**3GPP TSG-RAN WG2 Meeting #127**  draft-**R2-2407612**

**Maastricht, Netherlands, 19th - 23rd August 2024**

**Agenda item: 7.7.2**

**Source: Qualcomm Incorporated**

**Title: Report of [AT127][301][R18 NR NTN] corrections for satellite switch with re-sync**

**Document for: Discussion and Decision**

# Introduction

In this document, the report of the following offline discussions is provided.

**[AT127][301][R18 NR NTN] corrections for satellite switch with re-sync (Qualcomm)**

Scope: Continue the discussion on p1 and p2 in [R2-2406641](file:///C:\Data\3GPP\Extracts\R2-2406641%20issue%20on%20PCI%20unchanged.docx)

Intended outcome: report of offline discussion

Deadline for companies' feedback: Thursday 2024-08-22 20:00

Deadline for rapporteur's summary (in R2-2407612): Friday 2024-08-23 08:00

# Discussion

Following was captured during the discussion.

[R2-2406641](file:///C:\Data\3GPP\Extracts\R2-2406641%20issue%20on%20PCI%20unchanged.docx) Discussion on soft satellite switch with re-sync Qualcomm Incorporated discussion Rel-18 NR\_NTN\_enh-Core

*Proposal 1 Based on LS response, keep the reference point of ssb-TimeOffset at ULSRP and clarify the field description of ssb-TimeOffset that the source satellite and target satellite may have its own different ULSRP as below:*

*Indicates the time offset between the SSB from source and target satellite at the uplink time synchronization reference point between a SSB burst of the target cell at its uplink time synchronization reference point and the SSB burst of the source cell at its uplink time synchronization reference point. It is given in number of subframes.*

1. **Continue in offline 301 to discuss a clarification for ssb-TimeOffset based on the text proposal in p1**

There was a question whether the SSB time offset can have negative value. However, as per current signaling, the value of SSB time offset is always positive.

SatSwitchWithReSync-r18 ::= SEQUENCE {

ntn-Config-r18 NTN-Config-r17,

t-ServiceStart-r18 INTEGER (0..549755813887) OPTIONAL, -- Need R

ssb-TimeOffset-r18 INTEGER (0..159) OPTIONAL -- Need R

}

In this case, we need to clarify whether the positive offset is applied with respect to source ULSRP or target ULSRP. We have options:

#1: Target SSB at ULSRP = Source SSB at ULSRP + ssb-TimeOffset

#2: Source SSB at ULSRP = Target SSB at ULSRP + ssb-TimeOffset

It was also discussed whether it is beneficial to have option of signaling negative value of ssb-TimeOffset.

Q1: Do you think negative value of SSB time offset is needed?

|  |  |  |
| --- | --- | --- |
| Company name | Yes/No | Comments |
| Google | No | For option#1 above, a negative value would point to a Target SSB that occurs before the Serving SSB. However, it is always possible point to a Target SSB that occurs after the Serving SSB by using a positive value instead. |
| Sequans | No | This would be only required if the offset range needs to be extended to more than 160sf.  Otherwise -x would be same as 160-x, so not needed. |
| ZTE | No |  |
| TCL | No |  |
| Apple | No |  |
| Lenovo | No |  |
| LGE | No |  |
| Samsung | No |  |
| vivo | No | Agree with Google and Sequans. |
| ITRI | No |  |
| CMCC | No | From our point of view, since the SSB is broadcasted periodically, positive value can cover both use cases:  Case 1: Target SSB that occurs before the Serving SSB;  Case 2: Target SSB that occurs after the Serving SSB;  For example, when the SSB period is setting as 20ms and if Target SSB that occurs before the Serving SSB by 2ms, then the offset can set 18ms;(Case 1)  when the SSB period is setting as 20ms and if Target SSB that occurs after the Serving SSB by 2ms, then the offset can set 2ms; (Case 2) |

Q2: If we stick to current positive value of the ssb-TimeOffset, what is current understanding?

Option#1: Target SSB at ULSRP = Source SSB at ULSRP + ssb-TimeOffset

Option#2: Source SSB at ULSRP = Target SSB at ULSRP + ssb-TimeOffset

|  |  |  |
| --- | --- | --- |
| Company name | Option 1 or Option 2 | Comments |
| Google | Option#1 | It is more intuitive to use the Source SSB (that the UE has already synchronized with) as the basis. |
| Sequans | Option#1 | This was our understanding of “Indicates the time offset between the SSB from source and target satellite”. |
| ZTE | Option#1 |  |
| TCL | Option#1 | Same view with google |
| Apple | Option 1 |  |
| Lenovo | Option 1 |  |
| LGE | Option #1 |  |
| Samsung | Option 1 |  |
| vivo | Option 1 |  |
| ITRI | Option 1 |  |
| CMCC | Option 1 |  |

Q2: Based on above, how should we clarify the field description of *ssb-TimeOffset*?

