3GPP TSG-RAN WG1 Meeting #98bis ***R1-19xxxxx***
Chongqing, China, October 14 – 20, 2019

CR-Form-v12.0

DRAFT CHANGE REQUEST

38.213	CR	xxxx	rev	-	Current version:	15.7.0

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Proposed change affects: UICC apps [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	Introduction of Industrial IoT		
Source to WG:	Samsung		
Source to TSG:			
Work item code:	NR_IIOT-Core	***Date:***	<Res_date>
Category:	B	***Release:***	Rel-16
	Use one of the following categories: ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *Rel-8 (Release 8)* *Rel-9 (Release 9)* *Rel-10 (Release 10)* *Rel-11 (Release 11)* *Rel-12 (Release 12)* *Rel-13 (Release 13)* *Rel-14 (Release 14)* *Rel-15 (Release 15)* *Rel-16 (Release 16)*

Reason for change:	
Summary of change:	
Consequences if not approved:	

Clauses affected:				
	Y	**N**		
Other specs affected:			Other core specifications	TS/TR ... CR ...
(show related CRs)			Test specifications	TS/TR ... CR ...
			O&M Specifications	TS/TR ... CR ...
Other comments:				

This CR's revision history:	

APPLE 1144
Apple v. Apex Beam
IPR2025-00908

9.2.1 PUCCH Resource Sets

If a UE does not have dedicated PUCCH resource configuration, provided by *PUCCH-ResourceSet* in *PUCCH-Config*, a PUCCH resource set is provided by *pucch-ResourceCommon* through an index to a row of Table 9.2.1-1 for transmission of HARQ-ACK information on PUCCH in an initial UL BWP of $N_{\text{BWP}}^{\text{size}}$ PRBs. The PUCCH resource set includes sixteen resources, each corresponding to a PUCCH format, a first symbol, a duration, a PRB offset $RB_{\text{BWP}}^{\text{offset}}$, and a cyclic shift index set for a PUCCH transmission. The UE transmits a PUCCH using frequency hopping. An orthogonal cover code with index 0 is used for a PUCCH resource with PUCCH format 1 in Table 9.2.1-1. The UE transmits the PUCCH using the same spatial domain transmission filter as for a PUSCH transmission scheduled by a RAR UL grant as described in Subclause 8.3.

If the UE provides HARQ-ACK information in a PUCCH transmission in response to detecting a DCI format 1_0 or DCI format 1_1, the UE determines a PUCCH resource with index r_{PUCCH}, $0 \le r_{\text{PUCCH}} \le 15$, as $r_{\text{PUCCH}} = \left\lfloor \frac{2 \cdot n_{\text{CCE},0}}{N_{\text{CCE}}} \right\rfloor + 2 \cdot \Delta_{\text{PRI}}$, where N_{CCE} is a number of CCEs in a CORESET of a PDCCH reception with DCI format 1_0 or DCI format 1_1, as described in Subclause 10.1, $n_{\text{CCE},0}$ is the index of a first CCE for the PDCCH reception, and Δ_{PRI} is a value of the PUCCH resource indicator field in the DCI format 1_0 or DCI format 1_1.

If $\lfloor r_{\text{PUCCH}}/8 \rfloor = 0$

- the UE determines the PRB index of the PUCCH transmission in the first hop as $RB_{\text{BWP}}^{\text{offset}} + \lfloor r_{\text{PUCCH}}/N_{\text{CS}} \rfloor$ and the PRB index of the PUCCH transmission in the second hop as $N_{\text{BWP}}^{\text{size}} - 1 - RB_{\text{BWP}}^{\text{offset}} - \lfloor r_{\text{PUCCH}}/N_{\text{CS}} \rfloor$, where N_{CS} is the total number of initial cyclic shift indexes in the set of initial cyclic shift indexes
- the UE determines the initial cyclic shift index in the set of initial cyclic shift indexes as $r_{\text{PUCCH}} \bmod N_{\text{CS}}$

