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Title: **MCCH Mapping onto the MCH**
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1. Introduction

3GPP TS 36.300 specifies that the MCCH and MTCH should at least map to the MCH transport channel. [2] further discusses how the MCH resource allocation update or 'refresh' interval could be associated with MCCH delivery on a periodic basis, over an interval labelled the MCH Resource Allocation Interval (MRAI). [2] further proposes to clarify that there is a one-to-one mapping between an MCCH and its associated MCH (and further associated SFA). An obvious requirement is then a clear definition of the location of MCCH information within the associated MCH Resource Allocation Interval, so as to support ready acquisition of MCCH information by UE's while maintaining good coverage and channel change performance. This contribution discusses how those requirements might potentially be met.

2. MCCH Codeword Structure and Interleaving

The MCCH is obviously distinct from the L1/L2 (PDCCH) control channel associated with the DL/UL-SCH. The MCCH must be transmitted over the entire cell, and so UE-specific optimisation of control channel modulation and coding scheme (MCS) based on H-ARQ, CQI, channel state, etc. is generally inapplicable. Accordingly, the primary means of optimising delivery of the MCCH is to a) maximise time-frequency diversity and b) maximise turbo-codeword length, subject to maintaining good UE power consumption performance (i.e. minimum duty cycle).

Codeword length maximisation suggests concatenation of as much MCCH control information as possible into a single MCCH codeword transmission. Concerning time-frequency diversity maximisation, at least two options are available for mapping the MCCH onto the MCH Resource Allocation Interval, and these appear in Figure 1. In the first approach – Option 1 – the entire MCCH codeword is transmitted in the first (or potentially staggered) MCH-allocated subframe of each MCH Resource Allocation Interval, while in the second approach – Option 2 – the MCCH codeword is distributed in time over the MCH Resource Allocation Interval.

The location of the physical resource – i.e. Resource Blocks or other time-frequency resource partition – comprising each redundancy version of the resulting MCCH codeword is specified with respect to a predetermined segmentation of the MCH Resource Allocation Interval. In Figure 1, for example, the MCH Resource Allocation Interval is divided into M segments and the MCCH codeword also is segmented into M redundancy versions, each of which are then mapped onto the first (or staggered) subframe of each segment.

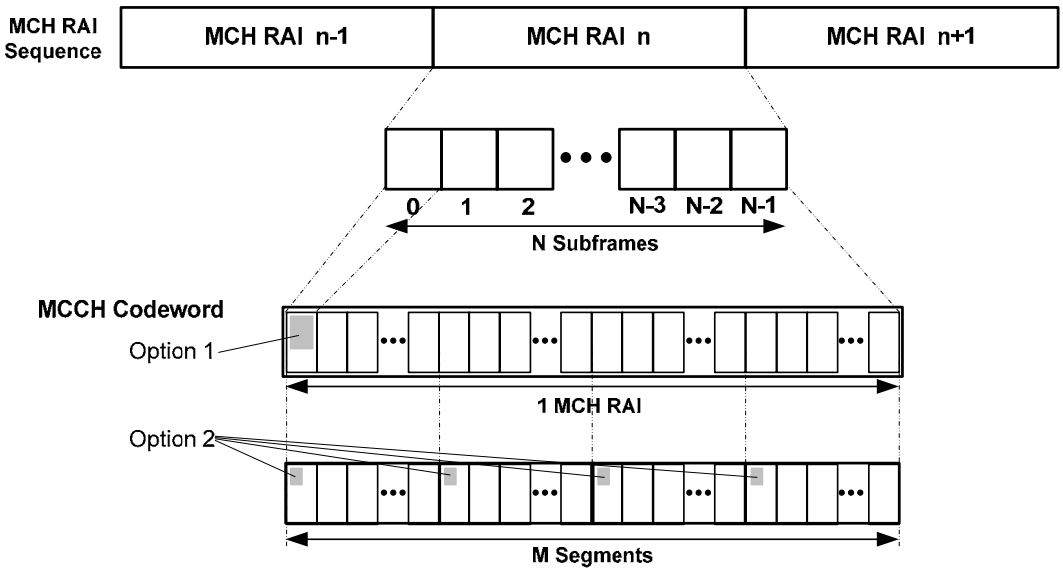

Figure 1 – Options for MCCH mapping onto the MCH RAI.

3. Discussion

Option 1 clearly supports the minimum possible reception duty cycle, and hence minimum UE power consumption. If the resource allocation description contained in MCCH codeword applies to the *same* MCH Resource Allocation Interval as that bearing the MCCH codeword, then UE's accessing the specified MCH asynchronously would have a delay of between (0-1) MCH Resource Allocation Intervals before they could begin to access the MCH. If the resource allocation description contained in MCCH codeword applies to the *next* MCH Resource Allocation Interval then asynchronous UE's would require (1-2) MCH Resource Allocation Intervals before the MCH could be accessed.

Option 2 generally provides enhanced time diversity for moderate to high Doppler frequencies. If the redundancy versions comprising Option 2 are, however, defined to be individually self-decodable, then:

a) for UE's in good SINR conditions, and assuming the resource allocation description contained in MCCH codeword applies to the *current* MCH Resource Allocation Interval, the delay before the UE can access the MCH is in the range $(0,1/M)$ of the MCH Resource Allocation Interval duration. If the MCCH codeword applies to the *next* MCH Resource Allocation Interval, then the delay before a UE can access the MCH is in $(1,1+1/M)$. In either case, the MCH access delay is reduced.

b) UE's in poor SINR conditions may attempt to decode the MCCH by conventional redundancy version combining, with associated MCCH coverage benefits.

4. Conclusions

Distributing the MCCH codeword as a sequence of redundancy versions distributed over a MCH Resource Allocation Interval may provide benefits in terms of MCCH coverage and MCH channel change time reduction, and merits further study.

5. References

[1] TS 36.300, Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2 (Release 8)

[2] R2-070755, “Considerations on MBMS Resource Allocation”, RAN WG2#7, St. Louis, U.S.A, Feb. 12–16, 2007