**3GPP TSG-RAN WG2 #112-e *Draft\_R2-2009676***

**E-meeting, November 2020**

Agenda Item: 6.4.2

Source: OPPO

Title: Summary of [AT112-e][709][V2X]: Left issue on inter-frequency operation (OPPO)

Document for: Discussion, Decision

# Introduction

This is for the discussion below

* [AT112-e][709][V2X] Left issue on inter-frequency operation (OPPO)

Discuss proposals in R2-2009676 and prepare the agreeable CR in R2-2010939 (discussion summary in R2-2010938 if needed). CR will be agreed by email. Deadline is 12:00pm 11/12/2020 (UTC).

# Discussion

In last meeting, the following issue was discussed in “[Post111-e][701][V2X] 38.304 and 36.304 corrections”.



According to the email discussion of [Post111-e][701], there seem two interperatations of use case of the target section (section 8.2 of TS 38.304)

* One interpretation is the section is for inter-frequency cell reselection, i.e., UE was camping on Frequency-1, but later switches to Frequency-2;
* The other interpretation is the section is for a “virtual cell reselection”, i.e., UE keeps camping on Frequency-1, but also reading V2X SIB on Frequency-2;

Regardless which interpretation is correct, considering the former behavior of “*UE was camping on Frequency-1, but later switches to Frequency-2*” is allowed and already captured in TS 36.304/38.304, the uncertainty is whether the latter behaviour of “*UE keeps camping on Frequency-1, but also reading V2X SIB on Frequency-2*” is allowed, so it would be helpful to firstly check if RAN2 has common understanding on allowing the latter operation.

In details, according to [1]

*For NR-V2X:*

* *On the one hand, currently in TS 38.331, the UE behaviour for reading F2 while staying at F1 is not specified.*
* *On the other hand, there is a following agreement at least to address the dual-RAT transmission on PC5 interface (from RAN2#110), in the direction of allowing such operation but no specification needed.*

=> In the case UE supports both NR and LTE SL RAT, but UE’s camped cell can only provide one SL RAT configuration, then if the UE is also in coverage for the other RAT, then the UE may acquire the other SL RAT configuration by reading the broadcast V2X SIB on the concerned carrier. There will be no specification impact.

*Given the current text in TS 36.304 and TS 38.304 as follows, it is probably true that V2X SIB reading at F2 is allowed. But since there is no clear agreement or RRC specification, it will be beneficial for RAN2 to formally confirm for NR-V2X, whether the UE can stay at F1, but reading V2X SIB at F2.*

8.2 Cell selection and reselection for Sidelink

[…]

When UE is interested to perform NR sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter carrier NR sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 38.133[8]. When UE is interested to perform V2X sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter carrier V2X sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 38.133[8].

**Q1a: For NR-V2X, whether UE can keep camping on a carrier-1, and read V2X SIB on a carrier-2?**

* **Yes;**
* **No;**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo(Jing) | Yes with comments | We think this is not officially discussed for NR sidelink but according to LTE 36.331, a UE can read V2X SIB on carrier-2 if the V2X communication is configured to be performed on carrier-2, while the UE may keep camping on carrier-1. Therefore, it seems the same behaviour can be applied to NR sidelink. But at the same time, we understand this may depend on UE’s capability that not all UEs are capable of this kind of operation. |
| MediaTek | Yes | Looking at the dual-RAT case identified by the rapporteur, we understand that this was concluded to be possible without spec impact. We don’t see why this would be different for the single-RAT case, and our understanding is that reading the SIB from carrier 2 is allowed but nowhere mandated. |
| CATT | Yes | We share the same view as vivo. Following the LTE principle, a UE can V2X SIB on a carrier-2‎, when the UE can keep camping on a carrier-1‎ in NR sidelink. |
| OPPO | Yes |  |
| Huawei | Yes | As mentioned above, we already discussed this scenario and achieved an agreement. |
| Samsung | Yes |  |
| ZTE | Yes | This is a previous agreement |
| Nokia | Yes |  |

Furthermore, if one answers Yes for Q1a, it needs to further clarify what is the applicable scenariofor this “read V2X SIB on a carrier-2” operation:

* Either limited to intra-frequency scenario, i.e., for PC5 activity can only happen at carrier-2;
* Or applicable to both inter-ferquency and intra-frequency scenario, i.e., PC5 activity can happen at not only carrier-2 but another carrier-3 (i.e., different from carrier-1 and carrier-2);

The latter one is probably true given the current specification,

8.2 Cell selection and reselection for Sidelink

[…]

When UE is interested to perform NR sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter carrier NR sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 38.133[8]. When UE is interested to perform V2X sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter carrier V2X sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 38.133[8].

