**3GPP TSG RAN WG1 #112bis-e R1-2303971**

**e-Meeting, April 17th – 26th, 2023**

**Source: Moderator (OPPO)**

**Title: FL summary #1 for AI 9.4.1.1: SL-U channel access mechanism**

**Agenda item: 9.4.1.1**

**Document for:** **Discussion and Decision**

Introduction

In the last RAN#99 meeting, the revised WID for Rel-18 NR sidelink evolution project was updated in [1] but nothing was changed for the SL-U objective. The latest objective for SL-U is provided in the following for convenience.

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| 1. Study and specify support of sidelink on unlicensed spectrum for both mode 1 and mode 2 where Uu operation for mode 1 is limited to licensed spectrum only [RAN1, RAN2, RAN4]
* Channel access mechanisms from NR-U shall be reused for sidelink unlicensed operation
	+ Assess the applicability of sidelink resource reservation from Rel-16/Rel-17 to sidelink unlicensed operation within the boundaries of unlicensed channel access mechanism and operation
		- No specific enhancements for Rel-17 resource allocation mechanisms
		- If the existing NR-U channel access framework does not support the required SL-U functionality, WGs will make appropriate recommendations for RAN approval.
* Physical channel design framework: Required changes to NR sidelink physical channel structures and procedures to operate on unlicensed spectrum
	+ The existing NR sidelink and NR-U channel structure shall be reused as the baseline.
* No specific enhancements for existing NR SL feature
* Focus on FR1 unlicensed bands (n46 and n96/n102).
* Note: In sidelink unlicensed operation, the gNB does not perform Type 1 channel access to initiate and share a channel occupancy, neither Type 2 channel access to share an initiated channel occupancy, nor semi-static channel access procedures to access an unlicensed channel.
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This contribution provides a summary of submitted contributions, discussion topics and outcomes that are related to the channel access mechanisms for SL-U (blue text part of objective) during this RAN1 meeting. Note that, all past outcomes including agreements, conclusions and working assumptions reached during this WI are captured in Section 5 (Appendix) of this document.

Collection of agreements / outcomes of RAN1#112bis-e

To be collected once agreement is reached.

Topics for discussion

## [ACTIVE] Topic #1: Type 1 SL channel access procedures

**Background**: For Type 1 channel access procedures, the following agreements have been reached so far with remaining details/open issues highlighted in yellow (considering CW adjustment procedures as a separate topic).

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| **Agreement**Type 1 and Type 2 (2A/2B/2C) channel access procedures, transmission gap and LBT sensing idle time requirements specified in TS37.213 for NR-U are taken as baseline for NR sidelink operation in a shared channel.* FFS conditions for the actual channel access type(s) used for each SL channel and signal transmitted, and based on COT sharing conditions (if supported)
* FFS whether UL CAPC or DL CAPC or both should be used as the baseline,
	+ FFS how the channel access priority classes apply to each SL channel and signal
	+ FFS sidelink priority levels (PQI or L1 priority), channel and signal mapping to the 4 channel access priority classes. The discussion may involve other WGs.

**Agreement*** Type 1 SL channel access procedure is applicable to the following transmissions by a UE:
	+ PSSCH/PSCCH transmission(s) scheduled or configured by a gNB in SL Mode 1 resource allocation.
	+ PSSCH/PSCCH transmission(s) from the UE in SL Mode 2 resource allocation.
	+ Other SL transmissions including S-SSB and PSFCH transmissions from a UE
		- FFS: how to set CAPC for S-SSB and PSFCH
	+ Note: Type 1 can be used to initiate a COT
* A UE uses a channel access priority class applicable to the sidelink user plane data multiplexed in PSSCH for performing the Type 1 channel access procedures to transmit transmission(s) including PSSCH with user plane data and its associated PSCCH.
	+ Note: how to set CAPC for MAC CE multiplexed in PSSCH is up to RAN2
* A UE shall not transmit on a channel for a Channel Occupancy Time that exceeds the maximum COT duration where the channel access procedures are performed based on a channel access priority class *p* associated with the UE transmissions, as given in CAPC table for SL.

**Agreement**In Type 1 SL channel access procedure, the following table is adopted for channel access priority class (CAPC) for SL. * FFS: the applicability and usage of NOTE1 in the table
* FFS: whether ***mp****=1* can be used with ***p=1***, and applicable cases

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| Channel Access Priority Class (*p*) | *mp* | *CWmin,p* | *CWmax,p* | *Tslmcot,p* | allowed *CWp* sizes |
| 1 | 2 | 3 | 7 | 2 ms | {3,7} |
| 2 | 2 | 7 | 15 | 4 ms | {7,15} |
| 3 | 3 | 15 | 1023 | 6ms [or 10 ms] | {15,31,63,127,255,511,1023} |
| 4 | 7 | 15 | 1023 | 6ms [or 10 ms] | {15,31,63,127,255,511,1023} |
| [NOTE1:  For *p*=3,4, *Tslmcot*,*p*=10*ms* if the higher layer parameter absenceOfAnyOtherTechnology-r14 or absenceOfAnyOtherTechnology-r16 is provided, otherwise,*Tslmcot*,*p*=6*ms*.]NOTE 2:  When *Tslmcot*,*p*=6*ms* it may be increased to 8*ms* by inserting one or more gaps. The minimum duration of a gap shall be 100*μs*. The maximum duration before including any such gap shall be 6*ms*.  |

**Agreement**The CAPC level that should be used for S-SSB transmissions:* Option 1: CAPC value (p) should be set to 1 when UE performs Type 1 channel access procedure for S-SSB transmission

**Agreement**The CAPC level that should be used for PSFCH transmission, CAPC value (p) should be set to 1 when UE performs Type 1 channel access procedure for PSFCH transmission |

* NOTE 1 in the CAPC table for SL

One of the remaining issues in Type 1 channel access procedures for SL is related to whether a higher layer parameter “*absenceOfAnyOtherTechnology*” should be supported. When it is (pre-)configured (i.e., by gNB or supported by regulation) the MCOT length is extended from 6ms to 10ms for SL transmissions with CAPC value p = 3 and 4.

Based on Tdoc review in this meeting, firstly the support of this (pre-)configuration is independent to whether FBE is supported or not for SL-U. Secondly, it can greatly improve SL-U performance according to simulation results provided by [2]. This FFS/remaining issue has been on the table for some time already, and according to Tdoc review summary in Section 4.2, no concern has been raised. Therefore, FL proposes to support the (pre-)configurability of this higher layer parameter in Proposal 1-1 below.

* Additional LBT sensing before transmission (i.e., 43µs for p=1 and 2, 55µs for p=3, 88µs for p=4)

In [7], it is pointed out the additional LBT sensing in the Type 1 channel access procedures is longer than the GP symbol in a SL slot structure. In 15kHz SCS, a GP symbol length = 71.35us. In 30kHz SCS, a GP symbol length = 35.68us. In 15kHz SCS, a GP symbol length = 17.84us. That is,

* In 15kHz SCS, the additional LBT length when p=4 will be longer than a GP symbol
* In 30kHz and 60kHz SCSs, the additional LBT length for all CAPC level will be longer than a GP symbol

In [7], it is proposed that the additional LBT sensing length should be based on (pre-)configuration such that it will be shorter than one GP symbol in a corresponding SCS. Since the (pre-)configuration can significantly help with Type 1 channel access especially in 30kHz and 60kHz SCSs, the FL would like to ask whether this (pre-)configurability can be supported in SL-U.

* Which one of the EDT procedures (DL or UL from NR-U) should be used as the baseline for SL-U

RAN1 has not yet discussed the energy detection threshold adaptation procedure for SL-U in Rel-18, but it is a necessary part of LBT operation in both Type 1 and Type 2 channel access procedures. Based on Tdoc review in this meeting, the majority of company (except one) expressed that the existing NR-U EDT procedures for uplink transmission should be used as the baseline for SL-U operation. But since there were only a limited number of contributions discussed about this topic/issue in this meeting, the FL would first like to ask if taking NR-U EDT procedures for uplink transmissions as the baseline for SL-U is acceptable for the group in Question 1-3 below.

### FL Proposal for round 1 discussion

**Proposal 1-1 (I):**

* A higher layer parameter “*absenceOfAnyOtherTechnology*” is supported in Rel-18 for SL transmissions in unlicensed bands (e.g., by level of regulation) and it is a per resource pool (pre-)configuration.

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | NO | Why is longer COT necessary in SL when there is no other technology?If longer COT is allowed, it becomes more difficult to perform other UE’s transmission with higher priority due to existence of SL transmission with lower priority during the COT and thus due to LBT failure.Or if some solution for inter-UE blocking issue discussed in section 3.8 is introduced, then we are fine with this proposal. |
| LGE | No | In case of NR-U, gNB can control DL transmission and UL transmission, and resources for CG-PUSCH. However, in case of NR SL, especially for Mode 2 UE, LBT operation and channel occupancy will be done in distributed manner. In this case, it is unclear whether some fairness issue is present or not. Moreover, even if we live with this direction, it would be necessary to further investigate whether this parameter will be separated or common with that of Uu link. Moreover, whether it is allowed to enable both parameters simultaneously or it is possible that either of them is enabled in a time.  |
| NOKIA, Nokia Shanghai Bell | YES | We are fine with per resource pool (pre-)configuration, but could also consider other options, i.e., FFS where channel access parameter for SL-U should be defined, e.g., per RP, per BWP, other. |
| Lenovo | Yes, see comment | Regarding the scope, we prefer to have the following FFS instead of agreeing already on RP configuration:A higher layer parameter “*absenceOfAnyOtherTechnology*” is supported in Rel-18 for SL transmissions in unlicensed bands (e.g., by level of regulation). FFS configuration details, e.g. per RB set, resource pool, …We may further consider an indication that there is no Uu (i.e., absence of unlicensed UL/DL) in addition to the absence of other technology. With such deployment awareness, SL UEs would not need to perform LBT and can perform channel access and resource selection only based on Rel-17 SL sensing.  |
| Apple | No |  For in-network with NR-U gNB, can reuse the same configuration. For out of network, it is not clear how pre-configuration can ensure no other technologies exists.  |
| CableLabs | No | We consider the question as being implicit, rather than explicit: we suspect that this is about FBE (semi-static) transmissions, but it is not clear |
| QC | Yes | This was supported in NR-U and we do not see any technical reason for which this should not be supported in SL-U as well. |
| Intel | Yes with comment | We are fine in defining such parameter, which in our understanding was defined since LAA with the understanding that the network could know via implementation or by deployment whether there would be a presence or absence of an incumbent. Moving forward with SL-U, we believe same principle could be used and this should then be reflected in the way how the EDT calculation is done as similar to NR-U some relaxation could be applied. Also we agree with other companies to leave at least for the moment the type of configuration. Therefore, we propose the following text update until we converge on the details for the EDT:A higher layer parameter “*absenceOfAnyOtherTechnology*” is supported in Rel-18 for SL transmissions in unlicensed bands (e.g., by level of regulation) ~~and it is a per resource pool (pre-)configuration.~~ FFS configuration details, e.g. per RB set, resource pool, …FFS: relaxation of the energy detection threshold in absence of incumbent |
| Vivo |  | We prefer the configuration is per-BWP. It is much simpler to configure “*absenceOfAnyOtherTechnology*” per-BWP especially when a UE is configured with FDMed or TDMed resource pools. There is no motivation to configure different resource pools with different parameters in case of the absence of other technology. |
| CMCC | Yes | NR-U design should be followed. |

**Question 1-2 (I):**

* Should (pre-)configurability of the additional LBT sensing duration in Type 1 channel access procedure be supported in SL-U?
	+ E.g., at least for 30kHz and 60kHz SCSs, when the (pre-)configuration is provided, the (pre-)configured length is applied for the additional LBT sensing duration; otherwise, the additional LBT sensing duration is determined according to NR-U.

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| **Company** | **Support?** | **Comments** |
| OPPO | Support | The actual value for each SCS and channel (PSCCH/PSSCH, PSFCH, S-SSB) can be FFS, by also taking into account of CPE starting position. |
| DCM |  | Intention of this proposal is unclear. If this proposal is trying to solve inter-UE blocking issue, it should be discussed in section 3.8. Otherwise, what is the assumed situation should be clarified. |
| LGE | No | Even in NR-U, for 30 or 60 kHz SCS, they do not change the additional LBT sensing duration in Type 1 channel access procedure. The shortened additional LBT sensing duration will cause fairness issue with other RAT.  |
| InterDigital |  | It is preferable to defer the discuss on additional LBT sensing duration for Type 1 after more progress on CPE starting position for both full RB allocation and partial RB allocation. |
| NOKIA, Nokia Shanghai Bell | No | It is not clear what could be a better additional LBT sensing duration compared with what is already specified in 37.213 and compliant with regulation. The additional sensing slot duration, i.e., one sensing slot, seems to be already the minimum duration it can be. |
| Ericsson | No | LBT sensing duration should be compliant with the regulations. |
| Lenovo | No | Our understanding of 37.213 is that for p=1,2 mp=2 -> 34 µs, for p=3 mp=3 -> 43 µs, for p=4 mp=7 -> 79 µs. So FL’s numbers would be 9 µs too large, maybe this could be confirmed by others?To allow arbitrary sensing duration configuration would affect coexistence with NR Uu as well as other technologies, so we don’t see sufficient motivation at this point. |
| Apple | No | Follow 37.213 type 1 UL channel access procedure, as agreed in previous meeting.  |
| CableLabs | No | The LBT sensing duration is clearly specified in 37.213 |
| QC | No  | Firstly, in our understanding the set of values for different CAPCs is {34, 34, 43, 79} (and not {43, 43, 55, 88} ), so it seems that at least for p=1,2 the measurement could fit in the gap symbol. Secondly, we do not see a critical problem that needs solution here. In our understanding fitting the additional LBT into the gap symbol is not even something a UE would strive for in the first place: the UE that concludes the countdown of Type1 access will select a starting position with CPE (discussion still open in Topic #3) and perform the additional LBT sensing to check if the medium has been occupied between the end of its countdown and the selected TX starting point, in practice it is checking if the slot before is free. Given the past agreements on CPEs, it seems RAN1 wants to support collision resolution via CPE selection as in NR-U. In some cases a CPE from Option 2 can be chosen (2 symbols in 30 and 60 KHz). We do not see what the benefit of making the measurement shorter would be if one of the early starting position is selected (e.g. within symbol 12), that is actually what a UE would strive for (to avoid to get blocked). To summarize, the additional LBT measurement would naturally fail anyway if the slot before is occupied, as it was the case in NR-U. |
| Intel | No | It is quite unclear why we should modify the procedure already defined in the specification, and as mentioned by other companies there is no supportive study that indicates any gain.  |
| Vivo | No | Following the regulation, LBT sensing duration is determined according to NR-U. if the issue is to be handled, we prefer to enlarge the gap length, e.g., more than 1 symbol |
| CMCC | No | We think NR-U design should be reused, otherwise, it will cause some unfairness to other RAT. |

**Question 1-3 (I):**

* Should the existing NR-U EDT procedures for uplink transmissions to be taken as the baseline for SL-U in Rel-18?

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM |  | Before agreeing this direction, at least why NR-U UL rather than NR-U DL can be reused should be clarified first. |
| LGE | Yes | It would be also useful to consider EDT for COT sharing as in NR-U EDT procedure for UL transmission.  |
| InterDigital | Yes | We are fine with to re-use the existing NR-U EDT for uplink as baseline. |
| NOKIA, Nokia Shanghai Bell | YES |  |
| Ericsson | Yes | As per WID. |
| Lenovo | Yes |  |
| Apple | Yes | Use NR-U UL EDT as baseline. Consider both NW configured EDT and UE autonomously determined EDT based on PC,MAX. |
| CableLabs | No | Before proceeding with the UL selection, we should clarify firstly when the UE assumes a gNB role and when a UE role (see also R1-230002). EDT will be used in different ways by SL-U: when acting as gNB (the SL-U will apply EDT for S-SSB with TA=5dB and when acting as UE, TA=10dB). The gNB/UE acting ambiguity must be resolved before answering this question |
| QC | Yes | It is acceptable.One needed addition would be for S-SSB (that is covered in DL EDT adaptation procedure RS 37.213, Section 4.1.5) |
| Intel | Yes | However, we should discuss separately how to treat S-SSB (and PSFCH if any excemption are also applied to it) as this cam be transmitted using type 2A LBT inside and outside a COT. |
| Vivo | Yes |  |
| CMCC | Yes |  |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #2: Type 2 SL channel access procedure

**Background**:

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| **Agreement*** Type 2A/2B/2C SL channel access procedures
	+ Type 2A channel access procedure is applicable to the following case:
		- Transmission(s) by a UE following transmission(s) by another UE for a gap ≥ 25μs in a shared channel occupancy
		- FFS any other transmission by a UE (e.g., other than COT sharing)
		- FFS whether Type 2A is used also for the case of short control signalling transmission
	+ Type 2B channel access procedure is applicable to the following case:
		- Transmission(s) by a UE following transmission(s) by another UE at least when the gap is 16μs in a shared channel occupancy
		- FFS the case when the gap is between 16 and 25us
		- FFS any other transmission by a UE (e.g., other than COT sharing)
	+ Type 2C channel access procedure is applicable to the following case:
		- Transmission(s) by a UE following transmission(s) by another UE for a gap ≤ 16μs in a shared channel occupancy and the duration of the corresponding transmission is at most 584us.
		- FFS any other transmission by a UE (e.g., other than COT sharing)
		- FFS whether Type 2C is used also for the case of short control signalling transmission
	+ FFS under which conditions (other than the gap) UEs can apply the Type 2A/2B/2C SL channel access procedures
	+ FFS under which conditions Type 2B or Type 2C is applied in case of a gap of 16 μs

**Agreement*** Type 2A channel access procedure is applicable for S-SSB transmissions from a UE without a shared channel occupancy, when the following constraints are met:
	+ Time duration is at most 1ms per transmission
	+ The duty cycle of the S-SSB transmissions is at most 1/20
	+ FFS: details of EDT
	+ FFS: whether/how to define observation period, including whether or not observation period would be captured in the specifications if defined
* FFS: Type 2A applicability for PSFCH without a shared channel occupancy and further limitations for combined transmissions of both S-SSB and PSFCH using Type 2A channel access procedure
 |

* Apply Type 2B or 2C when transmission gap is 16us

According to the existing agreement for Type 2B and Type 2C channel access procedures for SL-U (also in NR-U), both can be applied by a SL TX UE when the transmission(s) by the UE following transmission(s) by another UE when the transmission gap is 16μs in a shared channel occupancy. And it is FFS under which condition(s) Type 2B or Type 2C should be applied by the UE. According to the agreement, the applicability of Type 2C is further conditioned that the duration of the corresponding transmission is at most 584µs. So, it means that if a UE is transmitting a PSCCH/PSSCH or S-SSB that is longer than 584µs in a shared channel occupancy when SCS is 15kHz, only Type 2B LBT should be applied. In all other cases, PSFCH transmissions in all SCSs and all SL transmissions in 30kHz and 60kHz, Type 2C could be used by the UE without performing any LBT sensing. In FL’s understanding, this is quite beneficial as the potential TX/RX switching and RX/TX switching times will not need to be considered / no impact on the channel access procedure.

According to contributions submitted to this meeting, besides the existing agreed condition for the corresponding transmission to be less than 584µs, no company has proposed any additional condition. As such, FL proposes that it is up to UE implementation to perform either Type 2B or Type 2C channel access procedures in a shared channel occupancy when the transmission gap is 16us and the duration of the corresponding transmission is at most 584µs in Proposal 2-1 below.

* Whether Type 2A can be applied for PSFCH without a shared channel occupancy

One of the remaining issues for Type 2A channel access procedure is related to whether Type 2A can be applied for PSFCH transmissions without a shared channel occupancy. According to an existing agreement, this feature is allowed for UE transmitting S-SSB since synchronization burst is considered as a high priority and allowed by regulation. Similarly, the PSFCH control signalling can be also considered as a high priority transmission (CAPC p=1 is agreed for PSFCH) and skipping PSFCH / SL-HARQ feedback will cause unnecessary retransmission of SL TBs in the system (i.e., higher congestion, longer latency and degraded performance).

Based on Tdoc review outcome in this meeting, there is a clear majority to support this feature also for PSFCH transmissions. Therefore, the FL proposes to support this in Proposal 2-2 below and adopt a combined limitation / restriction as S-SSB.

* Whether/how to define observation period for S-SSB when Type 2A is applied without a shared channel occupancy

Since the applicability of whether Type 2A can be applied for PSFCH transmissions without a shared channel occupancy in Proposal 2-2, the decision on whether to define an observation period for S-SSB transmissions when Type 2A is applied without a shared channel occupancy should be postponed at least in Round 1 discussion.

### FL Proposal for round 1 discussion

**Proposal 2-1 (I):**

* When the gap between the transmission(s) by a UE following transmission(s) by another UE is 16μs and the duration of the corresponding transmission is at most 584µs in a shared channel occupancy, it is up to UE implementation to perform either Type 2B or Type 2C channel access procedures.

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | OK |  |
| LGE | Yes | As in NR-U, it is up to implementation.  |
| InterDigital | OK |  |
| NOKIA, Nokia Shanghai Bell | YES |  |
| Lenovo | No, it should be specified | In case of 16us gap, UE applies Type 2C channel access if the corresponding transmission is at most 584µs; otherwise UE applies Type 2B |
| Apple | OK |  |
| CableLabs | No | 37.213 clearly specifies the 584us interval for Type 2C |
| QC | Yes | Since the TX max duration is enforced while using Type 2C, no additional rules are needed. |
| Intel | Yes with comments | We are generally OK with the direction of the proposal and to leave up to implementation on what type of LBT to use. However, if the time constrain of 584us is kept, this will imply in our understanding that for 15 kHZ SCS S-SSB could never be transmitted with type 2C defeating the purposeof sharing a COT for S-SSB and contrary of what happens in the Wi-fi design, where control information are actually transmitted with no LBT. Therefore, we would like to better understand if RAN1 is OK with such a restriction.  |
| vivo | yes |  |
| CMCC | Yes |  |

**Proposal 2-2 (I):**

* Type 2A channel access procedure is applicable for PSFCH transmissions from a UE without a shared channel occupancy, when the following constraints are met
	+ Time duration is at most 1ms per transmission
	+ The combine number of S-SSB and PSFCH transmissions by the UE shall be equal to or less than 50 within an observation period of 50ms

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | OK |  |
| LGE | No | Considering both channel types, it would not be helpful to simplify LBT operation for S-SSB transmission. Regarding the proposal itself, since the PSFCH resource period is defined in logical slot domain while the S-SSB period is defined in physical slot domain, when the observation period is 50ms, it would be unclear whether the condition is met or not. If it is allowed the simplified LBT for both S-SSB and PSFCH, the observation period should be resource pool period (i.e., 10240ms), and then the duty cycle will be checked according to the following agreement. **Agreement*** Type 2A channel access procedure is applicable for S-SSB transmissions from a UE without a shared channel occupancy, when the following constraints are met:
	+ Time duration is at most 1ms per transmission
	+ The duty cycle of the S-SSB transmissions is at most 1/20
	+ FFS: details of EDT
	+ FFS: whether/how to define observation period, including whether or not observation period would be captured in the specifications if defined
* FFS: Type 2A applicability for PSFCH without a shared channel occupancy and further limitations for combined transmissions of both S-SSB and PSFCH using Type 2A channel access procedure
 |
| InterDigital | Support |  |
| NOKIA, Nokia Shanghai Bell | YES (see comments) | We propose slight clarifications to the conditions:* Time duration of each PSFCH transmission is at most 1ms
* The combined number of S-SSB and PSFCH transmissions by the UE using Type 2A LBT shall be equal to or less than 50 within an observation period of 50ms
* The duty cycle of the S-SSB and PSFCH transmissions by the UE using Type 2A LBT is at most 1/20
 |
| Lenovo | See comments | We support that Type 2A is applicable for PSFCH transmissions without shared channel occupancy. But the second constraint is unsuitable and not acceptable: The constraint needs to take the overall usage time for S-SSB/PSFCH within an observation period into account; the number of transmissions by itself is irrelevant (for example, if we adopted the number as suggested, the usability becomes SCS-specific, which doesn’t make sense to us). |
| Apple | No | In LAA/eLAA and NR-U, PDCCH (ACK/NACK for CG-PUSCH) and PUCCH transmission are subject to type 1 CCA when transmitted outside of shared COT. We do not see any reason why SL ACK/NACK transmission should be prioritized over Uu link ACK/NACK transmission.  |
| CableLabs | No | DL Type 2A is clearly specified by 37.213 in section #4.1.2. This behavior qualifies as *“Type 2A channel access procedures as described in clause 4.1.2.1 are only applicable to the following transmission(s) performed by an eNB/gNB:**- Transmission(s) initiated by an eNB including discovery burst and not including PDSCH where the transmission(s) duration is at most ”*Also it is not clear the meaning of the conditions ‘without a shared channel occupancy’ in the context of 37.213. |
| QC | No | We prefer that S-SSB access is simplified, and a joint use of Type 2A for S-SSB and PSFCH would complicate UE’s implementations. We also believe that to improve the reliability of PSFCH transmission, the relaxation of conditions to share the COT is the way to go, which can be discussed in Topic #5. |
| Intel | No | We are not OK to apply the short control exemption to PSFCH as well, and agree with LG’s comments. If we apply type 2A to PSFCH, this would complicate quite a bit the design, and furthermore we may need to discuss a lot more details as for instance any priority rules UE behaviour when in an observation period we have both S-SSB and PSFCH transmissions.  |
| Vivo | Yes with comment | One more subbullet should be added:The total duration of the S-SSB and PSFCH should also be clarified, i.e., less than 2500us within 50ms |
| CMCC | No | It may need more workload to discuss when one of S-SSB, PSFCH cannot fulfil the limitation, which one should be transmitted with Type 2A channel access procedure, or only partial occasions of PSFCHs can be transmitted with Type 2A; we prefer to do not support Type 2A channel access procedure for PSFCH to avoid more complexity.  |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #3: CP Extension (CPE)

**Background**:

All of the CPE related agreements that have been reached so far in this WI are listed below with remaining FFSs are highlighted in yellow. We will try to address as many of these remaining FFSs as possible in this meeting.

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| **Agreement*** CP extension (CPE) is supported for NR sidelink operation in a shared channel.
	+ FFS all remaining details including applicable scenarios, usage, PHY structure, etc.

