**3GPP TSG RAN WG1 #117 R1-240xxxx**

**Fukuoka, Japan, May 20th – 24th, 2024**

**Agenda item:** 7

**Source:** Moderator (Samsung)

**Title:** Summary on PTRS-DMRS association field for Rel-17 UL multi-TRP PUSCH repetition

**Document for:** Discussion and Decision

# Introduction

This contribution summarizes companies’ view about draft CR on PTRS-DMRS association field for Rel-17 UL multi-TRP PUSCH repetition.

## Relevant contributions

R1-2404078 Discussion on PTRS-DMRS association field for Rel-17 UL multi-TRP PUSCH repetition Samsung

R1-2404079 Draft CR on PTRS-DMRS association field for Rel-17 UL multi-TRP PUSCH repetition (Rel-17 spec) Samsung

R1-2404080 Draft CR on PTRS-DMRS association field for Rel-17 UL multi-TRP PUSCH repetition (Rel-18 spec) Samsung

# Discussion

## TP in R1-2404079

In R1-2404079, the following TP is proposed with the following reason.

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| ***Reason for change:*** | There are descriptions for PTRS-DMRS association for a case which maxRank or maxRankDCI-0-2 = 2 for DCI format 0\_1 or 0\_2, in Clause 7.3.1.1.2 and 7.3.1.1.3 in TS38.212, when multi-TRP PUSCH repetition is scheduled. The condition of an SRS resource set indicator is described as “10” and “11”, but either only “10” or “11” can be indicated, hence “10” or “11” is correct expression which also has been used in other specification (e.g., TS38.214). |
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| ***Summary of change:*** | Change “10” and “11” into “10” or “11” to clarify either of two codepoints is indicated by SRS resource set indicator. |
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| ***Consequences if not approved:*** | There is no case when SRS resource set indicator equals both “10” and “11”. |

**TP in Clause 7.3.1.1.2 and 7.3.1.1.3 in TS38.212-h80 as alignment CR**

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| 7.3.1.1.2 Format 0\_1  <omit unrelated parts>  - PTRS-DMRS association – number of bits determined as follows  - 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRank=1*;  - 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field. When the SRS resource set indicator field is present and *maxRank>2*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26. When the SRS resource set indicator field is present and equals "10" ~~and~~or "11" and *maxRank=2*, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.  <omit unrelated parts>  7.3.1.1.3 Format 0\_2  <omit unrelated parts>  - PTRS-DMRS association – number of bits determined as follows  - 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRankDCI-0-2=1*;  - 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field. When the SRS resource set indicator field is present and *maxRankDCI-0-2>2*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26 field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26. When the SRS resource set indicator field is present and equals "10" ~~and~~or "11" and *maxRankDCI-0-2=2*, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A. |

Please provide your view whether you agree on above TP or not.

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## TP in R1-2404080

In TS38.212-i20 [3], the relevant part in the above TP which is in TS38.212-h80 [1] has been updated as cyan highlighted part as below, for both DCI format 0\_1 and 0\_2, by using the condition of an RRC parameter *multipanelScheme* adopted in Rel-18.

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| 7.3.1.1.2 Format 0\_1  <omit unrelated parts>  - PTRS-DMRS association - number of bits determined as follows  - 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRank=1* and *multipanelScheme* is not configured, or if *maxRank=1* and *maxRankSfn=1*, or if *maxRank=1* and *maxRankSdm=1* when two PTRS ports are configured by *maxNrofPortsforSdm*;  - 2 or 4 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A/7.3.1.1.2-25B/7.3.1.1.2-26/7.3.1.1.2-26A are used to indicate the association between PTRS port(s) and DMRS port(s), and the DMRS ports are indicated by the Antenna ports field.  - 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, SRS resource set indicator field is absent or SRS resource set indicator field is present and equals "00" or “01” and *maxRank*<=4, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.  - 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" or “11”, *maxRank=3 or 4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.  - 2 bits when one PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" and "11", *maxRank=2* and *multipanelScheme* is not configured, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.  <omit unrelated parts>  7.3.1.1.3 Format 0\_2  <omit unrelated parts>  - PTRS-DMRS association - number of bits determined as follows  - 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRankDCI-0-2=1* and *multipanelScheme* is not configured, or if *maxRankDCI-0-2=1* and *maxRankSfnDCI-0-2=1*, or if *maxRankDCI-0-2=1* and *maxRankSdmDCI-0-2=1* when two PTRS ports are configured by *maxNrofPortsforSdm*;  - 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A/7.3.1.1.2-25B/7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s), and the DMRS ports are indicated by the Antenna ports field.  - When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, SRS resource set indicator field is absent or SRS resource set indicator field is present and equals "00" or “01” and maxRank*DCI-0-2*<=4, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.  - When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" or “11”, *maxRankDCI-0-2=3 or 4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.  - When one PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" and "11" and *maxRankDCI-0-2=2* and *multipanelScheme* is not configured, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A. |

