**3GPP TSG RAN WG1 #105-e R1-210xxxx**

**e-Meeting, May 10th – 27th, 2021**

**Source: Moderator (ZTE)**

**Title: Summary of Email Discussion [105-e-AI5-LS-02]**

**Agenda item: 5**

**Document for:** **Discussion/Decision**

# Introduction

Per Chairman’s guidance, the following email discussion is allocated to discuss and finalize the reply LS for R2-2104550.

[105-e-AI5-LS-02] A reply LS to [R1-2104162](file:///C%3A%5CUsers%5Cwanshic%5COneDrive%20-%20Qualcomm%5CDocuments%5CStandards%5C3GPP%20Standards%5CMeeting%20Documents%5CTSGR1_105%5CDocs%5CR1-2104162.zip) is necessary – email discussion/approval till 5/25 (Xingguang Wei, ZTE)

In this meeting, five contributions are submitted to discuss the issues raised in this LS [2, 3, 4, 5 and 6].

This summary is generated to collect companies’ views for the questions raised in RAN2 LS R2-2104550 and try to reach consensus among companies.

# Discussion

During RAN2#113bis-e meeting, RAN2 sent an LS to RAN1 and RAN4 to seek information for five UE capabilities related to intra-band and inter-band (NG) EN-DC/NE-DC [1]. In this contribution, we provide our analysis for two RAN1 UE capabilities.

During RAN2 discussion, companies found that some UE capabilities are only applicable to intra-band EN-DC/NE-DC. However, the definition of intra-band EN-DC/NE-DC is not clear and hence RAN2 asked RAN1/RAN4 to provide feedback for the concerned UE capabilities.

The following five UE capabilities are mentioned in the RAN2 LS [2]. Among them, **6-24 (*ul-TimingAlignmentEUTRA-NR*)** and **6-23 (*pa-PhaseDiscontinuityImpacts*)** are originated from RAN1. Thus, in this contribution, we focus on them.

| **R1**: 6-24 | Applying the same UL timing between NR and LTE | ***ul-TimingAlignmentEUTRA-NR***Indicates whether to apply the same UL timing between NR and LTE for dynamic power sharing capable UE operating in a synchronous intra-band contiguous (NG)EN-DC. If this field is absent, UE shall be capable of handling a timing difference up to applicable MTTD requirements when operating in a synchronous intra-band contiguous (NG)EN-DC network, as specified in TS 38.133 [5]. If this capability is included in an inter-band (NG)EN-DC BC with an intra-band (NG)EN-DC BC part, this capability is used to indicate the restriction to the intra-band (NG)EN-DC BC part. |
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| **R1**: 6-23 | Incapability motivated by impacts of PA phase discontinuity with overlapping transmissions with non-aligned starting or ending times or hop boundaries across carriers for intra-band EN-DC, intra-band CA, and FDM based ULSUP | ***pa-PhaseDiscontinuityImpacts***Indicates incapability motivated by impacts of PA phase discontinuity with overlapping transmissions with non-aligned starting or ending times or hop boundaries across carriers for intra-band (NG)EN-DC/NE-DC, intra-band CA and FDM based ULSUP. |
| R4: 2-16 | PA architectures for intra-band EN-DC | ***dualPA-Architecture***For an intra-band band combination, this field indicates the support of dual PAs. If absent in an intra-band band combination, the UE supports single PA for all the ULs in the intra-band band combination. For other band combinations, this field is not applicable. |
| R4:2-4 | Simultaneous reception and transmission for inter-band EN-DC (TDD-TDD or TDD-FDD) | ***simultaneousRxTxInterBandENDC***Indicates whether the UE supports simultaneous transmission and reception in TDD-TDD and TDD-FDD inter-band (NG)EN-DC/NE-DC. It is mandatory for certain TDD-FDD and TDD-TDD band combinations defined in TS 38.101-3 [4]. |
| R4:2-6 | Asynchronous FDD-FDD intra-band EN-DC DC | ***asyncIntraBandENDC***Indicates whether the UE supports asynchronous FDD-FDD intra-band (NG)EN-DC with MRTD and MTTD as specified in clause 7.5 and 7.6 of TS 38.133 [5]. If asynchronous FDD-FDD intra-band (NG)EN-DC is not supported, the UE supports only synchronous FDD-FDD intra-band (NG)EN-DC. |

The following types of intra-band/inter-band EN-DC/NE-DC are listed in the RAN2 LS [1] (the **bolder part** denotes UL).

