      - Note: the technical solutions can be extended to FR1, when applicable
    - [1.7C FR2 BWP switching time enhancements] [RAN4]
      - Specify, if feasible, reduced FR2 BWP switching delay requirements for ┤DCI/Timer/RRC├ based BWP switching.
      - Note: enhancements shall aim to provide switching delay in between Rel-15 BWP switching type 1 and type 2 BWP switching delay for FR2
    - Note: RAN1/RAN2 work can be triggered by RAN4 LS only

4.5.3 Working area #2: General RRM enhancement and leftovers

4.5.3.1 Prioritization

18 companies provided comments.

- Majority of companies supported moderator proposal on prioritization.
- One company commented that objective 2.18 (support NCD-SSB in IDLE mode for RedCap UE) involves RAN4 and RAN2 work. Company proposed to further discuss in RAN#95-e how to cover the work. Moderator would like to clarify that the proposal to de-prioritize 2.18 (and other topics) is applicable to this email discussion and is used for the purpose of preparing the scope of the RRM and MG enhancements WIDs. In this email discussion moderator does not see a sufficient level of support to include these proposals in the scope. So, this topic is recommended to be de-prioritized from the scope of this discussion. It is moderator understanding that it is not precluded for companies to make proposals in future to include the proposals in the scope of other items.
- One company commented that objective 2.17 (PUCCH SCell activation delay requirements) is relevant to an ongoing Rel-17 discussion and suggested to add a note can add a note that "additional discussion can be required after Rel-17 RRM Enhancements WI completion on leftover issues". In this email discussion moderator does not see a sufficient level of support to include these proposals in the scope at this moment. Same time, given companies comments that this objective depends on the Rel-17 WI progress, moderator will add a corresponding clarification ("Objective 2.17 - additional discussion on leftover issues can take place after Rel-17 feRRM WI completion".

The updated proposal will be added to the email discussion summary document.

- Proposal #3: Working Area #2 (RRM enhancements and leftovers)
  - Prioritized objectives for further discussion
    - #2.2 FR1-FR1 NR-DC RRM requirements
    - #2.4 HO with PSCell requirements for new scenarios
    - #2.5 TCI switching enhancements
    - *Note: further prioritization of objectives can be required in RAN #95e*
  - De-prioritize the following objectives
    - 2.1 UL frame boundary offset reporting
    - 2.3 Enhancements for CSI-RS based L3 measurement
    - 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
    - 2.7 RLM enhancements
    - 2.8 HST RRM enhancement
    - 2.9 CGI reading requirement for NR-U cell
    - 2.10 Harmonized RLM/BM

- □ 2.11 RRM enhancement for large CC number
- □ 2.12 allowInterruption mechanism for deactivated SCell measurements
- □ 2.13 CSI-RS based CFRA in RRM requirement
- □ 2.14 Fast and gapless Scell activation
- □ 2.15 Fast RRC connection re-establishment
- □ 2.16 RRM enhancement for NR-U
- □ 2.17 PUCCH SCell activation delay requirements with multiple DL Scells
- □ 2.18 Support NCD-SSB in IDLE mode for RedCap UE

undefined

Note: Objective 2.17 - additional discussion on leftover issues can take place after Rel-17 feRRM WI completion

4.5.3.2 Topic #2.2: FR1-FR1 NR-DC RRM requirements

15 companies provided comments.

- Majority of companies supported objectives proposed by moderator in the intermediate round
- One company proposed to prioritize Rel-15 functionalities/requirements and adjust objective as "*Other missing Rel-15 requirements are not precluded and are subject to WI stage discussion*". Several companies supported the text and moderator will include it in the revised objectives.
- One company commented that "*RRM requirements should also be specified for the Rel-16 feature HO with PSCell and for the Rel-17 feature deactivated one SCG measurement and CPAC, targeting FR1+FR1 NR-DC*." Moderator recommends companies to further check the proposal (since this is a new one and not raised before) and further discussion whether clarifications are needed can take place in RAN #95e.
- One company proposed to merge 2.2 and 2.4. Moderator has already made merging in the draft WID after the intermediate round and companies are encouraged to check.
- One company commented that it is "*enough to list 'define the necessary RRM requirements for introduction of FR1-FR1 NR-DC scenarios' and leave out the detailed list (which now anyway is open ended 'other requirements are not precluded….')*.". Moderator view is that in the intermediate round several companies requested to include example requirements and therefore the description was extended. Therefore, it is recommended to keep the current objective.

