**3GPP TSG RAN WG1 #117 R1-24xxxxx**

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**Agenda item:** 8.2.1

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

**Title:** Summary of discussion on UE features for NR sidelink evolution

**Document for:** Discussion and Decision

# **Introduction**

This document summarizes contributions submitted to AI 8.2.1 regarding UE features for NR sidelink evolution.

# **FGs for NR sidelink on unlicensed spectrum**

Following inputs are provided in contributions for the RAN1#117 meeting.

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| [2] | Huawei, HiSilicon | **FG 47-k1 SL channel access for dynamic channel access mode**  In the UE features list after RAN1#116bis, FG 47-k1 is as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-k1 | SL channel access for dynamic channel access mode | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS | At least one of {15-25, 15-3, [32-4, 32-4a]} | Yes | No | UE does not support channel access for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR SL in shared spectrum and when shared spectrum channel access must be used, UE must indicate this FG is supported |   The brackets of prerequisites can be removed because SL channel access is also applicable to partial sensing and random selection.  **FG 47-m1 Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception**  In the UE features list after RAN1#116bis, FG 47-m1 is as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m1 | Interlace RB-based SL transmission/reception | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | At least one of {15-25, 15-3, [32-4, 32-4a]} | Yes | No | UE does not support Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception | Per band | N/A | N/A |  | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must indicate this FG is supported. |   The brackets of prerequisites can be removed because SL interlaced transmission/reception are applicable to partial sensing and random selection.  **FG 47-m3 and FG 47-m4 Transmitting/Receiving PSCCH/PSSCH from 2nd starting symbol in a slot**  In the UE features list after RAN1#116bis, FG 47-m3 and 47-m4 are as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m3 | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | At least one of {15-25, 15-3, [32-4, 32-4a]} | No | No | UE transmits PSCCH/PSSCH only from 1st starting symbol in a slot |  |  |  |  | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | [15-1 except Component 5] | No | No | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot |  |  |  |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.] |   The columns with yellow highlights for FG 47-m3 can be updated as below:   * FG 47-m3 is applicable to partial sensing and random selection and we suggest to remove the brackets for the prerequisites.   The columns with yellow highlights for FG 47-m4 can be updated as below:   * For the prerequisites, FG 15-1 is enough. FG 15-1 is per band, and Component 5 in FG 15-1 is invalid in FR1, so it is unnecessary to note that “Component 5 is excluded”.   **FG 47-m13 Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH**  In the UE features list after RAN1#116bis, FG 47-m13 is as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | TBD | No | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling |   The columns with yellow highlights can be updated as below:   * The prerequisite includes FG 47-k1 and 15-11. If the prerequisites do not include 47-k1, in order to clarify the applicable scenario of the FG, it should be noted that the signaling is only expected for a band where shared spectrum channel access must be used. * The total number of PSFCH that UE can transmit/receive means the number of channels rather than the number of PRBs. For example, if a UE can transmit M PSFCH, it can transmit M PSFCH regardless of how many RBs each PSFCH occupies. Thus,   + Candidate values for K are M\*K3, where M is the same for each carrier and is reported by FG 15-11 component 3, and K3 is the number of dedicated PRBs of each PSFCH.   + Candidate values for L are N\*K3, where N is the same for each carrier and is reported by FG 15-11 component 2, and K3 is the number of dedicated PRBs of each PSFCH. * Other highlighted parts are reasonable.   **Proposal 1: Support UE feature list in Appendix 1 for R18 NR SL.**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-k1 | SL channel access for dynamic channel access mode | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS | At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~} | Yes | No | UE does not support channel access for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR SL in shared spectrum and when shared spectrum channel access must be used, UE must indicate this FG is supported | | 47. NR\_SL\_enh2 | 47-m1 | Interlace RB-based SL transmission/reception | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~} | Yes | No | UE does not support Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception | Per band | N/A | N/A |  | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must indicate this FG is supported. | | 47. NR\_SL\_enh2 | 47-m3 | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~} | No | No | UE transmits PSCCH/PSSCH only from 1st starting symbol in a slot |  |  |  |  | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | ~~[~~15-1 ~~except Component 5]~~ | No | No | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot |  |  |  |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.~~]~~ | | 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | ~~TBD~~47-k1, 15-11 | No | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are ~~FFS~~ M\*K3, where M is the same for each carrier and is reported by FG 15-11 component 3, and K3 is the number of dedicated PRBs of each PSFCH.  Candidate values for L are ~~FFS~~ N\*K3, where N is the same for each carrier and is reported by FG 15-11 component 2, and K3 is the number of dedicated PRBs of each PSFCH. | Optional without capability signalling | |
| [3] | ZTE | **The prerequisite feature groups for FG 47-k1, 47-m1, and 47-m3**  In RAN2#125bis meeting, the applicability of SL features has been discussed, relevant agreements were consolidated in LS R1-2403827 (R2-2403924) and sent to RAN1. In this LS, RAN2 reached an agreement as follows:  From R2 perspective, UE is not expected to be (pre)configured to perform partial sensing operation over an unlicensed spectrum using interlace RB based transmission, in Rel-18.  Following RAN2’s agreement, partial sensing operation is not supported over an unlicensed spectrum using interlace RB based transmission. That means FG 32-4, Transmitting NR sidelink mode 2 with partial sensing, should not be one prerequisite feature group for FG 47-k1, 47-m1, and 47-m3. For FG 32-4a, same as partial sensing, the same treatment can be adopted. Thus, [32-4, 32-4a] should be removed from the prerequisite feature groups for FG 47-k1, 47-m1, and 47-m3.  ***Proposal 4: [32-4, 32-4a] should be removed from the prerequisite feature groups for FG 47-k1, 47-m1, and 47-m3.***  **FG 47-m4 Receiving PSCCH/PSSCH from 2nd starting symbol in a slot**  Regarding 47-m4 after RAN1#116-bis, the prerequisite feature groups are pending. Considering that to receive PSCCH/PSSCH from 2nd starting symbol in a slot, the prerequisite FG should be receiving NR sidelink, i.e. 15-1. But in Rel-18, only FR1 unlicensed bands (n46 and n96/n102) is supported, thus, PT-RS is not supported in this item. So, we think the prerequisite feature groups should be kept as it is without brackets, i.e. 15-1 except Component 5.  ***Proposal 5: the prerequisite feature groups of FG 47- m4 should be 15-1 except Component 5, this FG should be updated as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | 15-1 except Component 5 | No | No | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot |  |  |  |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.] |   **FG 47-m13 Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH**  For FG 47-m13, considering that common interlace-based PSFCH is one option of PSFCH formats, in addition to dedicated interlace-based PSFCH. Thus, this FG is should be defined additionally. And our views on the pending issues are as follows:  1, Prerequisite feature groups: To transmit multiple dedicated PRBs in interlace-based PSFCH on the shared spectrum, UE should support multi-channel access procedures, i.e. FG 47-k2 should be one of the prerequisites. Besides, PSFCH is used for ACK/NACK feedback of PSSCH, so FG 47-m1 should be one of the prerequisites.  2, The need for the gNB to know if the feature is supported: There are three formats of PSFCH supported on shared spectrum, Rel-16 legacy format, dedicated interlace-based PSFCH and common interlace-based PSFCH. And SL feedback is supported on Uu, thus, it is beneficial for gNB to have information of this capability to configure the proper resource pool or to enable HARQ, so this FG is necessary to be reported to gNB.  3, The capability signalling exchange between UEs: Considering that SL HARQ is supported for unicast and groupcast, in groupcast, PSSCH Tx UE has no knowledge about whether Rx UE is able to transmit PSFCH or not, so there is no requirement for exchanging such FG between UEs.  4, Mandatory/Optional: Considering that there is no need exchange capability information between UEs, and other PSFCH formats, e.g. R16 legacy format, dedicated interlace-based PSFCH could be supported by a UE, so this FG should be optional with capability signalling.  5, Other highlighted parts are reasonable.  ***Proposal 6: FG 47- m13 should be updated as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | 47- k2, 47-m1 | Yes | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling | |
| [4] | Samsung | ***FG 47-m13***  The following Feature 47-m13 was proposed in RAN1 #116 meeting:   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | TBD |  | No | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling |   For this FG, it is preferable to limit the number of dedicated PRBs that can be used/monitored by the UE at any given slot similar to the case of Rel-16 NR sidelink. In other words, sending an AKC/NACK feedback over *K* dedicated PRBs will still require the UE to send *K* Zadoff-Chu sequences and will require the power to be distributed among the dedicated PRBs. Similarly, in case of RX, a UE will need to monitor *L* dedicated PRBs for ACK/NACK feedback. Hence, it needs to maintain the limit on the number of PSFCH transmissions from FG 15-11 on *K* and *L*. In this case, the candidate values for *K* are {4, 8, 16} and for L are {5, 15, 25, 32, 35, 45, 50, 64}. Finally, it proposes to have FG 47-k1 as a pre-requisite for this FG.  **Proposal 1:** For FG 47-m13,   * Support FG 47-m13 to bound the number of PRBs that need to be monitored for PSFCH transmission/reception in shared spectrum. * Support the following candidate values for K   + {4, 8, 16} * Support the following candidate values for L   + {5, 15, 25, 32, 35, 45, 50, 64} |
| [5] | vivo | In this section, the remaining details of UE features for SLU are discussed.  Firstly, in the previous RAN1 meetings, the FG 32-4 and 32-4a are added as prerequisites for some FGs, such as 47-m10, 47-k5, etc., as well as the candidate prerequisites for some other FGs, e.g., 47-m1, assuming that partial sensing and random selection can operate in unlicensed band with interlace RB based transmission. On the other hand, RAN2 agreed [2] that *UE is not expected to be (pre)configured to perform partial sensing operation over an unlicensed spectrum using interlace RB based transmission, in Rel-18*, which does not align with RAN1’s assumption. In order to reflect the RAN2’s agreement, the FG 32-4 and 32-4a should be removed from prerequisites at least for FG 47-m1 (i.e., Interlace RB-based SL transmission/reception). Otherwise, if RAN1 intends to revert RAN2’s agreement, the decision of prerequisite would have to be pending on RAN2’s further decision.  *Proposal 1:* *The FG 32-4 and 32-4a should be removed from prerequisites at least for 47-m1, if RAN1 decides to follow RAN2’s agreement.*  Secondly, for the prerequisites of other FGs, such as 47-k1 (SL channel access for dynamic channel access mode), 47-k5 (Resource allocation for multi-consecutive slots transmission), 47-m3 (Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot), and 47-m10 (Contiguous RB-based PSCCH/PSSCH transmission/reception), although RAN2’s agreement does not preclude the partial sensing and random selection to be used in contiguous RB-based SL transmission over unlicensed spectrum, it seems to be simpler and safer to handle them in the same way, i.e., to remove the FG 32-4 and 32-4a from prerequisites.  *Proposal 2:* *The FG 32-4 and 32-4a should be removed from prerequisites for 47-k1, 47-k5, 47-m3 and 47-m10 if they are not the prerequisites of FG 47-m1.*  Thirdly, for the prerequisite of FG 47-m4, given that it is optional without capability, it is not important (and even not meaningful) to define the prerequisite. Removing a FG from the prerequisite does not prevent the UE from supporting that FG. On the other hand, it is actually problematic to define a ‘partial prerequisite FG’, i.e., introduce a FG with the exception of some of the components. More especially, if a UE indicates both FG 15-1 and 47-m4 (with 15-1 as prerequisite except Component 5) in the same band, it is very confusing on whether or not the UE supports Component 5 of 15-1: on one hand, the UE indicate FG 15-1 for this band, thus it should support all the components of this FG, while on the other hand, another FG 47-m4 indicates that the UE is not required to do so. Thus, it is desirable to avoid such kind of ambiguity.  *Proposal 3:* *Do not define “15-1 except Component 5” as the prerequisite of FG 47-m4.*  Finally, regarding whether to introduce the FG 47-m13, the essential issue here is how to determine the maximum number of simultaneous PSFCH transmissions in SLU.  In R16/17 SL, UE may drop some PSFCHs based on the number of PSFCH(s) resources that the UE can transmit/receive in a slot indicated in UE’s capability. Since each PSFCH occupies one PRB in R16/17 SL, there is no ambiguity about the number of PSFCH resources and the number of PSFCHs. However, regarding R18 SLU, it is not clear how to perform PSFCH prioritization, especially to determine the simultaneous PSFCH transmissions based on UE’s capability, since both types of PSFCH transmission occupy more than one PRB. Therefore, a clarification of the UE’s capability about the UE can transmit/receive PSFCHs in a slot is needed in SLU.  Option 1: the UE’s capability indicates the number of PSFCH(s) PRBs that the UE can transmit/receive in a slot.  Option 2: the UE’s capability indicates the number of PSFCH(s) interlaces that the UE can transmit/receive in a slot.  Option 3: the UE’s capability indicates the number of PSFCH resources with valid HARQ-ACK information in response to a PSSCH reception or with conflict information that the UE can transmit/receive in a slot.  In option 1, the number of simultaneous PSFCHs transmissions is subject to the PSFCH(s) PRB numbers. As the PRB number of each PSFCH transmission increases, the number of simultaneous PSFCH transmission decreases. It is noted that each PSFCH interlace contains 10/11 PRBs, thus the number of simultaneous HARQ-ACK or IUC transmission is approximately 1/10 compared with Rel-16. When the UE’s capability is 20 PRBs, the number of PSFCH transmissions is shown in Table 1. The decreased number of simultaneous PSFCH transmission may result in a decline in system performance.   |  |  |  | | --- | --- | --- | | Rel-16: 20 PSFCHs | Alt 1-1b: 2 PSFCHs(20 PSFCH RBs) | Alt 2-3a: 2 PSFCHs(20 PSFCH RBs) | |  |  |  |   Table 1 the number of PSFCH transmissions when UE’s capability is 20 PRBs  For Alt 2-3a, option 2 implies that the number of simultaneous PSFCH transmission is equal to the interlace number indicated in UE’s capability. However, in Alt 1-1b, each interlace may contain multiple sets of dedicated K3 PRBs, resulting in the number of simultaneous PSFCH transmission being much more than the interlace number indicated in UE’s capability. For example, UE can transmit 20 different HARQ-ACK/IUC in 3 interlaces (including common interlace) when K3 is equal to 1. When the UE’s capability is 3 interlaces, the number of PSFCH transmissions is shown in Table 2. In this case, the processing complexity will be dramatically increased compared with Rel-16.   |  |  |  | | --- | --- | --- | | Rel-16: 30 PSFCHs | Alt 1-1b: 20 PSFCHs(K3=1) | Alt 2-3a: 3 PSFCHs | |  |  |  |   Table 2 the number of PSFCH transmissions when UE’s capability is 3 interlaces  In Option 3, the number of PSFCH resources is determined excluding the common interlace, and the number of simultaneous PSFCH transmission is equal to the indication in UE’s capability. The processing complexity slightly increases due to the PRB repetition of the PSFCH transmission compared with Rel-16. When the UE’s capability is 3 PSFCH resources, the number of PSFCH transmissions is shown in Table 3. Moreover, since the UE may drop the PRB of common interlace in Alt 1-1a, it is reasonable that the UE performs PSFCH prioritization based on the PSFCH resource without common interlace. Therefore, option 3 is preferred.   |  |  |  | | --- | --- | --- | | Rel-16: 3 PSFCHs | Alt 1-1b: 3 PSFCHs | Alt 2-3a: 3 PSFCHs | |  |  |  |   Table 3 the number of PSFCH transmissions when UE’s capability is 3 interlaces  *Proposal 4: The UE’s capability of the supported number of PSFCH indicates the number of PSFCH resources with valid HARQ-ACK information in response to a PSSCH reception or with conflict information that the UE can transmit/receive in a slot.*  With this understanding, it seems not necessary to introduce the FG 47-m13.  *Proposal 5:* *The UE capability 47-m13 is not necessary.* |