**Agreement*** A CPE is transmitted from a CPE starting position before SL transmission within a COT, select one or both of the two options:
	+ Option 1: within the symbol just before the next AGC symbol
	+ Option 2: within at most 1, 2 or 4 symbols just before the next AGC symbol for 15, 30 or 60 kHz SCS, respectively
	+ FFS: whether Option 1 and Option 2 are both applicable and the conditions (e.g., Option 1 in case of COT sharing and Option 2 in case of initiating a COT)
	+ FFS: which channel access type(s) is applicable for option 1 and option 2
	+ FFS: other details
* A single CPE starting position for PSFCH
	+ FFS CPE starting position and whether it should be (pre-)configured in each RP, pre-defined or indicated
	+ FFS other details (e.g., indication granularity)
	+ Note: value 0 is a candidate
* At least one CPE starting position for S-SSB
	+ FFS CPE starting position should be (pre-)configured, pre-defined or indicated
	+ FFS: Whether multiple CPE starting positions should be (pre-)configured, pre-defined or indicated
	+ FFS CPE starting positions for the R16 S-SSB and the additional S-SSBs
	+ Note: value 0 is a candidate
* One or multiple CPE starting positions can be (pre-)configured in each resource pool for PSSCH/PSCCH
	+ When multiple CPE starting positions are (pre-)configured,
		- FFS whether/how to define a criteria for selecting a default CPE starting position (e.g., according to partial/full RB set allocation, resource reservation information, within or outside of a COT, etc.)
		- FFS criteria for selecting one of the multiple CPE starting positions (e.g., according to priority level (e.g., CAPC or L1), selected randomly by UE from the (pre-)configured set of CPEs, selected by the UE based on channel access result, determined based on indication from the COT initiating UE, etc.)
	+ FFS other details

**Agreement**A CPE can be transmitted from a CPE starting position before SL transmission for the following two options:* Option 1: within the symbol just before the next AGC symbol
* Option 2:
	+ within the symbol just before the next AGC symbol for 15 kHz SCS
	+ within at most 2 symbols just before the next AGC symbol for 30 or 60 kHz SCS
* FFS applicable scenario(s), condition(s) and channel type(s) to apply Option 1 or Option 2
 |

Based on reviewing submitted Tdocs in this meeting, there are a couple of high level questions brought up by some and we should probably address those first.

* Clarification on the CPE transmission is restricted within the SL symbols in a slot or any symbol within a slot (due to the starting symbol for PSCCH/PSSCH may not be the first symbol in a slot)

It is brought up in [5] that since it has been agreed in the PHY agenda that the starting symbol for PSCCH/PSSCH transmission in a slot for SL-U may be (pre-)configured to be, for example, not the first symbol in a slot. Then it is questioned that whether the existing agreements for CPE (i.e.., a CPE can be transmitted from a CPE starting position within “the symbol” or “at most 2 symbols“ just before the next AGC symbol for an intended SL transmission), the symbol(s) for transmitting CPE is part of SL symbols or physical symbols in a slot. It is at least to FL’s understanding, the CPE symbol(s) is/are physical symbols before the next AGC symbol of the intended SL transmission to ensure occupancy continuity of the channel for SL transmission. Maybe it is worthwhile to clarify this point using Question 3-1 below to get everyone’s understanding on this issue.

* Clarification on the need to consider UE TX/RX switching time and RX/TX switching time in LBT sensing and CPE transmission, respectively.

It has been pointed by several papers whether the UE TX/RX and RX/TX switching times (i.e., 13µs in one direction) should be taken into account of as part of LBT sensing and/or CPE transmission. While most of the paper brought up this issue have the view that these switching times do not need to be considered (as also the case in NR-U), since the actual switching time can be account for as part of the LBT sensing slot duration, it is good to have a common understanding on this topic/issue (or even make a conclusion). Please indicate your view on this for Question 3-2 below.

* Selection of time window for CPE transmission (Option 1 and Option 2)

In the last RAN1#112 meeting, a time window for CPE transmission was agreed for 15kHz, 30kHz and 60kHz SCSs (let’s denote this as a “CPE window”), where the CPE window is always 1 symbol length for 15kHz SCS, and up to 2 symbols for 30kHz and 60kHz SCSs before the next AGC symbol of the intended SL transmission. One of the remaining FFS points is how to select/determine whether Option 1 (1-symbol length) or Option 2 (2-symbol length) should be used by a SL TX UE in 30 and 60kHz SCSs.

Based on the Tdoc review in this meeting (summary provided in Section 4.5), a clear majority of company thinks the selection/determination should be based on whether the UE is initiating a COT or sharing a COT from another UE (same as NR-U). Specifically, when UE is initiating a COT for an intended SL transmission, since the additional LBT that needs to be performed (43us, 55us, …) is longer than a symbol length in 30kHz and 60kHz SCSs (35.7us, 17.9us), Option 2 (2-symbol length) would be required. And since the LBT sensing time / transmission gap requirements for Type 2A/2B/2C channel access procedures are 25us, 16us, and up to 16us, respectively, generally Option 1 (1-symbol length) would be sufficient. Alternatively, the selection / determination could be based on availability of the channel (e.g., whether there is SL / WiFi transmission in the prior symbols). When the channel is idle in the prior symbols, the additional LBT could be performed and CPE is transmitted within the CPE window using Option 2. When the channel is busy (e.g., SL transmission in symbol #12), the additional LBT will always fail. The same could be said for the COT initiating/sharing approach. So, it is FL understanding, both approaches can work and the end result is the same. As such, the simplest way in FL’s view is to go with the majority to adopt the NR-U approach. A corresponding proposal is listed in Proposal 3-3 below.

* When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH (selecting a default CPE)

For another one of the remaining FFS points from RAN1#111, when multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH transmission, whether/how to define a criterion for selecting a default CPE starting position. From reviewing the contributions in this meeting, the majority is split between the two following criteria.

* Whether the intended SL transmission has a partial or full RB set allocation.

Companies who preferred this approach were mainly due to firstly it aligns with NR-U mechanism, and secondly it always allows FDMing of concurrent transmissions in a slot for partial RB set allocation. That is, when it is a full RB set allocation, the chances of a SL collision could be high when there is no existing reservation. However, other companies think that even for partial RB set allocation and there is no existing reservation, this approach does not offer collision resolution.

* Whether there is an existing reservation of resources in the slot of the intended SL transmission (including own reservation).

For this approach, whenever there is an existing reservation (including own reservation) in the slot of the intended SL transmission, the CPE starting position should always be aligned among all SL TX UEs (based on a default/common starting position) to allow FDM of concurrent transmissions in the same slot. TX collision resolution for both partial RB set and full RB set allocations is based on the existing SL sensing and reservation (including re-evaluation and pre-emption checking) mechanism. When there is no existing reservation, then one of the multiple (pre-)configured CPE starting position should be selected to achieve collision resolution.

Since there is no clear majority of preference from the Tdoc review (summary in Section 4.5), FL would like to collect company views in the first round of discussion using Question 3-4 below.

* When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH (selecting a starting position)

For another one of the remaining FFS points from RAN1#111, when multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH transmission, what is the criteria for selecting one of the multiple CPE starting positions when the default CPE position is not selected. From reviewing the contributions in this meeting, the majority is split between the two following approaches.

* Priority based (CAPC or L1 priority)

The reason(s) behind this approach is quite straight forward. High priority transmission would transmit longer CPE (earlier CPE starting point) than a lower priority one.

* Random selection based

Companies who preferred this approach were mainly due to firstly it is aligned with NR-U approach and secondly it is intended for full RB set allocation. However, companies who are not in favour of this approach concern about a low priority transmission could transmit a longer CPE and block a high priority transmission UE who select a shorter CPE length. Hence, this may not be a fair approach.

* Indication based

Companies who preferred this approach were mainly due to it is aligned with NR-U approach However, companies who are not in favour of this approach concern about the COT initiating UE has no knowledge about the transmission priority of the COT sharing UE, since SL transmissions are not scheduled by another UE.

Based on the Tdoc review in this meeting, FL propose to go with the priority-based approach since there is a clear majority. The corresponding proposal is provided in Proposal 3-5 below.

* Handling of the GP symbol(s) between the slots in MCSt

One of the topics that has been brought up by some companies is the treatment / handling of the GP symbol(s) between the slots of MCSt. While it is mentioned by several papers that the CPE starting position between the slots in MCSt should be 16µs (to be the same as the transmission burst in NR-U), some also expressed a concern that this would block channel access for UEs that perform Type 1 LBT (especially in 15kHz SCS) and MCSt should still allow FDM of different transmissions in a slot. Furthermore, there is also an opinion/view that the GP symbol(s) could be used for PSSCH transmission, but this would impact RX UEs who rely on the GP symbol to perform RX/TX switching in order to transmit SL in the following slot.

To this end, the FL would like to gather views/opinions from all companies (in Question 3-6 below) on this topic/issue of firstly whether CPE or PSSCH should be transmitted in the GP symbol(s) between the slots in MCSt and secondly how to resolve inter-UE blocking if a 16µs transmission gap is always applied. Note, this discussion is not intended for the GP symbol just before the start of a MCSt.

### FL Proposals/questions for round 1 discussion

**Question 3-1 (I):**

For the CPE agreements reached so far in this agenda, the 1 or at most 2 symbols just before the next AGC symbol for CPE transmission is/are SL or physical symbol(s)?

* Note, when the starting PSCCH/PSSCH symbol in a slot is (pre-)configured to be not the first symbol in a slot, it is assumed the symbols not to be used for PSCCH/PSSCH transmission are not SL symbols.

|  |  |  |
| --- | --- | --- |
| **Company** | **SL / physical symbol(s)** | **Comments** |
| OPPO | Physical symb | The intention of CPE transmission is to start early channel occupation (up to 2 OFDM symbols) just before the SL transmission. If CPE is transmitted only in configured SL symbols, then CPE transmission duration could be much longer than 2 OFDM symbols. |
| DCM | Physical |  |
| LGE | Physical symbols |  |
| InterDigital | Physical symbol | Our understanding of the CPE agreements is that CPE to be applied to the physical symbols before the next AGC.  |
| NOKIA, Nokia Shanghai Bell |  | In our view, this may not be a relevant issue for SL-U Rel-18 assuming that all symbols and slots are configured for SL, given that Uu is in licensed. So either approach is fine, without any specific solution needed. |
| Ericsson | Physical | SL symbols do not make sense from the perspective of channel access. |
| Lenovo | physical symbols | We understood all existing agreements to refer to the nominal slot duration with regular CP duration, i.e. depending only on the numerology but not considering the additional extension of cyclic prefix. |
| Apple |  | When starting symbol is not the 1st symbol in a slot, it still starts with AGC symbol. Then the previous agreement applies. When the starting symbol is the 1st symbol in a slot, the CPE is in the last symbol of previous slot.  |
| CableLabs | Physical symbols | Not clear what is the meaning of SL symbols |
| QC | Physical |  |
| Intel | Physical symbol | As other companies commented, our understanding is that CPE, regardless of option 1 or 2, would be applied to the physical symbols right before the AGC symbol. |
| Vivo | PHY symbol | The starting symbol of SL is configurable, if CPE is confined within SL symbol only, there may be gap between CPE and SL transmission, which is not preferred. |
| CMCC | physical symbol(s) |  |

**Question 3-2 (I):**

For the definition of CPE starting position(s) within a CPE window (1 to 2 symbols before the next AGC symbol of the intended SL transmission), is it necessary to take into account of the UE TX/RX and/or RX/TX switching times? If yes, how?

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| --- | --- | --- |
| **Company** | **Yes / No** | **Comments** |
| OPPO |  | We are OK to follow how it is handled in NR-U and/or follow the majority view. |
| DCM | YES | This discussion includes a case where UE-A transmits a TX at slot n and UE-B transmits a TX at slot n+1 with applying CPE. Then UE-A should be possible to receive UE-B’s TX. |
| LGE | No | According to TS 38.211, for FR1, the TX-RX switching time and the RX-to-TX switching time are the same as 13us for both NR SL and NR Uu link as follows:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4.3.2 Slots<…>A UE not capable of full-duplex communication is not expected to transmit in the uplink earlier than after the end of the last received downlink symbol in the same cell where is given by Table 4.3.2-3. A UE not capable of full-duplex communication is not expected to receive in the downlink earlier than after the end of the last transmitted uplink symbol in the same cell where is given by Table 4.3.2-3.<…>**Table 4.3.2-3: Transition time and**

|  |  |  |
| --- | --- | --- |
| **Transition time** | **FR1** | **FR2** |
|  | 25600 | 13792 |
|  | 25600 | 13792 |

 |
| 8.2.3.2 SlotsThe slot structure for sidelink transmission is defined in clause 4.3.2. |

Meanwhile, according to TS37.213, the basic unit for channel sensing is a sensing slot with a duration of 9 us, and the actual channel sensing duration for the LBT operation within the sensing slot is just 4 us, and its location is up to UE implementation. In this case, it is understood that the switching time from the RX for LBT operation to the TX after LBT operation is up to UE implementation and is already covered in the sensing slot or LBT duration. |
| InterDigital | No | Similar to NR U, no need to consider switching time. |
| NOKIA, Nokia Shanghai Bell | No | In NR-U there was no specific consideration related to the RX/TX switching, and we see no need for that here either.  |
| Ericsson | No | It is up to UE implementation how to handle it. |
| Lenovo | No | In our understanding NR-U does not explicitly consider switching time, so we see no strong motivation to deviate from there. |
| Apple | No.  | Rx to Tx switching is included in the sensing slot.  |
| CableLabs | No | Similar to NR-U, not clear why required to consider the switching time |
| QC | No | Two cases to be considered:1. if a UEA wants to keep transmitting, it cannot have a gap larger than between two consecutive transmissions (it might be needed to agree on a definition of a TX burst to clarify this). In that case, UEA does not perform any channel access, which means that it remains in TX state (**no switching at all for MCSt**).
2. Conversely when a COT is shared, but also in general when a UEB is receiving something from UEA and want to transmit after receiving, there will be a single Rx/Tx switching, and as highlighted by LGE, **an NR-U capable UE is intended to have enough time to perform this switching, the measurement, and send a gate-off signal for TX if LBT fails, within the minimum gap of** .
 |
| Intel | Yes with comments | We believe that the UE TX/RX and/or RX/TX switching times needs to be indeed taken into consideration when discussing CPE as the switching time may create a gap between two consecutive transmissions which may require LBT to be performed even within a shared COT. In order to minimize any LBT failure and LBT overhead, RAN1 should aim to fill these gaps when possible so that to aim for an LBT free design, without violating any regulatory requirements, as per RAN4 requirements the actual duration needed for TX/RX and RX/TX switching should be at most 13 us in FR1, which would allow to use type 2C LBT in many case. One example could be the one depicted in the following figure where both transmissions fall within a shared COT: for 15 kHz SCS, the gap between PSSCH/PSCCH and PSFCH would be sufficiently long to require type 2A before PSFCH, while by simply applying a CPE would be possible to use instead type 2C making the PSFCH more reliable and unconditional to any LBT when this occur back to back with another SL transmission. |
| Vivo | No | Reuse NR-U principle is sufficient, where switching time is not additionally defined. |
| CMCC | No |  |

**Proposal 3-3 (I):**

For 30kHz and 60kHz SCSs, a SL TX UE uses Option 1 (1-symbol length) for CPE window when the UE performs Type 2 channel access procedure and Option 2 (2-symbol length) for CPE window when the UE performs Type 1 channel access procedures.

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| --- | --- | --- |
| **Company** | **Support?** | **Comments** |
| OPPO | OK | Follow majority view. |
| DCM |  | Is this proposal mean that there are two sets of multiple starting positions? Our view is that at least the default starting position should be aligned regardless of type 1 or type 2. If this is ensured, we are fine with this proposal. That is, the default position is common for type 1/type 2 LBT, and additional position can be multiple (option 1 for type 2 LBT and option 2 for type 1 LBT).**Proposal 3-3 (I):** For 30kHz and 60kHz SCSs, a SL TX UE uses Option 1 (1-symbol length) for CPE window when the UE performs Type 2 channel access procedure and Option 2 (2-symbol length) for CPE window when the UE performs Type 1 channel access procedures. * Note: default starting position is the same regardless of type of channel access procedure.
 |
| LGE | No | In case of UE-to-UE COT sharing, due to the processing time for decoding PSCCH/PSSCH containing COT sharing information, it is possible that the time gap between PSCCH/PSSCH including COT sharing information and initial SL transmission utilizing the shared COT. In this situation, even though the UE performs Type 2 channel access procedure, Option 1 (1-symbol length) for CPE window can be used to minimize the time gap. Otherwise, the shared COT can be interrupted by other RAT or other UE. Simply, we can say that the transmissions within a MCSt except for the earliest transmission, Option 1 (1-symbol length) is used while the earliest transmission uses Option 2 (2-symbol length).  |
| InterDigital |  | We are fine with the proposal. |
| Lenovo | See comments | For Proposal 3-5, the CPE is determined based on L1 priority; then whether the CPE is within one symbol or two symbol duration does not need extra discussion.  |
| Apple | No | We assume the proposal is about multiple CPE starting position. If this one is about single starting position, we can discuss the CPE length directly without one or two symbol option discussion. Multiple CPE starting position is to introduce intentional mutual blocking. When FDM transmission is enabled, mutual blocking is not desirable. Therefore, we do not see the reasoning to separate one symbol (less starting positions, i.e., less choices to mutual blocking) versus two symbols (more starting positions, i.e., more choices to mutual blocking) based on type 2 versus type 1 LBT. In fact, when type 2 LBT is used (COT sharing and S-SSB transmission), we do not see the value of multiple CPE starting position. One common starting position (default one or dynamic signaled one by SCI in shared COT) should be used. The default CPE value is to fill in the gap left after 25us LBT. Since 60KHz SCS one OFDM symbol length is shorten than 25us, the CPE length is 2 OFDM symbol – 25us. For 30KHz SCS, it is one OFDM symbol length – 25us. For type 1 LBT, multiple starting position is used with fullBW transmission for intentional mutual blocking.  |
| CableLabs | See comments | Not clear why Type 1 access may require CPE. Perhaps the question needs to be re-phrased? |
| QC | Ok | We believe that FL version is a simple solution that achieves the objective of using as much as collision resolution when accessing a channel to initiate the COT, and limiting the positions in a shared COT to gap symbol (so that Type 2A/2B/2C does not fail if another SL TX occupies the target slot). That is:* Two sets of CPEs are pre-configured, one based on Option 1 and one based on Option 2, which one to use is based on COT initiation vs. COT sharing

On LGE version: thanks for your input. there may be some error cases to be avoided (UE incurs in unnecessary UE blockage due to try using Option 2 in a shared COT), e.g. in Case1 the UE is trying to TX the CPE in same slot (after initiator’s TX) it may need to restrict CPEs to Option 1. In Case2, if the UE is trying to do TX the CPE after another third UE had the chance to use the shared COT the problem is the same. **In general the UE should assume that the slot is occupied until the end of symbol 12**.To DCM, thanks for your input. we should definitely define the default starting position for both COT sharing and COT initiation, it may be the next discussion point. In fact the default starting position may change due to the different needs in COT initiation and shared COT. This is related to how many CPE position are available in each of those cases, which is also tied to how many collision resolution capability we need. As discussed before, Option 1 limit the # of CPE positions, and provide less collision resolution capability, while Option 2 provide more CPEs and more collision resolution capability. So we believe that the conditions and the location of the default CPE can be discussed in parallel (Question 3-4 from FL), under the principle that when a UE does not need to resolve collisions, then can use default CPE (to transmit concurrently with other UEs) |
| Intel | OK |  |
| Vivo | No | In later proposal, we discuss the CPE selection rule, once the CPE starting position is determined, the CPE may locate either in 1 or 2 symbol.Therefore, the LBT type is not used for option 1 or option 2 selection. |
| CMCC | Yes |  |

**Question 3-4 (I):**

When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH transmission, which one of the following selection criteria should be used by a SL TX UE for selecting a default CPE starting position?

Partial/full RB set allocation based

Existing resource reservation based

|  |  |
| --- | --- |
| **Company** | **Comments** |
| OPPO | For the simplest way, we still prefer to use Mode 1 / Mode 2 RA to decide when to use the default CPE starting position. In Mode 2, a single default CPE starting position can be (pre-)configured within the CPE window and all UEs use the same CPE starting position to achieve FDM transmissions among different UEs. In Mode 1, multiple CPE starting positions are configured within the CPE window and the gNB indicates which one of the configured positions to be used by the UE. |
| DCM | Prefer 1.For 2, we do not think this option is meaningful since what is addressed here is resource conflict due to initial TX. If there is resource reservation, then the TX UE should avoid resource conflict by selecting appropriate resource in R16/17 mechanism. |
| LGE | According to NR-U design, for the partial RB set allocation, a single CPE is used. In that point of view, for simplicity, partial RB set allocation uses the default CPE starting position. We think that existing resource reservation also needs to be used to determine the usage of the default CPE even for full RB set allocation. According to NR SL resource (re)selection, if the UE detects the existing resource reservation, and if it is overlapping with its own TX resources, and if the RSRP measurement is above threshold, the UE may reselect its TX resource to avoid the resource collision. If the UE detects the existing resource reservation, and if it is overlapping with its own TX resources, and if the RSRP measurement is below threshold, the UE may not reselect its TX resource. If the UE detects the existing resource reservation, and if it is not overlapping with its own TX resources, the UE may not reselect its TX resource regardless of whether and if the RSRP measurement is above or below threshold. In this case, if the different CPEs are used, one of them would be unnecessarily blocked due to LBT failure.  |
| InterDigital | We think 2 can be used as criteria to select CPE starting position. Based on the existing resource reservation, the UE selects the CPE starting position to align with the reserved resource’s priority to enable FDM in the same slot. |
| Ericsson | Both |
| Lenovo | Partial/full RB set allocation should be considered., but see also Proposal 3-5 to use the L1 priority |
| Apple | Option 1. For mode-1 with dynamic grant, the CPE can be signalled in DCI, same as Uu link for PUSCH transmission. For mode-1 with configured grant, and for mode-2 with resource selection procedure, similar as NR-U CG-PUSCH transmission, depending on FDM case or TDM case, single or multiple CPE can be used. When option 1 is used (FDM or fullBW), the resource selection procedure is assumed as well.  |
| QC | Prefer 2In our view the CPE method (from NR-U) and the reservation/re-evaluation check method (from NR SL) that can lead to reselection are nicely complementary for solving the collision issue. Furthermore, the NR SL method is effective when a reservation is provided (if there is no reservation, the UE don’t have a chance to avoid collision via reselection when re-evaluation check is performed T3 before the transmission). So if we adopt a harmonized strategy we can reap the benefits of both.To DCM: Thanks for your view. On your comment on 2, it is exactly because “If there is resource reservation, then the TX UE should avoid resource conflict by selecting appropriate resource in R16/17 mechanism” that NR SL mechanism can solve collisions and therefore the default CPE can be used. When this is not available (e.g. first TX) then the collision resolution via CPE is used. In our view going for 1, means that partial RB sets transmissions cannot benefit from collision resolution for 1st TX.To Apple: Thanks for your view. For mode 2 operation, we agree with you that FDM or TDM case is a relevant partition, but the way in which FDM or TDM is determined, is via resource reservations and the related re-evaluation and pre-emption check. FDMing cannot be assessed based only on partial RB set allocation (there is no gNB that ensure it). Conversely, concurrent transmissions can coexist if their mutual RSRP level is acceptable, which again can be assessed from a received reservation.  |
| Intel | As long as the resource reservation are sufficiently spaced from the candidate resources, the selection of the CPE should only depend on partial/full RB set allocation. However, some specific exclusion rules may need to be defined first in this sense.  |
| vivo | Default CPE is used to achieve FDM. Reservation signalling can help to detect whether FDMed transmission exist or not. So, at least reservation signalling should be considered. Of course, FDMed transmission exist only when there is partial RB set transmissionboth of the factors can be considered. |
| CMCC | The 2nd one;For the 1st one, even the UE occupy full RB set, the resource can also be selected by other UEs based on RSRP measurement, but this may cause the LBT failure. |

**Proposal 3-5 (I):**

When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH transmission, when a default CPE starting position is not selected by the UE, one of the (pre-)configured multiple CPE starting position is selected based on the priority of the intended PSCCH/PSSCH transmission.

* FFS whether the priority is based on CAPC or L1 priority

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM |  | Whether default starting position is used or not should be determined by priority. We do not understand why ‘when a default CPE starting position is not selected by the UE’ is necessary here. |
| LGE | No | If the intention of this proposal is to avoid resource collision, why don’t we handle the resource collisions with the same priority? With this proposal, resource collision between SL transmissions with the same priority cannot be resolved. For a sake of progress, we can accept that the CPE is selected randomly selected among the multiple CPE starting position (pre)configured per priority of the PSCCH/PSSCH transmission.  |
| InterDigital | Support |  |
| NOKIA, Nokia Shanghai Bell | Support with corrections | We suggest the following edit:When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH transmission, when a default CPE starting position is not selected by the UE, one of the (pre-)configured multiple CPE starting position is selected based on the access level ~~priority~~ of the intended PSCCH/PSSCH transmission.* FFS whether the access level ~~priority~~ is based on CAPC or L1 priority, or a semi-persistent transmission, or a retransmission.

That is to also consider the transmission type, such as semi-persistent transmissions and retransmissions for determining the CPE in addition to priority. |
| Ericsson |  | It is OK in addition to any of the options in Proposal 3-4(I). |
| Lenovo | Yes | For the FFS, L1 priority is preferred. We think that it will never be possible to avoid all collisions, but priority-based CPE reduces the problem. |
| Apple | No | We think multiple CPE is used with type 1 CCA. For type 2 CCA, we do not see why multiple CPE is needed. For type 1 CCA, the priority is already handled by the CAPC value. For low CAPC class, the type 1 success rate is already low. In addition, due to transmission from previous slot, for example, in 30KHz SCS with one gap symbol in previous slot, an earlier CPE does not give higher chance of transmission since it can collide with the transmission from previous slots. Therefore, it is not clear whether a large CPE or a smaller CPE should be given to high priority traffic. Random selection like NR-U can service the purpose of interference randomization. The traffic prioritization is handled by CAPC and resource selection procedure. Larger/smaller CPE does not indicate higher/lower transmission probability and further complicate the design.  |
| QC | Yes | We also see LGE point, and when possible, some randomization within a priority level could be beneficial. Unfortunately, this may not be possible in all cases (e.g., in 30KHz, with Option 1, only 3 CPE positions are possible, and there are 4 CAPC levels). This could be anyway added as FFS point, e.g., **FFS: random CPE position within a given priority level and related details.**In general, we are anyway open to random selection for progress. |
| Intel | No | We agree with LG and we do not think such enhancement is needed compared to NR-U, as it is unjustified.  |
| vivo | Yes | We suggest to add another FFS: FFS whether the UE only uses the selected CPE starting position or later CPE starting position(s) than the selected one.One case is that, if 2 symbol used for CEP, 1 symbol in prior PSSCH and 1 gap symbol. If UE determines to use the 1 st CPE starting position based on TB priority, this CPE is overlapped with prior slot, then there is high probability for the UE to fail the channel access. In this case, we should allow smart UE implementation to select a later CPE confined within the gap for channel access.Another case is that, if UE failed channel access using the selected CPE, UE tries a later CPE again for channel access based on deferred LBT rule.  |
| CMCC | Yes |  |

**Question 3-6 (I):**

Please provide your view on

* whether a CPE or PSSCH should be transmitted in the GP symbol(s) between the slots in MCSt?
* how to resolve inter-UE blocking if a 16µs transmission gap is always applied (especially when SCS = 15kHz).

Note, this discussion is not intended for the GP symbol just before the start of a MCSt.

