**3GPP TSG-RAN WG4 Meeting # 101bis-e R4-22XXXX**

**Electronic Meeting, January 17-25, 2022**

**Agenda item:** 6.10.2.3

**Source:** CATT

**Title:** WF on further RRM enhancement for NR and MR-DC - PUCCH SCell activation/deactivation requirements

**Document for:** Approval

# Introduction

This is the WF to capture all the agreements and open issues in email discussion [101-bis-e][208] NR\_RRM\_enh2\_3 for RAN4#101-bis-e meeting.

# Sub-topic 1-1 PUCCH SCell activation requirements for unknown cell

### Issue 1-1-1: Whether to define PUCCH SCell activation requirements for unknown cell case for UE supporting the Rel-17 capability of cross PUCCH group CSI reporting?

*Agreements:*

* + RAN4 to define PUCCH SCell activation requirements for unknown cell case for UE supporting the Rel-17 capability of cross PUCCH group CSI reporting.
	+ The detailed requirements can be discussed in sub-topic 1-2 and sub-topic 1-3.

### Issue 1-1-2: Whether to define PUCCH SCell activation requirements for unknown cell case for UE not supporting the Rel-17 capability of cross PUCCH group CSI reporting?

*Candidate options:*

* Option 1c: (Apple, Ericsson, QC, DOCOMO, vivo, Intel, CMCC, CATT, OPPO)
	+ RAN4 to not specify PUCCH SCell activation requirement for the scenarios in which beam information needs to be reported to network but UE cannot support CSI reporting cross PUCCH groups
* Option 2: (Huawei, MTK, Intel, Nokia)
	+ Wait RAN2 to determine whether to define requirements for unknown PUCCH SCell activation for UE not supporting cross PUCCH group CSI reporting.

# Sub-topic 1-2 PUCCH Scell activation delay requirement for valid TA case

### Issue 1-2-1: Whether to consider the time uncertainty of MAC CE for PL-RS activation?

*Candidate options:*

* Option 1: (CATT, Apple, DOCOMO)
	+ Keep the agreement in last meeting.
* Option 2: (Huawei, Ericsson, Intel, Nokia)
	+ There is no need to consider uncertainty of MAC CE for PL-RS activation in PUCCH SCell activation delay requirements.
* Option 3: (Ericsson, QC, Apple)
	+ Send LS to RAN1 to check the PL-RS configuration of PUCCH Scell to be activated.

### Issue 1-2-2: For Tactivation\_time, whether spatial relation will introduce extra delay time?

*Agreements:*

* + For Tactivation\_time, spatial relation activation would not introduce additional delay time.

### Issue 1-2-3: For Tactivation\_time, whether the PL-RS will introduce extra delay time?

*Agreements:*

* + For Tactivation\_time in FR2 PUCCH SCell activation requirement, only define detailed requirement when PL-RS of target PUCCH SCell is known.
	+ If the PL-RS of target PUCCH SCell is unknown, clarify that “longer activation time is expected if the pathloss reference signal is unknown.” in the spec.
	+ FFS the known condition of PL-RS.
	+ FFS the detailed requirements when PL-RS of target PUCCH SCell is known.

### Issue 1-2-3a: the known condition of PL-RS

*Candidate options:*

* Option 1: (Huawei, Ericsson)
	+ The known condition is to be defined as:
		- For known PUCCH SCell,
			* TCI sate, PL-RS and spatial relation indication are assumed to be based on the L3 measurement.
		- For unknown PUCCH SCell,
			* TCI sate, PL-RS and spatial relation indication are assumed to be based on L1-RSRP measurement.
* Option 2: (Apple)
	+ Similar as in legacy PL-RS switching requirement, but only replace the L1-RSRP measurement report of PL-RS by “L3 measurement report of PL-RS”
* Option 3: (CATT)
	+ Use the same condition in PL-RS switching delay requirements.

### Issue 1-2-3b: the detailed requirements when PL-RS of target PUCCH SCell is known

*Tentative agreement:*

* + 5 samples time is considered when PL-RS is not maintained before SCell is activated.
	+ No additional delay is needed when PL-RS is maintained before SCell is activated.

