3GPP TSG RAN WG2 Meeting #111-e R2-200xxxx

**Electronic meeting,** **17th – 28th August 2020**

**Agenda item:** x.x.x

**Source:** Intel Corporation, NTT DoCoMo

**Title:** Report of email discussion [Post109bis-e][082] UE Capabilties

**Document for:**  Discussion and decision

# Introduction

This contribution is to progress some of the general open issues that were left over from the previous email discussion from the last meeting as listed in the RILs in [1] and [2] as part of the email discussion below:

* [Post110-e][082][NR16] UE Capabilities (Intel, NTT Docomo)

      Scope: Progress further R1R4 UE capabilities and general items (if needed). Take into account latest R1 feature list. Discuss handling of FFS’es at next meeting. Can consider Reply LSes (to R4 and R1), e.g. on general matters or on specific points/questions from earlier discussion.

      Intended outcome: Report, Agreeable LSs out to be sent first day of next meeting (if applicable), Draft CRs 38306 38331 (agreeable as baseline for next meeting).

      Deadline: Next meeting.

The outcome is to provide proposals on the general open issues discussed and to provide Reply LS to RAN1 or RAN4 (if needed) for some of the open issues based on the proposals from the discussion points.

Also as part of the email discussion, a draft CRs for 38.306 and 38.331 will also be produced for review based on the latest RAN1 feature list [3] once the June version specifications are available and ASN.1 RIL will be used for collecting review comments on the newly added capabilities as well as any miscellaneous corrections on Rel-16 capabilities added in the previous email discussion.

UL capabilities related to LPP (i.e. updates to TS37.355) will not be handled in this email discussion and are assumed to be handled in positioning session.

V2X UE capability issues will all be discussed in email discussion [707], including all the remaining issues from the last email discussion.

The deadline of this email discussion is into the next meeting, however we suggest having 2 phases:

* Phase 1 until 2020-07-31 23:59 PST for companies to provide their views on the discussion points listed and the drafted CRs to 38.306 and 38.331.
* Phase 2 until 2020-08-06 23:59 PST for companies to provide their views on the updated CRs and the draft LSes.

# Discussion

## Handling of FFS’es at next meeting

It is assumed that further update of RAN1/RAN4 feature list will be made available at the end of week 1 of RAN2 meeting. Hence it can be handled in the same way as in the last meeting to include the further updates to the mega CRs. If there are still FFS’es in the further updates from RAN1/4, the same as in last meeting can be follow that they will not be included in the mega CRs.

**Potential Proposal 1:** Upon receiving further update of RAN1/RAN4 feature list at end of week 1 of RAN 2 meeting, Intel/DCM to trigger RAN2 review of the CRs before or by Thursday of August 27th with the deadline for review and RAN2 agreement set to Wednesday of September 2nd

**Potential Proposal 2:** Include the following in a LS to RAN1/4:

* Explain to them that any content that is FFS will NOT be part of the UE capability signalling for the September specification version but could be considered in the next quarter.
* Inform them that further agreements, if any, from email discussions after their meetings cannot be part of September specification version but could be considered in the next quarter.
1. Companies are requested to provide their view on the potential proposals on how to handle FFS’es at next meeting:

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
| Apple | Agree | We have one more item to be added to the LS to RAN4. Pls see response to Q4 (discussion point 2.4). |
| OPPO | Agree with comment | For FFS issue if RAN2 can make sure about ASN.1, then such UE capability should be at least captured in 38.331 and leave FFS in the 38.306 just to make progress. |
| Huawei, HiSilicon |  | We understand from RAN plenary discussion, RAN1 and RAN4 should aim to complete the remaining FFSs in August meeting. Thus we think the LS to RAN4 should be written in a more positive way, i.e. to inform them that RAN2 expects RAN1 and RAN4 completes remaining FFSs in August. |
| Qualcomm Incorporated | Agree |  |
| Ericsson | Agree | If there are FFSs on a given feature, we do not see the point of including it in 38.331 without the corresponding 38.306 description. Essentially the capability anyway could not be used yet without its 38.306 description. And with high probability the capability signalling added to 38.331 prematurely will later require changes that are usually not doable in a backwards compatible manner.  |
|  |  |  |

## Handling of the Per UE capability with XDD and FRX differentiation

In the previous email discussion, there is the following RIL which was postponed :

**[RIL]**: E010 **[Delegate]**: Ericsson (Lian) **[WI]**: MobEnh **[Class]**:3 **[Status]**: NotAgree **[TDoc]**: None **[Proposed Conclusion]**: Rapporeur thinks this needs to be discussed separately. Pls see comments

**[Description]**: If we keep “Yes” on both xDD and FRX column, we should add such parameters per band instead, i.e. condHandover-r16, condHandoverFailure-r16 and condHandoverTwoTriggerEvents-r16.

