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

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

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

**Title:** **Summary on [101-e-Post-NR-UE-Features-03]**

**Agenda Item:** **7.2.11**

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

1. Introduction

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

[101-e-Post-NR-UE-Features-03]  Email discussion/approval for remaining issues on UE features for Positioning, till 6/10 – Hiroki (DCM)

* How to define details of FG13-11a
* Whether location server should know if the FG13-8/8a/8b is supported or not
1. Discussion on how to define details of FG13-11a

## 2.1 Summary on the discussion in RAN1#101-e [14]

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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 betw aseen 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 13-11a**
	+ **Component 1**
		- **Add a note as follows: [10]**
			* **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**
	+ **Component**
		- **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).: [11]**
	+ **Pre-requisite**
		- **FG 13-4, 13-8: [6]**
	+ **Need for the gNB to know if the feature is supported**
		- **No: [10]**
	+ **Type of ignalling**
		- **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 |

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| [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 ignalling: Per UE
* FG 13-11
	+ Support
	+ Pre-requisite: 13-4 and 13-8
	+ Type of ignalling: 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 |

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| [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:

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| *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 |

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| [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 |

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Based on above, following FL proposals are made.

**FL proposal 10:**

* **Add “The DL PRS resource/resource sets can be in different positioning frequency layers” and “PRS and SRS used for the measurements are in a different band” in component description of FG13-11a**
* **13-4 and 13-8 are prerequisite feature groups for FG13-11a**
* **Type of FG13-11a is “Per UE”**
	+ **Need of FDD/TDD differentiation is “No”**
	+ **Need of FR1/FR2 differentiation is “Yes”**
* **Need for the gNB to know if the feature is supported is “No” for FG13-11a**

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| 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 | 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:

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| Company | Comment |
| Qualcomm | * We think it should be reported “per-band” at least for the purpose of licensed/unlicensed band differentiation and for the IODT purposes. PRS and SRS need to be in bands for which the UE has reported it supports this feature.
* Clarify that for 13-11, “PRS and SRS used for the measurements are in the same band.”
 |
| MTK | We updated our view, as in ED#01, we support FG13-11 covers the case that SRS and DL PRS are on the same band.For FG13-11a, we propose to change the description “PRS and SRS used for the measurements are in a different band” to “ PRS and SRS used for the measurements may in different bands” |
| Moderator (NTT DOCOMO) | Further discussion on type and necessity of “PRS and SRS used for the measurements are in the same band” for 13-11 seems necessary. Other parts for 13-11a are assumed to be acceptable to all. |
| CATT | We share the same view with MTK that for FG13-11a, change the description “PRS and SRS used for the measurements are in a different band” to “ PRS and SRS used for the measurements may in different bands”. |
| Huawei/HiSilicon | Unclear why inter-frequency measurement for DL-AoD and DL-TDOA are per band, while that for Multi-RTT is per UE.Suggest to have per band, and OK to have they can be in different bands. |
| LG | We support per band for the type of this FG. Except of this, we are supportive of FL’s proposal. |

Based on the above feedbacks, following agreements were made.

**Agreements:**

* **FFS: Add “The DL PRS resource/resource sets can be in different positioning frequency layers” and “PRS and SRS used for the measurements are in a different band” in component description of FG13-11a**
* **13-4 and 13-8 are prerequisite feature groups for FG13-11a**
* **FFS: Type of FG13-11a is “Per UE”**
	+ **Need of FDD/TDD differentiation is “No”**
	+ **Need of FR1/FR2 differentiation is “Yes”**
* **Need for the gNB to know if the feature is supported is “No” for FG13-11a**

**Updated FL proposal 10:**

* **Add “The DL PRS resource/resource sets can be in different positioning frequency layers” and “PRS and SRS used for the measurements may be in a different band” in component description of FG13-11a**
* **Type of FG13-11a is “Per band”**

Companies are encouraged to discuss further on FFS points in the above agreements.

