**3GPP TSG RAN WG1 #100bis R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Source: Ad-Hoc Chair (AT&T)**

**Title: Chairman's Notes of AI 7.2.11.4**

**Agenda Item:** **7.2.11.4**

**Document for:** **Endorsement**



#### 7.2.11.4 UE features for 5G V2X

[R1-2001867](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_100b\Docs\R1-2001867.zip) Summary on UE features for 5G V2X Moderator (AT&T)

## Working assumption: Agree on FG 15-18 as shown below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-18 | Support of rank 2 transmission | 1) UE additionally supports rank 2 PSSCH transmission | [At least one of 15-2 and 15-3] | FFS | FFS | UE supports rank 1 PSSCH transmission only. | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |

**Conclusion:**

For support of NR Uu controlling LTE PC5, RAN1 considers that the contents of UE-EUTRA-Capability for LTE-V2X sidelink is sufficient. RAN2 is requested to define the necessary NR signalling.

Matthew (Huawei) to draft LS, continue discussion in same email thread

**Revised FL Proposal 2:**

* Specifications support signalling to report at least the following features to the network
  + - Either 15-1 or 15-1a pending further down-selection of alternatives in FL Proposal 3 (15-1 receiving NR sidelink) in R1-2001867
    - Either 15-3 or 15-3a pending further down-selection of alternatives in FL Proposal 5 (15-3 transmitting NR sidelink mode 2) in R1-2001867
    - [15-4]
    - 15-6 [mode 1 only]
    - 15-10(a)
    - 15-14
    - 15-16
    - 15-18
    - 15-19 if outcome of FL Proposal 14 (15-19 rank 2 reception) in R1-2001867 is Alt. 2
    - 15-23 [mode 1 only] if outcome of FL Proposal 16 (15-23 RSRP report) in R1-2001867 is Alt. 2
    - FFS: 15-16

Note: only 15-18 has been agreed as WA so far

**High priority feature groups transparent to pre-configuration versus Uu configuration**

## Working assumption: Keep FG 15-19 (Support of rank 2 reception)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-19 | Support of rank 2 reception | 1) UE additionally supports rank 2 PSSCH reception | [15-1] | FFS | FFS | UE supports rank 1 PSSCH reception only. | Per band | N.A. | N.A. | N.A. |  | [Optional with capability signalling] |

Note1: RAN1 will decide whether this is a basic FG also for UEs as part of FL Proposal 1. It will be indicated to RAN2 that this discussion is on-going if FL Proposal 1 is not agreed by the time the LS is sent (or any LS thereafter)

Conclusion:

RAN4 to decide any UE capability related decisions in regard to 256 QAM sidelink reception support in R16 V2X for both FR1 and FR2

* Include conclusion in LS to RAN2/4

Agreement: There will be a FG 15-10 for 256QAM sidelink transmission

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-10 | 256QAM sidelink transmission | 1) UE can transmit PSSCH with 256QAM in NR sidelink |  |  |  |  |  |  |  |  |  | Optional with capability signalling |

## Agreement: The following FG will be defined in the V2X NR UE feature list

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-23 | Support of open loop SL power control and RSRP report | 1) Support sidelink pathloss based open loop power control and RSRP report in case of unicast | FFS | FFS | Yes |  | Per band | N.A. | N/A | N.A. |  | Optional with capability signalling FFS: whether this FG will be a basic VUE FG |

WA: This FG is a basic UE FG [at least] for UEs supporting mode 1

Note1: RAN1 will decide whether this is a basic FG also for UEs not supporting mode 1 as part of FL Proposal 1. It will be indicated to RAN2 that this discussion is   
 on-going if FL Proposal 1 is not agreed by the time the LS is sent (or any LS thereafter)

Note2: The existence of this FG cannot be construed as guidance as to whether this FG should be a basic UE FG or not for UEs not supporting mode 1

Note3: The FFS “whether this FG will be a basic UE FG” will be aligned across all V2X rows

