3GPP TSG-RAN WG2 Meeting #116 Electronic R2-210xxxx

Online, November 1st– November 12th, 2021

**Agenda item: 6.1.4.3**

**Source: OPPO**

**Title: Summary of [AT116-e][012][NR16] UE capabilities I**

**Document for: Discussion and Decision**

# 1 Introduction

This document summarizes the following offline discussion.

* [AT116-e][012][NR16] UE capabilities I (OPPO)

 Scope: Determine agreeable parts in a first phase, for agreeable parts agree on CRs. Treat [R2-2109331](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109331.zip), [R2-2109395](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109395.zip), [R2-2110563](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110563.zip), [R2-2110633](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110633.zip), [R2-2110023](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110023.zip), [R2-2110024](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110024.zip), [R2-2110420](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110420.zip), [R2-2110231](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110231.zip)

 Intended outcome: Report, Agreed CRs if applicable

 Deadline: Schedule 1

The deadline Schedule 1 for this email discussion is copied from Chair notes:

* A first round with Deadline for comments Thursday W1 Nov 4 1200 UTC to settle scope what is agreeable etc
* A Final round with Final deadline Thursday W2 Nov 11 1200 UTC. to settle details / agree CRs etc. -
* Additional check points etc if needed are defined by the Rapporteur. In case some parts of an email discussion need more time, doesn’t converge, need on-line treatment etc Rapporteur please contact chair.

This document summarizes the following contributions from Agenda Item 6.1.4.3 UE capabilities:

[1] [R2-2109331](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109331.zip) Reply LS on Two PUCCH Capability (R1-2108657; contact: Qualcomm) RAN1 LS in Rel-16 NR\_L1enh\_URLLC-Core To:RAN2 Moved from 6.1.1

[2] [R2-2109395](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109395.zip) Discussion on capability for DAPS OPPO discussion Rel-16 NR\_Mob\_enh-Core

[3] [R2-2110563](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110563.zip) Keeping or removing diffSCS-DAPS Ericsson discussion Rel-16 NR\_Mob\_enh-Core

[4] [R2-2110633](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110633.zip) Discussion on some issues for DAPS Huawei, HiSilicon discussion Rel-16 NR\_Mob\_enh-Core Moved from 6.1.4.1.1

[5] [R2-2110023](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110023.zip) Correction on R16 UE capability of supportedSINR-meas-r16 Apple CR Rel-16 38.331 16.6.0 2822 - F NR\_eMIMO-Core

[6] [R2-2110024](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110024.zip) Correction on R16 UE capability of supportedSINR-meas-r16 Apple CR Rel-16 38.306 16.6.0 0647 - F NR\_eMIMO-Core

[7] [R2-2110420](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110420.zip) Discussion on the handover delay due to SCell activation OPPO discussion Rel-16 LTE\_NR\_DC\_CA\_enh

[8] [R2-2110231](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110231.zip) Add the missing capabilities for SON and MDT CMCC CR Rel-16 38.822 16.1.0 0007 - B NR\_SON\_MDT-Core

# 2 Contact from companies

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# 3 Discussion

## 3.1 Two PUCCH capablitiy

This topic is from the following contribution.

[R2-2109331](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109331.zip) Reply LS on Two PUCCH Capability (R1-2108657; contact: Qualcomm) RAN1 LS in Rel-16 NR\_L1enh\_URLLC-Core To:RAN2

RAN1 provides their feedback to the change of twoHARQ-ACK-Codebook-type1-r16 proposed by RAN2 (R2-2106681) as follows:

| ***twoHARQ-ACK-Codebook-type1-r16***<Unchanged text is omitted>NOTE 1:   If the UE indicates support of this feature and is simultaneously configured with two slot-based HARQ-ACK codebooks:* ~~whether the UE supports two PUCCH of format 0 or 2 for each HARQ-ACK codebook is subjected to the capability reported by~~ *~~twoPUCCH-F0-2-ConsecSymbols.~~*
* whether the UE supports two PUCCH of format 0 or 2 in consecutive symbols in the same slot for each HARQ-ACK codebook is subjected to the capability reported by *twoPUCCH-F0-2-ConsecSymbols.*
* whether the UE supports one PUCCH format 0 or 2 and one PUCCH format 1, 3 or 4 in the same ~~sub~~slot for each HARQ-ACK codebook is subjected to the capability reported by *onePUCCH-LongAndShortFormat*.
* whether the UE supports two PUCCH transmissions in the same ~~sub~~slot for each HARQ-ACK codebook not covered by *twoPUCCH-F0-2-ConsecSymbols* and *onePUCCH-LongAndShortFormat* is subjected to the capability reported by *twoPUCCH-AnyOthersInSlot.*
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**Question 1: Do companies think the changes provided by RAN1 are agreeable?**

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| Company | Yes or No | Comments |
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## 3.2 DAPS

This topic is from the following contributions.

