

**IEEE P802.11
Wireless LANs**

Complement to Comparison DATA of QPSK modulation

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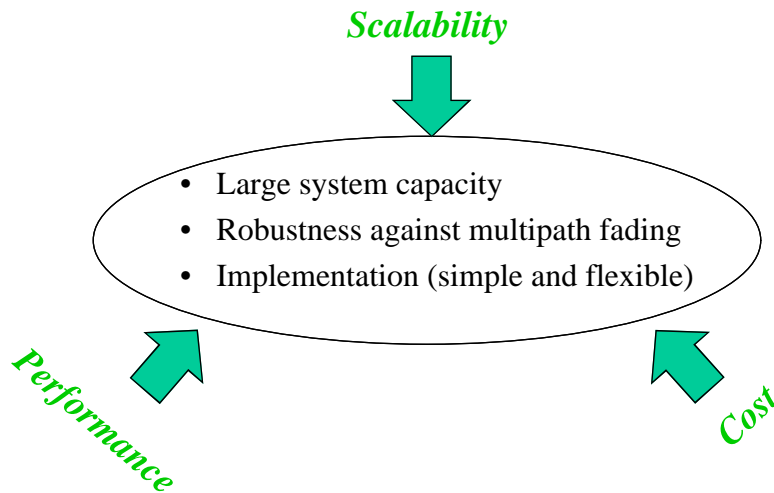
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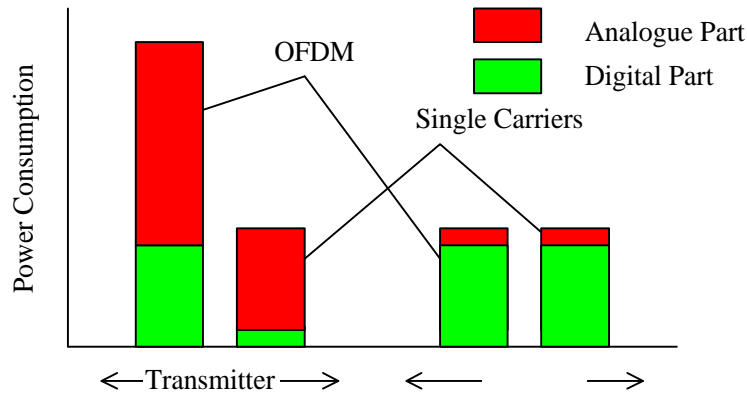
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Requirements for 5GHz Wireless LAN



