**3GPP TSG RAN WG2 Meeting #117-e**   **R2-220xxxx**

**E-Meeting, 21st February – 3rd March 2022**

**Agenda Item:** **6.1.4.3**

**Source:**  **Intel Corporation**

**Title:** **Summary report of [AT117-e][034][NR16] UE capabilities I (Intel)**

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

# Introduction

This is to kick-off the following offline discussion:

* [AT117-e][034][NR16] UE capabilities I (Intel)

Scope: Treat R2-2202146, R2-2202107, R2-2202665, R2-2203163, R2-2203167, R2-22002195, R2-2202196, R2-2203488, R2-2202293. Ph1 Determine agreeable parts, Ph2 for agreeable parts, progress CRs.

Intended outcome: Report, Agreed CRs.

Deadline: Schedule 1

For Schedule 1:

A **first round** with **Deadline for comments W1 Thur Feb 24th 1200 UTC** to settle scope what is agreeable etc

A Final round with **Final deadline W2 Wed March 2nd 1200 UTC** to settle details / agree CRs etc.

# Companies’ point of contact

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# Leftover issues for DAPS capability

The following papers are for DAPS remaining issues:

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| DAPS  R2-2202195 Left issues on DAPS capability OPPO discussion Rel-16 NR\_Mob\_enh-Core  R2-2203488 Discussion on DAPS capabilities and configuration Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core  R2-2202293 Correction on DAPS capability OPPO CR Rel-16 38.306 16.7.0 0677 - F NR\_Mob\_enh-Core |

In Ph1, we could focus on proposals in discussion papers, and leave the CR part to Ph2.

**Signalling structure:**

**In RAN2#116, the following agreements were made:**

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| * [012] The capability for source/target cell in intra-frequency DAPS handover is derived based on a pair of per-CC feature-set ID in the same band-entry, and  the capability for source/target cell in inter-frequency DAPS handover is derived from a pair of per-CC feature-set ID in the same or different band entries. Correction in TS 38.306 is needed to clarify this. |

In R2-2203488, a further proposal is made to discuss whether the same two FSPC IDs can be reported for a band intra-frequency DAPS capability within DAPS FSC, while in case of CA normally different FSPC IDs are included for a band.

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| **Observation1: The DAPS capability should be derived from a pair of FSPCs for both intra-freq and inter-freq DAPS.**  For the FSPC IDs reported by UE in a DAPS FeatureSetCombination, there is network coordination between the source and target cell. The target can determine which one of FSPC ID to use based on the received source configuration. This principle should be applicable for both intra-freq DAPS and inter-freq DAPS. Thus, for a band with intra-freq DAPS capability, same or different FSPC IDs should be allowed to report within DAPS FSC.  **Proposal 1: Same or different FSPC IDs are allowed to report for a band with intra-frequency DAPS capability within DAPS FSC.** |

**Question 3-1: Whether the following proposals can be agreeable?**

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| **Proposal 1: Same or different FSPC IDs are allowed to report for a band with intra-frequency DAPS capability within DAPS FSC.** |