Updated justification / objectives are provided below and will be added to the draft WID:

- Justification:

- FR1 + FR1 NR-DC band combinations ~~have been~~were introduced in~~since~~ Rel-16 and the relevant deployment scenarios are expected to be used globally. However, the RRM requirements for FR1 + FR1 NR-DC are missing, which may negatively affect the overall performance in NR-DC scenarios and shall be specified. The following missing Rel-15 requirements were~~are~~ identified ~~initially~~: ~~as~~ number of serving carrier requirement, PSCell addition and release delay, PSCell change and conditional PSCell change delay, scheduling availability of UE during RLM and BFD, and CSSF for NR-DC.

- Candidate objectives
  - Extension of requirements for existing features to new scenarios
    - Define RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]
      - RRM requirements include number of serving carriers, PSCell addition/release delay requirement, PSCell change and conditional PSCell change delay, scheduling availability, and CSSF. Other Rel-15 requirements are not precluded and are subject to WI stage discussion.

4.5.3.3 Topic #2.4: HO with PSCell requirements for new scenarios

No discussion took place in the final round and objectives are stable.

4.5.3.4 Topic #2.5: TCI switching enhancements

14 companies provided comments.

- Several companies commented that further prioritization between objectives is needed in RAN #95e with majority companies supporting at least 2.5C. It is moderator understanding that further discussion on the prioritization can take place in RAN #95e, which is already captured in prioritization proposals. Based on the current level of support during previous rounds moderator recommends keeping 2.5A and 2.5B in brackets in the email discussion summary.
- One company suggested to remove the word “simultaneous” for 2.5A. Moderator recommends companies to check by RAN #95e if any clarifications on simultaneous switching are needed and will keep “simultaneous” in [] in final version of objectives.

Updated justification / objectives are provided below and will be added to the draft WID:

- Justification (justification text can be selected depending on the set of prioritized objectives):
  - 2.5A: Active TCI switching has been introduced since Rel-15. However, the requirements for TCI switching on multiple carriers are missing in the current specification, and it could be a practical scenario for network to activate or switch multiple TCIs on multiple serving carriers simultaneously. In order to improve the throughput performance and speed up the TCI switching, it’s desirable to define requirements for such use case.

- 2.5B: In the existing TCI switching requirements, UE is not required to receive PDCCH after MAC CE decoding until the end of the TCI switching delay, which would cause throughput loss in case the TCI switching takes a long period. In order to improve the throughput performance and speed up the TCI switching, it's desirable to consider enhancing UE behavior during TCI switching procedure.
- 2.5C: For MAC CE based and RRC based TCI state switch, and active TCI state list update, one SSB is needed for timing/frequency tracking if target TCI state is not in the active TCI state list for PDSCH, which will result in a very long TCI switch delay due to waiting for the SSB. Temporary RS has been introduced for fast SCell activation in Rel-17 and has been identified that it can serve the purpose of timing/frequency tracking.

- Candidate objectives
  - 2.5 Define TCI switching enhancements
    - 2.5C Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements [RAN4, RAN1, RAN2]
      - Note: RAN1/RAN2 work can be triggered by RAN4 LS
    - [2.5A Define[simultaneous] TCI state switching requirements over multiple carriers] [RAN4]
    - [2.5B Allow UE to receive DL data after TCI state switch command decoding and before TCI state switch starts] [RAN4]

4.5.4 Working area #3: MG related enhancements and leftovers

4.5.4.1 Prioritization

17 companies provided comments.

- One company commented that Inter-RAT LTE measurements are under discussion and shall be included in the set of prioritized topics. Moderator will adjust the proposal to include inter-RAT LTE (in []).
- One company commented they would like to remove 3.10 from the deprioritized group and that it we shall keep at least open rather than concluding it as low priority. The moderator proposal to de-prioritize topics is applicable to this email discussion and is intended for the purpose of preparing the scope of the RRM and MG enhancements WIDs. In this email discussion moderator did not see a sufficient level of support to include these proposals in the scope. Same time many companies mentioned it is relevant to the progress of the ongoing MG enhancements work item in RAN4 February meeting and proposed to postpone the discussion. Moderator will add a corresponding clarification.

