3GPP TSG RAN WG1 Meeting #108-e R1-2202493

February 21th – March 3rd, 2022

Agenda item: 8.2.6

Source: Moderator (Qualcomm Incorporated)

Title: FL summary of channel access mechanism for 52.6GHz-71GHz band, ver01

Document for: Discussion and Decision

# Introduction

This paper summarizes the channel access related proposals submitted to agenda item 8.2.6 in RAN1-108-e and email discussion as follows:

[108-e-NR-52-71GHz-07] Email discussion for maintenance on channel access mechanism – Jing (Qualcomm)

* 1st check point: February 25
* Final check point: March 3

# Summary of contributions

The section summarises key proposals and observations from submitted contributions. Discussion points arising from each group of topics are captured separately in subsections.

## LBT Bandwidth FFS Items

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| Agreement:   * For LBT for single carrier transmission, gNB/UE performs LBT over the channel bandwidth (or BWP bandwidth) (Alt SC.1. in earlier agreements) * For LBT for multi-carrier transmission in intra-band CA, gNB/UE performs multiple LBT, one for each channel bandwidth separately (Alt CA.1. in earlier agreements)   + FFS: Additional support of performing single LBT over all CCs (Alt CA.2. in earlier agreements)   more than one alternative for at least multi-carrier transmission in intra-band CA is not precluded.  Conclusion:  There is no consensus to support explicitly introducing in the spec using single LBT covering multiple CCs under CA.   * Note: This does not rule out gNB/UE implementation to perform single LBT to cover multiple CCs. However, the EDT needs to be selected such that if interference on one of the CCs exceeds the CC EDT, the LBT is declared as failed   Agreement   * For DL to UL COT sharing, when the UL BWP is wider than the DL BWP, COT sharing based transmission at the UE is only supported if the transmission is within the bandwidth of DL BWP * For UL to DL COT sharing, when the DL BWP is wider than the UL BWP, COT sharing based transmission at the gNB is only supported if the transmission is within the bandwidth of UL BWP |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 3: For operation in FR2-2, adopt following TP#1 for TS 37.213 v17.0.0 |
| FUTUREWEI | Proposal 1: For LBT for single carrier transmission, UE performs LBT over a BW that at least includes the active UL BWP bandwidth • The ED threshold used should not be higher than the ED threshold associated with the active UL BWP bandwidth • The BW that at least includes the active UL BWP bandwidth is captured as “channel” in 37.213. |
| FUTUREWEI | Proposal 2: For LBT for single carrier transmission, gNB performs LBT over the channel bandwidth Note: Channel can be any part of carrier consisting of a contiguous set of resource blocks on which transmission(s) on beam(s) are performed within a channel occupancy. |
| vivo | Proposal 1: For LBT for single carrier transmission, UE performs LBT over the active UL BWP bandwidth, gNB performs LBT over the channel bandwidth, where the channel is defined as in TS 37.213. |
| ZTE Sanechips | Proposal 3: The Operating Channel BW used in the EDT equation is equivalent to the LBT BW. |
| ZTE Sanechips | Proposal 4: For single carrier case, the LBT bandwidth defined in previous agreement can align with the the definition of “channel” in TS 37.213 and no need to further update previous agreement. |
| ZTE Sanechips | Proposal 5: For multi-carrier case, the LBT bandwidth defined in previous agreement only corresponds to one of case covered in the definition of “channel” in TS 37.213.  l How to change the current spec can be left to the spec’s editor for this case. |
| NTT DOCOMO INC. | Proposal 3: For LBT bandwidth, support TP#2 l Bandwidth to be sensed can be equal to or wider than the one configured for active BWP, which does not require any TP l Bandwidth to be considered for EDT adaptation should be fixed (e.g. active BWP bandwidth at UE, or channel bandwidth defined in TS38.101-2) , as captured in TP#2, or determined from a limited range (e.g. consider channel bandwidth to be maximum) |
| TCL Communications | Proposal 5：Clarify LBT performing range in frequency domain regarding the BWPs. |
| Nokia Nokia Shanghai Bell | Observation 2: There is no need to revise the earlier agreement on LBT bandwith for single carrier or for intra-band CA transmission. |
| Nokia Nokia Shanghai Bell | Proposal 9: It can be clarified that in UL the “channel” contains at least the active UL BWP in FR 2-2. |
| Intel Corporation | Proposal 4: For single carrier transmission, a device performs LBT over a channel bandwidth, where for the case when the UE is the device performing LBT, then the channel bandwidth should include at least the active UL BWP. |
| Intel Corporation | Proposal 5: For LBT for multi-carrier transmission, gNB/UE performs multiple LBT, one for each channel bandwidth separately. |
| Intel Corporation | Proposal 6: TP#3 should be supported. |
| Ericsson | Observation 1 RAN4 channel bandwidth/Carrier bandwidth is different from RAN1 channel bandwidth |
| Ericsson | Observation 2 RAN1 channel bandwidth is the bandwidth of the “channel” defined in 37.213. “Channel” BW in 37.213 already refers to BWP BW for UEs and carrier BW for gNBs. |
| Ericsson | Proposal 1 RAN1 to agree Proposal 2.1-2a2 and modify Proposal 2.1-2b as follows:  Proposal 2.1-2a2: For LBT for single carrier transmission, UE performs LBT over a BW that at least includes the active UL BWP bandwidth The ED threshold used should not be higher than the ED threshold associated with the active UL BWP bandwidth The BW that at least includes the active UL BWP bandwidth is captured as “channel” in 37.213 Proposal 2.1-2b For LBT for single carrier transmission, gNB performs LBT over the channel active DL BWP bandwidth This does not rule out gNB implementation to performance LBT over a wider bandwidth, but the ED threshold used should not be higher than the ED threshold associated with the active DL BWP bandwidth Text Proposal for 37.213 4.4.7 Energy detection threshold adaptation procedures A gNB/UE accessing a channel on which transmission(s) on beam(s) are performed within a channel occupancy, shall set the energy detection threshold X"Thresh" to be less than or equal to the maximum energy detection threshold X"Thresh\_max" that is determined as follows: XThresh\_max=-80dBm+Pmax- Pout+ 10⋅log10(BW) where: - Pmax is the RF output power limit in dBm. - Pout is the maximum EIRP of the intended transmission(s) by the gNB/UE to acquire a channel occupancy in dBm where Pout≤Pmax. The maximum EIRP used for the transmission(s) by the initiating gNB/UE during the channel occupancy is limited to Pout. - BW is the [channel bandwidth or bandwidth part bandwidth] in MHz |
| Qualcomm Incorporated | Proposal 1: For LBT for single carrier transmission, UE performs LBT over a BW that at least includes the active UL BWP bandwidth • The ED threshold used should not be higher than the ED threshold associated with the active UL BWP bandwidth • The BW that at least includes the active UL BWP bandwidth is captured as “channel” in 37.213 |
| Qualcomm Incorporated | Proposal 2: For LBT for single carrier transmission, gNB performs LBT over the active DL BWP bandwidth • This does not rule out gNB implementation to performance LBT over a wider bandwidth, but the ED threshold used should not be higher than the ED threshold associated with the active DL BWP bandwidth |
| Qualcomm Incorporated | Proposal 4: Modify the earlier agreements as follows Agreement: For LBT for multi-carrier transmission in intra-band CA, gNB/UE performs multiple LBT, one for the active BWP bandwidth in each channel bandwidth separately (Alt CA.1. in earlier agreements)  Note: Per earlier agreements, gNB/UE can always perform LBT over wider bandwidth and/or with ED threshold lower than the ED threshold associated with the active BWP bandwidth as implementation |
| Transsion | Proposal 1: Modify the earlier agreements as follows Agreement: For LBT for single carrier transmission, gNB/UE performs LBT over the channel bandwidth (or at least the active BWP bandwidth) with at least the ED threshold associated with the active BWP bandwidth. Agreement: For LBT for multi-carrier transmission in intra-band CA, gNB/UE performs multiple LBT, one for the active BWP bandwidth in each channel bandwidth separately (Alt CA.1. in earlier agreements) |
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Proposal 2.1-1

For LBT for single carrier UL transmission, UE performs LBT over a BW that at least includes the active UL BWP bandwidth

* The ED threshold used should not be higher than the ED threshold associated with the active UL BWP bandwidth
* The BW that at least includes the active UL BWP bandwidth is captured as “channel” in 37.213

Please provide your view:

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| Company | View |
| vivo | We support the proposal. |
| Intel | We are Ok with the FL’s proposal |
| Apple | OK with the proposal. |
| WILUS | OK with the proposal. |
| DOCOMO | Support Proposal 2.1-1 |
| Ericsson | We support this proposal in principle. However, the TP in 2.1-A does not reflect that UL BWP is captured as “channel”. Hence, we modify the proposal as follows only for the UE part. Please note that “channel” here is NOT the RAN4 channel definition. This TP is for 37.213 and channel is a local variable that corresponds to a carrier or part of a carrier according to the definition in 37.213.  \*\*\*\*\*\*\*\*\*\*\*\* TP start\*\*\*\*\*\*\*\*\*\*\*  is the ~~uplink active bandwidth part~~ channel bandwidth in MHz for UEs and …..  \*\*\*\*\*\*\*\*\*\*\*\* TP end\*\*\*\*\*\*\*\*\*\*\*  Moderator: We can discuss TP later |
| ZTE, Sanechips | We are fine with the proposal |
| OPPO | Based on the LS from RAN4, the channelization has been introduced in FR2-2by RAN4, and RAN1 should take the information in the LS into account in the discussions related to channelization. Therefore, RAN1 should firstly discuss whether or not to determine the LBT bandwidth based on channelization.  In addition, our Proposal 1 on LBT bandwidth was not captured in the summary, which is as follows:  Proposal 1: For the LS from RAN4, RAN1 should firstly discuss whether or not to determine the LBT bandwidth based on channelization. |
| InterDigital | We support the proposal |
| FW | Support |
| Nokia, NSB | It may be better to discuss LBT BW first and then address EDT. We are fine with the proposal for LBT BW part, but we do not see need to introduce additional new restrictions on EDT. |
| Xiaomi | OK with the proposal |
| Samsung | We are fine with the proposal. |

Proposal 2.1-2 (closed and replaced by 2.1-2a)

For LBT for single carrier DL transmission to a UE, gNB performs LBT over the active DL BWP bandwidth configured for that UE.

* This does not rule out gNB implementation to performance LBT over a wider bandwidth, but the ED threshold used should not be higher than the ED threshold associated with the active DL BWP bandwidth
* TP 2.1-A
* Moderator note: There are proposals to use channel bandwidth for DL LBT. However, consider it is possible to configure a much wider channel bandwidth while using a much narrower DL BWP with relaxed ED threshold, the proposal is to use DL BWP BW

For LBT for single carrier DL transmission to multiple UEs, from each UE point of view, gNB performs LBT over the active DL BWP bandwidth configured for that UE.

* This does not rule out gNB implementation to performance LBT over a wider bandwidth includes the active DL BWP of multiple UEs, but the ED threshold used should not be higher than the ED threshold associated with the minimum of active DL BWP bandwidths of all served UEs
* Since the spec is written from a single UE’s perspective, this may not have spec impact

Proposal 2.1-2a

For LBT for single carrier DL transmission to a UE, gNB performs LBT over a bandwidth that at least includes the active DL BWP bandwidth configured for that UE.

* This does not rule out gNB implementation to performance LBT over a wider bandwidth, but the ED threshold used should not be higher than the ED threshold associated with the active DL BWP bandwidth
* ~~TP 2.1-A~~
* Moderator note: There are proposals to use channel bandwidth for DL LBT. However, consider it is possible to configure a much wider channel bandwidth while using a much narrower DL BWP with relaxed ED threshold, the proposal is to use DL BWP BW

For LBT for single carrier DL transmission to multiple UEs, from each UE point of view, gNB performs LBT over a bandwidth that at least includes the active DL BWP bandwidth configured for that UE.

* This does not rule out gNB implementation to performance LBT over a wider bandwidth includes the active DL BWP of multiple UEs, but the ED threshold used should not be higher than the ED threshold associated with the minimum of active DL BWP bandwidths of all served UEs
* Since the spec is written from a single UE’s perspective, this may not have spec impact

Moderator note: There are questions that why not using DL channel bandwidth for EDT determination. My intention is to avoid allowing the gNB to transmit with narrow band but using much wider bandwidth for LBT EDT determination, as it can be very relaxed. In NR, it is possible for gNB to configure 2GHz channel bandwidth, but only use 100MHz for active DL BWP. If we allow gNB to use channel bandwidth for EDT, we effectively relaxed 13dB. Same issue for UL.

Please provide your view:

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| Company | View |
| vivo | We don’t support the proposal. BWP is UE-specific. If gNB schedules two UEs at the same time, gNB performs LBT over a bandwidth at least covering the DL BWPs of the two UEs. It does not make sense to announce that gNB performs LBT over a UE’s DL BWP. We suggest to change the proposal as below:  Proposal 2.1-2  For LBT for single carrier DL transmission to a UE, gNB performs LBT over a bandwidth that at least includes the active DL BWP bandwidth configured for that UE.  The TP 2.1-A below is not reasonable. “downlink active bandwidth part bandwidth in MHz for gNB” is not a cleat concept.  Moderator: Captured the suggested changed in 2.1-2a |
| Intel | We are still quite confused with what the proposal is meaning and what the TP is implementing. The TP actually defines and refers to “UL bandwidth part bandwidth”, while in proposal 2.1-1 it seems that the intention is to refer directly to the channel bandwidth as defined in 37.213. |
| Apple | If gNB perform CCA over channel BW, the EDT should be calculated based on channel BW.  Moderator: Please see note above |
| WILUS | We support modified proposal 2.1.-2 by vivo. |
| DOCOMO | We prefer to refer to channel bandwidth defined in RAN4. We think DL BWP is the wording from UE perspective, while here we discuss on LBT BW from gNB perspective, where gNB would perform transmissions to multiple UEs over channel bandwidth in many cases. Also, There should be no problem even when we say channel bandwidth is LBT BW for EDT adaptation at gNB.  Moderator: Please see note above |
| Ericsson | We still cannot support the proposal. We understand the intention of the moderator, but it is still not clear to us why the EDT needs to be performed based on the minimum active DL BWP BW ? A device is allowed to perform LBT over a wider bandwidth and transmit using a narrower bandwidth.  We think that this should be the RAN4 channel BW. Even if gNB uses a wider BW to attain higher EDT, it is worthy to note that, the interference in the wider band is also included while calculating energy in the band. Furthermore, a device is also allowed to use any bandwidth to perform sensing according to EN 302 567 v2.2.1, unlike Rel-16 which had a fixed nominal BW of 20 MHz and occupied BW requirement.  Moderator: Please see note above |
| ZTE, Sanechips | We generally agree with vivo’s modification with the following minor changes:  For LBT for single carrier DL transmission to UE(s), gNB performs LBT over a bandwidth that at least includes the active DL BWP bandwidth configured for UE(s). |
| OPPO | This discussion is also related to channelization, so RAN1 should firstly discuss whether or not to determine the LBT bandwidth for DL transmission based on channelization.  Moderator: I am not sure why we need to discuss the channelization first. |
| InterDigital | We agree with vivo’s updated proposal. |
| Lenovo | We are not too clear on the purpose of the proposal. In 37.213, we can and do write specification text also from a gNB's perspective.  We think the first part of the proposal should not just consider transmissions to a single UE, but to all UEs. So we don't think an agreement about "For LBT for single carrier DL transmission to a UE" is very meaningful, since from the gNB's perspective, whether it transmits to one UE or multiple UEs shouldn't make a difference as far as LBT is concerned. For example, shouldn't the LBT from gNB's perspective be the same regardless whether a transmission is intended to a single UE over 20 MHz or to two UEs over the same 20 MHz?  For the second part of the proposal, we don't see why the proposal says "from a UE's point of view". If the second part is intended to specify from a UE's point of view, it would be better to state for what purpose a UE needs to make such an assumption (e.g. COT sharing), and then rather state "A UE shall/should/may assume that LBT was done by the gNB at least over the active DL BWP bandwidth of the UE" or similarly.  Moderator: Please see the note above for my intention |
| Moderator | Updated in Proposal 2.1-2a capturing the vivo’s suggestion. Also removed the reference to the TP. The TP is for example only, and we can discuss that after agreeing on the proposal. |
| FW | We can support updated proposal incorporating Vivo’s suggestion.  We understand and see merit in the following point in terms of enforcing compliant behavior/testing but think more discussion is warranted:   * ED threshold used should not be higher than the ED threshold associated with the minimum of active DL BWP bandwidths of all served UEs |
| Nokia, NSB | We don’t support the proposal.  In the proposal, “from each UE point of view” means that the proposal defines UE’s assumption of gNB LBT BW. It should also be clarified and agreed what impact UE’s assumption of gNB LBT BW has on UE behavior.  The proposal is to arbitrarily further restrict the gNB EDT, without any assessment of fairness benefits that would be achieved. The gNB transmission bandwidth may be wider than the minimum active DL BWP BW, so the EDT restriction is not motivated from that viewpoint either. It is not clear why gNB EDT should be dependent on UEs’ DL BWP BW, as the EDT has not been agreed to be defined based on BW of actual transmissions. |
| Xiaomi | Support the updated Proposal. |
| Samsung | We would like to clarify why the fact mentioned by the FL is an issue. The transmitter is in the risk of meeting more interference by sensing larger BW with relaxed EDT, which looks pretty reasonable behavior by its implementation. |
| DOCOMO2 | Thanks FL for your answer. But we actually share similar view to Ericsson and Nokia on this issue.  From gNB perspective, we think in many cases it tries to access the channel to transmit something to more than one UEs. Then it would be too restrictive to define DL BWP for EDT adaptation at gNB.  Even if DL BWP is referred, when gNB performs transmissions for multiple UEs, which DL BWP does it take into account? The minimum one to align with CA case? But we do not think it is always CA case practically. |

TP 2.1-A

=====For 37.213 4.4====

4.4 Channel access procedures for frequency range 2-2

\*\*\*\* Unchanged part omitted \*\*\*\*

When the gNB/UE can perform simultaneous sensing in different beams, Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy per sensing beam where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed the transmission within the channel occupancy can occur following the procedures in Clause 4.4.2 before switching to a different beam within the channel occupancy.

When the gNB/UE perform sensing, the channel should at least include the set of RBs in the active downlink/uplink bandwidth part of the carrier respectively.

\*\*\*\* Unchanged part omitted \*\*\*\*

4.4.7 Energy detection threshold adaptation procedures

A gNB/UE accessing a channel on which transmission(s) on beam(s) are performed within a channel occupancy, shall set the energy detection threshold to be less than or equal to the maximum energy detection threshold that is determined as follows:

where:

- is the RF output power limit in

- is the maximum EIRP of the intended transmission(s) by the gNB/UE to acquire a channel occupancy in where . The maximum EIRP used for the transmission(s) by the initiating gNB/UE during the channel occupancy is limited to .

- is the uplink active bandwidth part bandwidth in MHz for UE and downlink active bandwidth part bandwidth in MHz for gNB.

