**3GPP TSG-RAN WG4 Meeting # 96-e R4-20xxxx**

**Electronic Meeting, 17 – 28 August, 2020**

**Agenda item: 10.27, 10.28**

**Source:** Ashish Gupta (Reliance Jio)

**Title:** Email discussion summary for [96e][138] DSS\_bands

**Document for:** Information

# Introduction

Email discussion for contributions submitted under agenda item 10.27, 10.28 for dynamic spectrum sharing in band n40 and n38.

List of candidate target of email discussion for 1st round and 2nd round

* 1st round: Discussion on the following topics:

a) DSS band n40 CRs: R4-2009589, R4-2009590, R4-2009591 for approval

b) DSS band n38 CRs: R4-2009859, R4-2009707 for approval

c) Decision on R4-2009944. Enabling LTE/NR spectrum sharing with 4-port LTE

 transmissions

d) R4-2010274. Discussion the test model in DSS

e) R4-2010752, R4-2010751. UL shift for LTE/NR spectrum sharing in band

 40,38 / n40,n38

* 2nd round:
1. Discussion on draft modified CRs for n40 and n38
2. Round 2 discussion on R4-2009944.
3. Round 2 discussion on R4-2010274
4. Round 2 discussion on R4-2010752, R4-2010751

# Topic #1: DSS band n40 CRs for approval

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009589 | Reliance Jio | CR to spec 38.101-1 (REL-17) |
| R4-2009590 | Reliance Jio | CR to spec 38.104 (REL-17) |
| R4-2009591 | Reliance Jio | CR to spec 38.307 (REL-17) |

## Open issues summary

## Companies views’ collection for 1st round

### CRs/TPs comments collection

|  |  |
| --- | --- |
| CR/TP number | Comments collection |
| R4-2009589 | Qualcomm: The CR doesn’t limit the UL shift to 15kHz SCS which was the plenary agreement. Should be revised to contain some wording that the shift is only applicable to UE transmissions with 15kHz SCS. Also, I believe the CRs should be for Rel.15, not 17 for which there is no spec yet. |
| Apple: With regards to UL shift, there is the same discussion for band n48 DSS on whether to make UL shift applicable for both 15 and 30kHzkHz, whether mandate it for 15kHz and keep optional for 30kHz, or whether deprecate 30kHz completely. We do not have a particularly strong view, but UL shift is the common baseband feature that it is not band or even FDD/TDD specific. We do not have any restriction for FDD bands, even though the same concern could have been raised also for FDD bands. From that perspective limiting UL shift only to 15kHz might cause more confusion and problems in specs. As a reminder, when UL shift was added for TDD band n90, it was also made generic for both 15 and 30kHz.There is a good point from Qualcomm on whether the CR should be for Rel-17 or Rel-15. Since band n40 is Rel-15 band, then UL shift should be ideally added to Rel-15 specs to avoid UE fragmentation. That will also align CRs with band n38 approach, in which CRs are for Rel-15. That should be discussed/checked further to make sure that we do not break any procedural things in 3GPP. |
| Futurewei: UL shift applicable for 15kHz SCS. Open to discuss 30kHz SCS. Yes, the coversheet needs to be updated regarding release. |
| R4-2009590 | Qualcomm: See our comment for 9589 |
| Company B |
|  |
| R4-2009591 | Qualcomm: See our comment for 9589 |
| Company B |
|  |

## Summary for 1st round

### CRs/TPs

|  |  |
| --- | --- |
| CR/TP number | CRs/TPs Status update recommendation  |
| R4-2009589 | **To be revised**. Text will be modified to mention 15KHz PDSCH SCS explicitly |
| R4-2009590 | **To be revised**. Text will be modified to mention 15KHz PDSCH SCS explicitly |
| R4-2009591 | **To be revised**.Text will be modified to mention 15KHz PDSCH SCS explicitly |

## Discussion on 2nd round (if applicable)

### CRs/TPs comments collection

|  |  |
| --- | --- |
| CR/TP number | Comments collection |
| R4-2011822CR to spec 38.101-1 (REL-17) |  |
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|  |
| R4-2011823CR to spec 38.104 (REL-17) |  |
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|  |
| R4-2011824CR to spec 38.307 (REL-17) |  |
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## Summary on 2nd round (if applicable)

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| --- | --- |
| CR/TP/LS/WF number | T-doc Status update recommendation  |
| XXX | Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised” |

# Topic #2: DSS band n38 CRs for approval

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009859 | Vodafone | CR to spec 38.101-1 (REL-15) |
| R4-2009707 | Vodafone | CR to spec 38.101-1 (REL-16) |