The updated proposal will be added to the email discussion summary document.

- **Proposal #4: Working Area #3 (MG enhancements)**
  - Prioritized objectives for further discussion
    - #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
    - #3.1 NeedForGap requirements
    - #3.3 Inter-RAT NR and [LTE] measurement without gaps
    - *Note: further prioritization of objectives can be required in RAN #95e*
  - De-prioritized objectives
    - 3.2. Per-FR gap capability indication enhancements
    - 3.4. MG sharing enhancement
    - 3.6. Enhancements for pre-configured MG
    - 3.8. Dynamic activation and switching of the MG pattern for different applications
    - 3.9. Allow UE to report NCSG capability based on its active serving cells
    - 3.10. Further enhancement on Pre-MG, NCSG and concurrent gaps
    - 3.11. MG enhancement for other R17 features
    - 3.12. Concurrent gap for DC

undefined *Note: Objective 3.10 - additional discussion on leftover issues can take place after Rel-17 MG Enhancements WI completion*

4.5.4.2 Topic #3.5: Joint requirements for pre-configured MG, concurrent MG and NCSG

14 companies provided comments.

- Several proposals were made to clarify the prioritized cases for joint requirements
  - Option 1 (current text)
    - Case 1: Pre-configured MGs and multiple concurrent MGs
    - Case 2: NCSG and multiple concurrent MGs
  - Option 2:
    - Case 1: Multiple concurrent Pre-configured MGs
    - Case 2: Multiple concurrent NCSGs
  - Option 3:

        - Case 1: Concurrent MGs where (at least) one of the gaps is a pre-configured gap,
        - Case 2: Concurrent MGs where (at least) one of the gaps is NCSG.

undefined In moderator's understanding majority of companies have a common view on the expected scenarios. Overall companies are fine to keep Option 1 description. Same time Option 3 seems to provide a more precise description, which is helpful to improve the clarity. Therefore, moderator proposes to update the objective and merge Options 1 and 3.

- One company proposed to have more focused work and remove a note on prioritization ('Note: Prioritization among other .....'). Taking into account discussion in the previous rounds moderator recommends keeping the note and additional prioritization can be discussed in RAN #95e.

undefined

Updated justification / objectives are provided below:

- Justification:
    - The baseline functionality of pre-configured MG, concurrent MG and NCSG was introduced in Rel-17 NR and MR-DC Measurement gap enhancements WI. Meanwhile, the work on requirements for the joint configuration of pre-configured MG, concurrent MG and NCSG was deprioritized. Support of respective joint requirements will improve network configuration flexibility and allow addressing additional use cases via a combination of pre-configured MG, concurrent MG and NCSG mechanisms.
- Candidate objectives
    - Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG
        - Define RRM requirements for UEs configured with a combination of pre-configured MGs, and/or multiple concurrent MGs and/or NCSG [RAN4]
            - Prioritize at least joint requirements for UE configured with
                - Case 1: Pre-configured MGs and multiple concurrent MGs **(i.e., concurrent MGs where at least one of the gaps is a pre-configured gap)**
                - Case 2: NCSG and multiple concurrent MGs **(i.e., concurrent MGs where at least one of the gaps is NCSG)**
            - ote: Prioritization among other possible combinations of pre-configured MG, concurrent MG and NCSG can be discussed in WI phase

4.5.4.3 Topic #3.1: NeedForGap requirements

15 companies provided comments.

- Several companies commented that further prioritization is needed and that this objective is not needed. It is moderator understanding that further discussion on this can take place in RAN #95e, which is already captured in prioritization proposals.
- One company proposed to clarify that the objective is relevant to 'NeedForGapsInfoNR' IE signalling and remove specific signaled value ('no gap'). Moderator thinks that the details can be discussed in the WI stage and agrees with the suggestion to have a more generic description of objective
- Whether additional interruption is allowed when UE reporting 'no gap': Diverse views provided by companies with some companies preferring to focus on 'no interruption' case and some companies proposing to discuss interruptions in the WI stage. Moderator recommends to further discuss it in the WI stage and keep current objectives unchanged.
- Whether additional work for intra-frequency measurements is needed: Diverse views provided by companies and companies commented that it depends on whether any interruptions will be defined. Moderator recommends to further discuss it in the WI stage and keep current objectives unchanged.
- One company proposed editorial correction as "Define **RRM**~~measurement~~ requirements **for the measurement** without gaps for the following cases". Moderator thinks this is a helpful clarification and will update a high-level objective description for #3.1 and #3.3.

