IEEE P802.11
Wireless LANs

Comparison DATA of QPSK modulation

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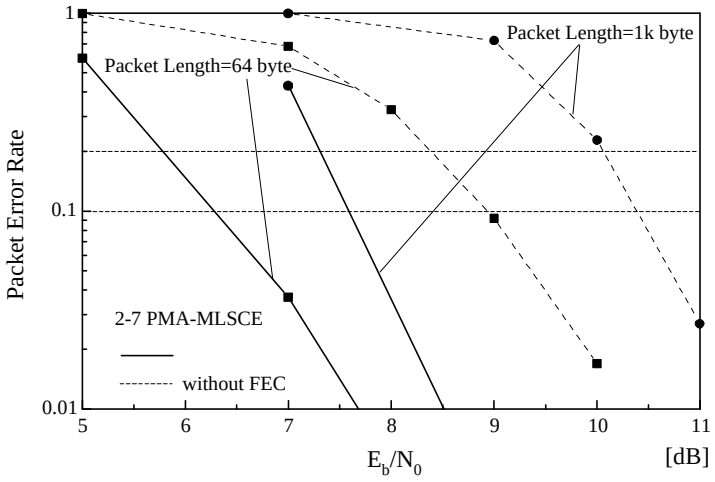
General Description

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 loewer 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

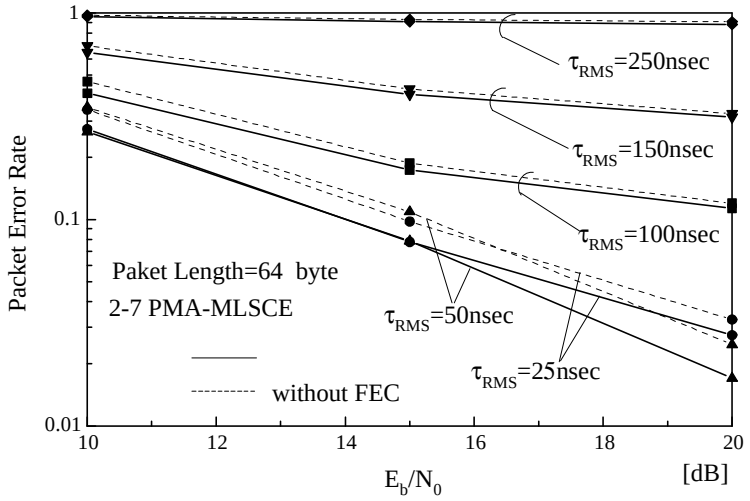
Per-Rate Feature Summary

Parameter	Rate A	RateB
Data rate	25Mbps	20.3125Mbps
ECC method	No	(31,26) expanded Hamming code
Interleaving method	No	No
Suggested minimal sensitivity	-74dbm	-76dbm
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

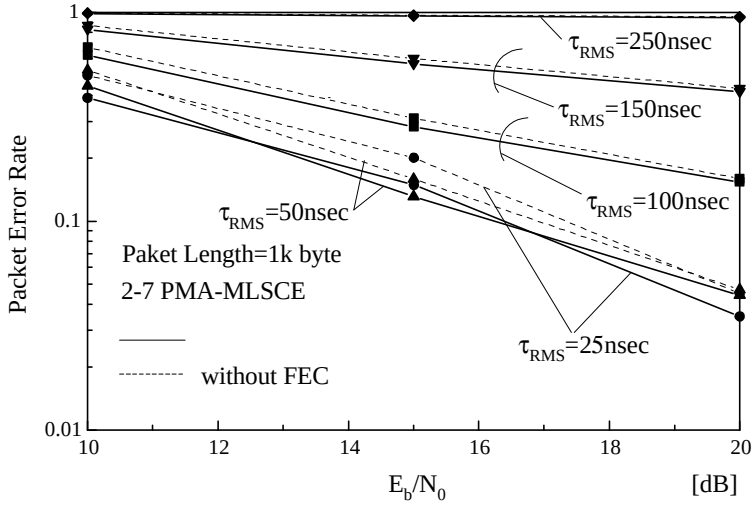
PER in AWGN channel



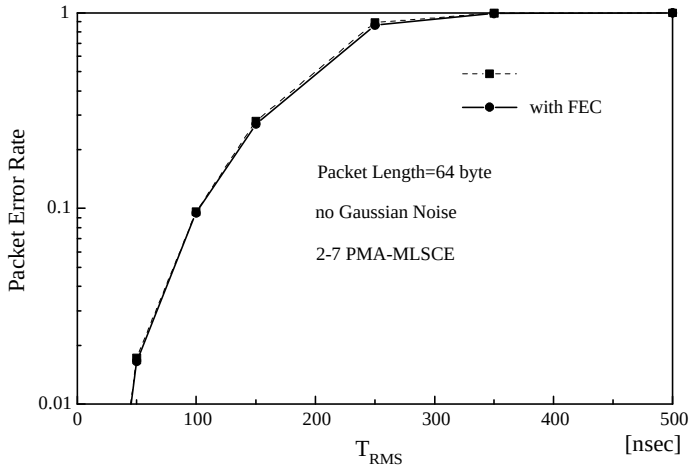
PER in Fading with Gaussian Noise (64byte-packet) (Simple Implementation)



