

RAN4

3GPP TSG-RAN WG4 Meeting # 98-bis-e

R4-2105825

Electronic Meeting, 12th – 20th April, 2021

Agenda item: 12.1

Source: Moderator (Huawei, HiSilicon)

Title: Email discussion summary for [98-bis-e][225]
LS_reply_R1-2009798_MR_DC

Document for: Information

1 Introduction

This email thread discusses the R17 LS on temporary RS for efficient SCell activation in NR CA [R1-2009798] in agenda 12.1. In RAN4#98e meeting, an reply LS [R4-2104067] on temporary RS for efficient SCell activation was sent to RAN1. The LS reply answered a part of questions from RAN1. This email discussion aims to discuss the remaining part of the questions in the LS R1-2009798.

Four sub-topics are discussed:

-Sub-topic 1: SCell being activated is known and belongs to FR1

-Sub-topic 2: SCell being activated is unknown and belongs to FR1

-Sub-topic 3: SCell being activated belongs to FR2

-Sub-topic 4: Other information informed to RAN1

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

1st round: Invite companies to review the recommended WF in each sub-topic, and provide comments.

2nd round: TBA

2 Topic #1: Temporary RS for efficient SCell activation

2.1 Companies' contributions summary

Table 1:

T-doc number	Company	Proposals / Observations
R4-2104428	ZTE	<p>Observation 1: Whether or not UE can directly re-use the AGC parameters for the current SCells may depend on the relationship between the activated SCell and current SCells.</p> <p>Proposal 1: If the power imbalance between the SCell and activated serving cells is less than a threshold, no AGC is required.</p> <p>Proposal 2: At least for co-located scenarios (intra-band CA), no AGC adjustment is needed since the transmission power of different cells can be seen as identical.</p>
R4-2104631	vivo	<p>Proposal 1: For the scenario where SCell being activated is unknown and belongs to FR1, after acquisition the coarse timing based on SSB, temporary RS can be used for either time/frequency tracking and AGC. However the necessity to use temporary RS for AGC is low .</p> <p>Proposal 2: For SCell being activated belongs to FR2, 1 burst is sufficient to be used for time/frequency tracking for two cases listed above.</p> <p>Proposal 3: For the case when SCell being activated belongs to FR2 and SCell being activated is unknown and there is no active serving cell on that FR2 band, a few pre-conditions need be satisfied if using temporary RS for AGC adjustments and time/frequency tracking. These pre-conditions will make this temporary RS based mechanism hard to work and the benefit of this mechanism needs be addressed as well.</p>

R4-2106443	Intel	<p>Proposal 1: No requirement is defined for temporary RS based SCell activation targeting unknown SCell.</p> <p>Proposal 2: No requirement is defined for inter-band CA for temporary RS based SCell activation.</p> <p>Proposal 3: No requirement is defined for the case where no active serving cell is in the target FR2 band.</p> <p>Proposal 4: We propose that for all kinds of AGC or T&F tracking operations, two slots of temporary RS resources are needed to facilitate fair performance, respectively.</p> <p>Proposal 5: RAN4 does not prevent any temporary RS configuration that is with close allocated temporary RS bursts in time.</p> <p>Proposal 6: The network is not required to transmit on any other serving cell than the target SCell.</p>
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R4-2106887	Ericsson	<p>Proposal 1: For SCell measurement cycle larger than 160ms, there shall be time for the UE to determine and apply new gain setting between first and second sets of RSs used for AGC and time/frequency refinement, respectively.</p> <p>Proposal 2: For activation of unknown SCell in FR1, TRS can be considered for reducing latency for fine gain tuning and fine time/frequency tuning, i.e., activities following upon coarse gain setting and cell detection. Number of bursts depends on side condition on \hat{E}_s/I_{ot} as well as on uncertainty on at which point in time UE detects the target SCell.</p> <p>Proposal 3: For activation of known SCell in FR2, TRS can be used for time/frequency tuning. Number of bursts depends on side condition on \hat{E}_s/I_{ot}.</p> <p>Proposal 4: RAN4 does not consider usage of TRS for speeding up activation of unknown SCell in FR2 in this release.</p>
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R4-2106938	Huawei, HiSilicon	<p>Proposal 1: When SCell to be activated is known and belongs to FR1, if SCell measurement cycle is larger than 160ms, 1 2 slot gap is needed between the RS symbols for AGC and the RS symbols for time/frequency acquisition.</p> <p>Proposal 2: When SCell to be activated is known and belongs to FR1, if SCell measurement cycle is larger than 160ms, AGC adjustment is performed based on temporary RS on the to-be-activated SCell and another RS and/or SSB (burst) on the other activated serving cell in the same band, and These RSs are not required to be transmitted in the same slot.</p> <p>Proposal 3: When SCell to be activated is unknown and belongs to FR1 SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA) -UE can perform AGC adjustment and time-frequency tracking based on temporary RS. -Two temporary RS bursts are required for AGC and one temporary RS burst is required for time-frequency tracking respectively. -No cell detection is needed. Intra-band non-continuous CA - UE performs AGC adjustment, cell detection based on SSB -UE performs time-frequency tracking based on temporary RS. One temporary RS burst is required.</p> <p>Inter-band CA -Leave this scenario FFS and wait for R15 conclusion.</p> <p>Proposal 4: SCell to be activated belongs to FR2 If there is at least one active serving cell on that FR2 band and temporary RS for the target SCell is provided, no matter whether the SCell to be activated is known or unknown temporary RS can be used for time/ frequency tracking</p>
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R4-2107125	MediaTek	<p>Observation 1: For the case of unknown cell in FR1, approximately 11.76% SCell activation delay can be reduced if only TRS is provided as the temporary RS, and 70.59% SCell activation delay can be reduced if both TRS and SSS/PSS based RS are provided as the temporary RS</p> <p>Observation 2: For the case of unknown cell in FR2, approximately 1.89% SCell activation delay can be reduced if only TRS is provided as the temporary RS, and 72.92% SCell activation delay can be reduced if both TRS and SSS/PSS based RS are provided as the temporary RS</p> <p>Proposal 1: RAN4 to inform RAN1 the evaluation results for unknown cell cases and suggest RAN1 to further study the possibility of introducing other RS type to expedite the activation process when cell search procedure is needed.</p>
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2.2 Open issues summary

2.2.1 Sub-topic 1: SCell being activated is known and belongs to FR1

Background: The followings were agreed in [R4-2104067]:

Issue 1-1: If SCell measurement cycle is larger than 160ms, whether minimum gap between the RS symbol(s) for AGC and the RS symbols for time/frequency acquisition is needed?

