

Proposal for IEEE 802.16m Synchronization Channel

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE C802.16m-08/286

Date Submitted:

2008-05-05

Source:

Sung-Eun Park, Songnam Hong, Seunghoon Choi, Jaeweon Cho,
Jaehye Cho, Heewon Kang, Hokyu Choi, DS Park

Samsung Electronics, Co., Ltd.

416 Maetan-3, Suwon, 443-770, Korea

Voice: +82-31-279-5249

E-mail: se.park@samsung.com

Venue:

IEEE 802.16m-08/016r1, "Call for Contributions on Project 802.16m System Description Document (SDD)",

On topic of "Preambles."

Base Contribution:

None

Purpose:

To be discussed and adopted by TGM for use in 802.16m SDD

Notice:

This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups. It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.

Release:

The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

Patent Policy:

The contributor is familiar with the IEEE-SA Patent Policy and Procedures:

<<http://standards.ieee.org/guides/bylaws/sect6-7.html#6>> and <<http://standards.ieee.org/guides/opman/sect6.html#6.3>>.

Further information is located at <<http://standards.ieee.org/board/pat/pat-material.html>> and <<http://standards.ieee.org/board/pat>>.

Proposal for IEEE 802.16m Synchronization Channel

*Sung-Eun Park, Songnam Hong, Seunghoon Choi, Jaeweon Cho,
Jaehee Cho, Heewon Kang, Hokyu Choi, DS Park*

Samsung Electronics Co., Ltd.

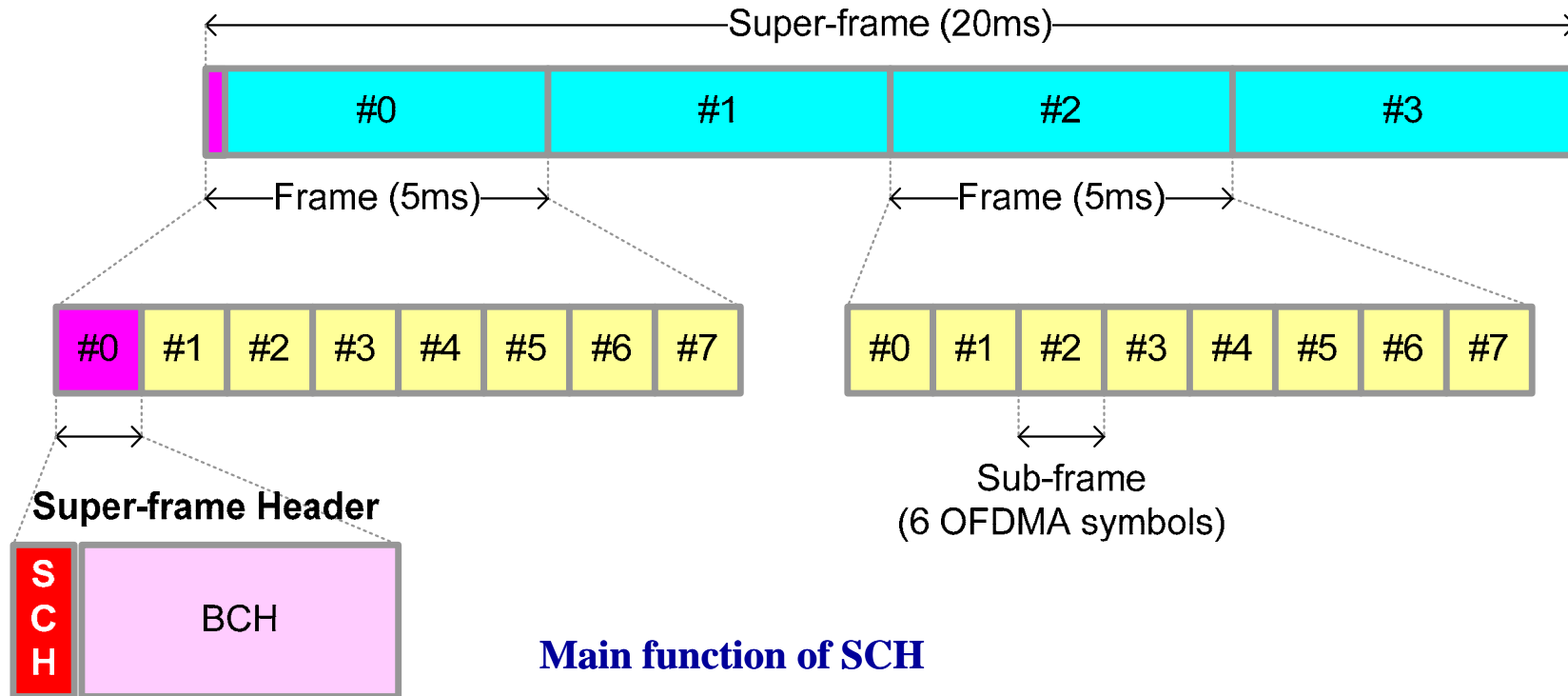
About This Contribution

- Goal and scope of this contribution
 - Propose a synchronization channel(SCH) design for 802.16m
- Issue to be addressed in this contribution
 - Transmit period of SCH
 - Number of SCH symbol per super-frame
 - Number of cell ID
 - Timing synchronization method
 - Bandwidth of SCH