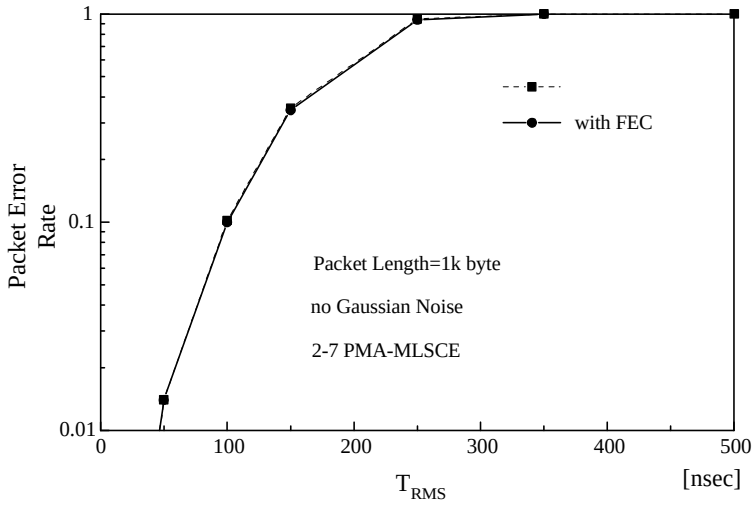
PER in Fading with Gaussian Noise (1kbyte-packet) (Simple Implementation)



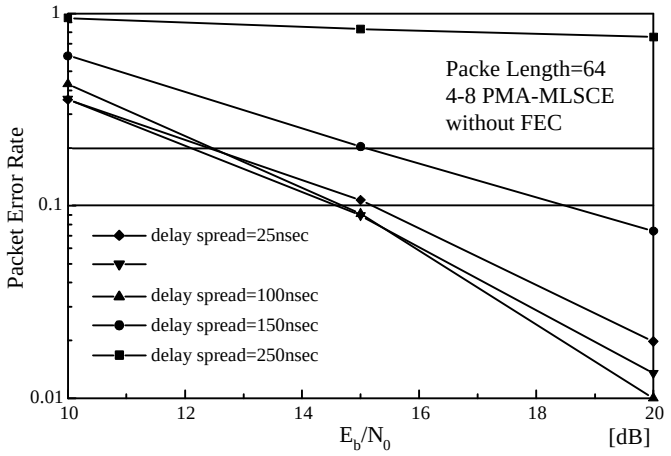
PER versus T_{RMS} (64byte-Packet) (Simple Implementation)



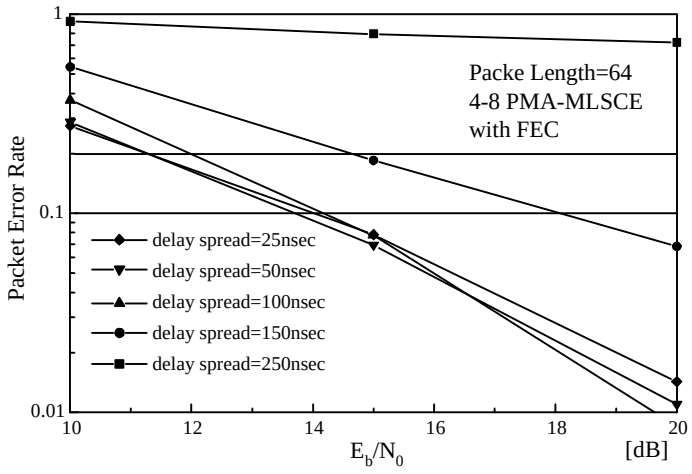
PER versus T_{RMS} (1kbyte-Packet) (Simple Implementation)



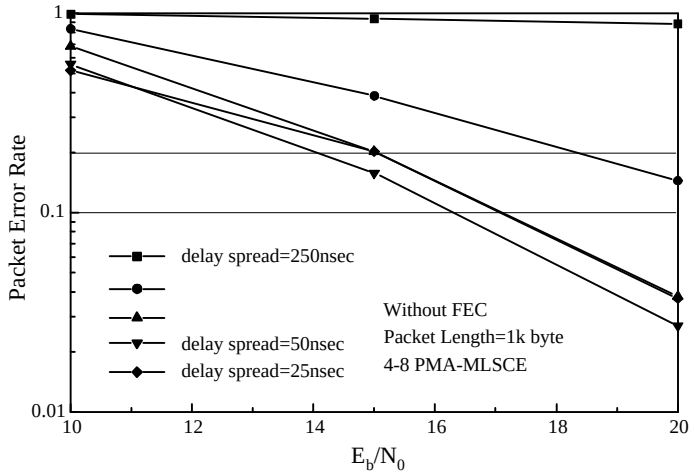
PER in Fading with Gaussian Noise without FEC (64byte-packet) (Complex Implementation)



