**3GPP TSG-RAN WG4 Meeting # 111**   **R4-2410192**

**Fukuoka, JP, 20 – 24 May 2024**

**Agenda Item: 7.12.3**

**Source: Ericsson**

**Title:** **WF on RedCap positioning and PRS/SRS bandwidth aggregation**

**Document for: Approval**

# Introduction

The WF is related to general aspects, RedCap positioning and PRS/SRS BW aggregation, which are discussed under the following email thread [1]:

* [111][212] NR\_pos\_enh2\_part1.

The following sections contain agreements reached at RAN4#111.

# Work split and test cases

**Updated work split on test cases for RedCap positioning**

***Agreement***:

* Update the work split document as in [R4-2409586](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_111/Docs/R4-2409586.zip), for RedCap test cases.

**Test cases for RRC\_IDLE mode**

***Agreement***:

Option 1: RAN4 to define new TCs for RRC\_IDLE

* Align with previous agreements, e.g., for LPHAP
* The TCs for RRC\_IDLE are to be based on the corresponding TCs for RRC\_INACTIVE, if such TCs exist, otherwise, new TCs are to be defined (e.g., for eDRX)
	+ new clauses will be created, worksplit to be updated.

***Agreement***:

For RRC\_IDLE RSTD TCs, at least the following applies:

* Specify TCs:
	+ 4 samples with eDRX, for normal and RedCap UEs (without Rx FH)
	+ For normal UE: with and without PRS BW aggregation
* No TCs for 1 sample

For RRC\_IDLE RSRP TCs, at least the following applies:

* Specify TCs:
	+ 4 samples without eDRX, for normal and RedCap UEs (without Rx FH)
* No TCs for 1 sample

For RRC\_IDLE RSRPP TCs:

* No TCs

RRC\_IDLE RSCPD TCs:

* needed

Applicability rules:

* For each measurement, UE supporting both RRC\_IDLE and RRC\_INACTIVE shall be tested in RRC\_IDLE and does not need to be tested in RRC\_INACTIVE.

**Testing principles for positioning TCs in RRC\_IDLE mode**

***Conclusion***: To be discussed together with the worksplit in RAN4#111 and draft CRs in RAN4#112.

# RedCap Positioning

## Core requirement

**Update to RAN4 UE feature list.**

***Agreement***

* + - * RAN4 UE feature list for RedCap positioning is updated to align with the RAN1 UE feature list for RedCap positioning.
			* Pre-requisite groups for RAN4 FGs 37-1 is updated to “RAN1 feature 28-1 **or 48-1**, 27-3-1, 41-5-1”.
			* Pre-requisite groups for RAN4 FG 37-1A is updated to “ RAN1 feature 28-1 **or 48-1**, 27-3-1, 41-5-1”.

**Time window for RX FH in RRC\_INACTIVE/IDLE state**

***Agreement***

* + - * Do not update time window for PRS measurement for RedCap positioning, including Rx FH, in RRC\_INACTIVE/IDLE state.

**Mapping between PRS configuration and number of hops per slot in core requirements**

***Agreement***

* + - * The mapping between PRS configuration and number of hops per slot

|  |  |  |  |
| --- | --- | --- | --- |
| $$RRT\_{FH}$$ | **(comb size, Number of PRS symbols)** | **Applicable number of hops per slot** $\left(N\_{hops}^{slot}\right)$ | **Applicable length per hop (**$T\_{hop}$**) in number of symbols** |
| $$RRT\_{FH}\leq 2 symbols$$ | (2, 12) with SCS 15kHz, 30kHz in FR1, and 60kHz, 120kHz in FR2 | 2 | 7 |
| All others | 1 | 14 |
| $$2 symbols <RRT\_{FH}\leq 6 symbols$$ | (≤ 6, any) | 1 | 14 |
| (12, 12) | ½ | 28 |
| $$RRT\_{FH}>6 symbols$$ | Any combination | ½ | 28 |

## Performance requirement

**Bandwidth configuration for accuracy requirement for positioning measurement with RX FH for RedCap positioning**

***Agreement***:

* Define accuracy requirements for FH case based on at least following BW groups:

- 15kHz: per-hop BW ≥ 52 RB, min total BW = [268] RB

- 30kHz: per-hop BW ≥ 52 RB, min total BW = [272] RB

- 60kHz (FR1): per-hop BW ≥ 24 RB, min total BW = [132] RB

- 60kHz (FR2): per-hop BW ≥ 68 RB, min total BW = [264] RB

- 120kHz: per-hop BW ≥ 68 RB, min total BW = [264] RB

* FFS: additional BW configurations for accuracy requirements, e.g., smaller total BW.

