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Wireless LANs

QPSK Modulation With Anti-multipath Scheme for High Speed Wireless LAN

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Status of the Presentation

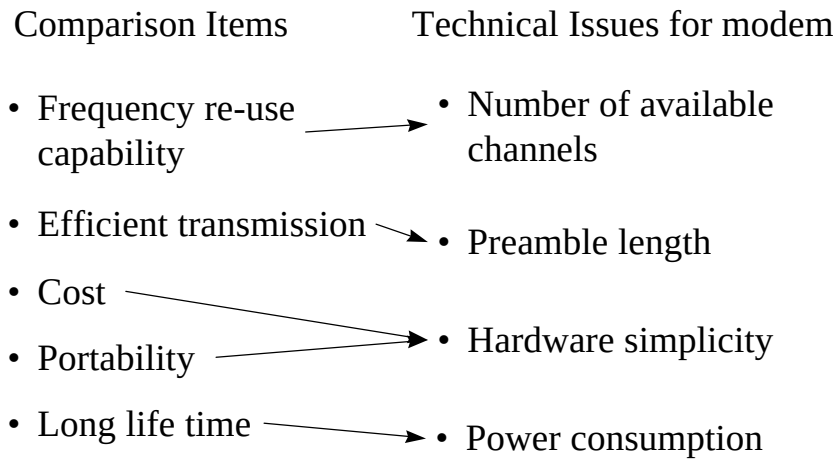
A skeleton proposal for
QPSK modulation with an anti-multipath scheme

- A candidate of single carrier systems
- Possibilities to change the proposed scheme through future studies

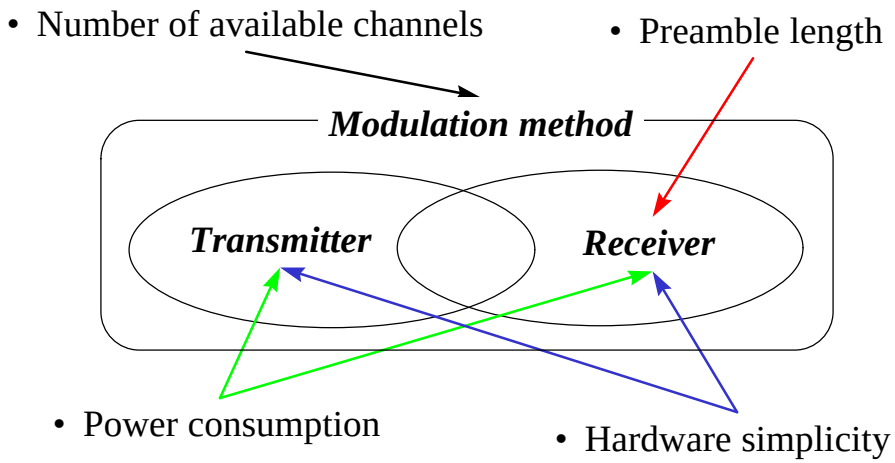
Requirements for High Speed Wireless LAN

- Requirements from System side: **Large system capacity**
  - Additional comparison items
    - **Frequency re-use capability**
    - **Efficient transmission**
- Requirements from Equipment side: **Usability for users**
  - Additional comparison items
    - **Cost**
    - **Portability**
    - **Long life time**

Technical issues for the comparison items



Impacts of the issues on modems



Considerations on Transmitter

Modulation method: QPSK

	Power Consumption	H/W Simplicity
baseband	**Low** (mature digital technology)	**Simple**
RF/IF	***To be solved*** (***linear high power amplifier***)	***To be solved***

Amplifier in Transmitter

High capacity ⇨ Less adjacent channel Interference

⇩

Linear Amplifier

↙

Trade off for system design

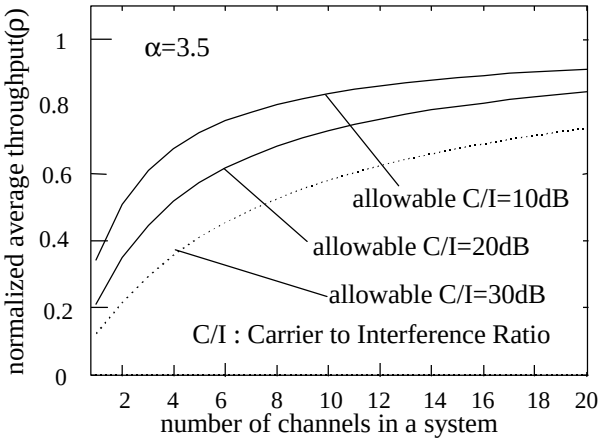
↖

Non-Linear Amplifier

⇧

Low power consumption ⇨ More efficient amplifier

Consideration on modulation method



System capacity/channel=
(data rate/channel)·ρ

⇩

More available channel,
More system capacity

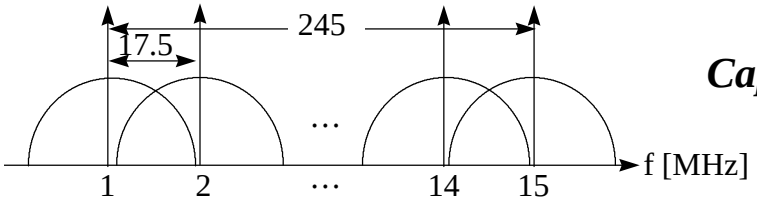
⇩

QPSK

Estimation of System capacity/channel(***Cap***)

- Modulation: QPSK (roll-off=50%)
- Data rate: 20Mbps/channel(12.5Msymbol/sec)
- Carrier interval: 12.5[MHz]·1.4 = 17.5 [MHz]
- System bandwidth: 300MHz