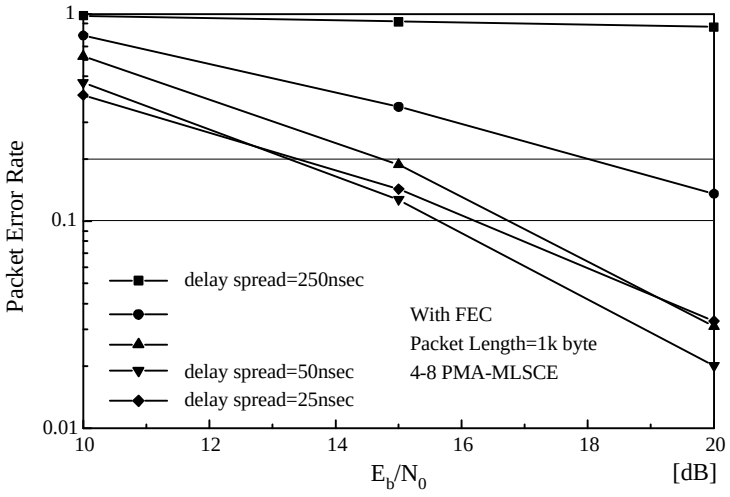
PER in Fading with Gaussian Noise with FEC (64byte-packet) (Complex Implementation)



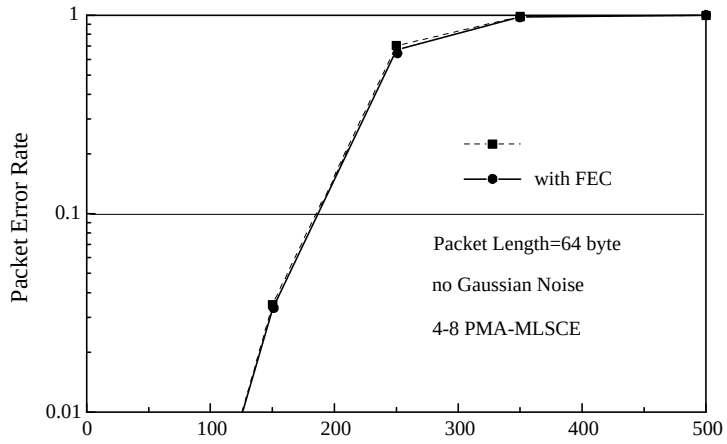
PER in Fading with Gaussian Noise without FEC (1kbyte-packet) (Complex Implementation)



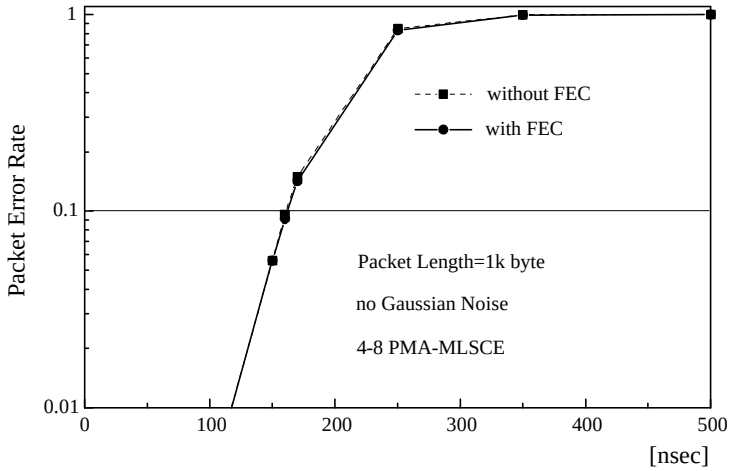
PER in Fading with Gaussian Noise with FEC (1kbyte-packet) (Complex Implementation)



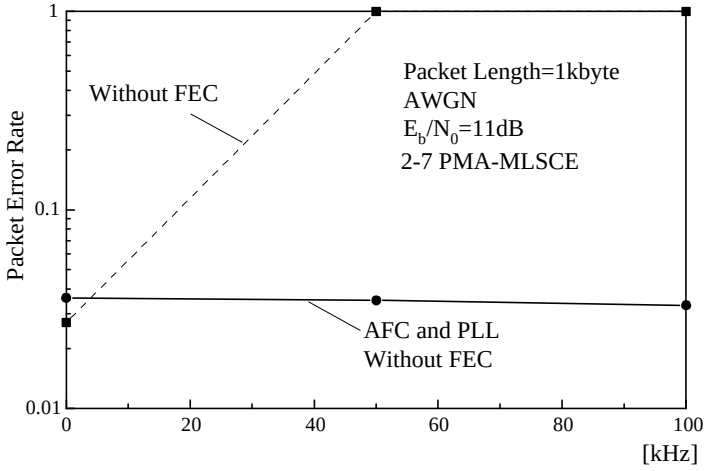
PER versus T_{RMS} (64byte-Packet) (Complex Implementation)