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| --- | --- |
| **Company** | **Comments** |
| OPPO | When one UE is transmitting MCSt in a RB set, it should be allowed for others to access the channel and transmit in the same slot(s) in a FDM manner. This is not possible if PSSCH is transmitted in the GP symbol(s), causing inter-UE blocking. Therefore, CPE should be transmitted instead of PSSCH (rate matching).It is desirable to always apply a 16us transmission gap between the slots in MCSt. In 30kHz and 60kHz SCSs, since the GP symbol is always smaller than the additional LBT sensing duration in Type 1 channel access procedures, a UE can never successfully complete the additional LBT sensing if there is a SL transmission in the preceding symbols (regardless of the CPE starting symbol). But in 15kHz, Type 1 UE will have to take a hit when there is an on-going MCSt transmission. We are open to good solutions. |
| DCM | Even for MCSt, the signal structure should be the same as normal TX. Longer TX for MCSt degrades FDM performance in SL. |
| LGE | For the 1st question, our answer is yes. For the 2nd question, when we design CPE starting position, if there is no CPE starting position making the transmission gap less than 16us, there is no inter-UE blocking issue at least for the MCSt. According to TS 37.213, at least for DL or UL transmission burst, the transmission gap between transmission within the burst is no greater than 16us, and then the gNB or UE can skip sensing in the middle of the TX burst, and there is no restriction on the TX duration as in Type 2C.

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| TS 37.213 Section 4.0- A *DL transmission burst* is defined as a set of transmissions from an eNB/gNB without any gaps greater than . Transmissions from an eNB/gNB separated by a gap of more than are considered as separate DL transmission bursts. An eNB/gNB can transmit transmission(s) after a gap within a *DL transmission burst* without sensing the corresponding channel(s) for availability.- A *UL transmission burst* is defined as a set of transmissions from a UE without any gaps greater than . Transmissions from a UE separated by a gap of more than 16s are considered as separate UL transmission bursts. A UE can transmit transmission(s) after a gap within a *UL transmission burs*t without sensing the corresponding channel(s) for availability. |

With the above assumption, the UE will not perform sensing for the transmission in the middle of MCSt, so UE will not drop the transmissions of MCSt.  |
| InterDigital | We think CPE to be used in the GP symbol(s) between the slots in MCSt.  |
| NOKIA, Nokia Shanghai Bell | RAN1 can define rules for determining whether GP should be disabled or enabled (i.e., applying a transmission gap in the GP symbol) during a MCSt of a Tx UE, e.g., depending on whether it expects other SL UE transmission allocations overlapping in time with its MCSt allocation. If there is no other transmission expected to be FDMed with the MCSt of the Tx UE the GP can be disabled. Otherwise, if there is a resource reservation of another UE which overlaps in time with an allocation of its MCSt, the Tx UE should enable the GP on the MCSt slot prior to detected reserved resource. When the Tx UE enables the GP, it may enable a partial GP filling (i.e. only stop its transmission in a fraction of the GP symbol in order to achieve a certain gap duration, then it can start CPE for the upcoming slot), in order to reduce the possibility of losing the COT while allowing other SL-U UE to access the channel simultaneously, e.g. with Type 2A/2B LBT, for FDMed transmissions. It can also be defined that GP can be enabled to facilitate FDM for SL-U Ues, in case there is no other RAT using the channel, as there is less risk to lose the COT in the middle of a MCSt. |
| Ericsson | PSSCH should be used.If MCSt is used, there is no gap between transmissions. There will be inter-UE blocking, but this should not be a problem. A UE transmitting MCSt will have a large TBS and it should select many sub-channels. So blocking is beneficial because it avoids collisions by others. Once the UE grabs the channel, it transmits. |
| Lenovo | For MCSt, there should be no gap symbol between two contiguous transmissions so that the spectrum efficiency can be improved and the risk of losing the channel is avoided. |
| Apple | For 1st bullet, when PSSCH transmission in gap symbol, this means UE will transmit continuously in MCSt, and TB match to the last symbol of each slot other than the last slot of MCSt? For 2nd bullet, CPE should allow 25us gap, to enable FDM transmission for each slot with MCSt.  |
| CableLabs | There are 2 questions asked here. Concerning GP used for MCSt: due to the GP length, the GP can’t be part of a COT spanning multiple slot. |
| QC | On the first bullet, MCSt requires gaps smaller or equal than 16 us. That is: we need the short gap for a UE to keep transmitting, o.w. the COT is lost. It is our view that currently the behavior of a UE stopping TX, and resuming via a Type 2A LBT is not supported. Therefore we propose to allow use of CPE and PSSCH rate matching to fill the gap (at least partially in the case of CPE) in symbol 13.The discussion of how to allow other transmissions to FDM if a UE is doing an MCSt, this topic has no evident easy solution. When a UE1 is doing MCSt for PSSCH, it might be difficult for a UE2 to FDM during UE1’s MCSt. For PSFCH and S-SSB concurrent transmissions to UE1 can be discussed. |
| Intel | For better spectral efficiency, PSSCH should be used. As per MCSt in FDM, we agree with Ericsson comments: as a UE transmitting in MCSt may have a large TB to transmit this would be likely associated many sub-channels, and therefore blocking may be indeed beneficial to avoid collisions . |
| vivo | Transmitting PSSCH in the GP is beneficial for resource efficiency, RAN1 can consider to optimize this feature for the case when RX UE can identify the MCSt. Regarding how to resolve inter-UE blocking, our preference is not to optimize the inter-UE blocking issue for MCSt case. |
| CMCC | PSSCH should be transmitted in the GP symbol(s).We do not think the Rx UE need to switch to perform transmission before the end of MCSt if it has decided to receive the TB(s) transmitted by Tx UE; and for how to achieve FDM b/w UEs, UE can prioritize select the resource which is FDMed with other UE’s reservation, which is the first slot of potentially transmitted MCSt. |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #4: Contention window (CW) adjustment

**Background**:

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| **Agreement*** CW adjustment
	+ NR-U DL CW adjustment mechanism is used as the baseline for SL-U when SL-HARQ feedback is enabled in SCI for unicast
		- FFS any necessary update for SL-U operation
	+ FFS: how to determine CW size when SL-HARQ feedback is disabled in SCI
	+ FFS the case of groupcast option 1 (NACK-only) and groupcast option 2

**Agreement*** RAN1 is to study the definition of a “SL reference duration” following the NR-U principle and RAN1 is to agree on the definition before down-selection to an option for CW adjustment for SL HARQ-ACK feedback enabled/disabled and each cast type
* In Type 1 SL channel access procedure, further study the following cases and options. Other options are not precluded.
	+ CW adjustment when SL-HARQ feedback is disabled (at least if all transmissions within the latest SL reference duration have SL-HARQ feedback disabled):
		- Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- Option 2: CW is adjusted according to number blind retransmissions of the TBs within a COT.
		- Option 3: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported for SL-U
		- Option 4: If a is consecutively used times for generation of , is updated for each priority class to the next higher allowed value.
		- Option 5: If a collision indicator is received, increase for every priority class to the next higher allowed value.
	+ CW adjustment for groupcast option 2 with SL-HARQ feedback enabled (at least In case only groupcast option 2 PSSCH(s) is (are) transmitted within the latest SL reference duration):
		- Option 1: Based on a (pre-)configurable ratio of received SL HARQ-ACK feedbacks in the latest SL reference duration, is reset to for every priority class , otherwise increase for every priority class to the next higher allowed value.
			* FFS: whether the ratio of the received SL HARQ-ACK feedbacks is ‘ACK’, ‘NACK’ or ‘ACK+NACK’
			* FFS: how to calculate the ratio
			* FFS: the (pre-)configuration ratio values
		- Option 2: If at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class ; otherwise is increased.
	+ FFS whether groupcast option 1 (NACK-only) with SL-HARQ feedback enabled can be supported for SL-U. If supported, further study the following options (at least if all transmissions within the latest SL reference duration are groupcast option 1 transmissions)
		- Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- Option 2:
			* If ‘NACK’ or a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration, increase for every priority class to the next higher allowed value.
			* When neither ‘NACK’ nor a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration,
				+ Option A: is reset to for every priority class .
				+ Option B: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- Option 3: An ACK-only procedure is used instead of a NACK-only procedure. In this case, if at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class , otherwise is increased
		- Option 4: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported for SL-U
		- Option 5 (option 3+legacy): ACK feedback is performed when a TB is successfully decoded in addition to the legacy NACK-only procedure. In this case, if ACK only is received related to any transmissions within the latest SL reference duration then ,  otherwise is increased.
	+ CW adjustment for unicast with SL-HARQ feedback enabled (at least in case only unicast PSSCH(s) is (are) transmitted within the latest SL reference duration):
		- Option 2: If at least one ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class ; otherwise is increased.
* FFS the case when UE is operating with different SL-HARQ feedback schemes (e.g., UE has concurrent broadcast transmission + unicast with SL-HARQ enabled, or GC option 1 + GC option 2, etc in the SL reference duration).

**Agreement*** SL reference duration is defined as a duration corresponding to a channel occupancy initiated by the UE including transmission of PSSCH(s), starting from the beginning of the channel occupancy initiated by the UE including transmission of PSSCH(s), until either (one option to be selected later):
	+ Option 1a:
		- the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted
		- Note, SL reference duration is not used if PSSCH with ACK/NACK HARQ-ACK enabled cannot be found in the latest COT
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed
	+ Option 1b:
		- the end of the first slot where at least one PSSCH with HARQ-ACK enabled is transmitted
		- Note, SL reference duration is not used if PSSCH with HARQ-ACK enabled cannot be found in the latest COT
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed
	+ Option 2a:
		- the end of the first slot where at least one PSSCH with HARQ-ACK enabled if it is transmitted, otherwise until the end of the channel occupancy
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed
	+ Option 2b:
		- the end of the first slot where at least one PSSCH with HARQ-ACK enabled if it is transmitted, otherwise until the time when UE updates the CW
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed

**Agreement*** If , the next higher allowed value for adjusting is .
* If the is consecutively used times for generation of , is reset to only for that priority class for which is consecutively used times for generation of . is selected by UE from the set of values {1, 2, …,8} for each priority class .

**Agreement**The end timing for the definition of reference duration in the contention window adjustment procedure for SL-U is defined as follows:* Option 1a
	+ the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted
	+ Note, SL reference duration is not used if PSSCH with ACK/NACK HARQ-ACK enabled cannot be found in the latest COT
	+ FFS: Whether to support another ending timing is FFS, e.g. for MCSt if needed
	+ Whether/how to adjust CWS for groupcast option 1 NACK-only case and whether/how to define reference duration for groupcast option 1 NACK-only case can still be discussed
 |

* whether/how to define reference duration for groupcast option 1 NACK-only case

In the last RAN1#112 meeting in Athens, RAN1 made an agreement on the definition of reference duration specifically targets ACK/NACK HARQ-ACK enabled case only. That is, for the case of NACK-only, it was excluded. But leaving the option open to further discussion if there is a strong need/essentiality due to adjustment for groupcast option 1 NACK-only case.

Based on the Tdoc review this time, more companies think there is no need to define / modify the existing reference duration definition for the groupcast option 1 NACK-only case. Only two companies preferred to have a new reference duration definition. In most Tdocs, there was no opinion expressed, and the FL thinks this issue are not important for them. Therefore, the FL will not pursue with any proposal/question on this FFS issue.

* Whether the reference duration ending time needs to change for the case of MCSt

Based on the submitted contribution in this meeting, it seems there is some preference from 9 companies who think the existing reference duration definition could be updated to accommodate the case of MCSt. Some think it can be updated in the same manner as adopted in NR-U for the transmission burst. Therefore, the FL proposes in the following Proposal 4-1 below accordingly.

* CW adjustment for unicast with SL-HARQ feedback enabled during the reference duration

From reviewing the contributions, all companies proposed / are fine to go with Option 2 from the previous agreement. Therefore, the FL proposes accordingly in the following Proposal 4-2 below (reusing existing NR-U spec description as much as possible).

* CW adjustment when SL-HARQ feedback is not available for all SL transmission(s) during the latest COT

From reviewing the contributions, for the case of explicit HARQ-ACK feedback is not associated with SL transmission, CW adjustment option 1 and option 3 have the most support. Therefore, these two options are down-selected firstly. Please indicate your preference between these two options in the following Question 4-3 below.

* CW adjustment for groupcast option 2 (ACK/NACK feedback) during the reference duration

From reviewing the contributions, for the case of SL groupcast option 2, CW adjustment option 1 and option 2 have the most support. Therefore, these two options are down-selected firstly. Please indicate your preference between these two options in the following Question 4-4 below.

* CW adjustment groupcast option 1 during the latest COT

When discussing CW adjustment options for groupcast option 1, at that time, it was assumed that there will be a reference duration for this SL-HARQ feedback option. According to the reference duration definition agreed from the last two meeting and lack of contributions in this meeting to introduce a reference duration for it, it seems we need to re-discuss / further study the CW adjustment options for groupcast option 1. To this end, let’s take the 5 options as a starting point and make necessary updates to them. Please express your view(s) on how to modify the CW adjustment option(s) that you prefer. E.g., if you are only interested in Option 2 and 3, you only need to propose changes for these options. In the end, for option(s) that requires changes but no one propose any modification for it, I will consider it is eliminated. Please expressed your views for Question 4-5 below.

* Any change necessary to the reference duration definition to take care of the case when partial slot transmission is in the first slot of a COT, where it could be a high chance/probability that this partial slot transmission is a NACK

It is brought up in [30] that if PSSCH is transmitted in a partial slot (i.e., from the 2nd starting symbol), due to the same TBS and a smaller number of available SL symbols are used, there is a higher chance that the RX UE will report a NACK. Since this is not a typical SL transmission and thus should be excluded from the CW adjustment procedure as such. FL would like to gather more views/opinions on this issue from others. Please indicate in Question 4-6 below whether a PSSCH transmission from the 2nd starting symbol should be excluded from the definition of reference duration if a such transmission occurs in the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted in a channel occupancy initiated by the UE.

### FL Proposal for round 1 discussion

**Proposal 4-1 (I):**

* The existing SL reference duration definition is updated according to the following to accommodate the case of MCSt.
	+ SL reference duration is defined as a duration corresponding to a channel occupancy initiated by the UE including transmission of PSSCH(s), starting from the beginning of the channel occupancy initiated by the UE including transmission of PSSCH(s), until the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted, or until the end of the first MCSt transmission by the UE that contains PSSCH with ACK/NACK HARQ-ACK enabled, whichever occurs earlier.
		- Note, SL reference duration is not used if PSSCH with ACK/NACK HARQ-ACK enabled cannot be found in the latest COT

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | NO | MCSt should be treated as separate multiple TXs. No need to use ‘MCSt’ for any definition.  |
| LGE | No | It is redundant because the SL MCSt is not within a slot, and then “the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted” always occurs earlier than “the end of the first MCSt transmission by the UE that contains PSSCH with ACK/NACK HARQ-ACK enabled”. If we remover “whichever occurs earlier”, then the redundant issue will be resolved. However, since the UE may need to wait the corresponding SL HARQ-ACK feedback to determine the contention window size, the Type 1 channel access procedure at the UE side could be also delayed. It will results that the UE fails to access the channel before its own transmission due to the lack of time for LBT operation. In this point of view, it is not preferable to further delay the ending time of the reference duration for CWS adjustment. |
| NOKIA, Nokia Shanghai Bell | Yes |  |
| Ericsson | No | The first slot seems enough. There is no need to introduce optimizations with respect to NR-U. |
| Lenovo | Yes |  |
| Apple | No | For MCSt, the difference is referring to a full slot when the 1st transmission starting symbol is not the 1st symbol. If multi-slot transmission is enabled, reference duration is from the starting point until the 1st full slot where PSSCH transmission happens, or burst end, whichever comes first (i.e., only partial slot transmission happens).  |
| CableLabs | No | Same view as LGE |
| QC | Yes, with mods | We follow up to Apple comment, since we have a similar view.We believe there is a case for extension to “end of MCSt” (same as burst end), that is the case where the first transmission is a partial-slot TX (starting from 2nd starting symbol). In case TBS is determined according to a large number of symbols that TX may be prone to failure (and lead to unnecessary CW double). To remove the redundancy and capture this case we propose the following wording:* The existing SL reference duration definition is updated according to the following ~~to accommodate the case of MCSt~~.
	+ SL reference duration is defined as a duration corresponding to ~~a~~ the latest channel occupancy initiated by the UE including transmission of PSSCH(s), starting from the beginning of the channel occupancy ~~initiated by the UE including transmission of PSSCH(s)~~, until the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted from the 1st starting symbol, or until the end of the first MCSt transmission by the UE that contains at least one PSSCH with ACK/NACK HARQ-ACK enabled transmitted from the 1st starting position, whichever occurs earlier.
		- Note, SL reference duration is not used if PSSCH with ACK/NACK HARQ-ACK enabled cannot be found in the latest COT
 |
| Intel | Yes | In addition with comments already provided by other companies, we would like to highlight to companies opposing to this proposal that this exactly reflects the NR-U behaviour with the distinction that we are now using different terminologies: burst -> MCSt. |
| vivo | no | We think the first MCSt transmission contains PSSCH with A/N is the same as the PSSCH with A/N in the first slot. No need to update the agreement. |
| CMCC | No | We share the same view with LGE, we are also not clear about why we need to further delay the ending time of the reference duration. |

**Proposal 4-2 (I):**

* The ACK/NACK HARQ-ACK feedback corresponding to the PSSCH (for SL unicast) in the reference duration for the latest SL channel occupancy for which ACK/NACK HARQ-ACK feedback is available is used as follows:
	+ If ‘ACK’ is received, for each priority class , ; otherwise is increased to the next allowed value.

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | OK | (Our understanding is that this was already agreed..) |
| LGE | Yes with modification. | We prefer to reuse the same description of TS 37.213. In other words, “each” needs to be replaced with “every”.

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| TS 37.213 Section 4.1.4.24) Increase for every priority class to the next higher allowed value.5) For every priority class *,* maintain as it is; go to step 2. |

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| InterDigital | Support |  |
| NOKIA, Nokia Shanghai Bell | Yes |  |
| Ericsson | Yes  |  |
| Lenovo | Yes | LG’s modification looks ok. |
| Apple | Support | Agree with LGE’s comment.  |
| CableLabs | Yes with modifications | Agree with LGE proposal |
| QC | Yes with mods | “If at least one 'ACK' is received”Also agree with LGE suggestion. |
| Intel | Yes | Also OK with LG’s modification. |
| Vivo | Yes |  |
| CMCC | Yes |  |

**Question 4-3 (I):**

* If a UE performs SL transmission using Type 1 channel access procedures associated with the channel access priority class on a channel and the SL transmission is not associated with explicit HARQ-ACK feedback by the corresponding UE(s), please indicate which one of the following options is preferred for the CW adjustment.
	+ Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
	+ Option 3: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported for SL-U.

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| **Company** | **Option 1 or 3** | **Comments** |
| OPPO | Option 1 |  |
| DCM | Option 1 |  |
| LGE | Option 1 | In NR-U, any measurement-based CWS adjustments was not considered.  |
| InterDigital |  | We are fine with both options |
| NOKIA, Nokia Shanghai Bell | Option 1 |  |
| Ericsson | Option 1 | The use of SL transmissions without HARQ-ACK should be avoided except for S-SSB, etc. |
| Lenovo | Option 3Also see suggested modification to Option 1. | We cannot accept any solution that would allow the indefinite use of the latest value such as Option 1.We can support a modified Option 1 as a compromise, if necessary:Option 1a: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class . After using the latest for *K = {1,2,4}* times, is increased to the next higher allowed value. |
| Apple | Option 1 |  |
| CableLabs | Option 1 | Per 37.213 specs |
| QC | Option 1 |  |
| Intel | Option 1 |  |
| Vivo | Option 1 |  |
| CMCC | Option 1 |  |

**Question 4-4 (I):**

* The ACK/NACK HARQ-ACK feedback corresponding to the PSSCH (for SL groupcast option 2) in the reference duration for the latest SL channel occupancy for which ACK/NACK HARQ-ACK feedback is available is used according to one of the follows:
	+ Option 1: Based on a (pre-)configurable ratio of received SL HARQ-ACK feedbacks in the latest SL reference duration, is reset to for every priority class , otherwise increase for every priority class to the next higher allowed value.
		- FFS: whether the ratio of the received SL HARQ-ACK feedbacks is ‘ACK’, ‘NACK’ or ‘ACK+NACK’
		- FFS: how to calculate the ratio
		- FFS: the (pre-)configuration ratio values
	+ Option 2: If at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class ; otherwise is increased.

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| **Company** | **Option 1 or 2** | **Comments** |
| OPPO | Option 1 |  |
| DCM |  | If Option 1 includes (pre-)configurability of 100% ACK RX, we are fine with the Option 1. |
| LGE | Option 2 | For compromise, it can be considered that the Option 2 is default behaviour for the case when no ratio is (pre)configured.If the ratio is (pre)configured, Option 1 is used. Moreover, to cover the case where CWS is reset only if the TX UE receives ACK from all the RX UEs, the ratio value can be 100%.  |
| InterDigital | Option 2 |  |
| NOKIA, Nokia Shanghai Bell | Option 2 |  |
| Ericsson | Option 2 |  |
| Lenovo | Option 1 |  |
| Apple |  | We can support either option 1 or option 2.  |
| CableLabs | Option 2 |  |
| QC | Option 2 | Support LGE suggestion |
| Intel | Option 2 | As option 1 will fragment the design, and may prioritize groupcast option 2 transmissions over unicast transmissions depending on how the ratio is pre-configured. |
| Vivo | Option 1 | Option 1 can reflect the channel condition more precise than option 2. |
| CMCC | Option 2 |  |

**Question 4-5 (I):**

* CW adjustment for groupcast option 1, please indicate how to modify your preferred option(s) below to be in line with the fact that the latest definition of reference duration does not consider groupcast option 1 (NACK-only feedback).
	+ Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
	+ Option 2:
		- If ‘NACK’ or a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration, increase for every priority class to the next higher allowed value.
		- When neither ‘NACK’ nor a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration,
			* Option A: is reset to for every priority class .
			* Option B: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
	+ Option 3: An ACK-only procedure is used instead of a NACK-only procedure. In this case, if at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class , otherwise is increased
	+ Option 4: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported for SL-U
	+ Option 5 (option 3+legacy): ACK feedback is performed when a TB is successfully decoded in addition to the legacy NACK-only procedure. In this case, if ACK only is received related to any transmissions within the latest SL reference duration then ,  otherwise is increased.

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| **Company** | **Comments** |
| OPPO | Option 1 (no modification is required) |
| DCM | Support Option 1 as it is. |
| LGE | Option 2 with Option A is supported. What is the UE behaviour, when the UE receives NACK for its unicast PSSCH transmission within a reference duration? The answer is that the UE will increase its CWS since it is part of the case when the UE does not receives the explicit ACK. In case of GC option 1, at least explicit NACK is supported. Then, it is consistent that UE increases CWS if the UE receives NACK for the groupcast PSSCH with HARQ-ACK feedback option 1. Unlike unicast, in groupcast HARQ-ACK feedback option 1, since the absence of PSFCH can include ACK or DTX, Option B would be conservative approach. If we support Option 2, then the reference duration also needs to be updated to include the PSSCH with GC option 1.  |
| Lenovo | We can support Option 4 and a modified Option 1:Option 1a: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class . After using the latest for *K = {1,2,4}* times, is increased to the next higher allowed value. |
| Apple | Option 1.  |
| CableLabs | Option 2 coupled with the subsequent Option A |
| QC | Option 1. There still seems to be no good way to assess channel conditions when only GC option 1 PSSCH(s) are transmitted over a COT, and we suggest that RAN1 does not optimize for this case. |
| Intel | We actually do not think that groupcast option 1 transmissions may be proper for unlicensed design unless some fundamental changes are made since all the options above would not properly reflect the congestion level due to the fact that an LB failure may be reflected as a ‘ACK’. For this reason, we think that groupcast option 1 may not be allowed. If RAN1 consider this as an essential component of the design, we are OK to compromise with option 1 or option 1a as proposed by Lenovo. |
| vivo | Option 1 or option 2 can be further discussed. option 3/5 incur large spec. effort w/o strong motivation. |
| CMCC | Option 1 |

**Question 4-6 (I):**

* Do you think it is necessary to modify / update the existing reference duration definition to exclude / not consider a PSSCH transmission from the 2nd starting symbol if such transmission is the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted in a channel occupancy initiated by the UE?