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| Company | Comment |
| Huawei/HiSilicon | Support. |
| Nokia/NSB | Support FL proposal |
| MTK | Support FL proposal |
| Qualcomm | Support |
| Moderator (NTT DOCOMO) | Suggest to agree on FL proposal. |
| Huawei/HiSilicon | I heard that RAN4 is not going to define intra-frequency and inter-frequency PRS measurement, so we do not need FG13-11a. |
| MTK | FG13-11a is not need as RAN4 is not going to define intra-frequency and inter-frequency PRS measurement |
| CATT | Support FL’s proposal.  |
| Moderator (NTT DOCOMO) | Need more inputs on whether we should remove FG13-11a or we should modify FG13-11a (if so, how to modify). |
| Qualcomm | we think we need to keep 13-11a, as we sent before. Keep it per band, and just introduce the components:*1.       Support of measurements derived on DL PRS resource/resource sets which are in different positioning frequency layers**2.       Support of  measurements derived on PRS and SRS which may be in a different band* |
| Moderator (NTT DOCOMO) | FL proposal 10 is updated according to above comment. |
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**Updated FL proposal 10:**

* **FG13-11a is updated as below**
* **Type of FG13-11a is “Per band”**

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| 13. NR Positioning | 13-11a | SRS-PRS association for Multi-RTT | 1.      Support of measurements derived **on one or more** DL PRS resource/resource set(s) which **may be** in different positioning frequency layers for SRS transmitted in a single CC. Note: ~~Support of measurements derived on~~ PRS and SRS ~~which~~ may be in a different band  | 13-4 and 13-8 |

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| Company | Comment |
| Huawei/HiSilicon 0604 | I am a bit confused at the new proposed components.For component 1, I thought the intention was single SRS can used to associate DL PRS from multiple positioning frequency layers. Otherwise, we do not need component 1, since number of PRS positioning frequency layer for multi-RTT positioning is already covered by FG13-4. Suggest the following change for clarification.For component 2, I would rather put that in the note than saying that UE support such a measurement that PRS and SRS may be in different bands.Also the comment from Alex in ED#1

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| With regards to the association of PRS/SRS on different bands, we think the spec supports it. It is not up to UE implementation. What we said in the all ED is that there is no additional signaling, but this does not mean that it is up to UE implementation. A UE can still be configured with PRS in one band and SRS in another band, there is nothing that excludes that, and there is no ambiguity in this case. So, we cannot agree removing the inter-frequency RTT without explicitly covering this aspect.  |

When I say it is up to implementation is that if we have two SRS bands and multiple PRS bands, how to pair them is up to UE implementation, and UE may select the pair that is not desired by the network without notifying LMF at all; howevere if we only have single SRS bands, there is only one way of pairing for sure. What confuses me is that which alternative should be adopted?* Alt.1 UE is allowed to only report the PRS layer(s) that is in the same band as SRS and ignore the PRS layers that is not in the same band as SRS
* Alt.2 UE shall report all PRS layers within its measurement capability that is detected, associated with the single SRS band

If it is not clarified, we suggest the following wording, i.e. Alt.1. Note that the new FG name has not been decided yet.

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| 13. NR Positioning | 13-11a | SRS-PRS association for Multi-RTT | 1. Support of measurements derived on DL PRS resource/resource sets which are in different positioning frequency layers for SRS transmitted in a single CC.

Note: ~~Support of measurements derived on~~ PRS and SRS ~~which~~ may be in a different band  | 13-4 and 13-8 |

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**Agreements**

* **Change FG13-11a as below**
	+ **FFS: Type**

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| --- | --- | --- | --- | --- |
| 13. NR Positioning | 13-11a | SRS-PRS association for Multi-RTT | 1. Support of measurements derived on one or more DL PRS resource/resource sets which may be in different positioning frequency layers for SRS transmitted in a single CC.

