**3GPP TSG RAN WG1#104bis\_e R1-21XXXXX**

**E-meeting, 12th – 20th April 2021**

Agenda Item: **8.9.3**

Source: **Moderator (Sony)**

Title: **Feature Lead Summary [104b-e-****LTE-Rel17\_NB\_IoT\_eMTC-03]**

Document for: **Discussion**

# Introduction

In RAN1#104e, the following agreement was made:

**Agreement**

The number of soft channel bits is calculated based on the equation:



Working Assumption: N=8

This document is the feature lead summary (FLS) for agenda item 8.9.3 on introduction of a 1736 bit DL TBS for eMTC.

The proposals in this document will be discussed via NWM. The details are:

NWM document name: ***RAN1-104b-e-NWM-LTE-Rel17\_NB\_IoT\_eMTC-03***

Link to NWM: <https://nwm-trial.etsi.org/#/>

# Discussion

The following issues were raised in the input Tdocs to RAN1#104bis\_e:

## Working assumption on N=8 / number of soft channel bits

FL Summary

The working assumption that N=8 can be confirmed based on the following considerations.

* **Precedence**. N=8 was used for 10 HARQ processes were introduced in Rel-14. N=8 is going to be used for 14 HARQ processes in Rel-17. We should hence still use N=8 for this feature.
* **Performance**. Simulations showed that there was very little performance impact from basing the number of soft channel bits on more than N=8 HARQ processes. There is a very low probability that more than 8 HARQ processes fail successively. Hence little performance impact.
* **Complexity**. More than 8 HARQ processes increases complexity.

All input documents agreed that the working assumption of “N = 8” could be agreed.

**FL Proposal 1**:

**In the calculation where the number of soft channel bits is calculated based on the equation:**

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**Confirm the working assumption that N = 8.**

**FL Proposal 2**:

**The soft channel bits** **for UEs supporting maximum DL TBS of 1736 bits is 43008 bits.**

The proposals above are discussed via NWM (see section 1 for details of accessing NWM discussion).

Company views:

|  |  |
| --- | --- |
| **Company** | **View** |
| Huawei / HiSilicon[R1-2102359](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102359.zip) | **Precedence**. N=8 was used for 10 HARQ processes were introduced in Rel-14. N=8 is going to be used for 14 HARQ processes in Rel-17. We should hence still use N=8 for this feature.**Performance**. Very low probability that more than 8 HARQ processes fail successively. Hence little performance impact.**Complexity**. More than 8 HARQ processes increases complexity. |
| Nokia / NSB [R1-2102654](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102654.zip) | Similar views to HW / HiSi. The working assumption should be confirmed considering precedence, performance, complexity. |
| ZTE[R1-2102859](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102859.zip) | Similar views to HW / HiSi. The working assumption should be confirmed considering precedence, performance, complexity. |
| Qualcomm Incorporated[R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | Overbooking can be applied to handle cases with more than 8 HARQ processes (as per previous releases). |
| SONY[R1-2103313](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103313.zip) | Similar views to HW / HiSi. The working assumption should be confirmed considering precedence, performance, complexity. |
| Sierra Wireless, S.A.[R1-2103462](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103462.zip) | No issues found with N=8. |
| Ericsson[R1-2103725](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103725.zip) | There is no performance impact from the choice of N=8 over N=10. Hence, N=8 is a suitable parameter on which to base the soft buffer size for this feature. |

Proposals:

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| **Company** | **Proposal** |
| Huawei / HiSilicon[R1-2102359](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102359.zip) | **Proposal 1：Confirm the working assumption as below.****The number of soft channel bits is calculated based on the equation:**$$N\_{soft}=N∙96∙\left⌈\frac{\left(1736+28\right)}{32}\right⌉$$**Where N=8****Proposal 2: The soft channel bits** **for UEs supporting maximum DL TBS of 1736 bits is 43008 bits.** |
| Huawei / HiSilicon[R1-2102359](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102359.zip) | **Proposal 1: Confirm the working assumption to use *N* = 8 for calculating the number of soft channel bits with the increased maximum DL TBS of 1736 bits.** |
| ZTE[R1-2102859](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102859.zip) | ***Proposal: The working assumption of N=8 can be confirmed and 43008 is specified for soft buffer size for DL TBS of 1736 bits.***  |
| Qualcomm Incorporated[R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | **Proposal 1: Confirm the working assumption on the number of HARQ processes for soft buffer determination:** * **N=8**
* **The soft buffer size is** $N\_{soft}=$**43008**
 |
| SONY[R1-2103313](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103313.zip) | **Proposal: Confirm the working assumption that ‘N = 8’ is used in the equation to calculate the number of soft channel bits for a DL TBS of 1736 bits.**  |
| Sierra Wireless, S.A.[R1-2103462](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103462.zip) | **Proposal 1: Confirm the Working Assumption: N=8 and Nsoft = 43008** |
| Ericsson[R1-2103725](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103725.zip) | **Observation 1 : Using an equation that accounts for the number of HARQ processes and the coding rate of the turbo encoder, the required soft buffer size was estimated:*** **For 8 HARQ processes: In principle, 43008 soft channel bits are estimated to be required.**
* **For 10 HARQ processes: In principle, 53760 soft channel bits are estimated to be required.**
* **For 14 HARQ processes: In principle, 75264 soft channel bits are estimated to be required.**