Note4: The existence of this FG cannot be construed as guidance for other V2X FGs

## FL Proposal 17 (15-24 multiple synchronization references)

**Alt. 1: Delete 15-24**

**Alt. 2:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-24 | Support of multiple synchronization references | 1) UE can support sidelink reception using up to A synchronziaion references in a carrier/BWP from reception perspective | At least one of 15-1, 15-2, 15-3 | Yes | No | UE supports only a single synchronization reference in a carrier/BWP. | Per band | N.A. | N.A. | N.A. | Component-1 candidate value set: {1, 2, 3, 4} | Optional with capability signalling |

Note1: RAN1 will decide whether this is a basic FG also for UEs as part of FL Proposal 1. It will be indicated to RAN2 that this discussion is on-going if FL Proposal 1 is not agreed by the time the LS is sent (or any LS thereafter)

Conclusion: The absence of a dedicated FG for sensing in Rel. 16 cannot be construed as guidance for Rel. 17 as to whether Rel. 17 V2X UEs that do not support sensing can be introduced

**High priority feature groups potentially not transparent to pre-configuration versus Uu configuration**

## Agreement: The following is considered the baseline for further discussion of 15-1 “receiving NR sidelink”

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-1 | Receiving NR sidelink | 1) UE can receive NR PSCCH/PSSCH. Up to [A] sidelink processes are supported.  2) UE can receive [X] PSCCH in a slot.  3) UE can decode [Y] RBs per slot (FFS: counting both PSCCH and PSSCH).  4) UE supports reception based on the normal 64QAM MCS table [and 256QAM MCS table in FR1].  5) UE supports PT-RS reception in FR2.  FFS: 6) The UE can receive [Z] total number of soft channel bits in a slot.  [7) UE supports 2 receive antennas.]  8) UE can receive using the subcarrier spacing it reports.  FFS: 9) CP length  10) Supports 14-symbol SL slot with DMRS patterns corresponding to {#PSSCH symbols, #DMRS symbols} = {12, 4}, {9, 3} for slots w/wo PFSCH  [11) UE can receive PSSCH with 256QAM in NR sidelink]  12) UE can receive using 30 kHz subcarrier spacing in FR1, FFS FR2 | None | FFS | No |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 8 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 12 is required in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Component-2 candidate value set: {value1, value2, …}  FFS: whether to report different value for each SCS indicated in component-8  Component-3 candidate value set: {value1, value2, …}  FFS: whether to report different value for each SCS indicated in component-8  FFS: Component-6 candidate value set: {value1, value2, …}  Component-8 candidate value set in FR1:  {{15 kHz}, {30 kHz}, {60 kHz}, {15, 30 kHz}, {30, 60 kHz}, {15, 60 kHz}, {15, 30, 60 kHz}}  Component-8 candidate value set in FR2:  {{60 kHz}, {120 kHz}, {60, 120 kHz}}  FFS: whether to mandate an SCS.  Candidate values for A are {value1, value2 …} | Optional with capability signaling. For UE supports NR sidelink, UE must indicate this FG is supported. |

* Note: This means this FG will not be split as proposed in R1-2001867

## Agreement: The following is considered the baseline for further discussion of 15-3 transmitting NR sidelink mode 2:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-3 | Transmitting NR sidelink mode 2 | 1) UE can transmit PSCCH/PSSCH using NR sidelink mode 2 configured by ~~[~~NR Uu or~~]~~ preconfiguration. Up to [B] sidelink processes are supported.  2) UE supports transmission based on the normal 64QAM MCS table.  3) UE supports PT-RS transmission in FR2.  [4) UE can perform sensing and resource allocation operations.]  [5) UE supports rank 1 PSSCH transmissions.]  6) UE can transmit using the subcarrier spacing it reports for FG 15-1.  FFS: 7) CP length  8) Supports 14-symbol SL slot with [FFS: all] DMRS patterns corresponding to {#PSSCH symbols, #DMRS symbols} = {12, 4}, {9, 3} for slots w/wo PFSCH  9) default SCS with pre-configuration: 30 kHz with normal CP: [operator managed] same as Rel. 15 Uu  10) UE can transmit using 30 kHz subcarrier spacing in FR1, FFS FR2 | 15-1 | FFS | No |  | Per band | N.A. | N.A. | N.A. | Note: Random selection in the exceptional pool is supported.  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  This is the basic FG for sidelink in ITS spectrum where gNB is not defined and optional FG for licensed spectrum where gNB is defined  [Note: Component 5 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1]  Note: Component 6 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 10 is required in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1 | Optional with capability signalling  For UE supports NR sidelink, for UE supports NR sidelink in ITS spectrum where gNB is not defined, UE must indicate this FG is supported, UE must indicate this FG is supported.  Candidate values for B are {value1, value2 …} |

