**3GPP TSG-RAN WG4 Meeting # 109 R4-2318185**

**Chicago, USA, November 13 – November 17, 2023**

**Agenda item:** 8.30.6

**Source:** Moderator (LG Electronics)

**Title:** Topic summary for [109][229] NR\_SL\_enh2\_part1

**Document for:** Information

# Introduction

*This topic summary is for Rel-18 NR sidelink Evolution in Agenda 8.30.3.2. The scope of the summary is sidelink unlicensed operations.*

*The recommendation of issues for online discussion:*

* **Issue 1-1-1**: When exceeding the maximum unavailable S-SSB periods (allowed LBT failures) during the evaluation
* **Issue 1-2-1**: Condition for sync detection requirements
* **Issue 1-3-1**: Definition for SL-RSSI measurement
* **Issue 1-3-2**: Requirement for SL-RSSI measurement
* **Issue 1-4-1**: Side condition for sync detection
* **Issue 1-2-4**: Requirements for fast sync SyncRef UE detection

# Topic #1: SL unlicensed operation (SL-U)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318832 | LG Electronics Inc. | **-** Proposal 1: Do not define UE behavior when L1 exceeds L1,max during Tevaluate,SLSS.  - Proposal 2: Revise the condition to meet sync detection requirements for selection/reselection sync reference source in SL-U   * All S-SSB priods selected for selection/reselection to SyncRefUE are available during the Tdetect,SyncRef UE\_V2X seconds.   - Proposal 3: Need further study on clear conditions for fast sync SyncRef UE detection requirements  - Proposal 4: Consider combining N repeated S-SSB for anchor RB set when sync detection requirements are defined,   * e.g., the side condition for selection/reselection of synchronization referece source could be Es/Iot ≥ -10\*log10(N)+α (α = 0.5dB)based on single S-SSB within anchor RB set (α = 0.5dB) |
| R4-2318872 | Xiaomi | Proposal 1: RAN4 to introduce x\_max= 4 for requirements of SyncRef UE as synchronization reference source.  Proposal 2: RAN4 to clarify in clause 12.3.1.4 that UE is expected to reselect to a different SyncRefUE as per TS38.331 when the number of LBT failures exceeds the maximum allowed LBT failures during the evaluation period.  Proposal 3: RAN4 to introduce y\_max= 2 for requirement of Tmeasure,PSBCH-RSRP.  Proposal 4: When y exceeding y\_max for measuring the PSBCH-RSRP of the current selected SyncRef UE, UE is expected to conduct SyncRef UE re-selection as per TS38.331 |
| R4-2318937 | Qualcomm, Inc. | Observation 1: From the highlighted part in above quoted RAN1 CR, UE power control is based on 11RB (the same as legacy approach). Therefore, UE power control mechanism will ensure that monitoring legacy 11RB S-SSB is sufficient to achieve performance in legacy case.  Observation 2: When the same coverage requirement as NR-U is considered, in average with less than 2 SyncRefUEs are enough to cover the same area even when the S-SSB power from SyncRef UE is half of SSB power from gNB in NR-U. Typical SL-U operation scenario has many more than 2 SyncRefUEs in an area typically covered by a NR-U gNB.  Proposal 1: The side condition of SNR >= 0dB for SyncRef UE search and measurement is based on legacy 11RB S-SSBs.  Observation 3: PSBCH-RSRP relative accuracy requirement may limit UE’s ability to measure multiple repetitions of S-SSB on frequency domain when it applies to comparison of two sources with different number of S-SSB repetitions.  Proposal 2: To accommodate UEs capable of measuring multiple S-SSB repetitions on frequency domain, the PSBCH-RSRP relative accuracy requirement is applicable only when the two sources have the same number of S-SSB repetitions on frequency domain configured.  Observation 4: The congestion control mechanism from R16 can mitigate the congestion when the observations of congestion (channel occupancy rate by RSSI measurements) and the reaction to the congestion (channel access ratio adjustment) are with the same RAT. However, in R18 SL-U scenarios, the observation of congestion is based on multiple RATs (including other unlicensed technologies), while the access control is applicable only to one RAT (SL-U) and limit the channel access of SL-U while leaving other RATs channel access behavior the same.  Proposal 3: RSSI accuracy requirement for congestion control is not applicable to SL-U.  Observation 5: The current SyncRefUE is either the only sync source available, or with the strongest RSRP or highest priority before the evaluation period started.  Observation 6: If RAN4 goes for this option “Option 3: UE keeps current SLSS transmission status,” RAN4 has to additionally discuss the clarification of UE behavior when there is no other valid SyncRef UE since keeping the current transmission status is problematic.  Proposal 4: To keep consistent UE behavior across different cases and to keep the cluster connected and synchronized, we propose to clarify the UE behavior after maximum LBT failures are reached as “initiate SLSS transmissions”.  Observation 7:  • Common SL scenarios are indoor application scenarios without GNSS access in which UEs in the same area form a sync cluster, and the search for async SyncRef UE is performed.  • Since UE doesn’t travel across different sync clusters very often in SL-U scenarios, the newly detectable SyncRef UEs are most likely synchronous SyncRef UEs, while the legacy spec requires UE to perform only the asynchronous SyncRef UE search, which has a long detection time up to 8s+x\*8s.  • To keep sync cluster synchronized in SL-U application scenarios, more UEs have to transmit SLSS when the current SyncRef UEs provides timing to other UEs by transmitting SLSS experiencing frequent LBT failures.  Proposal 5: When gNB is the highest priority sync source, or when GNSS is the highest priority sync source and the source SyncRef UE is not synchronized directly or indirectly to GNSS, in addition to allowing 6% data Tx dropping, allowing 30% SLSS Tx dropping and the requirement for sync SyncRef UE detection applies.  Proposal 6: The additional dropping rate and requirements in proposal 6 can be conditionally applied when one or all the following conditions are met:  No detected SyncRef UE is available, or  The RSRP of the current SyncRef UE as sync source is lower than a threshold of z, or maximum LBT is reached during the evaluation for initialization/cease of SLSS transmission.  z can follow the SLSS evaluation threshold, or a separately configured threshold. |
| R4-2319495 | OPPO | Proposal 1: Consider the following TP1  - UE is synchronized to a SyncRef UE that is synchronized to GNSS directly or in-directly,  - UE shall not drop any sidelink data transmission for the purpose of selection/reselection to the SyncRef UE. The UE shall be able to identify newly detectable intra-frequency SyncRef UE within Tdetect,SyncRef UE\_V2X seconds if the SyncRef UE meets the selection / reselection criterion defined in TS 38.331[2] and all the SSB periods are determined as available by the UE during Tdetect,SyncRef UE\_V2X seconds. Tdetect,SyncRef UE\_V2X is defined as 1.6 seconds at S-SSB Ês/Iot ≥ 0 dB, provided that the UE is allowed to drop a maximum of 30% of its SLSS transmissions during Tdetect,SyncRef UE\_V2X for the purpose of selection / reselection to the SyncRef UE.  Proposal 2: When y exceeding y\_max for measuring the PSBCH-RSRP of the current selected SyncRef UE, the current SyncRef UE is considered invalid and the UE is expected to perform reselection per RAN2 conclusion.  Proposal 3: Not consider new condition to initiate SLSS transmission, and remove the FFS part as shown in TP2.  Table 12.3A.1.4-1: Tevaluate,SLSS when SyncRef UE is transmitting S-SSB on a carrier subject to CCA and is used as synchronization reference source   |  |  | | --- | --- | | SL-DRX cycleNote 1 [ms] | Tevaluate,SLSS [ms] | | No SL-DRX | (4 + L1) x S-SSB periods | | SL-DRX cycle ≤ 160ms | (4 + L1) x S-SSB periods | | SL-DRX cycle > 160ms | (4 + L1) x SL-DRX cycle | | Note 1: If multiple SL-DRX cycles are configured for SL UE, the SL-DRX cycle in the requirement is the shortest of all the configured SL-DRX cycles. When the shortest SL-DRX cycle UE used changes, the requirements do not apply to the time of transition.  Note 2: L1 is the number of unavailable S-SSB period during Tevaluate,SLSS\_CCA due to the CCA failures; where L1 ≤ L1, max and L1, max=[4]. | |   Proposal 4: Update the SL RSSI definition by using the OFDM symbols start from the next symbols of the 2nd candidate starting symbols. |
| R4-2319632 | MediaTek Inc. | Proposal 1: Based on RAN2 reply, RAN4 does not need to discuss UE behavior when exceeding the maximum allowed LBT failure during evaluation to initiate/cease SLSS transmission and there is no impact on RAN4 spec.  Proposal 2: UE behavior when the selected SyncRef UE is invalid is already defined in 38.331. There is no need to discuss UE behavior when there are too many LBT failures at selected SyncRef UE in RAN4.  Proposal 3: Reuse legacy side condition for the requirements even with repeated S-SSB in frequency domine. |
| R4-2319969 | Huawei, HiSilicon | Proposal 1: For PSBCH-RSRP measurements under SL-U operation, there is no need to specify additional UE behaviour when y exceeding y\_max.  Proposal 2: For SL synchronization reference source selection/reselection under SL-U operation, it is suggested not to introduce faster synchronous SyncRef UE detection. |
| R4-2320115 | Nokia, Nokia Shanghai Bell | Observation 1: Based on the LS reply from RAN2 to RAN4, such UE behavior is clear that UE is expected to reselect to a new synchronization reference source when y > y\_max.  Proposal 1: RAN4 need not to discuss/define additional UE procedure.  [Observation 2: If legacy definition of SL RSSI is used for SL-U configured with 2 candidate starting symbols, in case SL-U UEs often start their transmission on the 2nd candidate occasion, the measured SL RSSI may turn out to be very low, even though the SL channel is busy by the SL-U UEs. Such measurement would affect the CBR determined by the UEs.](#_Toc149898693)  [Observation 3: If legacy SL RSSI definition is used, an SL-U transmission starting from the 2nd starting symbol would infringe the RAN4 specification in TS 38.133 clause 10.4.3.1 that all symbols during each RSSI measurement duration are available for RSSI sampling.](#_Toc149898694)  [Proposal 2: RAN4 to send LS to RAN1 to update SL RSSI definition in TS 38.215, so that the received power is observed from the OFDM symbol after the 2nd candidate starting symbol, to avoid impacts on RSSI measurement accuracy.](#_Toc149898695) |
| R4-2320123 | Ericsson | Proposal #1: No need to define additional UE behaviour when y exceeding y\_max for measuring the PSBCH-RSRP of the current selected SyncRef UE.  Proposal #2: RAN4 to consider relaxed dropping rate of SLSS transmissions to allow faster SyncRef UE detection.  Proposal #3: RAN4 to evaluate the sidelink RSRP measurement performance using the new S-SSB design. |