=====End of TP========

## Energy Detection Threshold and Pout Determination

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| Agreement:  The baseline ED threshold can be computed as  Where Pout is RF output power (EIRP) and Pmax is the RF output power limit, Pout≤Pmax.   * FFS: Further adjustment on ED threshold based on the sensing beam and the transmission beam (further adjustment should not violate EDT requirements as per regulations) * FFS: If Pout is max output EIRP of the device or instantaneous output EIRP * FFS definition of Operating Channel BW * FFS: Whether ED threshold for NR-U and NR-U coexistence scenarios (eg, at regulation level) can be appropriately relaxed compared with the threshold of coexistence between NR-U and Wi-Fi. * FFS: EDT when the COT has time varying transmission beams and varying EIRP   Agreement  Confirm the WA with some clarifications  Working assumption:   * For Pout in EDT determination, define Pout as the maximum EIRP of the intended transmissions by the node determining EDT during a COT.   + The node is not expected to transmit in the COT with higher Pout than the Pout used to determine the EDT used to acquire the COT   Agreement   * For LBT purpose, the energy at gNB/UE is measured after antenna and antenna gain is included in the energy measurement. * The energy measurement is compared with EDT with no further adjustment to EDT standardized in Rel.17   + Note: This does not rule out extra backoff (conservative) EDT being applied as gNB or UE implementation   Agreement  For gNB initiated COT, for Pout in EDT determination at the initiating device (gNB), the Pout of the responding device (UE) is not considered  Agreement  For UE initiated COT, for EDT determination at the initiating device (UE), the Pout of the responding device (gNB) is not considered  Agreement  In Rel-17, the same ED threshold determination mechanism is used for UL to DL COT sharing and for UL transmission without COT sharing with UE as initiating device.  FFS: Spec impact for UL to DL COT sharing mechanism |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 1: For operation in FR2-2, clarify in the current specifications that the EDT determination mechanism is not restricted to a node initiating a COT. The node determining EDT could be also a responding node. |
| Huawei HiSilicon | Proposal 2: For operation in FR2-2, when independent per-beam LBT is performed at the start of the COT, define Pout for each sensing beam as the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during a COT. |
| vivo | Proposal 2: Adopt text proposal 1 for TS37.213. |
| vivo | Proposal 9: For Pout in EDT determination for a sensing beam, define Pout as the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during a COT. |
| Nokia Nokia Shanghai Bell | Observation 3: There is no need to restrict UL EDT to be at most the EDT defined for UL BWP bandwidth. |
| LG Electronics | Proposal #1: For Pout in EDT determination for a sensing beam, define Pout as the maximum EIRP of all intended transmissions by the node determining EDT during a COT. |
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Discussion 2.2-1:

For a COT with MU-MIMO (SDM) transmission or TDM transmission of beams with beam switching, when independent per-beam LBT is performed at the start of the COT, for Pout in EDT determination of LBT for each sensing beam:

* Alt 1: For Pout in EDT determination for a sensing beam, define Pout as the maximum EIRP of all intended transmissions by the node determining EDT during a COT
  + Support: Apple, LGE, Ericsson,
* Alt 2: For Pout in EDT determination for a sensing beam, define Pout as the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during a COT
  + Support: Samsung, Intel, FW, Transsion, CATT, Lenovo, vivo, ZTE, DCM, Nokia, Oppo, HW, Wilus, IDCC

Please provide your view if not captured above:

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| Company | View |
| vivo | Our position is correctly captured. We support Alt 2 to perform the independent perf-beam LBT. |
| Intel | We support Alt.2, and we believe that when determining the EDT value only the maximum EIRP related to the beams that cover the sensing beam for the intended transmission should be considered since those will be the beams over which the sensing will be performed. We feel that Alt.1 is quite unnecessary, and lead to an over pessimistic approach where the EDT value will be accounting for beams that are not used for sensing. |
| Apple | Suggest to leave it to implementation, similar to the conclusion when omni-sensing and directional transmission is used, the EDT adjustment is left to implementation. |
| WILUS | We support Alt 2 on Discussion 2.2-1. |
| Ericsson | Alt 1 is the baseline according to the regulations.  Pout is already defined as follows-  *is the maximum EIRP of the intended transmission(s) by the gNB/UE to acquire a channel occupancy in where . The maximum EIRP used for the transmission(s) by the initiating gNB/UE during the channel occupancy is limited to .*  In other words, the intended transmissions in the channel occupancy are the intended multiple beams in this case and maximum EIRP of those beams is considered as Pout. Alt2 defines multiple Pouts for multiple sensing beams, and hence multiple EDTs and multiple parallel LBTs. It is worthy to note that RAN2 have agreed that they do not need beam-specific LBT result from PHY to MAC. Therefore, it is not clear if there are any benefits in specifying as multi-beam sensing is anyway an implementation choice. This too can be left to implementation if companies wish to do so. |
| ZTE, Sanechips | Our position has been correctly captured. |
| OPPO | We support Alt 2 and it takes full advantage of directional LBT. |
| InterDigital | We support Alt 2. |
| FW | We support Alt.2. We agree with Intel that Alt.1 can be too pessimistic and with Oppo that once node has decided to use multiple sensing beams it makes sense to take full advantage of directional LBT. |
| WILUS | We support Alt 2 on Discussion 2.2-1. |
| Nokia, NSB | As Alt 2 is less restrictive, we have a slight preference for that one. We are also ok to leave this up to implementation, |
| Xiaomi | We prefer Alt2. but currently, we haven’t defined what is “cover”. we think Alt1 is a default solution if we can’t reach consensus on Alt2. |

## Multi-Beam COT

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| **Agreement**  For a COT with MU-MIMO (SDM) transmission, support both Alt 1 and Alt 2 below:   * Alt 1: Single LBT sensing at the start of the COT with wide beam ‘cover’ all beams to be used in the COT with appropriate ED threshold * Alt 2: Independent per-beam LBT sensing at the start of COT is performed for beams used in the COT, if the node can perform simultaneous sensing in different beams   Note: On UE side, no UE capability will be introduced for this purpose.  Agreement:  Within a COT with TDM of beams with beam switching, down-select one or more of the following LBT operations   * Alt 1: Single LBT sensing with wide beam ‘cover’ all beams to be used in the COT with appropriate ED threshold   + FFS: Details on the definition of “cover” * Alt 2: Independent per-beam LBT sensing at the start of COT is performed for beams used in the COT * Alt 3: Independent per-beam LBT sensing at the start of COT is performed for beams used in the COT with additional requirement on Cat 2 LBT before beam switch   **Agreement**  Within a COT with TDM of beams with beam switching, at least support Alt 1   * Alt 1 (from previous agreement): Single LBT sensing with wide beam ‘cover’ all beams to be used in the COT   Agreement:   * SSB transmission with LBT is supported, at least when the conditions for contention exempt short control signalling based SSB transmission is not met   + Note the channel access for SSB with LBT may not be different from a normal COT with multiple beams   + FFS: If any difference from a multi-beam COT LBT needs to be introduced   Agreement:  For a COT with MU-MIMO (SDM) transmission, when independent per-beam LBT sensing at the start of COT is performed for beams used in the COT (Alt 2 in earlier agreement) is considered, the following alternatives are further considered   * Alt A: The per-beam LBT for different beams is performed in TDM fashion   + Alt A-1: The node completes one eCCA on one beam, and directly move on to the eCCA on the other beam, with no transmission in the middle   + Alt A-2: The node completes one eCCA on one beam, start transmission with the beam to occupy the COT, then move on to the eCCA on the other beam   + Alt A-3: The node performs eCCA of the different beams simultaneous, round robin between different beams * Alt B: The per-beam LBT for different beams is performed simultaneously in parallel, assuming the node has the capability to simultaneously sense in different beams   Agreement:  Within a COT with TDM of beams with beam switching, when independent per-beam LBT sensing at the start of COT is performed for beams used in the COT (Alt 2 or Alt 3 in earlier agreement) is considered, the following alternatives are further considered   * Alt A: The per-beam LBT for different beams is performed one after another in time domain   + Alt A-1: The node completes one eCCA on one beam, and directly move on to the eCCA on the other beam, with no transmission in the middle   + Alt A-2: The node completes one eCCA on one beam, start transmission with the beam to occupy the COT, then move on to the eCCA on the other beam   + Alt A-3: The node performs eCCA of the different beams simultaneous, round robin between different beams * Alt B: The per-beam LBT for different beams is performed simultaneously in parallel, assuming the node has the capability to simultaneously sense in different beams   **Agreement**  Within a COT with TDM of beams with beam switching, Alt 2 is supported if the node has the capability to perform simultaneous sensing in different beams. Alt 3 is allowed as node implementation choice if the node also supports Cat 2 LBT. The use of Alt 2 or Alt 3 is based on node’s implementation.   * Alt 2 from previous agreement: Independent per-beam LBT sensing at the start of COT is performed for beams used in the COT * Alt 3 from previous agreement: Independent per-beam LBT sensing at the start of COT is performed for beams used in the COT with additional requirement on Cat 2 LBT before beam switch |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 2: For operation in FR2-2, when independent per-beam LBT is performed at the start of the COT, define Pout for each sensing beam as the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during a COT. |
| Huawei HiSilicon | Proposal 17: When independent per-beam LBTs are performed to initiate a multi-beam COT with TDMed or SDMed transmission beams, support aligning the channel access start time for the multiplexed beams as follows such that a transmission on one beam does not start while sensing is ongoing on another beam:  If the backoff counter N\_(B\_i ) for a sensing beam B\_i reaches zero before the aligned channel access start time, the device continues to decrement the counter〖 N〗\_(B\_i ) and transmits in the corresponding beam at the aligned start time if either the channel continues to be sensed idle in all of the additional sensing slot durations or the channel is sensed idle within at least T\_d duration ending immediately before the aligned start time.  If the backoff counter N\_(B\_i ) for a sensing beam B\_i does not reach zero before the aligned start time, or reaches zero but the channel has been sensed busy in any of the additional sensing slot durations and has not been sensed idle within at least T\_d duration ending immediately before the aligned start time, the transmission(s) in the corresponding beam is dropped.  Denote the sensing beam with the maximum backoff counter at the start of the channel access procedure as B\_j. Aligned channel start time is at least T\_min after the start of the channel access procedure where T\_min is the minimum required duration for N\_(B\_j ) to decrement to zero. |
| FUTUREWEI | Proposal 4:  For a COT with multiple beam transmission, when Independent per-beam LBT sensing at the start of COT is performed, transmission is done (via either spatial or time multiplexing) along beams whose corresponding Type-1 LBTs are the first to acquire their respective channels. |
| FUTUREWEI | Proposal 5:  When independent per-beam LBT sensing is performed, a transmission may be allowed to occur as long as the LBT procedure has been successful before a channel occupancy for at least a single beam. However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the corresponding LBT procedure was not successful. |
| InterDigital Inc. | Proposal 1: For a COT with MU-MIMO (SDM) transmission, support simultaneous round robin eCCA between different beams (Alt A-3). |
| InterDigital Inc. | Proposal 2: For a COT with TDM of beams with beam switching, support Alt A-2 or A-3. |
| InterDigital Inc. | Proposal 3: Support of Alt B for SDM or TDM of beams can be considered for some UEs. |
| InterDigital Inc. | Proposal 5: Agree on Proposal 2.3-1 from RAN1 107b-e FL Summary [4] “When independent per-beam LBT sensing is performed, a transmission may be allowed to occur as long as the LBT procedure has been successful before a channel occupancy for at least a single beam. However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the LBT procedure was not successful.”. |
| OPPO | Proposal 2: Alt A (i.e., per beam LBT for different beam is performed in TDM fashion) should be supported to address the overprotection issue of Alt 1. |
| OPPO | Proposal 3: For COT containing multiple beams, including MU-MIMO (SDM) and TDM of beams, Alt A-2 is not supported. Alt A-1 and Alt A-3 can be left for implementation. |
| OPPO | Proposal 4: Introduce Cat 2 LBT for the independent per-beam LBT sensing procedure. |
| CATT | Proposal 7：If the gNB/UE perform independent per-beam LBT sensing at the start of COT and the results of per-beam LBT are not successful on all the beams , the gNB/UE can perform transmission on the beams where the LBT result is successful. |
| ZTE Sanechips | Proposal 14: Considering LBT overhead and transmission delay, Alt B that“The per-beam LBT for different beams is performed simultaneously in parallel, assuming the node has the capability to simultaneously sense in different beams” should be considered for the transmission with multiple beams . |
| ZTE Sanechips | Proposal 15: If the node has no the capability to simultaneously sense in different beams, Alt A-3 that “The node performs eCCA of the different beams simultaneous, round robin between different beams” can be considered for the transmission with multiple beams. |
| ZTE Sanechips | Proposal 19: If directional LBT is used, it is recommended that per-beam LBT failure indication is supported in FR2-2 to better align the directional beam transmission characteristics and be compatible with the existing mechanisms. |
| Nokia Nokia Shanghai Bell | Proposal 10: Single Ninit value is used in all per-beam LBT sensing procedures. |
| Nokia Nokia Shanghai Bell | Proposal 11: When independent per-beam LBT sensing is performed at gNB, transmission is allowed on beams determined to be idle before channel occupancy. Transmission is not allowed on beams determined to be occupied. |
| Nokia Nokia Shanghai Bell | Proposal 12: When independent per-beam LBT sensing is performed at UE, channel occupancy is not started if channel is determined to be occupied on any of the sensing beams. |
| Intel Corporation | Proposal 7: For a COT with MU-MIMO (SDM) transmission or TDM transmission of beams with beam switching, when independent per-beam LBT is performed at the start of the COT, define Pout as the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during the COT. |
| Intel Corporation | Proposal 13: When independent per-beam LBT sensing is performed, a transmission may be allowed to occur as long as the LBT procedure has been successful before a channel occupancy for at least a single beam. However, a transmission (via either spatial or time multiplexing) may not be allowed on those beams for which the LBT procedure was not successful. |
| Intel Corporation | Proposal 14: When independent per-beam LBTs are performed to initiate a multi-beam COT with TDMed or SDMed transmission beams, independent counters are maintained per beam. |
| Intel Corporation | Proposal 15: When independent per-beam LBTs are performed to initiate a multi-beam COT with TDMed or SDMed transmission beams, support to align transmission starting time across the multiplexed beams such that a transmission on one beam does not start while sensing is ongoing on another beam. In this matter, a device should behave as follows:  If the backoff counter N\_(B\_i ) for a sensing beam B\_i reaches zero before the aligned transmission starting time, the device continues to decrement the counter〖 N〗\_(B\_i ) by continuing to sense the channel via sensing slots of 5us each and transmits in the corresponding beam at the aligned start time if the channel continues to be sensed idle in all of the additional sensing slot durations.  If the backoff counter N\_(B\_i ) for a sensing beam B\_i does not reach zero before the aligned start time, or reaches zero but the channel has been sensed busy in any of the additional sensing slot durations, the transmission(s) in the corresponding beam is dropped. |
| Intel Corporation | Proposal 16: After the gNB/UE ceases transmission in any of the beam for which the channel access procedure was done, the gNB/UE will reinitialize the counter for all beams. |
| Intel Corporation | Proposal 17: When time-domain switching across beams within the same COT is supported, the per-beam LBT for different beams is also performed in a sequential manner. In particular, the initiating device may sense on a beam before either transmitting on that beam or switching to a separate beam to perform sensing. |
| Intel Corporation | Proposal 18: When independent per-beam LBT sensing is performed, an LBT failure is counted per transmission, and an LBT failure is reported only if all per beam LBTs fail. |
| Intel Corporation | Proposal 19: RAN1 should send an LS to RAN2 to inform them about the decision made in terms of how an LBT failure should be counted. |
| Ericsson | Proposal 7 RAN1 to agree that only a single Type 1 channel access mechanism (or same N\_init for all the applicable sensing) is initiated for multi-beam COTs when the gNB/UE can perform simultaneous sensing in different beams. |
| Ericsson | Proposal 8 RAN1 to agree that for simultaneous per-beam LBT in a multi-beam COT, if the channel is failed to be accessed for any sensing beam, all the beam transmission(s) is/are dropped during the channel occupancy. |
| Ericsson | Proposal 9 Considering above two proposals, following changes highlighted in yellow with some pats of the text struck through are proposed for 37.213 [If a channel occupancy includes transmission(s) in different beams that are multiplexed in spatial domain, one of the followings is applicable for the corresponding sensing to perform the transmission(s) within the channel occupancy: - Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy using a single sensing beam where the single beam covers all the transmission beams within the channel occupancy. When the channel is accessed the transmission(s) within the channel occupancy across different beams can occur. - A single Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy simultaneously per sensing beam using multiple sensing beams where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed the transmission(s) within the channel occupancy a]ross different beams can occur. If the channel is failed to be accessed for any sensing beam, the channel access is deemed to have failed for all the]sensing beams. If a channel occupancy includes transmissions in different beams that are multiplexed in time domain, one of the followings is applicable for the corresponding sensing to perform the transmissions within the channel occupancy: - Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy using a single sensing beam where the single beam covers all the transmissions beams within the channel occupancy. When the channel is accessed the transmissions within the channel occupancy across different beams can occur following the procedures described in Clause 4.4.3. - When the gNB/UE can perform simultaneous sensing in different beams, a single Type 1 channel access procedure as described in Clause 4.4.1 is applied before the start of the channel occupancy per sensing beam using multiple sensing beams where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed the transmission within the channel occupancy across different beams can occur following the procedures described in Clause 4.4.3. If the channel is failed to be accessed for any sensing beam, the channel access is deemed to have failed for all the sensing beams. - When the gNB/UE can perform simultaneous sensing in different beams, a single Type 1 channel access procedure as odomabed in Clause 4.4.1 is applied before the start of the channel occupancy using multiple sensing beams per sensing beam where each sensing beam covers a transmission beam within the channel occupancy. When the channel is accessed the transmission within the channel occupancy can occur following the procedures in Clause 4.4.2 before switching to a different beam within the channel occupancy.] |
| Samsung | Proposal 2: For SDM scenario, when Type 1 channel access procedure is applied before the start of the channel occupancy simultaneously per sensing beam where each sensing beam covers a transmission beam within the channel occupancy, if a channel is failed to be accessed for any sensing beam, the corresponding transmission(s) is dropped during the channel occupancy. • Adopt TP#1 for TS 37.213. |
| Samsung | Proposal 3: For TDM scenario, when Type 1 channel access procedure is applied before the start of the channel occupancy simultaneously per sensing beam where each sensing beam covers a transmission beam within the channel occupancy, and no LBT is performed within the channel occupancy, if a channel is failed to be accessed for any sensing beam, the corresponding transmission(s) is dropped during the channel occupancy. • Adopt TP#2 for TS 37.213. |
| MediaTek Inc. | Proposal 1: For multi-beam COT, support Alt 5, if any issues for Alt 5, support Alt 2. |
| Qualcomm Incorporated | Proposal 20: For a COT with MU-MIMO (SDM) transmission or TDM transmission of beams with beam switching, when independent per-beam LBT is performed at the start of the COT, for Pout in EDT determination of LBT for each sensing beam define Pout as the maximum EIRP of the intended transmissions “covered” by the sensing beam by the node determining EDT during a COT |
| Qualcomm Incorporated | Proposal 21: When independent per-beam LBT sensing is performed, a transmission may be allowed to occur as long as the LBT procedure has been successful before a channel occupancy for at least a single beam. However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the LBT procedure was not successful. |
| LG Electronics | Proposal #3: When simultaneous sensing in different beams is used to Type 1channel access for gNB-initiated COT to transmit SDM transmission, the partial SDM transmission can be allowed for transmission(s) corresponding to the beam direction that succeeded in LBT, except for transmission(s) corresponding to the beam direction that failed the LBT, instead of dropping the entire transmission(s). |
| LG Electronics | Proposal #4: When simultaneous sensing in different beams is used to Type 1channel access for UE-initiated COT to transmit SDM transmission, the entire transmission(s) can be dropped if at least one sensing beam is failed to LBT considering the UE complexity. |
| LG Electronics | Proposal #5: When simultaneous sensing in different beams is used to Type 1channel access for gNB-initiated COT to transmit TDM transmission, the partial TDM transmission can be allowed for the transmission(s) corresponding to the beam direction that succeeded in LBT, except for transmission(s) corresponding to the beam direction that failed the LBT, instead of dropping the entire transmission(s). |
| Lenovo Motorola Mobility | Proposal 1: For NR unlicensed bands between 52.6 GHz and 71 GHz with directional LBT based channel access mechanism, If a channel occupancy includes transmission(s) in different beams that are multiplexed in spatial domain, then one or both of the following behaviors can be applied for sensing to perform transmission(s) within the channel occupancy: - Single wider beam sensing before the start of the channel occupancy - Multiple beam sensing before the start of the channel occupancy (including both simultaneous sensing and TDM sensing, when simultaneous not supported by the node) |
| Lenovo Motorola Mobility | Proposal 2: For NR unlicensed bands between 52.6 GHz and 71 GHz with directional LBT based channel access mechanism, If a channel occupancy includes transmission(s) in different beams that are multiplexed in time odoma, then one or both of the following behaviors can be applied for sensing to perform transmission(s) within the channel occupancy: - Single wider beam sensing before the start of the channel occupancy - Multiple beam sensing before the start of the channel occupancy (including both simultaneous sensing and TDM sensing, when simultaneous not supported by the node) |
| Lenovo Motorola Mobility | Proposal 3: For NR unlicensed bands between 52.6 GHz and 71 GHz with directional LBT based channel access mechanism, if a UE is going to transmit a set of consecutive PUSCH transmissions including both dynamically scheduled PUSCH transmissions and CG-PUSCH transmissions, the UE can select the latest indicated UL Tx beam to transmit the consecutive UL transmissions |
|  |  |

Proposal 2.3-1:

When independent per-beam LBT sensing is performed, a transmission may be allowed to occur as long as the LBT procedure has been successful before a channel occupancy for at least a single beam. However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the LBT procedure was not successful.