## Open issues summary

## Companies views’ collection for 1st round

### CRs/TPs comments collection

|  |  |
| --- | --- |
| CR/TP number | Comments collection |
| R4-2009859 | Qualcomm: The CR doesn’t limit the UL shift to 15kHz SCS which was the plenary agreement. Should be revised to contain some wording that the shift is only applicable to UE transmissions with 15kHz SCS. |
| Apple: With regards to UL shift, there is the same discussion for band n48 DSS on whether to make UL shift applicable for both 15 and 30kHzkHz, whether mandate it for 15kHz and keep optional for 30kHz, or whether deprecate 30kHz completely. We do not have a particularly strong view, but UL shift is the common baseband feature that it is not band or even FDD/TDD specific. We do not have any restriction for FDD bands, even though the same concern could have been raised also for FDD bands. From that perspective limiting UL shift only to 15kHz might cause more confusion and problems in specs. As a reminder, when UL shift was added for TDD band n90, it was also made generic for both 15 and 30kHz. |
| CHTTL: It is questionable that can a Rel.17 WI issue a CR for previous release? |
| R4-2009707 | Qualcomm: see our comments for 9859 |
| CHTTL: same comment for 9859 |

## Summary for 1st round

### CRs/TPs

|  |  |
| --- | --- |
| CR/TP number | CRs/TPs Status update recommendation  |
| R4-2009589 | **To be revised. There is a conflict between WI release and CR release. To be resolved.**  |
| R4-2009707 | **To be revised.** **There is a conflict between WI release and CR release. To be resolved.** |

## Discussion on 2nd round

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| --- | --- |
| CR/TP number | Comments collection |
| R4-2011900CR to spec 38.101-1 (REL-17) |  |
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| R4-2011826 CR to spec 38.101-1 (REL-16) |  |
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|  |
| R4-2011825CR to spec 38.101-1 (REL-15) |  |
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|  |
| R4-2011901CR to spec 38.104 (REL-17) |  |
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|  |
| R4-2011899CR to spec 38.104 (REL-16) |  |
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| R4-2011898 CR to spec 38.104 (REL-15) |  |
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## Summary on 2nd round (if applicable)

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| CR/TP/LS/WF number | T-doc Status update recommendation  |
|  |  |

# Topic #3: Enabling LTE/NR spectrum sharing with 4-port LTE transmissions

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2009944 | Apple, Reliance Jio | Observations:1. NR sync pattern C can work with 1-2 port LTE deployments, but 4 port LTE CRS transmission will collide with all NR SSB instances.
2. 4-port LTE transmission modes are widely supported by UEs and used in commercial deployments.
3. Letting NR SSB to collide with LTE CRS has unknown negative impact on both technologies, but NR impact will be worse because LTE CRS are transmitted more often.
4. Since candidate LTE MBSFN sub-frames do not overlap with OFDM symbols where NR SSB is transmitted, LTE MBSFN cannot be considered as a viable solution to avoid overlaps (unless some further changes are introduced impacting other WGs)
5. Blanking LTE sub-frames with the MBSFN feature will diminish the whole point of the DSS feature as it will result in almost static partitioning of resources between LTE and NR.
6. Adding synchronisation pattern B will avoid collision between NR SSB and LTE CRS.
7. The main concern is that enabling synchronisation pattern B might cause larger cell search time if a particular TDD band overlaps with another band that uses only pattern C.

Proposal:1. RAN WG4 to devise a solution that would enable dynamic spectrum sharing between NR and LTE using 4-port CRS transmission.
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## Open issues summary

Enable dynamic spectrum sharing between NR and LTE using 4-port CRS transmission.

### Sub-topic 3-1

RAN WG4 to devise a solution that would enable dynamic spectrum sharing between NR and LTE using 4-port CRS transmission.

Issue 3-1:

* Proposals
	+ Option 1: SSB Sync Pattern B for 30KHz SSB SCS
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| Company | Comments |
| OPPO | Sub topic 3-1: A few questions to Apple. 1. Objectives of these WIs

In RP-201314 WID of Band 38/n38, the objective is described as “Adapt n38 RF requirements to enable Dynamic Spectrum Sharing between devices operating LTE B38 and devices operating n38, by introducing a UL 7.5 kHz frequency shift for this band for 15 kHz SCS operation. This requirement shall be Release independent from Rel-15.”In RP=201362, WID of Band 40/n40, the objective is captured as “The work item aims to specify spectrum sharing requirements for n40. Introduce UL 7.5kHz frequency shift for 15kHz data SCS [RAN4],Study for backward compatibility”As you may notice the sync pattern and 4-port LTE supported were not mentioned in the corresponding proposals and the objectives of the WIDs is more focused on UL 7.5KHz frequency shift. So we are wondering whether the discussion of sync pattern here is out the scope of this AI. 1. Sync Pattern

