3GPP TSG-RAN WG4 Meeting # 109 R4-23xxxxx

Chicago, US, November 13 – 17, 2023

**Agenda item:** 10

**Source:** Moderator (CMCC)

**Title:** Topic summary for [109][150] NR\_LTE\_Rel-18\_feature\_list

**Document for:** Information

# Introduction

This summary focuses on the Rel-18 UE feature list for LTE and NR including agenda 10. Companies contributions are listed as below.

|  |  |  |  |
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| **TDoc** | **Title** | **Source** | **Related UE feature** |
| [**R4-2318344**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318344.zip) | Discussion on Rel-18 feature list | CATT | 32. NR\_MG\_enh2  40. NR\_NTN\_enh  42. Netw\_Energy\_NR |
| [**R4-2318465**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318465.zip) | Discussion on Rel-18 feature list | Huawei, HiSilicon | 27. NR\_ENDC\_RF\_FR1\_enh2  28. NR\_channel\_raster\_enh  29. NR\_RF\_FR2\_req\_Ph3  32. NR\_MG\_enh2  33.NonCol\_intraB\_ENDC\_NR\_CA  34.NR\_HST\_FR2\_enh  37.NR\_pos\_enh2  38.NR\_MC\_enh  40.NR\_NTN\_enh  41.NR\_cov\_enh2  42.Netw\_Energy\_NR  44.4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC  45.NR\_SL\_enh2 |
| [**R4-2318487**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318487.zip) | Rel-18 RAN4 UE feature list for NR\_MC\_enh | NTT DOCOMO INC. | 38. NR\_MC\_enh |
| [**R4-2318488**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318488.zip) | Proposals on Rel-18 feature list | Nokia, Nokia Shanghai Bell | 29. NR\_RF\_FR2\_req\_Ph3 |
| [**R4-2318498**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318498.zip) | Rel-18 RAN4 UE feature list for NR | MediaTek inc. | 27. NR\_ENDC\_RF\_FR1\_enh2  30. NR\_FR2\_multiRX\_DL  31. NR\_RRM\_enh3  32. NR\_MG\_enh2  33. NonCol\_intraB\_ENDC\_NR\_CA  36. NR\_demod\_enh3  38. NR\_MC\_enh  39. NR\_Mob\_enh2  40. NR\_NTN\_enh  42. Netw\_Energy\_NR  43. NR\_DualTxRx\_MUSIM |
| [**R4-2318703**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318703.zip) | On Rel-18 UE feature list | Apple | 27. NR\_ENDC\_RF\_FR1\_enh2  28. NR\_channel\_raster\_enh  29. NR\_RF\_FR2\_req\_Ph3  30. NR\_FR2\_multiRX\_DL  31. NR\_RRM\_enh3  32. NR\_MG\_enh2  33.NonCol\_intraB\_ENDC\_NR\_CA  34. NR\_HST\_FR2\_enh  36. NR\_demod\_enh3  38. NR\_MC\_enh  39. NR\_Mob\_enh2  40.NR\_NTN\_enh  41. NR\_cov\_enh2  42. Netw\_Energy\_NR  XX. R18\_3Tx\_NR\_CA\_ENDC-core |
| [**R4-2318898**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318898.zip) | UE Feature List | Qualcomm Incorporated | 27. NR\_ENDC\_RF\_FR1\_enh2  51. NR\_FR1\_lessthan\_5MHz\_BW |
| [**R4-2318918**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318918.zip) | Rel-18 RAN4 ATG UE feature list for NR | CMCC | 35. NR\_ATG |
| [**R4-2318976**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2318976.zip) | Discussions on Rel-18 UE feature list | vivo | 27. NR\_ENDC\_RF\_FR1\_enh2  30. NR\_FR2\_multiRX\_DL  31. NR\_RRM\_enh3  38. NR\_MC\_enh  39. NR\_Mob\_enh2  40. NR\_NTN\_enh  41. NR\_cov\_enh2  42. Netw\_Energy\_NR  43. NR\_DualTxRx\_MUSIM  44.4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC |
| [**R4-2319438**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319438.zip) | Input to the Rel-18 RAN4 UE feature list for NR | Ericsson | 28. NR\_channel\_raster\_enh  33. NonCol\_intraB\_ENDC\_NR\_CA |
| [**R4-2319811**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319811.zip) | Views on RAN4 Rel-18 UE feature list | Intel Corporation | 27. NR\_ENDC\_RF\_FR1\_enh2  28. NR\_channel\_raster\_enh  29. NR\_RF\_FR2\_req\_Ph3  31. NR\_RRM\_enh3  32. NR\_MG\_enh2  33.NonCol\_intraB\_ENDC\_NR\_CA  34.NR\_HST\_FR2\_enh  37.NR\_pos\_enh2  41. NR\_cov\_enh2  42. Netw\_Energy\_NR |
| [**R4-2319912**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319912.zip) | Rel-18 RAN4 UE feature list for 3T4R and eSL | OPPO | 44.4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC  45.NR\_SL\_enh2 |
| [**R4-2320349**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320349.zip) | Initial summary of Rel-18 RAN4 UE feature list for NR | ZTE Corporation | 27. NR\_ENDC\_RF\_FR1\_enh2  28. NR\_channel\_raster\_enh  30. NR\_FR2\_multiRX\_DL  31. NR\_RRM\_enh3  32. NR\_MG\_enh2  33.NonCol\_intraB\_ENDC\_NR\_CA  35. NR\_ATG  38. NR\_MC\_enh  39. NR\_Mob\_enh2  41. NR\_cov\_enh2  44.4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC |

# Topic #1: General

## Companies’ contributions summary

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| --- | --- | --- |
| T-doc number | Title | Company |
| [R4-2319811](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319811.zip) | Views on RAN4 Rel-18 UE feature list | Intel Corporation |

## Open issues summary

**Issue 1-1: Schedule of RAN4 Rel-18 UE feature list**

Proposal #1: Provide inputs to RAN2 on RAN4 Rel-18 UE feature list in accordance with the following schedule:

o Initial inputs in RAN4 #109 (Nov 2023)

o Updated/Refined inputs in RAN4 #110 (Feb 2024)

o Updated/Refined inputs in RAN4 #110bis (Apr 2024)

o Final feature list in RAN4 #111 (May 2024)

Send intermediate LS to RAN2 during the RAN4 WG meeting weeks (e.g., initial version on Tuesday and final versions on Friday) starting from February RAN4 #110 meeting.

**Recommended WF:**

Regarding the timeline of feature list discussion, RAN2 and RAN4 chair already provide guidance, no discussion is needed.

**Issue 1-2: General principles of UE feature llist**

o All RAN4 features shall be captured in the Rel-18 UE feature list and communicated to RAN2 in a LS in a consolidated manner.

o RAN4 feature list shall include/summarize 1) all previously agreed UE features/capabilities, which were already decided and potentially communicated to RAN2 in individual LSs; 2) newly agreed UE features.

o Starting from RAN4 #109 meeting, RAN4 should not send RAN2 separate LSs requesting to introduce new capabilities for individual Rel-18 WIs or features.

o The feature list implementation in RAN2 is expected to be based on the consolidated RAN4 UE feature list and shall not be based on previously communicated LS on separate features (to avoid potential mismatches).

o Any overlap between RAN4 and RAN1 corresponding features shall be avoided, and proponents are recommended to check each of their proposed feature to avoid any overlapping.

o Like in Rel-17 it is recommended that initial discussion/agreements on the individual features are made under individual work items in the respective sessions (main, RRM, BDaT), and afterwards the respective features will be combined in the joint RAN4 feature list in the dedicated UE feature list thread by the moderator.

**Recommended WF:**

From moderator’s perspective, some of the principles are already followed.

**Issue 1-3: Contents of UE feature list**

**Proposal #3: Endorse that the below reference rules for work item RAN4 UE feature list drafting**

* + **The feature list shall include the full set of information for each individual features:**

**1) Feature group**

**2) Components**

**3) Prerequisite feature groups**

**4) Need for the gNB to know if the feature is supported**

**5) Applicable to the capability signalling exchange between UEs (V2X WI only)**

**6) Consequence if the feature is not supported by the UE**

**7) Type**

**8) Need of FDD/TDD differentiation**

**9) Need of FR1/FR2 differentiation**

**10) Capability interpretation for mixture of FDD/TDD and/or FR1/FR2**

**11) Notes (optional)**

**12) Mandatory/Optional**

* + **For the ‘type’ column** 
    - **The values should be based on the granularity of** 
      * **1) Per UE**
      * **2) Per Band**
      * **3) Per BC**
      * **4) Per FS**
      * **5) Per FSPC**
    - **Avoid declaring the feature as Per Band Per Band Combination and use “Per FS” granularity instead.**
    - **Avoid declaring the feature as Per CC Per Band Per Band Combination and use “Per FSPC” granularity instead.**
  + **For the ‘Mandatory/Optional’ column the following values are possible:** 
    - ***“Optional with capability signalling”***
    - ***“Optional without capability signalling”***
    - ***“Mandatory with capability signalling”***
    - ***“Mandatory without capability signalling”***
  + **Values of each enumerated feature/component should not appear in 'component' column, however the values should be provided in the 'note' column.**
  + **Undecided features/part of description shall be clearly indicated (e.g., in marked yellow, [] or via FFS/TBD), so that RAN2 know this and can make the decision whether the feature is stable enough to be implemented. Based on previously adopted principles in Rel-17 RAN2 did not implement the feature groups with any FFS (highlighted yellow, [] and marked as FFS/TBD) into the CRs. Also, the capabilities that are dependent on FFS capabilities were not implemented. Same principles are planned to be adopted for Rel-18.**

**Recommended WF:**

**From moderator perspective, the proposed contents and rule are already captured in the template of UE feature list. Companies please take the above into account when proposing FGs.**

1. NR\_ENDC\_RF\_FR1\_enh2

## 27-1 TxD for 4Tx

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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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** |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-1 | Support TxD for 4Tx (Huawei) | Support per FS TxD capability for 4Tx from Rel-18 |  | Yes | N/A | No capability is available to indicate Tx diversity for 4Tx | Per FS | N/A | Applicable to FR1 only | N/A | see LS in R4-2317617 | Optional with capability signalling |
|  |  | TxDiversity for 4Tx (ZTE) | Indicates UE supports Tx diversity for 4Tx in the band configured from Rel-18. | [44-1] | Yes | no | UE doesn’t support Tx diversity for 4Tx due to R16 IE *txDiversity-r16* can not be applied | per band per BC | No need | FR1 only | N/A | Detailed information can refer to the LS to RAN2 in  R4-2317617 | Optional |
|  |  | TxD capability (vivo) | TxD support capability for 4Tx |  | YES | NO | 4Tx TxD can not be supported and verified | TBD | No | FR1 only |  |  | Optional with capability signalling |
|  |  | Support of 4Tx Transparent Tx Diversity  (Intel) | 1. Support of 4Tx Transparent Tx Diversity as specified in TS 38.101-1 | No | Yes | N/A | UE does not support 4Tx Transparent Tx Diversity | Per FS | No | FR1 only | N/A | Component 1: true/false | Optional with capability signalling |

**Recommended WF:**

4 companies propose FG of TXD capability for 4Tx, there is no big difference among the proposals. Detailed information can refer to the LS to RAN2 in R4-2317617. It is recommended to capture following feature group in RAN4 UE feature list.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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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** |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-1 | TxDiversity for 4Tx | Indicates UE supports Tx diversity for 4Tx. |  | Yes | N/A | 4Tx TxD cannot be supported and verified | Per FS | No | FR1 only | N/A |  | Optional with capability signalling |

## 27-2 low MSD

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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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** |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-2 | LowerMSD for inter-band NR CA and EN-DC  **(Huawei)** | Capability to indicate better MSD performance than the specified minimum requirements. The essential information of this capability includes:  - victim band and aggressor band(s) of the band combination  - MSD type  - Lower-MSD capability class  - power class |  | Yes |  | The UE shall comply with the minimum requirements for MSD. | Per BC  Note: This does not prevent the capability is reported in a “per victim band” way as described in RAN2 LS R2-2311586. | No | Applicable to FR1 only | Support mixture of FDD/TDD | Detailed information can refer to the LS to RAN2 in R4-2312247, R4-2310276, R4-2306594 and R4-2315238. | Optional with capability signalling |
|  |  | MSD improvement for band combination  **(ZTE)** | Indicates UE report the low MSD capability for any MSD mechanism and order for a given band combination |  | Yes | no | UE doesn’t support MSD improvement for a certain band combination | Per victim band Per MSD type per BC | No need | FR1 only | Support mixture of FDD/TDD | The following MSD types/orders are agreed to be reported:  ▪Harmonic, harmonic mixing, crossband isolation, IMD with order=2/3/4/5  ▪‘ALL’: all above mentioned MSD types/orders could meet the reported  3-bit signalling is used for reporting thresholds. The MSD thresholds requirements are defined in subclause 7.3A.7 in TS38.101-1.  Detailed information can refer to the LS to RAN2 in R4-2310276 and R4-2312247. | Optional |
|  |  | Lower MSD for inter-band CA/EN-DC/DC combinations **(Apple)** | Indicates that UE is capable of supporting lower MSD than specified. The following components will be specified:   * MSD type: H2, H3, H4, H5, HR2, HR3, HR4, HR5, cross-band, IMD2, IMD3, IMD4, IMD5, Number of bits needed: 4 bits? * MSD threshold: (number of bits needed: 3 bits)   Aggressor bands and victim bands (not sure if needed to be included in the feature list) | N/A | Yes | N/A | UE cannot support lower MSD capability | Per BC | No | FR1 only | N/A |  | Optional with capability signalling |
|  |  | Support of Lower MSD capability for inter-band CA/EN-DC/DC combinations (**Intel)** | 1. Support of lower MSD capability UE reporting mechanism and respective RF requirements as specified in TBA | No | Yes | N/A | UE does not support of reporting and requirements for lower MSD | [Per BC] | No | FR1 only | N/A | Component 1: true/false  The lower MSD capability reporting is in accordance with LSs  R4-2306594,  R4-2310276,  R4-2315238 | Optional with capability signalling |
|  | 27-y | Network query filter  **(MediaTek)** | UE supports network query filter such as band(s), MSD types, power class, frequency range, minimum lower-MSD class, top-K largest MSD class and etc for low MSD reporting | 27-x [lower-MSD capability] | Yes | No | Network cannot apply the query filter | per BC | No | FR1 only | N.A |  | Optional with UE capability |

**Recommended WF:**

4 companies propose lower MSD feature group, there is no big difference among the proposals. Detailed information can refer to the LS to RAN2 in R4-2312247, R4-2310276, R4-2306594 and R4-2315238.

It is recommended to capture following feature group in RAN4 UE feature list.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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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** |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-2 | LowerMSD for inter-band NR CA and EN-DC | Capability to indicate better MSD performance than the specified minimum requirements. The essential information of this capability includes:  - victim band and aggressor band(s) of the band combination  - MSD type  -Lower-MSD capability class  - power class |  | Yes |  | The UE shall comply with the minimum requirements for MSD. | Per BC | No | FR1 only | Support mixture of FDD/TDD | The capability is reported in a “per victim band” way as described in RAN2 LS R2-2311586. | Optional with capability signalling |

1 company propose a new FG to support network query filter for lower MSD. More discussion is needed on whether to introduce this 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**  **(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** |
|  | 27-y | Network query filter  **(MediaTek)** | UE supports network query filter such as band(s), MSD types, power class, frequency range, minimum lower-MSD class, top-K largest MSD class and etc for low MSD reporting | 27-x [lower-MSD capability] | Yes | No | Network cannot apply the query filter | per BC | No | FR1 only | N/A |  | Optional with UE capability |

## 27-x Other FGs: SRS intertion loss

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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** |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-3 | [Static Antenna switching SRS Insertion Loss Imbalance Reporting] (Huawei) | Capability to indicate the absolute value of reported actual IL imbalance of each SRS resource other than the first one within the SRS resource set configured for antenna switching usage.   * The reported values shall not exceed the ΔTRxSRS requirements that defined in TS 38.101-1 for each AS-SRS capability accordingly.   If the UE support this capability, it should also support 27-5. | 2-55 or 23-8-3 | Yes |  |  | Per BC | N/A | N/A | N/A | Static reporting means that the UE will not change the indicated actual IL imbalance once it has reported that for configured SRS resource set with antenna switching usage. | Optional with capability signalling |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-4 | [Dynamic Antenna switching SRS Insertion Loss Imbalance Reporting]  (Huawei) | Capability to indicate support of dynamic report of the absolute value of actual IL imbalance of each SRS resource other than the first one within the SRS resource set configured for antenna switching usage.  If the UE support this capability, it should also support 27-5. | 2-55 or 23-8-3 | Yes |  |  | Per BC | N/A | N/A | N/A | The reported values shall not exceed the ΔTRxSRS requirements that defined in TS 38.101-1 for each AS-SRS capability accordingly.  Dynamic reporting means that the UE may trigger a reporting once it finds out the actual IL imbalance would be different from previous reporting. | Optional with capability signalling |
|  |  | 8Rx SRS insertion loss (Qualcomm) | 1. Static IL indication 2. Dynamic IL indication | 8L MIMO support | Yes |  | Network will not be aware of the power difference when SRS is transmitted from different ports | Per band | No | FR1 only | N/A |  | Optional |
| 27.NR\_ENDC\_RF\_FR1\_enh2 | 27-5 | [Tx power threshold] (Huawei) | Capability to indicate the threshold. When the transmission power (as defined in TS 38.213 clause 7.3) is larger than the threshold, the UE shall maintain the reported values by following [Static Antenna switching SRS Insertion Loss Imbalance Reporting] or [Dynamic Antenna switching SRS Insertion Loss Imbalance Reporting] corresponding to each SRS resource other than the first one for each configured SRS resource set.  The candidate value of the threshold can be one from the set {P0, P0-1, P0-2,…, P0-8}dBm, where P0 = min(PEMAX,c, PPowerClass) | (2-55 or 23-8-3) and (27-3 or 27-4) | Yes |  |  | Per BC | N/A | N/A | N/A |  | Optional with capability signalling |

**Recommended WF:**

More technical discusison is required.

