3GPP RAN WG4 Meeting #104-e R4-2214448

Online, August 15th – 26th, 2022

Title: WF on FR1 2UL inter-band CA coexistence requirements

Agenda item: 11.3.4

Source: Apple

Document for: Approval

# 1 Background

* The FR1 uplink inter-band CA (two bands) spurious emission for UE coexistence requirements in Table 6.5A.3.2.3-1 in TS 38.101-1 has been derived based on the requirements for single carrier operation from each constituent UL band as specified in Table 6.5.3.2-1 in TS 38.101-1.
* The protected bands and frequency ranges for a band combination however are not necessary to cover all the protected bands and frequency ranges from each constituent band due to the reason that one frequency band may be deployed in many different regions and countries, while the other frequency band may not be deployed in all the same regions and countries.
* Therefore, the protected bands and frequency ranges for a band combination in principle should be specified based on the intersection set from each constituent band coexistence requirements.
* Despite the principle on specifying the UE coexistence requirements for a band combination is rather simple and clear, explicitly penning down the requirements in technical specifications is still prone to errors if not checked carefully.
* In [1] it was proposed that the inter-band CA UE coexistence requirements is specified with a normative text as “For inter-band carrier aggregation with uplink assigned to two NR bands, the requirements are the intersection set from each constituent band coexistence requirements as specified in Table 6.5.3.2-1.” without an explicit coexistence table.
* The benefits for not having an explicit coexistence table for band combinations can be perceptibly realized to not only simplify the contents of the technical specifications (16 pages reduction in TS 38.101-1), but also to save time and efforts on manually checking the errors and the associated CR processes.
* During the first-round discussions, the proposal above had received majority supports as a potential way forward on handling 2UL inter-band CA UE co-existence requirements among all the commented companies.
* However, there were also a few concerns raised by companies on how to specify the intersection set in the following cases:
	+ Requirements specified as frequency ranges applicable for one band may also be applicable to the other band but with different requirements, for example, CA\_n1-n3 where both n1 and n3 needs to protect n39 but with different requirements.
	+ For CA\_n1-n18, where n1 needs to protect the entire n39 range from 1880 – 1920MHz while n18 only needs to protect PHS range in 1884.5 – 1915.7MHz. However, the combination still needs to protect the entire n39 range in the current specifications.
	+ A combination is specific to a country where the protected number of bands and ranges are smaller than the intersection set of the two bands.
* This WF is aimed to follow up with the proposal on specifying the 2UL inter-band CA UE co-existence requirements based on the intersection set of the protected bands and frequency ranges from each constituent band without an explicit coexistence table to potentially simplify the contents of the technical specifications and save time and efforts on manually checking the errors and the associated CR processes.

# Way forward discussions

## 2.1 Way forward

* Companies are encouraged to investigate whether the 2UL inter-band CA UE co-existence requirements can be specified based on the intersection set of the protected bands and frequency ranges from each constituent band without an explicit coexistence table.
* Investigate on how to handle the intersection band/ranges with different requirements from each constituent band.
* Identify if there are exceptions not applicable to the principle of the intersection set and how to handle them in either a generic or a combination specific approach.

## 2.2 Company comments

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| **Company** | **Comments** |
| CHTTL | First, we wonder whether this is in the scope of the SI, it seems like the SID doesn’t mention the simplification on the UE co-existence requirements.* + *Study the methodology to simplify RF requirement specifications for*
		- *MSD requirements in 38.101-1 and 38.101-3, e.g., reducing the test configurations with different bandwidth combinations*
		- *For Delta\_TIB and Delta\_RIB requirements, investigate and define the framework of the general principle or requirements with band-combination specific exceptions*
		- *For Delta\_TC,c, investigate whether it can be removed in low boundary formula for Pcmax*

Second, based on the first round comments from the companies, the intersection set is not applied to all the cases, and probably union set shall be applied in some of the cases, it seems a bit too early to have this WF, and the WF seems too oriented to the intersection methods. |
| Nokia | Since this is the first meeting for this SI we think it is a bit to early to focus on only the intersection method proposed. We are fine to further discuss this but would also like to keep other options open. |
| Skyworks | We support that coexistence for 2UL inter-band case is only relevant for band that coexist with UL bands which is the proposed intersection set. If exceptions are needed this can be discussed on top of the baseline assumption like always but needs to be justified: if justified, then it would grant updating the single band coexistence band list.We do think it is in-scope as with any other requirement where we set better guidelines to ensure that specification is accurate and to the point. |
| Apple | Thanks to companies for the valuable comments. Based on our understanding, the intersection set has been the fundamental principle on how the 2UL inter-band CA UE coexistence requirements were constituted. On the other hand, we also realize that there might be exceptions to the principle as commented by companies in the first-round discussions. Therefore, the WF has been drafted with a quite neutral stance as the first bullet basically keeps the door open for companies to investigate whether the requirements can be specified based on the intersection set.We are also open for other options which may help simplify the spec structure and improve the spec quality to minimize the time consuming error correction CR process in future.  |
| Xiaomi | Based on our observation, coexistence protected bands for some band combinations are specified with the intersection principle but some are exceptions. We think the intersection principle can be used as a baseline principle for non-exception cases. For exception cases, RAN4 can study and specify them in the table on a case-by-case basis. With this the spec structure would be significantly simplified. |
| SoftBank | We understand the motivation of updating the co-ex table but we need to discuss how to update it carefully to avoid the reader’s misunderstandings. The intersection method seems to have many exceptions as already discussed in the 1st round.  |
| ZTE | To CHTTL, we think this is in the scope of the SID, since it is impractice to list all the concrete objectives in the SID since there are lots of simplification approaches from different aspects, and the approach proposed Apple is one of the simplification aspect for the specification.For the WF, if my remember is correct, the protected bands for band combination is the intersection set of the constitute bands (maybe there are exceptions) while the frequency range is the union set of the constitute bands (this is different with the WF). Our undertanding is that the terminal goal is to remove the co-existence table, but before do that, we can further discuss how to treat the exceptions after some baseline principle are agreed, especially in the case of no table. |
| DOCOMO | We have the same concerns as Softbank.Basically, we agree with the intersection method, but there are some exceptions. In addition, finding intersection set between bands protected from band A and frequency ranges protected from band B is not simple. We are afraid that the reader may misunderstand the requirements. |

# 3 Reference

1. R4-2212357 “On FR1 2UL inter-band CA coexistence requirements”, Apple, 3GPP TSG-RAN WG4 Meeting #104-e, August 15th – 26th, 2022