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Source: **Vodafone Group**
Title: **Options for removal of unnecessary MBMS combining schemes**
Agenda Item: **9.4**
Document for: **Discussion**

1. Introduction

As agreed by RAN WG1, RAN WG2 and RAN WG3, at the moment there exist three macro-diversity combining schemes that could be used for improving the reception of the MBMS P2M:

- Rake combining.
- Soft combining.
- Selective combining.

At RAN4 meeting #34, Nokia presented a document [1] suggesting that we should simplify MBMS. The main idea in their proposal was to remove one of the combining schemes. Within [1] it was suggested to remove selective combining.

The aim of this contribution is primarily to propose not to have different combining options within the 3GPP specifications. More specifically we propose the removal of Rake and Selective combining.

2. Removal of Rake combining

Rake combining is not feasible in all network scenarios, i.e. it is recognised that it is only really feasible in intra-Node B cases. Although there is no major impact on the UE, if we want to rely on UE support for this, we would need some performance requirements to be defined and signalling from the network. This would take time for RAN WG4 to define, and also it would increase the number of performance tests that need to be performed by UEs. In addition, if operators wish to rely on this scheme, all UEs would need to implement it before MBMS would be switched on in the live network.

Considering the small system level gains here, there does not seem to be much point in specifying something that can only be used in a small number of cases. Therefore Vodafone propose to remove this combining scheme from RAN specifications.

3. Benefits of additional removal of either “Selective” or “Soft” combining

3.1 UE availability timeframes

If the network does not implement both selective and soft combining schemes in the initial phase of MBMS deployment, it is unlikely that both schemes would be implemented in the UE, due to the lack of possibilities for IOT. If one of the schemes were not implemented in the UE initially, then it would not be possible for the operator to get any gain from UEs implementing this scheme at a later stage. This may be fine if all operators intend to use the same combining scheme, but then in that case we may as well remove the scheme not intended for use.

On the other hand, if both schemes were actually implemented in all UEs during the initial implementation of MBMS, due to the availability of both schemes across network implementations, then we need to consider that this would force a delay to the usage of MBMS in live networks. This delay would be due to:

1) Extra UE implementation being required to support two schemes.
2) The fact that operators would not probably switch on MBMS in live networks until all available MBMS-supporting UEs in the market had been IOT’d against the scheme that they intend to use in the short and long term.

3.2 UE performance testing

Clearly if we have two different combining possibilities, we need to do more simulation work and perform more testing of the UE. Currently in RAN WG4, we have agreed to simulate configurations for both soft and selective combining.

Therefore if we wish to prevent unnecessary work for RAN WG4 and the later definition of tests in GCF, and then additional delay in deployment due to UE verification against these tests in the GCF, it would be useful to make a decision on removing one of these schemes as soon as possible.

4. Which scheme is appropriate for removal?

4.1 Radio efficiencies

From a radio perspective, both soft and selective combining schemes provide the same types of benefits. It has been shown that soft combining gives the greater benefit from this aspect. Within RAN WG1, studies simulations showed that soft combining with 2 radio links gives in the order of 2dB gain in power reduction over selective combining, and in the order of 6dB gain compared to no combining at all. If we rely on the ability to maximise these gains in general across the whole network it would be beneficial.

4.2 Network implementation complexity

4.2.1 Synchronisation

Soft combining requires quite a high level of synchronisation (1 TTI + 1 slot) provided by the UTRAN. Currently RAN WG3 believe that this could be performed in an implementation specific way with no extra standardisation required. The outcome of further discussion with network vendors also suggests that the required level of synchronisation is possible without any major complexity within the network. Therefore selective combining should not be needed as a fallback mechanism.

4.2.2 Service scheduling

When soft combining is used, there is the requirement for a common physical and transport channel configuration to be used on all combinable S-CCPCHs within the instance of a single TTI. In the case where multiple services are being transmitted in the cell on the same S-CCPCH, it would therefore be required for the time scheduling of different services to be common among all combinable cells.

Scenario A:
If in a particular area, service 1 and service 2 were transmitted, but in some cells service 1 was not transmitted on the S-CCPCH due to a lack of users in the cell, then DTX would need to be applied on the S-CCPCH during the time periods over which Service 1 would have been transmitted. This is due to the requirement to maintain a common physical channel configuration so that service 2 can be soft combined. Therefore, the same code resources would need to be retained even though they are not necessarily needed. However Vodafone consider that the proportion of cell power used for S-CCPCH to transmit MBMS will anyway be greater than the corresponding proportion of code resources used. Therefore we do not consider that this would cause a major resource limitation.

Scenario B:
Also, if we take another scenario where two service areas (service 3 and service 4) overlap, then in the cells of the overlapping area it would be useful to use a different physical channel configuration (to transmit service 3 and service 4) than would have been used within the non-overlapping area where only service 3 OR service 4 were being transmitted. Due to the different physical channel configurations, this would mean that in cells bordering the overlapped and non-overlapped areas, soft combining could not be applied, and selective combining would be needed here. However, Vodafone do not consider this scenario to be such a common scenario across the whole network. And therefore the non-availability of selective combining would not have a huge impact on resources.

4.2.3 Services using background QoS RABs

In the case where services are transmitted over a background radio bearer, i.e. only transmitted when there is spare capacity in the cell, soft combining would not work very effectively. However, it is likely that in any case an application level combining may actually be more useful than using selective combining here, due to the potentially high variation in rate, and the likelihood that such a service would be a download service.

5. Way forward

From section 2, Vodafone would like TSG RAN to agree on the removal of rake combining in order to speed up the availability of the MBMS feature.

From section 3,we have described some of the concerns that we have if multiple combining schemes are required. Due to these reasons we request TSG RAN to agree for the removal of one of the combining schemes from the MBMS feature.

From section 4, we have tried to describe the relative benefits and drawbacks of the schemes in the different areas, primarily looking at the areas where the use of soft combining may not be applicable. Vodafone have not found any issues where soft combining will not be useful. Therefore we feel that “selective combining” should be the prime candidate for removal from the MBMS feature.

If TSG RAN cannot agree on one or more of the above proposals at this stage, Vodafone propose that the discussion is continued until the next RAN plenary in June. We believe that this discussion should take place “offline” in the meantime. This will prevent time being spent on this issue during the Working Group meetings, time that is better spent completing the other essential aspects of MBMS feature.

6. References

[1] R4-050167 MBMS performance analysis, Nokia