**[101-e--NR-5G\_V2X\_NRSL-SYNC-02]**

**Email discussion regarding**

* **Issue 8: Start symbol of S-SSB**
* **Issue 17: In-device coexistence between LTE-V2X and NR-V2X**
* **Issue 5: Sidelink timing definition**

**Till 5/28. If consensus can be reached, any follow-up TP by 6/3 – Teng (CATT)**

**Issue 8 Start symbol of S-SSB**

From the email responses 5/25-5/26, **all of the responded companies agree with the FL proposal**. There is one wording suggestion that “mapped” can be replaced by “aligned” which is more accurate. According to my checking and understanding, the intention and meaning of this proposal is that the first symbol of S-SSB is located in the first symbol in the slot. Regarding to the spec wording, we can also find “mapped” in the previous sentence. Since “mapped” can be clearly understood by us, I would like to suggest keep it.

Based on the responses in the first round, I would like to suggest having a consensus on the FL proposal, and the corresponding draft TP is also added below. Your further check and comments are welcome.

***Potential consensus:***

* ***The first OFDM symbol in an S-SS/PSBCH block is mapped to the first OFDM symbol in the slot***

----------------------------------------------------Start of draft TP for 38.211----------------------------------------------------

8.4.3.1 Time-frequency structure of an S-SS/PSBCH block

In the time domain, an S-SS/PSBCH block consists of OFDM symbols, numbered in increasing order from 0 to within the S-SS/PSBCH block, where S-PSS, S-SSS, and PSBCH with associated DM-RS are mapped to symbols as given by Table 8.4.3.1-1. The number of OFDM symbols in an S-SS/PSBCH block for normal cyclic prefix and for extended cyclic prefix. The first OFDM symbol in an S-SS/PSBCH block is mapped to the first OFDM symbol in the slot.

--------------------------------------------------< Unchanged parts are omitted >-------------------------------------------------

-----------------------------------------------------End of draft TP for 38.211-----------------------------------------------------

**Comments 5/27-5/28**

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| **Company** | **Views** |
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**Email responses 5/25-5/26**

*FL Proposal: The first OFDM symbol in an S-SS/PSBCH block is mapped to the first OFDM symbol in the slot.*

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| **Company** | **Views** |
| Huawei, HiSilicon | Ok with it. |
| Intel | Agree. Clarification is needed. |
| MediaTek | Fine with it. |
| OPPO | Agree |
| Nokia, Nokia Shanghai Bell | Agree |
| vivo | Agree. |
| ITRI | We are fine with the proposal. |
| ZTE/Sanechips | Agreed |
| LGE | Supported. |
| Ericsson | We agree with the proposal. |
| CATT | Agree with the proposal. |
| Samsung | OK with the proposal. The wording “mapped” may not be accurate, since usually it is specified as a signal/channel is mapped to a set of resources. “Aligned” may be more accurate here.  FL: Thank you for your suggestion. I also think an accurate word should be used when describe the symbol resource location. But I am not very sure “aligned” is accurate or not. When I prepared the TP, I found the previous sentence used “mapped”. Even they are used in different procedure, but I think “mapped” can be understood by companies. |
| Qualcomm | Agree with the proposal |
| FUTUREWEI | Agree |

**Issue 17 In-device coexistence LTE-V2X and NR-V2X**

From the email responses 5/25-5/26, majority companies have concerns on the proposal or disagree with it.

From the **proponent**’s perspective, it is not an UE implementation issue. There are two aspects under this issue.

* First, some agreements in AI in-device coexistence are missing in current spec, and these agreements are related to work of SL synchronization. Furthermore, some RAN2’s work should also be triggered and LS is needed.
* Second, when single module (NR) UE and dual-module (NR-LTE) UE are coexisting in NR SL carrier, it will have severe interference because of independent sync operations. Besides, there is also boundary misalignment if NR SL DFN is not derived from LTE SL DFN, which leads to failure configuration on resource pool.

From the **majority views** that disagree with the proposal, it can be summarized below:

* At this stage, only subframe alignment related agreements are waiting for being captured into the spec.
* How to ensure the alignment is up to UE implementation.
* For DFN alignment, it can be depending on configuration but not mandatory.
* S-SSB synchronization is mandatory for NR SL UE, while it is an optional feature in LTE. NR sync is more robust in the overall system.

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| **Alternatives** | **In-device coexistence FL proposal** | **Supportive companies** |
| Alt 1 | Agree | [LGE] |
| Alt 2 | Disagree | [Huawei, HiSilicon] [Intel] [MediaTek] [OPPO] [Nokia, NSB] [vivo] [ITRI] [ZTE, Sanechips] [Ericsson] [CATT] [Samsung] [Qualcomm] [Futurewei] |

By summarizing the first round discussion, I would like to have the following proposal which is to encourage capturing the missing agreements in the spec, related to time alignment/boundary alignment. Regarding the in-device coexistence proposal, I think it is a proper way as leaving it by UE implementation.