[R2-2109395](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2109395.zip) Discussion on capability for DAPS OPPO discussion Rel-16 NR\_Mob\_enh-Core

[R2-2110563](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110563.zip) Keeping or removing diffSCS-DAPS Ericsson discussion Rel-16 NR\_Mob\_enh-Core

[R2-2110633](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110633.zip) Discussion on some issues for DAPS Huawei, HiSilicon discussion Rel-16 NR\_Mob\_enh-Core

**DAPS capability**

Based on 38.306, DAPS specific FSC is mandatory for DAPS capability reporting. And based on the following sentence, one can understand that each carrier-pair in the DAPS-FSC shall support DAPS, without any condition on scenario (intra/inter-frequency) and UE capability for the related scenarios.

| ***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*. | BC | N/A | N/A | N/A |
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For intra-frequency DAPS, according to the description as highlighted, one interpretation could be that the capability for source/target cell can be derived based on the capability reported for a **pair** of CC entries. While as also defined in TS 38.306, it seems that at least for bandwidth, another interpretation can be this capability is to be derived based on the **single** CC entry. Thus, clarification is needed.

| ***supportedBandwidthDL***Indicates maximum DL channel bandwidth supported for a given SCS that UE supports within a single CC (and in case of intra-frequency DAPS handover for the source and target cells), which is defined in Table 5.3.5-1 in TS 38.101-1 [2] for FR1 and Table 5.3.5-1 in TS 38.101-2 [3] for FR2.[…] | FSPC | CY | N/A | N/A |
| --- | --- | --- | --- | --- |
| ***supportedBandwidthUL***Indicates maximum UL channel bandwidth supported for a given SCS that UE supports within a single CC (and in case of intra-frequency DAPS handover for the source and target cells), which is defined in Table 5.3.5-1 in TS38.101-1 [2] for FR1 and Table 5.3.5-1 in TS 38.101-2 [3] for FR2.[…] | FSPC | CY | N/A | N/A |

As proposed in 9395 P1 below

P1: RAN2 clarify for intra-frequency DAPS HO, the source/target cell capability is to be derived based on 1) a same per-CC feature-set ID or 2) a pair of per-CC feature-set ID.

Furthermore, besides intra-frequency case, as clarified in 9395, another question seems whether the sentence above needs to be clarified to differentiate between intra-/inter-frequency support cases,

1. for intra-frequency DAPS, regardless of either a single or a pair of per-CC feature-set ID to be used, it is limited to a single band-entry
2. for inter-frequency DAPS, the pair of per-CC feature-set ID come from different band-entries

**Question 2a: How to derive the capability for source/target cell in intra-frequency DAPS handover:**

**Option1: based on a same per-CC feature-set ID**

**Option2: based on a pair of per-CC feature-set ID in the same band-entry**

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| Company | Option1/2 | Comments |
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**Question 2b: For the capability for source/target cell in inter-frequency DAPS handover, should it be derived from a pair of per-CC feature-set ID in different band-entries?**

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For **inter**-frequency DAPS handover, the following case seems not clear whether supported or not, i.e.,the BW is **overlapping** between source and target cell which is shown as follows:



Questions is raised on whether this configuration is supported, and if it is supported, how to determine the capability for anchor/target cell?

P3: RAN2 clarify whether inter-frequency DAPS HO with overlapping BW between source and target cell is supported or not. If hard to confirm in RAN2, send LS to RAN1/4 to ask. If confirmed to be supported, RAN2 confirm the source/target cell capability in this case is derived based on a pair of per-CC feature-set ID for a same band entry.

**Question 3: Whether inter-frequency DAPS HO with overlapping BW between source and target cell (as shown in the figure above) is supported or not?**

**Option-1: Yes**

**Option-2: No**

**Option-3: Send LS to RAN1/4 to ask**

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| Company | Option-1/2/3 | Comments |
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**Question 4: If the answer of Q3 is yes, how to derive the capability for source/target cell in inter-frequency handover with overlapping BW?**

**Option1: a single per-CC feature-set ID**

**Option2: a pair of per-CC feature-set ID for a same band entry**

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| Company | Option1/Option2 | Comments |
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Regrading the configuration of BW for source and target cells, 9395 propose to clarify whether legacy BCS and and frequency separation is applicable for intra-frequency DAPS handover and inter-frequency DAPS handover with overlapping BW.

P4: RAN2 clarify for intra-frequency DAPS HO, and inter-frequency DAPS HO where the BW of source and target cells are overlapping with each other (if concluded as supported by P3), the legacy reported field of frequency-separation and BCS is NOT applicable.