If Sync Pattern were to be considered here. Could you elaborate on how the issues on band 38/n38, band 40/n40 are different from that on band 48/n48 since Apple is the moderator of the latter topic. With regards to sync pattern, if band 38, 40, 48 share the same issue which is 4-port LTE cannot be supported with existing pattern C , we would recommend to start another WI (or AI) to discuss DSS support for bands share the same challenges.  |
| Qualcomm | Sync pattern was already agreed in the last meeting, what is the issue with pattern C?Regarding the 4 port LTE issue, this was brought up before but we believe it’s a non-issue. The SSB is only sent once every 20ms and only some of the CRS Res are impacted. So far, nobody has actually quantified this performance loss but it should be very small. The simplest solution is for the eNB not to schedule and LTE transmission on the 3rd and 4th layer on the RBs occupied by SSB. 3rd and 4th layer CRS are not used by the UE for measurements so there will be no impact. |
| Nokia | Sub topic 3-1: This issue has been discussed for n48 for a long time but no consensus is made. We are ok to add pattern B on top of pattern C.We prefer the same conclusion (whatever it is) about sync pattern is made for all band n38, n40 and n48. |
| Apple | As pointed out in our discussion paper and mentioned by other companies, the issue indeed concerns several TDD bands: n41, n48, n38, and n40. In fact, this problem applies to any TDD band in which DSS will run.At least during the DSS for band n48 discussion the following “solutions” were mentioned: “let’s conclude that 4-port LTE CRS is not possible with DSS”, “let them collide”, “mute LTE CRS”, “use LTE MBSFN”, “add sync pattern B”. Unfortunately, none of the approaches was perfect and there was not enough time either to actually evaluate properly pros and cons. Our major preference is not to ignore the problem, because otherwise the same discussion will emerge every time DSS is considered for a new DSS band. Instead, we would welcome companies to look deeper into what we can do. How we do it – offline discussions, TEI, SI/WI – can be contemplated further and will depend just on us. |
| Jio | Band n40 does not overlap with any other band. Hence, we believe, Sync Pattern B is an ideal mode of operation for DSS in this band. Any degradation in LTE performance due to collision with NR will be detrimental to our network experience. Neither we can afford excessive LTE Muting.  |
| Samsung | It seems operator shared the view to have SSB pattern B in previous meeting discussion for band n40. However, it is not addressed in the final CR to update the SSB pattern for this band. We would support to resolve the issue to avoid restriction on NW configuration, such as add SSB pattern B on top of pattern C, or replace SSB pattern C by pattern B. And other solution is not preclude as well. We also agree that the solution should be generic and applied to all sub6GHz NR with the use case of DSS.  |
| Huawei | Sub topic 3-1:No option is preferred. We prefer not to change the SSB pattern C, since the agreement on the change to 30KHz + Pattern C based on majority of companies’ views was reached last meeting.Adding pattern B on top of pattern C is undesirable, because UE has to support both pattern B and pattern C and the searching time is correspondingly prolonged. As for four ports, even with Pattern B, only the #0 can avoid the four port CRS-es, but the SSB with other index cannot. So anyway port#2 and port#3 CRS will interfere SSB. From LTE perspective, the four-port performance for the scheduling overlapping with SSB will be impacted even with pattern B, if more than 1 SSB are configured for NR. From NR perspective, NR measurement performance and PBCH decoding performance on SSB#0 with pattern C would be worse than that for SSB#0 with pattern B, but the performance on other SSBs would be the similar. We would like to consider MBSFN solution or other solution, e.g., network punctures the LTE port 3/4 CRS which overlaps with SSB#0 to avoid the big change again, since the change is related to initial access. On the subframe overlapped with CRS, maybe network can schedule the 2 port CRS transmission or using 4 port DMRS transmissions. Or the subcarriers contained SSB are reserved for NR transmission only. Such impacts happen once every 20ms.In sum, we still think pattern C can work. But the key is to keep the spec stable as soon as possible, otherwise it will impact the deployment on n40 or other bands. |
| Ericsson | We do not support adding pattern B. In our understanding it was agreed to keep pattern C.We believe the complexity of supporting both patterns is not justified considering the gain over alternative ways to support 4 port LTE. |
| CHTTL | The proposal seems generic, would like to know whether it is for specific band only or not.And not sure about the issue of the MBSFN solution mentioned in the observation, as mentioned by Qualcomm, the SSB is sent every 20ms. |
| Vodafone | We share similar views to Huawei and Ericsson. Adding pattern B on top of C is undesirable due to the increased search time and potential impact on UE battery life, and replacing C with B goes against the consensus reached in the last meeting. It should be possible to support 4 port LTE through other techniques (e.g. gNB/eNB timing offset to align SSB and MBSFN candidate locations) and we would be happy to support further investigating such solutions. |
|  Futurewei | Agree with Apple suggestion. The potential performance degradation with 4-port LTE CRS is a reality, but then MBSFN solution is a possibility. Pros and cons of different solutions can be studied. Question is whether in this(ese) WI(s) and in this release or later? |

