# **[102-e-NR- 5G\_V2X\_NRSL-PHYprocedure-02] Email discussion/approval regarding the assumptions for the CSI reference resource for sidelink CSI**

[102-e-NR- 5G\_V2X\_NRSL-PHYprocedure-02] Email discussion/approval regarding the assumptions for the CSI reference resource for sidelink CSI by 8/21, followed by potential TPs by 8/26 – Hanbyul (LGE)

Q1: Do you agree following assumption?

* + For the sidelink CSI reference resource, UE assumes
    - First SL symbol is occupied by duplicated symbol of 2nd SL symbol within a SL slot
    - Numerology (CP length and SCS) of configured SL BWP is used

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| Company | Answer | Comment |
| NTT DOCOMO |  | For the first sub-bullet, the situation is always true, so the ‘assumption’ would not be necessary.  Second sub-bullet is OK. |
| Sharp | Agree |  |
| Ericsson | Agree |  |
| Huawei, HiSilicon | Agree | The first SL symbol is “*sl-LengthSymbols* – 2”.  Note, that we understand the meaning of “assumption” here to be what is used for the purpose of determining a CSI reference resource. |
| ZTE, Sanechips | Agree |  |
| Intel | Agree |  |
| Futurewei | Agree |  |
| Samsung |  | For the first sub-bullet, we share view with NTT DOCOMO  We agree with the second sub-bullet |
| OPPO | Agree |  |
| Qualcomm | Agree |  |
| Apple | Agree |  |
| vivo | Agree |  |
| LG Electronics | Yes |  |
| Nokia, NSB | Agree |  |
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Q2: What is the assumption on RV for the sidelink CSI reference resource?

* + Option 1: RV0
  + Option 2: RV indicated by SCI triggering the CSI report
  + Option 3: Others (please specify)

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| Company | Preferred option | Comment |
| NTT DOCOMO | Option 1 | Reuse NR-Uu.  For CSI report, self-decodable RV is feasible. RV0 should be OK. |
| Sharp | Option 1 | Reuse NR Uu. |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |
| ZTE, Sanechips | Option 1 | Reuse logic on NR Uu. |
| Intel | Option 1 | Following Uu assumption on the most self-decodable RV |
| Futurewei | Option 1 |  |
| Samsung | Option 2 | Unlike NR Uu link, sidelink CSI-RS is confined within the PSSCH transmission always and only aperiodic CSI reporting is supported. Therefore, UE can simply use the resource configuration and transmission parameters applied in the sidelink CSI reference resource. |
| OPPO | Option 1 |  |
| Qualcomm | Option 1 |  |
| Apple | Option 1 |  |
| vivo | Option 1 |  |
| LG Electronics | Option 1 | As in NR Uu link, it would be beneficial in terms of UE complexity to have a single reference configuration for CSI measurement. In this case, the UE may need to have CSI conversion rule from RV0 to RV j, where j=1, 2, 3. If Option 2 is supported, the UE may need to have more CSI conversion rules (e.g. RV i to RV j, where i=0, 1, 2, 3, j=0, 1, 2, 3, and i is not equal to j). |
| Nokia, NSB | Option 1 |  |
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Q3: What is the assumption on PSCCH overhead for the sidelink CSI reference resource?

* + Option 1: PSCCH occupies 2 OFDM symbols
  + Option 2: PSCCH occupies timeResourcePSCCH OFDM symbols and frequencyResourcePSCCH PRBs in the resource pool
  + Option 3: Others (please specify)

