**3GPP TSG RAN WG1 #101 R1-20xxxxx**

**e-Meeting, May 25th – June 5th, 2020**

**Source: Moderator (NTT DOCOMO, INC.)**

**Title:** **Summary on [101-e-NR-UEFeatures-Positioning-01]**

**Agenda Item:** **7.2.11.8**

**Document for:** **Discussion and Decision**

1. Introduction

This contribution summarizes the following email discussion/approval regarding UE features for Positioning.

[101-e-NR-UEFeatures-positioning-01] Email discussion/approval on feature group structure for NR positioning (25th – 29th May) – (DCM, Hiroki)

* Discuss and decide whether FG13-7/7a (Support of SSB from neighbor cell (DL PRS from serving/neighbor cell) as QCL source of a DL PRS) is kept or removed
* Discuss and decide whether FG13-11 (UE Rx-Tx Measurement Report for Multi-RTT) is kept or removed
* Discuss and decide whether FG13-12/12a (NR E-CID DL SSB (CSI-RS) RRM measurements with LPP support for NR Positioning) is kept or removed
* Discuss and decide whether a new FG 13-1a (Common DL PRS Processing Capability without MG) is introduced or not, and if not, what is the expected UE behavior if MG is not configured (according to outcome of the email discussion/approval in 7.2.8)
* Discuss and decide whether a new FG 13-10g (AP-SRS with carrier switching) is introduced or not (according to outcome of the email discussion/approval in 7.2.8)
* Discuss and decide whether FG13-9c, FG13-9d, FG13-10 and FG13-10a are combined into a new single basic FG
* Discuss and decide whether a new FG (Parallel LTE/NR PRS processing) is introduced or not, and if not, what is the expected UE behavior if both NR and LTE PRS are configured
1. Discussion on UE features for NR positioning

## 2.1 FG13-1

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | 13-1 | Common DL PRS Processing Capability | 1. Maximum DL PRS bandwidth in MHz, which is supported and reported by UE.

a) FR1 bands: {5, 10, 20, 40, 50, 80, 100}b) FR2 bands: {50, 100, 200, 400}1. DL PRS buffering capability: Type 1 or Type 2
2. Type 1 – sub-slot/symbol level buffering
3. Type 2 – slot level buffering
4. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.
5. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
6. N: {0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50} ms

Notes:* 1. UE reports one combination of (N, T) values per band, where N is a duration of DL PRS symbols in ms processed every T ms for a given maximum bandwidth (B) in MHz supported by UE
	2. UE is not expected to support DL PRS bandwidth that exceeds the reported DL PRS bandwidth value
	3. UE DL PRS processing capability is defined for a single positioning frequency layer. UE capability for simultaneous DL PRS processing across positioning frequency layers is not supported in Rel.16 (i.e. for a UE supporting multiple positioning frequency layers, a UE is expected to process one frequency layer at a time)
	4. UE DL PRS processing capability is agnostic to DL PRS comb factor configuration
	5. The reporting of (N, T) values for maximum BW in MHz is not dependent on SCS
1. Max number of DL PRS resources that UE can process in a slot under it
	1. FR1 bands: {1, 2, 4, [6], 8, 12, 16, [24], 32, [48], 64} for each SCS: 15kHz, 30kHz, 60kHz
	2. FR2 bands: {1, 2, 4, [6], 8, 12, 16, [24], 32, [48], 64} for each SCS: 60kHz, 120kHz

Note: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than X% (FFS: X).FFS case w/o measurement gap configured |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **Necessity of additional separate FG(s)**
	+ **Introduce a new FG for the case w/o measurement gap configured: [8], [11]**

Above remaining issues and proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

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| [8] | In RAN1#100bis-e meeting, we made the following agreement on DL PRS processing UE capability:

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| Agreement:UE capability for DL PRS processing is defined assuming the case with configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than X%* FFS: X
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Accordingly, in UE feature, FG 13-1 Common DL PRS processing capability is defined with a note that the parameters are reported with assuming a configured measurement gap. However, the UE would have different behavior for the cases when measurement gap is configured and not configured. For instance, when the measurement gap is not configured, the UE may need to process PDCCH/PDSCH too, while when the measurement gap is configured, the UE may not need to process signals other than DL PRS.Therefore, we need specify the case when measurement gap is not configured. For that we can consider two alternatives. One option is that we can add one new FG, FG13-1a, for the UE to report common DL processing capability by assuming measurement gap not configured. Another option is to clarify that the UE can expect measurement gap is always configured for processing DL PRS resource.Proposal 1: For the UE processing DL PRS capability, support one of the following options:* Option 1: add a new FG, FG13-1a, for the UE to report common DL processing capability with assuming that measurement gap is not configured.
* Option 2: clarify that the UE can expect measurement gap for processing DL PRS is always configured.
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| [11] | The max number of layers that are configured to the UE should be reported across all methods. So, we consider it as part of the “Common PRS capabilities”. Note that the fact that this capability is reported per band, it does NOT mean that the UE can report different value per band or that the number of layers scale with the number of bands. For example, we can agree that if the UE supports PRS processing in two bands, then the same total number of bands needs to be reported. The minimum capability for a UE in Rel-16 should be that 1 positioning frequency layer across all bands in FR1/FR2. ***Proposal 2: The max number of frequency layers per UE across FR1/FR2 should be defined across positioning methods inside the 13-1 row. UE reports the same value for all bands across both FR1/FR2.******Proposal 3: Introduce a separate PRS processing capability without MG configured (reported per band) in which the UE can at least report, if supports this feature, a component for (N,T) and number of PRS resources per slot.*** * ***The same maximum ratio of PRS Length to PRS periodicity should be assumed with the maximum MGL/MGRP for the case of PRS processing with MG.***
* ***If this is not agreeable, conclude that PRS processing without MG is not supported in NR Rel-16.***

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-1 | Common DL PRS Processing Capability with MG | 1. Maximum DL PRS bandwidth in MHz, which is supported and reported by UE.

a) FR1 bands: {5, 10, 20, 40, 50, 80, 100}b) FR2 bands: {50, 100, 200, 400}1. DL PRS buffering capability: Type 1 or Type 2
2. Type 1 – sub-slot/symbol level buffering
3. Type 2 – slot level buffering
4. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.
5. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
6. N: {0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50} ms

Notes:* 1. UE reports one combination of (N, T) values per band, where N is a duration of DL PRS symbols in ms processed every T ms for a given maximum bandwidth (B) in MHz supported by UE
	2. UE is not expected to support DL PRS bandwidth that exceeds the reported DL PRS bandwidth value
	3. UE DL PRS processing capability is defined for a single positioning frequency layer. UE capability for simultaneous DL PRS processing across positioning frequency layers is not supported in Rel.16 (i.e. for a UE supporting multiple positioning frequency layers, a UE is expected to process one frequency layer at a time)
	4. UE DL PRS processing capability is agnostic to DL PRS comb factor configuration
	5. The reporting of (N, T) values for maximum BW in MHz is not dependent on SCS
1. Max number of DL PRS resources that UE can process in a slot under it
	1. FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz
	2. FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz

Note: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than 1/3.1. Max number of positioning frequency layers UE supports across all methods and FR1/FR2 bands.

Values = {1, 2, 3, 4} |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-1a | Common DL PRS Processing Capability without MG | 1. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.1. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
2. N: {0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50} ms

2.Max number of DL PRS resources that UE can process in a slot under it* 1. FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz
	2. FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz

Note: The above parameters are reported assuming a maximum ratio of PRS instance length and PRS periodicity of no more than 1/3. | 13-1 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
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Based on above, following FL proposals are made.

