**3GPP TSG RAN WG1 #114** **R1-230xxxx**

**Toulouse, France, August 21st – 25th, 2023**

**Agenda item:** 9.17

**Source:** Samsung

**Title:** Summary of email discussions [114-R18-38.213-NR\_cov\_enh2]

**Document for:** Discussion and decision

# Introduction

The purpose of this document is to collect inputs/comments on the draft CR for TS 38.213 [draftCR\_38213 Coverage](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/%5B38.213%20draft%20CRs%5D/NR_cov_enh2/R1-230xxxx%20draftCR_38213%20Coverage.docx) on the introduction of further NR coverage enhancements. If a comment on a particular aspect has been made by another company, please do not repeat it until, if needed, after a response.

The first checkpoint is on September 5, UTC 13:00.

# First Round Discussion

Please provide your comments on the draft CR for TS 38.213 [draftCR\_38213 Coverage](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/%5B38.213%20draft%20CRs%5D/NR_cov_enh2/R1-230xxxx%20draftCR_38213%20Coverage.docx).

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| Company | Comments |
| LG | First of all, the following seems to be temporarily written last time, but it seems to overlap with the newly written content, so it would be good to delete it.

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| A time period, starting from frame 0, for determining [RO groups] for PRACH transmission with repetitions, is the smallest number of SS/PBCH block to PRACH occasion association pattern period(s) such that at least one RO group is determined for all configured and the determined [RO group pattern] repeats at every such time period.  |

Next, if a timing offset is configured, it was agreed that the timing offset would be applied between ROs in the same frequency location, and also to use the timing offset from the first valid RO of the previous RO group.

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| AgreementFor a given number of *N* multiple PRACH transmissions, to determine the starting RO of all the RO groups within a time period X:* + If a time offset is configured, then
		- the starting RO of the first RO group for each is determined from the first valid RO within the time period X, first in increasing order of frequency resource index for frequency multiplexed PRACH occasions; second in increasing order of time resource index.
		- the starting RO of the *n*-th RO group for each is determined as the RO at the time offset equal to a number of valid ROs from the starting RO of the (*n-1*)-th RO group for the same .
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Therefore, the part below can be modified as follows.

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| For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from ~~a~~ the first ~~last~~ valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, . |

Finally, since the RAR window for multiple PRACH transmissions has been agreed to start after last RO, it might be clear to mention it as below so that it can be distinguished from legacy PRACH transmission.

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| In response to a PRACH transmission, a UE attempts to detect a DCI format 1\_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. For a PRACH transmission without preamble repetitions, t~~T~~he window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in clause 10.1, that is at least one symbol, after the last symbol of the ~~last~~ PRACH occasion corresponding to the PRACH transmission, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in clause 10.1. For a PRACH transmission with preamble repetitions, the window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in clause 10.1, that is at least one symbol, after the last symbol of the last PRACH occasion corresponding to the multiple PRACH transmissions, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in clause 10.1. |

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| DOCOMO | **Issue 1: Determination for first RO of all RO groups**In RAN1#114, we have following agreements to determine the first RO for all RO groups in time period X.AgreementFor a given number of *N* multiple PRACH transmissions, to determine the starting RO of all the RO groups within a time period X:* + If a time offset is configured, then
		- the starting RO of the first RO group for each is determined from the first valid RO within the time period X, first in increasing order of frequency resource index for frequency multiplexed PRACH occasions; second in increasing order of time resource index.

* + - the starting RO of the *n*-th RO group for each is determined as the RO at the time offset equal to a number of valid ROs from the starting RO of the (*n-1*)-th RO group for the same .

* + If time offset is not configured, then
		- the starting RO of the first RO group is the first valid RO within the time period X.
		- the starting RO of other RO groups are determined as the first valid RO after the previous RO group in the following order within the time period X: first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes.

**Comment 1**: According to the agreement, the configured time offset is from the starting RO of the *(n-1)th* RO group to the starting RO of the *nth* RO group for the same frequency location. In the below CR, the time offset seems to be the offset between the last RO of the *(n-1)th* RO group and the first RO of *nth* RO group.Suggested change: Modify the “last” (in positions as highlighted below) into “first”.

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| For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, . |

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| For a PRACH transmission with preamble repetitions within a time period, the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the association period for preamble repetitions. The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, for the SS/PBCH block |

**Comment 2**: The above two paragraphs are both about determination for first RO of RO groups. We feel the first paragraph seems redundant, since it can be captured by the second paragraph.Suggested change: Remove the first paragraph as above. **Issue 2: RO groups for same repetition number****Comment 3**: In RAN1#114, it was agreed that no overlapping between RO groups for the same repetition number (as highlighted part below). The CR seems not capture this limitation/rule.AgreementFor a given number of *N* multiple PRACH transmissions, all the RO groups within a time period X are determined as follows:* Firstly, the starting RO of the first RO group is determined, then its remaining ROs are determined. Next, the starting RO of other RO groups and its remaining ROs are determined sequentially.
* the starting RO is determined as follows (down select only one of the Alt.):

**Alt.1 (w/o density control)*** + the starting RO of the first RO group is the first valid RO within the time period X.
	+ the starting RO of other RO groups are determined as the first valid RO after the previous RO group in the following order within the time period X: first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes.