* Note: This means this FG will not be split as proposed in R1-2001867

## Working assumption: The following is considered the baseline for further discussion of 15-4 synchronization source):

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-4 | Synchronization sources for NR sidelink | 1) UE can receive S-SSB in NR sidelink if it supports 15-1.  2) UE can transmit S-SSB in NR sidelink if it supports 15-2 or 15-3.  3) UE supports GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to false.  4) UE can transmit or receive NR sidelink based on the synchronization to an gNB  5) UE additionally supports gNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to gnbEnb.  6) UE additionally supports gNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to true. | At least one of 15-1, 15-2, 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink.  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 4 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 5 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 6 is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1 | Optional with capability signalling  For UE supports NR sidelink, UE must indicate this FG is supported. |

* Note: This means this FG will not be split as proposed in R1-2001867

## FL Proposal 11 (15-11 PSFCH format 0)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-11 | PSFCH format 0 | 1) UE can transmit and receive NR PSFCH format 0  2) UE can receive [N] PSFCH(s) in a slot.  3) UE can transmit [M] PSFCH(s) in a slot.  4) UE can report sidelink HARQ-ACK to gNB via PUCCH and PUSCH when it is operating in NR sidelink mode 1. ~~[FFS: move to 15-2 or to new FG 15-11a]~~ | At least one of 15-1, 15-2, 15-3 | Yes | Yes |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink.  Note: configuration by NR Uu is not required to be supported in a band indicated with only the PC5 interface in 38.101-1 Table 5.2E-1  Note: Component 4 is not required to be supported in a band indicated with the PC5 interface in 38.101-1 Table 5.2E-1 | Optional with capability signalling  FFS: For UE supports NR sidelink, UE must indicate this FG is supported.  ALT 1) Candidate values for N are {5, [10,] 15, [20,] 25, [30,] 35, [40,] 45, 50 }  ALT 2) Candidate values for N are {32, 64}  Candidate values for M are {1, 4, 8, 16} |

* Note: This means this FG will not be split as proposed in R1-2001867

**Medium/low priority feature groups**

## FL Proposal 4 (15-2 transmitting NR sidelink mode 1)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-2 | Transmitting NR sidelink mode 1 scheduled by NR Uu | 1) UE can transmit PSCCH/PSSCH using dynamic scheduling or configured grant type 1 and 2 in NR sidelink mode 1 scheduled by NR Uu. Up to [8] configured grants can be configured for a UE. Up to [C] sidelink processes are supported.  2) UE supports transmission based on the normal 64QAM MCS table.  3) UE supports PT-RS transmission in FR2.  4) UE can monitor DCI format 3\_0 for NR sidelink dynamic scheduling and configured grant type 2.  6) UE can transmit using the subcarrier spacing it reports.  FFS: 7) CP length  8) Supports 14-symbol SL slot with DMRS patterns corresponding to {#PSSCH symbols, #DMRS symbols} = {12, 4}, {9, 3} for slots w/wo PFSCH |  | Yes | No |  | Per band | N.A. | N.A. | N.A. | Note: Random selection in the exceptional pool is supported.  This is the basic FG for sidelink in licensed spectrum where gNB is ~~defined~~ operating on or managing that spectrum and optional FG otherwise ~~for ITS spectrum where gNB is not defined~~.  Component-6 candidate value set in FR1:  {{15 kHz}, {30 kHz}, {60 kHz}, {15, 30 kHz}, {30, 60 kHz}, {15, 60 kHz}, {15, 30, 60 kHz}}  Component-6 candidate value set in FR2:  {{60 kHz}, {120 kHz}, {60, 120 kHz}}  FFS: whether to mandate an SCS. | Optional with capability signalling  For UE supports NR sidelink in licensed spectrum where gNB is defined, UE must indicate this FG is supported.  Candidate values for C are {value1, value2 …} |

