**3GPP TSG-RAN WG1 #100b-eMeeting R1-200xxxx**

**April 20th –30th, 2020**

**Source: Moderator (Apple)**

**Title: Feature lead summary#2 of UL Power Control for NN-DC**

**Agenda item:** **7.2.10.1**

**Document for:** **Discussion and Decision**

# 1 Introduction

### Based on the outcome of the e-meeting preparation phase (See section 3 in [9]), the following email discussion has been kicked-off:

[100b-e-NR- LTE\_NR\_DC\_CA-ULPC-01] Email discussion/approval of issues 1/2/3/4/5 in [R1-2002346](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2002346.zip) till 4/24, with potential TPs for approval till 4/29 (Apple, Hong)

# 2. Discussion

## Issue #1: Handling TPC Commands in DCI format 2-2 and 2-3.

In the latest 3GPP TS 38.213, the following was captured for the UE to compute the transmit power for the SCG staring from $T\_{0}$ with taking into account MCG

|  |
| --- |
| *The UE does not expect to have transmissions on the MCG that* *- are scheduled by DCI formats in PDCCH receptions with a last symbol that is earlier by less than or equal to* $T\_{offset}$ *from the first symbol of the transmission occasion on the SCG, and**- overlap with the transmission occasion on the SCG* |

However, as already brought up in last meeting and listed in feature leader summary, this text does not cover the case where a TPC command is transmitted by DCI format 2\_2 or 2-3 on MCG between $T\_{0}-T\_{offset}$ and $T\_{0}$. Figure 1 provides one example of CG-PUSCH to illustrate this problem, citing from [6]. This can happen for at least CG-PUSCH and periodic PUCCH (e.g. SR, P-/SP-CSI) and P-/SP-SRS and a common solution to solve all of cases should be targeted. This issue was discussed in [2][4][5][6][7]



Figure 1: Dynamic power sharing with PUSCH without dynamic UL grant on MCG

### On DCI format 2\_2

The following alternatives were proposed according to the contributions and email discussions in preparation phase:

* When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE shall only consider TPC commands that are provided by DCI format 2-2 in PDCCH receptions with a last symbol that is earlier by less than or equal to $T$ from the first symbol of the transmission occasion on the SCG
	+ Alt.1: $T=T\_{offset}$
	+ Alt.2: $T=T\_{Proc,2}$
* Alt.3: When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE does not expect to receive TPC commands that may impact on the transmission power of the MCG UL transmission that are provided by DCI format 2-2 in PDCCH receptions with a last symbol that is not earlier by less than or equal to $T\_{offset}$ from the first symbol of the transmission occasion on the SCG

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | Our first preference is Alt.2. Alt.1 is also ok if RAN2 confirms our working assumption in last meeting, otherwise we even don’t konw the specific value of Toffset.From our perspective, Alt.3 doesn’t make sense. If there are continuous UL transmissions in SCG and each UL transmission in SCG has a duration Toffset, this may end up with no transmission occasion for DCI 2\_2/2\_3 in MCG. Take the following figure as an example, if there are three continuous PUSCH transmissions in SCG, network is not possible to transmit any DCI 2\_2/2\_3 during the whole time duration overlapping with either Toffset, if the DCI 2\_2/2\_3 is not allowed to be transmitted after T0 – Toffset.  |
| Qualcomm | Support Alt.3. From the performance point of view, Alt.1 and Alt.3 are identical, while Alt.1 requires UE to expect receive a DCI format 2\_2, that is in the end ignored. It is also not clear how to handle the ignored TPC command in the DCI format 2\_2; whether it is still accumulated or not. The original intention of the agreement was to cut-down MCG UL transmission power impact at time T0 – T\_offset, so that the UE can determine SCG UL transmission power taking into account the information available until T0 – T\_offset. Alt.1 and Alt.2 may be against the principle. |
| OPPO  | Support Alt.3 |
| MTK | We support Alt. 3. Alt. 1/2 says that * “UE shall only consider TPC commands with a last symbol that is earlier by less than or equal to $T$ from the first symbol transmission on SCG“

This seems to violate the principle that there should be enough time for UE to adjust power of MCG and then SCG. If Alt 1/2 means * “UE shall only consider TPC commands with a last symbol that is earlier by more ~~less~~ than or equal to $T$ from the first symbol transmission on SCG“