**Alt.2 (w/ density control)*** + If a time offset is configured, then
		- the starting RO of the first RO group for each is determined from the first valid RO within the time period X, first in increasing order of frequency resource index for frequency multiplexed PRACH occasions; second in increasing order of time resource index.

* + - the starting RO of the *n*-th RO group for each is determined as the RO at the time offset equal to a number of valid ROs from the starting RO of the (*n-1*)-th RO group for the same .

* + If time offset is not configured, then Alt.1 Applies.
* It is not expected to have overlapping RO between any two RO groups for the given number of *N* multiple PRACH transmissions.
* the remaining *N-1* ROs are the next *N-1* ROs after the starting RO with increasing order of time resource indexes and associated with the same SSB(s) as the starting RO, and (down select only one of the Alt.)
	+ - Alt. 1 (the starting RB of ROs within a RO group is the same) the *N-1* ROs are with the same starting RB as the starting RO.
		- Alt. 2 (the starting RB of ROs within a RO group can be different) the *N*-1 ROs are with the lowest frequency resource index in corresponding time instance.
		- Alt. 3 (the starting RB of within a RO group can be different and a frequency offset is configured) the *N-1* ROs are determined based on a configured frequency offset.
		- Alt. 4 (the starting RB of ROs within a RO group can be different), the *N*-1 ROs are with the same relative frequency resource index among the multiple frequency multiplexing ROs associated with the same SSB in corresponding time instances.

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| For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, .For a PRACH transmission with preamble repetitions within a time period, the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the association period for preamble repetitions. The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, for the SS/PBCH blockFor a PRACH transmission with preamble repetitions, all respective valid PRACH occasions are consecutive in time and use same frequency resources and are associated with a same SS/PBCH block index. |

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| Nokia/NSB | **Issue 1: Association with Type-2 random access procedure.**

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| For Type-2 random access procedure or for a Type-1 random access procedure with preamble repetitions with common configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-CB-PreamblesPerSSB-PerSharedRO*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *msgA-SSB-SharedRO-MaskIndex* according to [11, TS 38.321].For Type-2 random access procedure or for a Type-1 random access procedure with preamble repetitions with separate configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided; otherwise, by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*. |

**Comment:** For both cases of common configuration and separate configurations of PRACH occasions between Type-1 random access procedure with preamble repetitions and Type-1 random access procedure without preamble repetition, it is unclear why the number of contention based preambles per SS/PBCH block index per valid PRACH occasion cannot be determined from *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* (as a temporary solution to be changed, if applicable, after finalization of the RRC signaling details by RAN2). The current wording, albeit temporary, creates a relationship between multiple PRACH transmissions and 2-step RACH. In this context, RAN1 never agreed to reuse the “msgA-CB-PreamblesPerSSB-PerSharedRO” parameter for the determination of the number of contention based preambles per SS/PBCH block index per valid PRACH occasion. Although the editor commented that the sentence may be revised depending on how RAN2 defines the feature combination, we still prefer an approach based on a 1:1 mapping with agreements to be used.**Suggested change for addressing Issue 1**:Either remove or put the changes in the following paragraph in square brackets.

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| For Type-2 random access procedure [or for a Type-1 random access procedure with preamble repetitions] with common configuration of PRACH occasions with Type-1 random access procedure [without preamble repetitions], a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-CB-PreamblesPerSSB-PerSharedRO*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *msgA-SSB-SharedRO-MaskIndex* according to [11, TS 38.321].For Type-2 random access procedure [or for a Type-1 random access procedure with preamble repetitions] with separate configuration of PRACH occasions with Type-1 random access procedure [without preamble repetitions], a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided; otherwise, by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*. |

**Issue 2: Definition of an association period**

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| For a PRACH transmission without preamble repetitions, an association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest value in the set determined by the PRACH configuration period according Table 8.1-1 such that SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*. |

**Comment:** The definition of association period is fixed and applicable for a PRACH transmission, irrespective of whether this is with or without preamble repetition. Legacy SSB-to-RO mapping is reused entirely by multiple PRACH transmissions, and no repetitions-specific collision handling rules or RO validity/invalidity rules are introduced in Rel-18. Therefore, there is no need to clarify that the association period is for a PRACH transmission without preamble repetitions. Otherwise, the definition of the association period for a PRACH transmission with preamble repetitions is missing.**Suggested change for addressing Issue 2**:Remove the added text in the paragraph above and reuse Rel-17 text:

