3GPP TSG-RAN WG3 #114-e R3-215818
Online, 1-11 November 2021

Agenda Item: 8.1

Source: Ericsson (moderator)

Title: CB: # 13\_RACS

Document for: Discussion

# Introduction

**CB: # 13\_RACS**

**- Update NGAP to clarify the AMF behaviour, upon the reception of the optional UE Radio Capability for Paging of NR IE and the UE Radio Capability for Paging of E-UTRA IE? Introduce the UE Radio Capability for Paging encoded in TS 38.331 format in the S1AP UE CAPABILITY INFO INDICATION message? Nok**

**- For TS 36.413, add the NR format of the UE Radio Capability for Paging in the UE CAPABILITY INFO INDICATION message? Add the UE radio capability ID in S1: Paging, NG: Paging, and Xn RAN Paging messages? Include the UE radio capability for paging in the NG: UE RADIO CAPABILITY ID MAPPING RESPONSE message? HW**

**- Add a new UE Radio Capability for Paging for NR IE in the UE CAPABILITY INFO INDICATION message? E///**

**- Reply LS to SA2 if needed**

# To the chair’s notes (Draft)

**R3-216086 revision of R3-215335 (adding E///, Hw, Deutsche Telekom, Qualcomm Incorporated co-signers) agreed**

**R3-216087 revision of R3-215336 (adding E///, Hw,** **Deutsche Telekom, Qualcomm Incorporated co-signers) agreed**

# Introduction

RAN3 received a LS from SA2 [1] in which a set of agreed CRs is attached that introduce the storage of the UE Radio Capability For Paging (URCFP) in the UCMF, so that the UE Radio Capability ID a UE provides is sufficient for the MME and AMF to also obtain these from the UCMF, without requiring the upload of the Radio capabilities and related URCFP from the RAN.

SA2 then asks RAN3, CT4, CT to

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| **To RAN3, CT4, CT:****ACTION:** Please take these CRs into account for any impact they might have on the specifications under your responsibility and provide any feedback if necessary. |

# Discussion

## Addition of URCFP – NR format- to S1-AP

A common point that emerges from all companies’ proposals is the addition of a new URCFP IE encoded in TS 38.331 format (***UE Radio Capability for Paging – NR Format*** IE) in the S1AP UE CAPABILITY INFO INDICATION message.

Taking as examples the proposal from [4] and merging the procedural text from [4], [7] and [13], it is proposed to discuss the addition of the IE to S1-AP and whether there are any details regarding the procedural text and the encoding of the IE (presence, tabular description, asn.1, etc.) that need to be discussed.

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| 8.9.2 Successful Operation**Figure 8.9.2-1: UE Capability Info Indication procedure. Successful operation.**The eNB controlling a UE-associated logical S1-connection initiates the procedure by sending a UE CAPABILITY INFO INDICATION message to the MME including the UE capability information. The UE CAPABILITY INFO INDICATION message may also include paging specific UE capability information within the *UE Radio Capability for Paging* IE and within the *UE Radio Capability for Paging – NR Format* IE. The UE capability information received by the MME shall replace previously stored corresponding UE capability information in the MME for the UE, as described in TS 23.401 [11]. If UE CAPABILITY INFO INDICATION message contains the *LTE-M indication* IE, the MME shall, if supported, store this information in the UE context and use it according to TS 23.401 [11].If the UE indicates the support for UE Application Layer Measurement, the eNB shall if supported include the UE Application Layer Measurement Capability IE in the UE CAPABILITY INFO INDICATION message. The MME shall, if supported, store and use thie information when initiating UE Application Layer Measurement.If UE CAPABILITY INFO INDICATION message contains the *UE Radio Capability – NR Format* IE, the MME shall, if supported, use it according to TS 23.401 [11].If the UE RADIO CAPABILITY INFO INDICATION message contains the *UE Radio Capability for Paging* IE and the *UE Radio Capability for Paging – NR Format* IE, the MME shall, if supported, use it according to TS 23.401 [11]. |

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| 9.2.1.x UE Radio Capability for Paging – NR FormatThis IE contains paging specific UE Radio Capability information encoded as specified in TS 38.331 [50] in order to support Mode of operation A as specified in TS 23.401 [11].