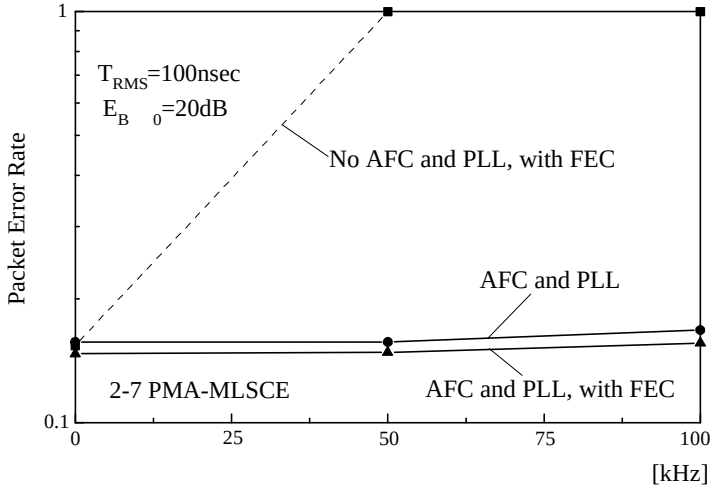
PER versus T_{RMS} (1kbyte-Packet) (Complex Implementation)



PER versus Frequency offset (AWGN)



PER versus Frequency offset (Fading+G-Noise)



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(Ψ_{RMS}=0.25)	12(Ψ_{RMS}=0.25)

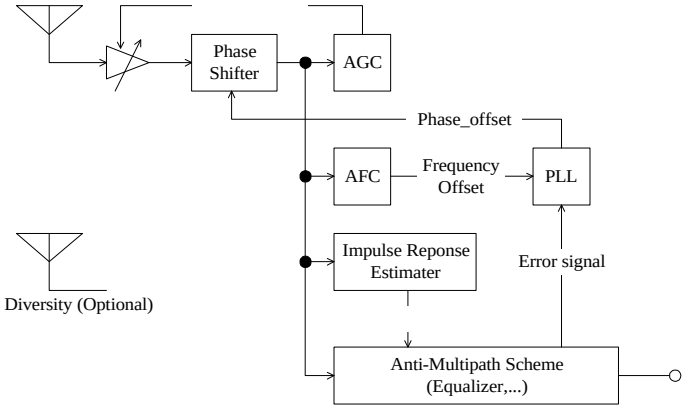
Per-Rate Performance Summary (Complex Implementation)

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(Ψ_{RMS}=0.25)	12(Ψ_{RMS}=0.25)

Timing and Overhead related Summary

Attribute	Suggested Value
aSlotTime	8.9µsec
aCCATime	4µsec
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

Receiver Structure (1) -Basic structure-



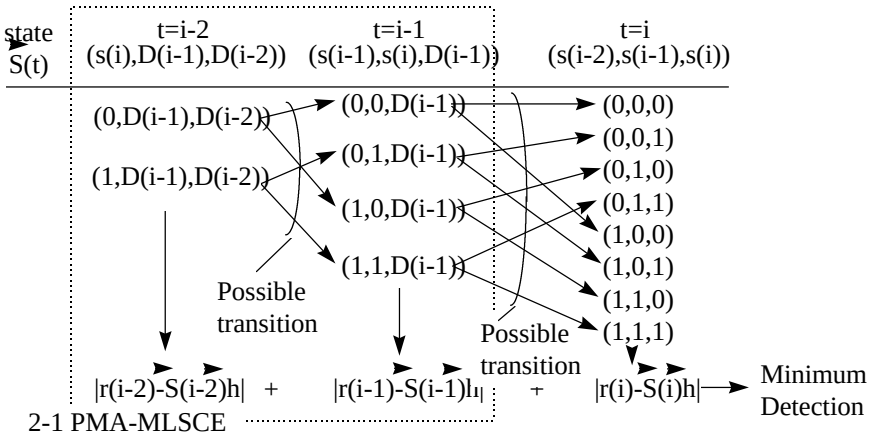
Receiver Structure (2)
-Example of Anti-Multipath scheme -

Past Metric Addition MLSCE (PMA-MLSCE)

- Symbol-by-Symbol detection based on Maximum Likelihood Sequence Estimation during Channel Impulse Response duration
- Low calculation amount by using decision results

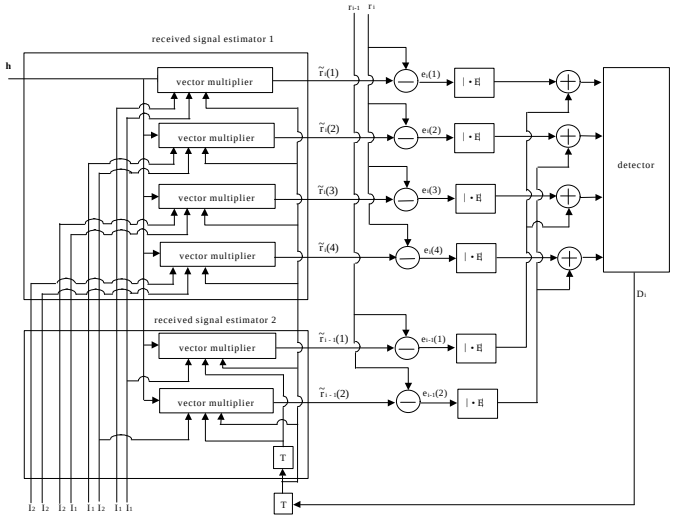
Receiver Structure (3)
-State Transition of PMA-MLSCE -