**[Proposed Change]**: See above.

**[Comments]**:[Rapporteur] There are quite many cases in this table, that “yes” for both XDD and FRX, but not put under per Band, e.g. ***handoverLTE-5GC, etc.***

Prefer to keep as is, as per endorsed CR, the FRX-XDD differentiation needs to be discussed for other capabilities as well.

Some examples of such Rel-16 capabilities that have these issues are listed below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***condHandover-r16***Indicates whether the UE supports conditional handover including execution condition, candidate cell configuration and maximum 8 candidate cells. | UE | No | Yes | Yes |
| ***condHandoverFailure-r16***Indicates whether the UE supports conditional handover during re-establishment procedure when the selected cell is configured as candidate cell for condition handover. | UE | No | Yes | Yes |
| ***condHandoverTwoTriggerEvents-r16***Indicates whether the UE supports 2 trigger events for same execution condition. This feature is mandatory supported if the UE supports *condHandover-r16*. | UE | CY | Yes | Yes |

One proposal is to make these Rel-16 capabilities per band (instead of per UE) to resolve the issue when either XDD or FRX or both is set to ‘Yes’, as per RAN2 intention as in the LS to RAN1 [R2-2006367]:

*For release-16 UE capabilities for which both xDD and FRx differentiations are allowed, RAN2 intends to use “per band” capability signalling.*

Based on the above, the solution could be: Make those Rel-16 UE capabilities which have either XDD or FRX or both = ‘Yes’ to per band, if they are not already so.

1. Companies are requested to provide their view on the above solution or provide other suggestions:

|  |  |  |
| --- | --- | --- |
| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
| Apple | Agree | Per-band approach seems reasonable. |
| OPPO | Agree with comment | If an UE capability could be different for either XDD or FRX, then there is no any controversial issue. Therefore for those UE capability, they should still be per UE capability instead of per band. |
| Huawei, HiSilicon | Partly Agree | According to the LS sent to RAN1, the “per band” solution only applies to R16 UE capabilities for which both xDD and FRx differentiations are allowed. So those R16 UE capabilities which have either XDD or FRX = ‘Yes’ are not included.And we still suggest to analyse these UE capabilities case by case. Regarding CHO UE capabilities, it perhaps good to keep them in *MeasAndMobParameters* field. If this capability is indicated per band, the meaning is a bit unclear, does it mean the source band supports CHO for any other target band? Originally the capability is differed between FR1 and FR2, this means the UE should have the same capability for FR1 bands and FR2 bands respectively, by indicating now per band would this original requirement be fulfilled?  |
| Qualcomm Incorporated | Agree and additional comments | ***condHandover-r16*:**Given other related capabilities we have defined, *condHandoverFDD-TDD-r16* and *condHandoverFR1-FR2-r16*, our understanding is that this capability covers the following cases.* Intra-frequency CHO
* Inter-frequency CHO
	+ Intra-DD/Intra-FR/Intra-band
	+ Intra-DD/Intra-FR/Inter-band

This capability should be changed to per band capability according to the previous RAN2 agreement. Additional restriction can be added to indicate that the UE shall set the capability value consistently for all FDD-FR1 bands, all TDD-FR2 bands and all TDD-FR2 bands respectively.***condHandoverFailure-r16*:**It is not clear how this capability applies to different conditional handover cases.We think this should be per UE capability without xDD or FRx split.That is, the UE capability indicates that the UE supports the failure handling in CHO scenarios the UE supports according to *condHandoverFDD-TDD-r16, condHandoverFR1-FR2-r16* and *condHandover-r16***.*****condHandoverTwoTriggerEvents-r16*:**It is not clear how this capability applies to different conditional handover cases.We think this should be per UE capability without xDD or FRx split.That is, the UE capability indicates that the UE supports the 2 trigger events in CHO scenarios the UE supports according to *condHandoverFDD-TDD-r16, condHandoverFR1-FR2-r16* and *condHandover-r16***.**We think the same issues apply to the following CPC capabilities.* **condPSCellChange-r16**
* **condPSCellChangeFDD-TDD-r16**
* **condPSCellChangeFR1-FR2-r16**
* **condPSCellChangeTwoTriggerEvents-r16**
 |
| Ericsson | Partially agree | The per band approach is needed only for Rel-16 UE capabilities for which both xDD and FRx differentiation is allowed. For the simpler cases i.e. only xDD differentiation **or** FRx differentiation, the signalling in the corresponding xDD or FRx branch should be used.Generally, we wonder why those capabilities require any distinction by frequency range or duplex mode. It does not seem to impose any additional radio or measurement requirements. Shouldn’t this be a pure “per UE” feature? |