***FL proposal:***

* ***The missing parts of the following agreements are captured in the specification.***

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| **Agreements:**   * For TDM solutions for in-device coexistence between LTE and NR V2X:   + Time Alignment     - Subframe boundary alignment is required between LTE and NR V2X sidelinks     - Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers   **Agreements:**   * For intra-band and inter-band FDM dynamic power sharing solutions, the following additional conditions apply:   + Subframe boundary alignment is required between LTE and NR V2X sidelinks   + Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers |

**Comments 5/27-5/28**

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| **Company** | **Views** |
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**Email responses 2/25-5/26**

*FL Proposal: When a UE is configured to operate the in-device coexistence between LTE-V2X and NR-V2X, the SL transmission timing and DFN of NR-V2X are derived from those of LTE-V2X*

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| **Company** | **Views** |
| Huawei, HiSilicon | Disagree.  As discussed during the preparing stage, we think the only issue left is to capture the subframe alignment between LTE-V and NR-V sidelinks. The related agreements as following:   * Agreements on TDM solutions   + For TDM solutions for in-device coexistence between LTE and NR V2X:     - Time Alignment       * Subframe boundary alignment is required between LTE and NR V2X sidelinks       * Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers * Agreements on FDM solutions   + For intra-band and inter-band FDM dynamic power sharing solutions, the following additional conditions apply:     - Subframe boundary alignment is required between LTE and NR V2X sidelinks     - Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers   If a UE cannot detect the NR-V S-SSB in coexistence scenarios, then the UE can derive its sidelink timing by implementation according to the timing in LTE-V module inside or by its local timing. |
| Intel | Disagree. We only need subframe aligned timing. Regarding DFN, we think it should be supported by configuration but not mandated |
| MediaTek | No need of the proposal. Maybe the early agreement on the subframe alignment is enough. How to secure the alignment is up to UE implementation. |
| OPPO | Disagree  According to the agreement copied above, the subframe boundary of NR SL and LTE SL should be aligned. how to promise that is up to UE implementation since both modules are within a UE. No specification is needed. |
| Nokia, Nokia Shanghai Bell | Disagree.  According to the WID, FDM-based in-device coexistence solutions with static power allocation should be supported when LTE SL and NR SL are in the different frequency bands. According to the NR V2X TR 38.885 when inter-band FDM-based in-device coexistence with static power assignment of Pc,max for each carrier is configured, synchronization between the SLs is not assumed. Therefore, statements that imply that synchronization is always required for in-device coexistence cannot be agreed.  Regarding the intra-band case when synchronization is needed, we think that it would be better if NR V2X is synchronized to SSBs from other NR V2X UEs. There will likely be UEs that are not operating in the in-device coexistence mode and those NR V2X UEs will anyway use SSBs from other NR V2X UEs. |
| vivo | Disagree.  The agreement made in-device coexistent just specifies that the subframe level boundary between LTE and NR are aligned, but it does not impose any restriction on the DFN mis-alignment. |
| ITRI | Disagree.  The coexistence between LTE-V2X and NR-V2X will cause the time alignment issue. |
| ZTE/Sanechips | We disagree. If the UE derives SL Tx timing and DFN of NR V2X from LTE V2X, other NR V2X UEs nearby may be unable to communicate with this UE. Because LTE V2X can not provide valid TDD-UL-DL config information and SLSSID for S-SSB. The other UEs could not derive the valid timing information from this UE.  In our view, NR V2X module should determine SL Tx timing and DFN of NR V2X based on NR V2X sync procedure. If NR V2X and LTE V2X are misaligned in subframe boundary, the coordination for in-device coexistence is not applicable. |
| LGE | FL proposal needs to be divided into the following two proposals.  ***Proposal 1:***  *The following agreements are captured in the specification.*  *Agreements:*   * *NR V2X sidelink operation includes the following cases:*   + *NR V2X sidelink is synchronized with LTE V2X sidelink*   *Agreements****:***   * *For TDM solutions for in-device coexistence between LTE and NR V2X:*   + *Time Alignment*     - *Subframe boundary alignment is required between LTE and NR V2X sidelinks*     - *Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers*   *Agreements****:***   * *For intra-band and inter-band FDM dynamic power sharing solutions, the following additional conditions apply:*   + *Subframe boundary alignment is required between LTE and NR V2X sidelinks*   + *Both LTE and NR V2X sidelinks are aware of the time resource index (e.g., DFN for LTE) in both carriers*   We need to discuss how and where to capture the above agreements, which are missing in the current specification.  For the first agreement, we need a conclusion that triggers RAN2 work to capture it in RAN2 spec. An LS may be sent to RAN2 for further specification work, if necessary.  For the second and the third agreement, our preference is to capture them in RAN1 specification as UE should align subframe boundary between LTE SL and NR SL for in-device coexistence operation.  ***Proposal 2:***  *When a UE is configured to operate the in-device coexistence between LTE-V2X and NR-V2X, the SL transmission timing and DFN of NR-V2X are derived from those of LTE-V2X*  The FL proposal is only related to the case when the in-device coexistence is used. It does not mean that in-device coexistence is always required.  In the in-device coexistence scenario, if NR-V2X-only UE coexists with in-device coexistence (COEX) UE in NR SL carrier, there will be severe interference between NR-V2X-only UE and COEX UE because of their independent sync operations. Therefore, in the in-device coexistence scenario, it’s assumed that every UE is COEX UE.  When the in-device coexistence mode is used, if we only capture the subframe boundary alignment and no rule for DFN value derivation, there will be ambiguity in NR SL DFN among UEs. For example, if NR SL DFN is not derived from LTE SL DFN, there will be a problem in interpreting the resource pool configuration, which makes SL communication impossible. In this sense, it cannot be UE implementation issue. Considering agreement that NR V2X is synchronized to LTE V2X, it’s reasonable to derive NR SL DFN from LTE SL DFN.  In the in-device coexistence scenario, regardless of NR S-SSB detection, NR V2X should be synchronized to LTE V2X in any case. |
| Ericsson | Disagree. We do not think this agreement is needed. It is up to the operator to ensure synchronization. |
| CATT | Disagree.  How to align the subframe boundary between LTE and NR V2X is up to UE implementation. Because the two modules are both inside a UE, the timing from LTE and NR should be clearly known by the UE. |
| Samsung | Disagree.  According to the agreements made in RAN1 #94bis, NR-V2X synchronization procedure can operate independently from LTE-V2X, and doesn’t need to be associated with LTE-V2X. It’s true from the first bullet that synchronization between LTE-V2X and NR-V2X should be guaranteed, however, it doesn’t mean an association between LTE-V2X and NR-V2X has to be introduced. Moreover, since NR-V2X and LTE-V2X operates independently, it is highly possible that NR-V2X and LTE-V2X are synchronized to different synchronization sources with different reliability. Then, following the timing of LTE-V2X may degrade the synchronization performance of NR-V2X. Lastly, LTE UE is not supported as synchronization source for NR-V2X, hence, NR-V2X may not need to follow the timing of LTE-V2X. In summary, the issue should be left to UE implementation, and no specification impact is expected.  Agreements **(RAN1#94bis)**  NR V2X sidelink operation includes the following cases:   * NR V2X sidelink is synchronized with LTE V2X sidelink * NR V2X sidelink synchronization procedure operates independently to the LTE V2X sidelink synchronization procedure |
| Qualcomm | Our concern with the proposal is it could lead to performance degradation when a UE supports in-device coexistence. In NR, it’s agreed that SSB synchronization is mandatory (basic FG) for an NR sidelink UE, whereas it is an optional feature in LTE. Therefore, NR synchronization is more robust from an overall system point of view. |
| FUTUREWEI | We do not think that the proposal is necessary |