Example for channel impulse response(h) of length 3 and binary symbol

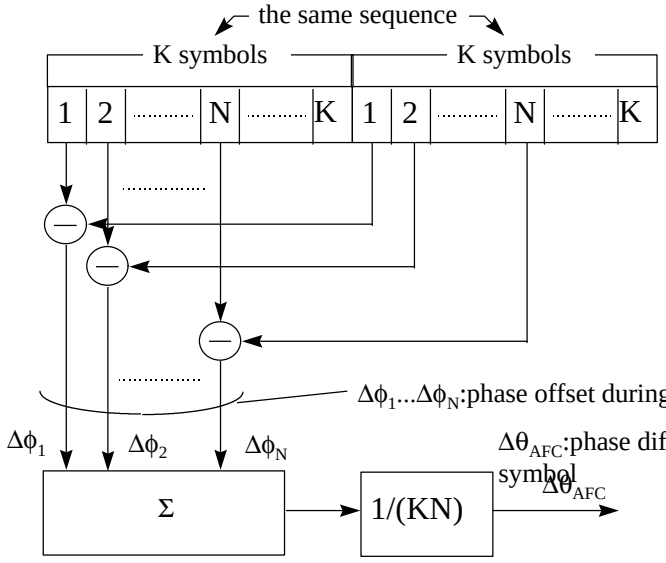


s(i): symbol candidate D(i-k): Decision result at t=i-k r(i): received signal at t=i

