Proposal for 5-GHz PHY

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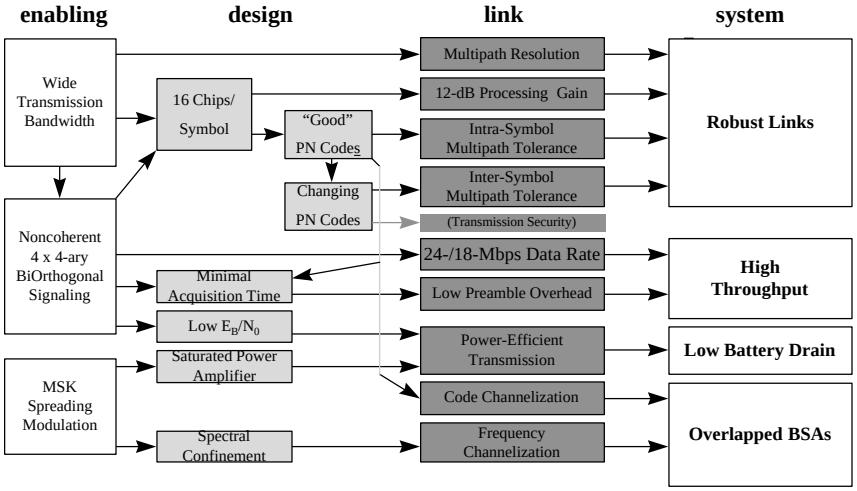
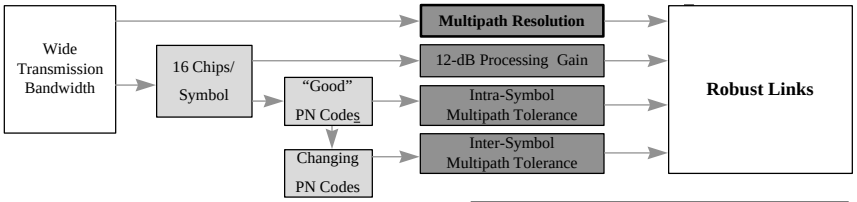
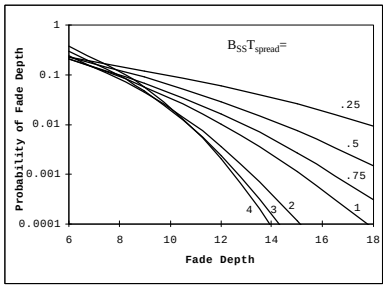
Key Features



Robust Links



- Resolving paths gives more independent trials
- Reduced strength per path, but
- Low probability that all fade
- **D11-97/119** demonstrates for diffuse Rayleigh
- Even better with specular multipath



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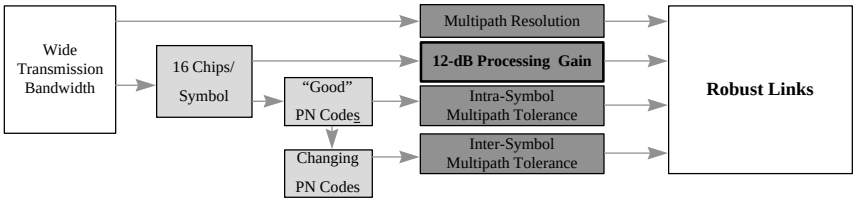
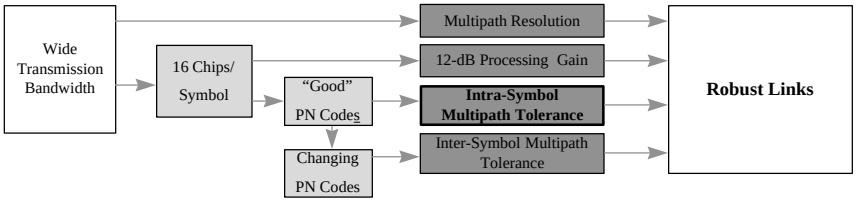
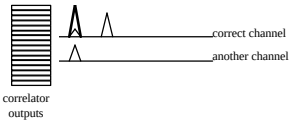


- Functional processing gain (PG) of 12 dB
- Probably required as the UNII band fills up