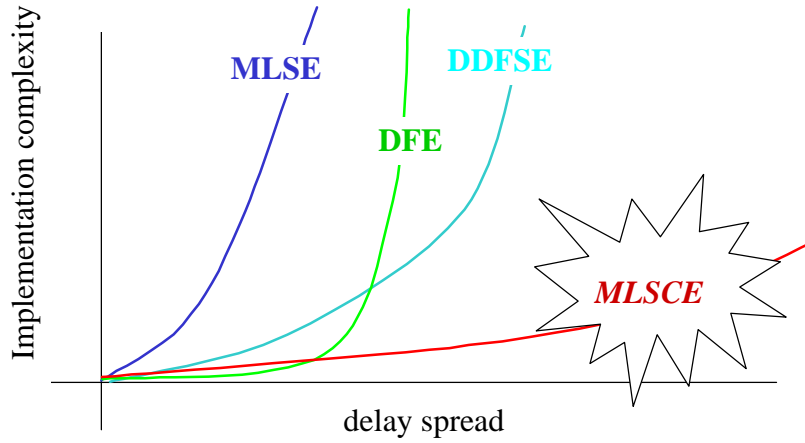
TX-RX Power Consumption Balance



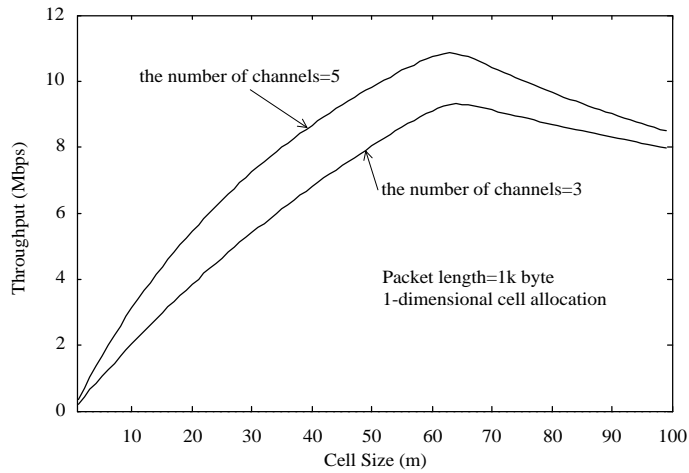
Feature of our proposal

- Large system capacity
 - 5 channels for U-NII lower and middle band
 - 4 channels for U-NII upper band
- Robustness against multipath fading
 - 100nsec delay spread (simple implementation)
 - 160nsec delay spread (complex implementation)
- Implementation (simple and flexible)
 - PMA-MLSCE (as an implementation example)

Equalizer Implementation



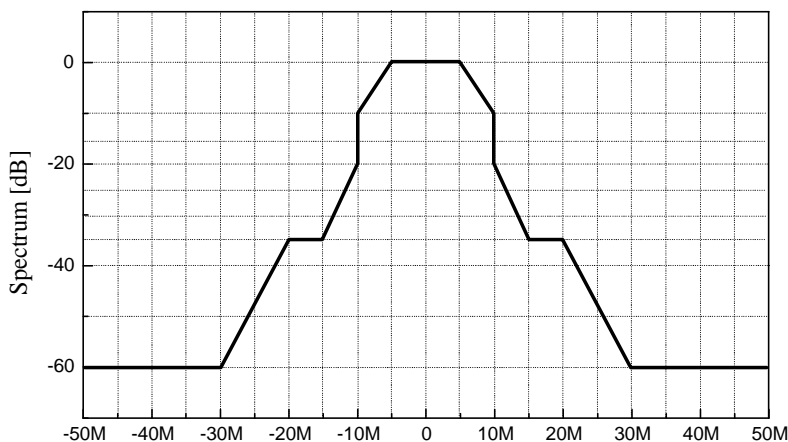
System Capacity



General Description

Parameter	Value(s)
Data Rates Supported	25Mbps, 20.3125Mbps
Channel Spacing	18.75Mhz
Center Frequencies	5162.5, 5181.25, 5200.0, 5218.75, 5237.5 for loeuer band [MHz] 5262.5, 5282.25, 5300.0, 5318.75, 5337.5 for middle band [MHz] 5746.875, 5765.625, 5784.375, 5803.125 for upper band [MHz]
Power Levels	40mW for 5162.5, 5181.25, 5200.0, 5218.75, 5237.5 MHz 200mW for 5262.5, 5282.25, 5300.0, 5318.75, 5337.5 MHz 800mW for 5746.875, 5765.625, 5784.375, 5803.125 MHz
Sensitivities	-76dbm for 20.3125Mbps, -74dbm for 25Mbps
CCA threshold	-78dm
Clock Rate accuracy	+/- 10ppm
Carrier Frequency accuracy	+/- 20ppm
Waveform implementation accuracy specification method	RMS value of error signal power between actual tranmitted signals around ideal signal points sampled at an ideal sample timing
Power Backoff in RF PA	3dB for 25Mbps and 20.3125Mbps
Implementation Complexity	depending on receiver architecture 30k gates for modems except equalizer 40k gates for simple equalizer 100k gates for complex equalizer

Spectrum Mask for calculation of maximum power



Per-Rate Feature Summary

Parameter	Rate A	RateB
Data rate	25Mbps	20.3125Mbps
ECC method	None	(31,26) expanded Hamming code
Interleaving method	None	None
Suggested minimal sensitivity	-74dbm ¹⁾	-76dbm ¹⁾
Suggested Co-Channel rejection	DUR more than or equal to 10dB	DUR more than or equal to 10dB
Suggested Adjacent Channel rejection	DUR more than or equal to -10dB	DUR more than or equal to -10dB
Suggested Alternate Channel rejection	DUR more than or equal to -25dB	DUR more than or equal to -25dB
Implementation Accuracy	RMS of the error signal power < 0.125	RMS of the error signal power < 0.125