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| **Company** | **Y or N** | **Additional comments** |
| Intel | Y | it’s possible that source cell and target cell have the same FSPC capabilities. |
| Qualcomm Incorporated | Y? | We suggest the proposal text be clarified.  We understand this proposal means that for intra-frequency DAPS, one or two FeatureSetDownlinkPerCC(s) can be reported within a single featureSetDownlink.  We also propose this to be clarified in the standard. |
| OPPO | Clarification needed | We see some different interpretation  For “**Same FSPC IDs are allowed to report for a band with intra-frequency DAPS capability within DAPS FSC**”, is it to say that for a single FS-entry, e.g., in case of BWC-A, when supporting intra-f DAPS, it can report two same FSpCC ID, and so source/target gNB would make use of the two IDs which are the same? Or a single FSpCC ID (would this go against the 116 conclusion that “The capability for source/target cell in intra-frequency DAPS handover is derived based on a pair of per-CC feature-set ID in the same band-entry”)?  For “**different FSPC IDs are allowed to report for a band with intra-frequency DAPS capability within DAPS FSC**”, is it to say that for a single FS-entry, e.g., in case of BWC-A, when supporting intra-f DAPS, it can report two different FSpCC IDs, and so source/target gNB would make use of the two IDs which are different.  After clarification on the intention, we also support to clarify it in the spec. |
| Huawei, HiSilicon | Y | For the question raised by Qualcomm and OPPO, we understand it has been agreed that the intra-freq DAPS capability should be derived from a pair of FSPC IDs, which means there are at least two FSPC(s) within a single featureSetDownlink in DAPS FSC. Our intention for proposal 1 in R2-2203488 is to clarify that the two FSPC ID(s) can be same or different. Thus we still prefer the original wording. |
| ZTE(Mengjie) | Y | We also think that at least two FSpCCs with a single featureSetDownlink are reported for intra-freq DAPS. And the two FSPC ID(s) can be same or different. |
| Nokia | Y | We agree but one question: if UE just has single CC capability in given band is intra-frequency DAPS possible? We think yes as long as UE is CA capable |
| Apple | Y | We also agree to the clarification reported by Qualcomm |
| Samsung | Y |  |
| Qualcomm Incorporated | Y | (Second comment after seeing feedback from Huawei and ZTE)  We now understood the intention of the proposal, which we can agree to. We may need to improve the text, but it can be done as part of CR review. |
| Ericsson | N | Since there is no coordination between source and target node, the target node cannot know based on which capabilities the source node configured the UE. Hence, if the two FSPC ID(s) can be different, both target and source node may configure the UE according to only one of the FSPC ID(s), which could exceed the UE capabilities. |
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**Applicability of legacy CA BC capabilities:**

In RAN2#116 meeting, the following agreement was made, and one discussion point was postponed:

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| * [012] RAN2 confirms: the legacy reported field of 1) frequency-separation and 2) BCS is not applicable for intra-frequency DAPS handover. * [012] RAN2 further discuss that, for inter-frequency DAPS HO cases where the BW of source and target cells are NOT overlapping with each other, the 1) BW-class, 2) frequency-separation and 3) BCS restriction reported in the same BC-entry are all applicable to DAPS FSC. |

In R2-2203488, a general proposal regarding this leftover issue is made as below:

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| **Proposal 2: For inter-frequency DAPS HO cases where the BW of source and target cells are not overlapping with each other, the 1) BW-class, 2) frequency-separation and 3) BCS restriction reported in the same BC-entry are all applicable to DAPS FSC.** |

While in R2-2202195, the proposals with a detailed differentiation between BWC D/E, BWC B/C and BWC A are provided as follows:

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| **Proposal 1 R2 discuss that BWC of D/E and above (and BCS, frequency separation in case of BWC D/E and above) are 1) not applicable to DAPS FSC for inter-frequency DAPS, or 2) applicable to DAPS FSC for inter-frequency DAPS based on 2-CC fallback BC.**  **Proposal 2 R2 discuss that BWC of B/C (and BCS, frequency separation in case of BWC B/C) for intra-band non-continguous BC or inter-band BC are 1) not applicable to DAPS FSC for inter-frequency DAPS HO, or 2) applicable to DAPS FSC for inter-frequency DAPS based on 2-CC fallback BC.**  **Proposal 3 R2 clarify BWC of B/C and BCS in case of BWC B/C for intra-band continguous BC is applicable to DAPS FSC for inter-frequency DAPS HO.**  **Proposal 4 R2 clarify for intra-band non-continguous BC and inter-band BC limited to BWC A, frequency separation (only valid for intra-band non-continguous BC) and BCS is applicable to DAPS FSC for inter-frequency DAPS HO.** |

In Ph1, at least some general question can be asked, and companies can provide exceptions if any.