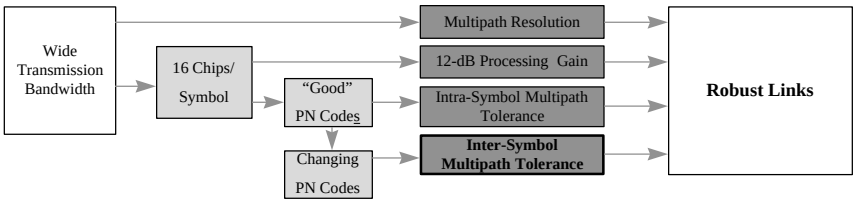
Robust Links



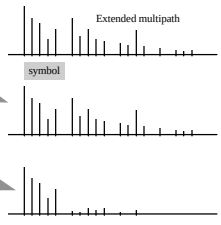


- Test with specular multipath, without noise
  - must consider crosscorrelation side lobes
- **D11-97/117** documents preferred 16-bit codes
  - best 8 of 2048 cosets
- Must analyze self-interference with sum of four

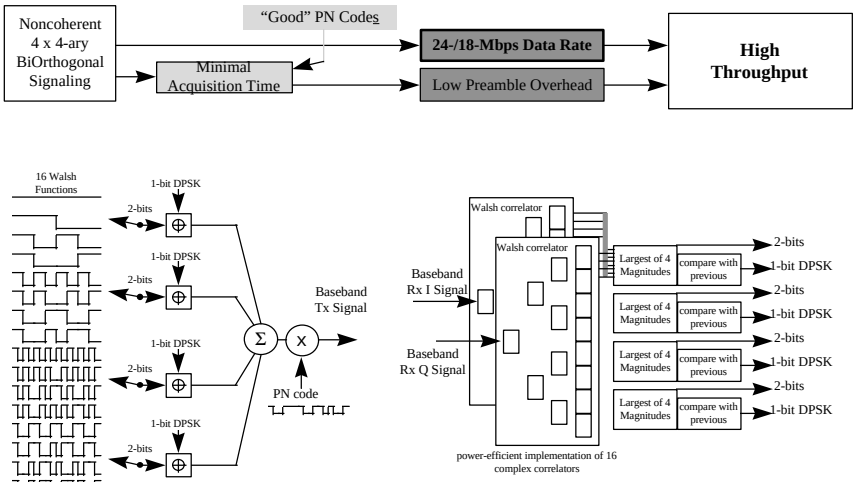
Robust Links



- Repeated spreading code correlates with far-out multipath
  - strong intersymbol interference (ISI)
- Use 4 cosets cyclically
  - no correlated ISI for four symbols
- Could use 8 cosets, but
  - not really needed
  - better to have 2 groups of 4 codes for spatial re-use