Note: ~~Support of measurements derived on~~ PRS and SRS ~~which~~ may be in a different band  | 13-4 and 13-8 |

**Updated FL proposal 10:**

* **Type of FG13-11a is “Per band”**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Per UE.If it goes with per band, it will be complicated to explain the applicability of PRS and SRS in different bands in the note. |
| MTK | Agree with HW.  |
| CATT | We slightly prefer this FG should be per UE, in order to reduce the complexity. |
| LG | Support the updated FL proposal. |

## 2.2 Discussion in email discussion after RAN1#101-e

Based on the discussion on the type of FG13-11a in [101-e-NR-UEFeatures-Positioning-02], the following proposal is made based on suggested compromise in the discussion.

### **Proposal 1:**

* **The reporting type of FG13-11a is “Per UE”**
	+ **Need for FR1/FR2 differentiation is “Yes”**

Companies are encouraged to check above proposal and to provide feedback if any in below. If you cannot accept the proposal, 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 |
| CATT | We slightly prefer this FG should be per UE, in order to reduce the complexity of indication, as the bands for DL-PRS and SRS-Pos may be different.In addition, we suggest to change the name of Component 13-11a from “SRS-PRS association for Multi-RTT” to “Association between SRS for positioning and DL PRS for Multi-RTT”, in order to avoid any ambiguity. |
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1. Discussion on whether location server should know if the FG13-8/8a/8b is supported or not

## 3.1 Summary on the discussion in RAN1#101-e [14]

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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 | 13-8 | 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 |

* **FG 13-8**
	+ **Components**
		- **Component 3**
			* **Remove the component 3: [4]**
			* **Remove the bracket: [7], [11]**
			* **Remove the value 1: [9]**
		- **Component 4**
			* **Remove the component 4: [4], [5] (remove either component 4 or 5), [7]**
		- **Component 5**
			* **Remove the bracket: [4], [11]**
			* **Remove the component 5: [3], [5] (remove either component 4 or 5), [6]**
		- **Component 6**
			* **Remove the component 6: [4]**
			* **Remove the bracket: [11]**
		- **Confirm values for all components: [6]**
	+ **Pre-requisite**
		- **N/A: [6], [12]**
	+ **Type of signaling**
		- **Per FS: [4], [6], [11], [12]**
* **FG 13-8a**
	+ **Components**
		- **Component 2**
			* **Remove the component 2: [4]**
			* **Remove the bracket: [7], [11]**
		- **Confirm values for all components: [6]**
	+ **Pre-requisite**
		- **FG 13-8: [6], [12]**
	+ **Type of signaling**
		- **Per FS: [4], [6], [11], [12]**
* **FG 13-8b**
	+ **Components**
		- **Component 2**
			* **Remove the component 2: [4]**
			* **Remove the bracket: [7], [11]**
		- **Confirm values for all components: [6]**
	+ **Pre-requisite**
		- **FG 13-8: [6], [12]**
	+ **Type of signaling**
		- **Per FS: [4], [6], [11], [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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| [3] | * FG 13-8
	+ Remove component 5 which is same with component 4.

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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 | 13-8 | 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 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 |

 |
| [4] | * FG 13-8
	+ Per FS
	+ Support to add Component 5, and remove Component 3, 4 and 6.
* FG 13-8a, 13-8b
	+ Per FS
	+ Support to remove Component 2.
 |
| [5] | **Proposal 6**: FG 13-8, component 4 is the same as component 5, suggest to remove one of them |
| [6] | * FG 13-8
	+ Pre-requisite: NA
	+ Type of signaling: Per FS
	+ Remove component#5 which is a duplication of component #4:
		- RSRP support
		- RSTD measurement per DL PRS Resource Set
	+ Confirm all values for all components in FG 13-8.
* FG 13-8a, 13-8b
	+ Pre-requisite: 13-8
	+ Type of signaling: Per FS
	+ Confirm all values for all components in FGs 13-8a/8b.
 |
| [7] | * FG 13-8
	+ Component 4 and component 5 are same. Suggest to remove Component 4.
	+ Component 3: support it and the [] shall be removed.
* FG 13-8a, 13-8b
	+ Support it and the [] shall be removed.
 |
| [9] | * FG 13-8
	+ For component 3, we do not think that 1 is necessary. In our understanding, this component means the maximum number of SRS resources considering both of SRS for MIMO and SRS for positioning, so we think the minimum value might be 2 among the possible values.
	+ For component 4/5/6, we think that the captured values on maximum number of SRS resources are enough so we do not support additional values. For the captured values, we are fine.
 |
| [10] | * For FG13-8
	+ Component 3: This is related to a Rel-15 capability counting only MIMO SRS. We would like to make sure that the value reported should be no lower than the value for periodic MIMO SRS in a slot.
	+ Component 5: It seems to be the same as Component 4.
 |
| [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 | 13-8 | 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 |