Requirements

- Simple timing/frequency synchronization
 - Fast cell search
 - Low computational/implementation complexity
 - Low memory requirement
- More number of cell ID than 802.16e
 - Support femto cell
- Support channel estimation
 - Flat frequency spectrum
- Low PAPR for power boosting
- Low overhead

SCH Structure



Main function of SCH

- Provide reference of time/frequency synch, and BS identification

SCH structure

- 1 symbol in Super-frame header

SCH Features

Attribute		Value	
Channel Structure	Tx Period	20ms	
	Bandwidth	5MHz, 10MHz	
	Position	Time	Within super-frame header
		Freq	Center of FFT BW
Symbol Structure	Num of cell IDs	1024	
	Num of Symbols	1	
	Time Sync method	2x time repetition (Schmidl & Cox)	
	Fast Cell Search	2 sets are interlaced in frequency domain	
	Sequence	BPSK modulated Frequency Domain Sequence	
Other functions than Sync	NBR Cell Search for Handover	Common Pilot (5ms) based cell-search	
	Additional function/Information	TBD	

SCH and Common Pilot Operation

- SCH [20ms Tx period]
 - Time/freq synchronization + cell ID detection
- Common Pilot (DL reference signal) [5ms Tx period]
 - Common (or predetermined cell-specific) time/freq position among cells
 - Covered by a cell-specific code
 - Provide reference signal for each antenna to support MIMO

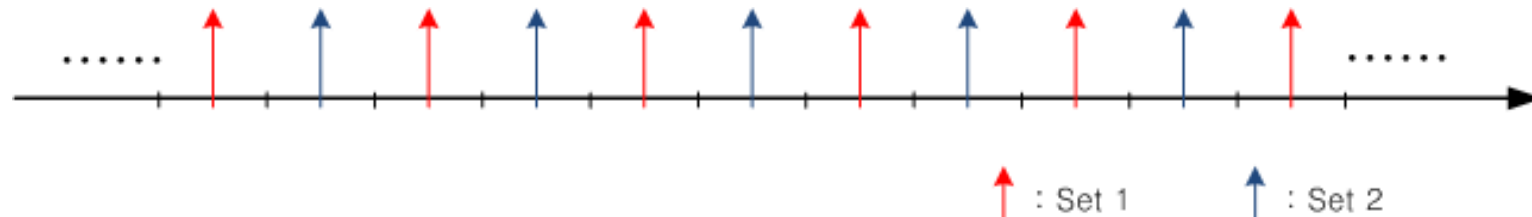
Function	Update period	Channel
Time sync.	20ms	SCH
Freq sync.	20ms	SCH
Cell ID detection	20ms	SCH
CQI measure (per Ant)	5ms	Common Pilot (DL Ref. Signal)
RSSI measure	5ms	Common Pilot (DL Ref. Signal)
NBR cell measure	5ms	Common Pilot (DL Ref. Signal)

SCH Symbol Structure

- Number of cell ID = 1024
- 1 symbol used for time/freq synch & BS identification
- Time Synchronization by Schmidl & Cox using 2x time repetition
- Support fast cell search
 - Two sets are interlaced in frequency domain
 - Each set has 32 sequences ($32 \times 32 = 1024$)

	5 MHz	10 MHz
FFT size	512	1024
Sequence Length	108	216

- BPSK modulated frequency domain sequence with low PAPR and good correlation properties
 - Low complexity at terminal



