Preamble for 16m

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE C80216m-08/479

Date Submitted:

2008-5-5

Source: Zexian Li, Shashikant Maheshwari,   Voice: +358 50 48 69272

Adrian Boariu, Yousuf Saifullah,   Email: zexian.li@nokia.com

Xin Qi

Nokia, Nokia Siemens Networks

Yan-Xiu Zheng, Richard Li   Email: zhengyanxiu@itri.org.tw

ITRI   richard929@itri.org.tw

Yong Sun   Email: sun@toshiba-trel.com

Toshiba Research Europe Limited

Venue:

IEEE 802.16 Session #55, Macao, P. R. China

Re: IEEE 802.16m-08/016: Call for Contributions on Project 802.16m System Description Document (SDD)

Topic: Preamble

Purpose:

Discuss and adopt the proposed text into 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:

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 >.

Background and introduction

- Overhead reduction, latency reduction, minimizing complexity are among the list of system requirements in 802.16m SRD.

- Preamble, a.k.a synchronization channel design in 16m plays a key role. The following factors need to be taken into account:
  - Overhead vs periodicity
  - Impacts on synchronization latency
  - Minimizing network entry/re-entry latency
  - Impacts on channel estimation accuracy
  - Impacts on pilot overhead
  - Minimizing efforts and time for preamble design
    - Reusing 16e preamble whenever possible
    - Benefits should be clearly seen before going to new preamble design.

Legacy mode

- Due to the legacy support requirement, 16e preamble shall be transmitted at the beginning of every radio frame (i.e. every 5ms).
- According to SRD, 802.16m MS shall be able to operate with a legacy BS which means 16m MS has the capability of synchronizing with 16e preambles.
- If new preamble is transmitted in every superframe and occupies one OFDM symbol, roughly the additional overhead is 0.5%.
- If 16m MS just relies on 16m preamble for initial network entry, performance degradation can be introduced due to the long periodicity of 16m preamble (e.g. 20 ms).
- In order to avoid any additional overhead, it is reasonable to reuse the legacy preambles and compatible to legacy system, i.e.
  - Both 16e and 16m MSs search for 16e preamble for initial network entry
  - No impacts on legacy MSs.
  - 16m MS can find out 16m subframes by looking into e.g. FCH which can be used to indicate the starting point of 16m DL.
  - if 16m MS detect new 16m preamble sequences, it does not need to decode 16e FCH.
  - We proposed the simple design for 16m MS network entry for both legacy and green-field operation with tradeoff between minimal complexity and overhead.

Greenfield mode

- Is there a need to change the periodicity different to the current 16e?
    - If we increase the preamble periodicity, for example, preambles are transmitted every 10 or 20ms, initial network synchronization time and thus network entry latency will be increased compared to 16e case (2 times/4 times longer) if assuming the same synchronization procedure is used.
    - If we reduce the preamble periodicity, the preamble will appear not in every frame, but in several subframes, more overhead is introduced with negligible performance improvement.
    - Preamble can be used to improve channel estimation performance especially helping for the control channel information which comes right after/before preamble. With increased periodicity of preambles, it is very likely the pilot density need to be increased in order to keep similar channel estimation performance which will result in extra overhead.
    - Our conclusion is there is no need to change the periodicity of preamble transmission, i.e. **preamble can be transmitted in every 5 ms radio frame**.
- Is there a need to design new preamble sequence?
    - Yes, in order to
        - Disable legacy support by using new preamble.
        - Efficiently support femto cells (self organization network)
        - Reduce preamble collision
    - It is proposed to have 192 new preamble sequences (3 segments * 64 Id-cell) for 16m.

Proposed text for SDD

11.x.2 Synchronization channel (SCH)

Synchronization channel (i.e. preamble) is required by MS to maintain DL synchronization with the BS.

The synchronization channel shall be transmitted at the beginning of every radio frame.

The preamble shall provide the cell identity. BS transmits legacy preamble when legacy support is enabled. In the green field deployment scenarios BS may transmit new preamble sequences. The number of preambles is TBD.