### **FL proposal 1:**

* **A new FG 13-1a for “Common DL PRS Processing Capability without MG” is added in the UE features list for Positioning (depending on [101-e-NR-Pos-01])**
	+ **Components are same as component 3 and 4 for FG13-1**
	+ **13-1 is prerequisite feature group for FG13-1a**
	+ **Type of FG13-1a is “Per band”**
	+ **FG13-1a is “Optional with capability signaling”**

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| 13. NR Positioning | 13-1a | Common DL PRS Processing Capability without MG | 1. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.1. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
2. N: {0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50} ms

2.Max number of DL PRS resources that UE can process in a slot under it* 1. FR1 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 15kHz, 30kHz, 60kHz
	2. FR2 bands: {1, 2, 4, 6, 8, 12, 16, 24, 32, 48, 64} for each SCS: 60kHz, 120kHz

Note: The above parameters are reported assuming a maximum ratio of PRS instance length and PRS periodicity of no more than 1/3. | 13-1 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

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| Company | Comment |
| Moderator (NTT DOCOMO) | Whether to define DL PRS processing capability for the case w/o measurement gap will be discussed in [101-e-NR-Pos-01], and then the outcome of the discussion can be reflected here. |
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## 2.2 FG[13-7/7a]

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | [13-7] | [Support of SSB from neighbor cell as QCL source of a DL PRS] | 1. [Support of SSB from neighbor cell as QCL source of a DL PRS]
2. [Support of reuse SSB measurement from RRM for receiving PRS]

Note: Refers to Type-C for FR1 and Type-C & Type-D support for FR2 | 13-1 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-7a] | [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS] | 1. [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS]

Note: Refers to Type-D support for FR2 | 13-1 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **FG 13-7**
	+ **Necessity**
		- **FG is kept: [4], [6], [7], [9], [12]**
		- **FG is removed: [13]**
	+ **Component 1**
		- **Remove the bracket: [7], [11]**
	+ **Component 2**
		- **Remove the bracket: [7], [11]**
		- **Remove the component 2: [5], [12]**
	+ **Pre-requisite**
		- **FG 13-1: [6]**
	+ **Type of signaling**
		- **Per band: [4], [6], [9], [11], [12]**
	+ **Need of FR1/FR2 differentiation**
		- **N/A: [11]**
		- **Yes: [12]**
* **FG 13-7a**
	+ **Necessity**
		- **FG is kept: [4], [6], [7], [9], [12]**
		- **FG is removed: [13]**
	+ **Component 1**
		- **Remove the bracket: [7]**
	+ **Pre-requisite**
		- **FG 13-1: [6]**
	+ **Type of signaling**
		- **Per band: [4], [6] [9], [11], [12]**
	+ **Need of FR1/FR2 differentiation**
		- **N/A: [11]**
		- **Yes: [12]**

Above remaining issues and proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

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| [4] | * FG 13-7, 13-7a
	+ Support
	+ Per band
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| [5] | **Proposal 5**: FG 13-7, not clear about the intention of component 2, suggest to remove it |
| [6] | * FG 13-7, 13-7a
	+ Support
	+ Pre-requisite: 13-1
	+ Type of signaling: Per band
 |
| [7] | * FG 13-7, 13-7a
	+ Support
	+ the [] shall be removed
 |
| [9] | * FG 13-7

SSB from neighbour cell can be configured as a QCL type-C and type -D source RS of a DL PRS resource. In our understanding this feature is an optional feature, and some UEs might not support this, so this FG is necessary.* + Support
	+ Per band
* FG 13-7a

Support this FG with the same reason on [13-7], and we suggest to add QCL type-C for both FR1 and FR2 in addition to QCL type-D.* + Support
	+ Per band
 |
| [11] |

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-7 | Support of SSB from neighbor cell as QCL source of a DL PRS | 1. Support of SSB from neighbor cell as QCL source of a DL PRS
2. Support of reuse SSB measurement from RRM for receiving PRS

Note: Refers to Type-C for FR1 and Type-C & Type-D support for FR2 | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-7a | Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS | 1. Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS

Note: Refers to Type-D support for FR2 | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [12] | * FG 13-7
	+ OK to confirm the FG
	+ component 2 is not needed, and it is actually unclear how this information would be used by the LMF in the first place.
* FG 13-7a
	+ OK to confirm the FG

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | [13-7] | [Support of SSB from neighbor cell as QCL source of a DL PRS] | 1. [Support of SSB from neighbor cell as QCL source of a DL PRS]
2. [Support of reuse SSB measurement from RRM for receiving PRS]

Note: Refers to Type-C for FR1 and Type-C & Type-D support for FR2 | 13-1 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-7a] | [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS] | 1. [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS]

Note: Refers to Type-D support for FR2 | 13-1 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [13] | The prerequisite of the feature is feature 13-1 which is the Common DL PRS Processing Capability. If a UE can process and receive a PRS, it means that the UE has worked out a receive beam for this PRS. Then, the motivation for introducing an additional capability for ‘Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS’ is not clear to us. Hence, we do not see the need for feature 13-7a.Similarly, component 13-7 refer to re-using the SSB measurement for RRM. We do not see the need to introduce this as additional capability. The UE is able to perform RRM on SSB, and we have agreed that there is no additional measurement performed beside the already available RRM measurement. We do not see the additional capability needs. Proposal 5 Do not include feature 13-7 and 13-7a in the list of UE features for NR positioning.  |

Based on above, following FL proposals are made.

### **FL proposal 2:**

* **FG 13-7 for “Support of SSB from neighbor cell as QCL source of a DL PRS” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
	+ **13-1 is prerequisite feature group for FG13-7**
	+ **Type of FG13-7 is “Per band”**
* **FG 13-7a for “Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS” is kept in the UE features list for Positioning**
	+ **Component 1 is kept**
	+ **13-1 is prerequisite feature group for FG13-7a**
	+ **Type of FG13-7a is “Per band”**

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| 13. NR Positioning | 13-7 | Support of SSB from neighbor cell as QCL source of a DL PRS | 1. Support of SSB from neighbor cell as QCL source of a DL PRS
2. Support of reuse SSB measurement from RRM for receiving PRS

Note: Refers to Type-C for FR1 and Type-C & Type-D support for FR2 | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-7a | Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS | 1. Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS

Note: Refers to Type-D support for FR2 | 13-1 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

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| Company | Comment |
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## 2.3 FG13-9/9a/9b/9c/9d/9e

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell
 | [13-1],[One of {13-2, 13-3, 13-4}], and 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells
 | 13-8 and [13-9d] | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells
 | 13-8 and 13-9 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell | 1. OLPC for SRS for positioning based on CSI-RS from serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9d | OLPC for SRS for positioning based on SSB from serving cell | 1. [OLPC for SRS for positioning based on SSB from serving cell]
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9e | [PathLoss estimate maintenance] | 1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}]1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}] | One of {13-9, 13-9a,b,c,[d]} | No | N/A |  | [Per band]  | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **FG structure**
	+ **Combine FG13-9c, FG13-9d, FG13-10, FG13-10a into a single basic FG: [10]**
* **FG 13-9d**
	+ **Neccesity**
		- **Remove FG 13-9d: [3], [4], [5], [11]**
		- **Keep FG 13-9d (remove the bracket): [7], [12]**
	+ **Pre-requisite**
		- **FG 13-8: [6]**
	+ **Need for the gNB to know if the feature is supported**
		- **Yes: [10]**
	+ **Type of signaling**
		- **Per band: [6]**
* **FG 13-9e**
	+ **Necessity**
		- **FG is kept and remove the brackets: [12]**
	+ **Component 1**
		- **Rewording the component 1: [3]**
		- **Remove the brancket: [4], [6], [7], [9]**
	+ **Component 2**
		- **Remove the component 2: [3]**
		- **Remove the brancket: [4], [6], [7]**
	+ **Pre-requisite**
		- **One of {13-9, 13-9a,b,c,d}: [6]**
	+ **Need for the gNB to know if the feature is supported**
		- **Yes: [10]**
	+ **Type of signaling**
		- **Per band: [4], [6], [11], [12]**
		- **Per UE with FR differentiation: [5]**
	+ **Change FG name to**
		- **“Pathloss monitoring for SRS for positioning”: [6]**
		- **“simultaneous maintenance of path-loss estimate”: [9]**

Above remaining issues and proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [3] | * FG13-9, FG13-9a, FG13-9b, FG13-10b
	+ should assume SRS and other RS are in the same band.
* FG13-9d
	+ For SRS transmission, pathloss RS should be configured. OLPC for SRS based on SSB from serving cell should be the basic component for SRS for positioning. So this FG should be either removed.

