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Date Submitted	<b>2008-05-05</b>	
Source(s)	<p>Yong Sun, Toshiba Research Europe Limited 32 Queen Square, Bristol BS1 4ND, UK</p> <p>Tsuguhide Aoki, Shohei Kikuchi, Hiroki Mori Mobile Communication Laboratory, Corporate R&amp;D Center, Toshiba Corporation, 1, Komukai Toshiba-Cho, Saiwai-ku, Kawasaki, 212-8582, Japan</p> <p>Zheng Yan-Xiu, Ren-Jr Chen, Fang-Ching Ren, Richard Li ITRI</p>	<p>Voice: +44-117-9060749 Email <a href="mailto:Sun@toshiba-trel.com">Sun@toshiba-trel.com</a></p> <p>Voice: +81-44-549-2283 Email: <a href="mailto:tsuguhide.aoki@toshiba.co.jp">tsuguhide.aoki@toshiba.co.jp</a></p> <p>Voice: +886-3-5914715 E-mail: <a href="mailto:zhengyanxiu@itri.org.tw">zhengyanxiu@itri.org.tw</a></p> <p>*&lt;<a href="http://standards.ieee.org/faqs/affiliationFAQ.html">http://standards.ieee.org/faqs/affiliationFAQ.html</a>&gt;</p>
Re:	Call for Contributions on Project 802.16m System Description Document (SDD) issued on 2008-03-20 (IEEE 802.16m-08/016r1) Topic covered: Preambles	
Abstract	Preamble design for a common preamble deployment for 802.16m and its legacy system	
Purpose	For discussion and approval by IEEE 802.16m TG	
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# A common preamble deployment in DL for 802.16m and its legacy Support

*Yong Sun*

*Toshiba Research Europe Limited, 32 Queen Square, Bristol BS1 4ND, UK*

*Tsuguhide Aoki, Shohei Kikuchi, Hiroki Mori*

*Mobile Communication Laboratory, Corporate R&D Center, Toshiba Corporation,*

*1, Komukai Toshiba-Cho, Saiwai-ku, Kawasaki, 212-8582, Japan*

*Zheng Yan-Xiu, Ren-Jr Chen, Fang-Ching Ren, Richard Li*

*ITRI*

## 1. Introduction

This document is provided in response to the Call for Contributions on Project 802.16m System Description Document (SDD) issued on 2008-03-20 (IEEE 802.16m-08/016r1) on technical topic of ‘Preamble’.

In this contribution, we present preamble designs and propose a common preamble deployment for both 802.16m and its legacy systems. The core concept of this contribution is to make one complete system for 802.16m to meet IMT-advanced requirement with intelligent legacy support for high efficient deployment of 802.16m system.

## 2. Key issue and challenge on 802.16m preamble

There are many discussions and contributions on 802.16m frame structure, which have shown different concerns on preamble definition. For a new system such as 802.16m under development, it is critical to make consensus on its true target and purpose and keep them consistence during the whole development. We would like to emphasize in this contribution that 802.16m shall target on meeting IMT-Advanced requirements without too much constraint. 802.16m shall support legacy system(s) but the legacy support shall not have adverse impact on 802.16m system.

There could be many issues on 802.16m. However, the key issue is the function of preamble for 802.16m system. We need to consider if we need a preamble for 802.16m system to achieve the following basic requirements:

- Synchronization;
- Channel estimation;
- Handover

Some proposals on preamble for 802.16m and legacy support by employing separate preamble usage for legacy and 802.16m system cannot ensure the new system to meet the basic requirement but only waste resources. It could be a problem to guarantee new system’s requirements with adopting legacy system as a whole part in the system design. In this contribution, we propose the common preamble to compromise the conflictions.

## 3. Common preamble concept and advantages

It is well-understood that the downlink preamble should meet the basic requirements of accurate initial synchronization, fast/accurate synchronization for handover and reliable cell/sector search performance. It also

needs to support easy deployment of system and high system throughput. Furthermore, the preamble should provide initial channel estimation as it is always supported by WiMAX system.

A common preamble deployment is proposed in this contribution to deploy only one preamble for 802.16m and its legacy support to achieve quick initial synchronization, fast handover and reliable cell search. It also achieves high efficiency with less overhead in the system operation.

With the common preamble deployment, both 802.16m and legacy systems are possible to share/employ the same mapping zone which is able to further reduce overhead.

The basic concept of a common preamble of downlink for 802.16m and its support of legacy system can be depicted in Figure 1.

