**3GPP TSG RAN WG1 Meeting #110 R1-22xxxxx**

**Toulouse, France, August 22nd –26th, 2022**

**Source: Moderator (vivo)**

**Title: FL summary #1 of PDSCH/PUSCH enhancement (RS and timeline)**

**Agenda item: 8.2**

**Document for: Discussion and decision**

# Introduction

In this contribution, we summarize issues regarding PDSCH/PUSCH enhancements for new SCSs on supporting NR from 52.6 GHz to 71 GHz in RAN1 #110.

Note that only issues related to time line related aspects adapted to each of the new numerologies 480kHz and 960kHz and reference signals are summarized here based on contributions to AI 8.2.

# Remaining issues

## 2.1. reportSlotOffsetList for 480/960 kHz SCS

In [4, Huawei], it is pointed out that UE determines the slot offset to transmit PUSCH only carrying CSI reports with no TB according to higher layer parameters *reportSlotOffsetList, reportSlotOffsetListDCI-0-1* and *reportSlotOffsetListDCI-0-2* as in TS38.214.

It is observed in [4, Huawei] that RRC parameter of *extendedK2-r17* in *PUSCH-Allocation-r16* is extended to 128 for 480kHz and 960kHz SCS in order to maintain similar processing capability as that of 120kHz SCS. However, the value range of the RRC parameters of *reportSlotOffsetList, reportSlotOffsetListDCI-0-1* and *reportSlotOffsetListDCI-0-2* for 480kHz and 960kHz SCS is not adjusted accordingly in TS 38.331 copied below.

semiPersistentOnPUSCH SEQUENCE {

reportSlotConfig ENUMERATED {sl5, sl10, sl20, sl40, sl80, sl160, sl320},

reportSlotOffsetList SEQUENCE (SIZE (1.. maxNrofUL-Allocations)) OF INTEGER(0..32),

p0alpha P0-PUSCH-AlphaSetId

},

aperiodic SEQUENCE {

reportSlotOffsetList SEQUENCE (SIZE (1..maxNrofUL-Allocations)) OF INTEGER(0..32)

}

semiPersistentOnPUSCH-v1610 SEQUENCE {

reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R

reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL -- Need R

} OPTIONAL, -- Need R

aperiodic-v1610 SEQUENCE {

reportSlotOffsetListDCI-0-2-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL, -- Need R

reportSlotOffsetListDCI-0-1-r16 SEQUENCE (SIZE (1.. maxNrofUL-Allocations-r16)) OF INTEGER(0..32) OPTIONAL -- Need R

} OPTIONAL, -- Need R

It is proposed in [4, Huawei] to extend the value range of *reportSlotOffsetList, reportSlotOffsetListDCI-0-1* and *reportSlotOffsetListDCI-0-2* for 480kHz and 960kHz SCS to INTEGER(0..128) and send LS to RAN2. A corresponding CR to TS 38.214 is provided in [91, Huawei].

Moderator’s comment:

The extension of applying the same treatment to *reportSlotOffsetList* parameters for 480 and 960 kHz SCS to maintain the same timeline as that of 120 kHz seems straightforward. The following proposal is formulated for discussion.

##### Proposal 1-1

Support the value range of *reportSlotOffsetList-r17*, *reportSlotOffsetListDCI-0-1-r17* and *reportSlotOffsetListDCI-0-2-r17* for 480kHz and 960kHz SCS to INTEGER (0..128).

* Send an LS to RAN2
* Endorse in principal the corresponding CR to TS38.214 in [91] (TP copied below for convenience)

========================= Start of TP #1-1 for TS 38.214, clause 6.1.2.1===================

6.1.2.1 Resource allocation in time domain

=============================== Unchanged Text Omitted ===================================

When the UE is scheduled to transmit a PUSCH with no transport block and with a CSI report(s) by a '*CSI request'* field on a DCI, the '*Time domain resource assignment'* field value *m* of the DCI provides a row index *m* + 1to the allocated table as defined in Clause 6.1.2.1.1. The indexed row defines the start and length indicator SLIV, or directly the start symbol *S* and the allocation length *L*, and the PUSCH mapping type to be applied in the PUSCH transmission and the *K2* value is determined as , where  are the corresponding list entries of the higher layer parameter

- *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17*, if PUSCH is scheduled by DCI format 0\_2 and *reportSlotOffsetListDCI-0-2* or *reportSlotOffsetListDCI-0-2-r17* is configured;

- *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17*, if PUSCH is scheduled by DCI format 0\_1 and *reportSlotOffsetListDCI-0-1* or *reportSlotOffsetListDCI-0-1-r17*is configured;

- *reportSlotOffsetList* or *reportSlotOffsetList-r17*, otherwise;

in *CSI-ReportConfig* for the  triggered CSI Reporting Settings and  is the *(m+1)*th entry of .

