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Title	Structure of PBCH (PSI) and SBCH (SSI)
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Re:	TGm SDD: Other
Abstract	Proposal for IEEE 802.16m Super-frame Header Structure and its contents
Purpose	Discussion and Approval
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Structure of PBCH (PSI) and SBCH (SSI)

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1. Introduction and Background

Section 11.7.2.2.1 of current SDD IEEE 802.16m-08/003r6 provides description about the Primary Broadcast Channel (PBCH) and Secondary Broadcast Channel (SBCH) broadcast channels. This contribution proposes the structure and transmission format of PBCH and SBCH. This contribution also refers PBCH as Primary System Information (PSI) and SBCH as Secondary System Information (SSI).

1.2 Proposed PBCH (PSI) and SBCH (SSI) Structure

This contribution proposes structure of SFH for IEEE 802.16m based WiMAX network as shown in Figure 1.

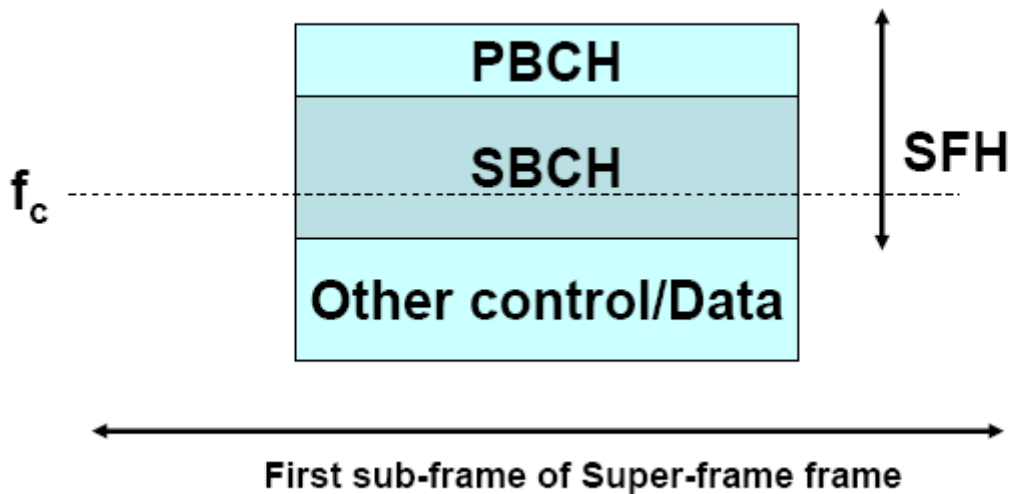


Figure 1: Structure of PBCH and SBCH.

PBCH (PSI) carries essential information that is required every super-frame. Possible fields of PBCH are as follows

- system BW index
- Transmission format of SBCH (SSI)
- Resources (# of PRUs) used for SBCH (SSI) (4-5 bits)
- LSBs for frame number
- DL FFR information
- UL FFR information
- CP length

- Sector ID
- CRC

SBCH (SSI) carries rest of the system information. Instead of using many different methods such as use of DCD/UCD, neighbor advertisement etc this contribution proposes a structure of SBCH using which different system information can be transmitted in a flexible manner. SBCH (SSI) is always transmitted after PBCH (PSI). The transmission format and structure (arrangement on information fields in SBCH (SSI)) proposed in this contribution is flexible for different deployment scenarios and achieve a good balance between the latency requirement for different system information acquisition and L1/L2 overhead.

This contribution divided the contents of SBCH into different sub-packets: Sub-packet 1, Sub-packet 2, Sub-packet 3, Sub-packet 4, Sub-packet n etc. It may be noted that n is a non-zero integer. Sub-packet 1 is always present in SBCH. However, the other sub-packets (Sub-packet 2 to Sub-packet n) may not be present in every SBCH. The presence or absence of Sub-packet 2 to Sub-packet n is specified using a SBCH Sub-packet (SP) bit map. The first bit (MSB) of SBCH Sub-packet (SP) bit map corresponds to Sub-packet 2, the second bit of SBCH Sub-packet (SP) bit map corresponds to Sub-packet 3 and so on. When a particular bit of this bit MAP is set to 1, it implies that the corresponding Sub-packet is included in the SBCH. On the other hand, when a particular bit of this bit MAP is set to 0, it implies that the corresponding Sub-packet is not included in the SBCH. This structure of PBCH and SBCH is shown in Figure 2. The contents of different SBCH sub-packets are determined by the transmission frequency of the information. A lower order sub-packets (e.g., sub-packet 1, sub-packet 2) is transmitted more frequently compared to a higher order sub-packet (e.g., sub-packet 3, sub-packet 4).