Proposals

-Option 1 (Ericsson, Huawei): Yes

-Option 2 (Intel): No

Recommended WF

- *If SCell measurement cycle is larger than 160ms^o*
 - *temporary RS can be used for AGC^o*
 - *1 burst (2-slot with four CSI-RS resources) is required^o*
 - *temporary RS can be used for time/frequency tracking^o*
 - *1 separate burst (2-slot with four CSI-RS resources) is required in addition to the one burst required for AGC^o*
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- *The agreements above apply based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798^o*
 - *FFS: whether minimum gap between the RS symbol(s) for AGC and the RS symbols for time/frequency acquisition is considered to account for UE AGC application time delay^o*
 - *The minimum gap length is FFS^o*

Figure 1:

Further discussion

Feedback Form 1: 1st round Comment collection for Issue 1-1

Item	Com-pany	Comments
1	Huawei Technologies France	In R15/R16, both AGC and fine timing are based on SSB, the time interval between two consecutive SSB burst is one SMTC periodicity. In R17 CA/DC enhancement, when AGC and fine timing are based on temporary RS, according to RAN1 working assumption, the interval between two TRS bursts is 10 OFDM symbol. This time interval may be not sufficient for AGC application.
2	Qual-comm Incorporated	Option 1. Depending on UE implementation, UE may need a gap for temporary RS buffering, processing, and application of new gain value as mentioned in R4-2106887. We do not see any harm in Option 1 as long as a zero-gap configuration can be supported, e.g. subject to UE capability. For the detailed candidate values for the gap, it can be further discussed later as needed.
3	Intel	It is OK to have the gap for UE when considering requirements as long as there is no restriction on the CSI-RS configurations. We agree that we can allow the UE to use different bursts for respective operations of AGC and t/f refining. Our proposal was that RAN4 does not prevent any temporary RS configuration that is with close allocated temporary RS bursts in time.
4	Ericsson GmbH, Eurolab	Option 1 (for the reasons given in R4-2106887)
5	Apple GmbH	Support option 1. Applying new AGC level requires some time.

Item	Company	Comments
6	vivo Mobile Communication Co.,	we are ok with option 1
7	MediaTek Inc.	MTK: ok with option 1

Issue 1-2: If the answer to Issue 1-1 is Yes, how long the minimum gap is?

Proposals

Option 1(Huawei, Ericsson): 1 2 slot(s)

Recommended WF

Further discussion

Feedback Form 2: 1st round Comment collection for Issue 1-2

Item	Company	Comments
1	Huawei Technologies France	The value proposed in option 1 can be as starting point.
2	Qualcomm Incorporated	Option 1. It can be up to UE capability, Frequency range, etc.
3	Intel	No capability is preferred. Allowing UE to have the gap between two periodicities is enough. Creating fragmentation is not preferred.
4	Ericsson GmbH, Eurolab	Option 1 as starting point. Chipset vendors can further look into the needed length of the gap.
5	Apple GmbH	It depends on UE implementation such as AGC update periodicity and so on. Conservatively, we suggest 3 5ms to allow all kinds of implementation.
6	MediaTek Inc.	ok with the proposal

Issue 1-3: If SCell measurement cycle is larger than 160ms, whether the UE requires to receive another RS transmitted also on the other activated serving cell in the same band in the same slot?

Proposals

Option 1(Intel, Huawei):

- AGC adjustment is performed based on temporary RS on the to-be-activated SCell and another RS and/or SSB (burst) on the other activated serving cell in the same band, and
- These RSs are not required to be transmitted in the same slot

Recommended WF

Could option 1 be agreed?

Feedback Form 3: 1st round Comment collection for Issue 1-3

Item	Company	Comments
1	Huawei Technologies France	<p>Support option 1. We admit the AGC adjustment shall be based on the RS on both the to-be-activated SCell and other activated SCells in the same band (intra-band). However the restriction of in the same slot is unnecessary and questionable:</p> <p>1.If AGC is based on temporary RS, it is not realistic to request temporary RS transmission on other activated serving cells. In our understanding, temporary RS is used to expedite SCell activation and only transmitted on the to-be-activated SCells.</p> <p>2. if AGC adjustment is performed on the temporary RS on the to-be-activated SCell and SSB burst on active serving cells are transmitted . If it is request they are in the same slot, it will restrict temporary RS within SMTC. The motivation of introducing temporary RS is to fasten the activation time. If the temporary RS shall be aligned with SSB on the active serving cell, then SCell activation time is restricted by SSB which is similar as R15. Therefore the gain of reduction SCell activation delay will be highly limited.</p>
2	Qualcomm Incorporated	Option 1 is okay. Concerns on the restriction mentioned by Huawei is understandable.
3	Ericsson GmbH, Eurolab	Support Option 1.

Item	Company	Comments
4	Apple GmbH	<p>We have concern on option 1. Option 1 actually implies completely different assumption that is being used as assumption in legacy R15/16 SCell activation delay requirements:</p> <p>- In FR1, in case of intra-band SCell activation, <u>the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot; in case of inter-band SCell activation, the first occasion when the SCell being activated is transmitting SSB burst.</u></p> <p>- In FR2, <u>the occasion when all active serving cells and SCells being activated or released are transmitting SSB bursts in the same slot.</u></p> <p>we understand the concern raised by Huawei. However, logically, the feasibility shall be confirmed depending on whether it is doable by the UE, rather than whether the use case would be limited.</p> <p>On the other hand, it is not always unrealistic to have RS on the other serving cells at the same time. The temporary RS on the target cell being activated can be aligned with not only SMTC, but also TRS on the other cells.</p>
5	MediaTek Inc.	Ok with the proposal

2.2.2 Sub-topic 2: SCell being activated is unknown and belongs to FR1

Background: In R15/R16, the corresponding requirements are specified as below:

If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}_s/I_{ot} \geq -2\text{dB}$ is fulfilled, $T_{activation_time}$ is:

*- $T_{FR1SSB_MAX} + T_{SMTC_MAX} + 2 * T_{rs} + 5ms.$*

It means that in this case UE needs to perform AGC (2 SSB), cell detection (1 SSB) and then time-frequency tracking (1 SSB).

Figure 2:

Issue 2-1: Requirements or benefits for FR1 unknown case

Proposals

-Option 1 (ZTE, vivo, Huawei, Ericsson): Requirements are supposed to be considered for FR1 unknown case

-Option 2 (Intel): No requirement is defined for temporary RS based SCell activation targeting unknown SCell.

Recommended WF

Further discussion

**Feedback Form 4: 1st round Comment collection for
Issue 2-1**

Item	Company	Comments
1	ZTE Photonics	Support Option 1. No requirement would lead to broken specifications.
2	Huawei Technologies France	Support option 1. We understood option2 means temporary RS can not be applied for unknown SCell case or the benefit is very limited. However we think we shall analyze the issue case by case. Under certain case (i.e., intra-band continuous CA), the unknown SCell activation procedure resembles with known case (this is to be discussed in later questions).
3	Qualcomm Incorporated	Option 2. We don't think unknown SCell is a target scenario for temporary RS based SCell activation latency optimization.
4	Intel	Option 2. Question to Huawei: Could we understand why is the network not configuring intra-band contiguous neighbor cell (even colocated) measurement to the UE but suddenly requiring the UE to have fast activation on this cell?
5	Ericsson GmbH, Eurolab	For unknown SCell scenario, our view is that TRS can be used for fine-tuning of gain/time/frequency after the SCell has been detected. However for the detection as such we think SSB is needed.
6	Apple GmbH	Support option 2. We don't see significant gain here. For unknown case UE may several SMTC to finish activation. if network wants to use temporary RS to facilitate the procedure, network may have to configure temporary RS several times (after each STMC windows), since RAN4 only defines requirement based on the worst scenario. in practice UE can do better if side condition is good.
7	vivo Mobile Communication Co.,	For the FR1 unknown case, our view is the benefit of applying temporary RS is quite low. Prefer option 2 since it is more aligned with our position.
8	MediaTek Inc.	MTK: support option 1

Issue 2-2: when SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA), whether temporary RS can be used for AGC and/or time frequency tracking?