Updated justification / objectives are provided below:

- Justification:
  - The NeedForGaps feature can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied. The existing RRM requirements for UEs supporting NeedForGaps feature are specified for intra-frequency SSB based measurements without gaps, while requirements for inter-frequency measurements without gaps are missing. Also, RRM requirements for intra-frequency SSB based measurements without gaps do not assume interruptions, which may be required. ~~This feature can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.~~
- Candidate objectives
  - **Define RRM requirements for** measurement ~~**requirements**~~ without gaps **for the following cases**
    - ~~**Define requirements for**~~ NR inter-frequency and intra-frequency SSB-based measurements without gaps for UEs reporting NeedForGapsInfoNR IE [RAN4]
      - Study whether the additional interruption is allowed when UE reporting **'NeedForGapsInfoNR'**~~**'no gap**~~. Further define the interruption length, occasion and ratio, if the interruption is allowed
      - Define related requirements, such as CSSF, measurement period, scheduling restriction etc.

4.5.4.4 Topic #3.3: Inter-RAT NR measurement without gaps

14 companies provided comments.

- Inter-RAT LTE measurements
  - One company proposed to keep inter-RAT LTE measurement in [] and further discuss in RAN #95e.
  - One company proposed to add a study stage “”Study if extra enhancement is needed on top of NCSG. Whether to introduce Inter-RAT LTE measurement without gap depends on the conclusion of the study.””
  - One company proposed to limit the scenarios and “Specify inter-RAT E-UTRA measurement requirements without gaps when the target CRS is contained in the UE active BWP in connected mode”.
  - One company commented that they see different understandings on inter-RAT measurement without gaps. One approach would be based on redundant UE hardware to measure like NCSG/NeedForGap. Another approach would be based on measurement within UE active BWP or UE channel BW.
  - Moderator recommends keeping inter-RAT LTE measurements open and let companies further assess till RAN #95e. LTE measurements in the requirements can be kept in [] for now.
- Inter-RAT NR measurements
  - The objective is stable based on received comments.

Updated justification / objectives are provided below (taking into account comments in topic #3.1 on general objectives refinement):

- Justification:
  - Inter-frequency measurements without gaps are already supported in Rel-17. Support of gap-less inter-RAT NR [and LTE] measurements can bring gains for system throughput and/or mobility performance under certain conditions, where gap-less measurements can be applied.
- Candidate objectives
  - **Define RRM requirements for** measurement ~~**requirements**~~ without gaps **for the following cases**
    - Inter-RAT measurements without gaps [RAN4]
      - ~~First priority:~~ Inter-RAT NR measurements
      - **[**~~Second priority:~~ Inter-RAT LTE measurement**]**

4.5.4.5 Topic #3.7: RRM requirements for MUSIM

14 companies provided comments.

- Majority of companies support moderator's proposal to "Further discuss inclusion of objectives on RRM requirements for Rel-17 MUSIM features in the scope of Rel-18 MUSIM WI in RAN #95e."
- Companies indicated diverse views whether the work shall be performed in Rel-18 or not. Several companies commented that whether to define RRM requirements is up to RAN and subject to TU availability.
- During the discussion moderator further clarified that the scope of current email discussion is whether to include certain objectives in the scope of RAN4-led items. Based on the initial round there was no strong support to include MUSIM requirements in the scope of RRM/MG enhancements items. Therefore, moderator proposed to consider this in the scope of Rel-18 MUSIM WI. The intention of proposal is to give an indication that the topic needs to be treated in RAN #95e in the scope of MUSIM discussion. Whether to include these objectives in the MUSIM WI and which specific objectives can be included, shall be discussed in RAN #95e.
- As the outcome of discussion moderator proposes to proceed with original proposal under clarification that RRM MUSIM requirements shall be discussed in the scope of Rel-18 MUSIM WI and whether to update the WI scope shall be discussed in RAN #95e. Meantime, RRM MUSIM objectives will not be included in the scope of RAN4-led work items.

Proposal #5: Further discuss inclusion of objectives on RRM requirements for Rel-17 MUSIM features in the scope of Rel-18 MUSIM WI in RAN #95e.

