[102-e-NR-5G\_V2X\_NRSL-PHYstructure-03] Email discussion/approval w.r.t. “PSFCH sequence related”: 4A (as in the summary) by 08/20, with potential TPs by 8/25 – Jeongho (Samsung)

The current text for PSFCH in TS38.211 is as below.

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| 8.3.4.2 PSFCH format 08.3.4.2.1 Sequence generationThe sequence $x\left(n\right)$ shall be generated according to$$x\left(n\right)=r\_{u,v}^{α,δ}\left(n\right)$$$$n=0,1,…,N\_{sc}^{RB}-1$$where $r\_{u,v}^{\left(α,δ\right)}(n)$ is given by clause 6.3.2.2 with the following exceptions:- $m\_{cs}$ is given by clause 16.3 of [5, TS 38.213]; - $m\_{0}$ is given by clause 16.3 of [5, TS 38.213];- $l$ is the OFDM symbol number in the PSFCH transmission where $l=0$ corresponds to the first OFDM symbol of the PSFCH transmission;- $l'$ is the index of the OFDM symbol in the slot that corresponds to the first OFDM symbol of the PSFCH transmission in the slot given by [5, TS 38.213] |

In RAN1#102-e, the five contributions [CATT], [Huawei, HiSilicon], [OPPO], [Sharp], [NTT DCM] raised the issues related to PSFCH sequence.

With the current specifications, it is necessary to define $u$, $v$, and $α$. In order to define those parameters, the followings are to be discussed in this thread.

* Group/sequence hopping
	+ A1. Depending on whether to be supported or not, how to define the hopping parameter $u$ and $v$
* For alpha,
	+ B1. How to define m\_init
	+ B2 How to define c\_init

# **A1. How to define u and v**

Two contributions propose to use u = n\_ID mod 30, where n\_ID is given by *hoppingID\_PSFCH* and v=0.

(This is the same as replacing *hoppingId* with *hoppingID\_PSFCH* and pucch\_GroupHopping=’neither’.)

Please provide your views and reason.

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# **B1. How to define m\_init**

$m\_{init}$ is introduced for interlaced PUCCH format. Therefore, $m\_{init}=0$ can be used for PSFCH.

Please provide your views and reason.

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# **B2. How to define c\_init**

The remaining issue is how to define the pseudo-random sequence  used for .

Three contributions propose to the following alternative to define $c(i)$.

* Alt 1. C\_init = *hoppingID\_PSFCH*
* Alt 2. Depending on the source ID
* Alt 3. Depending on the CRC of the PSSCH

Please provide your views and reason.

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Reference

1. R1-2005292 Remaining details on physical layer structure for the sidelink FUTUREWEI
2. R1-2005307 Remaining issues of NR sidelink physical layer structure ZTE, Sanechips
3. R1-2005338 Remaining issues on physical layer structure for NR sidelink vivo
4. R1-2005646 Discussion on sidelink physical layer structure MediaTek Inc.
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7. R1-2005761 TP on 1st symbol duplication for AGC NEC
8. R1-2005786 Remaining issues of V2X PHY layer structure Mitsubishi Electric RCE
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12. R1-2006074 Remaining issues on PHY structure for NR V2X InterDigital, Inc.
13. R1-2006099 On Physical Layer Structures for NR Sidelink Samsung
14. R1-2006254 Remaining issues for sidelink physical layer structure Spreadtrum Communications
15. R1-2006433 TPs related to PHY structures Ericsson
16. R1-2006484 On Remaining Issues of Sidelink Physical Layer Structure Apple
17. R1-2006535 Remaining issue on physical layer structure for sidelink in NR V2X Panasonic Corporation
18. R1-2006557 Remaining issues on physical layer structure for NR sidelink Sharp
19. R1-2006584 Remaining issues on sidelink physical layer structure on NR V2X ASUSTeK
20. R1-2006693 Maintenance for sidelink physical layer structure NTT DOCOMO, INC.
21. R1-2006768 Sidelink Physical Layer Structure Qualcomm Incorporated

