**3GPP TSG-RAN WG1 Meeting #109-e R1-2205256**

**e-Meeting, May 9th – 20th, 2022**

**Agenda Item: 8.5.2**

**Source: Moderator (Huawei)**

**Title: Summary #2 of [109-e-R17-ePos-05] on latency improvements and RRC\_INACTIVE**

**Document for: Discussion and decision**

# Introduction

In RAN1#109-e, the following papers provided input on maintenance of latency improvements for DL and DL+UL methods and positioning for UE in RRC\_INACTIVE.

1. R1-2203176 Maintenance of Other NR positioning enhancements Nokia, Nokia Shanghai Bell
2. R1-2203437 Maintenance on latency reduction for NR positioning CATT
3. R1-2203516 Discussion on other maintenance issues on NR positioning enhancements vivo
4. R1-2203620 Remaining issues other than accuracy improvement for Rel-17 Positioning ZTE
5. R1-2203786 Remaining issues on PRS collision detection xiaomi
6. R1-2203865 Maintenance on latency and efficiency improvement related enhancement Samsung
7. R1-2203961 Maintenance of Rel-17 Positioning enhancement other than accuracy enhancement OPPO
8. R1-2204128 Remaining issues for NR positioning InterDigital, Inc.
9. R1-2204276 Remaining issues on latency improvements CMCC
10. R1-2204522 Discussion on maintenance for NR positioning other enhancements LG Electronics
11. R1-2204903 Maintenance of Rel-17 positioning latency and efficiency improvements Huawei, HiSilicon
12. R1-2204942 Maintenance of accuracy improvements for NR positioning enhancements Ericsson
13. R1-2204986 Maintenance on Other Issues in NR Positioning Enhancements Qualcomm Incorporated

The following t-docs are the incoming LSs under agenda item, which are related to latency improvements and RRC\_INACTIVE state positioning.

1. R1-2203022 LS on lower Rx beam sweeping factor for latency improvement RAN4, Intel
2. R1-2203023 LS reply on condition of PRS measurement outside MG RAN4, vivo
3. R1-2203026 On applicable number of PFL for the gapless PRS measurement RAN4, Ericsson
4. R1-2203028 Reply LS on latency improvement for PRS measurement with MG RAN4, Huawei

The following t-docs are submitted under agenda item 5, which are related to the above incoming LSs.

***Related to R1-2203022***

1. R1-2203406 Discussion on lower Rx beam sweeping factor for latency improvement CATT
2. R1-2203407 Draft reply LS on lower Rx beam sweeping factor for latency improvement CATT
3. R1-2203489 Draft Reply LS on lower Rx beam sweeping factor for latency improvement vivo
4. R1-2203616 Draft reply LS on lower Rx beam sweeping factor ZTE
5. R1-2203964 Discussion on LS on lower Rx beam sweeping factor for latency improvement OPPO
6. R1-2204923 Discussion on lower Rx beam sweeping factor Huawei, HiSilicon

***Related to R1-2203026***

1. R1-2203410 Discussion on applicable number of PFL for the gapless PRS measurement CATT
2. R1-2203411 Draft reply LS on applicable number of PFL for the gapless PRS measurement CATT
3. R1-2203490 Draft Reply LS on applicable number of PFL for the gapless PRS measurement vivo
4. R1-2203617 Draft reply LS on applicable number of PFL for the gapless PRS measurement ZTE
5. R1-2203847 Draft reply on applicable number of PFL for the gapless PRS measurement Samsung
6. R1-2204925 Discussion on applicable number of PFLs for the gap-less PRS measurement Huawei, HiSilicon

This paper provides the moderator summary of solutions to improve positioning latency for DL and DL+UL methods and positioning for UEs in RRC\_INACTIVE, subject to the following email discussion.

[109-e-R17-ePos-05] Email discussion under 8.5.2 for maintenance on latency improvements for both DL and DL+UL positioning methods for issues 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12, 5-18 and 6-4 in R1-2205097, and on positioning for UEs in RRC\_ INACTIVE for issues 6-1, 6-2, 6-3, 6-6, 6-7, 6-9 in R1-2205097, including discussion on LSs in R1-2203022 R1-2203023 R1-2203026 R1-2203028 – Su (Huawei)

* 1st check point: May 13 (any RRC impact by May 12)
* Final check point: May 18

# Latency improvements

## (Issue 5-1) PRS-data collision detection timeline

This corresponds to Issue 5-1 of R1-2205097.

|  |  |
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| **Company** | **Proposals** |
| Nokia, NSB [1] | **Proposal 4**: Add a buffer between the PDCCH and PRS in some cases of UE measurement of PRS outside the MG (e.g., for capability 2, state 2 of option 2 priority).  **Proposal 5**: Within the PRS processing window, UE follows configured TCI in a CORESET providing QCL type-D in a potential PDSCH region (during *N* symbols (e.g., *timeDurationForQCL)* from the last symbol of PDCCH) for the PRS measurement outside the MG at least for state 2 of option 2 of capability 2. |
| vivo [3] | **Proposal 5**   * The corresponding DCI for [other DL signals or channels except SSB] within the DL PRS processing window is not later than [T] before the start of the PRS processing window if [other DL signals or channels except SSB] is dynamic scheduling of DL channel/signal(s). * Adopt the following text proposals into TS 38.214 for the conditions for the dynamic scheduling timeline of DL channel/signal(s).  |  | | --- | | < Unchanged parts are omitted >  When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-1A] and if the DL PRS is determined to be higher priority than the DL signals and channels inside the PRS processing window, those DL signals and channels are not expected to be measured by the UE, and if the [other DL signals or channels except SSB] is dynamic scheduling of DL channel/signal(s), the corresponding DCI for the [other DL signals or channels except SSB] is not later than [T] before the start of the PRS processing window. When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-1B] and if the DL PRS is determined to be higher priority than the DL signals and channels inside the PRS processing window, those DL signals and channels in the same band as the DL PRS are not expected to be measured by the UE, and if the [other DL signals or channels except SSB] is dynamic scheduling of DL channel/signal(s), the corresponding DCI for the [other DL signals or channels except SSB] is not later than [T] before the start of the PRS processing window. When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-2] if the DL PRS is determined to be higher priority than the DL signals and channels inside the PRS processing window, those DL signals and channels from the impacted serving cells are not expected to be measured by the UE on the overlapped symbols with the DL PRS, where impacted serving cells refer to the serving cell on which the [*PRSProcessingWindow*] is configured for a frequency range 1 band, and all the serving cells in the same band as the DL PRS for a frequency range 2 band.  < Unchanged parts are omitted > | |
| Xiaomi [5] | **Proposal 1:** The PRS collision detection timeline/condition will be defined at least for the case when PRS is lower priority than the dynamically scheduled DL signals/channels, which is applicable for all PRS processing window types (1A, 1B, 2). |
| Samsung [6] | **Proposal 3:** Adopt following collision handling between PRS and other DL signals/channels .   |  |  |  | | --- | --- | --- | | PRS priority state | Collision handling vs other DL signals in the window (type 1A/1B) and overlapped part (type 2) | X factor | | high priority | For all non-first activated PPW, PRS is received over all semi-static other DL signals except SSB;  For the first activated PPW,  if UE could determine that it expects to receive other DL signals before a N time units earlier than the start of the first activated PPW, UE expects to receive PRS and **may receive the other DL signals subject to its capability**  if UE could NOT determine that it expects to receive other DL signals before a N time units earlier than the start of the first activated PPW, UE expects to receive PRS and **drop the other DL signals;** | The PPW is activated by MAC CE (which is carried by DCI/scheduled PDSCH); so if UE cannot determine the PRS has to be received before it starts its procedure for receiving the other DL signal, then such (partial) reception of other DL signals should be allowed even the PRS reception should always be prioritized; | | Low priority | For an activated PPW,  If UE could determine that it expects to receive other DL signals before a N time units earlier than the start of the first PRS, UE expects to receive **other DL signals** and **drop the PRS;**  If UE could NOT determine that it expects to receive other DL signals before a N time units earlier than the start of the first PRS, UE expects to receive **other DL signals** and **may receive the PRS subject to its capability;** | When PRS is low priority, the first thing is the DL signals are always prioritized; and the PRS could be allowed to be received if UE cannot determine it should do the DL signal reception early enough, then the PRS reception could be allowed. | |
| IDC [8] | **Proposal 1 :** PDCCH/PDSCH will be dropped inside the PRS processing window if the corresponding scheduling DCI does not come within N2 symbols before the start of the PRS processing window |
| CMCC [9] | **Proposal 1:** Support to define the collision detection timeline for the case when PRS has lower priority than the data.  **Proposal 2:** The collision detection timeline is appliable to the dynamically scheduled signals/channels, and to the activation/deactivation of the semi-persistent/configured grant signals/channels.  **Proposal 3:** The collision detection timeline is defined for all PRS processing window capability type (1A, 1B, 2). |
| Huawei, HiSilicon [11] | **Proposal 1:** Define the PRS collision detection timeline for the case when PRS may be lower priority than the dynamically scheduled DL traffic, which is applicable to all PRS processing window types (1A, 1B, 2).   * The first PDSCH for SPS is considered as dynamically scheduled DL traffic.   **Proposal 2:** Agree with the following UE behaviour for both high priority PRS and low priority PRS.   * UE declares a duration Tdetection per band in the capability signaling for detecting the collision between PRS and higher priority DL signals/channels.  |  |  |  | | --- | --- | --- | |  | Case 1: PRS measurement is of higher priority | Case 2: PRS measurement is of lower priority | | 1A | UE is not expected to receive the DL signals and channels within the PRS processing window on all serving cells including SCG. | The UE is not expected to receive the scheduled DL signals/channels in the PRS processing window on all serving cells including SCG, if the corresponding DCI is later than Tdetection before the start of the PRS processing window and there are no DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with the scheduling DCI earlier than Tdetection before the start of the PRS processing window on any serving cell including SCG;  The UE is not expected to receive the DL PRS within the PRS processing window if there are DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with the scheduling DCI earlier than Tdetection on any serving cell including SCG. | | 1B | UE is not expected to receive the DL signals/channels within a PRS processing window on the serving cells in the same band as the DL PRS. | The UE is not expected to receive the scheduled DL signals/channels in the PRS processing window on the serving cells in the same band as the DL PRS, if the corresponding DCI is later than Tdetection before the start of the PRS processing window and there are no DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with DCI earlier than Tdetection before the start of the PRS processing window on serving cells in the same band as the DL PRS;  The UE is not expected to receive the DL PRS within the PRS processing window if there are DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with the scheduling DCI earlier than Tdetection before the start of the PRS processing window on any serving cell in the band as the DL PRS. | | 2 | UE is not expected to receive any DL signals/channels on a DL PRS symbol within the PRS processing window on the impacted serving cells | The UE is not expected to receive the scheduled DL signals/channels on the DL PRS symbol on the impacted serving cells, if the corresponding DCI is later than a threshold before the symbol and there are no DL signals/channels configured on the symbol on the impacted serving cells;  The UE is not expected to receive the DL PRS on the symbol within the PRS processing window if there are DL signals/channels configured on the symbol or scheduled on the symbol with the scheduling DCI earlier than Tdetection before the symbol on the impacted serving cells. |   **Proposal 3:** Endorse the following TP to TS 38.214.   * Reason of change: The current description is not complete in terms of describing the UE behaviour to handle the collision between PRS of low priority and communication signals/channels of high priority. * Summary of change: Add UE behaviour to handle the low priority PRS, including the collision detection timeline. * Consequences if not approved: The UE behaviour for receiving PRS of low priority is not specified.   **====================** Start of the TP **====================**  When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-1A]  - if the DL PRS is determined to be higher priority than the DL signals and channels, the UE is not expected to receive the DL signals and channels within the PRS processing window on all serving cells including SCG;  - if the DL PRS is determined to be lower priority than the DL signals and channels  - the UE is not expected to receive the scheduled DL signals/channels in the PRS processing window on all serving cells including SCG, if the corresponding DCI is later than [*detectionTime]* before the start of the PRS processing window and there are no DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with the scheduling DCI earlier than [*detectionTime*] before the start of the PRS processing window on any serving cell including SCG;  - the UE is not expected to receive the DL PRS within the PRS processing window if there are DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with the scheduling DCI earlier than [*detectionTime*] before the start of the PRS processing window on any serving cell including SCG.  When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-1B]  - if the DL PRS is determined to be higher priority than the DL signals and channels, the UE is not expected to receive the DL signals/channels within a PRS processing window on the serving cells in the same band as the DL PRS;  - if the DL PRS is determined to be lower priority than the DL signals and channels  - the UE is not expected to receive the scheduled DL signals/channels in the PRS processing window on the serving cells in the same band as the DL PRS, if the corresponding DCI is later than [*detectionTime*] before the start of the PRS processing window and there are no DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with DCI earlier than [*detectionTime*] before the start of the PRS processing window on serving cells in the same band as the DL PRS;  - the UE is not expected to receive the DL PRS within the PRS processing window if there are DL signals/channels configured during the PRS processing window or scheduled during the PRS processing window with the scheduling DCI earlier than [*detectionTime*] before the start of the PRS processing window on any serving cell in the band as the DL PRS.  When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-2]  - if the DL PRS is determined to be higher priority than the DL signals and channels, the UE is not expected to receive any DL signals/channels on a DL PRS symbol within the PRS processing window on the impacted serving cells;  - if the DL PRS is lower priority than the DL signals and channels  - the UE is not expected to receive the scheduled DL signals/channels on the DL PRS symbol on the impacted serving cells, if the corresponding DCI is later than [*detectionTime*] before the symbol and there are no DL signals/channels configured on the symbol on the impacted serving cells;  - the UE is not expected to receive the DL PRS on the symbol within the PRS processing window if there are DL signals/channels configured on the symbol or scheduled on the symbol with the scheduling DCI earlier than [*detectionTime*] before the symbol on the impacted serving cells;  - the impacted serving cells refer to the serving cell on which the [*PRSProcessingWindow*] is configured for a frequency range 1 band, and all the serving cells in the same band as the DL PRS for a frequency range 2 band.  **====================** End of the TP **====================** |
| Qualcomm [13] | **Proposal 3:** For an activated PRS processing window starting in symbol of carrier and a conflicting transmission in carrier starting in symbol, the UE shall apply the prioritization / dropping between the PRS and the conflict transmission taking into account:   * DCI(s) for which the time interval between the last symbol of PDCCH and is at leastsymbols, and the time interval between the last symbol of PDCCH and is at least symbols,   wherein the time interval unit of OFDM symbol is counted based on the smaller subcarrier spacing across and the corresponding scheduling cell of  **Proposal 4:** For an activated PRS processing window starting in symbol of carrier and a conflicting transmission in carrier starting in symbol, the UE shall apply the prioritization / dropping between the PRS and the conflict transmission taking into account:   * DL channels & signals considered active at least before and at least symbols before ,   wherein the time interval unit of OFDM symbol is counted based on the smaller subcarrier spacing across and the corresponding scheduling cell of . |

**FL comments**

All companies contributing to this issue tend to agree to introduce this detection timeline.

* Nokia [1] described it as a buffer between PDCCH and PRS, and propose to reuse the default Rx beam after the PDCCH.
* vivo [2] proposed that the DCI should be no later than T before the start of the PRS processing window. vivo also provided a TP.
* Xiaomi [5] proposed to define the timeline for PRS being lower priority than dynamic scheduled DL signals/channels.
* Samsung [6] proposed to specify the moment that UE does the determination of potential collision. In addition, Samsung also provided views on special handling of the first activated PPW, and opportunistic reception of PRS with low priority.
* IDC [8] proposed that PDCCH/PDSCH should be dropped inside PRS processing window if the corresponding scheduling DCI comes too late.
* CMCC [9] proposed to define the collision detection timeline for PRS being lower priority than dynamic scheduled DL signals/channels and activation/deactivation of the semi-persistent/CG signals/channels.
* Huawei [11] proposed to define the collision detection timeline for PRS being lower priority than dynamic scheduled DL signals/channels and clarified that first SPS-PDSCH is considered as dynamic scheduled DL traffic. Huawei also provided a table on defining the UE behaviour considering the collision detection timeline for PRS being low priority and high priority for three types of PRS processing window, and provided a TP capture the table into specification.
* Qualcomm [13] proposed to take into account the collision between PRS and dynamic DL signals/channels so that at least the corresponding DCI is N2 symbol head of both PRS and DL signals/channels. In addition, for semi-persistent and dynamic DL signals/channels, the head and tail effect should be considered as well.