Option#1: *Indicates the time offset between a SSB of the target cell at its uplink time synchronization reference point and the SSB burst of the source cell at its uplink time synchronization reference point. It is given in number of subframes.*

Option#2: *Indicates the time offset between a SSB of the source cell at its uplink time synchronization reference point and the SSB burst of the target cell at its uplink time synchronization reference point. It is given in number of subframes.*

Option#3: *Indicates the time offset of the SSB of the target cell at its uplink time synchronization reference point from the SSB burst of the source cell at its uplink time synchronization reference point. It is given in number of subframes.*

Option#4: others

|  |  |  |
| --- | --- | --- |
| Company name | Option 1 or Option 2 | Comments |
| Google | Option 1 with some modifications | *Indicates the time offset between a SSB of the target cell at its uplink time synchronization reference point and ~~the~~ a SSB burst of the source cell at its uplink time synchronization reference point, where the SSB of the target cell is the nearest SSB occurring after the SSB of the source cell. It is given in number of subframes* |
| Sequans | Option 4 | 1) There is only one cell, no source cell and target cell, so we should not introduce this wording for sat switch with resync.  2) Checking in 38.331 for other time offsets, “with respect to” could be used to clarify the direction.  Proposal:  “Indicates the time offset of the SSB from target satellite at its uplink time synchronization reference point with respect to the SSB from source satellite at its uplink time synchronization reference point. It is given in number of subframes.” |
| ZTE | Option 4 from Sequans |  |
| TCL | Option 4 from Sequans |  |
| Lenovo | Option 4 from Sequans |  |
| LGE | Option 4 from Sequans | We have similar view with Sequans w.r.t wording for SAT switch with resync. Source and target should be a satellite. |
| Samsung | Option 4 from Sequans |  |
| vivo |  | We are fine with Sequans’ TP. |
| ITRI | Option 4 from Sequans |  |
| CMCC | Option 4 from Sequans with minor modification | We are fine with Sequans’ TP. But to avoid the *SSB offset* being extented to other mobility scenarios except sat switch with resync  “Indicates the time offset of the SSB from target satellite at its uplink time synchronization reference point with respect to the SSB from source satellite at its uplink time synchronization reference point for two cells with same SSB channel. It is given in number of subframes.” |

Following was also discussed.

*Proposal 2 Confirm that there is no impact to running timers (e.g., HARQ RTT timer) due to cell timing change after soft satellite switch with resync. Consider updating NOTE 1 in section 3.1 by adding another example as “due to soft satellite switch with resynchronization” in addition to “due to BWP switching”.*

- Ericsson and Apple confirm the understanding but think we don’t need any further clarification

**Continue the discussion in offline 301**

Q2: Do you agree to confirm the following?

* *Confirm that there is no impact to running timers (e.g., HARQ RTT timer) due to cell timing change after soft satellite switch with resync. No further clarification is needed.*

|  |  |  |
| --- | --- | --- |
| Company name | Yes/No | Comments |
| Google | Yes |  |
| Sequans | With change | “*due to* ***possible*** *cell timing change*”  The original sentence seems to imply that there will always be a cell timing change, but it is also possible to implement without cell timing change. |
| TCL | Yes |  |
| Apple | Yes |  |
| Lenovo | Yes |  |
| Samsung | Yes |  |
| vivo | Yes | No spec changed is required. |
| ITRI | Yes |  |
| CMCC | Yes | No spec changed is required. |

Based on the consensus view, following conclusions are made.

1. The field description of ssb-TimeOffset is updated as “Indicates the time offset of the SSB from target satellite at its uplink time synchronization reference point with respect to the SSB from source satellite at its uplink time synchronization reference point. It is given in number of subframes”.
2. Confirm that there is no impact to running timers (e.g., HARQ RTT timer) due to possible cell timing change after soft satellite switch with resync. No further clarification is needed.

# Conclusion

Following proposals are made.

Proposal 1 The field description of ssb-TimeOffset is updated as “Indicates the time offset of the SSB from target satellite at its uplink time synchronization reference point with respect to the SSB from source satellite at its uplink time synchronization reference point. It is given in number of subframes”.

Proposal 2 Confirm that there is no impact to running timers (e.g., HARQ RTT timer) due to possible cell timing change after soft satellite switch with resync. No further clarification is needed.