### Sub-topic 3-1: Tx switching with multiple TAGs

#### Issue 3-1-1: UL switching time

*Summary of round 1 discussion*

* + Option 2: The switching time is the same for single TAG and 2 TAGs (China Telecom, HW, Samsung, OPPO, ZTE, Xiaomi, Nokia, vivo, MTK, E///)
    - China Telecom, Samsung, OPPO, ZTE, vivo, E///: the difference is on UL outage time, or alternatively, TA can be considered separately
    - MTK: On top of UE reported Tx switching time, network need to handle delta MTTD as described in R4-2212220.
    - QC question: how to reflect the difference on the UL outage time in RAN4 specification. so the ran4 specifcation should then say “network is not expected to the schedule transmission for the outage time…” instead of referring to switching time?
  + Option 3: Agree that the switching time should not include timing difference. But switching time for one given band combination can be different when UE supports TX switching on a band pair with single TAG and multiple TAGs. (QC)

*Tentative agreement:*

* + The UL Tx switching time does not include the timing difference.

*Recommendation for round 2:*

* Further discuss the two options:
  + Option A: The UL switching time is the same for single TAG and 2 TAGs.
  + Option B: The switching time for one band pair can be different for single TAG and 2 TAGs, while the candidate switching time values are still in the set of {35us, 140us, 210us}.

#### Issue 3-1-2: UL outage time

*Summary of round 1 discussion*

* + Option 1: For Tx switching between 2 bands with 2 TAGs, the UL outage time due to switching is depending on 3 factors (China Telecom, QC, Samsung, ZTE, vivo - basically agree)
    - #1: The UL switching time reported by UE (i.e., the Rel-16/17 switching time)
    - #2: The delta of TA values on the two bands, assuming that the non-collocated BSs can exchange the estimated TA information timely.
    - #3: The timing measurement error, including: the DL timing estimation error, UL TA estimation error and UL TA quantization error.
  + Additional comment/questions related to option 1:
    - Samsung: For switching across 3/4 bands, whether or not exact the same R16/17 value, still depends on Issue 2-1-3.
    - QC: For #2, the TA values can not be compared directly since it is up to the UE to choose the reference DL band.
    - E///: The UL timing in each TAG follows the DL timing of the same TAG.
    - Nokia, E///: not agree to consider the last two bullets.
    - Apple: The 2nd and 3rd bullets can be merged into MTTD, which also includes the propagation delay difference. Note that delta of TA cannot represent propagation delay difference.
    - OPPO, MTK: discuss in RRM session?
    - OPPO, ZTE: how to reflect this in spec?
    - HW: the timing other than switching period could be addressed by NW scheduling implementation, and can be clarified in the spec while not updating the time mask requirements

*Recommendation for round 2:*

* + For UL outage time discussion, focus on the UL 2 bands with 2 TAGs scenario at first.
  + Further discuss:
    - The potential factors to be considered
    - Whether and how to reflect the UL outage time in the specification
    - Is it a RF dominant issue or RRM dominant issue?

#### Issue 3-1-3: PUSCH preparation time

*Summary of round 1 discussion*

* + Option 1: PUSCH preparation time has to be extended by the switching period and time difference of the carriers for the leading carrier. (QC)
    - QC: LS to ran1 would be needed or alternatively define extended PUSCH preparation time in ran4 requirements.
    - E///: The PUSCH preparation time already accounts for different TA on uplink serving cells, multiple-TAG was specified in Rel-15. Then the switching period was added to the PUSCH preparation time in Rel-16, see R4-2204604.
  + Option 2: to discuss PUSCH preparation time for single TAG firstly (HW, Samsung)
  + Option 3: to be addressed in RAN1 first (Nokia, QC, HW)
    - HW: don’t agree with the LS to RAN1

*Related RAN1 conclusion in May meeting:*

***Conclusion***

*It is RAN1’s understanding that RAN4 should lead the discussion on UL Tx switching with multiple TAGs for both 2 bands case and more than 2 bands case*

* *For further discussion in RAN1 with regards to UL Tx switching with multiple TAGs, it will be discussed only if triggered by RAN4*
* *……*

*Recommendation for round 2:*

* + Focus on the UL 2 bands with 2 TAGs scenario at first.
  + Further discuss the need of potential impact on PUSCH preparation time.

#### Issue 3-1-4: DL interruption time for Tx switching with multiple TAGs

*Summary of round 1 discussion*

* + Option 2: To be discussed in RRM session. (China Telecom, Huawei, Samsung, Nokia, MTK, E///, Apple)

*Tentative agreement:*

* + To discuss in RRM session.