At least a common aspect that is identified among the companies is the necessity to handle the collision detection timeline between low priority PRS and high priority dynamic scheduled DL signals/channels.

### Round 1

The TP can be discussed when the functionality is agreed.

**Proposal 2.1.1-1**

The PRS collision detection timeline for the case when PRS is lower priority than the DL signals/channels is define as following.

* For a type 1A and type 1B PRS processing window
  + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channel and drop the PPW.
  + .If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL PRS in the PPW and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the start of the PPW.
* For a type 2 PRS processing window
  + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol at [N symbol/T ms] before the PRS symbol, UE expects to receive the DL signals/channels and drop the PRS symbol.
  + If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol at [N symbol/T ms] before the PRS symbol, UE expects to receive the PRS symbol and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the PRS symbol.

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Generally in an agreeable direction for us / some comments | Even though I think the Moderator’s intentions make sense, I think the wording is still not fully clear to me. First, a simple clarification is to say that this is for “activated” PRS processing window. Second, I don’t understand why it appears as if the “2nd bullet” has 2 cases bundled together (case 1, case 2):   * + If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL PRS in the PPW and may drop DL signals/channels scheduled during the PRS processing window with the corresponding scheduling DCI later than [N symbol/T ms] before the start of the PPW.   Wouldn’t it be cleaner if we write it in 3 subbulets, or is there something that I am missing:   * For a type 1A and type 1B activated PRS processing window   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channel and drop the PPW.   + If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL PRS in the PPW .   + UE may drop DL signals/channels scheduled during the PRS processing window with the corresponding scheduling DCI later than [N symbol/T ms] before the start of the PPW. |
| Nokia/NSB | Yes | In generally we agree with the proposal. The QC version is also okay to us. |
| ZTE | Yes in principle | Generally, we agree QC’s views. However, in case when UE determines the absence of other DL signals in the PPW, we think UE just need to drop DL signals during the PPW. It is not reasonable to further drop the DCI later than N symbol and before the PPW. That is because a DCI may be used to schedule multiple instances of PDSCH as shown in the following figure where we think it is sufficient to only drop PDSCH1.    Based on QC’s revision, we prefer to further revise as follows   * For a type 1A and type 1B activated PRS processing window   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channel and drop the PPW.   + If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL PRS in the PPW .     - UE may drop DL signals/channels during the PRS processing window ~~with the corresponding scheduling DCI later than [N symbol/T ms] before the start of the PPW~~. |
| Xiaomi | Yes | We support the proposal and QC’s version. From our understanding, “with the scheduling DCI later than [N symbol/T ms] before the start of the PPW” does not mean to drop the DCI, it means to drop the DL signals/channels scheduled by the DCI later than [N symbol/T ms] before the start of the PPW. In order to avoid the misunderstaning, it can be revised to  UE may drop DL signals/channels scheduled during the PRS processing window ~~with the corresponding scheduling~~ and scheduled by the DCI later than [N symbol/T ms] before the start of the PPW. |
| vivo |  | We are generally okay with the intention, and think bullet 2 can align with bullet 1, So, we prefer to further revise as follows   * + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW at [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channel and drop the PPW,   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than [N symbol/T ms] before the start of the PPW, UE may drop the DL signals/channels during the PRS processing window |
| Samsung |  | Thx FL for the proposal. We share some intentions of it, and some comments as following:  In first sub-bullet, “drop the PPW” is not correct, the PPW is anyway activated, only the PRS reception is dropped. Suggested to change to “drop the PRS reception in the PPW” ;  In second sub-bullet, the timeline detection is fine, but the UE behaviour is not fine to us. Since the PRS is low priority, DL signals should always be expected to be received, even though considering dropping PRS operation is some small time needed (which takes into account in N). and PRS reception in this case, may be allowed, subject to UE itself. We are aware of that many companies wants to drop DL and expect to PRS instead. We think this is contradictory to the intention of setting PRS to be low priority. Pls see the suggested change.  We agree Vivo’s suggested change, which makes sense. Pls see the suggested change.   * For a type 1A and type 1B PRS processing window   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channel and drop PRS reception in the PPW.   + .If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE expects to receive the other DL signals/channels except SSB of higher priority and may receive the DL PRS in the PPW ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the start of the PPW.~~ * For a type 2 PRS processing window   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE expects to receive the DL signals/channels and drop the PRS symbol.   + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE expects to receive the other DL signals/channels except SSB of higher priority and may receive the PRS symbol ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the PRS symbol~~. |
| Qualcomm |  | To Samsung:  Unfortunately we don’t agree with the changes and their motivation. The spec writes the minimum UE expectations and the expectation is that the UE will not do the data processing if that is determined “too late”. Whether, some UE, depending on the other workload, CA configuration, etc, might try to partially do some of the processing, can be always left up to UE implementation.  Even in NR Rel-16, we say that PRS is only being processed within MG, but, a UE may attempt to do some processing outside MG also. There are many such occasions actually of similar spec language. In any of the dropping rules that the spec defines, one could argue that some UE may be able to not perform the dropping. To the extreme, if we go with Samsung’s logic, a UE can already by Full Duplex by implementation, and there is no need to drop UL channels if they collide with DL channels, however the spec writes a “specified behavior” that the UE is expected to drop one of the channels. In a similar logic, when a UE reports a max PRS/CSIRS/TRS processing, there can be scenarios, that a UE may be able to do more than what “is the reported as maximum”, but we don’t write in the spec: “Nominally this is the maximum capability, but maybe a UE may be able to do more”. There are so many cases like that.  The typical UE behavior with regards to 3GPP based Priority timelines is that   * if the UE determines “too late” that a dynamically-triggered high priority procedure/signal/channel collides with a semi-static low-priority procedure/channel/signal, then the UE “cannot apply the specified prioritization”, or in other words, the UE is expected to perform actions according to the semi-static low-prirotiy procedure/channel/signal.   This rule does not violate the fact that the dynamically-trigerred high priority procedure/signal/channel is high priority. It just says to the network what to minimally expect from a UE.  The above basic rule translates in our case to: UE may drop DL signals/channels scheduled during the PRS processing window with the corresponding scheduling DCI later than [N symbol/T ms] before the start of the PPW.  Please also note that in the above sentence, we say “UE may drop”. So, some UE may do its magic, and may not drop the DL signal/channel. However, the specified behavior should be that it is allowed to drop the channel even if it is high priority, when the UE learns about this high priority channel too late. |
| Qualcomm2 |  | Notice that I didn’t comment with the ZTE’s concern.  We agree with ZTE’s view that PDSCH2 should *not* be dropped. But we think that this is what the sentence currently says in the formulation (3 subbullets) that I suggested above:   * UE may drop DL signals/channels scheduled during the PRS processing window with the corresponding scheduling DCI later than [N symbol/T ms] before the start of the PPW   The UE drops the DL signal if both conditions are satisfied: the DL signal overlaps with the PPW AND the DCI is received too late. If we remove the 2nd condition, the sentence doesn’t make sense anymore.  Maybe the initial proposal from the FL, that had the sentence  “drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the start of the PPW. “  Connected with the 2nd bullet, appeared as if to suggest that the PDSCH2 will be dropped, if the DCI is received “too late” with respect to the PPW, independent of whether there is collision with the PPW. We are not sure if the FL’s intention is indeed this interpretation, but we think that this is too conservative and doesn’t seem necessary to us. |

**Proposal 2.1.1-2**

RAN1 to discuss whether special handling of the first instances of PPW after activation is defined.

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm |  | More motivation is needed why the “first instances” are different. Could it be clarified further? |
| ZTE |  | Same question as QC |
| vivo |  | No |
| Huawei, HiSilicon |  | We think that the first instance may consider the MAC CE activation delay, but in general, this is triival. |
| Samsung |  | First instance is not very clear. HW makes clear understanding that, this is the actually the first activated PPW considering the MAC CE activation delay, which is similar to what we are discussing in first proposal. The difference is, this impacts the first activated PPW, and the first proposal impacts possible every activated PPW. But the issue itself is same. Thus, we think it worthy discussing it. |

**Proposal 2.1.1-3**

RAN1 to discuss whether how semi-persistent or periodic data is handled.

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| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes | In other scenarios, such scenarios were also clarified. It is generally not a difficult case, to just reuse the word: “considered active” as was done in other similar cases. |
| ZTE | Yes |  |
| Xiaomi | Yes |  |
| vivo |  | Based on the FL version, “determines the presence of other DL signals/channels except SSB…” already covered all type data. |
| Samsung |  | Share the view as vivo, and that’s also the reason why we suggested to remove the “scheduling DCI part” in the first proposal. |

**Proposal 2.1.1-4**

RAN1 to discuss whether special handling of the Rx beam considering the default TCI state for PDSCH in a slot is defined.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm |  | Unclear to us whether this is needed |
| Nokia/NSB | Yes | We need to discuss this issue. If PRS is configured on the symbols right after PDCCH, the UE does not know if there is PDSCH or not (we could consider it as potential PDSCH region) and usually the UE should try to buffer it until it decodes DCI clearly. For the configured PRS resources in this potential PDSCH region, it is unclear for UE to determine Rx beam, which could be from QCL type-D of PRS resource or could be appropriate beam for buffering potential PDSCH. |
| ZTE | No | Based on the proposal 2.1.1-1, the timeline will be clear. One of PRS and PDSCH will be dropped. Then, there is no such issue. For the remaining one which is not dropped, the beam will follow the legacy behaviour. |
| Vivo | No | Same view as ZTE, the value of [N symbol/T ms] can consider the issue to define. |
| Huawei, HiSilicon | No | Reply to Nokia, we think that having larger [N symbol/T ms] than the *timeDurationForQCL* would avoid the ambiguity. We think [N symbol/T ms] should typically be larger than *timeDurationForQCL*. |
| Samsung | No | Share the view as ZTE. |
| Nokia/NSB |  | To ZTE: we are confused about the comment. Is gNB restricted to schedule PDSCH right after PDCCH in type 2 window? We think that by the time the UE determines the presence or absence of PDSCH in type 2 window, the UE needs to buffer potential PDSCH |

**FL comments**

On proposal 2.1.1-1, at least for the case of the first sub-subbullet, there seems to be some common ground. For the second sublet, Qualcomm etc insist that data may be dropped, while Samsung prefer to mandate data reception and PRS may or may not dropped is subject to UE capability. The proposal can be drafted based on the joint version from Qualcomm and Samsung.

On proposal 2.1.1-2, as Qualcomm suggested, we may also use “considered active” for the PPW.

On proposal 2.1.1-3, as Qualcomm suggested, we may use “considered active” to overcome this, but my feeling is that “presence/absence” is somehow equivalent. vivo and Samsung also think the current statement already covered the semi-persistent and periodic traffic. My suggestion is not to change it.

On proposal 2.1.1-4, there was no consensus, and understanding from FL is that this may be needed if the timeDurationForQCL is longer than the [T ms/N ms]. Maybe it is better to further discuss it.

### Round 2

### Proposal 2.1.2-1

The PRS collision detection timeline for the case when PRS is lower priority than the DL signals/channels is define as following.

* For an activated type 1A and type 1B PRS processing window
  + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channels and drop the DL PRS in the PPW.
* For an activated type 2 PRS processing window
  + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE expects to receive the DL signals/channels and drop the PRS symbol.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | Basically Yes, assuming some typo? | Wording change:  The PRS collision detection timeline for the case when PRS is lower priority than the DL signals/channels is define as following.   * For a active type 1A and type 1B PRS processing window ~~considered active~~   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE expects to receive the DL signals/channels and drop the PRS symbol ~~the DL PRS in the PPW~~. * For a active type 2 PRS processing window ~~considered active~~   + If UE determines the presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than ~~at~~ [N symbol/T ms] before the PRS symbol in the PPW, UE expects to receive the DL signals/channels and drop the PRS symbol. |
| FL |  | Yes. That was a typo. Thanks for pointing out.  Corrected as above. I also changed “active” to “activated”.  No need to worry about the terminology alignment, e.g. “activated” v.s. “considered active”; they will be aligned if we can agree to them in principle. |
| Xiaomi | Yes |  |
| ZTE | Yes | Agree the FL update proposal |
| Ericsson | Yes | Ok with FL’s updated proposal |
| Qualcomm | Yes | Agree with FL version, but not Samsung version. Samsung version says that only the PRS symbol is dropped. We think the whole PRS inside the PPW should be dropped. Which “PRS symbol” is dropped?  For Type 2, we think the PRS resource should be dropped, and not do “partial PRS resource dropping”. E.g. imagine a N-symbol PRS resource, wherein the first X symbols are too close to the scheduling DCI, but the rest N-X are far away, are we saying that the UE will measure the first X symbols, and drop the remaining N-X? I think we can just say that the UE will “drop the corresponding PRS resource”. |
| Huawei, HiSilicon | Yes | We are fine with dropping the entire resource as suggested by Qualcomm for type 2. Honestly this could be further checked by RAN4 on how to count the effective samples, and how to define the performance requirement when such dropping happens. |

### Proposal 2.1.2-2

The PRS collision detection timeline for the case when PRS is lower priority than the DL signals/channels is define as following. (To select from one of the alternatives)

**Alt.1**

* For a type 1A and type 1B PRS processing window considered active
  + If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS in the PPW no later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE expects to receive the DL PRS in the PPW.
  + UE may drop DL signals/channels scheduled during the PPW with the corresponding scheduling DCI later than [N symbol/T ms] before the start of the PPW.
* For a type 2 PRS processing window considered active
  + If UE determines the absence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol no later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE expects to receive the DL PRS in the PPW.
  + UE may drop DL signals/channels scheduled on a PRS symbol during the PPW with the corresponding scheduling DCI later than [N symbol/T ms] before the PRS symbol.