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| **Company** | **Yes / No** | **Comments** |
| OPPO |  | This is not an essential issue in our view.  |
| DCM | NO | TX UE can determine MCS/TBS to solve the concern. |
| LGE | No | It is still open that the TX UE selects low MCS conservatively for the case when the PSSCH starts from the 2nd starting symbol. As mentioned before, delaying the CWS determination will delay the Type 1 channel access procedure, and it is not preferable.  |
| NOKIA, Nokia Shanghai Bell | No |  |
| Lenovo | Postpone | The answer is dependent on the TBS determination. It can be discussed after the conclusion of TBS determination. |
| Apple | Yes | See comments related to proposal 4-1.  |
| CableLabs | No |  |
| QC | Yes | Our reasoning is tied to the one in Proposal 4-1, we briefly repeat here, please check the reply to Proposal 4-1 for the proposed updated wording:We believe there is a case for extension to “end of MCSt”, that is the case where the first transmission is a partial-slot TX (starting from 2nd starting symbol). In case TBS is determined according to a large number of symbols that TX may be prone to failure (and lead to unnecessary CW double). That is, we need to revise the reference duration definition to capture this. |
| Intel | No | We also agree that this is not an essential component. |
| vivo |  | In NR-U, the transmission on all the allocated symbol is considered in the reference duration. Similar description can be used for SL. The *reference duration* corresponding to a channel occupancy initiated by the UE including transmission of PUSCH(s) is defined in this clause as a duration starting from the beginning of the channel occupancy until the end of the first slot where at least one PUSCH is transmitted over all the resources allocated for the PUSCH, or until the end of the first transmission burst by the UE that contains PUSCH(s) transmitted over all the resources allocated for the PUSCH, whichever occurs earlier. If the channel occupancy includes a PUSCH, but it does not include any PUSCH transmitted over all the resources allocated for that PUSCH, then, the duration of the first transmission burst by the UE within the channel occupancy that contains PUSCH(s) is the *reference duration* for CWS adjustment. |
| CMCC | No |  |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #5: UE-to-UE COT sharing

**Background**:

|  |
| --- |
| **Agreement*** UE-to-UE COT sharing is supported in NR sidelink operation in a shared channel (SL-U).
	+ FFS applicable SL channels and signals (e.g., PSCCH/PSSCH, PSFCH, S-SSB) for shared COT access and any restrictions (e.g. whether the COT can be shared with a single UE or multiple UEs)
	+ FFS all other details in compliance with the regulatory requirements

**Agreement*** For UE-to-UE COT sharing, continue considering the following alternatives:
	+ Alt. 1: A responding SL UE can utilize a COT shared by a COT initiating UE when the responding SL UE is a target receiver of the at least COT initiating UE’s PSSCH data transmission in the COT.
		- When the responding UE uses the shared COT for its transmission has an equal or smaller CAPC value than the CAPC value indicated in a shared COT information
		- FFS any additional conditions
	+ Alt. 2: A responding SL UE can utilize a COT shared by a COT initiating UE when the responding SL UE is a target receiver of the COT initiating UE’s transmission in the COT.
		- When the responding UE uses the shared COT for its transmission has an equal or smaller CAPC value than the CAPC value indicated in a shared COT information
		- FFS how to determine a SL UE is a target receiver
		- FFS: details of the channel type of the COT initiating UE’s transmission
		- FFS any additional conditions
	+ For Alt1 and Alt2: When a responding UE uses a shared COT for its transmission(s), the COT initiating UE is a target receiver of the responding UE’s transmission(s).
		- FFS: details of the channel type of the responding UE’s transmission(s)
* gNB relaying/forwarding a UE initiated COT to another UE is not supported in Rel-18
* FFS whether a Mode 1 UE can report a COT or related information to gNB for aiding Mode 1 RA

**Agreement**For UE-to-UE COT sharing,* When performing S-SSB transmission(s), a responding UE can utilize a COT shared by a COT initiating UE (using type 1 channel access) when the responding UE is intended to transmit S-SSB within RB set(s) corresponding to the shared COT.
* When performing PSFCH transmission(s), a responding UE can utilize a COT shared by a COT initiating UE at least when at least one of the responding UE’s PSFCH transmissions in a symbol/slot within RB set(s) corresponding to the shared COT is intended for the COT initiating UE.
	+ FFS: whether a responding UE can transmit PSFCH(s) to UE(s) other than the initiator
* When performing PSSCH/PSCCH transmission(s), a responding UE can utilize a COT shared by a COT initiating UE at least when the responding UE’s PSSCH/PSCCH transmission(s) within RB set(s) corresponding to the shared COT is intended for the COT initiating UE
	+ FFS whether to support the case if a responding UE transmits PSSCH/PSCCH to destination ID other than the source ID of the COT initiating transmission, where the destination ID of the responding UE’s PSSCH/PSCCH transmission(s) can be different from the source/destination IDs of COT initiating UE’s PSSCH/PSCCH transmission when sharing the COT information.
		- FFS: how to determine / what are the restrictions to the destination ID of the responding UE’s PSSCH/PSCCH transmission(s) to utilize the COT shared by the initiating UE.
		- FFS whether the responding UE can utilize the COT when at least the responding UE’s PSCCH transmission in the reserved resources within the shared COT or MCSt is intended for the COT initiating UE and what are the restrictions (e.g., priority, etc.) and indication to the responding UE.
* FFS: UE forwarding/relaying information about a COT initiated by another UE.

**Agreement*** A responding UE over a shared COT can be:
	+ a receiving UE, which is the target of a PSCCH/PSSCH transmission of a COT initiator
		- In the case of unicast from the COT initiator, within the same COT when the source and destination IDs contained in the COT initiator’s SCI match to the corresponding destination and source IDs relating to the same unicast at the receiving UE
		- In the case of groupcast and broadcast, when the destination ID contained in the COT initiator’s SCI match to a destination ID known at the receiving UE
	+ a UE identified by ID(s), if additional IDs are supported in the COT sharing information (in addition to the source and destination IDs of the PSCCH/PSSCH transmission), when additional IDs are included in the COT sharing information from the COT initiator
		- FFS Limitations on what additional IDs may be included and how they may be indicated

**Agreement**A responding UE’s SL transmission(s) within RB set(s) corresponding to a shared COT can be transmitted when the CAPC value(s) of the SL transmission(s) have an equal or smaller CAPC value than the CAPC value indicated in the COT sharing information.**Agreement**A responding UE’s PSSCH/PSCCH transmission(s) within RB set(s) corresponding to a shared COT is intended for the COT initiating UE when,* In the case of unicast from the responding UE, when the source and destination IDs contained in the responding UE’s PSCCH/PSSCH match to the destination and source IDs from a COT initiator’s unicast transmission that included COT sharing information, or match to the additional ID(s) included in the COT sharing information (if supported)
* In the case of groupcast or broadcast from the responding UE, when the destination ID contained in the responding UE’s PSCCH/PSSCH matches to the destination ID from a COT initiator’s groupcast or broadcast transmission that included COT sharing information, or matches to the additional ID(s) included in the COT sharing information (if supported)
* FFS: all other details and additional restrictions
 |

* UE forwarding / relaying a COT shared by another UE

There is an overwhelming majority still has the opinion that a UE (even a responding UE) cannot forward / relay COT sharing information from the COT initiating UE. This may even violet regional regulations relating to COT sharing. FL proposes to close this FFS issue in this meeting with the following Proposal 5-1.

* PSFCH (Proposal 8-3)

In RAN1#112 meeting, a proposal 8-3 was made by FL to support the case where “**a responding UE’s PSFCH transmission(s) within RB set(s) corresponding to a shared COT can be transmitted to UEs other than the COT initiator without requiring that at least one of PSFCH transmissions is intended for the COT initiator**”. The main motivations were [4, 6]:

* More transmissions ensuring continuity of transmissions over the COT (e.g., the initiator may lose the COT due to large gap if there is a slot in the COT with PSFCH symbols and the initiator neither expects to receive PSFCH nor has a PSFCH to transmit).
* More chances to deliver HARQ feedback for all UEs (a UE that wants to transmit a PSFCH to another UE (not an COT initiator UE) may not be able to complete Type 1 channel access procedure within the gap in symbol #10 but it is in proximity of a COT initiator UE). Even it is able to complete the Type 1 LBT, the additional LBT sensing length would be different to other UEs who are sharing the COT. In this case, they would have different CPE starting position and cause blocking to Type 1 LBT UEs. Subsequently, more SL retransmissions are needed and increase system load, channel occupancy and traffic congestion.
* There won’t be any damage in terms of collision if we allow more UEs to send PSFCH.
* As per regulation, only the responding UE receiving the grant from the COT initiating UE can use a shared resource for its transmission, thus for the case PSFCH transmitted within shared COT, only the resource indicated by COT initiating UE, the shared UE can use the resource for PSFCH transmission. However, there should be no limitation that at least one responding UE’s PSFCH transmissions should be intended for the COT initiating UE. Based on the regulation, any UE can share the COT once a grant is received from COT initiating UE.

Based on reviewing the contributions submitted to this meeting, there is a very clear majority who want to support this feature. Therefore, FL is proposing accordingly in Proposal 5-2 below.

* Additional ID(s)

The usage and benefits of supporting additional ID(s) are extensive discussed in the last RAN1#112 meeting and in the submitted contributions this time. The main benefits at least to FL’s understanding include 1) allowing more SL UEs to access the channel and utilize the resources within the COT duration which will anywhere be used for SL transmissions; 2) to improve resource usage efficiency and reduced system load/congestions due to less UEs performing Type 1 channel access; 3) the additional ID(s) are intended for the COT initiating UE as such it does not violet the regulations.

Based on Tdoc review summary provided in Section 4.6, there is a very clear majority who wants to / can accept to introduce the additional ID(s) as part of the COT sharing information from the COT initiator UE. There was one concern on the payload for this additional ID(s) field, especially when it is carried in SCI (which is the majority preference for the COT sharing container). So, FL proposes to support the inclusion of the additional ID(s) as part of the COT sharing information from the COT initiator UE and FFS on the number of additional ID(s) / payload size and the container.

* Contents of COT sharing information

Based on the submitted contributions in this meeting (the same has been observed over the last few meeting), the following contents of COT sharing information are supported by majority of companies. Therefore, FL proposes to include at least these information fields and FFS others.

* COT length (remaining COT duration)
* Existing L1 source and destination IDs
* CAPC level
* Sensed RB sets
* Container for COT sharing information

As for the container to carry the COT sharing information, according to submitted contributions, all companies think SCI (1st and/or 2nd stage) should be used. Given the above discussion on the payload for the additional ID(s), FL proposes to FFS whether MAC CE could be additionally used to carry some COT sharing information (e.g., additional ID(s)).

### FL Proposal for round 1 discussion

**Proposal 5-1 (I):**

* UE forwarding/relaying information relating to a COT initiated by another UE is not supported in Rel-18.

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| --- | --- | --- |
| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | YES |  |
| LGE |  | UE forwarding/relaying information related to COT sharing is not supported |
| InterDigital | Support | We support the proposal (not to support UE forwarding the information related to a shared COT) |
| NOKIA, Nokia Shanghai Bell | Yes |  |
| Ericsson | Support |  |
| Lenovo | Yes | We don’t see COT forwarding as a fundamental feature in Rel-18. |
| Apple | Support |  |
| CableLabs | Yes | Since the proposal is backed by a negation and to avoid any misunderstanding: UE to UE COT forwarding is not supported in Rel 18 |
| QC | Yes | We support the FL proposal (forwarding is NOT supported) |
| Intel | No | As the SL UEs suffer half-duplexing issue, we believe that the responding devices able to decode the COT sharing information could also redundantly provide some information about the shared COT information. In fact, considering that the group of beneficiaries of a shared COT is quite limited, and the COT sharing information may be transmitted by the initiating device in the first symbols of the COT, it may be possible that some UEs may miss this information due to half-duplexing, which may lead to unutilized resources, and increased congestion either among SL UEs or incumbent technology. As we also believe that the shared COT information may need to be indicated in stage 1st stage SCI as this is a time sensitive information, if this is not provided by all UEs regardless of whether they are initiating or responding UEs, this may increase complexity at the RX since blind decoding may be required as effectively a UE may expect two SCI types with different payload in 1st stage. For this reason, we may prefer to conclude on this topic soon after we conclude on the detail of the container of the COT sharing information.  |
| Vivo | Agree  |  |
| CMCC | Yes |  |

**Proposal 5-2 (I):**

* A responding UE’s PSFCH transmission(s) within RB set(s) corresponding to a shared COT can be transmitted to UEs other than the COT initiator without requiring that at least one of PSFCH transmissions is intended for the COT initiator.

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| **Company** | **Support?** | **Comments** |
| OPPO | Support | For the same reasons cited in the background section. |
| DCM |  | If this is allowed from regulation perspective, we are fine with this proposal. |
| LGE | No | According to TS 37.213, the above proposal is not aligned with NR-U:

|  |
| --- |
| If a gNB shares a channel occupancy initiated by a UE using the channel access procedures described in clause 4.2.1.1 on a channel, the gNB may transmit a transmission that follows a UL transmission on scheduled resources or a PUSCH transmission on configured resources by the UE after a gap as follows:- The transmission shall contain transmission to the UE that initiated the channel occupancy and can include non-unicast and/or unicast transmissions where any unicast transmission that includes user plane data is only transmitted to the UE that initiated the channel occupancy.  |

In NR-U, double COT sharing which is that the node A utilize a COT initiated by node B for its transmission to node C is not supported. Moreover, with this understanding, we also does not support Proposal 5-1. However, this proposal 5-2 itself tries to support this **double COT sharing**. It should not be supported.  |
| InterDigital | Support | It can maximize the COT usage and it does not violate the regulation.  |
| NOKIA, Nokia Shanghai Bell | No | If there is no PSFCH towards COT initiator, the UE transmitting PSFCH needs to either perform Type 1 LBT or Type 2A LBT if SCSt channel access is supported for PSFCH. |
| Lenovo | Yes; see comment | (1) S-SSB transmission should be allowed for UEs regardless of whether the COT initiator is a recipient or not.(2) If periodic PSFCH is configured, the COT may be interrupted by the periodic PFSCH occasions. It is noted that the periodic PSFCH occasions may be used by a Rx UE to transmit PSFCH corresponding to PSSCHs transmitted by the COT initiator UE or other UEs other than the COT initiator UE (e.g., a UE sharing the COT for transmitting PSSCHs). Therefore, it is required that a responding UE can transmit periodic PSFCH(s) in a COT to UE(s) other than the COT initiator UE. |
| Apple  | No | Agree with LGE’s comments.  |
| CableLabs | No | For a few reasons:* Not clear what is the use case
* Perform Type 1 LBT

Not compliant with 37.213 |
| QC | Yes | Agree with FL background description |
| Intel | No | We believe that, as no regulatory constraints exist, within a shared COT a responding UE can indeed perform PSFCH and PSSCH/PSCCH meant to other devices. However, a responding device should transmit at least one transmission within a shared COT to the initiating device, as this is a condition necessary to ensure re-transmissions or PSFCH transmissions from other device rather than the initiating and responding device would be somewhat limited during a shared COT so that to limit potential blocking and interference.  |
| Vivo | No | We prefer to use the same principle for PSSCH and PSFCH COT sharing, i.e., at least one of PSFCH transmissions is intended for the COT initiator |
| CMCC | No | We agree with LGE’s comments. |

**Proposal 5-3 (I):**

* Additional ID(s) can be included as part of COT sharing information from the COT initiator UE.
	+ FFS the payload size / number of additional ID(s) can be included
	+ FFS the additional ID(s) are L1 ID(s) or layer 2 logical ID(s)
	+ FFS the container for the additional ID(s) (e.g., SCI or MAC CE)

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM |  | Before agreeing this proposal, usage of additional ID(s) should be clarified in detail. Even when a UE is not destination UE of the COT initiating UE’s TX, the first UE can use the COT if additional ID is matched? If YES, is this allowed in regulation? |
| LGE | No | To decide this, some clarification on the benefits is needed. It is necessary to check whether or how the COT initiator UE will know when the UE associated with the additional ID will have data to the COT initiator UE. If the COT initiator UE does not know this situation and the UE associated with the additional ID does not have data to the COT initiator UE, it just waste the SCI fields or transmission resources for indicating the additional ID. In this case, the additional ID is useless. The possibility that TX UE provide data to be transmitted to the RX UE is under the discussion in RAN2. Depending on the outcome of the discussion, the additional ID may or may not be needed.  |
| InterDigital | Support | Allowing COT sharing to a list of additional IDs sent by the COT initiator UE will increase the COT sharing efficiency. |
| NOKIA, Nokia Shanghai Bell | No | In our view, the benefit of supporting Additional IDs is not so clear, and the specification effort may be quite high.Firstly, in case additional IDs are added for identifying UEs which can use the COT, but do not have a transmission response towards the COT initiator, that should not be supported as it goes against the definition of “a responding UE” in regulations. Additionally, if additional IDs are only for restricting who can use a COT, such restriction can already be achieved by CAPC, i.e., only UEs with same or lower CAPC value can use the COT. Otherwise, there is no clear benefit of restricting a UE with higher priority transmission to use the COT. |
| Ericsson | No |  |
| Lenovo | Yes; see comment | (1) We think SLSS IDs (plus Iic) needs to be included to support S-SSB transmission in a shared COT.(2) Source ID and destination IDs are transmitted in every slot, which can be leveraged for the indicating the additional IDs , Hence the following mechanism can be investigated. * Support additional IDs transmission to the COT recipient in the same COT implicitly

For (2), we suggest to add the following to the proposal:* Further investigate the following: Implicit indication of additional ID, explicit indication of additional ID, truncated additional ID, logical ID

Whether transmitted as part of the COT sharing information or in every PSSCH/PSSCH in the channel occupancy duration  |
| Apple  | No | There are many issues with the additional ID: * The COT initiating UE does not know the traffic condition of other UEs, since there is no SR or BSR sent to the COT initiating UE.
* The additional ID are overhead in the SCI. But the UEs indicated by the additional ID may or may not transmit using the shared COT. Therefore, the benefit is not clear.
* There can be multiple COT initiating UEs (FDMed transmission). This will result in many UEs to share the COT, increasing collision probability.
* UEs with additional ID transmit with COT sharing might not meet regulation requirement.
 |
| CableLabs | No | No clear use case |
| QC | Yes | To DCM questions: Yes, per our understanding of past agreements and regulationsTo LGE “It is necessary to check whether or how the COT initiator UE will know when the UE associated with the additional ID will have data to the COT initiator UE”: in our view this is not necessary, the initiator UE can open the COT sharing to some other UEs (electing them as potential responders). Those UEs still to pass the ID check for their new transmission (needs to be towards the initiator). It is our understanding that using some bits in SCI to allow (not necessarily guarantee) cross-cast COT sharing is beneficial. On RAN2 engagement, our agreements should not depend on it, besides the responder having data for the initiator, the initiator could open up the shared COT region to more UEs to maximize the COT utilization. |
| Intel | No | While we understand that supporting additional IDs may allow a slightly better utilization of the shared COT, on the other hand this may require a very significant specification impact as this may require additional procedures to allow the initiating UE to properly select the group of UEs with who to share the COT without causing blocking and collisions across UEs.  |
| Vivo |  | Due to large overhead, we prefer not to support the additional ID. COT length is usually short, e.g., few ms. If the additional ID is included in MAC CE, then the COT may be passed after UE decoding the MAC CE. |
| CMCC | Yes with comments | Additional ID can be supported only when the additionally indicated responding UE’s transmission includes the initiating UE. |

**Proposal 5-4 (I):**

* Beside the additional ID(s), at least the following information should be included as part of COT sharing information from the COT initiator UE.
	+ CAPC level of the COT initiator UE’s PSCCH/PSSCH transmission
	+ Remaining COT duration (FFS it is an absolute time length in ms or in number of slots)
	+ Applicable RB set(s) for which the indicated COT can be used
	+ Existing / legacy R16/17 L1 source and destination IDs
	+ FFS other(s)

|  |  |  |
| --- | --- | --- |
| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | OK |  |
| LGE |  | The intention of the applicable RB set(s) seems that the COT initiator UE can partition its frequency resources; one is for its own transmission and the other is for COT sharing with others. In this case, on top of the remaining COT duration, the starting time of the shared COT also needs to be included. Otherwise, within a COT, COT initiator UE’s transmission can be collided with the COT responding UE’s transmission. If it is assumed that once the COT initiator UE shares its COT to another UE, then the COT initiator UE does not use remaining resources within the COT, neither the starting time of the shared COT nor applicable RB set(s) are needed.  |
| InterDigital | OK |  |
| NOKIA, Nokia Shanghai Bell | Yes, with edits | The part “Beside the additional ID(s),” should be removed from the proposal, as that should be discussed separately. |
| Ericsson | No |  |
| Lenovo | Yes | COT sharing information should indicate the starting slot and the number of shared slots as well as the remaining COT duration to enable identification whether a UE has been a recipient in a shared COT before the COT sharing information is transmitted.  |
| Apple | Support | Additional information related Tx power/CCA power used to acquire to COT. Related to EDT discussion in 3.1 |
| CableLabs | No |  |
| QC | Yes with mods. | As pointed by LGE, also in our understanding the start of a shared COT region should be added in COT-SI |
| Intel | OK with comments | As highlighted by Nokia, “Beside the additional ID(s),” should be removed from the proposal. |
| Vivo |  | In NR-U the COT duration and starting offset is used. To reuse NR-U design, starting offset for the COT sharing should be captured in the content. |
| CMCC | Yes |  |

**Proposal 5-5 (I):**

* The container for carrying the COT sharing information from a COT initiator UE includes at least the SCI.
	+ FFS 1st and/or 2nd stage SCI
	+ FFS whether MAC CE can be additionally used (e.g., to carry additional ID(s))

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| --- | --- | --- |
| **Company** | **Support?** | **Comments** |
| OPPO | Support | 1st **and** 2nd stage SCI |
| DCM | OK |  |
| LGE | Yes | One clarification on the 2nd FFS. Only the data destination UE will try to decode PSSCH, and then the MAC CE is applicable to only the data destination UE. Then, how it work when the MAC CE is used to carry the additional ID(s).  |
| InterDigital | Yes |  |
| NOKIA, Nokia Shanghai Bell | Yes |  |
| Ericsson | OK | Remove the last FFS. It makes no sense to share a COT with signalling in MAC CE. |
| Lenovo | Yes | Support 1st or 2nd Stage SCI2nd FFS can be removed and can be discussed separately.  |
| Apple | Yes |  |
| CableLabs | Yes with comments | Remove the last FFS |
| QC | Yes |  |
| Intel | Yes | 1st stage SCI is preferred. |
| Vivo | Yes | SCI is preferred |
| CMCC | Yes |  |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #6: Channel access procedures for SL multi-channel transmission(s)

**Background**:

|  |
| --- |
| **Agreement**Channel access procedures for transmission(s) on multiple channels are supported for NR sidelink operation as defined by TS37.213 for NR-U (wherever applicable)* FFS whether the downlink, uplink and/or semi-static multiple channel access procedure(s) (if supported) from NR-U should be used as a baseline and whether/how they are applied in SL mode 1 and mode 2 operation

**Agreement**For dynamic channel access mode with multi-channel case in SL-U, NR-U UL channel access procedure is considered as baseline for transmission on multiple channels* FFS: whether transmission of PSFCH and/or S-SSB on a subset of RB sets is supported (using the NR-U DL channel access procedure as baseline)
* FFS any necessary enhancement and modification for the SL-U operation

**Agreement*** For dynamic channel access mode with multi-channel case in SL-U, use NR-U DL (Type A or Type B) multi-channel access procedure as the baseline for multiple PSFCH transmissions on multiple channels, where each PSFCH transmission is confined within one LBT channel
	+ FFS: the case for S-SSB if agreed to transmit S-SSB (or S-SSB can be (pre-)configured) in more than one RB set
	+ FFS: whether type A or type B or both will be supported for this case for PSFCH
	+ FFS: whether multiple PSFCH transmissions on multiple channels after performing the multi-channel access procedure is limited to contiguous RB sets
 |

* PSCCH/PSSCH

Currently in NR-U channel access procedures for UL multiple-channel transmission(s), the spec (TS 37.213) described cases (scheduling and configured grant) that are under the gNB control in Section 4.2.1.0.4.

|  |
| --- |
| If a UE - is scheduled to transmit on a set of channels , and if the UL transmissions are scheduled to start transmissions at the same time on all channels in the set of channels , or- intends to perform an uplink transmission on configured resources on the set of channels , and if UL transmissions are configured to start transmissions at the same time on all channels in the set of channels , … |

In SL, these corresponds to Mode 1 resource allocation. However, the case for Mode 2 RA, where resources are autonomously selected by the UE should also be captured. Hence, FL proposes to include such case in Proposal 6-1 below.

* PSFCH

There are two remaining issues on multi-channel access for PSFCH as captured as FFS points in the latest agreement.

1. Whether type A, type B or both should be supported for PSFCH transmissions on multiple shared channels; According to the existing NR-U DL multi-channel access procedures, the gNB is required to perform Type 1 LBT and count-down of a random value *N* for each channel that the gNB intends to transmit under Type A multi-channel access procedures. Under Type B, to transmit on channel , , the gNB senses the channel for at least a sensing interval immediately before transmitting on channel , and the gNB may transmit on channel immediately after sensing the channel to be idle for at least the sensing interval .

According to contributions submitted in this meeting, there is more preference to support both Type A and Type B multi-channel access procedures for PSFCH than only supporting Type A. Some companies expressed that at least Type A should be supported. Therefore, FL proposes to support both in Proposal 6-2 below.

1. Multi-PSFCH transmissions are limited to contiguous RB set; Based on the Tdoc review (summary in Section 4.7), most of the companies has an opinion that there should not be such a limitation, as a RX UE may need to transmit individual SL-HARQ feedback to multiple TX UEs in a same slot but on different channels. And often these transmissions are not on contiguous/adjacent channels. There is also a view to send a LS to RAN4 asking their opinion. But FL thinks this may not be necessary since in R16 multiple PSFCH transmissions are allowed to be in non-contiguous PRBs in a resource pool. If there is a strong need, of course we can do so. For now, FL proposes a conclusion that multi-PSFCH transmissions are not limited to contiguous RB sets in Proposal 6-3 below.
* S-SSB

Still need to wait for a decision/outcome whether the legacy S-SSB should be transmitted in all RB sets where the UE has channel occupancy, and whether the additional S-SSB is transmitted inside/outside a resource pool and multiple RB sets. Until these aspects/decisions are made, it is unclear whether a multi-channel access procedure is needed for S-SSB.

### FL Proposal for round 1 discussion

**Proposal 6-1 (I):**

Channel access procedures for SL multi-channel transmission(s) should include the following case for SL Mode 2 operation (which is not described in TS37.213 for NR-U UL transmission).

* If a UE intends to perform a sidelink transmission on selected resources on the set of channel , and if SL transmissions are to start at the same time on all channels in the set of channels .

|  |  |  |
| --- | --- | --- |
| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | NO | At first we should focus on what is the exact behavior for SL. No need to discuss CR-like proposal now. NOTE that UL-like mechanism has not been agreed yet; just ‘baseline’ was agreed. |
| LGE | OK |  |
| Apple | OK |  |
| CableLabs | No | The differentiation between the SL-U UE acting as a gNB or as a UE should be agreed on before having this discussion |
| QC | Ok |  |
| Intel | No | Agree with DCM. We also believe that we should first focus on behaviour and only later discuss CR-like proposals. |
| Vivo | Yes |  |
| CMCC | OK |  |

**Proposal 6-2 (I):**

* For dynamic channel access mode with multi-channel case in SL-U, both NR-U DL Type A and Type B multi-channel access procedure are supported for multiple PSFCH transmissions on multiple channels.

|  |  |  |
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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM | NO | At first we should discus how to consider COT sharing for multi-channel access. In our understanding, NR-U multi-channel access does not consider COT sharing and thus type 1 LBT is mandatory for multi-channel access at least in an RB-set.Or if NR-U multi-channel access procedure considers COT sharing, please share which spec text explains it. |
| LGE | OK |  |
| NOKIA, Nokia Shanghai Bell | Support | Both or at least Type A multi-channel access can be supported for PSFCH. |
| Ericsson | OK |  |
| Apple | OK |  |
| CableLabs | OK |  |
| QC | Ok |  |
| Intel | OK |  |
| Vivo |  | At least type A is supported. Type B has a demerit that once the type-1 LBT fails, all the PSFCHs are dropped, while Type A only drops the PSFCH of the LBT channel that LBT fails.If both types are supported, how the UE select one type, based on implementation or configuration? |
| CMCC | OK |  |

**Proposal for conclusion 6-3 (I):**

* PSFCH transmissions across multiple shared channels are not limited to contiguous RB sets.

