3GPP TSG-RAN WG1 Meeting #118 R1-2407263

Maastricht, The Netherlands, August 19 – 23, 2024

Agenda Item: 8.1

Source: Moderator (Ericsson)

Title: Moderator Summary #1 on Two TAs for multi-DCI

Document for: Discussion & Decision

*During RAN#94e, a new WID for Rel-18 MIMO evolution for DL and UL was agreed. The highlighted Part of objective 7 is relevant for this AI:*

1. Study, and if justified, specify the following
	* Two TAs for UL multi-DCI for multi-TRP operation
	* *Power control for UL single DCI for multi-TRP operation where unified TCI framework extension in objective 2 is assumed.*

For the case of simultaneous UL transmission from multiple panels, the operation will only be limited to the objective 6 scenarios.

*The proposals submitted by Tdocs submitted to RAN1#118 are summarized in this document.*

# **1. Draft CRs**

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| --- | --- | --- |
| # | Text Proposal | Company Position |
| 1.1 | **Proposal:** Adopt draft CR for 38.213 Clause 8.1 [1] **Reason for change:** For two TA operation, the UE can be configured with multiple RACH configurations, where different RACH configurations correspond to different cells. However, currently, the SSB-RO mapping rule including the RO validation rule is defined for serving cell only, and the SSB-RO mapping rule for neighbor cell is missing. Then how to identify the RO to transmit the PRACH ordered by PDCCH for TA measurement for neighbor cell is unclear. **Summary of change:**  Clarify that the SSB-RO mapping for neighbor cell is based on the neighbor cell SSB, which is based on the same principle as serving cell.**Consequence if not approved:** SSB-RO mapping is unclear when multiple RACH configurations are configured.**-----------------------------------------------------Start of draft CR--------------------------------------------------**8.1 Random access preamble<unrelated text omitted>SS/PBCH block indexes provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* are mapped to valid PRACH occasions in the following order where the parameters are described in [4, TS 38.211].- First, in increasing order of preamble indexes within a single PRACH occasion- Second, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions- Third, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot- Fourth, in increasing order of indexes for PRACH slotsAn association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest integer number in the set determined by the PRACH configuration period according Table 8.1-1 such that $N\_{Tx}^{SSB}$ SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains $N\_{Tx}^{SSB}$ from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI*. If after an integer number of SS/PBCH block indexes to PRACH occasions mapping cycles within the association period there is a set of PRACH occasions or PRACH preambles that are not mapped to $N\_{Tx}^{SSB}$ SS/PBCH block indexes, no SS/PBCH block indexes are mapped to the set of PRACH occasions or PRACH preambles. An association pattern period includes one or more association periods and is determined so that a pattern between PRACH occasions and SS/PBCH block indexes repeats at most every 160 msec. PRACH occasions not associated with SS/PBCH block indexes after an integer number of association periods, if any, are not used for PRACH transmissions.**-----------------------------------------------------unchanged part omitted--------------------------------------------------**For paired spectrum or supplementary uplink band all PRACH occasions are valid. For unpaired spectrum, - if a UE is not provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion for a cell in a PRACH slot is valid if it does not precede a SS/PBCH block in the PRACH slot and starts at least $N\_{gap}$ symbols after a last SS/PBCH block reception symbol, where $N\_{gap}$ is provided in Table 8.1-2 and, if *channelAccessMode* = "*semiStatic*" is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where the UE does not transmit [15, TS 37.213].- the candidate SS/PBCH block index of the SS/PBCH block corresponds to the SS/PBCH block index provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* corresponding to the cell, as described in clause 4.1- If a UE is provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion for a cell in a PRACH slot is valid if - it is within UL symbols, or - it does not precede a SS/PBCH block in the PRACH slot and starts at least $N\_{gap}$ symbols after a last downlink symbol and at least $N\_{gap}$ symbols after a last SS/PBCH block symbol, where $N\_{gap}$ is provided in Table 8.1-2, and if *channelAccessMode* = "*semiStatic*" is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where there shall not be any transmissions, as described in [15, TS 37.213]- the candidate SS/PBCH block index of the SS/PBCH block corresponds to the SS/PBCH block index provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* corresponding to the cell, as described in clause 4.1. For preamble format B4 [4, TS 38.211], $N\_{gap}=0$. Table 8.1-2: $N\_{gap}$ values for different preamble SCS $μ$