1. NR\_channel\_raster\_enh

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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** |
| 28.NR\_channel\_raster\_enh | 28-1 | Enhanced channel raster (Ericsson) | The UE supports the radio requirements for UE channel bandwidths located on the enhanced channel raster of a band as specified in TS 38.101-1 and in TS 38.101-5. | N/A | Yes |  | N/A (not defined) | Per Band | No | FR1 only | The feature is supported for applicable bands in FDD-TDD and FR1/FR2 combinations | Applies only for bands with a 100 kHz channel raster for both TN and NTN. | Mandatory for  1) RedCap UEs from Rel-17 in supported bands.  2) In bands as specified in 38.101-1 and 38.101-5 (based on operator requests) |
|  |  | 100 KHz channel raster (Huawei) | Capability to indicate support of the enhanced channel raster, i.e. 10 KHz channel raster (Huawei) |  | yes |  | 100 KHz channel raster shall be applied | Per Band | N/A | Applicable to FR1 only | N/A | The capability should be indicated per band and be applicable for all TN and NTN FR1 bands below 3GHz with a 100 kHz channel raster. (R4-2317773) | Optional with capability signalling |
|  |  | Enhanced channel raster (Intel) | 1. Support of enhanced channel raster for NR FR1 bands below 3GHz | No | Yes | N/A | UE does not support enhanced channel raster | Per Band | No | FR1 only | N/A | 1. The feature is applicable for all TN and NTN FR1 bands below 3GHz with a 100 kHz channel raster.  2. The feature is not applicable for bands within FR2-1/FR2-2.  3. The capability shall be considered for early implementation from Rel-16. Changes to the RAN4 specifications will be introduced from Rel-18. | Mandatory with capability signalling from Rel-18  Optional with capability signalling for Rel-16/17 |
|  |  | UE support of 10 kHz channel raster (ZTE) | Capability of supporting 10 kHz channel raster | Support of 100 kHz channel raster | Yes | No | UE channel bandwidth with an odd/even PRBs can not be located within a wider BS channel bandwidth with an even/odd PRBs if the center of both channel bandwidth is on 100 kHz channel raster. | Per Band | No | Applicable to FR1 bands below 3GHz only | N/A | Detailed information can refer to draft LS to RAN2 in R4-2317773. | UE support of 10 kHz channel raster |
|  |  | Enhanced channel raster (Apple) |  | N/A | Yes | N/A | UE cannot channel rasters with a step less than 100kHz | [Per Band] | No | FR1 only | N/A |  | [Optional with capability signalling] |

**Recommended WF:**

5 companies propose FG of enhanced channel raster. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 UE5** | **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** |
| 28.NR\_channel\_raster\_enh | 28-1 | Enhanced channel raster | The UE supports the radio requirements for UE channel bandwidths located on the enhanced channel raster of a band as specified in TS 38.101-1 and in TS 38.101-5. | N/A | Yes |  | [N/A (not defined)] | Per Band | No | FR1 only | The feature is supported for applicable bands in FDD-TDD and FR1/FR2 combinations | Applies only for bands with a 100 kHz channel raster for both TN and NTN. | [Mandatory for  1) RedCap UEs from Rel-17 in supported bands.  2) In bands as specified in 38.101-1 and 38.101-5 (based on operator requests)] |

1. NR\_RF\_FR2\_req\_Ph3

## 29-x Beam correspondence in RRC\_IDLE and RRC\_INACTIVE

Proposal 1 (Nokia): There is no need to include Beam correspondence requirements for RRC\_INACTIVE and initial access in Rel-18 feature list.

Proposal 2 (Huawei, Intel, Apple): Introduce FG of beam correspondence in RRC\_IDLE and RRC\_INACTIVE in Rel-18 feature list as mandatory without capability signaling.

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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** |
| 29. NR\_RF\_FR2\_req\_Ph3 | 29-1 | Beam correspondence in RRC\_IDLE and RRC\_INACTIVE  (Huawei) | Support of beam correspondence requirement specified in TS 38.101-2 section 6.6.4 for RRC\_IDLE and RRC\_INACTIVE. The requirement applies to Power Class 3 in this release. | N/A | N/A | N/A | The UE’s beam correspondence performance in RRC\_IDLE and RRC\_INACTIVE is unspecified. | Per UE | N/A | FR2 only | N/A |  | Mandatory without capability signalling |
|  |  | Beam correspondence for RRC\_INACTIVE and initial access  (Intel) | 1. Support of beam correspondence for RRC\_INACTIVE and initial access defined in TS 38.101-2 Clause TBA |  | No | N/A | UE may not satisfy the beam correspondence requirements for RRC\_INACTIVE and initial access | N/A | N/A | FR2 only | N/A |  | Mandatory without capability signalling |
|  |  | Beam correspondence in IA for PC3 UEs  (Apple) | R18 onward UE shall support beam correspondence in initial access and satisfy the corresponding spherical coverage requirement for IA as specified in 38.101-2 | 8-2 | No |  | UE performance in IA in FR2 cannot be guaranteed | Per UE | N/A | FR2 only |  |  | Mandatory without capability signaling |

**Recommended WF:**

From moderator perspective, since no new UE capability for BC is introduced, it is OK to not capture it as a FG in UE feature list.

## 29-x UL 256QAM

Proposal 1 (Nokia): There is no need to include UL 256QAM in Rel-18 feature list.

**Recommended WF:**

Do not introduce UL 256QAM for FR2 in Rel-18 UE feature list.

1. NR\_FR2\_multiRX\_DL

## 30-1 Simultaneous reception

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 30. NR\_FR2\_multiRX\_DL | 30-1 | Support of requirements for multiRx\_DL (MediaTek) | * Supports simultaneous reception of PDCCH/PDSCH and RS for L1 measurement with different QCL Type-D on overlapping OFDM symbols, and * Supports simultaneous measurement of 2 RS for L1 measurements different QCL Type-D on overlapping OFDM symbol(s), and * Supports requirements for dual TCI state switch in TS38.133   Note: Above 3 bullets belong to one single UE capability | 16-2c | Yes | No | UE does not follow the requirements | [Per band] | TDD only | FR2-1 only |  |  | Optional with capability signalling |
| 30. NR\_FR2\_multiRX\_DL | 30-1 | Simultaneous reception of NR PDCCH/PDSCH and L1 measurement of reference signal or simultaneous L1 measurement of two RSes when the PDCCH/PDSCH and the L1 RS or two L1 RSes overlap in time and have different QCL Type-D (Apple) | 1. Support of simultaneous reception of PDCCH/PDSCH and L1 measurement of reference signal overlapping in time and with different QCL Type-D. 2. Support of simultaneous measurement of two L1 reference signals overlapping in time and with different QCL Type-D. | 16-2c, [2-29a: groupBeamReporting] | Yes | N/A | The UE does not support simultaneous reception/measurement | [Per FSPC] | N/A | FR2 only |  |  | Optional with capability signaling |
| 30. NR\_FR2\_multiRX\_DL | 30-1 | Simultaneous reception of NR PDCCH/PDSCH overlapping with layer 1  RS with different QCL Type-D (vivo) | Supports simultaneous reception of PDCCH/PDSCH with different QCL Type-D layer 1 RS for measurement on overlapping OFDM symbols. | 16-2c | Yes | N/A |  | Per band | N/A | FR2 only |  |  | Optional with capability signalling |
| 30. NR\_FR2\_multiRX\_DL | 30-2 | Simultaneous measurement of layer 1 RS overlapping with another layer 1 RS with different QCL Type-D (vivo) | Supports Simultaneous measurement of layer 1 RS overlapping with another layer 1 RS with different QCL Type-D on overlapping OFDM symbol(s). | 16-2c | Yes | N/A |  | Per band | N/A | FR2 only |  |  | Optional with capability signalling |
| 30. NR\_FR2\_multiRX\_DL | 30-1 | Simultaneous reception of NR PDCCH/PDSCH overlapping with layer 1  RS with different QCL Type-D (ZTE) | Supports simultaneous reception of PDCCH/PDSCH with different QCL Type-D layer 1 RS for measurement on overlapping OFDM symbols. | 16-2c | Yes | N/A |  | Per band | N/A | FR2 only |  |  | Optional with capability signalling |
|  | 30-2 | Simultaneous measurement of layer 1 RS overlapping with another layer 1 RS with different QCL Type-D (ZTE) | Supports Simultaneous measurement of layer 1 RS overlapping with another layer 1 RS with different QCL Type-D on overlapping OFDM symbol(s). | 16-2c | Yes | N/A |  | Per band | N/A | FR2 only |  |  | Optional with capability signalling |

**Recommended WF:**

Different companies propose different sets of FGs. Discuss whether the following combined single FG can be considered as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 30. NR\_FR2\_multiRX\_DL | 30-1 | Support of requirements for multiRx\_DL (MediaTek) | * Supports simultaneous reception of PDCCH/PDSCH and RS for L1 measurement with different QCL Type-D on overlapping OFDM symbols, and * Supports simultaneous measurement of 2 RS for L1 measurements different QCL Type-D on overlapping OFDM symbol(s), and * Supports requirements for dual TCI state switch in TS38.133   Note: Above 3 bullets belong to one single UE capability | 16-2c | Yes | No | UE does not follow the requirements | [Per band] | TDD only | FR2-1 only | N/A |  | Optional with capability signalling |

## 30-2 Fast beam sweeping

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 30. NR\_FR2\_multiRX\_DL | 30-2 | Fast beam sweeping for L1 measurement (MediaTek) | * Supports beam sweeping factor reduction for SSB-based layer 1 measurement. |  | No | N/A | UE’s L1 measurement delay is not reduced | Per band | TDD only | FR2-1 only |  | Candidate values: {2,4,6} | Optional without capability signalling |
| 30. NR\_FR2\_multiRX\_DL | 30-2 | Fast beam sweeping (Apple) | Support of fast beam sweeping (or smaller beam sweeping factor N) for SSB-based or CSI-RS based L1 measurement.  Candidate values for beam sweeping factor: {2,4,6} for FR2-1 |  | Yes | N/A | The UE does not support fast beam sweeping | [Per FSPC] | N/A | FR2 only |  | It’s agreed in RAN4. [R4-2310047] | Optional with capability signaling |
| 30. NR\_FR2\_multiRX\_DL | 30-3 | Fast beam sweeping (vivo) | Supports beam sweeping factor reduction for SSB-based layer 1 measurement. |  | Yes | N/A |  | Per band | N/A | FR2 only |  | Candidate values for Component 2: {2,4,6} for FR2-1 | Optional with capability signalling |
|  | 30-3 | Fast beam sweeping (ZTE) | Supports beam sweeping factor reduction for SSB-based layer 1 measurement. |  | Yes | N/A |  | Per band | N/A | FR2 only |  | Candidate values for Component 2: {2,4,6} for FR2-1 | Optional with capability signalling |

**Recommended WF:**

It seems agreeable to introduce FG of fast beam sweeping. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 30. NR\_FR2\_multiRX\_DL | 30-2 | Fast beam sweeping for L1 measurement | Supports beam sweeping factor reduction for SSB-based layer 1 measurement. |  | TBD | N/A | UE’s L1 measurement delay is not reduced | Per band | N/A | [FR2-1 only] | N/A | Candidate values: {2,4,6} | TBD |

## 30-3 Joint processing

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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** | Need of FDD/TDD differentiation | Need of FR1/FR2 differentiation | Capability interpretation for mixture of FDD/TDD and/or FR1/FR2 | Note | Mandatory/Optional |
| 30. NR\_FR2\_multiRX\_DL | 30-3 | Joint demodulation processing of multiple RX panels (MediaTek) | * Supports joint demodulation processing of multiple RX panels | 16-2c [ and 30-1] | Yes | N/A | In scenarios with cross-talk between RX panels demodulation performance is worse | Per band | TDD only | FR2-1 only |  |  | Optional with capability signalling |
| 30. NR\_FR2\_multiRX\_DL | [30-3] | [Joint Processing of received signal across all RX for single-DCI] (Apple) | [Support of joint processing for single DCI transmission schemes with different QCL Type D.] | 16-2c | No | N/A | UE doesn't support joint processing and cannot meet the demod requirements defined with joint processing | [Per FSPC] | TDD only | FR2 only |  | Pending PDSCH demod requirements | Optional without capability signaling |
| 30. NR\_FR2\_multiRX\_DL | [30-4] | [Joint Processing of received signal across all RX for multi-DCI] (Apple) | [Support of joint processing for multi-DCI fully overlapping transmission with different QCL Type-D.] | 16-2c | No | N/A | UE doesn't support joint processing and cannot meet the demod requirements defined with joint processing | [Per FSPC] | TDD only | FR2 only |  | Pending PDSCH demod requirements | Optional without capability signaling |

**Recommended WF:**

More technical discusison is required.

1. NR\_RRM\_enh3

## 31-1 L3 measurement report for unknown SCell activation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 31. NR\_RRM\_enh3 | 31-1 | Enhanced L3 report after SCell activation command (MediaTek) | Support network triggered L3 measurement report upon SCell activation command. |  | Yes | No | UE cannot support network triggered L3 measurement report upon SCell activation command | Per UE | [No] | [No] | N/A |  | Optional with UE capability |
| 31. NR\_RRM\_enh3 | 31-1 | L3 measurement report for unknown SCell activation (Apple) | Support of reporting valid L3 measurement results for the target being-activated SCell after receiving the SCell activation command |  | Yes | N/A | UE does not support reporting valid L3 measurement results after receiving the SCell activation command | Per UE | No | No | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported. | Optional with capability signaling |
| 31. NR\_RRM\_enh3 | 31-1 | L3 measurement report for unknown SCell activation (vivo) | Support of reporting valid L3 measurement results for the target being-activated SCell after receiving the SCell activation command |  | Yes | N/A | UE does not support reporting valid L3 measurement results after receiving the SCell activation command | Per UE | No | Yes | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported. | Optional with capability signalling |
| 31. NR\_RRM\_enh3 | 31-1 | Enhanced L3 report after SCell activation command (Intel) | 1. Support of enhanced UE L3 report after SCell activation command | No | Yes | NA | UE does not support enhanced L3 report after SCell activation command | Per UE | No | No | NA | Component 1 candidate value: true/false | Optional with capability signalling |
| 31. NR\_RRM\_enh3 | 31-1 | Enhancement L3 report after SCell activation command (ZTE) |  |  |  |  |  |  | No | No |  |  | Optional with capability signalling |

**Recommended WF:**

It seems agreeable to introduce FG of L3 measurement report for unknown Scell activation. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 31. NR\_RRM\_enh3 | 31-1 | L3 measurement report for unknown SCell activation | Support of reporting valid L3 measurement results for the target being-activated SCell after receiving the SCell activation command |  | Yes | N/A | UE does not support reporting valid L3 measurement results after receiving the SCell activation command | Per UE | No | [No] | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported. | Optional with capability signaling |

## 31-2 Beam sweeping factor reduction for FR2 unknown SCell activation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
|  | 31-2 | Reduced beam sweeping factor (MediaTek) | 1. Value X1 for the reduce beam sweeping factor for L3 cell search during SCell activation 2. Value X2 for the reduce beam sweeping factor for SSB-based L1 measurements during SCell activation |  | Yes | No | The beam sweeping factor is 8 for both cases | Per band | TDD only | FR2 only | N/A | Candidate values for X1 ={1, 2, 4, 6}  Candidate values for X2 ={0, 1, 2, 3, 4, 5, ,6 ,7} | Optional with UE capability |
| 31. NR\_RRM\_enh3 | 31-2 | Beam sweeping factor reduction for FR2 unknown SCell activation (Apple) | Support of reducing beam sweeping factor for cell detection if UE has full set (N=8) of beam sweeping during AGC settling part during FR2-1 unknown SCell activation procedure  Support of reducing beam sweeping factor for SSB based L1-RSRP measurement if UE has full set (N=8) of beam sweeping during AGC settling part during FR2-1 unknown SCell activation procedure |  | Yes | N/A | UE does not support beam sweeping factor reduction for cell detection during FR2-1 unknown SCell activation.  UE does not support beam sweeping factor reduction for SSB based L1-RSRP measurement during FR2-1 unknown SCell activation. | Per Band | N/A | FR2 only | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported.  Candidate values for beam sweeping reduction for cell detection during FR2-1 unknown SCell activation are 1,2,4, or 6. [Agreed in WF R4-2310081]  Candidate values for beam sweeping reduction for SSB based L1-RSRP measurement during FR2-1 unknown SCell activation are 0,1,2,3,4,5,6, or 7. [Agreed in WF R4-2310081] | Optional with capability signaling |
| 31. NR\_RRM\_enh3 | 31-2 | Beam sweeping factor reduction for FR2 unknown SCell activation (vivo) | Support of reducing beam sweeping factor for cell detection if UE has full set (N=8) of beam sweeping during AGC settling part during FR2-1 unknown SCell activation procedure  Support of reducing beam sweeping factor for SSB based L1-RSRP measurement if UE has full set (N=8) of beam sweeping during AGC settling part during FR2-1 unknown SCell activation procedure |  | Yes | N/A | UE does not support beam sweeping factor reduction for cell detection during FR2-1 unknown SCell activation.  UE does not support beam sweeping factor reduction for SSB based L1-RSRP measurement during FR2-1 unknown SCell activation. | Per Band per BC | N/A | FR2 only | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported.  Candidate values for beam sweeping reduction for cell detection during FR2-1 unknown SCell activation are 1,2,4, or 6. [Agreed in WF R4-2310081]  Candidate values for beam sweeping reduction for SSB based L1-RSRP measurement during FR2-1 unknown SCell activation are 0,1,2,3,4,5,6, or 7. [Agreed in WF R4-2310081] | Optional with capability signalling |
| 31. NR\_RRM\_enh3 | 31-2 | Reduced UE beam sweeping factor for L3 and L1 RRM measurements (Intel) | 1. Support of reduced beam sweeping factor for L3 measurements in cell detection requirements: X1 value  2. Support of reduced beam sweeping factor for SSB-based L1-RSRP measurement reporting requirements: X2 value | No | Yes | NA | Legacy X1, X2 values are applied in measurement requirements | Per Band | No | FR2 only | NA | Component 1 candidate value: true/false  Component 2 candidate value: true/false | Optional with capability signalling |
|  | 31-2 | beam sweeping factor reduction for L3 and L1 (ZTE) | - X1 for L3 beam sweeping factor reduction  - X2 for L1 beam sweeping factor reduction  The candidates for X1, X2 include:  X1= {1,2,4,6}  X2= {0,1,2,3,4,5,6,7} ent, beam sweeping factor for cell detection part is 8  If X2 is absent, beam sweeping factor for SSB-based L1 measurement is 8 |  |  |  |  |  | No | No |  |  | Optional with capability signalling |