15 carriers + • Allowable C/I: 20dB ⇒ ρ=0.8



Cap = 16Mbps

Consideration on Receiver

	Power Consumption	H/W Simplicity	Preamble
baseband	Pending issue	Pending issue	Pending issue
	(***Anti-multipath scheme***)		
RF/IF	Low	Simple	Short
	(conventional technologies can be applied)		

Innovative anti-multipath scheme must be proposed

Anti-multipath Scheme

Tap Coefficient Shift MLSCE
(Maximum Likelihood Symbol Candidate Estimator)

- Symbol-by-symbol base ML estimator
- Effective usage of decision feedback loop
  - Reduction of likelihood calculation
  - Avoidance of weak point of ML estimator

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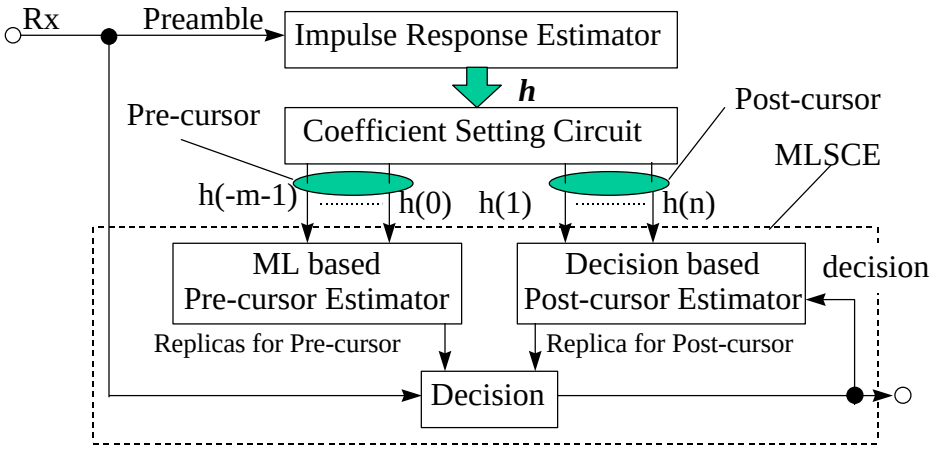
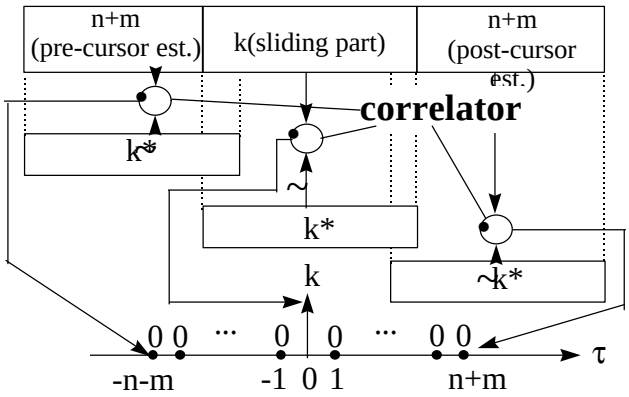
Tap Coefficient Shift MLSCE



Preamble for Tap Coefficient Shift MLSCE



m:number of pre-cursor
n:number of post-cursor
k:S/N improvement

Preamble Length
= k+2(n+m)

Length of Inter-Symbol Interference (ISI)

k=10-32 symbols (10-15dB Improvement)
n+m=6-10 symbols (ISI Length)

22-52 symbols for preamble

*:complex conjugate

Comparison of Calculation Amount

	MLSCE	DDFSE	DFE
multiplier (complex)	0	0	m
adder	$n+m \cdot L^m$ *	$n+m \cdot L^m$ *	n+m
Viterbi	None	Required	None

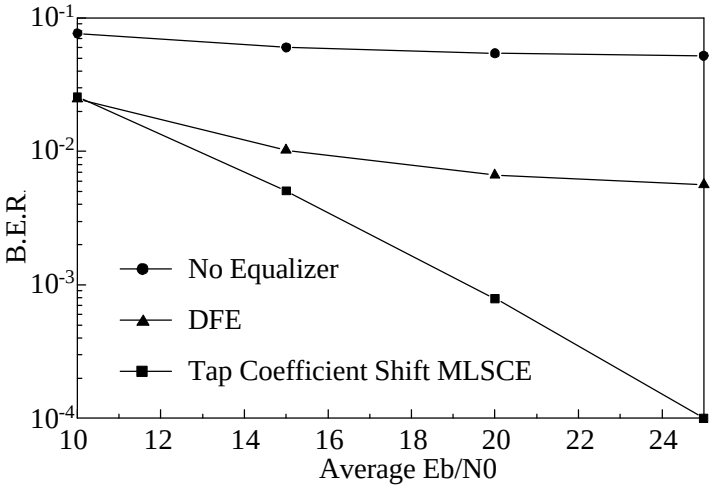
* $m \cdot L^m$:one time per packet

m:tap number of Pre-cursor Estimator
n:tap number of Post-cursor Estimator
L:phase number of Modulation

Simulation Conditions

Modulation Method	QPSK(Roll off=50%)
Symbol Rate	12.5Msymbol/s
Propagation Model	2-path Rayleigh model (1symbol delay)
tap	Pre-cursor Estimator : 2tap Post-cursor Estimator : 3tap

Simulation Results



Conclusions

QPSK + Tap Coefficient Shift MLSCE

Skeleton Proposal for single carrier system

- Large capacity: 16Mbps/channel for 300MHz bandwidth
- Transmitter: trade off for system design
- Short preamble: about 20-50 symbols for MLSCE
- Simplicity: neither Viterbi process nor complex multiplier