Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Proposal for Uplink Physical Structure Section (11.6.4) in the SDD document**
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Re:	PHY: Text; in response to the TGm Call for Contributions and Comments 802.16m-08/033 for Session 57
Abstract	In order to provide FDM-based legacy PUSC support, a symbol structure is proposed.
Purpose	Include the proposed text of section 11.6.4 in the SDD document
Notice	
Release	
Patent Policy	

Proposal to Include Uplink Physical Structure Section (11.6.4) to the SDD document

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1. Introduction

Section 11.6.4 of SDD [1] is not complete because there is still TBD. In this contribution, FDM-based legacy PUSC support mode – ‘ 16m PUSC mode’ is proposed when the legacy system operates in the PUSC mode. Furthermore proposed text is provided.

2. Background

FDM-based legacy PUSC support mode is necessary in order to guarantee the uplink link budget of legacy users so that SRD [3] is satisfied [4]. If the legacy system operates in the PUSC mode, however, 16m system cannot use DRU/LLRU structures which are defined in current SDD. Instead, a new symbol structure should be provided to be compatible with legacy PUSC subchannel in FDM manner.

3. Symbol Structure Design Requirement

A new symbol structure should be compatible with the legacy PUSC symbol structure.

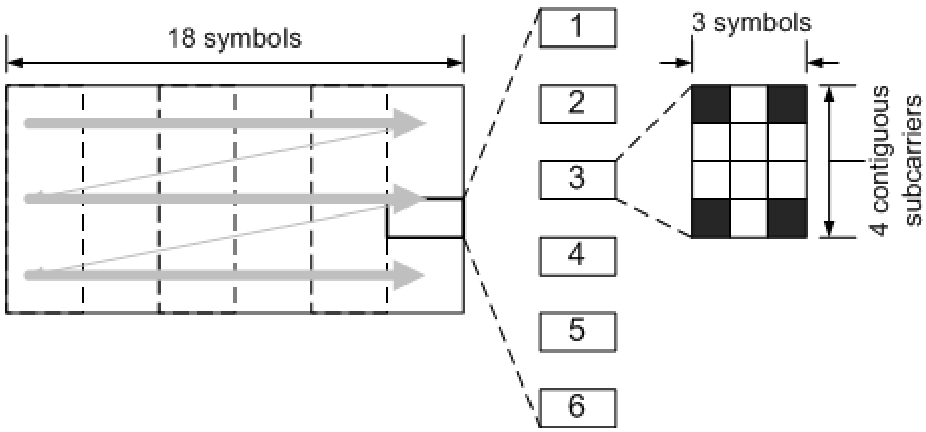
A new symbol structure should maximize the 16m system performance.

A new symbol structure should minimize the complexity which is additionally induced by the new symbol structure.

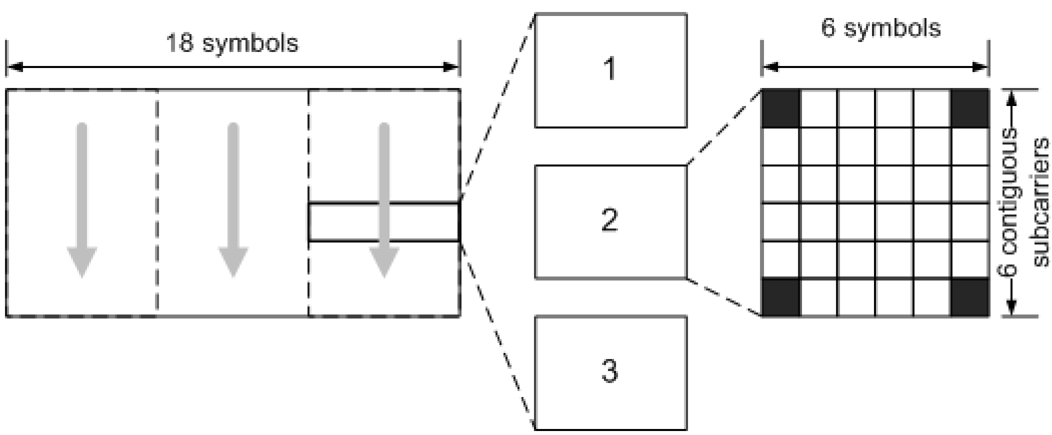
4. Performance of the Proposed 16m PUSC

Three kids of symbol structure are compared ; The first one is legacy PUSC, the second one is 802.16m DRU (6x6 tile structure) and the third one is the proposed 16m PUSC. Symbol, tile and pilot structures used for simulation are shown as follows :

