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| Project | **IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>** |
| Title | **OFDMA PHY AAS Enhancements** |
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| Source(s) | Panyuh Joo, Seungjoo Maeng, Jaeho Jeon, Soonyoung Yoon, Jeong-Heon Kim, Jaehyok Lee, Myungkwang Byun, JeongTae Oh, Wonil Roh, Inseok Hwang, Jaehee Cho, Sanghoon Sung, Hun Huh, Jiho Jang, Ikbeom Lee, HeeSang Seo, Sijun Cho, Chiwoo Lim, Youngbin Chang, Jaeweon Cho, Jaeyoel Kim, Sung-Eun Park, Samsung Electronics Co. Ltd.<br>John Liebetreu, Jeff Foerster, Jose Puthenkulam, Randall Schwartz, David Johnston, Hassan Yaghoobi, Intel Corporation |
| Re: | Working Group Review of P802.16-REVd_D3 |
| Abstract | |
| Purpose | To propose AAS related enhancements to the OFDMA PHY in 802.16REVd_D3 draft for better performance in a broad set of channel widths. |
| Notice |  |
| Release |  |
| Patent Policy and Procedures |  |

## OFDMA PHY AAS Enhancements

### *Introduction*

In this contribution we propose enhancements to the WirelessMAN OFDMA PHY for better AAS operation. In current 802.16 OFDMA standard, AAS_DL_Scan_IE, which is transmitted by the BS in a specific direction of the AAS beam, is defined for AAS operation. But its operation is not clearly defined, and its operation is not so efficient because AAS mode is optional feature both in BS and MS.

In this contribution we propose a frame structure for AAS mode, and operation scenario when AAS is exploited in the system.

### 1 Enhancements for AAS operation

AAS mode can get its performance gain when adjacent subcarriers are allocated to a user terminal. However, only distributed-subcarrier permutation is defined in non-AAS mode, so it is needed to define optional subchannelization, i.e., adjacent-subcarrier permutation, to operate in AAS mode. It makes the AAS operation difficult, since we should support both non-AAS terminals and AAS terminals.

Also, DL_MAP transmission is not so clearly described. AAS_DL_Scan_IE is transmitted once in N frames, where N is the number of AAS beam angles. Since DL_MAP location is indicated by AAS_DL_Scan_IE, it implies that DL_MAP is also transmitted once in N frames, which makes the AAS operation inefficient.

Furthermore, it is not clear how to transmit uplink MAP.

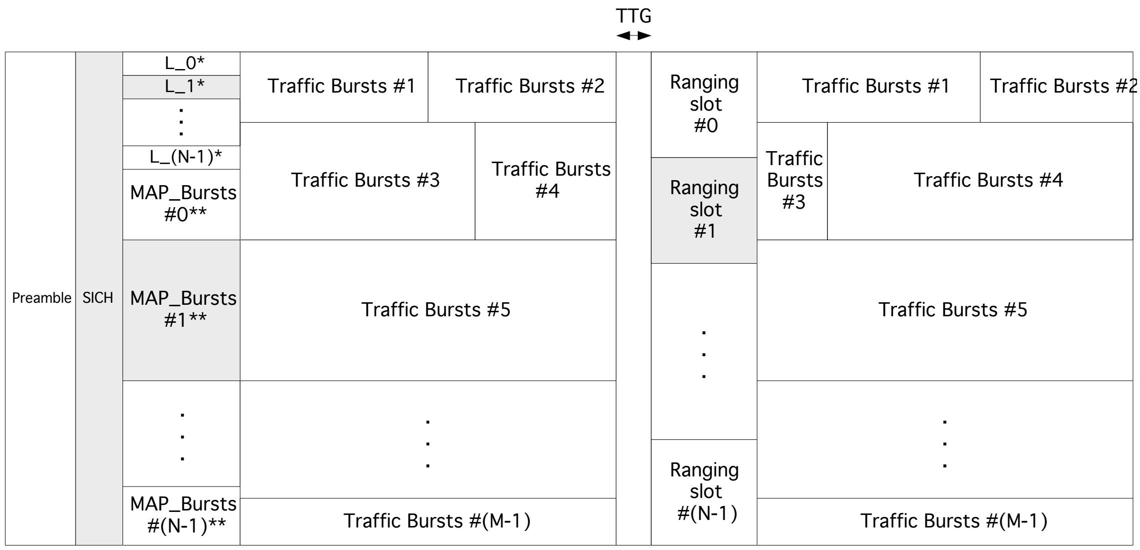
We already propose to use both distributed-subcarrier permutation and adjacent-subcarrier permutation in non-AAS mode, to achieve both band-AMC gain and diversity gain according to the channel condition. AAS mode can be supported in frame format since adjacent-subcarrier permutation is already supported. So we propose that the AAS support should be a mandatory feature for user terminal and optional feature for base station.

