3GPP TSG-RAN WG2 Meeting #109e R2-200xxxx

Online, 24th February – 6th March 2020 Revision of R2-2002020

**Agenda Item: 6.7.2.3**

**Source: MediaTek Inc.**

**Title: Summary on Ethernet Header Compression**

**Document for: Discussion and decision**

# 1 Introduction

This document summarises the issues identified in the discussion documents submitted to this meeting, and provides a combined list of proposals. Proposals are classified in the conclusion section based on the Chair’s guidance.

In this revision, companies can provide their feedback on the various proposals in this document.

# 2 Discussion

### 2.1 Compressor operation

At R2-108, we reached the following agreement:

* *Q-TAGs can be removed in EHC, considering all sub-fields, assuming this is static (i.e. no dynamic indications in EHC)*

The mechanism of Q-Tag compression has been discussed in [8], [10] and [13]. [8] suggests that the uncompressed header can indicate whether Q-Tag compression is to take place or not. However we have already agreed that there will be no dynamic indications in EHC. [10] and [13] suggest that each permutation of QTag value(s) is associated with a different CID. [13] goes on to suggest that in case of multiple tags (QinQ, double tagging), all Q-Tags are removed at the compressor and associated with a unique CID.

Based on the papers above, the following two proposals summarise the open issues raised:

**Proposal 1: Each different PCP/DE value combination in a flow across all Q Tags (single or multiple) is associated with a separate context ID.**

P1 is classified as an easy proposal as it clarifies our earlier agreement. Please provide your feedback on P1.

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| **Company** | **Support P1 (yes/no)** | **Additional comment(s)** |
| Qualcomm | yes |  |
| Ericsson | yes |  |
| LG | yes |  |
| OPPO | yes |  |
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**Proposal 2: The uncompressed EHC header format for a context ID indicates whether Q-Tag removal is performed for that context ID.**

As we have already agreed that there are no dynamic indications in EHC with regards to Q-Tag removal, P2 is identified as a candidate for postponement. Please provide your feedback, if any, on P2.

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| **Company** | **Support P2 (yes/no)** | **Additional comment(s)** |
| Qualcomm | no | We may have understood the yes/no aspect of the question incorrectly, but our view is that Q-Tag removal is either done always for a context (this is the case where context create packet included Q-Tag) or never done for a context (this is the case when the context create packet did not include Q-Tag).  If this is what the moderator implies by “no dynamic indications”, then we support the rapporteur proposal to not discuss Q-Tag related enhancements. |
| Ericsson | Depends | If PCP/DE Q-tag variations are handled with different contents, many more contexts are required (contexts multiplied by PCP/DEI variations), therefore we should agree to a high number of supported contexts (e.g. 15bit CID).  In [8] we outline that an alternative approach would be to indicate in uncompressed format whether Q-tags are static/compressed or not for a context, this saves context IDs and related memory consumption for storing the contexts. |
| LG | no | We want to keep the current agreement, i.e., no dynamic indications in EHC. |
| OPPO | no | We prefer a simple solution with no dynamic indication included. Even if considering the possibility of PCP/DEI variation, CID can be used to differentiate the value of PCP/DEI field (we are fine to have 14/15-bit CID). |
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At R2-107bis, we reached the following agreement:

* *The EHC can removes the following fields: SOURCE/DESTINATION ADDRESS, TYPE, and EHC do not support multiple formats*

[13] raises the issue of compressor behaviour when presented with an 802.3 Ethernet frame with LENGTH field in place of TYPE field, i.e. value smaller than or equal to 1500. The paper goes on to suggest to treat the LENGTH field similar to the TYPE field. The compressor can either send the Ethernet header as uncompressed, or compress the header in which case, each unique value of the LENGTH field is associated with a separate context ID, leading to the following proposal:

**Proposal 3: No special handling for LENGTH is needed. Each different value in a flow can either be associated with a separate context or be sent uncompressed.**

P3 needs further discussion as we need to determine compressor behaviour when it encounters an Ethernet packet with a length field. Please provide your feedback on P3, and also comment on expected EHC behaviour if a length field is encountered.