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| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
| UE Radio Capability for Paging – NR Format | M |  | OCTET STRING | Includes the RRC *UERadioPagingInformation* message as defined in TS 38.331 [50]. |

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* **Do companies have any consideration on the above changes to S1-AP: procedural ext and encoding of the new IE?**

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| **Company** | **Comment** |
| Ericsson | First of all, we realize that the new IE should have a “Conditional” presence in the UE CAPABILITY INFO INDICATION message, because the IE must come together with the E-UTRA URCfP IE. Otherwise, it would be possible for an eNB to signal the URCFP for NR but not the URCFP for E-UTRA. This creates issue as NR connected to EPC is not a supported deployment in 3GPP. (Note that there is no issue with URC, as the E-UTRA IE has a M presence, while the NR URCP is Optional)Otherwise, we think that just the first text change is sufficient, and there is no need for the second added sentence at the end, since we already have the TS 23.401 reference in the legacy text and the IE tabular description further clarifies the use of the IE (to support Mode A operation). |
| Nokia | For changes in 8.9.2, Stage-3 defines the behavior from receiver side. The 1st change is not needed. (We understand this is copied from S1AP spec) First, we do not need to define when the eNB includes both in 36.413 (actually, the SA2 spec defined it). Second, it may cause confusion that eNB may have to always include both. The 2nd change actually address the “conditional” presence, since it only defines the case when both IEs are included in the message. So we prefer to only keep the 2nd change.  |
| Huawei | First about the “conditional” presence, indeed this new IE is signalled together with the legacy *UE Radio Capability for Paging* IE in case of mode A. About the procedure texts, given that TS 23.401 is referenced, there are no big differences about these two options. And we can even have 3rd option to have only procedure texts for the new IE (in 5396). If UE CAPABILITY INFO INDICATION message contains the *UE Radio Capability for Paging – NR Format* IE, the MME shall, if supported, use it according to TS 23.401 [11].We may slightly prefer to have the 2nd change or the option 3 above.  |
| ZTE | We also slightly prefer to have the second change. |
| Deutsche Telekom | We also have a preference for the 2nd change. |
| Samsung | We prefer keeping only the 2nd change. The text with the 1st change describes the paging related operation in the EPS. So the 1st change seems not be proper. |
| CATT | We are fine to have the 2nd change, and the new IE should be conditional. |
| **Moderator’s conclusion:*** Most companies prefer the procedural text in R3-215336
* It is acknowledged that the new IE should have a Conditional presence on the presence of the E-UTRA *UE Radio Capability for Paging* IE.
* **Conclusion: R3-215336 is revised to change the *UE Radio Capability for Paging – NR Format* IE presence to "C"**
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## AMF behaviour

It is proposed in [3] to update NGAP to clarify the AMF behaviour, upon the reception of the optional URCFP for NR IE **and** the URCFP for E-UTRA IE in the UE CAPABILITY INFO INDICATION message as below:

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| 8.14.1.2 Successful Operation**Figure 8.14.1.2-1: UE radio capability info indication**The NG-RAN node controlling a UE-associated logical NG connection initiates the procedure by sending a UE RADIO CAPABILITY INFO INDICATION message to the AMF including the UE radio capability information.The UE RADIO CAPABILITY INFO INDICATION message may also include paging specific UE radio capability information within the *UE Radio Capability for Paging* IE. If the *UE Radio Capability for Paging* IE includes the *UE Radio Capability for Paging of NR* IE and the *UE Radio Capability for Paging of E-UTRA* IE, the AMF shall, if supported, use it as specified in TS 23.501 [9].The UE radio capability information received by the AMF shall replace previously stored corresponding UE radio capability information in the AMF for the UE, as described in TS 23.501 [9].If the UE RADIO CAPABILITY INFO INDICATION message includes the *UE Radio Capability – E-UTRA Format* IE, the AMF shall, if supported, use it as specified in TS 23.501 [9]. |