**Recommended WF:**

It seems agreeable to introduce FG of Beam sweeping factor reduction for FR2 unknown SCell activation. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 31. NR\_RRM\_enh3 | 31-2 | Beam sweeping factor reduction for FR2 unknown SCell activation | Support of reducing beam sweeping factor for cell detection if UE has full set (N=8) of beam sweeping during AGC settling part during FR2-1 unknown SCell activation procedure  Support of reducing beam sweeping factor for SSB based L1-RSRP measurement if UE has full set (N=8) of beam sweeping during AGC settling part during FR2-1 unknown SCell activation procedure |  | Yes | N/A | UE does not support beam sweeping factor reduction for cell detection during FR2-1 unknown SCell activation.  UE does not support beam sweeping factor reduction for SSB based L1-RSRP measurement during FR2-1 unknown SCell activation. | [Per Band] | N/A | FR2 only | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported.  Candidate values for beam sweeping reduction for cell detection during FR2-1 unknown SCell activation are 1,2,4, or 6.  Candidate values for beam sweeping reduction for SSB based L1-RSRP measurement during FR2-1 unknown SCell activation are 0,1,2,3,4,5,6, or 7. | Optional with capability signaling |

## 31-3 Measurement enhancement for unknown Scell activation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
|  | 31-3 | Enhanced SCell activation delay (MediaTek) | * Support of using SSB periodicity instead of SMTC periodicity during SCell activation * Perform L1-RSRP measurements with the delay assuming non-DRX during SCell activation even DRX is configured |  | Yes | No | UE will still use SMTC periodicity and follow the L1-RSRP measurement delay with DRX if DRX configured during SCell activation | Per UE | [No] | [No] | N/A |  | Optional with UE capability |
| 31. NR\_RRM\_enh3 | 31-3 | Other measurement enhancement for unknown SCell activation (Apple) | Support of using SSB periodicity instead of SMTC periodicity for the measurement interval during unknown SCell activation when the SMTC is only configured in measurement object for enhanced unknown SCell activation requirement.  Support of performing L1-RSRP measurement in non-DRX mode even DRX is configured during unknown SCell activation |  | Yes | N/A | UE does not use SSB periodicity instead of SMTC periodicity for the measurement interval during unknown SCell activation when the SMTC is only configured in MO for enhanced unknown Scell activation requirement.  UE does not support performing L1-RSRP measurement in non-DRX mode even DRX is configured during unknown SCell activation | Per UE | No | No | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported. | Optional with capability signaling |
| 31. NR\_RRM\_enh3 | 31-3 | Other measurement enhancement for unknown SCell activation (vivo) | Support of using SSB periodicity instead of SMTC periodicity for the measurement interval during unknown SCell activation when the SMTC is only configured in measurement object for enhanced unknown SCell activation requirement.  Support of performing L1-RSRP measurement in non-DRX mode even DRX is configured during unknown SCell activation |  | Yes | N/A | UE does not use SSB periodicity instead of SMTC periodicity for the measurement interval during unknown SCell activation when the SMTC is only configured in MO for enhanced unknown Scell activation requirement.  UE does not support performing L1-RSRP measurement in non-DRX mode even DRX is configured during unknown SCell activation | Per UE | No | Yes | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported. | Optional with capability signalling |
| 31. NR\_RRM\_enh3 | 31-3 | Replace SMTC periodicity with SSB periodicity & perform L1-RSRP measurements irrespective of DRX configuration (Intel) | 1. Support of replacement of SMTC periodicity with SSB periodicity in measurement requirements  2. Support to perform L1-RSRP measurements assuming no DRX configuration is available irrespective of DRX configuration | No | Yes | NA | 1. UE does not replace SMTC periodicity with SSB periodicity in measurement requirements  2. UE does not perform L1-RSRP measurements assuming no DRX configuration when DRX is configured to the UE in CONNECTED mode | Per UE | No | No | NA | Component 1 candidate value: true/false  Component 2 candidate value: true/false | Optional with capability signalling |
|  | 31-3 | Using SSB periodicity instead of SMTC and Perform L1-RSRP measurement in non-DRX mode even DRX is configured (ZTE) | Two components.  One for “Using SSB periodicity instead of SMTC and Perform L1-RSRP ”,  The other for “Perform L1-RSRP measurement in non-DRX mode even DRX is configured” |  |  |  |  |  | No | No |  |  | Optional with capability signalling |

**Recommended WF:**

It seems agreeable to introduce FG of Measurement enhancement for unknown Scell activation. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 31. NR\_RRM\_enh3 | 31-3 | Measurement enhancement for unknown SCell activation | Support of using SSB periodicity instead of SMTC periodicity for the measurement interval during unknown SCell activation when the SMTC is only configured in measurement object for enhanced unknown SCell activation requirement.  Support of performing L1-RSRP measurement in non-DRX mode even DRX is configured during unknown SCell activation |  | Yes | N/A | UE does not use SSB periodicity instead of SMTC periodicity for the measurement interval during unknown SCell activation when the SMTC is only configured in MO for enhanced unknown Scell activation requirement.  UE does not support performing L1-RSRP measurement in non-DRX mode even DRX is configured during unknown SCell activation | Per UE | No | [No] | N/A | UE is required to meet the shortened SCell activation delay requirement in TS38.133 [section 8.x.y] if the feature is supported. | Optional with capability signaling |

1. NR\_MG\_enh2

## 31-1 Concurrent gap with Pre-MG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 | 32-1 | Combination of Pre-MG and concurrent MG （CATT） | Support of combined configuration of Pre-MG and concurrent MG |  | Yes | 19-2, 19-3-1/19-3-2 | UE cannot be configured with concurrent MG and Pre-MG simultaneously | Per UE | No | No |  |  | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-1 | Combination of pre-configured MG and concurrent MG （Huawei） | UE can be configured with concurrent MGs with one or more of the gaps being pre-configured MGs | 19-2, and 19-3-1 or 19-3-2 | Yes |  | UE cannot be configured with combination of pre-configured MG and concurrent MG | Per-UE | N/A | N/A |  |  | Optional with capability signalling |
|  | 32-1 | Concurrent gap with Pre-MG (MediaTek) | Support of multiple per-UE (or per-FR) measurement gap patterns with at least one per-UE (or per-FR) Pre-MG. Detail in Table 9.1.x-1 of TS 38.133. | 19-3-x and 19-2  x = 1 or 2 | Yes | No | Network should not configure concurrent gap with Pre-MG | Per UE | No | No |  |  | Optional with capability signalling |
|  | 32-1 | Pre-configured MG and concurrent MG (Apple) | Simultaneous activation/deactivation of two Pre-MGs in the same FR | 1) 19-2,  2) 19-3-1 or 19-3-2 | Yes | N/A | UE does not support simultaneous activation/deactivation of two Pre-MGs in the same FR | [Per UE] | No | [Yes] | N/A | Agreed in RAN4#108 R4-2314323 | Optional with capability signaling |
|  |  | Concurrent measurement gap with Pre-MG (Intel) | 1. Support of RRM requirements in TS 38.133 for multiple per-UE (or per-FR) measurement gap patterns with at least one per-UE (or per-FR) Pre-MG. | 1) 19-3-1 or 19-3-2  2) 19-2-1 | Yes | NA | The UE does not support multiple per-UE (or per-FR) measurement gap patterns with at least one Pre-MG and related RRM requirements | Per UE | No | No | NA |  |  |

**Recommended WF:**

Agreed in RAN4#108 R4-2314323. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 | 32-1 | Concurrent gap with Pre-MG | Support of multiple per-UE (or per-FR) measurement gap patterns with at least one per-UE (or per-FR) Pre-MG. Detail in Table 9.1.x-1 of TS 38.133. | 19-3-x and 19-2  x = 1 or 2 | Yes | No | Network should not configure concurrent gap with Pre-MG | Per UE | N/A | N/A |  |  | Optional with capability signalling |

## 31-2 Concurrent gap with NCSG

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 | 32-2 | Combination of NCSG and concurrent MG （CATT） | Support of combined configuration of NCSG and concurrent MG |  | Yes | 19-1a/19-1b, 19-2 | UE cannot be configured with concurrent MG and NCSG simultaneously | Per UE | No | No |  |  | Optional with capability signalling |
|  |  | Combination of NCSG and concurrent MG （Huawei） | UE can be configured with concurrent MGs with one or more of the gaps being NCSG | 19-2 and 19-1-2 | Yes |  | UE cannot be configured with combination of NCSG and concurrent MG | Per-UE | N/A | N/A |  |  | Optional with capability signalling |
|  |  | Concurrent gap with NCSG (MediaTek) | Support of multiple per-UE (or per-FR) measurement gap patterns with at least one per-UE (or per-FR) NCSG. Detail in Table 9.1.y-1 of TS 38.133. | 19-1 and 19-2 | Yes | No | Network should not configure concurrent gap with NCSG | Per UE | No | No |  |  | Optional with capability signalling |
|  |  | NCSG and concurrent MG (Apple) | Concurrent gaps with NCSG in an FR | 1) 19-1a or 19-1b  2) 19-2 | Yes | N/A | UE cannot be configured with NCSG and concurrent gap in the same FR | [Per-UE] | No | [Yes] | N/A | Agreed in RAN4#108 R4-2314323 | Optional with capability signaling |
|  |  | Concurrent measurement gap with NCSG (Intel) | 1. Support of RRM requirements in TS 38.133 for multiple per-UE (or per-FR) measurement gap patterns with at least one per-UE (or per-FR) NCSG. | [19-1a and 19-2-1] | Yes | NA | The UE does not support multiple per-UE (or per-FR) measurement gap patterns with at least one NCSG and related RRM requirements | Per UE | No | No | NA |  |  |

**Recommended WF:**

Agreed in RAN4#108 R4-2314323. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 |  | Concurrent gap with NCSG | Support of multiple per-UE (or per-FR) measurement gap patterns with at least one per-UE (or per-FR) NCSG. Detail in Table 9.1.y-1 of TS 38.133. | 19-1 and 19-2 | Yes | N/A | Network should not configure concurrent gap with NCSG | Per UE | No | No | N/A |  | Optional with capability signalling |

## 31-3 Inter-RAT measurements without gaps

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 |  | Interruption for inter-RAT NR measurement （CATT） | Report whether interruptions and gap are needed for inter-RAT NR measurement |  | Yes |  | Gap and interruptioninformation is not clear for inter-RAT NR measurement | Per UE | No | No |  | Already sent to RAN2 | Optional with capability signalling |
|  |  | Inter-RAT EUTRAN measurement with RS on UE active BWP (MediaTek) | Support inter-RAT EUTRAN measurements with CRS contained within UE’s active DL BWP |  | Yes | No | Measurement gap will be needed for inter-RAT EUTRAN measurements | Per UE | No | FR1 only |  |  | Optional with capability signalling |
|  |  | Inter-RAT measurements without gaps (Apple) | Inter-RAT LTE measurements without gap when LTE CRS to be measured are fully contained within UE’s active BWP |  | Yes | N/A | UE does not support inter-RAT LTE measurements without gap when LTE CRS to be measured are fully contained within UE’s active BWP | Per-UE | No | Only FR1 | N/A | Already sent LS to RAN2: R4- 2310158 | Optional with capability signaling |
|  |  | Inter-RAT EUTRAN measurements without measurement gap using vacant RF chain (case b-1) (Intel) | 1. Support of inter-RAT EUTRAN measurements without gap with or without interruption | No | Yes | NA | The UE does not support inter-RAT EUTRAN measurements without gap for case b-1 | Per UE | No | No | NA |  |  |
|  |  | Inter-RAT EUTRAN measurements without measurement gap when target CRS is within UE active bandwidth part (case b-2) (Intel) | 1. Support of inter-RAT EUTRAN measurements without gap when CRS is fully contained within UE active BWP | No | Yes | NA | The UE does not support inter-RAT EUTRAN measurements without gap for case b-2 | Per UE | No | No | NA |  |  |

**Recommended WF:**

Already sent LS to RAN2: R4- 2310158. According to the LS, it is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 |  | Inter-RAT EUTRAN measurement without gaps | Support inter-RAT EUTRAN measurements with LTE CRS to be measured are fully contained within UE’s active DL BWP |  | Yes | N/A | Measurement gap will be needed for inter-RAT EUTRAN measurements | Per UE | No | FR1 only | N/A |  | Optional with capability signalling |

## 31-4 Interruption for UE supporting needforgap for intra/inter-frequency measurements

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 | 32-3 | Interruption for UE supporting needforgap （CATT） | Report whether interruptions are needed when UE report “no-gap” in needforgap |  | Yes | 24-6 | Interruption is not clear when UE report “no-gap” in needforgap | Per UE | No | No |  | Already sent to RAN2 | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-4 | Intra and Inter-frequency measurement without gap using vacant RF chain  (Intel) | 1. Support of intra- and inter- frequency measurements without gap with or without interruption | No | Yes | NA | The UE does not support intra- and/or inter-frequency measurements without gap with or without interruption | Per UE | No | No | NA |  |  |

**Recommended WF:**

Already sent LS to RAN2: R4-2303306. According to LS, two UE capabilities will be introduced:

* **RAN4 would like to ask RAN2 to introduce additional Rel-18 UE signalling to enable the UE to indicate to the NW whether interruption is needed for the case of NR SSB based inter/intra-frequency measurement without gap.**
* For Case a-1 (inter-RAT NR measurements without gap as there is vacant RF chains for UE measurements), RAN4 agreed to introduce additional Rel-18 signalling from UE to indicate the inter-RAT NR measurements without gap but interruption needed.

It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 | 32-4 | Interruption for UE supporting needforgap | Report whether interruptions are needed when UE report “no-gap” in needforgap for intra/inter-frequency measurement without gap. | 24-6 | Yes |  | Interruption is not clear when UE report “no-gap” in needforgap | Per UE | no | no | N/A |  | Optional with capability signalling |

## 31-5 Interruption for UE supporting needforgap for inter-RAT E-UTRAN measurement

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  |  | Inter-RAT EUTRAN measurements without measurement gap using vacant RF chain (case b-1) (Intel) | 1. Support of inter-RAT EUTRAN measurements without gap with or without interruption | No | Yes | NA | The UE does not support inter-RAT EUTRAN measurements without gap for case b-1 | Per UE | No | No | NA |  |  |

**Recommended WF:**

Already sent LS to RAN2: R4- 2310158. Discuss the following proposed 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**  **(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** |
| 32. NR\_MG\_enh2 |  | Inter-RAT EUTRAN measurements without measurement gap using vacant RF chain (case b-1) | 1. Support of inter-RAT EUTRAN measurements without gap with or without interruption | No | Yes | NA | The UE does not support inter-RAT EUTRAN measurements without gap for case b-1 | Per UE | No | No | NA |  |  |

## 31-6 Interruption for UE supporting needforgap for inter-RAT E-UTRAN measurement

## 31-x Other FGs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 32. NR\_MG\_enh2 | 32-2 | Combination of pre-configured MG and concurrent MG with dynamic collision （Huawei） | UE can be configured with concurrent MGs with one or more of the gaps being pre-configured MGs, and the pre-configured MG is configured with higher priority and is colliding with another MG. | 32-1 | Yes |  | UE cannot be configured with combination of pre-configured MG and concurrent MG with dynamic collision | Per-UE | N/A | N/A |  |  | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-X | Short effective measurement window duration for inter-RAT E-UTRA measurement （Huawei） | UE can be configured with short effective measurement window duration of 2ms for inter-RAT E-UTRA measurement, where the measurement is performed outside MG and causes scheduling restriction | 19-1 or [new capability for Case b-1] | Yes |  | UE cannot be configured with short effective measurement window duration for inter-RAT E-UTRA measurement. | Per-UE | N/A | N/A |  |  | Optional with capability signalling |
|  | 32-2 | 2 Pre-MG configuration with simultaneous activation/deactivation (MediaTek) | Support configurations of 2 Pre-MG with simultaneous activation/deactivation in the same FR. | 32-1 | Yes | No | Network should not configure 2 Pre-MG in the same FR | Per UE | No | No |  |  | Optional with capability signalling |
|  | [32-3] | Dynamic collision (MediaTek) | Support the RRM requirements when the activation/deactivation delay of Pre-MG overlaps the other measurement gap or Pre-MG | 32-1 | Yes | No | UE is not expected to meet the requirements | Per UE | No | No |  |  | Optional with capability signalling |
|  | [32-5] | 2 NCSG configuration (MediaTek) | Support configurations of 2 NCSG in the same FR | 32-4 | Yes | No | Network should not configure 2 NCSG in the same FR | Per UE | No | No |  |  | Optional with capability signalling |
|  | [32-7] | Effective measurement window for inter-RAT EUTRAN measurements (MediaTek) | Support configuration of effective measurement window for inter-RAT EUTRAN measurements, including offset, duration and periodicity. | 32-6 | Yes | No | Undefined UE behavior about when to measurement and scheduling restriction | Per UE | No | No |  |  | Optional with capability signalling |
|  | [32-8] | simultaneousRxDataCRS-DiffNumerology (MediaTek) | Support concurrent inter-RAT measurement on EUTRAN cell with CRS contained within UE’s active DL BWP and PDCCH or PDSCH reception from the serving cell with a different numerology | 32-6 | Yes | No | scheduling restriction is applicable | Per UE | No | No |  |  | Optional with capability signalling |
| 32. NR\_MG\_enh2 | 32-3 | Support of effective measurement window (EMW) for Inter-RAT EUTRAN measurements without measurement gap (Intel) | 1. Supported EMW patterns for Inter-RAT EUTRAN measurements without measurement gap | 32-1 or 32-2 | Yes | NA | The UE does not support the EMW configurations in addition to the mandatory ones specified in TS 38.133 | Per UE | No | No | NA |  |  |

**Recommended WF:**

More technical discussion is required.

## 31-x LTE FG: Interruption for inter-RAT NR measurement

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 32. NR\_MG\_enh2 | x-x | Inter-RAT NR measurement without gap using vacant RF chain (Intel) | 1. Support of inter-RAT NR measurements without gap with or without interruption | No | Yes | NA | The UE does not support inter-RAT NR measurements without gap with or without interruption | Per UE | No | No | NA | Component 1 candidate value: true/false  The signalling name and structure are expected to be the same as the implementation of Rel-17 feature *NeedForNCSG-NR-r17* in TS38.331 | Optional with capability signalling |
| 32. NR\_MG\_enh2 |  | Interruption for inter-RAT NR measurement | Report whether interruptions and gap are needed for inter-RAT NR measurement |  | Yes |  | Gap and interruptioninformation is not clear for inter-RAT NR measurement | Per UE | No | No |  | Already sent to RAN2 | Optional with capability signalling |

**Recommended WF:**

More discussion is needed.