5 Summary

In this email discussion the following candidate RRM working areas identified in RP-212682 were discussed

1. **FR2 RRM enhancements**
2. **General RRM requirement enhancement and leftover**
3. **Measurement gap related enhancement and leftover**

The following agreements on the work item structure for Rel-18 RRM enhancements work area were made:

Proposal #1: Split the objectives into the following 2 WIs as an output of email discussion

a) **Rel-18 NR and MR-DC RRM enhancement WI covering working areas #1 (FR2 RRM) and #2 (General RRM)**

b) **Rel-18 NR and MR-DC MG enhancements WI covering working area #3 (MG enhancements)**

Note: the set of WIs can be reconsidered at a later stage subject to further set of objectives

The following prioritization of candidate topics was performed during the email discussion

Proposal #2: Working Area #1 (FR2 RRM enhancements)

- **Prioritized objectives for further discussion**
  - 1.7 FR2 delay reduction enhancements
  - 1.3. SCell activation enhancements in FR2 (i.e., reduction of SCell activation delays)
  - 1.4 FR2 BWP switching time enhancements (i.e., reduce time comparing to Type 2)
    Note: further prioritization of objectives can be required in RAN #95e
- **De-prioritized objectives**
  - 1.1 Enhancement to FR2 beam measurement requirements
  - 1.2 Define FR2-FR2 DAPS requirements
  - 1.5 RRM measurements for different Rx beam sets in FR2
  - 1.6 Network-controlled gaps for UE Rx beam switching
  - 1.8 Requirements for leftover Rel-17 FR2-2 deployment scenarios

Proposal #3: Working Area #2 (RRM enhancements and leftovers)

- **Prioritized objectives for further discussion**
  - #2.2 FR1-FR1 NR-DC RRM requirements
  - #2.4 HO with PSCell requirements for new scenarios
  - #2.5 TCI switching enhancements
  - *Note: further prioritization of objectives can be required in RAN #95e*
- **De-prioritize the following objectives**
  - 2.1 UL frame boundary offset reporting
  - 2.3 Enhancements for CSI-RS based L3 measurement
  - 2.6 CMTC (i.e., timing window for L3 CSI-RS measurement)
  - 2.7 RLM enhancements
  - 2.8 HST RRM enhancement
  - 2.9 CGI reading requirement for NR-U cell

- 2.10 Harmonized RLM/BM
- 2.11 RRM enhancement for large CC number
- 2.12 allowInterruption mechanism for deactivated SCell measurements
- 2.13 CSI-RS based CFRA in RRM requirement
- 2.14 Fast and gapless Scell activation
- 2.15 Fast RRC connection re-establishment
- 2.16 RRM enhancement for NR-U
- 2.17 PUCCH SCell activation delay requirements with multiple DL Scells
- 2.18 Support NCD-SSB in IDLE mode for RedCap UE

  Note: Objective 2.17 - additional discussion on leftover issues can take place after Rel-17 feRRM WI completion

undefined

Proposal #4: Working Area #3 (MG enhancements)

- **Prioritized objectives for further discussion**
  - #3.5 Joint requirements for pre-configured MG, concurrent MG and NCSG
  - #3.1 NeedForGap requirements
  - #3.3 Inter-RAT NR and [LTE] measurement without gaps
  - *Note: further prioritization of objectives can be required in RAN #95e*
- **De-prioritized objectives**
  - 3.2. Per-FR gap capability indication enhancements
  - 3.4. MG sharing enhancement
  - 3.6. Enhancements for pre-configured MG
  - 3.8. Dynamic activation and switching of the MG pattern for different applications
  - 3.9. Allow UE to report NCSG capability based on its active serving cells
  - 3.10. Further enhancement on Pre-MG, NCSG and concurrent gaps
  - 3.11. MG enhancement for other R17 features
  - 3.12. Concurrent gap for DC

    Note: Objective 3.10 - additional discussion on leftover issues can take place after Rel-17 MG Enhancements WI completion

Additionally, for MUSIM RRM requirements the following can be concluded:

Proposal #5: Further discuss inclusion of objectives on RRM requirements for Rel-17 MUSIM features in the scope of Rel-18 MUSIM WI in RAN #95e.