**Alt.2**

* For a type 1A and type 1B PRS processing window considered active
  + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE expects to receive the other DL signals/channels except SSB of higher priority and may receive the DL PRS in the PPW ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the start of the PPW.~~
* For a type 2 PRS processing window considered active
  + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE expects to receive the other DL signals/channels except SSB of higher priority and may receive the PRS symbol ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the PRS symbol~~.

|  |  |  |
| --- | --- | --- |
| **Company** | **Alt.1/Alt.2** | **Comments** |
| Samsung | Alt.2 | To QC, we are aware of the logic of defining counter-behaviour towards its original priority state, but we did not feel it’s suitable to do it here. Now let’s summary:  The cause is same: the DL data comes relatively too late;  The exceptional behaviour as in the alternatives:  Alt.1: Receive PRS, drop DL data. This counters the nature of DL data to be high priority but maintain the type1A/1B to handle one type of signal;  Alt.2: receive DL data, may allow PRS reception. This counters the nature of type1A/1B to handle one type of signal, but maintain the DL data to be high priority.  We choose alt.2, why?  We think the whole priority thing is about to allow non-PRS signals, otherwise, for latency perspective, always high priority for PRS is enough; so the vital basis for the design, there will be some DL signals more important than the PRS;  The alt.1 will ask UE to drop all possible DL data in the PPW even data is not overlapped with PRS, which is too much.  **Making a counter-behaviour towards its original priority state is risky, since other WG has also defined some other behaviour/rules according to the priority states, which they expect the normal behaviour towards its original priority state**, let me give two examples as following. If companies really wanted this, the alt.1 is better to make the PRS to be considered as high priority under the condition the DL signals comes later in type1a/1b;  **In RAN4 38.133 h50 9.5.1.2**  The requirements for RSTD, PRS-RSRP, UE Rx-Tx time difference, and PRS-RSRPP measurement without measurement gaps specified in clauses 9.9.2.~~6~~7, 9.9.3.6, 9.9.4.6 and 9.9.x1.6 shall apply provided that:  UE is configured with PPW,  No active BWP switching occurs during PPW,  PRS is within PPW and do not overlap with other signals/channels of higher priority,  Receive timing difference between the serving cell and a neighbor cell PRS ≤ Threshold; Threshold = {CP length, 0.5 slot}, other options are not precluded,  SCS of PRS within PPW and SCS of DL active BWP are the same.  **In RAN2 38.321 H00,** Handling of PRS Processing Window When PPW is activated and PRS has higher priority than DL channel and signals, for the affected symbols within the PPW according to clause 5.1.6.5 in TS 38.214 [7], the MAC entity shall: |
| vivo | Alt 2 with modification | **We propose to revise Alt 2 as follows.**  **Alt.2**   * For a type 1A and type 1B PRS processing window considered active   + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE ~~expects to receive the other DL signals/channels except SSB of higher priority and~~ may receive the DL PRS in the PPW ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the start of the PPW.~~ * For a type 2 PRS processing window considered active   + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE expects to receive the ~~other DL signals/channels except SSB of higher priority and~~ may receive the PRS symbol ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the PRS symbol~~. |
| Xiaomi | Alt 2 with modification | **Alt.2**   * For a type 1A and type 1B PRS processing window considered active   + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS in the PPW later than ~~at~~ [N symbol/T ms] before the start of the PPW, UE doesn’t expect~~s~~ to receive the other DL signals/channels except SSB of higher priority and may receive the DL PRS in the PPW ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the start of the PPW.~~ * For a type 2 PRS processing window considered active   + If UE determines the ~~absence~~ presence of other DL signals/channels except SSB of higher priority than PRS on a PRS symbol later than ~~at~~ [N symbol/T ms] before the PRS symbol, UE doesn’t expect~~s~~ to receive the other DL signals/channels except SSB of higher priority and may receive the PRS symbol ~~and may drop DL signals/channels with the scheduling DCI later than [N symbol/T ms] before the PRS symbol~~. |
| ZTE | Alt 1 | To be honest, we don’t understand Alt 2. In the duration that later than [N symbol/T ms] before the PRS symbol, UE is not able to determine whether other DL signals is presence in PPW as it has not sufficient processing time.  So we still think Alt 1 is feasible. But the wording is not crytal enough. Here is our suggestion for the sub-bullet   * + UE may drop DL signals/channels scheduled during the PPW where ~~with~~ the corresponding scheduling DCI of the DL signals/channel is later than [N symbol/T ms] before the start of the PPW. |
| Ericsson | Alt 2 | We tend to agree with Alt 2 as formulated by the FL. |
| Qualcomm | Alt. 1  Xiaomi Alt. 2  vivo’s alt. 2 | To Samsung: By the time the UE has determined that there is high priority data, the UE has already “scheduled/programmed” the PRS processing. We don’t think that the UE should stop what is doing, and it should not be expected that the the UE will stop the PRS processing.  We could be OK with vivo’s alternative, that doesn’t say that the UE is expected to do data. A UE should be allowed to not “reprogram/reschedule” too late its processing, and this vivo’s Alternative allows that. We think it also allows a UE implementation that really, drops what ever It has started, to go and measure the data. |
| Huawei, HiSilicon | Alt.1  Xiaomi Alt. 2 | We felt that Xiaomi’s revision is very close to the expression of Alt.1. |

### Proposal 2.1.2-3

RAN1 to discuss whether special handling of the Rx beam considering the default TCI state for PDSCH in a slot is defined, considering the following statements:

* Proponent
  + If PRS is configured on the symbols right after PDCCH, the UE does not know if there is PDSCH or not (we could consider it as potential PDSCH region) and usually the UE should try to buffer it until it decodes DCI clearly. For the configured PRS resources in this potential PDSCH region, it is unclear for UE to determine Rx beam, which could be from QCL type-D of PRS resource or could be appropriate beam for buffering potential PDSCH.
  + Is gNB restricted to schedule PDSCH right after PDCCH in type 2 window? We think that by the time the UE determines the presence or absence of PDSCH in type 2 window, the UE needs to buffer potential PDSCH
* Opponent
  + Based on the proposal 2.1.1-1, the timeline will be clear. One of PRS and PDSCH will be dropped. Then, there is no such issue. For the remaining one which is not dropped, the beam will follow the legacy behaviour.
  + Having larger [N symbol/T ms] than the *timeDurationForQCL* would avoid the ambiguity. We think [N symbol/T ms] should typically be larger than *timeDurationForQCL*.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| ZTE | No | No further discussion |
| Ericsson |  | No further discussion |
| Qualcomm | Yes | After hearing proponents view, and further considerations, we are OK to discuss it. |

## (Issue 5-2) Low latency PRS processing capability

This corresponds to Issue 5-2 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| vivo [3] | **Proposal 3:**   * NR supports two modes of PRS processing outside MG inside the PRS processing window, according to the reported UE PRS resource capabilities. * Mode 1: A UE is expected to measure all the PRS within the PRS processing window * Mode 2: A UE is expected to measure only up to the N ms PRS within a PRS processing window * Send LS to RAN4 informing Tlast can be T+PPWL when UE is expected to measure up to the N ms PRS within a PRS processing window |
| ZTE [4] | **Proposal 2:** For the PRS processing capability in a PRS processing window, UE has to report its capability with at least of the combination {N, T},   * During the first part of the window with duration of L-(T-N) msec, up to N msec of PRS symbols are expected to be buffered, where L is the duration of the PRS processing window, and (N,T) is the reported capability for MG-less PRS processing. * The UE is expected to be capable of reporting measurements derived on the PRS measured in the first window after T-N msec from the end of first part of the PRS processing window * UE is not expected to be configured a PRS processing window with duration smaller than (T-N) msec |
| Samsung [6] | **Proposal 6:** no new PRS processing capability or mode is introduced. |
| IDC [8] | **Proposal 2:** For Cap. 1A and Cap. 1B (PRS prioritization over all other DL signals/channels in all symbols inside the window), a UE is expected to measure and process PRS only within a PPW length. |
| Huawei, HiSilicon [11] | **Proposal 4:** Introduce an indicator in the existing UE capability ignalling for the PRS processing capability of {N, T} that indicates whether the reported T ms is assumed within the PRS processing window or not.   * The indicator is associated with any processing type that UE supports. * The {N, T} component should take that from FG 13-1, and values {1, 2, 4} ms are added to the existing T values. |
| Qualcomm [13] | **Proposal 1:** For Type 1A/1B PRS processing, a UE is capable to measure and process PRS only  within a PPW length with the following interpretation of the (N,T) UE capabilities:   * A UE is capable of measuring up to N ms PRS within a PPW and is capable of completing the PRS processing within the PPW, if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T-N ms. |

**FL comments**

It was FL proposal in R1-2202515 at RAN1#108-e that

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| **Proposal 3.5.4-2 (GTW)**  NR supports two modes of PRS processing outside MG inside the PRS processing window, according to the reported UE PRS resource capabilities.   * + Mode 1: A UE is expected to measure all the PRS within the PRS processing window     - No relationship between the PRS processing window and UE reported (N, T) will be defined.     - Mode 1 at least applies to PRS processing window type 2.       * FFS type 1A/1B   + FFS Mode 2:     - Alt. 1: A UE is expected to measure only up to the first N ms PRS within the first part of a PRS processing window, and is expected to complete the PRS processing if the time duration from the last symbol of the last PRS resource of the up to N ms PRS, to the end of the PRS processing window is not smaller than T-N ms.     - Alt. 2: A UE is expected to measure only up to ~~the first~~ N ms PRS within ~~the first part of~~ a PRS processing window according to the reported PRS resource capabilities, and is expected to complete the PRS processing if the time duration from the last symbol of the last PRS resource ~~of the up to N ms PRS symbol~~ inside the window, to the end of the PRS processing window is not smaller than T-N ms.     - Alt. 3: A UE is expected to measure and process PRS only within a PPW length.     - Mode 2 applies to PRS processing window type 1A and 1B.       * FFS type 2   Note: The concept of mode is used to differentiate two UE behaviors, and may not be part of the signaling  Discuss in the UE feature session the values {N, T} for all types. |

The proposals are somewhat divergent.

* vivo [3] proposed to define two modes, and proposed to send an LS to RAN4 to redefine Tlast
* ZTE [4] had the same proposal aiming to refine the “mode 2 operation”.
* Samsung [6] proposed not to define any new PRS processing capability or mode.
* IDC [8] proposed to define “mode 2 operation” with Alt.3
* Huawei [11] proposed to add a new UE capability signalling to indicate whether the reported (N, T) is based on the assumption that T is within the PRS processing window duration, and also proposed to add smaller T values in the capability signalling if (N,T) takes the form of FG 13-1.
* Qualcomm [13] proposed to define “mode 2 operation” combining Alt.3 and Alt.2.

The FL has the following consolidated proposal for comments.

### Round 1

**Proposal 2.2.1-1**

* For UE supporting Type-1A or Type-1B PRS processing window, the UE is expected to measure and process PRS only within a PRS processing window length.
  + The reported (N, T) in the capability signalling assumes that UE measures and processes PRS only within the PRS processing window length
  + Add the following Note to the corresponding FG in the UE feature spreadsheet
    - Note: The (N,T) UE capabilities is interpreted such that the UE is capable of measuring up to N ms PRS within a PPW and is capable of completing the PRS processing within the PPW, if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T-N ms
* For UE supporting Type-2 PRS processing window, the UE is expected to process PRS outside a PRS processing window.
* Discuss in the UE feature session the values {N, T} for all types.
* Send an LS to RAN4 informing them the potential change of Tlast for gap-less PRS measurements.

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| CATT |  | For the second bullet, should it be: “…the UE is expected to process PRS outside *MG in* a PRS processing window”? |
| Nokia/NSB |  | On the 2nd bullet if the UE is expected to process PRS outside PPW, it looks unclear when the UE is ready for reporting from LMF side. |
| ZTE | Yes |  |
| InterDigital |  | We are ok with the first bullet. Similar to CATT, clarification may be needed for the second bullet. |
| Vivo | No | We are not okay with the note. For the bullet 2, we think it equals the mode 1 in last meeting (Mode 1: A UE is expected to measure all the PRS within the PRS processing window) so that additional Tlast after PPW is needed.  In addition, based on the RAN4 agreement, the low latency processing time for outside MG can be = T +PPW Length   |  | | --- | | **Agreements in RAN4#102-e***:*  Define Tlast as T+MGL when all of the PRS resources to be measured are available in the same MG occasion during Tavailabe.  *TS 38.133 h50*  is the measurement duration for the last PRS RSTD sample in positioning frequency layer *I*, including the  sampling time and processing time. If all of the PRS resources to be measured are available in the same MG occasion during Tavailabe, = +MGL. Otherwise, = + , |   So, we can agree with the following modification Proposal 2.2.1-1  * For UE supporting Type-1A or Type-1B PRS processing window, the UE is expected to measure and process PRS only within a PRS processing window length.   + The reported (N, T) in the capability signalling assumes that UE is measure only up to the N ms PRS within a PRS processing window   + Add the following Note to the corresponding FG in the UE feature spreadsheet     - Note: The (N,T) UE capabilities is interpreted such that the UE is capable of measuring up to N ms PRS within a PPW and is capable of completing the PRS processing within the T+ PPW length, ~~if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T-N ms~~ * For UE supporting Type-2 PRS processing window, the UE is expected to process PRS outside a PRS processing window. * Discuss in the UE feature session the values {N, T} for all types. * Send an LS to RAN4 informing them the potential change of Tlast = T+ PPW length for gap-less PRS measurements. |
| Huawei, HiSilicon | Yes | Maybe the second bullet can be changed as follows to resolve Nokia’s concern.   * For UE supporting Type-2 PRS processing window, the UE is expected to receive the PRS within the PRS processing window and but the processing of the received PRS may be outside a PRS processing window.   Reply to vivo, we think that changing processing time to (T+PPW) does not work because it actually means that UE needs additional T after PPW ends, which is against the intention of using PPW to cover both buffering and processing period for type-1A and type-1B. |
| Samsung |  | For the sake of progress, we can be ok to separate discussion for different types. But that is for {N,T} value reporting, rather than the actual UE behaviour to measure and process. From this point of view, we think using a new N2,T2 might serve the purpose.   * For UE supporting the PRS processing outside MG inside the PRS processing window, the UE could report a (N2,T2) value, by assuming to measure and process the N2 time of PRS only within the PRS processing window length (which covers the T2). * Discuss in the UE feature session the values {N2, T2} for all types. |
| Qualcomm |  | To Samsung: We can accept having an additional (N2,T2) with a wording shown above. Thanks for trying to identify a common ground.  To vivo: We agree with the reply from HW, HiSilicon. The whole point of having priortiziation of data in ALL the PPW was that the UE is doing processing during that time, otherwise we would just need only Type-2. The whole point of the Type-1A/1B, is to enable the UE do allthe processing asap and report as far as UE-possible by not distracting the UE from data/CSIRS processing.  Ok with the change suggested by Nokia and implemented by HW in the reply above, to clarify the main difference between Type-1 and Type-2 with regards to UE PRS processing assumption. |
|  |  |  |

**FL comments**

It appears some common ground was found, which is somehow aligned with the previous version of the UE feature spread-sheet, although the Type 1 and Type 2 in the component 2 and component 3 do not seem to have the same meaning as Type 1 and Type 2 in the component 1.

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| --- | --- | --- |
| 27-3-3 | DL PRS Processing Capability outside MG – buffering capability | 1. DL PRS buffering capability  a) Type 1 – sub-slot/symbol level buffering  b) Type 2 – slot level buffering  ~~[~~2. Type 1 – Maximum duration of DL PRS symbols N in units of ms a UE can process in the first part of a PRS processing window assuming maximum DL PRS bandwidth in MHz, such that the UE is capable of reporting the measurements T-N ms after the last PRS symbol~~]~~  3. Type 2 – Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE  4. Max number of DL PRS resources that UE can process in a slot ~~under it~~ |

### Round 2

### Proposal 2.2.2-1

* For UE supporting Type-1A or Type-1B PRS processing window, UE may report (N, T) and (N2, N2) in the capability signalling
  + With the reported (N, T) in the capability signalling similar to the legacy (N, T) in FG 13-1, the UE is expected to receive the PRS within the PRS processing window and but the processing of the received PRS may be outside a PRS processing window.
  + The reported (N2, T2) in the capability signalling assumes to measure and process the N2 time of PRS only within the PRS processing window length (which covers the T2).
  + Add the following Note to the corresponding FG in the UE feature spreadsheet
    - Note: The (N2, T2) UE capabilities is interpreted such that the UE is capable of measuring up to N2 ms PRS within a PPW and is capable of completing the PRS processing within the PPW, if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T2-N2 ms
* For UE supporting Type-2 PRS processing window, UE may report (N, T) in the capability signalling similar to the legacy (N, T) in FG 13-1
  + The UE is expected to receive the PRS within the PRS processing window and but the processing of the received PRS may be outside a PRS processing window.
* Discuss in the UE feature session the values {N, T} for all types.
* Send an LS to RAN4 informing them the potential change of Tlast for gap-less PRS measurements.