## Summary for 1st round

### Open issues

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| --- | --- |
|  | Status summary |
| Sub-topic 3-1 | 1. One company recommended the creation of WI/SI for further study
2. One company suggested adding pattern b on top of pattern c
3. Two companies suggested to resolve the issue through further study
4. Four companies opposed the proposal
5. Two companies supported the proposal.

Tentative agreements:1. **Further study can be done on the proposal to define possible solutions and performance impacts for 4 port LTE and DSS transmissions.**

Recommendations for 2nd round: |

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 |  |  |

## Discussion on 2nd round (if applicable)

### Open issues

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| --- | --- |
| Company | Comments |
| Huawei | We made the similar comments as for DSS n48/48.As commented in the first round, the issue due to LTE CRS interference cannot be fully addressed by the current standard, especially considering the use of massive MIMO with multiple SSBs.One potential solution to mitigate the issue due to LTE four ports is to puncture part of CRS LTE port-2 and port-3 for SSB#0. Such puncture won’t impact LTE RRM measurement, since LTE UE does the measurement based on CRS port-0 and port-1. The suframes containing SSB#0 can be kept for NR scheduling only, scheduling two CRS port transmission or scheduling DMRS based four port transmission. The PRB containing SSB may not be scheduled for LTE since LTE UE may not support sTTI. |
| OPPO | We agree with Vodafone which is keep the existing pattern. Other techniques might be adopted to support 4 port LTE rather than adding Pattern B .  |

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation**  |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #4: Discussion the test model in DSS

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2010274 | Samsung | Proposal 1: The test model should be introduced for DSS to measurement timing/framing alignment errorProposal 2: Define the minimum requirement of timing/framing alignment error for DSS scenariosProposal 3: Common physical channel parameters for PDCCH for BS type 1-C and BS type 1-H test models for DSS. Refer TDOCProposal 4: Common physical channel parameters for PDSCH for BS type 1-C and BS type 1-H test models for DSS. Refer TDOCProposal 5: Common physical channel parameters for PDSCH by RNTI for BS type 1-C and BS type 1-H test models for DSS. Refer TDOCProposal 6: Common physical channel parameter for LTE CRS and MBSFN for DSS with considering NR and LTE deployed in the same or different center frequency, respectively. Refer TDOC |

## Open issues summary

### Sub-topic 4-1

Discussion on Samsung Proposal

## Companies views’ collection for 1st round

### Open issues

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| --- | --- |
| Company | Comments |
| Nokia | Sub topic 4-1: We are not convinced to have a new test model. We wonder what additional RF impairments would be tested with such a new test model, which cannot be tested with existing test models. The need of such a new test model has never been discussed in n90 DSS and n48 DSS work items. |
| Apple | Just for our understanding, the proposed test model will be for the network, not for UE, right?  |
| Samsung | In case of NR co-exist with LTE, NR and LTE can interfere each other. When deploying NR systems in a certain LTE site, new NR DUs shall be combined with LTE DUs for the DSS. Regarding resource slot-level sharing, where the NR DUs combined with LTE DUs in a time domain, NR and LTE can interfere each other at the presence of timing alignment error between NR and LTE systemsThe current test model in RAN4 cannot guarantee the basic performance considering frame timing error for more complex system performance, we see a need to introduce the related test model.The test model is applied for network |
| Huawei | If our understanding on the proposals is correct, the proponent proposed to define the BS Tx time alignment error requirement between LTE DL CC and NR DL CC with certain test setup. It would be better to first focus on whether such requirement is needed.For the DSS using a single infra vendor BS, it would be OK but since the requirement is general and the NR BS has already been deployed. We should limit the potential tests to Rel-17 maybe rather than applying to the early release. And there is other network implementation, where although there is DL timing misalignment between LTE and NR, BS can know the TA values from both LTE and NR and adjust the uplink timing for LTE and NR UEs to align the arrival time from different uplinks across LTE and NR. After all the uplink demodulation performance degradation is the main concern here. We think such implementation should also be considered if the requirement needs be specified.For the DSS using multiple infra vendors’ BS, we are not sure how to conduct conformance testing across multiple vendors’ devices following RAN4 specifications. In our view, we are afraid such multiple vendor testing is not feasible. |
| Ericsson | There is no need to create a new test model because LTE and NR models are sufficient for assessing compliance to 38.141. Assessing DSS performance would depends on very much on assumptions on configuration, sharing, implementation and so on. It’s not obvious that assessing such performance belongs to standardised 3GPP compliance. |

