**3GPP TSG-RAN** **WG2 Meeting #111-e R2-200xxxx**

**Electronic, 17th – 28th August 2020**

**Agenda Item: 6.1.2**

**Source: China Telecom**

**Title: Summary of offline 019 UE cap UL TX switching**

**Document for: Discussion and decision**

# Introduction

This document summarizes the following offline discussion.

* [AT111-e][019][NR16] UE cap UL TX switching (China Telecom)

Scope: Treat R2-2006985, 7604, 7949, 7085, 8106, 7086, 7950, 7087, 6895, 6896

Deadlines: Short UE Caps

This offline discussion includes contributions [1]-[10] which were moved from 6.15.

Rapporteur suggests to divide to discussion into two phases:

Phase I: solution selection, Deadline 2020-08-19 19:00 UTC

Phase II: CR/LS details, Deadline 2020-08-21 07:00 UTC

# Discussion

## Remaining issues for UE capability report

In RAN2#110e meeting, the following agreement on UE capability reporting was achieved,

* In the new BC list, the UE reports a mixed UE capability which exceeds its total Tx number, e.g., 1Tx on carrier 1 and 2 Tx on carrier 2 and relies on NW side to figure out 1Tx+2Tx can only be used in a TDM manner.

The remaining issue whether report 1T+1T capability in new BC list for option2 was discussed in [1][2][3][4].

**Issue 1: whether report 1T+1T capability in new BC list for option2.**

[2] thought there is no particular use of advertising 1Tx+1Tx or 0Tx+2Tx in *BandCombination-UplinkTxSwitch-r16* and proposed that

* The band combinations where UL Tx switching is supported can only contain two UL carriers, where 1Tx is advertised on one of the carriers and 2Tx is advertised in the other carrier.

[3] had an observation that whether to report 1T+1T in addition to agreed 1T+2T UE capability is the specific issue for inter-band CA/EN-DC option2 and proposed that

* RAN2 to confirm apart from the agreed 1T+2T UE capability there is no need to report 1T+1T UE capability in new BC list specific for inter-band CA/EN-DC option2.

[4] thought it is unclear whether some capabilities would make a difference when carrier 2 switches to 1Tx, and proposed that

* Send a LS to RAN1/RAN4 for ask in Option 2 for carrier 2, whether 1Tx UE capability can be derived from 2Tx UE capability.

Therefore, there are two potential solutions for this issue:

* **Solution 1-a: no need to report 1T+1T UE capability in new BC list specific for option2 [2][3].**
* **Solution 1-b: send a LS to RAN1/RAN4 for ask in Option 2 for carrier 2, whether 1Tx UE capability can be derived from 2Tx UE capability [4].**

Please note the deadline for the solution selection, i.e., Question 1, is 2020-08-19 19:00 UTC. IF Solution 1-b is preferred, we would discuss the LS details then and the LS discussion deadline will be 2020-08-21 07:00 UTC. [6] provided a draft LS.

**Question 1: do companies prefer Solution 1-a or Solution 1-b? Any comments?**

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| --- | --- | --- |
| Company | Solution 1-a/ Solution 1-b/  other | Comments if there is any |
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There is a sequent issue raised in [2] for the UE capability signalling structure. [2] thought there is no particular advantage between indicating support of UL Tx switching in *BandCombination-UplinkTxSwitch-r16* rather than using *BandCombinationList*, and proposed that

* RAN2 to discuss whether it is still beneficial to keep a separate band combination list for the support of UL Tx switching.

We discussed the problem that introducing a new BC list for UL Tx switching or using legacy BC list in RAN2#109bis-e [12] and RAN2#110e [13]. The majority choose to introduce a new BC list, which was agreed to introduce a new BC list [14], because of the following concerns for using legacy BC list:

-backward compatibility,

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

-difficulty to identify the specific parameters impacted by UL Tx switching.

According to the proposal of [2], the question would be re-opened as whether keep a separate band combination list for the support of UL Tx switching or use the legacy BC list, which is aligned with the motivation of the proposal of [2] in Rapporteur’s understanding. If there is any analysis of pros and cons for either option, companies can offer it in the below table.

**Issue 2: whether keep a separate band combination list for the support of UL Tx switching or use the legacy BC list.**

Please note the deadline for Question 2 is 2020-08-19 19:00 UTC. If we need corresponding CRs, we would discuss the CRs details then and the CRs discussion deadline will be 2020-08-21 07:00 UTC. [2] provided a text proposal for using legacy BC list.