Already sent LS to RAN2: R4-2303306. According to LS, two UE capabilities will be introduced:

* RAN4 would like to ask RAN2 to introduce additional Rel-18 UE signalling to enable the UE to indicate to the NW whether interruption is needed for the case of NR SSB based inter/intra-frequency measurement without gap.
* **For Case a-1 (inter-RAT NR measurements without gap as there is vacant RF chains for UE measurements), RAN4 agreed to introduce additional Rel-18 signalling from UE to indicate the inter-RAT NR measurements without gap but interruption needed.**

Discuss following LTE 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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
|  |  | Interruption for inter-RAT NR measurement | indicates whether interruptions and gap are needed for inter-RAT NR measurement |  | Yes | N/A | [Gap and interruption nformation is not clear for inter-RAT NR measurement] | Per UE | No | No | N/A |  | Optional with capability signalling |

1. NonCol\_intraB\_ENDC\_NR\_CA

## 33-1 Support of intra-band non-collocated NR CA operation

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 33.NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | Support of intra-band non-collocated NR-CA deployment  (Huawei) | The UE can support TDD-TDD intra-band non-collocated NR-CA operation with MTTD/MRTD requirements according to Table 7.5.4.1/Table 7.6.4-2 in 38.133 and UE RF requirements for intra-band non-collocated NR-CA in 7.10A in 38.101-1. |  | Yes | N/A | The UE will not be able to support an intra-band non-collocated NR-CA deployment | per BC | N/A | FR1 Only |  |  | Optional with capability signalling |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | non-collocated NR intra-band non-contiguous CA  (MediaTek) | Indicates the UE supports NR TDD intra-band non-collocated non-contiguous CA with NR CA MRTD according to Table 7.6.4-2 in 38.133 in FR1 and inter-band RF requirements (i.e., Type 2 UE) | **-** | Yes | N/A | UE supports intra-band non-contiguous NR CA with MRTD<3us according to Table 7.6.4-1 in 38.133 in FR1 and intra-band RF requirements (i.e., Type 1 UE) | [Per BC] | TDD only | FR1  only | N/A | **-** | Optional with UE capability signalling |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | Support of intra-band non-collocated NR CA operation  (Apple) | Indicates the UE supports TDD-TDD intra-band non-collocated NR-CA operation with MTTD/MRTD requirements according to Table 7.5.4.1/Table 7.6.4-2 in 38.133 [5] and UE RF requirements for intra-band non-collocated NR-CA including 7.10A in 38.101-1 [2]. And the UE also supports TDD-TDD intra-band NR-CA operation with MRTD according to Table 7.6.4-1 in 38.133 and UE RF requirements for intra-band NR-CA except for 7.10A in 38.101-1 [2].  If the capability is not reported, the UE supports TDD-TDD intra-band NR-CA operation with MRTD according to Table 7.6.4-1 in 38.133 and UE RF requirements for intra-band NR-CA except for 7.10A in 38.101-1 [2]. |  | Yes | n/a | Intra-band non-collocated NR CA operation is not supported. | Per BC | TDD only | FR1 only |  |  | Optional with capability signaling |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | Intra-band non-collocated EN-DC/NR-CA deployment  (Ericsson) | For a supported intra-band NR CA configuration, the UE supports a relative transmission timing difference between UL carriers as specified in Table 7.5.4-1 and a relative transmission timing difference between DL carrier as specified in Table 7.6.4-2 of TS 38.133.  The feature is supported for up to 2-layer MIMO per carrier. | N/A | Yes |  | The UE supports requirements specified in TS38.133 for intra-band contiguous NR CA with collocated carriers: a relative transmission timing difference between UL carriers of 5.21 µs and a relative transmission timing difference between DL carrier of 3 µs. | Per BC | TDD only | FR1 only | N/A.  Capability only supported within an TDD band. | [Supported for band n77/n78 only] | Optional |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | TDD-TDD intra-band non-collocated NR-CA operation  (Intel) | 1. Support of TDD-TDD intra-band non-collocated NR-CA operation with MTTD/MRTD requirements according to Table 7.5.4.1/Table 7.6.4-2 in TS 38.133 and UE RF requirements for intra-band non-collocated NR-CA including 7.10A in TS 38.101-1 (Type 2 capability requirement). | No | Yes | N/A | The UE supports TDD-TDD intra-band NR-CA operation with MRTD according to Table 7.6.4-1 in TS 38.133 and UE RF requirements for intra-band NR-CA except for 7.10A in TS 38.101-1 (Type 1 capability requirement) | Per BC | No | FR1 only | N/A | Component 1: true/false | Optional with capability signalling |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | Non-collocated for TDD-TDD intra-band non-contiguous CA  (ZTE) | Indicate the UE supports TDD-TDD intra-band non-collocated NR-CA operation with MTTD/MRTD requirements according to Table 7.5.4.1/Table 7.6.4-2 in 38.133 and UE RF requirements for intra-band non-collocated NR-CA including 7.10A in 38.101-1 |  | [yes] | no | UE doesn’t support non-collocated for intra-band non-contiguous CA | Per BC | TDD only | FR1 only |  | Applicable to only band n77 and n78.  Detailed information can refer to the LS to RAN2 in RP-232692. | Optional |

**Recommended WF:**

The agreements on the associated signalling are provided in RP‑232692 LS on signaling support for intra-band non-collocated NR-CA,EN-DC.

It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-1 | Support of intra-band non-collocated NR CA operation | Indicates the UE supports TDD-TDD intra-band non-collocated NR-CA operation with MTTD/MRTD requirements according to Table 7.5.4.1/Table 7.6.4-2 in 38.133 [5] and UE RF requirements for intra-band non-collocated NR-CA including 7.10A in 38.101-1 [2]. And the UE also supports TDD-TDD intra-band NR-CA operation with MRTD according to Table 7.6.4-1 in 38.133 and UE RF requirements for intra-band NR-CA except for 7.10A in 38.101-1 [2]. |  | Yes | N/A | Intra-band non-collocated NR CA operation is not supported. The UE supports TDD-TDD intra-band NR-CA operation with MRTD according to Table 7.6.4-1 in 38.133 and UE RF requirements for intra-band NR-CA except for 7.10A in 38.101-1 [2]. | Per BC | TDD only | FR1 only | N/A | Supported for band n77/n78 only | Optional with capability signaling |

## 33-x Support of network indication

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 33. NonCol\_intraB\_ENDC\_NR\_CA | 33-2 | Support of network control of non-collocated MTTD/MRTD and UE RF requirements applicability  (Intel) | 1. Support of network control of non-collocated MTTD/MRTD and UE RF requirements applicability for TDD-TDD inter-band EN-DC with overlapping or partially overlapping bands  2. Support of network control of non-collocated MTTD/MRTD and UE RF requirements applicability for TDD-TDD intra-band NR-CA | Component 1: 2-19 (Rel-16 RAN4 feature)  Component 2: 33-1 | Yes | N/A | UEs supporting features 33-1 and 2-19 are required to meet corresponding non-collocated RRM/RF requirements for all conditions | Per UE | No | FR1 only | N/A | Component 1: true/false  Component 2: true/false | Optional with capability signalling |
| 33.NonCol\_intraB\_ENDC\_NR\_CA | 33-2 | Rel-18 requirement type indication for UE supporting *interBandMRDC-WithOverlapDL-Bands-r16 (Huawei)* | For Rel-18, introduce a new UE capability which indicates the support of the new BS signaling per UE. This UE capability is only applicable to the UE indicating “interBandMRDC-WithOverlapDL-Bands-r16”. | 2-19 | Yes | N/A | The UE will support “interBandMRDC-WithOverlapDL-Bands-r16” only which means in Rel-18 the network can’t enforce modification on the UE types | per BC | N/A | FR1 Only |  |  | Optional with capability signalling |

**Recommended WF:**

More technical discussion is required.

1. NR\_HST\_FR2\_enh

## 34-1 Simultaneous multi-panel operation for train roof-mounted FR2 high power devices

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 34.NR\_HST\_FR2\_enh | 34-1 | Support of FR2 HST multi-RX reception.  (Huawei) | Support of simultaneous DL reception with two different QCL TypeD RSs on single component carrier for FR2 HST. | 16-2c  16-2a or 16-2b-1 | N/A | N/A | The UE could not receive downlink signals with two different QCl TypeD RSs | Per Band | N/A | FR2 only | N/A |  | Optional with capability signalling |
| 34. NR\_HST\_FR2\_enh | 34-1 | Simultaneous multi-panel operation for train roof-mounted FR2 high power devices  (Apple) | Support of simultaneous multi-panel reception for Rel-18 FR2 PC6 UE | 22-1, 16-2c | Yes | N/A | UE does not support simultaneous multi-panel reception | [Per band or Per FSPC] | N/A | FR2 only | N/A | Agreed in R4-2314297 | Optional with capability signaling |
| 34. NR\_HST\_FR2\_enh |  | Support of FR2 HST with multi-panel simultaneous reception operation  (Intel) | 1. Support of RF requirements for FR2 PC6 UE with two panel simultaneous reception  2. Support of enhanced RRM requirements for FR2 PC6 UE with two panel simultaneous reception  3. Support of enhanced demodulation requirements for HST FR2 UE multi-panel receptions | 22-1 | Yes | NA | UE does not meet FR2 high speed train scenario with two panel simultaneous reception | Per Band | No | FR2 only | N/A | A single indication element is used to indicate for all three componentscandidate value: true/false | Optional with capability signalling |

**Recommended WF:**

Agreed in R4-2314297

o Define a new UE capability [simultaneousReceptionFR2HST-r18] to indicate support of simultaneous multi-panel reception for Rel-18 FR2 PC6 UE

- Details can be discussed in Rel-18 feature list discussion.

 The conclusion from Rel-18 Multi-RX WI could be considered

It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 34. NR\_HST\_FR2\_enh | 34-1 | Simultaneous multi-panel operation for train roof-mounted FR2 high power devices | Support of simultaneous multi-panel reception for Rel-18 FR2 PC6 UE | [22-1, 16-2c] | Yes | N/A | UE does not support simultaneous multi-panel reception | [Per band or Per FSPC] | N/A | FR2 only | N/A |  | Optional with capability signaling |

## 34-2 Enhanced CA and inter-frequency measurement

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 34. NR\_HST\_FR2\_enh | 34-2 | Intra-band CA and Inter-frequency measurement enhancement  (Apple) | FR2 HST CA and inter-frequency measurement enhancement | 22-1 | Yes | N/A | UE does not support FR2 HST CA and inter-frequency measurement enhancement | [Per-UE] | N/A | FR2 only | N/A | Agreed in R4-2314297 | Optional with capability signaling |
|  |  | Enhanced RRM requirements for CA HST FR2  (Intel) | 1. Support of the enhanced RRM requirements specified for CA and inter-frequency measurements for HST FR2 UE | 22-1 | Yes | NA | UE does not support enhanced RRM requirements for CA and/or inter-frequency measurements | Per Band | No | FR2 only | N/A | Component 1 candidate value: true/false | Optional with capability signalling |
|  |  | Enhanced IDLE mode FR2 HST UE measurement requirements  (Intel) | 1. Support of enhanced IDLE mode measurement requirements for FR2 HST UE | No | No | NA | UE does not support enhanced IDLE mode FR2 HST UE mobility | NA | No | FR2 only | NA |  | Optional without capability signalling |

**Recommended WF:**

Agreed in R4-2314297: Issue 2-1-1: Whether need to support separate CA and inter-frequency enhancements for Rel-18 FR2 HST (UE capability)

* Agreement:
  + A single per-UE capability is introduced for FR2 HST CA and inter-frequency measurement enhancement:
    - [measurementEnhancementCAInterFreqFR2-r18] indicates whether the FR2 PC6 UE supports the enhanced RRM requirements for carrier aggregation as specified in TS 38.133 and the UE supports the enhanced RRM requirements for inter-frequency measurements in connected and idle mode as specified in TS 38.133.

According to the agreements in R4-2314297, it seems single per-UE capability is enough for both connected and idle mode requirements enhancement. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 34. NR\_HST\_FR2\_enh | 34-2 | Enhanced Intra-band CA and Inter-frequency measurement | Indicates whether the FR2 PC6 UE supports the enhanced RRM requirements for carrier aggregation as specified in TS 38.133 and the UE supports the enhanced RRM requirements for inter-frequency measurements in connected and idle mode as specified in TS 38.133 | 22-1 | Yes | N/A | UE does not support FR2 HST CA and inter-frequency measurement enhancement | Per UE | N/A | FR2 only | N/A |  | Optional with capability signaling |

## 34-x Enhanced demodulation and UL timing adjustment.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 34. NR\_HST\_FR2\_enh |  | Support of enhanced UL timing adjustment  (Intel) | 1. Support of enhanced UL timing adjustment | 22-2 | Yes | NA | UE does not support enhanced UL timing adjustment | Per Band | No | FR2 only | N/A | Component 1 candidate value: true/false | Optional with capability signalling |
|  |  | Enhanced IDLE mode FR2 HST UE measurement requirements  (Intel) | 1. Support of enhanced IDLE mode measurement requirements for FR2 HST UE | No | No | NA | UE does not support enhanced IDLE mode FR2 HST UE mobility | NA | No | FR2 only | NA |  | Optional without capability signalling |

**Recommended WF:**

More technical discussion is required.

1. NR\_ATG

## 35-1 Enhanced RRM requirements for measurements in IDLE and INACTIVE modes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 35. NR\_ATG | 35-1 | Enhanced RRM requirements for measurements in IDLE and INACTIVE modes  (CMCC) | Indicate the support of enhanced inter-frequency cell re-selection requirements for ATG (as specific in TS 38.133 Table 4.2D.2.4-2) |  | no | N/A | If UE does not support the capability, legacy measurement requirements (as specified in TS 38.133, Table 4.2D.2.4-1) are applied. | 1. Per UE | No | FR1 only | N/A |  | Optional without capability signaling |
|  |  | Enhanced RRM requirements for measurements in IDLE and INACTIVE modes  (ZTE) | If UE does not support the capability, other ATG measurement requirements (as specified in TS 38.133, clause 4.2D.2) are applied. |  |  |  |  |  | No | No |  |  | Optional without capability signaling |

**Recommended WF:**

It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 35. NR\_ATG | 35-1 | Enhanced RRM requirements for measurements in IDLE and INACTIVE modes  (CMCC) | Indicate the support of enhanced inter-frequency cell re-selection requirements for ATG (as specific in TS 38.133 Table 4.2D.2.4-2) |  | no | N/A | If UE does not support the capability, legacy measurement requirements (as specified in TS 38.133, Table 4.2D.2.4-1) are applied. | Per UE | No | FR1 only | N/A |  | Optional without capability signaling |

## 35-2 and 35-3: Omni-directional antenna type and Antenna array type

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  | 35-2 | Omni-directional antenna type  (CMCC) | Indicate the support of RF and RRM requirements with omni-directional antenna as specified in TS 38.101-1 section 6.1J, 7.1J and TS 38.133. |  | yes | N/A | If UE does not support omni-directional antenna type, the corresponding requirements cannot be guaranteed. | 1. Per Band | No | FR1 only | N/A | For one band, if UE does not report support of omni-directional antenna type, UE should report support of antenna array type. | Optional with capability signaling |
| 35-3 | Antenna array type  (CMCC) | Indicate the support of RF and RRM requirements with antenna array as specified in TS 38.101-1 section 6.1J, 7.1J and TS 38.133. |  | yes | N/A | If UE does not support antenna array type, the corresponding requirements cannot be guaranteed. . | 2)Per Band | No | FR1 only | N/A | For one band, if UE does not report support of antenna array type, UE support of omni-directional antenna type. | Optional with capability signaling |

**Recommended WF:**

35-2 and 35-3: these features have been approved in previous meeting and have sent the LS to RAN2. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  | 35-2 | Omni-directional antenna type | Indicate the support of RF and RRM requirements with omni-directional antenna as specified in TS 38.101-1 section 6.1J, 7.1J and TS 38.133. |  | yes | N/A | If UE does not support omni-directional antenna type, the corresponding requirements cannot be guaranteed. | Per Band | No | FR1 only | N/A | For one band, if UE does not report support of omni-directional antenna type, UE should report support of antenna array type. | Optional with capability signaling |
| 35-3 | Antenna array type | Indicate the support of RF and RRM requirements with antenna array as specified in TS 38.101-1 section 6.1J, 7.1J and TS 38.133. |  | yes | N/A | If UE does not support antenna array type, the corresponding requirements cannot be guaranteed. . | Per Band | No | FR1 only | N/A | For one band, if UE does not report support of antenna array type, UE support of omni-directional antenna type. | Optional with capability signaling |

## 35-4 Enhanced RRM requirements for measurements in IDLE and INACTIVE modes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  | 35-4 | Rated max output power  (CMCC) | Indicate the support of rated maximum output power at maximum modulation order and full PRB configurations |  | yes | N/A | If UE does not support the capability, network does not know ATG UE’s maximum output power. | Per band | No | FR1 only | N/A | Value range from 23dBm to 40dBm with 1dB as granularity | Mandatory with capability signaling |
|  |  | The rated maximum output power is declared via UE capability [*RatedMOPATG*] at maximum modulation order  (ZTE) | The rated maximum output power is declared via UE capability [*RatedMOPATG*] at maximum modulation order reported by ATG UE and full PRB configurations within the channel bandwidth of NR carrier unless otherwise stated. The period of measurement shall be at least one sub frame (1ms). UE capability [*RatedMOPATG*] is an integer value in the range 23 to 40 dBm. |  |  |  |  |  | NO | NO |  |  | Mandatory with capability signalling, |

**Recommended WF:**

The feature has been approved in previous meeting and have sent the LS to RAN2. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  | 35-4 | Rated max output power | Indicate the support of rated maximum output power at maximum modulation order and full PRB configurations |  | yes | N/A | If UE does not support the capability, network does not know ATG UE’s maximum output power. | Per band | No | FR1 only | N/A | Value range from 23dBm to 40dBm with 1dB as granularity | Mandatory with capability signaling |