| [6] | Apple | Sidelink on unlicensed spectrum with channel access mechanism For FG 47-k1, type 1 and type 2A/2B/2C channel access are used with mode 1 and mode 2 resource selection procedure. Therefore the “prerequisite feature groups” should include either mode 1 or mode 2 with full sensing or partial sensing.  ***Proposal 1:*** *For FG 47-k1, the prerequisite feature groups include at least one of the 15-25, 15-3 and 32-4.* Resource allocation in sidelink on unlicensed spectrum In SL-U, a UE can have the capability of either mode 1 resource allocation or mode 2 resource allocation or both. It is necessary for a UE to report its resource allocation capability. For example, if a UE reports its capability of mode 2 resource allocation, network will not send DCI 3\_0 to this UE.  The mode 2 resource selection operations in interlace RB-based PSCCH/PSSCH are different from Rel-16 NR sidelink. For example, a candidate resource for interlace RB-based PSCCH/PSSCH is in terms of sub-channel indexes in an RB set, RB set indexes and slot index. The prerequisite of this FG is FG 15-3. Hence, we have the following proposal for transmitting interlace RB-based PSCCH/PSSCH in mode 2 resource allocation.  ***Proposal 2:*** *Introduce a new FG (e.g., FG 47-k10) as “Sidelink mode 2 resource allocation for interlace RB-based PSCCH/PSSCH transmission”,*   * *with the components of* * *UE can perform mode 2 sensing and resource selection operations for interlace RB-based PSCCH/PSSCH.* * *UE can transmit interlace RB-based PSCCH/PSSCH.* * *with prerequisite of FG 15-3.*   For PSCCH/PSSCH, it was agreed that both contiguous RB-based and interlace RB-based transmissions are supported. For contiguous RB-based PSCCH/PSSCH, a sub-channel is defined and indexed in a similar way as Rel-16 NR sidelink. The main difference is related to the handling of intra-cell guard band. It was agreed that for a sub-channel including intra-cell guard band PRBs, it cannot be used for PSCCH transmission and can be used for PSSCH transmission. Subsequently, the mode 2 resource selection procedure is modified such that a candidate resource whose lowest sub-channel includes intra-cell guardband PRBs is excluded. The prerequisite of this FG is FG 15-3. Hence, we have the following proposal.  ***Proposal 3:*** *Introduce a new FG (e.g., FG 47-k11) as “Sidelink mode 2 resource allocation for contiguous RB-based PSCCH/PSSCH transmission”,*   * *with the components of* * *UE can perform mode 2 sensing and resource selection operations considering intra-cell guardband.* * *UE can transmit contiguous RB-based PSCCH/PSSCH.* * *with prerequisite of FG 15-3.*  Sidelink on unlicensed spectrum with physical channel designPSCCH/PSSCH For the physical channel design framework for sidelink on unlicensed spectrum, all Rel-16 NR sidelink physical channels are enhanced for sidelink on unlicensed spectrum.  FG 47-m1 was introduced for interlace RB-based SL transmission/reception. This includes the transmission and reception of PSCCH/PSSCH/PSFCH.  It is open whether FG 32-4 and FG 32-4a could be prerequisite of FG 47-m1. In our view, partial sensing and random resource selection could be used for sidelink operations on unlicensed spectrum. Hence, we propose to keep one of FG 32-4 and FG 32-4a as prerequisite of FG 47-m1.  ***Proposal 4:*** *The prerequisites of FG 47-m1 include FG 32-4 and FG 32-4a.* Slot structure It was agreed to support maximum 2 candidate starting symbols in a slot for a PSCCH/PSSCH transmission. The PSCCH/PSSCH slot structure in this case are different from Rel-16 NR sidelink.  Subsequently, FG 47-m3 and FG 47-m4 are defined for transmitting and receiving PSCCH/PSSCH from 2nd starting symbol in a slot, respectively.  It is open whether FG 32-4 and FG 32-4a could be prerequisite of FG 47-m3. In our view, partial sensing and random resource selection could be used for sidelink operations on unlicensed spectrum. Hence, we propose to keep one of FG 32-4 and FG 32-4a as prerequisite of FG 47-m3.  ***Proposal 5:*** *The prerequisites of FG 47-m3 include FG 32-4 and FG 32-4a.*  In our view, to receive PSCCH/PSSCH from 2nd starting symbol in a slot, UE needs to have the capability of receiving NR sidelink. Hence, FG 47-m1 can be the prerequisite FG for FG 47-m4.  ***Proposal 6:*** *The prerequisite of FG 47-m4 is FG 47-m1.* PSFCH For PSFCH, to meet the OCB requirements, each PSFCH transmission is composed of either a dedicated interlace or a common interlace plus K3 dedicated PRBs. Like in FG 15-11, we should define the total number of PSFCH receptions and the total number of PSFCH transmissions in a slot. These total numbers could be defined, in terms of the number of PRBs.  To transmit PSFCH composed of a common interlace and multiple dedicated PRBs, UE needs to support PSFCH transmission capability. Hence, FG 47-m1 is the prerequisite, and we have the following proposal for transmitting/receiving interlace RB-based PSFCH.  ***Proposal 7:*** *Keep FG 47-m13 with the existing components, and the prerequisite of FG 47-m13 is FG 47-m1.* Inter-UE coordination In RAN1 #114bis meeting and RAN1 #115 meeting, it was agreed to support both inter-UE coordination scheme (IUC) 1 and inter-UE coordination scheme 2 in SL-U. Hence, the corresponding UE features for IUC schemes in SL-U should be examined.  To support IUC scheme 1 in interlace RB-based PSCCH/PSSCH transmissions in SL-U, the SCI format 2-C field is updated to include RB set related information.  For IUC information, SCI format 2-C has a new field of “lowest RB set indices” and a modified “resource combinations” field. Hence, a new FG should be introduced for a UE to support the reception of IUC information over 2nd SCI in interlace RB-based PSCCH/PSSCH. The prerequisites of this FG include FG 47-m1 and FG 32-6-1.  ***Proposal 8:*** *Introduce a new FG of “Reception of scheme 1 inter-UE coordination information over 2nd SCI in interlace RB based PSCCH/PSSCH”,*   * *with component of “UE can receive Scheme 1 inter-UE coordination transmission over 2nd SCI that is used in addition to the MAC-CE carrying the same inter-UE coordination information in the same transmission, in interlace RB based PSCCH/PSSCH.”* * *with prerequisites of FG 47-m1 and FG 32-6-1.*   For IUC request, SCI format 2-C has a new field of “number of RB sets”. Hence, a new FG should be introduced for a UE to support the reception of IUC request over 2nd SCI in interlace RB-based PSCCH/PSSCH. The prerequisites of this FG include FG 47-m1 and FG 32-6-2.  ***Proposal 9:*** *Introduce a new FG of “Reception of scheme 1 explicit request over 2nd SCI in interlace RB based PSCCH/PSSCH”,*   * *with component of “UE can receive an explicit request for inter-UE coordination information of both preferred resource set and non-preferred resource set over 2nd SCI that is used in addition to the MAC-CE carrying the explicit request in the same transmission, in interlace RB based PSCCH/PSSCH.”* * *with prerequisites of FG 47-m1 and FG 32-6-2.* |
| [7] | CATT, CICTCI, CBN | On FG47-m13(PSFCH transmission with common interlace and dedicated PRBs) In RAN1#116bis meeting, the FG on PSFCH transmission with 1 common interlace and K3 dedicated PRBs were discussed, and FL provide the following proposal for this FG[1].   |  | | --- | | (H) Proposal 2.10-1:  * FG47-m13 is kept, i.e., remove yellow highlight * Component for FG47-m13 is updated as follows   + 1. UE can transmit up to K PSFCH(s) in a slot, where each PSFCH transmission occupy K3 dedicated PRBs.   + 2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy K3 dedicated PRBs * “Need for the gNB to know if the feature is supported” for FG47-m13 is No * “Applicable to the capability signalling exchange between UEs” for FG47-m13 is No * FG47-m13 is Optional without capability signaling   + Reporting granularity of FG47-m13 is not described   + Replace “signaling” by “FG” for “The signaling is only expected for a band where shared spectrum channel access must be used.” in the note of FG47-m13 * “Consequence if the feature is not supported by the UE” for FG47-m13 is kept as it is * Prerequisite FG of FG47-m13 is 47-m1 * Note for FG47-m13 is updated as follows   + The FG is only expected for a band where shared spectrum channel access must be used.   + Candidate values for K are {4, 8, 16}   + Candidate values for L are {5, 15, 25, 32, 35, 45, 50, 64} |   ***Proposal 2: Regarding FG47-m13, the proposal 2.10-1 in RAN1#116bis FL summary(R1-2403430) is preferred.*** FG on PSFCH transmission and reception with dedicated interlace For PSFCH transmission in SL-U, there are two types PSFCH transmission when interlaced-RB based transmission is required, one is the PSFCH transmission with 1 common interlace and K3 dedicated PRBs, another is the PSFCH transmission with one dedicated interlace. Since the PSFCH transmission and reception capability for 1 common interlace and dedicated K3 PRBs has been discussed and introduce FG47-m13, it would be better to introduce one FG on PSFCH transmission and reception capability for dedicated interlace. Some company think that the current FG47-m1 has supported the interlaced RB-based transmission and reception for PSCCH/PSSCH/PSFCH, but there is no definition of maximum number of PSFCH Transmission and Reception in a slot in FG47-m1.  ***Proposal 3 Introduce FG 47-m13a(PSFCH transmission and reception with dedicated interlace) as follows.***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-m13a | Transmissions/receptions of multiple resources in dedicated interlace-based PSFCH | 1. UE can transmit up to K PSFCH(s) in a slot, where each PSFCH transmission occupy a dedicated interlace.  2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy K3 dedicated PRBs | 47-m1 | No | No | UE does not support multiple transmissions/receptions of dedicate interlace-based PSFCH. | N/A | N/A | N/A |  | The FG is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are [{4, 8, 16}]  Candidate values for L are [{5, 15, 25, 32, 45, 50, 64}] | Optional with capability signalling | |
| [8] | Nokia | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-k1 | SL channel access for dynamic channel access mode | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS | At least one of {15-25, 15-3, 32-4, 32-4a} | Yes | No | UE does not support channel access for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR SL in shared spectrum and when shared spectrum channel access must be used, UE must indicate this FG is supported | | 47. NR\_SL\_enh2 | 47-m1 | Interlace RB-based SL transmission/reception | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | At least one of {15-25, 15-3, 32-4, 32-4a} | Yes | No | UE does not support Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception | Per band | N/A | N/A |  | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must indicate this FG is supported. | | 47. NR\_SL\_enh2 | 47-m3 | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | At least one of {15-25, 15-3, 32-4, 32-4a} | No | No | UE transmits PSCCH/PSSCH only from 1st starting symbol in a slot | Per band | n/a | n/a |  | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols |  | No | No | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot | Per band | n/a | n/a |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.] | | 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot |  | No | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling | |
| [9] | OPPO, Huawei, HiSilicon, LG Electronics | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-k1 | SL channel access for dynamic channel access mode | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS  9. SL Type 1 and Type 2 channel access for multiple starting positions in a slot | At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~} | Yes | No | UE does not support channel access for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR SL in shared spectrum ~~and when~~ where shared spectrum channel access must be used, UE must ~~indicate~~ support this FG ~~is supported~~ | | 47. NR\_SL\_enh2 | 47- k2 | SL multi-channel access for dynamic channel access mode | 1. UE supports multi-channel access procedures for PSCCH/PSSCH/S-SSB/PSFCH transmission(s) in multiple RB sets in a slot  4) UE supports multi-channel access procedure on N channel(s) with 20MHz LBT bandwidth for each channel. Candidate values of N: {2, 3, 4, 5} | 47-k1 | Yes | No | UE does not support multi-channel access in dynamic channel access mode for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used.  