**Question 2: do companies prefer to keeping a separate band combination list for the support of UL Tx switching or using the legacy BC list? Any comments, including analysis of pros and cons?**

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| --- | --- | --- |
| Company | Keep New BC list/  use legacy BC list | Comments if there is any |
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## Fallback band combinations

In last RAN2 meeting, RAN2 made the following agreements:

* Do not consider the lower order band combination from the parent band combination with UL Tx switching as fallback band combination.
* Confirm that for a parent band combination without UL Tx switching, UE is allowed to report a lower order band combination with UL switching.

The issue how to interpret fallback BC in new BC list in [1][2][3][4][5].

**Issue 3: how to interpret fallback BC in new BC list.**

For issue 3, we can directly go to the details of the corresponding CRs or TPs in [7] (R2-2007950, which has been revised to R2-2008100[11] with updating source companies), [8] and [5]. The changes are copied under the solutions respectively.

**Solution3-a: Changes for 38.306 in [11].**

| ***supportedBandCombinationList-UplinkTxSwitch***  Defines the NR inter-band UL CA, SUL and/or EN-DC band combinations where UE supports dynamic UL Tx switching. UE only includes this field if requested by the network. A lower order band combination not including a band pair supporting UL Tx switching reported in the parent band combination is not considered to be a fallback band combination of the parent band combination. For an inter-band UL CA band combination that supports UL Tx switching, the UE shall also support the inter-band UL CA without UL Tx switching in a band combination with the same band entries. | UE | No | No | No |
| --- | --- | --- | --- | --- |

**Solution3-b: Changes for 38.306 in [8].**

| ***supportedBandCombinationList-UplinkTxSwitch***  Defines the NR inter-band UL CA, SUL and/or EN-DC band combinations where UE supports dynamic UL Tx switching. UE only includes this field if requested by the network.  Lower order band combinations with only carrier 1 or only carrier 2 from parent band combination with UL Tx switching are not considered as fallback band combinations. | UE | No | No | No |
| --- | --- | --- | --- | --- |

**Solution3-c: Changes for 38.306 and 38.331 in [5].**

Changes for 38.306 in [5]:

| ***supportedBandCombinationList-UplinkTxSwitch***  Defines the NR inter-band UL CA, SUL and/or EN-DC band combinations where UE supports dynamic UL Tx switching. UE only includes this field if requested by the network. A fallback band combination resulting from the reported band combination, which includes at least carrier 1 and carrier 2 for a band pair supporting UL TX switching, shall be supported by the UE. | UE | No | No | No |
| --- | --- | --- | --- | --- |

[5] also proposed that

* Clarify in 38.331 that no need to consider UL-switching during removal of fallback-BC, so that lower order band combination (e.g., band A/B-only) can be removed as fallback-BC of the parent band combination reported in *supportedBandCombinationList* even if the the same patent band combination supports UL-switching (i.e., is also reported in *supportedBandCombinationList-UplinkTxSwitch*), and agree either Alt-1 or Alt-2 of the TP in Annex-I,

and provided the text proposal for 38.331 by adding either one of the following two notes to 38.331 5.6.1.4:

* **Alt-1:** NOTE 5: UL TX switching capability is not taken in account when evaluating “the same capabilities of another band combination”.
* **Alt-2:** NOTE 4: When compiling the list of "candidate band combinations", for a same band combination supporting UL TX switching, two separate entries for the band combination shall be included, for with and without UL TX switching capability.

**Question 3: which solution do companies prefer? Any comments or other text proposals?**

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| Company | Solution 3-a/ Solution 3-b/  Solution 3-c/  other | Comments /other text proposals |
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## Introducing power boosting in UL Tx switching CA case

In the RP#88e meeting, the support of power boosting for CA case was discussed. The following exception sheet [2] and the WF [3] were approved/endorsed during the meeting.

The exception sheet for NR\_RF\_FR1 included the following bullet as

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| RAN2:   * The capability to indicate support of power boosting for CA case, and the RRC signalling to indicate whether such power boosting for CA case is allowed will be specified. |

The corresponding part of the WF is copied as below,

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| --- |
| For RAN2, the capability to indicate support of power boosting for CA case, and the RRC signaling to indicate whether such power boosting for CA case is allowed will be specified in Q3, while keep the RAN2 CR pack to this RAN plenary as approved. The capability for 3dB power boosting is defined per band combination. No spec change for RAN2 RRC procedures and MAC procedures. Send the LS to RAN2 in this RAN plenary. |

As indicated above, RAN2 should specify the UE capability and RRC configuration when the UE supports power boosting for CA case in UL Tx switching.

**Issue 4: Introducing power boosting in UL Tx switching CA case.**

For issue 3, we can directly go to the details of the corresponding CRs [9][10] or TPs for RRC configuration in [2]. [2] proposed that

* a single field is included per band combination to indicate support of power boosting for CA case. This field can only be present if UL Tx switching is supported in the band combination.