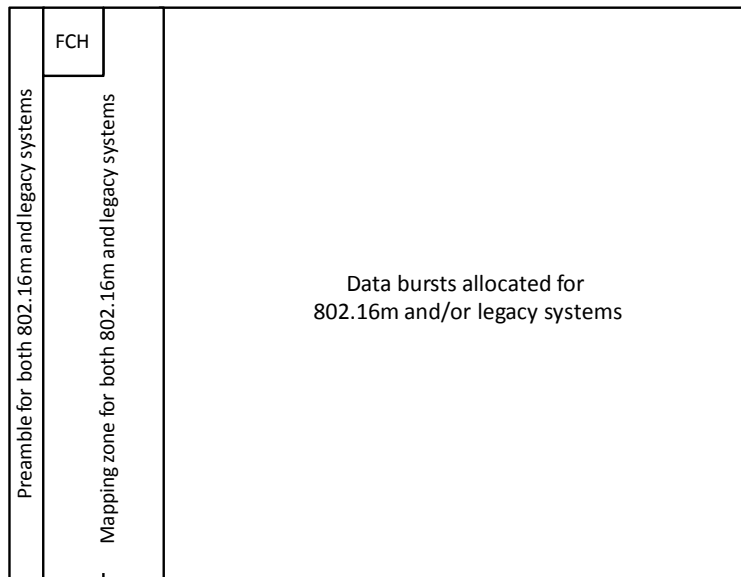


Figure 1: A common preamble deployment for 802.16m

As shown in figure 1, the preamble proposed for 802.16m is a true preamble positioned at the beginning of a frame for synchronization, handover, channel estimation, etc. Furthermore, in order to support legacy system(s), the preamble has to be recognized by the legacy system(s) for synchronization, handover and channel estimation.

#### 4. Preamble deployment and its development

As described above, the preamble should be sit at the beginning of 802.16m frame to achieve the basic requirements. There are several deployment scenarios of the preamble but fundamentally we are targeting on supporting both 802.16m and legacy system(s). In this contribution, we only discuss two typical scenarios.

1. Same bandwidth for 802.16m and legacy system(s);
2. Wider bandwidth for 802.16m with two concatenated legacy systems;

For the first situation, it is straightforward to apply legacy preamble in 802.16m frame with the consideration to support legacy system(s). In this application, both 802.16m and legacy system employ the same legacy preamble without any needs to updates.

For the second situation, we also need to adopt legacy preamble(s) to form a new preamble to support 802.16m and legacy system. In the case of two concatenated legacy systems, two concatenated legacy preambles should be employed and a PAPR control window is proposed as shown in figure 2.

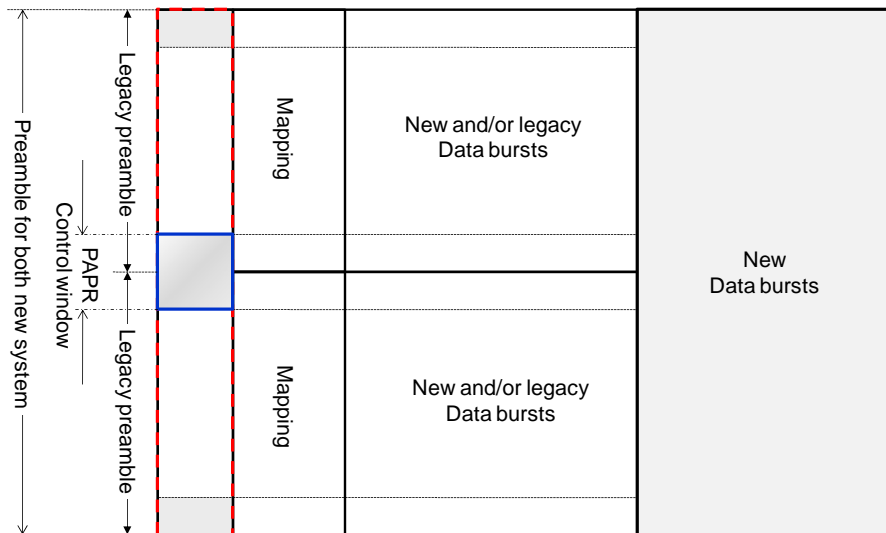


Figure 2: Wider bandwidth for 802.16m with two concatenated legacy systems

With this design, the new preamble maintains the good correlation properties, which is capable to support both legacy system and new system configurations, especially for legacy system – no needs to have any modifications.

