3GPP TSG-RAN WG2#59
August 20-24, 2007. Athens, Greece. **R2-073525**

Agenda Item: **4.7.1**

Source: Motorola

Title: MCCH design and Sub-frame allocations

Document for: Discussion and Decision

1 Introduction

LTE MBMS will have two modes: MBSFN and Point-to-multipoint. Below we consider the design of the MCCH to enable support of both modes and provide our views on the various issues.

2 Discussion

The information to be carried on the MCCH can be categorized as follows:

Type of information	**Applies to MBSFN or PTM (or both)**
MBMS access information Includes parameters needed for counting (eg., probability factors). Could apply to both PTM and MBSFN. Parameters are listed by service ID.	PTM and MBSFN
MBMS Service Information Identifies MBMS services that are available in the cell	PTM and MBSFN
MBMS SFA information Information about each SFA that the cell participates in. Must include for each SFA at least: • MBSFN Sub-frame allocation pattern (MSAP) • Number of control channel symbols in MBSFN subframes (indication of whether an MBSFN subframe has one or two PDCCH OFDM symbols). • Scrambling code for the MBSFN subframes	MBSFN
MBMS PTM Radio Bearer information Description of PTM bearer used within the cell	PTM
MBMS Neighbouring cell Information MBMS PTM information for neighbouring cells	PTM

Based on the categories, the information that applies to MBSFN can be transmitted via the SFN and the non-MBSFN information needs to be broadcast independently in each cell. Thus we have MCCHs that are transmitted in SFN and MCCHs that are cell specific.

The primary considerations in the design of the MCCH are:

1. The number of MCCHs should be minimized.
2. The number of MCCHs a UE needs to receive are minimized regardless of how many services it is interested in.
3. MCCH can be acquired by UEs quickly.
4. MCCH can be re-acquired quickly when there is change in MCCH information, with minimal UE battery impact.

A: How many MCCHs should be supported?

Option A1: One cell specific MCCH to contain all MCCH information (for both PTM and MBSFN).

Option A2: One cell specific MCCH to contain all PTM information and one MCCH per MCH in the cell (referred to as SFA specific MCCH).

Option A3: One cell specific MCCH to contain all PTM information and one MCH MCCH for all MBSFN services in the cell (referred to as Common SFA MCCH).

Option A1 may be simpler than the other options (does not require multiplexing of MCCH on to the MCH or setting up a new MSAP for the MCCH). The UE needs to monitor a single MCCH for all services and channel switch time is minimized. However, it does not benefit from SFN.

Option A2 is the hierarchical MCCH approach described in [1] . Each MCH (SFA) has an associated SFA specific MCCH. If a cell has several SFAs then there would be several SFA specific MCCHs. If a UE is interested in services that are on different SFAs then it may need to do one of the below:

- Monitor MCCHs for multiple SFAs; this could impact the UE's battery life
- Whenever there is a need to get information about a new/different service, UE reads the cell specific MCCH and all the SFA MCCHs; this could result in long channel switch times.

Option A3 has one cell specific MCCH and one MCCH for all the SFAs. That is, all the MBSFN information for all SFAs in the network is carried on a single MCCH in SFN mode. The MBSFN subframe allocation pattern (MSAP) for this MCCH can be indicated in the cell specific MCCH or in the BCCH. This option provides the benefits of SFN. However, the SFA MCCH needs to have its own subframe allocation; since the SFA MCCH carries information for multiple SFAs it cannot use the MSAP corresponding to any of the SFAs. The SFAs that a particular cell participates in is signalled on the BCCH (BCCH includes a list of SFA IDs).

Preference: Option A3.

B: How does UE acquire the MCCHs?

Option B1: BCCH carries pointers (scheduling information) to the MCCHs

Option B2: BCCH carries pointer to the cell specific MCCH; Cell specific MCCH carries pointer to SFA specific MCCH or Common SFA MCCH.

Clearly, if there are no SFA specific or Common SFA MCCHs, then Option B1 is used.

Option B2 may include a significant delay in acquiring the MBSFN parameters because the UE has to acquire the BCCH, followed by the cell specific MCCH and then the SFA specific MCCHs or the Common SFA MCCH. We see no significant advantage in option B2 over option B1.

Preference: Option B1.

The various combinations of A and B options are illustrated below. Note that Option A1+Option B2 is not possible.