Note: per-hop BW is to be converted in the accuracy requirements to BW in MHz and aligned with RAN2 signaling.

* For accuracy requirements for FH case, derive accuracy numbers from simulation results.
* The requirements apply, provided that the BWtotal defined in clause core requirements is no less than the total BW above.

**Accuracy requirement for RedCap positioning**

***Agreement***:

* Accuracy requirements are different from the legacy (more accurate than legacy) for the cases with and without Rx FH for the scenario where the total PRS BW after all hops is larger than the PRS BW without Rx FH.
* FFS: With some BW configurations, accuracy requirements can be same as legacy for the cases with and without Rx FH for the scenario where the total PRS BW after all hops is equal to the PRS BW without Rx FH, if such exist.

## Test cases for RedCap positioning

**PRS bandwidth for FH TCs for RedCap positioning**

***Conclusion***: Collect feedback from TE vendors.

**PRS RMC for RedCap positioning TCs**

***Agreement***:

* For small BWs, reuse the existing one.
* For larger BWs non-FH: new PRS RMC I to be defined (to be used for measurement accuracy TCs), e.g.:
* 104/48/64 RB for 15/30/120kHz, respectively

# PRS/SRS aggregation

## Core requirement

**Core requirement for PRS-RSRP/RSRPP measurement based on bandwidth aggregation**

***Agreement***

* + - * Core requirement for timing measurements (RSTD or UE Rx-Tx) based on aggregated carriers/PFLs apply to PRS-RSRP/RSRPP, when UE reports PRS-RSRP/RSRPP together with the timing measurements (RSTD or UE Rx-Tx) based on the aggregated carriers/PFLs.

**Interruption delay requirement for SRS aggregation**

***Agreement***

* + - * Define interruption requirements for SRS transmission with BW aggregation on CC without PUSCH/PUCCH.
			* Reuse the framework of SRS carrier and/or antenna switching based interruption requirements as the starting point
			* The interruption length is FFS

## Performance Requirement

**Bandwidth configuration for PRS aggregation based measurement accuracy requirement**

***Agreement***:

* + - * Define RSTD and UE Rx-Tx measurement accuracy requirements with PRS BW aggregation for aggregated PFLs of equal bandwidth, with the per-PFL bandwidth values agreed in the simulation assumptions
			* Accuracy requirements are defined based on combination (per-PFL BW, number of PFLs).

**Accuracy requirement for PRS-RSRP/RSRPP measurement based on PRS aggregation**

***Agreement***:

* + - * The requirements are defined, based on the following principle:
				+ For a given side condition and propagation condition, existing legacy accuracy requirement corresponding (same or closest smaller) to the total aggregated BW applies also for the total aggregated BW to the PRS-RSRP/ RSRPP measurements in case of PRS BW aggregation.

**Accuracy requirement based on baseband sampling rate for measurements based on PRS aggregation**

***Agreement***:

* + - * Baseband sampling rate is not captured in accuracy requirements for RSTD and UE Rx-Tx measurements.
			* Sampling rate assumptions are for RAN4 simulation purposes.

**Accuracy requirements for 2 PFL and 3 PFL cases**

***Agreement***:

* + - * Define separate accuracy requirements for RSTD and UE Rx-Tx measurements for 2 and 3 aggregated PFLs.

**Applicability of requirements for PRS aggregation**

***Agreement***:

* + - * Define the following requirement applicability for RSTD with DL PRS CA:
				+ For RSTD with DL PRS aggregation, the accuracy requirement corresponding to the smallest BW between the reference and target TRP.
				+ In the specification, adapt to the multi-PFL requirement wording from legacy requirements.

## Test cases for PRS aggregation

**PRS resource set up for measurement delay test cases**

***Agreement***:

* + - * For RRM delay and accuracy test cases with PRS CA, only configure the PRS resources for aggregate measurement.

# References

1. R4-2410133, Ad-hoc minutes for NR\_pos\_enh2 WI (Monday) , Ericsson.
2. R4-2410134, Ad-hoc minutes for NR\_pos\_enh2 WI (Tuesday), Ericsson.
3. R4-2410135, Ad-hoc minutes for NR\_pos\_enh2 WI (Wednesday), Intel.