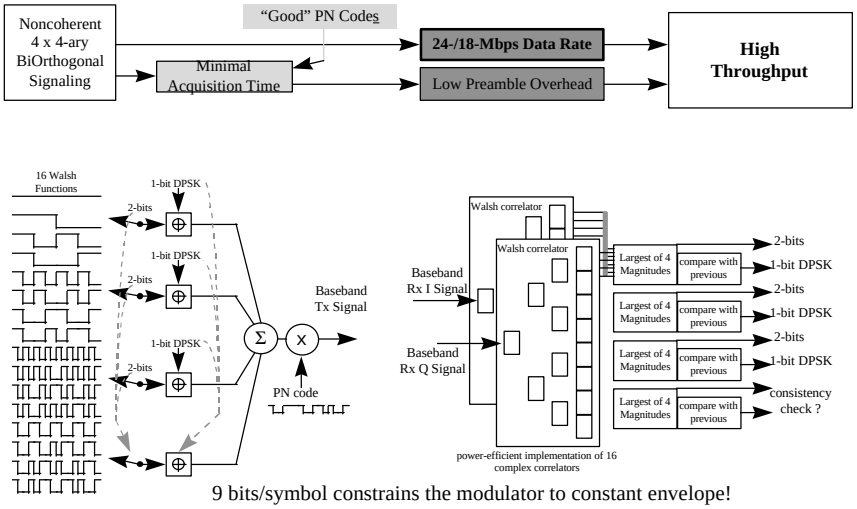


High Throughput



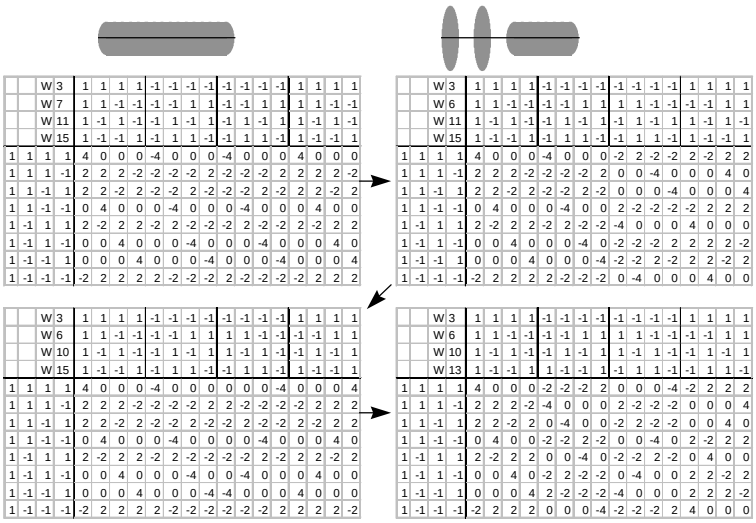
12 bits/symbol with 6-dB peak/average envelope

High Throughput

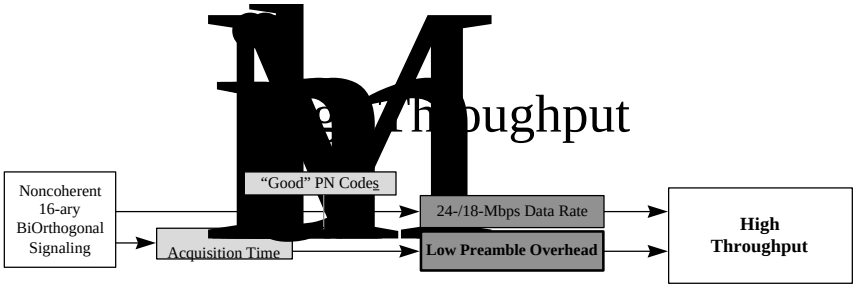


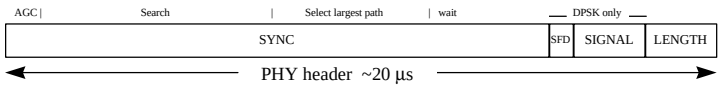
9 bits/symbol constrains the modulator to constant envelope!

Examples of Tx Waveforms

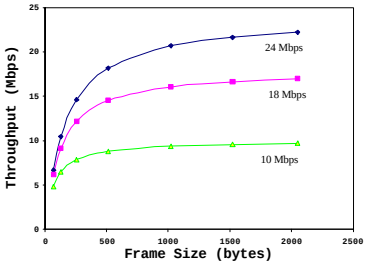


High Throughput

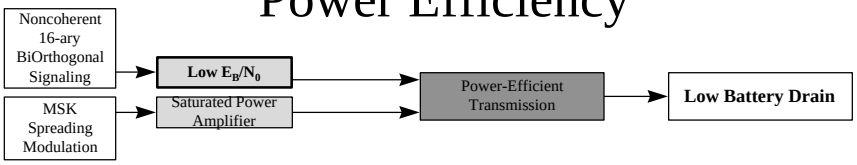




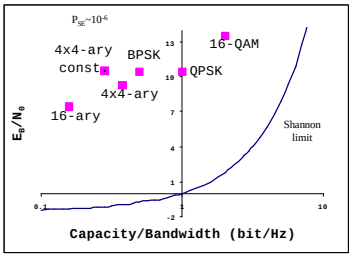
- Noncoherent: no PLL, no settling time
- Good PN codes: no equalizer, no adaptation time
- DPSK on SFD & SIGNAL: no CRC required