Proposals

-Option 1(ZTE): At least for co-located scenarios (intra-band CA), no AGC adjustment is needed

-Option 2(Huawei, Ericson, vivo): UE can perform AGC adjustment and time-frequency tracking based on temporary RS

-Option 2a (Huawei, Ericsson): UE can perform AGC adjustment and time-frequency tracking based

on temporary RS; No cell detection is needed.

-Option 2b (vivo): UE can perform AGC adjustment and time-frequency tracking based on temporary RS, however the necessity to use temporary RS for AGC is low

Recommended WF

Further discussion

Feedback Form 5: 1st round Comment collection for Issue 2-2

Item	Company	Comments
1	Qualcomm Incorporated	If the question is whether UE can skip legacy coarse AGC and SSB detection procedures, we don't think so based on the current SCell activation requirements.
2	Huawei Technologies France	to Qualcomm, in this case UE can perform AGC adjustment and time-frequency tracking based on temporary RS (rather than skip AGC adjustment). And based on the latest SCell activation requirements (agreed in the last meeting), UE can skip SSB detection procedures.
3	Huawei Technologies France	To be clearer, each procedure is analyzed separately for the Intra-band continuous CA case: - AGC adjustment: in intra-band continuous CA, MRTD is 260ns which is far smaller than CP. Thus the coarse timing of SCell being activated can be based on active serving cell on the same band. Moreover in intra-band continuous CA, only co-located deployment is applied. Thus the TCI of temporary RS can be QCLed with PDCCH on active serving cell. In other words, the network knows how to transmit temporary RS. Therefore in this scenario, temporary RS can be correctly received. Thus AGC adjustment can be performed based on temporary RS. - Cell detection: in last meeting, the R16 SCell activation requirement was agreed(see the endorsed CR[R4-2103621]) that no cell detection is needed in this case. So in this WI, the same conclusion shall be inherited, i.e., cell detection can be skipped. - Time frequency tracking: as temporary RS can be correctly received by UE, time-frequency tracking can be based on it.
4	Ericsson GmbH, Eurolab	Our preference is Option 2a. As Huawei points out above, we already have an assumption on that intra-band contiguous SCells do not need SSB-based cell detection when conditions pertaining to TCI state are fulfilled. We think we shall use this as baseline here too.
5	MediaTek Inc.	Support option 2
6	vivo Mobile Communication Co.,	If a UE still needs coarse timing then we think the benefit is low

Issue 2-3: If the answer to Issue 2-2 is Yes or “Yes for partial cases”, how many temporary RS bursts are required for AGC / time frequency tracking respectively?

Side condition (specified in existing specification): If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}_s/I_{ot} -2dB$ is fulfilled.

Proposals

For AGC:

-Option 1(Huawei): Two temporary RS bursts are required.

For time frequency tracking:

-Option 1(vivo, Huawei): One temporary RS burst is required.

Recommended WF

Further discussion

Feedback Form 6: 1st round Comment collection for Issue 2-3

Item	Company	Comments
1	Qualcomm Incorporated	The question seems incomplete. Does this assume UE already acquired coarse AGC gain and detected SSB ID for the target cell, hence, effectively the same condition as known-SCell with measurement cycle > 160ms? If so, is there a reason to have a different number of RS bursts than what is captured in R4-2104067?
2	Huawei Technologies France	As discussed in Issue 2-2, both AGC and time/frequency tracking can be performed based on temporary RS (cell detection procedure can be skipped). In legacy R15/ R16 requirement, when SCell is unknown in FR1, 2 SSB bursts are request for AGC and 1 SSB burst is request for time/frequency tracking. Following this principle, we propose that 2 temporary RS bursts are for AGC, and 1 temporary RS burst is for time/frequency tracking. @ Qualcomm, hope the above explanations can answer your question.
3	MediaTek Inc.	ok with the proposal

Issue 2-4: when SCell is non-contiguous to an active serving cell in the same band (Intra-band non-continuous CA), whether temporary RS can be used for AGC and/or time frequency tracking?

Proposals

For AGC:

-Option 1(ZTE): If the power imbalance between the SCell and activated serving cells is less than a threshold, no AGC is required.

-Option 2a (Huawei): UE performs AGC adjustment based on SSB rather than temporary RS.

-Option 2b (vivo): UE can perform AGC adjustment based on temporary RS, however the necessity to use temporary RS for AGC is low.

-Option 3 (Ericsson): UE can perform AGC adjustment based on temporary RS

For time frequency tracking:

-Option 1(Huawei, Ericsson, vivo): UE can perform time-frequency tracking based on temporary RS.

Recommended WF

Further discussion

Feedback Form 7: 1st round Comment collection for Issue 2-4

Item	Company	Comments
1	ZTE Photonics	Temporary RS can be used to let UE adjust AGC but it can also be done using SSB. So basically Option 1, 2a and 2b are not mutually exclusive. Option 3 points out that it is feasible to use temporary RS to settle AGC, which is also true, but since AGC settling can be done with SSB, maybe there is no strong motivation to use temporary RS to do that.
2	Qualcomm Incorporated	The same comment as Issue 2-2. And we don't think this is a target scenario for temporary RS based SCell activation latency optimization.
3	Huawei Technologies France	In the Intra-band non-continuous CA case, - AGC: for intra-band non-continuous CA, MRTD is 3us which is larger than CP length when SCS is 30kHz. Thus it is not feasible for UE to obtain the timing information. In other words, UE can not correctly detect temporary RS. Then AGC adjustment shall be based on SSB. - Cell detection: shall be based on SSB as well. After cell detection, the coarse timing is acquired. - time/frequency tracking: After cell detection, the temporary RS can be correctly detected by UE. UE can perform temporary RS based time/frequency tracking.
4	Ericsson GmbH, Eurolab	Our view is that the UE can use TRS for fine-tuning of gain/timing/frequency once the SCell has been detected. For detection, we assume that SSBs are needed.
5	Apple GmbH	Similar comments as above. we don't see benefit for unknown case.
6	MediaTek Inc.	For AGC: support option 2a. For time frequency tracking: support option 1

Item	Company	Comments
7	vivo Mobile Communication Co.,	Similar view as ZTE where option 1, 2a and 2b are not mutually exclusive. We do not see the benefit through temporary RS for unknown case.

Issue 2-5: If the answer to Issue 2-4 is “Yes or “Yes for partial cases”, how many temporary RS bursts are required?

Side condition (specified in existing specification): If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}_s/I_{ot} -2dB$ is fulfilled.

Proposals

-Option 1(Huawei, vivo): One temporary RS burst is required for time-frequency tracking.