## Open issues summary

### Sub-topic 1-1: Initiation/Cease of SLSS Transmission

*This sub-topic is for initiation/cease of SLSS transmission requirements*

*Open issues and candidate options before meeting:*

**Issue 1-1-1: When exceeding the maximum unavailable S-SSB periods (allowed LBT failures) during the evaluation**

* Proposals
  + Option 1 (LGE, OPPO, MediaTek): Do not define UE behavior when L1 exceeds L1,max during Tevaluate,SLSS.
    - Remove FFS part in the draft Big CR
  + Option 2 (Xiaomi, Ericsson): RAN4 to clarify in clause 12.3.1.4 that UE is expected to reselect to a different SyncRefUE as per TS38.331 when the number of LBT failures exceeds the maximum allowed LBT failures during the evaluation period.
    - Option 2-1 (Ericsson): Add “The UE shall initiate the procedure for selection/reselection of synchronization reference source defined in TS 38.331[2] when L1 exceeds L1,max.” in TS38.133.
  + Option 3 (Qualcomm): To keep consistent UE behavior across different cases and to keep the cluster connected and synchronized, we propose to clarify the UE behavior after maximum LBT failures are reached as “initiate SLSS transmissions”
* Recommended WF
  + Moderator’s view: Need further discussion.

**Issue 1-1-2: Requirements for SyncRef UE as a synchronization reference source (x\_max)**

* Proposals
  + Option 1 (Xiaomi): RAN4 to introduce x\_max= 4 for requirements of SyncRef UE as synchronization reference source
* Recommended WF
  + Moderator’s view: Option 1 is agreeable

### Sub-topic 1-2: Selection/Reselection of V2X synchronization Reference source

*This sub-topic is for Selection/Reselection of V2X synchronization Reference source.*

*Open issues and candidate options before meeting:*

**Issue 1-2-1: Condition for sync detection requirements**

* Proposals
  + Option 1 (LGE, OPPO): Revise the condition to meet sync detection requirements for selection/reselection sync reference source in SL-U
    - Option 1-1 (LGE): All S-SSB priods selected for selection/reselection to SyncRefUE are available during the Tdetect,SyncRef UE\_V2X seconds.
    - Option 1-2 (OPPO): All the SSB periods are determined as available by the UE during Tdetect,SyncRef UE\_V2X seconds.
* Recommended WF
  + Moderator’s view: Need further discussion

**Issue 1-2-2: Requirement for Tmeasure,PSBCH-RSRP (y\_max)**

* Proposals
  + Option 1 (Xiomi): RAN4 to introduce y\_max= 2 for requirement of Tmeasure,PSBCH-RSRP.
* Recommended WF
  + Moderator’s view: Option 1 is agreeable.

**Issue 1-2-3: Requirement when exceeding the maximum allowed LBT failures (for current SyncRef UE)**

* Proposals
  + Option 1 (Xiomi, OPPO): When y exceeding y\_max for measuring the PSBCH-RSRP of the current selected SyncRef UE, UE is expected to conduct SyncRef UE re-selection as per TS38.331
  + Option 2 (MediaTek, Huawei, Nokia,): There is no need to discuss UE behavior when there are too many LBT failures at selected SyncRef UE in RAN4.
* Recommended WF
  + Moderator’s view: To be discussed.