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| **Company** | **Yes/No** | **Comments** |
| Samsung | Some suggested change | Since we will have the N2,T2 as separate reported UE capability, we don't think the note is needed. And we remove the specific UE behaviour by replacing with the conditional UE behaviour corresponding to the reported UE capability.  Suggested change:   * For UE supporting Type-1A or Type-1B PRS processing window, UE may report (N, T) and (N2, N2) in the capability signalling   + ~~With~~ the reported (N, T) in the capability signalling similar to the legacy (N, T) in FG 13-1, which assumes to measure the N ms of PRS within a PPW ~~the UE is expected to receive the PRS within the PRS processing window and~~ but the processing of the ~~received~~ measured PRS may be outside ~~a~~ the PRS processing window.   + The reported (N2, T2) in the capability signalling assumes to measure and process the N2 time of PRS only within the PRS processing window length (which covers the T2).   + ~~Add the following Note to the corresponding FG in the UE feature spreadsheet~~     - ~~Note: The (N2, T2) UE capabilities is interpreted such that the UE is capable of measuring up to N2 ms PRS within a PPW and is capable of completing the PRS processing within the PPW, if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T2-N2 ms~~ * For UE supporting Type-2 PRS processing window, UE may report (N, T) in the capability signalling similar to the legacy (N, T) in FG 13-1   + ~~The~~ Assuming the UE ~~is expected~~ to ~~receive~~ measure the PRS within the PRS processing window and but the processing of the ~~received~~ measured PRS may be outside a PRS processing window. |
| vivo |  | For the progress, we can compromise if the last sentence of the following note can be removed.   * + Add the following Note to the corresponding FG in the UE feature spreadsheet     - Note: The (N2, T2) UE capabilities is interpreted such that the UE is capable of measuring up to N2 ms PRS within a PPW and is capable of completing the PRS processing within the PPW~~, if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T2-N2 ms~~ |
| ZTE | Yes | We cannot accept removing the last part of note. This is the key part where the sufficient processing time is reserved for UE. Otherwise, if N2 symbols are closed to the end of PPW, how could UE finish processing within the PPW.  Technically, we don’t prefer reporting two pairs, i.e. (N,T) and (N2, T2), this makes specs and implementation complicated. But we can accept it without further touching the note. |
| Ericsson (updated comment) | some comments | We have similar comment as ZTE about reporting two pairs. Reporting two pairs seem complicated. But for making progress, we can live with it.  We have a question regarding the use of (N,T): when the processing time T exceeds the PPW length, what happens to the data traffic that is outside of the PPW but within the T period where the UE is still processing PRS? we assume the data is received and not dropped. |
| Qualcomm | Yes | The fact that there needs to be enough processing time **inside the window** to finish the processing, needs to be captured. To vivo/Samsung, if the N2 PRS is at the end the window, then, what usefulness does it have this new (N2,T2)? The UE doesn’t have any processing time left!  With regards to the question from E// about (N,T), the UE continues the data as usual. The UE is effectively doing the PRS processing “in the background”, so it will be slower, and not really low-latency, but the understanding is tha the UE will report larger T (compared to T2),so that it has enough time to finish the PRS processing. |

## (Issue 5-3) LMF indication of Rx beam sweeping factor

This corresponds to Issue 5-3 of R1-2205097 and the incoming LS R1-2203022.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| vivo [3] | **Proposal 1:**   * LMF can request UE to perform PRS measurements with a reduced Rx beams sweeping factor in FR2 based on UE capability. * No assumption can be made that UE will perform PRS measurement with a reduced Rx beam sweeping factor without network configuration. * UE can report the reduced Rx beam sweeping factor if no specific Rx beam sweeping factor is requested or the UE choice is different with network requests. |
| ZTE [4] | **Proposal 3:** A UE should be configured by LMF to perform PRS measurements in FR2 with a reduced Rx beam sweeping factor. |
| Ericsson [12] | **Proposal 5** Introduce a new higher layer parameter in the PRS processing window configuration which indicates the single DL PRS processing frequency layer the UE shall measure inside the configured PRS processing window. |
| Qualcomm [13] | **Proposal 6:** Support the LMF to be able to indicate in the Location request an Rx Beam Sweeping factor that can take one of 2 possible values:   * Value 1: Equal to the UE’s reported Rx Beam Sweeping value in the corresponding capability * Value 2: Equal to 8 (default assumption)   Send an LS to RAN2 to finalize the ignalling. |
| CATT [18] | **Proposal 1:** UE need to be configured by LMF to perform PRS measurements in FR2 with a reduced Rx beam sweeping factor.  **Proposal 2:** UE can report only one value for the reduced beam sweeping factor instead of multiple ones in UE capability reporting. |
| CATT [19] | Response to RAN4:  UE needs to be configured by LMF to perform PRS measurements in FR2 with a reduced Rx beam sweeping factor. In addition, UE can report only one value of the reduced beam sweeping factor as UE capability instead of multiple ones. |
| Vivo [20] | In RAN1 view, LMF can request UE to perform PRS measurement with a reduced Rx beam sweeping based on UE capability. And if without Rx beam sweeping factor reporting from UE, no assumption about PRS measurement with a reduced Rx beam sweeping can be made on LMF side. |
| ZTE [21] | With regard to RAN4’s question, RAN1 thinks that LMF signalling is needed to request UE to perform PRS measurements with the reduced Rx beam sweeping factor. |
| OPPO [22] | **Proposal 1:** Answer the question as follows:   * The UE does not need to be configured by LMF to perform PRS measurements with a lower Rx beam sweeping factor and it is up to UE implementation to use a Rx beam sweeping factor. |
| Huawei, HiSilicon [23] | **Proposal 1:** Support the LMF to request the Rx beam sweeping factor.  **Proposal 2:** Introduce a single bit indicator per positioning method.   * The presence of the bit means that LMF expects UE to use the reported Rx beam sweeping factor for the FR2 bands on which UE supports the feature, and to use 8 for the FR2 bands on which UE does not support the feature. * The absence of the bit means that LMF expects UE to use 8 for all FR2 bands. * The same status (presence/absence) of the bit is indicated across DL-TDOA, DL-AoD, and Multi-RTT methods in case of hybrid positioning. |

**FL comments**

Among the papers submitted for the subject matter

* vivo, ZTE, Qualcomm, Ericsson, CATT, Huawei proposed that the indication from LMF is necessary.
* OPPO proposed that it is up to UE implementation to use a Rx beam sweeping factor.

The FL suggest to take the majority view for this.

On details of the signalling, Qualcomm [13] proposed that a 2-value Rx beam sweeping factor that can take the either default one (8) or the UE reported one, and Huawei [23] proposed that such an interpretation can be based “absence/presence” of the bit.

In addition, Huawei [23] proposed that the bit is provided per positioning method, and the same status is indicated across DL-TDOA, DL-AoD, and Multi-RTT in case of hybrid methods, and given the Rx beam sweeping factor is per band, the requested reduced number should only be applied to the band for which UE supports the feature.

### Round 1 (closed)

**Proposal 2.3.1-1 (email)**

Support the LMF to request the Rx beam sweeping factor.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| FL | Yes |  |
| Nokia/NSB |  | We don’t really see this as necessary but can live with the majority. |
| ZTE | Yes |  |
| vivo | Yes | LMF can request UE to perform PRS measurements with a reduced Rx beams sweeping factor in FR2 based on UE capability. |
| Huawei, HiSilicon | Yes |  |

Proposal 2.3.1-2 (email)

The request from LMF on the Rx beam sweeping factor is a single bit per positioning method, which can take two values.

* Value 1: Equal to the UE’s reported Rx beam sweeping factor in the corresponding capability for the band UE supports the feature, and equal to 8 for the FR2 bands that UE does not support the feature.
* Value 2: Equal to 8 (default assumption) for FR2 bands.
* The bit value should be set to the same across DL-TDOA, DL-AoD, and Multi-RTT for hybrid positioning.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| CATT | Yes |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Huawei, HiSilicon | Yes |  |

### Outcome of email endorsement

|  |
| --- |
| **Agreement**  Support the LMF to request the Rx beam sweeping factor.  **Agreement**  The request from LMF on the Rx beam sweeping factor is a single bit per positioning method, which can take two values.   * Value 1: Equal to the UE’s reported Rx beam sweeping factor in the corresponding capability for the band UE supports the feature, and equal to 8 for the FR2 bands that UE does not support the feature. * Value 2: Equal to 8 (default assumption) for FR2 bands. * The bit value should be set to the same across DL-TDOA, DL-AoD, and Multi-RTT for hybrid positioning. |

## (Issue 5-4) Rx timing difference condition for measurement of PRS from non-serving cells

This corresponds to Issue 5-4 of R1-2205097 and the incoming LS R1-2203023.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Nokia, NSB [1] | **Proposal 2:** Enable UE to use local estimate of ExpectedRSTD for comparing the received time difference with the threshold for measurement outside of MG.  **Proposal 3**: Adopt the following TP to 38.214:  The UE is not expected to measure the DL PRS outside the measurement gap if the received timing difference between PRS from the non-serving cell and that from the serving cell as determined [by assistance data] is larger than a threshold as determined by higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty*.  ------------------------------------------------Start TP-------------------------------------------------  The UE may use different values of the parameters than the values configured in *nr-DL-PRS-ExpectedRSTD* and *nr-ExpectedRSTD* when determining if the received timing difference is larger than a threshold.  ------------------------------------------------End TP----------------------------------------------------- |
| vivo [3] | **Proposal 2:**   * Adopt the following text proposals into TS 38.214 for the conditions for measuring the PRS outside of a MG.  |  | | --- | | < Unchanged parts are omitted >  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. The UE is not expected to measure the DL PRS outside the measurement gap, if the expected received timing difference between the DL PRS from the non-serving cell and that from the serving cell determined by higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* is larger than maximum Rx timing difference provided by [UE capability]*.* For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  < Unchanged parts are omitted > | |
| OPPO [7] | **Proposal 5:** Adopt the following TP for 38.214:   |  | | --- | | TP for TS 38.214:  ***Reason for change:*** One condition on processing non-serving cell DL PRS outside MG is missed in the current spec.  ***Summary of change:*** Add text to specify that one of the conditions for processing non-serving cell DL PRS outside MG is the Rx timing difference is within a threshold.  ***Consequences if not approved:***  Wrong behavior for processing DL PRS resource of non-serving cell outside MG. | | 5.1.6.5 PRS reception procedure  <Unchanged parts are omitted>  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. To measure a DL PRS of a non-serving cell outside the measurement gap, the expected Rx timing difference between the DL PRS of a non-serving cell and that from the serving cell must be not larger than a threshold and the UE may calculate expected Rx timing difference based on the expected RSTD and expected RSTD uncertainty of the DL PRS resource of the non-serving cell. For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-1A] and if the DL PRS is determined to be higher priority than the DL signals and channels inside the PRS processing window, those DL signals and channels are not expected to be measured by the UE. When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-1B] and if the DL PRS is determined to be higher priority than the DL signals and channels inside the PRS processing window, those DL signals and channels in the same band as the DL PRS are not expected to be measured by the UE. When the UE is expected to measure the DL PRS outside the measurement gap in a configured PRS processing window with [Type-2] if the DL PRS is determined to be higher priority than the DL signals and channels inside the PRS processing window, those DL signals and channels from the impacted serving cells are not expected to be measured by the UE on the overlapped symbols with the DL PRS, where impacted serving cells refer to the serving cell on which the [*PRSProcessingWindow*] is configured for a frequency range 1 band, and all the serving cells in the same band as the DL PRS for a frequency range 2 band.  <Unchanged parts are omitted> | |

**FL comments**

Both vivo [3] and OPPO [7] provided TP to add the text to describe the receive time difference threshold as the UE capability.

In general, vivo’s TP is more aligned with the terminology used in the spec.

Nokia [1] proposed that the UE may use its local estimate of receive time difference instead of expected RSTD and expected RSTD uncertainty in the assistance data. From FL perspective, the terminology “UE is not expected to do something” as provided in vivo’ TP could still leave the interpretation and implementation margin for the UE to decide based on its own judgement to actually do something, but there should be no requirement from specification perspective. Otherwise, it becomes unnecessary specification that network expects UE to do something based on the criterion decided by UE its own, which is not specified anywhere.

The TP from vivo is taken as the baseline for comment.

### Round 1

**Proposal 2.4.1-1**

Adopt the following text proposals into TS 38.214 for the conditions for measuring the PRS outside of a MG.

|  |
| --- |
| < Unchanged parts are omitted >  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. The UE is not expected to measure the DL PRS outside the measurement gap, if the expected received timing difference between the DL PRS from the non-serving cell and that from the serving cell determined by higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* is larger than maximum Rx timing difference provided by [UE capability]*.* For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  < Unchanged parts are omitted > |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| CATT | Yes |  |
| Nokia/NSB |  | We think it still overly limits the UE behavior but we propose the following as a compromise:  The UE is not expected to measure the DL PRS outside the measurement gap, if the ~~expected~~ received timing difference between the DL PRS from the non-serving cell and that from the serving cell determined by at least higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* is larger than maximum Rx timing difference provided by [UE capability]*.* |
| ZTE | Yes | We don’t see the need from Nokia’s revision. |
| vivo | Yes |  |
| Huawei, HiSilicon | Yes | Reply to Nokia, we think that the terminology “UE is not expected” does not limit UE behaviour, but rather limit gNB behaviour. |

The proposal is updated for email endorsement with cover sheet information.

### Proposal 2.4.1-1a (email, TP)

Adopt the following text proposals into TS 38.214 for the conditions for measuring the PRS outside of a MG.

* Reason of change: The UE capability for the maximum Rx timing difference in MG-less measurement is introduced. The relevant content about the conditions for measuring the PRS outside of a MG needs to be captured in our specification
* Summary of change: Added the conditions of measuring the PRS from the non-serving cells outside the measurement gap.
* Consequence if not approved: The spec is not clear when UE should receive the PRS from the non-serving cell outside the measurement gap.

|  |
| --- |
| < Unchanged parts are omitted >  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. The UE is not expected to measure the DL PRS outside the measurement gap, if the expected received timing difference between the DL PRS from the non-serving cell and that from the serving cell determined by higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* is larger than maximum Rx timing difference provided by [UE capability]*.* For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  < Unchanged parts are omitted > |

## (Issue 5-5) UL transmission in PPW

This corresponds to Issue 5-5 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| vivo [3] | **Proposal 6:**   * During an activated PPW, the UE   + not expect to transmit UL channel and signal except for Msg3 or the MSGA payload for all the bands if activated PRS processing window with [Type-1A]   + not expect to transmit UL channel and signal except for Msg3 or the MSGA payload in the same band of PPW if activated PRS processing window with [Type-1B]   + can transmit UL channel and signal in UL symbol if activated PRS processing window with [Type-2]. |
| Samsung [6] | **Proposal 4:** The priority of PRS and LP UL signals/channels follow determined PRS priority state with that for other DL signals/channels. HP UL signals/channels have higher priority than PRS.  **Proposal 5:** Adopt following collision handling between PRS and UL signals/channels .   |  |  | | --- | --- | | PRS priority state | Collision handling vs UL signals in the window (type 1A/1B) and overlapped part (type 2) | | high priority | For all non-first activated PPW, PRS is received over all semi-static other UL signals/channels transmission;  For the first activated PPW,  if UE could determine that it expects to transmit the UL signals before a N time units earlier than the start of the PRS in the first activated PPW, UE expects to receive PRS and **may transmit the UL signals subject to its capability;**  if UE could NOT determine that it expects to receive UL signals before a N time units earlier than the start of the first activated PPW, UE expects to receive PRS and **drop the UL signals tx;** | | Low priority | For an activated PPW,  If UE could determine that it expects to transmit the UL signals before a N time units earlier than the start of the first PRS, UE expects to transmit the UL **signals** and **drop the PRS;**  If UE could NOT determine that it expects to receive other DL signals before a N time units earlier than the start of the first PRS, UE expects to transmit U**L signals** and **may receive the PRS subject to its capability;** | |

**FL comments**

According the understanding from the FL, UL transmission in the PRS processing window is not impacted for any type of PRS processing window, according to the existing agreement, which differentiates PRS processing window from the measurement gap.

It is also FL understanding that it in Rel-16, the symbol level collision between PRS and UL is already specified in TS 38.213.