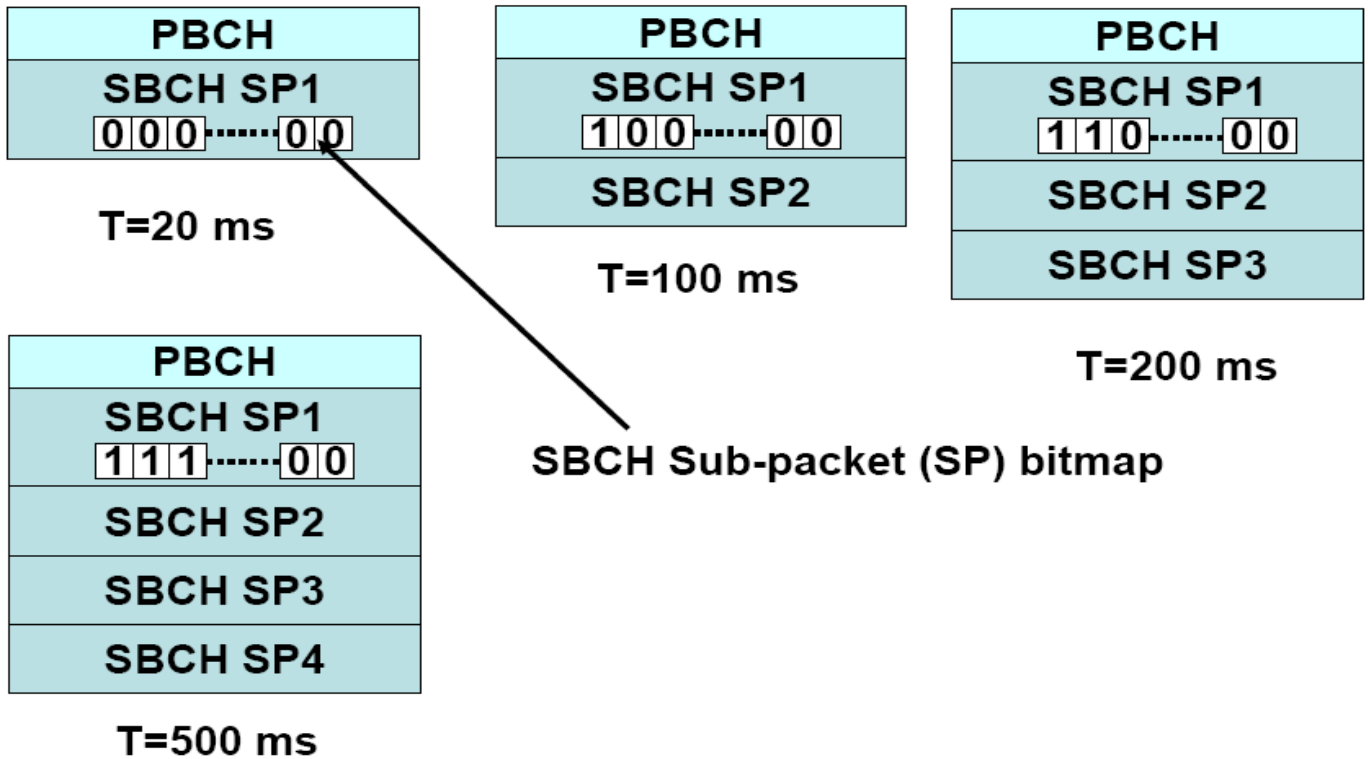
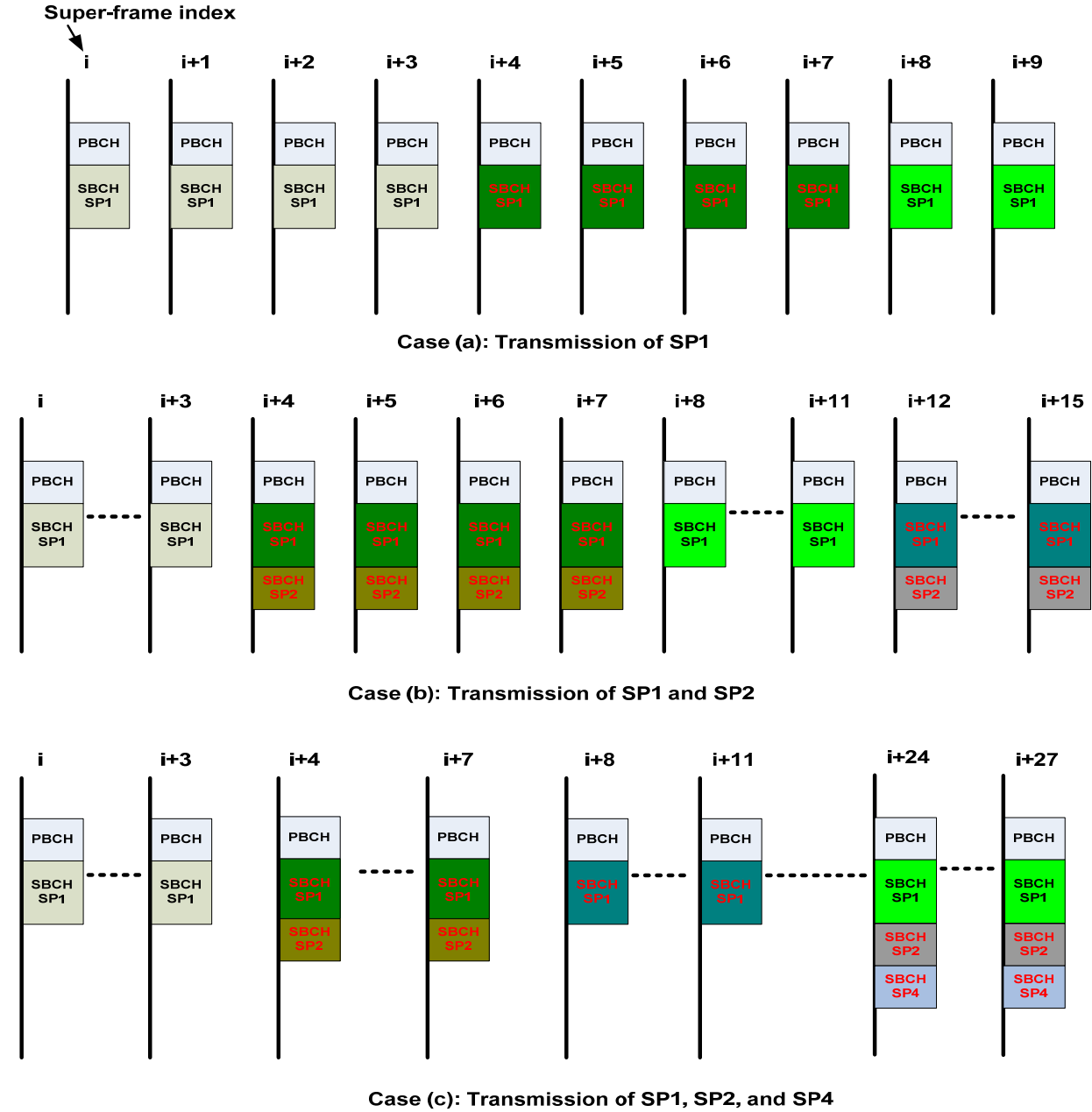


