Source: Mitsubishi Electric (MMCE)

Title: Request for WI 8.1.1 continuation

Agenda Item: 8.1.1

Document for: Approval

1 Introduction

This document deals with the need for keeping the WI 8.1.1 Improvement of inter-frequency and inter-system handover measurements open so that RAN1 would have time to further discuss the proposal of compressed mode using unequal frame segmentation. Discussion about this proposal shall be continued as it has been decided during RAN1#38 in Prague as it is reported in [1] and [2].

Furthermore, in [1] and [2], in discussion section about another proposal, namely "On channelisation code sharing during compressed mode", it was decided to raise the question to RAN whether further work on this WI is needed in RAN1.

2 Discussion

In reports [1] and [2] RAN1 decided to continue discussion about the proposal for inter-system/inter-frequency measurements improvements described in [3].

2.1 Needs for compressed mode improvements

Compressed mode handling currently comprises 3 methods : "higher layer scheduling", "SF reduction" and "puncturing". Compressed mode by "higher layer scheduling" is well applicable to packet data, as this data is not so delay sensitive. Compressed mode by puncturing is currently applicable only to DL fixed position multiplexing, so it is well applicable to the case of circuit data where this type of multiplexing does not imply bad usage of the OVSF code resource. SF reduction is known to suffer from several limitations, and this is why compressed mode by puncturing was so eagerly discussed during release 99 specification.

New cases of service multiplexing have been considered since release 99 specification, in which none of current compressed mode methods is well adapted. This is notably the case for mixed packet and circuit data where neither is dominant.

2.2 Brief presentation of the proposed scheme

The new scheme is based on unequal frame segmentation. That is to say that a TTI of F radio frames is segmented into F segments that are potentially of different sizes, which allows to map less data to some of the frames, thus making some room available for the transmission gap.

The new scheme exhibits the following aspects :

- Inherently provides multi-frame compressed mode compression, thus reducing the necessary power raise. Compared to current DL compressed mode by puncturing in fixed positions power raise can be spread on longest TTI, rather than shortest TTI.

- Allows compressed mode with puncturing with flexible position in DL

- Applicable also to both UL and DL

- Can be combined with higher layer scheduling.

- In DL no impact on the data path is anticipated as unequal frame segmentation is already used in compressed mode by puncturing in fixed position, in the form of unequal distribution of prune bits over the TTIs.

2.2.1 Potential Benefits of the new scheme

The new scheme is applicable and powerful especially:
- When PS and CS data are mixed as :
  - higher layer scheduling would not be sufficient to build up the gap.
  - current puncturing scheme is not available, because PS data is multiplexed most beneficially in flexible position
  - SF reduction is known to suffer from many issues, on which this paper elaborates a bit more later on.
- In UL, because of the power raise limitation that is welcome due to UE PA limitations
- It is applicable to fixed position multiplexing also, with the benefit that compared to current puncturing scheme **power raise is spread over longest TTI rather than shortest TTI**.
- In case of PS data, long TTIs and high density transmission gaps. In this case, the use of higher scheduling alone would constantly reduce the throughput, and therefore the QoS, as any TTI may be overlapped by a transmission gap. The use of the new scheme in combination with higher layer scheduling alleviates this issue.

2.2.2 Gain compared to other compressed modes

2.2.2.1 Compressed mode by puncturing

The proposed scheme may be combined with higher layer scheduling and puncturing methods so that their performance may be significantly increased.

In the RAB's combination taken as example in [3], using unequal segmentation method **divides the puncturing rate by 5** compared to method with equal frame segmentation. The new puncturing rate equals 4.2% so the **TFC set can be entirely used without degrading transmission performance**.
The corresponding **power raise is 0.8 dB** spanned over the longest TTI.

2.2.2.2 Compressed mode by SF reduction

Drawbacks of the SF reduction method compared to the proposed method can be summarized by :

- **OVSF code consumption** SF reduction method is expensive in term of OVSF code. The proposed method does not require more code resource.
- **Power raise** In case of SF reduction the Tx power is increased by 3 dB during compressed frames. In the new scheme instead, the power increase is not only applied to compressed frames but spanned over the whole global interval since all the TrCHs are impacted by the gap. Spreading the power raise over time is beneficial when the channel is close to its maximum power.
- **DTX rate** SF reduction involves high DTX rate for transmitted slots, which happens as the number of gap slots may be significantly lower than half of the frame. It the example, DTX rates reaches 32.8 % during 2 frames. The proposed method does not need to introduce DTX bits.

2.3 Elements to be discussed

If it is agreed, the contributions that will be presented in next RAN1 meeting will focus on :

- Performance : the RAB's combination definition for which the proposed scheme increases the throughput in compressed TTI and allows other compressed modes uses than SF reduction method.

- Implementation : scheme and CR in corresponding specifications. In addition, this point will give an idea of the complexity raised by the proposed enhancement

3 Conclusion

Inter-system/inter-frequency measurements suffer of several issues that are addressed by the work item 8.1.1 about improvement of inter-frequency and inter-system measurements. The proposed method potentially improves the system capacity and operational flexibility in addition to the existing methods at the physical layer. Discussion about the proposal has been decided in last RAN1 meeting. So it is proposed to report the closure date of this item 8.1. till march 2005. This date is aligned with the closure date of the parent work item whose title is Radio Interface Improvement Feature.

4 References

[1] Draft Report WG1 #38 (Prague, Czech Republic, 16 – 20 August, 2004)
[2] RP-04xxxx draft report on WI IF IF improvements (Nokia)
[3] R1-040822 "Proposal for multiframe compressed mode by puncturing and unequal frame segmentation" (Mitsubishi Electric: MMCE)