## Intra-frequencies DAPS related issues

RAN4 feature list has left FFS on per FS or per BC on the following capabilities. HoweverRAN2 had agreed that they are to be made per band per band combination from the RAN2 WI session in the last meeting.

| ***intraFreqAsyncDAPS-r16***Indicates whether the UE supports asynchronous DAPS handover. | Band | No | No | No |
| --- | --- | --- | --- | --- |
| ***intraFreqDAPS-r16***Indicates whether UE supports DAPS handover in source PCell and intra-frequency target PCell, e.g support of simultaneous DL reception of PDCCH and PDSCH from source and target cell. | Band | No | No | No |
| ***intraFreqDiffSCS-DAPS-r16***Indicates whether UE supports different SCS in source PCell and intra-frequency target PCell in DPAS handover. The UE can include this field only if *intraFreqDAPS-r16* is present. Otherwise, the UE does not include this field. | Band | No | No | No |
| ***intraFreqDynamicPowersharingDAPS-r16***Indicates the value of T offset (short or long) for the UE supports dynamic UL power sharing during DAPS handover between source and target cells of same FR. It is only applicable to DAPS HO in synchronous scenarios. The UE can include this field only if *intraFreqSemiStaticPowerSharingDAPS-Mode 1-r16* is present. Otherwise, the UE does not include this field. | Band | No | No | No |
| ***intraFreqMultiUL-TransmissionDAPS-r16***Indicates that the UE supports simultaneous UL transmission in source PCell and target PCell. The UE can include this field only if *intraFreqDAPS-r16* is present, and if any of *intraFreqSemiStaticPowerSharingDAPS-Mode1-r16, intraFreqSemiStaticPowerSharingDAPS-Mode2-r16* or *intraFreqDynamicPowersharingDAPS-r16* are present. Otherwise, the UE does not include this field. | Band | No | No | No |

During the email discussion, it was proposed to check with RAN4 by sending a LS to confirm that they are ok with RAN2 decision, while RAN2 keeps RAN2 agreement.

From the rapporteur point of view, it is reasonable to send a LS to RAN1/RAN4 to inform them of RAN2 decision and check their view.

1. Companies are requested to provide their view on including the above in the LS to RAN 1/4 to check their view on the RAN2 decision

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| --- | --- | --- |
| **Company’s name** | **Agree/Disagree** | **Company’s comments, if any** |
| Apple | Agree | Ok to send an LS to RAN4 to inform them. |
| OPPO | Agree  |  |
| Huawei, HiSilicon | Agree | ***DynamicPowersharingDAPS-r16*** is from RAN1 feature list, in which it is per BC. But in current spec, we specify ***intraFreqDynamicPowersharingDAPS-r16*** as per band, and ***DynamicPowersharingDAPS-r16*** as per BC for inter-frequency case. We also need to inform RAN1 about this change, as in RAN1 feature list it is per BC and if this capability is also applied to intra-frequency DAPS is not clear. The same clarifications also apply to other power sharing related UE capabilities in RAN1 feature list.RAN2 also need to mention that regarding the granularity of intra-frequency DAPS UE capability, there is a misalignment between RAN1 and RAN4, i.e. per band in RAN1 and [per FS or per BC] in RAN4. |
| Qualcomm Incorporated | Disagree | We strongly believe that the RAN2 agreement should be kept as it is. We do not see strong need of sending an LS just informing RAN2 agreement. |
| Ericsson | Agree to send the LS, but | 38.306 lists these capabilities as “per band”, whereas 38.331 implements them as “per-band-per-BC”. Capability signalling “per-band-per-BC” is not only the most heavy in terms of overhead and validation – it also seems unnecessary for this feature: –When initiating the DAPS HO, the UE anyway first deconfigures all SCells and then tunes to target PCell while holding the connection to the source PCell; only after completing the HO to the target side it sets up the SCells again. In other words, while performing a DAPS HO the UE does not use carrier aggregation. We don’t see why DAPS support would depend on whether and how carrier aggregation is configured prior or after the DAPS HO. Therefore, giving this misalignment between 38.331 and 38.306, it seems one could make this a “per-band” capability instead.  |