**Issue 5 Sidelink timing definition**

From the email responses 5/25-5/26, 3 companies explained why and how to support UL/DL timing in NR SL, while 10 companies do not support the proposal by explaining their concerns.

Opponent views/concerns can be summarized as follows:

* DL timing is used, whereas NR V2X should follow LTE V2X on the SL timing. RAN4’s agreement captured in TS 38.133 indicates that DL timing is used as SL timing reference.
* It is not work for Mode 2 UE, because there is no Uu (UL) timing.
* For mode 1, it is not always work. Tx UE (RRC connected) uses UL timing, Rx UE (not RRC connected) does not have UL timing.
* UE does not know whether the carrier is dedicated or not. GNSS will be preferred when SL works on dedicated carrier.

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| **Alternatives** | **Support DL/UL Timing on SL** | **Supportive companies** |
| Alt 1 | Support | [Huawei, HiSilicon] [OPPO] [Futurewei] |
| Alt 2 | NOT support/with concerns | [Intel] [MediaTek] [ZTE, Sanechips] [Ericsson] [CATT] [Samsung] [Qualcomm] [Nokia, NSB] [vivo] [ITRI] |

According to the summary of the discussion, there are many technical concerns on how UL timing can be used for mode 2 UEs, and GNSS is always preferred when SL Tx is on dedicated carrier. Therefore, I propose to discuss the two alternatives on this issue.