Note: Support of S-SSB/PSFCH transmission(s) in multiple RB-sets in a slot is according to the support of {47-m11, 47-m11a} and {47-m12, 47-m12a} | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47- k2-1 | SL multi-channel access allowing ~~Transmitting~~ PSFCH/S-SSB transmission on a subset of ~~the~~ intended number of RB sets based on the outcome of channel access on individual RB sets | UE supports Type A and Type B multi-channel access procedures for PSFCH/S-SSB transmissions in multiple RB sets in a slot | 47-k2 | No | No |  |  |  |  |  |  | Optional without capability signaling | | 47. NR\_SL\_enh2 | 47- k3 | Receiving UE to UE COT sharing information | 1. UE supports monitoring SCI to read COT sharing information  2. UE supports transmitting NR SL based on COT sharing information subject to COT sharing conditions | 47-k1 | No | No | UE does not support using UE-to-UE COT sharing information contained in SCI for sharing COT for NR sidelink operation in shared spectrum. |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR SL in shared spectrum where shared spectrum channel access must be used, UE must support this FG | | 47. NR\_SL\_enh2 | 47-k4 | Transmitting UE to UE COT sharing information | 1. UE supports using ue-toUE-COT-SharingED-Threshold for Type 1 channel access for UE to UE COT sharing  2. UE supports indicating COT sharing information in SCI | 47-k1 | No | Yes | UE does not support transmitting UE-to-UE COT sharing information for sharing COT for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-k5 | Resource allocation for multi-consecutive slots transmission | UE supports resource (re-)selection for PSCCH/PSSCH transmission on multiple consecutive slots | at least one of {15-3, 32-4} | No | No | UE does not support resource (re-)selection for multi-consecutive slots transmission |  |  |  |  |  | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-k6 | Type1 LBT blocking Option 1 | UE supports  1. avoid selection of N consecutive resource(s) before a reserved resource when the L1 SL priority value for the transmission is higher than the L1 SL priority value of the reserved resource. It is up to UE whether to do it  2. avoid selection of M consecutive resource(s) after a reserved resource when the transmitting symbols of the reserved resource overlap with LBT of the selected resource. It is up to UE whether to do it | 47-k1 | Yes | No | UE does not support Type1 LBT blocking Option 1 | Per band | n/a | n/a |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-k7 | Type1 LBT blocking Option 2 | UE supports  1. If transmission in slot(s) at least T\_proc,0 before a reserved resource is able to share its initiated COT to the reservation, UE prioritize / select resource(s) in the slot(s) for transmission. It is up to UE whether to do it | 47-k1 | Yes | No | UE does not support Type1 LBT blocking Option 2 | Per band | n/a | n/a |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-k8 | CW autonomous update for SL transmission without HARQ feedback | UE support autonomous update of the *CWp* to the next higher allowed value when the same *CWp* ≠ *CWmax*,*p* value is consecutively used for X times for generation of *Ninit* for PSCCH/PSSCH transmission without HARQ feedback. | 47-k1 | No | No | UE does not update *CWp* for PSCCH/PSSCH transmission without HARQ feedback. |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-k9 | Sidelink mode 1 resource allocation in shared spectrum | 1. UE can monitor DCI format 3\_0 on a licensed band for NR sidelink dynamic scheduling and configured grant type 2 for transmitting PSCCH/PSSCH on a shared spectrum  2. UE supports reporting NACK to gNB when transmitting PSCCH/PSSCH on scheduled resource(s) is failed due to LBT failure | 47-k1 | Yes | No | UE does not perform PSCCH/PSSCH based on mode 1 resource allocation in a shared spectrum. | Per band | N/A | N/A |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-m1 | Interlace RB-based SL transmission/reception | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | At least one of {15-25, 15-3, ~~[~~32-4, 32-4a]} | Yes | No | UE does not support Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception | Per band | N/A | N/A |  | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must ~~indicate~~ support this FG ~~is supported~~. | | 47. NR\_SL\_enh2 | 47-m3 | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~} | No | No | UE transmits PSCCH/PSSCH only from 1st starting symbol in a slot |  |  |  |  | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | ~~[~~15-1 ~~except Component 5]~~ | No | No | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot |  |  |  |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum ~~and when~~ where shared spectrum channel access must be used, UE must support this FG.~~]~~ | | 47. NR\_SL\_enh2 | 47-m5 | Multiple PSFCH occasions per PSCCH/PSSCH | 1. UE supports PSFCH transmission/reception on N PSFCH occasion(s) per PSCCH/PSSCH | 15-11 | Yes | No | UE supports only one PSFCH occasion per PSCCH/PSSCH transmission | Per band | N/A | N/A |  | Candidate values for N are {1,2,3,4}  The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-m6 | Transmitting SSB repetitions within one RB set | 1. UE supports transmitting S-PSS/S-SSS/PSBCH multiple times by repetition in frequency domain within one RB set | 15-4 | No | No | UE does not support transmitting S-PSS/S-SSS/PSBCH multiple times by repetition in frequency domain within one RB set |  |  |  |  | This is the basic FG for NR sidelink in shared spectrum where PSD and/or OCB requirements are defined by regulation.  It is up to UE implementation whether S-SSB RX UE monitors more than one S-SSB repetition in frequency domain within one RB set as long as RAN4 requirements are satisfied  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum where PSD and/or OCB requirements are defined by regulation, UE must support this FG. | | 47. NR\_SL\_enh2 | 47-m8 | Transmitting S-SSB on additional S-SSB occasion(s) | 1. UE supports transmitting S-SSB on additional S-SSB occasion(s) | 15-4 | No | No | UE does not support transmitting S-SSB on additional S-SSB occasion(s) but supports to exclude those occasion(s) from SL resource pool(s) |  |  |  |  |  | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m9 | Receiving S-SSB on additional S-SSB occasion(s) | 1. UE supports receiving S-SSB on additional S-SSB occasion(s) | 15-4 | No | No | UE does not support receiving S-SSB on additional S-SSB occasion(s) but supports to exclude those occasion(s) from SL resource pool(s) |  |  |  |  |  | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m10 | Contiguous RB-based PSCCH/PSSCH transmission/reception | 1. UE supports contiguous RB-based PSCCH/PSSCH transmission/reception  2. UE supports resource (re-)selection for contiguous RB-based PSCCH/PSSCH transmission | At least one of {15-25, 15-3, 32-4, 32-4a} | Yes | No | UE does not support contiguous RB-based PSCCH/PSSCH transmission/reception | Per band | N/A | N/A |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-m11 | PSFCH transmissions in multiple contiguous RB sets | UE supports PSFCH transmissions in multiple contiguous RB sets | at least one of {47-k2, 47-k2-1} | Yes | Yes | UE does not support PSFCH transmissions in multiple contiguous RB sets | Per band | N/A | N/A |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-m11a | PSFCH transmissions in multiple non-contiguous RB sets | UE supports PSFCH transmissions in multiple non-contiguous RB sets | 47-m11 | Yes | Yes | UE does not support PSFCH transmissions in multiple non-contiguous RB sets | Per band | N/A | N/A |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-m12 | S-SSB transmissions in multiple contiguous RB sets | UE supports S-SSB transmissions in multiple contiguous RB sets | at least one of {47-k2, 47-k2-1} | No | No | UE does not support S-SSB transmissions in multiple contiguous RB sets |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m12a | S-SSB transmissions in multiple non-contiguous RB sets | UE supports S-SSB transmissions in multiple non-contiguous RB sets | 47-m12 | No | No | UE does not support S-SSB transmissions in multiple non-contiguous RB sets |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling | | 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | TBD | No | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The ~~signaling~~ FG is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling | |
| [10] | NTT DOCOMO, INC. | FG 47-k1  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Index** | **FG** | **Components** | **Prerequisite** | **Report to gNB** | **Report to UE** | **Type** | **Note** | **M/O** | | 47-k1 | SL channel access for dynamic channel access mode | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS | At least one of {15-25, 15-3, [32-4, 32-4a]} | Yes | No | Per band | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR SL in shared spectrum and when shared spectrum channel access must be used, UE must indicate this FG is supported |   For prerequisite, whether 32-4 (mode 2 RA with partial sensing) / 32-4a (mode 2 RA with random selection) are necessary as well as 15-25 (mode 1 RA based on different Uu carrier) and 15-3 (mode 2 RA with full sensing) is the remaining issue. Based on SL-U discussion so far, there seems to be no intention to preclude partial sensing and random selection from SL-U, therefore, these FGs should also be kept here.  Besides, although one additional component “9. SL Type 1 and Type 2 channel access for multiple starting positions in a slot” was proposed for this FG, we do not think this FG is necessary. The existing components (+ FG 47-m3) covers it.  **Proposal 1: For FG 47-k1,**   * **Prerequisite FG is “At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~}”.** * **Not add “9. SL Type 1 and Type 2 channel access for multiple starting positions in a slot”.**  FG 47-m1  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Index** | **FG** | **Components** | **Prerequisite** | **Report to gNB** | **Report to UE** | **Type** | **Note** | **M/O** | | 47-m1 | Interlace RB-based SL transmission/reception | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | At least one of {15-25, 15-3, [32-4, 32-4a]} | Yes | No | Per band | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must indicate this FG is supported. |   For pre-requisite, there seems to be no intention to preclude partial sensing and random selection from SL-U as mentioned for FG 47-k1.  **Proposal 2: For FG 47-m1,**   * **Prerequisite FG is “At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~}”.**  FG 47-m3  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Index** | **FG** | **Components** | **Prerequisite** | **Report to gNB** | **Report to UE** | **Type** | **Note** | **M/O** | | 47-m3 | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | At least one of {15-25, 15-3, [32-4, 32-4a]} | No | No |  | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling |   For pre-requisite, there seems to be no intention to preclude partial sensing and random selection from SL-U as mentioned for FG 47-k1.  **Proposal 3: For FG 47-m3,**   * **Prerequisite FG is “At least one of {15-25, 15-3, ~~[~~32-4, 32-4a~~]~~}”.**  FG 47-m4  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Index** | **FG** | **Components** | **Prerequisite** | **Report to gNB** | **Report to UE** | **Type** | **Note** | **M/O** | | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | [15-1 except Component 5] | No | No |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.] |   For pre-requisite, the reception capability FG 15-1 should be kept and notes to exclude unrequired part can be added.  **Proposal 4: For FG 47-m4,**   * **Prerequisite FG is 15-1, and following notes are added.**   + **Note: If UE supports 15-1, the UE is not required to support Component 5.**   + **Note: It is up to RAN2 whether/how to implement the above Note and whether/how to update the prerequisite FGs.**  FG 47-m13  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Index** | **FG** | **Components** | **Prerequisite** | **Report to gNB** | **Report to UE** | **Type** | **Note** | **M/O** | | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | TBD | No | No | Per band | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling |   At the last meeting, this FG was proposed but there was no agreement due to time limitation. In our view, this aspect on the newly introduced PSFCH structure is not covered in any other FG and thus this FG is necessary.  For components, they should be updated as described in the moderator’s proposal at the last meeting. When the number of receptions is discussed, basically the number of resources is considered since decoding capability is the main point. The same way can be applied to this FG as well. The number of PRBs is not used.  For pre-requisite, this feature is relative to interlaced structure, which means that FG 47-m1 should be prerequisite here.  For cap per X, ‘per band’ would be OK as in other FGs.  For report to gNB/UE, ‘report to gNB’ can be YES and ‘report to UE’ can be NO, as in FG 47-m1.  For the other columns, the existing texts can be agreed without any modification except for the candidate values. Candidate values defined in FG 15-11 (basic PSFCH TX/RX) can be reused, i.e., {5, 15, 25, 32, 45, 50, 64} for L and {4, 8, 16} for K.  **Proposal 5: Introduce FG 47-m13 as follows.**   |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47-m13 | Transmissions/receptions of multiple resources in dedicated PRB(s) in interlace-based PSFCH | 1. UE can transmit up to K PSFCH(s) in a slot, where each PSFCH transmission occupy K3 dedicated PRBs.  2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy K3 dedicated PRBs. | 47-m1 | Yes | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are {4, 8, 16}  Candidate values for L are {5, 15, 25, 32, 45, 50, 64} | Optional with capability signalling | |
| [11] | Qualcomm Incorporated | On the FG 47-m13, the intention of this FG was to limit the number of dedicated PRBs that can be transmitted/received in a slot when the waveform with K3 dedicated PRBs is used. In 15-11, the capability range is for PSFCHs that use a single PRB each. With a range of K3={1,2,5}, if K3=5 the legacy capability is greatly augmented, which is not preferred due to the burden it poses on UE implementation (e.g., under current proposal 64 PSFCH with K3=5 PRBs each could be received, that is 320 PRBs, much more than the 64 PRBs in 15-11).  We propose to keep the definition of K and L unmodified in FG 47-m13, and suggest a range of K,L PRBs that largely comply the PRBs intended in 15-11, to do so we should consider the ranges of N,M in 15-11 and consider the min/max values of K3, e.g. K={4, 8, 16, 20} and L={5, 10, 15, 25, 30, 32, 35, 45, 50, 64, 70, 75}. The red values are extensions that we can be ok with to capture some additional combinations ok K3 and N/M (e.g., 20=(M=4)x(K3=5), 70=(N=35)x(K3=2), and 75=(N=25)x(K3=3)).  Proposal 4: In FG 47-m13, K and L are the number of total dedicated PRBs in a slot for transmitting/receiving PSFCH, respectively. The value ranges for K and L is K={4,8,16,20} and L={5,10,15,25,30,32,35,45,50,64,70,75}, respectively.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-k1 | | | SL channel access for dynamic channel access mode | | | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS | | | At least one of {15-25, 15-3, ~~[~~ 32-4, 32-4a ~~]~~ } | | | Yes | | | No | | UE does not support channel access for NR sidelink operation in shared spectrum. | | | | | | Per band | | | n/a | | | n/a | | |  | | | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | | | Optional with capability signalling  For UE supports NR SL in shared spectrum and when shared spectrum channel access must be used, UE must indicate this FG is supported | | 47. NR\_SL\_enh2 | 47-m1 | | | Interlace RB-based SL transmission/reception | | | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | | | At least one of {15-25, 15-3, ~~[~~ 32-4, 32-4a ~~]~~ } | | | Yes | | | No | | UE does not support Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception | | | | | | Per band | | | N/A | | | N/A | | |  | | | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | | | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must indicate this FG is supported. | | 47. NR\_SL\_enh2 | | 47-m3 | | | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | | | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | | | At least one of {15-25, 15-3, ~~[~~ 32-4, 32-4a ~~]~~ } | | | No | | | No | | | UE transmits PSCCH/PSSCH only from 1st starting symbol in a slot | | |  | | |  | | |  | | |  | | | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | | | Optional without capability signalling | | | 47. NR\_SL\_enh2 | | 47-m4 | | | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | | | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | | | ~~[~~ 15-1 except Component 5 ~~]~~ | | | No | | | No | | | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot | | |  | | |  | | |  | | |  | | | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | | | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.] | | | 47. NR\_SL\_enh2 | | | 47-m13 | | | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | | | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | | | 15-11 | | | No | | | | No | | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. |  | | | N/A | | | N/A | | |  | | | The FG is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are ~~FFS~~ {4,8,16,20}  Candidate values for L are ~~FFS~~ {5,10,15,25,30,32,35,45,50,64,70,75} | | | Optional without capability signalling | | | |