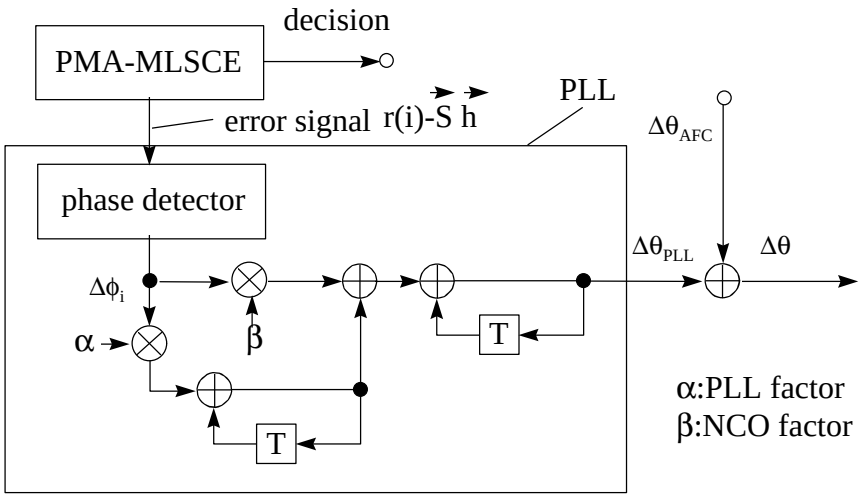
Receiver Structure(4) - 2-1 PMA-MLSCE-



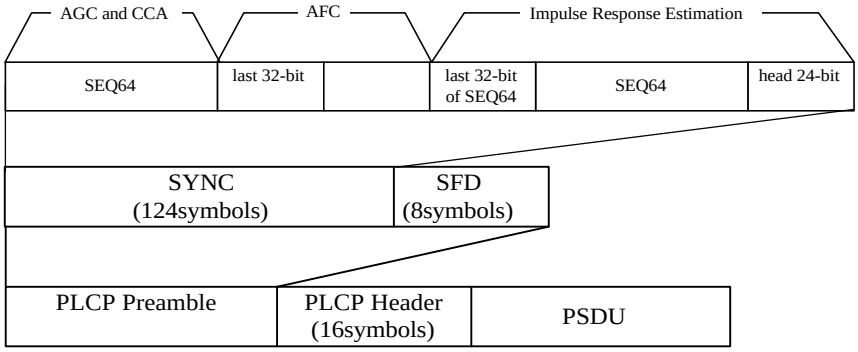
Receiver Structure(5) - AFC -



Receiver Structure(6) - PLL -



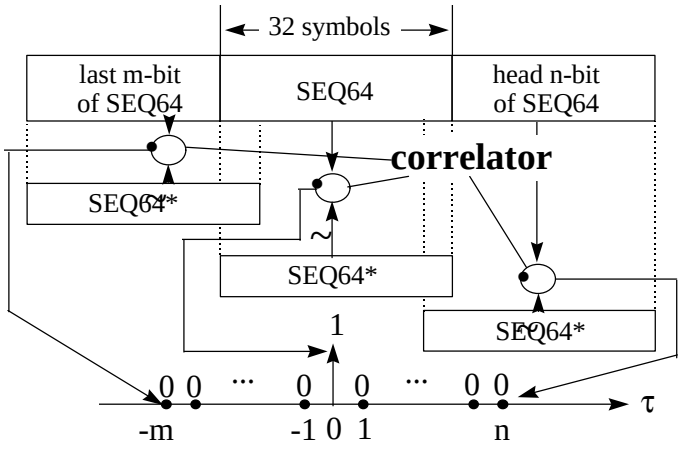
Preamble Structure



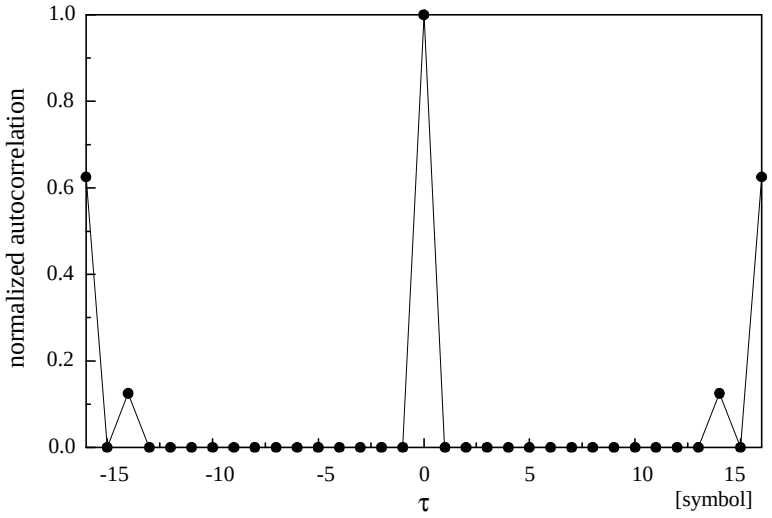
SEQ64=($X_0Y_0X_1Y_1\ldots X_{30}Y_{30}X_{31}Y_{31}$)
=(0xFF 0xF0 0xF3 0x30 0xC0 0x0F 0x0C 0xC0)

Channel Impulse response Estimation

SEQ64=($X_0Y_0X_1Y_1\ldots X_{30}Y_{30}X_{31}Y_{31}$)
=(0xFF 0xF0 0xF3 0x30 0xC0 0x0F 0x0C 0xC0)



Correlation function of SEQ64



SlotTime and SIFSTime

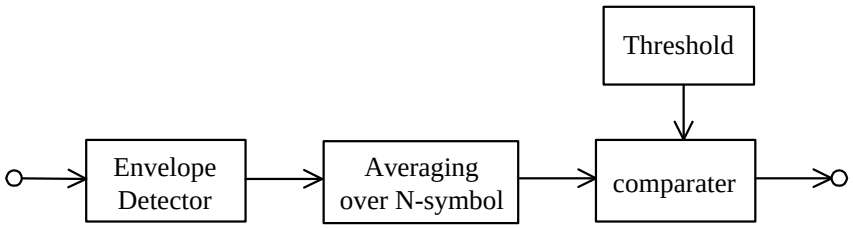
SlotTime=CCATime+RxTxTurnaroundTime+AirPropagationTime+MACProcessingTime

SIFSTime=RxRFDelay+RxPLCPDelay+MACProcessingDelay+RxTxTurnaroundTime

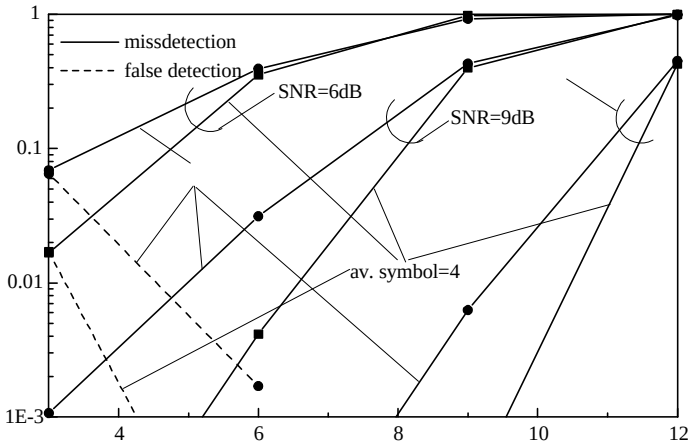
CCATime	RxRFDelay	1usec	4usec
	RxPLCPDelay	2usec	
	Time to detect Envelope(Doc 98/35, Section 3.2)	1usec	
RxTxTurnaround Time	TxPLCPDelay	0.4usec	2.4usec
	RxTxSwitchTime	0.3usec	
	TxRampOnTime	0.7sec	
	TxRFDelay	1usec	
AirPropagationTime			0.5usec
MACProcessingTime			2usec