### Round 1

**Question 2.5.1-1**

Do you think that collision between PRS processing window and UL should be defined for the Type-1A and Type-1B PRS processing window?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | UL is not affected by the PPW. That was the reason in the initial WA we only said that PPW affects **DL** signals/channels. |
| CATT | No | Having the same understanding as FL and QC. |
| Nokia/NSB | No |  |
| ZTE | Yes | For type 1A and 1B, we may need to consider UL signal in CC1 collides with PPW activated in CC2. |
| vivo | Yes | For operation in MG, TS 38.321 specifies the UE behavior for UL transmission in MG that no UL can be transmitted except for Msg3 or the MSGA payload. So, we think the related UE behavior for UL transmission in PPW needs to be clarified.  In addition, for the view of QC and FL, based on the following specification, we can find the DL PRS can be transmitted as downlink or flexible symbol and may be dropped by PUSCH. Besides, considering RAN4 sync condition(e.g, 0.5 slot ), we don’t think UL transmission is not affected by the PPW   |  | | --- | | For operation on a single carrier in unpaired spectrum, if a UE is configured by higher layers to receive a PDCCH, or a PDSCH, or a CSI-RS, or a DL PRS in a set of symbols of a slot, the UE receives the PDCCH, the PDSCH, the CSI-RS, or the DL PRS if the UE does not detect a DCI format that indicates to the UE to transmit a PUSCH, a PUCCH, a PRACH, or a SRS in at least one symbol of the set of symbols of the slot; otherwise, the UE does not receive the PDCCH, or the PDSCH, or the CSI-RS, or the DL PRS in the set of symbols of the slot.  For a set of symbols of a slot that are indicated to a UE as uplink by *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated*, the UE does not receive DL PRS in the set of symbols of the slot, if the UE is not provided with a measurement gap.  - if the UE is configured by higher layers to receive DL PRS in the set of symbols of the slot, the UE receives the DL PRS in the set of symbols of the slot only if an SFI-index field value in DCI format 2\_0 indicates the set of symbols of the slot as downlink or flexible. | |
| Huawei, HiSilicon | No | PRS and UL collision is inherent, regardless of whether it is in MG or in PPW.  The point is that if UE is doing post-buffer processing in the PRS processing window, UE should spare some processing capability for UL related operations. |
| Samsung | Yes | Share the view as vivo.  And reply to HW, we cannot assume there is only a certain type of implementation, and we cannot ask always there is a spare room for UL handling.  PPW is introduced for latency but somehow it introduces the low priority compared to other DL signals, we was told that some important DL data should be prioritized and as shown in the option 2 of priority. So why there should not be any important UL data for exmaple? |

**Question 2.5.1-2**

If the answer to Question 2.5.1-1 is “Yes”, do you think that the collision detection timeline between PRS reception within a PRS processing window and UL should be defined for all types of PRS processing windows?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| ZTE | Partially Yes | Only for type 1A and 1B in the case UL and PPW are not activated in the same CC. |
| Samsung | Yes |  |
|  |  |  |

**Question 2.5.1-3**

If the answer to Question 2.5.1-1 is “Yes”, do you think that the existing PRS priority associated with the PRS processing window can be applied to UL?

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| ZTE | Yes |  |
| Samsung | Yes with some modification | As the current one is only for DL signals and especially there is one for “URLLC PDSCH”, so some part should be modified but generally yes. |
|  |  |  |

**FL comment**

There seems no consensus to include the impact on UL within a PPW.

According to existing working assumptions and agreements, there is no interruption agreed for UL transmission within the PPW, meaning UL is taken as usual within the PPW.

### Round 2

### Proposal 2.5.2-1 (for conclusion)

UL will not be affected within the PPW, regardless of which PPW type.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Samsung | No | First, this should be agreement and rewording that the UL transmission is prioritized than the PRS in PPW regardless the PRS priority state.  Second, 3 vs 4 companies think this should be discussed and defined, rather FL suggested to directly concluded with doing nothing, in which we are asking more clarification.  third, even with this intention of the conclusion, UL is prioritized, we still need to discuss the collision (with/without timeline) for UL vs PRS/PPW. It’s not clear by meaning of “not affected”, problem is not solved. |
| Qualcomm | Yes |  |
| Huawei, HiSilicon | Yes | We think that withn the same carrier, PRS will be punctured by UL in TDD configuration, regardless of whether there is actual UL traffic.  The only case that may require some consideration on the timeline is about scheduled UL on FL symbol, but we consider it very corner case, and low priority for this meeting. |

## (Issue 5-6) More than one positioning frequency layers to process within a PPW

This corresponds to Issue 5-6 of R1-2205097 and the incoming LS R1-2203026.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Ericsson [12] | **Proposal 5** Introduce a new higher layer parameter in the PRS processing window configuration which indicates the single DL PRS processing frequency layer the UE shall measure inside the configured PRS processing window. |
| Qualcomm [13] | **Proposal 5:** For gapless PRS measurement within a PPW instance, only a single PFL is expected to be measured. |
| CATT [24] | **Proposal 1:** The maximum number of PFLs within an active BWP is 1 for gapless PRS measurement in PRS processing window configured for the active BWP. |
| CATT [25] | RAN1 discussed the issue raised in RAN4’s LS and would like to provide the following response:  **RAN1’s Response:**  The PRS processing window is configured per DL BWP. The maximum number of PFLs within an active BWP is 1 for gapless PRS measurement in the PRS processing window configured for the active BWP. |
| Vivo [26] | The following agreements about gapless PRS measurement have been reached in the RAN1#108-e meeting. So, RAN1 would like to confirm: inside each single instance of a PRS processing window, a single PFL can be measured.  In addition, if multiple PFLs can be measured in one PPW, at least, multiple periodicities are needed for multiple PFLs measurements since only a PFL can be measured in a single periodicity of a PPW.  Besides, if multiple PPWs in multiple activated BWPs can be activated with not overlapping in time, and one PFL is associated with each PPW, the multiple PFLs can be measured serially in one periodicity.   |  | | --- | | Agreement  Inside each single instance of a PRS processing window, a single PFL can be measured. This is applicable to all Types of MG-less PRS processing.  Agreement  With regards to the issues of PRS processing window  Issues:  FFS:Whether PRS processing window configuration is provided per BWP or not is up to RAN1 to decide.  FFS: Whether UE can be configured with multiple PRS processing windows should be decided by RAN1.  FFS on the max number of PPW configurations (from Stage 2 discussion)  RAN1 Answer:  RAN1 agreed that PRS processing window configuration is provided per DL BWP.  UE can be configured with multiple PRS processing windows in one DL BWP.  The maximum number of PPW configuration is 4 per DL BWP, but the number of activated PRS processing window per DL BWP is 1. In addition, RAN1 would like to note the maximum number of activated PRS processing windows across all active DL BWPs is 4, and those activated PRS processing windows are not overlapping in time. | |
| ZTE [27] | In RAN1#108-e meeting, RAN1 sent a reply LS R1-2202849 to RAN2 with the following information which is related to RAN4’s question. That is, maximum number of PRS processing windows activated by MAC CE across all active DL PWBs is 4, but those activated PRS processing windows are not overlapping in time.   |  | | --- | | RAN1 agreed that PRS processing window configuration is provided per DL BWP.  UE can be configured with multiple PRS processing windows in one DL BWP.  The maximum number of PPW configuration is 4 per DL BWP, but the number of activated PRS processing window per DL BWP is 1. In addition, RAN1 would like to note the maximum number of activated PRS processing windows across all active DL BWPs is 4, and those activated PRS processing windows are not overlapping in time.  It is RAN1 understanding that UE should monitor PDCCH during RAR window/msgB window or contention resolution timer for the affected symbols by the PRS processing window. | |
| Samsung [28] | From RAN1’s understanding, for a given measurement instance, the applicable number of PFL for the gapless PRS measurement is one. |
| Huawei, HiSilicon [29] | Proposal 2: For gap-less PRS measurement, multiple positioning frequency layers may be present in a single PRS processing window.   * The union of PRS symbols across all positioning frequency layers for a type-2 PRS processing window shall be used to determine the scheduling restriction for the low priority data. |

**FL comments**

The question from RAN4 is not fully relevant to the agreement made by RAN1 at RAN1#108-e. According to the understanding of the FL, what RAN4 is trying to understand is whether it is allowed from RAN1 perspective, that a single PRS processing window in a DL BWP can cover the PRS measurement from multiple positioning frequency layers within the same BWP. If it is allowed, given that UE will measure a single positioning frequency layer for a given time instance, the measurement period requirement for the gap-less measurement for a PRS processing window may extend to handle the serial processing of more than one positioning frequency layers.

Among the papers submitted for the subject matter

* CATT, vivo, Samsung proposed that the applicable number of positioning frequency layer within a PRS processing window is 1.
* Ericsson, Huawei proposed that the applicable number of positioning frequency layers within a PRS processing window can be more than 1.
  + Ericsson proposed to introduce a new higher layer parameter so that network use it to indicate the positioning frequency layer within a PRS processing window that UE shall measure.
  + Huawei proposed that given that network is not aware which positioning frequency layer UE is processing for a given time instance of the PRS processing window, the union of PRS symbols across all positioning frequency layers for a type-2 processing window shall be used to determine the scheduling restriction for the low priority data.
* Qualcomm used the previous agreement in reply, but according to the understanding from the FL, it is not fully relevant to RAN4’s question.
* ZTE cited RAN1 agreement, but according to the understanding from the FL, those agreement is not fully relevant to RAN4’s question.

The FL suggest to take the majority view for this release.

### Round 1 (closed)

**Proposal 2.6.1-1 (email)**

Reply to the RAN4’s question in LS R1-2203026 with

* RAN1 already agreed in RAN1#108-e that inside each single instance of a PRS processing window, a single PFL can be measured. This is applicable to all Types of MG-less PRS processing.
* In addition, it is RAN1 understanding that the applicable number of positioning frequency layers for the gapless PRS measurement within a PRS processing window is one across all instances of the PRS processing window.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| CATT | Yes |  |
| Nokia/NSB | Yes |  |
| ZTE | Yes |  |
| Xiaomi |  | We are fine with that the number of positioning frequency layer is one across all instances of the PRS processing window. But from our understanding, even in this case, network also need to indicate the PRS processing window will be used for the measurement of which positioning frequency layer, if the UE is configured with more than one positioning frequency layer. |
| Vivo | Yes |  |
| Huawei, HiSilicon | Yes | To Xiaomi, in this case, given different PRS processing windows do not overlap in time, it should be clear what positioning frequency layer is processed within each PRS processing window. |
| Samsung | Yes |  |

### Outcome of email endorsement

|  |
| --- |
| **Agreement**  Reply to the RAN4’s question in LS R1-2203026 with   * RAN1 already agreed in RAN1#108-e that inside each single instance of a PRS processing window, a single PFL can be measured. This is applicable to all Types of MG-less PRS processing. * In addition, it is RAN1 understanding that the applicable number of positioning frequency layers for the gapless PRS measurement within a PRS processing window is one across all instances of the PRS processing window. |

## (Issue 5-7) TP to clarify the PRS duration calculation in relation to collision with other DL/UL signals

This corresponds to Issue 5-7 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Samsung [6] | **Proposal 7:** Text proposal for TS38.214 5.1.6.5 PRS reception procedure  ***\*\*\* Unchanged text is omitted \*\*\****  ***- For Type 1, is the smallest interval in msec within slot corresponding to an integer number of OFDM symbols based on the numerology of the DL PRS of a serving cell that covers the union of the potential PRS symbols and determines the PRS symbol occupancy within slot , where the interval considers the actual nr-DL-PRS-ExpectedRSTD, nr-DL-PRS-ExpectedRSTD-Uncertainty provided for each pair of DL PRS resource sets (target and reference).***  ***- For Type 2, is the numerology of the DL PRS, and is the cardinality of the set .***  ***For the case when PRS processing window is configured, the potential DL PRS resources referred in the calculation of the duration K msec of DL PRS symbols are the DL PRS resources not collides with other higher priority DL/UL signals.***  ***\*\*\* Unchanged text is omitted \*\*\**** |

**FL comments**

This TP can be directly used for comments.

### Round 1 (closed)

**Proposal 2.7.1-1 (TP)**

Text proposal for TS38.214 5.1.6.5 PRS reception procedure

***\*\*\* Unchanged text is omitted \*\*\****

***- For Type 1, is the smallest interval in msec within slot corresponding to an integer number of OFDM symbols based on the numerology of the DL PRS of a serving cell that covers the union of the potential PRS symbols and determines the PRS symbol occupancy within slot , where the interval considers the actual nr-DL-PRS-ExpectedRSTD, nr-DL-PRS-ExpectedRSTD-Uncertainty provided for each pair of DL PRS resource sets (target and reference).***

***- For Type 2, is the numerology of the DL PRS, and is the cardinality of the set .***

***For the case when PRS processing window is configured, the potential DL PRS resources referred in the calculation of the duration K msec of DL PRS symbols are the DL PRS resources not collides with other higher priority DL/UL signals.***

***\*\*\* Unchanged text is omitted \*\*\****

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | We don’t see the need of this change. The PRS duration should not change based on whether there are collisions or not. |
| CATT |  | The TP may be related to Question 2.5.1-1. It is unclear how to DL PRS resources collides with UL signals. |
| Nokia/NSB | No | Non-essential. |
| ZTE | No | Even in Rel-16, PRS may not be inside MG. We don’t think this is a new issue. |
| Vivo | No | Firstly, from RAN1 perspective, it is better to keep the original description of the PRS Buffer, since there are many factors affecting the UE buffer PRS, which can be generally captured in the RAN4 specification.  Then, it is still not clear how to determine the collision between DL PRS and other DL signals/channels. For example, if the PRS buffer type is ‘slot level’, when colliding, whether to consider only the collision at the ‘slot level’; on the contrary, whether to consider only the collision at the ‘symbol level’. |
| Huawei, HiSilicon | No | We agree with Qualcomm’s interpretation. |
| Samsung | Yes | Our intention was that the RAN4 has considered the collision on the PRS measurement period determination, and so the PRS duration is actually different from what we assumed for MG, because the PRS in or overlapped with MG boundary will be valid, but now PPW is not.  In RAN4 38.133 h50 9.5.1.2  The requirements for RSTD, PRS-RSRP, UE Rx-Tx time difference, and PRS-RSRPP measurement without measurement gaps specified in clauses 9.9.2.~~6~~7, 9.9.3.6, 9.9.4.6 and 9.9.x1.6 shall apply provided that:  UE is configured with PPW,  No active BWP switching occurs during PPW,  PRS is within PPW and do not overlap with other signals/channels of higher priority,  Receive timing difference between the serving cell and a neighbor cell PRS ≤ Threshold; Threshold = {CP length, 0.5 slot}, other options are not precluded,  SCS of PRS within PPW and SCS of DL active BWP are the same.    In 9.9.2.7  is the time duration of available PRS in the positioning frequency layer i to be measured during , and is calculated in the same way as PRS duration K defined in clause 5.1.6.5 of TS 38.214 [26]. For calculation of , only the PRS resources unmuted and fully or partially overlapped with PPW are considered. |
| FL |  | Just to clarify to SS:  In Rel-16, the (P,K) calculation is considered as generalized function of obtaining the PRS duration K ms in a P ms window subject to UE capability of type1 or type2. How to use it, e.g. which P values should set, which PRS symbols are considered, e.g. muting, are up to RAN4 to choose.  In this particular case, whether the collided symbols will be discounted, and even whether RAN4 will specify the requirement when PRS is dropped due to collision is up to RAN4 to decide, because the only impact on it is the measurement period requirement managed by RAN4.  Hopefully that clarifies. |

**FL comments**

No consensus to endorse the TP.

This discussion is closed.

## (Issue 5-8) TP to capture the priority states

This corresponds to Issue 5-8 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Ericsson [12] | **Proposal 4** Adopt text proposal TP1 for TS 38.214.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of TP1 for TS 38.214 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*].  For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, the UE may be indicated by higher layer parameter [*PRS-priority-indicator*] subject to UE capability  - the DL PRS is higher priority than all the DL signal/channels except SSB, or  - the DL PRS is lower priority than PDCCH and the PDSCH scheduled by DCI formats 1\_1 or 1\_2 with the priority indicator field in the corresponding DCI format set to 1, and is higher priority than other DL signals/channels except SSB, or  - the DL PRS is lower priority than all the DL signals/channels except SSB.  Inside one instance of the *[PRSProcessingWindow]* the UE is only expected to measure a single DL PRS positioning frequency layer.  \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* |
|  |  |
|  |  |

**FL comments**

This TP can be directly used for comments.

### Round 1

### Proposal 2.8.1-1 (TP)

Adopt text proposal TP1 for TS 38.214.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of TP1 for TS 38.214 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*].

For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, the UE may be indicated by higher layer parameter [*PRS-priority-indicator*] subject to UE capability

- the DL PRS is higher priority than all the DL signal/channels except SSB, or

- the DL PRS is lower priority than PDCCH and the PDSCH scheduled by DCI formats 1\_1 or 1\_2 with the priority indicator field in the corresponding DCI format set to 1, and is higher priority than other DL signals/channels except SSB, or

- the DL PRS is lower priority than all the DL signals/channels except SSB.

