**3GPP T****SG-RAN WG4 Meeting # 97-e R4-2016927**

**Electronic Meeting, 2-13 Nov., 2020**

**Source: Nokia, Nokia Shanghai Bell**

**Title: WF on timing text proposal to TR**

**Agenda item: 13.2.1.2**

**Document for: Aproval**

1. Background

At RAN4#97-e, a way forward for timing issues on the FS\_NR\_52\_to\_71GHz was created based on the discussion in R4-2016981. This WF addresses the text proposal to TR 38.808 incorporating elements of R4-2016036 and R4-2016000.

In the WF section a single text proposal has been generated taking into account feedback received during first round discussion. All specific numbers have been left out and only guidance is provided on which areas need further work during the work item. Specifically, it has been taken into account that requirement work is to be done in WI. As the input contributions included proposals, the text proposal is formulated to also take into account those proposals.

1. Way forward

A text proposal shall be drafted capturing the following content into TR 38.808

<Start of TP>

4.2.x Timing aspects

During the study item timing aspects were evaluated with to goal of providing observations and guidance on which technical topics need to be considered in the work item phase when timing related requirements are agreed. The evaluated topics were cell phase synchronization, base station timing alignment error, analog beam switching delay, UE timing advance operation and transient periods.

It was observed that while highest SCSs may limit the available time budget left for e.g. delay spread, the issue can be mitigated by adopting correct network configuration based on deployment scenario and use case. TDD pattern can be adjusted according to the propagation environment, and higher SCS provides more opportunities to achieve optimal configuration for with minimal overhead when compared to lower SCS.

Currently transient times for UE are 20 us in FR1 and 5 us in FR2. For base stations these are 10 us and 3 us for FR1 and FR2, respectively. It was concluded during the SI, that possible improvements for transient times should be evaluated and the final agreement for transient time requirements shall be made during the work item.

Guard period is also related to cell phase synchronization as for overlapping cells, synchronization error needs to be taken into account as it contributes to the possibility of BS-to-BS interference. Due to smaller cell sizes in this frequency cells compared to lower frequencies and therefore shorter propagation delays possibility of such interference is reduced. As network has to control over guard period, motivation to re-visit cell-phase synchronization was not found during the SI.

OTA TAE requirements in clause for FR2 base stations specify 65 ns for MIMO transmission. This requirement has been in place since UMTS and is derived to align with quarter of the time of a single UMTS chip. Technology has evolved, and therefore possible updates to TAE requirements can be studied and considered during the work item.

Worst case beam switching delay < 100 ns was assumed by RAN4 in Rel15. The state of the art of phase shifters can change state in few ns today, i.e. in lot less than 100ns. Therefore, it can be assumed that beam switching time is << 70 ns meaning that normal cyclic prefix length of 960 kHz subcarrier spacing is long enough to handle beam switching and no explicit beam switching gap is needed for example between successive SSB blocks. Therefore, analog beam switching delay is not limiting SCS selection.

The PHY-layer specifications for UE timing advance are defined to be scalable with SCS, i.e. the update granularity becomes more accurate when SCS increases. Similar behaviour exists in timing advance requirements. Overall, it is necessary to consider UE timing advance requirements, including UE initial access timing error limit, BS controlled timing advance and UE autonomous timing adjustment requirements during work item. Adjustments to initial timing advance requirements should be studied in detail only after the parameters of the signals present during initial access phase are known.

Overall, it was concluded that from timing perspective subcarrier spacings up to at least 960 kHz are feasible taking into account the considerations in this section.

<End of TP>