**Question 3-2: Whether the following proposal can be agreeable? And please indicate the exception if any.**

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| **Proposal 2: For inter-frequency DAPS HO cases where the BW of source and target cells are not overlapping with each other, the 1) BW-class, 2) frequency-separation and 3) BCS restriction reported in the same BC-entry are all applicable to DAPS FSC.** |

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| **Company** | **Y or N** | **Additional comments** |
| Intel | Y | The basic principle is to reuse CA UE capability for DAPS, and consider DAPS as a two-CC CA. |
| Qualcomm Incorporated | Y, but | Please confirm that the proposal is not to redefine the frequency-separation capability. So it should be applicable only to **intra-band** inter-frequency DAPS HO. For **inter-band** inter-frequency, we do not expect UE implementation would have limitation for frequency separation. |
| OPPO | See comment | Please clarify that for a BC entry which is not two-CC CA (e.g., w/ band entry of BWC-D/E, or w/ more than two band entries of BWC-A), when indicating a DAPS FSC, when it says “**1) BW-class, 2) frequency-separation and 3) BCS restriction.. are all applicable to DAPS FSC**”, it means the bandwidth(s) of the two-CC BC as the **fallback BC** of the original BC-entry applies to DAPS FSC. |
| Huawei, HiSilicon | Y | We also suggest to define a general principle to the applicability of legacy CA capabilities for DAPS handover, as observed in our discussion paper R2-2203488.  **Observation 2: No clarification is needed in spec for the applicability of legacy CA BC capabilities for DAPS handover unless an inter-operability issue is found, which should be discussed case by case.**  For BC entry with more than 2 CCs, if DAPS capability is reported, then it is up to network to configure any pair of CCs for source/target cell in DAPS handover. This intention has been captured in current 38.306 as below.  ***featureSetCombinationDAPS-r16***  Indicates the feature set that the UE supports for DAPS handover on the NR band combination by FeatureSetCombinationId. A UE shall include this field if intra-freq or inter-freq DAPS handover is supported for this band combination. If the number of CCs within a band combination is more than two, UE shall support DAPS handover between every CC pair. A feature set including *intraFreqDAPS-r16* can only be referred to by *featureSetCombinationDAPS-r16*, not by *featureSetCombination*. A feature set without *intraFreqDAPS-r16* is only applied to inter-freq DAPS handover if it is referred to by *featureSetCombinationDAPS*. Both feature sets with and without *intraFreqDAPS-r16* can be referred to by the same *featureSetCombinationDAPS-r16*.  Besides, as Qualcomm mentioned, in current spec, it is clear that the frequency separation capability is only applicable for intra-band inter-frequency DAPS. We are OK to confirm it. |
| ZTE(Mengjie) | Y | The inter-freq DAPS can follow the CA BC capability principle. |
| Nokia | Yes | We agree with Qualcomm |
| Apple | Yes | And agree on clarification to intra-band only. |
| Samsung | Y |  |
| Ericsson | Y, but | We agree with Huawei and Qualcomm. But we would like to highlight that the discussion should only be about whether those fields are applicable to DAPS or not. How the network derives e.g. BCS for fallback BCs was already discussed previously and we would prefer to not open up this discussion again. |
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**Synchronous DAPS capability:**

In R2-2203488, the following proposals are made to clarify the synchronous DAPS capability:

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| In our view, if there is the case that syncDAPS only capability is supported, one possible way is to report the intrafreqDAPS-r16 or interfreqDAPS-r16 IE without any sub-field included. Besides, in this case, the intra-freq and inter-freq syncDAPS capability should be understood separately by including corresponding IE.  **Proposal 3: If the intraFreqDAPS-r16 is included and no sub-fields are included inside, it indicates support of intra-frequency syncDAPS handover.**  **Proposal 4: If the interFreqDAPS-r16 is included and no sub-fields are included inside, it indicates support of inter-frequency syncDAPS handover.** |

**Question 3-3: Whether the following proposals can be agreeable?**

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| **Proposal 3: If the intraFreqDAPS-r16 is included and no sub-fields are included inside, it indicates support of intra-frequency syncDAPS handover.**  **Proposal 4: If the interFreqDAPS-r16 is included and no sub-fields are included inside, it indicates support of inter-frequency syncDAPS handover.** |