## FL Proposal 7 (15-5 sidelink congestion control)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-5 | Sidelink congestion control | 1) UE can report CBR measurement to gNB when operating in Mode 1 (FFS: delete component 1)  2) UE can adjust its radio parameters based on CBR measurement and CRlimit.  3) UE can process CBR and CR within the time it indicates | 15-1 and at least one of 15-2 and 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. | Component-3 candidate value set  {Congestion process time 1, Congestion process time 2} where  Congestion process time 1: 2, 2, 4, 8 slots for 15, 30, 60, 120 kHz subcarrier spacing.  Congestion process time 2: 2, 4, 8, 16 slots for 15, 30, 60, 120 kHz subcarrier spacing | Optional with capability signalling |

## FL Proposal 8 (15-6 in-device coexistence)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-6 | Short-term time-scale TDM for in-device coexistence | 1) Support prioritization between LTE sidelink transmission/reception and NR sidelink transmission/reception | At least one of 15-1, 15-2, 15-3 | No | No |  | Per band | N.A. | N.A. | N.A. | FFS whether a set of candidate values need to be defined for the time required for the inter-RAT conflict resolution | Optional with capability signalling |

## FL Proposal 9 (15-9 transmitting LTE sidelink mode 4)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-9 | Transmitting LTE sidelink mode 4 configured by NR Uu ~~or preconfiguration~~ | 1) UE can be configured over NR Uu ~~or preconfiguration~~ for LTE sidelink mode 4 operation.. |  | Yes | No |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |

## FL Proposal 12 (15-14 sidelink CSI report)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-14 | Sidelink CSI report | 1) UE can transmit and receive sidelink CSI-RS with 1 or 2 antenna port(s).  2) UE supports RI and CQI feedback on sidelink. | 15-1 and at least one of 15-2 and 15-3 | No | Yes |  | Per band | N.A. | N.A. | N.A. | FFS: This is the basic FG for NR sidelink | Optional with capability signalling. |