Proposal 2.3-1a:

When independent per-beam LBT sensing is performed, a transmission ~~may be~~ is allowed to occur ~~as long as the~~ on a beam if the LBT procedure has been successful before a channel occupancy for ~~at least a single~~ that beam. ~~However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the LBT procedure was not successful.~~

* Support 2.3-1 but please check if 2.3-1a is acceptable as well: vivo, Intel, Apple, WILUS, MediaTek, DCM, ZTE, OPPO, IDCC
* Support 2.3-1a: Lenovo
* Not support: Ericsson,

Please provide your view if not captured above:

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| Company | View |
| vivo | We are fine with the proposal. |
| Intel | We are OK with this proposal. |
| Apple | OK |
| WILUS | We are fine with the proposal. |
| Mediatek | Ok with the proposal |
| DOCOMO | Support Proposal 2.3-1: |
| Ericsson | We cannot support this proposal in this form. Firstly, we think that there is no way to verify this and there is no apparent benefit in doing so. Secondly, the sensing beams may have some overlap and leakage. Thirdly, by allowing this behavior, it requires the transmitter to drop some scheduled/prepared packets in the failed LBT beam(s), which could increase the delay and buffer at the transmitter. Finally, dropping of such scheduled beams/packets for UL transmissions would require large specification impacts on handling the receiving of the packets since some scheduled beams would be missing.  Therefore, for UL we only support transmissions if LBT is successful for all beams (similar behaviour on sub-band LBT in rel-16). For DL we could consider supporting dropping failed beams as an implementation choice. |
| ZTE, Sanechips | We are fine with the proposal |
| OPPO | If multi-beam COTs are aligned, we are OK with the proposal. |
| InterDigital | We are fine with the proposal |
| Lenovo | We are generally fine with the intention of the proposal, though think that the wording could be improved. If we modify the first part to a condition that must be fulfilled, we don't need to specify for the case that LBT was unsuccessful. For that matter, we share Ericsson's view that overlapping beams could result in ambiguity with the original wording.  When independent per-beam LBT sensing is performed, a transmission ~~may be~~ is allowed to occur ~~as long as the~~ on a beam if the LBT procedure has been successful before a channel occupancy for ~~at least a single~~ that beam. ~~However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the LBT procedure was not successful.~~  Regarding Ericsson's point about dropping scheduled beams/packets, we think that situation already occurs in Rel-16 LBT failure cases (where we think packets are not dropped from the HARQ buffer, so they can be transmitted at a later opportunity), so we don't see why this could be a blocking issue for Rel-17. |
| Moderator | Added 2.3-1a from Lenovo’ suggestion. |
| FW | Support updated 2.3-1a |
| Nokia, NSB | We are ok with the initial proposal as well as Lenovo’s revision. |
| Xiaomi | OK with updated 2.3-1a |
| Samsung | In general ok with the proposal. Suggest wording change to clarify the CO should be the one including the corresponding transmission (not “a” arbitrary CO).  When independent per-beam LBT sensing is performed, a transmission ~~may be~~ is allowed to occur ~~as long as the~~ on a beam if the LBT procedure has been successful before the channel occupancy including the transmission for ~~at least a single~~ that beam. ~~However, a transmission (via either spatial or time multiplexing) is not allowed on those beams for which the LBT procedure was not successful.~~ |
| DOCOMO2 | Fine with Samsung update. |

Discussion 2.3-2:

When independent per-beam LBT is performed to initiate a COT with MU-MIMO (SDM) transmission or TDM transmission of beams with beam switching, shall we reuse the same design for multi-channel channel access mechanism, instead of introducing something different?

* For example, independent Type 1 channel access per channel becomes independent Type 1 channel access per sensing beam

Please provide your view:

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| Company | View |
| vivo | Yes, we think multi-channel channel access mechanism can be considered as a baseline for independent per-beam LBT. |
| Intel | We are OK with using as a baseline the Type A multi-carrier channel access procedure for the independent per-beam LBT procedure. However, the two should be discussed separately to accommodate for different considerations that may arise. |
| Apple | Does not support the proposal. They are separate issue. |
| WILUS | It should be separately discussed for independent per-beam LBT and multi-channel access. |
| Mediatek | We share similar view with Apple and WILUS that these are different issues. |
| DOCOMO | Maybe we do not get the point here, but this question seems to be implying to ask whether we need to wait for the progress in section 2.4, which seems not needed in our view. |
| Ericsson | We do not see a need to specify this together. |
| ZTE, Sanechips | we can first discuss this issue with multi-channel channel access separately. |
| OPPO | We agree that the multi-channel channel access mechanism can be the baseline for independent per beam LBT. |
| InterDigital | We do not support the proposal. Similar to other companies, we think these are different issues that have different considerations. |
| FW | Prefer separate discussion |
| Nokia, NSB | We see these as separate issues. |
| Xiaomi | When saying “we reuse the same design for multi-channel channel access mechanism”, does it mean that independent LBT is done per beam? If so, we can agree to take it as a baseline. |
| Samsung | We agree to discuss these separately. |

## Multi-Channel channel access

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| Agreement:  Define Type A and Type B multi-channel channel access as:   * Type A: Perform independent eCCA for each channel * Type B: Identify a primary channel and perform eCCA on the primary channel, while perform Cat 2 LBT for other channels in the last observation slot   Down-selection between   * Alt1: Support Type A multi-channel channel access only * Alt2: Support both Type A and Type B multi-channel channel access.   Note: How eCCA is performed on each channel, and the BW of the channels over which eCCAs are performed are separately discussed  Agreement  Type A multi-channel channel access is supported.   * FFS whether legacy mechanisms such as type A1 is supported |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 16: For Type A multi-channel access procedure in FR2-2, specify that the counters resume decrementing synchronously when idle slots are detected on the corresponding channels after either one of the following;  a duration of 2\*Tsl (5us each) from the end of previous transmission(s), or  reinitializing the counters |
| FUTUREWEI | Proposal 7: For Type A multi-channel channel access, for each channel, the counter is independently determined. After the COT expires in any one channel, the gNB/UE reinitializes the counter for each one of the channels. |
| ZTE Sanechips | Proposal 12: In addition to support Type A multi-channel channel access, Type B multi-channel channel access can be supported based on the device’s capability to support Cat 2 LBT. |
| ZTE Sanechips | Proposal 13: For Type A multi-channel channel access, after the device ceases transmission in any one channel, one of the following methods can be considered: l Alt1: the device can reinitialize the counter for all channels. l Alt2: the device can reinitialize the counter for the other channel except channel on which the device ceases transmission(corresponding to part of the legacy Type A1 mechanism) |
| NTT DOCOMO INC. | Proposal 9: For Type A1/A2 multi-channel access,  l Support either of the following approach for the exact specification text: Ø Alt 1: Newly define Type A1 and/or Type A2 for FR2-2, which generally follows the same text as in Clause 4.1.6.1 of 37.213 other than the parts related to CW\_p Ø Alt 2: Refer to Clause 4.1.6.1, and add a clarification that CW\_p is always expected to be 3 in FR2-2 l Support not to consider Type A2 in FR2-2 |
| Spreadtrum Communications | Proposal 1: For type A multi-channel channel access, for each channel, the counter is independently determined. |
| Spreadtrum Communications | Proposal 2: For type A multi-channel channel access, the legacy counter maintenance mechanism in type A1 is supported. |
| TCL Communications | Proposal 3: After the gNB/UE ceases transmission in any one channel, the gNB/UE reinitializes the counter for all channels. |
| Nokia Nokia Shanghai Bell | Proposal 7: Only Type A multi-channel access procedure (i.e. Alt.1 defined in RAN1#104-e meeting) shall be supported in NR-U on 60GHz band. |
| Nokia Nokia Shanghai Bell | Proposal 8: For Type A multi-channel channel access, for each channel, the counter is determined and maintained independently. |
| Ericsson | Proposal 2 RAN1 to agree that for LBT in intra-band CA multi-carrier transmissions, the gNB/UE performs multiple LBTs, one each channel separately. |
| Qualcomm Incorporated | Proposal 5: For Type A multi-channel channel access, for each channel, the counter is independently determined. After the gNB/UE ceases transmission in any one channel, the gNB/UE reinitializing the counter for all channels. |
| Intel Corporation | Proposal 20: For FR2-2, multi-carrier channel access procedure is employed through independent counters, one for each carrier. |
| Intel Corporation | Proposal 21: Support to align transmission starting time across the carrier such that a transmission on one carrier does not start while sensing is ongoing on another carrier. In this matter, a device should behave as follows:  If the backoff counter N\_(C\_i ) for a carrier C\_i reaches zero before the aligned transmission starting time, the device continues to decrement the counter〖 N〗\_(C\_i ) by continuing to sense the channel via sensing slots of 5us each and declares the channel for that carrier to be idle if the channel continues to be sensed idle in all of the additional sensing slot durations.  If the backoff counter N\_(C\_i ) for a carrier C\_i does not reach zero before the aligned start time, or reaches zero but the channel has been sensed busy in any of the additional sensing slot durations, channel access procedure in carrier C\_i is considered to have failed. |
| Intel Corporation | Proposal 22: After the gNB/UE ceases transmission in any of the carrier for which the channel access procedure was done, the gNB/UE will reinitialize the counter for all channels. |
| Ericsson | Observation 4 Owing to the small contention window values (ranging from 0 to 3)it does not matter whether the device reinitializes or resumes the counter after a certain duration like Type A1 channel access, in the case of channel busy or after a successful transmission.  Based on the extensive analysis and observations provide in this contribution, we propose |
| Ericsson | Proposal 19 RAN1 to agree that for multi-carrier transmissions, the alignment of the counters or the transmission start times on each channel can be left for gNB implementation. |

Proposal 2.4-1: (closed and replaced by 2.4-1a)

For Type A multi-channel channel access, the initial value of the counter is independently determined for each channel, and count-down process is independent for each channel.

Proposal 2.4-1a:

For the multi-channel channel access procedure, the initial value of the counter is independently determined for each channel, and count-down process is independent for each channel.

* Support: Intel, MediaTek
* Mentioned support for 2.4-1 but please check if also fine with 2.4-1a: vivo, Apple, DCM, Ericsson, ZTE, OPPO, IDCC

Please provide your view if not captured above:

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| Company | View |
| vivo | We support the proposal. |
| Intel | We are generally OK with the principles behind the proposal, but we are not OK with the text since this references directly to the type A multi-channel access procedure. The proposal could be updated as follows:  For ~~Type A~~ the multi-channel channel access procedure, the initial value of the counter is independently determined for each channel, and count-down process is independent for each channel. |
| Apple | OK |
| WILUS | We support the Proposal 2.4-1. |
| Mediatek | We are ok with the principle of the proposal and Intel’s revised version. |
| DOCOMO | We interpret this Proposal 2.4-1 as “whether to support Type A1 multi-channel access in FR2-2” but not sure if it is correct. If correct, we support this proposal.  Moderator: Yes this is to address that FFS.  BTW, if RAN1 reuses Clause 4.1.6.1 for FR2-2, whether to treat CW\_P should be resolved since CW\_P seems not defined at all for FR2-2. One approach could be not to reuse this Clause but to have a new clause with similar text to Clause 4.1.6.1 (without referring to CW\_P). Another could be to refer to Clause 4.1.6.1 and to have a note like “CW\_P is always considered as 3”. Either way (or even other ways) is fine for us, but we believe it should be clarified.  Moderator: By the current 37.213 structure, the FR2-2 will be in new section 4.4 and will not reuse 5/6GHz spec |
| Ericsson | We support the proposal. |
| ZTE, Sanechips | we agree with the proposal |
| OPPO | We support the proposal. |
| InterDigital | We support the proposal. |
| Moderator | Proposal 2.4-1a added to replace proposal 2.4-1 per Intel’s suggestion |
| FW | Support 2.4-1a |
| Nokia, NSB | We support the proposal, and we are fine also with Intel’s modifications. |
| Xiaomi | Support 2.4-1a |
| Samsung | We are ok with Proposal 2.4-1a |
| DOCOMO2 | Intel’s update looks nice. We agree Proposal 2.4-1a: |

Proposal 2.4-2: (closed and replaced)

For Type A multi-channel channel access, after each COT, possibly using a subset of the channels, the counters for all channels are re-initialized.

Moderator: Updated to be consistent with language used in proposal 2.4-1a.

Proposal 2.4-2a:

For the multi-channel channel access procedure, after a COT, possibly using a subset of the channels, the counters for all channels are re-initialized.

* Support 2.4-2, but need to verify also fine with 2.4-2a: vivo, Ericsson

Moderator note: Here is an example. There are two channels in the channel access, channel 0 and channel 1. The gNB starts type 1 channel access on both channels, and only channel 0 passed LBT, so the gNB transmits on channel 0 only. After the COT on channel 0, the gNB tries to start another COT. For channel 0, it is clear the gNB will need to re-draw a random number. The question is for channel 1. Should the gNB re-draw a random number, or continue count down from the previous number, adding 4 (This is allowed in the current Type A1)? The proposal is the re-draw a random number even for channel 1, consider the maximum random number you will get is 3, smaller than the 4 you need to add in the alternative approach.

Please provide your view:

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| Company | View |
| vivo | We support the proposal. |
| Intel | We are not sure what is the meaning of this proposal, and it is unclear what “possibly using a subset of the channels” and what will trigger the re-initialization of the counters. Is the counter re-initialized for all channels when a transmission burst is elapsed or at the end of a COT when this is acquired?  Moderator: An example added above. The intention is to after the previous COT. Exactly when to redraw after the previous COT does not matter. Just somewhere after the previous COT and before starts another COT |
| Apple | Since proposal 2.4-1 propose independent per channel, re-initialization should be independent as well. I.e., for channels which did not transmit, resume count down from previous value.  Moderator: Per current 5/6GHz band design, it is allowed to resume, but you will need to add 4 to the counter, which is already larger than our maximum counter value. Do you still want to do that? |
| Mediatek | This proposal is not clear to us. Is the intention to define when the counter should be re-initialized?  Moderator: An example added above |
| DOCOMO | We interpret this Proposal 2.4-2 as “whether to support Type A2 multi-channel access in FR2-2” but not sure if it is correct. If correct, we don’t see the strong need for that, while open to discuss.  When we support this, we believe the same issue as in the last proposal should be resolved here as well: how to treat CW\_P?  Moderator: This is not about A2. Please see the example above |
| Ericsson | We support the proposal. |
| ZTE, Sanechips | we don’t understand what the proposal means.  Moderator: Sorry for the confusion. Please see if the example added above can help. |
| InterDigital | Similar to others, we are unclear what the purpose of the proposal is.  Moderator: Sorry for the confusion. Please see if the example added above can help. |
| Lenovo | We think that the LBT counter is frozen if the channel is busy, no matter whether a COT ends on another channel or not. So there is no need to re-initialize all channels after each COT.  Moderator: Please see the example above |
| Moderator | Proposal 2.4-2a added to replace 2.4-2 |
| FW | Support 2.4-2a |
| Nokia, NSB | It is not clear why re-initialization should be mandated. This could be left for implementation |
| Xiaomi | Thanks Moderator for the clear example. we can support 2.4-2a. |
| Samsung | If the example is the gNB “can” redraw to get a smaller value, then we agree with Nokia that this can be up to implementation and no need to specify. It seems we need an example to clarify why the gNB has to redraw. |
| DOCOMO2 | I see this is considered for the case after only a part of channels are obtained. We are ok with Proposal 2.4-2a. |

## Directional LBT

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| Agreement:  3GPP specification consider defining at least the relative relationship between all applicable sensing beam(s) and the transmission beam(s) to define sensing beam for LBT, where at least sensing beam(s) “covers” the transmission beam(s), considering following alternatives. Target down-selection by RAN1 #106bis-e   * Alt 1: Specify necessary requirement/test procedure to guarantee sensing beam “covers” the transmission beam   + Some methods to define “cover” have been discussed in RAN1 (may further down select the list) and are considered as acceptable from RAN1 perspective     - Alt-1A: the angle included in the [3] dB beamwidth of the transmission beam is ncluding in the [X, FFS] dB beamwidth of the sensing beam.     - Alt-1B: the sensing beam gain measured along the direction of peak transmission direction is at least X [FFS] dB of the transmission beam gain     - Alt-1C: The sensing beam gain is measured in one or more directions where the transmission beam EIRP is within A [FFS] dB of the peak EIRP. The sensing beam gain measured along the chosen directions is at least X [FFS] dB of the transmission beam gain in those directions.     - Alt-1D: The sensing beam gain is measured in one or more directions where the transmission beam EIRP is within A [FFS] dB of the peak EIRP and the sensing beam gain measured along the chosen directions is at least X [FFS] dB of the peak sensing beam gain     - Alt-1E: Sensing beam has the minimum [3] dB beamwidth which at least contains all beam peak directions of transmission beams.   + Sending LS to RAN4 and inform them the above and request them to make the final choice     - RAN4 choice may not be limited by the list above, but if different method is selected, RAN1 would like to have an opportunity to check as well * Alt 2. Extending the beam correspondence framework and QCL/TCI/SpatialRelationInfo framework to define “cover” and to indicate sensing beam(s) associated with a transmission beam(s)   + On gNB side sensing beam selection for a DL transmission beam,     - Option 1: The selection of eligible sensing beam for a transmission beam is left for gNB implementation       * No testing or enforcement introduced in 3GPP spec for this option     - Option 2: Beam correspondence at gNB side is assumed. Supporting one or more of the following behaviors       * A1. For a gNB transmission beam corresponding to TCI state A for a certain UE, the gNB can use the same beam for sensing       * A2. If TCI B is used as QCL source (Type D) for TCI A for a certain UE, then gNB transmission beam corresponding to TCI B can be used as the sensing beam for transmission with TCI A.       * A3. If TCI C is NOT used as QCL source (Type D) for TCI A for any UE, then gNB cannot use the transmission beam corresponds to TCI C as the sensing beam for transmission with TCI A.       * FFS: How and if to support sensing with a beam without corresponding RS sent? For example, how to use quasi-Omni beam for sensing if there is no SSB transmitted with quasi-omni beam   + On UE side sensing beam selection for a UL transmission beam     - Beam correspondence is assumed at UE       * FFS: What if beam correspondence is not supported at UE.     - Supporting one or more of the following behaviors       * If the UE is indicated to transmit with a beam corresponding to a certain SRI, the UE can use the same beam for sensing       * Assuming Rel.17 unified TCI framework, if the UE is indicated to transmit with a beam corresponding to a certain unified TCI, the UE can use the reception beam corresponding to the TCI for sensing       * FFS: How and if to support a wider sensing beam (such as pseudo-omni beam, which is supported in WiFi) to be used for a narrower transmission beam under QCL/TCI framework         + Option 0: Not supported         + Option 1: UE implementation.   No testing or enforcement introduced in 3GPP spec for this option   * + - * + Option 2: gNB indication.   FFS details.   * + FFS: How and if to support multiple sensing beams to be used for a transmission beam under QCL/TCI framework * Note: Supporting both alternatives or a combination of the two alternatives is not precluded   Agreement:   * When UE indicates a capability for beam correspondence with beamCorrespondenceWithoutUL-BeamSweeping ={1}, support the following behaviors * If the UE is indicated to transmit with a beam corresponding to a certain SRI, the UE can use the same beam for sensing * Assuming Rel.17 unified TCI framework, if the UE is indicated to transmit with a beam corresponding to a certain unified TCI, the UE can use the reception beam corresponding to the TCI for sensing * FFS: The case when UE does not indicate a capability for beam correspondence * Note: The UE should meet local regulatory requirements |

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| Company | Key Proposals/Observations/Positions |
| Ericsson | Proposal 5 RAN1 to agree to modify the sentence in CR 37.213, clause 4.4 to the following- [The spatial domain filter for sensing beam(s) during the sensing slot duration at the gNB, or at a UE when the UE does not indicate a capability for beam correspondence without the uplink beam sweeping, or at a UE when the UE uses a different beam for sensing than the beam used for transmission, covers relates to the transmission beam(s) of the intended transmission(s) within the channel occupancy according to [RAN4 reference].] Editor’s note: Definition of “cover” Where [RAN4 reference] is pending RAN4 LS response. |
| Ericsson | Proposal 6 RAN1 to agree to modify the sentence in CR 38.214 to the following- [A UE that has indicated a capability beamCorrespondenceWithoutUL-BeamSweeping set to ‘1’, as described in [X, TS 38.306], can determine a spatial domain filter to be used while performing the applicable channel access procedures described in [16, TS 37.213] prior to transmit a UL transmission on the channel as follows:] |
| LG Electronics | Proposal #7: Introduce a mechanism to indicate the sensing beam that is not corresponding to the transmission beam, or a single (wide) sensing beam (such as pseudo-omni beam), i.e., a resource index (e.g., SSB index for wide sensing beam or CSI-RS index for sensing beam same as transmission beam) corresponding to the sensing beam can be jointly encoded or separately indicated together with SRI or TCI indication for the transmission beam in the DCI. |
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Summary of positions so far:

## Channel Access Mode, i.e. LBT mode vs No-LBT mode

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| Agreement:  For regions where LBT is not mandated, gNB should indicate to the UE this gNB-UE connection is operating in LBT mode or no-LBT mode   * Support both cell specific (common for all Ues in a cell as part of system information or dedicated RRC signalling or both) and UE specific (can be different for different Ues in a cell as part of UE-specific RRC configuration) gNB indication   Conclusion:  There is no consensus to support per beam LBT mode or no-LBT mode UE specific gNB indication.  Conclusion:  For regions where LBT is not mandated, there is no consensus to introduce L1 signalling for gNB to indicate to the UE if the operation is in LBT mode or no-LBT mode. Note this is different from the DCI field indicate the LBT type for UL transmission. |