***Proposal 1:*** *FG 13-9d should be removed.** FG13-9e
	+ Remove component 2
	+ Suggest to rewording the component 1 into “Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all serving cells within a band in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions”.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell | [13-1],[One of {13-2, 13-3, 13-4}], and 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells | 13-8 and [13-9d] | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells
 | 13-8 and 13-9 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell | 1. OLPC for SRS for positioning based on CSI-RS from serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13. NR Positioning | 13-9e | [PathLoss estimate maintenance] | 1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells within a band in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}] | One of {13-9, 13-9a,b,c,[d]} | No | N/A |  | [Per band]  | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [4] | * FG 13-9, 13-9a, 13-9b, 13-9c
	+ Per band
* FG 13-9d
	+ Not needed. All UEs should support SRS for positioning can do OLPC based on SSB from serving cell.
* FG 13-9e
	+ Per band
	+ Support to add Component 1 and 2.
 |
| [5] | **Proposal 7**: FG 13-9, 13-9b, if it is per band signaling, we would like to clarify that whether it means SRS and PRS are in the same band? If the answer is yes, suggest to put a note in this FG to clarify this understanding**Proposal 8**: FG 13-9b, the pre-requisite FGs doesn’t need to contain FG 13-8 (since FG 13-9 is an pre-requisite FG)**Proposal 9**: FG 13-9a, 13-9d, if it is per band signaling, we would like to clarify that whether it means SSB and PRS are in the same band? If the answer is yes, suggest to put a note in this FG to clarify this understanding**Proposal 10**: FG 13-9c, if it is per band signaling, we would like to clarify that whether it means CSI-RS and PRS are in the same band? If the answer is yes, suggest to put a note in this FG to clarify this understanding**Proposal 11**: FG 13-9e and 13-10f, it should be per UE with FR differentiation**Proposal 12**: FG 13-9d, this FG is not needed, since UE supporting SRS for positioning should all support OLPC based on SSB from serving cell |
| [6] | * FG 13-9
	+ Pre-requisite: 13-1, 13-8
	+ Type of signaling: Per band
* FG 13-9a
	+ Pre-requisite: 13-8 and 13-9d
	+ Type of signaling: Per band
* FG 13-9b
	+ Pre-requisite: 13-9
	+ Type of signaling: Per band
* FG 13-9c
	+ Pre-requisite: 13-8
	+ Type of signaling: Per band
* FG 13-9d
	+ Pre-requisite: 13-8
	+ Type of signaling: Per band
	+ In our view this FG can be either a basic FG for UEs supporting SRS for positionng i.e. supporting FG13-8. We are also open to have FG 13-9d as a pre-requisite to other FGs covering OLPC or merge it as a component for the FG 13-8.
		- The RAN1 to select one of the following options
			* Option 1. Define 13-9d as a basic FG for UEs supporting SRS for positioning (i.e. 13-8)
			* Option 2. Make it a pre-requisite for all FGs 13-9x
			* Option 3. Merge it as a component of the FG 13-8
* FG 13-9e
	+ Pre-requisite: One of {13-9, 13-9a,b,c,d}
	+ Type of signaling: Per band
	+ Regarding the FG 13-9e, we propose to change it name to “Pathloss monitoring for SRS for positioning” and are open to keep both components considering UL CA scenario and potential pathloss sharing between UL CCs of serving cell as well as to avoid configuration of all pathlosses per serving cell.
		- change name to “Pathloss monitoring for SRS for positioning”
		- keep both components
 |
| [7] | * FG 13-9d
	+ Support it and the [] shall be removed.
* FG 13-9e
	+ It shall be supported and remove all the []s.
	+ Support both components 1 and 2.
 |
| [9] | * FG 13-9
	+ For the path-loss estimation for a DL PRS resource which is transmitted from a serving/neighbour TRP/cell, we believe that at least 13-1 should be the prerequisite FG.
* FG 13-9a
	+ 13-9d is a prerequisite FG
* FG 13-9e
	+ In our side, we have some confusions on the name of this FG, so we suggest a change of this FG name as “simultaneous maintenance of path-loss estimate”
	+ In this FG, component 1 seems necessary
 |
| [10] | * We suggest to combine FG13-9c, FG13-9d, FG13-10, FG13-10a into a single basic FG, as below. The components are listed of follows, and is reported per band. The prerequisite FGs of other FGs should be updated accordingly.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-19 | Basic SRS for positioning | 1. Support of single SRS resource for positioning per BWP.
2. Support of OLPC for SRS for positioning based on SSB from serving cell.
3. Support of OLPC for SRS for positioning based on CSI-RS from serving cell.
4. Support of spatial relation for SRS for positioning based on SSB from the serving cell for FR2 bands
5. Support of spatial relation for SRS for positioning based on CSI-RS from the serving cell for FR2 bands
 |  | Yes | N/A |  | Per band | [N/A] | [N/A] | [N/A] | Need for the location server to know if the feature is supported. | Optional with capability signaling |

* For FG13-9
	+ Need for the gNB to know should be “Yes”.
	+ Regarding per band reporting, is it per SRS band or per PRS band?
* For FG13-9a
	+ Need for the gNB to know should be “Yes”.
	+ Regarding per band reporting, is it per SRS band or per SSB band?
* For FG13-9b
	+ Need for the gNB to know should be “Yes”.
	+ Regarding per band reporting, is it per SRS band or per PRS band?
* For FG13-9c
	+ Need for the gNB to know should be “Yes”.
	+ Suggest to have a basic FG to include this. Only need to design the signaling of the basic FG.
* For FG13-9d
	+ Need for the gNB to know should be “Yes”.
	+ Suggest to have a basic FG to include this. Only need to design the signaling of the basic FG.
* For FG13-9e
	+ Need for the gNB to know should be “Yes”.
	+ Component 1: How can component 1 be interpreted if it is reported per band? Should it be all serving cells within the reported band?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell
 | [13-1],[One of {13-2, 13-3, 13-4}], and 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells
 | 13-8 and [13-9d] | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells
 | 13-8, 13-9 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell | 1. OLPC for SRS for positioning based on CSI-RS from serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | **Need for location server to know if the feature is supported.** | Optional with capability signaling |
| 13. NR Positioning | 13-9d | OLPC for SRS for positioning based on SSB from serving cell | 1. [OLPC for SRS for positioning based on SSB from serving cell]
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9e | [PathLoss estimate maintenance] | 1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}]1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}] | One of {13-9, 13-9a,b,c,[d]} | No | N/A |  | [Per band]  | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [11] | SRS for positioning is another SRS which is very similar to the regular SRS-for-communications, and follows the basic principles of an SRS transmission supported in NR. Performing Open loop power control with serving cell SSB is one of such features that should be assumed as mandatory for any SRS transmission. Threefore we propose to remove the separate FG on this feature.***Proposal 5: Remove row 13-9 called “OLPC for SRS for positioning based on PRS from the serving cell”.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell
 | [13-1],[One of {13-2, 13-3, 13-4}], and 13-8 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells
 | 13-8 and [13-9d] | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells
 | 13-8 and 13-9 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell | 1. OLPC for SRS for positioning based on CSI-RS from serving cell
 | 13-8 | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13. NR Positioning | 13-9e | PathLoss estimate maintenance | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16} | One of {13-9, 13-9a,b,c} | No | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [12] | * FG 13-9d, 13-9e
	+ OK to confirm the FG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell
 | [13-1],[One of {13-2, 13-3, 13-4}], and 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells
 | 13-8 and [13-9d] | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells
 | 13-8 and 13-9 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell | 1. OLPC for SRS for positioning based on CSI-RS from serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9d | OLPC for SRS for positioning based on SSB from serving cell | 1. [OLPC for SRS for positioning based on SSB from serving cell]
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9e | [PathLoss estimate maintenance] | 1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}]1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}] | One of {13-9, 13-9a,b,c,[d]} | No | N/A |  | [Per band]  | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |

Based on above, following FL proposals are made.

### **FL proposal 3:**

* **Not to combine FG13-9c, FG13-9d, FG13-10, FG13-10a into a single basic FG**
* **FG [13-9d] (OLPC for SRS for positioning based on SSB from serving cell) is removed**
	+ **OLPC for SRS for positioning based on SSB from serving cell is a component of 13-8**
* **FG 13-9e for “PathLoss estimate maintenance” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
	+ **One of {13-9, 13-9a, 13-9b, 13-9c} is prerequisite feature group for FG13-9e**
	+ **Type of FG13-9e is “Per band”**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13. NR Positioning | 13-9e | PathLoss estimate maintenance | 1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}1. Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16} | One of {13-9, 13-9a,13-9b,13-9c} | No | N/A |  | Per band  | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | If FG13-9d is removed without adding the following FG serving as prerequisite, we would like to emphasize that the FG-9d is conditionally mandatory without capability and is assumed supported by gNB if UE reports support of FG13-8.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 13. NR Positioning | 13-19 | Basic SRS for positioning | 1. Support of single SRS resource for positioning per BWP.
2. Support of OLPC for SRS for positioning based on SSB from serving cell.
3. Support of OLPC for SRS for positioning based on CSI-RS from serving cell.
4. Support of spatial relation for SRS for positioning based on SSB from the serving cell for FR2 bands
5. Support of spatial relation for SRS for positioning based on CSI-RS from the serving cell for FR2 bands
 |  | Yes | N/A |  | Per band |

For 13-9e, for per-band indication granularity, we need to clarify that* If UE supports this capapability, UE supports configuration of SRS on that band with the feature, regardless of the band where SSB and/or PRS is configured in.
	+ Also OK with the proposed change in ED#2 by restricting them to the same band.
* Component 2 reported per band should be interpreted as the pathloss maintainance of SRS resources across all cells in the reported band.
 |
| Moderator (NTT DOCOMO) | Following two proposals are added for clarification.* **Not to combine FG13-9c, FG13-9d, FG13-10, FG13-10a into a single basic FG**
* **OLPC for SRS for positioning based on SSB from serving cell is a component of 13-8**
 |
|  |  |
|  |  |