## 35-5 Enhanced RRM requirements for measurements in IDLE and INACTIVE modes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  | 35-5 | ATG specific P-max | Indicate the support of ATG specific P-max configured by network. |  | no | N/A | If UE does not support ATG specific P-max value, ATG UE can’t identify configured maximum output power PCMAX,f,c | Per UE | No | FR1 only | N/A | Value range from  -21dBm to 42dBm | Mandatory without capability signaling |

**Recommended WF:**

The feature has been approved in previous meeting and sent the LS to RAN2. It is recommended to take following FG as baselie.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
|  | 35-5 | ATG specific P-max | Indicate the support of ATG specific P-max configured by network. |  | no | N/A | If UE does not support ATG specific P-max value, ATG UE can’t identify configured maximum output power PCMAX,f,c | Per UE | No | FR1 only | N/A | Value range from  -21dBm to 42dBm | Mandatory without capability signaling |

1. NR\_demod\_enh3

## 36-1 MU-MIMO Interference Mitigation advanced receiver

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 36.  NR\_demod\_enh3 | 36-1 | Support of requirements for advanced receiver in MU‑MIMO scenarios  (MediaTek) | * Supports new DCI field for network assistance signalling without modulation order blind detection of co-scheduled UEs |  | Yes | N/A | UE does not follow the requirements (Fallback to Rel‑17 MU‑MIMO requirements) | [Per FSPC] |  | FR1 only |  |  | Optional with capability signalling |
| 36. NR\_demod\_enh3 | 36-1 | MU-MIMO Interference Mitigation advanced receiver  (Apple) | 1) R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression for MU-MIMO transmissions for total 2 layers with 2 RX antennas.   * 2) R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression for MU-MIMO transmissions for 2,3, 4 total layers with 4 RX antennas. | 3-4 | Yes | N/A | UE not capable of advanced receiver to suppress inter-user inference in MU-MIMO | Per FSPC | N/A | FR1 only |  | Agreed in WF R4-2316915 to introduce optional UE capability for R-ML receiver for MU-MIMO | Optional with capability signaling |

**Recommended WF:**

Agreed in WF R4-2316915 to introduce optional UE capability for R-ML receiver for MU-MIMO. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 36. NR\_demod\_enh3 | 36-1 | MU-MIMO Interference Mitigation advanced receiver | 1) R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression for MU-MIMO transmissions for total 2 layers with 2 RX antennas.   * 2) R-ML (reduced complexity ML) receivers with enhanced inter-user interference suppression for MU-MIMO transmissions for 2,3, 4 total layers with 4 RX antennas. | [3-4] | Yes | N/A | UE not capable of advanced receiver to suppress inter-user inference in MU-MIMO | Per FSPC | No | FR1 only | N/A |  | Optional with capability signaling |

## 36-x Others

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 36.  NR\_demod\_enh3 | 36-2 | Support of co-scheduled UE modulation order blind detection  (MediaTek) | * Supports modulation order blind detection of co-scheduled UEs | 36-1 | Yes | N/A | UE does not follow the requirements that require modulation order blind detection of co-scheduled UEs | [Per FSPC] |  | FR1 only |  | Candidate value options:   * {Supported, Not supported} * {All supported, Partial support, Not supported | Optional with capability signalling |
| 36. NR\_demod\_enh3 | [36-2] | [Blind detection for co-UE modulation order]  (Apple) | * [Blind detection of modulation order for co-scheduled layers which has the same DMRS sequence as the target UE and in each PRB allocated to the target UE only single modulation order is allocated for the co-scheduled layers.] | 36-1 | Yes | N/A | UE not capable of blind detection for modulation order | Per FSPC | N/A | FR1 only |  | If PDSCH demod requirements with blind detection of modulation order are introduced. | Optional with capability signaling |
| 36. NR\_demod\_enh3 | 36-3 | DMRS Configuration for MU-MIMO advanced receiver  (Apple) | 1) DMRS configuration supported with R-ML for MU-MIMO   * 2) Max number of DMRS ports for blind detection on co-scheduled layers with same DMRS sequence as co-scheduled UE. | 36-1 | Yes | N/A | UE indication of number of ports it can detect | Per FSPC | N/A | FR1 only |  |  | Optional with capability signaling |

**Recommended WF:**

More technical discussion is required.

1. NR\_pos\_enh2

## 37-1 DL PRS or UL SRS frequency hopping for RedCap UEs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 37.NR\_pos\_enh2 | 37-1 | DL PRS or UL SRS frequency hopping for RedCap UEs  (Huawei) | Indicate the switching time for UL SRS or DL PRS hopping for RedCap UEs. |  | Yes | N/A | UE does not support DL PRS or UL SRS frequency hopping for RedCap UEs | Per Band | N/A | N/A | N/A | Candidate value set: FR1: {70us, 140us, 210us}. FR2: {35us, 70us, 125us}  Detailed information can refer to the LS to RAN1 in R4-2306659 and R4-2310305 | Optional with capability signalling |

**Recommended WF:**

Detailed information can refer to the LS to RAN1 in R4-2306659 and R4-2310305. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 37.NR\_pos\_enh2 | 37-1 | DL PRS or UL SRS frequency hopping for RedCap UEs | Indicate the switching time for UL SRS or DL PRS hopping for RedCap UEs. |  | Yes | N/A | UE does not support DL PRS or UL SRS frequency hopping for RedCap UEs | Per Band | No | No | N/A | Candidate value set: FR1: {70us, 140us, 210us}. FR2: {35us, 70us, 125us} | Optional with capability signalling |

## 37-2 DL PRS or UL SRS frequency hopping before the first hop and after the last hop for RedCap UEs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 37.NR\_pos\_enh2 | 37-2 | DL PRS or UL SRS frequency hopping before the first hop and after the last hop for RedCap UEs  (Huawei) | Indicate the switching time for UL SRS or DL PRS transmission between the initial/active BWP to first hop and switching time between last hop to the initial/active BWP for RedCap UEs. | 37-1 | Yes | N/A | The switching time repoted in 37-1 would apply for DL PRS or UL SRS frequency hopping before the first hop and after the last hop for RedCap UEs | Per Band | N/A | N/A | N/A | Candidate value set: {100us, 140us, 200us, 300us, 500us }  Detailed information can refer to the LS to RAN1 in R4-2314732. | Optional with capability signalling |

**Recommended WF:**

Detailed information can refer to the LS to RAN1 in R4-2314732.. It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 37.NR\_pos\_enh2 | 37-2 | DL PRS or UL SRS frequency hopping before the first hop and after the last hop for RedCap UEs | Indicate the switching time for UL SRS or DL PRS transmission between the initial/active BWP to first hop and switching time between last hop to the initial/active BWP for RedCap UEs. | 37-1 | Yes | N/A | The switching time repoted in 37-1 would apply for DL PRS or UL SRS frequency hopping before the first hop and after the last hop for RedCap UEs | Per Band | N/A | N/A | N/A | Candidate value set: {100us, 140us, 200us, 300us, 500us } | Optional with capability signalling |

## 37-x Others

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 37.  NR\_pos\_enh2 | 37-x | Support of reduced number of samples for PRS based positioning measurements with frequency hopping  (Intel) | 1. Support of reduced number of samples in PRS based positioning measurements with frequency hopping | RAN1 feature 28-1, 27-3-1, 45-5-1 | Yes | NA | RedCap UE does not support reduced number of samples for PRS based positioning measurements with frequency hopping | Per Band | No | No | NA | Component 1 candidate value: true/false | Optional with capability signalling |
| 37.  NR\_pos\_enh2 | 37-x | Support of reduced number of samples in positioning measurements with PRS/SRS bandwidth aggregation  (Intel) | 1. Support of reduced number of samples in positioning measurements with PRS bandwidth aggregation  2. Support of reduced number of samples in positioning measurements with SRS bandwidth aggregation | Component 1 RAN1 feature 41-4-1  Component 2 RAN1 feature 41-4-6 | Yes | NA | UE does not support reduced number of samples in positioning measurements with PRS and/or SRS bandwidth aggregation | Per Band | No | No | NA | Component 1 candidate value: true/false  Component 2 candidate value: true/false | Optional with capability signalling |
| 37.  NR\_pos\_enh2 | 37-x | Support of reduced number of samples in sidelink positioning measurements based on SL-PRS  (Intel) | 1. Support of reduced number of samples in sidelink positioning measurements based on SL-PRS | RAN1 feature 41-1-1 | Yes | No | UE does not support reduced number of samples in RSTD measurements based on SL-PRS | Per Band | No | No | NA | Component 1 candidate value: true/false | Optional with capability signalling |

**Recommended WF:**

More technical discussion is required.

1. NR\_MC\_enh

## 38-x Dynamic UL Tx switching

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 38.  NR\_MC\_enh | 38-1 | Switching period for dynamic UL Tx switching across up to 4 bands in case of inter-band CA, SUL  (DOCOMO) | [switchingPeriodFor2T-r18 indicates the length of 2Tx-2Tx switching period. switchingPeriodFor1T-r18 indicates the length of 1Tx-2Tx switching and/or 1Tx-1Tx switching period, as specified in TS 38.101-1. n35us represents 35 us, n140us represents 140us, and so on, as specified in TS 38.101-1.] |  | Yes |  | UL Tx switching across more than 2 bands cannot be supported for the band pair in the band combination | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |
| 38.NR\_MC\_enh | 38-1 | Dynamic Tx switching between 2 bands in 3-band or 4-band combination 1Tx-1Tx switching  (Huawei) | Indicate the supported switching period for dynamic UL Tx switching between two bands both with one transmit antenna connectors in 3-band or 4-band band combination with inter-band UL CA or SUL |  | Yes | N/A | UE does not support Tx switching among 3 or 4 bands 1Tx-1Tx switching for inter-band UL CA and SUL band combinations | UE signals supported switching period per band pair per band combination | N/A | Applicable only to FR1 | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2303507 and R4-2310271. | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-2 | Dynamic Tx switching between 2 bands in 3-band or 4-band combination 1Tx-2Tx switching  (Huawei) | Indicate the supported switching period for dynamic UL Tx switching between one band capable of one transmit antenna connector and the other band capable of two transmit antenna connectors in 3-band or 4-band band combination with inter-band UL CA or SUL |  | Yes | N/A | UE does not support Tx switching among 3 or 4 bands 1Tx-2Tx switching for inter-band UL CA and SUL band combinations | UE signals supported switching period per band pair per band combination | N/A | Applicable only to FR1 | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2214464. | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-3 | Dynamic Tx switching between 2 bands in 3-band or 4-band combination 2Tx-2Tx switching  (Huawei) | Indicate the supported switching period for dynamic UL Tx switching between two bands both with two transmit antenna connectors in 3-band or 4-band band combination with inter-band UL CA or SUL. |  | Yes | N/A | UE does not support Tx switching among 3 or 4 bands 2Tx-2Tx switching for inter-band UL CA and SUL band combinations | UE signals supported switching period per band pair per band combination | N/A | Applicable only to FR1 | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2214464. | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-5 | Dynamic Tx switching of two band pairs among 3 bands 1Tx-1Tx switching  (Huawei) | Indicate the switching period for dynamic UL Tx switching of two band pair in three bands all with one transmit antenna connector. | 38-1 | Yes | N/A | The switching period applied to the two band pairs in the three bands is shorter. | UE signals supported switching period per band(with the number of Tx chains unchanged) per band pair per band combination | No need | Applicable only to FR1 | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2317610 | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-8 | Dynamic Tx switching between two uplink carriers 1Tx-2Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between one carrier capable of one transmit antenna connector and other carrier capable of two transmit antenna connectors in inter-band UL CA or SUL | 7-1 | Yes | N/A | UE does not support Tx switching between two uplink carriers 1Tx-2Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-9 | Dynamic Tx switching between 2CC 2Tx-2Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between two uplink carriers with two transmit antenna connectors in inter-band UL CA or SUL | 16-1 | Yes | N/A | UE does not support Tx switching between 2CC 2Tx-2Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-10 | Dynamic Tx switching between 3CC 1Tx-2Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between one band (with one carrier) capable of one transmit antenna connector and the other band (with two carriers) capable of two transmit antenna connectors in inter-band UL CA or SUL | 16-2 | Yes | N/A | UE does not support Tx switching between 3CC 1Tx-2Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-11 | Dynamic Tx switching between 3CC 2Tx-2Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between one band (with one carrier) capable of two transmit antenna connectors and one band (with two carriers) capable of two transmit antenna connectors in inter-band UL CA or SUL | 16-3 | Yes | N/A | UE does not support Tx switching between 3CC 2Tx-2Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-12 | Dynamic Tx switching between 2 bands in 3-band or 4-band combination 1Tx-1Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between two bands both with one transmit antenna connector in 3-band or 4-band band combination with inter-band UL CA or SUL | 38-1 | Yes | N/A | UE does not support Tx switching between 2 bands in 3-band or 4-band combination 1Tx-1Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-13 | Dynamic Tx switching between 2 bands in 3-band or 4-band combination 1Tx-2Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between one band capable of one transmit antenna connector and the other band capable of two transmit antenna connectors in 3-band or 4-band band combination with inter-band UL CA or SUL | 38-2 | Yes | N/A | UE does not support Tx switching between 2 bands in 3-band or 4-band combination 1Tx-2Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-14 | Dynamic Tx switching between 2 bands in 3-band or 4-band combination 2Tx-2Tx switching with dual-TAG  (Huawei) | Support UE omitting uplink transmission on OFDM symbols that partially or fully overlap with the configured switching period for any timing advance difference for dynamic UL Tx switching between two bands both with two transmit antenna connectors in 3-band or 4-band band combination with inter-band UL CA or SUL. | 38-3 | Yes | N/A | UE does not support Tx switching between 2 bands in 3-band or 4-band combination 2Tx-2Tx switching with dual-TAG |  | N/A | Applicable only to FR1 | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 38.  NR\_MC\_enh | ~~38-x~~ | ~~Preferred switching band pairs~~  ~~(MediaTek)~~ | Support the indication of UE’s preferred (switched-from, switched-to) switching band pairs for parallel UL transmission switching for a band combination consisting of four different bands | 38-1 [Rel-18 Tx switching] | Yes | No | Network can only assume the maximum switch period | Per BC | No | FR1 only | N.A |  | Optional with capability signalling |
|  | 38-1 | UL Tx switching across 3 bands for single-TAG  (Apple) | * UE to indicate support of dynamic UL Tx switching across 3 bands for inter-band UL CA, SUL or inter-band EN-DC * UE to declare the switching period for UL Tx switching across 3 bands for in inter-band EN-DC, inter-band UL CA or SUL band combinations. Switching period value to be from the set (35uSec, 140uSec, 210uSec) |  | yes | no | UE does not support Tx switching across 3 bands for inter-band EN-DC, inter-band UL CA and SUL band combinations, single-TAG | per band pair per BC | No | FR1 only | N/A | Agreed in RAN#98-e RP-223557 | Optional with capability signalling |
|  | 38-2 | UL Tx switching across 4 bands for single-TAG  (Apple) | * UE to indicate support of dynamic UL Tx switching across 4 bands for inter-band UL CA, SUL or inter-band EN-DC * UE to declare the switching period for UL Tx switching across 4 bands for in inter-band EN-DC, inter-band UL CA or SUL band combinations. Switching period value to be from the set (35uSec, 140uSec, 210uSec) |  | yes | no | UE does not support Tx switching across 4 bands for inter-band EN-DC, inter-band UL CA and SUL band combinations, single-TAG | per band pair per BC | No | FR1 only | N/A | Agreed in RAN#98-e RP-223557 | Optional with capability signalling |
|  | 38-3 | UL Tx switching across 2 bands for dual-TAG  (Apple) | * UE to indicate support of dynamic UL Tx switching across 2 bands for inter-band UL CA, SUL or inter-band EN-DC, dual-TAG mode * UE to declare the switching period for UL Tx switching across 2 bands for in inter-band EN-DC, inter-band UL CA or SUL band combinations, dual-TAG mode. Switching period value to be from the set (35uSec, 140uSec, 210uSec) |  | yes | no | UE does not support Tx switching across 2 bands for inter-band EN-DC, inter-band UL CA and SUL band combinations, dual-TAG | per band pair per BC | No | FR1 only | N/A | Agreed in RAN#101 RP-232418 | Optional with capability signalling |
|  | 38-4 | UL Tx switching across 3 bands for dual-TAG  (Apple) | * UE to indicate support of dynamic UL Tx switching across 3 bands for inter-band UL CA, SUL or inter-band EN-DC, dual-TAG mode * UE to declare the switching period for UL Tx switching across 3 bands for in inter-band EN-DC, inter-band UL CA or SUL band combinations, dual-TAG mode. Switching period value to be from the set (35uSec, 140uSec, 210uSec) | 38-1 and 38-2 | yes | no | UE does not support Tx switching across 3 bands for inter-band EN-DC, inter-band UL CA and SUL band combinations, dual-TAG | per band pair per BC | No | FR1 only | N/A | NOTE: Signalling structure is up to RAN2.  RAN4 will specify for UL CA and EN-DC for which band combinations DL interruptions are  Agreed in RAN#101 RP-232418 | Optional with capability signalling |
|  | 38-5 | UL Tx switching across 4 bands for dual-TAG  (Apple) | * UE to indicate support of dynamic UL Tx switching across 4 bands for inter-band UL CA, SUL or inter-band EN-DC, dual-TAG mode * UE to declare the switching period for UL Tx switching across 4 bands for in inter-band EN-DC, inter-band UL CA or SUL band combinations, dual-TAG mode. Switching period value to be from the set (35uSec, 140uSec, 210uSec) | 38-1 and 38-2 | yes | no | UE does not support Tx switching across 4 bands for inter-band EN-DC, inter-band UL CA and SUL band combinations, dual-TAG | per band pair per BC | No | FR1 only | N/A | NOTE: Signalling structure is up to RAN2.  RAN4 will specify for UL CA and EN-DC for which band combinations DL interruptions are  Agreed in RAN#101 RP-232418 | Optional with capability signalling |
| 38.  NR\_MC\_enh | 38-1 | Dynamic Tx switching between 2CC 2Tx-2Tx switching cross 3 or 4 bands  (ZTE) | * Indicate the supported switching period for dynamic UL Tx switching between two uplink carriers with two transmit antenna connectors in inter-band UL CA or SUL cross 3 or 4 bands |  | Yes | no | UE does not support 2CC 2Tx-2Tx switching for inter-band UL CA and SUL band combinations cross 3 or 4 bands | per band pair per BC | No need | FR1 only | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2214464 and  [R4-2303507](file:///D:\RAN4%23106\Docs\R4-2303507.zip) | Optional |
| 38.  NR\_MC\_enh | 38-2 | Dynamic Tx switching between 3CC 1Tx-2Tx switching cross 3 or 4 bands  (ZTE) | * Indicate the supported switching period for dynamic UL Tx switching between one band (with one carrier) capable of one transmit antenna connector and one band (with two carriers) capable of two transmit antenna connectors in inter-band UL CA or SUL cross 3 or 4 bands |  | Yes | no | UE does not support 2CC 1Tx-2Tx switching for inter-band UL CA and SUL band combinations cross 3 or 4 bands | per band pair per BC | No need | FR1 only | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2214464 and  [R4-2303507](file:///D:\RAN4%23106\Docs\R4-2303507.zip) | Optional |
| 38.  NR\_MC\_enh | 38-3 | Dynamic Tx switching  (ZTE) | Indicate UE transmits on the band with the number of Tx chain unchanged during the switching as follows:   * Per band (only for the band(s) in the band combination but not included in the pair of bands before and after switching) for each pair of bands before and after switching in each band combination. |  | Yes | no | UE doesn’t support to transmit on the band for each pair of bands before and after switching in each band combination. | per band per band pair per BC | No need | FR1 only | Support mixture of FDD/TDD | Detailed information can refer to the LS to RAN1 and RAN2 in R4-2303507 | Optional |
| 38.  NR\_MC\_enh | 38-5 | Dynamic Tx switching for 4 bands  (ZTE) | * Indicate UE report the preferred case and the corresponding improved switching period. |  | Yes | no | UE doesn’t support to report the preferred case | Per BC | No need | FR1 only | Support mixture of FDD/TDD | This capability cannot be reported simultaneously with 38-4.  Detailed information can refer to the LS to RAN2 in R4-2317609. | Optional |
| 38.  NR\_MC\_enh | 38-6 | Dynamic Tx switching for 3 bands  (ZTE) | * Indicate UE reports switching period for the case that the unaffected band is involved in the switching process |  | Yes | no | UE doesn’t support to report switching period for the case that the unaffected band is involved in the switching process | Per band per band pair | No need | FR1 only | Support mixture of FDD/TDD | Candidate values are {35u, 140us, 210us}.  Detailed information can refer to the LS to RAN2 in R4-2317610. | Optional |

**Recommended WF:**

Regarding dynamic Tx switching FGs, different companies propose different set of FGs.