Recommended WF

Further discussion

Feedback Form 8: 1st round Comment collection for Issue 2-5

Item	Company	Comments
1	Qualcomm Incorporated	It is unclear if it is also assumed UE already acquired coarse AGC gain and detected SSB ID for the target cell. If that is the case, what is different from Issue 2-3 in terms of whether temporary RS can be used for AGC and/or time frequency tracking?
2	Huawei Technologies France	As analyzed in Issue 2-4, only time-frequency tracking can be performed based on temporary RS in this case. 1 temporary RS is required as proposed in option 1. @ Qualcomm, in this issue, UE acquired coarse AGC gain and detected SSB ID for the target cell based on SSB, after AGC and SSB detection, the coarse timing is obtained. The difference between Issue 2-3 and 2-5 is that both AGC and time frequency tracking can be based on temporary RS in Issue 2-3, while only time frequency tracking is based on temporary RS in Issue 2-5.
3	Apple GmbH	same comments as above. using temporary RS for unknown case is not encouraged.
4	MediaTek Inc.	Support option 1

Issue 2-6: when SCell to be activated and active serving cell are in the different band (Inter-band CA), whether temporary RS can be used for AGC and/or time frequency tracking?

Proposals

For AGC:

-Option 1(ZTE): If the power imbalance between the SCell and activated serving cells is less than a threshold, no AGC is required.

-Option 2a (Huawei): UE performs AGC adjustment based on SSB rather than temporary RS.

-Option 2b (vivo): UE can perform AGC adjustment based on temporary RS, however the necessity to use temporary RS for AGC is low.

-Option 3 (Ericsson): UE can perform AGC adjustment based on temporary RS.

For time frequency tracking:

-Option 1(Ericsson, vivo): UE can perform time-frequency tracking based on temporary RS.

-Option 2(Huawei): Leave this scenario FFS and wait for R15 conclusion.

Recommended WF

Further discussion

Feedback Form 9: 1st round Comment collection for Issue 2-6

Item	Com-pany	Comments
1	ZTE Pho-tonics	Similar to Issue 2-4. Temporary RS can be used to let UE adjust AGC but it can also be done using SSB. So basically Option 1, 2a and 2b are not mutually exclusive. Option 3 points out that it is feasible to use temporary RS to settle AGC, which is also true, but since AGC settling can be done with SSB, maybe there is no strong motivation to use temporary RS to do that.
2	Qual-comm Incorporated	The same comment as Issue 2-4.
3	Huawei Technologies France	This issue focus on inter-band CA scenario. - AGC: MRTD is 33us which is larger than CP length. Thus UE shall perform AGC adjustment based on SSB rather than temporary RS. So option 2a for AGC is supported. - Cell detection: shall be based on SSB as well. After cell detection, the coarse timing is acquired. - Time-frequency tracking: option 1 for Time-frequency tracking is also fine.
4	Intel	No requirement for inter-band CA case. The UE is not required to have faster activation based on temp RS.

Item	Company	Comments
5	Ericsson GmbH, Eurolab	In our view, TRS can be used for fine-tuning of gain/timing/frequency once the SCell has been detected. For detection (also including coarse gain setting), we assume SSBs are needed.
6	Apple GmbH	Same comments as on previous issue. no gain for unknown case.
7	MediaTek Inc.	For AGC: support option 2a For time-freq. tracking: support option 1
8	vivo Mobile Communication Co.,	Same view as 2-4, benefit is low

Issue 2-7: If the answer to Issue 2-6 is “Yes or “Yes for partial cases”, how many temporary RS bursts are required?

Side condition (specified in the existing specification): If the SCell is unknown and belongs to FR1, provided that the side condition $\hat{E}_s/I_{ot} -2dB$ is fulfilled.

Proposals

-Option 1(vivo): One temporary RS burst is required for time-frequency tracking.

Recommended WF

Further discussion

Feedback Form 10: 1st round Comment collection for Issue 2-7

Item	Company	Comments
1	Qualcomm Incorporated	The same comment as Issue 2-5.
2	Huawei Technologies France	option 1 is fine.
3	MediaTek Inc.	support option 1

2.2.3 Sub-topic 3: SCell to be activated belongs to FR2

Background: The followings were agreed in [R4-2104067]:

- SCell to be activated belongs to FR2
 - *If there is at least one active serving cell on that FR2 band and temporary RS for the target SCell is provided, no matter whether the SCell to be activated is known or unknown*
 - *temporary RS can be used for time/ frequency tracking*
 - *The number of temporary RS symbols is under discussion*
 - *If there is no active serving cell on that FR2 band, and the SCell to be activated is known to UE*
 - *temporary RS can be used for fine timing tracking*
 - *The number of temporary RS symbols is under discussion*

Figure 3:

Issue 3-1: If there is at least one active serving cell on that FR2 band and temporary RS for the target SCell is provided, no matter whether the SCell to be activated is known or unknown, how many temporary RS bursts are required for time/ frequency tracking?

Proposals

-Option 1(vivo, Huawei): 1 burst is required based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798.

Recommended WF

Further discussion

Feedback Form 11: 1st round Comment collection for Issue 3-1

Item	Company	Comments
1	Qualcomm Incorporated	One burst is required. And the number of slots for the temporary RS transmission for time/frequency tracking should be the same as that for FR1, i.e. 2-slot with four CSI-RS resources, because there is technically no reason to have different values depending on frequency range for the same digital signal processing. We had proposed “1 slot based burst” in the previous RAN4 meeting because one slot based TRS is supported even for FR1 as presented in R4-2106443, however, RAN4 agreed with “2 slot based burst”.
2	Huawei Technologies France	Support option 1.
3	Intel	Two slots have to be guaranteed. No matter how many bursts. There is no spec to guarantee 2 slots in a burst for TDD bands.
4	Apple GmbH	Support 2 slots.
5	MediaTek Inc.	Support option 1

Item	Company	Comments
6	vivo Mobile Communication Co.,	support option 1

Issue 3-2: If there is no active serving cell on that FR2 band, and the SCell to be activated is known to UE, how many temporary RS bursts are required for time/frequency tracking?

Proposals

-Option 1(vivo, Huawei): 1 burst is required based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798

Recommended WF

Further discussion

Feedback Form 12: 1st round Comment collection for Issue 3-2

Item	Company	Comments
1	Qualcomm Incorporated	The same comment as Issue 3-1.
2	Huawei Technologies France	support option 1
3	Intel	Could anyone clarify on the Known condition here for FR2? We believe that anyway the UE needs to have beam training under the case where no other serving cell is in this FR2 band. Thus requiring the UE to use temp RS to train beams is sense less.

Item	Company	Comments
4	Apple GmbH	<p>@Intel, we assume the same known conditions as defined in existing SCell activation delay requirement apply here:</p> <p>For the first SCell activation in FR2 bands, the SCell is known if it has been meeting the following conditions:</p> <ul style="list-style-type: none"> - During the period equal to 4s for UE supporting power class1 and 3s for UE supporting power class 2/3/4 before UE receives the last activation command for PDCCH TCI, PDSCH TCI (when applicable) and semi-persistent CSI-RS for CQI reporting (when applicable): - the UE has sent a valid L3-RSRP measurement report with SSB index - SCell activation command is received after L3-RSRP reporting and no later than the time when UE receives MAC-CE command for TCI activation - During the period from L3-RSRP reporting to the valid CQI reporting, the reported SSBs with indexes remain detectable according to the cell identification conditions specified in clauses 9.2 and 9.3, and the TCI state is selected based on one of the latest reported SSB indexes. <p>according to the conditions, UE shall have measured target cell before activation. UE can know the proper rough beam for DL reception. But UE may still need to do fine beam training. however, this part is somehow missing in current SCell activation requirements.</p>
5	MediaTek Inc.	Support option 1
6	vivo Mobile Communication Co.,	ok with option 1

Issue 3-3: If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, whether temporary RS can be used for AGC?