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| --- | --- |
| Preamble SCS | $$N\_{gap}$$ |
| 1.25 kHz or 5 kHz | 0 |
| 15 kHz or 30 kHz or 60 kHz or 120 kHz | 2 |
| 480 kHz | 8 |
| 960 kHz | 16 |

If a random access procedure is initiated by a PDCCH order, the UE, if requested by higher layers, transmits a PRACH in the selected PRACH occasion, as described in [11, TS 38.321], for which a time between the last symbol of the PDCCH order reception and the first symbol of the PRACH transmission is larger than or equal to $N\_{T,2}+∆\_{BWPSwitching}+∆\_{Delay}+T\_{switch}+T\_{SSB}+∆\_{RF/BB preparation}$ msec, where - $N\_{T,2}$ is a time duration of $N\_{2}$ symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] assuming $μ$ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission - $∆\_{BWPSwitching}=0$ if the active UL BWP does not change, or if a cell indicator field in the PDCCH order indicates a non-serving cell [5, TS 38.212], and $∆\_{BWPSwitching}$ is a time duration of $T\_{BWPswitchDelay}$ defined in [10, TS 38.133] otherwise - $∆\_{Delay}=0.5$ msec for FR1 and $∆\_{Delay}=0.25$ msec for FR2- $T\_{switch}$ is a switching gap duration as defined in [6, TS 38.214] - $T\_{SSB}=0$ if a cell indicator field in the PDCCH order indicates a serving cell or if cell indicator field is not present, and $T\_{SSB}$ is defined in [10, TS 38.133] otherwise- $∆\_{RF/BB preparation}=0$ if a cell indicator field in the PDCCH order indicates a serving cell or if cell indicator field is not present, and $∆\_{RF/BB preparation}$ is defined in [10, TS 38.133] otherwiseFor a PRACH transmission using 1.25 kHz or 5 kHz SCS, the UE determines $N\_{2}$ assuming SCS configuration $μ=0$.**-----------------------------------------------------End of draft CR--------------------------------------------------** | **Support**: Google, Huawei, Samsung, ZTE, Lenovo, vivo, Qualcomm, CATT, OPPO/LG (suggest some revisions), **Not support**: |
| 1.2 | **Proposal:** Discuss either TP 1 or TP 2 for adoption in TS 38.213 Section 7.1.1 [2]**Reason for change:** Unnecessary resetting of first closed loop (l=0) configured for the first TRP instead of the resetting the second closed loop (l=1), when CFRA based PDCCH order triggers PRACH towards the second TRP.**Summary of change:**  Clarify the spec on whether to reset the first closed loop power control adjustment state (l=0) or reset the second closed loop power control adjustment state (l=1) based on whether the PRACH is toward the first TRP or the second TRP.**Consequence if not approved:** Current code results in unnecessary resetting of the wrong closed loop when PRACH is triggered towards the second TRP.============TP1 (Option 1) for 38.213 Section 7.1.1 ==============================--Unchanged part omitted------------------------- If the UE transmits a PUSCH associated with the first RS resource index $q\_{d}$, the UE applies the first $P\_{O\\_UE\\_PUSCH,b,f,c}\left(j\right)$ value, the first $α\_{b,f,c}\left(j\right)$ value, and $f\_{b,f,c}\left(i,l\right)$ for determining $P\_{PUSCH,b,f,c}(i,j,q\_{d},l)$. If the UE transmits a PUSCH associated with the second RS resource index $q\_{d}$, the UE applies the second $P\_{O\\_UE\\_PUSCH,b,f,c}\left(j\right)$ value, the second $α\_{b,f,c}\left(j\right)$ value, and $f\_{b,f,c}\left(i,l\right)$ or $f\_{b,f,c}\left(i,0\right)$ if *twoPUSCH-PC-AdjustmentStates* is provided or not provided, respectively, for determining $P\_{PUSCH,b,f,c}(i,j,q\_{d},l)$.