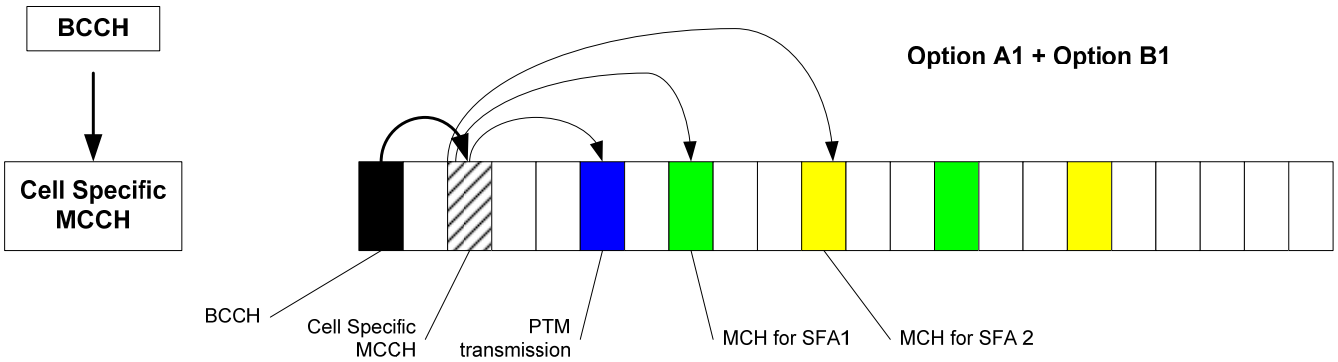

Figure 1: Options A1+Option B1

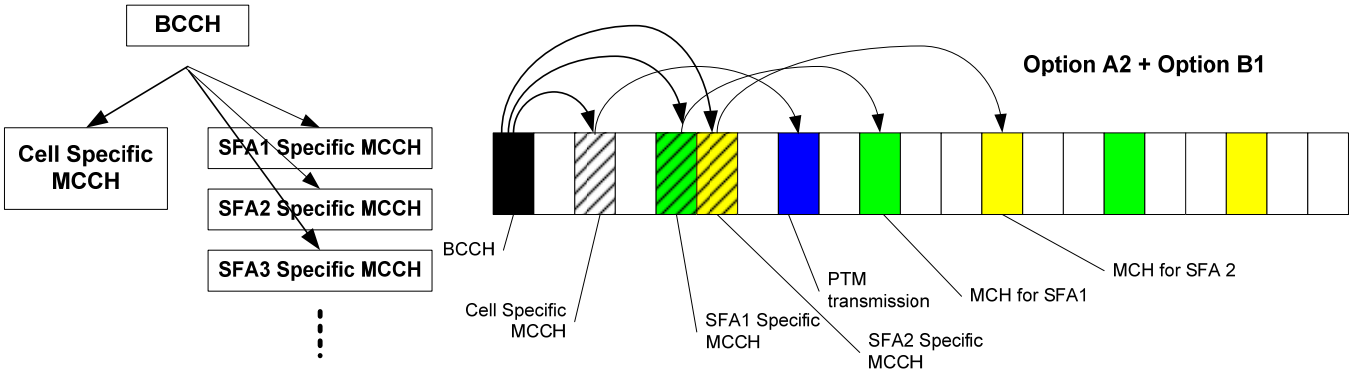

Figure 2: Option A2+Option B1

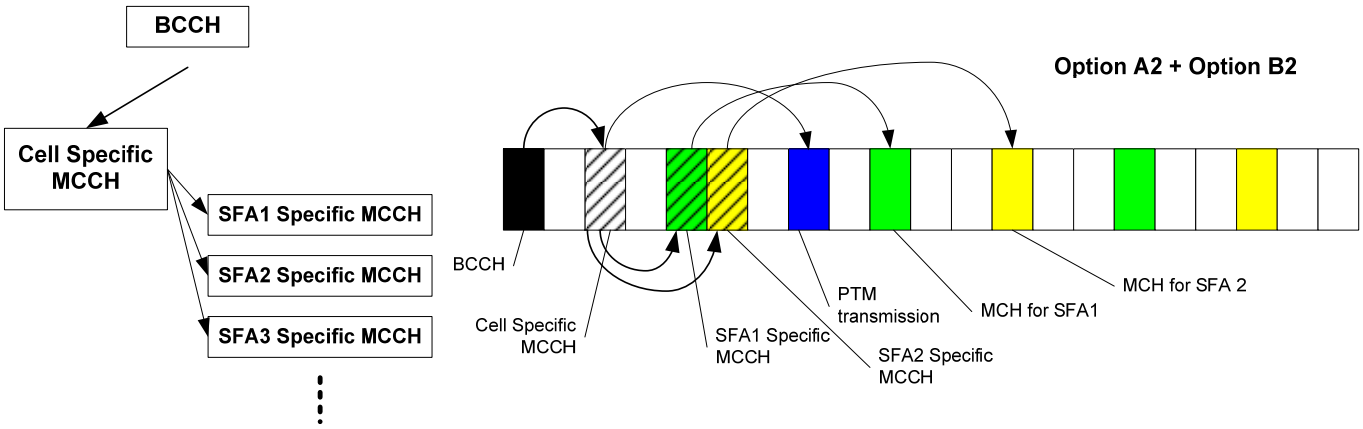

Figure 3 : Option A2 +Option B2

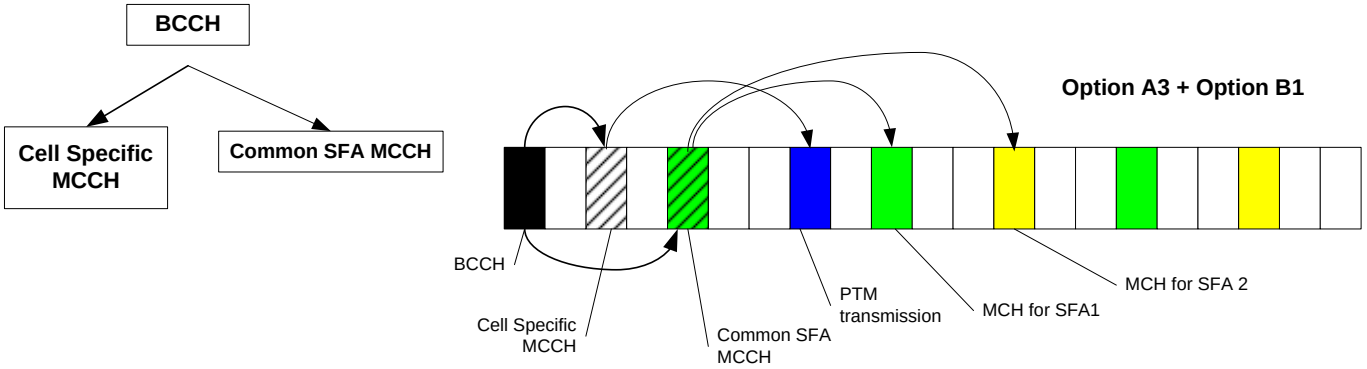

Figure 4 : Option A3 + Option B1

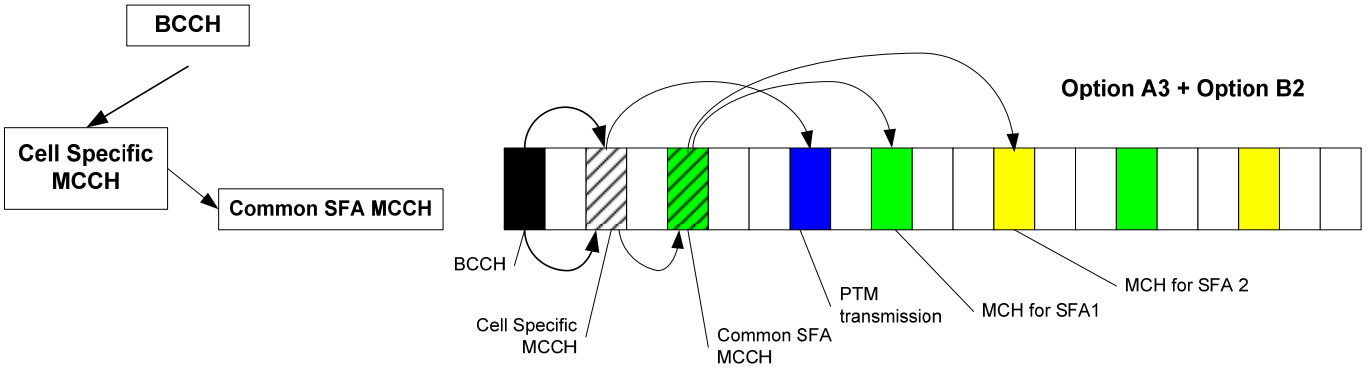

Figure 5 : Option A3+Option B2

C: How is change in MCCH information indicated?

Option C1: A single indicator on BCCH to indicate change on any MCCH.

Option C2: An SFA specific indicator on BCCH to indicate changes to any particular SFA.

Option C3: A service specific indicator on BCCH to indicate changes to any particular service.

Option C1 requires a UE to reacquire all MCCH information even when one service has a minor change. If there are a significant number of services this may result in impact to UE battery life.

Option C2 enables the network to indicate to the UE when there is a change on a particular SFA. This indicator is carried in the cell-specific MCCH or in the BCCH; therefore the UE would need to monitor the cell specific MCCH or the BCCH at modification times in addition to any other MCCH it may be monitoring. This option still requires the UE to reacquire all of the MCCH information for that SFA.

Option C3 enables the network to indicate to the UE when there is a change on a particular service. This indicator is carried in the cell-specific MCCH or in the BCCH, and the UE would need to monitor the cell specific MCCH or the BCCH in addition to any other MCCH it may be monitoring. This option minimizes the amount of information the UE needs to reacquire.

Each of the indicators considered above are single-bit indicators. We think the overhead for option C2 or C3 is justified by the minimization of MCCH reacquisition by the UE.

Preference: Option C3.

3 Conclusion

We have looked at the organization of MCCH information and its association with the two types of MBMS transmission. With the intention of keeping the design simple while taking into account the primary considerations mentioned earlier, we propose the following:

- One cell-specific MCCH to carry all PTM information. Scheduling information for this MCCH is carried in the BCCH.
- BCCH carries the list of SFA identifiers for the SFAs that the cell participates in.
- One MCCH for all MBSFN services. Scheduling information for this MCCH is carried in the BCCH.
- The BCCH carries service specific change indicators.

4 References

[1] R2-072477, “Hierarchical MCCH”, Nortel.