1) 802.16e legacy system



2) 802.16m only system



3) 802.16m legacy support – 16m PUSC

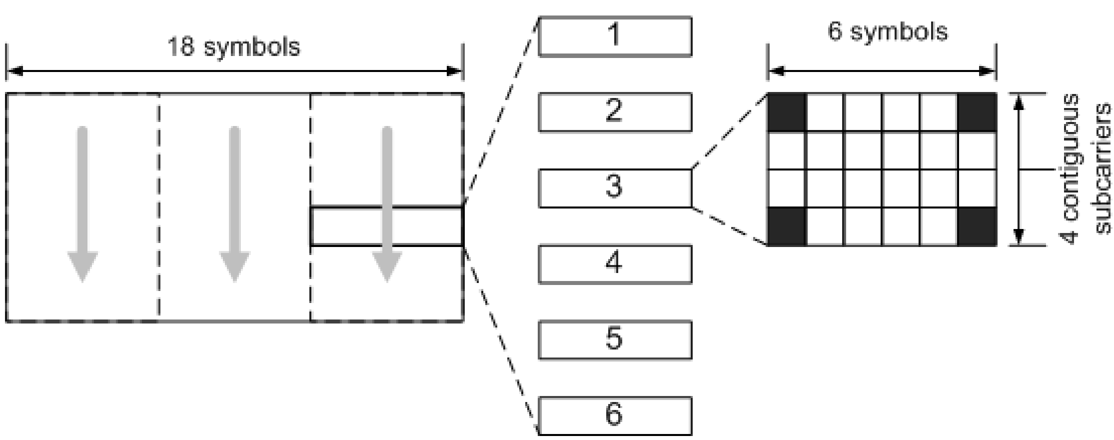


Table 1 System and cell edge throughput comparison between proposed 16m PUSC, legacy and 802.16m only

	802.16e legacy systems	802.16m only systems	**16m PUSC** legacy support	Comparison
System throughput (Mbps)	3.16	4.06	3.89	Legacy → 16mPUSC : +23.1% 16m only → 16m PUSC : -4.2%
Cell edge throughput (Kbps)	72.38	98.76	96	Legacy → 16mPUSC : +32.6% 16m only → 16m PUSC : -2.8%

In Table 1, 16m PUSC shows very comparable performance with 16m only case. On the other hand, 16m PUSC is far better from 16e systems.

Table 2 Simulation conditions

Basic Conditions	802.16m EMD
Scenario	NGMN Configuration
UL symbols	18 symbols
Control OH in UL symbols	None (100% data)
Channel Mix	ITU-B, 3km/h 100%
Error Vector Magnitude	N/A
Channel Estimation	Real (reflected in LLS)
Power control	FPC
UL CINR Estimation	Last Packet
Target UL IoT Level	10 dB
NI averaging	in Linear scale
Number of subcarriers	864
Number of scheduled users	6
Traffic type	Best Effort
Queue size	Infinite
Scheduling	PF
Number of users per sector	10

5. Conclusions

The proposed 16m PUSC symbol structure can be fully compatible with the legacy PUSC mode. Also, 16m PUSC can provide system performance which is comparable to 16m only system and much better to 16e system, while little additional complexity is required.

6. References

[1] The draft IEEE 802.16m System Description Document IEEE 802.16m-08/003r4

[2] P802.16Rev2/D6a (July 2008)

[3] IEEE 802.16m System Requirements - IEEE 802.16m-07/002r4

[4] C80216m-08_283r2

Text Proposal for the 802.16m SDD

-- Start of Proposed Text ---
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11.6 Uplink Physical Structure

11.6.4 Uplink Physical Structure for Legacy Support

The 802.16m uplink physical structure supports both FDM (frequency division multiplexing) and TDM (time division multiplexing) with the legacy system. When the legacy system operates in the PUSC mode, then the type of multiplexing is FDM or TDM~~TBD~~. If the legacy system operates in the AMC mode, then the uplink resources for the legacy and the 802.16m system are multiplexed using FDM or TDM.

When the legacy system operates in the PUSC mode, a symbol structure according to 16m PUSC should be used in order to provide FDM-based legacy support.