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| **Company** | **Support P3 (yes/no)** | **Additional comment(s)** |
| QC | Partial support | Length field usage is extremely rare in practice, and sending such packets uncompressed should be the only method supported in the standard. We are not sure creating a context for length field should be supported as it creates unnecessary complexity. |
| Ericsson | yes | Can be handled by indicating special context (uncompressed) acc. to P25. |
| LG | yes |  |
| OPPO | yes | Length field can be inferred or changing. It can be decompressed using a separate context or be sent uncompressed. |
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### 2.2 Decompressor operation

We have agreed on the following baseline for the feedback operation:

* *For context establishment the de-compressor sends an explicit feedback to the compressor after the establishment of the context, i.e. when a full header packet is received with a context id.*
* *For context establishment the explicit feedback includes the “Context ID”.*
* *When the compressor receives the feedback it is confident that the context is successfully established, and from this time compressed header packets can be transmitted.*

The feedback operation has been discussed in [2], [5], [8], [10], [11] and [15].

On the configuration of the feedback mechanism, [8] suggests that the feedback mechanism can be made configurable per DRB. When not configured for a DRB, the compressor sends a configurable number of uncompressed packets following which compressed packets are sent. This leads to the following proposals:

**Proposal 4: Feedback for EHC is configurable per DRB.**

**Proposal 5: When feedback is not configured, the compressor can start sending compressed formats after a configurable number of uncompressed formats are sent for this context.**

P4 and P5 are identified as candidates for postponement in the interest of time, as they introduce alternative behaviour to the feedback mechanism that has been agreed. Please provide your feedback on P4 and P5, if any.

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| **Company** | **Support P4, P5 (yes/no)** | **Additional comment(s)** |
| Qualcomm | no | We would like to go one step farther than moderator proposal, and exclude these proposals from Rel-16 (instead of only postpone). |
| Ericsson | Yes | We believe that with repeated uncompressed transmission for robust EHC are sufficient, and feedback reception should not be mandatory required for compressor to start compression. |
| LG | no | In the last meeting agreement, it was agreed that the EHC algorithm is not allowed to be configured for a uni-directional link. Thus, there is always feedback-link present, and we think EHC feedback is mandatory. |
| OPPO | no | Agree with LG, we have excluded the case of uni-directional link for EHC. |
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There were a few papers discussing issues regarding mismatch between the compressor and decompressor. [2], [5], [10] and [11] address the issue raised in the email discussion [3] on whether the decompressor should indicate to the compressor if it receives a compressed header bearing a context ID that is not recognised. [2], [5] and [11] suggest not addressing the issue, and therefore the following proposal is suggested.

**Proposal 6: The decompressor behaviour is not specified if it receives a compressed packet with a context ID that it does not recognise.**

P6 is marked for further discussion due to mixed input from email discussions, but it is the majority view from the documents submitted. Please provide your feedback on P6.

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| **Company** | **Support P6 (yes/no)** | **Additional comment(s)** |
| Qualcomm | No | It will be good to agree and document this as an error case. Any related actions could be discussed later. |
| Ericsson | Yes |  |
| LG | yes | The EHC compressor keeps transmitting full header packets until the EHC feedback is received. Then, we think such an error case would happen with extremely low probability, e.g. < 10^-6. |
| OPPO | Yes | Even if it exists, we prefer an implementation way. |
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### 2.3 Joint EHC and RoHC operation

We have the following agreement regarding EHC and RoHC operation:

* *ROHC and EHC are independent, e.g. from specification point of view they could both be configured for a DRB.*
* *The EHC header is located after the SDAP header, and it is ciphered*

Documents [1], [4], [5], [12], [15], [16] and [18] address an open issue from email discussion 108#52 [20] on the joint operation of RoHC and EHC. Documents [1], [4], [5], [15] and [16] suggest not specifying the processing order when RoHC and EHC is configured, while [18] suggests that EHC should be performed before RoHC. Regardless of the processing order, the common view is that the header format needs to be specified and the contributions are aligned on the header format, leading to the following proposals:

**Proposal 8: The processing order of the EHC and ROHC is up to UE implementation.**

P8 is identified as an easy proposal due to the significant number of supporting documents. Please provide your feedback on P8.