* Type 1: Intra-band (NG)EN-DC/NE-DC combination without additional inter-band NR and LTE CA component, e.g. DC **41A\_n41A**
* Type 2: Intra-band (NG)EN-DC/NE-DC combination supporting both UL and DL intra-band (NG)EN-DC/NE-DC parts with additional inter-band NR/LTE CA component, e.g. *DC\_25A\_****41A\_n41A***
* Type 3: Intra-band (NG)EN-DC/NE-DC combination without supporting UL in both the bands of the intra-band (NG)EN-DC/NE-DC UL part, e.g. DC\_**25A**\_41A\_**n41A**
* Type 4: Inter-band (NG)EN-DC/NE-DC combination without Intra-band component, in short we call it as Inter-band (NG)EN-DC/NE-DC combination.
* Type 5: Inter-band (NG)EN-DC combination configurations where the frequency range of the E-UTRA band is a subset of the frequency range of the NR band, e.g., DC\_B42\_n77 and DC\_B42\_n78.

To summarize, among the five different types,

* Type 1 and type 2 have intra-band UL carriers (NG)EN-DC/NE-DC.
* Type 1and type 3 have intra-band DL carriers (NG)EN-DC/NE-DC.
* Type 5 is a bit different from other types because the band for LTE and NR are different however they are overlapping in frequency.

Companies are invited to answer the following questions.

## Question#1

Question#1: For **6-24 (*ul-TimingAlignmentEUTRA-NR*)** and **6-23 (*pa-PhaseDiscontinuityImpacts*)**, which type(s) of (NG)EN-DC/NE-DC are they applicable to?

|  |  |
| --- | --- |
| **Company** | **View** |
| ZTE | **Type1, Type2 and Type5**Both of these two UE capabilities are only related to intra-band UL carriers. Thus, from our perspective, it is clear that 6-24 (*ul-TimingAlignmentEUTRA-NR*) and 6-23 (*pa-PhaseDiscontinuityImpacts*) are applicable to type 1 and type 2. Regarding whether the two UE capabilities can be applied to type 5. From our perspective, for the type 5 band combination, UE may encounter the same timing issue and PA phase discontinuity issue, thus they are also applicable to type 5 (NG)EN-DC/NE-DC. However, we are open to hear other companies’ views on this. |
| vivo | Type 1, Type 2 and Type 5 |
| MTK | **Type1, Type2 and Type5**The two capabilities should only apply to the cases with multiple intra-band UL carriers or overlapped UL frequency in NR and LTE UL carriers as moderator suggested. |
| Ericsson | Type 1, Type 2. In our understanding, applicability for Type 5 would not be aligned with previous agreements and would need more discussion. |

## Question#2

Question#2:For **6-24 (*ul-TimingAlignmentEUTRA-NR*)** and **6-23 (*pa-PhaseDiscontinuityImpacts*)**, are they used to indicate the restriction to the intra-band (NG)EN-DC/NE-DC BC part if they are applicable to Type1/2/3?

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| **Company** | **View** |
| ZTE | **Yes.**They are only applicable to the intra-band (NG)EN-DC/NE-DC BC part. |
| Vivo | Yes |
| MTK | Yes |
| Ericsson | Generally OK but for this it is good to have common handling for all the RAN1/4 capabilities under discussion.  |

**Any other comments?**

Do you have any other question/comments? If yes, please put them in the table below.