Then, Alt. 1/2 and Alt. 3 are different only in the way that* In Alt.1, gNB is allowed to transmit TPC command and UE just ignores it;
* In Alt.3, it prevents gNB from sending this TPC command

Since this DCI is invalid and UE would not process it, we prefer Alt. 3. |
| Samsung | Assuming the correction suggested by MTK for Alt. 1, either Alt. 1 or Alt. 3 is fine as they can be equivalent.One additional consideration for Alt. 3 is that it is conditioned on the UE having overlapping transmissions on MCG and SCG. That may not be known at T\_offset prior to the MCG transmission because, depending on what the SCG transmission is, the SCG transmission can be scheduled/triggered after T\_offset.In that sense, Alt. 1 is cleaner (but fine to write from a “UE does not expect“ perspective to align with Alt. 3)  |
| Nokia/NSB | Support Alt. 3. |
| Ericsson | Prefer Alt 1 (with correction suggested by MTK) over Alt 3. With Alt 3, if MN sends a group TPC command (e.g for power adjustment for some other UE2) and if the command happens to be within T\_ofset for UE1 SCG, what UE1 does with the command (i.e., whether it applies the power adjustment or not for MCG) is unclear. With Alt1, it will be specified that UE1 will not use that command for MCG power adjustment. |
| vivo | Support Alt.1, and change “less than or equal“ to “more than“.Agree with MTK’s clarification on Alt.1 and Alt.3. Since MCG may not know the actual value of T\_offset, it is not possible to prevent transmitting DCI from NW. |
| CATT | Alt. 3. Most of the TPC commands are zero with no power adjustment in NR because the small variation of interference statistic from inter-cell co-channel interference. We don’t see the need to specify it.  |
| Huawei, HiSilicon | Support the Alt.1 version revised by MediaTek, which is helpful to make clearer UE behaviors. |

Based on the feedback so far, more support is voted for Alt.1 (implementing MTK correction, 4 companies) and Alt.3 (6 companies). Hence, let’s first remove Alt.2 (1 company) from list. It seems Alt.3 got majority support. However, It seems there still have some concerns raised by companies on Alt.3. It would be great for Qualcomm to address them first

|  |  |
| --- | --- |
| **Company** | **View/Position** |
|  |  |

### On DCI format 2\_3

In NR, the DCI format 2\_3 is used to trigger SRS carrier switching along with TPC commands for the SRS transmission. One point raised during email discussion of preparation phase is whether or not the DCI format 2\_3 has time restriction, instead of TPC command only.

The following options were therefore listed for discussion:

* When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE shall only consider DCI format 2-3 in PDCCH receptions with a last symbol that is earlier by less than or equal to $T$ from the first symbol of the transmission occasion on the SCG
	+ Alt.1: $T=T\_{offset}$
	+ Alt.2: ???
* Alt.3: When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE does not expect to receive DCI format 2-3 in PDCCH receptions with a last symbol that is not earlier by less than or equal to $T\_{offset}$ from the first symbol of the transmission occasion on the SCG
* Alt.4: ??

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | If I understand Alt.1 correctly, Alt.1 needs to be updated as below.* When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE shall only consider DCI format 2-3 in PDCCH receptions with a last symbol that is earlier by ~~less~~ more than or equal to $T$ from the first symbol of the transmission occasion on the SCG

We support Alt.1 if RAN2 confirms our working assumption in last meeting, otherwise we even don’t konw the specific value of Toffset.Similar comments for DCI format 2\_3 as we provided in previous section. If there are continuous UL transmissions in SCG and each UL transmission in SCG has a duration Toffset, this may end up with no transmission occasion for DCI 2\_2/2\_3 in MCG.Regarding the case when DCI format 2\_3 is used to trigger SRS carrier switching along with TPC commands for the SRS transmission, we believe Alt.1 is also applicable to this case. |
| Qualcomm | Support Alt.3.Same reason as our answer to the question on DCI format 2\_2.  |
| OPPO | Support Alt.3  |
| Intel | One clarification: it seems the words „less than or equal to T\_offset“ should be „more than or equal to T\_offset“. Hope I didn’t make a confusion. Agree with Qualcomm that Alt 1 and Alt 3 are functionally same. Alt 2 should have the largest gain since a most proper processing time is used. Alt 1 or Alt 3 is also OK if a single threshold for look-ahead operation is preferred |
| MTK | Support Alt.3 with the following update:* When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE does not expect to receive DCI format 2-3 in PDCCH receptions with a last symbol that is ~~not~~ earlier by less than or equal to $T\_{offset}$ from the first symbol of the transmission occasion on the SCG