Need to first discuss whether to combine them into one FG as rapporteur proposed. In addition, dual TAG case may need seperate 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**  **(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** |
| 38.  NR\_MC\_enh | 38-1 | Switching period for dynamic UL Tx switching across up to 4 bands in case of inter-band CA, SUL  (DOCOMO) | [switchingPeriodFor2T-r18 indicates the length of 2Tx-2Tx switching period. switchingPeriodFor1T-r18 indicates the length of 1Tx-2Tx switching and/or 1Tx-1Tx switching period, as specified in TS 38.101-1. n35us represents 35 us, n140us represents 140us, and so on, as specified in TS 38.101-1.] |  | Yes |  | UL Tx switching across more than 2 bands cannot be supported for the band pair in the band combination | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |

## 38-x DL interruption

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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** |
| 38.  NR\_MC\_enh | 38-2 | Application of DL interruptions due to dynamic UL Tx switching  (DOCOMO) | [uplinkTxSwitching-DL-Interruption-r18 indicates that DL interruption on the band will occur during UL Tx switching, as specified in TS 38.133. UE is not allowed to set this field for the band combination of SUL band+TDD band, for which no DL interruption is allowed.  Field encoded as a bit map, where bit N is set to "1" if DL interruption on band N will occur during uplink Tx switching as specified in TS 38.133 [5]. The leading / leftmost bit (bit 0) corresponds to the first band of this band combination, the next bit corresponds to the second band of this band combination and so on. The capability is not applicable to the following band combinations, in which DL reception interruption is not allowed:  - TDD+TDD CA with the same UL-DL pattern] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |
|  | 38-6 | DL interruption for Tx switching across 3 bands  (Apple) | Capability to indicate that for the band where DL interruption is needed, the RRM interruption requirements defined in RAN4 shall be applied for duplex mode combinations except the combinations   * SUL+TDD * TDD+TDD CA with the same UL-DL pattern * TDD+TDD EN-DC with the same UL-DL pattern | 38-1, 38-2, 38-3 | yes | no | UE not reporting this capability means DL interruption is not required | per band pair per BC | No | FR1 only | N/A |  | Optional with capability signalling |
|  | 38-7 | DL interruption for Tx switching across 4 bands  (Apple) | Capability to indicate that for the band where DL interruption is needed, the RRM interruption requirements defined in RAN4 shall be applied for duplex mode combinations except the combinations   * SUL+TDD * TDD+TDD CA with the same UL-DL pattern * TDD+TDD EN-DC with the same UL-DL pattern | 38-1, 38-2, 38-3 | yes | no | UE not reporting this capability means DL interruption is not required | per band pair per BC | No | FR1 only | N/A |  | Optional with capability signalling |

**Recommended WF:**

Regarding DL interruption for Tx switching, different companies propose different set of FGs.

Need to first discuss whether to combine them into one FG as rapporteur proposed.

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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** |
| 38.  NR\_MC\_enh | 38-2 | Application of DL interruptions due to dynamic UL Tx switching  (DOCOMO) | [uplinkTxSwitching-DL-Interruption-r18 indicates that DL interruption on the band will occur during UL Tx switching, as specified in TS 38.133. UE is not allowed to set this field for the band combination of SUL band+TDD band, for which no DL interruption is allowed.  Field encoded as a bit map, where bit N is set to "1" if DL interruption on band N will occur during uplink Tx switching as specified in TS 38.133 [5]. The leading / leftmost bit (bit 0) corresponds to the first band of this band combination, the next bit corresponds to the second band of this band combination and so on. The capability is not applicable to the following band combinations, in which DL reception interruption is not allowed:  - TDD+TDD CA with the same UL-DL pattern] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |

## 38-x Unaffected 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**  **(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** |
| 38.  NR\_MC\_enh | 38-3 | Switching Period for unaffected Band for Dual UL  (DOCOMO) | *[SwitchingPeriodUnaffectedBandDualUL-r18* indicates for a given band pair {band X and band Y}, whether/how the switching period is to be applied on band X, Y, Z, when a UL Tx switching is triggered from band pair {band X and band Z} to band pair {band Y and band Z}, as defined in 38.101-1. If absent for band Z, the UE is not required to transmit on any UL bands, if switching period is located on X, during the switching period reported for the band pair of band X and band Y.  - *maintainedUL-Trans-r18* indicates that if the switching period is located on band X, the UE is capable of uplink transmission on band Z and is not required to transmit on band X and Y during the switching period reported for the band pair of band X and band, as specified in 38.101-1.  -  - *periodOnULBands-r18* indicates the switching period to be applied on any UL bands as specified in 38.101-1. N35us represents 35 us, n140us represents 140us, and so on.  - Band Z corresponds to the zth entry in the *uplinkTxSwitchingPeriodUnaffectedBandDualUL-List-r18*, which includes the UL band of this band combination excluding band X and band Y listed in the same order of the band combination.] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |
| 38.NR\_MC\_enh | 38-4 | Continuation of uplink transmission on the band with number of Tx chain unchanged  (Huawei) | When dynamic UL Tx switching happens between two bands both with one transmit antenna connectors, and there is another band in the band combination with number of Tx chain unchanged, this capability indicates UE support of continuation of uplink transmission on the band with number of Tx chain unchanged during the switching period of the Tx switching between other two bands  If this capability is not supported, the switching period of the two bands applies to the band with number of Tx chain unchanged. | 38-1 | Yes | N/A | The switching period of the two bands applies to the band with number of Tx chain unchanged. | Per band per band pair per band combination | N/A | Applicable only to FR1 | Support mixture of FDD/TDD | Detailed information can refer to the LS to RAN2 in R4-2303507 | Optional with capability signalling |
|  | 38-8 | Optional UE TX switching capability  (Apple) | * For the band with the number of Tx chain **unchanged** due to switching, in addition to the baseline UE assumption agreed in RAN4 #104e, introduce optional UE capability to allow UL transmission on the band with the number of Tx chain unchanged (i.e., one Tx chain is maintained on the band) during UL switching.     The swithing period is the switching period between band A and band B | 38-1 | yes | no | UE not reporting this capability means UE does not support optional Tx switching capability | per band pair per BC | No | FR1 only | N/A | RAN2 to define how the UE could signal to the network its support of this this optional feature.  Agreed in RAN#98-e RP-223557 | Optional with capability signalling |
| 38.  NR\_MC\_enh | 38-3 | Dynamic Tx switching  (ZTE) | Indicate UE transmits on the band with the number of Tx chain unchanged during the switching as follows:   * Per band (only for the band(s) in the band combination but not included in the pair of bands before and after switching) for each pair of bands before and after switching in each band combination. |  | Yes | no | UE doesn’t support to transmit on the band for each pair of bands before and after switching in each band combination. | per band per band pair per BC | No need | FR1 only | Support mixture of FDD/TDD | Detailed information can refer to the LS to RAN1 and RAN2 in R4-2303507 | Optional |
| 38.  NR\_MC\_enh | 38-6 | Dynamic Tx switching for 3 bands  (ZTE) | * Indicate UE reports switching period for the case that the unaffected band is involved in the switching process |  | Yes | no | UE doesn’t support to report switching period for the case that the unaffected band is involved in the switching process | Per band per band pair | No need | FR1 only | Support mixture of FDD/TDD | Candidate values are {35u, 140us, 210us}.  Detailed information can refer to the LS to RAN2 in R4-2317610. | Optional |

**Recommended WF:**

Regarding the unaffected or unchanged bands for dynamic Tx switching, more discussion is needed on how to capture the FG(s).

Consider the rapporteur input as baseline for further discusison.

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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** |
| 38.  NR\_MC\_enh | 38-3 | Switching Period for unaffected Band for Dual UL  (DOCOMO) | *[SwitchingPeriodUnaffectedBandDualUL-r18* indicates for a given band pair {band X and band Y}, whether/how the switching period is to be applied on band X, Y, Z, when a UL Tx switching is triggered from band pair {band X and band Z} to band pair {band Y and band Z}, as defined in 38.101-1. If absent for band Z, the UE is not required to transmit on any UL bands, if switching period is located on X, during the switching period reported for the band pair of band X and band Y.  - *maintainedUL-Trans-r18* indicates that if the switching period is located on band X, the UE is capable of uplink transmission on band Z and is not required to transmit on band X and Y during the switching period reported for the band pair of band X and band, as specified in 38.101-1.  -  - *periodOnULBands-r18* indicates the switching period to be applied on any UL bands as specified in 38.101-1. N35us represents 35 us, n140us represents 140us, and so on.  - Band Z corresponds to the zth entry in the *uplinkTxSwitchingPeriodUnaffectedBandDualUL-List-r18*, which includes the UL band of this band combination excluding band X and band Y listed in the same order of the band combination.] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |

## 38-x Additional switching Period

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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** |
| 38.  NR\_MC\_enh | 38-4 | Additional switching Period for Dual UL  (DOCOMO) | [Indicates the UL Tx switching period for switching between a band pair and another band pair or another band, when Rel-18 UL Tx switching is configured by *uplinkTxSwitchingMoreBands-r18*. If the capability is not reported, the switching period reported in *switchingPeriodFor2T-r18* or *switchingPeriodFor1T-r18* applies, as specified in TS 38.214 and TS 38.101-1.  - *bandPairIndex1-r18*/*bandPairIndex2-r18* xx refers to the xxth band pair entry in the band pair list indicated by *ULTxSwitchingBandPair-r18.*  - *bandIndex-r18* xx refers to the xxth band entry in this band combination.  - *switchingAdditionalPeriodDualUL-r18* indicateds the length of switching period for switching between one band pair indicated by *bandPairIndex1-r18* and another band pair indicated by *bandPairIndex2-r18* or another band indicated by *bandIndex-r18.*  - n35us represents 35 us, n140us represents 140us, and so on, as specified in TS 38.101-1.  A UE supporting this feature shall also indicate the support of *dualUL* switching option for the band pair(s) indicated in *bandPairIndex1-r18*/*bandPairIndex2-r18*.] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |
| 38.NR\_MC\_enh | 38-6 | Dynamic Tx switching with additional period of two band pairs among 3 bands 1Tx-2Tx switching  (Huawei) | Indicate the additional switching period for dynamic UL Tx switching of two band pair in three bands including one band with two transmit antenna connectors. | 38-2 | Yes | N/A | The switching period applied to the two band pairs in the three bands is shorter. | UE signals supported switching period per band combination | N/A | Applicable only to FR1 | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2310495 | Optional with capability signalling |
| 38.NR\_MC\_enh | 38-7 | Dynamic Tx switching of two Tx chains with additional period among 4 bands 1Tx-1Tx switching  (Huawei) | Indicate the additional switching period for two Tx chains switching among 4 bands. | 38-1 | Yes | N/A | The switching period applied to the two band pairs in the four bands is shorter | UE signals supported switching period per band combination | N/A | Applicable only to FR1 | Support mixture of FDD/TDD | Candidate value set: {35us, 140 us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2310495 | Optional with capability signalling |
| 38.  NR\_MC\_enh | 38-4 | Dynamic Tx switching for 4 bands  (ZTE) | Indicate UE additional report new switching periods for switching of 2Tx chains between 2 different band pair as a switching event, i.e., between {1T, 1T, 0T, 0T} and {0T, 0T, 1T, 1T}. |  | Yes | no | UE doesn’t support to report new switching periods | per band pair | No need | FR1 only | Support mixture of FDD/TDD | Candidate values are {35u, 140us, 210us}  Detailed information can refer to the LS to RAN2 in R4-2310495. | Optional |

**Recommended WF:**

Regarding additional switching period, need to discuss whether to have one FG or multiple FGs. Disucss whether the following rapporteur input can be considered as baseline.

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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** |
| 38.  NR\_MC\_enh | 38-4 | Additional switching Period for Dual UL  (DOCOMO) | [Indicates the UL Tx switching period for switching between a band pair and another band pair or another band, when Rel-18 UL Tx switching is configured by *uplinkTxSwitchingMoreBands-r18*. If the capability is not reported, the switching period reported in *switchingPeriodFor2T-r18* or *switchingPeriodFor1T-r18* applies, as specified in TS 38.214 and TS 38.101-1.  - *bandPairIndex1-r18*/*bandPairIndex2-r18* xx refers to the xxth band pair entry in the band pair list indicated by *ULTxSwitchingBandPair-r18.*  - *bandIndex-r18* xx refers to the xxth band entry in this band combination.  - *switchingAdditionalPeriodDualUL-r18* indicateds the length of switching period for switching between one band pair indicated by *bandPairIndex1-r18* and another band pair indicated by *bandPairIndex2-r18* or another band indicated by *bandIndex-r18.*  - n35us represents 35 us, n140us represents 140us, and so on, as specified in TS 38.101-1.  A UE supporting this feature shall also indicate the support of *dualUL* switching option for the band pair(s) indicated in *bandPairIndex1-r18*/*bandPairIndex2-r18*.] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |

## 38-x Switching band pair indication

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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** |
| 38.  NR\_MC\_enh | 38-5 | [Switching band pair indication approach]  (DOCOMO) | [TBD] | 38-1 | Yes |  |  | [Per BC, details are up to RAN2] | No need | Applicable only to FR1 |  |  | Optional with capability signaling |
| 38.  NR\_MC\_enh | 38-x | Preferred switching band pairs  (MediaTek) | Support the indication of UE’s preferred (switched-from, switched-to) switching band pairs for parallel UL transmission switching for a band combination consisting of four different bands | 38-1 [Rel-18 Tx switching] | Yes | No | Network can only assume the maximum switch period | Per BC | No | FR1 only | N.A |  | Optional with capability signalling |
| 38.  NR\_MC\_enh | 38-5 | Dynamic Tx switching for 4 bands  (ZTE) | * Indicate UE report the preferred case and the corresponding improved switching period. |  | Yes | no | UE doesn’t support to report the preferred case | Per BC | No need | FR1 only | Support mixture of FDD/TDD | This capability cannot be reported simultaneously with 38-4.  Detailed information can refer to the LS to RAN2 in R4-2317609. | Optional |

**Recommended WF:**

More technical discussion is required on whether to introduce the FG of switching band pair indication.

1. NR\_Mob\_enh2

## 39-1 L1-RSRP measurement on LTM candidate 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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | 39-1 | L1-RSRP measurement on LTM candidate cell  (Apple) | SSB based intra-frequency L1 measurement with RTD between the SSBs of serving cell and neighbour cell on the same carrier is larger than CP length of the corresponding SCS | 45-1 | [Yes] | N/A | [FFS] | [Per-band/BC] | [No] | [No] | N/A | Already sent to RAN1/2 R4-2303308 | Optional with capability signaling |

**Recommended WF:**

Already sent to RAN1/2 R4-2303308. It is recommended to take following FG as baseline for discussion.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | 39-1 | L1-RSRP measurement on LTM candidate cell | Support of SSB based intra-frequency L1 measurement with RTD between the SSBs of serving cell and neighbour cell on the same carrier is larger than CP length of the corresponding SCS | 45-1 from RAN1 feature list | [Yes] | N/A | [FFS] | [Per-band/BC] | [No] | [No] | N/A | 8 | Optional with capability signaling |

## 39-2 Interruption on DL symbols due to PDCCH- ordered RACH

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | 39-3 | Interruption on DL symbols due to PDCCH- ordered RACH  (MediaTek) | Capability on whether UE will cause interruption on DL symbols on serving cells due to PDCCH-ordered RACH | 45-5 | Yes | No | UE will not cause interruptions on DL symbols on serving cells due to PDCCH-ordered RACH | Per band pair (between the target band for RACH transmission and band under UE’s current band combo) per band combination | No | No | N/A |  | Optional with capability signaling |
|  | 39-2 | PDCCH order based RACH to LTM candidate cell  (Apple) | Interruption on DL during PDCCH order RACH transmission to LTM candidate cell | 45-5 | [Yes] | N/A | [FFS] | [Per-FS] | [No] | [No] | N/A | Agreed in RAN4#108bis R4-2317330 | Optional with capability signaling |

**Recommended WF:**

Agreed in RAN4#108bis R4-2317330: Introduce a UE capability to indicate whether there will be interruption on DL during PDCCH order RACH transmission to target cell. FFS the details of the capability.

