**3GPP TSG-****RAN2 Meeting#109bis-e R2-200xxxx**

**Electronic, 20 April - 30 April, 2020**

**Agenda Item:** **6.19**

**Source: China Telecom**

**Title:** **Report of [AT109bis-e][045][NR16 Other] UL TX Switching-NR\_FR1 (China Telecom)**

**Document for: Discussion and decision**

# Introduction

In RAN2#109bis-e meeting UL TX Switching-NR\_FR1 was assigned an offline discussion as following

* [AT109bis-e][045][NR16 Other] UL TX Switching-NR\_FR1 (China Telecom)

Scope: Treat papers above on UL TX Switching-NR\_FR1. If convergence is difficult, this may be treated on-line.

Wanted Outcome: Agreed-in-principle CRs

Deadline: April 28 0700 UTC

The discussion includes the below papers:

[R2-2002531](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2002531.zip) LS on UE Tx switching period delay and DL interruption (R4-2002816; contact: Apple) RAN4 LS in Rel-16 NR\_RF\_FR1 To:RAN1, RAN2

[R2-2003264](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003264.zip) Report of email discussion [Post109e#33][R16 Other] UL TX Switching-NR\_FR1 ChinaTelecom discussion Rel-16 NR\_RF\_FR1

=> Revised in R2-2003823

R2-2003823 Report of email discussion [Post109e#33][R16 Other] UL TX Switching-NR\_FR1 ChinaTelecom discussion Rel-16 NR\_RF\_FR1

R2-2002689 Clarifications on UL Tx switching Nokia, Nokia Shanghai Bell discussion Rel-16 NR\_RF\_FR1 R2-2000861 Late

[R2-2003266](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003266.zip) 38331CR for UE capability and RRC configuration of supporting UL Tx switching ChinaTelecom CR Rel-16 38.331 16.0.0 1546 - B NR\_RF\_FR1

[R2-2003265](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2003265.zip) 38306CR for UE capability of supporting UL Tx switching ChinaTelecom CR Rel-16 38.306 16.0.0 0277 - B NR\_RF\_FR1

[R2-2002805](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2002805.zip) On Tx switching Apple CR Rel-16 38.331 16.0.0 1524 - B NR\_newRAT-Core

[R2-2002806](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2002806.zip) On Tx switching Apple CR Rel-16 38.306 16.0.0 0275 - B NR\_newRAT-Core

The draft CRs for TS38.306 and TS38.331 were uploaded based on which the comments from multiple companies were updatd. Unitl now there are 10 companies joining the offline discussion in reflector. The major views are summarized as following. There are also some other comments on the CR specifics. We suggest focusing on the high level priciples firstly.

# Summary

2.1 summary for RRC configuration

1) to indicate the UL carrier pair (a carrier on one band and another carrier on the other band) for UL Tx switching.

2) to indicate switching period (i.e., UL interruption) in *UplinkConfig*.

3) whether need explicitly indicate which carrier is carrier1, which carrier is carrier2.

|  |  |
| --- | --- |
| view | Company (number) |
| Yes | Nokia (1) |
| No | CTC, Apple, OPPO, HW, CATT (5)  We should also notice that the original CR from CTC, which didn’t differentiate carrier 1 and carrier 2 by explicit indication, has two more co-signers CMCC and China Unicom. |
| Neutral | MTK (1)  MTK’s understanding is that both should be work and prefer use extension to reduce maintenance effort. But fine to follow majorities view. |
| Other | ZTE (1)  ZTE’s view is depending on whether scenario 1 and scenario 2 in UL CA case can co-exist.       ----- Scenario 1: band A(carrier 1) + band B(carrier 2)       ----- Scenario 2: band B(carrier 1) + band A(carrier 2)  If the above scenarios can co-exist, the UE need to be explicitly indicated which one is carrier1 or carrier 2.  If not, the current signalling of RRC configuration is sufficient. As agreed in RAN4, UE must support 2 UL MIMO on carrier2, and 2Tx<->2Tx is not considered, then carrier2 can be implicitly indicated by the support of MIMO capability, e.g. maxNumberMIMO-LayersCB-PUSCH. |

2.1 summary for UE capability reporting

4) to use legacy BC list or introduce a new BC list for reporting UE capability

|  |  |
| --- | --- |
| view | Company (number) |
| Legacy BC list | ER, QC (2) |
| New BC list | Nokia, CTC, OPPO, HW, CATT, ZTE, Apple (7)  We should also notice that the original CR from CTC, which introduced a new BC list, has two more co-signers CMCC and China Unicom. |
| Neutral | MTK (1) |

The main concern on introducing new BC list is the signalling overhead. If we use legacy BC list, it seems essential to find specific capabilities subject to UL Tx switching. ER and QC asked if we should send a LS to RAN4 to check the specific capabilities.