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| Company | Preferred option | Comment |
| NTT DOCOMO | Option 1 | Reuse Uu.  UE receiving the CSI report would correct the information for actual transmission. As discussed before/after this question, there are some/many assumptions. Regardless of outcome of this question, the UE needs to do that. So it seems that option 2 has no benefit. |
| Sharp | Option 1 | Reuse NR Uu. |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 2 | It would seem there is no need for a fixed assumption here since the exact values are already known to both the reporting and triggering UEs. TX UE can still perform whatever adjustments it needs, and they will be from a more accurate base. |
| ZTE, Sanechips | Option 2 | We can also accept Option 1. |
| Intel | Option 2 | When semi-static configuration is available, it is better to follow that with no harm to the system or UE implementation |
| Futurewei | Option 2 | There is no unknown, so no point in making assumption |
| Samsung | Option 2 | In sidelink, UE can simply use the resource configuration and transmission parameters applied in the sidelink CSI reference resource. |
| OPPO | Option 1 | It is possible that TX UE can change the transmission resource pool. A default assumption of PSCCH resource can be used for CSI reporting. How to modify it based on actual PSCCH resource is up to TX UE |
| Qualcomm | Option 1 | Following NR Uu, having a fixed assumption implies lower UE implementation complexity |
| Apple | Option 2 | Both “timeResourcePSCCH” and “frequencyResourcePSCCH” are resource pool configuration, which is semi-static and easy to capture. |
| vivo | Option 1 | CSI measurement in one pool can be reported at another pool, to avoid misunderstanding, all the assumptions are not pool specific. |
| LG Electronics | Option 2 | Unlike NR Uu link, the number of REs for PSCCH is determined in a semi-static manner. There is no need to have unnecessary CSI conversion rule for this.  For Option 1, if the PSCCH symbol duration is 3, then the UE may need have CSI conversion rule. |
| Nokia, NSB | Option 1 | A fixed assumption would be an easier implementation for CSI reference source. |
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Q4: What is the assumption on the number of PSSCH and DM-RS symbols for the sidelink CSI reference resource?

* + Option 1: 10
  + Option 2: sl-LengthSymbols ‒ 2
  + Option 3: the number of PSSCH and DM-RS symbols in a slot where SCI triggering the CSI report is transmitted
  + Option 4: sl-LengthSymbols ‒ 5 if periodPSFCHresource = 1. Otherwise, sl-LengthSymbols ‒ 2.
  + Option 5: Others (please specify)

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| Company | Preferred option | Comment |
| NTT DOCOMO | Option 1 | Reuse NR-Uu, where assumption of the number of PDSCH and DM-RS is fixed as 12.  Similar to our comment on Q3. |
| Sharp | Option 1 | Reuse NR Uu, where the assumption is (14-2-2)=10 |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 3 | We do not yet understand why a Uu slot format baseline is of high relevance sidelink.  The number of PSSCH and DM-RS symbols depends on whether the CSI reference resource includes PSFCH. If there is PSFCH, then the number should be *sl-LengthSymbols* ‒ 5, where 2 AGC symbols, 2 GAP symbols and 1 PSFCH symbol are considered. Otherwise, it should be *sl-LengthSymbols* ‒ 2. |
| ZTE, Sanechips | option 2 | We can also accept Option 1. |
| Intel | Option 2 | When semi-static configuration is available, it is better to follow that with no harm to the system or UE implementation |
| Futurewei | Option 2 |  |
| Samsung | Option 3 | In sidelink, UE can simply use the resource configuration and transmission parameters applied in the sidelink CSI reference resource. |
| OPPO | Option 2 |  |
| Qualcomm | Option 1 | Reuse NR Uu, having a fixed assumption implies lower UE implementation complexity |
| Apple | Option 5 | As long as PSFCH resources are configured (i.e., “sl-PSFCH-Period-r16” = 1,2,4 slots), we could assume PSSCH symbol number is equal to “sl-LengthSymbols ‒ 5”. Hence, we prefer  “sl-LengthSymbols ‒ 2” if “sl-PSFCH-Period-r16” = 0; Otherwise, “sl-LengthSymbols ‒ 5”  This approach is based on resource pool configuration and achieves the balance between implementation complexity and performance. |
| Vivo | Option 1 | Reuse NR Uu principle |
| LG Electronics | Option 4, or  Option 2 | As in NR Uu link, it would be beneficial in terms of UE complexity to have a single reference configuration for CSI measurement. In this case, the UE may need to have CSI conversion rule from PSSCH transmission in non-PSFCH-slot to PSSCH transmission in PSFCH-slot. |
| Nokia, NSB | Option 1 or Option 2 | A simple design on the CSI reference resource should be sufficient. |
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Q5: What is the assumption on sidelink CSI-RS overhead for the sidelink CSI reference resource?