=============================== Unchanged Text Omitted ===================================

Companies are encouraged to provide comments.

|  |  |
| --- | --- |
| Company Name | Comments/Views |
| Ericsson | Seems okay |
| vivo | We support this proposal. |
| Nokia/NSB | Support |
| LG Electonics | We are fine with the proposal |

## 2.2. UE PDSCH processing procedure time for operation with shared spectrum channel access in FR2-2

It is pointed in [11, ZTE] that for operation with shared spectrum channel access in FR2-2, cyclic prefix extension specified in Re-16 NR-U is not supported, thus  for calculating UE PDSCH processing procedure time should be equal to 0. It proposed that in order to avoid ambiguity, calculated according to TS 38.211 should be restricted to only be applicable to Rel-16 NR-U in FR1.

Moderator’s comment:

The following proposal is formulated below for discussion.

##### Proposal 2-1

Endorse in principal the corresponding CR to TS38.214 in [11] (TP copied below for convenience).

========================= Start of TP #2-1 for TS 38.214, clause 5.3===================

5.3 UE PDSCH processing procedure time

=============================== Unchanged Text Omitted ===================================

If the first uplink symbol of the PUCCH which carries the HARQ-ACK information, as defined by the assigned HARQ-ACK timing *K1* and Koffset, if configured, and the PUCCH resource to be used and including the effect of the timing advance, starts no earlier than at symbol *L1*, where *L1* is defined as the next uplink symbol with its CP starting after  after the end of the last symbol of the PDSCH carrying the TB being acknowledged, then the UE shall provide a valid HARQ-ACK message.

*- N1* is based on *µ* of table 5.3-1 and table 5.3-2 for UE processing capability 1 and 2 respectively, where *µ* corresponds to the one of (*µPDCCH*, *µPDSCH*, *µUL*) resulting with the largest *Tproc,1*, where the *µPDCCH* corresponds to the subcarrier spacing of the PDCCH scheduling the PDSCH, the *µPDSCH* corresponds to the subcarrier spacing of the scheduled PDSCH, and *µUL* corresponds to the subcarrier spacing of the uplink channel with which the HARQ-ACK is assumed to be transmitted regardless of whether or not the PDSCH reception provides a transport block for a HARQ process with disabled HARQ-ACK information as indicated by *HARQ-feedbackEnabling-disablingperHARQprocess*, if provided, and κ is defined in clause 4.1 of [4, TS 38.211].

*-* For operation with shared spectrum channel access in FR1, is calculated according to [4, TS 38.211], otherwise =0.

*-* If the PDSCH DM-RS position for the additional DM-RS in Table 7.4.1.1.2-3 in clause 7.4.1.1.2 of [4, TS 38.211] is then *N1,0=14* inTable 5.3-1*,* otherwise *N1,0=13.*

=============================== Unchanged Text Omitted ===================================

Companies are encouraged to provide comments.

|  |  |
| --- | --- |
| Company Name | Comments/Views |
| Ericsson | Seems okay |
| vivo | We support this proposal. |
| Nokia/NSB | Support |
| LG Electonics | We support the proposal |

## 2.3. Slot configuration period

It is proposed in [21, CATT] that with the new SCS 480/960 KHz are introduced for FR2-2 operation, the slot configuration period of P msec including 0.625ms, P=1.25ms and P=2.5ms shall be also applied for 480/960 KHz. A corresponding CR is provided in [21, CATT].

Moderator’s comment:

The following proposal is formulated below for discussion.

Proposal 3-1

Endorse in principal the corresponding CR to TS38.213 in [21] (TP copied below for convenience).

========================= Start of TP #3-1 for TS 38.213, clause 11.1===================

11.1 Slot configuration

=============================== Unchanged Text Omitted ===================================

The *pattern1* provides

- a slot configuration period of  msec by *dl-UL-TransmissionPeriodicity*

- a number of slots  with only downlink symbols by *nrofDownlinkSlots*

- a number of downlink symbols  by *nrofDownlinkSymbols*

- a number of slots  with only uplink symbols by *nrofUplinkSlots*

- a number of uplink symbols  by *nrofUplinkSymbols*

A value  msec is valid only for , . A value  msec is valid only for  , , . A value  msec is valid only for , or , or , .

