3GPP TSG-RAN WG2 Meeting #112-e R2-20xxxxx

Electronic, 02 November - 13 November 2020

Agenda item: 6.15

Source: Apple

Title: Summary on [AT112-e][023][R4 NR16] UL 7.5kHz Shift (Apple)

Document for: Discussion

# 1 Introduction

This document is to capture offline discussions for the below.

* [AT112-e][023][R4 NR16] UL 7.5kHz Shift (Apple)

 Treat R2-2008740, R2-2009466, R2-2009467, R2-2009468, R2-2009469, R2-2009470, R2-2009471, R2-2009700, R2-2009701, R2-2010227

 Intended outcome: Intermediate: Determine agreeable parts. Final: For agreeable parts, agreed CRs.

 Deadline: Intermediate deadline(s) by Rapporteur, Final: Discussion stop at Wed Nov 11, 1200 UTC

# 2 Contact Information

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# 3 Discussion

There were recently some discussions in RAN4 on UL 7.5kHz shifting especially on whether UE is mandatory to support it on NR TDD spectrums for dynamic spectrum sharing. This topic is in response to RAN4 LS R4-2011746 [1] which proposes that RAN4 understanding is if a UE does not support UL 7.5kHz shift for the given network configuration, the UE should avoid camping on this cell and consider this cell as barred.

R2-2009466 [2] presents three alternatives to introduce the access barring mechanism. R2-2009701 [3] proposes a way similar to the 3rd alternative in R2-2009466 [2]. While R2-2010227 [9] has a different view and thinks that there is no need to prevent UE camping in RAN2 specification for TDD 7.5kHz shift function for Rel-16 onwards UEs. And for Rel-15 UE which supports the TDD bands but not support 7.5kHz shift, R2-2010227 [9] proposes to rely on RAN4 spec [38.101] which specifies that “A UE that does not support it will be unable to communicate with a network that signals Δshift = 7.5 kHz.” and there is no need of RAN2 spec change to support UL 7.5kHz shift for TDD bands.

**Q1: Should we change RAN2 spec to support the RAN4 agreement that if a UE does not support UL 7.5kHz shift for the given network configuration, the UE should avoid camping on this cell and consider this cell as barred?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | As explained in our paper R2-2009466, the access barring procedure is needed in order to support: 1) legacy Rel-15 UE which does not implement the potential CR to be introduced; 2) UL shift is only mandatory for Band n40 from Rel-17, thus Rel-16 UE can still have UL 7.5kHz shift optional. |
| Huawei, HiSilicon | No | We understand RAN4 agreement is as follows:1. For n38, it is mandatory to support 7.5KHz shift for 15KHz SCS;
2. For n38, 7.5KHz shift for 30KHz SCS is not supported.

So in this case currently all the 7.5KHz support agreed by RAN4 so far is mandatory for UEs and we don’t see need to address the case that a UE does not support it. If in the future it appears optional support for 7.5KHz, we can discuss whether to have some mechanism in RAN2 but this can be discussed only when there is new agreement from RAN4 to optionally support 7.5KHz for some bands. |
| Qualcomm Incorporated | Yes | We agree to Huawei’s observation. So the requirement for the UE as suggested is only for the forward compatibility, i.e. to address future cases where 7.5kHz shift is introduced in some new configuration combination that is not supported by the standard today. |
| CATT | No | We agree with Huawei’s comments.  |
| Nokia | No | We agree with Huawei’s comments. Furthermore, RAN4 has not agreed any optional UE capability for 7.5 kHz UL shift or requested any special handling in the RAN2 specifications. If in the future RAN4 considers optional UE support for 7.5 kHz UL shift in some case, RAN4 will then also request the corresponding UE capability from RAN2. Until then no UE capability or special handling in the RAN2 specs should be defined for 7.5 kHz UL shift UE support. |
| Ericsson | Maybe Yes | We do not have a strong preference on this, but if majority of companies believe it is helpful to clarify the UE behaviour mentioned in the RAN4 LS, we are okay to do it.We have the same understanding as QC that this change is suggested only for the forward compatibility.  |
| MediaTek | Maybe Yes | We agree the observation from Huawei but also understand the change (if agreed) is for forward compatibility as commented by QC.  |
| Intel | Not sure | We have the same understanding that RAN4 has not decided 7.5kHz for 30kHz SCS. So, the current discussion should focus on 7.5kHz for 15kHz SCS . However, even for that, it is not clear what RAN2 need to resolve. According to RAN4 spec, n38, n48, n90 needs 7.5kHz as mandatory. * n38: defined from Rel-15
* n48, n90: defined from Rel-16  (n90 is a new band of n41 to address legacy issue due to 7.5kHz)