## FL Proposal 15 (15-22 less than 14 symbols)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 15-22 | Support of SL slot less than 14 consecutive symbols | 1) UE additionally supports transmission/reception of SL slot configured with 7, 8, 9, 10, 11, 12, 13 consecutive symbols and the corresponding DMRS patterns it reports. | At least one of 15-1, 15-2, 15-3 | Yes | No | UE supports SL only in a SL slot configured with 14 consecutive symbols. | Per band | N.A. | N/A | N.A. | The component-1 candidate value set can be DRMS patterns corresponding to {#PSSCH symbols, #DMRS symbols} = {{12,2},{12,1}, {11,4},{11,3},{11,2}, {10,4},{10,3},{10,2}, {9,2},{8,3},{8,2},{7,2},{6,2}, {5,2}} | Optional with capability signalling |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 |
| 15. 5G\_V2X\_NRSL | 15-1 | Receiving NR sidelink[by preconfiguration] | 1) UE can receive NR PSCCH/PSSCH. Up to [A] sidelink processes are supported.  2) UE can receive [X] PSCCH in a slot.  3) UE can decode [Y] RBs per slot (FFS: counting both PSCCH and PSSCH).  4) UE supports reception based on the normal 64QAM MCS table [and 256QAM MCS table].  5) UE supports PT-RS reception in FR2.  FFS: 6) The UE can receive [Z] total number of soft channel bits in a slot.  8) UE can receive using the subcarrier spacing it reports.  FFS: 9) CP length | None | FFS | No |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink  Component-2 candidate value set: {value1, value2, …}  FFS: whether to report different value for each SCS indicated in component-8  Component-3 candidate value set: {value1, value2, …}  FFS: whether to report different value for each SCS indicated in component-8  Component-8 candidate value set in FR1:  {{15 kHz}, {30 kHz}, {60 kHz}, {15, 30 kHz}, {30, 60 kHz}, {15, 60 kHz}, {15, 30, 60 kHz}}  Component-8 candidate value set in FR2:  {{60 kHz}, {120 kHz}, {60, 120 kHz}}  FFS: whether to mandate an SCS. | Optional with capability signaling. For UE supports NR sidelink, UE must indicate this FG is supported. |
| [15-1a] | FFS: Receiving NR sidelink configured by NR Uu | 1) UE can receive NR PSCCH/PSSCH. Up to [A] sidelink processes are supported.  2) UE can receive [X] PSCCH in a slot.  3) UE can decode [Y] RBs per slot (FFS: counting both PSCCH and PSSCH).  4) UE supports reception based on the normal 64QAM MCS table [and 256QAM MCS table].  5) UE supports PT-RS reception in FR2.  6) The UE can receive [Z] total number of soft channel bits in a slot.  7) UE supports 2 receive antennas.  [8) 30 kHz SCS is supported for FR1.] | 15-1 |  |  |  |  |  |  |  | [Component-2 and Component-3 are the same as in FG15-1 and are not reported separately] | Optional with capability signalling |
| 15-2 | Transmitting NR sidelink mode 1 scheduled by NR Uu | 1) UE can transmit PSCCH/PSSCH using dynamic scheduling or configured grant type 1 and 2 in NR sidelink mode 1 scheduled by NR Uu. Up to [8] configured grants can be configured for a UE.  2) UE supports transmission based on the normal 64QAM MCS table.  3) UE supports PT-RS transmission in FR2.  4) UE can monitor DCI format 3\_0 for NR sidelink dynamic scheduling and configured grant type 2.  6) UE can transmit using the subcarrier spacing it reports.  FFS: 7) CP length |  | Yes | No |  | Per band | N.A. | N.A. | N.A. | Note: Random selection in the exceptional pool is supported.  This is the basic FG for sidelink in licensed spectrum where gNB is defined and optional FGfor ITS spectrum where gNB is not defined.  Component-6 candidate value set in FR1:  {{15 kHz}, {30 kHz}, {60 kHz}, {15, 30 kHz}, {30, 60 kHz}, {15, 60 kHz}, {15, 30, 60 kHz}}  Component-6 candidate value set in FR2:  {{60 kHz}, {120 kHz}, {60, 120 kHz}}  FFS: whether to mandate an SCS. | Optional with capability signalling  For UE supports NR sidelink in licensed spectrum where gNB is defined, UE must indicate this FG is supported. |