=============================== Unchanged Text Omitted ===================================

Companies are encouraged to provide comments.

|  |  |
| --- | --- |
| Company Name | Comments/Views |
| Ericsson | Seems okay |
| vivo | We support this proposal. |
| Nokia/NSB | Support. Also, following can be further considered.  A value *P*=10 msec is valid only for , or , or , or .  (maxNrofSlots is 320, and for 960kHz, P=10ms require 640 slots.) |

##### Proposal 3-1a

Endorse in principal the following TP to TS38.213 (TP based on [21] and Nokia’s comment).

========================= Start of TP #3-1 for TS 38.213, clause 11.1===================

11.1 Slot configuration

=============================== Unchanged Text Omitted ===================================

The *pattern1* provides

- a slot configuration period of  msec by *dl-UL-TransmissionPeriodicity*

- a number of slots  with only downlink symbols by *nrofDownlinkSlots*

- a number of downlink symbols  by *nrofDownlinkSymbols*

- a number of slots  with only uplink symbols by *nrofUplinkSlots*

- a number of uplink symbols  by *nrofUplinkSymbols*

A value  msec is valid only for , . A value  msec is valid only for  , , . A value  msec is valid only for , or , or , . A value*P*=10 msec is valid only for , , or , or , or .

=============================== Unchanged Text Omitted ===================================

Companies are encouraged to provide comments.

|  |  |
| --- | --- |
| Company Name | Comments/Views |
| LG Electonics | We are fine with the proposal |
|  |  |
|  |  |

## 2.4. Aperiodic CSI triggering offset

It is pointed out in both [48, Samsung] and [57, LG] that the agreement made in RAN1#109-e meeting on the set of values of aperiodicTriggeringOffset-r17 for SCS 480 and 960 kHz has not been captured as the CSI-RS triggering offset value in the 38.214 specification.

Moderator’s comment:

The following proposal is formulated below for discussion.

##### Proposal 4-1

Endorse in principal the following TP to TS38.214 (TP is a merged version of [48] and [57]).

=====================Start of TP #4-1 for TS 38.214, clause 5.2.1.5.1 and 5.2.1.5.1a===================

5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology

=============================== Unchanged Text Omitted ===================================

When aperiodic CSI-RS is used with aperiodic reporting, the CSI-RS offset is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16 or aperiodicTriggeringOffset-r17*. The CSI-RS triggering offset has the values of {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} slots for or {0, 4, 8, 12, …, 60, 64, 96} slots for and , where is the subcarrier spacing configurations for CSI-RS. If the UE is not configured with *minimumSchedulingOffsetK0* for any DL BWP and *minimumSchedulingOffsetK2* for any UL BWP and if all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'typeD' in the corresponding TCI states, the CSI-RS triggering offset is fixed to zero. The aperiodic triggering offset of the CSI-IM follows offset of the associated NZP CSI-RS for channel measurement. The aperiodic CSI-RS is transmitted in a slot , , if UE is configured with ca-SlotOffset for at least one of the triggered and triggering cell, and in slot , otherwise, and where

*- n* is the slot containing the triggering DCI, *X* is the CSI-RS triggering offset according to the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16 or aperiodicTriggeringOffset-r17*,

=============================== Unchanged Text Omitted ===================================

5.2.1.5.1a Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have different numerologies

=============================== Unchanged Text Omitted ===================================

Aperiodic CSI-RS timing:

- When the aperiodic CSI-RS is used with aperiodic CSI reporting, the CSI-RS triggering offset *X* is configured per resource set by the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16 or aperiodicTriggeringOffset-r17,* including the case that the UE is not configured with *minimumSchedulingOffsetK0* for any DL BWP or *minimumSchedulingOffsetK2* for any UL BWP and all the associated trigger states do not have the higher layer parameter *qcl-Type* set to 'typeD' in the corresponding TCI states. The CSI-RS triggering offset has the values of {0, 1, …, 31} slots for or {0, 4, 8, …, 124} slots for and when the µPDCCH < µCSIRS and {0, 1, 2, 3, 4, 5, 6, …, 15, 16, 24} for or {0, 4, 8, 12, …, 60, 64, 96} slots for and when the µPDCCH > µCSIRS.. The aperiodic CSI-RS is transmitted in a slot , if UE is configured with ca-SlotOffset for at least one of the triggered and triggering cell, and *Ks* = , otherwise, and where

*- n* is the slot containing the triggering DCI, *X* is the CSI-RS triggering offset in the numerology of CSI-RS according to the higher layer parameter *aperiodicTriggeringOffset* or *aperiodicTriggeringOffset-r16 or aperiodicTriggeringOffset-r17*,

- and are the subcarrier spacing configurations for CSI-RS and PDCCH, respectively,