Simulation Assumption

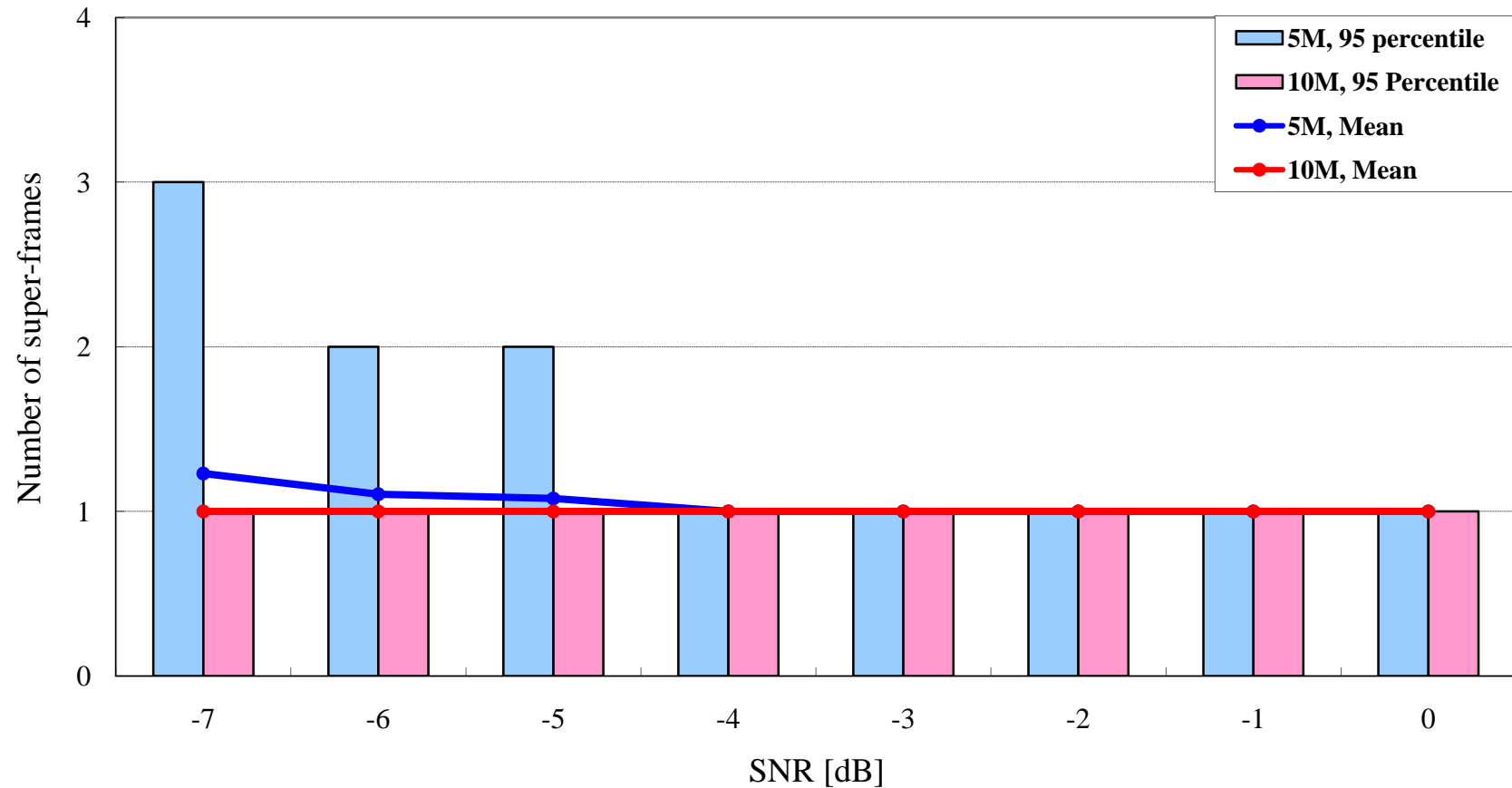
Parameter	Assumption	
System Bandwidth	5 MHz	10MHz
SCH Bandwidth	5 MHz	10MHz
Total number of sub-carriers	432	864
Number of sub-carriers for SCH	216	432
Length of sequence in the set	108	216
Sequences	BPSK modulated sequence (FD)	
Channel Models	PED B, 60km/h	
Number of cell IDs	1024	
Number of antennas	1 Tx, 2 Rx	
Power Boosting	7 dB ^{1), 2)}	
Cell ID Detection	Ideal timing and frequency offset compensation are assumed	

1) 7dB boosting comes from 3dB equal OFDM symbol power gain and 4dB PAPR gain against random data symbols. PAPRs of all SCH are 4dB lower than those of 99% random data symbols.

2) Power boosting is reflected on the timing synchronization only. It is assumed that there isn't any power boosting gain on cell ID detection. This is suitable for the interference limited environment.

Performance

- Timing & Cell Acquisition time (Number of super-frames)



Text Proposal to 802.16m SDD

Insert the following text into Physical Layer clause (Chapter 11 in [IEEE 802.16m-08/003r1])

11.x Synchronization Channel

Synchronization channel differentiates 1024 unique cell identities. Synchronization channel is transmitted at every 20msec on the one OFDMA symbol in the super-frame header. For FFT sizes of 512 and 1024, Synchronization channel spans 432 and 864 subcarriers of the OFDMA symbol respectively, and occupies every other subcarrier over this span.