**3GPP TSG RAN WG1 Meeting #100bis-e R1-200xxxx**

**e-Meeting, April 20th –30th, 2020**

**Source: Moderator (Ericsson)**

**Title: Discussion on the reply LS on preamble-to-PRU mapping for 2-step CFRA**

**Agenda item: 5**

**Document for:** **Discussion/Decision**

# Introduction

During RAN2#109e, an LS on preamble-to-PRU mapping for 2-step CFRA was sent to RAN1[1]. In this LS, RAN2 asks RAN1 to take into account the agreements made in RAN2 and provides 2 alternatives assuming the preamble to PRU mapping is needed.

Per chairman’s guidance, this summary is to collect companies’ views on this LS and try to make a conclusion for drafting the reply based on companies’ input.

[100b-e-LS-03] Email approval of the reply LS for [R1-2001508](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2001508.zip) by 4/23 (Ericsson, Zhipeng)

# Company’s input

Proposals from related contributions summarized in [2] on AI 5:

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| **Tdoc** | **Proposal** | **Companies** |
| [R1-2001639](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2001639.zip) | Alt.1 in LS R2-2002204. | vivo |
| [R1-2001948](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2001948.zip) | Only support preamble only MsgA transmission | LG Electronics |
| [R1-2002102](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002102.zip) | For 2step CFRA, the PUSCH occasion index and the DMRS resource index are explicitly indicated to UE and the ordering of the PO and DMRS resource are reused the one captured in TS38.213. The following signalling parameters are required:*PUSCH-Occasion-Index*The PUSCH occasions corresponding to a PRACH slot are sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PUSCH occasions; second, in increasing order of time resource indexes for time multiplexed PUSCH occasions within a PUSCH slot and Third, in increasing order of indexes for PUSCH slots corresponding to a PRACH slot.*DMRS-resource-Index*The DMRS resource index in each PUSCH occasion are sequentially numbered, where a DMRS resource index is determined first in an ascending order of a DMRS port index and second in an ascending order of a DMRS sequence index. | Samsung |
| [R1-2002311](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002311.zip) | Adopt Alt 1 to support the preamble-to-PRU mapping for 2-step CFRA. | Apple |
| [R1-2002374](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002374.zip) | only one msgA PUSCH occasion with one DMRS resource, i.e. single PRU, is needed per PRACH slot. | Ericsson |
| [R1-2002659](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002659.zip) | it is RAN2 possibility to work out with a solution without RAN1 impact [1], with respect to the WID that CFRA is not pursued in RAN1 | Huawei, HiSilicon |

Proposals from related contributions summarized in [3] on AI 7.2.1:

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| **Tdoc** | **Proposal** | **Company** |
| [R1-2001766](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2001766.zip) | Alt 1(Reusing the preamble-to-PRU mapping rule) is adopted. | OPPO |
| [R1-2001976](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2001976.zip) | Respond to RAN2 with reference to [2] that Alt1 is the preferred method for indicating the allocation of dedicated MsgA PUSCH resources. | Nokia, Nokia Shanghai Bell |
| [R1-2002112](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002112.zip) | The PUSCH occasion index and the DMRS resource index are explicitly indicated to UE for 2step CFRA and the ordering of the PO and DMRS resource are reused the one captured in TS38.213, and capture following contents in the reply LS to RAN2:PUSCH-Occasion-IndexThe PUSCH occasions corresponding to a PRACH slot are sequentially numbered, first, in increasing order of frequency resource indexes for frequency multiplexed PUSCH occasions; second, in increasing order of time resource indexes for time multiplexed PUSCH occasions within a PUSCH slot and Third, in increasing order of indexes for PUSCH slots corresponding to a PRACH slot.DMRS-resource-IndexThe DMRS resource index in each PUSCH occasion are sequentially numbered, where a DMRS resource index is determined first in an ascending order of a DMRS port index and second in an ascending order of a DMRS sequence index. | Samsung |
| [R1-2002259](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002259.zip) | If reusing the preamble-to-PRU mapping rule, the dedicated MsgA PUSCH resources for 2-step CFRA configured by dedicated RRC signalling should be used by a single UE;If dedicated MsgA PUSCH resources for 2-step CFRA are used by a single UE, it is unnecessary to take the number of contention free preambles per SSB into account when determining the preamble pool, only the indicated preambles associated with the SS/PBCH block index may be considered;One-to-one mapping and multiple-to-one mapping between preamble(s) associated with the SS/PBCH block index and PRU may be supported for 2-step CFRA. | Spreadtrum Communications |
| [R1-2002369](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002369.zip) | Only one PRU per PRACH slot is used for MsgA PUSCH transmission in CFRA and all preambles in a PRACH slot are mapped to the PRU for CFRA.A set of TPs (TP1 to TP4) in RAN1 are provided to complete the RAN1 work related MsgA PUSCH in 2-step CFRA. | Ericsson |
| [R1-2002371](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002371.zip) | Configure a single PRU in a single PO per PRACH slot for MsgA PUSCH transmission in CFRA of 2-step RA type | Ericsson |
| [R1-2002574](http://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_100b_e/Docs/R1-2002574.zip) | Neither alternative recommended by RAN2 should be pursued in RAN1 for support of CFRA 2-step RACH | Huawei, HiSilicon |

# Discussions

Based on the proposals provided in clause 2, the options/alternatives related to this issue could be summarized in the bullets below in a table.

There may be additional alternatives, or I may have misunderstood some of the proponents’ intentions. Please comment if that is the case.

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| **[Options and alternatives to be discussed]:*** Option 1: Configure multiple PRUs per PRACH slot via *msgA-CFRA-PUSCH (*Note: Alt A/B may be same or different from Alt1/2inR2-2002204, LS from RAN2)
	+ Alt A: Select one single PRU based on the preamble to PRU mapping similar to CBRA
		- Mapping ratio calculation, mapping definitions need to be revisited and further discussed
		- New CFRA preamble set definitions needed?
	+ Alt B: Select one PRU via explicit dedicated signaling
		- Additional signaling/rules are needed to determine one PO and/or one PRU
* Option 2: Only configure single PRU per PRACH slot in *msgA-CFRA-PUSCH*
	+ No additional signalling or mapping rules are needed
* Option 3: Only support the MsgA with only preamble part
	+ No discussions on MsgA PUSCH are needed
* Option 4: Ask RAN2 to make a solution different from the two alternatives in the LS[1] without any RAN1 impact.
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Please also provide your views in the tablebelow, where I’ve included views from Ericsson side.