The legacy issue may happen for n38 band. However, RAN4 add the following NOTE for Rel15 spec (not for Rel-16 spec)NOTE: A UE operating n38 should support application of FREF, shift for UL transmissions. A UE that does not support it will be unable to communicate with a network that signals Δshift = 7.5 kHz.We are wondering if the NOTE is enough to indicate the consequence of not supporting mandatory feature or if RAN2 needs to address. If we go with the latter option, the change would be required for Rel-15 not Rel-16 because it is mandatory from Rel-16. However, based on RAN4 LS, it is not clear whether RAN4 requested to address this NOTE in RAN2 spec. So, it is desirable to ask for clarification. Regarding forward compatibility, we are not aware of what exact case RAN4 is referring to. So, it is hard to comment.  |
| ZTE | Yes | We agree with Huawei’s observation, but considering the forward compatibility, we support to add some RAN2 spec change |
| Samsung | Yes | We think it is reasonable to bar UEs from accessing unusable cells. Even though it is not the immediate problem, it would be cleaner to have general solution as early as possible if the problem will occur anyway.  |
| vivo | Yes  | Simple method is ok for forward compatibility.  |
| OPPO | Maybe | There maybe no issue for band 38, but for band 40 RAN4 only agree on CR for Rel17, so it is not clear whether it is mandatory for R15 and R16. So it seems not clear whether backwards compatibility issue also exists. Our preference is to send LS back to RAN4 to check compatibility issue before RAN2 come to any conclusion |
| Reliance Jio | Yes | We agree to bar access to the cell for the UEs which do not support 7.5KHz shift. It will be much cleaner this way for backward compatibility (and future as well). We support to add to RAN2 spec changes |

**Summary: 13 companies replied to this question. 9 companies are supportive to make the RAN2 spec change (Yes and maybe yes).**

**Yes: 6**

**Maybe Yes: 3**

**Not sure: 1**

**No: 3**

**Proposal 1: Change to RAN2 spec is needed to support RAN4 agreement that that if a UE does not support UL 7.5kHz shift for the given network configuration, the UE should avoid camping on this cell and consider this cell as barred.**

**Q2: Do you think we should introduce a solution to let legacy Rel-15 UE to properly bar the cell configured with UL 7.5kHz shift?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| Apple | Yes | When RAN4 discussed the DSS problem for band n41, the main reason why they finally selected the solution to introduce a new band number n90 was exactly to not impact the legacy UE.Thus, we feel similar argument applies here and we prefer to have a backward compatible solution, i.e., let legacy Rel-15 UE to properly bar the cell configured with UL 7.5kHz shift. |
| Huawei, HiSilicon | No | To change Rel-15 is NBC, and would impact UEs which already support 7.5KHz shift.  |
| Qualcomm Incorporated | Yes | This is sensible proposal in order to to address future cases where 7.5kHz shift is introduced in some new configuration combination that is not supported by the standard today. |
| CATT | No |  |
| Nokia | No | RAN4 did not request any special handling for the legacy Rel-15 Ues and the Rel-15 CR approved in RP-202093 in RAN#89 includes an informative note to reflect that some legacy devices may not support the feature and therefore such legacy UE are not able to communicate with a network that signals UL shift of 7.5 kHz. No special handling was requested by RAN#89 either. For future devices no optional capability has been agreed and therefore, nothing is needed for the future purposes. |
| Ericsson | No | According to current Rel-15 specification, even if the UE (that does not support the shift) will try to perform RACH towards the gNB, the RACH will fails and the UE will trigger RLF (or do cell reselection/stay in IDLE). From this point of view there is nothing broken, and we would like to not touch Rel-15. |
| MediaTek | No | We prefer not to change R15 SPEC. |
| Intel | Not yet | We need more information. |
| ZTE | Yes | We share the same view with Qualcomm |
| Samsung | No | There would be at the moment no Release 15 UE supporting the concerned frequency band. Hence we don’t need to update Release 15 specification. For forward compatibility, R16 solution with early implementation would be fine. |
| Vivo | No  |  |
| OPPO |  | Please refer to answer to Q1 |
| Reliance Jio | Yes | Agree with QC  |