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| [12] |

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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 | 13-8 | 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 |

 |

Based on above, following FL proposals are made.

**Updated FL proposal 7:**

* **The component 3, 5 and 6 of FG13-8 are kept, and the component 4 of FG13-8 is removed**
* **The component 2 of FG13-8a is kept**
* **The component 2 of FG13-8b is kept**
* **Type of FG13-8/8a/8b is “Per FS”**
* **Note is [removed or kept]**

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| 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 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 |

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 | No need for the location server to know. Propose to remove the contents in the “Note” column. |
| Qualcomm | Location server should know.  |
| Huawei/HiSilicon | UE CA capability has nothing to do with UE CA configuration. For example, UE may report supporting number of SRS resources per band in a band combination, and there could be a lot of band combanations, but LMF has no idea what band combination is configured to the UE. There is nothing LMF can do with such a complicated UE capability reporting, majority of which are radio aspects.We are also worried on over-exposure of UE radio capability to core network as core network already has UE permanent ID. |
| MTK | Is there any information signalling from location server to gNB related to this FG? If no, then location server doesn’t need to know. |
| Nokia, NSB | It is not clear why the FGs would need to be “per FS”. Further clarification is needed. |
| Moderator (NTT DOCOMO) | Further discussion on the need for LMF to know seems necessary. Although there is a comment that why this FG should be Per FS, it seems all other companies are ok with Per FS according to contributions (and no other inputs for type).Therefore, suggestion is to agree on FL proposal (Per FS).I assume other parts of the proposal are acceptable to all. |
| CATT | We prefer to let location server to know. In our point of view, if the FG of max number of SRS Resource Sets for positioning supported by UE per BWP is known by LMF, more information will be benefit for LMF. In addition, we would like to ask what are the disadvantages of supporting LMF to know this information. Huawei comments to worry on over-exposure of UE radio capability to core network as core network already has UE permanent ID, but this information is known by core network, not base stations, we cannot understand why it is a problem indicated by Huawei in the above comments.PS: We are discussing “max number of SRS Resource Sets” in this FG, we cannot understand why Huawei mention **UE CA capability** in above comments. |
| Huawei/HiSilicon | Support Moderator’s suggestion.Reply to Nokia/Moderator* + - 1. Regarding why it is per FS, it is because similar capability was reported per FS (in FeatureSetUplink) in Rel-15.
			2. This per FS reporting allows UE to report how to allocate the processing units on each band for a CA band combination across all supported CA band combinations. This could happen if no SRS processing units are allocated for a band x in a band combination A, while some SRS processing units are allocated for the band x in another band combination B

Reply to CATT:* + - 1. Note that this is reported per FS, which is equivalent to per band per band combination. In summary, UE will report all its supported CA band combinations, and in each CA band combinations, UE will report the FG on each band. Note that this capability on a certain band may be different depending on which band combination this band is in. For example, capability in band A will be different for band combination A+B and for band combination A+B+C, simply because UE does not have so many Tx and does not have so much processing resource.
			2. Having permanence ID is different from having permanent ID plus its radio capability: ID is associated with SIM, capability is associated with the chipset/cellphone.
			3. Having the CA capability does not mean LMF will know the current CA configuration. E.g, UE reports it supports the following CA band combniations, and the capability on each band for each CA band combination
				* Band A
				* Band A+B
				* Band A+B+C

Knowing that does not means that LMF would know that currently UE is configured with inter-band CA with Band A+B, nor does it mean that LMF would know any intra-band CA configuration within Band A.* + - 1. Even if the LMF is so powerful to know the CA configuration, current RAN3 signaling provides little assistance from LMF to recommend SRS configuration at gNB, after I check the latest RAN3 contribution.
 |

Based on the above feedbacks, following agreements were made.