The consideration of this item is similar to DCI format 2\_2. |
| Samsung | Same as for DCI format 2\_2 (Alt. 3 as modified by MTK needs to additionally be modified by deleting the “or equal to“). |
| Nokia/NSB | Support Alt.3 |
| Ericsson | Prefer to use same principle that is agreed for 2-2. |
| Vivo | Same as DCI format 2\_2 |
| CATT  | Alt. 3 or no specificiation.  |
| Huawei, HiSilicon | Support the Alt.1 version revised by MediaTek, which is helpful to make clearer UE behaviors. |

The following was proposed for DCI format 2\_3 to make progress based on Alt.3:

[FL proposal]

* *When UE has an SCG UL transmission and an overlapping MCG UL transmission, then for adjusting the power of the MCG UL transmission, the UE does not expect to receive DCI format 2-3 in PDCCH receptions with a last symbol that is earlier by less than or equal to* $T\_{offset}$ *from the first symbol of the transmission occasion on the SCG*

Companies views on FL proposal can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
|  |  |

## Issue #2: Handling UL Transmission Cancelation on MCG

Another issue with regard to dynamic power sharing (DPS) operation was identified in RAN1 100-e is how to handle Uplink transmission skip for MCG dynamic grant PUSCH/configured grant PUSCH due to 5.4.3.1.3 of TS38.321 or by DCI format 2\_4. This issue was further discussed in [6]

Although DCI format 2-4 does not schedule uplink transmissions, it would impact on the value of $\hat{P}\_{MCG}^{actual}$ due to UL cancelation. Similarly, for CG-PUSCH transmission, the UE may or may not transmit the PUSCH. For dynamic grant PUSCH, the UE may skip the transmission if some conditions are met which are specified in 5.4.3.1.3 of TS38.321.

Solutions proposed by companies can be categorized as follows:

* For power determination of UL transmission in SCG starting at $T\_{0}$, *UE is not required to take into account the skipped MCG UL transmission due to either DCI format 2\_0/ 2\_4 or according to section 5.4.3.1.3 of TS 38.321 received after* $T\_{0}-T$ for $\hat{P}\_{MCG}^{actual}$ determination for the UL transmission in MCG overlapping with the concerned SCG transmission
* Alt.1: $T=T\_{offset}$
* Alt.2: $T=T\_{Proc,2}$
* Alt.3: When UE has an SCG UL transmission and an overlapping MCG UL transmission,
* The UE does not expect to receive a SFI that may impact on the transmission power of the MCG UL transmission that are provided by DCI format 2-0 in PDCCH receptions with a last symbol that is not earlier by less than or equal to T\_offset from the first symbol of the transmission occasion on the SCG;
* The UE is not required to take into UL transmission cancellation that may impact on the transmission power of the MCG UL transmission that are provided by DCI format 2-4 in PDCCH receptions with a last symbol that is not earlier by less than or equal to T\_offset from the first symbol of the transmission occasion on the SCG;
* It is up to UE whether to take into account UL skipping for CG-PUSCH or DG-PUSCH according to section 5.4.3.1.3 of TS 38.321