If $\lfloor r_{\text{PUCCH}}/8 \rfloor = 1$

- the UE determines the PRB index of the PUCCH transmission in the first hop as $N_{\text{BWP}}^{\text{size}} - 1 - RB_{\text{BWP}}^{\text{offset}} - \lfloor (r_{\text{PUCCH}} - 8)/N_{\text{CS}} \rfloor$ and the PRB index of the PUCCH transmission in the second hop as $RB_{\text{BWP}}^{\text{offset}} + \lfloor (r_{\text{PUCCH}} - 8)/N_{\text{CS}} \rfloor$
- the UE determines the initial cyclic shift index in the set of initial cyclic shift indexes as $(r_{\text{PUCCH}} - 8) \bmod N_{\text{CS}}$

Table 9.2.1-1: PUCCH resource sets before dedicated PUCCH resource configuration

Index	PUCCH format	First symbol	Number of symbols	PRB offset $RB_{\text{BWP}}^{\text{offset}}$	Set of initial CS indexes
0	0	12	2	0	{0, 3}
1	0	12	2	0	{0, 4, 8}
2	0	12	2	3	{0, 4, 8}
3	1	10	4	0	{0, 6}
4	1	10	4	0	{0, 3, 6, 9}
5	1	10	4	2	{0, 3, 6, 9}
6	1	10	4	4	{0, 3, 6, 9}
7	1	4	10	0	{0, 6}
8	1	4	10	0	{0, 3, 6, 9}
9	1	4	10	2	{0, 3, 6, 9}
10	1	4	10	4	{0, 3, 6, 9}
11	1	0	14	0	{0, 6}
12	1	0	14	0	{0, 3, 6, 9}
13	1	0	14	2	{0, 3, 6, 9}
14	1	0	14	4	{0, 3, 6, 9}
15	1	0	14	$\lfloor N_{\text{BWP}}^{\text{size}}/4 \rfloor$	{0, 3, 6, 9}

If a UE has dedicated PUCCH resource configuration, the UE is provided by higher layers with one or more PUCCH resources.

A PUCCH resource includes the following parameters:

- a PUCCH resource index provided by *pucch-ResourceId*
- an index of the first PRB prior to frequency hopping or for no frequency hopping by *startingPRB*
- an index of the first PRB after frequency hopping by *secondHopPRB*;
- an indication for intra-slot frequency hopping by *intraSlotFrequencyHopping*
- a configuration for a PUCCH format, from PUCCH format 0 through PUCCH format 4, provided by *format*

If the *format* indicates *PUCCH-format0*, the PUCCH format configured for a PUCCH resource is PUCCH format 0, where the PUCCH resource also includes an index for an initial cyclic shift provided by *initialCyclicShift*, a number of symbols for a PUCCH transmission provided by *nrofSymbols*, a first symbol for the PUCCH transmission provided by *startingSymbolIndex*.

If the *format* indicates *PUCCH-format1*, the PUCCH format configured for a PUCCH resource is PUCCH format 1, where the PUCCH resource also includes an index for an initial cyclic shift provided by *initialCyclicShift*, a number of symbols for a PUCCH transmission provided by *nrofSymbols*, a first symbol for the PUCCH transmission provided by *startingSymbolIndex*, and an index for an orthogonal cover code by *timeDomainOCC*.

If the *format* indicates *PUCCH-format2* or *PUCCH-format3*, the PUCCH format configured for a PUCCH resource is PUCCH format 2 or PUCCH format 3, respectively, where the PUCCH resource also includes a number of PRBs provided by *nrofPRBs*, a number of symbols for a PUCCH transmission provided by *nrofSymbols*, and a first symbol for the PUCCH transmission provided by *startingSymbolIndex*.

If the *format* indicates *PUCCH-format4*, the PUCCH format configured for a PUCCH resource is PUCCH format 4, where the PUCCH resource also includes a number of symbols for a PUCCH transmission provided by *nrofSymbols*, a length for an orthogonal cover code by *occ-Length*, an index for an orthogonal cover code by *occ-Index*, and a first symbol for the PUCCH transmission provided by *startingSymbolIndex*.