Side condition (specified in the existing specification): the side condition $\hat{E}_s/I_{ot} - 2dB$ is fulfilled.

Proposals

-Option 1(vivo, Huawei, Ericsson): No, temporary RS can not be used for AGC

-Option 2 (Intel): No requirements for this case

Recommended WF

Further discussion

**Feedback Form 13: 1st round Comment collection for
Issue 3-3**

Item	Company	Comments
1	ZTE Photonics	Support Option 1.
2	Qualcomm Incorporated	If the question is about coarse AGC which UE performs before SSB detection, we don't think temporary RS can be used for AGC.
3	Huawei Technologies France	Support option 1. UE needs to perform AGC adjustment , then cell detection, then time-frequency tracking. In FR2 UE shall perform RX beam sweeping, accordingly network shall transmit multiple consecutive beams (may be up to dozens of beams) in a periodic-like manner. We don't think temporary RS is suitable for consecutive transmission. And as the bandwidth of temporary RS is large, consecutive transmission will extremely increase the network payload. Meanwhile the motivation of introducing temporary RS is not for beam management. Thus temporary RS based AGC adjustment may not be such appropriate. @Qualcomm, you are correct, the question is about coarse AGC which UE performs before SSB detection.
4	Intel	Same comment as above.
5	Ericsson GmbH, Eurolab	Our view is that RAN4 does not consider usage of TRS for speeding up activation of unknown SCell in FR2 in this release.
6	Apple GmbH	same comments as above. unknown case should not be considered.
7	MediaTek Inc.	TRS can not be used to adjust AGC in this case. SSB-based RS is applicable
8	vivo Mobile Communication Co.,	unknown case should not be considered

Issue 3-4: If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, whether temporary RS can be used for time-frequency tracking?

Proposals

-Option 1(Huawei): Yes

-Option 2(vivo, Ericsson, Intel): No

Recommended WF

Further discussion

**Feedback Form 14: 1st round Comment collection for
Issue 3-4**

Item	Company	Comments
1	Qualcomm Incorporated	We don't think this is a target scenario for temporary RS based SCell activation latency optimization.
2	Huawei Technologies France	After AGC adjustment, cell detection, L1-RSRP measurement and reporting, the best RX beam is determined and the coarse timing is acquired as well. Afterwards fine timing doesn't need RX beam sweeping. Then temporary RS based time/frequency tracking can be performed.
3	Ericsson GmbH, Eurolab	Our view is that RAN4 shall not consider usage of TRS for speeding up activation of unknown SCell in FR2 in this release.
4	Apple GmbH	same comments as above. unknown case should not be considered. there would be a lot of uncertainty when UE can finish beam training and AGC settling. it is challenging for NW to properly configure temporary RF for time tracking.
5	MediaTek Inc.	Support option 1
6	vivo Mobile Communication Co.,	this scenario is not a suitable scenario where temporary RS can apply

Issue 3-5: If the answer to Issue 3-4 is Yes, how many temporary RS bursts are required for time-frequency tracking?

Side condition (specified in existing specification): the side condition $\hat{E}s/Iot -2dB$ is fulfilled.

Proposals

-Option 1(Huawei): 1 burst.

Recommended WF

Further discussion

**Feedback Form 15: 1st round Comment collection for
Issue 3-5**

Item	Company	Comments
1	Qualcomm Incorporated	The same comment as Issue 3-4.

Item	Company	Comments
2	Huawei Technologies France	support option 1.
3	Intel	We prefer not to require UE to have faster activation under such cases. Same comments as above.
4	MediaTek Inc.	Support option 1

2.2.4 Sub-topic 4: Other information informed to RAN1

Issue 4-1: Other information need to inform RAN1

Proposals

-Option 1(MTK): RAN4 to inform RAN1 the evaluation results for unknown cell cases and suggest RAN1 to further study the possibility of introducing other RS type to expedite the activation process when cell search procedure is needed.

Recommended WF

Further discussion

Feedback Form 16: 1st round Comment collection for Issue 4-1

Item	Company	Comments
1	ZTE Photonics	Prefer to limit the scope of discussion to focus on the questions asked by RAN1 and not to include other information. If there is need to communicate to RAN1 on other businesses, a separate LS can be sent if necessary. In this reply LS, we should focus on the questions asked and provide our answers.
2	Qualcomm Incorporated	We don't think it is necessary. The evaluation results from R4-2107125 demonstrate that the latency is still larger than 140ms even with PSS/SSS based RSs. We think the relative improvement percentage alone can't justify the necessity of temporary RS for unknown SCell activation latency optimization. The total number of PSS/SSS and TRS based RS bursts seems to be at least 26.
3	Intel	Before concluding on allowing other RS types RAN4 needs to see sufficient justification. Besides we don't think it is RAN4 work to guide RAN1 on how the temp RS is designed in physical layer.
4	Huawei Technologies France	Don't prefer to inform RAN1 these information. The evaluation in R4-2107125 had some assumptions, like the new introduced SSB has smaller periodicity (5ms), and has different sequence with the legacy SSB design. Small periodicity will largely increase network overhead. And the new SSB sequency design has not been discussed in RAN4 (also not in RAN4 work scope).

Item	Company	Comments
5	Apple GmbH	Prefer not to include such information in the LS. Unknown case shall be de-prioritized.
6	MediaTek Inc.	At least RAN4 should inform RAN1 that the dominate term in the activation time for unknown cell cases is the cell search time.
7	vivo Mobile Communication Co.,	we do not think this kind of information is necessary

2.2.5 CRs/TPs comments collection

None CR or TP

2.3 Summary for 1st round

2.3.1 Open issues

2.3.1.1 Sub-topic 1: SCell being activated is known and belongs to FR1

Issue 1-1: If SCell measurement cycle is larger than 160ms, whether minimum gap between the RS symbol(s) for AGC and the RS symbols for time/frequency acquisition is needed?

7 companies all support option 1.

Tentative agreements:

Option 1: Yes.

Recommendations for 2nd round: Consensus is reached and no need to discuss in the 2nd round.

Issue 1-2: If the answer to Issue 1-1 is Yes, how long the minimum gap is?

6 companies provided views on this issue. 4 companies support option 1, and 1 company suggest other candidate value and 1 company doesn't prefer to have capability. In Moderator's understanding, at current stage, no companies request such capability.

No tentative agreements.

Candidate options:

- Option 1: 1 slot

-Option 2: 2 slots

-Option 3: 3-5ms

Recommendations for 2nd round: Further discussion

Issue 1-3: If SCell measurement cycle is larger than 160ms, whether the UE requires to receive another RS transmitted also on the other activated serving cell in the same band in the same slot?

5 companies provided views on this issue. 4 companies support option 1, and 1 company disagree. To proceed, another compromised option is added, i.e., UE reports capability. These options are to be further discussed in 2nd round.

No tentative agreements.