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| **Company** | **Y or N** | **Additional comments** |
| Intel | Y | sub-fields are optional, and they don’t affect the support of syncDAPS. |
| Qualcomm Incorporated | Y | We think this is already clear in the current specification. |
| Huawei, HiSilicon | Y | In RAN2#110-e, it was agreed that all UEs supporting DAPS shall support synchronous DAPS. However, it is not clear whether “supporting DAPS” requires at least one optional sub-field included by UE, or this supporting can be represented by including an empty SEUQENCE type IE of *intraFreqDAPS-r16* or *interFreqDAPS-r16*.  Besides, in the field description in 38.306, the field description is ambiguous on whether the support of synchronous DAPS is implicitly indicated via *intraFreqDAPS-r16/interFreqDAPS-r16* separately.  We prefer to clarify it in RAN2 spec to avoid possible misunderstanding between the network and the UE.  ***interFreqDAPS-r16***  Indicates whether the UE supports inter-frequency handover, e.g. support of simultaneous DL reception of PDCCH and PDSCH from source and target cell. A UE indicating this capability shall also support synchronous DAPS handover, and single UL transmission for inter-frequency DAPS handover.  ***intraFreqDAPS-r16***  Indicates whether UE supports intra-frequency DAPS handover, e.g. support of simultaneous DL reception of PDCCH and PDSCH from source and target cell. A UE indicating this capability shall also support synchronous DAPS handover, single UL transmission and cancelling UL transmission to the source cell for intra-frequency DAPS handover. |
| ZTE(Mengjie) | Y | We think this is already clear in the current spec. No need extra clarification in the spec. |
| Nokia | Y |  |
| Apple | Y |  |
| Samsung | Y |  |
| OPPO | Y | Same view as Intel and QC above. |
| Ericsson | Y, but | We agree with Intel and Qualcomm. Though the clarification as such may be ok to be pursued if majority prefers to have it. |
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**Clarifications on multi-TRP configuration for DAPS:**

In R2-2203488, the following proposals are made to clarify the mTRP restriction on DAPS:

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| We think it is worth to figure out the detailed configuration so that the network is clear on the restrictions, and our suggestions are as below (details can be found in section 5.3):   |  |  |  | | --- | --- | --- | | **Feature** | **Configurations** | **Note** | | Multi-DCI based multi-TRP | *coresetPoolIndex-r16* in *ControlResourceSet* | RRC configuration  (defined in TS 38.331) | | TDM/FDM based Single-DCI based multi-TRP | *repetitionSchemeConfig-r16/ repetitionSchemeConfig-v1630* in *PDSCH-Config* | RRC configuration  (defined in TS 38.331) | | SDM based Single-DCI based multi-TRP | Enhanced TCI States Activation/Deactivation for UE-specific PDSCH MAC CE | MAC configuration  (defined in section 6.1.3.24 in TS 38.321) |   **Proposal 5: For DAPS configuration, the terminology multi-DCI/single-DCI based multi-TRP refers to the following definitions:**  **- Multi-DCI based multi-TRP: configured via the coresetPoolIndex-r16 IE in the ControlResourceSet IE**  **- TDM/FDM based Single-DCI based multi-TRP: configured via the repetitionSchemeConfig-r16/repetitionSchemeConfig-v1630 IE in the PDSCH-Config IE**  **- SDM based Single-DCI based multi-TRP: configured via the enhanced TCI States Activation/Deactivation for UE-specific PDSCH MAC CE, as specified in TS 38.321** |

**Question 3-4: Whether the following proposal can be agreeable?**

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| **Proposal 5: For DAPS configuration, the terminology multi-DCI/single-DCI based multi-TRP refers to the following definitions:**  **- Multi-DCI based multi-TRP: configured via the coresetPoolIndex-r16 IE in the ControlResourceSet IE**  **- TDM/FDM based Single-DCI based multi-TRP: configured via the repetitionSchemeConfig-r16/repetitionSchemeConfig-v1630 IE in the PDSCH-Config IE**  **- SDM based Single-DCI based multi-TRP: configured via the enhanced TCI States Activation/Deactivation for UE-specific PDSCH MAC CE, as specified in TS 38.321** |