- If the UE receives a random access response message in response to a PRACH transmission or a MsgA transmission on active UL BWP $b$ of carrier $f$ of serving cell $c$ as described in clause 8- $f\_{b,f,c}\left(0,l\right)=∆P\_{rampup,b,f,c}+δ\_{msg2,b,f,c}$, - where $l=0$ if the UE is not provided with *tag-Id2* or if the UE is not provided with *twoPUSCH-PC-AdjustmentStates*; otherwise, $l=0$ if the first TAG is indicated by the random access response message and$l=1$ if the second TAG is indicated by the random access response message, and- $δ\_{msg2,b,f,c}$ is a TPC command value indicated in a random access response grant of the random access response message corresponding to a PRACH transmission according to Type-1 random access procedure, or in a random access response grant of the random access response message corresponding to a MsgA transmission according to Type-2 random access procedure with RAR message(s) for fallbackRAR, on active UL BWP $b$ of carrier $f$ of serving cell $c$, and -  and $∆P\_{rampup\\_requested,b,f,c}$ is provided by higher layers and corresponds to the total power ramp-up requested by higher layers from the first to the last random access preamble for carrier $f$ in the serving cell $c$, $M\_{RB,b,f,c}^{PUSCH}(0)$ is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks for the first PUSCH transmission on active UL BWP$ b$ of carrier $f$ of serving cell $c$, and $∆\_{TF,b,f,c}\left(0\right)$ is the power adjustment of first PUSCH transmission on active UL BWP $b$ of carrier $f$ of serving cell $c$. ===========================================================================TP2 (Option 2) for 38.213 Section 7.1.1 ==============================--Unchanged part omitted------------------------- If the UE transmits a PUSCH associated with the first RS resource index $q\_{d}$, the UE applies the first $P\_{O\\_UE\\_PUSCH,b,f,c}\left(j\right)$ value, the first $α\_{b,f,c}\left(j\right)$ value, and $f\_{b,f,c}\left(i,l\right)$ for determining $P\_{PUSCH,b,f,c}(i,j,q\_{d},l)$. If the UE transmits a PUSCH associated with the second RS resource index $q\_{d}$, the UE applies the second $P\_{O\\_UE\\_PUSCH,b,f,c}\left(j\right)$ value, the second $α\_{b,f,c}\left(j\right)$ value, and $f\_{b,f,c}\left(i,l\right)$ or $f\_{b,f,c}\left(i,0\right)$ if *twoPUSCH-PC-AdjustmentStates* is provided or not provided, respectively, for determining $P\_{PUSCH,b,f,c}(i,j,q\_{d},l)$.- If the UE receives a random access response message in response to a PRACH transmission or a MsgA transmission on active UL BWP $b$ of carrier $f$ of serving cell $c$ as described in clause 8- $f\_{b,f,c}\left(0,l\right)=∆P\_{rampup,b,f,c}+δ\_{msg2,b,f,c}$, - where $l=0$ if the UE is not provided with *tag-Id2* or if the UE is not provided with *twoPUSCH-PC-AdjustmentStates*; otherwise, if the PRACH transmission is in response to a detection of PDCCH order, - $l$ is the closed loop index of the active TCI states associated with the PCI indicated by the PRACH association indicator as described in [5, TS38.212] if the UE is provided *SSB-MTC-AdditionalPCI*,- otherwise, *l* is the closed loop index of the active TCI states associated with a same *coresetPoolIndex* as PDCCH order if the PRACH association indicator is 0, and *l* is the closed loop index of the active TCI states associated with a different *coresetPoolIndex* from the PDCCH order if the PRACH association indicator is 1, and- $δ\_{msg2,b,f,c}$ is a TPC command value indicated in a random access response grant of the random access response message corresponding to a PRACH transmission according to Type-1 random access procedure, or in a random access response grant of the random access response message corresponding to a MsgA transmission according to Type-2 random access procedure with RAR message(s) for fallbackRAR, on active UL BWP $b$ of carrier $f$ of serving cell $c$, and -  and $∆P\_{rampup\\_requested,b,f,c}$ is provided by higher layers and corresponds to the total power ramp-up requested by higher layers from the first to the last random access preamble for carrier $f$ in the serving cell $c$, $M\_{RB,b,f,c}^{PUSCH}(0)$ is the bandwidth of the PUSCH resource assignment expressed in number of resource blocks for the first PUSCH transmission on active UL BWP$ b$ of carrier $f$ of serving cell $c$, and $∆\_{TF,b,f,c}\left(0\right)$ is the power adjustment of first PUSCH transmission on active UL BWP $b$ of carrier $f$ of serving cell $c$. =============================================================== | **Support TP1**: Qualcomm, ZTE, Google**Support TP2:** Qualcomm, Huawei, Lenovo, **Not support**: Samsung, OPPO, vivo, LG, CATT |

