[103-e-NR-Rel-16-V2X-01] Email discussion/approval for remaining issues for PT-RS design

* Issue PS-1-1: For PT-RS sequence generation, when r(m) is defined, which DM-RS symbol is used for reference is not clear.
* Issue PS-1-2: Removal of duplication for PT-RS mapping

till 10/29, with a potential CR by 11/4 – Jeongho (Samsung)

# **Issue PS-1-1. For PT-RS sequence generation, when r(m) is defined, which DM-RS symbol is used for reference is not clear**

Four contributions [Huawei, HiSilicon], [LG], [Sharp], [Apple] discuss on this topic, which is related to the yellow-highlighted part below in TS38.211.

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| 8.4.1.2 Phase-tracking reference signals for PSSCH8.4.1.2.1 Sequence generation The precoded sidelink phase-tracking reference signal for subcarrier $k$ on layer $j$ is given by$$r^{(\tilde{p}\_{j})}\left(m\right)=\left\{\begin{matrix}r\left(m\right)&if j=j^{'} or j=j"\\0&otherwise\end{matrix}\right.$$where- antenna ports $\tilde{p}\_{j^{'}}$ or $\left\{\tilde{p}\_{j^{'}},\tilde{p}\_{j^{''}}\right\}$ associated with PT-RS transmission are given by clause 8.2.3 of [6, TS 38.214];- $r\left(m\right)$ is given by clause 8.4.1.1.1 at the position of a DM-RS symbol. |

The proposed ways are that, r(m) is given at

* Alt 1. the position of the DM-RS symbol **transmitted in the first symbol of the 2nd-stage SCI** [Huawei, HiSilicon]
* Alt 2. the **last** position on a DM-RS symbol [LG]
* Alt 3. The position of the **first actual** transmitted DM-RS symbol [Sharp], [Apple]
* Alt 4. Other(s)

Please provide your views and reason.

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| **Company** | **Views** |
| LGE | It seems necessary to have clarification on alt 1 and alt 3. In Alt 1, considering following conclusion made in RAN1#102-e meeting, the first symbol of the 2nd SCI-stage SCI may not have DMRS REs.***Conclusion:****The 2nd SCI can be mapped from the first transmitted PSSCH DMRS symbol.** *No spec change is needed.*

For instance, if the first DMRS symbol is punctured in every RBs, in this case, the actual mapping of the 2nd SCI mapping will start right after the end of the PSCCH. Depending on the DMRS pattern, the next symbol of the PSCCH will not have DMRS. If the intention of alt 1 is to “**(Alt 4:** **use the first DMRS symbol after the end of the PSCCH**”, we are fine with this approach as well. In Alt 3, depending on the configuration, PSSCH DMRS and PSCCH can be FDMed. In this case, for the PT-RS mapped on sub-carrier where PSCCH is mapped, is it correct understanding that the DMRS REs used for PT-RS generation would not actually transmitted due to puncturing with PSCCH? Or, does it mean that depending on the sub-carrier where PT-RS is mapped, the first actual transmitted DMRS symbol could be different? At this moment, we are supportive of Alt 2 and Alt 4 (as described in the above).  |
| Huawei, HiSilicon | We proposed Alt 1 to avoid needing a number of other matching text changes that would result if we took Alt 3’s use of “first actual”, since that phrasing’s not present elsewhere.To answer LG: the key word is “transmitted” in Alt 1, which addresses your points. Since you focused on only the red text, I added some more red colouring to emphasize. |
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# **Issue PS-1-2: Removal of duplication for PT-RS mapping**

One contribution discusses on PT-RS mapping with the following TP.

