**3GPP TSG-RAN WG1 Meeting #109-e R1-220xxxx**

**e-Meeting, May 9th – 20th, 2022**

**Agenda Item: 8.5.2**

**Source: Moderator (Huawei)**

**Title: Summary #1 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).

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| < 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 > |

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| 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 .

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| 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. |

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| 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.

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|  | 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 $N\_{c\_{1}}$ of carrier $c\_{1}$ and a conflicting transmission in carrier $c\_{2}$ starting in symbol$ N\_{c\_{2}}$, 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 $N\_{c\_{1}}$ is at least$ N\_{2} $symbols, and the time interval between the last symbol of PDCCH and $N\_{c\_{2}}$ is at least $ N\_{2}$ symbols,

wherein the time interval unit of OFDM symbol is counted based on the smaller subcarrier spacing across $c\_{1}, c\_{2}$ and the corresponding scheduling cell of $c\_{2}.$**Proposal 4:** For an activated PRS processing window starting in symbol $N\_{c\_{1}}$ of carrier $c\_{1}$ and a conflicting transmission in carrier $c\_{2}$ starting in symbol$ N\_{c\_{2}}$, the UE shall apply the prioritization / dropping between the PRS and the conflict transmission taking into account:* DL channels & signals considered active at least $N\_{2}$ before $N\_{c\_{1}}$ and at least $N\_{2}$ symbols before $N\_{c\_{2}}$,

wherein the time interval unit of OFDM symbol is counted based on the smaller subcarrier spacing across $c\_{1}, c\_{2}$ and the corresponding scheduling cell of $c\_{2}$. |

**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~~.
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### 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 |
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### 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 |  |
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### 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.

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| **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.  |

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

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

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| **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 signaling 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 onlywithin 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.
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**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 signalingDiscuss 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.

|  |  |  |
| --- | --- | --- |
| **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 |  |

## (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 signaling.  |
| 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

### Proposal 2.3.1-1

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 |  |

### Proposal 2.3.1-2

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 |  |

## (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.  |

## (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.  |

### 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. |
|  |  |  |
|  |  |  |

### 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 |  |
|  |  |  |
|  |  |  |

## (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.

|  |
| --- |
| AgreementInside 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.AgreementWith regards to the issues of PRS processing windowIssues: 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

### Proposal 2.6.1-1

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 |  |

## (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,*** $\left[T\_{s}^{start}, T\_{s}^{end}\right]$ ***is the smallest interval in msec within slot*** $s$ ***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*** $s$***, where the interval*** $\left[T\_{s}^{start}, T\_{s}^{end}\right]$ ***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,*** $μ$ ***is the numerology of the DL PRS, and*** $\left|S\right|$ ***is the cardinality of the set*** $S$***.******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

### 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,*** $\left[T\_{s}^{start}, T\_{s}^{end}\right]$ ***is the smallest interval in msec within slot*** $s$ ***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*** $s$***, where the interval*** $\left[T\_{s}^{start}, T\_{s}^{end}\right]$ ***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,*** $μ$ ***is the numerology of the DL PRS, and*** $\left|S\right|$ ***is the cardinality of the set*** $S$***.***

***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. |

## (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.  |
|  |  |  |

## (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

### 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 |  |
|  |  |  |

## (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.  |
|  |  |  |

## (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

* 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.  |

## (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

### 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 |

## (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 2.12.1-1

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.  |

## (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

### 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.  |

# 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

### Proposal 3.1.1-1

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 |  |

### 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.  |
|  |  |  |

## (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** |
|  |  |  |
|  |  |  |
|  |  |  |

### 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? |
|  |  |  |
|  |  |  |

## (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

### 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** |
|  |  |  |
|  |  |  |
|  |  |  |

## (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 purposesWhen 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

### 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 purposesWhen 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 |  |
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## (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.

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| **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.

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| 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.

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| 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> |

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| **Company** | **Yes/No** | **Comments** |
| ZTE | Yes |  |
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## (Issue 6-9) PRS-data collision detection timeline for RRC\_INACTIVE

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

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| **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.

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| **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 |
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### 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** |
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# LS-in

## R1-2203022

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| 1 Overall descriptionRAN4 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:

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| 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.

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| * 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