Inside one instance of the *[PRSProcessingWindow]* the UE is only expected to measure a single DL PRS positioning frequency layer.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Nokia/NSB | No | Not needed. |
| ZTE |  | We suggest to wait the outcome of section 2.1, then update the spec together. |
| vivo |  | We are OK to add the description of priority state, however, above TP not only adds descriptions related to priority state, but also deletes other descriptions of PPW. |
| Huawei, HiSilicon | Yes. | We think the deleted description could wait for section 2.1. |
| Samsung | Yes for need, no for the current TP | This is needed as asn.1 will refer to this. But the wording need further revised. |
| Ericsson | Yes | 38.331 currently doesn’t define the priority states and simply refers to 38.214. So this needs to be captured in 38.214. But we are open to work on the wording. |

**FL comments**

The TP is postponed after 2.1 is resolved.

## (Issue 5-9) TP to update “[PRSProcessingWindow]” with “PRS processing window by higher layer parameter [PRSProcessingWindow]”

This corresponds to Issue 5-9 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| CATT [2] | Proposal 2: Adopt the following TP on PRS Processing Window:  ----------------Start of TP for TS 38.214---------------------  5.1.6.5 PRS reception procedure  ……  The UE is not expected to be indicated with more than 4 activated PRS processing windows by high layer parameter [*PRSProcessingWindow*] across all active DL BWPs and is not expected to be indicated with the activated PRS processing windows that overlap in time.  ……  ----------------End of TP for TS 38.214--------------------- |

**FL comments**

The TP can be directly used for comments.

### Round 1 (closed)

**Proposal 2.9.1-1 (TP)**

Adopt the following TP on PRS Processing Window:

----------------Start of TP for TS 38.214---------------------

5.1.6.5 PRS reception procedure

……

The UE is not expected to be indicated with more than 4 activated PRS processing windows by high layer parameter [*PRSProcessingWindow*] across all active DL BWPs and is not expected to be indicated with the activated PRS processing windows that overlap in time.

……

----------------End of TP for TS 38.214---------------------

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Yes |  |
| Nokia/NSB | Ok |  |
| vivo | Yes |  |
| Huawei, HiSilicon | Yes. |  |

The proposal is updated for email endorsement with cover sheet information.

**Proposal 2.9.1-1a (email, TP)**

Adopt the following TP on PRS Processing Window:

* Reason of change: *PRSProcessingWindow* is the name of the high layer parameter, instead of the concept of PRS processing window in RAN1’s agreements.
* Summary of change: Added PRS processing window before [PRSProcessingWindow]
* Consequence if not approved: The concept of PRS processing window is not clear from RAN1 perspective.

----------------Start of TP for TS 38.214---------------------

5.1.6.5 PRS reception procedure

……

The UE is not expected to be indicated with more than 4 activated PRS processing windows by high layer parameter [*PRSProcessingWindow*] across all active DL BWPs and is not expected to be indicated with the activated PRS processing windows that overlap in time.

……

----------------End of TP for TS 38.214---------------------

### Outcome of email endorsement

|  |
| --- |
| **Agreement**  Adopt the following TP (for TS 38.214 clause 5.1.6.5) on PRS Processing Window:   * Reason of change: *PRSProcessingWindow* is the name of the high layer parameter, instead of the concept of PRS processing window in RAN1’s agreements. * Summary of change: Added PRS processing window before [*PRSProcessingWindow*] * Consequence if not approved: The concept of PRS processing window is not clear from RAN1 perspective.   ----------------Start of TP for TS 38.214---------------------  5.1.6.5   PRS reception procedure  ……  The UE is not expected to be indicated with more than 4 activated PRS processing windows by high layer parameter [*PRSProcessingWindow*] across all active DL BWPs and is not expected to be indicated with the activated PRS processing windows that overlap in time.  ……  ----------------End of TP for TS 38.214--------------------- |

## (Issue 5-10) Adding “receiving DL signals/channels except SSB” in parallel to “receiving DL PRS” in the PPW

This corresponds to Issue 5-10 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| vivo [3] | **Proposal 4:**   * Adopt the following text proposals into TS 38.214 to explain the [other DL signals or channels except SSB] are received in PPW.  |  | | --- | | < Unchanged parts are omitted >  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. For receiving the DL PRS outside the measurement gap ~~and~~ or receiving [other DL signals or channels except SSB] within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  < Unchanged parts are omitted > | |

**FL comments**

The TP can be directly used for comments.

### Round 1

### Proposal 2.10.1-1 (TP)

Adopt the following text proposals into TS 38.214 to explain the [other DL signals or channels except SSB] are received in PPW.

|  |
| --- |
| < Unchanged parts are omitted >  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. For receiving the DL PRS outside the measurement gap ~~and~~ or receiving [other DL signals or channels except SSB] within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  < Unchanged parts are omitted > |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Okay |  |
| Nokia/NSB | No | Non-essential. Current spec is clear. |
| Vivo | Yes | In our view, if the UE determines the DL PRS priority is not higher than [other DL signals or channels except SSB], the colliding [other DL signals or channels except SSB] should be received within the PRS process window, but the current version is unclear. |
| Huawei, HiSilicon |  | It can be resolved together with 2.1 and 2.8. |

**FL comments**

The TP can be postponed.

## (Issue 5-11) PRS processing window activation request by UL MAC CE

This corresponds to Issue 5-11 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| IDC [8] | **Proposal 3:** UL MAC CE based request for a PRS processing window by the UE to the gNB is not supported |
| Qualcomm [13] | **Proposal 2:** For PRS processing window (PPW) activation request, support using   * an UL MAC CE for the UE to request one or more of the RRC (pre-)configured PPWs.   + The information in the UL MAC CE for PPW activation request by the UE can be one or more ID(s) associated with the preconfiguration of the PPW(s) * LMF to request one or more of the (pre-)configured PPW(s) from the serving gNB |

**FL comments**

This has been discussed for a couple of meetings, and no consensus was reached in RAN1#108-e.

With regards to the following reasons provided by Qualcomm [13], the understanding from the feature lead is that if indeed the activated PRS processing window or PRS processing window to be activated does not suit UE’s preference, UE may fallback to RRC LocationMeasurementIndication provide the full picture of what UE requires.

|  |
| --- |
| **Qualcomm [13]**  With regards to PRS processing, for MG-based Positioning, in NR Rel-16, a UE is the only entity that can request a specific MG. This is particularly useful because a UE may be aware of the Positioning QoS requirements and any other concurrent processes that need to run in order to satisfy all the communication and positioning tasks. In NR Rel-17, for MG-based Positioning, a new feature was introduced, which enables an LMF to suggest MG or PRS processing window parameters to a serving gNB.  We think that for the feature of PRS processing window, enabling a UE to request/suggest PRS processing window would enable the gNB to have a full picture of what the UE requires, and provide more information to the gNB to make a good decision.  Also, since we are introducing in NR Rel-17 a feature of pre-configuring MGs and the UE suggesting with UL MAC-CE, a specific MG, the additional work needed to generalize this feature to PRS processing request is minimal. |

### Round 1

### Proposal 2.11.1-1 (email, for conclusion)

* UL MAC CE based request for a PRS processing window by the UE to the gNB is not supported

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Yes |  |
| Nokia/NSB |  | This would be a conclusion? Seems unnecessary at this stage of the work to say this. |
| ZTE | Yes | It is a reasonable proposal to make MG/PPW have a unified signalling design. |
| InterDigital | Yes |  |
| vivo | Yes |  |
| Huawei, HiSilicon | Yes | A conclusion would be OK. |
| Samsung |  | Ok with the conclusion. |
| FL |  | Modified. |
| Ericsson | Yes |  |

## (Issue 5-12) The priority between PRS and SSB

This corresponds to Issue 5-12 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| CATT [2] | **Proposal 1:** Send an LS to RAN4 informing the following conclusion made in RAN1#108-e:  For the priority handling of PRS and SSB for PRS measurement outside MG, RAN1 understand that the priority between SSB and PRS is up to RAN4 to define. |
| Samsung [6] | **Proposal 1:** a priority indication is introduced to indicate the priority state between PRS resource and SSB, the candidate value can be high, low and equal inside the PRS processing window subject to UE capability.  **Proposal 2:** when the priority state of PRS resource and SSB is equal inside the PRS processing window, the reception of PRS and/or SSB is up to UE implementation. Inform RAN4 about this decision. |

**FL comments**

According to the agreement made in RAN1#109, RAN1 already left the details of priority between PRS and SSB up to RAN4. CATT [2] believed that an LS to RAN4 may be necessary to avoid ambiguity, while Samsung [6] prefer to introduce the explicit priority indication of PRS and SSB, which can be high, low, or equal.

The FL preference is not to reopen this issue, and companies may check whether the LS to RAN4 is indeed necessary.

### Round 1 (closed)

**Proposal 2.12.1-1**

Send an LS to RAN4 informing the following conclusion made in RAN1#108-e.

|  |
| --- |
| For the priority handling of PRS and SSB for PRS measurement outside MG, RAN1 understand that the priority between SSB and PRS is up to RAN4 to define. |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm |  | Our understanding is that RAN4 already works on this. Sending another LS will be a repetition from the previous LS. |
| CATT |  | We are fine w/o sending the LS if RAN4 already works on this. |
| Nokia/NSB |  | Same view as QC. |
| ZTE |  | Same view as QC and Nokia |
| Huawei, HiSilicon | No | We do not think an LS make any difference now. |
| Samsung |  | If majority thinks ran4 will handle that, we can live with it. |

**FL comments**

No need for the LS. The discussion is closed.

## (Issue 5-18) Maximum number of PPWs activated by a single MAC CE

This corresponds to Issue 5-18 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Qualcomm [13] | **Proposal 7:** Update previous RAN1 agreement on the maximum number of PPWs that can be activated/deactivated by a single DL MAC-CE to follow the RAN2 agreement and current 38.321 specification. |

**FL comments**

This reverts the previous RAN1 agreement, but attempts to align with RAN2 MAC specification.

The proposal can be directly used for comments.

### Round 1

**Proposal 2.13.1-1**

Update previous RAN1 agreement on the maximum number of PPWs that can be activated/deactivated by a single DL MAC-CE to follow the RAN2 agreement and current 38.321 specification.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| Nokia/NSB |  | Is there any RAN1 spec impact to this proposal? |
| ZTE |  | We prefer not to spend time on this proposal as RAN2 is handling this issue and no RAN1 impact. |
| vivo | Yes | To Nokia : no for us |
|  |  |  |

**FL comments**

The proposal can be updated if the intention is to seek clarification.

### Round 2

### Proposal 2.13.2-1 (email, for conclusion)

It is RAN1 understanding that the maximum number of PPWs that can be activated/deactivated by a single DL MAC-CE is up to RAN2.

* The previous agreement of maximum number of PPWs that can be activated/deactivated by a single DL MAC-CE is reverted.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| vivo | Yes |  |
| ZTE | Yes |  |
| Ericsson | ok |  |
| Qualcomm | Yes |  |

## (Issue 6-4) TP on clarifying that M-sample applies to DL PRS measurements including DL PRS-RSRPP

This corresponds to Issue 6-4 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| OPPO [7] | **Proposal 4:** adopt the following TP on M-sample measurement for 38.214:   |  | | --- | | TP for TS 38.214:  ***Reason for change:*** The specification does not specify that the same M-sample configuration is applied to all NR positioning method and the specification does not specify that M-sample configuration is applied to DL PRS-RSRPP.  ***Summary of change:*** Add text to specify that the M-sample indication is applied to all the concurrent NR positioning methods, and clairfy that M-sample indication is also applied to DL PRS-RSRPP.  ***Consequences if not approved:***  Ambiguity in UE behavior on M-sample measurement. | | 5.1.6.5 PRS reception procedure  <Unchanged parts are omitted>  The UE may be requested, subject to UE capability, to measure and report one or more of the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP or UE Rx-Tx time difference measurements with either 1 or 4 samples, as defined in [11, TS 38.133], via higher layer parameter [*numOfSamples-perMeasurement]* [17, TS 37.355] which applies for all concurrent DL RSTD, DL PRS-RSRP, DL PRS-RSRPP and UE Rx-Tx time difference measurements in all DL PRS positioning frequency layers.  <Unchanged parts are omitted> | |

**FL comments**

The TP can be directly used for comments.

### Round 1 (closed)

**Proposal 2.14.1-1 (TP)**

Adopt the following TP on M-sample measurement for 38.214:

|  |
| --- |
| TP for TS 38.214:  ***Reason for change:*** The specification does not specify that the same M-sample configuration is applied to all NR positioning method and the specification does not specify that M-sample configuration is applied to DL PRS-RSRPP.  ***Summary of change:*** Add text to specify that the M-sample indication is applied to all the concurrent NR positioning methods, and clairfy that M-sample indication is also applied to DL PRS-RSRPP.  ***Consequences if not approved:***  Ambiguity in UE behavior on M-sample measurement. |
| 5.1.6.5 PRS reception procedure  <Unchanged parts are omitted>  The UE may be requested, subject to UE capability, to measure and report one or more of the DL RSTD, DL PRS-RSRP, DL PRS-RSRPP or UE Rx-Tx time difference measurements with either 1 or 4 samples, as defined in [11, TS 38.133], via higher layer parameter [*numOfSamples-perMeasurement]* [17, TS 37.355] which applies for all concurrent DL RSTD, DL PRS-RSRP, DL PRS-RSRPP and UE Rx-Tx time difference measurements in all DL PRS positioning frequency layers.  <Unchanged parts are omitted> |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | No | We think the change is unnecessary. There is no reason to believe that this is not what is understood by the “M-sample” processing. We don’t see an ambiguity. |
| Nokia/NSB | No | Agree with QC. |
| ZTE | No | We don't think M is only used for ‘concurrent’ measurement. |

**FL comments**

No consensus to endorse the TP.

This discussion is closed.

# RRC\_INACTIVE state positioning

## (Issue 6-1) SRS switching time for transmission option 2 on FDD bands

This corresponds to Issue 6-1 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| vivo [3] | **Proposal 8:**   * For Option 2 of SRS for positioning transmission, support UE capability for switching time applying to FDD only for switching time between SRS Tx and other Tx in initial UL BWP. |
| LGE [10] | **Proposal #1:**  RAN1 should also agree to apply the capability for FDD and then leave the detail values up to RAN4. |
| Huawei, HiSilicon [11] | **Proposal 8:** For Option 2 of SRS for positioning transmission in RRC\_INACTIVE, the UE capability of switching time between SRS Tx and other Tx in initial UL BWP is introduced also for FDD and SUL bands.   * If the transmission of SRS for positioning with the switching time collides in time domain with other UL transmission for FDD and SUL, the SRS for positioning transmission is dropped in the symbols where the collision occurs. |

**FL comments**

The proposal from vivo [3] seemed the same as that from Huawei [11], except Huawei [11] expanded FDD to SUL.

Regarding the switching time values, it was already agreed to be left up to RAN4 for TDD.

### Round 1 (closed)

**Proposal 3.1.1-1 (email)**

For Option 2 of SRS for positioning transmission in RRC\_INACTIVE, the UE capability of switching time between SRS Tx and other Tx in initial UL BWP is introduced also for FDD.

* The switching time value(s) are left up to RAN4 discussion
* If the transmission of SRS for positioning with the switching time collides in time domain with other UL transmission for FDD, the SRS for positioning transmission is dropped in the symbols where the collision occurs.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm | Yes |  |
| CATT | Okay |  |
| Nokia/NSB | Okay |  |
| ZTE | Yes |  |
| vivo | Yes |  |
| Huawei, HiSilicon | Yes |  |

**Proposal 3.1.1-2**

For Option 2 of SRS for positioning transmission in RRC\_INACTIVE, the UE capability of switching time between SRS Tx and other Tx in initial UL BWP is introduced also for SUL.

* The switching time value(s) are left up to RAN4 discussion
* If the transmission of SRS for positioning with the switching time collides in time domain with other UL transmission for SUL, the SRS for positioning transmission is dropped in the symbols where the collision occurs.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| CATT | Okay |  |
| ZTE |  | We think the main bullet is enough as there is another case that SRS is in SUL and other signalling is in NUL. |
| Vivo | Yes | It is up to the support of SUL for option 2 SRS transmission (proposal 3.2.1-1). |
| Huawei, HiSilicon | Yes | Agree with vivo.  To ZTE: this proposal only address the same UL carrier case. |

**FL comment**

It is not clear whether comments from ZTE are addressed. We may have a second round discussion for Proposal 3.1.1-2.