#### Issue 3-1-5: UE capability and release independence

*Summary of round 1 discussion*

* + Proposal 1 on release independence: Switching band combinations for UEs indicating *supportedNumberTAG* (optional) for a band pair can be specified in a release independent manner from Rel-16 (pending final confirmation from RAN1 that no specification changes are needed in earlier releases for support of multiple-TAG). (E///)
    - Comments on proposal 1:
      * QC, CTC, Nokia, Apple: For UL 2 bands with 2-TAGs, release independent aspect can be discussed after we know requirements and spec impact.
      * HW, vivo, MTK: Tx switching with m-TAG is a Rel-18 feature
  + Proposal 2 on UE capability: (QC, MTK)
    - RAN4 will discuss further how the switching time capabilities will be defined for different cases of > 2 band TX switching features with > 1 TAG.
    - UE shall be able to declare multi TAG support for TX switching independent of declared capability for multiTAGs
    - Comments on Proposal 2:
      * CTC, E///, QC: the *supportedNumberTAG* can already be reported separately for non-Tx switching and Tx switching cases, based on the current RAN2 signaling.

*Tentative agreement:*

* On release independence:
  + To be discussed after we know requirements and spec impact
* On UE capability:
  + It is RAN4 understanding that, based on the current RAN2 signaling design, the *supportedNumberTAG* can already be reported separately for non-Tx switching and Tx switching scenarios, i.e., it is possible for UE to report 2-TAG for non-Tx switching scenario, and single-TAG for Tx switching scenario.
  + For Tx switching scenario, whether it is allowed to report different switching time for 2-TAG case compared to single-TAG case is discussed in Issue 3-1-1.

#### Issue 3-1-6: RAN4 CR text

* **Proposed modifications on the CR in R4-2204605 (Ericsson CR submitted to RAN4 #102-e)**
  + QC proposals:
    - Proposal 1: Define new two TAG requirements only for the case when the two cells that are part of the TX switching are assigned for different TAGs.
    - Proposal 2: Change the “UE is not expected to transmit” to “UE not expected to be scheduled for transmissions”.
    - Proposal 3: Simplify the language by referring to leading or lagging carriers.

*Recommendation for round 2:*

* + Further discuss in the next meeting.

#### Issue 3-1-7: Need of RAN1 spec impact

*Summary of round 1 discussion*

* + Option 1: Send the related RAN4 agreement (if reached) to RAN1, and it is up to RAN1 decision on whether any RAN1 impact is needed (E///, Nokia, China Telecom, ZTE, QC)
    - QC: Extension of PUSCH preparation time and DL interruption time, if agreed, can be sent to RAN1
    - China Telecom: For UL switching time, UL outage time and DL interruption time, if any agreements can be reached in RAN4, we can send them to RAN1.
    - E///, Nokia: Inform RAN1 that RAN4 intends to amend the 38.101-1 specification to accommodate multiple-TAG (dual-TAG) for switching between two bands and ask whether there are any changes to the RAN1 specifications required for accommodating this.
  + Option 2: Necessity of sending LS to RAN1 is not clear. (HW, Samsung, OPPO)

*Recommendation for round 2:*

* + Further discuss. A tdoc number for the LS on multi-TAGs will be requested, and whether the LS can be agreeable is pending on the discussion in round 2.

### Sub-topic 3-2: Additional issue for Tx switching accorss 3/4 bands with multiple TAGs

#### Issue 3-2-1: Target scenarios

*Related RAN1 conclusion in May meeting:*

***Conclusion***

*It is RAN1’s understanding that RAN4 should lead the discussion on UL Tx switching with multiple TAGs for both 2 bands case and more than 2 bands case*

* *……*
* *If it is decided to support UL Tx switching with multiple TAGs, it is RAN1's working assumption that the number of TAGs should be limited to up to 2*

*Summary of round 1 discussion*

* + Option 1: Limit number of TAGs to up to 2 for all the cases in the Rel-18 WI (QC, DCM, CTC, Samsung, OPPO, Xiaomi, Sony, OPPO, E///, Nokia)
  + Option 2: Limit number of TAGs for 3 and 4 band cases to 1 (QC, Nokia)
  + Option 3: In the scenario of multi-TAG, the switching time masks do not include timing advance difference but the timing advance difference should be considered with the switching time. (HW)
  + Option 4: focus on 2-TAG case at first, and then extend to the same number of bands if time allowed. (ZTE)

*Recommendation for round 2:*

* + Check whether option 1 is agreeable.