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| 8.4.1.2.2 Mapping to physical resourcesThe UE shall transmit phase-tracking reference signals only in the resource blocks used for the PSSCH, and only if the procedure in [6, TS 38.214] indicates that phase-tracking reference signals are being used.The PSSCH PT-RS shall be mapped to resource elements according to $\left[\begin{matrix}a\_{k,l}^{\left(p\_{o},μ\right)}\\\vdots \\a\_{k,l}^{\left(p\_{ρ-1},μ\right)}\end{matrix}\right]=β\_{DMRS}^{PSSCH}W\left[\begin{matrix}r^{(\tilde{p}\_{0})}(2n+k')\\\vdots \\r^{(\tilde{p}\_{υ-1})}(2n+k')\end{matrix}\right]$$$k=4n+2k^{'}+Δ$$when all the following conditions are fulfilled- $l$ is within the OFDM symbols allocated for the PSSCH transmission;- resource element $\left(k,l\right)$ is not used for sidelink ~~CSI-RS,~~ PSCCH, nor DM-RS associated with PSSCH;- $k'$ and $Δ$ correspond to $\tilde{p}\_{0}, …, \tilde{p}\_{υ-1}$The precoding matrix $W$ is given by clause 8.3.1.4*.*=====omitted=====~~PSSCH PT-RS shall not be mapped to resource elements containing PSCCH or PSCCH DMRS by puncturing PSSCH PT-RS.~~A UE is not expected to receive sidelink CSI-RS and PSSCH PT-RS on the same resource elements.=====omitted===== |

The contribution refers the following agreements in RAN1#101-e.

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| Agreements:-  SL-PT-RS is not mapped to the resources for PSCCH by puncturing SL-PT-RS (i.e., sequence & resource mapping).Agreements:* A TX UE is not expected to transmit a SL CSI-RS in a same symbol with the 2nd SCI or PSSCH DMRS
	+ Note: this implies that it’s an error case if there is such a collision

Working assumption:* The 2nd SCI is rate-matched around SL-PT-RS

Working assumption:* The frequency-domain OCC length for PSCCH is {~~2,~~ 3~~, 4~~}
	+ The same LTE requirement and procedure for UE blind decoding (w.r.t. to OCC vs. LTE’s cyclic shifts) for PSCCH applies

Agreements: A TX UE is not expected to transmit a SL CSI-RS and a SL PT-RS which overlap* Note: this implies that it’s an error case if there is such a collision (no puncturing, and the collision is avoided by the Tx UE)

This imples a Rx UE is not expected to receive a SL CSI-RS and a SL PT-RS which overlap |

Please share your views including whether this change is needed or not.

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| **Company** | **Views** |
| LGE | We are fine to remove the duplicated part.  |
| Huawei, HiSilicon | The first removal is fine, but not the second.The text under the second removal is to specify how “not used” is to be interpreted, and if it is removed we will need to CR it back in next meeting!*- resource element* $\left(k,l\right)$*is not used for sidelink ~~CSI-RS,~~ PSCCH, nor DM-RS associated with PSSCH;* |
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Reference

1. R1-2007610 Correction on sidelink PT-RS sequence generation Huawei, HiSilicon
2. R1-2007772 Discussion on essential corrections in physical layer structure LG Electronics
3. R1-2007809 Remaining issues on physical layer structure for NR sidelink CATT
4. R1-2007921 Remaining issues of NR sidelink physical layer structure ZTE, Sanechips
5. R1-2007934 Remaining opens of sidelink physical structure for NR V2X design Intel Corporation
6. R1-2008129 Text Proposals on Physical Layer Structures for NR Sidelink Samsung
7. R1-2008230 Draft TP on physical structure for NR sidelink OPPO
8. R1-2008381 Remaining issue on physical layer structure and procedure for sidelink in NR V2X Panasonic Corporation
9. R1-2008387 Remaining issues on physical layer structure for NR sidelink Sharp
10. R1-2008429 Remaining Issue of Sidelink Physical Layer Structure Apple
11. R1-2008496 Maintenance for PSFCH and PSCCH symbol on NR sidelink ASUSTeK
12. R1-2008529 Maintenance for sidelink physical layer structure NTT DOCOMO, INC.
13. R1-2008604 Remaining Issues in Physical Layer Structure Qualcomm Incorporated
14. R1-2008665 Remaining issues on physical layer structure for NR sidelink vivo
15. R1-2008750 Discussion paper on the remaining issues in Rel. 16 for NR V2X Ericsson