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| **Company** | **Support?** | **Comments** |
| OPPO | Support |  |
| DCM |  | We are fine with the direction, but meaning of ‘multiple shared channels’ is unclear. |
| LGE |  | It is up to RAN4. Some feasibility study including the impact on the maximum number of simultaneous PSFCH transmissions in a slot would be needed.  |
| NOKIA, Nokia Shanghai Bell | Support | We are fine with asking RAN4 also, if needed. |
| Ericsson | OK | In our view, the is already clear. But we are fine with a clarification. |
| Lenovo | Yes |  |
| Apple | OK | OK to ask RAN4 as well.  |
| CableLabs | No | Not clear what is the RAN4 impact. This discussion should take place after a RAN4 decision |
| QC | Support |  |
| Intel | NO | We agree with LG and this is a RAN4 subject matter which may require a feasibility study. In this sense, an LS to RAN4 would be advisable.  |
| Vivo | Yes |  |
| CMCC | OK |  |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #7: Multi-consecutive slots transmission (MCSt)

**Background:**

In RAN1#110bis-e, the following agreement is made on the topic of MCSt.

|  |
| --- |
| **Agreement**On the support of MCSt operation in SL-U, following options are to be further studied and one or more of the following options will be selected in future meetings.* When L1 is triggered for reporting a subset of candidate resources for MCSt,
	+ Option 1: Only one set of parameters (, remaining PDB, and ) is provided for the resource selection procedure in L1
		- Note, this is applicable for transmission of a single TB and multiple TBs
		- FFS: whether this is the same or different than Rel-16
	+ Option 2: one or multiple sets of parameters (, remaining PDB, and ) are provided for the resource selection procedure in L1
	+ FFS: any further information needs to be provided to L1 for MCSt
* When L1 reports a subset of candidate resources for MCSt,
	+ Option A: L1 reports candidate multi-slot resources in *SA* where a candidate multi-slot resource consists of a set of single-slot resources that are consecutive in time
		- FFS whether the set of single-slot resources within a candidate multi-slot resource can have different sizes
	+ Option B: L1 reports candidate single-slot resources in (*SA*) as in Rel-16
		- It is up to the higher (MAC) layer to select a set of single-slot resources that are consecutive in logical slots
	+ Option C: L1 reports consecutive single-slot candidate resources in *SA*
		- FFS whether the consecutive single-slot candidate resources can have different sizes
	+ FFS: any further information needs to be reported to MAC layer, provided to L1 or utilized for MCSt
	+ FFS: whether/how to consider the additional LBT time in SL resource allocation
 |

From reviewing the contributions (summary in Section 4.9), the majority of companies are in favour of Option 1 and Option A. The main reasons cited are to minimize the UE processing from triggering L1 resource selection procedure multiple times (as in Option 2) and to guarantee resources from consecutive slots can be selected for MCSt to occupy an initiated COT. Furthermore, for Option 1, the set of parameters (, remaining PDB, and ) provided by the higher layer is the same as Rel-16. And one additional information needed from the higher layer is number of slots for the MCSt.

It should be noted that as per above cited agreement for MCSt, Option 1 is applicable for transmission of a single TB case and multiple TBs case. Maybe it is worth to clarify that when only one set of parameters (, remaining PDB, and ) is provided to L1 for resource selection, this set of parameters is used for generating a set of candidate resources to be reported to the higher layer. It is up to the higher layer to select resources from the reported set for multiple TBs. That is, only one set of parameters will be used for resource selection of multiple TBs.

Considering all the comments received in last meeting’s discussion, an updated proposal (from the last meeting) is now provided in Proposal 5 below.

### FL Proposal for round 1 discussion

**Proposal 7 (I):**

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| **Agreement**On the support of MCSt operation in SL-U, following options are to be further studied and one or more of the following options will be selected in future meetings.* When L1 is triggered for reporting a subset of candidate resources for MCSt,
	+ Option 1: Only one set of parameters (, remaining PDB, and ) is provided for the resource selection procedure in L1
		- Note, this is applicable for transmission of a single TB and multiple TBs
		- FFS: whether this is the same or different than Rel-16
	+ Option 2: one or multiple sets of parameters (, remaining PDB, and ) are provided for the resource selection procedure in L1
	+ FFS: any further information needs to be provided to L1 for MCSt
* When L1 reports a subset of candidate resources for MCSt,
	+ Option A: L1 reports candidate multi-slot resources in *SA* where a candidate multi-slot resource consists of a set of single-slot resources that are consecutive in time
		- FFS whether the set of single-slot resources within a candidate multi-slot resource can have different sizes
	+ Option B: L1 reports candidate single-slot resources in (*SA*) as in Rel-16
		- It is up to the higher (MAC) layer to select a set of single-slot resources that are consecutive in logical slots
	+ Option C: L1 reports consecutive single-slot candidate resources in *SA*
		- FFS whether the consecutive single-slot candidate resources can have different sizes
	+ FFS: any further information needs to be reported to MAC layer, provided to L1 or utilized for MCSt
	+ FFS: whether/how to consider the additional LBT time in SL resource allocation
 |

For the above agreement made in RAN1#110bis-e,

* When L1 is triggered for reporting a subset of candidate resources for MCSt, Option 1 is selected
* When L1 reports a subset of candidate resources for MCSt, Option A is selected.
	+ Note, a candidate multi-slot resource reported in the set *SA* can be used for transmitting a single TB or multiple TBs
	+ FFS the calculation of interference RSRP level in resource exclusion (e.g., same as R16 or update is needed)
	+ FFS at which step in 8.1.4 of TS 38.214 the concept of candidate multi-slot resource is applied and whether candidate single-slot resources should still/also be reported to the higher layer (as in R16)
* Additional information needed from the higher layer is “number of slots for MCSt”.

|  |  |  |
| --- | --- | --- |
| **Company** | **Support / not support** | **Comments** |
| OPPO | Support with comment | We support to adopt option 1 and option A. But for multiple TBs transmission, multiple L1 resource selection triggers are necessary. In each trigger, it targets only one single TB. To achieve multiple TBs transmission, after reporting multiple candidate resource sets, it is up to the MAC layer to find consecutive groups of MCSt. |
| DCM | NO | Why PHY spec impact is necessary for resource identification of MCSt is unclear. Option 1 per TB and Option A per TB as in Rel-16/17 are sufficient. MAC layer can support enhanced selection for MCSt. |
| LGE | No | So, with the above proposal, when the set S\_A is used for multiple TB, is it correct understanding that only one set of parameters (, remaining PDB, and ) for multiple TBs? Otherwise, if the multiple TBs have different set of parameters, the MCSt will not be supported? We think that we can make a single set of multi-slot resources by using multiple S\_A,i for TB#i with the same or different parameters. Or, to make a single set of multi-slot resources, one representative parameter set could be determined based on multiple parameters for the set S\_A,i for TB#i. |
| InterDigital | Support |  |
| NOKIA, Nokia Shanghai Bell | Support | We are fine with the proposal including the FFS points.  |
| Ericsson | Option 1 – YesOption A – Yes with comments | For Option A, it is clear that the same Rel-16 procedure for RSRP calculation cannot be used as it consists of multiple RSRP values. |
| Apple | Support |  |
| QC | Support | To LGE, thanks for your view. In our understanding an agreement as per FL proposal, would mean that for multiple TBs with “similar parameters” (e.g. same prioTX value) a multi-slot resource selection is supported. In our view when a file is generated it will require the transmission of several TBs, therefore each single resource selection instance could target transmitting a part of that file (TBs with same prioTX).We believe that RAN1 could still discuss how MAC finally select a candidate, for this purpose, it could use the information of previously selected resources to select the next one consecutively. In this case, it would still be possible to select consecutive resources across resource selection triggers, that is useful when there are TBs with different prioTX values. |
| Intel | Support | We are fine with the proposal including the FFS point. |
| Vivo | support |  |
| CMCC | Support |  |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #8: Type 1 LBT blocking issue

**Background:**

On the problem of one UE performing a Type 1 LBT procedure for using its own selected/reserved resource(s) is blocked by another UE’s SL transmission at least in a slot preceding to the selected/reserved resource and causing the LBT to fail, we have discussed this topic in the last RAN1 meeting but without any conclusion/progress. In this meeting, besides numerous contributions discussing this topic/issue again, RAN1 also received an LS from RAN2 [44] informing RAN1 the following RAN2 agreements:

* RAN2 understands L1 handles LBT impact to/from other UEs’ reserved resources in SL candidate resource selection (inter-UE case).
* RAN2 will study how MAC performs resource (re)selection with the consideration of LBT impact to its own candidate resource (intra-UE case).

So, it seems there is a need to continue discussing this topic/issue in RAN1. The list of solution options in Proposal 8 below have been updated according to comments received in the last RAN1 meeting with additional ones such as Option X (no solution needed). Let’s use this as a starting point for discussion in this meeting.

### FL Proposal for round 1 discussion

**Proposal 8 (I):**

* To resolve the Type 1 LBT blocking issue, where one UE performing a Type 1 LBT procedure for using its own selected/reserved resource(s) is blocked by another UE’s SL transmission at least in a slot preceding to the selected/reserved resource and causing the LBT to fail, please provide comments and indicate any additional option(s) should be added to the list (for the first round of discussion).
	+ Option 1:
		- UE avoid selection of a resource before a reserved resource with high priority when the transmitting symbols of the selected resource overlap with Type 1 LBT of the reserved resource.
		- UE avoid selection of a resource with high priority after a reserved resource when the transmitting symbols of the reserved resource overlap with LBT of the selected resource.
		- FFS: the avoidance should be performed by L1 exclusion or L2 MAC selection
		- FFS: whether / how to achieve this in RA mode 1
	+ Option 2:
		- UE prioritizes/selects resource(s) for transmission in slot(s) after a reserved resource when transmission of the selected resource is able to share the initiated COT of the reserved resource (i.e., the selected resource(s) is within the COT duration of the reserved resource and the CAPC value of the selected resource(s) is equal to or higher than that of the reserved resource).
		- UE prioritizes/selects resource(s) for transmission in slot(s) before a reserved resource when transmission of the selected resource is able to share its initiated COT with the reserved resource (i.e., the reserved resource is within the CAT duration of the selected resource(s) and the CAPC value of the selected resource(s) is equal to or smaller than that of the reserved resource).
		- FFS whether / how to achieve this in RA mode 1.
	+ Option 3: UE selects extra / more resources than required for transmitting a TB (i.e., overbooking) to accommodate potential Type 1 LBT failures.
	+ Option 4: LBT duration is determined firstly, then resource selection takes into account of the LBT duration is performed.
	+ Option 5: At MAC layer, selection of resource(s) among the reported set of candidate resources from L1 is up to UE implementation in mode 2 for SL-U, instead of random selection.
	+ Option 6: UE excludes frequency resources (if any) previously reserved via SCI by other SL UEs in the corresponding slot, when estimating the detected power within a sensing slot duration in Type 1 channel access.
	+ Option 7: SL UE deems channel busy only if the UE detects transmission other than SL transmission occupying the channel (e.g., exceeding the energy detection threshold), i.e., the energy detection for EDT checking in LBT procedure does not take into account the energy from SL transmissions.
	+ Option X: No solution is needed. To avoid inter-UE blocking from performing Type 1 LBT can be handled based on UE implementation (e.g., as the start timing to perform LBT sensing is determined by each UE).

|  |  |  |
| --- | --- | --- |
| **Company** | **Preferred option(s)** | **Comments** |
| OPPO | Option 2 and X | We do not support and have strong concern on Option 1. If UE avoids selection of a resource just one slot before a reserved resource and one slot after the reserved resource, this means 50% of the slots in SL are unusable. If UE avoids two slots before and after a reserved resource, then 66.67% of slots are unusable in the system. |
| DCM | 1/2/7 |  |
| LGE | Option 1, Option 2 | It would be necessary to consider the case of insufficient resources. Moreover, since the total LBT duration for Type 1 channel access procedure, the exact LBT duration may not be used. In this point of view, rather than saying “avoid selection”, “deprioritize” could be used in Option 1. In Option 2, for the COT sharing condition, its transmission should be intended to the COT initiator UE. If at least one condition is not met, Option 2 need to fallback to Option 1.  |
| InterDigital | Option 1 and 3 |  |
| NOKIA, Nokia Shanghai Bell | Option 1 and/or Option 2 | Option 1 should be preferable, as well as Option 2 which can also be supported together. Option 3 should not be supported as it arises resource efficiency issues while it is not clear what benefits it has compared to existing repetition and retransmission mechanisms. Option 4 should be up to implementation if supported, and finally, Option 5 alone may not be sufficient to avoid inter-UE blocking because MAC layer does not know of other UEs reservations.Option 6 is not clear, seems not so different than Option 1.Option 7 should not be allowed by regulatory requirements. |
| Ericsson | Avoid fragmentation in time. See comments. | We think that:* Selecting resources with a frequency-first approach is the best way to minimize this issue.
* The GP should be respected when the UE intends to finish a transmission in one slot. That should give some chance to other UEs to clear LBT.
 |
| Lenovo |  | The motivation is clear to us. However, since UE can’t predict the LBT duration, it is not possible for UE to determine how many slots before the reserved resource in Option 1 or after the reserved resource in Option 2. It is necessary for a UE to have a rough estimation on the possible LBT duration.  |
| Apple | Option 4 (with comments) | Start of CCA time is up to UE implementation. Therefore whether the slot right before resource selection or two slots before are reserved will have similar impact to the UE’s CCA success if type 1 CCA starts 3 slots before. Note max CW is 1023, with 9us slot duration, it is more than 9ms even all slots are idle. When some slots are busy, the overall CCA time is random. Therefore we do not see the linkage of the slot before/after made key difference. Therefore option 1 and option 2 are not preferred. We support basic idea of option 4, with modification that the exact CCA time is unknown, but min/average CCA time can be calculated. And resource selection window can be adjusted. We also see option 4 is a general solution not only applies to inter-UE, also applies to WiFi transmission caused CCA delay.  |
| QC | Option X for this issue, other options can still be discussed to solve other issues. | We believe that there is no systematic way to ensure that a UE will/ will not transmit on a reserved resource. So there are no good way to address this issue (which may not be an issue at all) given the LBT uncertainty of the reserving UEsOption 3 could be still supported in RS enhancements for MCSt (e.g. MAC could trigger resource selection for N1 TBs by asking PHY to identify multi-slot resources of length N2, with N2>N1)Option 4 could still be supported towards making sure that RS is effectiveOption 5 could still be supported towards facilitating MCSt across RS triggers (especially when each RS is triggered based on one set of parameters, e.g. single priority prioTX) |
| Intel | Option 1 and 2  | * Option 1 is preferred. While option 1 per se decreases the set of candidate slots, these exclusions rules could be applied decoupling the resources within and outside a shared COT, as for inside a COT having back-to-back transmissions may be beneficial.
* We would be OK with Option 2 if combined with option 1
* Option 3 could be supported by implementation but by default it may cause high loss of spectral efficiency as commented by other companies.
* Option 4 can be supported by implementation.
* Option 5 may not actually solve alone the issue as higher layer may not be aware of other UEs’ reserved resources.
* Option 6 seems to be meant for FDM, where we do not think there would be any inter-UE blocking if transmissions across RB-sets are aligned.
* Option 7 implies modifications to the LBT procedure, and it is not clear how a UE may be able to discern during sensing between a SL and an incumbent technology.

If RAN1 converges that inter-UE blocking is indeed an issue, we are not sure how this could be solved by implementation. Perhaps, companies supporting this option could clarify. |
| Vivo | Option 1 and option 2 can be further discussed | Option 1 and Option 2 can be prioritized. Since this 2 options discuss inter-UE cases, implementation may not be good direction considering system performance.Regarding whether LBT first or resource selection first, no need to have a clear order for this, i.e., option 4. UE implementation can handle this issue.The spec. impact of option 3 is not clear.Option 6 and option 1 can be merged. |
| CMCC | Option 1, Option 2, or Option X | Option 3 may cause redundant resource selection;For option 4, we think resource selection should be done first, then LBT should be based on the selected resources;For option 5, we think the randomness for resource selection should not be broken;Option 6 and option 7 will bring unfairness to other RATs;We are also fine with option X to reduce the complexity and workload. |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #9: RAN2 LS on SL resource (re)selection (R1-2302278)

**Background [36-43]:**

An LS from RAN2 [36] informing RAN1 the following understandings/agreements:

* UE triggers resource (re)selection upon receiving an LBT failure indication from PHY for a PSSCH transmission
* It is FFS whether such new resource (re)selection trigger is also applicable for the multiple consecutive slots transmission (MCSt) case

Action to RAN1: RAN2 kindly asks RAN1 to take the above information into consideration and to provide feedback, if there are any concerns with such behaviour.

Several discussion papers / draft LS replies are submitted in this meeting [37-43], and they are summarised in the following.

[37/vivo]: Seeking clarification from RAN2 on the UE behaviour for “upon receiving an LBT failure indication from PHY, the resource (re)selection is triggered only for the PSSCH transmission that triggers the LBT failure indication report, or for all the (remaining HARQ retransmission) resources of the SL grant/HARQ process, or for all the SL grants in the resource pool?”

[38, 39/Ericsson]:

* The LBT failure situation is regarded as equivalent to the resource (re)selection trigger by the re-evaluation or pre-emption of the resources according to the existing (Rel-16/17) procedures.
* In the case of MCSt, it may not be advantageous to treat all the slots together when the LBT failure is received. In case of LBT failure at the beginning of MCSt, the UE may transmit a fraction of the slots belonging to the MCSt if the channel becomes available at a later point within the selected/reserved resources of MCSt.

[40/MediaTek]:

* Regarding LBT failure indication for the case of MCSt, whether it can be used as a new trigger for resource (re)selection depends on the MCS is used for one TB transmission and/or multiple TB transmissions.
* It should be clarified by RAN2 the resource (re)selection is for different resource within the same RB set for which LBT failure is indicated; and/or for different RB set for which LBT failure has not been indicated.
* It should be clarified by RAN2 the accumulation method of LBT failure counter if the resource (re)selection is aiming for different RB set.

[41/ZTE, SC]: from RAN1’s perspective, there is no concern on the UE behaviour that UE triggers resource (re)selection upon receiving an LBT failure indication from PHY for a PSSCH transmission. And RAN1 also thinks the similar behaviour for pre-emption and re-evaluation in Rel-16 can be applied to MCSt case.

[42/Qualcomm]: RAN1 considers that RAN2’s assumption might be premature. In fact, RAN2 indicated "FFS" (i.e., conditions for diverging from the made assumption) only for the MCSt case but there is another case under discussion in RAN1 that, if supported, would invalidate RAN2’s assumption:

* RAN1 study case: Multiple consecutive resources can be selected to provide more transmission occasions (e.g., N slots) for a single TB, that is, some LBT failures (e.g., up to N-1) can occur before triggering resource (re)selection.

This case is not within the MCSt subject, but it is currently under discussion in RAN1 and, if supported, it would render invalid RAN2’s original assumption.

[43/HW, HiSi]: There is no concern from RAN1 perspective that UE triggers resource (re)selection when receiving an LBT failure indication from PHY for a PSSCH transmission. For the multiple consecutive slots transmission (MCSt), it is still under discussion in RAN1 and RAN1 will notify RAN2 once there is agreement.

Based on the provided inputs (summary above), FL has the following comments.

* The LBT failure indication from PHY is for a PSSCH transmission. When higher triggers a resource (re)selection, the PHY reports a set of candidate resources (*SA*). It is up to MAC layer (RAN2 to decide) whether the re-selection is just for the PSSCH transmission that has the LBT failure or for all the (remaining HARQ retransmission) resources of the SL grant/HARQ process, or for all the SL grants in the resource pool. It’s FL’s understanding, it is more reasonable to re-select just the PSSCH transmission that has LBT failure.
* Currently, RAN1/2 has not agreed to support overbooking of resources for either single-TB or multiple-TB transmissions. Perhaps we should not make assumption/decision for something that has not been agreed. In this sense, higher layer trigger resource re-selection for single or multiple-TB cases should be fine (aligning with re-selection trigger due to LBT failure indication for the non-MCSt case).
* According to existing R16 resource re-selection behaviour, a resource can be selected from anywhere within the resource pool (confining within a resource selection window). If a SL-U resource pool spans over multiple RB sets, due to random selection among the reported candidate resources, a re-selected resource could be in the same RB set for which LBT failure is indicated or a different RB set (unless RAN2 changes this ransom selection behaviour in R18 SL-U).
* The received LS from RAN2 is not related to how LBT failure counter is accumulated for the purpose of consistent LBT failure declaration. The PHY layer is only responsible for reporting a set of candidate resources within a resource pool. How the MAC layer (re-)selects resources and how to take into account of consistent LBT failure in an RB set can be decided by higher layer (e.g., RAN2).
* It is unclear, besides the case of MCSt, RAN1 is studying the case where some LBT failures (e.g., up to N-1) can occur before triggering resource (re)selection for a single TB transmission.
* Based on the above comments and inputs from companies, it is unclear there is a serious concern on RAN2’s agreements in the received LS [36] and that RAN1 needs provide a reply LS (since details of MCSt are not finalized in RAN1).

### FL Proposal for round 1 discussion

**Question 9 (I):**

* Based on the above summary of inputs and FL comments, is there still a concern regarding RAN2’s agreements in the received LS [36] that RAN1 should inform RAN2 about? If yes, please elaborate the concern(s) in detail.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| OPPO | No concern on RAN2’s LS |
| InterDigital | No concern |
| Ericsson | There is no concern, but it may be good to explicitly agree that “The LBT failure situation is regarded as equivalent to the resource (re)selection trigger by the re-evaluation or pre-emption of the resources according to the existing (Rel-16/17) procedures” and indicate it to RAN2. |
| Lenovo | We agree with FL’s analysis and don’t have a concern. |
| Apple | No concern |
| CableLabs | No concerns |
| QC | We suggest to inform RAN2 of the still ongoing discussions in RAN1.Regarding FL’s comment “It is unclear, besides the case of MCSt, RAN1 is studying the case where some LBT failures (e.g., up to N-1) can occur before triggering resource (re)selection for a single TB transmission” we believe that Option 3 in Proposal 8 actually introduces the case we are talking about. So it is premature that RAN2 assumes that the “exit case” from their assumptions is only multi-consecutive slots TRANSMISSIONS, it could also be multi-consecutive slot SELECTION for transmitting a TB a single time. Even Under MCSt, anyway, there is the case where more slots N2 can be requested compared to the number of TBs N1 (N2>N1), even in that case, triggering re-selection for every single LBT failure may be not correct. |
| Intel | No - We do not have any concerns.  |
| vivo | We basically share the view with FL that “It is up to MAC layer (RAN2 to decide) whether the re-selection is just for the PSSCH transmission that has the LBT failure or for all the (remaining HARQ retransmission) resources of the SL grant/HARQ process, or for all the SL grants in the resource pool”. Our understanding is that RAN2 sending LS asking RAN1’s opinion on RAN2’s agreement, but RAN can hardy provide such evaluation without further details. If RAN2 does expect RAN1’s feedback, further details are needed.Alternatively, we may wait until RAN2 provides more information in the future LS. |
| CMCC | No concern |

### FL Proposals for round 2 discussion

TBD

## [ACTIVE] Topic #10: RAN2 LS on LBT and SL resource (re)selection (R1-2302283)

**Background [44-46]:**

An LS from RAN2 [44] informing RAN1 the following RAN2 agreements:

* RAN2 understands L1 handles LBT impact to/from other UEs’ reserved resources in SL candidate resource selection (inter-UE case).
* RAN2 will study how MAC performs resource (re)selection with the consideration of LBT impact to its own candidate resource (intra-UE case).

Action to RAN1: RAN2 respectfully asks RAN1 to take the agreements into account in their related work and provide feedback if any concern.

One draft reply LS [45] and one discussion paper [46] are provided in this meeting, and they are summarised in the following.

[45/CATT, GH]: It is RAN1’s understanding that LBT impact on SL candidate resource selection and resource (re)selection should be considered together. In fact, RAN1 has already discussed these aspects during several RAN1 meetings. Therefore, RAN1 respectfully asks RAN2 to reconsider these agreements and leave the resource (re)selection procedures for RAN1 to discuss.

[46/ZTE, SC]: To balance advantages and disadvantages, also considering there are quite a few essential issues to be addressed under the remaining Rel-18 budget, we think the LBT impact for inter-UE cases should not be considered during sensing and resource selection procedure, and the following proposal is given:

* The LBT impact for inter-UE cases should not be considered during sensing and resource selection procedure.

Based on the provided inputs (summary above), FL has the following comments.

* The comments and proposals in both [45][46] seemed reasonable. And special thanks to [46] for providing such detailed analysis. Unless a resource (re-)selection issue only exists in the higher layer (for which L1 has no knowledge about), e.g., consistent LBT failure detection (including the timer and counter), RAN1 has discussed and decided in the past SL resource allocation and procedure issues.
* For the inter-UE case, this issue is treated in Topic #8 of this FL summary in this meeting. We can further discuss whether this inter-UE case should be handled in RAN1 under the Topic #8, based on the analysis provided in [46].
* In [45], a draft response to RAN2 is provided. We can further discuss whether we should respond to RAN2 accordingly.

### FL Proposal for round 1 discussion

**Question 10 (I):**

* According to [45], a draft response is provided as followed. Should RAN1 respond to RAN2’s LS according to [45]? Or a modification on the wording / meaning is needed?
	+ It is RAN1’s understanding that LBT impact on SL candidate resource selection and resource (re)selection should be considered together. In fact, RAN1 has already discussed these aspects during several RAN1 meetings. Therefore, RAN1 respectfully asks RAN2 to reconsider these agreements and leave the resource (re)selection procedures for RAN1 to discuss.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| OPPO | We are open to send LS according to [45] (no strong view) and OK to follow the majority view |
| DCM | OK since we prefer to discuss resource selection including intra-UE case in RAN1. |
| LGE | We think that RAN1 should respect RAN2’s agreement as in other RAN2 ageements. We do not need to have reply LS to RAN2 for this purpose.  |
| NOKIA, Nokia Shanghai Bell | We don’t see the immediate need for the LS.We understand there is still work in progress in RAN1 to define LBT impact on SL candidate resource selection.But we don’t think there is any urgency to send LS to RAN2 to prevent them to study MAC resource (re)selection impact. |
| Lenovo | We agree with the intention of [45], though the detailed text could be reviewed. |
| QC | We agree with the spirit of the response. |
| Intel | As other companies, we do not see the need to respond right away to the LS as there is no urgency from RAN2, while RAN1 is still discussing and making progress.  |
| Vivo | we agree this is RAN1 issue. |
| CMCC | We agree with the spirit of the response. |

### FL Proposals for round 2 discussion

TBD

Contribution summary for channel access mechanism

## Regulation aspects (for easy reference)

* **Short control signalling transmission (SCSt)**
	+ According to European regulation (ETSI EN 301 893), The use of *Short Control Signalling Transmissions* is constrained as follows:
		- within an observation period of 50 ms, the number of Short Control Signalling Transmissions by the equipment shall be equal to or less than 50; and
		- the total duration of the equipment's Short Control Signalling Transmissions shall be less than 2 500 µs within said observation period.