## **Discussion**

### **(H) Proposal 2-1:**

* **Prerequisite FG of FG47-k1 is “At least one of {15-25, 15-3, 32-4, 32-4a}”**
* **“UE must indicate this FG is supported” is replaced by “UE must support this FG” in Mandatory/Optional column of FG47-k1**
* **“and when” is replaced by “where” in Mandatory/Optional column of FG47-k1**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * 47-k1   + Prerequisite     - At least one of {15-25, 15-3, 32-4, 32-4a}: Huawei/HiSilicon, ZTE, Apple, Nokia, FLs, DOCOMO, Qualcomm     - At least one of {15-25, 15-3}: vivo   + Component     - Add “SL Type 1 and Type 2 channel access for multiple starting positions in a slot”: FLs     - Not add: Huawei/HiSilicon, Nokia, DOCOMO, Qualcomm |
| OPPO | * Regarding vivo’s concern on adding 32-4, 32-4a as prerequisites for FGs 47-k1, 47-k5, 47-m3 and 47-m10, it should be noted that none of these FGs are related to RAN2 latest agreement on co-configuration of partial sensing and interlace RB based transmission. Therefore, they should not be impacted and we should only treat “**47-m1**” (Interlace RB-based SL transmission/reception) separately as a special case when we resolve or come to a conclusion on this RAN2 agreement in this meeting. Therefore, we propose finalize the prerequisites for 47-k1 as “At least one of {15-25, 15-3, 32-4, 32-4a}”, and settle the prerequisites for 47-m1 later in this meeting. * On adding “SL Type 1 and Type 2 channel access for multiple starting positions in a slot” as a component in 47-k1, it should be noted that this is different from the feature in 47-m3 (UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol). Currently 47-k1 is not a prerequisite for FG 47-m3 so there is no relationship between them. And currently, the FG 47-m3 is intended for use not restricting to unlicensed spectrum.   + BTW, we don’t seem to find concern in Huawei/HiSilicon, Nokia and Qualcomm’s papers. The only concern was raised form DOCOMO. |
| DCM | OK |
| CATT, CICTCI | OK |
| vivo | Our preference is to achieve a common design on the prerequisites for the FGs, i.e., if 32-4/4a are removed for 47-m1, then they are also removed for other FG, e.g., 47-k1/k5/… Otherwise, it would increase the maintenance efforts. It is worth noting that there is no fundamental impact if 32-4/4a are removed, because removing a prerequisite does not prevent the UE to support that FG.  Thus, our suggestion is to first settle the 47-m1, more specifically, the RAN2 LS. Then the other FGs/proposals can be easily aligned. |
| Huawei, HiSilicon | Ok for 1st and 2nd bullet.  For the 3rd bullet:  “when” was used intentionally to address MTK’s concern in previous meetings.  MTK mentioned that for a particular band, it can work in different modes. Some mode requires LBT, and some mode doesn’t require LBT.  Using “where” may not be able to reflect this. |

### **(H) Proposal 2-2:**

* **Prerequisite FG of FG47-m1 is “At least one of {15-25, 15-3, 32-4, 32-4a}”**
* **“UE must indicate this FG is supported” is replaced by “UE must support this FG” in Mandatory/Optional column of FG47-m1**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Prerequisite   + At least one of {15-25, 15-3, 32-4, 32-4a}: Huawei/HiSilicon, ZTE, Apple, Nokia, FLs, DOCOMO, Qualcomm   + At least one of {15-25, 15-3}: vivo |
| OPPO | As commented in Proposal 2-1, this issue is related to the RAN2’s LS in this meeting. We should resolve the agreements in RAN2’s LS first before treating this FG. |
| DCM | OK (or fine with OPPO’s suggestion) |
| CATT, CICTCI | OK |
| vivo | Please check our view on the P2-1. Our suggestion is to first settle the 47-m1, more specifically, the RAN2 LS. Then the other FGs/proposals can be easily aligned. |
| Huawei, HiSilicon | ok |

### **(H) Proposal 2-3:**

* **Prerequisite FG of FG47-m3 is “At least one of {15-25, 15-3, 32-4, 32-4a}”**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Prerequisite   + At least one of {15-25, 15-3, 32-4, 32-4a}: Huawei/HiSilicon, ZTE, Apple, Nokia, FLs, DOCOMO, Qualcomm   + At least one of {15-25, 15-3}: vivo |
| OPPO | As commented in Proposal 2-1, 47-m3 (Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot) is not related to RAN2’s agreement on “co-configuration of partial sensing and interlace RB based transmission”. Therefore, 32-4 and 32-4a should be added as prerequisites for 47-m3. |
| DCM | OK |
| CATT, CICTCI | OK |
| vivo | Please check our view on the P2-1. Our preference is to achieve a common design on the prerequisites for the FGs.  Let’s first settle the 47-m1, more specifically, the RAN2 LS. Then the other FGs/proposals can be easily aligned. |
| Huawei, HiSilicon | ok |