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | Our first preference is Alt.2. Alt.1 is also ok if RAN2 confirms our working assumption in last meeting, otherwise we even don’t konw the specific value of Toffset.From our perspective, Alt.1/Alt.2 is only applicable to UL cancellation with corresponding DCI, i.e., if the correspoding DCI is received after T0-T, UE is not required to take into account the DCI.For CG-PUSCH, there is no corresponding scheduling DCI. Alt.1/Alt.2 doesn’t work for CG-PUSCH. Two potential approaches could be considered for CG-PUSCH.Approach#1: UE assumes that actual CG-PUSCH transmission exists in every transmission occasion.Approach#2: If the time instance {T1 – Tproc,2} is earlier than {T0 – Toffset}, this CG-PUSCH is considered into the power calculation (i.e., Example 1). Otherwise, if the time instance {T1 – Tproc,2} is later than {T0 – Toffset}, this CG-PUSCH is not considered into the power calculation (i.e., Example 2). |
| Qualcomm | Alt.3.First of all, higher-layer determination of UL skipping should be considered separately from physical layer indication of UL skipping. That is, it is not appropriate to define the timeline for UL skip according to section 5.4.3.1.3 of TS 38.321.Regarding DCI format 2\_4, detection of it after T0 – T\_offset just reduce the transmission power of the MCG. This has no harmful impact.Regarding DCI format 2\_0, the problem is that if the UE determines MCG configured UL transmission does not take place due to the conflict with semi-static “F“, but if the UE monitors DCI format 2\_0 after T0 – T\_offset but does not detect a DCI format 2\_0, then the UE may transmit MCG configured UL transmission according to the following agreements. Agreement:* Allow configured UL (CUL) transmissions in a set of symbols of a slot when the UE is configured with DCI 2\_0 format monitoring and does not detect a DCI 2\_0 format providing a slot format for the set of symbols. This is applicable when operating with LBE for the following cases.
	+ When the set of symbols are indicated as ‘F’ with a semi-static TDD pattern or
	+ When the UE is not configured with a semi-static TDD pattern
 |
| OPPO | Alt.3 |
| Intel | As I commented during preparation phase, we need to differentiate two cases* Case 1: Cancelation indicated by gNB, e.g. DCI 2\_0/2\_4
* Case 2: ‘cancellation’ done by UE automatically, e.g. CG PUSCH if there is no UL data at UE side

For Case 1, it seems Alt 1 and Alt 3 are actually same operations. For Case 2, Xingguang provides nice figures. Approach#2 with T\_proc,2 as processing time seems the best way, but applying T\_offset is also OK. In latter case, Alt 1 and Alt 3 are actually same.  |
| MTK | We prefer Alt. 1 with Approach#1 proposed by ZTE. Due to the very limited discussion capacity during a E-meeting, this seems like a simple solution. |
| Samsung | Again, Alt.3 has the condition “When UE has an SCG UL transmission and an overlapping MCG UL transmission” which will be good to avoid. Alt.3 also needs to have same corrections as previously mentioned. Further, for Alt. 3, there is also no reason to have a different wording for DCI format 2\_0 and DCI format 2\_4 as, for the purpose in this dicussion, they do the same thing (cancel transmissions) – there could be a single subullet with same otherwise text, e.g. as below (the red may be deleted?). * Alt.3: When UE has overlapping transmissions an SCG UL transmission and an overlapping MCG UL transmission,
* The UE does not expect to detect a DCI format 2\_0 or a DCI format 2\_4 that may impact on the transmission power of the MCG UL transmission in a PDCCH reception with a last symbol that is earlier by less than T\_offset from the first symbol of the transmission occasion on the SCG;
* It is up to UE whether to take into account UL skipping for CG-PUSCH or DG-PUSCH according to section 5.4.3.1.3 of TS 38.321

Either Alt. 1 or the modified Alt. 3 above are OK as they are equivalent.  |
| Nokia/NSB | Support Alt.3 |
| vivo | Either Alt.1 or Alt.3(modified version by Aris, handling DCI format 2\_0 and 2\_4 in the same way) is fine to us. |
| CATT | Alt. 3 |
| Huawei, HiSilicon | Given the sentence “is not required to take into UL transmission cancellation“, the Atl.3 for DCI 2\_4 seems to change the UE behavior defined for URLLC, where the UL cancellation should be taken into account by a specified deadline. We should avoid new UE behavior conflicting with existing UE behavior.Therefore, we prefer Alt.1 and a note should be added,*Note: no spec change to the URLLC cancellation mechanism associated with DCI format 2\_4 except for the power determination of SCG in NR-DC*Agree with Intel that CG-PUSCH transmission is seperate issue from DCI-based cancellation. Better to have a seperate proposal for it. |

According to the inputs so far, it seems modified Alt.3 from Samsung is more precise and hence the following is proposed for discussion:

FL proposal:

* *[When UE has overlapping transmissions an SCG UL transmission and an overlapping MCG UL transmission],*
* *The UE does not expect to detect a DCI format 2\_0 or a DCI format 2\_4 that may impact on the transmission power of the MCG UL transmission in a PDCCH reception with a last symbol that is earlier by less than T\_offset from the first symbol of the transmission occasion on the SCG;*
* *It is up to UE whether to take into account UL skipping for CG-PUSCH or DG-PUSCH according to section 5.4.3.1.3 of TS 38.321*

Companies views on FL proposal can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
|  |  |

