Multi-Signal Clear Channel Assessment

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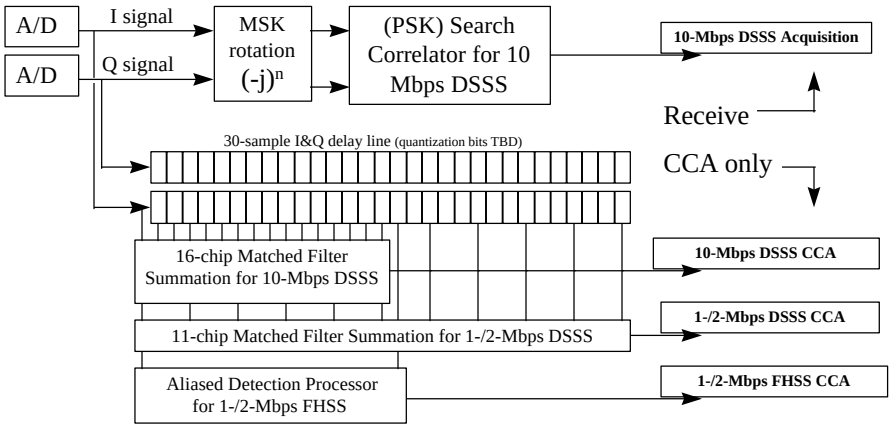
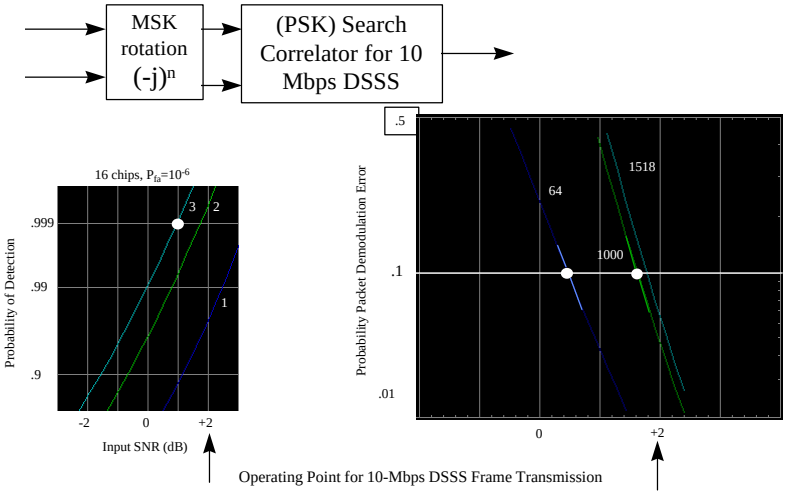
Introduction

- As a Result of London Meeting
  - Diversity Wanted by Most
  - Coexistence Seems Important to Many
- Look at New CCA Approach
  - 10-Mbps Detection For Low Slot Time
  - Other PHY Detection for Coexistence

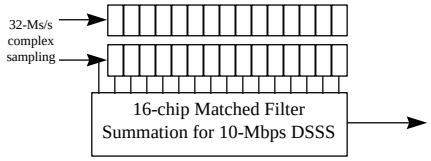
Multi-Signal Detection: Receive & CCA Modes

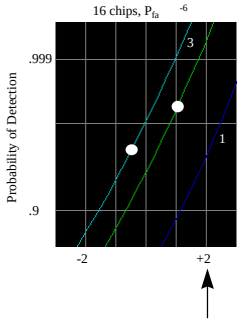


Corrrelator: 10Mbps DSSS Receive



Matched Filter: 10Mbps DSSS CCA

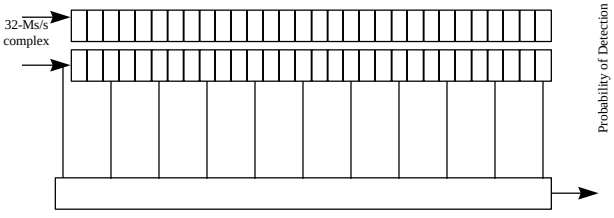


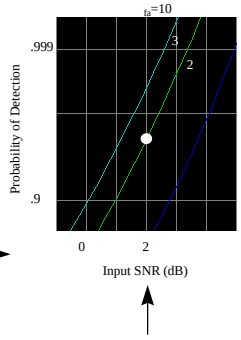


One-sample-per-chip operation:
- avoid doubling A/D speed
- reduction in circuitry required
- 2.44-dB worst-case straddling loss* (MSK)
- 0.83-dB average straddling loss* (MSK)
- use multiple-symbol (2-of-2 or 3-of-3) detection

* E.J. Kelly, Sampled-Data Receiver Design and Performance for BPSK and MSK Spreading Modulations, Lincoln Laboratory Technical Report 550, 19 January 1981 (public release, distribution unlimited).