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| **Company** | **Support P8 (yes/no)** | **Additional comment(s)** |
| Qualcomm | yes |  |
| Ericsson | yes |  |
| LG | no | We think performing EHC before ROHC has less complexity. |
| OPPO | yes | No need to specify the processing order, especially when padding removal is excluded. |
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**Proposal 9: The ROHC header is located after EHC header (illustrated below).**



P9 is identified as an easy proposal for agreement due to the significant number of supporting documents. Please provide your feedback on P9.

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| **Company** | **Support P9 (yes/no)** | **Additional comment(s)** |
| Qualcomm | yes |  |
| Ericsson | Yes |  |
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Documents [12] and [15] indicate that for an Ethernet PDU session, an IP packet or a non-IP based packet (e.g. Profinet) may follow the Ethernet header. In these cases, RoHC should only apply to IP packets. Conversely, [16] suggests reverting the earlier agreement that RoHC and EHC can be configured simultaneously, pointing out that RoHC should only apply to IP based PDU sessions while EHC should only apply to Ethernet based PDU sessions. Based on these contributions, the following proposals are suggested:

**Proposal 10: When a DRB is configured with RoHC and EHC, the sender/compressor behaviour for a non-IP Ethernet packet shall be to bypass ROHC and deliver that packet from EHC compressor to lower layers.**

**Proposal 11: When a DRB is configured with RoHC and EHC, the receiver/decompressor behaviour for a packet that has non-IP Ethertype (after EHC decompression) is to bypass RoHC and deliver the packet directly to higher layers.**

P10 and P11 are identified as easy proposals for agreement as they clarify behaviour from our earlier agreements. Please provide your feedback on P10 and P11.

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| **Company** | **Support P10, P11 (yes/no)** | **Additional comment(s)** |
| Qualcomm | yes |  |
| Ericsson | yes |  |
| LG | yes |  |
| OPPO | yes | But one additional issue is how the decompressor can differentiate the packet has non-IP Ethertype or IP Ethertype, if both non-IP Etertype and IP ethertype are mapped into one DRB. |
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### 2.4 Padding removal

The following discussion took place at R2-108 on padding removal:

* *The following tentative agreements are postponed, we send an LS to SA1, but we will decide next meeting regardless if get a reply in time or not.*

*Padding Removal tentative agreements*

* *Specify the EHC decompressor behaviour such that it checks the frame size after reapplying the Ethernet header and in case it is lower than 64 bytes, the decompressor appends random bytes to make the frame a valid Ethernet frame (e.g. 64 bytes long).*
* *We don’t specify the behaviour of the compressor/padding removal side*
* *Padding removal is an optional feature that is configurable.*

The padding removal mechanism has been discussed in [2], [4], [9], [15], [19] and [23]. Document [2] suggests that padding removal should be discussed in SA2 as part of the DS-TT and NW-TT functionality. [4] suggests that the tentative agreements from the last meeting be agreed. [9] suggests to only apply padding removal to untagged frames, raising the issue that tags may be added (and removed) within 5GC, which can result in the decompressor regenerating an incorrect packet size. [15] and [19] suggest to take the SA1 reply LS [21] into account, based on which [19] suggests that padding removal is not supported in EHC. Given the range of opinions expressed, we need to decide if padding removal is supported or not in EHC.

As we have agreed not to handle padding in EHC, P12 and P13 on padding are removed.