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| ~~For a PRACH transmission without preamble repetitions,~~ A~~a~~n association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest value in the set determined by the PRACH configuration period according Table 8.1-1 such that SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*. |

**Issue 3: Definition and determination of time period**

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| For a PRACH transmission with preamble repetitions, a time period, starting from frame 0, for mapping an SS/PBCH block index to PRACH occasions is the smallest value of SS/PBCH block to PRACH occasion association pattern periods such that the SS/PBCH block index is mapped at least once to PRACH occasions within the time period for each configured number of preamble repetitions.  |

**Comment 1**: According to an existing agreement , the PRACH occasions in a RO group need to have the same frequency location, otherwise they cannot be grouped together. Note that this is rightfully stated in the very last sentence of the text added by the Editor in the CR:

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| For a PRACH transmission with preamble repetitions, all respective valid PRACH occasions are consecutive in time and use same frequency resources and are associated with a same SS/PBCH block index. |

This implies that the time period, starting from frame 0, for mapping an SS/PBCH block index to PRACH occasions should be the smallest integer number of SS/PBCH block to PRACH occasion association pattern periods such that the SS/PBCH block index is mapped at least once to Image PRACH occasions with the same frequency location within the time period for all configured Image number of preamble repetitions.This problem may be solved by moving the last sentence of the added text prior to the definition of the time period (please see below).**Comment 2**: “the smallest value of SS/PBCH block to PRACH occasion association pattern periods” does not sound very accurate. We suggest using the wording used in the agreements, which is “smaller integer number of […]”**Suggested change for addressing Issue 3**:

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| For a PRACH transmission with preamble repetitions, all respective valid PRACH occasions are consecutive in time and use same frequency resources and are associated with a same SS/PBCH block index.For a PRACH transmission with preamble repetitions, a time period, starting from frame 0, for mapping an SS/PBCH block index to PRACH occasions is the smallest ~~value~~ integer number of SS/PBCH block to PRACH occasion association pattern periods such that the SS/PBCH block index is mapped at least once to PRACH occasions within the time period for ~~each~~ all configured numbers of preamble repetitions.**\*\*\* Unchanged parts are omitted \*\*\***~~For a PRACH transmission with preamble repetitions, all respective valid PRACH occasions are consecutive in time and use same frequency resources and are associated with a same SS/PBCH block index.~~ |

**Issue 4: Definition and determination of time period pattern**

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| A time period pattern for PRACH occasions includes one or more time periods and is determined so that a pattern between the PRACH occasions and the SS/PBCH block index repeats in time. |

**Comment 1**: We do not have agreements on the definition of time period pattern, while we have an agreement on what the role of the time period is, i.e., RO group determination procedure is repeated identically in different time periods until a new PRACH configuration is given (thus only the operations to be carried out in one time period need to be described). We are not sure we understand why the introduction of the concept is needed and we would assume that we should strive to keep the number of new quantities/definitions at the minimum necessary to capture all agreements. When reading the sentence, it is also unclear whether one or more time period patterns exist, i.e., one per configured value, while it should always be only one (since we have always only one time period, irrespective of how many repetition numbers are configured in the cell).**Suggested change for solving Issue 4**:

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| **\*\*\* Unchanged parts are omitted \*\*\***~~A time period pattern for PRACH occasions includes one or more time periods and is determined so that a pattern between the PRACH occasions and the SS/PBCH block index repeats in time.~~ The mapping between the PRACH occasions and the SS/PBCH block index repeats in time with periodicity given by the time period. |

**Issue 5: Starting ROs definition and determination**

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| For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, . |

**Comment 1**: This does not seem correct. According to existing agreement on starting ROs, and as rightfully pointed out by other companies before, is the gap between consecutive starting ROs and not between the last RO of a group and the first RO of the subsequent group. Furthermore, for any frequency resource location the first starting RO in a time period is always the first valid RO in the time period, since there is no previous starting RO to apply the time offset to. This also explains why the corresponding parameter is called *TimeOffsetBetweenStartingRO*, since it can only be applied between two starting ROs.In summary, we have two cases:* **Starting RO of the first RO group in a time period**; in this case is not applied and, for each frequency resource location, the starting RO is just the first valid RO in the time period. In other words, the starting RO of the first RO group is the same irrespective of whether *TimeOffsetBetweenStartingRO* is provided or not.
* **Starting RO of any other RO group in a time period**; in this case the starting RO of the group is not calculated by applying to the last RO of the previous group with same frequency resource location, but actually to the starting RO of the previous group. In other words, the starting RO of each group other than the first depends on whether *TimeOffsetBetweenStartingRO* is provided or not.