**Q1b: If Yes to Q1a, for NR-V2X, for the “reading V2X SIB on a carrier-2”, whether it is applicable to both intra- and inter-carrier configuration scenario, i.e., PC5 activity can happen at not only carrier-2 but also another carrier-3 (i.e., different from carrier-1 and carrier-2)?**

* **Yes;**
* **No;**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo | No | We think that the UE may ‘*perform measurements on that frequency or the frequencies which can provide inter carrier NR sidelink configuration for that frequency’* is for cell seletion/reselection which means the UE needs to switch from carrier-1 to carrier-2/3 afterwards. But for ‘**reading V2X SIB on a carrier-2 while camping on carrier-1**’*,* at least in LTE it seems this is only applicable to intra-carreir case as follows:1> if the UE is capable of V2X sidelink communication and is configured by upper layers to transmit V2X sidelink communication on a frequency, which is not primary frequency and is not included in *v2x-InterFreqInfoList* in *SystemInformationBlockType21* nor *SystemInformationBlockType26* of the serving cell/PCell:2> if the cell used for V2X sidelink communication on the concerned frequency meets the S-criteria as defined in TS 36.304 [4]:3> if *schedulingInfoList* on the concerned frequency indicates that *SystemInformationBlockType21* is present and the UE does not have stored a valid version of this system information block:4> acquire *SystemInformationBlockType21* from the concerned frequency;3> if *schedulingInfoList* on the concerned frequency indicates that *SystemInformationBlockType26* is present and the UE does not have stored a valid version of this system information block:4> acquire *SystemInformationBlockType26* from the concerned frequency;Therefore for NR sidelink we may follow the LTE to limit it to intra-carrier configuration case.  |
| MediaTek | See comment | We agree with the rapporteur’s reading of section 8.2: The UE may be served by F1, interested in SL communication on F2, and take measurements on F3 which can offer inter-carrier configuration for F2. It makes sense in this context that the UE would read the SIB from F3, but there isn’t explicit guidance in the spec on this.The description above by vivo also seems to be correct, that LTE only specifies reading the SIBs from the “concerned frequency” on which the UE is performing SL communication. If we want to *require* the inter-carrier behaviour in some circumstances, we would have spec impact. |
| CATT | Yes with comments | We think this case is only suitable for the scenario that NR or LTE carrier configures SL on only one RAT, but the V2X UE would like to perform SL on both NR and LTE.For example, a V2X UE camps on NR carrier 1, which only configures NR SL, while NR carrier 2 only configures LTE SL in carrier 3. Thus, if the V2X UE wants to perform SL on both NR and LTE, then the V2X UE needs to keep camping on NR carrier 1 to perform NR SL and read the SIB in NR carrier 2 to perform LTE SL in carrier 3. |
| OPPO | Yes | As mentioned by vivo, in LTE, it is limited to intra-carrier configuration.In NR, due to the highlighted text, seems so far the assumption is that inter-carrier configuration.So either way (fallback to LTE way of being limited to intra-carrier, or extend to inter-carrier case) would lead to some spec impact (i.e., either remove the inter-carrier configuration in 304, or keep thecurrent version for 304 but further clarify it in 331), and technically we see no reason to limit the operation to intra-carrier case. |
| Huawei | Yes | one case should be excluded, i.e., PC5 activity at carrier-1. |
| Samsung | Yes | We think there is no limitation. |
| ZTE | Yes | Since inter-carrier configuration is a valid configuration, we think both cases are reasonable. |
| Nokia | Yes | The highlighted text in section 8.2 reads “or the frequencies which can provide inter carrier NR sidelink configuration” which to our understanding includes the described scenario by the rapporteur i.e. PC5 can happen at carrier 3 (different from carrier 2 and 1). |

For TS 38.331, according to [1], if one answers Yes at least for Q1a, it is good to be clarified that the UE behaviour of “keep camping on a carrier-1, and read V2X SIB on a carrier-2” is allowed.