* **Do companies have any view on this procedural text addition?**

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| **Company** | **Comment** |
| Ericsson | A proposed rewording is to replace the second “includes” by “contains” to avoid repetition |
| Nokia | Agree with Ericsson comments.  |
| Huawei | Ok to have. But there are already procedure texts on the “*UE Radio Capability for Paging*” above. It is better to update the existing texts, or move the new sentence with existing one.  |
| ZTE | Agree with suggestion from E/// |
| Deutsche Telekom | Fine with Ericsson’s comment. |
| Samsung | Agee with Ericsson comment. |
| CATT | Agree with Ericsson’s comment. |
| **Moderator’s conclusion:*** Most companies agree to the NG-AP procedure text with a slight revision.
* One company proposes to have it following the existing text mentioning the *UE Radio Capability for Paging* IE.
* **Conclusion: R3-215335 is revised to capture the new procedural text as highlighted above.**
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## Addition of the UE radio capability ID in S1/NG/Xn Paging messages

In [6], it is proposed to add the UE radio capability ID in S1: Paging, NG: Paging, and Xn RAN Paging messages. This is based on the fact that when the AMF/MME has the UE radio capability ID, it can include the UE radio capability ID in the paging messages. The RAN node can either derive the URCFP directly from UE radio capability based on the UE radio capability ID if local cache is available, or lookup the URCFP directly if the local cache is available.

* **Do companies agree and have any view on the above proposal and the corresponding CRs in [7][8][9]?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson | No | We have concern that this proposal represents a costly and unnecessary optimization. If AMF only includes the UE Radio Cap ID in paging message, the NG-RAN will use it to determine the URCfP, when it is locally cached. However, if not cached in NG-RAN (an NG-RAN is not mandated to store the URCFP), then the paging procedure will get executed in a sub-optimal manner without the URCfP. Moreover, even if cached, the search the NG-RAN database may become costly depending on how big the cache is at the end…Hence, there is no real choice for the AMF but to include in the paging message the URCFP, which is technically possible from the set of agreed SA2 CRs; and providing both UE radio cap ID and URCFP provides no benefits. As the proponents even say in [6]: “Then it is easy for the AMF to include the URCFP in the NG/S1 paging messages”  |
| Nokia | No | This is not required by SA2 LS. This is a new requirement to CN (AMF/MME), and should be discussed in SA2 first. We prefer to not include it to simplify the processing in the CN and RAN. The paging procedure will be delayed and complex, e.g. in case no cached Paging capability in the RAN.  |
| Huawei | Yes | We see benefits to include the UE radio capability ID in the paging messages. First the paging message may be propagated to many RAN nodes, the signalling overhead can be reduced greatly, and the RACS gain can be fully achieved. Second, it is not correct to say that “the NG-RAN will use it to determine the URCFP, when it is locally cached”, but the RAN node can derive the URCFP directly from UE radio capability based on the UE radio capability ID if local cache is available. Note that the URFCP is generated by the RAN node, and is signalled to the CN. Therefore, there is no additional cost. Third, about the “search NG-RAN database may become costly”, this is the same procedure when the NG-RAN derives the UE radio capability in case of UE context setup. Also as analysed in 5395, this is feasible. And final words are that the RACS gain is not lost for paging procedures.  |
| ZTE | No | We also wish to simply our normative work, the optimization is not essential. |
| Deutsche Telekom | Yes | We also see the benefits on inclusion of UE Radio Cap ID in the paging messages and share Huawei’s view on it.  |
| Samsung | No | We have similar concern as other company, the eNB/gNB may not store the radio capability information mapped to the RACS ID. It would cause additional delay for RAN to retrieve the mapping information from the CN and require additional signalling. The *UE Radio Capability for Paging* IE contains some supportedBandList and other small information. So we think further optimization for the UE radio paging capability is not be needed. |
| CATT | No | This is not required by the LS, it seems like a kind of optimization.Share the similar view with companies above, as this will also impact the behavior of SA2, it should not be introduced, unless there’s clear requirement comes from SA2. |
| **Moderator’s conclusion:*** No support, [6]-[11] are noted
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## Addition of the URCFP in the NG-AP: UE RADIO CAPABILITY ID MAPPING RESPONSE message and reply LS