## Issue #3: Power Determination for PUCCH and SRS Transmission

Another issue identified in last meeting is how to determine the power of periodic PUCCH (e.g. SR, P-/SP-CSI) and P-/SP-SRS. It was discussed in [2][4][5] and the following was proposed for power determination of UL transmission in SCG:

* Alt.1: UE assumes there is always UL transmission in the periodic PUCCH (e.g. SR, P-/SP-CSI) resource and P-/SP-SRS resource (Proposed in [2])
* Alt.2: CG-PUSCH, Periodic PUCCH, P/SP-SRS should be taken into account (Proposed in [4])
* Alt.3: Different look-ahead windows were defined depending on the UCI types (Proposed in [5])
	+ For a PUCCH transmission on MCG for periodic CSI report, power allocation of SCG can always assume the presence of periodic CSI on MCG and no timeline checking.
	+ For a PUCCH transmission on MCG for SR, the period between time $t\_{0}-T\_{Offset}$ and the first symbol of SR resource is longer than SR preparation time.
* Alt.4:
	+ Higher layer configured UL transmissions shall be taken into account for power determination in general
	+ If the higher layer configured UL transmission is triggered or cancelled due to the UE internal process (e.g., SR, CG-PUSCH, UL skip), it is up to UE whether to take it into account for power determination (this is correlated with the third sub-bullet of the above Issue #2)
	+ If the higher layer configured UL transmission is cancelled due to a DCI indication, the UE does not expect to receive such DCI in PDCCH receptions with a last symbol that is not earlier by less than or equal to $T\_{Offset}$ from the first symbol of the transmission occasion of the SCG (this is correlated with the first sub-bullet of the above Issue #2)

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | We support Alt.1.Alt.3 could be optimal, however we are not sure whether RAN1 has sufficient time to discuss these timelines case by case. Regarding the second bullet of Alt.4, we are open to further discuss this rule. However, seems it should be udpated as below. As the gNB doesn’t know wheter there is UL transmission or not, gNB always allocates power for the potential UL transmission. If UE has actual UL transmission, UE has to take the UL transmission into account for power determination instead of up to implementation.* + If the higher layer configured UL transmission is ~~triggered or~~ cancelled due to the UE internal process (e.g., SR, CG-PUSCH, UL skip), it is up to UE whether to take it into account for power determination (this is correlated with the third sub-bullet of the above Issue #2)

Regarding the third bullet of Alt.4, as we commented in previous sections, it doesn’t make sense in some scenarios. |
| Qualcomm | Alt.4, which is aligned with Alt.3 in the previous topic.  |
| OPPO | Our propsal Alt.2 lacks details. Thus we are ok with either Alt.1 or Alt.4. |
| Intel | I delete two sub-bullet in Alt 3 (Intel proposal, so I delete some bullets not related)Our preference is Alt 3. In fact, better to have a discussion on whether to have differnet handling on P/SP-CSI/P/SP-SRS and SR* P/SP-CSI/P/SP-SRS are signals that will surely be transmitted by UE
* On the other hand, UE may or may not transmit SR based on the traffic condition.

I suggest we could first make a consensus on the above issue.  |
| MTK | We prefer Alt. 1. Due to the very limited discussion capacity during a E-meeting, this seems like a simple solution. |
| Samsung | Alt. 1 seems to somewhat contradict previous proposals that a UE considers SFI and UL CI, if not received after T\_offset. Alt. 4 is OK (now it does not have the condition for overlapping transmissions and the last part is not strictly needed as it can be captured by previous proposals). The text can be refined in the TP drafting phase. |
| Nokia/NSB | Support Alt.4. But due to the reason MTK mentioned, we are also fine with Alt.1 |
| vivo | Alt.1 is preferred. For CG-PUSCH, we can leave it to UE implementation. |
| CATT | Alt. 4.  |
| Huawei, HiSilicon | Prefer Alt.1. Because we don’t know how gNB can have cross-layer implementation to gurantee the scheduling restriction by the third bullet of Alt.4, i.e.* + *If the higher layer configured UL transmission is cancelled due to a DCI indication, the UE does not expect to receive such DCI in PDCCH receptions with a last symbol that is not earlier by less than or equal to* $T\_{Offset}$ *from the first symbol of the transmission occasion of the SCG (this is correlated with the first sub-bullet of the above Issue #2)*

It may not be allowed in RAN2 spec for the gNB PHY scheduling to cancel the DCI triggered by higher layer events. We are afraid that the proposal has impact on RAN2, especially such “higher layer events” may come from not only MAC layer but also RLC layer or higher. |