To optimize the designed preamble, we need to consider PAPR with the new designed preamble. For this purpose, we insert a control window as shown in the above figure. For practical application, the proposed PAPR control window might become more important to optimize the preamble transmission. The preamble optimization with the control window is to minimize both PAPR and impact on legacy system which is now with no guard interval in frequency domain.

The proposed preamble design can achieve synchronization for both new system and legacy system(s). It provides full channel estimation for both systems. It keeps PAPR as low as possible. More important, with the proposed common preamble scheme, it makes frame lined up as shown in figure 3.

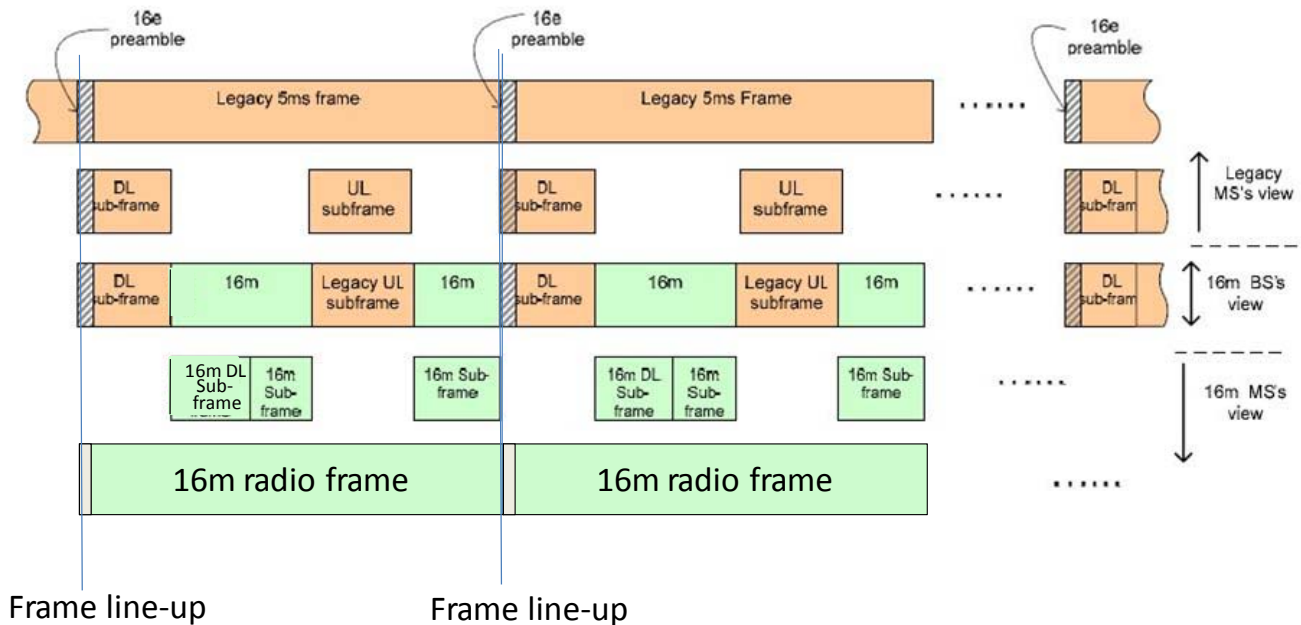


Figure 3: Frame lined up with a common preamble solution

## 5. Conclusion

In this contribution, we proposed a common preamble for 802.16m downlink to achieve system initialization, synchronization, channel estimation and handover with less overhead and also line up the frames with legacy support.

~~~~~ **Text Input start** ~~~~~

### *x.x.x Frame structure*

*[Insert the following text and diagram for 802.16m frame structure]*

### *x.x.y Downlink Preamble*

*One downlink preamble is employed to support both 802.16m and legacy systems for system initialization, synchronization, channel estimation and fast handover.*

~~~~~ **Text Input end** ~~~~~

## References

- [1] IEEE 802.16m PAR, December 2006, <http://standards.ieee.org/board/nes/projects/802-16m.pdf>
- [2] IEEE 802.16m System Requirements, IEEE 802.16m-07/002r4, 2007-10-19, [http://ieee802.org/16/tgm/docs/80216m-07\\_002r4.pdf](http://ieee802.org/16/tgm/docs/80216m-07_002r4.pdf)
- [3] 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 IEEE Std. 802.16-2004/Cor1-2005, Corrigendum 1, 28 February 2006
- [4] IEEE Std 802.16-2004: Part 16: IEEE Standard for Local and metropolitan area networks: Air Interface for Fixed Broadband Wireless Access Systems, June 2004