Please note the relevance of the reference to the frequency resource location for frequency multiplexed PRACH occasions. This is crucial to ensure that the result of applying a time offset results in blanking some of the RO groups in time domain (but not in frequency domain).**Comment 2**: suggesting a correction for this paragraph is not straightforward, given that the rest of the CR has been written consistently with it. From our perspective, it would be probably easier to have a structural change which may capture all the details of each agreement while, why not, reusing their very simple structure. We will provide a suggestion for a structural change after Issue 7. **Issue 6: First starting RO definition and determination**

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| For a PRACH transmission with preamble repetitions within a time period, the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the association period for preamble repetitions. |

**Comment 1**: According to the agreement copied above, the first starting RO for the first RO group associated with an SS/PBCH block is the first valid RO associated with an SS/PBCH block in the time period and not in the association period, as per text above. Indeed, we can have multiple association periods inside a time period, but only one first starting RO.**Suggested change for solving Issue 6**:Ensure that all definitions of starting ROs, RO groups, and so on, are given with reference to the time period and not to the association period. A more explicit suggested change is not provided for the same reasons outlined above for Issue 5. The suggestion for a structural change provided after Issue 7 will also address Issue 6. **Issue 7: Definition and determination of any starting RO other than the first**

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| The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, for the SS/PBCH block |

**Comment 1**: Other than the problem of the “last/first” valid RO highlighted by other companies, this does not seem to provide:1. An unambiguous description of how to determine any starting RO other than the first, when *TimeOffsetBetweenStartingRO* is not configured.
	* In this case, the role of frequency resource location is unclear. In other words, the text seems to imply that a relationship between the frequency resource location of the last starting RO in a previous time instance and the subsequent starting RO exists, while this is not the case. This may lead to different implementations depending on hos the sentence is interpreted.
2. A correct description of how to determine all starting ROs other than the first, when *TimeOffsetBetweenStartingRO* is configured.
	* In this case, the problem is that a literal reading of the sentence seems to suggest that if a starting RO with a given frequency resource index does not exist in a previous time instance, then no starting ROs with that frequency resource index can exist in the entire time period, whereas this is clearly not the case. Indeed, for a given time instance, and assuming that no other starting ROs can be found in frequency domain (frequency first), the sentence implies that for a different time instance there cannot be starting ROs whose frequency resource index is different from the frequency resource index of starting ROs in the given (previous) time instance. This is not correct according to existing agreements.

For instance, according to our understanding of the sentence, in a scenario like the one provided in the figure below (taken from R1-2306772, with #SSBs = 3, #msg1-FDMed = 8, #SSBsPerRO = 1/2), RO#4 and RO#5 in the second time instance, and RO#2 and RO#3 in the second time instance, would never be used as starting ROs of a group of 2 ROs according to the sentence in the current CR. This is not what has been agreed in RAN1.**Suggested change for solving Issue 7 [, Issue 5 and Issue 6]**:Given all the above and trying to re-use the existing text as much as possible, while ensuring that the text captures all the existing agreements and avoid the problem as per issue 7, we provide the following suggestion/simplification [text #2] for the entire section of the CR describing the starting RO determination and corresponding RO grouping [text #1]. We would like to highlight that our goal here is to provide a constructive alternative that, in our views, solves existing issues as per above descriptions. Alternative formulations surely exist and can be considered, if the one in [text #2] is not agreeable.

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| **Text #1 [Current text in the Editor CR]**For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, .For a PRACH transmission with preamble repetitions within a time period, the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the association period for preamble repetitions. The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, for the SS/PBCH block |

  Suggested change

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| **Text #2**For a PRACH transmission with preamble repetitions within a time period* If *TimeOffsetBetweenStartingRO* is provided, for each frequency resource index for frequency multiplexed PRACH occasions
	+ the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the time period for preamble repetitions
	+ the first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block is determined after *TimeOffsetBetweenStartingRO* consecutive valid PRACH occasions in time from a first valid PRACH occasion corresponding to the previous preamble repetitions.
* Otherwise
	+ the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the time period for preamble repetitions.
	+ The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions
		- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions
		- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions.
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| China Telecom | **Issue 1: SSB-to-RO mapping**

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| For a PRACH transmission without preamble repetitions, an association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest value in the set determined by the PRACH configuration period according Table 8.1-1 such that SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*.  |

**Comment**: Based on the following agreements, legacy SSB-to-RO mapping is reused for multiple PRACH transmissions.

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| Agreement* For multiple PRACH transmissions with separate preamble on shared ROs, reuse legacy SSB to RO mapping rule, and only the ROs mapped to SSBs for single PRACH transmission can be used for multiple PRACH transmissions.

AgreementFor multiple PRACH transmissions on separate ROs, reuse legacy SSB to RO mapping rule. |

Thus, the definition of association period, association pattern period is not needed to be limited to legacy PRACH transmission. The following changes are suggested.