The following table summarizes the company’s position:

|  |  |  |
| --- | --- | --- |
| Category | No. companies | Companies  |
| Alt.1 | 6 | ZTE, OPPO, MTK, Nokia/NSB (2nd preference), vivo, Huawei/HiSi |
| Alt.2 |  |  |
| Alt.3 | 1 | Intel |
| Alt.4 | 5 | Qualcomm, OPPO, Samsung, Nokia/NSB (1st preference), CATT |

Although Alt.3 got less support, it seems there is some technical considerations behind, i.e. some PUCCH channels are always transmitted, i.e. P-/SP-CSI on PUCCH; and some other channels may or may not be transmitted e.g. SR. Note that CG-PUSCH case has been covered by proposal of Issue 2 and hence excludes from here.

Also, Alt.1 seems focus on the always-transmitted PUCCH and Alt.4 seems have concrete proposals on conditional UL channel transmission e.g. SR. Taking both Alt.1 and Alt.4 into account and following logic of Alt.3, the following was proposed as compromise proposal:

FL proposal:

* *UE assumes there is always UL transmission in the periodic PUCCH (e.g. P-/SP-CSI) resource and P-/SP-SRS resource*
* *If the higher layer configured UL transmission is ~~triggered or~~ cancelled due to the UE internal process (e.g. SR and CG-PUSCH), it is up to UE whether to take it into account for power determination.*
* *If the higher layer configured UL transmission is cancelled due to a DCI indication, the UE does not expect to receive such DCI in PDCCH receptions with a last symbol that is not earlier by less than or equal to* $T\_{Offset}$ *from the first symbol of the transmission occasion of the SCG*

Companies views on FL proposal can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
|  |  |

## Issue #4: Handling UL Slot Aggregation on SCG

One issue raised in [7] with regard to dynamic power sharing is that current agreement causes severe constraint at gNB side due to lack of SCG scheduling information. As one consequence, MCG will have to assume worst case for SCG transmission length for scheduling MCG UL transmissions. Due to this, if SCG UL transmissions span multiple slots, the current specification text results in severe restrictions on MCG UL scheduling.

One example was provided in [7] as illustrated in FIG.2/FIG.3 below. For example, considering Figure 2 below, if the UE has an SCG UL transmission U1 spanning multiple slots, then MCG cannot schedule an uplink transmission U2m since $T\_{offset}$ is considered from “start of SCG UL transmission”. So, when the SCG transmission spans multiple slots, the $T\_{offset}$ restriction has to be effectively extended by the maximum number of slots allowed by slot aggregation. However, from UE perspective, it should be able to take U2m into account as long as P2m occurs $T\_{offset}$ ahead of start of second slot of U1. i.e., if there were two separate SCG UL transmissions U1 and U2 (as shown in Figure 3), the UE anyway has to support that case.



**Figure 2**



**Figure 3**

The following was proposed in [7]:

|  |
| --- |
| Proposal* $T\_{offset}$ is applied on per-SCG slot basis
 |

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | According to the current spec, the Toffset is applied on per-SCG transmission occasion basis. Regarding to UL transmission with slot aggregation, each repetition is regarded as on transmission occasion. From this perspective, the current spec is clear to us. If we have to make a proposal for this issue, we propose the following one.Proposal:Toffset is applied on per-SCG UL transmission occasion basis. |
| Qualcomm | Need to check if we need to take into account the on-going discussion on TPC and UCI multiplexing for PUSCH repetition Type B.  |
| OPPO | Agree with ZTE. The proposal of [7] is not an essential issue, just a further optimization. We don’t need any proposal (neither the proposal in [7] nor ZTE’s proposal) here.  |
| Intel | Agree with ZTE proposal. Since consecutive repetition of PUSCH type B is adopted in URLLC, ZTE proposal is better since it allows to adjust the power of the mulitple repetitions in a slot |
| MTK | Agree with ZTE. To our understanding, according to ZTE’s interpretation, Toffset is applied on a per-SCG transmission occasion basis and does not pose severe constraint at gNB side. If proponent of [7] thinks a clarification is needed, we are open to discuss it or adopt proposal from ZTE. |
| Samsung | Agree with ZTE – power control is per transmission occasion. For repetitions, each repetition is treated separately and power can vary across repetitions (which is anyway also the intention of the proposal).  |
| Nokia/NSB | Agree with ZTE.  |
| Ericsson | Is there any spec text already explaining below statements? If not, this should be clarified and we would be OK with having such spec clarification to resolve this issue.ZTE – „*Regarding to UL transmission with slot aggregation, each repetition is regarded as one transmission occasion*“Samsung – „*For repetitions, each repetition is treated separately and power can vary across repetitions*“ |
| vivo | Agree with ZTE. It is the common understanding that power determination is based on per transmission occasion, and there is no need for any agreement or TP for this issue. |
| CATT | Each transmission is an independent event for the UL transmit power setting. |
| Huawei, HiSilicon | Agree with that power control is per transmission occassion. |