## 2.4 FG13-10/10a/10b/10c/10d/10e/[10f]

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell | 1. Spatial relation for SRS for positioning based on SSB from the serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell | 1. Spatial relation for SRS for positioning based on CSI-RS from the serving cell
 | 13-10 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell | 1. Spatial relation for SRS for positioning based on PRS from the serving cell
 | One of {13-2, 13-3, 13-4} and13-8 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10c | Spatial relation for SRS for positioning based on SRS | 1. Spatial relation for SRS for positioning based on SRS
 | 13-8, | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell | 1. Spatial relation for SRS for positioning based on SSB from the neighbouring cell
 | 13-10 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell | 1. Spatial relation for SRS for positioning based on PRS from the neighbouring cell
 | 13-10b | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-10f] | [Spatial relation maintenance] | 1. [Component 1: Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}]1. [Component 2: Max Number of maintained spatial relations for all the SRS resource sets for positioning per serving cell in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}] | One of {13-10, 13-10a, b, d, e} | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **Necessity of additional separate FG(s)**
	+ **Add a new FG for AP-SRS with carrier switching: [10], [11]**
* **FG 13-10f**
	+ **Whether FG 13-10f is needed ot not should be discussed further: [9]**
	+ **Component 1**
		- **Reword the component 1: [3]**
		- **Remove the bracket: [4], [6], [7], [12]**
	+ **Component 2**
		- **Remove the component 2: [3], [6], [11]**
		- **Remove the bracket: [4], [7], [12]**
	+ **Add new components to FG 13-10f: [7]**
		- **Component 3: Max Number of maintained spatial relations based on SSB from neighboring cells for all the SRS resource sets for positioning across all serving cells**
		- **Component 4: Max Number of maintained spatial relations based on DL PRS from neighboring cells for all the SRS resource sets for positioning across all serving cells.**
	+ **Pre-requisite**
		- **One of {13-10, 13-10a, b, d, e}: [6]**
	+ **Type of signaling**
		- **Per band: [4], [6], [11], [12]**
		- **Per UE with FR differentiation: [5]**
	+ **Need for the gNB to know if the feature is supported**
		- **Yes: [10]**

Above remaining issues and proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [3] | * FG13-10f
	+ Remove component 2
	+ Suggest to rewording the component 1 into “Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells within a band in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions”.

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | [13-10f] | [Spatial relation maintenance] | 1. [Component 1: Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells within a band in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}] | One of {13-10, 13-10a, b, d, e} | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [4] | * FG 13-10, 13-10a, 13-10b, 13-10c, 13-10d, 13-10e
	+ Per band
* FG 13-10f
	+ Per band
	+ Support to add Component 1 and 2.
 |
| [5] | **Proposal 7**: FG 13-9, 13-9b, if it is per band signaling, we would like to clarify that whether it means SRS and PRS are in the same band? If the answer is yes, suggest to put a note in this FG to clarify this understanding**Proposal 8**: FG 13-9b, the pre-requisite FGs doesn’t need to contain FG 13-8 (since FG 13-9 is an pre-requisite FG)**Proposal 9**: FG 13-9a, 13-9d, if it is per band signaling, we would like to clarify that whether it means SSB and PRS are in the same band? If the answer is yes, suggest to put a note in this FG to clarify this understanding**Proposal 10**: FG 13-9c, if it is per band signaling, we would like to clarify that whether it means CSI-RS and PRS are in the same band? If the answer is yes, suggest to put a note in this FG to clarify this understandingThe argument in proposal 7,8,9 can also apply to FG 13-10, 13-10a, 13-10b, 13-10d, 13-10e.**Proposal 11**: FG 13-9e and 13-10f, it should be per UE with FR differentiation |
| [6] | * FG 13-10
	+ Pre-requisite: 13-8
	+ Type of signaling: Per band
* FG 13-10a
	+ Pre-requisite: 13-10
	+ Type of signaling: Per band
* FG 13-10b
	+ Pre-requisite: One of {13-2, 13-3, 13-4} and 13-8
	+ Type of signaling: Per band
* FG 13-10c
	+ Pre-requisite: 13-8
	+ Type of signaling: Per band
* FG 13-10d
	+ Pre-requisite: 13-10
	+ Type of signaling: Per band
* FG 13-10e
	+ Pre-requisite: 13-10b
	+ Type of signaling: Per band
* FG 13-10f
	+ Support
	+ Pre-requisite: One of {13-10, 13-10a, b, d, e}
	+ Type of signaling: Per band
	+ For spatial relation maintenance, we think component #1 only is sufficient and we assume that number of maintaned spatial relations is defined across total number of SSB and DL PRS.
		- Keep only component #1
		- Clarify that max number of spatial relations is defined in total i.e. across SSBs and DL PRSs
 |
| [7] | We support to include it and suggest to remove the []. Furthermore, we prefer to include two more components to specify the max number of spatial relations based on reference signal (SSB or DL PRS resource) from a neighbor cell. The reason for that is the UE behavior for tracking reference signals from serving cell and from neighbor cells for spatial relation information are different. Proposal 3: Support FG 13-10f and add two new components to FG 13-10f:* Component 3: Max Number of maintained spatial relations based on SSB from neighboring cells for all the SRS resource sets for positioning across all serving cells
* Component 4: Max Number of maintained spatial relations based on DL PRS from neighboring cells for all the SRS resource sets for positioning across all serving cells.
 |
| [9] | * FG 13-10f
	+ We are not sure that this FG would be necessary, and this needs to be discussed further. In our understanding, in case of path-loss reference RS, the UE needs to estimate in the long-terms sense to obtain accurate RSRP measurements to accurately compensate path-loss and the path-loss would be determined considering multiple measurements obtained for a long time, so maintaining many path-loss reference RSs could result in high overhead at the UE and hence, different UE capability needs to be defined. However, spatial relation information seems different.
	+ At this time, we would like to minor change of component 1 and 2. It is reasonable to remove “sets” from “Max Number of maintained spatial relations for all the SRS resources ~~sets~~ for positioning across all serving cells…”, since spatial relation information is configured for resource level (not resource set level).
 |
| [10] | * We suggest to combine FG13-9c, FG13-9d, FG13-10, FG13-10a into a single basic FG, as in section 2.15. The components are listed of follows, and is reported per band. The prerequisite FGs of other FGs should be updated accordingly.
	+ Support of single SRS resource for positioning per BWP.
	+ Support of OLPC for SRS for positioning based on SSB from serving cell.
	+ Support of OLPC for SRS for positioning based on CSI-RS from serving cell.
	+ Support of spatial relation for SRS for positioning based on SSB from the serving cell for FR2 bands
	+ Support of spatial relation for SRS for positioning based on CSI-RS from the serving cell for FR2 bands
* For FG13-10
	+ Need for the gNB to know should be “Yes”.
	+ Suggest to have a basic FG to include this, and it is for FR2. Only need to design the signaling of the basic FG.
* For FG13-10a
	+ Need for the gNB to know should be “Yes”.
	+ Suggest to have a basic FG to include this, and it is for FR2. Only need to design the signaling of the basic FG.
* For FG13-10b
	+ Need for the gNB to know should be “Yes”.
	+ Regarding per band reporting, is it per SRS band or per PRS band?
* For FG13-10c
	+ Need for the gNB to know should be “Yes”.
* For FG13-10d
	+ Need for the gNB to know should be “Yes”.
	+ Regarding per band reporting, is it per SRS band or per SSB band?
* For FG13-10e
	+ Need for the gNB to know should be “Yes”.
	+ Regarding per band reporting, is it per SRS band or per PRS band?
* For FG13-10f
	+ Need for the gNB to know should be “Yes”.
	+ Component 1: How can component 1 be interpreted if it is reported per band? Should it be all serving cells within the reported band?

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| 13. NR Positioning | 13-17 | AP-SRS with carrier switching | 1. Support of AP-SRS for positioning with carrier switching triggered by DCI format 2\_3.
 | 13-8 | Yes | N/A |  | Per UE | [N/A] | [N/A] | [N/A] |  | Optional with capability signaling |

 |
| [11] | ***Proposal 6: Introduce a FG bit for Aperiodic SRS for positioning triggered with DCI format 2\_3. This is reported per band.***

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell | 1. Spatial relation for SRS for positioning based on SSB from the serving cell
 | 13-8 | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell | 1. Spatial relation for SRS for positioning based on CSI-RS from the serving cell
 | 13-10 | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell | 1. Spatial relation for SRS for positioning based on PRS from the serving cell
 | One of {13-2, 13-3, 13-4} and13-8 | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10c | Spatial relation for SRS for positioning based on SRS | 1. Spatial relation for SRS for positioning based on SRS
 | 13-8, | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell | 1. Spatial relation for SRS for positioning based on SSB from the neighbouring cell
 | 13-10 | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell | 1. Spatial relation for SRS for positioning based on PRS from the neighbouring cell
 | 13-10b | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10f | Spatial relation maintenance | 1. Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16} | One of {13-10, 13-10a, b, d, e} | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10g | AP-SRS with carrier switching | 1. Support of AP-SRS for positioning with carrier switching triggered by DCI format 2\_3.
 | 13-8 | No | N/A |  | Per band | N/A | N/A  | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [12] | * FG 13-10f
	+ OK to confirm the FG
* General comment: FGs referring to “SRS for positioning” should refer instead to SRS-PosResource for clarity. This includes 13-9, 13-9a/b/c/d, 13-10, 13-10a/b/c/d/e.