## Type 1 channel access procedures

* **Remaining details of CAPC table, and p and**  **value for S-SSB and PSFCH**
	+ Support of RRC parameter “*absenceOfAnyOtherTechnology-r16*” or similar for SL-U
		- [2/Nokia, NSB] (performance gain provided), [7/OPPO], [10/Intel]
		- FFS: [9/CATT, GH]
* **Energy detection (ED) threshold setting**
	+ [5/vivo]:
		- No enhancement on the UE-to-UE ED threshold is needed.
		- SL UE deems channel busy only if the UE detects transmission other than SL occupying the channel (e.g., exceeding the energy detection threshold) during the LBT duration, i.e., the energy detection in LBT procedure does not take into account the SL transmissions.
	+ [10/Intel]:
		- The Rel.16 NR-U EDT calculation should be used as a baseline for SL-U.
		- For S-SSB transmissions:
			* for a UE without a shared channel occupancy, within the calculation of the EDT threshold a UE should apply TA = 5 dBm as in NR-U;
			* for a UE within a shared channel occupancy, within the calculation of the EDT threshold a UE should apply TA = 10 dBm as any other type of transmission.
	+ [13/LGE] For SL transmission, energy detection threshold is determined as follows:
		- If a UE does not share its COT duration to another UE(s),
			* + ;
				+ is the single channel bandwidth in MHz;
				+ ;
				+ *Down-select one of followings for :*

*Alt 1-1: 10 dB for all the cases*

*Alt 1-2: 5 dB at least for S-SSB or 10 dB otherwise*

*FFS: Other SL channel(s)*

* + - * + *Down-select one of followings for :*

*Alt 2-1:* PCMAX\_H,*c**for a given SL channel type and/or a given resource pool (if applicable)*

*Alt 2-2: (Pre)configured value*

* + - If a UE shares its COT duration to another UE(s), the energy detection threshold is set to one of followings:
			* Alt 3-1: (Pre)configured value
			* Alt 3-2: Value indicated by COT sharing information
		- FFS: ED threshold and/or its offset can be (pre)configured or PC5-RRC configured.
	+ [16/CableLabs]: The EDT procedure, defined by NR-U specs [2], section #4.1.5 (downlink) applies to S-SSB.
	+ [25/Transsion]: The EDT determination method for NR-U/LAA uplink can be used as a starting point for the study of EDT determination method for sidelink unlicensed access system.
	+ [27/Apple]: Type 1 EDT determination can use UL EDT as starting point. Consider both NW configured EDT and UE autonomously determined EDT based on PC,MAX.

## Type 2 channel access procedures

* **General aspects:**
	+ [10/Intel]:
		- If an initiating UE may pause its SL transmission and resume it within its own COT so that the following burst may fall within the MCOT, before transmission Type 2A LBT may be applied if the gap before any prior transmission may be larger than 25 us and the pause may be larger than 100 us.
	+ [13/LGE]: For Type 2A/2B/2C SL channel access procedure, a time gap to decide the type is measured according to one or more of followings:
		- Recently received PSCCH/PSSCH of which source ID and destination ID are the same as those of PSCCH/PSSCH conveying COT sharing information.
		- Recently received PSFCH in response of PSSCH transmission to the COT initiator UE.
	+ [15/xiaomi]: Type 2A and type 2B channel access is also applicable to the case of multi-slot transmissions from the same UE.
	+ [16/CableLabs]: DL Type 2B/2C communication, as specified by #4.1.2.2 and #4.1.2.3 [2] do not apply to the SL-U case.
	+ [22/Lenovo]: Support separate channel access procedure for uplink and sidelink in Rel-18 i.e., uplink and sidelink does not share the same UE initiated COT.
	+ [24/MediaTek]: If a UE determines the duration in time domain and the location in frequency domain of a remaining COT initiated by COT initiator, the UE may switch from Type 1 channel access procedures to Type 2A channel access procedures for its corresponding SL transmissions within the determined resources of the remaining COT.
	+ [27/Apple]: Type 2A/2B/2C SL channel access can be used for the COT initiating UE to resume transmission after gap within the COT, based on gap length.
* **Type 2A channel access procedure**
	+ When Type 2A is used for S-SSB without a shared COT
		- EDT:
			* Same as NR-U (max TX power and bandwidth): [2/Nokia, NSB], [4/HW, HiSi], [17/Samsung, 26/ZTE, SC] (=5 dB), [20/Intel]
			* FFS: [22/Lenovo]
		- Observation period:
			* Needed: [8/Spreadtrum],
				+ 50ms (SCSt regulation): [7/OPPO] (when 2A is used for PSFCH), [10/Intel], [30/QC], [35/WILUS]
				+ 160ms (S-SSB cycle): [9/CATT, GH], [17/Samsung]
				+ Up to UE implementation: [26/ZTE, SC]
			* Not needed: [4/HW, HiSi]
	+ Type 2A is used for PSFCH without a shared COT
		- Support: [5/vivo], [7/OPPO], [8/Spreadtrum], [9/CATT, GH], [11/Sony], [14/IDC], [18/Panasonic], [22/Lenovo], [25/Transsion], [26/ZTE, SC] (some PSFCH occasions), [31/NEC]
		- Not support: [3/FW], [4/HW, HiSi], [20/ETRI], [24/MediaTek]
		- Postpone: [21/CMCC] (after PHY structure)
	+ [14/IDC]: When the constraints are not met to transmit using Type 2A without shared channel occupancy, S-SSB and PSFCH can be transmitted using Type 1 or Type 2 channel access procedure in case of COT sharing.
* **Type 2B channel access procedure**
	+ [10/Intel]: The gap associated to a type 2B LBT is extended up to 25 us.
* **Type 2C channel access procedure**
	+ FFS under which conditions Type 2B or Type 2C is applied in case of a gap of 16 μs
		- Up to UE implementation: [4/HW, HiSi], [7/OPPO], [10/Intel], [15/xiaomi], [17/Samsung], [21/CMCC]
		- Subject to Tx duration at most 584us: [5/vivo], [22/Lenovo]

## Contention window adjustment procedures

* **Reference duration definition**
	+ Whether / how to define new reference duration or ending time for groupcast option 1
		- Yes: [13/LGE], [17/Samsung], [20/ETRI]
		- No: [5/vivo], [7/OPPO], [8/Spreadtrum], [13/LGE] (same ending time as existing one), [32/DCM]
	+ When MCSt is used in the latest COT,
		- No new ending time for the reference duration definition
			* [4/HW, HiSi], [17/Samsung], [23/E///]
		- the end of the first MCSt transmission that contains at least one PSSCH with ACK/NACK HARQ-ACK enabled
			* [2/Nokia, NSB], [5/vivo], [7/OPPO], [9/CATT, GH], [10/Intel], [25/Transsion], [34/ITL]
		- until the 1st full slot where PSSCH transmission happens, or burst end, whichever comes first:
			* [27/Apple]
* **SL-HARQ feedback is disabled in the latest COT / no PSFCH resource in RP (e.g., all cast types, S-SSB, PSFCH):**
	+ Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- [5/vivo], [9/CATT, GH], [10/Intel], [8/Spreadtrum], [7/OPPO], [13/LGE], [14/IDC], [18/Panasonic], [20/ETRI], [26/ZTE, SC], [30/QC], [32/DCM], [33/Sharp], [34/ITL], [35/WILUS]
	+ Option 2: CW is adjusted according to number blind retransmissions of the TBs within a COT.
		- [4/HW, HiSi], [17/Samsung]
	+ Option 3: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported in SL-U.
		- [2/Nokia, NSB], [14/IDC], [17/Samsung], [19/CAICT], [22/Lenovo], [29/Fraunhofer], [31/NEC]
	+ Option 4: If a is consecutively used times for generation of , is updated for each priority class to the next higher allowed value.
		- [17/Samsung], [22/Lenovo]
	+ Option 5: If a collision indicator is received, increase for every priority class to the next higher allowed value.
		- [29/Fraunhofer]
* **Unicast (ACK/NACK):**
	+ Option 2: If at least one ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class ; otherwise is increased.
		- [2/Nokia, NSB], [4/HW, HiSi], [7/OPPO], [10/Intel], [17/Samsung], [18/Panasonic], [29/Fraunhofer], [30/QC], [31/NEC], [13/LGE], [35/WILUS]
* **Groupcast option 1 (NACK-only):**
	+ Option 0: Not to be supported in SL-U
		- [9/CATT, GH], [14/IDC], [23/E///] (including BC)
	+ Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- [4/HW, HiSi], [5/vivo], [7/OPPO], [18/Panasonic], [32/DCM], [34/ITL]
	+ Option 2:
		- If ‘NACK’ or a collision indicator (IUC scheme 2) is received, increase for every priority class to the next higher allowed value.
		- When neither ‘NACK’ nor a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration,
			* Option A: is reset to for every priority class .
			* Option B: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- [2/Nokia, NSB, 20/ETRI, 25/Transsion, 29/Fraunhofer] (option A), [8/Spreadtrum], [19/CAICT], [13/LGE, 17/Samsung, 33/Sharp] (option B)
	+ Option 3: An ACK-only procedure is used instead of a NACK-only procedure. In this case, if at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class , otherwise is increased.
		- [10/Intel]
	+ Option 4: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported in SL-U.
		- [22/Lenovo]
	+ Option 5 (option 3+legacy): ACK feedback is performed when a TB is successfully decoded in addition to the legacy NACK-only procedure. In this case, if ACK only is received related to any transmissions within the latest SL reference duration, then ,  otherwise is increased.
		- [26/ZTE, SC] (if ACK supported)
	+ Option 6: [35/WILUS]
		- If no NACK feedbacks are received from the other SL UEs, CWS should be reset for the next PSSCH transmission,
		- Elseif, all NACK feedbacks are received from the other group of SL UEs, CWS should be increased to the higher allowed CWS value,
		- Else, one or more NACK feedbacks except all NACK feedbacks are received, CWS should be reset for the next PSSCH transmission since it can be considered that at least one of groups of SL UEs successfully received PSSCH with groupcast transmission.
	+ Option 7: [31/NEC]
		- If receiving power on the associated PSFCH is lower than a threshold, for each priority class ; otherwise is increased.
* **SL groupcast option 2 (ACK and NACK) within the last SL reference duration:**
	+ Option 1: Based on a (pre-)configurable ratio of received SL HARQ-ACK feedbacks,
		- If the ratio of ACK received is above the (pre-)configured value, is reset to for every priority class , otherwise increase for every priority class to the next higher allowed value.
		- [5/vivo], [7/OPPO], [9/CATT, GH], [17/Samsung], [18/Panasonic], [20/ETRI], [22/Lenovo], [26/ZTE, SC], [29/Fraunhofer], [31/NEC], [32/DCM], [34/ITL]
	+ Option 2: If at least a ‘ACK’ is received, for each priority class ; otherwise is increased.
		- [4/HW, HiSi] (from each RX UE), [10/Intel], [13/LGE], [14/IDC], [19/CAICT], [23/E///], [30/QC] (same as NR-U), [35/WILUS]
	+ Option 3: If 100% ACK (i.e., neither NACK nor DTX) is detected related to at least one TB transmission within the latest SL reference duration, for each priority class ; otherwise is increased.
		- [8/Spreadtrum], [32/DCM]
* **Mixed case (UE with different SL-HARQ feedback schemes) within the last SL reference duration:**
	+ [5/vivo]: UE adjusts the CWS based on the transmission with feedback enabled, where the unicast has the highest priority.
	+ [23/E///]: For MCSt, the CW is reset if at least one SL HARQ-ACK feedback for the TB(s) within the ‘reference duration’ is ‘ACK’.
* **Others:**
	+ [5/vivo]: The PSFCH or S-SSB within the reference duration cannot be used for CWS adjustment.
	+ [22/Lenovo]:
		- The uplink contention window size update procedure cannot be directly applied to sidelink.
		- To avoid priority-based dropping of HARQ-ACK associated with a CWS reference window, a Tx UE includes a 1-bit field to indicate if the corresponding PSFCH falls within the TX UE’s reference window. If so, an Rx UE uses the lowest priority value for the corresponding PSFCH priority determination (instead of the 3-bit field in the SCI).
	+ [23/E///]: SL-U transmissions without associated SL HARQ FB are not supported in Rel-18.
	+ [30/QC]:
		- For the reference duration, only PSCCH/PSSCH transmissions starting from the 1st starting symbol can be considered.
	+ [31/NEC]:
		- Contention window adjustment should be determined per priority, i.e., the same value and adjustment steps of the contention window should be used for each priority and all cast types with the same priority.

## CP extension (CPE)

* **Background information (variable**  **for CPE with configured grants in NR-U)**

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* **Selecting between Option 1 (1-symbol) and Option 2 (2-symbol) CPE window**
	+ For PSCCH/PSSCH transmission, motivation/criteria to select CPE starting position between Option 1 (1 symbol) and Option 2 (2 symbols) before the next AGC symbol in 30kHz and 60kHz
		- Option 1 (COT initiation)/Option 2 (COT sharing): [4/HW, HiSi], [9/CATT, GH], [18/Panasonic], [20/ETRI], [25/Transsion], [30/QC], [31/NEC], [34/ITL]
			* Not support: [15/xiaomi]
		- Option 1 (SL transmission in prior symbols)/Option 2(channel is idle / no prior SL or WiFi transmission): [7/OPPO], [13/LGE]
		- Option 1 (non-reserved resource)/Option 2 (reserved resource): [24/MediaTek]
		- Option 1/Option 2 (based on pre-configuration): [5/vivo]
* **When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH**
	+ Criteria for selecting a default CPE starting position
		- Partial/full RB set allocation: [2/Nokia, NSB], [8/ Spreadtrum], [10/Intel], [17/Samsung], [18/Panasonic], [21/CMCC], [27/Apple], [32/DCM] (partial, full RB set inside a COT, full RB set and high priority outside a COT)
		- Resource reservation (in the slot of the intended SL transmission): [4/HW, HiSi, 14/IDC] (highest reservation priority), [5/vivo] (RSRP threshold, partial RB set), [7/OPPO], [12/Fujitsu], [13/LGE] (RSRP threshold), [24/MediaTek], [30/QC] (RSRP threshold), [33/Sharp]
		- Mode 1 DG/CG or RA mode1/2: [7/OPPO] (Mode 2), [18/Panasonic]
		- COT sharing: [9/CATT, GH]
		- Always try the default CPE position first: [26/ZTE, SC]
	+ Criteria for selecting one of the multiple CPE starting positions
		- Priority level (e.g., CAPC or L1): [4/HW, HiSi] (full RB set, COT initiating, L1), [7/OPPO], [9/CATT, GH] (CAPC), [13/LGE], [26/ZTE, SC], [5/vivo] (CAPC), [12/Fujitsu] (existing reservation), [22/Lenovo], [31/NEC], [14/IDC], [30/QC], [33/Sharp] (CAPC), [24/MediaTek] (CAPC)
		- Random selection: [21/CMCC] (full RB set), [18/Panasonic] (full RB set), [27/Apple] (full RB set), [30/QC]
		- Indication from the COT initiating UE: [6/NSC], [15/xiaomi], [17/Samsung], [27/Apple]
			* Not support: [30/QC], [7/OPPO]
		- Indication from the gNB (Mode 1): [7/OPPO], [22/Lenovo]
	+ Candidate (pre-)configuration values for multiple CPE starting positions
		- Value 0 (earliest CPE starting position): [7/OPPO], [13/LGE]
		- Value (latest CPE starting position): [4/HW, HiSi], [5/vivo], [7/OPPO] (RX/TX switching time should be considered), [30/QC]
		- Value (16µs, 25µs, 34µs, 43µs, 52µs, 61µs, …) for 2-symbol CPE window: [4/HW, HiSi], [5/vivo], [7/OPPO], [13/LGE], [30/QC]
		- Value (16µs, 25µs) for 1-symbol CPE window: [4/HW, HiSi], [5/vivo], [30/QC]
		- Value (0, 16µs, 25µs, ) for 1-symbol CPE window: [7/OPPO],
* **For MCSt**
	+ The gap symbol should be used for
		- CPE transmission: [5/vivo] (earliest=16µs), [7/OPPO], [13/LGE] (16µs)
		- PSSCH transmission (rate matching):
		- FFS: [4/HW, HiSi]
* **For S-SSB**
	+ Only a single CPE starting position: [4/HW, HiSi], [7/OPPO], [6/NSC], [9/CATT, GH], [31/NEC], [32/DCM], [34/ITL]
	+ Multiple CPE starting positions: [2/Nokia, NSB], [26/ZTE, SC] (legacy), [24/MediaTek], [30/QC] (2)
	+ CPE starting position should be
		- (Pre-)configured: [2/Nokia, NSB], [4/HW, HiSi], [7/OPPO], [30/QC], [32/DCM]
		- Pre-defined: [10/Intel] ( within a shared COT)
	+ CPE starting positions for the additional S-SSBs
		- FFS (PHY agenda): [4/HW, HiSi], [5/vivo], [26/ZTE, SC], [30/QC]
		- Same as legacy: [7/OPPO],
* **For PSFCH**
	+ CPE starting position should be
		- (Pre-)configured: [2/Nokia, NSB], [4/HW, HiSi], [7/OPPO], [26/ZTE, SC], [9/CATT, GH], [21/CMCC], [30/QC], [32/DCM], [34/ITL] (16µs and 25µs)
		- Pre-defined: [2/Nokia, NSB], [3/FW] (16µs), [26/ZTE, SC], [6/NSC], [10/Intel] ( within a shared COT)
		- Indicated: [21/CMCC] (COT sharing)
* [2/Nokia, NSB]:
	+ Support CPE starting position within one symbol before the AGC for any subcarrier spacing (Option 1). Option 2 should be only considered if RAN1 assumes that SL CG transmissions or SL semi persistent transmissions from different UEs may occur on same PSSCH resources.
	+ The allowed CPE starting position for PSFCH should be discussed after deciding whether PSFCH can be transmitted to any UE during a shared COT and after deciding if PSFCH can use SCSt with Type 2A.
* [5/vivo]:
	+ RAN1 should clarify whether the CPE starting position can be transmitted in SL symbol only, or in any symbol before the next AGC symbol.
	+ The Tx/Rx and Rx/Tx switching time can be absorbed by the time gap for CPE based on the Table 5.3.1-2 in TS 38.214.
	+ When single CPE starting positions is configured for the resource pool, the CPE is at least used to fill the gap(s) between the consecutive SL transmissions in the same COT, and the CPE starts within 16us after the prior transmission, and ends until the ACG symbol of a following transmission.
	+ For LBT for Rel-18 S-SSB occasion within a resource pool, the following options can be considered for CPE determination:
		- Option 1: the CPE is the same as the R16 S-SSB occasion.
		- Option 2: the CPE is determined in the same way as PSSCH/PSCCH in the same resource pool.
		- Option 3: If the LBT for the corresponding R16 S-SSB occasions failed, the longest CPE, or the CPE associated with the highest priority should be used for S-SSB transmission.
		- Option 4: the CPE is configured for the resource pool.
	+ For consecutive S-SSB transmissions in a COT, a short enough CPE is used for the leading S-SSB to avoid being blocked by prior transmission, and a long enough CPE is used for other S-SSB to occupy the channel.
* [6/NSC]: Only Type 2 LBT is applicable for Option 2 CPE within at most 1, 2 symbols just before the next AGC symbol for 15, 30 and 60 kHz SCS, respectively.
* [9/CATT, GH]:
	+ Partial/full RB set allocation is not considered as a criterion for selecting a default CPE starting position.
	+ When multiple CPE starting positions are (pre-)configured for PSCCH/PSSCH, the default CPE starting position is selected for transmissions within a COT.
* [10/Intel]:
	+ For UEs operating in RA mode 2 with full RB allocation, a pseudo-random CP extension may be applied just before the next AGC symbol using the same design principles used for CG design in Rel.16 NR-U and whose length may be 1 symbol for 15 kHz SCS and 2 symbols for 30 or 60 kHz SCS (Option 2). Details are FFS.
	+ For a UE operating in RA mode 1 transmitting PSSCH/PSCCH within a shared COT, it is left up to UE’s implementation to append a CPE of maximum length of one OFDM symbol before the next AGC symbol.
* [23/E///]:
	+ Timing offsets are used for preventing inter-UE blocking of high-priority transmissions and transmissions on reserved resources.
	+ A TX UE avoids using the first starting point in a slot if it expects a PSFCH transmission by another UE.
	+ CPE offsets are used for preventing inter-UE blocking of Mode-1 UEs and other UEs.
* [24/MediaTek]:
	+ Multiple CPE starting positions are supported outside and inside of a COT.
	+ Only support multiple CPE starting positions can be (pre-)configured in each resource pool for PSSCH/PSCCH transmission.
	+ Single CPE starting position can be achieved by the indication of COT initiating UE inside a COT.
* [17/Samsung]:
	+ Support dynamic indication of CP extension in SCI for CO sharing, wherein the candidate values for indication include T\_ext = 0, 1 symbol – 25 us, and 1 symbol – 16 us, and the symbol duration is subject to the SCS of SL transmissions;
	+ Support (pre-)configured CP extension to align the transmission starting time, wherein the candidate values for (pre-)configuration include T\_ext = 0, 1 symbol – 16 us, 1 symbol – 25 us, 1 symbol – 34 us, 1 symbol – 43 us, 1 symbol – 52 us, 1 symbol – 61 us, and the symbol duration is subject to 15 kHz.
	+ Multiple CP extension values can be (pre-)configured, taking into account whether all the RB-sets are utilized, and whether the transmission is within a CO.
* [30/QC]
	+ When a set of multiple CPE starting positions is pre-configured for PSCCH/PSSCH, UE selects the CPE starting position for its transmission over a given starting slot as follows:
		- Case 1: if (1) the transmission has not been reserved by the UE (e.g., first transmission of the TB) and (2) the UE has not received SCI-1 reservations for transmissions within the same starting slot, UE selects a CPE starting position from the set of multiple CPE starting positions without any attempt to FDM with other UEs (down-select one):
			* Alt A: priority-based selection (e.g., CAPC)
			* Alt B: random selection
		- Case 2: if one of the two conditions in Case 1 does not hold, UE selects a CPE value that is common to all transmissions by other UEs that use the same starting slot, i.e., UEs are FDM’ed.
			* The CPE value for this case is (down-select one)
				+ Alt 1: a default CPE value that is pre-configured,
				+ Alt 2: a default CPE dynamically selected among those indicated in SCI-1 reservation(s) that reserved a transmission with this starting slot (e.g., the indicated CPE value is selected similarly to Case 1)

FFS: details (e.g. rule to determine the default CPE dynamically according to reservations, e.g. highest priority in local reservations.)

* + - * FFS: additional conditions to be satisfied for Case 2 to hold (e.g., reservation(s) with RSRP < threshold, partial RB set allocation for the transmission and/or other UE(s) reservation(s), FDMed allocation with other UE reservation(s))
				+ FFS: the behavior when Case 2 does not hold due to the additional conditions (e.g., default to selection as in Case 1)
* [13/LGE]:
	+ For PSFCH transmissions using COT, the channel access type is determined based on the minimum time gap among PSFCH transmission(s) within the RB set.
	+ The RX-TX switching time for Uu link is the same as the RX-TX switching time of SL, and the RX-TX switching time is not considered for CPE and LBT operation in NR-U. RAN1 does not pursue to modify LBT operation or CPE mechanism to consider the TX-RX or RX-TX switching time of 13µs.
	+ For Option 1 for CPE starting position, the CPE length candidate is given by
		- For 15kHz SCS
		- For 30kHz SCS
		- For 60kHz SCS
	+ When Option 2 for CPE starting position is enabled, the CPE length candidate is given by one of following alternatives:
		- Alternative 1:
			* For 30kHz SCS
			* For 60kHz SCS
		- Alternative 2:
			* For 30kHz SCS
			* For 60kHz SCS
			* When a UE detects another SL transmission in the previous slot, UE uses Option 1 instead of Option 2
* [25/Transsion]:
	+ For COT sharing, the TA values of both the COT initiating UE and the responding UE should be considered when calculating CPE (except for MCSt).
* [27/Apple]: For 60KHz SCS, to allow 25us CCA, extend the gap symbol to 2 symbol length.
* [32/DCM]:
	+ For single CPE starting symbol for PSCCH/PSSCH, the position is (pre-)configured per RP and within the symbol just before the next AGC symbol.
	+ UE can use an additional CPE starting position (pre-)configured per RP and within at most 2 symbols just before the next AGC symbol for PSCCH/PSSCH with full RB set allocation and with a priority value smaller than a (pre-)configured value when type 1 LBT is performed.
* [33/Sharp]: In SL-U, and in Resource Allocation Mode 1, a UE autonomously determines presence or length of CPE in the same way as in Resource Allocation Mode 2.
* **Topics for further study**
	+ FFS if more than one symbol for SL configured grant and semi persistent transmissions
	+ FFS extending the CP duration up to 1 OFDM symbol for CP extension
	+ FFS symbol repetition of the previous or following SL transmission
	+ FFS backward symbol extension, e.g., to avoid non-aligned SL transmission starting locations