**Observation 2: The total number of soft channel bits for Rel-13 Cat-M1 is 25344. In Rel-17, depending on the assumption on the number of HARQ processes, the soft buffer size is expected to be increased about 1.7 times for 8 HARQ processes, 2.12 times for 10 HARQ processes and 2.96 times for 14 HARQ processes.****Observation 3 : Depending on whether 8, 10 or 14 HARQ processes are to be used, the peak data rate can be either ~0.82 Mbps, or ~1.02 Mbps or ~1.23 Mbps, and in case of NACK(s) the soft-buffer size will determine how many of these HARQ processes can be buffered.****se to confirm the working assumption to set the soft channel bits to 43008bits for TBS=1736bits.** **Observation 4: The throughput performance when the assumption is 8 HARQ processes (43008 soft channel bits) is comparable to the performance when the assumption is 10 HARQ processes (53769 soft channel bits).****Observation 5: A throughput degradation was observed when a number of HARQ processes < 8 HARQ processes was evaluated. That is, N = 6 (as to obtain 32256 soft channel bits) and N = 4 (as to obtain 21504 soft channel bits) resulted in a throughput degradation.****Proposal 1 : Confirm the working assumption on N = 8 HARQ processes, as to determine the soft-buffer size to consist of 43008 soft channel bits.** |

## RAN2 Impacts

FL Summary

The RAN1 decision on the number of soft channel bits for support of a DL TBS of 1736 needs to be conveyed to RAN2 via an LS. The actual implementation of the number of soft channel bits in the RAN2 TS36.306 specification can be left to RAN2. The following text from Sierra Wireless seems appropriate. This text proposal can be made in RAN2, once RAN2 have received the LS from RAN1.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE DL Category | Maximum number of DL-SCH transport block bits received within a TTI (Note 1) | Maximum number of bits of a DL-SCH transport block received within a TTI | Total number of soft channel bits | Maximum number of supported layers for spatial multiplexing in DL |
| DL Category M1Note 4 | 1000 or 1736 | 1000 or 1736 | 25344 or 43008 | 1 |

NOTE 4: The UE supports "Maximum number of DL-SCH transport block bits transmitted within a TTI" and "Maximum number of bits of an DL-SCH transport block transmitted within a TTI" of 1736 bits if the UE indicates support of *{Feature\_Name\_DL\_1736\_TBS}* and otherwise the UE supports 1000 bits. The UE supports "Total number of soft channel bits" of 43008 bits if the UE indicates support of *{Feature\_Name\_DL\_1736\_TBS}* and otherwise the UE supports 1000 bits.

When sending an LS, RAN1 should include a RAN2-impacting agreement from RAN1#104e:

*The 1736 bits DL TBS feature is enabled by unicast RRC configuration.*

The question remains as to the timing of sending an LS to RAN2. While the LS could be sent at the conclusion of the work item, it may be beneficial to inform RAN2 as soon as RAN1 has made this decision. This allows RAN1 work on this topic to be concluded and RAN2 to get a head start on their specification.

**FL Proposal 3**:

**During RAN1#104bis\_e, send an LS to RAN2 informing them of RAN1’s decisions on the following:**

* **The soft channel bits** **for UEs supporting maximum DL TBS of 1736 bits is 43008 bits.**
* **The 1736 bits DL TBS feature is enabled by unicast RRC configuration.**

The proposal above are discussed via NWM (see section 1 for details of accessing NWM discussion).