It is proposed in [6] to discuss the addition of the UE radio capability for paging in the NG message from AMF to RAN UE RADIO CAPABILITY ID MAPPING RESPONSE message.

* **Do companies agree and have any view on the above proposal?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson | No | Currently, we do not see the need to provide thia. To our knowledge this is not part of 502 or 501 CRs. What would be the use cases? |
| Nokia | No | This seems only needed with 4.3, e.g. when the Paging message includes an ID but no cached info in RAN, RAN initiates the mapping procedure and receive the Paging capability in the Mapping Response message.  |
| Huawei | Yes | This is related to 4.3. Note that without the proposal, including the UE radio capability ID in the paging messages could work as well.  |
| ZTE | No | Same reason as that in 4.3. |
| Deutsche Telekom | Yes | Related to 4.3. |
| Samsung | No | Same reason as that in 4.3. |
| CATT | No | It’s linked with the discussion in section 4.3. |
| **Moderator’s conclusion:*** No support, [6]-[11] are noted
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## Reply LS to SA2

* **Any need for a reply LS to SA2?**

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| **Company** | **Yes/No** | **Comment** |
| Ericsson | No | No, since we don’t have any necessary feedback |
| Nokia | Yes | Need to inform SA2 that RAN3 spec support SA2 decision.  |
| Huawei | Depends | No need if RAN3 just follows SA2 agreements (inclusion of the URCFP-NR format for S1AP). Need if RAN3 has agreements/questions related to the discussion in 4.3.  |
| ZTE | No | No need to send LS to SA2. |
| Deutsche Telekom | Depends | Share same view as Huawei. |
| Samsung |  | It would depend on the RAN3 agreements. |
| CATT | No | Not necessary to reply the LS as we just do the spec implementation following the requirement of SA2. |
| **Moderator’s conclusion:**Majority thinks a reply LS is not needed. Indeed, SA2 did not ask any particular request |

# Conclusion

* R3-215336 is revised to change the UE Radio Capability for Paging – NR Format IE presence to "C". Adding co-signers.
* R3-215335 is revised to capture the new procedural text as highlighted above. Adding co-signers.
* Other proposals noted.
* Reply LS to SA2 not agreed.