### **(H) Proposal 2-4:**

* **Prerequisite FG of FG47-m4 is “15-1”**
* **Following notes are added for FG47-m4**
  + **Note: If UE supports 15-1, the UE is not required to support Component 5.**
  + **Note: It is up to RAN2 whether/how to implement the above Note and whether/how to update the prerequisite FGs.**
* **“]” is removed from Mandatory/Optional column of FG47-m4**
* **“and when” is replaced by “where” in Mandatory/Optional column of FG47-m4**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Prerequisite   + 15-1: Huawei/HiSilicon, FLs, DOCOMO   + 15-1 except Component 5: ZTE, Qualcomm   + None: vivo, Nokia   + 47-m1: Apple * Note   + Add following notes: DOCOMO     - Note: If UE supports 15-1, the UE is not required to support Component 5.     - Note: It is up to RAN2 whether/how to implement the above Note and whether/how to update the prerequisite FGs. |
| DCM | OK |
| CATT, CICTCI | OK |
| vivo | We basically would like to avoid defining a ‘partial prerequisite FG’, i.e., introduce a FG with the exception of some of the components, which is actually problematic. Especially, if a UE indicates both FG 15-1 and 47-m4 (with 15-1 as prerequisite except Component 5) in the same band, it is very confusing on whether or not the UE supports Component 5 of 15-1: on one hand, the UE indicate FG 15-1 for this band, thus it should support all the components of this FG, while on the other hand, another FG 47-m4 indicates that the UE is not required to do so. Thus, it is desirable to avoid such kind of ambiguity. |
| Huawei, HiSilicon | On last bullet: “when” was used intentionally, see our comment in Proposal 2-1. |

### **(H) Proposal 2-5:**

* **FG47-m13 is kept, i.e., remove yellow highlight**
* **Component for FG47-m13 is updated as follows**
  + **1. UE can transmit up to K PSFCH(s) in a slot, where each PSFCH transmission occupy K3 dedicated PRBs.**
  + **2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy K3 dedicated PRBs**
* **“Need for the gNB to know if the feature is supported” for FG47-m13 is No**
* **“Applicable to the capability signalling exchange between UEs” for FG47-m13 is No**
* **FG47-m13 is Optional without capability signaling**
  + **Reporting granularity of FG47-m13 is not described**
  + **Replace “signaling” by “FG” for “The signaling is only expected for a band where shared spectrum channel access must be used.” in the note of FG47-m13**
* **“Consequence if the feature is not supported by the UE” for FG47-m13 is kept as it is**
* **Prerequisite FG of FG47-m13 is 47-m1**
* **Note for FG47-m13 is updated as follows**
  + **The FG is only expected for a band where shared spectrum channel access must be used.**
  + **Candidate values for K are {4, 8, 16}**
  + **Candidate values for L are {5, 15, 25, 32, 35, 45, 50, 64}**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Support or not   + YES: Huawei/HiSilicon, ZTE, Samsung, Apple, CATT/CICTCI/CBN, Nokia, DOCOMO, Qualcomm   + NO: vivo * Component   + OK/Keep: Huawei/HiSilicon, ZTE, Apple, Nokia, Qualcomm   + Updated as below: CATT/CICTCI/CBN, DOCOMO     - 1. UE can transmit up to K PSFCH(s) in a slot, where each PSFCH transmission occupy K3 dedicated PRBs.     - 2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy K3 dedicated PRBs * Prerequisite   + 47-k1, 15-11: Huawei/HiSilicon,   + 47-k1: Samsung   + 47-k2, 47-m1: ZTE   + 47-m1: Apple, CATT/CICTCI/CBN, DOCOMO   + None: Nokia   + 15-11: Qualcomm * Report to gNB   + NO: Huawei/HiSilicon, Apple, CATT/CICTCI/CBN, Nokia   + YES: ZTE, DOCOMO     - Per band * Report to other UE   + NO: Huawei/HiSilicon, ZTE, Apple, CATT/CICTCI/CBN, Nokia, DOCOMO * Consequence if not supported   + OK/Keep: Huawei/HiSilicon, ZTE, Apple, CATT/CICTCI/CBN, Nokia, DOCOMO * Note   + Candidate for K     - Candidate values for K are M\*K3, where M is the same for each carrier and is reported by FG 15-11 component 3, and K3 is the number of dedicated PRBs of each PSFCH.: Huawei/HiSilicon     - {4, 8, 16}: Samsung, CATT/CICTCI/CBN, DOCOMO     - {4, 8, 16, 20}: Qualcomm   + Candidate for L     - Candidate values for L are N\*K3, where N is the same for each carrier and is reported by FG 15-11 component 2, and K3 is the number of dedicated PRBs of each PSFCH.: Huawei/HiSilicon     - {5, 15, 25, 32, 35, 45, 50, 64}: Samsung, CATT/CICTCI/CBN, DOCOMO     - {5, 10, 15, 25, 30, 32, 35, 45, 50, 64, 70, 75}: Qualcomm * Mandatory/optional   + Optional without capability signaling: Huawei/HiSilicon, Apple, CATT/CICTCI/CBN, Nokia   + Optional with capability signaling: ZTE, DOCOMO |
| OPPO | BTW, the FLs’ inputs in R1-2404841, support to have this FG. It was hard to show in R1-2404841 to remove the yellow highlight. And FLs are OK with existing descriptions and values. |
| DCM | OK for progress |
| CATT, CICTCI | OK |
| vivo | It should be discussed first how to understand/interpret the supported number of PSFCH(s) for the interlace-based PSFCH in Rel-18. If we have to reinterpret the max number of PSFCH based on the interlace, of course we have to introduce a new FG. This is a discussion point that not addressed in the main section but left to the UE feature discussion. |
| Huawei, HiSilicon | We are ok to discuss the issue Vivo mentioned.  In RAN1#116, FL in SL AI prepared a proposal to address this issue (see FLS in R1-2401522 and screenshot below). Mr. Vice chair suggests us to discuss in UE feature session.  So maybe we can discuss following proposal first to reach common understanding. If it is agreed, then there is no need to introduce 47-m13, and we can avoid spending much time discussing all the details of 47-m13 including the controversial value range. This agreement can be captured in 47-m1 component or Note column.  **Proposal 4-3**  The UE’s capability of the supported PSFCH indicates the number of PSFCH resources with valid HARQ-ACK information in response to a PSSCH reception or with conflict information that the UE can transmit/receive in a slot.  ==  If 47-m13 is to be introduced as a separate FG, after further thinking, we think 47-m13 needs to be basic FG to avoid additional RAN1 discussion.  Because if the resource pool enables HARQ-ACK and configures ‘common interlace’ for PSFCH transmission, but if some UE does not support 47-m13, such UE’s behavior becomes unclear, i.e., whether/how the UE sends PSFCH. RAN1 needs additional agreements to resolve such issue. If 47-m3 is basic FG, such issue is avoided.  == |

### **(H) Proposal 2-6:**

* **Introduce new FG 47-k10 for Sidelink mode 2 resource allocation for interlace RB-based PSCCH/PSSCH transmission.**
  + with the components of
    - UE can perform mode 2 sensing and resource selection operations for interlace RB-based PSCCH/PSSCH.
    - UE can transmit interlace RB-based PSCCH/PSSCH.
  + with prerequisite of FG 15-3.

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Introduce new FG for Sidelink mode 2 resource allocation for interlace RB-based PSCCH/PSSCH transmission: Apple |
| OPPO | This is already covered by 47-m1. In 47-m1 (Interlace RB-based SL transmission/reception), it implies both Mode 1 and Mode 2 resource allocation. If this is unclear, we can improve the component description for 47-m1. |
| DCM | Necessity is unclear for us. |
| CATT, CICTCI | We are open for the discussion, it may be needed, since there is new UE behavior for RA |
| Huawei, HiSilicon | Similar view with OPPO/DCM, this is not so necessary. We prefer not to create a new FG for a very small thing. Otherwise, there will be too many small FGs. |

### **(H) Proposal 2-7:**

* **Introduce new FG 47-k11 for Sidelink mode 2 resource allocation for contiguous RB-based PSCCH/PSSCH transmission.**
  + with the components of
    - UE can perform mode 2 sensing and resource selection operations considering intra-cell guardband.
    - UE can transmit contiguous RB-based PSCCH/PSSCH.
  + with prerequisite of FG 15-3.

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Introduce new FG for Sidelink mode 2 resource allocation for contiguous RB-based PSCCH/PSSCH transmission: Apple |
| OPPO | Similar comment as Proposal 2-6, we can improve the component description for 47-m1 to cover the case of Mode 2 RA considering intra-cell guardband, if needed. Currently, we are not sure if this is even needed since Mode 2 RA is already supported and no special handling is needed for intra-cell guardband in TS 38.214. |
| DCM | Necessity is unclear for us. |
| Huawei, HiSilicon | Similar view with OPPO/DCM, this is not so necessary. |

### **(H) Proposal 2-8:**

* **Introduce new FG for Reception of scheme 1 inter-UE coordination information over 2nd SCI in interlace RB based PSCCH/PSSCH.**
  + with the components of
    - UE can receive Scheme 1 inter-UE coordination transmission over 2nd SCI that is used in addition to the MAC-CE carrying the same inter-UE coordination information in the same transmission, in interlace RB based PSCCH/PSSCH
  + with prerequisite of FG 47-m1 and 32-6-1.

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Introduce new FG for Reception of scheme 1 inter-UE coordination information over 2nd SCI in interlace RB based PSCCH/PSSCH: Apple |
| OPPO | Same comment as before, this is already covered in 47-m1. |
| DCM | Necessity is unclear for us. |
| Huawei, HiSilicon | Similar view with OPPO/DCM, this is not so necessary. |

### **(H) Proposal 2-9:**

* **Introduce new FG for Reception of scheme 1 explicit request over 2nd SCI in interlace RB based PSCCH/PSSCH.**
  + with the components of
    - UE can receive an explicit request for inter-UE coordination information of both preferred resource set and non-preferred resource set over 2nd SCI that is used in addition to the MAC-CE carrying the explicit request in the same transmission, in interlace RB based PSCCH/PSSCH
  + with prerequisite of FG 47-m1 and 32-6-2.

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Introduce new FG for Reception of scheme 1 explicit request over 2nd SCI in interlace RB based PSCCH/PSSCH: Apple |
| OPPO | Same comment as before, this is already covered in 47-m1. |
| DCM | Necessity is unclear for us. |
| Huawei, HiSilicon | Similar view with OPPO/DCM, this is not so necessary. |

### **(H) Proposal 2-10:**

* **Introduce new FG 47-m13a for Transmissions/receptions of multiple resources in dedicated interlace-based PSFCH.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 47. NR\_SL\_enh2 | 47-m13a | Transmissions/receptions of multiple resources in dedicated interlace-based PSFCH | 1. UE can transmit up to K PSFCH(s) in a slot, where each PSFCH transmission occupy a dedicated interlace.  2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy K3 dedicated PRBs | 47-m1 | No | No | UE does not support multiple transmissions/receptions of dedicate interlace-based PSFCH. | N/A | N/A | N/A |  | The FG is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are [{4, 8, 16}]  Candidate values for L are [{5, 15, 25, 32, 45, 50, 64}] | Optional with capability signalling |

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Introduce new FG for Transmissions/receptions of multiple resources in dedicated interlace-based PSFCH: CATT/CICTCI/CBN |
| OPPO | Not quite clear the difference between this and 47-m13 that is already under the discussion (in yellow highlight). Isn’t this already covered by 47-m13? |
| DCM | Maybe 47-m13 is enough. |
| CATT, CICTCI | From our understanding, the current FG-m13 is for the PSFCH transmission type with 1 common interlace and K3 dedicated PRBs, this new introduced FG is for the PSFCH transmission type with dedicated interlace. Even FG47-m1 has supported interlaced-RB based PSFCH, but the maximum number of PSFCH Tx and Rx for different PSFCH transmission type should be defined. |
| Huawei, HiSilicon | This is covered by 47-m13. RAN1 can discuss 47-m13 first.  In CATT’s reply above, CATT mentioned “this new introduced FG is for the PSFCH transmission type with dedicated interlace”. However, “dedicated interlace” mechanism does not involve K3, and K3 appears in the component 2. It’s hard to understand 47-m13a. |
| CATT, CICTCI | Sorry for mis-wording of component 2.  The component 2 should be updated to  2. UE can receive up to L PSFCH(s) in a slot, where each PSFCH reception occupy ~~K3 dedicated PRBs~~ **a dedicated interlace** |