1) Assumptions:

- noise floor of -174 dBm/Hz, +74dB for transmission bandwidth
- noise figure +10dB, an implementation margin of +5dB

Per-Rate Performance Summary (Simple Implementation)

Parameter	25Mbps	20.3125Mbps
Eb/No at PER=10%, AWGN, 64b	9dB	6.5dB
Trms at PER=10%, noise free, 64b	100nsec	100nsec
Eb/No @ 20%, with Trms @ 10%, 64b	20dB	20dB
Eb/No at PER=10%, AWGN, 1000b	10.5dB	8dB
Trms at PER=10%, noise free, 1000b	100nsec	100nsec
Eb/No @ 20%, with Trms @ 10%, 1000b	20dB	20dB
CCI immunity [dB]	8	7
ACI immunity [dB]	-12	-11
CW jammer immunity [dB]	28	28
Narrowband Gaussian noise immunity [dB]	9	< 7
Phase noise tolerance, (BW=50 kHz), rad ² [dBc] at which PER becomes 10%	12($\Psi_{RMS}=0.25$)	12($\Psi_{RMS}=0.25$)

Per-Rate Performance Summary (Complex Implementation)

Parameter	25Mbps	20.3125Mbps
Eb/No at PER=10%, AWGN, 64b	9dB	6.5dB
Trms at PER=10%, noise free, 64b	170nsec	170nsec
Eb/No @ 20%, with Trms @ 10%, 64b	20dB	20dB
Eb/No at PER=10%, AWGN, 1000b	10.5dB	8dB
Trms at PER=10%, noise free, 1000b	160nsec	160nsec
Eb/No @ 20%, with Trms @ 10%, 1000b	20dB	20dB
CCI immunity [dB]	8dB	7dB
ACI immunity [dB]	-12dB	-11dB
CW jammer immunity [dB]	28dB	28dB
Narrowband Gaussian noise immunity [dB]	9dB	<7dB
Phase noise tolerance, (BW=50 kHz), rad ² [dBc] at which PER becomes 10%	12($\Psi_{RMS}=0.25$)	12($\Psi_{RMS}0.25$)

Timing and Overhead related Summary

Attribute	Suggested Value
aSlotTime	9.99μsec
aCCATime	5μsec
aRxTxTurnaroundTime	2.4μsec
aTxPLCPDelay	0.4 μsec
aRxTxSwitchTime	0.3 μsec
aTxRampOnTime	0.7μsec
aTxRFDelay	1μsec
aSIFSTime	7.4μsec
aRxRFDelay	1μsec
aRxPLCPDelay	2μsec
aMACProcessingDelay	2μsec
aTxRampOffTime	0.7μsec
aPreambleLength	10.56μsec
aPLCPHdrLength	1.28μsec
aMPDUDurationFactor	1.0 for 25Mbps, 1.23077 for 20.3125Mbps
aAirPropagationTime	0.5μsec
aCWmin	15
aCWmax	1023

SlotTime and SIFSTime

$$\text{SlotTime} = \text{CCATime} + \text{RxTxTurnaroundTime} + \text{AirPropagationTime} + \text{MACProcessingTime}$$

$$\text{SIFSTime} = \text{RxRFDelay} + \text{RxPLCPDelay} + \text{MACProcessingDelay} + \text{RxTxTurnaroundTime}$$

CCATime	RxRFDelay	1usec	4usec
	RxPLCPDelay	2usec	
	Time to detect Envelope(Doc 98/35, Section 3.2)	1 usec	
RxTxTurnaround Time	TxPLCPDelay	0.4usec	2.4usec
	RxTxSwitchTime	0.3usec	
	TxRampOnTime	0.7sec	
	TxRFDelay	1usec	
AirPropagationTime			0.5usec
MACProcessingTime			2usec

$$\text{SlotTime} = 8.9\text{usec}$$

$$\text{SIFSTime} = 7.4\text{usec}$$