SlotTime=8.9usec SIFSTime=7.4usec

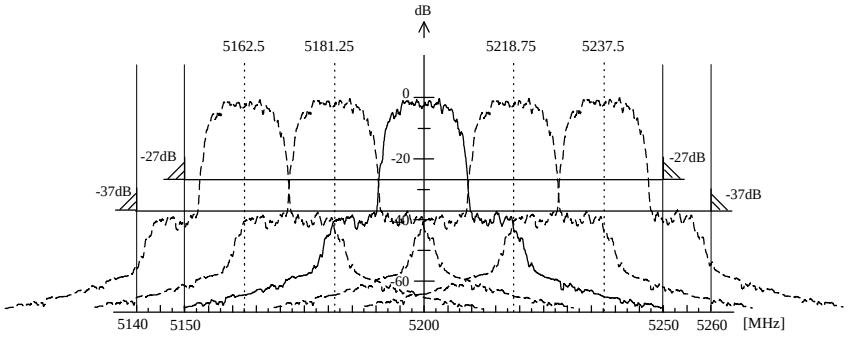
CCA mechanism



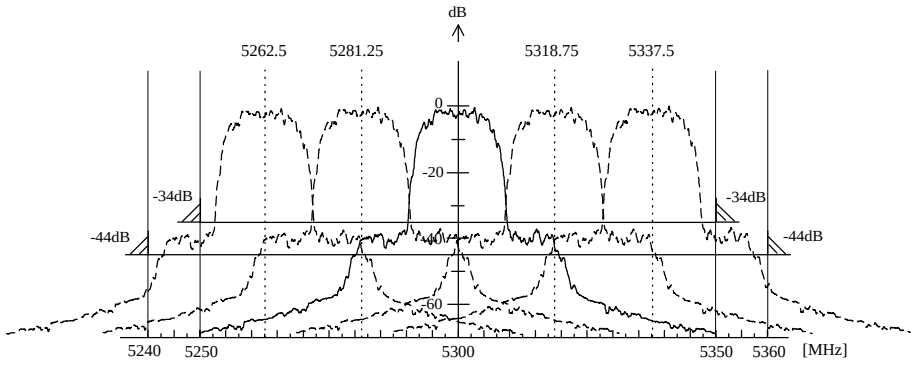
CCA Detection Performance



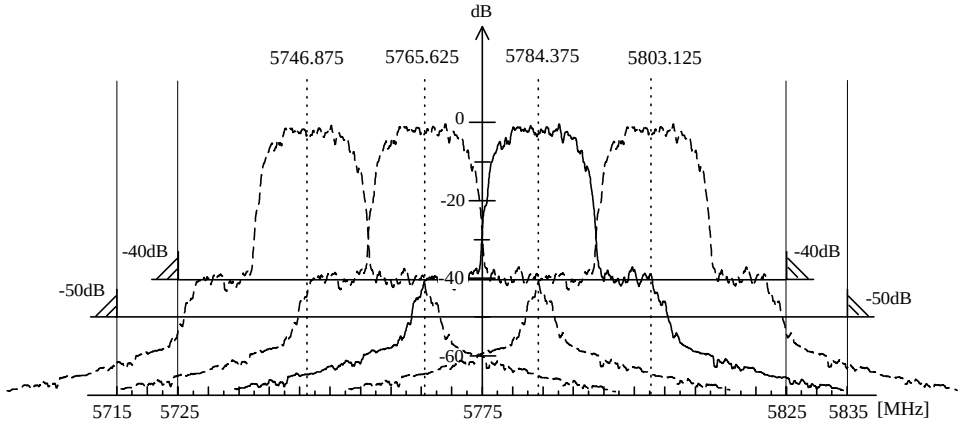
Channel Allocation in 5.15-5.25GHz band



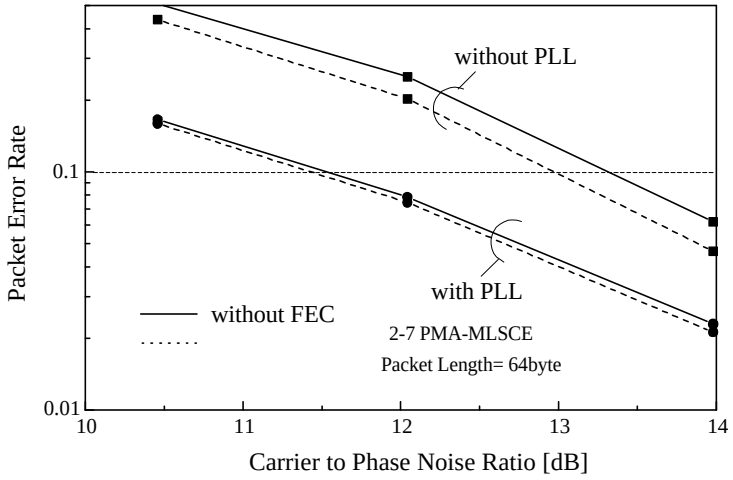
Channel Allocation in 5.25-5.35GHz band



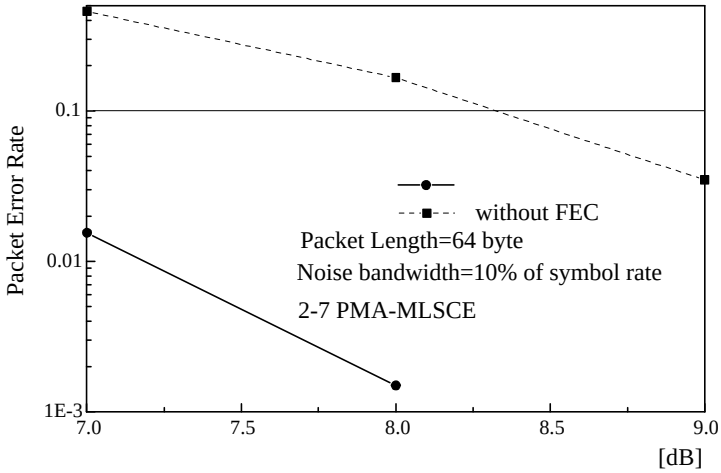