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell | 1. Spatial relation for SRS for positioning based on SSB from the serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell | 1. Spatial relation for SRS for positioning based on CSI-RS from the serving cell
 | 13-10 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell | 1. Spatial relation for SRS for positioning based on PRS from the serving cell
 | One of {13-2, 13-3, 13-4} and13-8 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10c | Spatial relation for SRS for positioning based on SRS | 1. Spatial relation for SRS for positioning based on SRS
 | 13-8, | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell | 1. Spatial relation for SRS for positioning based on SSB from the neighbouring cell
 | 13-10 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell | 1. Spatial relation for SRS for positioning based on PRS from the neighbouring cell
 | 13-10b | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-10f] | [Spatial relation maintenance] | 1. [Component 1: Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}]1. [Component 2: Max Number of maintained spatial relations for all the SRS resource sets for positioning per serving cell in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}] | One of {13-10, 13-10a, b, d, e} | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |

Based on above, following FL proposals are made.

### **FL proposal 4:**

* **FG 13-10f for “Spatial relation maintenance” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
	+ **One of {13-10, 13-10a, 13-10b, 13-10d, 13-10e} is prerequisite feature group for FG13-10f**
	+ **Type of FG13-10f is “Per band”**
* **A new FG 13-10g for “AP-SRS with carrier switching” is added in the UE features list for Positioning (depending on [101-e-NR-Pos-01])**
	+ **13-8 is prerequisite feature group for FG13-10g**
	+ **Type of FG13-10g is “Per band”**
	+ **FG13-10g is “Optional with capability signaling”**

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| 13. NR Positioning | 13-10f | Spatial relation maintenance | 1. Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}1. Max Number of maintained spatial relations for all the SRS resource sets for positioning per serving cell in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16} | One of {13-10, 13-10a, 13-10b, 13-10d, 13-10e} | No | N/A |  | Per band | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10g | AP-SRS with carrier switching | 1. Support of AP-SRS for positioning with carrier switching triggered by DCI format 2\_3.
 | 13-8 | No | N/A |  | Per band | N/A | N/A  | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Moderator (NTT DOCOMO) | Capabilities for SRS carrier switching will be discussed in [101-e-NR-Pos-01], and then the outcome of the discussion can be reflected here. |
| Huawei/HiSilicon | For 13-9f, for per-band indication granularity, we need to clarify that* If UE supports this capapability, UE supports configuration of SRS on that band with the feature, regardless of the band where SSB and/or PRS is configured in.
	+ Also OK with the proposed change in ED#2 by restricting them to the same band.
* Component 2 reported per band should be interpreted as the spatial relation maintainance of SRS resources across all cells in the reported band.
 |
| Qualcomm | Cannot accept that “Component 2” is kept in 13-10f. We would like to keep it in brackets for futher discussion. We think that spatial relation makes sense to be defined across all serving cells, and we don’t see the need of a per-serving capability reporting. For 13-9f and the comment from HW, we don’t consider inter-band spatial relation an important feature to be supported For us, a per-band 13-9f reporting means that tboth source and target are in the same band. So, we prefer to clarify the meaning as:”both source and target” are on the same band. Can we suggest to add a note in 13-10f: “FFS: Whether inter-band QCL indication is supported”. |
|  |  |

## 2.5 FG13-11a/[11]

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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | 13-11a | Inter-frequency measurement for Multi-RTT | 1. Inter-frequency measurement for Multi-RTT
 | 13-4 and 13-8 | Yes | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-11] | [UE Rx-Tx Measurement Report for Multi-RTT] | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

[Note: The DL PRS resource/resource sets can be in different positioning frequency layers]1. [Support RSRP measurements. Values = {0, 1}]
 | 13-4 and 13-8 | No | N/A |  | [Per UE] | [N/A] | [Yes] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **FG 13-11**
	+ **Necessity**
		- **FG is kept: [6], [9], [12]**
	+ **Component 1**
		- **Remove the note: [10]**
	+ **Component 2**
		- **Remove the bracket: [2], [4], [6]**
		- **Add the value 2: [2]**
	+ **Pre-requisite**
		- **FG 13-4 and 13-8: [6]**
	+ **Need for the gNB to know if the feature is supported**
		- **No: [10]**
	+ **Type of signaling**
		- **Per band: [11]**
		- **Per UE: [4], [6]**

Above remaining issues and proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

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| [2] | To align with RAN2’s specification, we propose to add a component to FG 13-11 as the following.

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| --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** |
| 13. NR Positioning | [13-11] | [UE Rx-Tx Measurement Report for Multi-RTT] | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

Note: The DL PRS resource/resource sets can be in different positioning frequency layers1. Support of additional path report. Values = {0, 1, 2}
 | 13-4 and 13-8 | No |

 |
| [4] | * FG 13-11a
	+ Per UE
* FG 13-11
	+ Per UE
	+ Support to add Component 2.
 |
| [6] | * FG 13-11a
	+ Pre-requisite: 13-4 and 13-8
	+ Type of signaling: Per UE
* FG 13-11
	+ Support
	+ Pre-requisite: 13-4 and 13-8
	+ Type of signaling: Per UE
	+ Support FG split into two components:
		- RSRP support
		- UE Rx-Tx measurement per DL PRS Resource Set
 |
| [9] | * FG 13-11
	+ In principle, we think that this FG is necessary.
 |
| [10] | * For FG13-11
	+ Need for the gNB to know should be “No”.
	+ Component 1: We suggest to remove the note.
* For FG13-11a
	+ Need for the gNB to know should be “No”.
	+ Why is it reported per UE while for DL-AoD and DL-TDOA are per band?
	+ Component 1: We suggest to add the following note:
		- Note: The UE Rx – Tx time difference measurements for a single SRS can be associated with DL PRS resource/resource sets can be in different positioning frequency layers.

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | [13-11] | [UE Rx-Tx Measurement Report for Multi-RTT] | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

[Note: The DL PRS resource/resource sets can be in different positioning frequency layers]1. [Support RSRP measurements. Values = {0, 1}]
 | 13-4 and 13-8 | No | N/A |  | [Per UE] | [N/A] | [Yes] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-11a | Inter-frequency measurement for Multi-RTT | 1. Inter-frequency measurement for Multi-RTT
 | 13-4 and 13-8 | Yes | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [11] | RSRP reporting for MRTT and TDOA methods should be considered an optional feature for two main reasons: * In short, usefulness of RSRP in TDOA and MRTT positioning has not been proven in any Study Item or Work Item. No company provided results on how the RSRP can be really used and what are any the potential gains.
* It was not supported at all in LTE OTDOA; adding it as a mandatory feature in NR without any study or at least without having a precedence of usefulness in LTE, is not reasonable.

***Proposal 4: Support of RSRP reporting is optional for both M-RTT and TDOA positioning. If the UE supports the feature, it can report as many RSRPs as Rx-Tx or RSTD values.***The following has been agreed and has been endorsed in the 38.214:

|  |
| --- |
| *The UE may be configured to measure and report, subject to UE capability, up to 4 UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in different positioning frequency layers.* |

***Proposal 7: The feature of UE reporting multiple Rx-Tx, each one on PRS from different frequency layers, should be included inside the Inter-frequency M-RTT FG (13-11a).***

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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-11a | Inter-frequency measurement for Multi-RTT | 1. Inter-frequency measurement for Multi-RTT* The DL PRS resource/resource sets can be in different positioning frequency layers
* PRS and SRS used for the measurements are in a different band.
 | 13-4 and 13-8 | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-11 | UE Rx-Tx Measurement Report for Multi-RTT | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.
	1. PRS and SRS used for the measurements are in the same band.
2. Support RSRP measurements. Values = {0, 1}
 | 13-4 and 13-8 | No | N/A |  | Per band | [N/A] | N/A | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [12] | * FG 13-11
	+ OK to confirm the FG
	+ Component 2: remove “values = {0, 1}” as this would be equivalent to disabling a component, which is not aligned to the design rules followed in defining the Rel-16 UE features. Clarify that multiple DL PRS-RSRP could be reported if multiple UE Rx-Tx are supported in component 1. Replace RSRP with “DL PRS-RSRP” for clarity.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | 13-11a | Inter-frequency measurement for Multi-RTT | 1. Inter-frequency measurement for Multi-RTT
 | 13-4 and 13-8 | Yes | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-11] | [UE Rx-Tx Measurement Report for Multi-RTT] | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

[Note: The DL PRS resource/resource sets can be in different positioning frequency layers]1. [Support RSRP measurements. Values = {0, 1}]
 | 13-4 and 13-8 | No | N/A |  | [Per UE] | [N/A] | [Yes] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |

Based on above, following FL proposals are made.

