

Fast and Efficient Bandwidth Request Mechanism for IEEE 802.16 OFDM PHY

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Purpose:

Consider this information in the preparation of IEEE Standard 802.16.

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Fast and Efficient Bandwidth Request
Mechanism for
IEEE 802.16a OFDM PHY

Need for OFDM BW Request Details

Existing Text in 80216ab-01_01r2

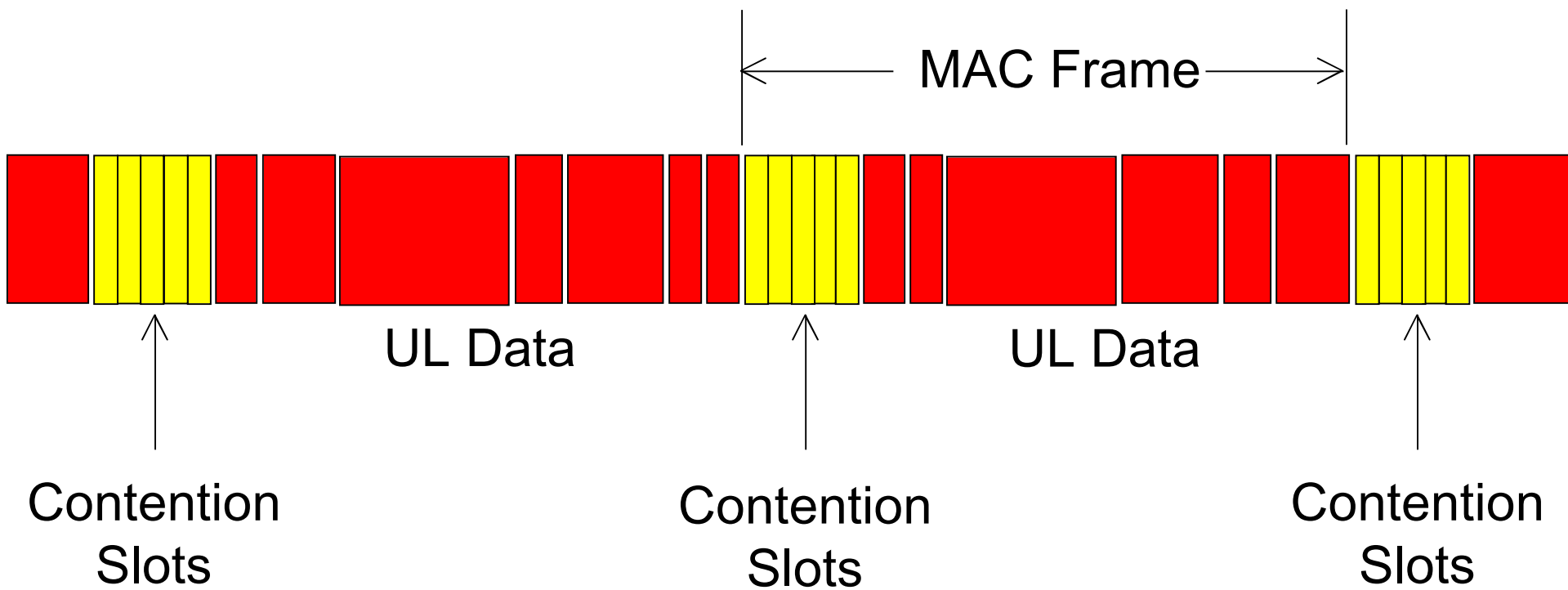
8.3.5.3.3.2 Bandwidth requesting

Bandwidth requests in OFDM are contention based, wherein regular uplink bursts shall be used for bandwidth requests. Bandwidth requests are further provisioned by a piggy-back mechanism provided by the MAC.

The base station shall allocate a number of symbols every frame for bandwidth requests. This number of symbols shall be large enough to contain one or a multiple of long preamble uplink bursts with one OFDM symbol in data. SSSs requiring bandwidth may, using a backoff mechanism, use these slots to request bandwidth.