**Q2a: If Yes to Q1a (and Q1b), do you agree to clarify the UE operation (i.e., keep camping on a carrier-1, and read V2X SIB on a carrier-2) in TS 38.331?**

* **Yes;**
* **No;**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo | Maybe not | This kind of UE operation may depend on UE capability and we think it can be left to UE implementation.  |
| MediaTek | Yes | The fact that this discussion is needed suggests that there is some lack of clarity in the current spec. |
| CATT | No | We also think it can be left to UE implementation. |
| OPPO | Yes | Same view as MTK, this controversial issues itself proves some clarification would help. |
| Huawei | No | This has been discussed in RAN2 #110e meeting and the agreement was explicitly captured that such UE handling is allowed and there will be no specification impact.According to the existing specifications, including 38.304 and 38.331, there is no restriction forbidding UE to do this (which means UE implementation of doing this is allowed).. Therefore, we don’t see necessity to introduce clarification in TS 38.331. |
| Samsung | Yes | Agree with MediaTek that some clarification of UE behaviour would be fine.  |
| ZTE | No | Previously we have agreement that there will be no spec impact. |
| Nokia | Yes with comment | We admit that clarification can help the understanding as the discussion shows, however we would like to remind to a more exact wording in the statement by the use of the auxillary verb “can” or “may” since we agreed there will be no spec impact and finally it’s up to UE implementation: “keep camping on a carrier-1, and **can** read V2X SIB on a carrier-2” to stress the fact that the UE may acquire other SL RAT configuration by monitoring SIB broadcast, but UE is not obliged to do so.  |

In [1], it is proposed to add a NOTE to clarify that,

NOTE 5: A UE capable of NR sidelink communication and is configured by upper layers to perform NR sidelink communication on a frequency can acquire *SIB12* from a cell other than serving cell (for RRC\_INACTIVE or RRC\_IDLE) or primary cell (for RRC\_CONNECTED), if *SIB12* of serving cell (for RRC\_INACTIVE or RRC\_IDLE) or primary cell (for RRC\_CONNECTED) does not provide configuration for NR sidelink communication for the frequency, and if the cell providing configuration for NR sidelink communication for the frequency meets the S-criteria as defined in TS 38.304 [20].

**Q2b: If Yes to Q2a, do you agree with the change proposed in [1] above for TS 38.331?**

* **Yes;**
* **No;**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| MediaTek | Minor comments | The word “is” in the first line can be removed, and we think “can” in the second line should be “may” (“can” could be misunderstood to say “all UEs are capable of doing this”). |
| OPPO | Yes | We are fine with the suggestion from MTK. |
| Huawei |  | See the answer to Q2a. |
| Samsung | Yes |  |
| Nokia | Yes with comments | Fine with MediaTek’s rewording |

For TS 36.304, currently there are two use cases captured

11.4 Cell selection and reselection for sidelink

The requirements defined in this clause for sidelink operation apply for UEs in RRC\_IDLE and in RRC\_CONNECTED.

When UE is interested to perform sidelink communication or sidelink discovery announcement on non-serving frequency, it shall perform measurements on that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 36.133 [10]. When UE is interested to perform V2X sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter-carrier V2X sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 36.133 [10]. When UE is interested to perform NR sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter-carrier NR sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 36.133[10].

[…]

If the UE has selected a cell on a non-serving frequency for sidelink communication or V2X sidelink communication or NR sidelink communication or sidelink discovery announcement, it shall perform additional intra-frequency reselection process to select a better cell for sidelink operation on that frequency in accordance with clause 11.4.1.

Similarly, the two cases are included in TS 38.304

8.2 Cell selection and reselection for Sidelink

The requirements defined in this clause for sidelink operation apply for UEs in RRC\_IDLE, RRC\_INACTIVE and in RRC\_CONNECTED.

When UE is interested to perform NR sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter carrier NR sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 38.133[8]. When UE is interested to perform V2X sidelink communication on non-serving frequency, it may perform measurements on that frequency or the frequencies which can provide inter carrier V2X sidelink configuration for that frequency for cell selection and intra-frequency reselection purpose in accordance with TS 38.133[8].

[…]

If the UE has selected a cell on a non-serving frequency for NR sidelink communication or V2X sidelink communication, it shall perform additional intra-frequency reselection process to select a better cell for sidelink operation on that frequency in accordance with clause 8.2.1.