Candidate options:

-Option 1(Intel, Huawei, Qualcomm, MTK):

- AGC adjustment is performed based on temporary RS on the to-be-activated SCell and another RS and/or SSB (burst) on the other activated serving cell in the same band, and

- These RSs are not required to be transmitted in the same slot

-Option 2 (Apple):

- AGC adjustment is performed based on temporary RS on the to-be-activated SCell and another RS and/or SSB (burst) on the other activated serving cell in the same band, and

- These RSs are required to be transmitted in the same slot

- Option 3 (new compromised option): UE reports capability which indicates whether UE requires to receive another RS transmitted also on the other activated serving cell in the same band in the same slot.

Recommendations for 2nd round: Further discussion

2.3.1.2 Sub-topic 2: SCell being activated is unknown and belongs to FR1

Issue 2-1: Requirements for FR1 unknown case

8 companies provided views on this issue. As the latter issue 2-2, 2-4, 2-6 discuss more detailed scenarios, then we suggest to skip issue 2-1 in the 2nd round discussion. When issue 2-2, 2-4, 2-6 have conclusions, issue 2-1 naturally becomes clear.

No tentative agreements.

Recommendations for 2nd round: discuss the latter Issue 2-2, 2-4, 2-6 firstly.

Issue 2-2: when SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA), whether temporary RS can be used for AGC and/or time frequency tracking?

5 companies provided views on this issue. After offline discussion, all companies who provided comments in the first round can agree with option 2a with explicit side condition.

Tentative agreements:

- UE can perform AGC adjustment and time-frequency tracking based on temporary RS;
- No cell detection provided the conditions specified for intra-band contiguous CA case in TS38.133 section 8.3.2 are satisfied.

Recommendations for 2nd round: Consensus is reached and no need to discuss in the 2nd round.

Issue 2-3: If the answer to Issue 2-2 is Yes or “Yes for partial cases”, how many temporary RS bursts are required for AGC / time frequency tracking respectively?

3 companies provided views on this issue. For time-frequency tracking, the consensus was achieved that one temporary RS burst is required. For AGC, the views are diverse.

Tentative agreements:

- For time frequency tracking: One temporary RS burst is required.

For AGC, candidate options:

- Option 1: Two temporary RS bursts are required.
- Option 2: One temporary RS bursts are required.

Recommendations for 2nd round: Further discussion on how many temporary RS bursts are required for AGC.

Issue 2-4: when SCell is non-contiguous to an active serving cell in the same band (Intra-band non-continuous CA), whether temporary RS can be used for AGC and/or time frequency tracking?

7 companies provided views on this issue. The views are diverse.

No tentative agreements.

Candidate options:

- Option1: it is not a target scenario for temporary RS based SCell activation latency optimization.
- Option 2: temporary RS can be used for AGC and/or time frequency tracking
- For AGC: UE performs AGC adjustment based on SSB rather than temporary RS.
- For time frequency tracking: UE can perform time-frequency tracking based on temporary RS.

Recommendations for 2nd round: Further discussion

Issue 2-5: If the answer to Issue 2-4 is “Yes or “Yes for partial cases”, how many temporary RS bursts are required?

4 companies provided views on this issue. As there is no consensus on issue 2-4, the views are diverse.

No tentative agreements.

Candidate options:

- Option 1: One temporary RS burst is required for time-frequency tracking.*

Recommendations for 2nd round: Further discussion

Issue 2-6: when SCell to be activated and active serving cell are in the different band (Inter-band CA), whether temporary RS can be used for AGC and/or time frequency tracking?

7 companies provided views on this issue. The views are diverse.

No tentative agreements.

Candidate options:

- Option1: it is not a target scenario for temporary RS based SCell activation latency optimization.*
- Option 2: temporary RS can be used for AGC and/or time frequency tracking*
- For AGC: UE performs AGC adjustment based on SSB rather than temporary RS.*
- For time frequency tracking: UE can perform time-frequency tracking based on temporary RS*

Recommendations for 2nd round: Further discussion

Issue 2-7: If the answer to Issue 2-6 is “Yes or “Yes for partial cases”, how many temporary RS bursts are required?

3 companies provided views on this issue. As there is no conclusion on issue 2-6, the views are diverse.

No tentative agreements.

Candidate options:

- Option 1: One temporary RS burst is required for time-frequency tracking.*

Recommendations for 2nd round: Further discussion

2.3.1.3 Sub-topic 3: SCell to be activated belongs to FR2

Issue 3-1: If there is at least one active serving cell on that FR2 band and temporary RS for the target SCell is provided, no matter whether the SCell to be activated is known or unknown, how many temporary RS bursts are required for time/ frequency tracking?

6 companies provided views on this issue. All companies think 1 temporary RS burst is needed. The controversial point is 1 burst is “1-slot or 2-slot” or “2-slot”.

Candidate options:

- Option 1: 1 burst is required based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798 (“1-slot with two CSI-RSs resources (2 samples)” or “2-slot with four CSI-RSs resources (4 samples)” for FR2).
- Option 2: 1 burst is required (2-slot with four CSI-RSs resources (4 samples))

Recommendations for 2nd round: further discussion

Issue 3-2: If there is no active serving cell on that FR2 band, and the SCell to be activated is known to UE, how many temporary RS bursts are required for time/ frequency tracking?

5 companies provided views on this issue. All companies think 1 temporary RS burst is needed. The controversial point is 1 burst is “1-slot or 2-slot” or “2-slot”.

Candidate options:

- Option 1: 1 burst is required based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798 (“1-slot with two CSI-RSs resources (2 samples)” or “2-slot with four CSI-RSs resources (4 samples)” for FR2).
- Option 2: 1 burst is required (2-slot with four CSI-RSs resources (4 samples))

Recommendations for 2nd round: further discussion

Issue 3-3: If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, whether temporary RS can be used for AGC?

8 companies provided views on this issue. All companies think temporary RS can not be used for AGC.

Tentative agreements:

-If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, temporary RS can not be used for AGC.

Recommendations for 2nd round: Consensus is reached and no need to discuss in the 2nd round.

Issue 3-4: If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, whether temporary RS can be used for time-frequency

tracking?

6 companies provided views on this issue. The views are diverse.

No tentative agreements.

Candidate options:

-Option1: Yes

-Option 2: No

Recommendations for 2nd round: Further discussion

Issue 3-5: If the answer to Issue 3-4 is Yes, how many temporary RS bursts are required for time-frequency tracking?

4 companies provided views on this issue. As there is no conclusion on issue 3-4, the views are diverse.

No tentative agreements.

Candidate options:

- Option 1: One temporary RS burst is required for time-frequency tracking.

Recommendations for 2nd round: Further discussion

2.3.1.4 Sub-topic 4: Other information informed to RAN1

Issue 4-1: Other information need to inform RAN1

7 companies provided views on this issue. 6 companies don't prefer to inform RAN1 about these information. One company suggest to inform RAN1 that the dominate term in the activation time for unknown cell cases is the cell search time.

No tentative agreements.