Desirable Features

- Contention, to support many users
- Efficient *optimized for the PHY*
- Fast



Bandwidth Request MAC Header from P802.16/D4-2001

2001-07-24

IEEE P802.16/D4-2001

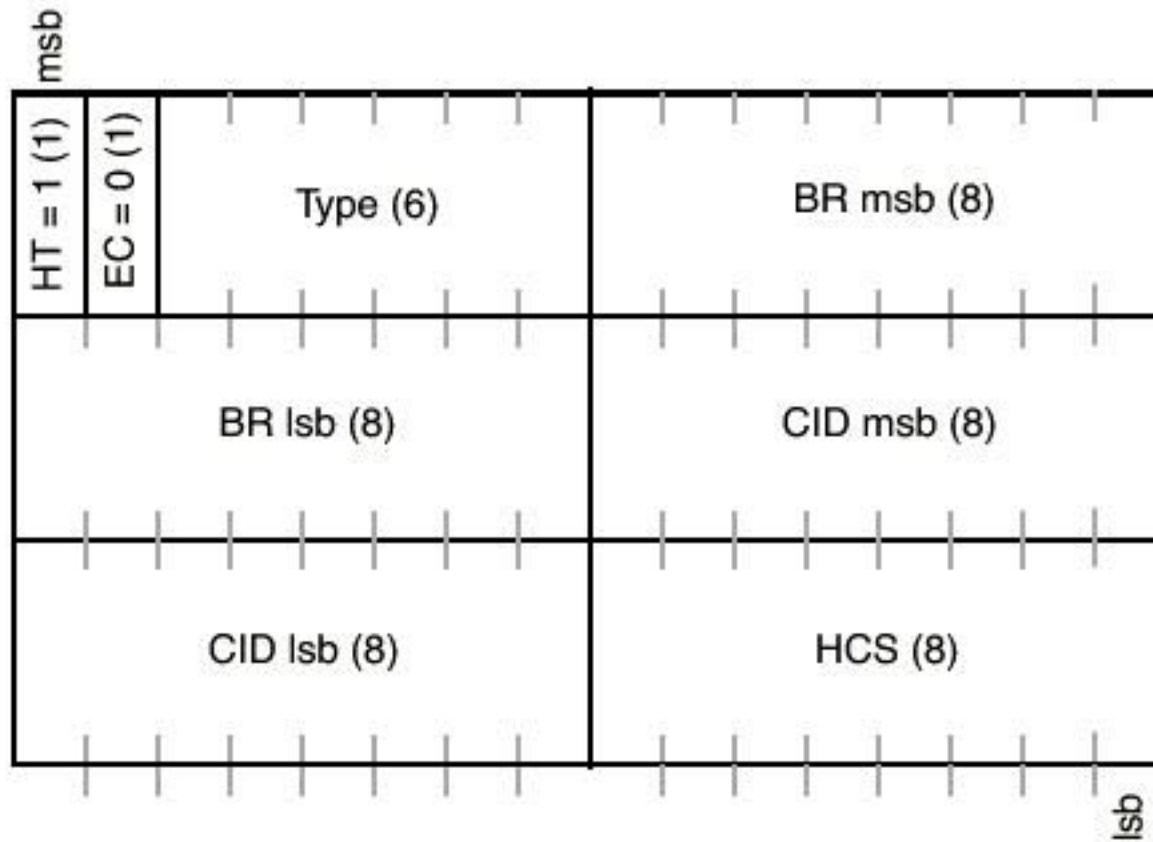
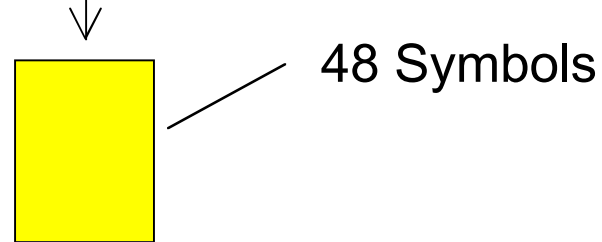