**Summary: 13 companies replied to this question.**

**Yes: 4**

**No: 8**

**Proposal 2: No need to support backward compatibility to Rel-15 UE which does not support UL 7.5kHz shift.**

**Q3: If the answer to Q2 is Yes, which alternative is preferred?**

* **Approach 1: Alternative 1 in R2-2009466**
* **Approach 2: Alternative 2 in R2-2009466**
* **Approach 3: R2-2010983 (Only if the UE behaviour needs to be clarified)**

|  |  |  |
| --- | --- | --- |
| Company | Approach | Comments |
| Apple | Approach 2 | We believe both Approach 1 and Approach 2 are feasible and prefer Approach 2 since it is cleaner and not impact the existing field *frequencyShift7p5khz* in SIB1. |
| Huawei, HiSilicon | None | See our response to Q2. |
| Qualcomm Incorporated | Approach 3 | Alternative 3 in R2-2009466 |
| CATT | None |  |
| Nokia | None | Nothing is needed as discussed in our earlier responses. |
| Ericsson | Approach 3 in R2-2010983 | This CR is only to clarify the UE behaviour according to what is stated in the RAN4 LS. No new capability is introduced. |
| MediaTek | None or Approach 3 in R2-2010983 | Similar view as Ericsson |
| Intel | None | We need more information. |
| ZTE | Approach 3 |  |
| Samsung | Approach 3 | Even though approach 3 does not prevent legacy UE from camping on the inaccessible cell, there seem in practice no legacy UE at the moment. Approach 3 would be enough for forward compatibility.  |
| vivo | Approach 3 | Simple method is ok for forward compatibility.  |
| OPPO |  | Please refer to answer to Q1 |
| Reliance Jio | Approach 2 | Approach 2 would be cleaner for backward as well as future compatibility |

Summary: In order to support Proposal 1, Approach 3 (R2-2010983) seems to be the most feasible way to move forward.

Approach 2 (Alternative 2 in R2-2009466**)**: 2

Approach 3 (R2-2010983): 6

None: 5

Proposal 3: Introduce the change to RAN2 spec to support UL 7.5kHz shift for TDD bands, based on R2-2010983.

In R2-2009466 [2] and R2-2010983[8] UE capability is raised to support mobility case where UE is handed over from a band without UL 7.5kHz shift to a TDD band with UL 7.5kHz shift. Further, R2-2009466 [2] proposes to have a per SCS UE capability for future proof.**Q4: Do you agree that a corresponding UE capability for UL 7.5kHz shift is needed? If Yes, should we make it per SCS UE capability?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | UE Capability on UL 7.5kHz shift?(Yes/No) | Per SCS UE capability? (Yes/No) | Comments |
| Apple | Yes | Yes (can consult with RAN4) | Even though the capability has no use during initial access, we can run into cases where the UE goes into connected state on one band where UL 7.5kHz shift is not applicable (where DSS is not possible) and afterwards NW can handover the UE to the cell which operates on the band with UL shift is configured. In order to do that, NW has to know if the UE actually supports the UL 7.5kHz shift.Secondly, it’s not clear to us whether 30kHz SCS would be applicable later with UL 7.5kHz SCS, thus we should better consult with RAN4 on whether a per SCS UE capability on UL 7.5kHz shift is required. |
| Huawei, HiSilicon | No | No | As we explained in Q2, currently 7.5KHz shift support is mandatory. There is no exceptional case defined in RAN4 to have optional support for 7.5KHz shift. So we should not introduce new UE capability now. |
| Qualcomm Incorporated | No | No | Same understanding as Huawei. Only thing we need to address at this moment is forward compatibility. |
| CATT | No | No | Agree with Huawei comment. |
| Nokia | No | No | As discussed in our earlier comments and we agree with Huawei’s comments |
| Ericsson | No | No |  |
| MediaTek | No | No |  |
| Intel | No | No | It is supported as mandatory features so far.  |
| ZTE | No | No | Same view as Huawei |
| Samsung | No | No |  |
| vivo | No | No |  |
| OPPO | NO | NO | Please refer to answer to Q1 |
| Reliance Jio | No | No |  |