| 15-3 | Transmitting NR sidelink mode 2 configured by [NR Uu or] preconfiguration | 1) UE can transmit PSCCH/PSSCH using NR sidelink mode 2 configured by [NR Uu or] preconfiguration. Up to [B] sidelink processes are supported.  2) UE supports transmission based on the normal 64QAM MCS table.  3) UE supports PT-RS transmission in FR2.  4) UE can perform sensing and resource allocation operations.  6) UE can transmit using the subcarrier spacing it reports for FG 15-1.  FFS: 7) CP length | 15-1 | FFS | No |  | Per band | N.A. | N.A. | N.A. | Note: Random selection in the exceptional pool is supported.  This is the basic FG for sidelink. | Optional with capability signalling  For UE supports NR sidelink, UE must indicate this FG is supported. |
| 15-3a | FFS: Transmitting NR sidelink mode 2 configured by NR Uu | 1) UE can transmit PSCCH/PSSCH using NR sidelink mode 2 configured by NR Uu. Up to [B] sidelink processes are supported.  2) UE supports transmission based on the normal 64QAM MCS table and 256QAM MCS table.  3) UE supports PT-RS transmission in FR2.  4) UE can perform sensing and resource allocation operations.  [5) UE supports rank 1 PSSCH transmissions.]  [6) 30 kHz SCS is supported for FR1.] | 15-1, 15-2 |  |  |  |  |  |  |  | Note: Random selection in the exceptional pool is supported. | Optional with capability signalling |
| 15-4 | GNSS and S-SSB for NR sidelink | 1) UE can receive S-SSB in NR sidelink if it supports 15-1.  2) UE can transmit S-SSB in NR sidelink if it supports 15-2 or 15-3.  3) UE supports GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to false. | At least one of 15-1, 15-2, 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink. | Optional with capability signalling  For UE supports NR sidelink, UE must indicate this FG is supported. |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15-5 | Sidelink congestion control | 1) UE can report CBR measurement to gNB.  2) UE can adjust its radio parameters based on CBR measurement and CRlimit.  3) UE can process CBR and CR within the time it indicates | 15-1 and at least one of 15-2 and 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. | Component-3 candidate value set  {Congestion process time 1, Congestion process time 2} where  Congestion process time 1: 2, 2, 4, 8 slots for 15, 30, 60, 120 kHz subcarrier spacing.  Congestion process time 2: 2, 4, 8, 16 slots for 15, 30, 60, 120 kHz subcarrier spacing | Optional with capability signalling |
| 15-6 | Short-term time-scale TDM for in-device coexistence | 1) Support prioritization between LTE sidelink transmission/reception and NR sidelink transmission/reception | At least one of 15-1, 15-2, 15-3 | No | No |  | Per band | N.A. | N.A. | N.A. | FFS whether a set of candicate values need to be defined for the time required for the inter-RAT conflict resolution | Optional with capability signalling |
| 15-7 | Transmitting LTE sidelink mode 3 scheduled by NR Uu | 1) UE can be scheduled over NR Uu for LTE sidelink mode 3 transmission..  2) UE reports a value ‘X’ for the minimum value it supports for the additional time indicated in the NR DCI scheduling LTE sidelink mode 3.  3) UE can monitor DCI format 3\_1 for LTE sidelink SPS grant. |  | Yes | No |  | Per band | N.A. | N.A. | N.A. | Component-2 candidate value set:  {0ms, 0.25ms, 0.5ms, 0.625ms, 0.75ms, 1ms, 1.25ms, 1.5ms,1.75ms, 2ms, 2.5ms, 3ms, 4ms, 5ms, 6ms, 8ms, 10ms, 20 ms } | Optional with capability signalling |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15-9 | Transmitting LTE sidelink mode 4 configured by NR Uu or preconfiguration | 1) UE can be configured over NR Uu or preconfiguration for LTE sidelink mode 4 operation.. |  | Yes | No |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
| 15-10 | 256QAM sidelink transmission | 1) UE can transmit PSSCH with 256QAM in NR sidelink | At least one of 15-2, 15-3 | Yes | Yes | UE supports QPSK, 16QAM, and 64 QAM for transmission only. | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
| 15-10a | FFS: 256QAM sidelink reception | 1) UE can receive PSSCH with 256QAM in NR sidelink | 15-1 | Yes | Yes | UE supports QPSK, 16QAM, and 64 QAM for reception only. | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
| 15-11 | PSFCH format 0 | 1) UE can transmit and receive NR PSFCH format 0  2) UE can receive [N] PSFCH(s) in a slot.  3) UE can transmit [M] PSFCH(s) in a slot.  4) UE can report sidelink HARQ-ACK to gNB via PUCCH and PUSCH when it is operating in NR sidelink mode 1. | At least one of 15-1, 15-2, 15-3 | Yes | Yes |  | Per band | N.A. | N.A. | N.A. | This is the basic FG for sidelink. | Optional with capability signalling  For UE supports NR sidelink, UE must indicate this FG is supported. |