Figure 24—Bandwidth Request Header Format

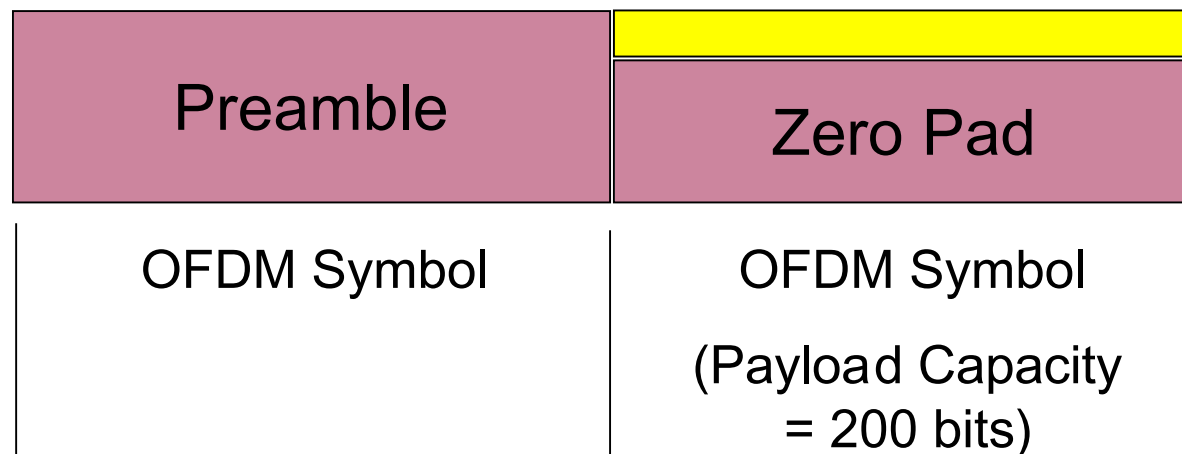
Simple Slotted ALOHA

Sending a Bandwidth-Request MAC Header

Single-Carrier Application:

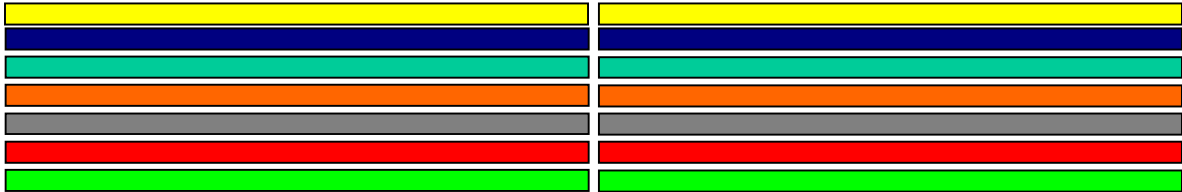
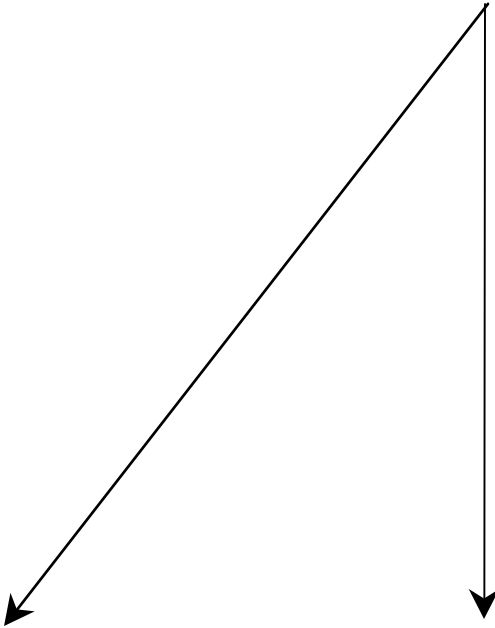


OFDM Application:



Proposed Scheme

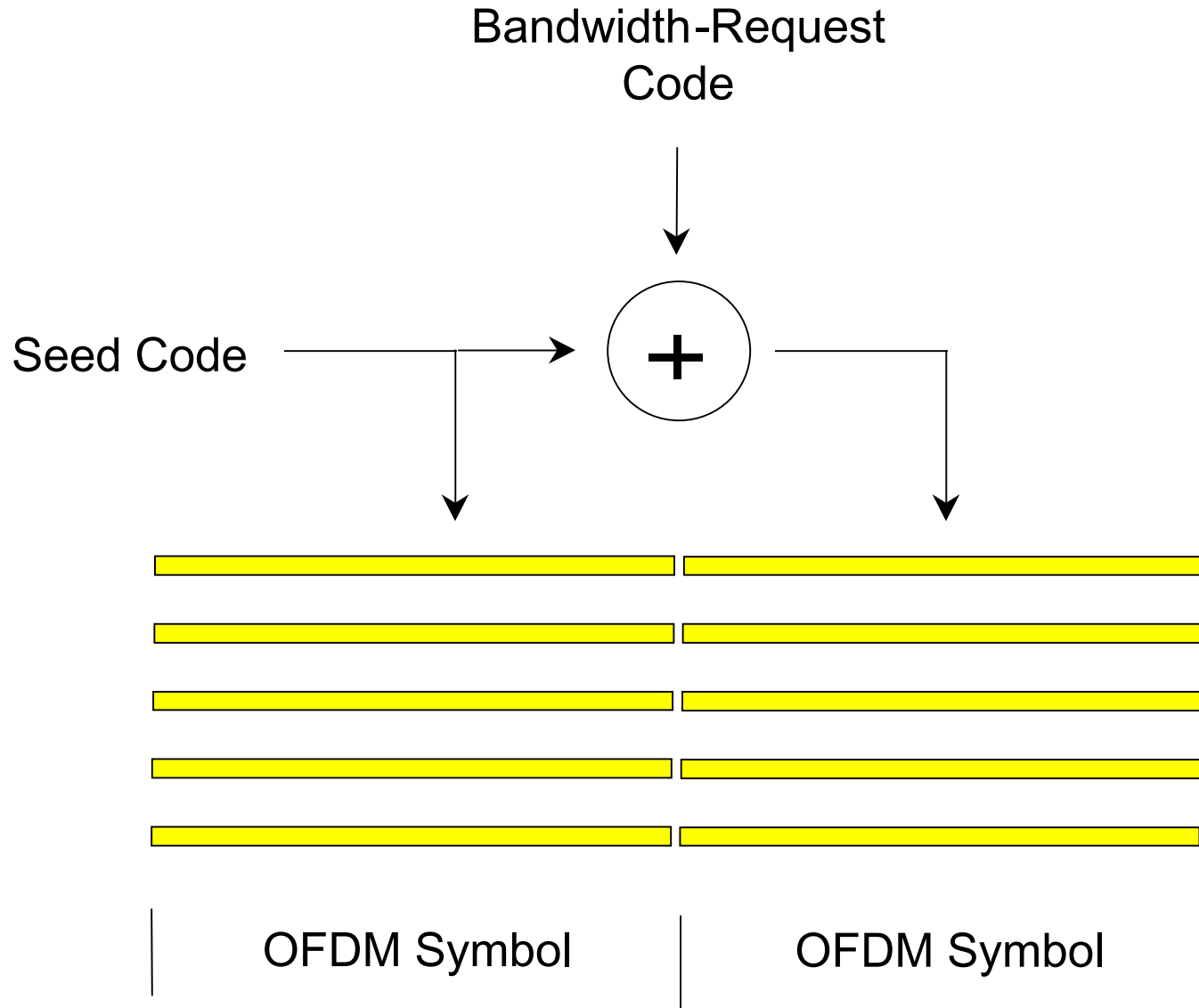
Sending a Bandwidth-Request Signal



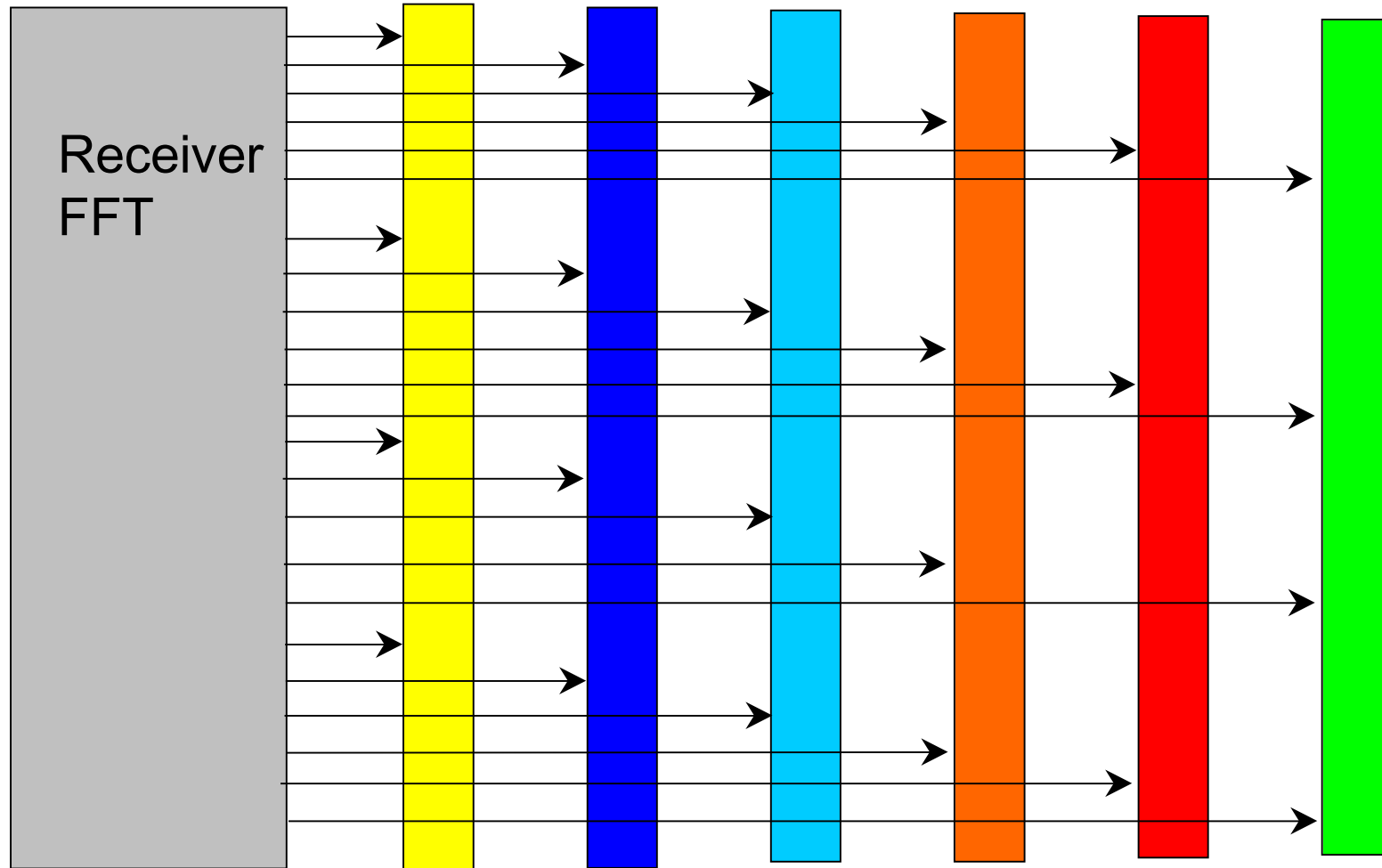
OFDM Symbol

OFDM Symbol
(Payload Capacity
= 200 bits)