**Question 5a: Do companies agree that the legacy reported field of 1) frequency-separation and 2) BCS is not applicable for intra-frequency DAPS handover?**

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**Question 5b: If Yes to Q3, do companies agree that the legacy reported field of 1) frequency-separation and 2) BCS is not applicable for inter-frequency DAPS handover with overlapping BW?**

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For BW-class, due to the 331 clarification below

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| *FeatureSetDownlink* field descriptions |
| ***featureSetListPerDownlinkCC***Indicates which features the UE supports on the individual DL carriers of the feature set (and hence of a band entry that refer to the feature set). The UE shall hence include at least as many *FeatureSetDownlinkPerCC-Id* in this list as the number of carriers it supports according to the *ca-BandwidthClassDL*, except if indicating additional functionality by reducing the number of *FeatureSetDownlinkPerCC-Id* in the feature set (see NOTE 1 in *FeatureSetCombination* IE description). The order of the elements in this list is not relevant, i.e., the network may configure any of the carriers in accordance with any of the *FeatureSetDownlinkPerCC-Id* in this list. |

It means even for class-A, there could be more than 1 per-CC FS ID. So

* If the class is higher than A (e.g., B, C..), it is not questionable that the per-CC FS IDs in the band-entry support intra and inter-frequency DAPS, at least in the shape of intra-band continuous manner, and maybe case-3 as well.
* Or if the class is A, not sure if the per-CC FS IDs in the band-entry support intra-frequency DAPS only.

So 9395 proposes to clarify

Proposal 5 RAN2 confirm if the reported BW-class for a band-entry is A, the per-CC feature-set IDs associated with this band entry only support intra-frequency DAPS HO, otherwise support inter-frequency DAPS HO as well (i.e., for BW-class B/C/…).

**Question 6a Do companies agree: if the reported BW-class for a band-entry is A, the per-CC feature-set IDs associated with this band entry only used to derive intra-frequency DAPS HO capability (in case supported as reported via intraFreqDAPS-r16), but cannot be used to derive inter-frequency DAPS capability for the corresponding band entry (if supported as reported via interFreqDAPS-r16)?**

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| Company | Yes or no | Comments |
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For the inter-frequency DAPS **without** overlapping between source and target cells, 9397 propose to confirm the following

P7: RAN2 for inter-frequency DAPS HO cases where the BW of source and target cells are not overlapping with each other, the BW-class, frequency-separation and BCS restriction reported in the same BC-entry is applicable to both non-DAPS FSC and DAPS FSC.

**Question 6b Do companies agree 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 both non-DAPS FSC and DAPS FSC?**

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**Keep of diffSCS-DAPS**

RAN4 requested in R4-2016850 to add the diffSCS-DAPS capability bits which are defined as follows:

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| *interFreqDiffSCS-DAPS-r16* indicates whether the UE supports different SCSs in source PCell and inter-frequency target PCell in DAPS handover. The UE only includes this field if different SCSs can be supported in both UL and DL. If absent, the UE does not support either UL or DL SCS being different in DAPS handover. |
| *intraFreqDiffSCS-DAPS-r16* indicates whether the UE supports different SCSs in source PCell and intra-frequency target PCell in DAPS handover. The UE only includes this field if different SCSs can be supported in both UL and DL. If absent, the UE does not support either UL or DL SCS being different in DAPS handover. |

RAN2 discussed last time whether to remove these capability bits while the decision is postponed. Some companies think they do not provide additional information considering it is already clear which SCS can be supported for UL and DL transmission of a DAPS pair. In [R2-2110563](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110563.zip), it is proposed to keep diffSCS-DAPS capabilitiy bits, i.e., interFreqDiffSCS-DAPS-r16 and intraFreqDiffSCS-DAPS-r16 unless requested by RAN4. [R2-2110633](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110633.zip) proposes to add a clarification that “In this release the UE shall not report this UE capablity”.

**Question 7: Do companies agree to keep the diffSCS-DAPS capability bits?**

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| Company | Yes or No | Comments |
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**Question 8: If the answer of Q7 is yes, do companies agree to add the clarification sentence “In this release the UE shall not report this UE capablity” ?**

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**DAPS definition on feature combination**

In current 38.331, daps-Config-r16 is defined in the RadioBearerConfig IE, and the condition DAPS is described as below:

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| **Conditional Presence** | **Explanation** |
| *[partially omitted]* |  |
| *DAPS* | The field is optionally present, need N, in case masterCellGroup includes ReconfigurationWithSync, SCell(s) and SCG are not configured, multi-DCI/single-DCI based multi-TRP are not configured in any DL BWP, *supplementaryUplink* is not configured, ethernetHeaderCompression is not configured for the DRB, *conditionalReconfiguration* for CHO is not configured, and NR sidelink and V2X sidelink are not configured. Otherwise the field is absent. |

[R2-2110633](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110633.zip) thinks there is ambiguity in the description as highlighted. One understanding of the sentence is ‘multi-DCI multi-TRP, and single-DCI multi-TRP’, and the other understanding is ‘multi-DCI (single or multi TRP), and single-DCI multi-TRP’. As RAN2 has already agreed, DAPS can not be configured simultaneously with multi-TRP, RAN2 is ask to check whether companies share the same view that the highlighted sentence has captured the agreement well.