**Issue 1-2-4: Requirements for fast sync SyncRef UE detection**

* Proposals
  + Option 1 (Qualcomm): When gNB is the highest priority sync source, or when GNSS is the highest priority sync source and the source SyncRef UE is not synchronized directly or indirectly to GNSS, in addition to allowing 6% data Tx dropping, allowing 30% SLSS Tx dropping and the requirement for sync SyncRef UE detection applies
    - The additional dropping rate and requirements can be conditionally applied when one or all the following conditions are met:
      * No detected SyncRef UE is available, or
      * The RSRP of the current SyncRef UE as sync source is lower than a threshold of z, or maximum LBT is reached during the evaluation for initialization/cease of SLSS transmission.
    - z can follow the SLSS evaluation threshold, or a separately configured threshold.
  + Option 2 (LGE): Need further study on clear conditions for fast sync SyncRef UE detection requirements
  + Option 3 (Ericsson): RAN4 to consider relaxed dropping rate of SLSS transmissions to allow faster SyncRef UE detection.
  + Option 4 (Huawei): For SL synchronization reference source selection/reselection under SL-U operation, it is suggested not to introduce faster synchronous SyncRef UE detection.
  + Option 5 (MTK): There is no need to discuss UE behavior when there are too many LBT failures at selected SyncRef UE in RAN4.
* Recommended WF
  + Moderator’s view: Need further discussion.

### Sub-topic 1-3: Congestion Control measurement

*This sub-topic is for requirements for SL-RSSI measurement.*

*Open issues and candidate options before meeting:*

**Issue 1-3-1: Definition for SL-RSSI measurement**

* Proposals
  + Option 1 (OPPO, Nokia): Update the SL RSSI definition by using the OFDM symbols start from the next symbols of the 2nd candidate starting symbols.
* Recommended WF
  + Moderator’s view: Need further discussion

**Issue 1-3-2: Requirement for SL-RSSI measurement**

* Proposals
  + Option 1 (Qualcomm): RSSI accuracy requirement for congestion control is not applicable to SL-U.
* Recommended WF
  + Moderator’s view: Need further discussion

### Sub-topic 1-4: Impact on new S-SSB transmission

*This sub-topic is for impact on new S-SSB transmission.*

*Open issues and candidate options before meeting:*

**Issue 1-4-1: Side condition for sync detection**

* Proposals
  + Option 1 (LGE): Consider combining N repeated S-SSB for anchor RB set when sync detection requirements are defined,
    - e.g., the side condition for selection/reselection of synchronization referece source could be Es/Iot ≥ -10\*log10(N)+α (α = 0.5dB) based on single S-SSB within anchor RB set
  + Option 2 (Qualcomm, MediaTek): The side condition of SNR >= 0dB for SyncRef UE search and measurement is based on legacy 11RB S-SSBs.
* Recommended WF
  + Moderator’s view: Need further discussion.

**Issue 1-4-2: PSBCH-RSRP measurement accuracy**

* Proposal
  + Proposal 1 (Qualcomm): To accommodate UEs capable of measuring multiple S-SSB repetitions on frequency domain, the PSBCH-RSRP relative accuracy requirement is applicable only when the two sources have the same number of S-SSB repetitions on frequency domain configured.
  + Proposal 2 (Ericsson): RAN4 to evaluate the sidelink RSRP measurement performance using the new S-SSB design.
* Recommended WF
  + Moderator’s view: Further discussion in performance part

# Topic #2: LS and CR

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2318833 | LG Electronics Inc. | Draft CR for RRM requirements for NR sidelink unlicensed operation |
| R4-2320124 | Ericsson | DraftCR: RRM requirements for initiation/cease of SLSS Transmissions with CCA |
| R4-2320450 | Nokia, Nokia Shanghai Bell | LS on SL-U RSSI measurement |

## Open issues summary

### Sub-topic 2-1

*This sub-topic is for LS and CR discussion.*

*Open issues and candidate options before meeting:*

**Issue 2-1-1: LS discussion**

* Proposals
  + Option 1 (Nokia): RAN4 respectfully asks RAN1 to update SL RSSI definition in TS 38.215, so that the received power is observed from the OFDM symbol after the 2nd candidate starting symbol, to avoid impacts on RSSI measurement accuracy
* Recommended WF
  + Moderator’s view: Further discussion depending on conclusion of Issue 1-3-2.

**Issue 2-1-2: Draft CRs**

* Proposals
  + R4-2318833 Draft CR for RRM requirements for NR sidelink unlicensed operation
  + R4- 2320124 DraftCR: RRM requirements for initiation/cease of SLSS Transmissions with CCA
* Recommended WF
  + Moderator’s view: These draft CRs will be updated by conclusions of Topic#1.