Figure 2: Proposed sub-packet structure for SBCH.

1.3 Transmission of PBCH (PSI) and SBCH (SSI)

The PBCH is transmitted in such a way that each PBCH can be decoded successfully. On the other hand, SBCH is transmitted in such a way that up to four consecutive instances of SBCH can be combined for successful decoding.



SBCH sub-packets of same color contain same information. SBCH sub-packets of different colors may contain different information

Figure 3: Proposed sub-packet structure for SBCH.

Transmission of PBCH and different sub-packets of SBCH is shown in Figure 3. For this illustration it is considered that SP1 is transmitted in every 100 ms (5 super-frames) and SP4 is transmitted in every 500 ms (25 super-frames).

1.3 Structure of SBCH in mixed mode operation of IEEE 802.16e and IEEE 802.16m based WiMAX networks:

In a scenario where WiMAX networks based on IEEE 802.16e and IEEE 802.16m are both present, some of the system information may be common between these two systems. This is known as mixed mode operation of WiMAX networks. In this case, transmission of this common information in both IEEE 802.16e and IEEE 802.16m based WiMAX networks may be unnecessary and incurs undesired overhead. To make the structure of SBCH flexible enough so that system information that is common to IEEE 802.16e and IEEE 802.16m need not be transmitted in IEEE 802.16m, the proposed contribution partition the sub-packet contents into 16m only part; and the 16e and 16m common part as shown in Figure 4. In a mixed mode operation the system information common to both 16e and 16m need not be transmitted in 16m to reduce system overhead as shown in Figure 5. The inclusion or exclusion of system information common to both 16e and 16m is specified using a single bit in each sub-packet.