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| **RACS** |
| **[1]** | [R3-214709](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-214709.zip) | LS on the UE Radio Capability for Paging in RACS context (SA2) | LS innoted |
| **[2]** | [R3-215334](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215334.zip) | Discussion on support the UE Radio Capability for Paging in RACS context (Nokia, Nokia Shanghai Bell, Vodafone) | Discussionnoted |
| **[3]** | [R3-215335](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215335.zip) | (NGAP CR) support the UE Radio Capability for Paging in RACS context (Nokia, Nokia Shanghai Bell, Vodafone) | CR0688r, TS 38.413 v16.7.0, Rel-16, Cat. F**Revised to be agreed (adding co-signers)** |
| **[4]** | [R3-215336](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215336.zip) | (S1AP CR) support the UE Radio Capability for Paging in RACS context (Nokia, Nokia Shanghai Bell, Vodafone) | CR1840r, TS 36.413 v16.7.0, Rel-16, Cat. F**Revised to be agreed (adding co-signers)** |
| **[5]** | [R3-215337](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215337.zip) | [Draft] Reply LS on the UE Radio Capability for Paging in RACS context (Nokia) | LS out To: SA2 CC: CT4, CTnoted |
| **[6]** | [R3-215395](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215395.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | Discussionnoted |
| **[7]** | [R3-215396](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215396.zip) | UE Radio Capability for Paging in RACS context - Local transcoding (Huawei, Deutsche Telekom) | CR1842r, TS 36.413 v16.7.0, Rel-16, Cat. Fnoted |
| **[8]** | [R3-215397](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215397.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | CR0694r, TS 38.413 v16.7.0, Rel-16, Cat. Fnoted |
| **[9]** | [R3-215398](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215398.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | CR0698r, TS 38.423 v16.7.0, Rel-16, Cat. Fnoted |
| **[10]** | [R3-215399](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215399.zip) | [Draft] Reply LS on the UE Radio Capability for Paging in RACS context (Huawei) | LS out To: SA2 CC: noted |
| **[11]** | [R3-215642](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215642.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | CR1849r, TS 36.413 v16.7.0, Rel-16, Cat. Fnoted |
| **[12]** | [R3-215417](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215417.zip) | Discussion on the SA2 LS on the UE Radio Capability for Paging in RACS context (Ericsson) | Discussionnoted |
| **[13]** | [R3-215418](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215418.zip) | Addition of UE Radio Capability for Paging for NR to S1-AP (Ericsson) | CR1845r, TS 36.413 v16.7.0, Rel-16, Cat. Fnoted |

# References

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| **RACS** |
| **[1]** | [R3-214709](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-214709.zip) | LS on the UE Radio Capability for Paging in RACS context (SA2) | LS in |
| **[2]** | [R3-215334](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215334.zip) | Discussion on support the UE Radio Capability for Paging in RACS context (Nokia, Nokia Shanghai Bell, Vodafone) | discussion |
| **[3]** | [R3-215335](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215335.zip) | (NGAP CR) support the UE Radio Capability for Paging in RACS context (Nokia, Nokia Shanghai Bell, Vodafone) | CR0688r, TS 38.413 v16.7.0, Rel-16, Cat. F |
| **[4]** | [R3-215336](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215336.zip) | (S1AP CR) support the UE Radio Capability for Paging in RACS context (Nokia, Nokia Shanghai Bell, Vodafone) | CR1840r, TS 36.413 v16.7.0, Rel-16, Cat. F |
| **[5]** | [R3-215337](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215337.zip) | [Draft] Reply LS on the UE Radio Capability for Paging in RACS context (Nokia) | LS out To: SA2 CC: CT4, CT |
| **[6]** | [R3-215395](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215395.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | discussion |
| **[7]** | [R3-215396](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215396.zip) | UE Radio Capability for Paging in RACS context - Local transcoding (Huawei, Deutsche Telekom) | CR1842r, TS 36.413 v16.7.0, Rel-16, Cat. F |
| **[8]** | [R3-215397](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215397.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | CR0694r, TS 38.413 v16.7.0, Rel-16, Cat. F |
| **[9]** | [R3-215398](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215398.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | CR0698r, TS 38.423 v16.7.0, Rel-16, Cat. F |
| **[10]** | [R3-215399](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215399.zip) | [Draft] Reply LS on the UE Radio Capability for Paging in RACS context (Huawei) | LS out To: SA2 CC:  |
| **[11]** | [R3-215642](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215642.zip) | UE Radio Capability for Paging in RACS context (Huawei, Deutsche Telekom) | CR1849r, TS 36.413 v16.7.0, Rel-16, Cat. F |
| **[12]** | [R3-215417](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215417.zip) | Discussion on the SA2 LS on the UE Radio Capability for Paging in RACS context (Ericsson) | discussion |
| **[13]** | [R3-215418](file:///D%3A%5C%E4%BC%9A%E8%AE%AE%E7%A1%AC%E7%9B%98%5CTSGR3_114-e%5CDocs%5CR3-215418.zip) | Addition of UE Radio Capability for Paging for NR to S1-AP (Ericsson) | CR1845r, TS 36.413 v16.7.0, Rel-16, Cat. F |