3GPP TSG-RAN2 Meeting #113bis-e R2-210xxxx

eMeeting, 12th – 20th April, 2021

Agenda Item: 5.4.3 UE capabilities and Capability Coordination

Source: Ericsson

Title: Summary of [Post113-e][051][NR15] DL scheduling slot offset

Document for: Discussion and Decision

# Introduction

The DL scheduling offset was discussed during RAN2#113-e [1,2], but no agreements were reached. It was decided to continue the discussion until RAN2#113bis-e:

* [Post113-e][051][NR15] DL scheduling slot offset (Ericsson)

 Scope: Continue discussion from [AT113-e][012] R2-2101731

 Intended outcome: Report with Agreeable proposals

 Deadline: Long

The deadline of the email discussion is **Wednesday, 24th of March 2021, 11 UTC**.

# Background

**K0>0 for System Information and Random Access**

During the offline discussion #012 during RAN2#113-e [2] the use of K0>0 for System Information (SI) and Random Access (RA) was mentioned. It is the understanding of the rapporteur that the use of K0>0 for SI is not possible, i.e. the network does not know if the UE has IOT-tested K0>0 in case of SI, and there can always be legacy UEs that did not IOT-test this feature. The network can also not use K0>0 for RA when the UE comes from Idle mode and the network does not know the UE capabilities or during Contention Based Random Access (CBRA) when the network does not know which UE responds. But in case of Contention Free Random Access (CFRA) in connected mode the network could use K0>0 with PDCCH/PDSCH transmissions when the UE has IOT-tested it.

The network can use K0>0 for Paging, when the (IOT) capability is signalled in the Paging message to the gNB. In case the UE(s) that are paged in the Paging Occasion (PO) have IOT-tested K0>0, then the network can safely use K0>0 in that PO. In case one or more UEs in the PO did not indicate to have IOT-tested K0>0, then the network cannot use K0>0 for that PO.

**PDSCH configuration in 38.331**

Up to 16 K0 values between 0-32 can be configured via *pdsch-TimeDomainAllocationList* in *SIB1* for the initial BWP used for Paging, System Information and Random Access in *PDSCH-ConfigCommon* IE:

pdsch-TimeDomainAllocationList PDSCH-TimeDomainResourceAllocationList OPTIONAL, -- Need R

PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation

PDSCH-TimeDomainResourceAllocation ::= SEQUENCE {

 **k0 INTEGER(0..32)** OPTIONAL, -- Need S

…

maxNrofDL-Allocations INTEGER ::= 16 -- Maximum number of PDSCH time domain resource allocations

The *pdsch-TimeDomainAllocationList* provides the possible K0 values the NW may use for the time between PDCCH and following PDSCH transmission. The actual value that is used in a particular PDCCH transmission, from the possible list in *SIB1*, is dynamically indicated in the PDCCH.

So for SI and CBRA the network would only use K0 is 0 values in the PDCCH transmissions. But for CFRA in connected mode the network could use a K0 > 0, if configured in the list and if the UE has indicated to have IOT-tested it. The intention is to enable similar flexibility for Paging by introducing the capabilities in the Paging message.

# Discussion

**Introduction of DL scheduling offset capabilities in Paging message**

The proposal is to add *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* to the *UERadioPagingInformation* message so that the gNB can know if the UE has IOT-tested K0>0 for Paging:

UERadioPagingInformation ::= SEQUENCE {

 criticalExtensions CHOICE {

 c1 CHOICE{

 ueRadioPagingInformation UERadioPagingInformation-IEs,

 spare7 NULL,

 spare6 NULL, spare5 NULL, spare4 NULL,

 spare3 NULL, spare2 NULL, spare1 NULL

 },

 criticalExtensionsFuture SEQUENCE {}

 }

}

UERadioPagingInformation-IEs ::= SEQUENCE {

 supportedBandListNRForPaging SEQUENCE (SIZE (1..maxBands)) OF FreqBandIndicatorNR OPTIONAL,

 nonCriticalExtension UERadioPagingInformation-vxyz-IEs OPTIONAL

}

UERadioPagingInformation-vxyz-IEs ::= SEQUENCE {

 dl-SchedulingOffset-PDSCH-TypeA ENUMERATED {supported} OPTIONAL,

 dl-SchedulingOffset-PDSCH-TypeB ENUMERATED {supported} OPTIONAL,

 nonCriticalExtension SEQUENCE {} OPTIONAL

}

**Issue 1**: Do companies agree to add *SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* to the *UERadioPagingInformation* message?

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| --- | --- | --- |
| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | We are not sure why these capabilities were not added from the beginning in REL-15, but perhaps the use of K0 > 0 was not considered in much details during that time period.  |
| Huawei, HiSilicon | Yes | We share the view from rapporteur in the Background clause. We introduce IOT bit for paging, if the UE has IOT-tested K0>0 for paging, the network can safely use K0>0 for scheduling of paging. But for SI and RA (except for CFRA in connected mode), no specific IOT bit is introduced, so the network CANNOT use K0>0 for SI and RA in this case. In addition to the introduction of IOT capability for paging, it would be good to clarify (e.g. capture it in meeting minutes):The network CANNOT use K0>0 before knows that the UE has IOT-tested K0>0. |
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**Configuration of K0 > 0 in *pdsch-TimeDomainAllocationList***

It is the understanding of the rapporteur that a UE implementation supports the configuration of possible K0 values that the UE implementation might not have IOT-tested. In case the UE has not IOT-tested K0 > 0 then the network will not use K0 > 0 in PDCCH transmissions to that UE:

**Issue 2**: Do companies confirm that a UE that does not support *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability does support *pdsch-TimeDomainAllocationList* configuration including K0 values larger than 0?

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| **Company** | **Yes/No** | **Comments** |
| Ericsson | Yes | Companies are kindly invited to make a distinction between support/IOT-tested and configuration in this case. We agree that a UE may set *dl-SchedulingOffset-PDSCH-TypeA* or *dl-SchedulingOffset-PDSCH-TypeB* capability to false. But in our understanding any UE implementation should support the configuration of K0 > 0.  |
| Huawei, HiSilicon | Yes | We understand UE can support the *pdsch-TimeDomainAllocationList* configuration including K0>0, but if the UE does not have IOT-tested K0>0 for paging, the network can only use K0=0 for scheduling of paging, even though the *pdsch-TimeDomainAllocationList* configuration includes K0>0. |
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# Summary of email discussion

TBD

# Conclusions

TBD

# References

1. [R2-2101731](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_113-e/Docs/R2-2101731.zip), *DL scheduling slot offset capability*, Ericsson, Qualcomm, DISC, Rel-15, RAN2#113-e
2. [R2-2102374](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2//TSGR2_113-e/Docs/R2-2102374.zip), *Summary of [012][NR15] UE Capabilites IV*, Huawei, Report, RAN2#113-e