### Issue 1-2-4: Relation between the associated RS for TCI state, PL-RS and spatial relation indication?

*Tentative agreements:*

* + The PUCCH Scell activation requirements are defined based on the following assumption:
		- For the activation with known condition, the SSB associated to PL-RS indication, TCI state switch and spatial relation is the same.
		- For the activation with unknown condition, the SSB or CSI-RS associated to PL-RS indication, TCI state switch and spatial relation is the same.
	+ No need to capture it in the specification.

### Issue 1-2-5: How to consider the Tx power of target PUCCH in PUCCH SCell activation requirement?

*Agreements:*

* + The issue can be covered by issue 1-2-3.

### Issue 1-2-6: The PUCCH Scell activation delay requirements for valid TA case?

*Agreements:*

* If the UE has a valid TA for transmitting on an SCell then the UE shall be able to transmit valid CSI report and apply actions related to the SCell activation command for the SCell being activated on the PUCCH SCell no later than in slot $n+\frac{T\_{HARQ}+T\_{activation\\_time+}T\_{CSI\\_Reporting+}[X]}{NR slot length}$, where
* THARQ (in ms) is the timing between DL data transmission and acknowledgement as specified in TS 38.213
* Tactivation\_time for FR1is the SCell activation delay as defined in section 8.3.2.
* Tactivation\_time for FR2 will be updated based on the conclusions of issue 1-2-1, issue 1-2-2 and issue 1-2-3.
* TCSI\_Reporting is specified in clause 8.3.2.
* FFS whether [X] which is the relaxation margin for unknown cell is needed.

### Issue 1-2-6a: Whether [X] is needed for the PUCCH Scell activation delay requirements for valid TA case?

* Option 1:
	+ Yes, [X] is the relaxation margin for reporting L1-RSRP of the target being-activated PUCCH SCell on any active serving cells belonging to primary PUCCH group, when the PUCCH SCell is unknown in FR2.
* Option 2:
	+ No. X can be included within Tactivation\_time

# Sub-topic 1-3 PUCCH Scell activation delay requirement for invalid TA case

### Issue 1-3-1: The PUCCH SCell activation requirements for invalid TA case

*Agreements:*

* The UE shall be capable to perform downlink actions related to the SCell activation command for the SCell being activated on the PUCCH SCell no later than in slot $n+\frac{T\_{HARQ}+T\_{activation\\_time+[X]}}{NR slot length}$.
* The UE shall be capable to perform uplink actions related to the SCell activation command for the SCell being activated on the PUCCH SCell no later than in slot $n+\frac{T\_{HARQ}+T\_{activation\\_time}+[T\_{PDCCH}]+[X]+T1+T2+T3+[T\_{CSI\\_reporting}]}{NR slot length}$.
* FFS: whether [X] which is the relaxation margin for unknown cell case is needed.
* FFS: whether [$T\_{PDCCH}$] which is the delay uncertainty for PDCCH order receiving is needed.
* FFS: whether [$T\_{CSI\\_reporting}$] is needed and FFS the definition of [$T\_{CSI\\_reporting}$] if applicable.

### Issue 1-3-2: the delay for obtaining a valid TA command for the sTAG to which the SCell configured with PUCCH belongs (i.e. T2)

*Agreements:*

* + T2 is the delay for obtaining a valid TA command for the target PUCCH SCell being activated from the point that UE transmit PRACH (i.e. end of T1).

### Issue 1-3-3: The components of Tactivatation\_time

*Agreements:*

* + Can be included in the discussion of issue 1-2-1, issue 1-2-2 and issue 1-2-3.

### Issue 1-3-4: The TPDCCH

*Candidate options:*

* Option 1: (Xiaomi, QC, ZTE, Nokia)
	+ RAN4 not to consider TPDCCH in the PUCCH SCell activation requirements for invalid TA case.
* Option 1a: (QC, ZTE)
	+ The uncertainty of PDCCH order reception should be part of T1.
* Option 2: (MTK, CATT)
	+ RAN4 need to consider TPDCCH in the PUCCH SCell activation requirements for invalid TA case.

### Issue 1-3-5: The TCSI-RS\_reporting

*Agreements:*

* + TCSI\_reporting is needed in the PUCCH SCell activation requirements for invalid TA case.