### **FL proposal 5:**

* **FG 13-11 for “UE Rx-Tx Measurement Report for Multi-RTT” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
		- **Note for component 1 is removed**
	+ **Type of FG13-11 is “Per UE”**
		- **Need of FDD/TDD differentiation is “No”**
		- **Need of FR1/FR2 differentiation is “Yes”**

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| 13. NR Positioning | 13-11 | UE Rx-Tx Measurement Report for Multi-RTT | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.
2. Support RSRP measurements. Values = {0, 1}
 | 13-4 and 13-8 | No | N/A |  | Per UE | No | Yes | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | A typo in “FG13-10f” should be corrected with “FG13-11”.We propose to clarfy that the remaining per UE/band reporting (FG13-11a) will be addressed in ED#2. |
| Moderator (NTT DOCOMO) | The typo is corrected. |
| Qualcomm | We ar OK with the row except: We cannot accept to be reported ber UE. Suggest to keep it in brackets and to be addressed in ED#2.  |
|  |  |

## 2.6 FG[13-12/12a]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****(the ‘type’ definition from UE features should be based on the granularity of 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | [13-12] | [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning]
 |  | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-12a] | [N R E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning]
 | 13-12 | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |

* **FG 13-12**
	+ **Necessity**
		- **FG is kept: [4], [9], [11]**
		- **FG is removed: [3]**
	+ **Pre-requisite**
		- **FG 1-1: [6]**
	+ **Type of signaling**
		- **Per band: [4]**
		- **Per UE: [6], [10]**
	+ **Need of FR1/FR2 differentiation**
		- **N/A: [11]**
* **FG 13-12a**
	+ **Necessity**
		- **FG is kept: [4], [9], [11]**
		- **FG is removed: [3]**
	+ **Pre-requisite**
		- **FG 1-4: [6]**
	+ **Type of signaling**
		- **Per band: [4]**
		- **Per UE: [6], [10]**
	+ **Need of FR1/FR2 differentiation**
		- **N/A: [11]**

Above remaining issues and proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| [3] | **13-12 and 13-12a: NR E-CID RRM**An LS [R3-202646] from RAN3 has agreed to introduce support in NRPPa for NG-RAN node assisted NR E-CID. According to RAN3 agreements, the following information may be transferred from gNB to LMF:- SS Reference Signal Received Power (SS-RSRP)- SS Reference Signal Received Quality (SS-RSRQ)- CSI Reference Signal Received Power (CSI-RSRP)- CSI Reference Signal Received Quality (CSI-RSRQ)- NR Cell Global Identifier / Physical Cell ID- Cell Portion IDAs RRM measurement information including RRM based on SSB and CSI-RS is reported from UE to gNB, and gNB can transfer it to LMF, it is unnecessary to redundantly support capability signaling from UE to LMF. Therefore, we think FG 13-12 and 13-12a are not needed. ***Proposal 2:*** *FG 13-12 and FG 13-12a are not needed*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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 |
| [4] | * FG 13-12
	+ Support
	+ Per band
* FG 13-12a
	+ Support
	+ Per band
 |
| [6] | * FG 13-12
	+ Support
	+ Pre-requisite: FG 1-1
	+ Type of signaling: Per UE
* FG 13-12a
	+ Support
	+ Pre-requisite: FG 1-4
	+ Type of signaling: Per UE
 |
| [9] | * FG 13-12, 13-12a
	+ In principle, we think that these FGs are necessary.
 |
| [10] | * For FG13-12
	+ It is LPP support of SSB RRM measurement report, it should be per UE. We cannot agree with per band reporting, which is confusing.
* For FG13-12a
	+ It is LPP support of CSI-RS RRM measurement report, it should be per UE. We cannot agree with per band reporting, which is confusing.
 |
| [11] |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-12 | [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning] | 1. NR E-CID DL SSB RRM measurements with LPP support for NR Positioning
 |  | No | N/A |  | Per band | [N/A] | N/A | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-12a | N R E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning | 1. NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning
 | 13-12 | No | N/A |  | Per band | [N/A] | N/A | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |
| [12] | * FG 13-12, 13-12a
	+ OK to confirm the FG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | Note | **Mandatory/Optional** |
| 13. NR Positioning | [13-12] | [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning]
 |  | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-12a] | [N R E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning]
 | 13-12 | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |

 |

Based on above, following FL proposals are made.

### **FL proposal 6:**

* **FG 13-12 for “NR E-CID DL SSB RRM measurements with LPP support for NR Positioning” is kept in the UE features list for Positioning**
	+ **Component 1 is kept**
	+ **1-1 is prerequisite feature group for FG13-12**
	+ **Type of FG13-12 is “Per UE”**
		- **Need of FDD/TDD differentiation is “No”**
		- **Need of FR1/FR2 differentiation is “Yes”**
* **FG 13-12a for “NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning” is kept in the UE features list for Positioning**
	+ **Component 1 is kept**
	+ **1-4 is prerequisite feature group for FG13-12a**
	+ **Type of FG13-12a is “Per UE”**
		- **Need of FDD/TDD differentiation is “No”**
		- **Need of FR1/FR2 differentiation is “Yes”**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 13. NR Positioning | 13-12 | NR E-CID DL SSB RRM measurements with LPP support for NR Positioning | 1. NR E-CID DL SSB RRM measurements with LPP support for NR Positioning
 | 1-1 | No | N/A |  | Per UE | No | Yes | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-12a | NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning | 1. NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning
 | 1-4 | No | N/A |  | Per UE | No | Yes | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | We are OK with the rows except: We cannot accept to be reported ber UE. Suggest to keep it in brackets and to be addressed in ED#2.  |
|  |  |
|  |  |
|  |  |

## 2.7 potential new FG

* **Simultaneous processing of LTE PRS and NR PRS**
	+ **A UE is not expected to support parallel processing of LTE PRS and NR PRS: [5], [7]**
	+ **If the above assumption is not common understanding, a new FG is needed: [5], [10]**

Above proposals are identified based on following feedbacks provided in contributions for the RAN1#101-e meeting.

|  |  |
| --- | --- |
| [5] | **Proposal 13:** UE is not expected to support parallel processing of LTE PRS and NR PRS. If this is not a common understanding, then an FG should be added for UE to indicate whether UE can support parallel processing of LTE PRS and NR PRS. |
| [7] | Regarding whether to define “Support of simultaneous processing of LTE PRS and NR PRS”, LTE PRS design and NR PRS design are quite different and provide different level of positioning accuracy. In this regard, we should not support simultaneous processing of LTE PRS and NR PRS.***Proposal 2****: Simultaneous processing of LTE PRS and NR PRS is not supported.*A max number of simultaneous transmissions of SRS for positioning on a symbol should be defined based on processing capability and max comb-size. In addition, if a max number is defined per symbol, there is no need to define a max number per slot.***Proposal 3****: A max number of simultaneous transmissions of SRS for positioning on a symbol should be defined based on processing capability and max comb-size and there is no need to define a max number per slot.* |
| [10] | * Based on RAN1 agreement, the following new FGs should be introduced.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-15 | Simultaneous SRS transmission for intra-band CA | 1. The number of SRS resources for positioning on a symbol for intra-band CA.

Values: {1,2} | 13-8 | Yes | N/A |  | Per band | [N/A] | [N/A] | [N/A] |  | Optional with capability signaling |
| 13. NR Positioning | 13-16 | Simultaneous SRS transmission for inter-band CA | 1. The number of simultaneously transmitted SRS resources for positioning for inter-band CA.
 | 13-8 | Yes | N/A |  | [Per band combination or per FS] | [N/A] | [N/A] | [N/A] |  | Optional with capability signaling |

* In addition, we suggest to have the following FG.
	+ If FG13-18 is not supported, we would like to see conclusion that UE is not expected to support parallel processing of LTE PRS and NR PRS.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Features** | **Index** | **Feature group** | **Components** | **Prerequisite feature groups** | **Need for the gNB to know if the feature is supported** | **Applicable to the capability signalling exchange between UEs (V2X WI only)”.** | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 13. NR Positioning | 13-18 | Parallel LTE/NR PRS processing | 1. Support of parallel LTE PRS and NR PRS processing
 | 13-1 | Yes | N/A |  | Per UE | [N/A] | [N/A] | [N/A] |  | Optional with capability signaling |

 |

Based on above, following FL proposals are made.