## Co-location indication for band combination

In the last email discussion, the following RAN4 feature is removed from the draft CRs as checking is needed on whether it is non-backward compatible:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 2-20 | support co-located scenario only for inter-band EN-DC | Indicates the inter-band EN-DC combination supported by the UE can only work at co-located scenario, and in this scenario the PSD difference between DL carriers and MRTD can be guaranteed. candidate values set: {type1, type2}type 1 UE: performance guaranteed with PSD difference between DL carriers < 6dB, and MRTD=3us (current only DC\_20\_n28 has this limitation)type 2 UE: performance guaranteed without limitation on PSD difference between DL carriers and MRTD=33us |  | Yes | N/A | If UE does not reports this capability, the performance cannot be guaranteed under inter-band non-collocated scenario. | Per band combination | N/A | FR1 only | NA | Optional |

The related RIL is also provided:

**[RIL]**: E009 **[Delegate]**: Ericsson (Lian) **[WI]**: Gen **[Class]**:3 **[Status]**: Proposal to remove this field in this version **[TDoc]**: None **[Proposed Conclusion]**: Rapporteur [Intel] proposes to handle this capability after discussion in RAN2, as the NBC as proposed by Ericsson is valid and we also cannot have BCs that are only from Rel-16 as RAN4 treats BCs as release independant.

**[Description]**: We assume that this field would be applicable to band combinations added in Rel-16, otherwise it would be non-backwards compatible. We would like to confirm this aspect.

**[Proposed Change]**:

**[Comments]**:

Such a Rel-16 extension of an inter-band EN-DC combination will not be release independent as Rel-15 gNBs and UEs will not be able use it to indicate whether the EN-DC inter-band combination is for only co-located or not.

As suggested in the RIL, one possibility is to make clear that such band combination with co-located indication can only be possible from Rel-16 (i.e. Rel-15 gNB and UE does not support/operate in such band combination with UE type indication). However, this would mean that band combination type indication can be not release independent. Use of magic sentence allowing UE and network to implement this signaling early without being fully Rel-16 compliant could also be considered.

Alternative is to introduce late critical extension for Rel-15. This will make the signaling release independent. However, it will still not be fully backward compatible since legacy gNBs will not be able to comprehend the UE type indication signaling.

If backward compatibility towards legacy gNBs is required, an alternative is to use a gNB “request”. If the UE only supports the co-located scenario for a certain inter-band EN-DC Band Combination, the UE will include these Band Combinations with co-located scenario in the reported capability only if gNB indicates it can comprehend type signalling i.e. UE will not include these Band Combinations in the list of supported band combinations when gNB cannot understand the UE type indication.

1. Companies are requested to provide their view on how to handle UE Type indication of the support of co-located only scenario for inter-band EN-DC combination

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| --- | --- |
| **Company’s name** | **Company’s comments, if any** |
| Apple | We think we can have the UE signal only type-2 and absence of this capability for inter-band EN-DC combinations would mean the UE supports type-1. Our approach is that any new restriction to be introduced, should be considered as baseline operation without signaling capability, and is associated with that feature. And UEs and NWs implementing that feature should support the baseline operation. Capability signaling is for extra options of the feature (or relaxation of restrictions).In this case, we request that RAN4 capture the type-1 restriction (of MRTD and PSD) is expected by the UEs and NWs for any inter-band EN-DC combination that gets added, and this is without any signaling support. Only for the UEs which can handle relaxed MRTD/PSD, can report this “additional” capability by signaling {type-2}. This can ensure backward compatibility as any UE or NW implementing the new combination already knows the minimum expected operation requirements. Our view is to add to the LS that is being prepared the below points:1. Explain to them that RAN2 will only add signaling for type-2 and expect type-1 as the default behaviour.
2. Request RAN4 to capture the type-1 requirement in RAN4 spec as default behaviour, and also follow this general principle for an future additions like these.
 |
| OPPO | To add a new filter is a valid approach and can resolve the backwards compatibility issue. Another alternative is to introduce a separate EN-DC band combination list. UE will report this new band combination list if it can only support co-located case, or report them in legacy band combination list otherwise. Legacy gNB will ignore them and hence no backward compatibility issue will be caused.  |
| Huawei, HiSilicon | Based on RAN4 feature list, only DC\_20\_n28 has the limitation of working at co-located scenario. Only “type1” (co-located) is supported for DC\_20\_n28 in Rel-15 (TS 38.101-3), so there is no backward compatibility issue for DC\_20\_n28. For other band combinations except for DC\_20\_n28, it seems that this UE type indication is not needed and the backward compatibility issue can be avoided.If the above understanding can be confirmed, RAN2 needs to send LS to inform RAN4 explicitly that if this new capability 2-20 is introduced, there is no backward compatibility issue for DC\_20\_n28, but backward compatibility issue exists if this UE type indication is extended to other band combinations already specified in Rel-15 (a better capability “type2” is by default supported for these band combinations). |
| Qualcomm Incorporated | We suggest RAN2 seek further guidance from RAN4.At least it should be clear what the baseline implementation of release-15 UEs is when the UE capability is not signalled (e.g. are all UEs considered type 1, type 2 or something else). |
| Ericsson | In the RAN4 feature table shown above it says “*current only DC\_20\_n28 has this limitation*”. This means that for all other existing BCs and for all future BCs for which RAN4 does not explicitly allow “type 1”, the UEs must support “type 2”, i.e., cope with any PSD and with 33µs MRTD.Since legacy networks do not have the BCS tables for the newly defined BCs (e.g. *DC\_20\_n28*), they would anyway not configure a UE accordingly. Hence, it would actually be backwards compatible to define “type 1” as incapability in the band combination. Of course, it requires a network to implement the new “type 1” incapability signalling when adding support for one of the new BCs allowing this type. A new filter suggested by OPPO can in general not ensure backwards compatibility since a new source gNB may forward such UE capabilities to a non-upgraded target gNB. Defining a new band combination list allows indeed to introduce “incapabilities” for existing band combinations. But since it increases specification and implementation complexity significantly, it should only be used as a very last resort. In this case it is not necessary.  |