Firstly, for cell selection, according to [1], it is used for PLMN selection as defined in TS 23.285

- If the UE finds such cell but not in the registered PLMN or a PLMN equivalent to the registered PLMN, and that cell belongs to a PLMN authorized for V2X communications over PC5 reference point and provides radio resources for V2X service then the UE shall perform PLMN selection triggered by V2X communications over PC5 reference point as defined in TS 23.122 [23]. If the UE has an ongoing emergency session, it shall not trigger any PLMN selection due to V2X communication over PC5 reference point.

So firstly, good to check whether cell selection is a valid use case.

**Q3a: Do you agree that cell selection is a valid use case of non-serving frequency measurement for NR-V2X?**

* **Yes;**
* **No;**

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| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo | Yes  | Cell selection is valid according to SA2 specification as well as when the UE intends to perform V2X communication but didn’t camp on any cell. |
| MediaTek | Yes | PLMN selection seems like a valid case. |
| CATT | Yes | In our CRs, we proposed to exclude the case of cell selection. However, after second round thinking, according to SA2 specification, we think Cell selection is valid use case. |
| OPPO | Yes |  |
| Huawei | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |

**Q3b: If No to Q3a, do you agree that “cell selection” is excluded for NR-V2X in TS 36.304 and TS 38.304?**

* **Yes;**
* **No;**

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| --- | --- | --- |
| Company | Yes/No | Comments |
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Secondly, for intra-frequency cell reselection, according to [1][2], it is used for vitual cell reselction, if the UE behaviour of “keep camping on a carrier-1, and read V2X SIB on a carrier-2” is allowed, as questioned in Q1a/b.

**Q4a: Do you agree that intra-frequency cell reselection is a valid use case of non-serving frequency measurement for NR-V2X?**

* **Yes (e.g., if one answer Yes to Q1a (and Q1b));**
* **No (e.g., if one answer No to Q1a);**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo | See comments | Even if we agree on the behaviour “keep camping on a carrier-1, and read V2X SIB on a carrier-2”, to use the term ‘intra-frequency cell reselection’ to represent this behaviour is sort of misleading because one can easily to interpret it as the UE may need to switch from carrier-1 to carrier-2 and wonder why it is not belonging to inter-carreir cell reselection. (and if we use sth like ‘virtual cell reselection’ it is even more hard to understand. The accurate terminology may even be like ‘(virtual) inter-frequency cell reselection for intra-carrier configuration for SL’) Therefore, we suggest to simply specify the UE behaviour clearly or leave it to UE implementation, without such ‘intra-frequency’ terminology for cell reselection. |
| MediaTek | Yes | We kind of agree with vivo that the term “intra-frequency cell reselection” is not perfect here, but given the way it is already used in section 8.2, we think it’s consistent to use it in this way. |
| CATT | Yes with comments | We think both intra and inter frequency cell reselection are valid use cases, so that such ‘intra-frequency’ terminology for cell reselection should be deleted. |
| OPPO | Yes | Same view as MTK |
| Huawei | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |

**Q4b: If No to Q4a, do you agree that “intra-frequency cell reselection” is excluded for NR-V2X in TS 36.304 and TS 38.304?**

* **Yes;**
* **No;**

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| --- | --- | --- |
| Company | Yes/No | Comments |
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Thirdly, according to [1][2], inter-frequency cell reselection should be included, rapporteur understands it could be

* Not only for the case of “*UE was camping on Frequency-1, but later switches to Frequency-2*”, where pre-measurement on F2 is needed;
* But also for the case of “*UE keeps camping on Frequency-1, but also reading V2X SIB on Frequency-2*”, where the reading on frequency-2 maybe later switch to another frequency-2’, since the inter-frequency configuration may come from any frequency, and thus pre-measurement on F2 is also needed.