A UE can be configured up to four sets of PUCCH resources. A PUCCH resource set is provided by *PUCCH-ResourceSet* and is associated with a PUCCH resource set index provided by *pucch-ResourceSetId*, with a set of PUCCH resource indexes provided by *resourceList* that provides a set of *pucch-ResourceId* used in the PUCCH resource set, and with a maximum number of UCI information bits the UE can transmit using a PUCCH resource in the PUCCH resource set provided by *maxPayloadMinus1*. For the first PUCCH resource set, the maximum number of UCI information bits is 2. A maximum number of PUCCH resource indexes for a set of PUCCH resources is provided by *maxNrofPUCCH-ResourcesPerSet*. The maximum number of PUCCH resources in the first PUCCH resource set is 32 and the maximum number of PUCCH resources in the other PUCCH resource sets is 8.

If the UE transmits O_{UCI} UCI information bits, that include HARQ-ACK information bits, the UE determines a PUCCH resource set to be

- a first set of PUCCH resources with *pucch-ResourceSetId* = 0 if $O_{\text{UCI}} \leq 2$ including 1 or 2 HARQ-ACK information bits and a positive or negative SR on one SR transmission occasion if transmission of HARQ-ACK information and SR occurs simultaneously, or
- a second set of PUCCH resources with *pucch-ResourceSetId* = 1, if provided by higher layers, if $2 < O_{\text{UCI}} \leq N_2$ where N_2 is equal to *maxPayloadMinus1* if *maxPayloadMinus1* is provided for the PUCCH resource set with *pucch-ResourceSetId* = 1; otherwise N_2 is equal to 1706, or
- a third set of PUCCH resources with *pucch-ResourceSetId* = 2, if provided by higher layers, if $N_2 < O_{\text{UCI}} \leq N_3$ where N_3 is equal to *maxPayloadMinus1* if *maxPayloadMinus1* is provided for the PUCCH resource set with *pucch-ResourceSetId* = 2; otherwise N_3 is equal to 1706, or

- a fourth set of PUCCH resources with *pucch-ResourceSetId* = 3, if provided by higher layers, if $N_3 < O_{\text{UCI}} \leq 1706$.

If the UE is provided more than one SPS PDSCH configurations and transmits O_{UCI} UCI information bits that include only HARQ-ACK information bits in response to one or more SPS PDSCH receptions, the UE is provided by *SPS-PUCCH-AN-List* a set of PUCCH resources and determines a PUCCH resource to be

- a PUCCH resource with *SPS-PUCCH-AN-ResourceID* = 0 if $O_{\text{UCI}} \leq 2$, or
- a PUCCH resource with *SPS-PUCCH-AN-ResourceID* = 1, if provided, if $2 < O_{\text{UCI}} \leq N_{1,SPS}$ where $N_{1,SPS}$ is either provided by *maxPayloadSize* in *SPS-PUCCH-AN-List~~ResourceID~~* for *SPS-PUCCH-AN-ResourceID* = 1 or is otherwise equal to 1706, or
- a PUCCH resource with *SPS-PUCCH-AN-ResourceID* = 2, if provided, if $N_{1,SPS} < O_{\text{UCI}} \leq N_{2,SPS}$ where $N_{2,SPS}$ is either provided by *maxPayloadSize* in *SPS-PUCCH-AN-ResourceID* for *SPS-PUCCH-AN-ResourceID* = 2 or is otherwise equal to 1706, or
- a PUCCH resource with *SPS-PUCCH-AN-ResourceID* = 3, if provided, if $N_{2,SPS} < O_{\text{UCI}} \leq N_{3,SPS}$ where $N_{3,SPS}$ is ~~either provided by *maxPayloadSize* in *SPS-PUCCH-AN-ResourceID* for *SPS-PUCCH-AN-ResourceID* = 3 or is otherwise~~ equal to 1706.

Commented [AP1]: SR cannot be multiplexed? If so, need to define whether positive SR or HARQ-ACK is prioritized if they collide. Else, need to amend the agreement for a behavior as in Rel-15 for HARQ-ACK + SR.