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| **Company** | **Y or N** | **Additional comments** |
| Intel | Probably No | This is not related to UE capability, but more about DAPS configuration. It would be better to discuss this as part of RRC configuration discussion. |
| Qualcomm Incorporated | No | We would rely on the stage-2 (38.300) description for multi-TRP (section 6.12) and nothing more. If there is an ambiguity, the stage-2 text should be clarified.  [Huawei2] Yes, stage-2 does capture DCI/TRP description, but it is about stage-2. It is too general so that it is not enough for network to check “**multi-DCI/single-DCI based multi-TRP**” configurations. For example, for the highlighted parts, PHY/MAC/RRC layers are involved, so it is quite confusing how the network does the DAPS configuration while considering the DCI/TRP restrictions. 6.12 Multiple Transmit/Receive Point Operation In Multiple Transmit/Receive Point (multi-TRP) operation, a serving cell can schedule UE from two TRPs, providing better PDSCH coverage, reliability and/or data rates.  There are two different operation modes for multi-TRP: single-DCI and multi-DCI. For both modes, control of uplink and downlink operation can be done by physical layer and MAC layer, within the configuration provided by the RRC layer. In single-DCI mode, UE is scheduled by the same DCI for both TRPs and in multi-DCI mode, UE is scheduled by independent DCIs from each TRP. |
| Huawei, HiSilicon | Y | Proponent.  The proposal mentioned in Q3-4 is following the following agreements made at RAN2#116-e meeting:  **[012] Postpone the discussion on the wording ”multi-DCI/single-DCI based multi-TRP are not configured in any DL BWP” for DAPS.**  At RAN2#116-e meeting, even if more companies provided preferences (e.g. RRC configuration), few companies showed the detailed configuration. The ambiguity of the wording ”multi-DCI/single-DCI based multi-TRP are not configured in any DL BWP” will lead to configuration failure for DAPS, which is a critical issue.  We would like to mention that firstly this discussion is important for both network side and UE side, especially for network side. Secondly, the above proposal is just our understanding based on previous RAN2 progress, and if companies have other opinions, please provide your concrete suggestions or the concrete spec text so that the network can clearly do the DAPS configuration. Thirdly, if RAN2 can reach some consensuses on the configuration, it is not only beneficial for DAPS configuration, but also for other features if DCI/TRP configuration is also used.  In general, we think RAN2 should have clear understandings on the configuration, and whether to make some clarifications in specs is the 2nd step. |
| ZTE(Mengjie) | Y, but | The explanation of mTRP configuration is aligned with our understanding. We also think it’s fine to reach some common understanding at RAN2, e.g. record something in the chairman note to avoid non-consistent understanding among companies. But no need to change the current spec about DAPS since the clarification is mainly about the mTRP definition (not for DAPS). If no consensus is reached at RAN2, perhaps we can ask RAN1 to check the mTRP configuration and decide whether need to clarify it in RAN1 spec, or in stage-2 spec (38.300, where mTRP is defined). |
| Nokia | No | We agree this should be clear from Stage-2 description. If this is about RRC configuration discussion, we need a separate discussion for that and more time for checking. |
| Apple | No | Stage-2 description is clear |
| Samsung | Agree to need clarification, but | At least, the clarification would be helpful to understand the multi-DCI/single-DCI based mTRP. On the other hand, it’s not UE capability issue. |
| OPPO | See comment | As commented by companies above, seems it is more proper to reach consensus in other spec/context other than DAPS capability. |
| Ericsson | No | We agree with QC. |
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# Miscellaneous updates on TR38.822

The CR [4] has the following reason for change:

Updates the feature list tables in TS38.822 based on the following:

* R2-2109178 Miscellaneous corrections to 38.306
* R4-2118537 R4 feature list – The corresponding 38.306/331 CRs are already agreed in R2-2111502 and R2-2111503 on TX diversity
* R1-2112777 R1 feature list

**Q5 Do companies agree with the proposed changes in the CR? For companies agreeing to the proposed changes, please also comment on the contents of the CR, if any.**

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| **Company** | **Yes/No** | **Comments** |
| Intel | Yes |  |
| Lenovo | Partly | The following corrections should be made:   * Cover page: the latest R4 feature list R4-2118537 should be added. * 5.3.12: in new FG 2-21 in the column “Parent IE in TS 38.331” change “RF-Parameters” to “BandNR”. * Remove grey background from the capabilities in 2-20, 2-21, 2-21 (RAN2). * Renumber “2-21 (RAN2)”, “2-22 (RAN2)” to “2-22 (RAN2)”, “2-23 (RAN2)”. |
| Qualcomm Incorporated | Yes |  |
| ZTE(Wenting) | Yes |  |
| Huawei, HiSilicon | Yes |  |
| Nokia | Yes |  |
| Apple | Yes |  |
| Samsung | Yes |  |
| OPPO | Yes |  |
| Ericsson | Yes |  |

# Rename of field extendedBand-n77

The CR [6] has the following reason for change:

* Field extendedBand-n77 has the suffix of r16 based on RP decision (RP-212598). After the ASN.1 frozen for the release, the suffix should use the version number (i.e. v1660, not r16 in this case) to track when the change occurs.