### Outcome of email endorsement

|  |
| --- |
| **Agreement**  For Option 2 of SRS for positioning transmission in RRC\_INACTIVE, the UE capability of switching time between SRS Tx and other Tx in initial UL BWP is introduced also for FDD.   * The switching time value(s) are left up to RAN4 discussion * If the transmission of SRS for positioning with the switching time collides in time domain with other UL transmission for FDD, the SRS for positioning transmission is dropped in the symbols where the collision occurs. |

### Round 2

Please only indicate if you have concern on the following proposal.

### Proposal 3.1.2-2

For Option 2 of SRS for positioning transmission in RRC\_INACTIVE, the UE capability of switching time between SRS Tx and other Tx in initial UL BWP is introduced also for SUL.

* The switching time value(s) are left up to RAN4 discussion
* If the transmission of SRS for positioning with the switching time collides in time domain with other UL transmission for SUL, the SRS for positioning transmission is dropped in the symbols where the collision occurs.

***Please only indicate if you have concern on the proposal.***

|  |  |  |
| --- | --- | --- |
| **Company** | **No** | **Comments** |
| ZTE |  | Thanks for clarification that SRS is also in SUL, then we suggest the following revision:   * If the transmission of SRS in SUL for positioning with the switching time collides in time domain with other UL transmission for SUL, the SRS for positioning transmission is dropped in the symbols where the collision occurs. |
| Huawei, HiSilicon |  | OK with ZTE’s revision. |
|  |  |  |

## (Issue 6-2) SUL support of SRS transmission option 2

This corresponds to Issue 6-2 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| vivo [3] | **Proposal 7:**   * For Option 2 of SRS for positioning configuration in inactive state, support the feature for SUL in Rel-17. |
| Huawei, HiSilicon [11] | **Proposal 6:** The feature of Option 2 SRS transmission in RRC\_INACTIVE state is supported for SUL.   * Network identifies UE support of the feature by   + The SRS resource capability reported for an SUL band, and   + The supported NUL+SUL band combination that follows the capability reporting of FG 6-16 and FG 6-17   **Proposal 7:** For the transmission of SRS (option 1 and option 2) associated with SUL   * No UL carrier selection is specified. * Simultaneous transmission on NUL and SUL on RRC\_INACTIVE state follows FG 6-19. |

**FL comments**

It was commented by ZTE in the email thread [109-e-Prep-AI8.5 R17 NR\_Pos\_Enh] as below

|  |
| --- |
| Regarding issue 6-2 (SUL support of SRS transmission option 2 ), I noticed RAN2's updated TS 38.331 almost get consensus to support SUL as follows. I don't see further discussion in RAN1 except for the switching time part which has been listed in issue 6-1.  cid:001f0001edc9ec23098be0b300002 |

However, the change in RAN2 has not been officially endorsed, while the proposals here also addresses the UE feature aspects.

The proposals from Huawei, HiSilicon can be directly used for comments.

### Round 1

**Proposal 3.2.1-1**

The feature of Option 2 SRS transmission in RRC\_INACTIVE state is supported for SUL.

* Network identifies UE support of the feature by
  + The SRS resource capability reported for an SUL band, and
  + The supported NUL+SUL band combination that follows the capability reporting of FG 6-16 and FG 6-17

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Huawei, HiSilicon | Yes |  |
|  |  |  |
|  |  |  |

**Proposal 3.2.1-2**

For the transmission of SRS (option 1 and option 2) associated with SUL

* No UL carrier selection is specified.
* Simultaneous transmission on NUL and SUL on RRC\_INACTIVE state follows FG 6-19.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| ZTE |  | This issue is related to the SRS switching time. If UE support this, does it mean SRS switching time introduced in section 3.1 can be 0? |
| Huawei, HiSilicon | Yes | To ZTE, if UE supports simultaneous transmission of NUL and SUL, when there is no switching between NUL and SUL. However, this does not prevent to have the intra-carrier switching between initial UL BWP and SRS outside initial BWP inside NUL or inside SUL, which is covered by 3.1. |
|  |  |  |

**FL comments**

It is not clear whether comments from ZTE are addressed, and also due to the lack of input, we may have a second round discussion for Proposal 3.2.1-1 and 3.2.1-2.

### Round 2

### Proposal 3.2.2-1

The feature of Option 2 SRS transmission in RRC\_INACTIVE state is supported for SUL.

* Network identifies UE support of the feature by
  + The SRS resource capability reported for an SUL band, and
  + The supported NUL+SUL band combination that follows the capability reporting of FG 6-16 and FG 6-17

***Please only indicate if you have concern on the proposal.***

|  |  |  |
| --- | --- | --- |
| **Company** | **No** | **Comments** |
|  |  |  |
|  |  |  |
|  |  |  |

### Proposal 3.2.2-2

For the transmission of SRS (option 1 and option 2) associated with SUL

* No UL carrier selection is specified.
* Simultaneous transmission on NUL and SUL on RRC\_INACTIVE state follows FG 6-19.

***Please only indicate if you have concern on the proposal.***

|  |  |  |
| --- | --- | --- |
| **Company** | **No** | **Comments** |
| vivo |  | We doubt in RRC\_inactive state, simultaneous transmission of SRS on an SUL/non-SUL carrier and other UL signals/channels on the other UL carrier in the same cell can be supported by UE. Maybe we can only support the SRS can be transmitted in the same carrier with other UL signals/channels in Rel-17.   |  |  | | --- | --- | | 6-19 | Simultaneous transmission of SRS on an SUL/non-SUL carrier and PUSCH/PUCCH/SRS on the other UL carrier in the same cell | |
| ZTE | No | RRC inactive positioning is mainly for power saving. We don’t believe it is a critical use case to support simultaneous tranmsision in both NUL and SUL. |
| Qualcomm |  | Similar view with ZTE |

## (Issue 6-3) Handling of SRS transmission and valid RO in RRC\_INACTIVE

This corresponds to Issue 6-3 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Samsung [6] | **Proposal 9:** if the SRS transmission (with a gap) collides with a valid RO, the SRS transmission is dropped. |

**FL comments**

The proposal can be directly used for comments.

### Round 1 (closed)

**Proposal 3.3.1-1**

If the SRS transmission (with a gap) collides with a valid RO, the SRS transmission is dropped.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| InterDigital |  | We would like to get clarification on situations such collision can happen. We assume that SRS will be scheduled to avoid ROs. |
| vivo | No | We would like to know the UE behavior in RRC\_connected. From our point of view, normally, such collisions can be avoided by serving gNB configuration/implementation according to the following specfication.  A PUSCH occasion is valid if it does not overlap in time and frequency with any valid PRACH occasion associated with either a Type-1 random access procedure or a Type-2 random access procedure. Additionally, for unpaired spectrum and for SS/PBCH blocks with indexes provided by *ssb-PositionsInBurst* in *SIB1* or by *ServingCellConfigCommon*  ***TS 38.213 8.1***  For single cell operation or for operation with carrier aggregation in a same frequency band, a UE does not transmit PRACH and PUSCH/PUCCH/SRS in a same slot or when a gap between the first or last symbol of a PRACH transmission in a first slot is separated by less than  symbols from the last or first symbol, respectively, of a PUSCH/PUCCH/SRS transmission in a second slot where  for  or 1,  for  or , and  is the SCS configuration for the active UL BWP. For a PUSCH transmission with repetition Type B, this applies to each actual repetition for PUSCH transmission [6, TS 38.214]. |
| Huawei, HiSilicon | No | We think the intention is to avoid SRS from UE1 collides with PRACH from UE2, what vivo cited is intra-UE collision between SRS and PRACH.  In general, we think this can be handled by network. If network chooses to configure SRS overlapped with PRACH (which normally is not the case), network may bear the sequence of the collision of SRS from one UE and PRACH from another UE. There is nothing UE should worry about. |
| Samsung | Yes | Thx HW for the explain to vivo, yes, the intention is that when UE1 tris to send SRS but the SRS is on a valid RO place, even though UE1 did not use that RO but other UE could. And such case will impact the reception at gNB side.  To HW, I am not sure if this is the way we handling the collision, there are always collision handling even for dynamic scheduled transmission. And I am not worry about UE behaviour but concern the UE sent UL transmission performance. The SRS for pos is designed in inactive to be low priority, so it should avoid the impact to other UE’s as well. At least for these expected UL signals. |
| Nokia/NSB | No | We think this issue is related to scheduling/configuration by network. |

**FL comment**

No consensus to define the SRS dropping due to the collision with valid RO, which can and should be taken into account in the gNB configuration.

The discussion is closed.

## (Issue 6-6) TP on terminology alignment on positioning SRS

This corresponds to Issue 6-6 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| OPPO [7] | **Proposal 2:** Adopt the following TP for TS 38.214 to keep the consistency within TS 38.214.   |  | | --- | | TP for TS 38.214  --------------------------------------------------------------------------------------------------------------------------------  ***Reason for change:*** From Rel-16, an SRS resource for positioning is described as an SRS resource configured by the higher layer parameter *SRS-PosResource* in TS 38.214, rather than use “an SRS resource for positioning directly”  ***Summary of change:*** Change “an SRS resource for positioning” to “an SRS resource configured by the higher layer parameter *SRS-PosResource*”  ***Consequences if not approved:***  Inconsistent terminologies within TS 38.214.  --------------------------------------------------------------------------------------------------------------------------------  6.2.1.4 UE sounding procedure for positioning purposes  When the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. If the UE is configured for transmission of SRS resource(s) configured by the higher layer parameter *SRS-PosResource* in RRC\_INACTIVE mode, the configured *spatialRelationInfoPos* is also applicable.  The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.  If the UE is not configured with the higher layer parameter *spatialRelationInfoPos* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *SRS-PosResource* across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources.  The UE is only expected to transmit an SRS configured by the higher layer parameter *SRS-PosResource* within the active UL BWP of the UE.  When the configuration of SRS is done by the higher layer parameter *SRS-PosResource*, the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource for positioning.  For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission.  The UE may be configured, subject to UE capability, to report UE TEGs (Timing Error Group), where the TEGs are:  *- ueTxTEG* which is associated with the transmissions of one or more UL SRS resources for the positioning purpose, which have the Tx timing error difference within a certain margin.  The UE may be configured to report, subject to UE capability, association information of SRS resource(s) configured by the higher layer parameter *SRS-PosResource* with UE Tx TEG(s) via higher layer parameter [*ueTxTEG*].  If the UE reports a UE Tx TEG ID with a UE Rx-Tx time difference measurement, as defined in clause 5.1.6.5, the UE shall report the association information of SRS resources configured by the higher layer parameter *SRS-PosResource* with the UE Tx TEG ID.  If the UE is configured with SRS resources configured by the higher layer parameter *SRS-PosResource* in multiple CCs, the UE should report the [*frequency information*] of the SRS resources when it reports the UE Tx TEG associations.  If the UE reports a UE RxTx TEG ID with a UE Rx-Tx time difference measurement, the UE may report a Tx TEG ID.  Subject to UE capability, the UE may be configured with an SRS resource configured by the higher layer parameter *SRS-PosResource* associated with the initial UL BWP, and the SRS resource is transmitted inside the initial UL BWP during RRC\_INACTIVE mode with the same CP and numerology as configured for the initial UL BWP. Subject to UE capability, the UE may be configured with an SRS resource configured by the higher layer parameter *SRS-PosResource* including frequency location and bandwidth, numerology, and CP length for transmission of the SRS in RRC\_INACTIVE mode. If the transmission of SRS for positioning in RRC\_INACTIVE mode [with the switching time] [in unpaired spectrum], subject to UE capability, collides in time domain with other DL signals or channels or UL signals or channels, the transmission of SRS resource(s) configured by the higher layer parameter *SRS-PosResource* is dropped in the symbol(s) where the collision occurs. The SRS resource configured by the higher layer parameter *SRS-PosResource* in RRC\_INACTIVE mode is configured in the same band and CC as the initial UL BWP.  If the UE in RRC\_INACTIVE mode determines that the UE is not able to accurately measure the configured DL RS in *SRS-SpatialRelationInfoPos* for a SRS resource for positioning where the DL RS is semi-persistent or periodic, the UE stops transmission of the SRS resource configured by the higher layer parameter *SRS-PosResource.* | |

**FL comments**

The TP can be directly used for comments.

### Round 1 (closed)

**Proposal 3.4.1-1 (TP)**

Adopt the following TP for TS 38.214 to keep the consistency within TS 38.214.

|  |
| --- |
| TP for TS 38.214  --------------------------------------------------------------------------------------------------------------------------------  ***Reason for change:*** From Rel-16, an SRS resource for positioning is described as an SRS resource configured by the higher layer parameter *SRS-PosResource* in TS 38.214, rather than use “an SRS resource for positioning directly”  ***Summary of change:*** Change “an SRS resource for positioning” to “an SRS resource configured by the higher layer parameter *SRS-PosResource*”  ***Consequences if not approved:***  Inconsistent terminologies within TS 38.214.  --------------------------------------------------------------------------------------------------------------------------------  6.2.1.4 UE sounding procedure for positioning purposes  When the SRS is configured by the higher layer parameter *SRS-PosResource* and if the higher layer parameter *spatialRelationInfoPos* is configured*,* it contains the ID of the configuration fields of a reference RS according to Clause 6.3.2 of [TS 38.331]. The reference RS can be an SRS configured by the higher layer parameter *SRS-Resource* or *SRS-PosResource*, CSI-RS, SS/PBCH block, or a DL PRS configured on a serving cell or a SS/PBCH block or a DL PRS configured on a non-serving cell. If the UE is configured for transmission of SRS resource(s) configured by the higher layer parameter *SRS-PosResource* in RRC\_INACTIVE mode, the configured *spatialRelationInfoPos* is also applicable.  The UE is not expected to transmit multiple SRS resources with different spatial relations in the same OFDM symbol.  If the UE is not configured with the higher layer parameter *spatialRelationInfoPos* the UE may use a fixed spatial domain transmission filter for transmissions of the SRS configured by the higher layer parameter *SRS-PosResource* across multiple SRS resources or it may use a different spatial domain transmission filter across multiple SRS resources.  The UE is only expected to transmit an SRS configured by the higher layer parameter *SRS-PosResource* within the active UL BWP of the UE.  When the configuration of SRS is done by the higher layer parameter *SRS-PosResource*, the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource for positioning.  For operation on the same carrier, if an SRS configured by the higher parameter *SRS-PosResource* collides with a scheduled PUSCH, the SRS is dropped in the symbols where the collision occurs.  The UE does not expect to be configured with *SRS-PosResource* on a carrier of a serving cell with slot formats comprised of DL and UL symbols, not configured for PUSCH/PUCCH transmission.  The UE may be configured, subject to UE capability, to report UE TEGs (Timing Error Group), where the TEGs are:  *- ueTxTEG* which is associated with the transmissions of one or more UL SRS resources for the positioning purpose, which have the Tx timing error difference within a certain margin.  The UE may be configured to report, subject to UE capability, association information of SRS resource(s) configured by the higher layer parameter *SRS-PosResource* with UE Tx TEG(s) via higher layer parameter [*ueTxTEG*].  If the UE reports a UE Tx TEG ID with a UE Rx-Tx time difference measurement, as defined in clause 5.1.6.5, the UE shall report the association information of SRS resources configured by the higher layer parameter *SRS-PosResource* with the UE Tx TEG ID.  If the UE is configured with SRS resources configured by the higher layer parameter *SRS-PosResource* in multiple CCs, the UE should report the [*frequency information*] of the SRS resources when it reports the UE Tx TEG associations.  If the UE reports a UE RxTx TEG ID with a UE Rx-Tx time difference measurement, the UE may report a Tx TEG ID.  Subject to UE capability, the UE may be configured with an SRS resource configured by the higher layer parameter *SRS-PosResource* associated with the initial UL BWP, and the SRS resource is transmitted inside the initial UL BWP during RRC\_INACTIVE mode with the same CP and numerology as configured for the initial UL BWP. Subject to UE capability, the UE may be configured with an SRS resource configured by the higher layer parameter *SRS-PosResource* including frequency location and bandwidth, numerology, and CP length for transmission of the SRS in RRC\_INACTIVE mode. If the transmission of SRS for positioning in RRC\_INACTIVE mode [with the switching time] [in unpaired spectrum], subject to UE capability, collides in time domain with other DL signals or channels or UL signals or channels, the transmission of SRS resource(s) configured by the higher layer parameter *SRS-PosResource* is dropped in the symbol(s) where the collision occurs. The SRS resource configured by the higher layer parameter *SRS-PosResource* in RRC\_INACTIVE mode is configured in the same band and CC as the initial UL BWP.  If the UE in RRC\_INACTIVE mode determines that the UE is not able to accurately measure the configured DL RS in *SRS-SpatialRelationInfoPos* for a SRS resource for positioning where the DL RS is semi-persistent or periodic, the UE stops transmission of the SRS resource configured by the higher layer parameter *SRS-PosResource.* |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| ZTE | Yes |  |
| Huawei, HiSilicon | No | The below text exists in Rel-16, and it should be clear that SRS resource for positioning refers to SRS resource configured by SRS-PosResource.  When the configuration of SRS is done by the higher layer parameter *SRS-PosResource*, the UE can only be provided with a single RS source in *spatialRelationInfoPos* per SRS resource for positioning.  Other sections managed by MIMO of TS 38.214 also used SRS for positioning. |
| Nokia/NSB | No | We don’t think there is ambiguity and prefer to keep the current specification |

**FL comments**

No consensus to adopt the TP. The discussion is closed.