It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | 39-2 | Interruption on DL symbols due to PDCCH- ordered RACH | indicates whether UE will cause interruption on DL symbols on serving cells due to PDCCH-ordered RACH transmission to LTM candidate cell | 45-5 | Yes | No | UE will not cause interruptions on DL symbols on serving cells due to PDCCH-ordered RACH | [Per band pair (between the target band for RACH transmission and band under UE’s current band combo) per band combination,  Or Per FS] | No | No | N/A |  | Optional with capability signaling |

## 39-3 Early ASN.1 decoding and validity/compliance check

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | 39-4 | Early ASN.1 decoding and validity check before cell switch  (MediaTek) | Capability of early ASN.1 decoding and validity check before cell switch to [reduce or skip] Texecution delay (refer to TS 38.133).  Note: Additional conditions to apply the capability is FFS in RAN4. Additional components may be introduced to this FG later | [Component 6 of 45-3 or 45-4] | Yes | No | Texecution delay will not be [reduced or skipped] | [Per UE] | No | No | N/A | [Candidate values: 0 or TBD] | Optional with capability signaling |
|  | 39-3 | Early ASN.1 decoding and validity/compliance check [of LTM candidates]  (Apple) | Early ASN.1 decoding and validity/compliance check [of LTM candidates] | 45-3 | [No] | N/A | 10ms is allowed for ASN.1 decoding and validity/compliance check of target cell configuration | [Per-UE/FR] | [No] | [No] | N/A | Agreed in RAN4#108bis R4-2317330 | Optional without capability signaling |

**Recommended WF:**

Agreed in RAN4#108bis R4-2317330: From RAN4 perspective, introduce new optional UE capability for early ASN.1 decoding and validity/compliance check [of LTM candidates]. FFS on capability design.

It is recommended to take following FG as baseline.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 39.  NR\_Mob\_enh2 | 39-3 | Early ASN.1 decoding and validity check before cell switch | Capability of early ASN.1 decoding and validity check before cell switch to [reduce or skip] Texecution delay (refer to TS 38.133).  Note: Additional conditions to apply the capability is FFS in RAN4. Additional components may be introduced to this FG later | [Component 6 of 45-3 or 45-4] | Yes | No | Texecution delay will not be [reduced or skipped] | [Per UE] | No | No | N/A | [Candidate values: 0 or TBD] | Optional with capability signaling |

## 39-x Duplicated features with RAN1 feature list

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | 39-x | Simultaneous L1-RSRP measurements for multiple cells with RTD > CP  (MediaTek) | 1. Capability of simultaneous L1-RSRP measurements for more than 1 Cells with RTD > CP on the same OFDM symbol in one FR1 frequency layer 2. Capability of L1-RSRP measurements for more than 1 Cells with RTD > CP in one FR2 frequency layer   Note: Duplication with component 1 of 45-1 and 45-1a in RAN1 feature list. Suggest to handle in RAN4 feature list | 45-1, or 45-1a from RAN1 Rel-18 feature list | Yes | No | [NW does not know which requirements UE will follow] | Per UE | No | Yes | N/A | Note: the max number of cells is up to 39-2 | Optional with capability signaling |
| 39.  NR\_Mob\_enh2 | 39-x | Number of [neighbour] cells to be measured per frequency layer  (MediaTek) | 1. Number of [neighbour] cells to be measured for L1-RSRP per frequency layer per intra-freq layer 2. Number of neighbour cells to be measured for L1-RSRP per frequency layer per inter-freq layer   Note: Duplication with component 3 of 45-1 and 45-1a in RAN1 feature list. Suggest to handle in RAN4 feature list | 45-1, or 45-1a from RAN1 Rel-18 feature list | Yes | No | NW does not know the max number of cells UE can measure | Per band | No | [No] | N/A | Candidate values: 2, 3, [… TBD] | Mandatory with capability signaling if UE supports 45-1, or  45-1a |

**Recommended WF:**

Since RAN1 already sent UE feature list to RAN2, it is recommended not to duplicate the FGs in RAN4 UE feature list.

## 39-x Others

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** | **Need of FDD/TDD differentiation** | **Need of FR1/FR2 differentiation** | **Capability interpretation for mixture of FDD/TDD and/or FR1/FR2** | **Note** | **Mandatory/Optional** |
| 39.  NR\_Mob\_enh2 | [39-5] | Shorter UE processing time during cell switch  (MediaTek) | Capability of reduced TLTM, processing delay (refer to TS 38.133).  Note: Additional conditions to apply the capability is FFS in RAN4. Additional components may be introduced to this FG later | [Component 6 of 45-3 or 45-4] | Yes | No | TLTM, processing delay will not be reduced | [Per UE] | No | No | N/A | Candidate values: TBD | Optional with capability signaling |
| 39.  NR\_Mob\_enh2 | [39-6] | Using L3 measurement results in L1-RSRP measurement report  (MediaTek) | Capability of using L3 measurement results in L1 measurement report  Note: Additional conditions to apply the capability is FFS in RAN4. | 45-1, or  45-1a | [Yes or No] | No | UE will not use L3 measurement results in L1 measurement report | [Per UE] | No | [Yes] | N/A |  | Optional with capability signaling |
| 39.  NR\_Mob\_enh2 | [39-7] | Measurement validation during connection setup/resume  (MediaTek) | Support of measurement validation during connection setup/resume |  | [Yes] | N/A | UE does not support measurement validation during connection setup/resume | [Per-UE] | No | [Yes] | N/A |  | Optional with capability signaling |
| 39.  NR\_Mob\_enh2 | [39-8] | Enhanced measurement during RRC connection setup/resume  (MediaTek) | Support of enhanced measurement during RRC connection setup/resume |  | [Yes] | N/A | UE does not support enhanced measurement during RRC connection setup/resume | [Per-UE] | No | [Yes] | N/A |  | Optional with capability signaling |
|  | [39-4] | Number of neighbor cells configured for L1-RSRP measurement  (Apple) | Max number of neighbor cells configured for intra-frequency L1-RSRP measurement  Max number of neighbor cells configured for inter-frequency L1-RSRP measurement | 45-1 or 45-1a | Yes | No | NW does not know the max number of cells UE can measure | [Per FS] | No | [No] | N/A |  | Mandatory with capability signaling if UE supports 45-1, or  45-1a |
|  | 39-5 | Measurement validation during connection setup/resume  (Apple) | Improvement on SCell/SCG setup delay based on existing measurement |  | [Yes] | N/A | UE does not support measurement validation during connection setup/resume | [Per-UE] | [No] | [Yes] | N/A |  | Optional with capability signaling |
|  | [39-6] | Enhanced measurement during RRC connection setup/resume  (Apple) | Improvement on SCell/SCG setup delay based on enhanced measurement during RRC connection setup/resume |  | [Yes] | N/A | UE does not support enhanced measurement during RRC connection setup/resume | [Per-UE] | No | [Yes] | N/A |  | Optional with capability signaling |
|  | 39-1 | Support of FR2 measurements during RRC connection setup/resume  (vivo) | 1. Support of FR2 measurements during RRC connection setup/resume   Support of continuing FR2 measurements after RRC connection setup/resume |  | YES | NO | 1.UE doesn’t support of FR2 measurements during RRC connection setup/resume | Per UE | No | FR2 only | NO |  | Optional with capability signalling |
|  | 39-2 | Support availability indication of IDLE/INACTIVE mode FR2 measurements  (vivo) | Support availability indication of IDLE/INACTIVE mode FR2 measurements for UE which is not capable of *idleInactiveNR-MeasBeamReport-r16* |  | YES | NO | 1. UE doesn’t support availability indication of IDLE/INACTIVE mode FR2 measurements if UE is not capable of *idleInactiveNR-MeasBeamReport-r16* | Per UE | No | FR2 only | NO |  | Optional with capability signalling |
|  | 39-3 | Support of reporting L3 measurement results in L1 reporting  (vivo) | 1. Support reporting L3 measurement results in L1 reporting. |  | YES | No | 1. UE can not report L3 measurement results in L1 reporting | Per UE | No | No | NO |  | Optional with capability signalling |
|  | 39-1 | Support of FR2 measurements validation during RRC connection setup or RRC resume  (ZTE) | 1. Support of FR2 measurements validation during RRC connection setup/ resume 2. [Support of continuing the FR2 measurements after RRC connection setup/resume]   2.1 [indicate measurement status when entering connected mode]  2.2 [Network may provide assistant information and measurement configuration] | - | Yes | No | UE does not support FR2 measurement validation during connection setup/resume | Per UE | No | FR2 only | No | []: under discussion and there is no agreement in RAN4 | optional |
|  | 39-2 | Support of availability indication of FR2 measurements done while in RRC\_IDLE/ RRC\_INACTIVE  (ZTE) | 1. Support of FR2 measurements validation during RRC connection setup/ resume   2. [Support availability of IDLE/INACTIVE mode FR2 measurements to be indicated with carrier information during RRC connection setup/ resume.] | idleInactiveNR-MeasBeamReport-r16 (for FR2) | Yes | No | UE does not support indication of available FR2 measurements and carrier information, performed during RRC\_IDLE/INACTIVE, during connection setup/resume | Per UE | No | FR2 only | No | []: under discussion and there is no agreement in RAN4 | optional |
|  | 39-3 | Support of L1-RSRP measurement in LTM  (ZTE) | 1. Supported maximum number of cells/SSBs configured for L1 measurement [on neighbour cell]   Support RTD of serving cell and neighbour cell larger than one CP for intra-frequency L1-RSRP measurement | - | Yes | No | UE dose not support of L1-RSRP measurement in LTM | [Per band] | No | No | No | []: under discussion and there is no agreement in RAN4 | optional |
|  | 39-4 | [ Support to use L3 measurement results for L1 measurement report]  (ZTE) | [ Support to use L3 measurement results for intra-frequency and inter-frequency L1 measurement report.] | - | Yes | No | UE dose not support to use L3 measurement results for L1 measurement report | Per UE | No | No | No | []: under discussion and there is no agreement in RAN4 | optional |

**Recommended WF:**

More technical discussion is required.

1. NR\_NTN\_enh

## 40-1 Rx beam steering

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 40.NR\_NTN\_enh | 40-3 | Rx beam steering  (Huawei) | Support of Rx beam steering capability   1. Type 1: Fully electronically-steered beam UEs 2. Type 2: Fully mechanically-steered beam UEs   A VSAT (Very Small Aperture Terminal) UE as defined in TS 38.101-5 must indicate support of this capability with one and only one type.  The capability is not applicable for UE other than VSAT. |  | Yes | N/A | Rx beam steering is not supported. | Per-band | FDD only | N/A | N/A |  | Optional with capability signaling |
| 40.  NR\_NTN\_enh | [40-1] | Mechanical beam sweeping delay  (MediaTek) | For mechanical beam steering UE, to indicate the beam switching delay from one satellite to another in Ka band | TBD | Yes | No |  | Per Band (Ka band only) | FDD only (Ka band only) | TBD | N.A | Candidate values are TBD | Optional with UE capability signalling |
| 40.  NR\_NTN\_enh | 40-2 | Beam switching time beam switching delay from one satellite to another for type 2 UE  (CATT) | The value of beam switching time beam switching delay from one satellite to another for type 2 UE |  | Yes |  | NW cannot know the beam switching time beam switching delay from one satellite to another for type 2 UE for NTN | Per UE | No | No |  |  | Optional with capability signalling |
| 40.  NR\_NTN\_enh | 40-1 | UE architectures for beam steering for band above 10GHz  (Apple) | Support of UE architectures for beam steering in above 10 GHz bands, either fully electronically-steered beam UEs (Type 1 UE) or fully mechanically-steered beam UEs (Type 2 UE) | ~~[Support of above 10GHz band]~~ | Yes | N/A | UE does not support NTN communication on above 10GHz bands. | **Per band** | FDD only | [FR2 only] | N/A | UE to indicate which architecture is used to support NTN above 10GHz:  (1)Type 1: fully electronically-steered beam UE, or  (2)Type 2: fully mechanically-steered beam UE.  [Agreed in R4-2314447] | Optional with capability signaling |
| 40.  NR\_NTN\_enh | 40-2 | [Beam steering speed for fully mechanically-steered beam UEs (Type 2 UE)]  (Apple) | Support of indicating the beam steering adjustment speed during mobility based measurement in inter-satellite Handover. | 40-x (Type 2 UE) | Yes | N/A | Type 2 UE cannot complete the inter-satellite handover within a time delay requirement in TS38.133 [section 6.x.y] | **Per band** | FDD only | FR2 only | N/A | UE to indicate which the beam steering adjustment speed during mobility based measurement in inter-satellite Handover, i.e., X degrees/sec.  The candidate values for X can be {22, etc} | Optional with capability signaling |
| 40.  NR\_NTN\_enh  *UEType MechanicalSteering-r18* | 40-3 | Support NTN UE capable of VSAT communicating with mechanical steering antenna  (vivo) | Support NTN UE capable of VSAT communicating with mechanical steering antenna |  | YES | NO | UE is not capable of VSAT communicating with mechanical steering antenna | Per UE | FDD only | FR2 only | NO |  | Optional with capability signalling |

**Recommended WF:**

It seems RAN4 agreed to introduce FG of Rx beam steering for VAST, it is recommended to take following FG as baseline for discussion. Whether to introduce other FGs proposal related to beam steering, e.g. delay, speed, still require more technical discussion.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 40.NR\_NTN\_enh | 40-3 | Rx beam steering | Support of Rx beam steering capability [in above 10 GHz band]   1. Type 1: Fully electronically-steered beam UEs 2. Type 2: Fully mechanically-steered beam UEs   A VSAT (Very Small Aperture Terminal) UE as defined in TS 38.101-5 must indicate support of this capability with one and only one type.  The capability is not applicable for UE other than VSAT. |  | Yes | N/A | Rx beam steering is not supported. | Per band | FDD only | N/A | N/A |  | Optional with capability signaling |

## 40-x FSS, MSS in NTN

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 40.NR\_NTN\_enh | 40-1 | FSS in NTN  (Huawei) | 1. Support fixed station service   Support access to an MSS cell or an FSS cell |  | Yes | N/A | The network doesn’t know the UE type and cannot decide whether to handover this UE to an FSS cell. | [Per UE/Per band] | N/A | N/A | N/A |  | Optional with capability signalling |
| 40.NR\_NTN\_enh | 40-2 | MSS in NTN  (Huawei) | 1. Support mobile station service 2. Support access to an MSS cell   Support receiving access control indication in system information |  | Yes | N/A | The network doesn’t know the UE type and cannot control whether to allow an MSS UE to access and cannot decide whether to handover this UE to an FSS cell | [Per UE/Per band] | N/A | N/A | N/A |  | Optional with capability signalling |

**Recommended WF:**

Discuss whether to introduce the FG of general support of FSS and MSS

## 40-x Others

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 40.  NR\_NTN\_enh | 40-1 | Supported MG patterns for FR2-NTN  (CATT) | Support of FR2 MG patterns for FR2-NTN |  | Yes |  | UE cannot support FR2 MG for NTN | Per UE | No | No |  |  | Optional with capability signalling |
| 40.  NR\_NTN\_enh | [40-3] | [NTN communication with SCS of 120kHz for band above 10GHz]  (Apple) | [Support of NTN communication with SCS of 120kHz for band above 10GHz.] | ~~[Support of above 10GHz band]~~ | [Yes] | [N/A] | [UE does not support NTN communication with SCS of 120kHz for band above 10GHz.] | [Per band] | FDD only | [FR2 only] | N/A | [UE is required to meet the Tx timing requirement for SCS=120kHz in TS38.133 [section 7.x.y].] | [Optional with capability signaling] |
| 40.  NR\_NTN\_enh | 40-4 | DMRS bundling for NTN coverage enhancement  (Apple) | The range of [*maxDurationDMRS-Bundling-r17*] for NTN bands for which RAN4 has introduced requirements is restricted as follows:   * Up to [4] slots if *ntn-ScenarioSupport-r17* is present and indicated as NGSO or only the IE field *nonTerrestrialNetwork-r17* is present * Up to [16] slots if *ntn-ScenarioSupport-r17* is present and indicated as GSO | [*maxDurationDMRS-Bundling-r17*], [*ntn-ScenarioSupport-r17*] | Yes | N/A | UE cannot support this feature | Per band |  |  | N/A |  | Optional with capability signalling |
| 40.  NR\_NTN\_enh  *parallelMeasurementWithoutRestriction-fr2-r18* | 40-1 | Parallel measurements on cells belonging to a different NGSO satellite than a serving satellite without scheduling restrictions on normal operations with the serving cell  (vivo) | Support of measurements on cells belonging to different satellite as the serving cell in parallel with normal operation (i.e., data/control transmission and/or reception, and L1 measurements) of serving cell without scheduling restrictions. [The feature is applicable only when the serving satellite is NGSO. If the serving cell belongs to GSO satellite, the scheduling restriction is not applied on the premise that a mixed type of satellites on the same frequency layer is not supported in this release (Rel-18).] |  | YES | NO | UE doesn’t support of measurements on cells belonging to different satellite as the serving cell in parallel with normal operation of serving cell without scheduling restrictions. | Per Band | FDD only | FR2 only | NO |  | Optional with capability signalling |
| 40.  NR\_NTN\_enh  *maxNumber-NGSO-SatellitesWithinOneSMTC-fr2-r18* | 40-2 | Parallel measurements on multiple NGSO satellites within a SMTC  (vivo) | Support of simultaneously measurements on target cells [belonging to different NGSO satellites within a SMTC] |  | YES | NO | UE doesn’t support of simultaneously measurements on target cells | Per Band | FDD only | FR2 only | NO |  | Optional with capability signalling |

**Recommended WF:**

More technical discussion is required.