Companies are asked to provide their views on the above draft CR/TPs. For companies supportive of issue 1.2, please indicate if you prefer TP1 or TP2.

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| **Company** | **Comments** |
| Huawei, Hisilicon | For issue 1.1, support the proposal.For issue 1.2, support TP2 for simplicity. |
| **Lenovo** | For issue 1.1, support the proposal.For issue 1.2, support TP2. |
| **Samsung** | Issue 1.1: Support proposalIssue 1.2: Don’t support. Not essential during maintenance.For Issue 1.2. TP1 forces a certain network mapping for TAGs and PC adjustment states.TP2 is a significant change for maintenance. This issue is not just related to 2TA, it can happen when there are two TRPs in a cell, and RACH can be sent from either TRP. This includes sDCI and mDCI scenarios, as well as scenarios when a single PC adjustment state is configured. The proposed change, just addresses one corner case. |
| **ZTE** | Issue 1.1: Support the TP.Issue 1.2: We can be fine with TP1 for simplicity if deemed necessary. |
| **vivo** | Issue 1.1: Support proposalIssue 1.2: Don’t support. Not essential in maintenance phase |
| **OPPO** | For issue 1.1We think it’s okay to add *SSB-MTC-AdditionalPCI* for inter-cell MTRP (with a different PCI). However, from our reading of TS 38.331, *SSB-MTC-AdditionalPCI* is also configured under *ServingCellConfig*, so we have a good reason to consider the SSBs from additional PCI belong to the same serving cell of the SSB configured in *SIB1* or *ServingCellConfigComm*. From this sense, we don’t think it’s necessary to add “for a cell” and “corresponding to the cell”. It is clear already. - if a UE is not provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion ~~for a cell~~ in a PRACH slot is valid if it does not precede a SS/PBCH block in the PRACH slot and starts at least $N\_{gap}$ symbols after a last SS/PBCH block reception symbol, where $N\_{gap}$ is provided in Table 8.1-2 and, if *channelAccessMode* = "*semiStatic*" is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where the UE does not transmit [15, TS 37.213].- the candidate SS/PBCH block index of the SS/PBCH block corresponds to the SS/PBCH block index provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* ~~corresponding to the cell~~, as described in clause 4.1- If a UE is provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion ~~for a cell~~ in a PRACH slot is valid if - the candidate SS/PBCH block index of the SS/PBCH block corresponds to the SS/PBCH block index provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* ~~corresponding to the cell~~, as described in clause 4.1. For issue 1.2: Not support. The power reset of PRACH or MsgA transmission seems belong the scope of 2 TA enhancement. During the maintenance phase, we share similar view as Samsung that we shouldn’t do enhancement to stable features. If the proponent(s) would like to make it right, we suggest to make slight change such as- If the UE receives a random access response message in response to a PRACH transmission or a MsgA transmission on active UL BWP $b$ of carrier $f$ of serving cell $c$ as described in clause 8- $f\_{b,f,c}\left(0,l\right)=∆P\_{rampup,b,f,c}+δ\_{msg2,b,f,c}$, - where $l=0$ if the UE is not provided with *tag-Id2* or if the UE is not provided with *twoPUSCH-PC-AdjustmentStates*; |
| **QC** | For Issue 1.1, it seems ok.For Issue 2.1, we support the simpler TP (TP1) but also included TP2 in our Tdoc to address some concerns (from Samsung and OPPO). This is a critical issue (resetting the wrong closed loop), and we believe should be addressed in maintenance. @Samsung: This issue is specific to 2TA enhancement since sending RACH to a specific TRP was only specified in Rel-18 (it was transparent to specification before Rel-18). |
| **Google** | Issue 1.1: We would like to provide some clarification to OPPO’s comments. The “cell” means “physical cell” instead of “serving cell (CC)”. Each cell should perform the SSB-RO mapping including the RO validation individually, since the ROs are shared for UEs with inter-cell mTRP configured or not. Please correct me if anything is wrong.Issue 2.1: We slightly prefer TP1. |
| **LG** | For Issue 1.1, generally fine, but seems OPPO mentioned valid point. If there is any ambiguity, it is fine to delete “for a cell” and “corresponding to the cell”.For Issue 2.1, not support. We have similar view as Samsung and OPPO. Our first preference is to do nothing since this issue is related with several two TRP cases(including pre-Rel-18 behaviors), as mentioned by Samsung.One possible way forward is not to touch the resetting procedure of closed-loop index in case of Rel-18 two TA, as below:- If the UE receives a random access response message in response to a PRACH transmission or a MsgA transmission on active UL BWP $b$ of carrier $f$ of serving cell $c$ as described in clause 8- $f\_{b,f,c}\left(0,l\right)=∆P\_{rampup,b,f,c}+δ\_{msg2,b,f,c}$, - where $l=0$ if the UE is not provided with tag-Id2, |
| **CATT** | Issue 1.1: the issue is valid and we are ok to discuss. Can be supportive if the majority is ok.Issue 2.1: It is our view that this should not be performed during the maintenance phase. Still, we are open to discuss. Slight prefer to TP1 as it is a straightforward solution. However, it may need further enhancement which needs more discussion. |
| **Moderator** | Almost all companies are supportive of the proposal for issue 1.1. We can discuss this Proposal in the online.Regarding proposal on issue 1.2, 5 companies commented that this is not essential while 6 companies support one version of the TP. More discussion is needed on this and we’ll not discuss this issue online unless convergence can be reached. |
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# **2. Proposal for online discussion**