### **FL proposal 7:**

* **A UE is not expected to support parallel processing of LTE PRS and NR PRS in Rel-16**

Companies are encouraged to check above FL proposals and to provide feedback if any in below. If you cannot accept the FL proposals, please put your company name after “Cannot accept the proposals” below and please provide your alternative proposal (in your comment) which could be acceptable to all in your consideration.

 Cannot accept the proposals:

|  |  |
| --- | --- |
| Company | Comment |
| Qualcomm | We have a preference to add a new FG, but If this is not aggregable, we can accept the above conclusion.  |
|  |  |
|  |  |
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1. Conclusion

**FL proposal 1:**

* **A new FG 13-1a for “Common DL PRS Processing Capability without MG” is added in the UE features list for Positioning (depending on [101-e-NR-Pos-01])**
	+ **Components are same as component 3 and 4 for FG13-1**
	+ **13-1 is prerequisite feature group for FG13-1a**
	+ **Type of FG13-1a is “Per band”**
	+ **FG13-1a is “Optional with capability signaling”**

**FL proposal 2:**

* **FG 13-7 for “Support of SSB from neighbor cell as QCL source of a DL PRS” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
	+ **13-1 is prerequisite feature group for FG13-7**
	+ **Type of FG13-7 is “Per band”**
* **FG 13-7a for “Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS” is kept in the UE features list for Positioning**
	+ **Component 1 is kept**
	+ **13-1 is prerequisite feature group for FG13-7a**
	+ **Type of FG13-7a is “Per band”**

**FL proposal 3:**

* **Not to combine FG13-9c, FG13-9d, FG13-10, FG13-10a into a single basic FG**
* **FG [13-9d] (OLPC for SRS for positioning based on SSB from serving cell) is removed**
	+ **OLPC for SRS for positioning based on SSB from serving cell is a component of 13-8**
* **FG 13-9e for “PathLoss estimate maintenance” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
	+ **One of {13-9, 13-9a, 13-9b, 13-9c} is prerequisite feature group for FG13-9e**
	+ **Type of FG13-9e is “Per band”**

**FL proposal 4:**

* **FG 13-10f for “Spatial relation maintenance” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
	+ **One of {13-10, 13-10a, 13-10b, 13-10d, 13-10e} is prerequisite feature group for FG13-10f**
	+ **Type of FG13-10f is “Per band”**
* **A new FG 13-10g for “AP-SRS with carrier switching” is added in the UE features list for Positioning (depending on [101-e-NR-Pos-01])**
	+ **13-8 is prerequisite feature group for FG13-10g**
	+ **Type of FG13-10g is “Per band”**
	+ **FG13-10g is “Optional with capability signaling”**

**FL proposal 5:**

* **FG 13-11 for “UE Rx-Tx Measurement Report for Multi-RTT” is kept in the UE features list for Positioning**
	+ **Component 1 and 2 are kept**
		- **Note for component 1 is removed**
	+ **Type of FG13-11 is “Per UE”**
		- **Need of FDD/TDD differentiation is “No”**
		- **Need of FR1/FR2 differentiation is “Yes”**

**FL proposal 6:**

* **FG 13-12 for “NR E-CID DL SSB RRM measurements with LPP support for NR Positioning” is kept in the UE features list for Positioning**
	+ **Component 1 is kept**
	+ **1-1 is prerequisite feature group for FG13-12**
	+ **Type of FG13-12 is “Per UE”**
		- **Need of FDD/TDD differentiation is “No”**
		- **Need of FR1/FR2 differentiation is “Yes”**
* **FG 13-12a for “NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning” is kept in the UE features list for Positioning**
	+ **Component 1 is kept**
	+ **1-4 is prerequisite feature group for FG13-12a**
	+ **Type of FG13-12a is “Per UE”**
		- **Need of FDD/TDD differentiation is “No”**
		- **Need of FR1/FR2 differentiation is “Yes”**

**FL proposal 7:**

* **A UE is not expected to support parallel processing of LTE PRS and NR PRS in Rel-16**

Reference

[1] R1-2003201 Summary on email discussion [100b-e-NR-UEFeatures-Remaining] NR positioning Moderator (NTT DOCOMO, INC.)

[2] R1-2003421 Discussion on UE features for NR positioning vivo

[3] R1-2003477 NR positioning UE features ZTE

[4] R1-2003609 Discussion of UE features for NR positioning CATT

[5] R1-2003693 Views on Rel-16 UE features for NR positioning MediaTek Inc.

[6] R1-2003758 On UE features for NR positioning Intel Corporation

[7] R1-2003899 UE features for NR positioning Samsung

[8] R1-2004060 Discussion on UE features for NR Positioning OPPO

[9] R1-2004139 Discussion on UE features for NR positioning LG Electronics

[10] R1-2004154 Rel-16 UE features for NR positioning Huawei, HiSilicon

[11] R1-2004483 Discussion on NR Positioning UE features Qualcomm Incorporated

[12] R1-2004566 On UE features for NR Positioning Nokia, Nokia Shanghai Bell

[13] R1-2004648 View on UE features for NR positioning Ericsson

Appendix: latest version of UE features list for Positioning [1]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (V2X WI only)”. | **Consequence if the feature is not supported by the UE** | **Type****( 1) Per UE or 2) Per Band or 3) Per BC or 4) Per FS or 5) Per FSPC)** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 13. NR Positioning | 13-1 | Common DL PRS Processing Capability | 1. Maximum DL PRS bandwidth in MHz, which is supported and reported by UE.

a) FR1 bands: {5, 10, 20, 40, 50, 80, 100}b) FR2 bands: {50, 100, 200, 400}1. DL PRS buffering capability: Type 1 or Type 2
2. Type 1 – sub-slot/symbol level buffering
3. Type 2 – slot level buffering
4. Duration of DL PRS symbols N in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE.
5. T: {8, 16, 20, 30, 40, 80, 160, 320, 640, 1280} ms
6. N: {0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50} ms

Notes:* 1. UE reports one combination of (N, T) values per band, where N is a duration of DL PRS symbols in ms processed every T ms for a given maximum bandwidth (B) in MHz supported by UE
	2. UE is not expected to support DL PRS bandwidth that exceeds the reported DL PRS bandwidth value
	3. UE DL PRS processing capability is defined for a single positioning frequency layer. UE capability for simultaneous DL PRS processing across positioning frequency layers is not supported in Rel.16 (i.e. for a UE supporting multiple positioning frequency layers, a UE is expected to process one frequency layer at a time)
	4. UE DL PRS processing capability is agnostic to DL PRS comb factor configuration
	5. The reporting of (N, T) values for maximum BW in MHz is not dependent on SCS
1. Max number of DL PRS resources that UE can process in a slot under it
	1. FR1 bands: {1, 2, 4, [6], 8, 12, 16, [24], 32, [48], 64} for each SCS: 15kHz, 30kHz, 60kHz
	2. FR2 bands: {1, 2, 4, [6], 8, 12, 16, [24], 32, [48], 64} for each SCS: 60kHz, 120kHz

Note: The above parameters are reported assuming a configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) of no more than X% (FFS: X).FFS case w/o measurement gap configured |  | Yes | N/A |  | Per band | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-2 | DL PRS Resources for DL AoD | 1. Max number of DL PRS Resource Sets per TRP per frequency layer supported by UE.

Values = {1, 2}1. Max number of DL PRS Resources per DL PRS Resource Set

Values = {[1], 2, 4, 8, 16, 32, 64}1. Max number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets.

Values = {64, 128, 192, 256, 512, 1024, 2048}1. Max number of TRPs across all positioning frequency layers per UE.

Values = {[3], 6, 12, [16], 24, 32, 64, 128, 256}1. Max number of DL PRS Resources per positioning frequency layer.

Values = {32, 64, 128, 256, 512, 1024}1. [Max number of positioning frequency layers UE supports

Values = {1, 2, 3, 4}] | 13-1 | No | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported.FFS: split of candidate values for FR1/FR2/mixed FR1-FR2 for each component | Optional with capability signaling |
| 13. NR Positioning | 13-3 | DL PRS Resources for DL-TDOA | 1. Max number of DL PRS Resource Sets per TRP per frequency layer.

Values = {1, 2}1. Max number of DL PRS Resources per DL PRS Resource Set.

Values = {1, 2, 4, 8, 16, 32, 64}1. Max number of DL PRS Resources across all frequency layers, TRPs and DL PRS Resource Sets.

Values = {64, 128, 192, 256, 512, 1024, 2048}1. Max number of TRPs across all positioning frequency layers per UE.