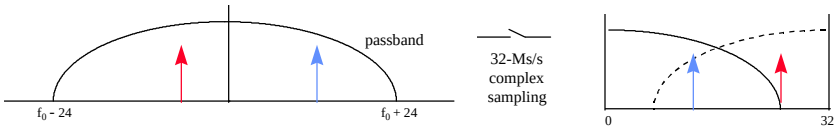
Matched Filter: 1-/2-Mbps DSSS CCA





Three-samples-per-chip operation:
- difference between 33-Ms/s and 32-Ms/s negligible
  1/6 chip error (filtered PSK)
- use multiple-symbol (2-of-2) detection

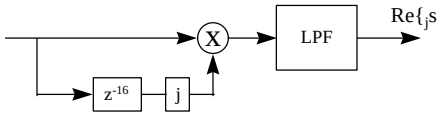
FH Detection for CCA



$s_n = e^{j(2\pi f_0 t + \delta \cos(\omega_m t)+\phi)}$ $f_0 = 2400+k$ $k=\{2,3,....80\}$

$s_n = e^{j(\pi nm/16 + \delta \cos(\omega_m n T_s)+\phi)}$ $m=\{0,1,....31\}$

carrier with FM signal and unknown phase



$\mathrm{Re}\{_j s\ s^{*}\ \sin(m\pi + [\cos(\ _m\ _s\ \omega\ (n-16)T\ )]\ )$

$_{m+1}\ \delta\ \omega\ T\ ) \sin(\ _m\ _s$

This is an aliased frequency discriminator which will capture an FH carrier which falls in the passband

802.11 FH Data Modes

$$_n = (-1)\ \sin(\ \pi\delta T\ \Sigma\ _m\ p\ \ (nT_s\ \ \ _B) \ \sim (-1)^k\ \pi\delta T\ \Sigma\ _m\ p\ \ (nT_s\ \ \ _B)$$