**Proposal:** Adopt draft CR for 38.213 Clause 8.1

**Reason for change:** For two TA operation, the UE can be configured with multiple RACH configurations, where different RACH configurations correspond to different cells. However, currently, the SSB-RO mapping rule including the RO validation rule is defined for serving cell only, and the SSB-RO mapping rule for neighbor cell is missing. Then how to identify the RO to transmit the PRACH ordered by PDCCH for TA measurement for neighbor cell is unclear.

**Summary of change:**

Clarify that the SSB-RO mapping for neighbor cell is based on the neighbor cell SSB, which is based on the same principle as serving cell.

**Consequence if not approved:** SSB-RO mapping is unclear when multiple RACH configurations are configured.

**-----------------------------------------------------Start of draft CR--------------------------------------------------**

## 8.1 Random access preamble

<unrelated text omitted>

SS/PBCH block indexes provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* are mapped to valid PRACH occasions in the following order where the parameters are described in [4, TS 38.211].

- First, in increasing order of preamble indexes within a single PRACH occasion

- Second, in increasing order of frequency resource indexes for frequency multiplexed PRACH occasions

- Third, in increasing order of time resource indexes for time multiplexed PRACH occasions within a PRACH slot

- Fourth, in increasing order of indexes for PRACH slots

An association period, starting from frame 0, for mapping SS/PBCH block indexes to PRACH occasions is the smallest integer number in the set determined by the PRACH configuration period according Table 8.1-1 such that $N\_{Tx}^{SSB}$ SS/PBCH block indexes are mapped at least once to the PRACH occasions within the association period, where a UE obtains $N\_{Tx}^{SSB}$ from the value of *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI*. If after an integer number of SS/PBCH block indexes to PRACH occasions mapping cycles within the association period there is a set of PRACH occasions or PRACH preambles that are not mapped to $N\_{Tx}^{SSB}$ SS/PBCH block indexes, no SS/PBCH block indexes are mapped to the set of PRACH occasions or PRACH preambles. An association pattern period includes one or more association periods and is determined so that a pattern between PRACH occasions and SS/PBCH block indexes repeats at most every 160 msec. PRACH occasions not associated with SS/PBCH block indexes after an integer number of association periods, if any, are not used for PRACH transmissions.