### Issue 1-3-5a: FFS the definition of TCSI-RS\_reporting

*Candidate options:*

* Option 1: (Nokia)
	+ TCSI\_Reporting\_PUCCH is the time uncertainty in acquiring the first available CSI reporting resources after RACH completion.
* Option 2: (QC)
	+ TCSI\_reporting is the delay (in ms) including uncertainty in acquiring the first available downlink CSI reference resource after Tactivation\_time, UE processing time for CSI reporting and uncertainty in acquiring the first available CSI reporting resources after T3 as specified in TS 38.331
* Option 3: (CATT)
	+ TCSI\_reporting is defined as the uncertainty in acquiring the first available downlink CSI reference resource after Tactivation\_time, and uncertainty in acquiring the first available CSI reporting resources after T3.

# Sub-topic 1-4 Interruption requirements for PUCCH SCell activation

### Issue 1-4-1: The scenarios of interruption requirements for PUCCH Scell activation?

*Tentative agreements:*

* + No PUCCH Scell requirements (including interruption requirements and delay requirements) for NR-DC according to RAN2 restiction on numebr of PUCCH group in each cell group.

# Sub-topic 1-5 Applicability of PUCCH SCell activation requirements

### Issue 1-5-1 Applicability on interruption:

*Agreements:*

* + PUCCH SCell activation requirements are applied when no interruption occurs in same FR as the target PUCCH Scell during the Scell activation procedure if UE supports per-FR MG, otherwise the PUCCH Scell activation delay can be extended, and
	+ PUCCH SCell activation requirements are applied when no interruption occurs during the Scell activation procedure if UE does not support per-FR MG, otherwise the PUCCH Scell activation delay can be extended.
	+ The above interruption is caused by factor defined in TS38.133 section 8.2.1.1 for EN-DC, in TS38.133 section 8.2.2.1 for NR SA, in TS38.133 section 8.2.3.1 for NE-DC and in TS38.133 section 8.2.4.1 for NR-DC.

### Issue 1-5-1a Whether to capture the agreement of issue 1-5-1 in the spec?

*Candidate options:*

* Option 1: (Apple, Nokia)
	+ Yes, which is same as LTE.
* Option 2: (Huawei, Ericsson, Xiaomi)
	+ No.

### Issue 1-5-2: Applicability on PDCCH order receiving:

*Tentative agreements:*

* + UE is not expected to receive a PDCCH order to initiate RA procedure on the PUCCH SCell earlier than n+ THARQ + Tactivation\_time;
	+ A delay uncertainty for reception of PDCCH order shall be accounted for in the activation timeline. The delay uncertainty for reception of PDCCH order starts from end of n + THARQ + Tactivation\_time until reception of PDCCH order.
	+ FFS whether and how to capture the delay uncertainty for reception of PDCCH order in the PUCCH SCell activation delay requirements (which can be included in issue 1-3-4)

### Issue 1-5-3: Applicability on use cases:

*Candidate options:*

* Option 1: (CATT, MTK, Huawei, Ericsson, Nokia)
	+ There is no needed to bundle the PUCCH Scell with single/multiple TAGs or intra-/inter band cases.
* Option 2: (Apple)
	+ RAN4 to only define the PUCCH SCell activation only for the case when target PUCCH SCell and existing active serving cells belong to the different TAGs.
	+ There is no need to bundle the PUCCH Scell with intra-/inter band cases.

# Sub-topic 1-6 UE feature list for PUCCH Scell activation/deactivation requirements

### Issue 1-6-1: The UE feature for support of RRM requirement of PUCCH SCell activation.

*Tentative agreements:*

* + No need to introduce UE capability for the support of RRM requirements (i.e. UE feature x-1 which indicates the support of RRM requirement of PUCCH SCell activation is not needed.)
	+ R15/16 UEs who support PUCCH SCell are not required to meet R17 PUCCH SCell activation requirement.

### Issue 1-6-2: The UE feature for support of CSI reporting cross PUCCH groups.

*Agreements:*

* + The UE capability which indicates the support of CSI reporting cross PUCCH group is within RAN1/2 scope.

# Reference

1. R4-22XXXX Email discussion summary for [101-bis-e][208] NR\_RRM\_enh2\_3, CATT, RAN4#101bis-e