Appendix. Sequence and CS hopping for PUCCH in TS38.211

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| 6.3.2.2 Sequence and cyclic shift hoppingPUCCH formats 0, 1, 3, and 4 use sequences $r\_{u,v}^{\left(α,δ\right)}(n)$ given by clause 5.2.2 with $δ=0$ where the sequence group $u$ and the sequence number $v$ depend on the sequence hopping in clause 6.3.2.2.1 and the cyclic shift $α$ depends on the cyclic shift hopping in clause 6.3.2.2.2.6.3.2.2.1 Group and sequence hoppingThe sequence group $u=\left(f\_{gh}+f\_{ss}\right) mod 30$ and the sequence number $v$ within the group depends on the higher-layer parameter *pucch-GroupHopping*:- if *pucch-GroupHopping* equals 'neither' where  is given by the higher-layer parameter *hoppingId* if configured, otherwise $n\_{ID}=N\_{ID}^{cell}$.- if *pucch-GroupHopping* equals 'enable'  where the pseudo-random sequence  is defined by clause 5.2.1 and shall be initialized at the beginning of each radio frame with  where  is given by the higher-layer parameter *hoppingId* if configured, otherwise $n\_{ID}=N\_{ID}^{cell}$.- if *pucch-GroupHopping* equals 'disable' where the pseudo-random sequence  is defined by clause 5.2.1 and shall be initialized at the beginning of each radio frame with $c\_{init}=2^{5}\left⌊{n\_{ID}}/{30}\right⌋+\left(n\_{ID} mod 30\right)$ where  is given by the higher-layer parameter *hoppingId* if configured, otherwise $n\_{ID}=N\_{ID}^{cell}$.The frequency hopping index $n\_{hop}=0$ if intra-slot frequency hopping is disabled by the higher-layer parameter *intraSlotFrequencyHopping*. If frequency hopping is enabled by the higher-layer parameter *intraSlotFrequencyHopping*,  for the first hop and  for the second hop.6.3.2.2.2 Cyclic shift hoppingThe cyclic shift $α$ varies as a function of the symbol and slot number according to$$α\_{l}=\frac{2π}{N\_{sc}^{RB}}\left(\left(m\_{0}+m\_{cs}+m\_{int}+n\_{cs}\left(n\_{s,f}^{μ},l+l'\right)\right) mod N\_{sc}^{RB}\right)$$where- $n\_{s,f}^{μ}$ is the slot number in the radio frame- $l$ is the OFDM symbol number in the PUCCH transmission where $l=0$ corresponds to the first OFDM symbol of the PUCCH transmission,- $l'$ is the index of the OFDM symbol in the slot that corresponds to the first OFDM symbol of the PUCCH transmission in the slot given by [5, TS 38.213]-  is given by [5, TS 38.213] for PUCCH format 0 and 1 while for PUCCH format 3 and 4 is defined in clause 6.4.1.3.3.1-  except for PUCCH format 0 when it depends on the information to be transmitted according to clause 9.2 of [5, TS 38.213]. - $m\_{int}$ is given by- $m\_{int}=5n\_{IRB}^{μ}$ for PUCCH formats 0 and 1 if PUCCH shall use interlaced mapping according to any of the higher-layer parameter *useInterlacePUCCH-Common-r16* or *useInterlacePUCCH-Dedicated-r16*, where $n\_{IRB}^{μ}$ is the resource block number within the interlace;- $m\_{int}=0$ otherwiseThe function  is given by $n\_{cs}\left(n\_{s,f}^{μ},l\right)=\sum\_{m=0}^{7}2^{m}c\left(8N\_{symb}^{slot}n\_{s,f}^{μ}+8l+m\right)$where the pseudo-random sequence  is defined by clause 5.2.1. The pseudo-random sequence generator shall be initialized with , where  is given by the higher-layer parameter *hoppingId* if configured, otherwise $n\_{ID}=N\_{ID}^{cell}$. |