=============================== Unchanged Text Omitted ===================================

Companies are encouraged to provide comments.

|  |  |
| --- | --- |
| Company Name | Comments/Views |
| Ericsson | Seems okay |
| vivo | We support this proposal. |
| Nokia/NSB | Support |
| LG Electonics | We support the proposal |

# Conclusion

TBD

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55. [R1-2207024](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207024.zip) Draft CR for SSSG switching with multiple cells in FR2-2 LG Electronics
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59. [R1-2207028](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207028.zip) Remaining issues of channel access mechanism to support NR above 52.6 GHz LG Electronics
60. [R1-2207029](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207029.zip) Draft CR for independent per-beam sensing and LBT procedure for UE in FR2-2 LG Electronics
61. [R1-2207030](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207030.zip) Draft CR on channel access indication for RAR grant in FR2-2 LG Electronics
62. [R1-2207031](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207031.zip) Draft CR for channel access indication within fallback-DCI in FR2-2 LG Electronics
63. [R1-2207082](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207082.zip) Initial access aspects Nokia, Nokia Shanghai Bell
64. [R1-2207098](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207098.zip) Correction on UE resuming a UE initiated COT Nokia, Nokia Shanghai Bell
65. [R1-2207179](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207179.zip) Draft CR on ChannelAccess-Cpext in Fallback DCI Qualcomm Incorporated
66. [R1-2207180](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207180.zip) Draft CR on ChannelAccess-Cpext in RAR UL Grant Qualcomm Incorporated
67. [R1-2207181](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207181.zip) Draft CR on sensing exempted transmission of first message of RACH Qualcomm Incorporated
68. [R1-2207182](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207182.zip) Draft CR on BW parameter in EDT determination and ED Value cap Qualcomm Incorporated
69. [R1-2207183](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207183.zip) Draft CR on UL transmission with LBT per sensing beam Qualcomm Incorporated
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71. [R1-2207185](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207185.zip) Draft CR on rule for resuming a transmission after a gap within MCOT Qualcomm Incorporated
72. [R1-2207186](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207186.zip) Draft CR on rule for channel access type upgrade Qualcomm Incorporated
73. [R1-2207187](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207187.zip) Discussion paper on Maintenance for NR from 52.6GHz to 71 GHz Qualcomm Incorporated
74. [R1-2207269](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207269.zip) Draft CR for spatial HARQ-ACK bundling for type-2 codebook with multi-PDSCH scheduling Nokia, Nokia Shanghai Bell
75. [R1-2207309](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207309.zip) Maintenance on Supporting NR from 52.6GHz to 71GHz Apple
76. [R1-2207380](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207380.zip) Draft CR on channel access type indication by fallback DCI in FR2-2 NTT DOCOMO, INC.
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78. [R1-2207382](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207382.zip) Discussion on remaining issues for NR in FR2-2 NTT DOCOMO, INC.
79. [R1-2207464](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207464.zip) Draft CR on UE capability name alignment Ericsson
80. [R1-2207465](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207465.zip) Discussion on UE capability name alignment Ericsson
81. [R1-2207466](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207466.zip) Draft CR on Group 2 search space configuration Ericsson
82. [R1-2207467](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207467.zip) Discussion on Group 2 search space configuration Ericsson
83. [R1-2207468](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207468.zip) Draft CR on LBT-type indication in RAR UL grant Ericsson
84. [R1-2207469](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207469.zip) Discussion on LBT-type indication in RAR UL grant Ericsson
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87. [R1-2207472](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207472.zip) Discussion on L3-RSSI measurements and LS to RAN4 Ericsson
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89. [R1-2207495](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207495.zip) Correction on CSI-RS validation ASUSTeK
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91. [R1-2207524](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207524.zip) Corrections on the timeline of CSI request in TS38.214 Huawei, HiSilicon
92. [R1-2207595](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207595.zip) Remaining issue on channel access for NR from 52.6GHz to 71GHz WILUS Inc.
93. [R1-2207608](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207608.zip) On spatial HARQ-ACK bundling for type-2 codebook with multi-PDSCH scheduling Nokia, Nokia Shanghai Bell
94. [R1-2207642](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207642.zip) Remaining issues of channel access mechanism for 60 GHz unlicensed operation Huawei, HiSilicon
95. [R1-2207663](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207663.zip) Corrections to ED threshold for use with Type 2 channel access procedure in FR2-2 in TS37.213 Huawei, HiSilicon
96. [R1-2207664](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110/Docs/R1-2207664.zip) Corrections to the conditions for channel sensing in FR2-2 in TS37.213 Huawei, HiSilicon