### 2 Proposed Text Changes

[Replace IEEE P802.16-REVd/D3-2004 "8.4.3.1" with the following text.]

8.4.3.1 AAS frame structure

When operating in the AAS mode, only AMC subchannelization is used for uplink and downlink traffic bursts. Downlink frame structure can be divided into preambles, SICH, MAP bursts, and traffic bursts. Uplink frame structure can be divided into ranging and traffic bursts. Uplink control channels may be transmitted within traffic burst region in AAS mode.




* L_n : AAS_MAP_Burst_Location_IE for beam direction #n

** MAP_Burst #n : Indicates three mini_MAP_Bursts for beam direction #n

**Figure 1 – Frame structure for AAS**

#### 8.4.3.1.1 Preambles

First two OFDMA symbols are used as preambles. Preambles are transmitted through broad beamforming pattern in the same way as in non-AAS mode. It is used for network synchronization and cell identification.

#### 8.4.3.1.2 SICH

System information channel is assigned in a separated OFDMA symbol following preambles. SICH is transmitted by BS with the AAS beam in a specific direction in a given time. SICH can be transmitted in multiple beams at the same time through SDMA.

In SICH, AAS beam direction index, which shall correspond to the direction the AAS beam is pointing at, is included. Also, size of the AAS_MAP_Burst_Location_IE is transmitted in SICH.

#### 8.4.3.1.3 AAS_MAP_Burst_Location IE

Subchannel 0 of the DL frame is used for delivering MAP allocation information. AAS_MAP_Burst_Location_IE() is transmitted in all possible beam directions. Each AAS_MAP_Burst_Location_IE() contains starting subchannel position in MAP_Burst symbols, and sizes of 3 mini_MAP_Bursts. Since AAS_MAP_Burst_Location_IE() has a fixed size and is arranged in the increasing order of beam ID, it is possible for MS to get the proper AAS_MAP_Burst_Location_IE() directing to that MS.

AAS_MAP_Burst_Location_IE() can be transmitted in multiple beams at the same time through SDMA in the same way as SICH.

Physical structure for the AAS_MAP_Burst_Location_IE () is shown in **Error! Reference source not found.**. The AAS_MAP_Burst_Location_IE () is transmitted with QPSK rate 1/12.

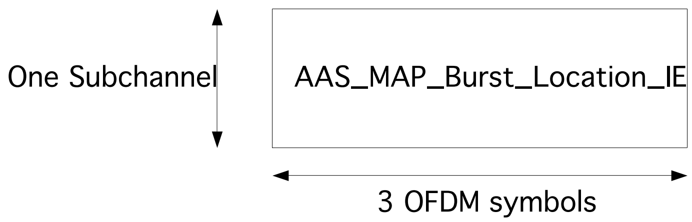



**Figure 2 – Example of allocation for AAS_MAP_Burst_Location IE**

The contents of the AAS_MAP_Burst_Location_IE () payload is described by **Error! Reference source not found.**.

**Table 1 – AAS_MAP_Burst_Location_IE format**

| Syntax | Size | Notes |
|---|---|---|
| AAS_MAP_Burst_Location _IE { | | |
| Subchannel_offset | 7 bits | |
| N_mini_MAP_Burst0 | 6 bits | Subchannel length of mini-MAP Burst 0 |
| N_mini_MAP_Burst1 | 5 bits | Subchannel length of mini-MAP Burst 1 |
| N_mini_MAP_Burst2 | 5 bits | Subchannel length of mini-MAP Burst 2 |

#### 8.4.3.1.4 Broadcasting MAP bursts

Each mini MAP burst of the AAS mode has the same format as that of the non-AAS mode. In Figure 1, MAP burst #n contains three mini-MAP bursts.

MAP_Bursts () can be transmitted in multiple beams at the same time through SDMA in the same way as SICH.