1. NR\_cov\_enh2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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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** |
| 41.NR\_cov\_enh2 | 41-1 | [Static full power transmission mode capabilities indication for HPUE under max duty cycle exceedance and return from exceedance scenarios]  (Huawei) | For HPUE, In addition to the full power transmission mode capability indication (e.g., one from ul-FullPwrMode-r16, ul-FullPwrMode2-r16 or ul-FullPwrMode2-TPMIGroup-r16) for the advertised power class, indicate all capabilities for each reference power class (refer to TS 38.101-1 the definition of ΔPPowerClass) as well. Specifically, for a PC1.5 capable HPUE, it is allowed to indicate full power transmission mode capability for PC1.5, PC2 and PC3 respectively. For a PC2 capable HPUE, if is allowed to indicate full power transmission mode capability for PC2 and PC3, respectively. |  | Yes |  | The legacy ul-FullPwrMode canapbility per FS shall be applied | Per band per band combination | N/A | FR1 only | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 41.NR\_cov\_enh2 | 41-2 | [Dynamic full power transmission mode capabilities indication for HPUE under max duty cycle exceedance and return from exceedance scenarios]  (Huawei) | For HPUE, indicate the capability (e.g., one from ul-FullPwrMode-r16, ul-FullPwrMode2-r16 or ul-FullPwrMode2-TPMIGroup-r16) once max duty cycle exceedance or return from exceedance happens, which means such UE may change its capability for the advertised/reference power class (refer to TS 38.101-1 the definition of ΔPPowerClass). |  | Yes |  | The legacy ul-FullPwrMode canapbility per FS shall be applied | Per band per band combination | N/A | FR1 only | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 41.NR\_cov\_enh2 | 41-3 | [ΔPPowerClass reporting for HPUE]  (Huawei) | To indicate the support of ΔPPowerClass reporting, which is triggered by max duty cycle exceedance or return from exceedance so that there is change for the value of ΔPPowerClass. |  | Yes |  |  | Per band per band combination | N/A | FR1 only | Support mixture of FDD/TDD |  | Optional with capability signalling |
| 41.NR\_cov\_enh2 | 41-4 | [Power boosting]  (Huawei) | For PC3 capable UE, indicate the support of [1] dB power boosting for QPSK DFT-s-OFDM waveform and inner RB allocations. |  | Yes |  |  | Per band | N/A | FR1 only |  |  | Optional with capability signalling |
|  | 41-1 | Power boosting for QPSK  (Apple) | Indicates whether UE supports power boosting for QPSK at nominal power of advertised power class | N/A | Yes | N/A | UE cannot support power boosting for QPSK | Per band | TDD only | FR1 only | N/A | A configuration signal from BS to UE is needed to activate this boosting option | Optional with capability signalling |
|  | 41-2 | Power boosting for QPSK at reduced power  (Apple) | Indicates whether UE supports power boosting for QPSK at lower power level than advertised power class i.e. when ΔPPowerClass = 3 dB. | N/A | Yes | N/A | UE cannot support power boosting for QPSK for ΔPPowerClass = 3 dB | Per band | TDD only | FR1 only | N/A | A configuration signal from BS to UE is needed to activate this boosting option (same signal as for X-1) | Optional with capability signalling |
| 41.  NR\_cov\_enh2 | 41-1 | Power boosting for QPSK for power class 3 UE  (vivo) | Power boosting for QPSK for power class 3 UE in TDD bands with duty cycle less than a certain value. |  | YES | NO | Power class 3 UE does not support power boosting for QPSK in TDD bands with duty cycle less than a certain value. | Per Band | TDD only | FR1 only | NO |  | Optional with capability signalling |
|  | 41-2 | Delta\_PowerClass reporting  (vivo) | Reporting ΔPPowerClass , ΔPPowerClass, CA parameter valuesto network |  | YES | NO | Network can’t know ΔPPowerClass related parameters | TBD | TDD only | FR1 only | NO |  | Optional with capability signalling |
| 41 NR\_cov\_enh2 | 41-1 | Support of ΔPPowerClass reporting mechanism  (Intel) | 1. Support of UE report on the ΔPPowerClass to indicate which power class requirements that the UE is referring to only when configured duty cycle is exceed as defined in TS TBA | No | Yes | N/A | UE does not support of report on the ΔPPowerClass to indicate which power class requirements that the UE is referring to only when configured duty cycle is exceed | [Per UE] | No | FR1 only | N/A | Component 1 candidate value: true/false | Optional with capability signalling |
| 41 NR\_cov\_enh2 | 41-2 | Enhancements to reduce MPR/PAR for PUSCH QPSK transmissions  (Intel) | 1. Support of MPR/PAR reduction for PUSCH QPSK transmissions for PC3  2. Support of MPR/PAR reduction for PUSCH QPSK transmissions for PC2 | No | Yes | N/A | UE does not support MPR/PAR reduction for PUSCH QPSK transmissions | Per Band | No | FR1 only | N/A | Component 1 candidate value: true/false  Component 2 candidate value: true/false | Optional with capability signalling |
| 41.  NR\_cov\_enh2 | 41-1 | PRACH coverage enhancements  (ZTE) | Support of multiple PRACH transmissions with the same Tx spatial filter.  Support {2, 4, 8} for the number of multiple PRACH transmissions with same Tx spatial filter.  FFS whether to separate this FG for CBRA and CFRA |  | Yes |  | UE doesn’t support multiple PRACH transmissions with the same Tx spatial filter. |  | N/A | N/A | N/A |  | Optional with capability signalling |

**Recommended WF:**

More technical discussion is required.

1. Netw\_Energy\_NR

## 42-1 SCell without SS/PBCH block

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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** |
| 42.  Netw\_Energy\_NR | 42-1 | Support of SSB-less SCell operation  (CATT) | Support of SSB-less SCell operation |  | Yes |  | UE cannot support SSB-less SCell operation | Per BC | No | No |  |  | Optional with capability signalling |
| 42.Netw\_Energy\_NR | 42-1 | SCell without SS/PBCH block for inter-band CA  (Huawei) | Support of SCell without SS/PBCH block for inter-band CA |  | Yes | NA | UE cannot support SCell without SS/PBCH block for inter-band CA | Per BC | NA | FR1 only | NA | UE support this feature shall be able to use SS/PBCH block from other Cells from another band within the band combination for time/frequency synchronization of SCell without SS/PBCH block. UE shall meet the SCell activation requirements based on periodic CSI-RS for tracking defined in 38.133 8.3.2 | Optional with capability signaling |
| 42.  Netw\_Energy\_NR | 42-1 | Scell without SSB for FR1 inter-band collocated CA  (MediaTek) | Support of Scell without SSB for FR1 inter-band collocated CA |  | Yes | No | UE can not support this feature | Per BC | No | FR1 only | N.A |  | Optional with UE capability |
| 42.  Netw\_Energy\_NR | 42-1 | FR1 Inter-band SSB-less SCell operation  (Apple) | Support of SSB-less SCell operation for inter-band CA for FR1 and co-located cells |  | Yes | N/A | UE does not support SSB-less SCell operation for inter-band CA for FR1 and co-located cells, and network cannot configure FR1 inter-band SSB-less SCell to the UE for CA. | Per FSPC (per CC per band per band combination) | No | FR1 only | N/A | UE is required to meet the RRM requirement of FR1 inter-band SSB-less SCell operations in TS38.133. | Optional with capability signaling |
| 42.  Netw\_Energy\_NR | 42-1 | SSB-less SCell operation for inter-band or intra-band non-contiguous CA  (vivo) | Support of SSB-less SCell operation for inter-band or intra-band non-contiguous CA under co-located deployment |  | Yes | No | UE does not support SSB-less operation | Per-FS | No | FR1 only | No |  | Optional with capability signalling |
| 42.  Netw\_Energy\_NR | 42-1 | Support of SCell without SS/PBCH block for NR FR1 inter-band [and intra-band non-contiguous] CA  (Intel) | 1. Support of SCell without SS/PBCH block for NR FR1 inter-band [and intra-band non-contiguous] CA | No | Yes | N/A | SSB-less operation for NR FR1 inter-band and [intra-band non-contiguous] CA scenarios is not supported | Per FS | No | FR1 only | N/A | Component 1: Whether or not UE is able to use SS/PBCH block from other Cells for time/frequency synchronization of SCell without SS/PBCH block. | Optional with capability signalling |

**Recommended WF:**

It seems all companies agree to introduce FG of SCell without SS/PBCH block for inter-band CA. Details need more discussion. It is recommended to take following FG as baseline.

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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** |
| 42.Netw\_Energy\_NR | 42-1 | SCell without SS/PBCH block for inter-band CA [and intra-band non-contiguous] CA | Support of SCell without SS/PBCH block for NR FR1 inter-band CA [and intra-band non-contiguous CA] |  | Yes | NA | UE cannot support SCell without SS/PBCH block for inter-band CA | [Per BC or Per FS or Per FSPC] | No | FR1 only | N/A | UE support this feature shall be able to use SS/PBCH block from other Cells from another band within the band combination for time/frequency synchronization of SCell without SS/PBCH block. UE shall meet the SCell activation requirements based on periodic CSI-RS for tracking defined in 38.133 8.3.2 | Optional with capability signaling |

## 42-x Aperiodic CSI-RS for tracking for fast SCell activation for SCell without SS/PBCH block for inter-band CA

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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** |
| 42.Netw\_Energy\_NR | 42-2 | Aperiodic CSI-RS for tracking for fast SCell activation for SCell without SS/PBCH block for inter-band CA  (Huawei) | Support of aperiodic CSI-RS for tracking for fast SCell activation for SCell without SS/PBCH block for inter-band CA | 42-1 | Yes | NA | UE cannot support fast SCell activation based on aperiodic CSI-RS for tracking for SCell without SS/PBCH block for inter-band CA | Per band | NA | FR1 only | NA | UE support this feature shall support fast SCell activation based on aperiodic CSI-RS for tracking for SCell without SS/PBCH block for inter-band CA. UE shall meet the SCell activation requirements based on Aperiodic CSI-RS for tracking defined in 38.133 8.3.2 | Optional with capability signaling |

**Recommended WF:**

Technical discussion is required on whether to introduce this FG.

1. NR\_DualTxRx\_MUSIM

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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** |
| 43.  NR\_DualTxRx\_MUSIM | 43-1 | Requirements for MUSIM gaps  (MediaTek) | Support of requirements of MUSIM gap, including priority indication to network, collision handling between MUSIM gap and measurement gap and among MUSIM gaps |  | Yes | No | UE cannot meet the requirement for MUSIM gap | Per UE | No | No | N/A |  | Optional with UE capability |
|  | 43-2 | Keep solution  (MediaTek) | Support the indication of keeping all MUSIM gaps upon colliding among MUSIM gaps | 43-1 | Yes | No | UE follows priority rule upon colliding among MUSIM gaps | Per UE | No | No | N/A |  | Optional with UE capability |
| 43.  NR\_DualTxRx\_MUSIM | 43-1 | MUSIM gap and “keep solution”  (vivo) | Support UE indicates preferred MUSIM gap priority and MUSIM gap priority configuration; support UE indicates “keep solution” and “keep solution” configuration | musim-GapPreference-r17 | YES |  | UE is not capable to support MUSIM feature | Per UE | No | No | N/A |  | Optional |

**Recommended WF:**

More technical discussion is required.

1. 4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC

## 44-1 TxDiversity for the band configured with 2Tx in the band combination

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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** |
| 44.4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC | 44-1 | Support per band per band combination TxD for 2Tx  (Huawei) | Support per FS TxD capability for 2Tx from Rel-18 |  | Yes | N/A | The existing *txDiversity-r16* cannot indicate the diversity capability differently per band and per band combination for a same NR band | Per FS | N/A | FR1 |  | see LS in R4-2317762  When TxD is supported for one of the bands in the CA/DC band combination. a new per band per band combination UE capability would be required to indicate support of TxD in the band configured with 2Tx, in Rel18. | Optional with capability signalling |
| 44. XX | 44-1 | TxD capability  (vivo) | TxD support capability for 2Tx |  | YES | NO | Per band per band combination of 2Tx TxD capability can not be supported and verified | TBD | No | FR1 only |  |  | Optional with capability signalling |
|  |  | TxD capability in an inter-band combination  (Apple) | Per band per combination indication on the support of TxD capability | N/A | Yes | N/A | TxD is not supported in an inter-band combination | Per band per BC | No | FR1 only | N/A |  | Optional with capability signalling |
|  |  | TxD capability for 3Tx inter-band  (OPPO) | Indicate whether UE supports Tx Diversity in a band under a band combination |  | Yes |  | UE cannot transmit with 2Tx chain in a band under a band combination with Tx diversity | Per FS | No | FR1 only |  |  | Optional with capability signalling |
|  |  | TxDiversity for the band support 2Tx in the band combination  (ZTE) | Indicates UE supports Tx diversity for one of the bands in the CA/DC band combination |  | Yes | no | UE doesn’t support Tx diversity for 2Tx bands in the CA/DC band combination due to R16 IE *txDiversity-r16* can not be applied | per band per BC | TDD only | FR1 only |  | The new TxD capability should be enabled from Rel-18.  Detailed information can refer to the LS to RAN2 in R4-2317762. | Optional |

**Recommended WF:**

Detailed information can refer to the LS to RAN2 in R4-2317762. It is recommended to take following FG as baseline.

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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** |
| 44.4Rx\_low\_NR\_band\_handheld\_3Tx\_NR\_CA\_ENDC | 44-1 | TxDiversity for the band configured with 2Tx in the band combination | Indicates UE supports Tx diversity for the band configured with 2Tx in the CA/DC band combination |  | Yes | N/A | UE doesn’t support Tx diversity for 2Tx bands in the CA/DC band combination due to R16 IE *txDiversity-r16* can not be applied | Per FS | No | FR1 ony | **N/A** | . | Optional with capability signalling |

1. NR\_SL\_enh2

## 45-1 Power class for sidelink CA

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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** |
| 45.  NR\_SL\_enh2 | 45-1 | UE power class for sidelink CA  (Huawei) | Support power class 3 per band combination for intra-band contiguous sidelink CA |  | Yes | Yes | UE does not support power class 3 for intra-band sidelink CA band combination | Per BC | NA | FR1 only | NA | Detailed information can refer to the LS to RAN2 in R4-2317751 | Optional [with capability signaling] |
|  | 45-1 | SL reception in intra-carrier guard band  (OPPO) | Capability of reception in the non-zero intra-cell guardband between contiguous RB sets in SL wideband carrier operation wider than 20MHz when LBT is successful only in a subset of RB sets |  | **Yes** | **Yes** | UE cannot receive in the intra-cell guard band specified in 38.101-1 | **Per band** | **No** | **No** |  |  | Optional with capability signalling |
|  | 45-2 | Power class for sidelink CA  (OPPO) | power class the UE supports when operating according to this band combination used for sidelink. If the field is absent, the UE supports the default power class. If this power class is higher than the power class that the UE supports on the individual bands of this band combination (*ue-PowerClassSidelink-r16* in *BandNR*), the latter determines maximum TX power available in each band. The UE sets the power class parameter only in band combinations that are applicable as specified in TS 38.101-1. |  | **Yes** | **Yes** | UE cannot transmit in proper power class as specified in 38.101-1 | **Per BC** | **No** | **No** |  |  | Optional with capability signalling |

**Recommended WF:**

Detailed information can refer to the LS to RAN2 in R4-2317751. It is recommended to take following FG as baseline.

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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** |
| 45.  NR\_SL\_enh2 | 45-1 | Power class for sidelink CA | Indicates power class the UE supports when operating according to this band combination used for sidelink. If the field is absent, the UE supports the default power class. If this power class is higher than the power class that the UE supports on the individual bands of this band combination (*ue-PowerClassSidelink-r16* in *BandNR*), the latter determines maximum TX power available in each band. The UE sets the power class parameter only in band combinations that are applicable as specified in TS 38.101-1. |  | **Yes** | **Yes** | UE cannot transmit in proper power class as specified in 38.101-1 | **Per BC** | **No** | FR1 only | NA |  | Optional with capability signalling |

## 45-x SL reception in intra-carrier guard band

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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** |
| 45.  NR\_SL\_enh2 | 45-x | SL reception in intra-carrier guard band  (OPPO) | Capability of reception in the non-zero intra-cell guardband between contiguous RB sets in SL wideband carrier operation wider than 20MHz when LBT is successful only in a subset of RB sets |  | **Yes** | **Yes** | UE cannot receive in the intra-cell guard band specified in 38.101-1 | **Per band** | **No** | **No** |  |  | Optional with capability signalling |

**Recommended WF:**

More technical discussion is required.

1. NR\_FR1\_lessthan\_5MHz\_BW

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 (Sidelink 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** |
| 51. NR\_FR1\_lessthan\_5MHz\_BW | 51-1 | Support for 3 MHz channel bandwidth | 1) Reception of 12 PRB PBCH based on RB-level puncturing  2) Short RACH preamble formats with 15kHz SCS, and long PRACH formats with 1.25kHz SCS  3) Reception of 15 PRB CORESET0 |  | Yes | N/A | UE is not able to support 3 MHz channel bandwidth with 15 PRB CORESET0 | Per Band | FDD only | FR1 only | N/A | This FG is supported for 15 kHz SCS only  This FG is applicable only when an associated SS/PBCH block is located according to Table 5.4.3.3-2 in TS 38.101-1 in Rel-18 | Optional with capability signalling |
| 51. NR\_FR1\_lessthan\_5MHz\_BW | 51-2 | Support 12 RB CORESET0 | 1) Reception of 12 RB CORESET0 | 51-1 | Yes | N/A | UE is not able to support 3 MHz channel bandwidth with 12 RB CORESET0 | Per UE | FDD only | FR1 only | N/A | This FG is supported for 15 kHz SCS only  This FG is only applicable when an associated SS/PBCH block is located in band n100 at GSCN 41637 of Table 5.4.3.1-3 in TS 38.101-1 in Rel-18.  Note: The UE supporting this FG supports configuration of 12 PRB BWP operation | Optional with capability signalling |
| 51. NR\_FR1\_lessthan\_5MHz\_BW | 51-3 | Support 5 MHz channel bandwidth with 20 PRB CORESET0 | 1) Short RACH preamble formats with 15kHz SCS, and long PRACH formats with 1.25kHz SCS  2) Reception of 20 PRB CORESET0 |  | Yes | N/A | UE is not able to support 5 MHz channel bandwidth with 20 PRB CORESET0 | Per UE | FDD only | FR1 only | N/A | This FG is supported for 15 kHz SCS only  This FG is only applicable when an associated SS/PBCH block is located in band n100 at GSCN 41638 of Table 5.4.3.1-3 in TS 38.101-1 in Rel-18.  Note: The UE supporting this FG supports configuration of 20 PRB BWP operation | Optional with capability signalling |

**Recommended WF:**

Since RAN1 already captured related features in RAN1 feature list and sent to RAN2, it is recommended to not duplicate the discussion in RAN4.