## (Issue 6-7) TP on clarifying that UE supporting PRS reception in RRC\_INACTIVE is not mandatory

This corresponds to Issue 6-7 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| OPPO [7] | **Proposal 3:** Adopt the following TP for TS 38.214 to avoid the misunderstanding that UE should always have the capability to receive PRS in RRC\_INACTIVITE.   |  | | --- | | TP for TS 38.214  --------------------------------------------------------------------------------------------------------------------------------  ***Reason for change:*** The current specification may lead to potential misunderstanding that any UE in RRC\_INACTIVE is expected to process DL PRS.  ***Summary of change:*** Rearrange the paragraph “The UE in RRC\_INACTIVE mode is expected to prioritize the reception of any other DL signals and DL channels than the reception of DL PRS.”  ***Consequences if not approved:***  Potential misunderstanding on the UE behaviour in RRC\_INACTIVE for PRS reception .  --------------------------------------------------------------------------------------------------------------------------------  5.1.6.5 PRS reception procedure  <omitted text>  The UE in RRC\_INACTIVE mode, subject to UE capability, is expected to process DL PRS outside and inside of the initial DL BWP. The UE may be configured with the same or different numerology and CP for PRS resources than those of the initial DL BWP for DL PRS processing outside of the initial DL BWP. The UE may be configured with the same numerology and CP for PRS resources as those of the initial DL BWP for DL PRS processing inside of the initial DL BWP. The UE in RRC\_INACTIVE mode is expected to prioritize the reception of any other DL signals and DL channels than the reception of DL PRS.  <omitted text> | |

**FL comments**

The text proposal can be directly used for comments.

### Round 1

### Proposal 3.5.1-1 (TP)

Adopt the following TP for TS 38.214 to avoid the misunderstanding that UE should always have the capability to receive PRS in RRC\_INACTIVITE.

|  |
| --- |
| TP for TS 38.214  --------------------------------------------------------------------------------------------------------------------------------  ***Reason for change:*** The current specification may lead to potential misunderstanding that any UE in RRC\_INACTIVE is expected to process DL PRS.  ***Summary of change:*** Rearrange the paragraph “The UE in RRC\_INACTIVE mode is expected to prioritize the reception of any other DL signals and DL channels than the reception of DL PRS.”  ***Consequences if not approved:***  Potential misunderstanding on the UE behaviour in RRC\_INACTIVE for PRS reception .  --------------------------------------------------------------------------------------------------------------------------------  5.1.6.5 PRS reception procedure  <omitted text>  The UE in RRC\_INACTIVE mode, subject to UE capability, is expected to process DL PRS outside and inside of the initial DL BWP. The UE may be configured with the same or different numerology and CP for PRS resources than those of the initial DL BWP for DL PRS processing outside of the initial DL BWP. The UE may be configured with the same numerology and CP for PRS resources as those of the initial DL BWP for DL PRS processing inside of the initial DL BWP. The UE in RRC\_INACTIVE mode is expected to prioritize the reception of any other DL signals and DL channels than the reception of DL PRS.  <omitted text> |

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| ZTE | Yes |  |
| vivo |  | There seems to be no difference between the 2 versions. |
| Huawei, HiSilicon | Yes |  |
| Samsung |  | We assume this is about having PRS is always low priority than other DL signals. It is still have the detection timeline issue, even though it’s in inactive state. Suggest to wait the decision in very first proposal 2.1 |

**FL comments**

The TP can be postponed.

## (Issue 6-9) PRS-data collision detection timeline for RRC\_INACTIVE

This corresponds to Issue 6-9 of R1-2205097.

|  |  |
| --- | --- |
| **Company** | **Proposals** |
| Xiaomi [5] | **Proposal 2:** one of two options should be supported for collision detection according to UE capability for PRS inside of the initial DL BWP:   * Option 1: collision is detected only when PRS overlapped in the symbols of DL signals/channels. * Option 2:collision is detected when PRS is in a time window which starts from X1 symbols before DL signals/channels and ends after Y1 symbols of DL signals/channels.   **Proposal 3:** For DL PRS outside of the initial DL BWP, collision is detected when PRS is in a time window which starts from X2 symbols before DL signals/channels and ends after Y2 symbols of DL signals/channels. |

**FL comments**

The proposal can be directly used for comments.

### Round 1

### Proposal 3.6.1-1

One of two options should be supported for collision detection according to UE capability for PRS inside of the initial DL BWP:

* Option 1: collision is detected only when PRS overlapped in the symbols of DL signals/channels.
* Option 2: collision is detected when PRS is in a time window which starts from X1 symbols before DL signals/channels and ends after Y1 symbols of DL signals/channels.

|  |  |  |
| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Qualcomm |  | Our understanding is that RAN4 is discussing this topic and, one thing, being considered, is the “collision” to include the RSTDuncertainty-window. Not sure if RAN1 has to also discuss it. |
| ZTE |  | We prefer to wait for RAN4’s decision |
| Xiaomi | Yes | We prefer to decide it in RAN1 since it will have some specification impact on UE behaviour to perform PRS measurement or not. As for the value of X1 and Y1, we can wait for the RAN4’s decision. |
| vivo |  | Regarding collision issues of DL PRS in inactive state, it is better to wait for RAN4 output according to the following agreement.  **Agreement**  For UE in RRC\_INACTIVE state can support DL PRS processing outside and inside of the initial DL BWP:   * For DL PRS processing outside of the initial DL BWP, the SCS, CP type of DL PRS can be the same or different as for the initial DL BWP * For DL PRS processing inside of the initial DL BWP, the SCS, CP type of DL PRS is the same as for the initial DL BWP. * Potential impact of retuning time and expected RSTD assistance information on DL PRS reception performance is up to RAN4 * UE capability(ies) will be defined for DL PRS processing in RRC\_INACTIVE state   + details are FFS * Send an LS to RAN4 on agreed by RAN1 UE behavior for reception of DL PRS in RRC INACTIVE state |
| Samsung |  | We assume this is about having PRS is always low priority than other DL signals. It is still have the detection timeline issue, even though it’s in inactive state. Suggest to wait the decision in very first proposal 2.1 |
| Nokia/NSB |  | We prefer to wait for RAN4’s discussion result. |
| Ericsson |  | Agree with Vivo’s observation of the agreement. |

### Proposal 3.6.1-2

For DL PRS outside of the initial DL BWP, collision is detected when PRS is in a time window which starts from X2 symbols before DL signals/channels and ends after Y2 symbols of DL signals/channels.

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| **Company** | **Yes/No** | **Comments** |
| Xiaomi | Yes | We prefer to decide it in RAN1 since it will have some specification impact on UE behaviour to perform PRS measurement or not. As for the value of X2 and Y2, we can wait for the RAN4’s decision. |
| Ericsson |  | Similar comment as for proposal 3.6.1-2. |
| Qualcomm |  | We also think it is up to RAN4 |

# LS-in

## R1-2203022

|  |  |
| --- | --- |
| 1 Overall description  RAN4 thanks RAN1 for the LS [1] on lower Rx beam sweeping factor for latency improvement. In the last RAN4 #101b-e meeting, RAN4 reached the agreements in [2].  In this meeting, RAN4 had the further discussions on whether UE needs to be configured by LMF to perform PRS measurements in FR2 with a reduced Rx beam sweeping factor. For an instance, if the UE supports the capability for reduced Rx beam sweeping factor for FR2 PRS measurement (e.g. <8), is the UE expected to perform PRS measurements with the reduced Rx beam sweepting factor only per LMF request? Therefore, RAN4 also reached the following agreements:   |  | | --- | | Agreements:   * FFS on whether UE needs to be configured by LMF to perform measurements with a reduced Rx beam sweeping factor?   + - Option 1:       * Yes     - Option 2:       * No * A LS can be send to RAN1 to check whether LMF needs to reqeuest UE to perform PRS measurements with a reduced Rx beams sweeping factor in FR2 |   2 Actions  **To RAN WG1:**   * **ACTION:** RAN4 kindly asks RAN1 to take the above information into account in the following work on NR positioning enhancements and anaswer the question bellow.   **Q1:** **Whether does UE need to be configured by LMF to perform PRS measurements in FR2 with a reduced Rx beam sweeping factor?** |

### FL comments

This LS-in is handled in section 2.3 (issue 5-3).

## R1-2203023

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| **1. Overall Description:**  RAN4 thanks RAN1 for the LS on the condition of PRS measurement outside MG.  RAN4 has discussed the threshold applied to the Rx timing difference between the serving cell PRS and PRS from a non-serving cell/TRP to determine the applicability of PRS measurements outside MG.  RAN4 has agreed to introduce a UE capability to accommodate different UE implementations of PRS measurements outside MG.   * Introduce UE capability for the maximum Rx timing difference in MG-less PRS measurement   + Option 1: two values {CP length, 0.5 slot}   + Other options are not precluded   The threshold corresponds to the maximum Rx timing difference that the UE supports for PRS measurement outside MG.  RAN4 has agreed that the expected Rx timing difference between the PRS from the non-serving cell/TRP and that from the serving cell is determined by the expected RSTD and expected RSTD uncertainty in the assistance data, and any difference in timing between reference cell and the serving cell. The UE is not required to determine whether the threshold condition is satisfied by performing measurements. Therefore, no requirements on the UE to calculate the Rx time difference and/or to compare it against the threshold will be defined.  The details of the UE capability for the maximum Rx timing difference in MG-less PRS measurement will be further discussed as part of Rel-17 RAN4 UE feature list.  **2. Actions:**  **To: RAN WG1**  **ACTION:** RAN4 kindly asks RAN1 to take the above RAN4 agreements into account in the future work. |

### FL comments

This LS-in is handled in section 2.4 (issue 5-4).

## R1-2203026

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| **1. Overall Description:**  RAN4 is working on defining requirements for gapless PRS measurement. Since number of PFL during gapless PRS measurement within an active BWP is one of the key factors that affects measurement period requirement, RAN4 would like to seek input from RAN1 on applicable number of PFL for the gapless PRS measurement.  **2. Actions:**  **To RAN WG1 group.**  **ACTION:**  **RAN4 kindly requests RAN1 to provide their input on applicable number of PFL for the gapless PRS measurement.** |

### FL comments

This LS-in is handled in section 2.6 (issue 5-6).

## R1-2203028

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| **1. Overall Description:**  RAN4 thanks RAN2 for the information in R2-2202052. RAN4 discussed the support of concurrent MGs and NCSG when the pre-configured MG for positioning are used, and reached the following conclusions.   |  | | --- | | * RAN4 to define measurement requirements when pre-configured MG for positioning are used for the following scenario.   + No MG is configured for RRM measurement * RAN4 understand that the pre-configured MG for positioning cannot be configured as NCSG. |   RAN4 respectfully asks RAN2 and RAN1 to take the above information into account.  **2. Actions:**  **To RAN2 and RAN1:**  RAN4 respectfully asks RAN2 and RAN1 to take the above information into account. |

### FL comments

This LS-in appears more related to RAN2, and thus RAN1 may simply note this LS-in.

No action or discussion in RAN1 is required for R1-2203028.

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| **Company** | **Yes/No** | **Comments** |
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# Conclusion

## Proposals for email endorsement on 12 May

### Proposal 2.3.1-1 (email)

Support the LMF to request the Rx beam sweeping factor.

### Proposal 2.3.1-2 (email)

The request from LMF on the Rx beam sweeping factor is a single bit per positioning method, which can take two values.

* Value 1: Equal to the UE’s reported Rx beam sweeping factor in the corresponding capability for the band UE supports the feature, and equal to 8 for the FR2 bands that UE does not support the feature.
* Value 2: Equal to 8 (default assumption) for FR2 bands.
* The bit value should be set to the same across DL-TDOA, DL-AoD, and Multi-RTT for hybrid positioning.

### Proposal 2.4.1-1a (email, TP)

Adopt the following text proposals into TS 38.214 for the conditions for measuring the PRS outside of a MG.

* Reason of change: The UE capability for the maximum Rx timing difference in MG-less measurement is introduced. The relevant content about the conditions for measuring the PRS outside of a MG needs to be captured in our specification
* Summary of change: Added the conditions of measuring the PRS from the non-serving cells outside the measurement gap.
* Consequence if not approved: The spec is not clear when UE should receive the PRS from the non-serving cell outside the measurement gap.

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| < Unchanged parts are omitted >  The UE is expected to measure the DL PRS outside the measurement gap, subject to UE capability, if the DL PRS is inside the active DL BWP and has the same numerology as the active DL BWP and is within the DL PRS processing window indicated by higher layer parameter [*PRSProcessingWindow*]. The UE is not expected to measure the DL PRS outside the measurement gap, if the expected received timing difference between the DL PRS from the non-serving cell and that from the serving cell determined by higher layer parameters *nr-DL-PRS-ExpectedRSTD* and *nr-DL-PRS-ExpectedRSTD-Uncertainty* is larger than maximum Rx timing difference provided by [UE capability]*.* For receiving the DL PRS outside the measurement gap and within the DL PRS processing window, if the UE determines the DL PRS priority is higher than [other DL signals or channels except SSB] as indicated by higher layer parameter [*PRS-priority-indicator*] or as implied by UE capability, the UE is expected to measure the DL PRS; otherwise, the UE is not expected to measure the DL PRS and expected to receive [other DL signals and channels], subject to UE capabilities. Inside one instance of the [*PRSProcessingWindow*] the UE is only expected to measure a single DL PRS positioning frequency layer.  < Unchanged parts are omitted > |

### Proposal 2.6.1-1 (email)

Reply to the RAN4’s question in LS R1-2203026 with

* RAN1 already agreed in RAN1#108-e that inside each single instance of a PRS processing window, a single PFL can be measured. This is applicable to all Types of MG-less PRS processing.
* In addition, it is RAN1 understanding that the applicable number of positioning frequency layers for the gapless PRS measurement within a PRS processing window is one across all instances of the PRS processing window.

### Proposal 2.9.1-1a (email, TP)

Adopt the following TP on PRS Processing Window:

* Reason of change: *PRSProcessingWindow* is the name of the high layer parameter, instead of the concept of PRS processing window in RAN1’s agreements.
* Summary of change: Added PRS processing window before [PRSProcessingWindow]
* Consequence if not approved: The concept of PRS processing window is not clear from RAN1 perspective.

----------------Start of TP for TS 38.214---------------------

5.1.6.5 PRS reception procedure

……

The UE is not expected to be indicated with more than 4 activated PRS processing windows by high layer parameter [*PRSProcessingWindow*] across all active DL BWPs and is not expected to be indicated with the activated PRS processing windows that overlap in time.

……

----------------End of TP for TS 38.214---------------------

### Proposal 3.1.1-1 (email)

For Option 2 of SRS for positioning transmission in RRC\_INACTIVE, the UE capability of switching time between SRS Tx and other Tx in initial UL BWP is introduced also for FDD.

* The switching time value(s) are left up to RAN4 discussion
* If the transmission of SRS for positioning with the switching time collides in time domain with other UL transmission for FDD, the SRS for positioning transmission is dropped in the symbols where the collision occurs.