**Summary:**

**Yes: 1**

**No: 13**

**Proposal 4: No need to introduce UE capability on UL 7.5kHz shift on TDD bands.**

**Q5: Which Release to start the change in RAN2 spec? If it starts from Rel-16, should it be marked as early implementable?**

|  |  |  |  |
| --- | --- | --- | --- |
| Company | Starting Release | Early implementable? (Yes/No) | Comments |
| Apple | Rel-16 | Yes |  |
| Huawei, HiSilicon | NA | No | See our response to Q4. |
| Qualcomm Incorporated | NA | NA |  |
| CATT | NA | No |  |
| Nokia | NA | No | As discussed in our earlier responses, nothing is needed to the RAN2 specs. |
| Ericsson | Rel-16 (only if we want to clarify the UE behaviour – capability is not needed) | No |  |
| MediaTek | Rel-16 | No |  |
| Intel | NA | No | We need more information.  |
| ZTE | Rel-16  | Yes |  |
| Samsung | Rel-16 | Yes |  |
| vivo | Rel-16 | No |  |
| OPPO |  |  | Please refer to answer to Q1 |

**Summary:**

**Rel-16: 6**

**N/A: 5**

**Early implementation: 3**

**Proposal 5: Introduce the CR R2-2010983 from Rel-16.**

# 4 Conclusions

**Proposal 1: Change to RAN2 spec is needed to support RAN4 agreement that if a UE does not support UL 7.5kHz shift for the given network configuration, the UE should avoid camping on this cell and consider this cell as barred.**

**Proposal 2: No need to support backward compatibility to Rel-15 UE which does not support UL 7.5kHz shift.**

**Proposal 3: Introduce the change to RAN2 spec to support UL 7.5kHz shift for TDD bands, based on R2-2010983.**

**Proposal 4: No need to introduce UE capability on UL 7.5kHz shift on TDD bands.**

**Proposal 5: Introduce the CR R2-2010983 from Rel-16.**

# 5 References

1. R4-2011746 LS on clarification for the UE behaviour when UL 7.5kHz shift is optionally supported by a UE
2. R2-2009466 Discussion on UL 7.5kHz shift in NR TDD bands Apple
3. R2-2009467 UL 7.5kHz shifting for NR TDD bands – Alt1 38.331 CR Apple
4. R2-2009468 UL 7.5kHz shifting for NR TDD bands – Alt 2 38.331 CR Apple
5. R2-2009469 UL 7.5kHz shifting for NR TDD bands – Alt 3 38.331 CR Apple
6. R2-2009470 UL 7.5kHz shifting for NR TDD bands 38.306 CR Apple
7. R2-2009471 Draft LS to RAN4 on UE capability for UL 7.5kHz shifting for NR TDD bands in DSS Apple
8. R2-2010983R2-2010983 UE behaviour when UL 7.5kHz shift is not supported Ericsson CR Rel-16 38.331 16.2.0 2107
9. [R2-2010227](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_112-e%5CDocs%5CR2-2010227.zip) Discussion on supporting 7.5KHz shift for TDD bands Huawei, HiSilicon discussion Rel-16 NR\_n48\_LTE\_48\_coex-Core