*** Unchanged text is omitted ***

10.2 PDCCH validation for DL SPS and UL grant Type 2

If a UE is provided a single configuration for UL grant Type 2 PUSCH or for SPS PDSCH, ~~A~~the UE validates, for scheduling activation or scheduling release, a DL SPS assignment PDCCH or configured UL grant Type 2 PDCCH if

- the CRC of a corresponding DCI format is scrambled with a CS-RNTI provided by *cs-RNTI*, and
- the new data indicator field in the DCI format for the enabled transport block is set to '0'.

Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-1 or Table 10.2-2.

Commented [AP2]: May need to determine how to differentiate/prevent a Rel-15 UE from using DCI 0_1 for scheduling release. If RAN2 introduces a _r16 IE for the SPS and CG Type 2 configurations, a statement can be added that DCI 0_1 is applicable to 'r16'.

If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH, a value of the HARQ process number field in a DCI format indicates an activation for a corresponding UL grant Type 2 PUSCH or of a SPS PDSCH configuration with a same value as provided by *Configuredgrantconfig-index* or by *SPSconfig-index*, respectively. Validation of the DCI format is achieved if the RV field for the DCI format is set as in Table 10.2-3.

If a UE is provided more than one configurations for UL grant Type 2 PUSCH or for SPS PDSCH

- if the UE is provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a corresponding entry for scheduling release of one or more UL grant Type 2 PUSCH or SPS PDSCH configurations
- if the UE is not provided *Type2Configuredgrantconfig-ReleaseStateList* or *SPS-ReleaseStateList*, a value of the HARQ process number field in a DCI format indicates a release for a corresponding value of an UL grant Type 2 PUSCH or of a SPS PDSCH configuration

Validation of the DCI format is achieved if all fields for the DCI format are set according to Table 10.2-4~~3~~.

If validation is achieved, the UE considers the information in the DCI format as a valid activation or valid release of DL SPS or configured UL grant Type 2. If validation is not achieved, the UE discards all the information in the DCI format.

Table 10.2-1: Special fields for single DL SPS ~~and~~or single UL grant Type 2 scheduling activation PDCCH validation

	DCI format 0_0/0_1/0_2	DCI format 1_0	DCI format 1_1
HARQ process number	set to all '0's	set to all '0's	set to all '0's
Redundancy version	set to all '0's~~set to '00'~~	set to all '0's~~set to '00'~~	For the enabled transport block: set to all '0's~~set to '00'~~

Table 10.2-2: Special fields for single DL SPS ~~and~~or single UL grant Type 2 scheduling release PDCCH validation

	DCI format 0_0/0_1/0_2	DCI format 1_0
HARQ process number	set to all '0's	set to all '0's
Redundancy version	set to all '0's~~set to '00'~~	set to all '0's~~set to '00'~~
Modulation and coding scheme	set to all '1's	set to all '1's
Frequency domain resource assignment	set to all '1's	set to all '1's

Table 10.2-3: Special fields for a single DL SPS or single UL grant Type 2 scheduling activation PDCCH validation when a UE is provided multiple DL SPS or UL grant Type 2 configurations

	DCI format 0_0/0_1/0_2	DCI format 1_0	DCI format 1_1
Redundancy version	set to all '0's	set to all '0's	For the enabled transport block: set to all '0's

Table 10.2-43: Special fields for multiple DL SPS and UL grant Type 2 scheduling release PDCCH validation

	DCI format 0_0/0_1/0_2	DCI format 1_0/1_1/1_2
Redundancy version (if any)	set to all '0's	set to all '0's
Modulation and coding scheme	set to all '1's	set to all '1's
Frequency domain resource assignment	set to all '1's	set to all '1's

A UE is expected to provide HARQ-ACK information in response to a SPS PDSCH release after N symbols from the last symbol of a PDCCH providing the SPS PDSCH release. For UE processing capability 1 [6, TS 38.214] and for the SCS of the PDCCH reception, $N=10$ for 15 kHz, $N=12$ for 30 kHz, $N=22$ for 60 kHz, and $N=25$ for 120 kHz. For a UE with capability 2 [6, TS 38.214] in FR1 and for the SCS of the PDCCH reception, $N=5$ for 15 kHz, $N=5.5$ for 30 kHz, and $N=11$ for 60 kHz.

*** Unchanged text is omitted ***