### **Proposal 2-11:**

* **Prerequisite FG of FG47-k5 is revised to “~~at least one of {~~15-3~~, 32-4}~~”**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Prerequisite   + 32-4 should be removed: vivo |
| OPPO | Not support |
| DCM | Not support |
| CATT, CICTCI | Not support. |
| vivo | Please check our view on the P2-1. Our preference is to achieve a common design on the prerequisites for the FGs.  Let’s first settle the 47-m1, more specifically, the RAN2 LS. Then the other FGs/proposals can be easily aligned. |
| Huawei, HiSilicon | Not support. |

### **Proposal 2-12:**

* **Prerequisite FG of FG47-m10 is revised to “At least one of {15-25, 15-3~~, 32-4, 32-4a~~}”**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Prerequisite   + 32-4 and 32-4a should be removed: vivo |
| OPPO | Not support |
| DCM | Not support |
| CATT, CICTCI | Not support. |
| vivo | Please check our view on the P2-1. Our preference is to achieve a common design on the prerequisites for the FGs.  Let’s first settle the 47-m1, more specifically, the RAN2 LS. Then the other FGs/proposals can be easily aligned. |
| Huawei, HiSilicon | Not support. |

### **Proposal 2-13:**

* **“signaling” is replaced by “FG” in note column of 47-k2/k4/k6/k7/k9/m5/m10/m11/m11a/m13**

|  |  |
| --- | --- |
| Company | Comment |
| OPPO | Support |
| DCM | OK |
| CATT, CICTCI | OK |
| vivo | OK |
| Huawei, HiSilicon | ok |

### **Proposal 2-14:**

* **FG name of FG47-k2-1 is updated to “**SL multi-channel access allowing ~~Transmitting~~ PSFCH/S-SSB transmission on a subset of ~~the~~ intended number of RB sets based on the outcome of channel access on individual RB sets**”**

|  |  |
| --- | --- |
| Company | Comment |
| OPPO | Support |
| DCM | OK |
| CATT, CICTCI | OK |
| vivo | OK |
| Huawei, HiSilicon | ok |

# **FGs for co-channel coexistence for LTE sidelink and NR sidelink**

Following inputs are provided in contributions for the RAN1#117 meeting.

|  |  |  |
| --- | --- | --- |
| [2] | Huawei, HiSilicon |  |
| [3] | ZTE |  |
| [4] | Samsung |  |
| [5] | vivo | The UE capability (FG 47-s1) of indicating the support of dynamic resource pool sharing for co-channel coexistence between LTE SL and NR SL has been finalized. On the other hand, dynamic resource pool sharing is not the only solution for co-channel coexistence between LTE SL and NR SL. It is concluded that TDM-based semi-static resource pool partitioning can be used for co-channel coexistence. It should be noted that co-channel coexistence between LTE and NR SL is not a basic SL UE feature. Even in rel-16, the support of in-device coexistence is optional. Moreover, co-channel coexistence is not the basic assumption of in-device coexistence. Instead, separate operating channels between RATs are assumed, as, e.g., described in the TR 37.985 [3], where frequency spacing is always assumed between LTE and NR SL:   |  | | --- | | It is envisaged that there will exist devices that support both LTE-V2X and NR-V2X, and which will be operating in both systems concurrently. If the two RATs are widely spaced in frequency, e.g. being in different bands, then there need be no particular issues to consider since it is assumed that a separate RF chain will be provided for each band.  If, however, a sufficiently close frequency spacing is deployed, then it is desirable to enable a single RF chain to be used in the implementation, and also to adhere to the sidelink half-duplex principle established in LTE-V2X, i.e. that the UE is not required to simultaneously transmit and receive on sidelink. The former constraint means that interference between the two RATs' receptions can occur in the device if they are placed sufficiently close together in the frequency domain, and that simultaneous transmission on both RATs is prevented by the UE's single power budget. The latter constraint implies that one RAT cannot be received/transmitted while the other RAT is doing the opposite. |   Moreover, the co-channel coexistence of LTE and NR with different SCSes (i.e., assuming simultaneous transmission and reception using different SCSes in the same channel for a SL UE), is not considered even for TDM-based semi-static resource pool partitioning.  Therefore, a UE cannot be assumed to mandatorily support the TDM-based co-channel coexistence. A separate UE capability should be defined to indicate whether the UE supports TDM-based semi-static resource pool partitioning for co-channel coexistence. The proposed UE capability is given below.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-s2 | TDM-based semi-static resource pool partitioning for co-channel coexistence of LTE sidelink and NR sidelink with mix SCSes | 1. UE supports TDM-based semi-static resource pool partitioning for co-channel coexistence between LTE sidelink and NR sidelink with 15 kHz SCS and/or 30kHz SCSs. Candidate value sets: {[15KHz, 30kHz, both]}. 2. Combination A (Mode 2 NR SL with Mode 4 LTE SL) is supported. 3. Device type A (the NR SL module uses the sensing and resource reservation information shared by the LTE SL module) is supported. | None | Yes | No |  | Per band | N/A | N/A |  |  | Optional with capability signalling. |   *Proposal 6:* *A capability of* *TDM-based semi-static resource pool partitioning for* *co-channel coexistence of LTE sidelink and NR sidelink with different SCS(es), e.g., 15kHz SCS for LTE SL and 30kHz SCS for NR SL, is introduced.* |
| [6] | Apple |  |
| [7] | CATT, CICTCI, CBN |  |
| [8] | Nokia |  |
| [9] | OPPO, Huawei, HiSilicon, LG Electronics |  |
| [10] | NTT DOCOMO, INC. |  |
| [11] | Qualcomm Incorporated | The support of in-device coexistence-based NR-LTE prioritization is not necessary for DRPS, only the exchange of priority and time for Tx and Rx is needed. FG 15-6 should be removed from the pre-requisite list of FG 47-s1  Proposal 5: FG 15-6 should be removed from the pre-requisite list of FG 47-s1.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-s1 | Transmission/Reception using dynamic resource pool sharing | 1) Avoidance of NR PSCCH/PSSCH/PSFCH overlapping with EUTRA SL resources in dynamic resource pool sharing using LTE sidelink resource reservation information in NR mode2 resource (re)selection  2) UE supports NR sidelink TXs and RXs in a resource pool in 15kHz and 30kHz SCSs and uses the SCS that is (pre)configured for a SL BWP. | 15-3, ~~15-6,~~ 15-11 | Yes | No | UE does not support transmission/reception using dynamic resource pool sharing | Per band | N/A | N/A |  | Component 2 does not imply that two different SCSs can be (pre)configured simultaneously in a SL BWP | Optional with capability signalling | |

## **Discussion**

### **(H) Proposal 3-1:**

* **Introduce new FG 47-s2 for TDM-based semi-static resource pool partitioning for co-channel coexistence of LTE sidelink and NR sidelink with different SCS(es), e.g., 15kHz SCS for LTE SL and 30kHz SCS for NR SL.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 47. NR\_SL\_enh2 | 47-s2 | TDM-based semi-static resource pool partitioning for co-channel coexistence of LTE sidelink and NR sidelink with mix SCSes | 1. UE supports TDM-based semi-static resource pool partitioning for co-channel coexistence between LTE sidelink and NR sidelink with 15 kHz SCS and/or 30kHz SCSs. Candidate value sets: {[15KHz, 30kHz, both]}. 2. Combination A (Mode 2 NR SL with Mode 4 LTE SL) is supported. 3. Device type A (the NR SL module uses the sensing and resource reservation information shared by the LTE SL module) is supported. | None | Yes | No |  | Per band | N/A | N/A |  |  | Optional with capability signalling. |

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Introduce new FG for TDM-based semi-static resource pool partitioning for co-channel coexistence of LTE sidelink and NR sidelink with different SCS(es), e.g., 15kHz SCS for LTE SL and 30kHz SCS for NR SL: vivo |
| vivo | As discussed in our paper, at least the co-channel coexistence of LTE sidelink and NR sidelink with different SCSes case is not considered nor mandated in Rel-16.  We would like to ensure that this is the common understanding. |
| Huawei, HiSilicon | We assume this is already covered by R16 V2X FG 15-6. 15-6 does not mention SCS, so it can cover 47-s2.  So no need to introduce new FG.  ==   |  |  |  | | --- | --- | --- | | 15-6 | Short-term time-scale TDM for in-device coexistence | 1) Support prioritization between LTE sidelink transmission/reception and NR sidelink transmission/reception | |

### **Proposal 3-2:**

* **Prerequisite FG of FG47-s1 is revised to “15-3~~, 15-6~~, 15-11”**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * Prerequisite   + 15-6 should be removed: Qualcomm |
|  |  |
|  |  |