## Summary for 1st round

### Open issues

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| --- | --- |
|  | Status summary |
| Sub-topic#1 | Tentative agreements: **FFS to create new test models for DSS**  |

## Discussion on 2nd round

### Open issues

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| --- | --- |
| Company | Comments |
| Huawei | As commented in the first round, we doubt the feasibility to have such test for multiple vendor case. It would be difficult to conclude in this meeting. |

## Summary on 2nd round (if applicable)

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| --- | --- |
| CR/TP/LS/WF number | T-doc Status update recommendation  |
|  |  |

# Topic #5: UL shift for LTE/NR spectrum sharing in band 40,38/n40,n38

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2010751 | OPPO | Proposal 1: Define requirements for the existing n38 band without introducing new band Proposal 2: UE optionally support UL 7.5KHz shift for SCS =30KHz, UE mandated to support 7.5 KHz for SCS = 15KHz.  |
| R4-2010752 | OPPO | Proposal 1: Define requirements for the existing n40 band without introducing new band Proposal 2: A UE is not mandated to support UL 7.5 KHz shift  |

## Open issues summary

### Sub-topic 5-1

Discussion on R4-2010751

Issue 5-1:

* Proposals
	+ Option 1: UE optionally support UL 7.5KHz shift for SCS =30KHz, UE mandated to support 7.5 KHz for SCS = 15KHz
	+ Option 2: TBA
* Recommended WF
	+ TBA

### Sub-topic 5-2

Discussion on R4-2010752

Issue 5-1:

* Proposals
	+ Option 1: A UE is not mandated to support UL 7.5 KHz shift
	+ Option 2: TBA
* Recommended WF
	+ TBA

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| Company | Comments |
| XXX | Sub topic 5-1: Support Proposal 1 by OPPO not to define a new band. We do not support an optional capability only for 30 kHz. Either the shift shall not be applicable at all to 30kHz, or it shall follow 15 kHz. The same conclusion between band n38 and n40 are preferred regarding mandatory/optional shift.Sub topic 5-2: Support Proposal 1 by OPPO not to define a new band.The same conclusion between band n38 and n40 are preferred regarding mandatory/optional shift. |
| Jio | Sub topic 5-2: 7.5KHz UL shift is required for 15KHz RE level Rate matching when operated in DSS. We don’t support making it optional.  |
| Ericsson  | UL shift shall be mandatory for 15 KHz for both bands n38 and n40. The UL shift can not be optional.For 30 KHz UL shift is not needed to be defined. |
|  Futurewei | UL shift mandatory for 15kHz for both the bands |

## Summary for 1st round

### Open issues

|  |  |
| --- | --- |
|  | Status summary |
| Sub-topic 5-1 | Tentative agreements: **UL shift to be mandatory for 15 KHz. No optional UL shift for 30KHz** |
| Sub-topic 5-1 | Tentative agreements: **UL shift to be mandatory for 15 KHz.**  |

## Discussion on 2nd round

### Open issues

|  |  |
| --- | --- |
| Company | Comments |
| OPPO | We agree with Ericson which is UL shift mandatory for 15KHz for both n38 and n40. NO need to define 30KHz UL shift.  |
| Huawei | This is the functionality of UE before finalizing the initial access. UE has no chance to report capability. Looking at draft CRs provided for TS38.104 by operators, it reads thatFor SUL bands, and for the uplink of all FDD bands defined in table 5.2-1 and for 15 kHz SCS operation in TDD band n38,Given that there is limitation of scenario according to BS requirement, which means that 7.5kHz shift is not required to support for BS when SCS is 30KHz, we think that we do not need make further standardization work on UE side for this issue. In this regard, we think that the issue has been addressed. No further agreement is needed. |

## Summary on 2nd round (if applicable)