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| --- | --- | --- | --- |
| **Company** | **Is it necessary to configure multiple PRUs per PRACH slot?** | **Option 1, or option 2, or option 3 or option 4** | **Alt A, or Alt B?** **Only valid when option 1 is selected** |
| Ericsson | No. Since the dedicated signaling for MsgA PUSCH is only for one single UE, only one PRU is needed per PRACH slot, and the PRU is always after the corresponding PRACH slot according to the agreed *msgA-CFRA-PUSCH*. | Option 2 * The simplest way to have minimum RAN1 and RAN2 impact. Single PRU can be configured with some restrictions on some parameters in RAN2 which can be specified through the use of field descriptions or need codes and no change in current RRC fields are needed.
* Avoids unnecessary waste of PUSCH resources.
 | N/A |
| ZTE | Yes.Multiple PRUs are supported for CBRA. We do not think there is any RAN1 impact if we reuse the same configurations for CFRA. And single PRU per PRACH slot can be supported well by setting the parameters properly. | Option 1One general comment is that, to minimize our work in RAN1, we think the simplest way is to select between the two alternatives in the LS, as RAN2 specifically asked us to implement one of the alternatives.------------For CFRA, RAN2 respectfully asks RAN1 to take the above alternatives into consideration and to implement one of the above solutions for CFRA preamble-to-PRU mapping and respond to RAN2 on the required signaling in order for the UE to successfully identify a PRU based on a dedicated preamble in respective SSB(s)/CSI-RS(s). | Alt A is preferred.There is no need to revisit the mapping ratio calculation, mapping definitions, etcAlt B can be acceptable if the PRU ordering is reused. |
| LGE | No | **Option 3** Only support the MsgA with only preamble partIn WI for 2-step RACH [RP-2000085], ‘RAN1 work addresses only CBRA (i.e. not considering CFRA)’ is described as a part of objective. As we observed, both option 1 and 2 bring RAN1 impact. We cannot accept any solution(s) for CFRA which bring RAN1 impact.On the other hand, for option 3, **no discussion is needed in RAN1.** In addition,option 3 has an advantage of early starting RA monitoring window than option 1 and option 2. | N/A |
| Qualcomm |  N/A | RAN1 should discuss whether or not to support CSI-RS based 2-step CFRA, before replying to RAN2’s LS on preamble-to-PRU mapping for CFRA. | N/A |
| Samsung | This is not a question for us to answer. RAN2 already agreed to have msgA PUSCH configuration dedicated for CFRA. | The key message from the LS is ask RAN1 to evaluate the two alternatives discussed in RAN2, to find which one is less impact to RAN1. So our focus is the compare these alternatives.Alt.1 intends to configure a preamble set for contention free random access which is never done before and will limit the flexibity as well as having more impact to ran1; while alt.2 just requires to provides the dedicated PO index and DMRS index, in which the ordering are purely reuse we have defined in 213.  | Alt.B Indicate the dedicated PO index and DMRS index. Reusing the ordering defined in 213. |
| Intel | N/A | We share similar view as ZTE and Samsung that it would be good to focus on the selection of two alternatives from RAN2 in the reply LS. We agree with ZTE that both alternatives can work if a single PRU is dedicatedly configured for a UE for CFRA. Between the two alternatives, we slightly prefer Alt. B as long as we can configure a dedicated PRU (PO + DMRS index) to a UE. | Alt. B |
| Nokia | Yes. | **Option 1:** As highlighted by ZTE and Samsung, RAN2 asked RAN1 to indicate the selected solution from the provided alternatives.  | Alternative 1 seems simpler and does not rely on PRU ordering. |
| Spreadtrum | YesRAN2 agreed full msgA PUSCH configuration dedicated for CFRA, how to configure it up to NW. A single PRU per PRACH slot is a special configuration | Option1Since Alt1 is preferred for RAN2, we may focus on alt1 and analyze impacts to ran1. Some issues need to be clarified from RAN1’s perspective: 1. Whether dedicated PUSCH resources for CFRA are used by a single UE which will impact the mapping between preamble and PRU.
2. Whether it is necessary to take the number of contention free preambles per SSB reserved for CFRA into account.
 | AltAMapping ratio and mapping can be determined based on the configuration. |
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# Conclusion

Based on the contributions submitted to this meeting, possible main text to be replied from RAN1 to RAN2 could be:

**RAN1 has discussed a set of following options and alternatives, including the two from RAN2 LS, for MsgA PUSCH resource determination for 2-step CFRA:**

* **Xxx (to be updated based on our discussions later)**

**Based on the discussions, RAN1 has following conclusions:**

* **Both alternative 1 and alternative 2 provided in the LS [1] have impact on RAN1 specifications.**
* **Xxx (to be updated based on our discussions later)**

# Reference

1. R2-2002204, “LS to RAN1 on preamble-to-PRU mapping for 2-step CFRA”, Ericsson, RAN2 #109-e, February 2020.
2. R1-2002736, “Outcome of RAN1#100b-e preparation phase on incoming LS”, 3GPP TSG RAN1 Chairman, RAN1 #100bis-e, April.
3. R1-2001712, “FL summary on the maintenance of 2-step RACH channel structure”, ZTE, RAN1 #100bis-e, April.