Differential Encoding and Modulation

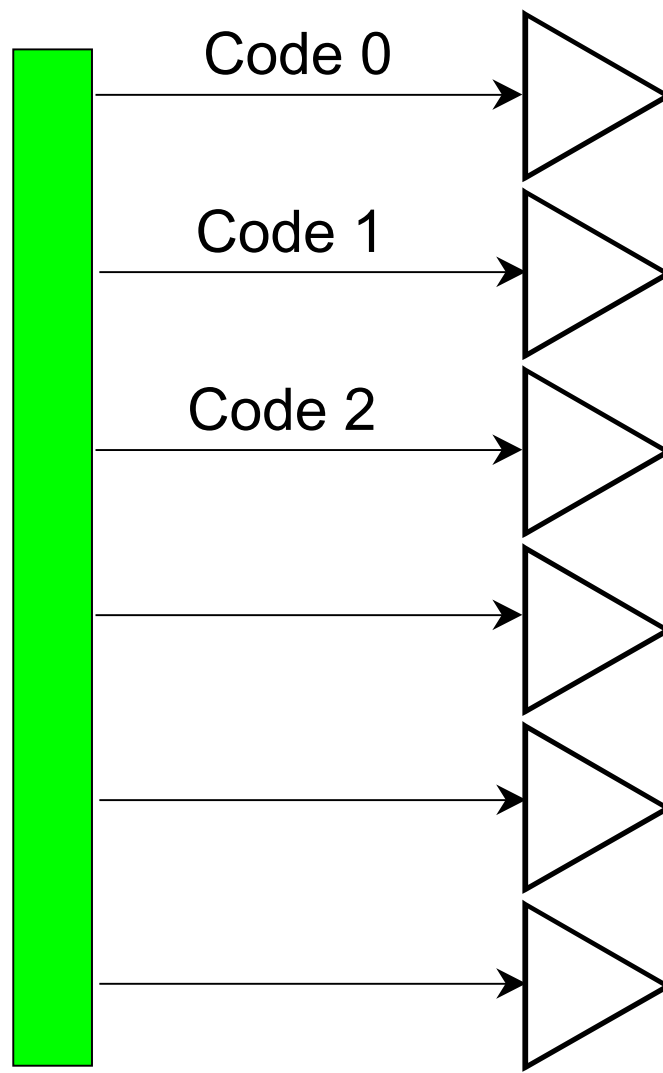


Decoding at Base Station



Banks of Differential Decoders

Threshold Detection



Included in Simulations:

Channel Model

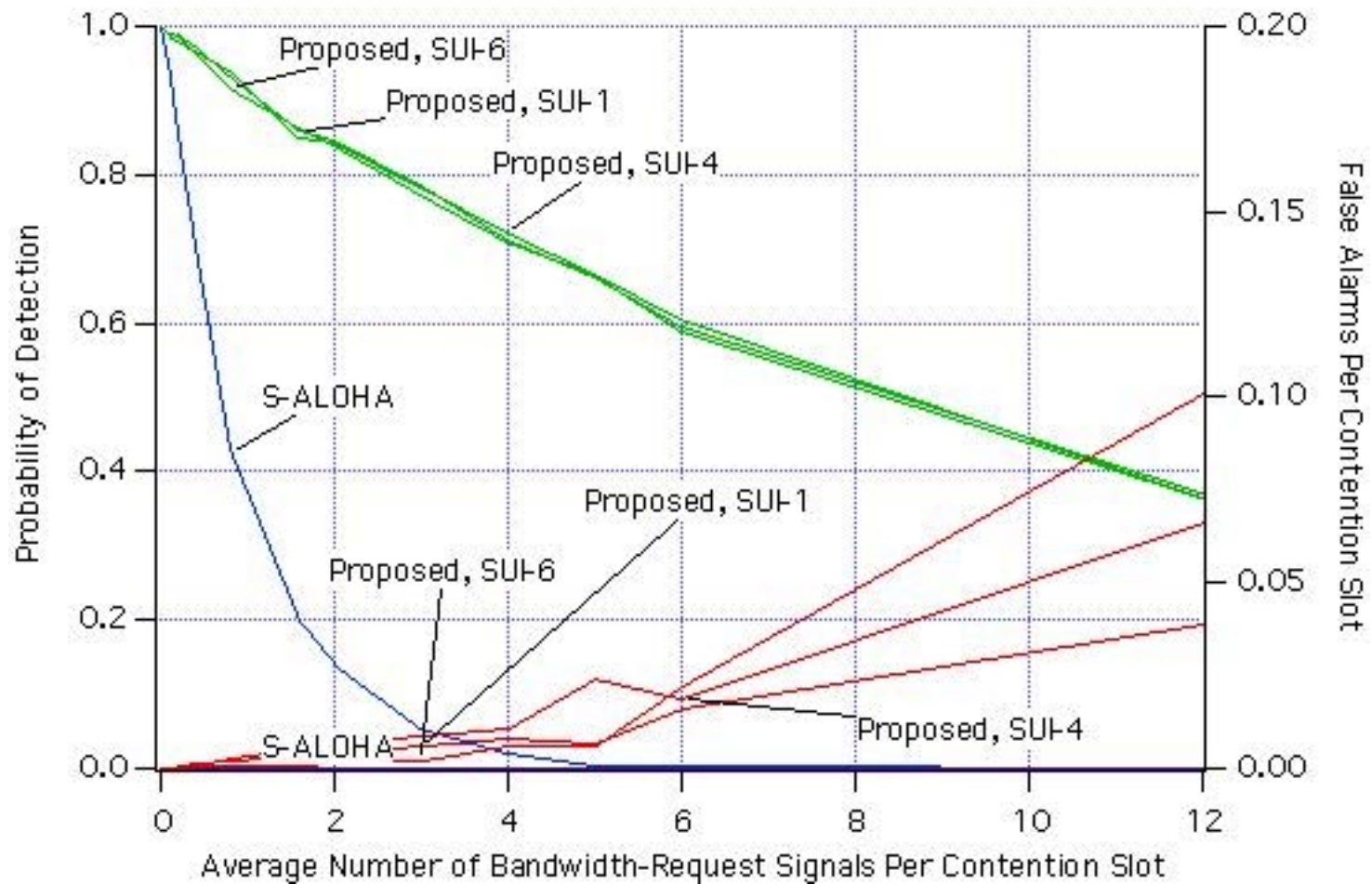
Rx Power Uncertainty

AWGN

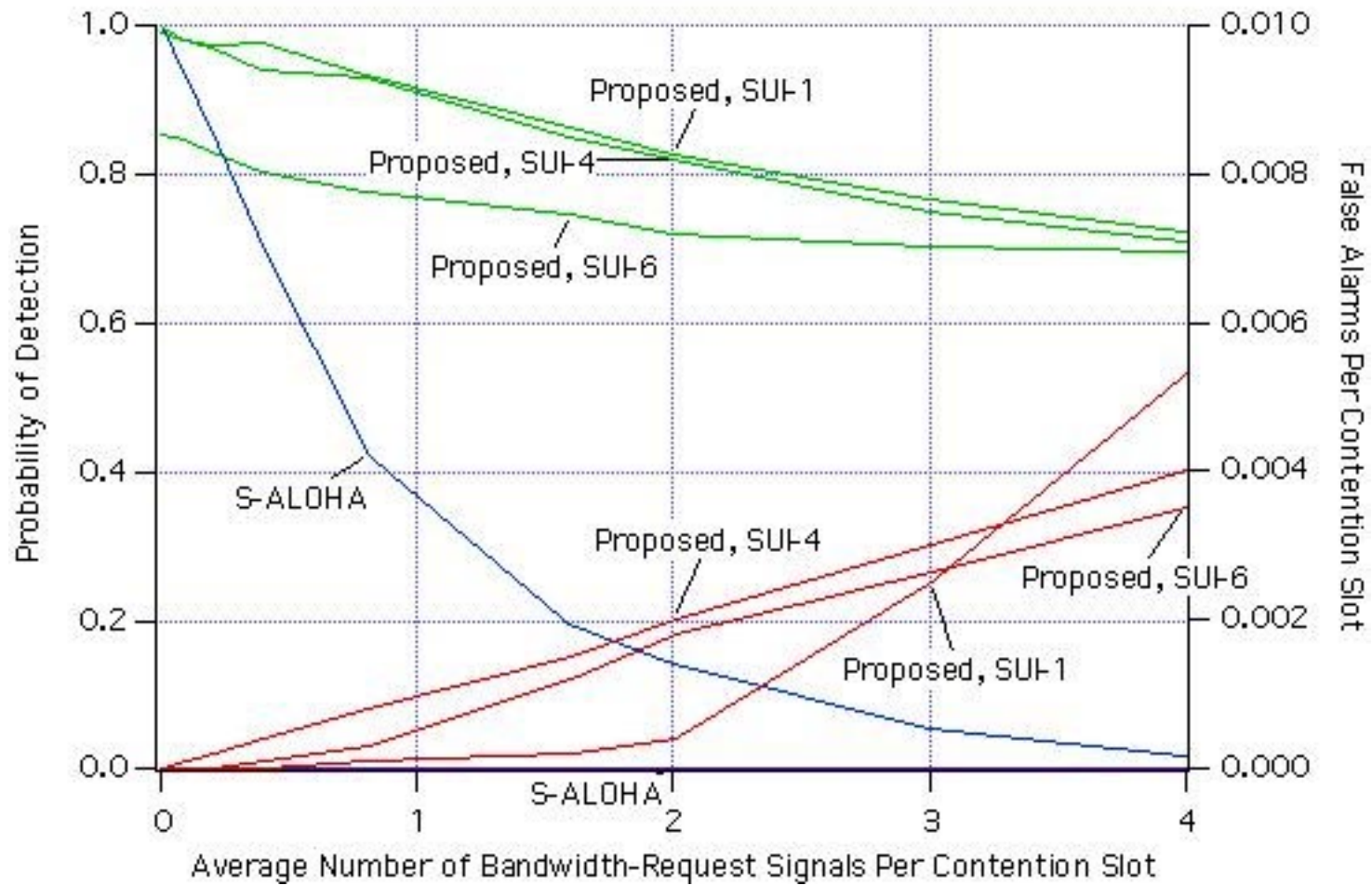
Collisions

False Alarms

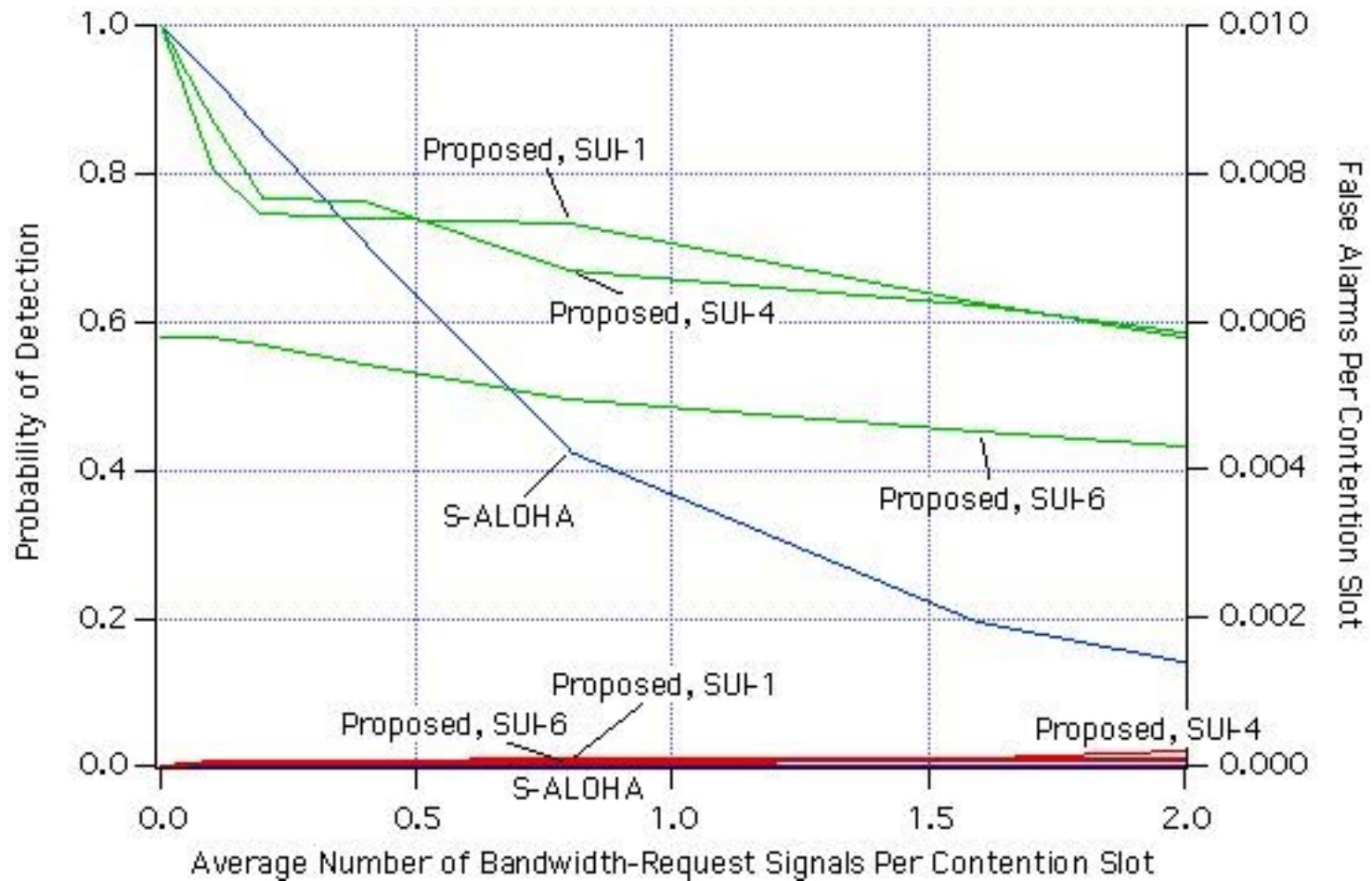
16-bit codes with 99 dB AWGN



16-bit codes with 21 dB AWGN



32-bit codes with 15 dB AWGN



Average Number of OFDM Symbols which the BS must allocate per each successful bandwidth request, assuming that the BS allocates Contention Slots to maximize contention throughput (*).

		Proposed Schemes			Simple Slotted ALOHA
		32-bit Codes, 6 Request Channels	16-bit Codes, 12 Request Channels	8-bit Codes, 24 Request Channels	
Contention		0.93	0.46	0.23	5.44
MAC Header Allocations	Useful	2.00	2.00	2.00	
	Wasted on False Alarms	0.04	0.10	0.44	0.00
Total		2.97	2.56	2.67	5.44

(*) For Simple Slotted ALOHA,
 $0.368 = 1/e$ Contention Slots per Contending User

For any of the proposed schemes,
 $0.368 = 1/e$ Bandwidth Request Channels per Contending User

Summary

- Fast, efficient BW Request Mechanism needed for OFDM mode in 80216ab-01_01r2
- Simple Slotted ALOHA is not efficient for OFDM
- Much better efficiency and/or delay can be obtained using the proposed scheme.