***FL proposal:***

* ***Alt 1: For sidelink transmission, the timing determination mechanism in LTE V2X is reused in NR V2X.***
* ***Alt 2: If the eNB/gNB synchronization source is applied***
* ***For PC5 only band, downlink timing is used.***
* ***For shared band, uplink timing is used for mode 1 and downlink timing is used for mode 2.***

***Send an LS to RAN4 to inform the above information.***

**Comments 5/27-5/28**

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| **Company** | **Views** |
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**Email responses 2/25-5/26**

*FL Proposal: For sidelink transmissions, uplink timing is used on shared carrier, and downlink timing is used on dedicated carrier.*

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| **Company** | **Views** |
| Huawei, HiSilicon | Agree.  To handle SL-UL interference in shared carriers in NR-V, we have to use UL timing alignment.  For dedicated carriers, DL timing is used to avoid the need for UE to perform PRACH to acquire TAC from gNB, and hence allow UE to operate SL in idle/inactive modes. |
| Intel | Disagree. Mode-2 UE may not have uplink timing. |
| MediaTek | We can just reuse the definition for LTE SL time relations in section 9.10 of TS36.211. |
| OPPO | Agree in principle.  Further clarification is needed for shard carrier: the uplink timing without TA is applied, follows the same mechanism as LTE-V2X. |
| Nokia, Nokia Shanghai Bell | Ok to use UL timing at least for mode 1 in shared carrier |
| vivo | Not sure if this proposal is applicable to both mode-1 and mode-2, or is just used for mode-1?  For mode-2, there may be no Uu timing. |
| ITRI | We agree the uplink timing is used on shared carrier. But, downlink timing is used on dedicated carrier need to be FFS. |
| ZTE/Sanechips | We disagree. We support reusing timing mechanism in LTE V2X. |
| LGE | Not supported.  RAN4 already made a relevant agreement and captured in TS 38.133 that DL timing is used as a SL timing reference. This is also in-line with LTE-V2X operation, and we see no issue with NR-V2X.  We can also reuse LTE-V2X rule regarding N\_TA,offset. In LTE-V2X, N\_TA,offset for SL is same as that for Uu link for in-coverage UE, while N\_TA,offset is zero for out-of-coverage UE.  So we suggest the following modification on the FL proposal.  ***FL Proposal:***  *For sidelink transmissions, downlink timing is used as a reference timing. N\_TA,offset for SL is same as that for Uu link for in-coverage UE, while N\_TA,offset is zero for out-of-coverage UE.* |
| Ericsson | Disagree. We are not sure how the UE would know that the carrier is dedicated. In any case, if the carrier is dedicated to SL we think that using GNSS would be more appropriate. |
| CATT | Disagree.  V2X UE would not know UL timing of Uu for any other V2X UE since UL timing is the DL timing plus TA. In particular, the TA value for each UE in the UL timing is different based on the propagation delay related to the gNB. V2X UE could only use DL timing if UE connects to gNB regardless shared or dedicated carrier. If the gNB is not available as the sync source, the reference timing of other sync source, such as GNSS, should be used. |
| Samsung | Disagree. Regardless of carrier type, DL timing should be used. |
| Qualcomm | We disagree with the proposal  A UE in RRC\_IDLE state would not have UL timing and as mentioned by others, this wouldn’t work for a Mode 2 UE. This also wouldn’t work for Mode 1: while Tx UEs are RRC connected and have UL timing, the Rx UEs are not required to be RRC connected and will not have UL timing.  We assume the proposal is for the case when gNB/eNB is used as a the high priority sync source. Otherwise, it is also not clear why DL timing would be forced in a dedicated carrier instead of GNSS. Configuration supports and selects between both. |
| FUTUREWEI | Agree that on a shared carrier, uplink timing is used. For the dedicated carrier, either timing can be used, and we have no strong view either way |
| Huawei, HiSilicon | The intention of the original proposal is not to define or limit the synchronization source. The synchronization source depends on the configuration. The key point is: in the licensed band, RAN4 required the sidelink and Uu link synchronized. Then uplink timing will be required.  According to our understanding, the DL timing in 38.133 is only applied to SL only bands.  It’s true for mode 2, UE may not obtain the uplink timing in idle states. But downlink or GNSS timing is used, it may not satisfy RAN4 requirement. Hence considering above different scenarios we propose the following. And an LS is needed to RAN4 to inform RAN1 understanding.  ***Proposal: If the eNB/gNB synchronization source is applied***   * ***For PC5 only band, downlink timing is used*** * ***For shared band, uplink timing is used for mode 1 and downlink timing is used for mode 2***   ***Send an LS to RAN4 to inform the above information.*** |