### 2.5 UE capabilities

There were a few open issues on UE capabilities identified in email discussion 108#47 [22]. These have been discussed in [4], [9], [14] and [15]. Documents [4] and [14] raises the need for a UE capability on the maximum number of EHC contexts that can be supported by a UE. Documents [4] and [9] suggest that padding removal and padding addition are separate UE capabilities. [4] also suggests the introduction of a UE capability to support EHC context continuation. Document [15] suggests the need for separate RoHC profile lists for an IP type PDU session and an Ethernet PDU session with/without EHC. This leads to the following proposals on UE capabilities:

**Proposal 14: Introduce a UE capability to indicate the maximum number of EHC contexts which can be maintained across all EHC enabled DRBs by the UE.**

**Proposal 16: Introduce a UE capability for EHC context continuation.**

**Proposal 17: Introduce separate RoHC profiles for IP type PDU sessions, Ethernet type PDU sessions with EHC and Ethernet type PDU sessions without EHC.**

As P14-P17 relate to UE capabilities, it is suggested to discuss these proposals in email discussion [AT109e][031]. P15 is dropped as we have agreed not to support padding removal.

### 2.6 Others

Documents [4] and [7] discuss the agreement on the placement of the EHC header after the SDAP header. They both indicate that for an SDAP control PDU, no EHC header is generated.

**Proposal 18. For SDAP Control PDU, the EHC header is not generated.**

P18 is identified as an easy proposal for agreement as no opposing views have been expressed in submitted documents. Please provide your feedback on P18.

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| **Company** | **Support P18 (yes/no)** | **Additional comment(s)** |
| Qualcomm | yes |  |
| Ericsson | Yes |  |
| LG | yes |  |
| OPPO | yes |  |
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Document [6] raises two new issues. One is that the NW should only reconfigure EHC upon PDCP re-establishment to avoid issues with distinguishing different header formats. The other is whether RAN should regenerate the preamble, SFD and FCS fields that are not transmitted over 5GS, resulting in the following proposals:

**Proposal 19: RAN2 to discuss whether and how to add back the preamble, SFD and FCS fields to Ethernet packet.**

P19 is identified as a candidate for postponement as preamble, SFD and FCS removal is not performed in RAN. Please provide your feedback on P19, if any.

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| **Company** | **Support P19 (yes/no)** | **Additional comment(s)** |
| Qualcomm | no | This issue does not need RAN2 discussion, as SA2 has already covered handling of preamble, SFD and FCS in Section 5.6.10.2, TS 23.501. If there are any gaps, companies should discuss in SA2. |
| Ericsson | No | Agree with Qualcomm. |
| LG | no | Not RAN2 issue |
| OPPO | no | Agree with Qualcomm. |
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**Proposal 20: NW reconfigures EHC function only upon reconfiguration involving PDCP re-establishment.**

P20 is identified as a candidate for postponement as it raises an issue that can be avoided by NW implementation. Please provide your feedback on P20, if any.

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| **Company** | **Support P20 (yes/no)** | **Additional comment(s)** |
| Qualcomm |  | Okay to postpone |
| Ericsson | No | Can be avoided by network configuration. |
| LG |  | We want to know first what can be reconfigured for EHC function. |
| OPPO |  | Agree to postpone |
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### 2.7 Issues already raised in other email discussions

The following issues have already been raised in other email discussions, and have therefore not been considered in this document.

1. EHC header format
2. Need for max CID
3. Reserved CID for no compression
4. EHC context continuation configuration
5. EHC feedback transmission reduction
6. EHC context re-use/overwrite
7. Inclusion of a SN in the EHC feedback

During the online session, only CID length was discussed and the following proposals remain from [3]. These were marked as potential easy agreements that could be agreed over email. Please provide comments below if you do not agree with any of these proposals and also provide your justifications.