**Q6-1 Do companies agree with the proposed changes in the CR? For companies agreeing to the proposed changes, please also comment on the contents of the CR, if any.**

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| **Company** | **Yes/No** | **Comments** |
| Intel | No | As the field is not a non-critical extension of an existing field, the suffix of ‘-r16’ should be used. |
| Lenovo | No | Agree with Intel |
| Qualcomm Incorporated | No | Agree with the comments above. |
| ZTE |  | We don’t have strong view on this, our understanding is that the modification in this CR is aligned with some other places, so it’s acceptable to us. |
| Huawei, HiSilicon | No | Agree with Intel. |
| Apple | No | Same view as Intel |
| Samsung | Yes | In our understanding, version number and release number has their own use cases, and for this case, our proposal seems to be correct. But we are ok to ask to the RRC rapporteur on this. |
| OPPO | No |  |
| Ericsson | No | Agree with Intel. |
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The CR [5] has the following reason for change:

* Field extendedBand-n77 has the suffix of r16 based on RP decision (RP-212597). However suffix is not specified in TS 38.306 unless it has to be distinguished explicitly.

As TS38.306 rapporteur point of view, unlike in TS38.331, suffix of a release (e.g. xxxx-r16) is included in field name in the field description to allow fast knowledge of the release of a UE capability. Hence the change is not correct.

**Q6-2 Do companies agree with the proposed changes in the CR? For companies agreeing to the proposed changes, please also comment on the contents of the CR, if any.**

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| **Company** | **Yes/No** | **Comments** |
| Intel | No | Agree with the rapporteur. The actual field name should be the same as the TS38.331 including the suffix. |
| Lenovo | No | Agree with rapporteur |
| Qualcomm Incorporated | No | Agree with the comments above. |
| ZTE |  | See above Q6-1 |
| Huawei, HiSilicon | No |  |
| Apple | No |  |
| Samsung | Yes | In principle, suffix is not used in 38.306 or field description. |
| OPPO | No |  |
| Ericsson | No | Agree with the rapporteur. |
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# Conclusion

To be added latter

# References

[1] R2-2202195 Left issues on DAPS capability OPPO discussion Rel-16 NR\_Mob\_enh-Core

[2] R2-2202293 Correction on DAPS capability OPPO CR Rel-16 38.306 16.7.0 0677 - F NR\_Mob\_enh-Core

[3] R2-2203488 Discussion on DAPS capabilities and configuration Huawei, HiSilicon discussion Rel-15 NR\_newRAT-Core

[4] R2-2202665 Miscellaneous updates on TR38.822 Intel Corporation CR Rel-16 38.822 16.2.0 0009 - F NR\_pos-Core, NR\_RF\_TxD-Core, NR\_unlic-Core, NR\_IAB-Core

[5] R2-2203163 Rename of field extendedBand-n77 Samsung R&D Institute UK CR Rel-16 38.306 16.7.0 0691 - D NR\_RF\_FR1-Core

[6] R2-2203167 Rename of field extendedBand-n77 Samsung R&D Institute UK CR Rel-16 38.331 16.7.0 2931 - D NR\_RF\_FR1-Core

[7] R2-2202107 LS on updated Rel-16 RAN1 UE features lists for NR after RAN1#107-e (R1-2112778; contact: NTT DOCOMO) RAN1 LS in Rel-16 To:RAN2 Cc:RAN4

[8] R2-2202146 LS on Rel-16 updated RAN4 UE features lists for LTE and NR (R4-2118536; contact: CMCC) RAN4 LS in Rel-16 To:RAN2 Cc:RAN1