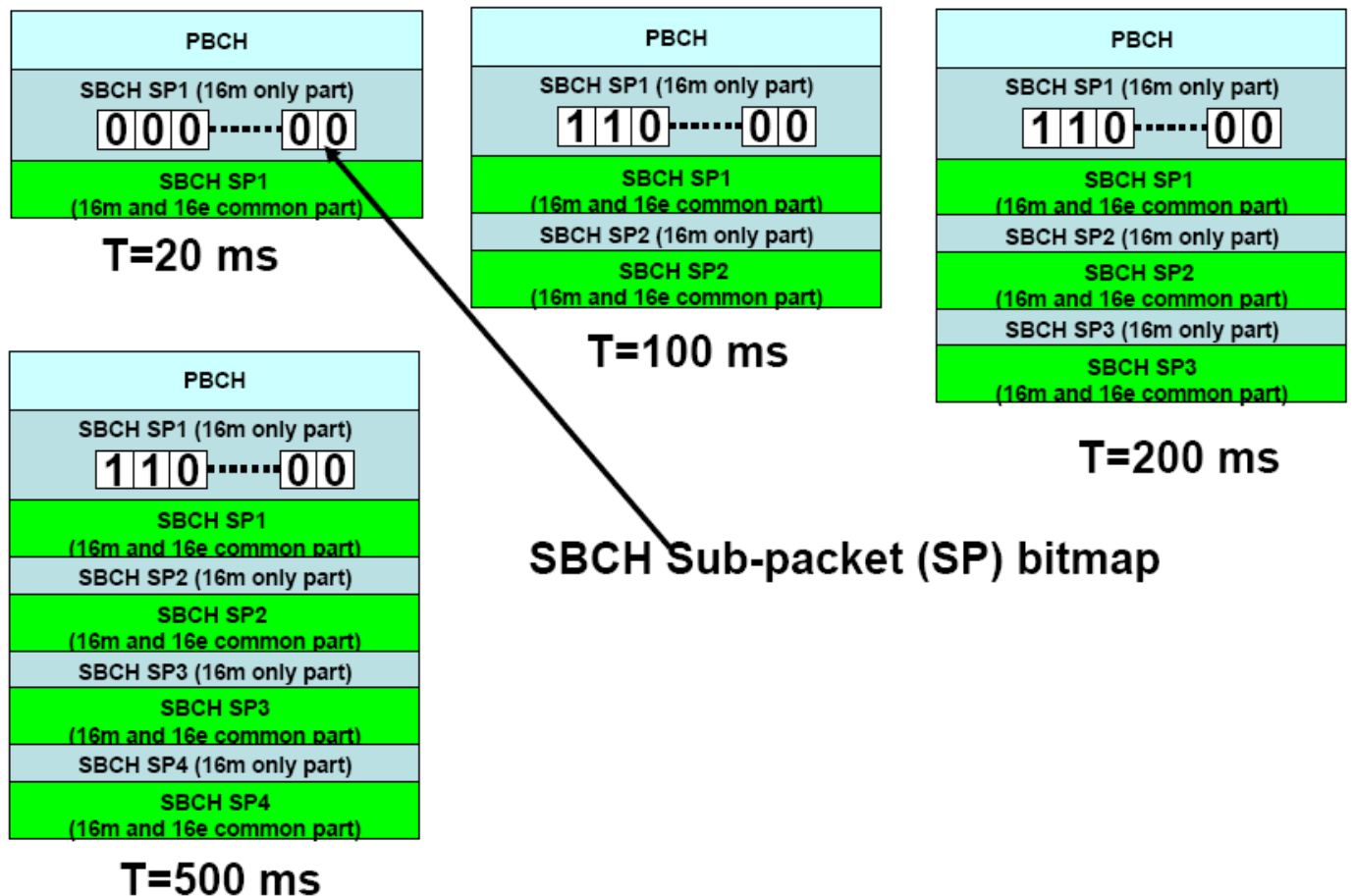


Figure 4: Proposed PBCH and SBCH Structure for 16m in mixed mode operation when both 16m and 16e parts are transmitted