* + Option 1: No CSI-RS mapping REs
  + Option 2: the number of CSI-RS REs in a PSSCH resource scheduled by SCI triggering the CSI report
  + Option 3: Others (please specify)

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| Company | Preferred option | Comment |
| NTT DOCOMO | Option 1 | Reuse NR-Uu. |
| Sharp | Option 1 | Reuse NR Uu |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 |  |
| ZTE, Sanechips | Option 1 | Reuse logic on NR Uu. |
| Intel | Option 1 | For something dynamic, our assumption that the least possible OH should be taken |
| Futurewei | Option 1 |  |
| Samsung | Option 2 | In sidelink, UE can simply use the resource configuration and transmission parameters applied in the sidelink CSI reference resource. |
| OPPO | Option 1 |  |
| Qualcomm | Option 1 | Reuse NR Uu |
| Apple | Option 1 |  |
| vivo | Option 1 | Reuse NR-Uu. |
| LG Electronics | Option 1 | As in NR Uu link, NZP CSI-RS does not need to be considered for CSI reference resource. |
| Nokia, NSB | Option 1 |  |
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Q6: What is the assumption on 2nd SCI overhead for the sidelink CSI reference resource?

* + Option 1: No 2nd SCI mapping REs
  + Option 2: Lowest overhead per (pre)configuration
  + Option 3: : the number of REs for 2nd SCI triggering the CSI report
  + Option 4: Others (please specify)

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| Company | Preferred option | Comment |
| NTT DOCOMO | Option 1 | Reuse NR-Uu.  Similar to our comment on Q3. |
| Sharp | Option 1 | Reuse NR Uu |
| Ericsson | Option 1 |  |
| Huawei, HiSilicon | Option 1 | Since 2nd SCI is also transmitted in PSSCH, there is no need to consider its overhead.  What does “re use NR Uu” mean, when there is no concept of 2nd SCI? |
| ZTE, Sanechips | Option 1 |  |
| Intel | Option 1 | For something dynamic, our assumption that the least possible OH should be taken. Although 2nd stage SCI is always present, it requires additional effort to account for least possible configuration, thus no OH is preferred in this case |
| Futurewei | Option 1 |  |
| Samsung | Option 3 | In sidelink, UE can simply use the resource configuration and transmission parameters applied in the sidelink CSI reference resource. |
| OPPO | Option 1 |  |
| Qualcomm | Option 1 | Reuse NR-Uu |
| Apple | Option 1 |  |
| vivo | Option 1 | Reuse NR-Uu |
| LG Electronics | Option 1 | It would be beneficial in terms of UE complexity to have a single reference configuration for CSI measurement. For simplicity, no 2nd SCI overhead could be considered. |
| Nokia, NSB | Option 1 |  |
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Q7: What is the assumption on 2nd SCI overhead for the PSSCH DMRS ~~the sidelink CSI reference resource~~?

* + Option 1: Smallest number of PSSCH DMRS symbols per (pre)confiugraiton
  + Option 2: the number of PSSCH DMRS symbols indicated by SCI associated with the triggered CSI report
  + Option 3: Others (please specify)

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| Company | Preferred option | Comment |
| NTT DOCOMO | Option 1 | First of all, the question would be about DM-RS, not 2nd-stage SCI overhead.  Regarding preferred option, reuse NR-Uu, where assumption of the number of DM-RS is based on the configurations. |
| Sharp | Option 3 | If the question refers to PSSCH DMRS overhead, then we propose to reuse NR Uu without containing DMRS, i.e. no overhead is assumed. |
| Ericsson | Option 1 |  |
| Huawei, Hisilicon | Option 2 | Using the indicated PSSCH DMRS time-domain pattern helps to provide accurate CSI result. The TX UE can easily adjust the MCS according to the DMRS pattern of the following transmissions. |
| ZTE, Sanechips | Option 1 |  |
| Intel | Option 1 | For something dynamic, our assumption that the least possible OH should be taken. |
| Futurewei | Option 1 |  |
| Samsung | Option 2 | In sidelink, UE can simply use the resource configuration and transmission parameters applied in the sidelink CSI reference resource. |
| OPPO | Option 1 |  |
| Qualcomm | Option 3 | Agree with Sharp this also needs to follow NR Uu definition, i.e., no overhead for DMRS |
| Apple | Option 1 |  |
| vivo | Option 3 | CSI measurement in one pool can be reported at another pool, to avoid misunderstanding, all the assumptions are not pool specific.  Agree with Sharp and QC, i.e., no overhead for DMRS |
| LG Electronics | Option 1 | It would be beneficial in terms of UE complexity to have a single reference configuration for CSI measurement.  For the reference, in NR Uu link, PDSCH DMRS pattern is determined in a semi-static manner, so the higher layer parameters for DMRS configuration is directly reused to define CSI reference resource as follows:  - Assume the same number of front loaded DM-RS symbols as the maximum front-loaded symbols configured by the higher layer parameter *maxLength* in *DMRS-DownlinkConfig.*  - Assume the same number of additional DM-RS symbols as the additional symbols configured by the higher layer parameter *dmrs-AdditionalPosition*.  Regarding whether data part and DMRS part can be FDMed or not, unlike NR Uu link, when the number of layer is 1, PSSCH data part and PSSCH DMRS will be always FDMed, so following assumption is not needed:  - Assume the PDSCH symbols are not containing DM-RS. |
| Nokia, NSB | Option 2 | Option 2 provides more dynamic PSSCH DMRS configuration than Option 1. This could provide better CSI measurements for various SL link quality. |
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Q8: Do you think there are other aspects RAN1 needs to consider in defining assumptions for the sidelink CSI reference resource?