## UE-to-UE COT sharing

* **When performing PSFCH transmission(s)**
	+ A responding UE can utilize a shared COT to transmit PSFCH(s) to UE(s) other than the initiator UE without requiring at least one of PSFCH transmissions is intended for the COT initiator.
		- Yes: [4/HW, HiSi], [8/Spreadtrum], [7/OPPO], [6/NSC], [9/CATT, GH], [20/ETRI], [21/CMCC], [14/IDC], [24/MediaTek] (pre-configured PSFCH), [26/ZTE, SC], [30/QC], [31/NEC], [32/DCM], [34/ITL]
		- No: [5/vivo], [13/LGE], [23/E///], [25/Transsion]
* **When performing PSCCH/PSSCH transmission(s)**
	+ Additional ID(s) can be supported (as part of COT sharing information)
		- Yes: [2/Nokia, NSB] (only targets COT initiating UE), [4/HW, HiSi], [6/NSC], [7/OPPO], [8/Spreadtrum], [9/CATT, GH], [13/LGE], [14/IDC], [15/xiaomi] (only one), [17/Samsung], [18/Panasonic], [19/CAICT], [20/ETRI], [21/CMCC], [22/Lenovo], [26/ZTE, SC], [29/Fraunhofer], [30/QC], [31/NEC], [32/DCM], [34/ITL], [35/WILUS]
			* IDs acquired from SL sensing: [4/HW, HiSi] (higher priority/lower CAPC), [19/CAICT],
			* IDs that are provided by UE higher layer (logical IDs): [7/OPPO]
			* PC5-RRC configuration / group management: [13/LGE]
			* RSRP or distance threshold: [15/xiaomi]
			* L1 ID: [7/OPPO], [18/Panasonic], [30/QC]
			* Minimize signalling overhead: [26/ZTE, SC]
		- No: [5/vivo], [10/Intel], [23/E///], [27/Apple]
* **Applicable channels / operation / receiver / cast types**
	+ [3/FW]:
		- UE forwarding/relaying information about a COT initiated by another UE should not be supported.
		- A S-SSB transmission cannot initiate a COT because the S-SSB slot format soes not support COT sharing information.
		- A PSFCH transmission alone cannot initiate a COT. To be part of the COT transmission initiation the PSFCH transmission should follow a PSCCH/PSSCH transmission in the same slot which carries COT sharing information.
	+ [5/vivo]:
		- For a set of consecutive slots configured for R16 S-SSB occasion, if UE intends to transmit S-SSB on one or multiple of the slot, and it detects no SCI indicating a shared COT that is overlapped with the one or multiple slots but detects S-SSB on at least one slot in the set of consecutive slots.
			* It assumes that there is a 2ms shared COT starting from the first detected S-SSB
			* If the assumed COT is overlapped with its occasion for S-SSB transmission, it can share the COT to transmit S-SSB.
		- When a UE only has S-SSB to transmit and it accesses the R16 S-SSB occasion with Type-1 LBT successfully, the reserved bits in MasterInformationBlockSidelink is used to indicate the shared COT information, e.g., whether the COT can be shared for S-SSB, and/or the start of the COT.
			* FFS: whether a responding UE can transmit PSFCH(s) to UE(s) other than the initiator
		- UE forwarding/relaying information about a COT initiated by another UE is not supported.
		- If more than one COT is identified by a COT sharing UE, the responding UE should determine which COT to share according to the COT sharing information.
		- No enhancement on the UE-to-UE ED threshold is needed.
	+ [8/Spreadtrum]: A minimum time gap between COT sharing indication and transmission of shared UE should be introduced.
	+ [9/CATT, GH]
		- The following conditions should be introduced under which UE can perform COT sharing:
			* UE has data to transmit.
			* The remaining COT is larger than a (pre-)configured threshold ~~or the channel access priority value is larger than a (pre-)configured value~~.
		- UE-to-UE COT sharing started with S-SSB or PSFCH transmission is not supported.
		- The cast type should be considered for COT sharing operation:
			* For unicast, the COT sharing duration between the unicast pair can be determined as that in NR-U, and the restriction of the absolute duration of the COT can be up to the regulation of each country.
			* For groupcast or broadcast, the COT sharing ending time for all the COT sharing UEs is an absolute time, i.e., determined by the absolute duration from the starting occasion of COT sharing.
	+ [10/Intel]:
		- A responding UE’s PSSCH/PSCCH transmission(s) within an RB set(s) corresponding to a shared COT can be transmitted to UEs other than the COT initiator when at least one PSSCH/PSCCH transmission is intended for the COT initiator.
		- Together with the initiating device, any responding UEs within a shared COT may redundantly carry the COT sharing information. [31/NEC]
		- There is no technical motivation for a Mode 1 UE to report to the associated gNB its COT sharing information.
	+ [12/Fujitsu]
		- For COT sharing, the RSRP or distance between UE-A and UE-B should be considered to determine whether UE-A can share a COT initiated by UE-B.
		- For COT sharing, it should be studied how to determine which COT to share if more than one COT is identified by a COT sharing UE.
	+ [13/LGE]: For utilizing the COT initiated by the COT initiating UE, the COT responded UE should use the transmit power in determining the resulting energy detection threshold which is used by the COT initiating UE to initiate the COT for UE-to-UE COT sharing.
		- FFS: Whether energy detection threshold to initiate the COT for UE-to-UE COT sharing is (pre)configured or indicated by the COT sharing information.
	+ [17/Samsung]
		- Support mode 1 UE report COT related information to gNB for aiding mode 1 RA.
			* Study if new/existing UCI format(s) in NR-U can be used to providing channel occupancy information from SL UE to gNB
			* FFS other details e.g., conditions and procedure.
	+ [19/CAICT]:
		- Limit the number of responding UE to share COT, considering the greater number of nodes to which COT is shared, the problem of COT interruption due to hidden node issue could be more serious.
	+ [21/CMCC]:
		- Do not support UE-to-UE COT sharing started with S-SSB or PSFCH from the initiator in SL-U.
		- Distance based COT sharing mechanism can be considered in SL-U:
			* If the distance between a pair of UEs is less than or equal to the threshold, COT sharing can be performed between them;
			* Otherwise, SL transmission can only be performed after successfully initializing a new COT by Type 1 channel access procedure.
	+ [22/Lenovo]
		- In order to support efficient transmissions of S-SSB in a shared COT, we think one of the following mechanisms should be adopted:
			* Option A: A responding UE over a shared COT for purposes of S-SSB transmissions can be any UE receiving the COT sharing indicator
			* Option B: The ‘additional ID’ functionality with the COT sharing indicator is supported and indicates one or more SLSS IDs + Iic to identify which synchronisation reference UE is allowed to use the shared COT for transmissions of S-SSB
			* Note: Neither of the proposed options are meant to allow such a UE to transmit signals/channels other than S-SSB, unless the UE is a target of a PSCCH/PSSCH transmission by a COT initiator.
		- RAN1 needs to study mechanism for COT recipient to select one COT sharing indicator/COT donor.
	+ [23/E///]
		- In the UE-to-UE COT sharing for the case of PSSCH/PSCCH, the receiver UEs of the transmission from the responder UE are restricted, e.g., based on a group belonging or based on specific service, while always including the initiator UE.
		- COT information is not shared or forwarded for any type of transmissions between different UEs.
		- The responding UE needs to ensure that the PSFCH transmission for the initiator UE is transmitted during the PSFCH occasion under the COT sharing mechanism, i.e., by means of re-prioritization of resources if needed.
		- For the case of PSCCH/PSSCH transmission, the responding UE needs to ensure that the transmission intended for the initiator UE and the UEs belonging to the IDs indicated in the COT sharing are transmitted within the COT sharing, i.e., by means of re-prioritization of transmissions.
	+ [26/ZTE, SC]: Before supporting additional ID (s) for COT sharing, the following two issues should be confirmed with RAN2:
		- For a transmission of one link from one UE, whether the source and destination IDs corresponding to other links associated with the UE are also available for this link
		- Whether a link can be identified by the truncated source/destination ID
	+ [27/Apple]: When the responding UE transmit within the shared COT, the resource selection window should be within the remaining COT length indicated in the initiating UE’s SCI.
	+ [29/Fraunhofer]:
		- The destination ID of the responding UE can be different to the source ID of the COT-initiating UE.
		- We propose that with regards to the channel types for the responding UEs transmissions using the shared COT, the responding UE should be capable of using the shared COT to transmit over PSCCH/PSSCH in the following time slot(s), or over the PSFCH in the same time slot.
		- The responding UE should be capable of using the shared COT to transmit over PSCCH/PSSCH in the following time slot(s), or over the PSFCH in the same time slot.
		- Use CPE and extended transmissions on guard symbols in order to retain the COT when sharing it across time slots and within the same time slot, respectively.
	+ [32/DCM]:
		- Send an LS to RAN2/SA to ask whether which UE (UE-ID) is included in a group of groupcast is known to each UE or not, and if the answer is YES, what is the condition if any
		- COT can be initiated by any SL channel/signal TX and can be shared to responding UE(s).
	+ [35/WILUS] At least for the unicast/groupcast SL transmission with HARQ-ACK enabled, UE-to-UE COT sharing should be supported in Rel-18 to guarantee PSFCH transmission opportunity to a receiver UE.
		- The UE-to-UE COT sharing may be desirable to be applied from PSCCH/PSSCH transmission to the nearest PSFCH transmission after channel access with a minimum period for UE-to-UE COT sharing.
* **COT sharing information contents for dynamic channel access (LBE)**
	+ COT length (starting offset and/or remaining): [4/HW, HiSi], [5/vivo], [9/CATT, GH], [10/Intel], [7/OPPO], [8/Spreadtrum], [22/Lenovo], [11/Sony], [27/Apple], [32/DCM], [30/QC], [26/ZTE, SC], [24/MediaTek], [18/Panasonic], [34/ITL], [31/NEC], [29/Fraunhofer]
	+ COT structure information (time and frequency resources): [4/HW, HiSi], [11/Sony], [30/QC]
	+ L1 ID (source ID/destination ID): [4/HW, HiSi], [5/vivo], [8/Spreadtrum], [9/CATT, GH], [7/OPPO], [22/Lenovo], [11/Sony], [32/DCM], [30/QC], [26/ZTE, SC], [24/MediaTek], [34/ITL], [29/Fraunhofer], [18/Panasonic]
	+ CAPC (priority): [4/HW, HiSi], [5/vivo], [8/Spreadtrum], [10/Intel], [9/CATT, GH], [7/OPPO], [22/Lenovo], [11/Sony], [27/Apple], [32/DCM], [30/QC], [26/ZTE, SC], [24/MediaTek], [18/Panasonic], [34/ITL], [31/NEC]
	+ Sensed LBT sub-bands / RB sets: [7/OPPO], [8/Spreadtrum], [9/CATT, GH], [11/Sony], [18/Panasonic], [32/DCM], [24/MediaTek], [34/ITL], [31/NEC]
	+ Initial Tx within the COT (e.g., PSFCH/S-SSB): [32/DCM]
	+ Channel access / LBT type: [4/HW, HiSi], [14/IDC], [27/Apple], [24/MediaTek], [29/Fraunhofer]
	+ CP extension: [27/Apple] (CPE index), [24/MediaTek]
	+ EDT: [27/Apple]
	+ Communication range: [21/CMCC]
	+ Responding UE’s transmission: [24/MediaTek]
	+ Whether the COT is allowed to be shared: [31/NEC]
	+ Whether source UE is the COT initiating or the responding UE: [18/Panasonic]
* **Container**
	+ SCI (1st and/or 2nd stage): [2/Nokia, NSB] (FFS), [4/HW, HiSi], [5/vivo], [9/CATT, GH], [10/Intel], [7/OPPO], [11/Sony], [22/Lenovo], [32/DCM], [30/QC], [29/Fraunhofer], [17/Samsung], [18/Panasonic], [15/xiaomi] (1st stage), [31/NEC], [34/ITL]
	+ MAC CE: [2/Nokia, NSB] (FFS)
* **Topics for further study**
	+ [13/LGE]: RAN1 conclude whether or how to support the case when a single PSCCH/PSSCH occupies multiple RB sets and a subset of the allocated RB sets belongs to the shared COT.
		- FFS: Whether or how to consider the shared COT in resource (re)selection
		- FFS: Whether or how to utilize the shared COT for the PSCCH/PSSCH transmission
	+ [17/Samsung]
		- For additional restrictions of responding UE transmitting PSSCH/PSCCH intended for the COT initiating UE, if a responding UE transmits PSSCH/PSCCH to destination groupcast ID with initiating UE as group member, study further conditions including HARQ option(s) of the groupcasted PSCCH/PSSCH.
		- In the case that a responding UE transmits PSSCH/PSCCH to destination groupcast ID with initiating UE as group member, further study:
			* Whether other receiver(s) of the groupcasted PSCCH/PSSCH can transmit PSFCH in the COT
			* How could the responding UE determine HARQ status in this case
	+ [30/QC]:
		- A method for grouping all the logical IDs related to communications with a COT initiating UE can be beneficial to support cross-cast and cross-session COT sharing.
		- RAN1 studies new COT sharing ID in COT sharing information, to signal COT sharing associated to a set of links (logical IDs)
			* FFS mapping of COT sharing ID to logical IDs (e.g., unicast source/destination ID, or destination ID for groupcast and broadcast).

## Multi-channel access

* **NR-U DL Type A and/or Type B multi-channel access (independent Type 1 or 2 LBT in each channel)**
	+ S-SSB
		- Support: [5/vivo], [7/OPPO], [15/xiaomi], [18/Panasonic] (Type A and B), [25/Transsion], [26/ZTE, SC]
		- Not support: [2/Nokia, NSB], [4/HW, HiSi], [9/CATT, GH], [24/MediaTek]
		- NR-U UL multi-channel access: [21/CMCC]
	+ PSFCH
		- Type A and/or Type B
			* Type A only: [2/Nokia, NSB], [5/vivo], [17/Samsung], [26/ZTE, SC], [35/WILUS] (at least)
			* Type B only: [9/CATT, GH]
			* Both Type A and Type B: [2/Nokia, NSB], [4/HW, HiSi], [6/NSC], [18/Panasonic], [31/NEC], [33/Sharp]
		- Multi-PSFCH transmissions are limited to contiguous RB set
			* Yes: [14/IDC], [35/WILUS]
			* No: [4/HW, HiSi], [7/OPPO], [6/NSC], [17/Samsung], [21/CMCC], [31/NEC], [33/Sharp]
			* Ask RAN4: [26/ZTE, SC]
* **Others**
	+ [3/FW]:
		- The maximum duration of multi-channel transmission on any channel , , shall not exceed , where the value of is determined using the Type 1 channel access parameters used to access channel .
		- Define conditions for SL-U multi-channel COT initiating and sharing.
	+ [5/vivo]:
		- The design of wideband operation in SL-U should support direct communication between a UE operating in multiple RB sets and another UE can only operate in one or subset of the RB sets. The SL UE transmits SCI in every allocated RB set and avoid to reserve resources in RB set other than the RB sets of the receiver.
		- In mode 2 resource selection, the number of the allocated RB sets should be limited as much as possible, especially when the TB size is small.
		- When determine whether to perform wideband transmission and the number of selected channels in wideband transmission, the information other than TB size, e.g. transmission priority or CBR measurement result, should be considered.
	+ [14/IDC]:
		- Support the COT initiator UE can maintain a subset of the acquired RB sets
		- Support COT sharing of all, or a sub-set of the RB sets acquired by the initiator UEs.
	+ [17/Samsung]: For PSCCH/PSSCH using multi-channel access, support transmitting corresponding PSFCH on a subset of RB sets. Further consider the following options:
		- Option 1: RX UE transmits PSFCH on the RB set with lowest index
		- Option 2: RX UE select a subset from RB set(s) of multi-channel access to transmit PSFCH, according to detected interference on each RB set, e.g., according to LBT result or CBR measurement
		- Option 3: RX UE select a subset from RB set(s) of multi-channel access to transmit PSFCH, according to pre-defined mapping rule
	+ [22/Lenovo]: Before discussing relaxations of channel access behaviour for SL-U in case of multiple TB transmissions on a carrier, RAN1 needs to have the technical discussion and agreement whether such a new transmission behaviour will be supported. This may involve RAN4's feedback on the feasibility and corresponding constraints.
	+ [24/MediaTek]: The CAPC value of PSFCH may have impact on the utilization of Type A/Type B NR-U DL multi-channel access for PSFCH transmission.
	+ [32/DCM]:
		- S-SSB and a PSFCH are not mapped across multiple RB sets.
		- For multi-channel access, support LBT type determination per channel based on whether COT is obtained/shared for each channel.
		- When a PSCCH/PSSCH is transmitted across multiple RB-sets, for how to perform LBT at each channel,
			* At channels where COT has not been initiated/shared, DL type A (type 1 at each channel) or type B (type 1 at a random channel and type 2 at the remaining channels) or UL mechanism (type 2 if condition is met; otherwise, type 1 at each channel) is reused.
			* At channels where COT has been initiated/shared, type 2 LBT is applied as in COT sharing procedure for a PSCCH/PSSCH transmission at a single RB-set.
* **Topics for further study**
	+ [9/CATT, GH]: For multiple channel access procedure,
		- How to identify initial contention window counter Ninit
		- How to perform COT sharing
		- The impact of half duplex

## Multi-consecutive slots transmission (MCSt)

* **Multi-Consecutive Slots transmission (MCSt)**
	+ When L1 is triggered for reporting a subset of candidate resources for MCSt,
		- Option 1: Only one set of parameters (, remaining PDB, and ) is provided for the resource selection procedure in L1
			* [4/HW, HiSi] (for each TB), [5/vivo], [7/OPPO, 9/CATT, GH, 10/Intel, 21/CMCC, 30/QC] (number of slots), [8/Spreadtrum], [14/IDC], [18/Panasonic], [20/ETRI], [23/E///], [24/MediaTek] (CAPC, number of slots), [25/Transsion], [26/ZTE, SC], [27/Apple], [31/NEC], [32/DCM], [33/Sharp]
		- Option 2: one or multiple sets of parameters (, remaining PDB, and ) are provided for the resource selection procedure in L1
			* [4/HW, HiSi] (multiple sets are provided independently), [15/xiaomi] (number of slots), [17/Samsung]
	+ When L1 reports a subset of candidate resources for MCSt,
		- Option A: L1 reports candidate multi-slot resources in *SA* where a candidate multi-slot resource consists of a set of single-slot resources that are consecutive in time
			* [5/vivo], [7/OPPO], [8/Spreadtrum], [9/CATT, GH], [10/Intel], [14/IDC], [15/xiaomi], [17/Samsung], [18/Panasonic], [21/CMCC], [23/E///], [24/MediaTek], [25/Transsion], [27/Apple], [29/Fraunhofer], [30/QC], [33/Sharp]
		- Option B: L1 reports candidate single-slot resources in (*SA*) as in Rel-16
			* [4/HW, HiSi] (for each TB), [15/xiaomi], [20/ETRI], [26/ZTE, SC], [31/NEC], [32/DCM]
		- Option C: L1 reports consecutive single-slot candidate resources in *SA*
			* [15/xiaomi]
	+ Multi-consecutive slots transmission as a single transmission of a TB is not supported:
		- [5/vivo], [7/OPPO], [32/DCM]
	+ The guard symbol between two adjacent slots in MCSt is filled-in such that there is no gap or the gap is less than 16 us (Type 2C or no LBT is needed) between the two slots by:
		- Option 1: Repeating the last PSSCH symbol of the earlier slot
			* [21/CMCC]
		- Option 2: Transmitting PSSCH / rate matching
			* [4/HW, HiSi] (FFS conditions), [12/Fujitsu], [22/Lenovo]
		- Option 3: Transmitting CPE
			* [5/vivo], [7/OPPO], [15/xiaomi], [30/QC], [32/DCM]
	+ [2/Nokia, NSB]
		- Regarding when L1 is triggered for reporting a subset of candidate resources for MCSt, both Option 1 or Option 2 are unclear how L1 determines the number of consecutive slots. When L1 is triggered for reporting a subset of candidate resources for MCSt, in case L1 should report candidate multi-slot resources (or consecutive single-slot candidate resources), RAN1 should consider another information for L1 to know the number of consecutive slots. Otherwise, the acquisition of candidate resources in consecutive slots should be based on implementation.
		- Regarding when L1 reports a subset of candidate resources for MCSt, RAN1 may discuss: (i) in case Option A/C is supported, how should L1 know about the number of consecutive slots for reporting (ii) in case Option B is supported, is up to MAC to select consecutive resources based on implementation instead of random selection (iii) MCSt only supported by implementation.
		- RAN1 can define rules for enabling/disabling GP during a MCSt, e.g., depending on whether it is expected different SL UE transmissions overlapping in time with a MCSt allocation.
	+ [4/HW, HiSi]
		- Option 1 and option 2 agreed in RAN1 #110bis-e agreement are not exactly the same as Rel-16 per TB-based resource selection procedure in L1, where multiple sets of parameters is provided for the resource selection procedure in L1 for the corresponding TBs, and the procedure is independently performed multiple times with multiple sets of parameters for multiple TBs.
		- In legacy sidelink design, the number of TBs and corresponding parameters are finally decided after receiving reported *SA* from PHY layer, it is unfeasible that number of consecutive slots indicated by MAC layer. If the length of multi-slot resources needs to be indicated by MAC layer, LS should be sent to RAN2 to check whether number of candidate TBs can be indicated before reporting candidate resource set.
		- L1 additionally reports resources to be shared to other UEs to higher (MAC) layer including corresponding L1 priority, CAPC and source/destination ID.
			* MAC layer shall select multi-consecutive slots resources for multiple TBs and resources to be shared if any.
	+ [5/vivo]:
		- One TB repetition and multi-TBs mapping over multiple slots are preferred for the scenarios of the multi-consecutive slot transmission in SL-U.
		- Additional ending loop condition in resource selection step 7) is required to ensure consecutive single-slot resources reported to higher layer.
	+ [8/Spreadtrum]: The consecutive single-slot candidate resources cannot have different sizes.
	+ [9/CATT, GH]:
		- For unicast and groupcast, HARQ feedback is transmitted after the whole MCSt transmission is finished and the mapping of PSFCH resource is based on the last resource of the MCSt.
		- Higher layer ensure that the CAPC level of a MCSt is a certain value.
	+ [10/Intel] Multi-UEs multi-consecutive slot transmission is supported by implementation by its procedure is not supported by design.
	+ [13/LGE]:
		- On the support of MCSt operation in SL-U, it is necessary to clarify whether the set S\_A is associated with a single TB/grant or can be associated with multiple TBs/grants.
		- On the support of MCSt operation in SL-U, if the set S\_A can be associated with multiple TBs/grants, it is necessary to further discuss which parameters (e.g., prio\_TX, L\_subCH, P\_rsvp\_TX) will be used to define candidate resource and to generate the set S\_A according to Mode 2 RA operation.
		- For MCSt for the different TBs or different SL grants of a UE, it is necessary to carefully investigate the case when the UE reselect or drop PSCCH/PSSCH transmission in the middle of MCSt due to resource collision or success of the TB.
	+ [14/IDC]
		- Support initial transmission and re-transmissions of a TB within a COT.
		- Study re-transmissions of a TB in a different COT than the one including the initial transmissions.
	+ [15/xiaomi]: Type 2A and type 2B channel access is also applicable to the case of multi-slot transmissions from the same UE.
	+ [17/Samsung]: How to handle the case that part of selected multi-slot resources become unavailable e.g., due to LBT failure or pre-emption/re-evaluation.
	+ [18/Panasonic]: Each slot has SCI and SCI indicates resource allocation of each slot.
	+ [20/ETRI] The higher layer triggers L1 resource selection procedures for MCSt one by one with the parameter set corresponding to each TB
		- If the higher layer cannot trigger L1 resource selection procedure sequentially due to almost same TB generation timing, it drops the resource selection procedure for some of TBs on a priority basis
	+ [21/CMCC]:
		- MCSt should be achieved by a single UE in Rel-18 SL-U.
		- Further study two options for the frequency domain resources in consecutive slots:
			* Option 1: The frequency domain resources are same among the consecutive transmitted slots;
			* Option 2: The frequency domain resources can be different among the consecutive transmitted slots.
		- For mode 1, enhancements on both DG and CG can be considered to allocate consecutive time domain resources, the design of DCI format 0\_1 and CG configuration in NR-U can be a reference.
	+ [22/Lenovo]
		- Multiple PSSCHs scheduled by a single SCI is supported for sidelink transmissions in FR1 unlicensed spectrum.
	+ [23/E///]
		- When a UE triggers MCSt, it performs the resource reservation procedure ensuring the allocation of consecutive resources for multiple TBs. In case there are not contiguous slots available to the already reserved ones, the UE might trigger resource reselection for all the TBs.
		- L1 reports candidate single-slot resources in (SA) as in Rel-16:
			* Selection of the first resource in a MCSt follows the legacy procedures.
			* For the subsequent resources, the TX UE disregards the reservations (FFS exceptions, based on priority).
		- Re-use the legacy procedure where one SCI reserves up to two resources for further transmissions.
		- Resources reserved by PSCCH scheduling one TB can be used for (re)transmission of a different TB.
	+ [26/ZTE, SC]: In order to avoid the interruption due to PSFCH symbols, the occupying signals should be allowed to transmit on a PSFCH occasion within the continuous SL slots.
	+ [27/Apple]:
		- Multi-slot transmission should prioritize multi-TB transmission.
		- For model 1 RA with CG and mode 2 RA, multi-slot transmission is enabled only for full BW transmission where all the resource blocks within an RB set is configured.
	+ [29/Fraunhofer]: Study the impact of multi-slot transmissions in SL-U, including aspects related to single TB transmissions across slots, and its effect on Mode 2 sensing and resource selection procedures.
	+ [30/QC]:
		- MCSt for multiple TBs is supported in SL-U for both Mode 1 and Mode 2 operation.
		- Mode 1:
			* Introduce multi-TTI grant to support MCSt in mode 1 SL-U. RAN1 should study details regarding
				+ TDRA indication for multiple slots
				+ HARQ ID and NDI for multiple TBs
				+ SCI-1 optimizations across multiple slots
				+ Utilization of gap symbol for data
		- Mode 2: one of the following alternatives is selected for enhancing the resource selection procedure:
			* Alt1: Resource selection is triggered independently for each TB/SL process. The legacy resource selection is reused as much as possible except for the selection of candidate resources in MAC, where the selection can take into account previously selected resources to select a contiguous one (not at random) as much as possible.
				+ Note: for each TB, in in the case where resources are selected for retransmissions, the minimum gap between any pair a resources still need to be ensured (as in R16/17 NR SL).
			* Alt2: Resource selection can be triggered for a set of TBs/SL processes. The steps of the R16/17 resource selection procedure are enhanced to guarantee selecting a multi-slot resource for the set of TBs/SL processes.
* **Issues that should be further studied:**
	+ FFS: how to enable MCSt when the slots are in more than one COT due to MCOT limitation.
	+ FFS: whether the number of multiple consecutive allocations should be dynamic or (pre)configured, and the impact on resource selection procedure, e.g., to prevent disrupting LBT of reserved resources.
	+ FFS: whether resources reserved by PSCCH scheduling one TB can be used for (re)transmission of a different TB.
	+ FFS: whether frequency resources are same or can be different among the slots.
	+ FFS: how to signal the number of consecutive slots in the UE’s initial slot transmission.
	+ FFS: details regarding TDRA indication for multiple slots, HARQ ID and NDI for multiple TBs, SCI-1 optimizations across multiple slots, and utilization of gap symbol for data.

## Resource allocation enhancements in SL-U

* **Type 1 LBT blocking solutions:**
	+ [2/Nokia, NSB], [4/HW, HiSi], [5/vivo], [11/Sony], [17/Samsung], [20/ETRI], [22/Lenovo]
		- Resource allocation procedure should avoid selection of a candidate resource before a reserved resource in case the transmitting symbols of candidate resource overlap with LBT of the reserved resource.
		- Resource allocation procedure should avoid selection of a candidate resource after a reserved resource in case the transmitting symbols of the reserved resource overlap with LBT of candidate resource.
	+ [5/vivo]
		- SL UE deems channel busy only if the UE detects transmission other than SL transmission occupying the channel (e.g., exceeding the energy detection threshold), i.e., the energy detection for EDT checking in LBT procedure does not take into account the energy from SL transmissions.
	+ [7/OPPO], [4/HW, HiSi], [17/Samsung], [20/ETRI], [22/Lenovo]
		- In order to utilize a shared COT from another UE in Mode 2 RA, in addition to the existing set *SA*, all received and usable COT information should be separately reported to the higher layer for resource selection.
		- To avoid inter-UE blocking in performing Type 1 LBT (i.e., one UE’s transmission is blocking another UE from performing a Type 1 LBT)
			* Prioritize / select a resource just after an existing reservation, where the COT initiated from the existing reservation can be shared with the selected resource.
			* Prioritize / select a resource just prior to an existing reservation, where the COT initiated from the selected resource can be shared with the existing reservation.
	+ [8/Spreadtrum]
		- No solution needed to address the insufficient time issue to perform Type 1 LBT before a selected resource.
	+ [17/Samsung], [24/MediaTek]
		- UE selects extra / more resources than required for transmitting a TB (i.e., overbooking) to accommodate potential Type 1 LBT failures.
	+ [17/Samsung], [32/DCM]
		- LBT duration is determined firstly, then resource selection takes into account of the LBT duration is performed.
	+ [19/CAICT]
		- For LBT contention back-off with inter-UE blocking or intra-UE blocking, the contention back-off continues in a slot if the SL UE can successfully decode the SCI transmitted from other UEs in the slot, or the SL UE sends its own data in the slot. Otherwise, the contention back-off is frozen in the slot.
	+ [32/DCM]:
		- LBT mechanism is modified
			* back-off count is skipped during the duration overlapped with a TX by another UE in a different COT
			* energy detection is skipped during the duration overlapped with a TX by another UE in a different COT
	+ [33/Sharp]:
		- When estimating the detected power within a sensing slot duration in Type 1 channel access, the UE excludes frequency resources (if any) previously reserved via SCI by other SL UEs in that slot.
* **Mode 1 RA**
	+ Indication of LBT failure to gNB
		- Reporting HARQ-NACK: [7/OPPO] (when SL-HARQ enabled), [30/QC] (additional bit in PUCCH for LBT failure)
		- Other means: [7/OPPO] (when SL-HARQ disabled)

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Appendix (outcomes of past meetings)

## RAN1#109-e (09 – 20 May 2022)

**Agreement**

Type 1 and Type 2 (2A/2B/2C) channel access procedures, transmission gap and LBT sensing idle time requirements specified in TS37.213 for NR-U are taken as baseline for NR sidelink operation in a shared channel.