## Others

Any other open issues that was left opened from the last email discussion and would need to be discussed (i.e. Class 3) can be included here

Note that any new miscellaneous or WI specific correction should be provided as RIL on the new updated mega CRs when they are sent out.

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| --- | --- |
| **Company’s name** | **Company’s comments, if any** |
| Apple | The support of async NR-DC is not part of the UE feature list from RAN1 and so it is not captured in the spec. However, RAN1 has asked for this separately in the same LS. We request that this capability be added. |
|  | 1. On Async DC and Cell Grouping for NR-DC:

We do not think it is correct understanding that this is FFS item from RAN1. RAN2 should capture LTE style cell grouping capability signalling with restriction to 5 bands. Specifically, RAN1 has requested RAN2 to introduce an FG that indicates support of asynchronous operation in RAN1 LS (R1-2003072). Meanwhile in reply LS to RAN1 (R2-2006030), RAN2 indicated it has agreed to use LTE style cell grouping capability signaling with restriction to 5 bands. And RAN1 response that “There is no additional suggestion from RAN1 for now.” in R1-2005096.1. Need clarification of the terminology “infra-FR NR-DC” in NR-DC power sharing capabilities (i.e*. intraFR-NR-DC-PwrSharingMode1-r16, intraFR-NR-DC-PwrSharingMode2-r16, intraFR-NR-DC-DynamicPwrSharing-r16* )

It may be misunderstood that only all SCells in MCG and SCG are in same FR. However according to latest 38.213, we think it also includes the case that part of SCells in MCG and SCG are from same FR (e.g. MCG has FR1 and FR2 SCell, SCG has FR1 SCells, where the power sharing can be applied to all FR1 SCells in both MCG and SCG):

|  |
| --- |
| TS38.213 Section 7.6.2[…]If a UE is configured with an MCG and a SCG using NR radio access in FR1 and/or in FR2, the UE is configured a maximum power for transmissions on the MCG by *p-NR-FR1* and/or by *p-NR-FR2* and a maximum power for transmissions on the SCG by *p-NR-FR1* and/or by *p-NR-FR2* and with an inter-CG power sharing mode by *NR-DC-PC-mode* for FR1 and/or by *NR-DC-PC-mode* for FR2. The UE determines a transmission power on the MCG and a transmission power on the SCG per frequency range. |

We suggest the following text : “infra-FR NR-DC” also includes the case that a subset of SCells of MCG and SCG are of the same frequency range”1. Dormancy capabilities, *scellDormancyWithinActiveTime-r16* and *scellDormancyOutsideActiveTime-r16*

RAN1 added the following notes to FG18-4. We propose to capture it in 38.306.

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| --- |
| One dormant BWP and one non-dormant BWP is supported per carrier.More than one non-dormant BWP per carrier is supported only if UE feature 6-3/6-4 is also supported. |

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# Report summary

*<If needed, to be updated when doing the summary>*

1. *<If needed, to be updated when doing the summary>*.

# Conclusion

The proposals captured are the following:

# References

1. R2-2005818 Release-16 UE capabilities based on RAN1, RAN4 feature lists and RAN2, CR to TS38.331
2. R2-2005817 Release-16 UE capabilities based on RAN1, RAN4 feature lists and RAN2, CR to TS38.306
3. R1-2005110 RAN1 UE features list for Rel-16 NR updated after RAN1#101-e