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| An association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest value in the set determined by the PRACH configuration period according Table 8.1-1 such that SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon*. |

**Issue 2: Repeated definition of time period**

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| A time period, starting from frame 0, for determining [RO groups] for PRACH transmission with repetitions, is the smallest number of SS/PBCH block to PRACH occasion association pattern period(s) such that at least one RO group is determined for all configured and the determined [RO group pattern] repeats at every such time period.  |

**Comment**: It seems the above paragraph is a old version without revision mark, since in the next paragraph, the time period is redefined. If so, suggest to delete the paragraph.**Issue 3: Definition of time period**

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| For a PRACH transmission with preamble repetitions, a time period, starting from frame 0, for mapping an SS/PBCH block index to PRACH occasions is the smallest value of SS/PBCH block to PRACH occasion association pattern periods such that the SS/PBCH block index is mapped at least once to PRACH occasions within the time period for each configured number of preamble repetitions. A time period pattern for PRACH occasions includes one or more time periods and is determined so that a pattern between the PRACH occasions and the SS/PBCH block index repeats in time. |

**Comment**: there are several issues related to the definition of time period. 1. Based on the following agreement, it can be seen that the time period X is not for mapping SSB to PRACH occasion, the mapping of SSB to PRACH occasion follows the legacy rule as commented in the 1st issue. The time period is to determine a set of RO groups for the configured number of multiple PRACH transmissions, so that the determined set of RO groups repeat in every time period.

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| AgreementA set of RO group(s) for a configured number of multiple PRACH transmissions is determined/configured within a time period X, starting from frame 0. The determined/configured set of RO groups repeats every time period X.* + The time period X is *K* SSB-to-RO association pattern periods.
	+ Note: Whether/how to introduce SSB-to-RO group mapping
	+ FFS: *K* is configured by the network or determined based on some rule.

AgreementFor the number of SSB-to-RO association pattern periods *K* within the time period X,* For multiple PRACH transmissions with different numbers, support

One common*K* is implicitly determined as a minimum integer for all the configured number of multiple PRACH transmissions such that for each of SSBs, there is at least one RO group per each configured number of multiple PRACH transmissions consisting of ROs associated with the SSB. |

2. there is no agreement for time period pattern definition, the time period already have the similar function as the so called “time period pattern”, the “pattern” of RO group repeats in each time period.The suggested changes are as follows:

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| For a PRACH transmission with preamble repetitions, a time period, starting from frame 0, is the smallest integer nubmer of SS/PBCH block to PRACH occasion association pattern periods such that the SS/PBCH block index is mapped at least once to PRACH occasions within the time period for each configured number of preamble repetitions.. The mapping between the PRACH occasions and the SS/PBCH block index repeats in each time period. |

**Issue 4: Starting RO of the first RO group and other RO groups.**

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| For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, .For a PRACH transmission with preamble repetitions within a time period, the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the association period for preamble repetitions. The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, for the SS/PBCH block |

**Comment**: Based on the following agreement, the starting ROs of the first RO group and other RO groups are a bit different. It can be seen that if a time offset is configured the starting RO of the first RO group for each is determined from the first valid RO within the time period. If not configured, then the starting RO of the first RO group is the first valid RO within the time period. While the starting RO of the other RO groups following an order with frequency first then time.

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| AgreementFor a given number of *N* multiple PRACH transmissions, to determine the starting RO of all the RO groups within a time period X:* + If a time offset is configured, then
		- the starting RO of the first RO group for each is determined from the first valid RO within the time period X, first in increasing order of frequency resource index for frequency multiplexed PRACH occasions; second in increasing order of time resource index.
		- the starting RO of the *n*-th RO group for each is determined as the RO at the time offset equal to a number of valid ROs from the starting RO of the (*n-1*)-th RO group for the same .
	+ If time offset is not configured, then
		- the starting RO of the first RO group is the first valid RO within the time period X.
		- the starting RO of other RO groups are determined as the first valid RO after the previous RO group in the following order within the time period X: first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes.
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We are fine with Nokia’s update in Issue 7, some minor updated as follows:

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| For a PRACH transmission with preamble repetitions within a time period* If *TimeOffsetBetweenStartingRO* is provided, for each frequency resource index for frequency multiplexed PRACH occasions
	+ the first valid PRACH occasion of the first preamble repetitions associated with [an SS/PBCH block] is the first valid PRACH occasion associated with the SS/PBCH block in the time period for preamble repetitions
	+ the first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block is determined after *TimeOffsetBetweenStartingRO* consecutive valid PRACH occasions in time from the first valid PRACH occasion corresponding to the previous preamble repetitions.
* Otherwise
	+ the first valid PRACH occasion of the first preamble repetitions associated with [an SS/PBCH block] is the first valid PRACH occasion associated with the SS/PBCH block in the time period for preamble repetitions.
	+ The first valid PRACH occasion of subsequent preamble repetitions associated with the SS/PBCH block in the time period, if any, is determined according to an ordering of PRACH occasions
		- First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions
		- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions.
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| vivo  | Some comments from our side:1. First of all, we share similar view as other companies that no updates are needed for paragraphs 4/5/7/8/11 for following reasons:
	1. PRACH repetition has nothing to do with 2 step RACH and there’s no preamble/RO configuration enhancements in Rel-18
	2. SSB to RO mapping and corresponding configurations are fully reused as pointed out by other companies as well
2. For the new paragraphs capturing agreements on how to determine the RO groups
	1. The term “time period pattern” requires further RAN1 discussions and RAN1 agreement is needed. So we should delete all related text at this stage.
	2. Regarding the proposed wording from Nokia on how to determine a number of RO groups in an order, it seems following agreement can not be covered. Therefore, additional wording is needed.

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| AgreementAdd the following notes to the above agreement:Note1: “the starting RO of other RO groups are determined as the first valid RO after the previous RO group in the following order within the time period X: first, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions; second, in increasing order of time resource indexes.” is illustrated as in the following figure (*N=2*, for ROs associated with SSB#0). This works for both Alt.1 and Alt.2 for the starting RO determination.图片包含 图示  描述已自动生成Note2: all the ROs mentioned in the agreement are valid ROs associated with the given same SSB(s) and all the RO groups mentioned in the agreement are RO groups consisting of valid ROs associated with the given same SSB(s).Note3: of an RO, frequency resource index of an RO, and the starting RB of an RO indicate the same meaning, i.e., locate in the same frequency position. |

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| Sharp | 1. Regarding separation of Type-1 random access procedure with preamble repetitions, current linkage with Type-2 random access procedure does not capture the agreements correctly since it corresponds to parameters for 2-step RACH (i.e. *msgA-CB-PreamblesPerSSB-PerSharedRO*). Our understanding is linkage with feature combination part is more appropriate though it is up to RAN2. Therefore, we prefer to remove all descriptions relating “for a Type-1 random access procedure with preamble repetitions”, at the moment. (Similar comment to Nokia’s Issue 1)
2. We think limitation of ‘For a PRACH transmission without preamble repetitions, an association period’ is not correct since a time period is determined based on the association pattern period for the case with preamble repetitions. (Similar comment to Nokia’s Issue 2)
3. For time period part, “at least once to PRACH occasions within the time period” does not well capture the definition of RO group. Our preference is “at least once to valid PRACH occasions within at least one frequency location within the time period”.
4. “A time period pattern for PRACH occasions includes one or more time periods and is determined so that a pattern between the PRACH occasions and the SS/PBCH block index repeats in time.”This part has not been agreed and it is not necessary since use of one or more of association pattern periods already guarantees a same pattern. (Similar comment to Nokia’s Issue 4)
5. For first RO with time offset part, we share same view with LG. Therefore, following update should be considered.

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| For a PRACH transmission with preamble repetitions within a time period, a first valid PRACH occasion is determined according to the ordering of PRACH occasions and is after consecutive valid PRACH occasions in time from a first~~last~~ valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, where is the value of *TimeOffsetBetweenStartingRO*, if provided; otherwise, . |

1. Following may be typo.

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| For a PRACH transmission with preamble repetitions within a time period, the first valid PRACH occasion of the first preamble repetitions associated with an SS/PBCH block is the first valid PRACH occasion associated with the SS/PBCH block in the time~~association~~ period for preamble repetitions |

1. Regarding the following part for ordering

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| - First, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Second, in increasing order of time resource indexes for time multiplexed PRACH occasions after consecutive valid PRACH occasions in time from a last valid PRACH occasion corresponding to previous preamble repetitions with same frequency location, if any, for the SS/PBCH block |

Following case may not well covered since starting RO of second RO group changes both frequency index and time instance. (e.g. if there is no FDMed ROs in same time instance, the second rule may be applied) If it is common understanding that current rule cover the case of figure, we are OK. |
| ZTE | We think the 7 issues raised by Nokia are all valid and the suggested changes are fine to us. We are also fine with the revision from CTC on the same issues.Moreover, we have some additional suggestions:* + 1. For the wording of “for a Type-1 random access procedure with preamble repetitions” or “Type-1 random access procedure without preamble repetitions”, we can remove the changes by now until we have more agreements or common sense from RAN1 and RAN2 discussion as other companies suggested. If we need something to talking about the SSB to RO mapping for a Type-1 random access procedure with preamble repetitions, maybe we can describe in separate paragraph as below:

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| For Type-1 random access procedure without preamble repetitions, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*. For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-CB-PreamblesPerSSB-PerSharedRO*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *msgA-SSB-SharedRO-MaskIndex* according to [11, TS 38.321].For Type-1 random access procedure with preamble repetitions with common configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *mulitplePRACH-CB-PreamblesPerSSB*.For Type-2 random access procedure with separate configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided; otherwise, by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB*.For a random access procedure associated with a feature combination indicated by *FeatureCombinationPreambles*, a UE is provided a number of SS/PBCH block indexes associated with one PRACH occasion by *ssb-perRACH-OccasionAndCB-PreamblesPerSSB* or *msgA-SSB-PerRACH-OccasionAndCB-PreamblesPerSSB* when provided and a number of contention based preambles per SS/PBCH block index per valid PRACH occasion by *startPreambleForThisPartition* and *numberOfPreamblesPerSSB-ForThisPartition*. The PRACH transmission can be on a subset of PRACH occasions associated with a same SS/PBCH block index within an SSB-RO mapping cycle for a UE provided with a PRACH mask index by *ssb-SharedRO-MaskIndex* according to [11, TS 38.321].For Type-1 random access procedure without preamble repetitions, or for Type-2 random access procedure with separate configuration of PRACH occasions from Type 1 random access procedure without preamble repetitions, or for Type-1 random access procedure with preamble repetitions with separate configuration of PRACH occasions from Type 1 random access procedure without preamble repetitions, or for Type-2 random access procedure with separate configuration of PRACH occasions from Type 1 random access procedure with preamble repetitions, if , one SS/PBCH block index is mapped to consecutive valid PRACH occasions and contention based preambles with consecutive indexes associated with the SS/PBCH block index per valid PRACH occasion start from preamble index 0. If , contention based preambles with consecutive indexes associated with SS/PBCH block index , , per valid PRACH occasion start from preamble index where is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure or by *msgA-TotalNumberOfRA-Preambles* for Type-2 random access procedure with separate configuration of PRACH occasions from a Type 1 random access procedure, or by *mulitplePRACH-TotalNumberOfRA-Preambles* for Type-1 random access procedure with repetitions with separate configuration of PRACH occasions from a Type 1 random access procedure, and is an integer multiple of . For Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, if , one SS/PBCH block index is mapped to consecutive valid PRACH occasions and contention based preambles with consecutive indexes associated with the SS/PBCH block index per valid PRACH occasion start from preamble index . If , contention based preambles with consecutive indexes associated with SS/PBCH block index , , per valid PRACH occasion start from preamble index , where is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure without preamble repetitions.For Type-1 random access procedure with preamble repetitions and for Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, if , one SS/PBCH block index is mapped to consecutive valid PRACH occasions and contention based preambles with consecutive indexes associated with the SS/PBCH block index per valid PRACH occasion start from preamble index . If , contention based preambles with consecutive indexes associated with SS/PBCH block index , , per valid PRACH occasion start from preamble index , where is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure without preamble repetitions. |

* + 1. Regarding the issues from Nokia, we have an update based on revisions from Nokia.

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| For a PRACH transmission with preamble repetitions, all respective valid PRACH occasions are consecutive in time and use same frequency resources and are associated with a same SS/PBCH block index.For a PRACH transmission with preamble repetitions, a time period, starting from frame 0, for mapping ~~an~~ each SS/PBCH block index to PRACH occasions is the smallest ~~value~~ integer number of SS/PBCH block to PRACH occasion association pattern periods such that ~~the~~ each SS/PBCH block index is mapped at least once to PRACH occasions within the time period for ~~each~~ all configured numbers of preamble repetitions.**\*\*\* Unchanged parts are omitted \*\*\***~~For a PRACH transmission with preamble repetitions, all respective valid PRACH occasions are consecutive in time and use same frequency resources and are associated with a same SS/PBCH block index.~~ |

The change on “each” is based on the agreement of

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| AgreementFor the number of SSB-to-RO association pattern periods *K* within the time period X,* For multiple PRACH transmissions with different numbers, support

One common*K* is implicitly determined as a minimum integer for all the configured number of multiple PRACH transmissions such that for each of SSBs, there is at least one RO group per each configured number of multiple PRACH transmissions consisting of ROs associated with the SSB. |

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| Xiaomi | **Comment#1 on CFRA**According to the RAN2#123 meeting agreement, multiple PRACH transmissions is not supported for PDCCH ordering CFRA.