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| Proposed conclusion 2.6-1c1 from [1]  Other than the already agreed cell-specific and UE-specific indication to the UE if the gNB-UE connection is operating in LBT mode or no-LBT mode, no separate indication from gNB to UE is introduced to indicate if LBT is mandated by regulation in the deployment   * Note: the cell-specific and UE-specific indications on LBT mode or no-LBT mode will be provide***d in regions where LBT is mandated (in which case LBT mode is indicated), or in regions where LBT is not mandated or the spectrum is licensed (in which case LBT mode or no LBT mode is gNB decision)*** |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 5: For operation in FR2-2, clarify that gNB indication of the LBT/No-LBT mode is also applicable in regions where LBT is mandated by regulations and when operating without shared spectrum access.  Adopt following TP#3 for TS 37.213 v17.0.0  Update the RRC parameters list sent to RAN2 accordingly |
| Huawei HiSilicon | Proposal 6: Support Proposed conclusion 2.6-1c1 in in [3]: |
| Huawei HiSilicon | Proposal 7: Modify the earlier agreement in RAN1#105-e as follows: |
| Huawei HiSilicon | Proposal 8: For operation in FR2-2, support enabling the validation procedures of periodic CSI-RS based on gNB’s indication of ‘LBT ON’ (Proposal 2.6-1d in RAN1#107bis-e) |
| FUTUREWEI | Proposal 8: Before the UE reports its LBT capability, gNB is allowed to schedule UL transmission with Type 1 or Type 2 channel access:  o If Type 2 channel access is indicated but not supported, then  § If UE supports Type 1 channel access and if the gap to scheduled transmissions allows for Type 1 channel access, use Type 1 access instead § Otherwise: UE does not transmit o If Type 1 channel access is indicated but not supported § UE does not transmit. |
| FUTUREWEI | Proposal 11: Priority or precedence rules should be defined to address the scenarios when UE receives multiple types of LBT or no-LBT mode indications. |
| FUTUREWEI | Proposal 12: If gNB indicates to the UE only by a cell specific indication that this gNB-UE connection is operating in LBT mode, the periodic CSI-RS should be validated by COT duration or dynamically granted PDSCH or aperiodic CSI-RS over the same set of symbols as in Rel.16 NR-U. |
| vivo | Proposal 6: Before UE reports its capability, gNB can only indicate UE to share the gNB-initiated COT with Type 3 channel access. |
| vivo | Proposal 7: Periodic CSI-RS validation should be supported if LBT mode is indicated for the gNB in the shared spectrum. |
| vivo | Proposal 8: gNB should indicate separate channel access modes for gNB and UE. |
| CATT | Proposal 1: Other than the already agreed cell-specific and UE-specific indication, no separate indication from gNB to UE is introduced to indicate if LBT is mandated by regulation in the deployment. |
| CATT | Proposal 2: For the UE in the region where LBT is mandated or the spectrum is licensed, at least the cell-specific indication of LBT/No-LBT mode should be provided. |
| CATT | Proposal 3: Tow bits can be used to indicate LBT mod information and Contention Exempt Short Control Signaling allowed information |
| ZTE Sanechips | Observation 1: Once the transmission of DL/UL channels/signals considered as Short Control Signalling exceeds 10ms limitation, it is a natural way to switch from No LBT mode to LBT mode. Observation 2: For the case of the transmission of DL/UL channels/signals considered as Short Control Signalling is in a COT initiated by gNB or UE and LBT is performed before Short Control Signalling transmission, it is suggested that such transmission should not be counted into 10ms limitation within the 100ms observation period. |
| ZTE Sanechips | Proposal 6: No LBT can be considered to be used in the following use cases: l Specific areas such as ITU region 2 and 3. l Interference controlled environment. l The transmission beams of nodes of different operators in the same system (e.g., NR-U) have little interference with each other. Observation 3: No LBT should be workable only if some interference elimination mechanisms are applied on top of it. If no LBT is supported, the spec impact of introducing such enhancement should be further studied and evaluated. |
| ZTE Sanechips | Proposal 8: Adopt TP2 into Section 4.4.3 of TS 37.213:  \*\*\* <Beginning of Text Proposal 2 TS 37.213> \*\*\*  \*\*\* <Ending of Text Proposal 2 TS 37.213> \*\*\* |
| ZTE Sanechips | Proposal 9: Conditions for No LBT fallback to LBT should be further studied, e.g., based on the interference level or correctly decoding rate. |
| ZTE Sanechips | Proposal 17: Propose RAN1 to assess the need to distinguish between licensed spectrum and shared spectrum without LBT first.  l If yes, an LS can be sent to RAN2 to ask a guidance on how to distinguish between licensed spectrum and shared spectrum without LBT. |
| ZTE Sanechips | Proposal 18: To distinguish between licensed spectrum and shared spectrum without LBT, the following method can be considered: l Case 1: gNB does not configure “channelAccessMode2 ”(it is RAN2 term) in cell specific and UE specific gNB indication, this case means UE is operating in licensed band. l Case 2: If gNB configures “channelAccessMode2 ”, this case can indicate the current operation in unlicensed band. And through enable or disable to indicate LBT or No LBT, respectively. |
| NTT DOCOMO INC. | Proposal 8: Support both P-/SP-CSI-RS validation and upgrading the type of channel access based on COT duration indication DCI 2\_0  l Support to define the rule so that COT duration indication is applicable only for the beam used for the corresponding DCI 2\_0 |
| TCL Communications | Proposal 4: The LBT mode/non-LBT mode indication from DCI has a higher priority than that from SIB. |
| Nokia Nokia Shanghai Bell | Observation 1: The agreed cell-specific and UE-specific indication of the LBT/no-LBT mode is sufficient for unlicensed operation, without any further dependency on the region. |
| Nokia Nokia Shanghai Bell | Proposal 5: Support the FL proposal 2.6-1d1: For unlicensed operation (or shared spectrum channel access), if gNB indicates to the UE this gNB-UE connection is operating in LBT mode, the periodic CSI-RS should be validated by COT duration or dynamically granted PDSCH or aperiodic CSI-RS over the same set of symbols as in Rel.16 NR-U. |
| Ericsson | Observation 3 UE behavior for consecutive scheduled UL transmissions in a gNB-initiated COT needs further clarifications |
| Ericsson | Proposal 14 For regions where sensing is not required before every transmission, if a UE is scheduled to transmit a set of consecutive UL transmissions with or without gaps including PUSCH using one or more UL grant(s), PUCCH using one or more DL grant(s), or SRS with one or more DL grant(s) or UL grant(s) and the UE transmits the first of the scheduled UL transmissions in the set after accessing the channel using the LBT indicated in the DCI, the UE may continue transmission of the remaining UL transmissions in the set without any LBT. |
| Ericsson | Proposal 15 For regions where sensing is not required before every transmission, and gNB shares a channel occupancy initiated by a UE with a UL transmission on scheduled resources or a PUSCH transmission on configured resources, the gNB may transmit a DL transmission that follows the UL transmissions without any LBT. |
| Apple | Proposal 1: Add one bit SIB1 signaling indicating LBT is required before all transmission (i.e. Japan). |
| Apple | Proposal 2: RACH msg 1 or msg A transmission • When indicated in SIB1 that LBT is required before all transmission, Type 1 or type 2 LBT can be performed depending on UE capability.  • Otherwise type 3 can be used. |
| Apple | Proposal 5: In regions where no LBT is mandated, the UE specific RRC LBT mode indication applies to UE only. The UE can assume SSB, CSI-RS are always transmitted for RRM/RLM and beam management. |
| NEC | Proposal 3: For regions where LBT is not mandated, when LBT mode or no-LBT mode is indicated to a UE, the mode applies to the UE for the operation between the gNB and the UE. The operating mode of the gNB could be additionally indicated explicitly or implicitly if necessary. |
| Samsung | Proposal 1: For indication of the LBT/no-LBT mode: • gNB determines its mode by implementation; • UE assumes both the gNB and UE operates according to the indicated mode in the cell-specific indication;  • UE assumes the UE operates according to the indicated mode in the UE-specific indication; • the UE-specific indication overrides the cell-specific indication when both of them are provided. |
| Qualcomm Incorporated | Proposal 7: If UE has not signalled that is capable of supporting Type2 LBT An indication for Type 2 LBT for UL transmission will be treated as an indicate for Type 1 LBT |
| Qualcomm Incorporated | Proposal 16: Modify the earlier agreement as follows. Agreement: For regions where LBT is not mandated, gNB should indicate to the UE this gNB-UE connection is operating in LBT mode or no-LBT mode • Support both cell specific (common for all Ues in a cell as part of system information or dedicated RRC signalling or both) and UE specific (can be different for different Ues in a cell as part of UE-specific RRC configuration) gNB indication When LBT mode or no-LBT mode is indicated to a UE, the UE assumes the mode applies to both gNB and UE for the operation between the gNB and UE. • Note: The gNB still may or may not perform LBT, but UE does not need to know |
| Qualcomm Incorporated | Proposal 17: Other than the already agreed cell-specific and UE-specific indication to the UE if the gNB-UE connection is operating in LBT mode or no-LBT mode, no separate indication from gNB to UE is introduced to indicate if LBT is mandated by regulation in the deployment • Note: the cell-specific and UE-specific indications on LBT mode or no-LBT mode will be provided in regions where LBT is mandated (in which case LBT mode is indicated), or in regions where LBT is not mandated or the spectrum is licensed (in which case LBT mode or no LBT mode is gNB decision) |
| Qualcomm Incorporated | Proposal 18: For unlicensed operation (or shared spectrum channel access), if gNB indicates to the UE this gNB-UE connection is operating in LBT mode, the periodic CSI-RS should be validated by COT duration or dynamically granted PDSCH or aperiodic CSI-RS over the same set of symbols as in Rel.16 NR-U |
| LG Electronics | Proposal #8: The cell-specific and UE-specific indications on LBT mode or no-LBT mode will be provided in regions where LBT is mandated (in which case LBT mode is indicated), or in regions where LBT is not mandated or the spectrum is licensed (in which case LBT mode or no LBT mode is gNB decision). |
| LG Electronics | Proposal #9: If gNB indicates to the UE this gNB-UE connection is operating in LBT mode, the periodic CSI-RS should be validated by COT duration or dynamically granted PDSCH or aperiodic CSI-RS over the same set of symbols as in Rel.16 NR-U. |
| LG Electronics | Proposal #10: When LBT mode or no-LBT mode is indicated to a UE, the UE assumes the mode applies to both gNB and UE for the operation between the gNB and UE (i.e., Approach 1). |
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Discussion 2.6-1

Please provide your view if LBT mode can be indicated by gNB if operating in licensed band

* Yes : HW, CATT, LGE, Intel, DCM,
* No: Apple, Ericsson, ZTE, Oppo, Samsung

Please provide your view:

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| Company | View |
| vivo | We think maybe we should first identify that if band number can be used to distinguish licensed and unlicensed spectrum. It that works, no additional LBT mode indication is needed for licensed band.  Moderator: That is RAN4 discussion how to use band numbers. |
| Intel | We agree with the proposal, and LBT mode should be also indicated in licensed band, so that to leave up to the network whether to use LBT or not when this is not strictly necessary (e.g, licensed band). |
| Apple | No. Do not see why LBT mode is indicated in licensed band.  Also if LBT mode can be indicated in licensed band, do we limit it to FR2-2, or general FR2. |
| DOCOMO | While do not understand why LBT can be needed in licensed band, we are ok with leaving it up to NW. |
| Ericsson | No. |
| ZTE, Sanechips | We disagree that LBT is indicated for licensed band, so we remove our position from proposal.  According to CR endorsed by RAN4, it has agreed to use band number to distinguish between licensed band and unlicensed band, so it does not seems to necessary to indicate LBT mode for licensed band to identify whether the node is operating in licensed band or unlicensed band. |
| OPPO | No, LBT mode should not be indicated in licensed band. |
| InterDigital | We are unsure why LBT would be needed in licensed band. Is the purpose of this proposal in case a UE doesn’t know that it is in licensed band, and expects an indication of LBT or no-LBT?  Moderator: It is about if gNB can use LBT for licensed band voluntarily. For example, the band is licensed, but the operator does not do a careful planning of the gNB locations, or there are mobile gNBs, and the operator can use LBT type techniques to avoid/reduce collisions. |
| Nokia, NSB | No. It is unclear why LBT should be used on a licensed band. |
| Xiaomi | Currently, we don’t see the need. But if operators do see the need, we are open to discuss it. |
| Samsung | No, we didn’t see the need. A UE can distinguish the band as a licensed band from the system information, and will assume LBT is not applicable for this band. We don’t think it makes sense to ask a UE support licensed band only to implement the feature of LBT. |

Proposed conclusion 2.6.1-2

Other than the already agreed cell-specific and UE-specific indication to the UE if the gNB-UE connection is operating in LBT mode or no-LBT mode, no separate indication from gNB to UE is introduced to indicate if LBT is mandated by regulation in the deployment

* Note: the cell-specific and UE-specific indications on LBT mode or no-LBT mode will be provided in regions where the band is shared and LBT is mandated (in which case LBT mode is indicated), or in regions where the band is shared but LBT is not mandated (in which case LBT mode or no LBT mode is gNB decision), or in regions where the band is licensed (in which case, depends on the outcome of discussion 2.6-1, either the gNB will always indicate no LBT mode, or LBT mode or no-LBT mode is gNB decision)
* Support: vivo, Intel, DCM, OPPO, Qualcomm, IDCC, FW

Alternative proposal from Apple.

Alt 2: One additional bit in SIB1 indicate whether LBT is required for all UL transmissions.

* Note: this is the ensure the system need Japan’s regulation on LBT. i.e., Type 3 is not allowed.
* Support: Apple, Ericsson,

Please provide your view:

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| --- | --- |
| Company | View |
| vivo | We support the proposal. |
| Intel | We agree with this proposal |
| Apple | Add alternative proposal 2 to capture 1 bit indication that all UL transmission require LBT.  Support Alt 2, which is on top of LBT and no LBT mode indication, to ensure system meet world-wide regulation. No type 3 is allowed for Msg 1 and msg A, also COT sharing when gap is less than a threshold. |
| DOCOMO | Support the Proposed conclusion 2.6.1-2 |
| Ericsson | We support the proposal and agree with Apple’s comments. |
| ZTE, Sanechips | We don’t think that LBT should be provided for licensed band. |
| OPPO | We support the Proposed conclusion 2.6.1-2. |
| InterDigital | We support the proposal. |
| FW | Support |
| Nokia, NSB | We are fine with the main bullet. The Note may not be necessary and can cause confusion. E.g. in Europe whether LBT is needed or not does not depend on the band but on the deployment/harmonized standards that is followed.  Apples alternative proposal 2 seems to relate more to Proposal 2.7-1 below |
| Xiaomi | support |
| Samsung | We are ok with the proposal other than part for licensed band. |

Proposal 2.6.1-3:

For unlicensed operation (or shared spectrum channel access), if gNB indicates to the UE this gNB-UE connection is operating in LBT mode, the periodic CSI-RS should be validated by COT duration or dynamically granted PDSCH or aperiodic CSI-RS over the same set of symbols as in Rel.16 NR-U

* Support: vivo, Intel, Ericsson, ZTE, IDCC
* Not support: Apple

Please provide your view:

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| Company | View |
| vivo | We support the proposal. |
| Intel | We are OK with the proposal. |
| Apple | Would like to separate in two cases.  Case 1: If SIB1 indicate LBT, agree the proposal.  Case 2: If SIB1 indicate No LBT, and UE specific RRC signaling indicate LBT for this gNB-UE link, then UE assume this LBT is for UE only. |
| DOCOMO | Perhaps it would be better to resolve this issue after concluding beam-specific COT SI issue since whether to enhance DCI 2\_0 will affect whether it is possible to reuse Rel-16 NR-U method.  Moderator: The discussion on directional DCI 2\_0 is on top of this. I don’t see we will need to wait for that conclusion. |
| Ericsson | We support the proposal. |
| ZTE, Sanechips | We are fine with the proposal |
| OPPO | If LBT mode is not allowed to be indicated by the gNB in licensed band, we can support the proposal. However, we should wait for the conclusion on Discussion 2.6-1, or we can discuss section 2.6-1 and Proposal 2.6.1-3 in the same package.  Moderator: This proposal is for unlicensed case only |
| InterDigital | We support the proposal |
| FW | We agree with Apple to separate into 2 cases.  We support Case-1 with slight clarification and Case-2.  Case 1: If SIB1 indicate LBT and UE specific RRC signaling does not indicate no-LBT for this gNB-UE link, agree to the proposal.  Case 2: If SIB1 indicate No LBT, and UE specific RRC signaling indicate LBT for this gNB-UE link, then UE assume this LBT is for UE only. |
| Nokia, NSB | We support the proposal. |
| Xiaomi | OK with the Proposal.  And has question for the case 2 raise by Apple. we can agree with case 1/2 clarification, but not sure why it is raised. For P-CSI, it is UE specifically configure, so if UE specific RRC signaling indicate LBT for this gNB-UE link, then UE should still assume LBT for P-CSI. |
| Samsung | We are ok with the proposal. |
| DOCOMO2 | Thanks FL for the following. .  *Moderator: The discussion on directional DCI 2\_0 is on top of this. I don’t see we will need to wait for that conclusion.*  We agree the issue itself can be solved together with or earlier than DCI 2\_0. But my point is that having the wording “as in Rel.16 NR-U” may be too broad and may affect the discussion on DCI 2\_0. Since time domain behavior seems well described already, we think it could be safer to remove “as in Rel.16 NR-U” to leave DCI 2\_0 enhancements up to the relevant section. Then P-CSI-RS validation is anyway supported, and the needed functionality can be discussed there. |

## Short Control Signaling and Contention Exempt Transmission

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| Agreement:   * Contention Exempt Short Control Signaling rules can be applicable to the transmission of SS/PBCH.   + FFS: What are the other DL signals and channels that can be multiplexed with SS/PBCH transmission under Contention Exempt Short Control Signaling rule   + FFS: Whether this can be applied to all supported SCS or specific SCS.   + FFS: Extension to discovery burst if it is defined including signals other than SS/PBCH   + Note: Restriction for short control signalling transmissions apply (10% over any 100ms interval) * FFS: Other DL signals/channels can be transmitted with Contention Exempt Short Control Signaling rule, such as PDCCH, broadcast PDSCH, PDSCH without user plain data, CSI-RS, PRS, etc   Agreement:  For contention exemption short control signalling based DL transmission of SS/PBCH, further consider if the following signals/channels can be multiplexed with SS/PBCH block transmission.   * RMSI PDCCH and RMSI PDSCH * Other broadcast PDSCH * PDSCH without user-plane data * PDCCH * CSI-RS * PRS * Other signals/channels contained in Discovery Burst (i.e., exemption applies to Discovery Burst)   Note: Total exempted signals/channels should meet the restriction of 10% over any 100ms interval.  FFS: If contention exemption short control signalling based DL transmission is allowed when not multiplexed with SS/PBCH block transmission. |