**Question 9: Companies is ask to confirm whether ‘multi-DCI/single-DCI based multi-TRP’ is interpreted as ‘multi-DCI multi-TRP and single-DCI multi-TRP’ ?**

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Considering multi-DCI multi-TRP is based on RRC signalling, but single-DCI multi-TRP can be controlled by MAC CE, another ambuiguity observed in [R2-2110633](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110633.zip) regards to the configuration of single-DCI based multi-TRP. Theythe wording ”multi-DCI/single-DCI based multi-TRP are not configured in any DL BWP” in TS 38.331 seems only refer to RRC configuration.

**Question 10: Do companies think there is ambiguity in ‘multi-DCI/single-DCI based multi-TRP are not configured in any DL BWP’, i.e., it only refers to RRC configuration ?**

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**Question 11: If the answer of Q10 is yes, how to clarify it in specification?**

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## 3.3 eMIMO

This topic is from the following contributions.

[R2-2110023](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110023.zip) Correction on R16 UE capability of supportedSINR-meas-r16 Apple CR Rel-16 38.331 16.6.0 2822 - F NR\_eMIMO-Core

[R2-2110024](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110024.zip) Correction on R16 UE capability of supportedSINR-meas-r16 Apple CR Rel-16 38.306 16.6.0 0647 - F NR\_eMIMO-Core

Referring to contributions above, the following observations and changes are proposed:

For R16 capability of the supportedSINR-meas-r16, current RAN2 RRC spec is not aligned with the RAN1 R16 feature list and the description in TS 38.822. In RRC spec, the capability of the supportedSINR-meas-r16 is defined in ENUMERATED type while it is defined in BITMAP type in TS38.822 and RAN1 feature list. The problem of using “ ENUMERATED” to indicate the capability is that UE cannot indicate more than one case, e.g. support of both csi-RSWithoutIMR and ssbWithNZP-IMR.

Based on the reason above, it is proposed to introduce new capability parameter supportedSINR-meas-v16xy to indicate the “BITMAP” type capability, and the description of each bit is provided in TS38.306.

**Question 12: Do companies agree with the issue and if yes, are the suggested CRs agreeable?**

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## 3.4 DCCA

This topic is from the following contributions.

[R2-2110420](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110420.zip) Discussion on the handover delay due to SCell activation OPPO discussion Rel-16 LTE\_NR\_DC\_CA\_enh

In this contribution, it is observed that handover delay would be increased due to the SCell activation indication in RRCReconfiguration message including reconfigurationWithSync:

* Compared RRC reconfiguration, the RRC processing delay is increased by 6ms for RRC reconfiguration with SCell addition/release indication.
* Delays at physical layers will also increase since it needs to make it ready for CSI report transmission and other actions of activated SCell.

UE shall always perform SCell activation at handover if it is indicated since no capability field is defined for this case in TS 38.306. Note that there is capbality defined to indicate whether to support SCell activation in RRC resume procedure. Therefore, it is propose to introduce a UE capability, which is used to indicate whether SCell activation during handover is supported by UE.

**Question 13: Do companies agree to introduce a new capability parameter to indicate whether SCell activation during handover is supported by UE?**

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## 3.5 MDT

This topic is from the following contribution.

[R2-2110231](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110231.zip) Add the missing capabilities for SON and MDT CMCC CR Rel-16 38.822 16.1.0 0007 - B NR\_SON\_MDT-Core

In RAN2#108 meeting, the following agreements on UE capability were agreed:

*Agreements:*

*Location related capability:*

*locationReport is mandatory supported without UE capability, i.e. if location information is available, UE shall include location information while performing MDT.*

*SON related capability:*

*CEF reporting and RLF reporting are mandatory supported without UE capability, same as LTE.*

From the agreement, it is clear that RAN2 agree that locationReport, CEF reporting and RLF reporting are mandatory supported without UE capability signalling. However, these capabilities are missing in TR 38.822 and it is proposed in [R2-2110231](file:///D%3A%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2%5CTSGR2_116-e%5CDocs%5CR2-2110231.zip) to fix it.

**Question 14: Do companies agree to add the following mandatory capabilities for NR SON and MDT feature in TS 38.822?**

|  |  |  |
| --- | --- | --- |
| Company | Yes or No | Comments |
|  |  |  |
|  |  |  |
|  |  |  |
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|  |  |  |
|  |  |  |

# 4 Conclusion

TBD.