**-----------------------------------------------------unchanged part omitted--------------------------------------------------**

For paired spectrum or supplementary uplink band all PRACH occasions are valid.

For unpaired spectrum,

- if a UE is not provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion for a cell in a PRACH slot is valid if it does not precede a SS/PBCH block in the PRACH slot and starts at least $N\_{gap}$ symbols after a last SS/PBCH block reception symbol, where $N\_{gap}$ is provided in Table 8.1-2 and, if *channelAccessMode* = "*semiStatic*" is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where the UE does not transmit [15, TS 37.213].

- the candidate SS/PBCH block index of the SS/PBCH block corresponds to the SS/PBCH block index provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* corresponding to the cell, as described in clause 4.1

- If a UE is provided *tdd-UL-DL-ConfigurationCommon*, a PRACH occasion for a cell in a PRACH slot is valid if

- it is within UL symbols, or

- it does not precede a SS/PBCH block in the PRACH slot and starts at least $N\_{gap}$ symbols after a last downlink symbol and at least $N\_{gap}$ symbols after a last SS/PBCH block symbol, where $N\_{gap}$ is provided in Table 8.1-2, and if *channelAccessMode* = "*semiStatic*" is provided, does not overlap with a set of consecutive symbols before the start of a next channel occupancy time where there shall not be any transmissions, as described in [15, TS 37.213]

- the candidate SS/PBCH block index of the SS/PBCH block corresponds to the SS/PBCH block index provided by *ssb-PositionsInBurst* in *SIB1* or in *ServingCellConfigCommon* or in *SSB-MTC-AdditionalPCI* corresponding to the cell, as described in clause 4.1.

For preamble format B4 [4, TS 38.211], $N\_{gap}=0$.

Table 8.1-2: $N\_{gap}$ values for different preamble SCS $μ$

|  |  |
| --- | --- |
| Preamble SCS | $$N\_{gap}$$ |
| 1.25 kHz or 5 kHz | 0 |
| 15 kHz or 30 kHz or 60 kHz or 120 kHz | 2 |
| 480 kHz | 8 |
| 960 kHz | 16 |

If a random access procedure is initiated by a PDCCH order, the UE, if requested by higher layers, transmits a PRACH in the selected PRACH occasion, as described in [11, TS 38.321], for which a time between the last symbol of the PDCCH order reception and the first symbol of the PRACH transmission is larger than or equal to $N\_{T,2}+∆\_{BWPSwitching}+∆\_{Delay}+T\_{switch}+T\_{SSB}+∆\_{RF/BB preparation}$ msec, where

- $N\_{T,2}$ is a time duration of $N\_{2}$ symbols corresponding to a PUSCH preparation time for UE processing capability 1 [6, TS 38.214] assuming $μ$ corresponds to the smallest SCS configuration between the SCS configuration of the PDCCH order and the SCS configuration of the corresponding PRACH transmission

- $∆\_{BWPSwitching}=0$ if the active UL BWP does not change, or if a cell indicator field in the PDCCH order indicates a non-serving cell [5, TS 38.212], and $∆\_{BWPSwitching}$ is a time duration of $T\_{BWPswitchDelay}$ defined in [10, TS 38.133] otherwise

- $∆\_{Delay}=0.5$ msec for FR1 and $∆\_{Delay}=0.25$ msec for FR2

- $T\_{switch}$ is a switching gap duration as defined in [6, TS 38.214]

- $T\_{SSB}=0$ if a cell indicator field in the PDCCH order indicates a serving cell or if cell indicator field is not present, and $T\_{SSB}$ is defined in [10, TS 38.133] otherwise

- $∆\_{RF/BB preparation}=0$ if a cell indicator field in the PDCCH order indicates a serving cell or if cell indicator field is not present, and $∆\_{RF/BB preparation}$ is defined in [10, TS 38.133] otherwise

For a PRACH transmission using 1.25 kHz or 5 kHz SCS, the UE determines $N\_{2}$ assuming SCS configuration $μ=0$.

**-----------------------------------------------------End of draft CR--------------------------------------------------**

# References

1. R1-2405949, Draft CR on SSB-RO mapping for two TA, Google
2. R1-2407014, Maintenance on NR MIMO Evolution for Downlink and Uplink, Qualcomm Incorporated