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| Agreement:   * Contention Exempt Short Control Signaling rules apply to the transmission of msg1 for the 4 step RACH and MsgA for the 2-step RACH for all supported SCS.   + Note restriction for short control signalling transmissions apply (10% over any 100ms intervals)   + Alt 1: The 10% over any 100ms interval restriction is applicable to all available msg1/msgA resources configured (not limited to the resources actually used) in a cell   + Alt 2: The 10% over any 100ms interval restriction is applicable to the msg1/msgA transmission from one UE perspective * FFS: Other UL signals/channels can be transmitted with Contention Exempt Short Control Signaling rule, such as msg3, SRS, PUCCH, PUSCH without user plain data, etc |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 14: In regions where channel sensing is mandated and short control signaling exemption is allowed by regulations, contention-exempt short control signaling rules apply to the transmission of msg1 for 4 step RACH and msgA for 2-step RACH such that the 10% over any 100ms interval restriction is applicable to all available msg1/msgA resources configured in a cell (Alt 1).   Adopt following TP#7 for TS 37.213 v17.0.0 |
| Huawei HiSilicon | Proposal 15: Providing an additional RRC configuration to indicate whether or not msg1 or msgA is transmitted based on Contention Exempt Short Control Signaling is not supported. |
| vivo | Proposal 11: The 10% over any 100ms interval restriction is applicable to the msg1/msgA transmission from one UE perspective. |
| vivo | Proposal 12: gNB provides RRC configuration in SIB1 to indicate if msg1 or msgA transmission with Contention Exempt Short Control Signaling based transmission is allowed. |
| vivo | Proposal 13: It is up to UE implementation to transmit msg1 or msgA based on short control signalling or with LBT. |
| CATT | Proposal 9: The 10% over any 100ms interval restriction should be applicable to all Contention Exempt Short Control Signals from cell perspective. |
| CATT | Proposal 10: In order to meet 10ms limit over 100ms, the Contention Exempt Short Signaling rules should be applied to sub-set of PRACH slots for msg1/msgA. |
| ZTE, Sanechips | Proposal 1: Adopt Alt 1: The 10% over any 100ms interval restriction is applicable to all available msg1/msgA resources configured (not limited to the resources actually used) in a cell  Proposal 2: Adopt TP1 into Section 4.4.5 of TS 37.213: |
| NTT DOCOMO INC. | Proposal 5: Define short control signaling by interpreting the exemption rule as “per device” |
| NTT DOCOMO INC. | Proposal 6: Support a signaling to configure whether short control signaling is applicable or not |
| Nokia Nokia Shanghai Bell | Proposal 4: Whether the short control signalling exemption is applicable in a cell or not is indicated to the UEs via system information. |
| Nokia Nokia Shanghai Bell | Observation 5: EN 302 567, v2.2.0 allows for Short Control Signalling transmissions for up to 10% of time within an observation period of 100 ms. |
| Nokia Nokia Shanghai Bell | Proposal 13: There is a separate 10% allowance for the gNB, and another one common for all the UEs in the cell. |
| Nokia Nokia Shanghai Bell | Observation 6: Depending on SSB sub-carrier spacings and SSB periodicity, only a sub-set of all SSBs can be covered by short control signalling exemption. |
| Nokia Nokia Shanghai Bell | Proposal 14: It is possible to apply SCSe to one part of actually transmitted SSBs and LBT procedure for other/rest of the SSBs. |
| Nokia Nokia Shanghai Bell | Proposal 15: UEs may assume that if short control signalling is in use in a cell, the network shall not configure more than 10% of all time resources for msg1/msgA. |
| Nokia Nokia Shanghai Bell | Proposal 16: Use of short control signal contention exemption and use of LBT for different SSBs is predefined: as many lowest indexed SSBs as possible are transmitted without LBT, and the SSBs exceeding the 10% maximum are transmitted subject to LBT. |
| Intel Corporation | Proposal 10: The gNB indicates through a cell-specific RRC parameter in SIB1 whether the short signal exemption should be applied or not. |
| Intel Corporation | Proposal 11: The 10% over any observation period of 100ms is applicable to the msg1/msgA transmission from one UE perspective. |
| Intel Corporation | Proposal 12: TP#4 should be supported. |
| Ericsson | Proposal 3 RAN1 to conclude that for short control signalling transmissions from UEs, the requirement of 10ms over 100ms duration is applicable to transmissions from a single UE perspective (Alt2 in the agreement) |
| Ericsson | Proposal 4 RAN1 to agree that the use of LBT for contention exempt transmissions is indicated in SIB1. The type of LBT (CAT3 or CAT2 LBT) to be used can be left for implementation and depending on the UE feature. |
| Samsung | Proposal 4: For short control signalling, the duty cycle calculation for UL is per UE. • No spec impact. |
| Qualcomm Incorporated | Proposal 9: gNB provides RRC configuration in SIB1 to indicate if msg1 or msgA transmission with Contention Exempt Short Control Signaling based transmission is allowed. |
| Qualcomm Incorporated | Proposal 10: Contention Exempt Short Control Signaling rules can be applicable to the transmission of discovery burst multiplexed with non-unicast information., provided the non-unicast transmissions are confined to the duration of the slots carrying DRS transmissions including SSB/PBCH blocks and RMSI PDSCH/PDCCH and NZP-CSI-RS. Note: Restriction for short control signalling transmissions apply (10% over any 100ms interval) |
| Qualcomm Incorporated | Proposal 11: The contention exemption for short control signaling applies to following DL transmission bursts not multiplexed with SS/PBCH block transmission, it but does not contain unicast information. The transmission burst may contain • PDSCH without user plane data • PDCCH  • CSI-RS  • PRS Note: Restriction for short control signalling transmissions apply (10% over any 100ms interval) |
| AsusTek | Observation 1: 10% limitation is too restricted for all possible PRACH resources and could induce undesired delay. |
| AsusTek | Observation 2: Handling the case actual transmitted Msg1/MsgA opportunities from a UE exceeding 10% limit is not required. |
| AsusTek | Proposal 1: 10% limitation over 100 ms applies to actual transmitted Msg1/MsgA opportunities from a UE |
| AsusTek | Proposal 2: the case of actual transmitted Msg1/MsgA opportunities from a UE exceeding such limit is not handled from specification perspective. |
| LG Electronics | Proposal #11: When Contention Exempt Short Control Signaling rules apply to the transmission of msg1 for the 4 step RACH and MsgA for the 2-step RACH for all supported SCS, the 10% over any 100ms interval restriction is applicable to all available msg1/msgA resources configured (not limited to the resources actually used) in a cell. |
| LG Electronics | Proposal #12: Whether a short control signaling rule is applicable or not to the configured msg1/msgA resources can be explicitly indicated by the gNB or implicitly determined by UE by checking duty cycle for the configured ROs (or ROs and POs) resources within the observation period. |
|  |  |

Proposal 2.7-1: (RRC impact)

gNB provides separate RRC configuration in SIB1 to indicate if msg1 or msgA transmission with Contention Exempt Short Control Signaling based transmission is allowed.

* Moderator note: This implies that UE does not need to figure out by itself if msg1 or msgA transmission with Contention Exempt Short Control Signaling is allowed. This also implies that even in regions SCS is allowed and the msg1/msgA configuration satisfy the 10% over 100ms requirement, gNB still has the flexibility to disable it.
* Support: Intel, DCM, OPPO
* Not support: Apple, ZTE,

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| vivo | Our understanding of the proposal is that SIB1 only informs that SCS is allowed **in the region** (**which means it is not Japan**). However, this does not imply that all the transmissions of Msg 1 or Msg A will fulfill the 10% requirement. So, we don’t support the note from the moderator. We do not have an agreement on the 10% requirement yet, i.e. proposal 2.7-2.  Moderator: No this is not about how the 10% is applied. This is about gNB can tell the UE if the UE can use SCS for msg1/msgA transmission or not. The condition when the gNB can set the flag is what you mean. |
| Intel | We agree with the proposal and we feel that this is necessary since coupling LBT with short control signaling exemption is not always possible, and an example is Japan where LBT is mandated but the short control signaling exemption is not allowed. In this case, a mechanism to indicate whether a UE can adopt this exemption or not is needed. |
| Apple | The 10% rule is applied per UE. And only UE knows whether the 10% short control signaling is exceed or not (i.e., RACH is transmitted but not received by gNB).  Do not really see how feasible it is for gNB to control the short control signaling overhead per UE. Not sure whether this proposal assume proposal 2.7-2.  Moderator: This is not about the 10% restriction. This is about gNB control on if the UE can use SCS at all. |
| DOCOMO | Support with the Proposal 2.7-1. |
| Ericsson | We do not support this proposal. We don’t see a need for this proposal if Apple’s proposal in 2.6.1-2 is agreed. We think that solves the issue for Japan use case as well where all UL transmission need LBT. |
| ZTE, Sanechips | We basically agree with the proposal. However, we think that it is still necessary to clarify some issues, as follows:  Issue1: if MSG 1 or MSGA transmission with Contention Exempt Short Control Signaling based transmission exceeds 10ms limitation, whether UE directly switch from No LBT to LBT for subsequent transmission.  Issue2: if MSG 1 or MSGA transmission with Contention Exempt Short Control Signaling based transmission is within a COT and LBT has been performed before COT, whether MSG 1 or MSGA transmission within a COT should be counted into 10% limitation. |
| OPPO | We support the proposal. |
| FW | Support |
| Nokia, NSB | We see that system information should include indication whether SCS is applicable or not in the cell. On UL part, this means msg 1 or msg A transmissions. |
| Xiaomi | Ok with the proposal in general. |
| Samsung | We are ok with the proposal. |

Proposal 2.7-2:

For Contention Exempt Short Control Signaling based transmission of msg1 for the 4 step RACH and MsgA for the 2-step RACH for all supported SCS, the 10% over any 100ms intervals restriction is applicable to all available msg1/msgA resources configured (not limited to the resources actually used) in a cell.

* This 10% allowance is separated from the 10% allowance for gNB
* TP 2.7-A
* Moderator note: Understand this is not the majority view. However, the moderator does not believe we can reach consensus on applying the restriction per UE, and this proposal is the minimum we can agree on.
* Support: ZTE, OPPO
* Not support: vivo, Apple, DCM, Ericsson,

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| vivo | We do not support the proposal. Regulation concerns only the actually transmitted signals. We see no motivation to tighten the requirement. |
| Intel | We still do not agree with the arguments brought up by companies that would like to apply this exemption per cell. This will certainly put our design in disadvantage compared to other technologies where this exemption is full utilized. Furthermore, if the gNB may realize that potential co-existence issues may arise if proposal 2-7-1 is agreed, it will still have the choice to disable this functionality. |
| Apple | Do not agree. Should be per device per regulation definition. |
| DOCOMO | We do not support the proposal since it is not clear why the proposed restriction on RO configuration is essential at this stage. No one does not regulate this, and this does not achieve any benefits. |
| Ericsson | We cannot support this proposal unfortunately. This is further restriction than the ETSI BRAN regulations and we do not see any coexistence issues as any technology may avail this feature from EN 302 567 and we don’t understand why companies think that 3GPP shouldn’t. |
| ZTE, Sanechips | We support the proposal |
| OPPO | We support the proposal. |
| FW | Support |
| Nokia, NSB | We support the proposal. |
| Xiaomi | OK with the Proposal |
| Samsung | We can be ok with the proposal for the sake of progress. |

TP 2.7-A

===================== for TS 37.213 =============

4.4.5 Exempted transmissions from sensing

In regions where channel sensing is required to access a channel for transmission and short control signalling exemption is allowed by regulation, a gNB/UE may transmit the following transmission(s) on a channel without sensing the channel:

- Transmission(s) of the discovery burst by the gNB

- Transmission(s) of the first message in a random access procedure by the UE

When the gNB/UE transmits the above transmission(s) without sensing on a channel by utilizing the exemption above, the total duration of such transmission(s) by the gNB~~/UE~~ shall not occupy the corresponding channel more than over any interval. The total configured resources for transmission(s) of the first message in a random access procedure shall not occupy the corresponding channel more than 10ms over any 100ms interval.

========================================

Discussion 2.7-3:

On non-unicast transmission (PDCCH, PDSCH carries system information other than SIB1, PDSCH without user plane data, CSI-RS, PRS) multiplexing with Contention Exempt Short Control Signaling based DRS transmission

* Alt 1: Support the multiplexing as long as the restriction for short control signalling transmissions apply (10% over any 100ms interval)
  + Nokia, Ericsson, Lenovo, Intel, Xiaomi, NEC, Transsion, Sony, DOCOMO, CATT, Samsung, LGE, OPPO, InterDigital, Transsion, WILUS, IDCC
* Alt 2: Not support the multiplexing
  + Apple, ASUSTek, Vivo, Huawei
* Alt 3: Support the multiplexing as long as the restriction for short control signalling transmissions apply (10% over any 100ms interval) and the multiplexing is only allowed in slots carry DRS (SSB, RMSI PDCCH/PDSCH, NZP-CSI-RS)
  + Qualcomm, IDCC, Apple(?)

Moderator note: We have been discussing this for quite a while without reaching consensus. There are two camps on Alt 1 and Alt 2. The Alt 3 is added to see if we can reach some compromise.

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| Intel | We are OK with Alt.1 and the rationale is similar as that provided above: extending this exemption to other channels up to the 10% duty cycle will allow the design to benefit from this exemption, which other technologies are taking advantage of. |
| Apple | Suggest modified proposal:  Support the multiplexing as long as the restriction for short control signalling transmissions apply (10% over any 100ms interval) and the multiplexing is only allowed in ~~slots~~ symbols carry DRS (SSB, RMSI PDCCH/PDSCH, NZP-CSI-RS)  Moderator: But there will leave many symbol levels gaps, while other RAT or other node cannot jump in (too short for LBT). This seems wasteful and not benefiting anyone? |
| WILUS | We support Alt-1. |
| Ericsson | Our preference Alt2 is correctly captured. We are open to support Alt3 as a compromise too. |
| ZTE, Sanechips | We are fine with Alt 1 |
| OPPO | We support Alt 1. |
| InterDigital | We support Alt 1 or 3. |
| Nokia, NSB | We support Alt. 1 |

Proposed conclusion 2.7-4:

There is no consensus to support transmitting DL burst not multiplexed with DRS with Contention Exempt Short Control Signaling based transmission

Support: vivo, Intel, Apple, WILUS, DCM, ZTE, OPPO, IDCC

Not support: Ericsson,

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| vivo | We support the proposal. |
| Intel | We are Ok with the conclusion, and as intended will like to apply this exemption only to non-unicast transmissions. |
| Apple | Agree |
| WILUS | We are ok with the proposed conclusion. |
| DOCOMO | Ok with the Proposed conclusion 2.7-4: |
| Ericsson | We cannot support this proposal and see this as a restriction on 3GPP devices. Any short control signal is allowed if the 10% DC limit is met according to the regulations. |
| ZTE, Sanechips | We are fine with the proposal |
| OPPO | We are OK with the conclusion. |
| InterDigital | We agree |
| FW | Agree |
| Nokia, NSB | We can accept the proposed conclusion. |
| Samsung | We are ok with the conclusion |

## CP Extension

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| OPPO | Observation 1: Introducing CPE may lead the UE to perform UL transmission in large number of symbols in advance for 480kHz and 960kHz. Proposal 6: For CG-PUSCH in FR2-2, CP extension has a granularity of 1 symbol according to 120kHz SCS or larger than 8 us. |
| Nokia Nokia Shanghai Bell | Proposal 1: NR-U like CP extensions are not introduced for CG-PUSCH in FR 2-2. |
| Intel Corporation | Proposal 3: Support cyclic prefix extension for CG-PUSCH transmissions in the FR2-2 frequency range using the same design principle as NR-U.  The first starting offset value should be equal to 8us and the granularity among the set of starting offsets should be equal to 5us. |
| NEC | Proposal 2: For CG-PUSCH in FR2-2 unlicensed operation, CP extension should be introduced, and the set of CP extension lengths should be designed based on the sensing slot duration and the defer duration for FR2-2. |
| Qualcomm Incorporated | Proposal 19: For CG-PUSCH in FR2-2 unlicensed operation, about CP extension, do not introduce CP extension. |
| Transsion | Proposal 2: CP extension is supported for CG-PUSCH transmission in FR2-2. |
| Transsion | Proposal 3: The set of candidate CP extension lengths should be 8us with a step size of 5us. |
| Nokia, NSB | We support the proposed conclusion. |

Even though there are a few companies proposing to reuse the NR-U design for CP extension for CG-PUSCH transmission, with new starting offsets design, it is clear many companies believe this is not needed. The moderator recommend to conclude we don’t have consensus to support this feature.

Proposed conclusion 2.8-1

There is no consensus to support CP extension for CG-PUSCH transmission in Rel.17.

Support: vivo, Apple, WILUS, MediaTek, DCM, Ericsson, ZTE, IDCC

Not support: Intel, OPPO

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| vivo | We support the proposal |
| Intel | Instead of making a rushed conclusion we would prefer to put on hold this discussion and focus on more fundamental issues, and only then come back to this.  We actually see benefits in supporting CP extension for CG-PUSCH, since this inherently allows to prioritize DG PUSCH over CG-PUSCH and solve potential blocking.  Moderator: I don’t see we have a lot of time to come back to this 😊 |
| Apple | Agree |
| WILUS | We are ok with the proposed conclusion. |
| Mediatek | We are ok with the proposed conclusion. |
| DOCOMO | Support Proposed conclusion 2.8-1 |
| Ericsson | We can support the proposed conclusion. |
| ZTE, Sanechips | Support |
| OPPO | We do not support the conclusion. Otherwise, the issue on collisions between UEs for CG-PUSCH cannot be addressed in FR2-2. |
| InterDigital | We agree |
| FW | OK with conclusion |
| Xiaomi | OK with the conclusion |
| Samsung | We are ok with the conclusion |

## LBT Type Indication in Fallback DCI and non-Fallback DCI

|  |
| --- |
| **Agreement**  For Non-Fallback DCI formats, for FR2-2 operation, for the configuration of the ChannelAccess-CPext field in DCI to indicate the channel access type only, new tables are introduced indicating channel access types for FR2-2, with entries “Type 1 channel access in 4.4.1 of 37.213”, “Type 2 channel access in 4.4.2 of 37.213” and “Type 3 channel access in 4.4.3 of 37.213”.  Conclusion  After the UE reports it LBT capability, UE does not expect the gNB to schedule UL transmission with LBT type it does not support |

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 9: For operation in a cell with shared spectrum access in FR2-2 and LBT-mode is provided and indicates that channel access procedures would be performed, the ChannelAccess-CPext field size in fallback DCI formats 0\_0/1\_0 and RAR UL grant is 2 bits; 0 bit otherwise-  Adopt following TP#4 for TS 38.212 v17.0.0 and TP#5 for TS 38.213 v17.0.0 |
| Huawei HiSilicon | Proposal 10: For operation in a cell with shared spectrum access in FR2-2, support Alt 2 if Proposal 2.9-2a from RAN1#107bis-e is agreed and capture that the UE does not expect to be indicated with Type 2 Channel access procedure if it has not indicated the capability to support it.-  Adopt following TP#6 for TS 37.213 v17.0.0 |
| Huawei HiSilicon | Proposal 11: For operation in a cell with shared spectrum access in FR2-2, it should be discussed whether to extend the indication of the corresponding LBT types to the ChannelAccess-CPext(-CAPC) field in the non-fallback DCI formats 0\_2/1\_2 as done in Rel-17 WI on enhanced IIoT/URLLC for FR1. |
| vivo | Proposal 4: Type 2 channel access should be indicated in the fallback DCI formats. |
| vivo | Proposal 5: The UE does not expect fallback DCI indicating Type 2 LBT for UL transmission to be received before it reporting the capability of supporting Type 2 LBT. |
| OPPO | Proposal 7: Type 2 channel access should be included in fallback DCI formats 0\_0 and 1\_0. |
| OPPO | Proposal 8: For a UE not reporting capable of supporting Type 2 LBT, the UE does not expect fallback DCI indicating Type 2 LBT for UL transmission to be received. |
| CATT | Proposal 4: Regardless of unlicensed band (LBT mode and no-LBT mode) or licensed band, the bit length of ChannelAccess-CPext field in fallback DCI for FR 2-2 operation is fixed to 2 bits. |
| CATT | Proposal 5: To reduce the overhead of non-fallback DCI, it is suggested that the bitwidth of ChannelAccess-CPext field in non-fallback DCI is 0 bit if no-LBT mode indication is configured with UE. |
| NTT DOCOMO INC. | Proposal 1: For channel access type indication by fallback DCI formats, adapt either of the following TPs: l TP#1 Alt-1: Support 2-bit indication to cover all the three channel access types l TP#1 Alt-2: Support 1-bit indication, and the association between entries and the indicated types to be configurable, where default table covers Type 1 and Type 3 |
| Nokia Nokia Shanghai Bell | Proposal 2: Fallback DCIs 0\_0 and 1\_0 support indication of Type 1 and Type 3 channel access, using 1 bit. |
| Intel Corporation | Proposal 1: For fallback DCI formats 0\_0/1\_0 and RAR UL grant, for FR2-2 operation, the ChannelAccess-Cpext field indicates one of the entries of a table which entries are “Type 1 channel access in 4.4.1 of 37.213”, “Type 2 channel access in 4.4.2 of 37.213” and “Type 3 channel access in 4.4.3 of 37.213”. |
| Intel Corporation | Proposal 2: TP#1 and TP#2 should be supported. |
| Ericsson | Proposal 13 For LBT indication in Fallback DCI formats support Option 2 in Proposal 2.4.2-1. |
| Apple | Proposal 3: 1 bit CCA indication in fall back DCI  • When indicated in SIB1 that LBT is required before all transmission, UE can determine whether type 1 or type 2 can be performed depending on UE capability. • Otherwise, follow type 1 or type 3 LBT indication in DCI. |
| Xiaomi | Proposal 2: For channel access type determination, DCI indication has higher priority than dedicated RRC signalling indication, and dedicated RRC signalling indication has higher priority than system information indication. |
| Qualcomm Incorporated | Proposal 6: For fallback DCI formats 0\_0 and 1\_0 and RAR UL grant, for FR2-2 operation, the ChannelAccess-Cpext field in DCI indicates the channel access type only. A new table similar to Table 7.3.1.1.1-4 is introduced with entries “Type 1 channel access in 4.4.1 of 37.213”, “Type 2 channel access in 4.4.2 of 37.213” and “Type 3 channel access in 4.4.3 of 37.213”, and “reserved”. • Note: This option requires 2 bis in fallback DC |
| LG Electronics | Proposal #13: All three channel access types should be able to be indicated through 2-bit ChannelAccess-CPext field in fallback DCI formats and RAR grant, and an indication for Type 2 LBT for a UE not capable of supporting Type 2 LBT can be treated as an indication of Type 1 LBT (i.e., Alt 1 in Proposal 2.9-2a should be supported). |
|  |  |

Proposal 2.9-1

Regardless of unlicensed band (LBT mode and no-LBT mode) or licensed band operation, the bit length of ChannelAccess-CPext field in fallback DCI formats 0\_0 and 1\_0 and RAR UL grant for FR 2-2 is fixed.