The changes for the capability to indicate support of power boosting for CA case are provided in [9] for 38.306 and [10] for 38.331.

**Solution4-a: the changes of 38.306 and 38.331 for the capability to indicate support of power boosting for CA case in [9][10].**

**Question 4: do companies agree with the changes for the capability to indicate support of power boosting for CA case are provided in [9] for 38.306 and [10] for 38.331? Any comments or text proposals?**

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| --- | --- | --- |
| Company | yes/yes but…/no | Comments/ text proposals |
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The changes forthe RRC signaling to indicate whether such power boosting for CA case is allowed are provided in [10] and [2] in different ways. [10] introduced a single field *uplinkTxSwitchingPowerBoosting* while [2] proposed that the field *uplinkTxSwitchingCarrier* is used to indicate the configuration of power boosting for CA.

**Solution4-b: introduce a signle field *uplinkTxSwitchingPowerBoosting* to indicate the configuration of power boosting for** **UL Tx switching CA case as the changes of 38.331 in [10].**

**Solution4-c: use the field *uplinkTxSwitchingCarrier* to indicate the configuration of power boosting for UL Tx switching CA case as the changes of 38.331 in section 5.2 of [2].**

**Question 5: do companies prefer Solution4-b or Solution4-c for the RRC signaling to indicate whether such power boosting for UL Tx switching CA case is allowed? Any comments or text proposals?**

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| --- | --- | --- |
| Company | Solution4-b/Solution4-c/other | Comments/ text proposals |
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# 3 Conclusions

Based on the discussion above, we have the following proposals.

# Reference

1. [R2-2006985](file:///D:\\Documents\\3GPP\\tsg_ran\\WG2\\TSGR2_111-e\\Docs\\R2-2006985.zip" \o "D:Documents3GPPtsg_ranWG2TSGR2_111-eDocsR2-2006985.zip) Discussion on remained issues of UL Tx switching China Telecom discussion
2. [R2-2007604](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2007604.zip) Remaining issues for UL Tx Switching Ericsson discussion
3. [R2-2007949](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2007949.zip) Remaining issues on dynamic UL Tx switching Huawei, HiSilicon, ZTE Corporation, Sanechips discussion Rel-16 NR\_RF\_FR1
4. [R2-2007085](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2007085.zip) Remaining issues on UL switching Apple, OPPO discussion Rel-16 TEI16, NR\_RF\_FR1
5. [R2-2008106](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2008106.zip) Discussion on fallback-BC for UL TX switching OPPO discussion Rel-16 TEI16, NR\_RF\_FR1
6. [R2-2007086](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2007086.zip) Draft LS on UE capability derivation from 2Tx to 1Tx in UL Tx switching Apple LS out Rel-16 TEI16, NR\_RF\_FR1 To:RAN1, RAN4
7. [R2-2007950](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2007950.zip) CR on clarification of fallback BC and prerequisite of CA case in supportedBandCombinationList-UplinkTxSwitch Huawei, HiSilicon, ZTE Corporation, Sanechips CR Rel-16 38.306 16.1.0 0399 - F NR\_RF\_FR1
8. [R2-2007087](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2007087.zip) Fallback band combination exception for UL Tx switching Apple, China Telecom, OPPO CR Rel-16 38.306 16.1.0 0372 - F TEI16, NR\_RF\_FR1
9. [R2-2006895](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2006895.zip) CR to 38.306 on introducing power boosting in UL Tx switching CA case ZTE Corporation, Sanechips, China Telecom, Huawei, HiSilicon, OPPO CR Rel-16 38.306 16.1.0 0369 - C NR\_RF\_FR1
10. [R2-2006896](file:///D:\Documents\3GPP\tsg_ran\WG2\TSGR2_111-e\Docs\R2-2006896.zip) CR to 38.331 on introducing power boosting in UL Tx switching CA case ZTE Corporation, Sanechips, China Telecom, Huawei, HiSilicon, OPPO CR Rel-16 38.331 16.1.0 1753 - C NR\_RF\_FR1
11. R2-2008100 CR on clarification of fallback BC and prerequisite of CA case in supportedBandCombinationList-UplinkTxSwitch Huawei, HiSilicon, China Telecom, ZTE Corporation, Sanechips CR Rel-16 38.306 16.1.0 0399 1 F NR\_RF\_FR1
12. R2-2004201 Report of [AT109bis-e][045][NR16 Other] UL TX Switching-NR\_FR1
13. R2-2006112 Report of [AT110e][026][Other] UL Tx switching
14. Draft\_RAN2\_110-e\_Meeting\_Report\_v2