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| --- | --- |
| **Company** | **View** |
| Ericsson | It would be good to have common handling for all the RAN1/4 capabilities under discussion as much as possible and we prefer to check status of RAN4 discussion before finalizing the LS in RAN1. |
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# Conclusion

**2021/05/21**

During the first round of discussion, 4 companies (ZTE, VIVO, MTK, Ericsson) provided comments via email discussion and 2 companies (CATT, Huawei/ HiSilicon) provided comments via tdoc contribution. Most of companies agree that RAN1 should focus on the RAN1 UE features, i.e., 6-24 (ul-TimingAlignmentEUTRA-NR) and 6-23 (pa-PhaseDiscontinuityImpacts). Ericsson mentioned it is good to have common handling for all the RAN1/4 capabilities under discussion as much as possible and prefers to check status of RAN4 discussion before finalizing the LS in RAN1.

The detailed summary is as below.

Regarding 6-24 (ul-TimingAlignmentEUTRA-NR) and 6-23 (pa-PhaseDiscontinuityImpacts),

* Applicable to **Type** **1** and **Type 2**: ZTE, VIVO, MTK, Ericsson, Huawei, CATT
* Also applicable to **Type 5** in addition to Type1 and Type 5: ZTE, VIVO, MTK

UE feature 6-24 (ul-TimingAlignmentEUTRA-NR) and 6-23 (pa-PhaseDiscontinuityImpacts) are used to indicate the restriction to the intra-band (NG)EN-DC/NE-DC BC part.

* Support: ZTE, VIVO, MTK, Huawei, CATT, Ericsson (Prefer to have common handling for all the RAN1/4 capabilities under discussion)

As we can see, all companies agree that 6-24 (ul-TimingAlignmentEUTRA-NR) and 6-23 (pa-PhaseDiscontinuityImpacts) can be applied to at least Type 1 and Type 2, which is straightforward. Regarding whether they can be applied to Type 5, from moderator’s perspective, as commented by Ericsson, it is better to align RAN1 and RAN4 understanding. Thus, we propose the following proposals.

**Moderator Proposal A:**

Regarding questions mentioned in RAN2 LS R1-2104162/R2-2104550,

* UE feature 6-24 (ul-TimingAlignmentEUTRA-NR) is applicable to Type 1 and Type 2 (NG)EN-DC BC types.
* UE feature 6-23 (pa-PhaseDiscontinuityImpacts) is applicable to Type 1 and Type 2 (NG)EN-DC/NE-DC BC types.
* Both 6-24 (ul-TimingAlignmentEUTRA-NR) and 6-23 (pa-PhaseDiscontinuityImpacts) are used to indicate the restriction to the intra-band (NG)EN-DC/NE-DC BC part.
* RAN1 further discusses whether 6-24 (ul-TimingAlignmentEUTRA-NR) and 6-23 (pa-PhaseDiscontinuityImpacts) can be applicable to Type 5 (NG)EN-DC/NE-DC BC type by taking RAN4 discussion outcome into account.

# Reference

1. R2-2104550, LS on the Intra-band and Inter-band (NG)EN-DC/NE-DC Capabilities, RAN2#113bis-e.
2. R1-2104319, Discussion on the Intra-band and Inter-band (NG)EN-DC NE-DC Capabilities, ZTE, RAN1#105-e.
3. R1-2104320 , [DRAFT] Reply LS on the Intra-band and Inter-band (NG)EN-DC NE-DC Capabilities, ZTE, RAN1#105-e.
4. R1-2104466 , Discussion on the Intra-band and Inter-band (NG)EN-DC/NE-DC Capabilities, CATT, RAN1#105-e.
5. R1-2105451, Draft reply LS on the Intra-band and Inter-band (NG)EN-DC/NE-DC Capabilities, vivo, RAN1#105-e.
6. R1-2105932 , Discussion on EN-DC/NE-DC UE capabilities, Huawei, HiSilicon, RAN1#105-e.