**Q5a: Do you agree that inter-frequency cell reselection is a valid use case of non-serving frequency measurement for NR-V2X?**

* **Yes;**
* **No;**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| vivo | Yes with comments | For the case when a UE need to switch from carrier-1 to carrier-2 and perform the normal inter-frequency cell reselection, it is valid.But for the case when a UE reads SIB on carrier-2 which provide inter-carreir configuration for carrier-3, while the UE is camping on carrier-1, we don’t think this needs to be supported as a total new feature compared to LTE.  |
| MediaTek | Yes | We tend to think this is OK without further spec impact. |
| CATT | Yes | Both intra and inter frequency cell reselection are valid cases. Therefore, “intra-frequency” should be removed. |
| OPPO | Yes | If both intra and inter frequency are included, remove “intra-frequency” would be sufficient. |
| Huawei | Yes |  |
| Samsung | Yes | Same view as OPPO |
| ZTE | Yes |  |
| Nokia | Yes |  |

**Q5b: If Yes to Q5a, do you agree that “inter-frequency cell reselection” is included for NR-V2X in TS 36.304 and TS 38.304?**

* **Yes;**
* **No;**

|  |  |  |
| --- | --- | --- |
| Company | Yes/No | Comments |
| CATT | Yes | See comments of Q5a. |
| OPPO | Yes | See comment on Q5a. |
| Huawei | Yes |  |
| Samsung | Yes |  |
| ZTE | Yes |  |
| Nokia | Yes |  |

**Summary:**

Q1a:

Summary: All companies agree with the use case.

1. For NR-V2X, UE can keep camping on a carrier-1 and read V2X SIB on a carrier-2.

Q1b:

Summary: 4 out of 6 companies agree with the use case, 1 (MTK) seems netrual, and 1 (vivo) disagree with the use case. Rapporteur suggest go for majority view. 1 (HW) points out the inter-carrier configuration at least should not target at carrier-1, for which rapporteur tends to agree.

Rapporteur suggest to go for majority view.

1. RAN2 confirm, for the behaviour of “keeping camping on a carrier-1 while reading V2X SIB on a carrier-2” in NR-V2X, the V2X SIB at carrier-2 is applicable to both intra- and inter-frequency carrier configuration scenario, i.e., NR PC5 activity can happen at not only carrier-2 but also another carrier-3 (i.e., different from carrier-1 and carrier-2).

Q2a/b:

Summary: 3 of 6 companies tend to avoid impact to 331, 3 of 6 companeis support the change to 331.

Rapporteur suggest to not go for CR in Phase-2 in this meeting, and interested companies can bring CR next meeting for further discussion.

Q3a:

Summary: All companies agree with the use case for cell selection.

Q4a:

Summary: 5 out of 6 companies agree with the use case for intra-freq cell reselection. 1 (vivo) raise concern on the wording. Rapporteur suggest to review the wording issue in Phase-2 discussion.

Q5a:

Summary: all companies agree with the use case for inter-freq cell reselection.

Based on the discussion on Q3/4/5.

1. Cell selection, intra- and iner-frequency cell reselection are all valid use cases of non-serving frequency measurement for NR-V2X.

Based on the proposals above, rapporteur suggest to start Phase-2 discussion, focusing on 36/38.304 CR to include all cell (re)selection use cases for NR-V2X.

# Conclusion

We have the following proposals:

[Proposal 1 For NR-V2X, UE can keep camping on a carrier-1 and read V2X SIB on a carrier-2.](#_Toc55578162)

[Proposal 2 RAN2 confirm, for the behaviour of “keeping camping on a carrier-1 while reading V2X SIB on a carrier-2” in NR-V2X, the V2X SIB at carrier-2 is applicable to both intra- and inter-frequency carrier configuration scenario, i.e., NR PC5 activity can happen at not only carrier-2 but also another carrier-3 (i.e., different from carrier-1 and carrier-2).](#_Toc55578163)

[Proposal 3 Cell selection, intra- and iner-frequency cell reselection are all valid use cases of non-serving frequency measurement for NR-V2X.](#_Toc55578164)

# Reference

1. R2-2009676 Left issue on inter-frequency operation for NR-V2X OPPO discussion Rel-16 5G\_V2X\_NRSL-Core
2. R2-2008875 Discussion on left issue of 38.304 and 36.304 CATT discussion Rel-16 5G\_V2X\_NRSL-Core
3. R2-2008876 Correction to TS 38.304 CATT CR Rel-16 38.304 16.2.0 0188 - F 5G\_V2X\_NRSL-Core
4. R2-2008877 Correction to TS 36.304 CATT CR Rel-16 36.304 16.2.0 0813 - F 5G\_V2X\_NRSL-Core