3GPP TSG-RAN WG3 #113-e R3-214170

**E-meeting, 16th – 26th August 2021**

Source: CATT (moderator)

Title: CB: # SONMDT6\_RACHOpt

Agenda Item: 9.3.4.1

Document for: Approval

# Introduction

**CB: # SONMDT6\_RACHOpt**

**- Possible solution down selection?**

**- Neighbour PRACH configurations over F1AP? X2 impact?**

**- Maximum number of PRACH Configurations?**

**- UE RACH report for SN?**

**- PRACH configuration conflict resolved by changing beam sweeping configuration?**

**- Capture agreements and open issues**

**- Proceed to TPs if there are agreements.**

(CATT - moderator)

Summary of offline disc in [R3-214170](Inbox\R3-214170.zip)

The deadline for the first phase is 00:00 UTC on 20th August (Friday).

# For the Chairman’s Notes

TBD.

# Discussion (first phase)

## PRACH Coordination

How to perform PRACH coordination in gNB-CU/DU split architecture (and for EN-DC as well maybe) is one open issue left over from Rel-16. This exhausting topic has cost us an additional whole year, but few agreements have ever been achieved.

So in this meeting, the moderator tries to align everybody’s understanding first, before going down to any details on TPs.

### When a PRACH conflict may occur

One of the most fundamental divergences on understanding comes from when a PRACH conflict may occur.

The most natural understanding is that PRACH conflicts occur only if two SSB areas of two cells spatially neighbours each other. This understanding is followed by some companies as of the raised discussion papers [1][8].

The moderator decides to name it as “Understanding 1” and to illustrate this case as following:



Figure 1: Understanding 1 of PRACH conflict.

In [8] it is further claimed that:

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| Even having beam relation information, it might not be straightforward to deduce whether a real PRACH conflict occurs as spatially neighbouring beams may not interfere due to different beam sweeping patterns in time domain. As exemplified in Figure 1, although SSB #1 of Cell-A is spatially neighbour to SSB #2 of Cell-B, RACH attempts do not collide even with the same RACH configurations, as the presence of SSB #1 of Cell A and SSB #2 of Cell B do not overlap at any time. |

And accordingly, a method to prevent PRACH conflict by requesting the aggressor to change the beam sweeping pattern is proposed in [7].

On the other side, one company shows some disagreement on that understanding, claiming that PRACH conflicts may occur not only in that very case [4]:

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| PRACH, as a physical channel, does not use any spatial domain multiplexing (SDM) at least from the perspective of specs. And using a much more “omnidirectional” mode (i.e. covering the entire cell) when receiving the random access preambles is a common implementation, with one reason that this is simple and another reason that multiple SSB areas may share the same RACH occasion, as indicated by the field SSB per RACH Occasion.  /////////////////////////////////////////////////////////////////////some words omitted/////////////////////////////////////////////////////////////////////  It will occur if one SSB area (of the aggressor cell) uses a PRACH resource which is the same as the one used in any SSB area of any cell (i.e. the victim cell) neighbouring the prior SSB area. |

The moderator decides to name it as “Understanding 2” and to illustrate this case as following:



Figure 1: Understanding 2 of PRACH conflict.

**Questions 1.1-1**: What is your understanding on when a PRACH conflict may occur, e.g. Understanding 1 or 2?

| Company | Comment |
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**Questions 1.1-2**: Do you agree to introduce the method to support requesting a neighbour cell to change the beam sweeping pattern?

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### How should the gNB-CU perform filtering

In previous meetings we have already agreed that the gNB-CU should perform some filtering before sending toward the gNB-DU about the PRACH configurations of neighbouring nodes. But companies’ views diverge on the detail level.

One company thinks that the gNB-CU should forward only the PRACH configuration currently in conflict [8]:

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| The list of neighbour PRACH configurations the gNB-CU signals to the gNB-DU consists of a filtered set of PRACH configurations, i.e. the PRACH configurations of the cells neighbouring the cell in conflict. |

Whereas some other companies think that the gNB-CU should forward not only the PRACH configuration currently in conflict, but also the PRACH configuration which may potentially in conflict [1][4]:

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| The gNB-DU needs to know enough neighbour cell’s PRACH configurators in order to effectively choose a new PRACH configuration for the cell in conflict. |

The moderator’s understanding is that, assume that there are one cell (let it be Cell A) using PRACH configuration #1 and two neighbour cell Cell B and Cell C using PRACH configuration #1 and #2 respectively:

* Current cell of gNB-DU: Cell A; PRACH #1;
* Neighbour cell: Cell B; PRACH #1;
* Neighbour cell: Cell C; PRACH #2;

And the two options can be described as:

* Option 1: To deliver only “Neighbour cell: Cell B; PRACH #1” toward that gNB-DU.
* Option 2: To deliver both, in order to prevent the gNB-DU from reconfiguring Cell A from PRACH #1 to #2.