11.6.4.1 Distributed Resource Unit for 16m PUSC

Unlike a DRU structure defined in 11.6.1.1, a DRU in 16m PUSC contains six tiles which size is 4xNsym where N_{sym} depends on the subframe type. Figure X1 shows a tile structure when a subframe has 6 symbols. Pilot pattern is TBD.

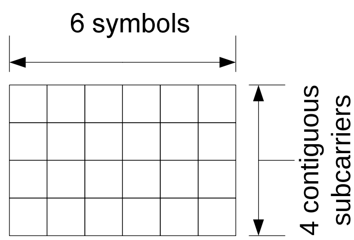

Figure X1 Tile structure in 16m PUSC

11.6.4.2 Subchannelization for 16m PUSC

A subchannelization for 16m PUSC is identical to legacy uplink PUSC [2]. For a given system bandwidth, total usable subcarriers are allocated to form tiles (four contiguous subcarriers) and every tiles are permuted according to permutation defined in uplink PUSC [2]. Once subchannelization is done, every subchannel is assigned to either legacy system or 16m system. Figure X2 shows the uplink frame which is divided in frequency domain into two logical region – one is for legacy PUSC subchannels and the other is for 16m PUSC DRUs.

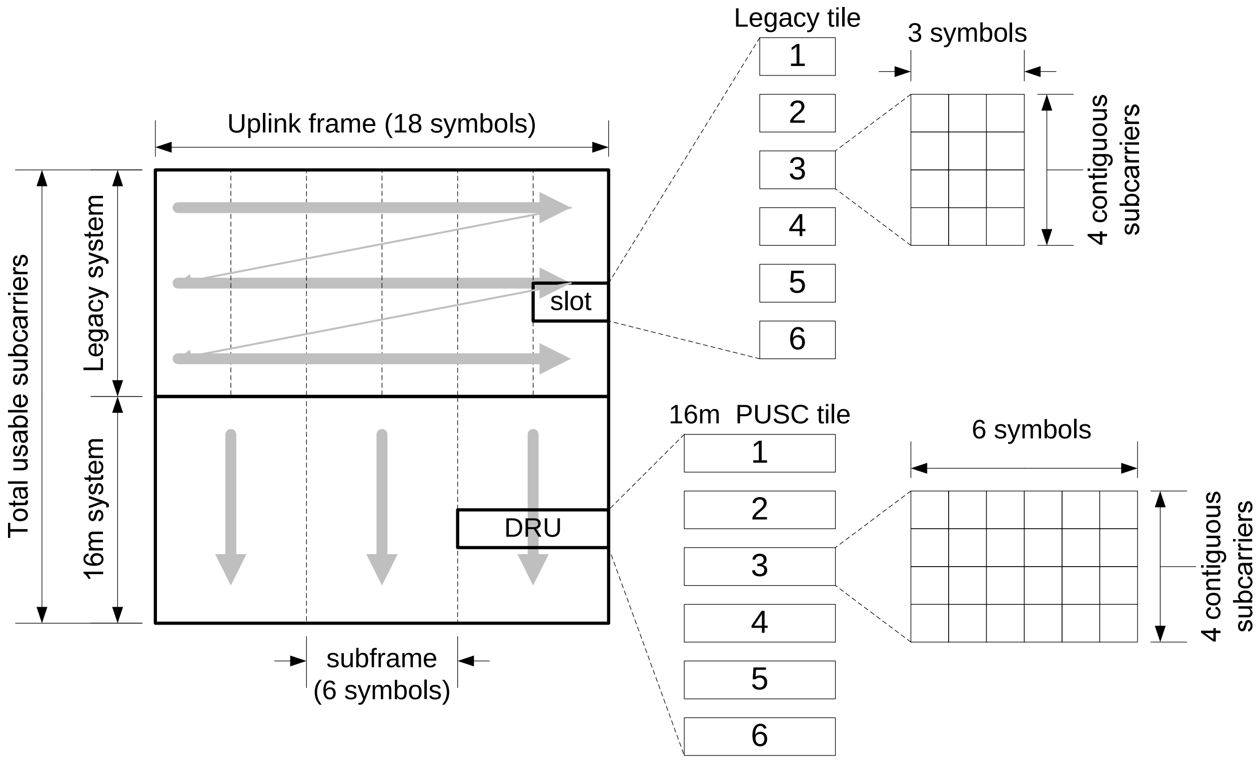

Figure X2 Subchannelization of 16m PUSC and DRU structure

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