* When the UE is configured to operate in no-LBT mode, the UE will ignore the content of the field
* TP 2.9-A and TP 2.9-B

Support: vivo, Intel, Apple, WILUS, DCM, Ericsson, ZTE, IDCC

Not support:

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| vivo | We support the proposal. |
| Intel | We are OK with the proposal |
| Apple | agree |
| WILUS | We agree the proposal. |
| DOCOMO | Fine with the proposal. |
| Ericsson | We can support this proposal. |
| ZTE, Sanechips | Support |
| OPPO | Based on the discussion 2.6-1, LBT mode may not be allowed to be indicated in licensed band. In this case, the UE should also ignore the content of ChannelAccess-CPext field. Therefore, the proposal 2.9-1 can be modified as follows:  Proposal 2.9-1(modified)  Regardless of unlicensed band (LBT mode and no-LBT mode) or licensed band operation, the bit length of ChannelAccess-CPext field in fallback DCI formats 0\_0 and 1\_0 and RAR UL grant for FR 2-2 is fixed.   * When the UE is not configured to operate in LBT mode, the UE will ignore the content of the field * TP 2.9-A and TP 2.9-B   Moderator: I believe these are equivalent. In licensed band case, if LBT mode is not allowed to be indicated, it is clear to me no-LBT mode is configured by default. To avoid changes to proposals, can you live with the original language? |
| InterDigital | We support the proposal |
| Nokia, NSB | We support the proposal |
| Xiaomi | support |
| Samsung | Ok with the proposal in general.  We also want to clarify the field may also be ignored for licensed band. |

TP 2.9-A (for 38.212)

==================================================

7.3.1.1.1 Format 0\_0

DCI format 0\_0 is used for the scheduling of PUSCH in one cell.

The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

\*\*\* Unchanged text is omitted \*\*\*

* ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided, for operation in a cell with shared spectrum channel access for frequency range 1, and [1 bit or 2 bits] indicating the channel access type as defined in Table 7.3.1.1.1-4B for operation in a cell in frequency range 2-2; 0 bit otherwise.

\*\*\* Unchanged text is omitted \*\*\*

The following information is transmitted by means of the DCI format 0\_0 with CRC scrambled by TC-RNTI:

\*\*\* < Unchanged parts are ommitted> \*\*\*

* ChannelAccess-CPext –2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided, for operation in a cell with shared spectrum channel access for frequency range 1, and [1 bit or 2 bits] indicating the channel access type as defined in Table 7.3.1.1.1-4B for operation in a cell in frequency range 2-2; 0 bit otherwise.

\*\*\* Unchanged text is omitted \*\*\*

Table 7.3.1.1.1-4: Channel access type & CP extension for DCI format 0\_0 and DCI format 1\_0 in frequency range 1

|  |  |  |
| --- | --- | --- |
| Bit field mapped to index | Channel Access Type | The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, TS 38.211] |
| 0 | Type2C-ULChannelAccess defined in [clause 4.2.1.2.3 in 37.213] | 2 |
| 1 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 3 |
| 2 | Type2A-ULChannelAccess defined in [clause 4.2.1.2.1 in 37.213] | 1 |
| 3 | Type1-ULChannelAccess defined in [clause 4.2.1.1 in 37.213] | 0 |

Table 7.3.1.1.1-4A: Channel access type & CP extension if *ChannelAccessMode-r16* = "*semistatic*" is provided in frequency range 1

|  |  |  |
| --- | --- | --- |
| Bit field mapped to index | Channel Access Type | The CP extension T\_"ext" index defined in Clause 5.3.1 of [4, TS 38.211] |
| 0 | No sensing as defined in Clause 4.3 in TS 37.213 | 0 |
| 1 | No sensing as defined in Clause 4.3 in TS 37.213 | 2 |
| 2 | 9us sensing within a 25us interval as defined in Clause 4.3 in TS 37.213 | 0 |
| 3 | - | - |

\*\*\* Unchanged text is omitted \*\*\*

7.3.1.2.1 Format 1\_0

DCI format 1\_0 is used for the scheduling of PDSCH in one DL cell.

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by C-RNTI or CS-RNTI or MCS-C-RNTI:

\*\*\* Unchanged text is omitted \*\*\*

- ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided, for operation in a cell with shared spectrum channel access for frequency range 1, and [1 bit or 2 bits] indicating the channel access type as defined in Table 7.3.1.1.1-4B for operation in a cell in frequency range 2-2; 0 bits otherwise

\*\*\* Unchanged text is omitted \*\*\*

The following information is transmitted by means of the DCI format 1\_0 with CRC scrambled by TC-RNTI:

\*\*\* Unchanged text is omitted \*\*\*

- ChannelAccess-CPext – 2 bits indicating combinations of channel access type and CP extension as defined in Table 7.3.1.1.1-4, or Table 7.3.1.1.1-4A if *ChannelAccessMode-r16* = "*semistatic*" is provided, for operation in a cell with shared spectrum channel access for frequency range 1, and [1 bit or 2 bits] indicating the channel access type as defined in Table 7.3.1.1.1-4B for operation in a cell in frequency range 2-2; 0 bits otherwise

\*\*\* Unchanged text is omitted \*\*\*

===========================================

TP 2.9-B (for 38.213):

\*\*\* Unchanged text is omitted \*\*\*

8.2 Random access response - Type-1 random access procedure

\*\*\* Unchanged text is omitted \*\*\*

The ChannelAccess-CPext field indicates a channel access type and CP extension for operation with shared spectrum channel access [15, TS 37.213] as defined in Table 7.3.1.1.1-4 in TS 38.212 or Table 7.3.1.1.1-4A in TS 38.212 if ChannelAccessMode-r16 = "semistatic" is provided for frequency range 1. For operation in a cell in frequency range 2-2, the ChannelAccess-CPext field indicates a channel access type as defined in Table7.2.1.1.1-4B in TS 38.212.

Table 8.2-1: Random Access Response Grant Content field size

|  |  |
| --- | --- |
| RAR grant field | Number of bits |
| Frequency hopping flag | 1 |
| PUSCH frequency resource allocation | 14, for operation without shared spectrum channel access  12, for operation with shared spectrum channel access |
| PUSCH time resource allocation | 4 |
| MCS | 4 |
| TPC command for PUSCH | 3 |
| CSI request | 1 |
| ChannelAccess-CPext | 0, for operation without shared spectrum channel access in frequency range 1, or for operation in a cell in frequency range 2-1  2, for operation with shared spectrum channel access, or for operation in a cell in frequency range 2-2. |

\*\*\* Unchanged text is omitted \*\*\*

8.2A Random access response - Type-2 random access procedure

\*\*\* Unchanged text is omitted \*\*\*

If the UE detects the DCI format 1\_0, with CRC scrambled by the corresponding MsgB-RNTI and LSBs of a SFN field in the DCI format 1\_0, if applicable, are same as corresponding LSBs of the SFN where the UE transmitted PRACH, and the UE receives a transport block in a corresponding PDSCH within the window, the UE passes the transport block to higher layers. The higher layers indicate to the physical layer

- an uplink grant if the RAR message(s) is for fallbackRAR and a random access preamble identity (RAPID) associated with the PRACH transmission is identified, and the UE procedure continues as described in clauses 8.2, 8.3, and 8.4 when the UE detects a RAR UL grant, or

- transmission of a PUCCH with HARQ-ACK information having ACK value if the RAR message(s) is for successRAR, where

- a PUCCH resource for the transmission of the PUCCH is indicated by PUCCH resource indicator field of 4 bits in the successRAR from a PUCCH resource set that is provided by *pucch-ResourceCommon*

- a slot for the PUCCH transmission is indicated by a HARQ Feedback Timing Indicator field of 3 bits in the successRAR having a value from {1, 2, 3, 4, 5, 6, 7, 8} and, with reference to slots for PUCCH transmission having duration , the slot is determined as , where is a slot of the PDSCH reception, is as defined for PUSCH transmission in Table 6.1.2.1.1-5 of [6, TS 38.214], is the SCS configuration of the active UL BWP, and is provided by *Koffset* in *ServingCellConfigCommon*; otherwise, if not provided,

- the UE does not expect the first symbol of the PUCCH transmission to be after the last symbol of the PDSCH reception by a time smaller than msec where is the PDSCH processing time for UE processing capability 1 [6, TS 38.214]

- for operation with shared spectrum channel access, a channel access type and CP extension [15, TS 37.213] for a PUCCH transmission is indicated by a ChannelAccess-CPext field in the successRAR as defined in Table 7.3.1.1.1-4 in TS 38.212 or Table 7.3.1.1.1-4A in TS 38.212 if *ChannelAccessMode-r16* = "*semistatic*" is provided for frequency range 1. For operation in a cell in frequency range 2-2, the ChannelAccess-CPext field indicates a channel access type as defined in Table7.2.1.1.1-4B in TS 38.212.

- the PUCCH transmission is with a same spatial domain transmission filter and in a same active UL BWP as a last PUSCH transmission

\*\*\* Unchanged text is omitted \*\*\*

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Proposal 2.9-2

For fallback DCI formats 0\_0 and 1\_0 and RAR UL grant, for FR2-2 operation, the ChannelAccess-Cpext field in DCI indicates the channel access type only. A new table similar to Table 7.3.1.1.1-4 is introduced with entries “Type 1 channel access in 4.4.1 of 37.213”, “Type 2 channel access in 4.4.2 of 37.213” and “Type 3 channel access in 4.4.3 of 37.213”, and “reserved”.

* Note: This option requires 2 bis in fallback DCI
* TP 2.9-C

This is a continuation from discussion last meeting. While most companies are fine with this proposal, objections from Ericsson, Apple and Nokia were received

Support: vivo, Intel, DCM, ZTE, OPPO, IDCC

Not support (prefer 1 bit): Apple, Ericsson,

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| vivo | We support the proposal. |
| Intel | We are OK with the proposal. |
| Apple | Prefer 1 bit.  This is similar to NR-U, where non-fall back DCI can configure up to 6 bits for this field. And fall-back DCI only has 2 bits. |
| DOCOMO | This proposal is indeed our best preference, but if it is difficult to obtain the consensus, then we can compromise with 1-bit. In this case, we would like to support the switching of Table, or update of the contents in the table, based on RRC configuration. Having Type 1 and Type 3 as default would be fine for us. |
| Ericsson | We cannot support this proposal. It is not reasonable to have more bits in fallback DCI to support an optional feature that is not mandated by any regulatory domain. Please note that even though Type 1 is also optional, it is at least required in one regulatory domain. |
| ZTE, Sanechips | We are fine with the proposal |
| OPPO | We support the proposal. |
| InterDigital | We support the proposal |
| FW | Support |
| Nokia, NSB | We prefer to have only one bit, especially if the overhead needs to always be carried. |
| Xiaomi | support |
| Samsung | We are ok with the proposal (tracking color in the TP is missing). |

TP 2.9-C (for 38.212)

=============================================

7.3.1.1.1 Format 0\_0

\*\*\* Unchanged text is omitted \*\*\*

Table 7.3.1.1.1-4B: Channel access type in frequency range 2-2

|  |  |
| --- | --- |
| Bit field mapped to index | Channel Access Type |
| 0 | Type 1 channel access defined in clause 4.4.1 of 37.213 |
| 1 | Type 2 channel access defined in clause 4.4.2 of 37.213 |
| 2 | Type 3 channel access defined in clause 4.4.3 of 37.213 |
| 3 | Reserved |

\*\*\* Unchanged text is omitted \*\*\*

======================================================

## DCI 2\_0

|  |
| --- |
|  |

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| InterDigital Inc. | Proposal 6: Introduce beam specific COT-SI delivery in DCI 2\_0 applicable to COT duration and SSGS. |
| vivo | Proposal 10: The remaining COT should be indicated together with the sensing beam related information. |
| CATT | Proposal 6：The maximum range value of higher layer parameter should be extended to 4480 symbols for FR2-2 unlicensed band. |
| ZTE Sanechips | Proposal 11: If directional LBT is configured, it is a natural way to support CO duration, search space group switching in a beam-specific manner in FR2-2. |
| NTT DOCOMO INC. | Proposal 7: Not support to introduce beam indication in DCI 2\_0.  l To define COT duration indication in DCI 2\_0 to be applicable only for the beam used by the DCI 2\_0 is sufficient to achieve the desired behavior |
| Sony | Proposal 1: Beam specific COT delivered in DCI 2\_0 should be supported. |
| Nokia Nokia Shanghai Bell | Proposal 6: Beam-specific indication of remaining COT duration and search space group switching in DCI format 2\_0 can be supported. • Indicatation can be e.g. a bitmap indicator of beam groups served in the CO, where reference signals in UE’s PUCCH-SpatialRelationInfo or TCI-State\_r17 are associated to a beam group via RRC signalling. |
| Ericsson | Proposal 17 RAN1 to agree to not support beam specific COT-SI indication in DCI 2\_0. |
| Samsung | Proposal 6: Support indicating COT, available RB set, and search space group switching in a beam-specific manner for 60 GHz licensed band. |
| Qualcomm Incorporated | Proposal 13: Introduce beam specific COT-SI (remaining COT duration) delivery in DCI 2\_0. The beam specific nature is applied to the SFI and SSGS as well. |
| Qualcomm Incorporated | Proposal 14: Consider the introduction of one or more optional TCI-like field in the DCI 2\_0 to make the DCI 2\_0 beam specific. |
| Transsion | Proposal 4: Introduce beam specific COT duration, SFI and SSSGS indication delivery in DCI 2\_0. |
| Transsion | Proposal 5: The beam specific COT duration, SFI and SSSGS indication can only be used for the COT of the corresponding beam that the information is received. |
| Panasonic | Proposal 1: RAN1 to agree on the issue of unintended COT sharing caused by the existing DCI 2\_0. |
| Panasonic | Proposal 2: To address the issue of unintended COT sharing, consider specifying one or both of the following approaches: Approach 1: Specify that a UL transmission is identified as within gNB’s COT if and only if - the UL transmission is configured/indicated to use the beam corresponding to the one that gNB has used to transmit DCI 2\_0 , which is represented by the TCI state ID of the CORESET carrying DCI 2\_0; and  - the UL transmission timing is within the duration of COT. Approach 2: Introduce a new field, beam availability indicator, in DCI 2\_0 to indicate whether a beam is available or unavailable for the gNB’s COT. - A UL transmission is identified as within the gNB’s COT if the UL transmit beam is covered by the available beam and timing of UL transmission is within duration of COT.  - For a UL transmission associated with a beam that is covered by unavailable beam, UE is not allowed to transmit the UL transmission for the duration of COT. |
| LG Electronics | Proposal #14: The information on the DL beam can be provided by DCI format 2\_0 by introducing TCI field or beam availability indicator to indicate whether a certain beam is available or unavailable for a list of beams for the COT similar to the RB set availability indicator in Rel-16. |
| LG Electronics | Proposal #15: If the beam-specific COT information on the DL beam transmitted by the gNB is identified through DCI format 2\_0, the UE can change Type 1 channel access to Type 2 or Type 3 channel access and transmit the UL transmission associated with DL beam in terms of QCL relationship by sharing the COT of the gNB. If the beam-specific COT information is not associated with the UL transmission, or not received by the UE, Type 1 channel access should be performed to transmit the UL transmission. |
| Lenovo Motorola Mobility | Proposal 4: For NR unlicensed bands between 52.6 GHz and 71 GHz with directional LBT based channel access mechanism, within a COT, PDCCH monitoring is not supported in the CORESETs corresponding to other COTs (PDCCH monitoring restricted to monitoring corresponding to only one COT at a time) |

Discussion 2.10-1 (RRC impact)

On introducing beam specific COT-SI (COT duration) delivery in DCI 2\_0

* Support: Samsung, Apple, ~~Intel,~~ NEC, LGE, Lenovo, Nokia, ~~DCM~~, vivo, OPPO, Panasonic, Transsion, CATT, Sony, Qualcomm
* Against: Huawei/HiSilicon, Ericsson, DCM, Intel
* Further support beam specific SFI
  + Support: Sony, Qualcomm, Lenovo, Motorola Mobility, OPPO
  + Not support: LG, ZTE, Transsion
* Further support beam specific SSGS switching
  + Support: Nokia, ZTE, Qualcomm, Transsion, LG, Lenovo, Motorola Mobility, InterDigital, Samsung, OPPO
  + Not support:
* Further support beam specific PDCCH monitoring
  + Support: Lenovo

This discussion is a continuation from #107bis. The positions are collected from the last meeting and contributions or this meeting. Please provide your view if there is position change.

|  |  |
| --- | --- |
| Company | View |
| vivo | We support beam-specific indication of the COT duration in DCI 2\_0. |
| Intel | After additional considerations, we no longer support this proposal, and we have updated our position. Our understanding is that beam indication may not be needed under the assumption of a reasonable well engineered gNB’s implementation. |
| DOCOMO | We update our position above.  We think the minimum specification impact would be to make sure that for P-CSI validation and/or COT sharing, only the beam used by the DCI 2\_0 is considered. We do not see the need to explicitly indicate TCI (or beam related information) in DCI 2\_0. |
| Ericsson | We cannot support this proposal. The motivation to introduce beam specific COT duration in DCI2\_0 is that a UE may accidentally position itself in the side lobe or back lobe of the DCI2\_0 and may accidentally share the COT while it is not supposed to. DCI 2\_0 doesn’t contain any scheduling information and if a UE accidentally positions itself in the side-back lobe and is able to decode DCI 2\_0, it means that the UE is able to receive good enough SINR to decode it and it is therefore allowed to share the COT. Furthermore, it still needs gNB’s indication to begin its UL transmission. In other words, even if a UE can decode DCI 2\_0, we don’t think it can accidentally share the COT. We believe the case that the UE may have a CG-PUSCH that originally would have been cancelled but would be transmitted in this scenario is a corner case that does not need any optimization. In addition, the specification will largely be impacted regardless which one of the three alternatives are agreed to introduce (multiple) beam indicator in DCI 2\_0. During the maintenance phase, we can not agree to discuss a new topic that is not beneficial and requires significant specification impact. In our view, without beam indicator enhancement, legacy DCI 2\_0 still work well and comply with the regulations. |
| ZTE, Sanechips | We support to introduce beam specific indication if directional LBT is used. |
| OPPO | We are OK to support beam specific SFI and beam specific SSGS switching, and add our position in the proposal. |
| InterDigital | We support beam specific indication and SSGS. |

Discussion 2.10-2 (RRC impact)

On mechanism to specific beam specific COT-SI (if supported)

* Alt 1: Bitmap indicator of beam groups served in CO for PUCCH-SpatialRelationInfo
  + Nokia
* Alt 2: Introduced one or more TCI field in DCI 2\_0
  + Nokia, Qualcomm TCI\_R17, LG, Apple, ~~Intel,~~ Lenovo, vivo, OPPO, ZTE, InterDigital, Transsion, NEC, Sony, Samsung
* Alt 3:Beam Availability indicator
  + Panasonic, LG, ZTE, InterDigital, Transsion, CATT, NEC
* Not supporting: HW, Ericsson, MTK, Intel

This discussion is a continuation from #107bis. The positions are collected from the last meeting and contributions or this meeting. Please provide your view if there is position change.

|  |  |
| --- | --- |
| Company | View |
| vivo | Alt 2 is supported |
| Intel | Once again we have updated our view and we do not support this proposal for the reasons provided above. |
| Ericsson | We cannot support this proposal for the reasons mentioned in our comment in discussion 2.10-1. |
| OPPO | We prefer Alt 2. |
| InterDigital | Our position is correctly captured and we support Alt 2 or Alt 3. |
| Sony | We support Alt 2. |

Proposal 2.10-3 (RRC impact):

* CO-Duration maximum value is increased to 4480 to support 5ms maximum COT under 960KHz.
* Support using 120KHz, 480KHz, and 960KHz as the reference SCS for CO-Duration definition
  + Note this may not have any additional spec impact

Support: vivo, Intel, Apple, WILUS, Ericsson, ZTE, OPPO, Qualcomm, Sony

Please provide your view.

|  |  |
| --- | --- |
| Company | View |
| vivo | We are fine with the proposal. |
| Intel | We are OK to update the CO-duration maximum value. |
| Apple | Support |
| WILUS | Support |
| Ericsson | OK to support. |
| ZTE, Sanechips | Support |
| OPPO | We are OK with the proposal. |
| Nokia, NSB | We support the proposal. |
| Sony | We support the proposal. |
| Samsung | We are ok with the proposal. |