**Questions 1.2-1**: Which method do you prefer? Or both methods should be supported?

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### Whether to include some assistance info, and what to include

In addition, some companies propose to introduce some assistance info.

One company in [1] proposes:

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| It is also likely that the gNB-CU does not send enough neighbour cells’ PRACH configurations by implementation. From this perspective, the request from DU seems needed. |

That is to say, a gNB-DU should be possible to “pull” PRACH configuration from the gNB-CU, in addition to the “push” method. It is further shown in the TP as to introduce a simple “ENUMERATED (yes, ...)” indicator directly in the message level, without providing any further information.

**Questions 1.3-1**: Do you agree to introduce the method to support that a gNB-DU can retrieve from the gNB-CU of the PRACH configuration of neighbour cells?

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Whereas another company proposes that the gNB-CU may provide some additional assistance info toward the gNB-DU [5]:

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| Additional assistance information from gNB-CU to gNB-DU looks beneficial. Exact content of assistance information needs further discussion, but more or less detailed information (not just binary indication) should be beneficial to detecting exact PRACH conflict situation and to guide gNB-DU actions for PRACH conflict resolution. |

**Questions 1.3-2**: Whether some additional assistance info should be possible to be provide from the gNB-CU toward the gNB-DU? If so, what to provide?

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### Where to include PRACH configurations of neighbour cells

The next question is on the high-level signalling design: In which F1AP message to include the PRACH configurations of neighbour cells?

Some companies show their preference to include it into all of the DL F1AP common messages: F1 SETUP RESPONSE, GNB-DU CONFIGURATION UPDATE ACKNOWLEDGE, and GNB-CU CONFIGURATION UPDATE [1][4][6].

Whereas another company propose to introduce a new procedure dedicated for this task [8].

**Questions 1.4-1**: What message to include the PRACH configuration of neighbour cells?

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### A small mirror Stage 2 change

The last issue regarding PRACH coordination is a small mirror Stage 2 change on TS 38.401 proposed in [2]:

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| In case of split gNB architecture, RACH configuration conflict detection and resolution function is located at the gNB-DU. To perform RACH optimisation at gNB-DU, gNB-CU sends the RACH report reported by the UE to gNB-DU via F1AP signalling. The gNB-DU signals the PRACH configuration per-cell to gNB-CU. The gNB-CU may forward a limited set of neighbour cell’s PRACH configurations received from neighbour gNBs and other gNB-DUs to the gNB-DU to resolve the configuration conflict. |

**Questions 1.5-1**: Do you agree with the Stage 2 change shown above?

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## Forwarding SCG RA Report

One company mentions an issue regarding RA Report forwarding for the case of Dual Connectivity [3], claiming that:

Considering the (Master) Node which receives the RA Report may be different from the Master Node when the concerned RA procedure occurs, the former (Master) Node should know what the latter Master Node is so that it can forward the RA Report firstly toward that node, or otherwise the RA Report may not be delivered to the correct Secondary Node.

**Questions 2-1**: Do you agree that the (Master) Node which receives the RA Report should know what Master Node the UE is connected to when the concerned RA procedure occurs?

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# Conclusion, recommendations [if needed]

# Reference

[1] R3-213217; (TP for SON BL CR for TS 38.473): Left overs on RACH Optimization Enhancements; Huawei.

[2] R3-213218; (TP for SON BL CR for TS 38.401):Stage 2 update for RACH Optimization; Huawei.

[3] R3-213219; UE RACH report for SN; Huawei.

[4] R3-213507; Discussion on Rel-16 leftover issues for PRACH coordination; CATT.

[5] R3-213662; PRACH conflict detection and resolution; NEC.

[6] R3-213689; Down-selection and open point for RACH optimization; Nokia, Nokia Shanghai Bell.

[7] R3-213818; Signaling solution for Beam Sweeping Reconfiguration from gNB-DU to the gNB-CU; Ericsson.

[8] R3-213819; (TP for SON BL CR for TS38.473) RACH conflict resolution and RACH report availability indication over F1 interface; Ericsson.