* FFS conditions for the actual channel access type(s) used for each SL channel and signal transmitted, and based on COT sharing conditions (if supported)
* FFS whether UL CAPC or DL CAPC or both should be used as the baseline,
	+ FFS how the channel access priority classes apply to each SL channel and signal
	+ FFS sidelink priority levels (PQI or L1 priority), channel and signal mapping to the 4 channel access priority classes. The discussion may involve other WGs.

**Agreement**

* UE-to-UE COT sharing is supported in NR sidelink operation in a shared channel (SL-U).
	+ FFS applicable SL channels and signals (e.g., PSCCH/PSSCH, PSFCH, S-SSB) for shared COT access and any restrictions (e.g. whether the COT can be shared with a single UE or multiple UEs)
	+ FFS all other details in compliance with the regulatory requirements
* CP extension (CPE) is supported for NR sidelink operation in a shared channel.
	+ FFS all remaining details including applicable scenarios, usage, PHY structure, etc.

**Agreement**

Channel access procedures for transmission(s) on multiple channels are supported for NR sidelink operation as defined by TS37.213 for NR-U (wherever applicable)

* FFS whether the downlink, uplink and/or semi-static multiple channel access procedure(s) (if supported) from NR-U should be used as a baseline and whether/how they are applied in SL mode 1 and mode 2 operation

**Agreement**

* The existing sidelink mode 1 RA including dynamic grant, Type 1 and Type 2 configured grants are supported as a baseline for sidelink operation in a shared carrier, subject to applicable regional regulations. At least in dynamic channel access, SL UE performs Type 1 or one of the Type 2 LBTs before SLtransmission using the allocated resource(s), in compliance with transmission gap and LBT sensing idle time requirements specified in TS37.213.
	+ FFS whether/how mode 1 resource allocation ~~selection~~ procedure needs to be updated / enhanced due to shared spectrum channel access
* The existing sidelink mode 2 RA schemes are supported as a baseline for sidelink operation in a shared carrier, subject to applicable regional regulations. At least in dynamic channel access, SL UE performs Type 1 or one of the Type 2 LBTs before SL transmission using the selected and/or reserved resources, in compliance with transmission gap and LBT sensing idle time requirements specified in TS37.213.
	+ FFS whether/how mode 2 resource selection procedure needs to be updated / enhanced due to shared spectrum channel access
* FFS whether/how multi-consecutive slots transmission can be supported for NR sidelink operation in unlicensed spectrum, including the following aspects
	+ channel access, resource allocation and PHY channel design
* FFS whether/how enhancement is needed between the end of the LBT procedure and the start of the SL transmission to retain channel access
* RAN1 to strive for a common solution for channel access for Mode 1 and Mode 2

## RAN1#110 (22 – 26 August 2022)

**Agreement**

The following evaluation scenario can be used for evaluating performance of SL-U designs, resource allocation schemes, and coexistence study with another RAT in a shared channel.

* Scenario 1 (commercial use cases) – recommended:
	+ Evaluation methodology baseline is NR-U from TR 38.889 with the following updates.
	+ Indoor layout
		- Option 1: a pairs topology for SL-U from R1-2205033 – recommended



* + - * a = 20m, b = 60m, c = 20m, d = 80 m
			* There are two operators to model two RATs at a time. The red one is SL-U UE, the blue one is Wi-Fi or NR-U.
			* For NR-U / Wi-Fi, the same number of UEs / Wi-Fi STA as the total number of SL-U devices are dropped in the area. The NR-U UE / Wi-Fi nodes are dropped uniformly per gNB/AP per 20 MHz.
				+ Companies should report if they used a different number of UEs / Wi-Fi STA as the total number of SL-U devices, as an additional evaluation scenario.
			* For evaluation of unicast traffic, the topology of SL-U is pair topology and the SL-U UEs are dropped uniformly at random in the area.
				+ Companies should report how SL-U UEs are paired
				+ 6 SL-U pairs and 4 NR-U UEs / Wi-Fi nodes per gNB/AP per 20 MHz
			* For evaluation of groupcast traffic, SL-U UEs are dropped uniformly at random in the area, SL-UEs form groupcast UE group based on TX-RX UE distancing, the distance is provided by each company.
				+ Companies should report how SL-U UEs form a group
				+ 12 SL-U UEs and 4 NR-U UEs / Wi-Fi nodes per gNB/AP per 20 MHz
			* For evaluation of broadcast traffic, SL-U UEs are dropped uniformly at random in the area.
				+ 12 SL-U UEs and 4 NR-U UEs / Wi-Fi nodes per gNB/AP per 20 MHz
		- Option 2: SL UE clusters (R1-2203146)

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* + - * Indoor layout and UE dropping model with N = 3 or 6 clusters and each with M=5 UEs
			* Each cluster is a circle, with a central point and radius Rmax = 15 or 10m and Rmin = 5 or 1m
			* No overlapping among the N clusters
			* For coexistence, there are two operators to model two RATs at a time, where the red one is Wi-Fi AP or NR-U gNB. NR-U UE / Wi-Fi STA are dropped uniformly per gNB/AP.
			* Simulation bandwidth can be larger than 20MHz (e.g., 80MHz)
	+ Channel model follows NR InH Mixed Office model used in NR-U (TR38.889)
	+ Traffic model
		- Option 1: R17 sidelink commercial traffic model with periodic model 3 with packet size reduced by a factor of (high: 1; mid: 5; low: 10)
			* FFS whether/how the PDB requirement can be captured
		- Option 2: FTP model 3 with arrival rate satisfying one of the followings:
			* BO Low load: 10%~25%
			* BO Mid load: 35%~50%
			* BO High load: above 55%
		- Option 3: XR cloud gaming model in TR38.838
			* FFS whether/how the PDB requirement can be captured
		- It is up to each company to use either Option 1 or 2 or Option 3 or mixed of them
	+ Interference model:
		- Layout option 1: Explicit modelling of NR-U / WiFi transmissions (as per TR38.889)
		- Note, for the interference traffic model:
			* The same or equivalent traffic model setting as SL-U should be used as much as possible to achieve equal load (e.g., SL-U RAT offered load equal the interfering RAT’s offered load).
			* The same number of traffic flows should be used between SL-U and the interfering RAT (e.g., 10 UEs with 10 flows, and 5 STAs with 2 flows each, one for DL and one for UL)
				+ Companies should report if they used a different assumption, as an additional evaluation scenario.
	+ Performance metric: UPT, latency, and PRR which regards the packet whose delay exceeding the remaining PDB as transmission failure.
		- FFS: UE satisfaction/system capacity as section 7.2 in TR 38.838 for XR traffic evaluation
		- FFS for groupcast and broadcast
	+ Fair coexistence criterion between SL-U and the interfering RAT (e.g., according to NR-U TR38.889)

**Agreement**

* CW adjustment
	+ NR-U DL CW adjustment mechanism is used as the baseline for SL-U when SL-HARQ feedback is enabled in SCI for unicast
		- FFS any necessary update for SL-U operation
	+ FFS: how to determine CW size when SL-HARQ feedback is disabled in SCI
	+ FFS the case of groupcast option 1 (NACK-only) and groupcast option 2

**Agreement**

* Type 2A/2B/2C SL channel access procedures
	+ Type 2A channel access procedure is applicable to the following case:
		- Transmission(s) by a UE following transmission(s) by another UE for a gap ≥ 25μs in a shared channel occupancy
		- FFS any other transmission by a UE (e.g., other than COT sharing)
		- FFS whether Type 2A is used also for the case of short control signalling transmission
	+ Type 2B channel access procedure is applicable to the following case:
		- Transmission(s) by a UE following transmission(s) by another UE at least when the gap is 16μs in a shared channel occupancy
		- FFS the case when the gap is between 16 and 25us
		- FFS any other transmission by a UE (e.g., other than COT sharing)
	+ Type 2C channel access procedure is applicable to the following case:
		- Transmission(s) by a UE following transmission(s) by another UE for a gap ≤ 16μs in a shared channel occupancy and the duration of the corresponding transmission is at most 584us.
		- FFS any other transmission by a UE (e.g., other than COT sharing)
		- FFS whether Type 2C is used also for the case of short control signalling transmission
	+ FFS under which conditions (other than the gap) UEs can apply the Type 2A/2B/2C SL channel access procedures
	+ FFS under which conditions Type 2B or Type 2C is applied in case of a gap of 16 μs

**Agreement**

Multi-consecutive slots transmission (MCSt) is supported for Mode 1 and Mode 2 resource allocation in SL-U.

* FFS details

**Agreement**

* For UE-to-UE COT sharing, continue considering the following alternatives:
	+ Alt. 1: A responding SL UE can utilize a COT shared by a COT initiating UE when the responding SL UE is a target receiver of the at least COT initiating UE’s PSSCH data transmission in the COT.
		- When the responding UE uses the shared COT for its transmission has an equal or smaller CAPC value than the CAPC value indicated in a shared COT information
		- FFS any additional conditions
	+ Alt. 2: A responding SL UE can utilize a COT shared by a COT initiating UE when the responding SL UE is a target receiver of the COT initiating UE’s transmission in the COT.
		- When the responding UE uses the shared COT for its transmission has an equal or smaller CAPC value than the CAPC value indicated in a shared COT information
		- FFS how to determine a SL UE is a target receiver
		- FFS: details of the channel type of the COT initiating UE’s transmission
		- FFS any additional conditions
	+ For Alt1 and Alt2: When a responding UE uses a shared COT for its transmission(s), the COT initiating UE is a target receiver of the responding UE’s transmission(s).
		- FFS: details of the channel type of the responding UE’s transmission(s)
* gNB relaying/forwarding a UE initiated COT to another UE is not supported in Rel-18
* FFS whether a Mode 1 UE can report a COT or related information to gNB for aiding Mode 1 RA

## RAN1#110bis-e (10 – 19 October 2022)

**Agreement**

* Type 1 SL channel access procedure is applicable to the following transmissions by a UE:
	+ PSSCH/PSCCH transmission(s) scheduled or configured by a gNB in SL Mode 1 resource allocation.
	+ PSSCH/PSCCH transmission(s) from the UE in SL Mode 2 resource allocation.
	+ Other SL transmissions including S-SSB and PSFCH transmissions from a UE
		- FFS: how to set CAPC for S-SSB and PSFCH
	+ Note: Type 1 can be used to initiate a COT
* A UE uses a channel access priority class applicable to the sidelink user plane data multiplexed in PSSCH for performing the Type 1 channel access procedures to transmit transmission(s) including PSSCH with user plane data and its associated PSCCH.
	+ Note: how to set CAPC for MAC CE multiplexed in PSSCH is up to RAN2
* A UE shall not transmit on a channel for a Channel Occupancy Time that exceeds the maximum COT duration where the channel access procedures are performed based on a channel access priority class *p* associated with the UE transmissions, as given in CAPC table for SL.

**Agreement**

On the support of MCSt operation in SL-U, following options are to be further studied and one or more of the following options will be selected in future meetings.

* When L1 is triggered for reporting a subset of candidate resources for MCSt,
	+ Option 1: Only one set of parameters (, remaining PDB, and ) is provided for the resource selection procedure in L1
		- Note, this is applicable for transmission of a single TB and multiple TBs
		- FFS: whether this is the same or different than Rel-16
	+ Option 2: one or multiple sets of parameters (, remaining PDB, and ) are provided for the resource selection procedure in L1
	+ FFS: any further information needs to be provided to L1 for MCSt
* When L1 reports a subset of candidate resources for MCSt,
	+ Option A: L1 reports candidate multi-slot resources in *SA* where a candidate multi-slot resource consists of a set of single-slot resources that are consecutive in time
		- FFS whether the set of single-slot resources within a candidate multi-slot resource can have different sizes
	+ Option B: L1 reports candidate single-slot resources in (*SA*) as in Rel-16
		- It is up to the higher (MAC) layer to select a set of single-slot resources that are consecutive in logical slots
	+ Option C: L1 reports consecutive single-slot candidate resources in *SA*
		- FFS whether the consecutive single-slot candidate resources can have different sizes
	+ FFS: any further information needs to be reported to MAC layer, provided to L1 or utilized for MCSt
	+ FFS: whether/how to consider the additional LBT time in SL resource allocation

**Agreement**

For dynamic channel access mode with multi-channel case in SL-U, NR-U UL channel access procedure is considered as baseline for transmission on multiple channels

* FFS: whether transmission of PSFCH and/or S-SSB on a subset of RB sets is supported (using the NR-U DL channel access procedure as baseline)
* FFS any necessary enhancement and modification for the SL-U operation

**Agreement**

In Type 1 SL channel access procedure, the following table is adopted for channel access priority class (CAPC) for SL.

* FFS: the applicability and usage of NOTE1 in the table
* FFS: whether ***mp****=1* can be used with ***p=1***, and applicable cases

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Channel Access Priority Class (*p*) | *mp* | *CWmin,p* | *CWmax,p* | *Tslmcot,p* | allowed *CWp* sizes |
| 1 | 2 | 3 | 7 | 2 ms | {3,7} |
| 2 | 2 | 7 | 15 | 4 ms | {7,15} |
| 3 | 3 | 15 | 1023 | 6ms [or 10 ms]  | {15,31,63,127,255,511,1023} |
| 4 | 7 | 15 | 1023 | 6ms [or 10 ms] | {15,31,63,127,255,511,1023} |
| [NOTE1:   For*p*=3,4, *Tslmcot*,*p*=10*ms* if the higher layer parameter absenceOfAnyOtherTechnology-r14 or absenceOfAnyOtherTechnology-r16 is provided, otherwise,*Tslmcot*,*p*=6*ms*.]NOTE 2:   When *Tslmcot*,*p*=6*ms* it may be increased to 8*ms* by inserting one or more gaps. The minimum duration of a gap shall be 100*μs*. The maximum duration before including any such gap shall be 6*ms*.  |

**Agreement**

* RAN1 is to study the definition of a “SL reference duration” following the NR-U principle and RAN1 is to agree on the definition before down-selection to an option for CW adjustment for SL HARQ-ACK feedback enabled/disabled and each cast type
* In Type 1 SL channel access procedure, further study the following cases and options. Other options are not precluded.
	+ CW adjustment when SL-HARQ feedback is disabled (at least if all transmissions within the latest SL reference duration have SL-HARQ feedback disabled):
		- Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- Option 2: CW is adjusted according to number blind retransmissions of the TBs within a COT.
		- Option 3: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported for SL-U
		- Option 4: If a is consecutively used times for generation of , is updated for each priority class to the next higher allowed value.
		- Option 5: If a collision indicator is received, increase for every priority class to the next higher allowed value.
	+ CW adjustment for groupcast option 2 with SL-HARQ feedback enabled (~~i.e.~~, at least In case only groupcast option 2 PSSCH(s) is (are) transmitted within the latest SL reference duration):
		- Option 1: Based on a (pre-)configurable ratio of received SL HARQ-ACK feedbacks in the latest SL reference duration, is reset to for every priority class , otherwise increase for every priority class to the next higher allowed value.
			* FFS: whether the ratio of the received SL HARQ-ACK feedbacks is ‘ACK’, ‘NACK’ or ‘ACK+NACK’
			* FFS: how to calculate the ratio
			* FFS: the (pre-)configuration ratio values
		- Option 2: If at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class ; otherwise is increased.
	+ FFS whether groupcast option 1 (NACK-only) with SL-HARQ feedback enabled can be supported for SL-U. If supported, further study the following options (at least if all transmissions within the latest SL reference duration are groupcast option 1 transmissions)
		- Option 1: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- Option 2:
			* If ‘NACK’ or a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration, increase for every priority class to the next higher allowed value.
			* When neither ‘NACK’ nor a collision indicator (IUC scheme 2) is received related to any transmissions within the latest SL reference duration,
				+ Option A: is reset to for every priority class .
				+ Option B: For every priority class ,use the latest used for any SL transmissions on the channel using Type 1 channel access procedures associated with the channel access priority class .
		- Option 3: An ACK-only procedure is used instead of a NACK-only procedure. In this case, if at least a ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class , otherwise is increased
		- Option 4: CW is adjusted according to CR/CBR measurement, if CR/CBR is supported for SL-U
		- Option 5 (option 3+legacy): ACK feedback is performed when a TB is successfully decoded in addition to the legacy NACK-only procedure. In this case, if ACK only is received related to any transmissions within the latest SL reference duration then ,  otherwise is increased.
	+ CW adjustment for unicast with SL-HARQ feedback enabled (at least In case only unicast PSSCH(s) is (are) transmitted within the latest SL reference duration):
		- Option 2: If at least one ‘ACK’ is received related to any transmissions within the latest SL reference duration, for each priority class ; otherwise is increased.
* FFS the case when UE is operating with different SL-HARQ feedback schemes (e.g., UE has concurrent broadcast transmission + unicast with SL-HARQ enabled, or GC option 1 + GC option 2, etc in the SL reference duration).

## RAN1#111 (14 – 18 November 2022)

**Agreement**

* Type 2A channel access procedure is applicable for S-SSB transmissions from a UE without a shared channel occupancy, when the following constraints are met:
	+ Time duration is at most 1ms per transmission
	+ The duty cycle of the S-SSB transmissions is at most 1/20
	+ FFS: details of EDT
	+ FFS: whether/how to define observation period, including whether or not observation period would be captured in the specifications if defined
* FFS: Type 2A applicability for PSFCH without a shared channel occupancy and further limitations for combined transmissions of both S-SSB and PSFCH using Type 2A channel access procedure

**Agreement**

* Performance metric, company to report which one of the following options is evaluated in their simulation results.
	+ Option 1:
		- For GC and BC, a device within the range (a, b) from the TX can be a receiver, and the UPT/latency/PRR can be calculated by average. The packet whose delay exceeding the remaining PDB as transmission failure.
	+ Option 2:
		- For GC, UPT and latency for a packet is measured from the perspective of the worst-case RX (i.e., the one with the longest transmission time).
		- For BC, UPT and latency for a packet are measured for each RX separately.
	+ Option 3:
		- For GC and BC, UPT, latency and PRR are measured from the perspective of each RX UE

**Agreement**

* For dynamic channel access mode with multi-channel case in SL-U, use NR-U DL (Type A or Type B) multi-channel access procedure as the baseline for multiple PSFCH transmissions on multiple channels, where each PSFCH transmission is confined within one LBT channel
	+ FFS: the case for S-SSB if agreed to transmit S-SSB (or S-SSB can be (pre-)configured) in more than one RB set
	+ FFS: whether type A or type B or both will be supported for this case for PSFCH
	+ FFS: whether multiple PSFCH transmissions on multiple channels after performing the multi-channel access procedure is limited to contiguous RB sets

**Agreement**

* SL reference duration is defined as a duration corresponding to a channel occupancy initiated by the UE including transmission of PSSCH(s), starting from the beginning of the channel occupancy initiated by the UE including transmission of PSSCH(s), until either (one option to be selected later):
	+ Option 1a:
		- the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted
		- Note, SL reference duration is not used if PSSCH with ACK/NACK HARQ-ACK enabled cannot be found in the latest COT
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed
	+ Option 1b:
		- the end of the first slot where at least one PSSCH with HARQ-ACK enabled is transmitted
		- Note, SL reference duration is not used if PSSCH with HARQ-ACK enabled cannot be found in the latest COT
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed
	+ Option 2a:
		- the end of the first slot where at least one PSSCH with HARQ-ACK enabled if it is transmitted, otherwise until the end of the channel occupancy
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed
	+ Option 2b:
		- the end of the first slot where at least one PSSCH with HARQ-ACK enabled if it is transmitted, otherwise until the time when UE updates the CW
		- FFS: Whether to support another ending timing is FFS, e.g for MCSt if needed

**Agreement**

* A CPE is transmitted from a CPE starting position before SL transmission within a COT, select one or both of the two options:
	+ Option 1: within the symbol just before the next AGC symbol
	+ Option 2: within at most 1, 2 or 4 symbols just before the next AGC symbol for 15, 30 or 60 kHz SCS, respectively
	+ FFS: whether Option 1 and Option 2 are both applicable and the conditions (e.g., Option 1 in case of COT sharing and Option 2 in case of initiating a COT)
	+ FFS: which channel access type(s) is applicable for option 1 and option 2
	+ FFS: other details
* A single CPE starting position for PSFCH
	+ FFS CPE starting position and whether it should be (pre-)configured in each RP, pre-defined or indicated
	+ FFS other details (e.g., indication granularity)
	+ Note: value 0 is a candidate
* At least one CPE starting position for S-SSB
	+ FFS CPE starting position should be (pre-)configured, pre-defined or indicated
	+ FFS: Whether multiple CPE starting positions should be (pre-)configured, pre-defined or indicated
	+ FFS CPE starting positions for the R16 S-SSB and the additional S-SSBs
	+ Note: value 0 is a candidate
* One or multiple CPE starting positions can be (pre-)configured in each resource pool for PSSCH/PSCCH
	+ When multiple CPE starting positions are (pre-)configured,
		- FFS whether/how to define a criteria for selecting a default CPE starting position (e.g., according to partial/full RB set allocation, resource reservation information, within or outside of a COT, etc.)
		- FFS criteria for selecting one of the multiple CPE starting positions (e.g., according to priority level (e.g., CAPC or L1), selected randomly by UE from the (pre-)configured set of CPEs, selected by the UE based on channel access result, determined based on indication from the COT initiating UE, etc.)
	+ FFS other details

**Agreement**

For UE-to-UE COT sharing,

* When performing S-SSB transmission(s), a responding UE can utilize a COT shared by a COT initiating UE (using type 1 channel access) when the responding UE is intended to transmit S-SSB within RB set(s) corresponding to the shared COT. When performing PSFCH transmission(s), a responding UE can utilize a COT shared by a COT initiating UE at least when at least one of the responding UE’s PSFCH transmissions in a symbol/slot within RB set(s) corresponding to the shared COT is intended for the COT initiating UE.
	+ FFS: whether a responding UE can transmit PSFCH(s) to UE(s) other than the initiator
* When performing PSSCH/PSCCH transmission(s), a responding UE can utilize a COT shared by a COT initiating UE at least when the responding UE’s PSSCH/PSCCH transmission(s) within RB set(s) corresponding to the shared COT is intended for the COT initiating UE
	+ FFS whether to support the case if a responding UE transmits PSSCH/PSCCH to destination ID other than the source ID of the COT initiating transmission, where the destination ID of the responding UE’s PSSCH/PSCCH transmission(s) can be different from the source/destination IDs of COT initiating UE’s PSSCH/PSCCH transmission when sharing the COT information.
		- FFS: how to determine / what are the restrictions to the destination ID of the responding UE’s PSSCH/PSCCH transmission(s) to utilize the COT shared by the initiating UE.
		- FFS whether the responding UE can utilize the COT when at least the responding UE’s PSCCH transmission in the reserved resources within the shared COT or MCSt is intended for the COT initiating UE and what are the restrictions (e.g., priority, etc.) and indication to the responding UE.
* FFS: UE forwarding/relaying information about a COT initiated by another UE.

**Agreement**

* If , the next higher allowed value for adjusting is .
* If the is consecutively used times for generation of , is reset to only for that priority class for which is consecutively used times for generation of . is selected by UE from the set of values {1, 2, …,8} for each priority class .

## RAN1#112 (February 27th – March 03rd, 2023)

**Agreement**

The CAPC level that should be used for S-SSB transmissions:

* Option 1: CAPC value (p) should be set to 1 when UE performs Type 1 channel access procedure for S-SSB transmission

**Agreement**

The CAPC level that should be used for PSFCH transmission, CAPC value (p) should be set to 1 when UE performs Type 1 channel access procedure for PSFCH transmission

**Agreement**

The end timing for the definition of reference duration in the contention window adjustment procedure for SL-U is defined as follows:

* Option 1a
	+ the end of the first slot where at least one PSSCH with ACK/NACK HARQ-ACK enabled is transmitted
	+ Note, SL reference duration is not used if PSSCH with ACK/NACK HARQ-ACK enabled cannot be found in the latest COT
	+ FFS: Whether to support another ending timing is FFS, e.g. for MCSt if needed
	+ Whether/how to adjust CWS for groupcast option 1 NACK-only case and whether/how to define reference duration for groupcast option 1 NACK-only case can still be discussed

**Agreement**

A CPE can be transmitted from a CPE starting position before SL transmission for the following two options:

* Option 1: within the symbol just before the next AGC symbol
* Option 2:
	+ within the symbol just before the next AGC symbol for 15 kHz SCS
	+ within at most 2 symbols just before the next AGC symbol for 30 or 60 kHz SCS
* FFS applicable scenario(s), condition(s) and channel type(s) to apply Option 1 or Option 2

**Agreement**

* A responding UE over a shared COT can be:
	+ a receiving UE, which is the target of a PSCCH/PSSCH transmission of a COT initiator
		- In the case of unicast from the COT initiator, within the same COT when the source and destination IDs contained in the COT initiator’s SCI match to the corresponding destination and source IDs relating to the same unicast at the receiving UE
		- In the case of groupcast and broadcast, when the destination ID contained in the COT initiator’s SCI match to a destination ID known at the receiving UE
	+ a UE identified by ID(s), if additional IDs are supported in the COT sharing information (in addition to the source and destination IDs of the PSCCH/PSSCH transmission), when additional IDs are included in the COT sharing information from the COT initiator
		- FFS Limitations on what additional IDs may be included and how they may be indicated

**Agreement**

A responding UE’s SL transmission(s) within RB set(s) corresponding to a shared COT can be transmitted when the CAPC value(s) of the SL transmission(s) have an equal or smaller CAPC value than the CAPC value indicated in the COT sharing information.

**Agreement**

A responding UE’s PSSCH/PSCCH transmission(s) within RB set(s) corresponding to a shared COT is intended for the COT initiating UE when,

* In the case of unicast from the responding UE, when the source and destination IDs contained in the responding UE’s PSCCH/PSSCH match to the destination and source IDs from a COT initiator’s unicast transmission that included COT sharing information, or match to the additional ID(s) included in the COT sharing information (if supported)
* In the case of groupcast or broadcast from the responding UE, when the destination ID contained in the responding UE’s PSCCH/PSSCH matches to the destination ID from a COT initiator’s groupcast or broadcast transmission that included COT sharing information, or matches to the additional ID(s) included in the COT sharing information (if supported)
* FFS: all other details and additional restrictions