The justification and candidate objectives for the prioritized topics are provided in the two Draft WIDs

RP-220051 New WID: Even Further RRM enhancement for NR and MR-DC

- Core part objectives
  - FR2 RRM requirements delay reduction enhancements
    - Cell identification and measurement delay reduction
      - Identify cases where FR2 cell identification and L3 measurement delay can be reduced and specify reduced delay requirements for such cases in IDLE/INACTIVE/CONNECTED modes [RAN4]
      - Identify cases where measurement/evaluation time of FR2 L1-RSRP can be reduced, and specify reduced delay requirements for such cases [RAN4]
      - Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN2]
      - Note: the work on CONNECTED mode enhancements shall be prioritized
      - [Note: delay reduction enhancements for UE supporting multi-Rx chain simultaneous DL reception are not in the scope]
    - FR2 SCell activation delay reduction
      - Identify cases where FR2 SCell activation delay can be reduced (e.g., unknown target cell cases), and specify reduced delay requirements for such cases [RAN4]
      - Specify if needed, enhancement and/or signalling enhancement for the UE to meet the enhanced delay requirements [RAN4, RAN1, RAN2]
      - Note: the technical solutions can be extended to FR1, when applicable
    - [FR2 BWP switching time enhancements] [RAN4]
      - Specify, if feasible, reduced FR2 BWP switching delay requirements for DCI/Timer/RRC based BWP switching.
      - Note: enhancements shall aim to provide switching delay in between Rel-15 BWP switching type 1 and type 2 BWP switching delay for FR2
    - Note: RAN1/RAN2 work can be triggered by RAN4 LS only

- Extension of requirements for existing features to new scenarios [RAN4]
  - Define RRM requirements for FR1-FR1 NR-DC scenarios [RAN4]
    - RRM requirements include the number of serving carriers, PSCell addition/release delay requirement, PSCell change and conditional PSCell change delay, scheduling availability, and CSSF. Other Rel-15 requirements are not precluded and are subject to WI stage discussion
  - Define HO with PSCell requirements for the following scenarios [RAN4]
    - HO from NR SA to NE-DC
    - HO from NR SA to NR-DC
    - HO from LTE SA to EN-DC
- TCI switching enhancements
  - Define reduced TCI switch delay requirements considering UE using temporary RS for fast measurements [RAN4, RAN1, RAN2]
    - Note: RAN1/RAN2 work can be triggered by RAN4 LS
  - [Define simultaneous TCI state switching requirements over multiple carriers] [RAN4]
  - [Allow UE to receive DL data after TCI state switch command decoding and before TCI state switch starts] [RAN4]

- **Performance part objectives**
  - Specify RRM performance requirements and test cases for the Core part enhancements.

RP-220052 New WID: Further enhancements on NR and MR-DC Measurement Gaps and measurements requirements without gaps

- **Core part objectives**
  - Enhancements of pre-configured MGs, multiple concurrent MGs and NCSG
    - Define RRM requirements for UEs configured with a combination of pre-configured MGs, and/or multiple concurrent MGs and/or NCSG [RAN4]
      - Prioritize at least joint requirements for UE configured with
        - Case 1: Pre-configured MGs and multiple concurrent MGs (i.e., concurrent MGs where at least one of the gaps is a pre-configured gap)

        - Case 2: NCSG and multiple concurrent MGs (i.e., concurrent MGs where at least one of the gaps is NCSG)

    - Note: Prioritization among other possible combinations of pre-configured MG, concurrent MG and NCSG can be discussed in WI phase

undefined

  - Define RRM requirements for measurement without gaps for the following cases
    - NR SSB-based inter-frequency and intra-frequency measurements without gaps for UEs reporting NeedForGapsInfoNR IE [RAN4]
      - Study whether the additional interruption is allowed when UE reporting 'NeedForGapsInfoNR'. Further define the interruption length, occasion and ratio, if the interruption is allowed
      - Define related requirements, such as CSSF, measurement period, scheduling restriction etc.
    - Inter-RAT measurements without gaps [RAN4]
      - Inter-RAT NR measurements
      - [Inter-RAT LTE measurement]

- **Performance part objectives**
  - Specify RRM performance requirements and test cases for the Core part enhancements.

Moderator recommends continue discussion in RAN #95e on

- **1) Further prioritization of objectives for the 2 work items (if needed)**
- **2) Refinement of the scope and details of objectives in []**