Candidate options:

- Option 1: don't inform RAN1

-Option 2: Inform RAN1 that the dominate term in the activation time for unknown cell cases is the cell search time

Recommendations for 2nd round: Further discussion

2.3.2 CRs/TPs

2.4 Discussion on 2nd round (if applicable)

2.4.1 Sub-topic 1: SCell being activated is known and belongs to FR1

Background: In the first round discussion, Issue 1-1 has achieved consensus:

Issue 1-1: If SCell measurement cycle is larger than 160ms, whether minimum gap between the RS symbol(s) for AGC and the RS symbols for time/frequency acquisition is needed?

Tentative agreements: Yes.

Issue 1-2: how long the minimum gap is?

Proposals:

- Option 1: 1 slot
- Option 2: 2 slots
- Option 3: 3-5ms

Feedback Form 17: 2nd round comment collection for Issue 1-2

Item	Company	Comments
1	Ericsson GmbH, Eurolab	Option 2 (2 slots) should be enough for allowing buffering, baseband processing, and application of new gain.
2	Qualcomm Incorporated	No more than 2 slots, i.e. disagree with Option 3.
3	Huawei Technologies France	After offline discussion, option 3 can be revised to 2ms. Please companies provide comments further. Thanks all!
4	Apple GmbH	Again, it depends on UE implementation as mentioned in the 1st round. we can accept 2ms.
5	Huawei Technologies France	As for 15kHz SCS, 2 slots is 2ms, either 2 slots or 2ms is acceptable to us.

Issue 1-3: If SCell measurement cycle is larger than 160ms, whether the UE requires to receive another RS transmitted also on the other activated serving cell in the same band in the same slot?

Proposals:

Option 1(Intel, Huawei, Qualcomm, MTK):

- AGC adjustment is performed based on temporary RS on the to-be-activated SCell and another RS and/or SSB (burst) on the other activated serving cell in the same band, and
- These RSs are not required to be transmitted in the same slot

Option 2 (Apple):

- AGC adjustment is performed based on temporary RS on the to-be-activated SCell and another RS and/or SSB (burst) on the other activated serving cell in the same band, and
- These RSs are required to be transmitted in the same slot

Option 3 (new compromised option):

UE reports capability which indicates whether UE requires to receive another RS transmitted also on the other activated serving cell in the same band in the same slot.

Feedback Form 18: 2nd round comment collection for Issue 1-3

Item	Company	Comments
1	Ericsson GmbH, Eurolab	Support Option 1. Would like to avoid capability as it complicates network implementation.
2	Qualcomm Incorporated	If we follow the legacy principle, we support Option 2. On the other hand, since this is enhancement of SCell activation latency based on new reference signal (i.e. not SSB), Option 1 is also okay. With Option 1, DL T-put for other UEs on the other carriers in the same band can potentially get affected by the UE specific temp-RS transmitted on multiple carriers.
3	Qualcomm Incorporated	Correction: With Option 1, DL T-put for other UEs on the other carriers in the same band can potentially get affected by the UE specific temp-RS transmitted on multiple carriers.
4	Huawei Technologies France	We support option 1. As we discussed in first round, the limitation on transmission on the same slot restricts temporary RS within SMTC. Then SCell activation time is restricted by SSB which is similar as R15. the gain of reduction SCell activation delay will be highly limited. If companies insist option 2, option 3 can be acceptable as a compromised solution.
5	Apple GmbH	we support option 2 and disagree with option 1. we raised concern in the 1st but no response received yet.

2.4.2 Sub-topic 2: SCell being activated is unknown and belongs to FR1

Issue 2-3: when SCell is contiguous to an active serving cell in the same band (Intra-band continuous CA), how many temporary RS bursts are required for AGC?

Background: In the first round discussion, Issue 2-2 and partial issue 2-3 (for time/frequency tracking) have reached consensus.

Proposals:

Option1: Two temporary RS bursts are required.

Option 2: One temporary RS bursts are required.

Feedback Form 19: 2nd round comment collection for Issue 2-3

Item	Company	Comments
1	Qualcomm Incorporated	<p>Option 2 assuming 2 slots per burst. We believe 2 slot based AGC is possible because of the following reasons:</p> <ul style="list-style-type: none"> • If temp-RS is TRS based one, its BW will most likely be more than 2 times than SSB's, hence, a better performance than SSB based legacy one. • If we reserve 4 slots just for AGC, then in total 6 slots will be used for Temp-RS transmission and there are likely two more slots for AGC gap after the first 4 slots, hence, a longer delay. • If we consider TTD system, most likely we won't get 4 consecutive DL slots. This means there will be an additional delay because UE has to wait for 1-2 more temp-RS slots coming in the next DL pattern. • Considering temp-RS is UE specific, we should also minimize the required # of temp-RS slots to minimize T-put impact on other active UEs to whom the temp-RS will affect scheduling code rate. • Since here we already assume the max reception power difference between to-be-active SCell and contiguous serving cell is up to 6dB and this is kind of a new feature, we believe UE can and should do something better if it wants to enhance activation latency.
2	Huawei Technologies France	<p>Option1 Two temporary RS bursts. Firstly, In legacy SSB based AGC adjustment, 2 SSB burst is required for unknown case. Secondly, From time domain, for SSB based AGC setting, if all 4 SSB symbols are used, then total 8 symbols for AGC evaluation. While for TRS in option 2, only 4 symbols for AGC. From frequency domain, the bandwidth of TRS is the $\min\{52RB, BWP \text{ bandwidth}\}$. If the BWP is a small one, it is not always 2 times of SSB's. Moreover increasing bandwidth is not linear to AGC performance. To guarantee the AGC performance, option 1 is suggested.</p>

Issue 2-4: when SCell is non-contiguous to an active serving cell in the same band (Intra-band non-continuous CA), whether temporary RS can be used for AGC and/or time frequency tracking?

Proposals:

Option1: it is not a target scenario for temporary RS based SCell activation latency optimization.

Option 2: temporary RS can be used for time frequency tracking only

-(For AGC: UE performs AGC adjustment based on SSB rather than temporary RS).

-For time frequency tracking: UE can perform time-frequency tracking based on temporary RS.

Feedback Form 20: 2nd round comment collection for Issue 2-4

Item	Company	Comments
1	Ericsson GmbH, Eurolab	We think it is possible to use TRS for refinements of control loops, so that would correspond to Option 2. But we can further discuss whether it is a target scenario.
2	Qualcomm Incorporated	Option 1. The motivation of the whole work here is, in our understanding, to optimize SCell activation latency so that buffered data in serving cell or UE can be delivered to UE or serving cell as quickly as possible. When SCell is unknown, i.e. serving cell hasn't received UE measurement of the cell for a long time, we consider the cell was not a cell that was intended to be quickly enabled for time-sensitive traffic. Thus, we don't think it is a target scenario. Unknown SCell in intra-band contiguous CA scenario is to us an exceptional case because even without frequent measurement report network can roughly tell the SCell's quality.
3	Huawei Technologies France	We prefer option 2. There is use case that network is willing to activate the unknown SCell, for example due to sudden traffic load. In this case somehow using temporary RS based time-frequency tracking can reduce SCell activation delay. It is true that when UE can complete AGC+SSB detection is left to UE implementation. Some UEs are fast, maybe one or two SSB burst (s) is needed. While some are slow, maybe 3 SSB bursts are needed. A simple way is that network start to transmit temporary RS after first SSB. After UE completed cell search, temporary RS based fine timing tracking can be performed. With defining temporary RS based time-frequency tracking, the minimum requirement can be defined in RAN4 (3SSB for AGC and cell detection+1 TRS), in parallel, leave room to UE implementation.
4	Apple GmbH	prefer option 1. On one hand the gain from latency perspective would be quite limited, given that we still allow 3 SSB burst. On the other hand, there will be unnecessary waste of resource and interference to other UE, since NW may start to transmit T-RS after the first SSB but UE only use the third one.