**Proposal 21: 1-bit Indication in EHC header is used for header format differentiation.**

**Proposal 22: EHC header only contains Context ID field, format indication bit, and reserved bit(s) if needed.**

**Proposal 23: CID overwriting mechanism is supported.**

**Proposal 24: Using a NOTE to specify CID overwriting mechanism in the specification.**

**Proposal 25: The compressor can use an “all zeros” context ID to indicate that no context is to be established, when transmitting uncompressed packets.**

**Proposal 26: EHC feedback is transmitted via PDCP Control PDU.**

**Proposal 27: EHC feedback contains only CID.**

**Proposal 28: No enhancement needed on the compressor side. The compressor keeps sending full header packets till the first feedback is received and start to transmit the compressed header packets.**

**Proposal 29: No need to specify how the compressor to determine that a context establishment procedure was unsuccessful.**

**Proposal 30: No special mechanism is needed on the decompressor side to control the number of feedbacks.**

**Proposal 31: Configuration of a parameters (e.g. drb-ContinueEHC) indicates whether or not EHC is reset at PDCP re-establishment.**

**Proposal 32: EHC context continue function can be indicted separately for UL and DL, through configuration of parameters, e.g. ul-drb-ContinueEHC and dl-drb-ContinueEHC.**

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| **Company** | **Controversial Prop. ID** | **Justification** |
| Qualcomm | 27 | We can agree to proposal 27 if changed to “contains at least CID”. We believe adding the SN to the feedback message comes at negligible cost and improves the design and debugging of the EHC feature. |
| Ericsson | 28 | See comment on P5. Given robustness of the link, feedback should be configurable. |
| LG | 30 | Radio resource wastage caused by transmitting frequent EHC feedback should be minimized. |
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# 3 Conclusion

# 4 References

1. [R2-2000112](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000112.zip) Discussion on the processing order of ROHC and EHC, CATT

1. [R2-2000113](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000113.zip) Remaining Issues of EHC, CATT

1. [R2-2000175](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000175.zip) Report of email discussion [108#53] [IIOT] EHC remaining issues, Huawei, HiSilicon

1. [R2-2000432](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000432.zip) Further discussion on EHC related issues, Huawei, HiSilicon

1. [R2-2000477](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000477.zip) Remaining issues in Ethernet header compression, Intel Corporation

1. [R2-2000494](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000494.zip) Remaining issues for EHC, vivo

1. [R2-2000726](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000726.zip) SDAP control PDU handling in Rel-16 EHC, Samsung

1. [R2-2000792](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000792.zip) EHC solution, Ericsson

1. [R2-2000793](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000793.zip) EHC padding removal, Ericsson

1. [R2-2000834](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000834.zip) EHC absence of Q-Tags and NACK feedback, Sony

1. [R2-2000867](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2000867.zip) Further Consideration on Ethernet Header Compression, China Telecom Corporation Ltd.

1. [R2-2001050](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001050.zip) Joint IP and Ethernet Header compression, Nokia, Nokia Shanghai Bell

1. [R2-2001051](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001051.zip) Ethernet Header compression remaining issues, Nokia, Nokia Shanghai Bell

1. [R2-2001229](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001229.zip) Remaining issues for EHC in TSC, ZTE Corporation, Sanechips

1. [R2-2001298](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001298.zip) Open issues in Ethernet Header Compression, Qualcomm Incorporated

1. [R2-2001309](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001309.zip) Configuration and Processing Order of ROHC and EHC, Futurewei

1. [R2-2001501](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001501.zip) Discussion on EHC feedback, LG Electronics Inc.

1. [R2-2001502](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001502.zip) Discussion on performing ROHC and EHC, LG Electronics Inc.

1. [R2-2001521](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001521.zip) Discussion on support of the padding removal, LG Electronics Inc.

1. [R2-2001280](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001280.zip) Summary of e-mail discussion 108#52 on PDCP running CR for NR IIOT, LG Electronics Inc.
2. S1-201085 Reply LS on need for Ethernet padding compression, SA1

1. [R2-2001053](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001053.zip) Summary of e-mail discussion: [108#47][IIOT] UE feature list, Nokia, Nokia Shanghai Bell

1. [R2-2001052](https://www.3gpp.org/ftp/tsg_ran/WG2_RL2/TSGR2_109_e/Inbox/Drafts/%5BOffline-034%5D%5BIIOT%5D Ethernet Header Compression (Mediatek%2C Huawei)/docs/R2-2001052.zip) Ethernet Header compression remaining issues, Nokia, Nokia Shanghai Bell