where

n and m index the sample and symbol, respectively

δ

T_B

p_{FM}

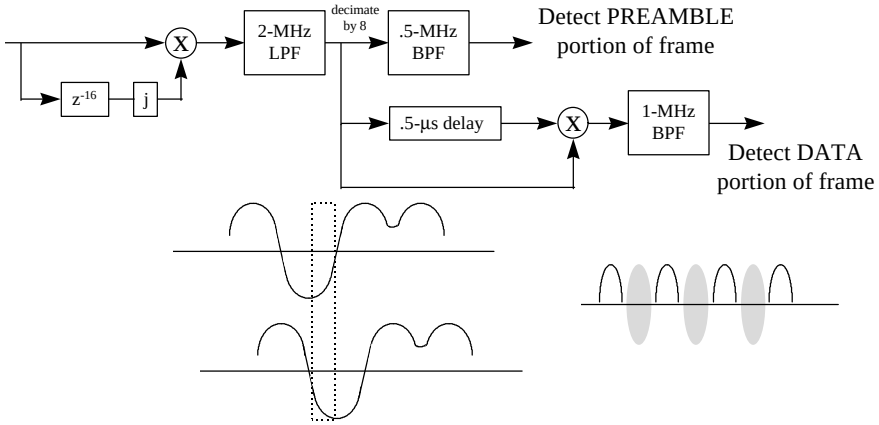
a_m th symbol

= (-1) during preamble

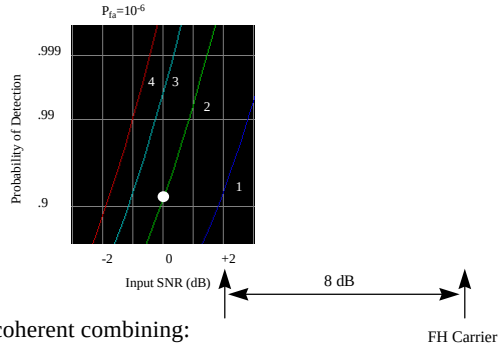
= {±1} for 1-Mbps data

= {±1/3, ±1} for 2-Mbps data

FH Detection Processor



FH Preamble Detectability

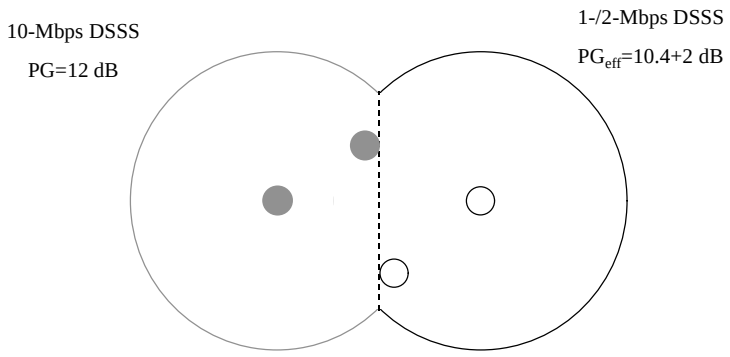


Approximate as noncoherent combining:
- use standard radar-detection curves
- 32 samples per symbol
- assume FM side bands -10 dBc

Detection Performance

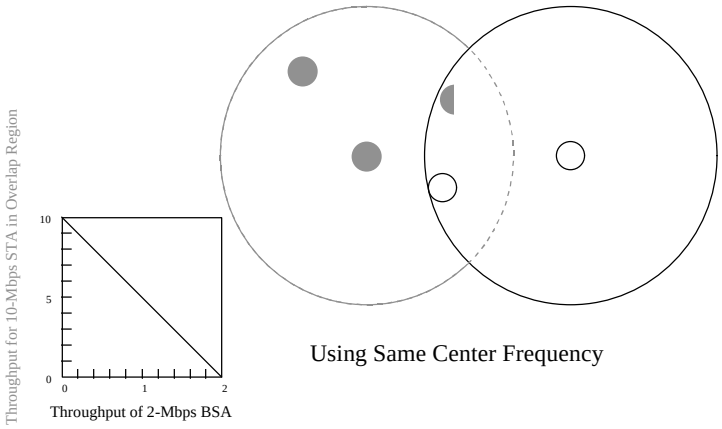
Detection Process		*	Sensitivity
10-Mbps Receive		≤ 8 µs	
		≤ 2 µs	-90 dBm
1-/2-Mbps DSSS CCA		≤ 2 µs	-90 dBm
1-/2-Mbps FHSS CCA	preamble	≤ 2 µs	
		TBD	TBD
	2-Mbps data	TBD	TBD

10-Mbps DSSS with 1-/2-Mbps DSSS
Ignoring Each Other



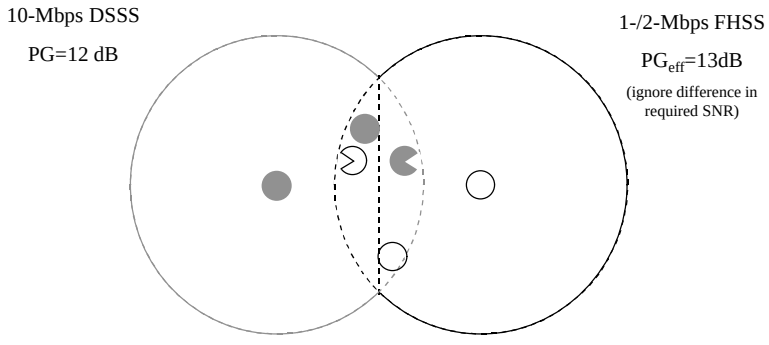
Using Same Center Frequency

10-Mbps DSSS with 1-/2-Mbps DSSS



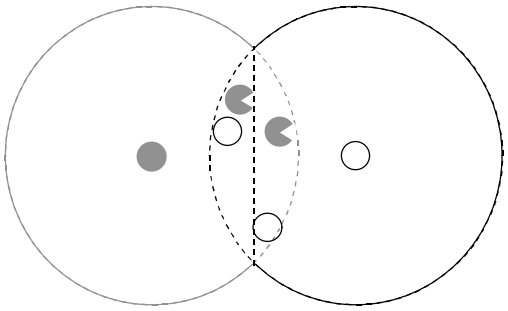
10-Mbps DSSS with 1-/2-Mbps FHSS

Ignoring Each Other



10-Mbps DSSS with 1-/2-Mbps FHSS

10-Mbps Defers



Using Same Portion of Band with 25% Probability

Summary

If “Coexistence” is Required,

- Avoids Excessive Overhead
- Lets 10-Mbps Transmissions Defer to 1-/2-Mbps
- Operates For Both DS and FH Legacy Systems
- Consumes Negligible Power
- Is Not Burdensome Circuitry

And Can Be Shut Off