Issue 2-5: If the answer to Issue 2-4 is “Yes or “Yes for partial cases”, how many temporary RS bursts are required?

Proposals:

- Option 1: One temporary RS burst is required for time-frequency tracking.

Feedback Form 21: 2nd round comment collection for Issue 2-5

Item	Company	Comments
1	Huawei Technologies France	option 1. One temporary RS burst is enough.

Issue 2-6: when SCell to be activated and active serving cell are in the different band (Inter-band CA), whether temporary RS can be used for AGC and/or time frequency tracking?

Proposals:

Option1: it is not a target scenario for temporary RS based SCell activation latency optimization.

Option 2: temporary RS can be used for time frequency tracking only

-(For AGC: UE performs AGC adjustment based on SSB rather than temporary RS).

-For time frequency tracking: UE can perform time-frequency tracking based on temporary RS.

Feedback Form 22: 2nd round comment collection for Issue 2-6

Item	Company	Comments
1	Ericsson GmbH, Eurolab	We think it is possible to use TRS for refinements of control loops, so that would correspond to Option 2. But we can further discuss whether it is a target scenario.
2	Qualcomm Incorporated	Option 1. The same reason as Issue 2-4.
3	Huawei Technologies France	Option 2. Same comments as Issue 2-4.
4	Apple GmbH	option 1. same comment as the under 2-4

Issue 2-7: If the answer to Issue 2-6 is “Yes or “Yes for partial cases”, how many temporary RS bursts are required?

Proposals:

- Option 1: One temporary RS burst is required for time-frequency tracking.

Feedback Form 23: 2nd round comment collection for Issue 2-7

Item	Company	Comments
1	Huawei Technologies France	Option 1. One temporary RS burst is enough.

2.4.3 Sub-topic 3: SCell to be activated belongs to FR2

Issue 3-1: If there is at least one active serving cell on that FR2 band and temporary RS for the target SCell is provided, no matter whether the SCell to be activated is known or unknown, how many temporary RS bursts are required for time/ frequency tracking?

Proposals:

- Option 1: 1 burst is required based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798 (“1-slot with two CSI-RSs resources (2 samples)” or “2-slot with four CSI-RSs resources (4 samples)” for FR2).
- Option 2: 1 burst is required (2-slot with four CSI-RSs resources (4 samples))

Feedback Form 24: 2nd round comment collection for Issue 3-1

Item	Company	Comments
1	Qualcomm Incorporated	Option 2. the number of slots for the temporary RS transmission for time/frequency tracking should be the same as that for FR1, i.e. 2-slot with four CSI-RS resources, because there is technically no reason to have different values depending on frequency range for the same digital signal processing.
2	Huawei Technologies France	Prefer Option 2. Qualcomm comments make sense. 2 slots (with four CSI-RSs resources (4 samples)) can guarantee better Doppler tracking performance. Moreover 1 set of RS configuration can simplify implementation.
3	Apple GmbH	option 2.

Issue 3-2: If there is no active serving cell on that FR2 band, and the SCell to be activated is known to UE, how many temporary RS bursts are required for time/frequency tracking?

Proposals:

- Option 1: 1 burst is required based on RAN1 working assumptions on temporary RS design provided in the LS R1-2009798 (“1-slot with two CSI-RSs resources (2 samples)” or “2-slot with four CSI-RSs resources (4 samples)” for FR2).
- Option 2: 1 burst is required (2-slot with four CSI-RSs resources (4 samples))

Feedback Form 25: 2nd round comment collection for Issue 3-2

Item	Company	Comments
1	Qualcomm Incorporated	Option 2. The same comment as Issue 3-1.
2	Huawei Technologies France	Prefer Option 2. 2 slots (with four CSI-RSs resources (4 samples)) can guarantee better Doppler tracking performance. Moreover 1 set of RS configuration can simplify implementation.
3	Apple GmbH	option 2. same comment as above.

Issue 3-4: If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, whether temporary RS can be used for time-frequency tracking?

Background: In the first round discussin, Issue 3-3 has reached consensus that If there is no active serving cell on that FR2 band and the SCell being activated is unknown to UE, temporary RS can not be used for AGC.

Proposals:

Option1: Yes

Option 2: No

**Feedback Form 26: 2nd round comment collection for
Issue 3-4**

Item	Company	Comments
1	Ericsson GmbH, Eurolab	Technically TRS can be used for time tracking, but it is not very efficient since there would be an uncertainty on when the UE is ready to receive/make use of the TRS. This due to beam sweeping etc for the cell detection. So therefore we support "No" i.e. Option 2.
2	Qualcomm Incorporated	We don't think this is a target scenario for temporary RS based SCell activation latency optimization. The reason is provided previously.
3	Huawei Technologies France	Technically after AGC adjustment, cell detection, L1-RSRP measurement and reporting, the best RX beam is determined. Afterwards fine timing doesn't need RX beam sweeping. As the coarse timing is acquired through cell detection, the temporary RS can be correctly detected. Then temporary RS based time/frequency tracking can be performed. However to proceed the progress, we can agree with option2. As beam sweeping is performed for AGC, cell detection, L1-RSRP, a long time is consumed. Then the gain from using temporary RS for time-frequency tracking is not outstanding.

Issue 3-5: If the answer to Issue 3-4 is Yes, how many temporary RS bursts are required for time-frequency tracking?

Proposals:

- Option 1: One temporary RS burst is required for time-frequency tracking.

**Feedback Form 27: 2nd round comment collection for
Issue 3-5**

Item	Company	Comments
1	Qualcomm Incorporated	The same comment as Issue 3-4.
2	Huawei Technologies France	As comment in Issue 3-4, we can agree that temporary RS is not applied for time-frequency tracking in this case.

2.4.4 Sub-topic 4: Other information informed to RAN1

Issue 4-1: Other information need to inform RAN1

Proposals:

- Option 1: Inform RAN1 that the dominate term in the activation time for unknown cell cases is the cell search time

- Option 2: No need to inform RAN1

Feedback Form 28: 2nd round comment collection for Issue 4-1

Item	Com-pany	Comments
1	Qual-comm Incorporated	Option 2.
2	Huawei Technologies France	Option 2

3 Recommendations for Tdocs

3.1 1st round

New tdocs

Table 2:

Title	Source	Comments
WF on Temporary RS for efficient SCell activation	Huawei, HiSilicon	
Reply LS on temporary RS for efficient SCell activation in NR CA	Huawei, HiSilicon	

Feedback Form 29: Comments for New tdocs

Item	Com-pany	Comments

3.2 2nd round

R4-2105798 WF on Temporary RS for efficient SCell activation Agreeable

R4-2105799 Reply LS on temporary RS for efficient SCell activation in NR CA Agreeable