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| Company | Answer | Comment |
| Sharp |  | Assume the SL CSI reference resource does not contain SL PT-RS. |
| Huawei, HiSilicon | Yes | The assumption on precoding matrix needs specifying, as in the Uu reference resource definition. |
| Intel |  | Agree with Huawei/HiSilicon regarding the precoder |
| Futurewei | Yes | Agree that precoding needs to be specified |
| Samsung | Yes | Agree that precoding needs to be specified |
| Qualcomm | Yes | Assumption for the PSSCH power to NZP CSI-RS power needs to be specified as well. |
| LG Electronics | Not necessary | NR sidelink already supports only identity matrix for precoding matrix. In addition, wideband precoding for PSSCH is only option for NR sidelink. For clarification, we are fine to have it as in Q1. |
| Nokia, NSB | Yes | Precoding, even we only have up to 2Tx. |
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**Proposal set #1**

Proposal 1

* UE assumes the following for the sidelink CSI reference resource:
  + A1) First SL symbol is occupied by duplicated symbol of 2nd SL symbol within a SL slot. Numerology (CP length and SCS) of configured SL BWP is used
  + A2) RV0 is used.
  + A3) PSCCH occupies
    - Option 1: 2 OFDM symbols
    - Option 2: timeResourcePSCCH OFDM symbols and frequencyResourcePSCCH PRBs in the resource pool
  + A4) the number of PSSCH and DM-RS symbols is
    - Option 1: 10
    - Option 2: sl-LengthSymbols ‒ 2
  + A5) No CSI-RS mapping REs
  + A6) No 2nd SCI mapping REs
  + A7) Smallest number of PSSCH DMRS symbols per (pre)confiugraiton
  + A8) No sidelink PT-RS
  + A9) Precoding is applied by 8.3.1.4 of TS 38.211.
  + A10) NZP CSI-RS RE power is the same as PSSCH RE power.

FL’s note:

* The FL took the majority view in most cases but the views on Q3 and Q4 are quite evenly divided around the two options. It is suggested to try to converge using emails with focus on the two options.

**Proposal set #2**

Proposal 1

* UE assumes the following for the sidelink CSI reference resource:
  + A1) Numerology (CP length and SCS) of configured SL BWP is used
  + A2) RV0 is used.
  + A3) PSCCH occupies
    - Option 1: 2 OFDM symbols
    - Option 2: timeResourcePSCCH OFDM symbols and frequencyResourcePSCCH PRBs in the resource pool
  + A4) the number of PSSCH and DM-RS symbols is
    - Option 1: 10
    - Option 2: sl-LengthSymbols ‒ 2
  + A5) No CSI-RS mapping REs
  + A6) No 2nd SCI mapping REs
  + A7) Smallest number of PSSCH DMRS symbols per (pre)confiugraiton
  + A8) No sidelink PT-RS
  + A9) Precoding is applied by 8.3.1.4 of TS 38.211.
  + A10) NZP CSI-RS RE power is the same as PSSCH RE power.