Channel Allocation in 5.725-5.825GHz band



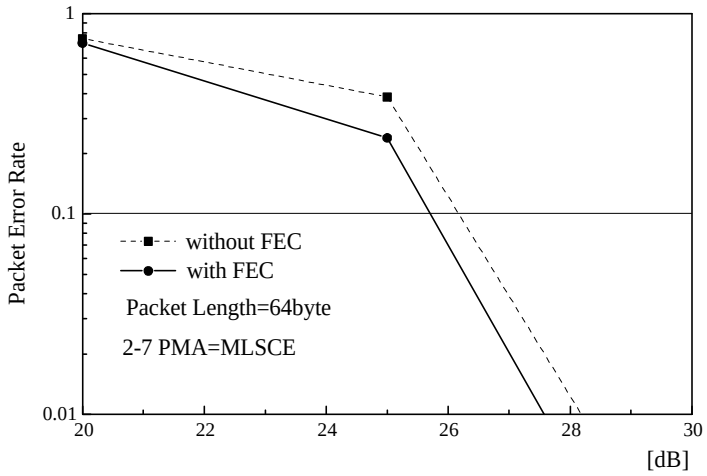
Appendix: PER versus Phase noise



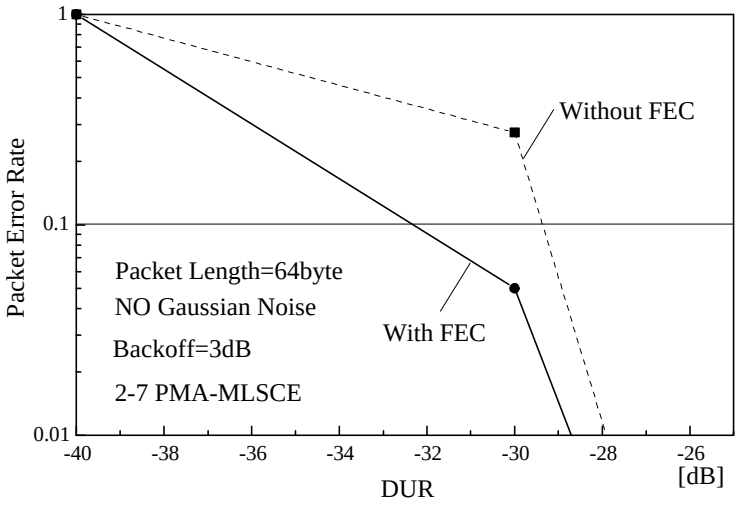
Appendix: PER v.s. Narrow-band Noise



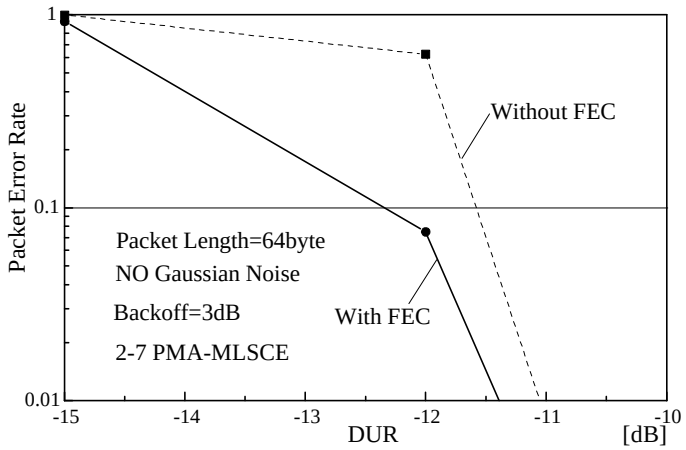
Appendix: PER v.s. CW-jamming



Appendix: PER v.s. Alternate Channel



Appendix: PER v.s. Adjacent Channel



Appendix: PER v.s. Co-Channel