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| **Company** | **View** |
| Qualcomm Incorporated[R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | Write an LS to RAN2 informing them of the soft buffer size for a UE supporting a larger TBS of 1736 bits. |
| Sierra Wireless, S.A.[R1-2103462](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103462.zip) | Since the WID states a new UE category is not going to be defined, Proposal 2: TS 36.306 should be modified by adding options to the DL category M1 row for TBS=1736 and soft channel bits=43008 with a note explaining that the options should be used when the TBS=1736 feature is indicated by the UE. An example of such a change and note could be:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE DL Category | Maximum number of DL-SCH transport block bits received within a TTI (Note 1) | Maximum number of bits of a DL-SCH transport block received within a TTI | Total number of soft channel bits | Maximum number of supported layers for spatial multiplexing in DL |
| DL Category M1Note 4 | 1000 or 1736 | 1000 or 1736 | 25344 or 43008 | 1 |

NOTE 4: The UE supports "Maximum number of DL-SCH transport block bits transmitted within a TTI" and "Maximum number of bits of an DL-SCH transport block transmitted within a TTI" of 1736 bits if the UE indicates support of *{Feature\_Name\_DL\_1736\_TBS}* and otherwise the UE supports 1000 bits. The UE supports "Total number of soft channel bits" of 43008 bits if the UE indicates support of *{Feature\_Name\_DL\_1736\_TBS}* and otherwise the UE supports 1000 bits. |

Proposals:

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| --- | --- |
| **Company** | **Proposal** |
| Qualcomm Incorporated[R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | **Proposal 2: RAN1 to inform RAN2 on the soft buffer size for UEs supporting a larger TBS of 1736 bits, and request them to capture this value in their specifications.** |
| Sierra Wireless, S.A.[R1-2103462](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103462.zip) | **Proposal 2: TS 36.306 should be modified by adding options to the DL category M1 row for TBS=1736 and soft channel bits=43008 with a note explaining that the options should be used when the TBS=1736 feature is indicated by the UE.** |

## Further work required on AI 8.9.3.

FL Summary

Once the soft buffer size has been decided, this AI can be closed. Any further issues can be addressed in the “others” AI.

The chairman can make a decision on whether to include AI8.9.3 in future meetings and there does not need to be explicit agreement on this point.

Company views:

|  |  |
| --- | --- |
| **Company** | **View** |
| Qualcomm Incorporated[R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | Once the soft buffer size has been decided, this AI can be closed. Any further issues can be addressed in the “others” AI. |

Proposals:

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| --- | --- |
| **Company** | **Proposal** |
| Qualcomm Incorporated[R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | **Observation 1: The above proposal completes the work for “larger TBS for eMTC”. A.I. 8.9.3 can be removed from future meetings and merged with ”Others”.** |

# Conclusions

This document is the feature lead summary for the support of a 1736 bit DL TBS for eMTC. The following proposals are made by the feature lead:

**FL Proposal 1**:

**In the calculation of number of soft channel bits is calculated based on the equation:**

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**Confirm the working assumption that N = 8.**

**FL Proposal 2**:

**The soft channel bits** **for UEs supporting maximum DL TBS of 1736 bits is 43008 bits.**

**FL Proposal 3**:

**Send an LS to RAN2 informing them of RAN1’s decisions on the following:**

* **The soft channel bits** **for UEs supporting maximum DL TBS of 1736 bits is 43008 bits.**
* **The 1736 bits DL TBS feature is enabled by unicast RRC configuration.**

The above proposals are to be discussed via NWM with the following topic name:

***RAN1-104b-e-NWM-LTE-Rel17\_NB\_IoT\_eMTC-03***

If the above proposals are agreed, this feature should be complete and there will be no need to have an agenda item AI8.9.3 in future meetings. Any issues that companies might observe in the future can be discussed under the “others” agenda item of 8.9.x.

# References

|  |  |  |
| --- | --- | --- |
| [R1-2102359](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102359.zip) | Support of a max DL TBS of 1736 bits in LTE-MTC | Huawei, HiSilicon |
| [R1-2102654](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102654.zip) | Support of a maximum DL TBS of 1736 bits for eMTC | Nokia, Nokia Shanghai Bell |
| [R1-2102859](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2102859.zip) | Remaining issues on DL TBS increase for eMTC | ZTE |
| [R1-2103069](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103069.zip) | Support of larger TBS for eMTC | Qualcomm Incorporated |
| [R1-2103313](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103313.zip) | Remaining issues for support of DL TBS of 1736 bits for eMTC | Sony |
| [R1-2103462](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103462.zip) | Design considerations to support DL TBS of 1736 bits for LTE-M | Sierra Wireless, S.A. |
| [R1-2103725](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_104b-e/Docs/R1-2103725.zip) | Support of a maximum DL TBS of 1736 bits in LTE-MTC | Ericsson |