## Issue #5: Maintenance or Editorial Issues

A number of TPs were proposed in [3][4][7] and listed below for discussions.

* **Issue 5-1:** TP to clarify the TDD UL/DL configuration for semi-static power sharing proposed in [3]

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | The current spec wording is in line with the wording in Section 11.1 (as shown below) of TS38.213. No spec update is needed.If a UE is not configured to monitor PDCCH for DCI format 2\_0, for a set of symbols of a slot that are indicated as flexible by *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated* if provided, or when *tdd-UL-DL-ConfigurationCommon* and *tdd*-*UL-DL-ConfigurationDedicated* are not provided to the UE |
| Qualcomm | Agree with ZTE. |
| OPPO | Agree with ZTE and QC |
| Intel | The TP in [3] is valid, i.e. using 'or' to repace 'and'. A 'F' symbol indicated by *tdd-UL-DL-ConfigurationCommon* can be overridden as 'D' by *tdd*-*UL-DL-ConfigurationDedicated.* Then the symbol is for downlink and should not be considered in *Semi-static-mode2* |
| MTK | Agree with ZTE. |
| Samsung | Yes, it says “if provided“. No spec update is needed. |
| Nokia/NSB | Agree with ZTE. No spec change is needed. |
| vivo | Firstly, *tdd-UL-DL-ConfigurationDedicated* may not be configured, as the wording in TS 38.213 section 11.1,If the UE is additionally provided *tdd-UL-DL-ConfigurationDedicated*, the parameter *tdd-UL-DL-ConfigurationDedicated* overrides only flexible symbols per slot over the number of slots as provided by *tdd-UL-DL-ConfigurationCommon*. …For a set of symbols of a slot that are indicated to a UE as uplink by *tdd-UL-DL-ConfigurationCommon*, or *tdd-UL-DL-ConfigurationDedicated*, the UE does not receive PDCCH, PDSCH, or CSI-RS when the PDCCH, PDSCH, or CSI-RS overlaps, even partially, with the set of symbols of the slot.Secondly, *tdd-UL-DL-ConfigurationCommon* should be provided, the wording “if provided“ is only applicable for *tdd-UL-DL-ConfigurationDedicated*, which is not applicable for *tdd-UL-DL-ConfigurationCommon*.Therefore, this TP is needed. |
| Huawei, HiSilicon | No spec update is needed. Please note that tdd-UL-DL-ConfigurationDedicated cannot be configured if tdd-UL-DL-ConfigurationCommon is not configured. |

**FL proposal:**

* *No specification change is needed.*
* Issue 5-2: TP to clarify the definitions of $\hat{P}\_{MCG}^{actual}\left(i\_{1}\right)$ and $\hat{P}\_{SCG}^{actual}\left(i\_{2}\right)$ (i.e., linear values) proposed in [3]

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | Fine with the update. |
| Qualcomm | Support the TP. |
| OPPO | Support |
| Intel | Fine with the TP |
| MTK | Support |
| Samsung | OK |
| Nokia/NSB | Support the change |
| Ericsson | Support |
| vivo | Support |
| CATT | Support |
| Huawei, HiSilicon | Support |

**FL proposal:**

*Agree the TP in [3]*

* Issue 5-3: TP to align RRC parameters between the endorsed MR-DC running CR of TS 38.331 and TS 38.213 proposed in [3] and [4]

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | Fine with the update. |
| Qualcomm | Fine in general, but it is still a running CR; it is sufficient to fix them after the parameters are actually fixed (unless there is any confusing aspect).  |
| OPPO | Support |
| Intel | Fine with the TP |
| MTK | Fine with the update. |
| Samsung | OK |
| Nokia/NSB | Support the update |
| Ericsson | Same comment as Qualcomm. |
| vivo | Support |
| CATT | Support |
| Huawei, HiSilicon | Suggest not to add „-r16“ as postfix to p-NR-FR2 as 38.331 description.  |