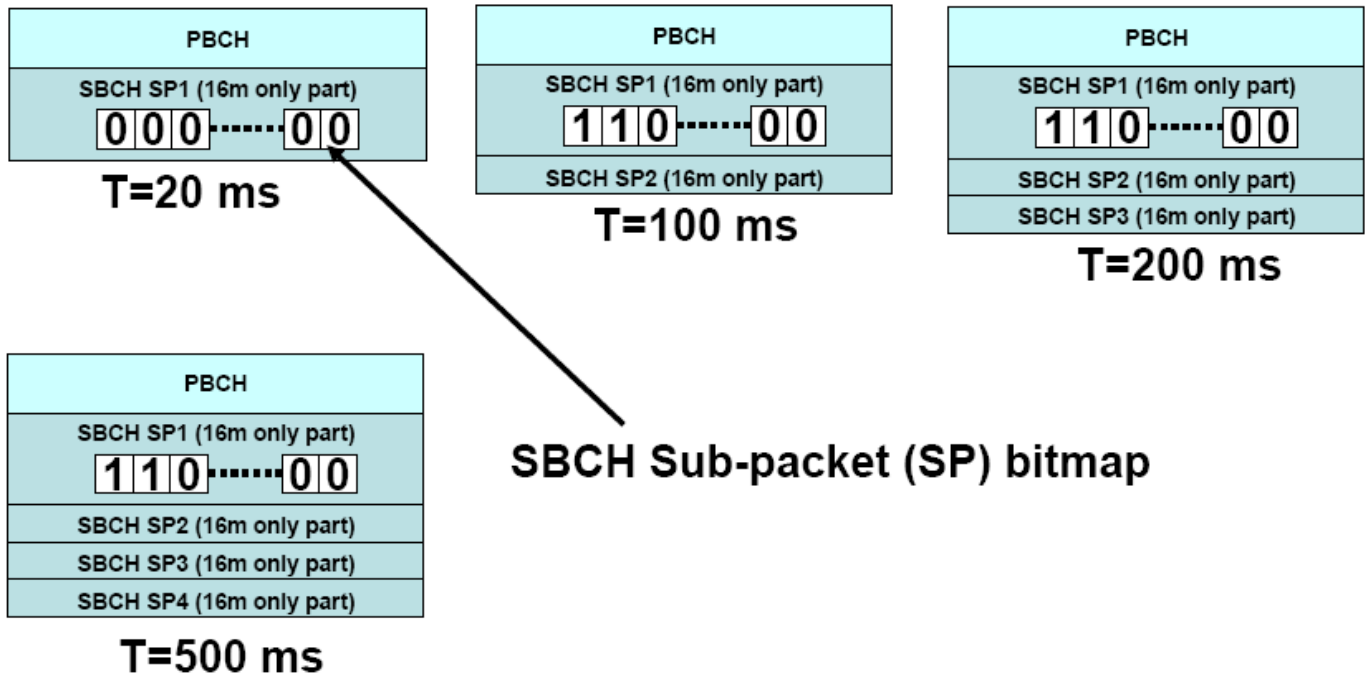


Figure 5: Proposed PBCH and SBCH Structure for 16m in mixed mode operation when 16m only parts are transmitted

This contribution has the following advantages:

- It minimizes the size of PBCH that is transmitted using most robust transmission format
- It transmits rest of system information (excluding extended system information) in one channel, i.e. SBCH so that a terminal has to look for one place for this information.
- Instead of using many different methods such as use of DCD/UCD, neighbor advertisement etc it is desirable to design SBCH in such a way that different system information can be transmitted in a flexible manner in SBCH

2. Proposed text changes for SDD

Replace the last sentence in 11.7.2.2.1 with the following text:

----- Text Start -----

The contents of PBCH (PSI) include essential system information that is required every 20 ms, for example, system BW index, Transmission format of SBCH (SSI), Resources (# of PRUs) used for SBCH (SSI) (4-5 bits), LSBs for frame number, DL FFR information, UL FFR information, CP length, Sector ID etc.

The contents of SBCH (SSI) are divided into different sub-packets. The lowest order sub-packet of SBCH (SSI) is present in all the SFH. On the other hand, the higher order sub-packets of SBCH (SSI) may or may not be present in all the SFH. The presence of higher order sub-packets in a SFH is specified using a SBCH (SSI) sub-packet bit map that is present in the lowest order sub-packet. Sub-packets of SBCH are transmitted over one or more super-frames.

To eliminate the duplication of essential system information in legacy system and in IEEE 802.16m based system, the contents of the sub-packets may be further divided into two classes: IEEE 802.16m specific information and information that is common to both legacy and IEEE 802.16m systems. In a mixed mode operation, the IEEE 802.16m system may transmit only 16m specific information in different sub-packets of SBCH to eliminate duplicate transmission of same information.

----- Text End -----

3. References

[1] IEEE Std. 802.16e-2005, IEEE Standard for Local and metropolitan area networks, Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems, Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands, and P802.16Rev2/D3 (February 2008).

[2] WiMAX Forum™ Mobile System Profile, Release 1.0 Approved Specification (Revision 1.4.0: 2007-05-02), <http://www.wimaxforum.org/technology/documents>.

[3] IEEE 802.16m-08/003r4, "The Draft IEEE 802.16m System Description Document"