**Agreements:**

* **The component 3, 5 and 6 of FG13-8 are kept, and the component 4 of FG13-8 is removed**
* **The component 2 of FG13-8a is kept**
* **The component 2 of FG13-8b is kept**
* **FFS: Type of FG13-8/8a/8b is “Per FS”**
* **FFS: Note is [removed or kept]**

**Updated FL proposal 7:**

* **Type of FG13-8/8a/8b is “Per FS”**
	+ **FFS: necessary note for reason why per FS**
* **Note for FG13-8/8a/8b is removed**

Companies are encouraged to discuss further on FFS points in the above agreements.

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Support. |
| Nokia/NSB | Support FL proposal, just noting that RAN2 expects RAN1 to explain the choice for “Per FS”.  |
| MTK | Support FL proposal |
| **Qualcomm** | **~~Per band~~ (Wrong). This is per FS, agre with the reply from HW** |
| Moderator (NTT DOCOMO) | Suggest to agree on FL proposal with some necessary note for reason why per FS. |
| Huawei/HiSilicon | To QC, why it is per band?The reason why it is per FS can be found in our reply ealier, copied below.* + - 1. Regarding why it is per FS, it is because similar capability was reported per FS (in FeatureSetUplink) in Rel-15.
			2. This per FS reporting allows UE to report how to allocate the processing units on each band for a CA band combination across all supported CA band combinations. This could happen if no SRS processing units are allocated for a band x in a band combination A, while some SRS processing units are allocated for the band x in another band combination B
 |
| CATT | Support FL’s proposal. |
|  |  |

**Agreements:**

* **Type of FG13-8/8a/8b is “Per FS”**
	+ **Add a note “Per FS is selected because similar capability was reported per FS (in FeatureSetUplink) in Rel-15”**
* **Note for FG13-8/8a/8b is removed**

**Updated FL proposal 7:**

* **Add a note “Need for location server to know if the feature is supported (FFS for RAN2)” for FG13-8**

|  |  |
| --- | --- |
| Company | Comment |
| Huawei/HiSilicon | Our first preference is that we should not open an issue that is closed.Our second preference would be single capability bit per FG, reported per UE.We do not think it is meaningful to report this FG per FS to LMF, simply because LMF does not know the CA configuration of the UE. |
| MTK | Agree with HW |
| CATT | We support FL proposal7 to add the note. |
| LG | Support FL proposal. |

## 3.2 Discussion in email discussion after RAN1#101-e

Based on the discussion in [101-e-NR-UEFeatures-Positioning-02], the following proposal is made.

### **Proposal 2:**

* **Add a note “Need for location server to know if the feature is supported (FFS for RAN2)” for FG13-8**

Companies are encouraged to check above proposal and to provide feedback if any in below. If you cannot accept the proposal, 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 | We can only accept a different reporting granularity than per FS (in RRC).If we go with per FS, our understanding is that* UE will report all supported band combinations
* Under each BC, UE will report the FGs on each band.

There is no useful information that LMF can utilize through this kind of reporting, which is why we cannot accept it even leave FFS for RAN2.We can accept that a single capability bit per FG, reported per UE or per band as a compromise. This is not something that RAN2 can decide. |
|  |  |
|  |  |
|  |  |

1. Conclusion

TBD

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

[14] R1-2004822 Summary on [101-e-NR-UEFeatures-Positioning-02] Moderator (NTT DOCOMO, INC.)