However, as we can observe in the cyan highlighted part above, **it is limited with the case of one PTRS port**, which is not an intention of the legacy specification, but includes both cases of one or two PTRS ports. Considering this error and the TP above in Section 2.1 as well, in R1-2404080, the following TP is proposed with the following reason.

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| ***Reason for change:*** | There are descriptions for PTRS-DMRS association for a case which maxRank or maxRankDCI-0-2 = 2 for DCI format 0\_1 or 0\_2, in Clause 7.3.1.1.2 and 7.3.1.1.3 in TS38.212, when multi-TRP PUSCH repetition is scheduled. There are two errors in these paragraphs:  1) The condition of an SRS resource set indicator is described as “10” and “11”, but either only “10” or “11” can be indicated, hence “10” or “11” is correct expression which also has been used in other specification (e.g., TS38.214).  2) The case when one PTRS port is configured is only considered, i.e., not considered with case of two PTRS ports. |
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| ***Summary of change:*** | 1) Change “10” and “11” into “10” or “11” to clarify either of two codepoints is indicated by SRS resource set indicator.  2) Add the case with two PTRS ports. |
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| ***Consequences if not approved:*** | 1) There is no case when SRS resource set indicator equals both “10” and “11”.  2) There is no UE behavior with two PTRS ports for PTRS-DMRS association when multi-TRP PUSCH repetition is scheduled and maxRank or maxRankDCI-0-2 = 2. |

**TP in Clause 7.3.1.1.2 and 7.3.1.1.3 in TS38.212-i20**

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| 7.3.1.1.2 Format 0\_1  <omit unrelated parts>  - PTRS-DMRS association - number of bits determined as follows  - 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRank=1* and *multipanelScheme* is not configured, or if *maxRank=1* and *maxRankSfn=1*, or if *maxRank=1* and *maxRankSdm=1* when two PTRS ports are configured by *maxNrofPortsforSdm*;  - 2 or 4 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A/7.3.1.1.2-25B/7.3.1.1.2-26/7.3.1.1.2-26A are used to indicate the association between PTRS port(s) and DMRS port(s), and the DMRS ports are indicated by the Antenna ports field.  - 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, SRS resource set indicator field is absent or SRS resource set indicator field is present and equals "00" or “01” and *maxRank*<=4, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.  - 2 bits when one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" or “11”, *maxRank=3 or 4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Tables 7.3.1.1.2-25 and 7.3.1.1.2-26.  - 2 bits when one or two PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" ~~and~~or "11", *maxRank=2* and *multipanelScheme* is not configured, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.  <omit unrelated parts>  7.3.1.1.3 Format 0\_2  <omit unrelated parts>  - PTRS-DMRS association - number of bits determined as follows  - 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRankDCI-0-2=1* and *multipanelScheme* is not configured, or if *maxRankDCI-0-2=1* and *maxRankSfnDCI-0-2=1*, or if *maxRankDCI-0-2=1* and *maxRankSdmDCI-0-2=1* when two PTRS ports are configured by *maxNrofPortsforSdm*;  - 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A/7.3.1.1.2-25B/7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s), and the DMRS ports are indicated by the Antenna ports field.  - When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, SRS resource set indicator field is absent or SRS resource set indicator field is present and equals "00" or “01” and maxRank*DCI-0-2*<=4, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.  - When one PTRS port or two PTRS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" or “11”, *maxRankDCI-0-2=3 or 4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26.  - When one or two PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is present and equals "10" ~~and~~or "11" and *maxRankDCI-0-2=2* and *multipanelScheme* is not configured, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A. |

Please provide your view whether you agree on above TP or not. If not agree, please feel free to comment why.

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# Conclusion

TBD

# References

1. 3GPP TS 38.212 V17.8.0 (h80): "NR; Multiplexing and channel coding (Release 17)"
2. 3GPP TS 38.212 V18.2.0 (i20): "NR; Multiplexing and channel coding (Release 18)"