## L3-RSSI

|  |
| --- |
| Agreement:  Support extending Rel.16 L3-RSSI to unlicensed operation in FR2-2   * Introduce RRC configuration for reference SCS, measurement duration, and measurement bandwidth   + Extend the reference SCS/CP field (*ref-SCS-CP-r16*) and measurement duration field (*measDurationSymbols-r16*) in *RMTC-Config*     - FFS value range and valid combinations for *ref-SCS-CP-r16* and *measDurationSymbols-r16*   + Introduce parameter in *RMTC-Config* to indicate the measurement bandwidth     - FFS: Value range for measurement bandwidth * For the QCL Type-D of L3-RSSI measurement, down-select one or both of the following alternatives   + Alt 1: gNB configures the beam when configures the L3-RSSI measurement   + Alt 2: Use the QCL type-D of the latest received PDSCH and the latest monitored CORESET   **Agreement**  Introduce new parameter in RMTC-Config for L3-RSSI to indicate measurement bandwidth.   * The value range for the configured measurement bandwidth should include the maximum and the minimum channel bandwidth and the intermediate channel bandwidths defined by RAN4.   Agreement  On measDurationSymbols and reference SCS/CP for L3-RSSI   * On measDurationSymbols-r16 with ref-SCS-CP-r16=120KHz, extend measDurationSymbols-r16 to {1,14,28,42,70,140} * On measDurationSymbols-r16 with ref-SCS-CP-r16=480KHz (if supported), extend measDurationSymbols-r16 to {1,14,28,42,70,140, 560} * On measDurationSymbols-r16 with ref-SCS-CP-r16=960KHz (if supported), extend measDurationSymbols-r16 to {1,14,28,42,70,140, 560,1120} |

|  |
| --- |
| Proposal 2.11-1a (new, original Alt 3 in previous discussion) [1]  For the QCL Type-D of L3-RSSI measurement for unlicensed operation in FR2-2, if explicit TCI state is configured ~~in RMTC-Config~~, use the TCI state. Otherwise use the QCL type-D of the latest PDSCH reception or latest CORESET monitoring for RSSI measurement   * A dynamic update mechanism for TCI-State in RMTC-Config is not further considered in Rel.17 * The explicit TCI state is configured at least in RMTC-Config * Note: For inter-frequency L3-RSSI measurement, the TCI state configured is with respect to the target frequency TCI state |

|  |  |
| --- | --- |
| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 12: For L3-RSSI enhancements in FR2-2, clarify whether or not 480kHz and/or 960kHz are supported as reference SCS. |
| Huawei HiSilicon | Proposal 13: For the QCL Type-D of L3-RSSI measurement, support using the explicit TCI state if configured in RMTC-Config, and using the QCL type-D of the latest PDSCH reception or latest CORESET monitoring otherwise. |
| FUTUREWEI | Proposal 10: For the QCL Type-D of L3-RSSI measurement for unlicensed operation in FR2-2, if explicit TCI state is configured, use the TCI state.  • FFS: whether to use the QCL type-D of the latest PDSCH reception or latest CORESET monitoring for RSSI measurement, if the explicit TCI state is not configured.  • A dynamic update mechanism for TCI-State in RMTC-Config is not further considered in Rel.17 • The explicit TCI state is configured at least in RMTC-Config • Note: For inter-frequency L3-RSSI measurement, the TCI state configured is with respect to the target frequency TCI state. |
| InterDigital Inc. | Proposal 8: Support Proposal 2.11-1a from RAN1 #107b-e [4]. |
| CATT | Proposal 8: Considering the transmitter transient period for the BS, for the duration of L3-RSSI measurement that are configured by measurement duration field (measDurationSymbols-r16) in RMTC-Config, the following two options can be further studied: - Option 1: Depending on gNB implementation to avoid configuring the L3-RSSI measurement on the symbols of transmitter transient time for BS. - Option 2: Depending on UE implementation to exclude the symbols of transmitter transient time for BS from the duration of L3-RSSI measurement. |
| ZTE Sanechips | Proposal 20: For QCL assumption of L3-RSSI measurement, the UE can assume the configured RSSI measurement resources are QCL-ed with Type-D to one of the latest received PDSCH and the latest monitored CORESET if explicit TCI state is not configured; Otherwise, use the TCI state configured by gNB.. |
| ZTE Sanechips | Proposal 21: Adopt the above updated RRC parameters list according to Running RRC CR for 71GHz from RAN2. |
| NTT DOCOMO INC. | Proposal 2: For QCL Type-D of L3-RSSI measurement, support to introduce RRC parameter for QCL Type-D configuration: l If there is a case that the RRC parameter for QCL Type-D configuration of L3-RSSI measurement is not configured, QCL Type D of the latest received PDSCH and the latest monitored CORESET is used. |
| Sony | Proposal 2: For the QCL Type-D of L3-RSSI measurement, at least Alt 1 (gNB configures the beam when configures the L3-RSSI measurement) should be supported. l Alt 2 (Use the QCL type-D of the latest received PDSCH and the latest monitored CORESET) could be applied in the case that gNB does not configure the beam for the L3-RSSI measurement |
| Nokia Nokia Shanghai Bell | Proposal 17: For the QCL Type-D of L3-RSSI measurement, gNB configures the beam when it configures the L3-RSSI measurement (Alt 1) |
| Intel Corporation | Proposal 8: ref-SCS-CP-r16 is extended to include all the supported SCS for FR2-2 (i.e., 120, 480 and 960 KHz). |
| Intel Corporation | Proposal 9: For the QCL Type-D of L3-RSSI measurement use the QCL type-D of the latest received PDSCH and the latest monitored CORESET. |
| Ericsson | Proposal 10 To support RSSI and CO measurement in FR2-2, the current ref-SCS-CP in RMTC-Config in Rel-16 is extended to include 120, 480 and 960 kHz SCS; the current measDurationSymbols in RMTC-Config in Rel-16 is extended to include 140, 560 and 1120. |
| Ericsson | Proposal 11 RAN1 to conclude that for L3-RSSI in FR2-2, UE can assume the configured RSSI measurement resources are QCL-ed with Type-D to either the latest received PDSCH or the latest monitored CORESET (i.e., Alt-2). |
| Samsung | Proposal 5: Support gNB configuring a TCI-State IE in RMTC-Config for L3-RSSI measurement. |
| Qualcomm Incorporated | Proposal 15: For the QCL Type-D of L3-RSSI measurement for unlicensed operation in FR2-2,  • if explicit TCI state is configured use the TCI state.  o A dynamic update mechanism for TCI-State in RMTC-Config is not further considered in Rel.17 • if the explicit TCI state is not configured. o Use the most recent of QCL type-D of the latest PDSCH reception or latest CORESET monitoring for RSSI measurement, with QCL type D for PDSCH recepetion taking precedence in case of a tie • The explicit TCI state is configured at least in RMTC-Config • Note: For inter-frequency L3-RSSI measurement, the TCI state configured is with respect to the target frequency TCI state |
| LG Electronics | Proposal #16: For the QCL Type-D of L3-RSSI measurement, gNB can configure the beam when configuring the L3-RSSI measurement by indicating SSB index or CSI-RS index for target frequency to perform L3-RSSI measurement. |
| InterDigital Inc. | Proposal 7: Support Alt. 1: the gNB configured the beam when it configured the L3-RSSI measurement. |

Proposal 2.11-1 (RRC impact)

Support 480KHz and 960KHz as reference SCS/CP for L3-RSSI.

Support: Intel, Apple, DCM, Ericsson, ZTE, IDCC

Please provide your view.

|  |  |
| --- | --- |
| Company | View |
| Intel | We are OK to extend the procedure and include 480 and 960 KHz as reference SCS for L3-RSSI measurements. |
| Apple | OK |
| DOCOMO | Support. |
| Ericsson | Ok |
| ZTE, Sanechips | Support |
| InterDigital | Support. |
| Nokia, NSB | We are ok with the proposal |
| Xiaomi | Support |
| Sony | Support |
| Samsung | Support |

Proposal 2.11-2 (RRC impact)

For the QCL Type-D of L3-RSSI measurement for unlicensed operation in FR2-2, if explicit TCI state is configured, use the TCI state.

* Use the QCL type-D of the latest PDSCH reception or latest CORESET monitoring for RSSI measurement, if the explicit TCI state is not configured.
* A dynamic update mechanism for TCI-State in RMTC-Config is not further considered in Rel.17
* The explicit TCI state is configured at least in RMTC-Config
* Note: For inter-frequency L3-RSSI measurement, the TCI state configured is with respect to the target frequency TCI state

From the last meeting discussion, most companies seem to be willing to accept the above as compromise, except Samsung.

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| Intel | We are Ok with this proposal. |
| Apple | Support the proposal.  We see value to explicit configure omni/quasi-omni sensing for L3-RSSI. One main function of L3-RSSI is channel selection, therefore enable omni sensing should be helpful. Otherwise, only omni sensing is used. |
| DOCOMO | Support Proposal 2.11-2 (RRC impact). We think it captures a good middle ground among the group. |
| Ericsson | We can support this proposal for progress’s sake. |
| ZTE, Sanechips | We are fine with the proposal |
| InterDigital | We support this proposal. |
| FW | OK to support |
| Nokia, NSB | We are ok with the proposal |
| Xiaomi | support |
| Sony | We support the proposal. |
| Samsung | We believe we are in the progress of getting a compromise without a reasonable technical justification. We still don’t believe two schemes are needed at the same time, and ask for a technical explanation of the extra benefit to support both schemes, but didn’t get any answer so far. |

Discussion 2.11-3

Need clarification on “Use the QCL type-D of the latest PDSCH reception or latest CORESET monitoring for RSSI measurement”. The meaning of “latest” is not clear. For example, a UE is granted to receive PDSCH in slot 0 with TCI state 1 and is configured to measure L3-RSSI in slot 1. Is TCI state 1 considered as the latest TCI state for the L3-RSSI measurement? What if the UE is scheduled to receive PDSCH with TCI state 0 in slot 1?

* Interpretation 1: For a given L3-RSSI measurement occasion, the UE needs to identify the late PDSCH reception or last configured CORESET monitoring (which ever is later) before the L3-RSSI measurement occasion, and use the QCL Type-D of that for L3-RSSI monitoring
  + What if the UE is scheduled receive with a different QCL Type-D during the L3-RSSI measurement? The UE should use L3-RSSI measurement QCL Type-D for reception, or the other way around?
  + DCM, Ericsson,
* Interpretation 2: For each symbol of a given L3-RSSI measurement occasion, the UE determines the QCL Type-D for the reception of the symbol based on CORESET monitoring configuration and PDSCH reception scheduling and use that QCL Type-D for the L3-RSSI measurement
  + If different symbols of L3-RSSI measurement have different QCL Type-D, the UE will measure L3-RSSI with different QCL Type-D in those symbols and compute the total
  + Intel,

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| Intel | Interpretation 2 is preferred. |
| DOCOMO | Beam switch is generally not preferred when SCS is larger. Thus we prefer Interpretation 1. And even if PDSCH reception with different QCL Type-D is scheduled during the L3-RSSI, the same QCL Type-D should be kept. |
| Ericsson | Interpretation 1. It is the same for CLI measurement.   Regarding the question by the moderator: It is not clear to us why would a gNB schedule PDSCH reception and RSSI measurement in the same slot? Moreover, there is a delay involved in processing the TCI state in addition to the scheduling delay required between PDCCH and PDSCH if different TCI states are indicated for these channels.  Moderator: Not sure why the gNB does that, but is it allowed? |
| FW | Prefer Interpretation-1 |

## LBT Upgrade

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| --- | --- |
|  | |
| Company | Key Proposals/Observations/Positions |
| vivo | Proposal 3: UE can switch from Type 1 channel access to Type 2 or Type 3 channel access when sharing gNB-initiated COT. The regional regulation information should be carried in the cell-specific signaling. |
| OPPO | Proposal 9: For LBT type switching within gNB COT, the gNB may configure a target LBT type between type 2 or type 3, then UE may switch to the target LBT type within gNB COT. |
| ZTE Sanechips | Proposal 10: Introduce a RRC parameter to control Type 2 channel access procedures or Type 3 channel access procedures will be used for the case where the UE later finds out the transmission is in a gNB COT. |
| Nokia Nokia Shanghai Bell | Proposal 3: For an UL transmission indicated or configured to use Type 1 channel access, if the UE later finds out the transmission is in a gNB COT, the UE can change the channel access type to Type 2 channel access or Type 3 channel access • RRC configuration is introduced to enable/disable and to control whether Type 2 channel access or Type 3 channel access is used for this case. |
| Apple | Proposal 4: UE LBT upgrade behavior • When indicated in SIB1 that LBT is required before all transmission, UE can perform type 1 LBT to type 2 LBT depending on UE capability, regardless COT information. • Otherwise, UE can upgrade type 1 LBT to type 3 LBT if the transmission is within gNB initiated COT. |
| Xiaomi | Proposal 1: If Type 1 or Type 3 channel access mechanism is indicated, Type 1 or Type 3 channel access can be applied to each transmission burst among the multiple scheduled PUSCHs. If Type 2 channel access mechanism is indicated, Type 2 channel access can be applied to the first transmission burst, and Type 1 channel access can be for the subsequent bursts, if any. |
| Ericsson | Proposal 18 RAN1 to agree that for an UL transmission indicated or configured using Type 1 Channel access, if the UE later finds out that the transmission is in a gNB COT via DCI 2\_0, the UE follows the mechanism in clause 4.4.4, TS 37.213. |
| Qualcomm Incorporated | Proposal 8: For an UL transmission indicated or configured to use Type 1 channel access, if the UE later finds out, through DCI 2\_0 detection, the transmission falls is in a gNB COT, the UE can change the channel access type to Type 2 channel access or Type 3 channel access • RRC configuration is introduced to control either Type 2 channel access or Type 3 channel access will be used for this case. |
| LG Electronics | Proposal #17: Introduce a new RRC parameter to configure which LBT type can be switched between Type 2 and Type 3 channel access if the UE later finds out the transmission is in a gNB COT. |
|  |  |

Proposal 2.12-1 (RRC impact)

For an UL transmission indicated or configured to use Type 1 channel access, if the UE later finds out, through DCI 2\_0 detection, the transmission falls in a gNB COT, the UE can change the channel access type to Type 2 channel access or Type 3 channel access

* Alt 1: RRC configuration is introduced to indicate either Type 2 channel access or Type 3 channel access will be used, subject to UE capability
  + Vivo (cell specific), OPPO, ZTE, Nokia (also enable the upgrade), LGE, Qualcomm, Intel, WILUS, DCM,
* Alt 2: Introduce RRC indication in SIB1 that all UL transmission requires LBT or not. UE upgrades to Type 2 LBT if the indication is on and upgrades to Type 3 LBT if the indication is off
  + Apple, Ericsson,

Please provide your view if not captured above:

|  |  |
| --- | --- |
| Company | View |
| Intel | We are OK with the general intention of the proposal given that there are regions where LBT may be needed within a shared COT.  Just one clarification question for Alt-1/Alt2, what if the UE does not support type 2 and I only supports type 1. In this if the RRC indicates that LBT should be used, will the UE use type 1 or type 3 LBT?  Moderator: That is discussed in 2.14 |
| Apple | Alt 2 saves 1 bit in SIB1 signaling, with the same effect. |
| WILUS | We support Alt.1. |
| DOCOMO | Fine with Alt 1. |
| Ericsson | Alt 2. We do not see a need to support UE-specific RRC configuration. RRC usually implies dedicated (per UE) signaling, whereas SIB1 is broadcast signaling (to all UEs). But this is a minor point. |
| OPPO | We support Alt 1. |
| Nokia, NSB | We support Alt.1. We read “subject to UE capability” to mean that if UE does not support Alt.2 while Alt.2 is configured, then the UE is not eligible to change the channel access type. |
| Xiaomi | Support Alt1 |

## Type 1 LBT Procedure

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| Agreement   * Clarify that the 5us observation slot is at the end of the 8us deferral period.   + Note: The 5us observation slot is the sensing slot  in 37.213 * The TP below for TS 37.213 v17.0.0 is endorsed   \*\*\* <Beginning of TP for TS 37.213 v17.0.0> \*\*\*  **4.4.1 Type 1 channel access procedures**  This clause describes channel access procedures to be performed by a gNB/UE where the time duration spanned by the sensing slots that are sensed to be idle before a transmission(s) is random based on a fixed contention window size. The clause is applicable to any transmission initiating a channel occupancy by the gNB/UE.  The gNB/UE may transmit a transmission after first sensing the channel to be idle during the sensing slot duration of a defer duration  and after the counter  is zero in step 4. The counter  is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps below:  1) set , where  is a random number uniformly distributed between 0 and , and go to step 4;  2) if  and the gNB/UE chooses to decrement the counter, set ;  3) sense the channel for an additional sensing slot duration, and if the channel is idle for the additional sensing slot duration, go to step 4; else, go to step 5;  4) if , stop; else, go to step 2.  5) sense the channel until either it is detected busy within an additional defer duration  or it is detected to be idle for the sensing slot of the additional defer duration ;  6) if the channel is sensed to be idle during the sensing slot duration of the additional defer duration , go to step 4; else, go to step 5;  In the above procedures,  is the contention window and .  The defer duration is and includes a sensing slot duration  at the end of the 8 μs for performing as least a single measurement to determine whether the channel is idle.  A gNB/UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds .  **4.4.2 Type 2 channel access procedures**  This clause describes channel access procedures to be performed by a gNB/UE where the time duration spanned by sensing slots that are sensed to be idle before a DL/UL transmission(s) is deterministic.  A gNB/UE may transmit a transmission(s) on a channel immediately after  which ~~includes~~ ends with a sensing slot ~~with~~ of a duration  where the channel is sensed to be idle.  \*\*\* <End of TP for TS 37.213 v17.0.0> \*\*\* |

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| Company | Key Proposals/Observations/Positions |
| Huawei HiSilicon | Proposal 4: For operation in FR2-2, for defining the behavior after the counter reaches 0 but the gNB/UE performing the Type 1 channel access procedure is not ready yet for transmission, support Alt 5 in RAN1#107bis-e:  The gNB/UE may continue sensing the channel in additional sensing slots before the target transmission start time. The transmission can start only if either the channel continues to be sensed idle in all additional sensing slot durations or the channel is sensed idle within at least Td duration ending immediately before the target transmission start time.  Adopt following TP#2 for TS 37.213 v17.0.0 |
| FUTUREWEI | Proposal 6:  During the count-down of Type 1 channel access, if the gNB/UE counter reaches down to zero but the gNB/UE is not ready for transmission, then adopt one of the following behaviors. Alt-1: The gNB/UE stops sensing, and resumes sensing for one sensing slot right before the target transmission start time. Only if the sensing slot is sensed as idle, the Type 1 channel access on that channel is declared as successful and the transmission can start Alt-2: Once the counter counts down to zero, COT starts. The time between counter equals to zero and start of transmission is treated as a gap, which is counted as part of the COT duration (with 5ms being total MCOT duration)  o If the gap is greater than or equal to a sensing slot duration, the node resumes sensing on the channel for one sensing slot, right before the target transmission start time. Only if the sensing slot is sensed as idle or if the gap is smaller than the sensing slot duration, the transmission is allowed to start Alt-3: The gNB/UE may continue sensing the channel in additional sensing slots before the target transmission start time. The transmission can start only if either the channel continues to be sensed idle in all additional sensing slot durations or the channel is sensed idle within at least Td duration ending immediately before the target transmission start time. |
| ZTE Sanechips | Proposal 16: For the case where the device counter reaches 0 but it is not ready for the transmission, a potential method, resume sensing for a one sensing slot immediately before the targeted transmission start time, can be considered. |
| NTT DOCOMO INC. | Proposal 4: Adopt the following TP#3 |
| TCL Communications | Proposal 1: Support Option 1 with a maximum waiting time defined. |
| TCL Communications | Proposal 2: Support Option 2. If the waiting time is short, no additional channel sensing before the target transmission time will be performed. |
| Nokia Nokia Shanghai Bell | Observation 4: Current specification of Type 1 channel access allows to extend the channel sensing in time until gNB/UE is ready for transmission. It can also be clarified that the LBT sensing shall be completed before the start of COT for all the beams that are intended to be used during the COT. |
| NEC | Proposal 4: If a gNB/UE has not transmitted a transmission after a successful Type 1 channel assess procedure, the gNB/UE may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration immediately before this transmission. If the channel has not been sensed to be idle in the sensing slot duration immediately before this intended transmission, the gNB/UE behavior could defined as following,  • Alt 1. The gNB/UE proceeds to step 1 after sensing the channel to be idle in a defer sensing duration.  • Alt 2. The gNB/UE proceeds to step 1 directly. • Alt 3. The gNB/UE drops the intended transmission. |
| Qualcomm Incorporated | Proposal 22: During the count-down of Type 1 channel access, if the gNB/UE counter reaches 0 but it is not ready for transmission, the gNB/UE stops sensing, and resume sensing for one sensing slot, right before the targeted transmission start time. Only if the sensing slot is sensed as idle, the Type 1 channel access on that channel is declared as successful and the transmission can start. |
| Transsion | Proposal 6: During the count-down of Type 1 channel access, if the gNB/UE counter reaches 0 but it is not ready for transmission, the gNB/UE stops sensing, and resume sensing for one sensing slot, right before the targeted transmission start time. Only if the sensing slot is sensed as idle, the Type 1 channel access on that channel is declared as successful and the transmission can start. |
| LG Electronics | Proposal #2: During the count-down of Type 1 channel access, if the gNB/UE counter reaches 0 but it is not ready for transmission, the gNB/UE stops sensing, and resume sensing for one sensing slot, right before the targeted transmission start time. Only if the sensing slot is sensed as idle, the Type 1 channel access on that channel is declared as successful and the transmission can start. |
| LG Electronics | Proposal #18: UL LBT failure indication in Rel-16 NR-U can also be supported for frequency range 2-2 and the enhancements such as managing the UL LBT failure counter for each sensing beam can be considered. |
| WILUS Inc. | Proposal 1: It should be discussed whether or not to specify the channel access mechanism after failure of Type 2 channel access procedure for UL/DL transmission. |
| WILUS Inc. | Proposal 2: Similar with NR-U and LTE-LAA, we propose to perform Type 1 channel access procedure after failure of Type 2 channel access (Cat-2 LBT) for DL/UL transmission followed by a UL/DL transmission(s) within the maximum Channel Occupancy Time in a shared channel occupancy on FR2-2. |
| OPPO | Proposal 5: One additional sensing slot immediately before the target transmission should be introduced for fair coexistence as in R16 NRU. |

Discussion 2.13-1

For Type 1 channel access, if the count-down reaches 0, but the gNB/UE is not yet ready to transmit:

* Alt 1. The gNB/UE will continue sensing with the Type 1 channel access procedure without further decrement the counter. The transmission can start only if the channel is sensed idle within at least T\_d duration ending immediately before the target transmission start time
  + Note this allows the channel sensed to be busy when the counter is 0, at which time, the gNB/UE will need to sense another initial deferral time after the channel is sensed as idle again
  + TP 2.13-A
  + HW, FW, Nokia, Qualcomm
* Alt 2. The gNB/UE stops sensing, and resume sensing for one sensing slot, right before the targeted transmission start time. Only if the sensing slot is sensed as idle, the Type 1 channel access on that channel is declared as successful and the transmission can start
  + TP 2.13-B
  + FW, ZTE, NEC, Qualcomm, Transsion, LGE, OPPO, Ericsson, WILUS, MediaTek, DCM, IDCC
* Alt 3. Once counter count down to zero, COT is considered as started.
  + Alt 3a: No further sensing before actual transmission starts
    - Apple
  + Alt 3b: The gNB/UE stops sensing, and resume sensing for one sensing slot, right before the targeted transmission start time. Only if the sensing slot is sensed as idle, the Type 1 channel access on that channel is declared as successful and the transmission can start
    - FW
* Alt.4: The gNB/UE will draw a new random number and start the Type 1 channel access again.