# **FGs for SL CA operation**

Following inputs are provided in contributions for the RAN1#117 meeting.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| [2] | Huawei, HiSilicon | **FG 47-v2 Synchronization for SL CA**  In the UE features list after RAN1#116bis, FG 47-v2 is as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 47-v1, [15-4] | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling |   The prerequisites for FG 47-v2 should include 47-v1 and 15-4. Remove the brackets and confirm the highlight.  **FG 47-v3 PSFCH for SL CA**  In the UE features list after RAN1#116bis, FG 47-v3 is as follows.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {FFS}  Candidate values for Y are {FFS}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling |   The columns with yellow highlights can be updated as below:   * In the current components, X and Y are the total number of PSFCHs in all of the aggregated carriers, where the UE is capable of receiving/transmitting at least one PSFCH on each of the aggregated carriers. In this case, the candidate values of X and Y can be the same as that of N and M from FG 15-11, which are {5, 15, 25, 32, 35, 45, 50, 64} and {4, 8, 16} respectively, where the selected value of X and Y should be greater than or equal to N and M. This would mean that the UE is capable of transmitting/receiving at least the same number of PSFCHs across multiple carriers as it can on a single carrier, in a given slot, but might be capable of more. We are also open to consider a higher value range of X and Y. If the UE supports SL CA, the values of X and Y signalled in 47-v3 would essentially override the values of N and M in 15-11, since in 15-11, the values of N and M are defined in a single carrier only. Hence it does not seem necessary to capture explicitly that X≥N, Y≥M, but this could also be done if preferred.   **Proposal 1: Support UE feature list in Appendix 1 for R18 NR SL.**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 47-v1, ~~[~~15-4~~]~~ | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {~~FFS~~5, 15, 25, 32, 35, 45, 50, 64}  Candidate values for Y are {~~FFS~~4, 8, 16}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling | |
| [3] | ZTE | **FG 47-v2** **Synchronization for SL CA**  Regarding 47-v2 after RAN1#116-bis, the prerequisite feature groups are still pending. Considering that FG 15-4 is a basic FG for sidelink synchronization, support of the synchronization reference, e.g. gNB, GNSS and SyncRef UE, and the synchronization procedure are essential for synchronization for SL CA, so FG 15-4 should be one of the prerequisites as well.  ***Proposal 7: FG 15-4 should be also one of the prerequisites of FG 47- v2, and the FG should be updated as follows:***   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 47-v1, 15-4 | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling | |
| [4] | Samsung | ***FG 47-v3***  For NR sidelink CA, the following was agreed for 47-v3.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {FFS}  Candidate values for Y are {FFS}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling |   For 47-v3, it is beneficial not to increase the processing burden on a UE for PSFCH transmission/monitoring. Hence, it suggests to reuse the limits from 15-11 per carrier for the case of multiple aggregated carriers. In this case, the candidate values for X are *Xi* \*{5, 15, 25, 32, 35, 45, 50, 64} and the candidate values of Y are *Xi* \*{4, 8, 16}, where *Xi* is the number of supported carriers.  **Proposal 2:** For 47-v3,   * Support the following candidate values for X   + Xi \*{5, 15, 25, 32, 35, 45, 50, 64}, where Xi is the number of supported carriers. * Support the following candidate values for Y   + Xi \*{4, 8, 16}, where Xi is the number of supported carriers. |
| [5] | vivo | Regarding the prerequisites of 47-v2, similar to the FG 47-v3, additional prerequisites beyond 47-v1 are not necessary. Including additional FG as a prerequisite does not provide additional benefits, while actually increasing the risk of introducing forward compatibility issue. Anyway, removing the FG 15-4 from the prerequisite does not prevent the UE from supporting 15-4 for non-CA case.  *Proposal 7:* *Additional prerequisite beyond 47-v1 is not necessary for* *FG 47-v2.*  Regarding 47-v3, one remaining issue is the candidate number of PSFCH transmission and reception, i.e., X and Y. For the single carrier case, a UE can report up to M={4, 8, 16} PSFCH transmissions and up to N={5, 15, 25, 32, 35, 45, 50, 64} PSFCH receptions. In the CA case, up to K={2, 3, 4, 5, 6, 7, 8} carriers can be supported. Thus, the candidate number of X and Y can be X=K\*N, Y=K\*M, where the value K is the number of SL carriers that the UE supports.  *Proposal 8:* *For FG 47-v3, the candidate number of PSFCH receptions X and PSFCH transmission Y can be X=K\*N, Y=K\*M, where the value K is the number of SL carriers that the UE supports.* |
| [6] | Apple | FG 47-v2 is based on the UE capability of S-SSB transmissions and receptions on a single carrier. Hence, the prerequisites of this FG should be FG 47-v1 and FG 15-4.  ***Proposal 10:*** *The prerequisites of FG 47-v2 are FG 47-v1 and FG 15-4.*  In FG 47-v3, UE supports receiving X PSFCH resources in a slot and supports transmitting Y PSFCH resources in a slot. It is open the possible values of X and Y. Considering in FG 15-11, UE supports receiving up to {5, 15, 25, 32, 35, 45, 50, 64} PSFCH resources in a slot and supports transmitting up to {4, 8, 16} PSFCH resources in a slot, it is natural that X is equal to A\*{5, 15, 25, 32, 35, 45, 50, 64} and Y is equal to A\*{4, 8, 16}, where A is the number of sidelink carriers supported by UE.  ***Proposal 11:*** *In FG 47-v3, candidate values for X are A\*{5, 15, 25, 32, 35, 45, 50, 64} and candidate values for Y are A\*{4, 8, 16}.* |
| [7] | CATT, CICTCI, CBN | In SL-CA, there is a remaining issue on determining the candidate values of X and Y for PSFCH reception and transmission in FG47-v3(PSFCH for SL-CA). In RAN1#116bis meeting, some companies think that the legacy RF chain can be reused to support the SL-CA operation for PSFCH transmission and reception. we think this is valid point, therefore we agree that legacy values should be support in UE capability. Additionally, since SL-CA will introduce more PSSCH transmission, and lead to more PSFCH transmission/reception than that in singe carrier operation. Therefore, it is preferred to introduce additional candidate values of X and Y for PSFCH transmission and reception besides the legacy candidate values in FG15-11.   * Candidate values for X are {5, 15, 25, 32, 35, 45, 50, 64, 100, 128} * Candidate values for Y are {4, 8, 16, 32, 64}   ***Proposal 1: Regarding the candidate values of X and Y for PSFCH reception and transmission in FG47-v3(PSFCH for SL CA)***   * ***It is preferred to introduce additional candidate values of X and Y for PSFCH transmission and reception besides the legacy candidate values in FG15-11.***   + ***Candidate values for X are {5, 15, 25, 32, 35, 45, 50, 64, 100, 128}***   + ***Candidate values for Y are {4, 8, 16, 32, 64}*** |
| [8] | Nokia | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. |  | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling | |
| [9] | OPPO, Huawei, HiSilicon, LG Electronics | |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 47-v1, ~~[~~15-4~~]~~ | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling | | 47. NR\_SL\_enh2 | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {5, 15, 25, 32, 35, 45, 50, 64, 128~~FFS~~}  Candidate values for Y are {4, 8, 16, 32~~FFS~~}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling | |
| [10] | NTT DOCOMO, INC. | FG 47-v2  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 47-v1, [15-4] | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling |   For the remaining issue what prerequisite FG(s) should be adopted in FG47-v2, we support FL’s proposal in the 116bis meeting. We agreed that the prerequisite FGs of FG47-v1 were 15-3 and 15-11, which implies Rel-18 NR SL-CA capable UEs should support Rel-16 NR SL basic capabilities. Therefore, it is natural to support basic capability of NR SL synchronization in Rel-16 for supporting Rel-18 NR SL-CA synchronization.  **Proposal 6:**   * **Prerequisite FG of FG47-v2 is kept as it is, i.e., 47-v1, 15-4**  FG 47-v3  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {FFS}  Candidate values for Y are {FFS}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling |   The remaining issue in FG47-v3 is about the candidate values for X and Y.  Theoretically, in our view, these values should highly depend on the legacy value of supported PSFCH RX (N) and TX (M) in a single carrier, the BW of each carrier and total aggregated BW. In the previous meetings, it was agreed that the total supported BW and the number of supported carriers for NR SL-CA were subject to UE capability reporting. Considering that the maximum total aggregated BW is 70Mh and the number of aggregated carriers is 2, which are defined in RAN4, whereas the maximum BW for a single carrier is 40Mhz, the reasonable way to define candidate values at this later stage would be make the values for the single carrier roughly doubled, and a UE can select, and report supported PSFCH numbers up to the doubled value.  **Proposal 7:**   * **Candidate values for X in component 1 of FG47-v3 are {5, 15, 25, 32, 35, 45, 50, 64, 70, 90, 100, 128}** * **Candidate values for Y in component 2 of FG47-v3 are {4, 8, 16, 32}** |
| [11] | Qualcomm Incorporated | NR sidelink Rel. 18 intra-band carrier aggregations is supported in the ITS band. For PSFCH receptions and transmissions, existing candidate values of X and Y respectively are sufficient to support SL CA in the ITS bands. Additionally, the number of simultaneously transmitted PSFCHs is an RF restriction that has no relation to the total data transmission across carriers.  Proposal 6: The UE supports receiving on X PSFCH resources in a slot across all aggregated SL carriers where candidate values of X are {5, 15, 25, 32, 35, 45, 50, 64}.  Proposal 7: The UE supports transmissions on Y PSFCH resources in a slot across all aggregated SL carriers where candidate values of Y are {4,8,16}.   |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 47. NR\_SL\_enh2 | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {5, 15, 25, 32, 35, 45, 50, 64}  Candidate values for Y are {4, 8, 16}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling | |

## **Discussion**

### **(H) Proposal 4-1:**

* **Prerequisite FG of FG47-v2 is “47-v1, 15-4”**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * 47-v2   + Prerequisite     - 47-v1, 15-4: Huawei/HiSilicon, ZTE, Apple, FLs, DOCOMO     - 47-v1: vivo     - None: Nokia |
| CATT, CICTCI | OK |
| vivo | Not sure why 15-4 is really needed. For 47-v3, only 47-v1 is defined as prerequisite. |
| Huawei, HiSilicon | Support.  47-v2 is about sync, so adding 15-4 as pre-requisite is straightforward.  ==   |  |  | | --- | --- | | 15-4 | Synchronization sources for NR sidelink | |

### **(H) Proposal 4-2:**

* **Candidate values for X in component 1 of FG47-v3 are {5, 15, 25, 32, 35, 45, 50, 64}**
* **Candidate values for Y in component 2 of FG47-v3 are {4, 8, 16}**

|  |  |
| --- | --- |
| Company | Comment |
| Moderator | Summary of companies’ views:   * 47-v3   + Candidate values for X     - {5, 15, 25, 32, 35, 45, 50, 64}: Huawei/HiSilicon, Qualcomm     - {5, 15, 25, 32, 35, 45, 50, 64, 100, 128}: CATT/CICTCI/CBN     - {5, 15, 25, 32, 35, 45, 50, 64, 128}: FLs     - {5, 15, 25, 32, 35, 45, 50, 64, 70, 90, 100, 128}: DOCOMO     - Xi \*{5, 15, 25, 32, 35, 45, 50, 64}, where Xi is the number of supported carriers: Samsung, vivo, Apple   + Candidate values for Y     - {4, 8, 16}: Huawei/HiSilicon, Qualcomm     - {4, 8, 16, 32, 64}: CATT/CICTCI/CBN     - {4, 8, 16, 32}: FLs, DOCOMO     - Xi \*{4, 8, 16}, where Xi is the number of supported carriers: Samsung, vivo, Apple |
| CATT, CICTCI | No, we prefer to introduce additional values for PSFCH transmission and reception for SL-CA.  We agree that the legacy values should be support with the consideration of reusing the legacy RF chain capability. However, since SL-CA will introduce more PSSCH transmission, and lead to more PSFCH transmission/reception than that in singe carrier operation. Therefore, it is preferred to introduce additional candidate values of X and Y for PSFCH transmission and reception besides the legacy candidate values in FG15-11 |
| vivo | Essentially does this proposal mean the UE with CA capability can at most only support the same capability as a non-CA UE?  Then what is the benefit to implement the CA? |

# **Conclusions**

To be updated

# **References**

[1] R1-2403703 Updated RAN1 UE features list for Rel-18 NR after RAN1#116bis Moderators (AT&T, NTT DOCOMO, INC.)

[2] R1-2403918 UE features for other Rel-18 work items (Topics A) Huawei, HiSilicon

[3] R1-2404006 Discussion on UE feature topics A ZTE

[4] R1-2404101 UE features for other Rel-18 work items (Topics A) Samsung

[5] R1-2404163 Discussion on Rel-18 UE features topics A (Sidelink, MBS) vivo

[6] R1-2404270 Discussion on UE Feature Topics A Apple

[7] R1-2404382 Remaining issues on UE features for NR sidelink evolution and MBS CATT, CICTCI, CBN

[8] R1-2404484 UE Features for Other Topics A (SLenh, MCenh, MBS, Sub-5MHz) Nokia

[9] R1-2404841 UE features list for Rel-18 NR sidelink evolution WI OPPO, Huawei, HiSilicon, LG Electronics

[10] R1-2405028 Discussion on UE features for other Rel-18 work items (Topics A) NTT DOCOMO, INC.

[11] R1-2405141 UE features for other Rel-18 work items (Topics A) Qualcomm Incorporated