The main concern for using legacy BC list includes:

-backward compatibility.

-fallback BC supporting UL Tx switching when its superset BC without such capability.

There are some clarifications for introducing new BC list as below, which were concluded in R2-2003823 [3] for better understanding:

* The introduced band combination list only includes the band combination(s) that support UL Tx switching, which means it is a subset of full supported BC list.
* The capability in the introduced band combination list is only supported while UL Tx switching is enabled.
* All capability parameters that could be reported per band combination are included in the introduced band combination list.
* For one particular BC supporting UL Tx switching, the UE will report capability without UL Tx switching operation (1Tx+1Tx) in the legacy BC list, while report capability with UL Tx switching operation (1Tx+2Tx) in the new BC list.

For the above last bullet, we need clarify that the network enables UL Tx switching by sending the UL Tx switching period location configuration to UE, thus UE monitors the DCI indicating UL transmission (using 1Tx or 2Tx) for both of the UL carriers, and performs UL Tx switching following the network scheduling. The UE behaviour of monitoring scheduling DCI is the same way as we have now.

5) Reporting capability on single band pair or each UL band pairs per BC

|  |  |
| --- | --- |
| view | Company (number) |
| single band pair per BC | Nokia, ER, OPPO (3) |
| each UL band pairs per BC | CTC, HW, MTK, ZTE, CATT, Apple (6)  We should also notice that the original CR from CTC, which reported capability on each UL band pairs per BC, has two more co-signers CMCC and China Unicom. |

6) whether including UL MIMO aspect in the capability parameters description

|  |  |
| --- | --- |
| view | Company (number) |
| Yes | Nokia (1) |
| No need/Wait for conclusion of RAN1/4 | HW, OPPO, MTK, Apple, CATT, ZTE (ZTE: wait for conclusion of RAN1/4 or partially captured in 306) (6) |
| Neutral | CTC (1) |

7) to use UE capability filter for UL Tx switching capability reporting.

# Conclusion

In summary, there are some easy aspects including 1), 2) and 7).

1) to indicate the UL carrier pair (a carrier on one band and another carrier on the other band) for UL Tx switching.

2) to indicate switching period (i.e., UL interruption) in *UplinkConfig*.

7) to use UE capability filter for UL Tx switching capability reporting.

The following problems 3)-6) we have not reached a consensus yet:

3) whether need explicitly indicate which carrier is carrier1, which carrier is carrier2.

4) to use legacy BC list or introduce a new BC list for reporting UE capability.

5) reporting capability on single band pair or each UL band pairs per BC.

6) whether including UL MIMO aspect in the capability parameters description

Considering majority’s comments, we have the following proposals to achieve some essential principles for agreeable CRs:

**Proposal Q1**: to indicate the UL carrier pair (a carrier on one band and another carrier on the other band) for UL Tx switching.

**Proposal Q2**: to indicate switching period (i.e., UL interruption) in *UplinkConfig*.

**Proposal Q7**: to use UE capability filter for UL Tx switching capability reporting.

**Proposal Q3**: it is sufficient to implicitly indicating that which carrier is carrier1, which carrier is carrier2.

**Proposal Q4:** to introduce a new band combination list, under which the UE capabilities associated with UL Tx switching are reported.

**Proposal Q5:** reporting capability on each UL band pairs per BC.

# References

[1] R2-2000043(R4-1916083), LS on UE capabilities and RRC signaling on Tx switching period delay, RAN4.

[2] [R2-2002531](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_109bis-e\Docs\R2-2002531.zip), LS on UE Tx switching period delay and DL interruption (R4-2002816; contact: Apple), RAN4

[3] R2-2003823, Report of email discussion [Post109e#33][R16 Other] UL TX Switching-NR\_FR1