**FL proposal:**

*Agree the TP in [3] and [4]*

* Issue 5-4: Removal of earlier text on dynamic power sharing proposed in [7]

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | We are open to this update. |
| Qualcomm | Support the TP. |
| Intel | We support the TP |
| MTK | Fine with the TP |
| Samsung | OK |
| Nokia/NSB | Support TP |
| Ericsson | Support the TP |
| vivo | Support |
| CATT | Support |
| Huawei, HiSilicon | OK |

**FL proposal:**

Agree the TP of removal of earlier text on dynamic power sharing proposed in [7]

* Issue 5-5: Correction the timing of maximum transmission power determination proposed in [4]

Companies views can be provided in the following Table:

|  |  |
| --- | --- |
| **Company** | **View/Position** |
| ZTE | Fine with the update. |
| Qualcomm | The current spec is clear and no problem is found. Can proponent clarify the issue? |
| OPPO | SupportReply to QC: Let me elaborate a bit more on the issue of current spec

|  |
| --- |
| **Current spec:**If a UE - is provided *NR-DC-PC-mode* = *Dynamic*, and - indicates a capability to determine a total transmission power on the SCG at a first symbol of a transmission occasion on the SCG by determining transmissions on the MCG that- are scheduled by DCI formats in PDCCH receptions with a last symbol that is earlier by more than $T\_{offset}$ from the first symbol of the transmission occasion on the SCG, and - overlap with the transmission occasion on the SCG the UE determines a maximum transmission power on the SCG at the beginning of the transmission occasion on the SCG as - $min\left(\hat{P}\_{SCG},\hat{P}\_{Total}^{NR-DC}- \hat{P}\_{MCG}^{actual}\right)$, if the UE determines transmissions on the MCG with a $\hat{P}\_{MCG}^{actual}$ total power- $\hat{P}\_{Total}^{NR-DC}$, if the UE does not determine any transmissions on the MCG |

The highlighted parts are quite confusing. There may be two interpretations1. The determination of transmission power on the SCG is done at a first symbol or the beginning of a transmission occasion on the SCG
2. The maximum or total transmission power is determined for the first symbol of a transmission occasion on the SCG

The first one is not correct since UE should determine the transmission before the first symbol or the beginning of the transmission occasion. The second one is not right either since the maximum transmission is for the whole transmission occasion rather than only the first symbol.  |
| Intel | We think the current spec is better. Based on another agreement, the power control with a CG following Rel-15 CA. That is, a transmisison is in a CG may change its power following the Rel-15 CA. Therefore, it is better to say the determined power is for the first symbol or begining as the current spec.  |
| MTK | Fine with the update. |
| Samsung | There is no problem with the current text but OK with the update for alignment. |
| Nokia/NSB | We are O.K. with the update. |
| Ericsson | We think the current spec text is clear |
| vivo | Fine with the update. |
| CATT | We are fine with current spec and don’t see the need for the update.  |

It seems four companies think the current spec is clear and one company even thinks the current spec is better. Considering the current status, unless there is critical issue identified, FL tended to keep the current spec without changes.

**FL proposal:**

* *No specification change is needed.*

# 3. Conclusion

# References

1. [R1-2001528](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2001528.zip) UL power control for NR-NR dual connectivity Huawei, HiSilicon
2. [R1-2001618](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2001618.zip) Remaining Issues of Dynamic Power Sharing for NR-DC ZTE
3. [R1-2001688](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2001688.zip) Remaining issues on uplink power control for NR-NR DC vivo
4. [R1-2001736](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2001736.zip) Text proposals for UL Power Sharing for NR-DC OPPO
5. [R1-2002012](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2002012.zip) Remaining issues on uplink power control for NN-DC Intel Corporation
6. [R1-2002345](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2002345.zip) Remaining issues of UL Power Control for NN-DC Apple
7. [R1-2002418](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2002418.zip) Remaining issues for NR-DC UL Power Control Ericsson
8. [R1-2002607](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_100b%5CDocs%5CR1-2002607.zip) Remaining details of Rel-16 DC uplink power control Nokia, Nokia Shanghai Bell
9. R1-2002743 Outcome of preparation discussion on UL Power Control for NN-DC Apple