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| **=> CFRA with Msg1 repetition for BFR and with PDCCH order are not supported (can be revisited if there is consensus to support this)**  |

So, the differentiation can be reflected in the specification if necessary. **Comment#2 on the terminology**We prefer to use the terminology “**multiple PRACH transmissions**” or “**PRACH repetitions**” rather than “**preamble repetitions for the PRACH transmission**”. “Preamble repetitions for the PRACH transmission” seems more like a single PRACH transmission with multiple preamble sequences.**Comment#3 on new RRC parameter**New RRC parameters will be introduced to determine the number Q of preambles per SSB index per valid RO for multiple PRACH transmissions especially for the shared RO case, such as *msgA-CB-PreamblesPerSSB-PerSharedRO,* which may be reflected in the further release.**Comment#4 on preamble partitioning within shared ROs**The following current description can be kept at this moment but will be revisited if new RRC parameter is introduced to determine the start point of the preamble set for one configured repetition number, just like the RRC parameter *startPreambleForThisPartition-r17* for the feature combination. It should be further discussed in RAN1 or RAN2.

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| For Type-1 random access procedure with preamble repetitions or for Type-2 random access procedure with common configuration of PRACH occasions with Type-1 random access procedure without preamble repetitions, if , one SS/PBCH block index is mapped to consecutive valid PRACH occasions and contention based preambles with consecutive indexes associated with the SS/PBCH block index per valid PRACH occasion start from preamble index . If , contention based preambles with consecutive indexes associated with SS/PBCH block index , , per valid PRACH occasion start from preamble index , where is provided by *totalNumberOfRA-Preambles* for Type-1 random access procedure without preamble repetitions. |

**Comment#5 on association (pattern) period** The association period and association pattern period are also applicable for multiple PRACH transmissions, so the new adding “For a PRACH transmission without preamble repetitions, an” for the association period paragraph is inappropriate.**Comment#6 on time period X**For the time period X, we guess it is used for the mapping relationship between RO groups and time instances rather than for the mapping relationship between SSBs to PRACH occasions. For simplify description, the concept of RO group should be reflected in the spec. We suggest to modify the related paragraph as follows:

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| For multiple PRACH transmissions ~~a PRACH transmission with preamble repetitions~~, a time period, starting from frame 0, ~~for mapping an SS/PBCH block index to PRACH occasions~~ is the smallest value of SS/PBCH block to PRACH occasion association pattern periods such that ~~the~~ each SS/PBCH block index is mapped to at least ~~once to PRACH occasions~~ one RO group within the time period for each configured number of preamble repetitions. A time period ~~pattern~~ ~~for PRACH occasions~~ includes one or more ~~time periods~~ RO groups and is determined so that a RO group pattern between different time periods repeats in time. |

Besides, in our view, the time period X is determined at first to maintain the RO group pattern in time instances, and then the actual available RO group is determined within one time period X. But, time period X is not used for the determination of RO group. So, the following paragraph seems like a duplicate and can be removed in our view.

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| ~~A time period, starting from frame 0, for determining [RO groups] for PRACH transmission with repetitions, is the smallest number of SS/PBCH block to PRACH occasion association pattern period(s) such that at least one RO group is determined for all configured and the determined [RO group pattern] repeats at every such time period.~~  |

**Comment#7 on the RO group determination**For the RO group determination, we provide the following version:

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| For a given number of multiple PRACH transmissions, each corresponding RO group consists of valid PRACH occasions associated with the same SS/PBCH block index. Within a time period X, all RO groups are determined as follows:The staring RO of the first RO group is the first valid RO within the time period X, and the starting RO of other each RO groups are determined first in increasing order of frequency resource index, and second in increasing order of time resource index with a time offset *L* if provided by *TimeOffsetBetweenStartingRO-r18*, otherwise, the time offset is 0. With the time offset *T*, two available RO groups multiplexed in time domain are separated by *L+1* RO groups. The remaining ROs within one RO group multiplexed in time domain use the same frequency resources as the starting RO.  |

**Comment#8 on RAR window initiating time** For multiple PRACH transmissions, the RAR window is started after the last valid RO within one RO group, regardless of whether the actual transmission is occurred on this valid RO, so we think it is better to make the description clearer. Our proposed description is as follows：

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| In response to a PRACH transmission, a UE attempts to detect a DCI format 1\_0 with CRC scrambled by a corresponding RA-RNTI during a window controlled by higher layers [11, TS 38.321]. The window starts at the first symbol of the earliest CORESET the UE is configured to receive PDCCH for Type1-PDCCH CSS set, as defined in clause 10.1, that is at least one symbol, after the last symbol of the ~~last~~ PRACH occasion corresponding to the PRACH transmission for the single PRACH transmission, or after the last symbol of the last valid PRACH occasion corresponding to a RO group and regardless of whether the actual transmission is omitted or not, where the symbol duration corresponds to the SCS for Type1-PDCCH CSS set as defined in clause 10.1. Ifor, as defined in [4, TS 38.211], is not zero, the window starts after an additional msec where is defined in [4, TS 38.211] and is provided by *kmac* or if *kmac* is not provided. The length of the window in number of slots, based on the SCS for Type1-PDCCH CSS set, is provided by *ra-ResponseWindow*.  |

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