# **Appendix: UE features list for NR sidelink evolution in [1]**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Features | Index | Feature group | Components | Prerequisite feature groups | Need for the gNB to know if the feature is supported | Applicable to the capability signalling exchange between UEs (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 |
| 47. NR\_SL\_enh2 | 47-k1 | SL channel access for dynamic channel access mode | UE supports  1. SL Type 1 channel access and contention window size adjustment  2. SL Type 2A channel access  3. SL Type 2B channel access  4. SL Type 2C channel access  5. 20MHz LBT bandwidth  6. CP extension up to 1 symbol in 15kHz SCS if the UE supports 15 kHz SCS  7. CP extension up to 2 symbols in 30kHz SCS  8. CP extension up to 2 symbols if the UE supports 60kHz SCS | At least one of {15-25, 15-3, [32-4, 32-4a]} | Yes | No | UE does not support channel access for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Component 8 is applicable in regions without OCB requirements.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR SL in shared spectrum and when shared spectrum channel access must be used, UE must indicate this FG is supported |
| 47. NR\_SL\_enh2 | 47- k2 | SL multi-channel access for dynamic channel access mode | 1. UE supports multi-channel access procedures for PSCCH/PSSCH/S-SSB/PSFCH transmission(s) in multiple RB sets in a slot  4) UE supports multi-channel access procedure on N channel(s) with 20MHz LBT bandwidth for each channel. Candidate values of N: {2, 3, 4, 5} | 47-k1 | Yes | No | UE does not support multi-channel access in dynamic channel access mode for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Note: Support of S-SSB/PSFCH transmission(s) in multiple RB-sets in a slot is according to the support of {47-m11, 47-m11a} and {47-m12, 47-m12a} | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47- k2-1 | Transmitting PSFCH/S-SSB on a subset of the intended number of RB sets based on the outcome of channel access on individual RB sets | UE supports Type A and Type B multi-channel access procedures for PSFCH/S-SSB transmissions in multiple RB sets in a slot | 47-k2 | No | No |  |  |  |  |  |  | Optional without capability signaling |
| 47. NR\_SL\_enh2 | 47- k3 | Receiving UE to UE COT sharing information | 1. UE supports monitoring SCI to read COT sharing information  2. UE supports transmitting NR SL based on COT sharing information subject to COT sharing conditions | 47-k1 | No | No | UE does not support using UE-to-UE COT sharing information contained in SCI for sharing COT for NR sidelink operation in shared spectrum. |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR SL in shared spectrum where shared spectrum channel access must be used, UE must support this FG |
| 47. NR\_SL\_enh2 | 47-k4 | Transmitting UE to UE COT sharing information | 1. UE supports using ue-toUE-COT-SharingED-Threshold for Type 1 channel access for UE to UE COT sharing  2. UE supports indicating COT sharing information in SCI | 47-k1 | No | Yes | UE does not support transmitting UE-to-UE COT sharing information for sharing COT for NR sidelink operation in shared spectrum. | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-k5 | Resource allocation for multi-consecutive slots transmission | UE supports resource (re-)selection for PSCCH/PSSCH transmission on multiple consecutive slots | at least one of {15-3, 32-4} | No | No | UE does not support resource (re-)selection for multi-consecutive slots transmission |  |  |  |  |  | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-k6 | Type1 LBT blocking Option 1 | UE supports  1. avoid selection of N consecutive resource(s) before a reserved resource when the L1 SL priority value for the transmission is higher than the L1 SL priority value of the reserved resource. It is up to UE whether to do it  2. avoid selection of M consecutive resource(s) after a reserved resource when the transmitting symbols of the reserved resource overlap with LBT of the selected resource. It is up to UE whether to do it | 47-k1 | Yes | No | UE does not support Type1 LBT blocking Option 1 | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-k7 | Type1 LBT blocking Option 2 | UE supports  1. If transmission in slot(s) at least T\_proc,0 before a reserved resource is able to share its initiated COT to the reservation, UE prioritize / select resource(s) in the slot(s) for transmission. It is up to UE whether to do it | 47-k1 | Yes | No | UE does not support Type1 LBT blocking Option 2 | Per band | n/a | n/a |  | The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-k8 | CW autonomous update for SL transmission without HARQ feedback | UE support autonomous update of the *CWp* to the next higher allowed value when the same *CWp* ≠ *CWmax*,*p* value is consecutively used for X times for generation of *Ninit* for PSCCH/PSSCH transmission without HARQ feedback. | 47-k1 | No | No | UE does not update *CWp* for PSCCH/PSSCH transmission without HARQ feedback. |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-k9 | Sidelink mode 1 resource allocation in shared spectrum | 1. UE can monitor DCI format 3\_0 on a licensed band for NR sidelink dynamic scheduling and configured grant type 2 for transmitting PSCCH/PSSCH on a shared spectrum  2. UE supports reporting NACK to gNB when transmitting PSCCH/PSSCH on scheduled resource(s) is failed due to LBT failure | 47-k1 | Yes | No | UE does not perform PSCCH/PSSCH based on mode 1 resource allocation in a shared spectrum. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-m1 | Interlace RB-based SL transmission/reception | 1. UE supports interlace RB-based SL transmissions for the physical layer channels that it is capable of transmit  2. UE supports interlace RB-based SL receptions for the physical layer channels that it is capable of receive | At least one of {15-25, 15-3, [32-4, 32-4a]} | Yes | No | UE does not support Interlace RB-based PSCCH/PSSCH/PSFCH transmission/reception | Per band | N/A | N/A |  | This is the basic FG for NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling  For UE supports NR sidelink in shared spectrum, where PSD and/or OCB requirements are defined by regulation, UE must indicate this FG is supported. |
| 47. NR\_SL\_enh2 | 47-m3 | Transmitting PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports transmitting PSCCH/PSSCH from 2nd starting symbol in a slot in addition to the first starting symbol | At least one of {15-25, 15-3, [32-4, 32-4a]} | No | No | UE transmits PSCCH/PSSCH only from 1st starting symbol in a slot |  |  |  |  | Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-m4 | Receiving PSCCH/PSSCH from 2nd starting symbol in a slot | 1. UE supports receiving PSCCH/PSSCH transmitted from 2nd starting symbol in a slot in addition to the first starting symbol  2. UE can monitor a total up to X PSCCHs in a slot in the 1st and 2nd starting symbols | [15-1 except Component 5] | No | No | UE receives PSCCH/PSSCH transmitted only from 1st starting symbol in a slot |  |  |  |  | The value X is the same as the reported value in FG 15-1  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum and when shared spectrum channel access must be used, UE must support this FG.] |
| 47. NR\_SL\_enh2 | 47-m5 | Multiple PSFCH occasions per PSCCH/PSSCH | 1. UE supports PSFCH transmission/reception on N PSFCH occasion(s) per PSCCH/PSSCH | 15-11 | Yes | No | UE supports only one PSFCH occasion per PSCCH/PSSCH transmission | Per band | N/A | N/A |  | Candidate values for N are {1,2,3,4}  The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-m6 | Transmitting SSB repetitions within one RB set | 1. UE supports transmitting S-PSS/S-SSS/PSBCH multiple times by repetition in frequency domain within one RB set | 15-4 | No | No | UE does not support transmitting S-PSS/S-SSS/PSBCH multiple times by repetition in frequency domain within one RB set |  |  |  |  | This is the basic FG for NR sidelink in shared spectrum where PSD and/or OCB requirements are defined by regulation.  It is up to UE implementation whether S-SSB RX UE monitors more than one S-SSB repetition in frequency domain within one RB set as long as RAN4 requirements are satisfied  The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling  For UE supports NR sidelink in shared spectrum where PSD and/or OCB requirements are defined by regulation, UE must support this FG. |
| 47. NR\_SL\_enh2 | 47-m8 | Transmitting S-SSB on additional S-SSB occasion(s) | 1. UE supports transmitting S-SSB on additional S-SSB occasion(s) | 15-4 | No | No | UE does not support transmitting S-SSB on additional S-SSB occasion(s) but supports to exclude those occasion(s) from SL resource pool(s) |  |  |  |  |  | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-m9 | Receiving S-SSB on additional S-SSB occasion(s) | 1. UE supports receiving S-SSB on additional S-SSB occasion(s) | 15-4 | No | No | UE does not support receiving S-SSB on additional S-SSB occasion(s) but supports to exclude those occasion(s) from SL resource pool(s) |  |  |  |  |  | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-m10 | Contiguous RB-based PSCCH/PSSCH transmission/reception | 1. UE supports contiguous RB-based PSCCH/PSSCH transmission/reception  2. UE supports resource (re-)selection for contiguous RB-based PSCCH/PSSCH transmission | At least one of {15-25, 15-3, 32-4, 32-4a} | Yes | No | UE does not support contiguous RB-based PSCCH/PSSCH transmission/reception | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Note1: If UE supports 15-25, the UE is not required to support Component 3 and 4 in 15-2.  Note2: If UE supports 15-3, the UE is not required to support Component 3 in 15-3, and FR2 parts of Component 7 in 15-3.  Note: It is up to RAN2 whether/how to implement the above Notes 1/2 and whether/how to update the prerequisite FGs | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-m11 | PSFCH transmissions in multiple contiguous RB sets | UE supports PSFCH transmissions in multiple contiguous RB sets | at least one of {47-k2, 47-k2-1} | Yes | Yes | UE does not support PSFCH transmissions in multiple contiguous RB sets | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-m11a | PSFCH transmissions in multiple non-contiguous RB sets | UE supports PSFCH transmissions in multiple non-contiguous RB sets | 47-m11 | Yes | Yes | UE does not support PSFCH transmissions in multiple non-contiguous RB sets | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used. | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-m12 | S-SSB transmissions in multiple contiguous RB sets | UE supports S-SSB transmissions in multiple contiguous RB sets | at least one of {47-k2, 47-k2-1} | No | No | UE does not support S-SSB transmissions in multiple contiguous RB sets |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-m12a | S-SSB transmissions in multiple non-contiguous RB sets | UE supports S-SSB transmissions in multiple non-contiguous RB sets | 47-m12 | No | No | UE does not support S-SSB transmissions in multiple non-contiguous RB sets |  |  |  |  | The FG is only expected for a band where shared spectrum channel access must be used. | Optional without capability signalling |
| 47. NR\_SL\_enh2 | 47-m13 | Transmissions/receptions of multiple dedicated PRBs in interlace-based PSFCH | 1. UE can transmit PSFCH(s) on up to a total of K dedicated PRBs in a slot.  2. UE can receive PSFCH(s) on up to a total of L dedicated PRBs in a slot | TBD | No | No | UE does not support multiple transmissions/receptions of common interlace-based PSFCH. | Per band | N/A | N/A |  | The signaling is only expected for a band where shared spectrum channel access must be used.  Candidate values for K are FFS  Candidate values for L are FFS | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-s1 | Transmission/Reception using dynamic resource pool sharing | 1) Avoidance of NR PSCCH/PSSCH/PSFCH overlapping with EUTRA SL resources in dynamic resource pool sharing using LTE sidelink resource reservation information in NR mode2 resource (re)selection  2) UE supports NR sidelink TXs and RXs in a resource pool in 15kHz and 30kHz SCSs and uses the SCS that is (pre)configured for a SL BWP. | 15-3, 15-6, 15-11 | Yes | No | UE does not support transmission/reception using dynamic resource pool sharing | Per band | N/A | N/A |  | Component 2 does not imply that two different SCSs can be (pre)configured simultaneously in a SL BWP | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-v1 | NR SL communication with SL CA | 1) UE supports transmitting/receiving PSCCH/PSSCH/PSFCH simultaneously over multiple X SL carriers:   * 1-1) Maximum number of simultaneous PSCCH/PSSCH TX, equal to X and 1 per carrier * 1-2) For the number of PSCCH decodes:   + UE can receive Z\* floor (NRB,*i* /10 RBs) PSCCH in a slot on carrier *i* of the X carriers. * 1-3) For the number of non-overlapped PRBs over aggregated SL carriers:   + UE can attempt to decode NRB,i non-overlapping RBs in a slot on carrier i of the X carriers. * 1-4) UE can aggregate up to total bandwidth Y MHz.   2) UE can adjust the transmission power of the PSCCH/PSSCH/PSFCH across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 15-3, 15-11 | Yes | Yes |  | Per band | N/A | N/A |  | Component 1: Candidate value of X = {2, 3, 4, 5, 6, 7, 8}  Component 1-2 candidate value set: Z={1, 2}  NRB,*i* is the number of RBs defined per channel bandwidth of carrier *i* by RAN4 in 38.101-1 Table 5.3.2-1 for FR1  Component 1-4 candidate value set: Y={20, 30, 40, 50, 60, 70}  Note: this feature is supported only in a band indicated with the PC5 interface in 38.101-1 Table 5.2E.1A-1 for FR1 | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-v2 | Synchronization for SL CA | 1-1) UE supports transmitting S-SSB on one selected or all candidate synchronization carriers with the same sync reference from Set-B  1-2) UE supports receiving S-SSB from all candidate synchronization carriers with the same sync reference from Set-B  2) UE can adjust the transmission power of the S-SSB across aggregated carriers such that its total transmission power does not exceed the maximum transmission power. | 47-v1, [15-4] | Yes | No |  | Per band | N/A | N/A |  | Note: Option of UE selection of one selected SL synchronization carrier with the same sync reference from Set-B is not based on limited Tx capability  Note: Component 1-2 does not require simultaneous reception of S-SSB on all candidate synchronization carriers with the same sync reference from Set-B | Optional with capability signalling |
| 47. NR\_SL\_enh2 | 47-v3 | PSFCH for SL CA | 1) UE supports receiving X PSFCH resources in a slot over all aggregated SL carriers   * 1-1) UE is capable of receiving at least one PSFCH resource on each of the aggregated carriers in a slot   2) UE supports transmitting Y PSFCH resources in a slot over all aggregated SL carriers according to PSFCH procedures   * 2-1) UE is capable of transmitting at least one PSFCH resource on each of the aggregated carriers | 47-v1 | Yes | No |  | Per band | N/A | N/A |  | Candidate values for X are {FFS}  Candidate values for Y are {FFS}  Note: for component 1-1, it is up to UE implementation which PSFCH(s) to receive | Optional with capability signalling |