Values = {[3,] 6, 12, [16], 24, 32, 64, 128, 256} 1. Max number of DL PRS Resources per positioning frequency layer.

Values = {32, 64, 128, 256, 512, 1024}1. [Max number of positioning frequency layers UE supports

Values = {1, 2, 3, 4}] | 13-1 | No | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported.FFS: split of candidate values for FR1/FR2/mixed FR1-FR2 for each component | Optional with capability signaling |
| 13. NR Positioning | 13-4 | DL PRS Resources for Multi-RTT | 1. Max number of DL PRS Resource Sets per TRP per frequency layer.

Values = {1, 2}1. Max number of DL PRS Resources per DL PRS Resource Set.

Values = {1, 2, 4, 8, 16, 32, 64}1. Max number of DL PRS Resources across all frequency layers, TRPs and DL PRS Resource Sets.

Values = {64, 128, 192, 256, 512, 1024, 2048}1. Max number of TRPs across all positioning frequency layers per UE.

Values = {[3], [6], [12], [16], 24, 32, 64, 128, 256}1. Max number of DL PRS Resources per positioning frequency layer.

Values = {32, 64, 128, 256, 512, 1024}1. [Max number of positioning frequency layers UE supports

Values = {1, 2, 3, 4}] | 13-1 | Yes | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported.FFS: split of candidate values for FR1/FR2/mixed FR1-FR2 for each component | Optional with capability signaling |
| 13. NR Positioning | 13-5 | DL PRS Measurement Report for DL-AoD | 1. Max number of DL PRS RSRP measurements on different PRS resources from the same TRP supported by the UE

Values = {1, 2, 3, 4, 5, 6, 7, 8} | 13-2, | No | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-5a | Inter-frequency measurement for DL-AoD | 1. Support of inter-frequency measurement for DL-AoD
 | 13-2 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signalling{supported, notSupported} |
| 13. NR Positioning | 13-6 | DL PRS RSTD/[RSRP] Measurement Report for DL-TDOA | 1. [DL RSTD measurements per pair of TRPs. Values = {1, 2, 3, 4}]
2. [Support RSRP measurements. Values = {0, 1}]
 | 13-3 | No | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-6a | Inter-frequency measurement for DL-TDOA | 1. Support of inter-frequency measurement for DL-TDOA
 | 13-3 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signalling{supported, notSupported} |
| 13. NR Positioning | [13-7] | [Support of SSB from neighbor cell as QCL source of a DL PRS] | 1. [Support of SSB from neighbor cell as QCL source of a DL PRS]
2. [Support of reuse SSB measurement from RRM for receiving PRS]

Note: Refers to Type-C for FR1 and Type-C & Type-D support for FR2 | 13-1 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-7a] | [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS] | 1. [Support of DL PRS from serving/neighbor cell as QCL source of a DL PRS]

Note: Refers to Type-D support for FR2 | 13-1 | No | N/A |  | [Per band] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-8 | SRS Resources for Positioning | 1. Max number of SRS Resource Sets for positioning supported by UE per BWP.

Values = {1, 2, 4, 8, 12, 16}.1. Max number of P/SP/AP SRS Resources for positioning per BWP.

Values = {1,2,4,8,16,32,64}1. [Max number of P/SP/AP SRS Resources including the SRS resources for positioning per BWP per slot.

Values = {1, 2, 3, 4, 5, 6, 8, 10, 12, 14}]1. [Max number of periodic SRS Resources for positioning supported by UE across all SRS Resource Sets per BWP.

Values = {1, 2, 4, 8, 16, 32, 64}]1. [Max number of periodic SRS Resources for positioning per BWP.

 Values = {1,2,4,8,16,32,64}]1. [Max number of periodic SRS Resources for positioning per BWP per slot.

Values = {1,2,3,4,5,6,8,10,12,14}] |  | Yes | N/A |  | [Per FS] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-8a | Support of Aperiodic SRS Resources for positioning | 1. Max number of aperiodic SRS Resources for positioning per BWP.

Values = {1,2,4,8,16,32,64}1. [Max number of aperiodic SRS Resources for positioning per BWP per slot.

 Values = {1,2,3,4,5,6,8,10,12,14}] | 13-8 | Yes | N/A |  | [Per FS] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-8b | Support of Semi-persistent SRS Resources for positioning | 1. Max number of semi-persistent SRS Resources for positioning supported by UE per BWP.

Values = {1,2,4,8,16,32,64}1. [Max number of semi-persistent SRS Resources for positioning supported by UE per BWP per slot.

Values = {1,2,3,4,5,6,8,10,12,14}] | 13-8 | Yes | N/A |  | [Per FS] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9 | OLPC for SRS for positioning based on PRS from the serving cell | 1. OLPC for SRS for positioning based on PRS from the serving cell
 | [13-1],[One of {13-2, 13-3, 13-4}], and 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9a | OLPC for SRS for positioning based on SSB from neighbouring cells | 1. OLPC for SRS for positioning based on SSB from neighbouring cells
 | 13-8 and [13-9d] | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9b | OLPC for SRS for positioning based on PRS from the neighbouring cells | 1. OLPC for SRS for positioning based on PRS from the neighbouring cells
 | 13-8 and 13-9 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9c | OLPC for SRS for positioning based on CSI-RS from serving cell | 1. OLPC for SRS for positioning based on CSI-RS from serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9d | OLPC for SRS for positioning based on SSB from serving cell | 1. [OLPC for SRS for positioning based on SSB from serving cell]
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-9e | [PathLoss estimate maintenance] | 1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}]1. [Max number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {1,4,8,16}] | One of {13-9, 13-9a,b,c,[d]} | No | N/A |  | [Per band]  | N/A | N/A | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10 | Spatial relation for SRS for positioning based on SSB from the serving cell | 1. Spatial relation for SRS for positioning based on SSB from the serving cell
 | 13-8 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10a | Spatial relation for SRS for positioning based on CSI-RS from the serving cell | 1. Spatial relation for SRS for positioning based on CSI-RS from the serving cell
 | 13-10 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10b | Spatial relation for SRS for positioning based on PRS from the serving cell | 1. Spatial relation for SRS for positioning based on PRS from the serving cell
 | One of {13-2, 13-3, 13-4} and13-8 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10c | Spatial relation for SRS for positioning based on SRS | 1. Spatial relation for SRS for positioning based on SRS
 | 13-8, | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10d | Spatial relation for SRS for positioning based on SSB from the neighbouring cell | 1. Spatial relation for SRS for positioning based on SSB from the neighbouring cell
 | 13-10 | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-10e | Spatial relation for SRS for positioning based on PRS from the neighbouring cell | 1. Spatial relation for SRS for positioning based on PRS from the neighbouring cell
 | 13-10b | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-10f] | [Spatial relation maintenance] | 1. [Component 1: Max Number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}]1. [Component 2: Max Number of maintained spatial relations for all the SRS resource sets for positioning per serving cell in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions.

Values = {0,1,2,4,8,16}] | One of {13-10, 13-10a, b, d, e} | No | N/A |  | [Per band] | N/A | N/A (FR2 only) | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-11a | Inter-frequency measurement for Multi-RTT | 1. Inter-frequency measurement for Multi-RTT
 | 13-4 and 13-8 | Yes | N/A |  | [Per UE] | N/A | [Yes] | N/A | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-11] | [UE Rx-Tx Measurement Report for Multi-RTT] | 1. Max number of UE Rx–Tx time difference measurements corresponding to a single SRS resource/resource set for positioning with each measurement corresponding to a single DL PRS resource/resource set.

[Note: The DL PRS resource/resource sets can be in different positioning frequency layers]1. [Support RSRP measurements. Values = {0, 1}]
 | 13-4 and 13-8 | No | N/A |  | [Per UE] | [N/A] | [Yes] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-12] | [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL SSB RRM measurements with LPP support for NR Positioning]
 |  | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | [13-12a] | [N R E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning] | 1. [NR E-CID DL CSI-RS RRM measurements with LPP support for NR Positioning]
 | 13-12 | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-13 | Simultaneous DL-AoD and DL-TDoA processing | 1. Support of simultaneous processing for DL AoD and DL TDoA measurements

If it is not indicated, a UE is not expected to perform simultaneously the processing for deriving DL AoD and DL TDoA measurements  | 13-2 and 13-3 | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |
| 13. NR Positioning | 13-14 | Simultaneous DL-AoD and Multi-RTT processing | 1. Support of simultaneous processing for DL AoD and Multi-RTT measurements

If it is not indicated, a UE is not expected to perform simultaneously the processing for deriving DL AoD and M-RTT measurements  | 13-2, 13-4 and 13-8 | No | N/A |  | [Per band] | [N/A] | [N/A] | [N/A] | Need for location server to know if the feature is supported. | Optional with capability signaling |