Moderator notes: The current Alt 1 is trying to harmonize previous discussion Alt 1 and Alt 5. The moderator would recommend companies proposing Alt 3 or Alt 4 to also consider one of Alt 1 and Alt 2.

Please provide your view:

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| --- | --- |
| Company | View |
| Intel | Another option is to continue sensing after the counter reaches 0, and channel is considered idle if in all the subsequent measurements the channel was assessed to be idle. We feel that this is a better option and will make sure that the channel is continuously idle until the actual start of the transmission. Performing a sensing only right before the transmission may not guarantee that the channel is actually idle especially in cases when the counter reaches 0 way earlier than when the transmission starts.  Moderator: Yes that is the original Alt 5. However, this does not address the issue if the a slot is sensed as busy when the counter is 0. I feel the current Alt 1 allows that to be handle, and is a “super-set”. Can you live with that? |
| Apple | In our understanding, Alt 3a aligns with current regulation specification. Also align with previous agreement that gap is counted as part of COT, and no LBT is needed after gap within COT. |
| WILUS | We support Alt-2 (and TP 2.13-B) with same behavior as post back-off in NR-U and LAA. |
| Mediatek | We support Alt 2. However, we think this issue should be discussed together with multi-beam COT in 2.3 |
| DOCOMO | We think Alt 2 is the legacy behavior in Rel-16 NR-U, which seems sufficient. Thus, we support Alt-2 (added above). |
| Ericsson | We support Alt 2. |
| OPPO | We support Alt 2. |
| InterDigital | We support Alt 2. |
| FW | Between Alt-1 and Alt-2, our first preference is for Alt.1 We can also compromise with the version suggested by Intel (which is more stricter than Alt.1). Our concern with Alt.2 remains the indeterminate duration between stop-of-sensing and resumption in which gNB/UE needs to do nothing. |
| Nokia, NSB | We can accept Alt-1 or Alt-2. Further, we see that current spec already allows for self-deferral as gNB/UE may choose not to decrement the counter. |
| Samsung | We support Alt 2 as the same behavior with NR-U. |

TP 2.13-A

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4.4.1 Type 1 channel access procedures

This clause describes channel access procedures to be performed by a gNB/UE where the time duration spanned by the sensing slots that are sensed to be idle before a transmission(s) is random based on a fixed contention window size. The clause is applicable to any transmission initiating a channel occupancy by the gNB/UE.

The gNB/UE may transmit a transmission after first sensing the channel to be idle during the sensing slot duration of a defer duration and after the counter is zero in step 4. The counter is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps below:

1) set , where is a random number uniformly distributed between 0 and , and go to step 4;

2) if and the gNB/UE chooses to decrement the counter, set ;

3) sense the channel for an additional sensing slot duration, and if the channel is idle for the additional sensing slot duration, go to step 4; else, go to step 5;

4) if , and the gNB/UE chooses to start transmission, stop; else, go to step 2.

5) sense the channel until either it is detected busy within an additional defer duration or it is detected to be idle for the sensing slot of the additional defer duration ;

6) if the channel is sensed to be idle during the sensing slot duration of the additional defer duration , go to step 4; else, go to step 5;

In the above procedures, is the contention window and .

The defer duration is and includes a sensing slot duration for performing as least a single measurement to determine whether the channel is idle.

A gNB/UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds .

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TP 2.13-B

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4.4.1 Type 1 channel access procedures

This clause describes channel access procedures to be performed by a gNB/UE where the time duration spanned by the sensing slots that are sensed to be idle before a transmission(s) is random based on a fixed contention window size. The clause is applicable to any transmission initiating a channel occupancy by the gNB/UE.

The gNB/UE may transmit a transmission after first sensing the channel to be idle during the sensing slot duration of a defer duration and after the counter is zero in step 4. The counter is adjusted by sensing the channel for additional sensing slot duration(s) according to the steps below:

1) set , where is a random number uniformly distributed between 0 and , and go to step 4;

2) if and the gNB/UE chooses to decrement the counter, set ;

3) sense the channel for an additional sensing slot duration, and if the channel is idle for the additional sensing slot duration, go to step 4; else, go to step 5;

4) if , stop; else, go to step 2.

5) sense the channel until either it is detected busy within an additional defer duration or it is detected to be idle for the sensing slot of the additional defer duration ;

6) if the channel is sensed to be idle during the sensing slot duration of the additional defer duration , go to step 4; else, go to step 5;

If a gNB/UE has not transmitted a transmission after step 4 in the procedure above, the gNB/UE may transmit a transmission on the channel, if the channel is sensed to be idle at least in a sensing slot duration immediately before this transmission. If the channel has not been sensed to be idle in a sensing slot duration immediately before this intended transmission, the gNB/UE proceeds to step 1 after sensing the channel to be idle during the sensing slot durations of a defer duration .

In the above procedures, is the contention window and .

The defer duration is and includes a sensing slot duration for performing as least a single measurement to determine whether the channel is idle.

A gNB/UE shall not transmit on a channel for a *Channel Occupancy Time* that exceeds .

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## Type 2 LBT procedure

Agreement:

For Cat 2 LBT, down-select from the following alternatives

* Alt 1: Do not introduce Cat 2 LBT for 60GHz unlicensed band operation
* Alt 2: Introduce Cat 2 LBT for 60GHz unlicensed band operation

Agreement:

If Cat 2 LBT is introduced, the following use cases can be further studied:

* Resume transmission after a gap Y:  Cat 2 LBT may be used to resume transmission by the initiating device within the COT after a gap Y (FFS the value of Y)
* COT sharing: Cat 2 LBT may be used before transmission by a responding node sharing a COT
* Multi-Beam LBT:  Cat 2 LBT may be used before switching to a new transmission beam (not used in earlier part of the COT) in a COT with TDM beams, or resume a previously used transmission beam after a gap Z (FFS the value of Z)
* Rx-Assistance:  Cat 2 LBT may be used for sensing at the receiver as a responding device for Rx-Assistance measurements and associated signalling

Other use cases not precluded.

FFS if Cat 2 LBT is mandated for each use case or not.

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| Company | Key Proposals/Observations/Positions |
| FUTUREWEI | Proposal 9: The initiating device can resume transmission with a Cat 2 LBT if there is gap longer than Y us from the previous transmission from that initiating device or responding device. |
| InterDigital Inc. | Proposal 4: A UE determines whether to use Cat 2 LBT based on the gap duration between an upcoming transmission and a preceding transmission on at least the same beam pair. |
| OPPO | Proposal 10: Cat-2 LBT should be introduced for resuming transmission within the COT after a gap and Rx-assisted LBT. |
| OPPO | Proposal 11: For resuming transmission after a gap, RAN1 should firstly discuss the gap is defined per device or per beam. |
| ZTE Sanechips | Proposal 7: Similar restriction as defined in Type 2C channel access procedure in TS 37.213 can also introduced in above 52.6GHz NR-U frequency band but the length of a transmission can be relaxed. l The duration of the corresponding DL transmission is at most [Y] symbols or ms. |
| Intel Corporation | Proposal 23: If an initiating device is capable to perform Cat-2 LBT, and if the initiating device performs an additional burst within the initiated COT which may be separated with any prior burst of at least a minimum gap Y, then under Alt-3 a Cat 2 LBT is needed before the initiating device transmission. |
| LG Electronics | Proposal #6: The pause within a COT may occur due to the transmission(s) corresponding to the beam direction that failed the LBT and further transmission(s) can be resumed after the pause without additional channel sensing or with additional channel sensing for a UE capable of cat 2 LBT. |
| LG Electronics | Proposal #19: gNB should be allowed to schedule UL transmission with Type 1 or Type 2 channel access before the UE reports its capability and the UE can use Type 1 channel access if Type 2 channel access is indicated but not supported (i.e., Support Alt 1B in Discussion 2.15-3). |

Discussion 2.14-1

Should we allow the initiating device to resume transmission within maximum COT without a Cat 2 LBT, no matter how long the gap is from the previous transmission from initiating device or responding device

* Note this is motivated by regions where LBT is not required before each transmission (say outside Japan)?
* Yes: Apple, DCM, Ericsson, IDCC,
* No: Intel, ZTE, OPPO

Please provide your view:

|  |  |
| --- | --- |
| Company | View |
| Intel | No, especially considering the Japanese regulatory requirements. In this case, same consideration made for the responding device are applicable. |
| Apple | Yes, for outside of Japan. |
| DOCOMO | Yes it should be possible in BRAN region. |
| Ericsson | Yes. CAT2 is not needed by the initiating device in EN 302 567. |
| ZTE, Sanechips | No, we think it may be necessary to perform a Cat 2 LBT for transmission within a COT to avoid unnecessary collision if the device has a Cat2 LBT capability.  Moderator: This is a region like EU where LBT before each transmission is not mandated |
| OPPO | No, Cat 2 LBT is needed to resume transmission for fair coexistence.  Moderator: This is a region like EU where LBT before each transmission is not mandated |
| InterDigital | It may be allowed (e.g. if UE is indicated no-LBT). However, that should not preclude use of CAT 2 LBT in other cases. |
| FW | We prefer use of CAT2 before resuming as it facilitates fairer coexistence but it seems difficult to make it mandatory. |
| Nokia, NSB | Yes, this is allowed according to the regulations |
| Samsung | It should be allowed for the region where regulation allows this. |

Discussion 2.14-2

Should we allow the initiating device to resume transmission with a Cat 2 LBT if there is gap longer than Y us from the previous transmission from initiating device or responding device

* Note this is motivated by regions where LBT is required before each transmission (say Japan)
* Yes: FUTUREWEI (>Y us), Interdigital, OPPO, ZTE, Intel, LGE, WILUS, DCM, Ericsson,
* No: Apple

Please provide your view if not captured above:

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| --- | --- |
| Company | View |
| Intel | Yes. |
| Apple | No.  Note Y is up to implementation, which can be any value essentially. Therefore we do not really see how to mandate CAT2 LBT within agreed Y value. |
| WILUS | Yes. |
| DOCOMO | Yes. |
| Ericsson | Yes, for gaps at least larger than 8us since we agreed that CAT2 duration is 8us, so devices need a gap of at least 8us to perform CAT2 LBT. |
| OPPO | Yes. |
| InterDigital | Yes |
| FW | Yes |
| Nokia, NSB | Since Y is up to implementation, this gNB behaviour can hardly be normative |

Proposal 2.14-3

Before the UE reports it LBT capability, gNB is allowed to schedule UL transmission with Type 1 channel access?

* If the UE does not support Type 1 channel access, the UE should not transmit

Support: Intel, Apple, DCM, Ericsson, ZTE, OPPO, IDCC

Please provide your view:

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| --- | --- |
| Company | View |
| Intel | Yes – the UE should be scheduled with type 1 until it reports capability with type 2, but this could be left up to implementation. |
| Apple | If UE does not support type 1, it means UE does not support unlicensed UL operation.  It can be DL only, on licensed band only. |
| DOCOMO | Fine with Proposal 2.14-3 |
| Ericsson | We support the proposal. |
| ZTE, Sanechips | Support |
| OPPO | We support the proposal. |
| InterDigital | Support |
| FW | Support |
| Nokia, NSB | We support the proposal. |
| Samsung | Ok with the proposal, but seems no specification impact since it’s about the gNB’s behavior being allowed. |

Proposal 2.14-4

Before the UE reports it LBT capability, gNB is allowed to schedule UL transmission with Type 2 channel access?

* If the UE does not support Type 2 channel access, but the UE supports Type 1 channel access, it is the UE implementation to transmit with Type 1 channel access or not to transmit
* If the UE does not support Type 2 channel access and does not support Type 1 channel access, the UE should not transmit

Support: DCM, ZTE,

Not support: Intel, Apple, WILUS, Ericsson, OPPO, IDCC

Please provide your view:

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| --- | --- |
| Company | View |
| Intel | No – The gNB should schedule an UL transmission with type 2 only when it knows that the UE is capable of performing that type of LBT. |
| Apple | No |
| WILUS | No |
| DOCOMO | Fine with Proposal 2.14-3 |
| Ericsson | We cannot support this proposal. Type 2 channel access is an optional implementation choice and not needed by any regulatory domain. We do not see a need to indicate this before knowing UE’s capability to support it. |
| ZTE, Sanechips | Yes |
| OPPO | No, the UE does not expect an indication of Type 2 LBT before reporting its LBT capability. |
| InterDigital | The gNB should only schedule an UL transmission with Type 2 when it knows that the UE is capable of performing Type 2 LBT. |
| Nokia, NSB | No |
| Samsung | This can be up to implementation, and we didn’t see a spec impact. |

## COT Sharing

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| Agreement:  On COT sharing from an initiating device transmission to responding device transmission, support both of the following two alternatives   * Alt 1: No maximum gap defined between the initiating device transmission and responding device transmission. A responding device transmission can occur without LBT with any gap within the maximum COT duration * Alt 3: Define a maximum gap Y, such that a responding device transmission can occur without LBT only if the transmission starts within Y from the end of the initiating device transmission. If the responding device transmission starts after Y from the end of the initiating device transmission, a Cat 2 LBT is needed before the responding device transmission.   + The Cat 2 LBT uses the same sensing structure as the 8 us initial deferral period as in eCCA   + Further downselect between the following options:     - Option 1: Y=8 us (motivated by need to operate in all regions)     - Option 2: Y=a multiple number of OFDM symbols     - Option 3: gNB determines Y (for example, according to local regulation)   + Cat. 2 LBT is a UE capability * The usage of the two alternatives is a gNB choice and depends at least on local regulations. * Note: Alt. 3 is motivated by the regulations in Japan but use of Cat. 3 LBT is also an option for operation in Japan and Cat. 2 LBT is not restricted for use only in Japan.   Note: Maximum gap allowed without Cat 2 LBT between two initiating device transmissions is to be separately discussed  Note: Other use cases of Cat 2 LBT will be separately discussed  **Agreement**  On COT sharing from an initiating device transmission to responding device transmission, when a maximum gap Y is defined, such that a responding device transmission can occur without LBT only if the transmission starts within Y from the end of the initiating device transmission, and a responding device transmission can occur with Cat 2 LBT if the transmission starts later than Y from the end of the initiating device transmission.   * gNB determines Y as gNB implementation (for example, according to local regulation) and the value of Y will not be captured in 3GPP spec other than requiring Y to be no less than 8 us. |

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| Company | Key Proposals/Observations/Positions |
| OPPO | Proposal 12: In FR2-2, if the higher layer parameter ul-toDL-COT-SharingED-Threshold-r16 is not provided, the UL to DL COT sharing mechanism still follow the R16 NRU case as if ul-toDL-COT-SharingED-Threshold-r16 is configured.  • Adopt following TP#1 for TS37.213 v17.0.0 • Adopt following TP#2 for TS38.212 v17.0.0 |
| Intel Corporation | Proposal 24: When a UE performing a CG transmission shares its COT with a gNB, the gNB is always allowed to perform both unicast and broadcast transmissions without any constrains, and cg-UCI may always indicate one entry of cg-COT-SharingList-r16. |
| Ericsson | Proposal 12 RAN1 to agree to modify the text in clause 4.4.4 in the CR 37.213 to the following including the text highlighted in yellow- [If a gNB/UE initiates a channel occupancy using the channel access procedures described in clause 4.4.1 on a channel, the gNB/UE may transmit a DL/UL transmission(s) that is followed by a UL/DL transmission(s) within the maximum Channel Occupancy Time described in Clause 4.4.1. In this case, the following are applicable to the UL/DL transmission(s): - for regions where there are no local regulatory requirements to perform sensing before each transmission in a shared channel occupancy • regardless of the duration of the gap between the UL/DL transmission(s) and previous DL/UL transmission(s) on the channel, the UL/DL transmission(s) occurs following the procedures described in Clause 4.4.3; or • the UL transmission(s) occurs following the channel access procedure indicated by the scheduling DCI - for regions where there are local regulatory requirements to perform sensing before each transmission in a shared channel occupancy • if the gap between the UL/DL transmission(s) and previous DL/UL transmission(s) on the channel is more than a threshold that is determined by the gNB and is at least 8μs, the UL/DL transmission(s) occurs following the procedures described in Clause 4.4.2. Otherwise, the UL/DL transmission(s) occurs following the procedures described in Clause 4.4.3.] |
| Ericsson | Proposal 16 In regions where sensing is required before all transmissions, for DL transmissions in a UE-initiated COT, the gNB may choose Type 1 channel access or Type 2 channel access based on implementation. |
| NEC | Proposal 1: The maximum gap allowed without LBT between two initiating device transmissions should be defined as follows • Alt 1: No maximum gap defined between two initiating device transmissions. An initiating device transmission can occur without LBT with any gap within the maximum COT duration. • Alt 2: Define a maximum gap Y, such that an initiating device transmission can occur without LBT only if the transmission starts within Y from the end of the last initiating device transmission. The value of Y could be determined by UE’s implementation or predefined by gNB. |
| LG Electronics | Proposal #20: If the information on UL beam (such as SSB index, CSI-RS index, preconfigured index, etc.) is identified explicitly through CG-UCI, gNB is allowed to perform Type 2 or Type 3 channel access and transmit the DL transmission associated with UL beam in terms of QCL relationship by sharing the COT acquired by CG-PUSCH. If the information on UL beam is not associated with the DL transmission, Type 1 channel access should be performed to transmit DL transmission. |
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## Editorial

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| Company | Key Proposals/Observations/Positions |
| Intel Corporation | Proposal 25: TP#5 should be supported. |
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## Others

On Rx assistance

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| Company | Key Proposals/Observations/Positions |
| OPPO | Proposal 13: RTS-like signal can be carried in a PDCCH and CTS-like signal can be carried in a PUCCH. |
| OPPO | Proposal 14: Introduce in the spec the DL transmission restriction that the gNB should not perform DL transmission if PUCCH/SRS/PUSCH is not detected. |
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# Summary of Relatively stable proposals that did not close in RAN1-107bis-e

# References

1. R1-2200753, FL summary#2 for channel access for 52.6 to 71 GHz band, Moderator (Qualcomm)
2. R1-2200957, Remaining issues of channel access mechanism for 60 GHz unlicensed operation, Huawei, HiSilicon
3. R1-2200991, Remaning Issues in Channel Access for Beyond 52.6 GHz, FUTUREWEI
4. R1-2201038, Remaining issues for channel access mechanisms, InterDigital, Inc.
5. R1-2201089, Remaining issues on channel access mechanism for NR operation from 52.6GHz to 71 GHz, vivo
6. R1-2201270, Discussion on remaining issue for channel access mechanism, OPPO
7. R1-2201355, Remaining issues on channel access mechanism for up to 71GHz operation, CATT
8. R1-2201393, Remaining issues on the channel access for 52.6 to 71GHz, ZTE, Sanechips
9. R1-2201474, Remaining issues on Channel access mechanism for NR in FR2-2, NTT DOCOMO, INC.
10. R1-2201543, Remaining issues on channel access mechanism for 52.6GHz to 71 GHz, Spreadtrum Communications
11. R1-2201578, Remaining issues on channel access mechanism for 60 GHz unlicensed spectrum, Sony
12. R1-2201594, Remaining issues on channel access for NR in 60GHz unlicensed band, TCL Communication
13. R1-2201666, Remaining issues on channel access mechanism, Nokia, Nokia Shanghai Bell
14. R1-2201692, Discussion on channel access mechanism for extending NR up to 71 GHz, Intel Corporation
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