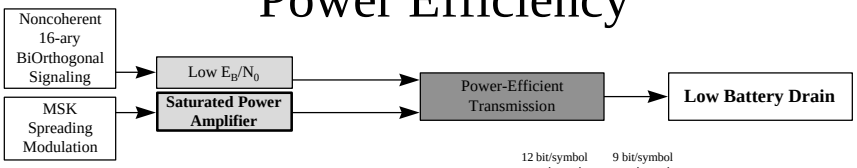
Power Efficiency



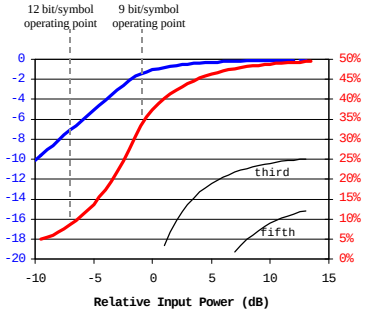
- Exploits bandwidth for robustness
- 9.3 to 10.5 dB E_B/N_0 for 10^{-6} P_{SE}
- Similar in efficiency t0 DPSK



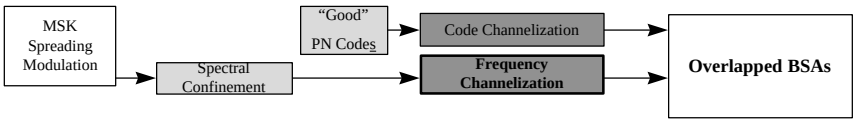
Power Efficiency



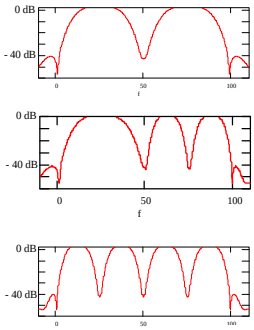
- MSK allows operation into power-amp saturation
  - constrained-amplitude mode only
  - 9 bits/symbol
  - but 6-dB greater average power
- PA efficiency greatly improves
- **D11-97/118** describes generation and performance



Channelization and Coexistence

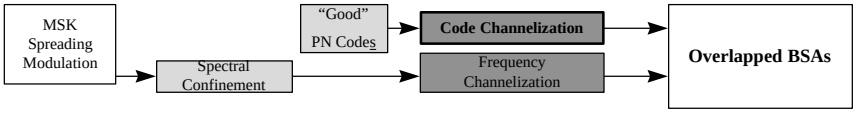


- MSK[1] (or MSK shaping) enhances channelization
- 32-Mchip/s
  - two wideband[2] per 100-MHz
- options if 16-Mchip/s
  - a wideband and two narrowband[3] per 100-MHz
  - four narrowband per 100-MHz
- 108 to 144 Mbps capacity in 6 to 12 frequency channels



[1] **D11-97/118** describes MSK generation [2] wideband = 24 or 18 Mbps [3] narrowband = 12 or 9 Mbps

Channelization and Coexistence



- Selected best 8 codes (of 2048) for demodulating data in multipath
- Selected best 8 codes for preamble search (and acquisition) in multipath
- Mutual rejection much better than "random" implied by processing gain
- Many strategies for code assignment
  - unique pairing of data/search codes gives 8 code channels
  - arbitrary pairing of data/search codes gives 64 code channels
  - intra-frame code changing greatly expands the possibilities
- Can be combined with six to twelve frequency channels

D11-97/117 describes data codes

Summary of Possible Data Modes

Chip Rate	Modulation Option	Data Rate	Threshold
32 MHz[1]	16-ary BiOrthogonal	10 Mbps	-92 dBm
	4 x 4-ary BiOrthogonal (constrained[3])	18 Mbps	-86 dBm[4]
	4 x 4-ary BiOrthogonal	24 Mbps	-86 dBm
16 MHz[2]	16-ary BiOrthogonal	5 Mbps	-95 dBm
	4 x 4-ary BiOrthogonal (constrained)	9 Mbps	-89 dBm[4]
	4 x 4-ary BiOrthogonal	12 Mbps	-89 dBm

[1] six total channels in UNII band

[2] twelve total channels in UNII band

[3] constant envelope MSK

[4] average transmitter power increases by 6 dB