| 15-12 | Low-spectral efficiency 64QAM MCS table | 1) UE can transmit or receive PSSCH with low-spectral efficiency 64QAM MCS table. | At least one of 15-1, 15-2, 15-3 | Yes | Yes | UE supports normal 64QAM MCS table and 256QAM MCS table only. | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 15-14 | Sidelink CSI report | 1) UE can transmit and receive sidelink CSI-RS with 1 or 2 antenna port(s).  2) UE supports RI and CQI feedback on sidelink. | 15-1 and at least one of 15-2 and 15-3 | FFS | Yes |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling. |
|  | 15-15 | eNB type synchronization source for NR sidelink | 1) UE can transmit or receive NR sidelink based on the synchronization to an eNB.  2) If UE supports 15-4, UE additionally supports eNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to gnbEnb.  3) If UE supports 15-4, UE additionally supports eNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to true. | At least one of 15-1, 15-2, 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling. |
|  | 15-15a | gNB type synchronization source for NR sidelink | 1) UE can transmit or receive NR sidelink based on the synchronization to an eNB.  2) If UE supports 15-4, UE additionally supports gNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to gnbEnb.  3) If UE supports 15-4, UE additionally supports gNB, GNSS and SyncRef UE as the synchronization reference according to the synchronization procedure with sl-SyncPriority set to GNSS and sl-NbAsSync set to true. | At least one of 15-1, 15-2, 15-3 | Yes | No |  | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling. |
|  | 15-16 | Simultaneous transmission of uplink and sidelink | 1) UE supports simultaneous transmission of NR uplink and NR sidelink (on different carriers) in all bands for which the UE indicated simultaneous sidelink and uplink support in a band combination. | At least one of 15-2 and 15-3 | Yes | No |  | Per band combination | N.A. | N.A. | N.A. |  | Optional with capability signalling. |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 15-18 | Support of rank 2 transmission | 1) UE additionally supports rank 2 PSSCH transmission | At least one of 15-2 and 15-3 | FFS | FFS | UE supports rank 1 PSSCH transmission only. | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
|  | 15-19 | FFS: Support of rank 2 reception | 1) UE additionally supports rank 2 PSSCH reception | 15-1 | FFS | FFS | UE supports rank 1 PSSCH reception only. | Per band | N.A. | N.A. | N.A. |  | Optional with capability signalling |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 15-22 | Support of SL slot less than 14 consecutive symbols | 1) UE additionally supports transmission/reception of SL slot configured with 7, 8, 9, 10, 11, 12, 13 consecutive symbols | At least one of 15-1, 15-2, 15-3 | Yes | No | UE supports SL only in a SL slot configured with 14 consecutive symbols. | Per band | N.A. | N/A | N.A. |  | Optional with capability signalling |
|  | 15-23 | FFS: Support of open loop SL power control and RSRP report | [1) Support sidelink pathloss based open loop power control and RSRP report in case of unicast] | FFS | FFS | Yes |  | Per band | N.A. | N/A | N.A. |  | Optional with capability signalling |
|  | 15-24 | FFS: Support of multiple synchronization references | [1) UE can support sidelink reception using up to A synchronziaion references in a carrier/BWP.] | At least one of 15-1, 15-2, 15-3 | Yes | No | UE supports only a single synchronization reference in a carrier/BWP. | Per band | N.A. | N.A. | N.A. | Component-1 candidate value set: {value1, value2, …} | Optional with capability signalling |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |

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[R1-2002565](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_100b\Docs\R1-2002565.zip) Discussion on V2X UE features Qualcomm Incorporated

[R1-2002666](file:///C:\Users\wanshic\OneDrive%20-%20Qualcomm\Documents\Standards\3GPP%20Standards\Meeting%20Documents\TSGR1_100b\Docs\R1-2002666.zip) Rel-16 UE features for 5G V2X Huawei, HiSilicon