

IEEE 802.11 5.2 GHz OFDM proposal MAC performance

Traffic & MAC assumptions

- Traffic
 - constant 1500 byte packet length
 - 20, 30 Mbit/s (according to Lucent/NTT proposal)
 - Poisson packet arrival process
 - 75% downlink traffic, 25% uplink traffic
 - No handoffs / roaming
- MAC
 - CMTSA/CA according to IEEE 802.11 spec
 - MAC Parameters according to Lucent/NTT proposal
 - SlotTime = 6 μ s
 - SIFS = 13 μ s
 - DIFS = 25 μ s
 - PHY overhead = 21 μ s + (2.4 or 1.6) μ s
 - Buffer capacity of 10 packets (15Kbyte)

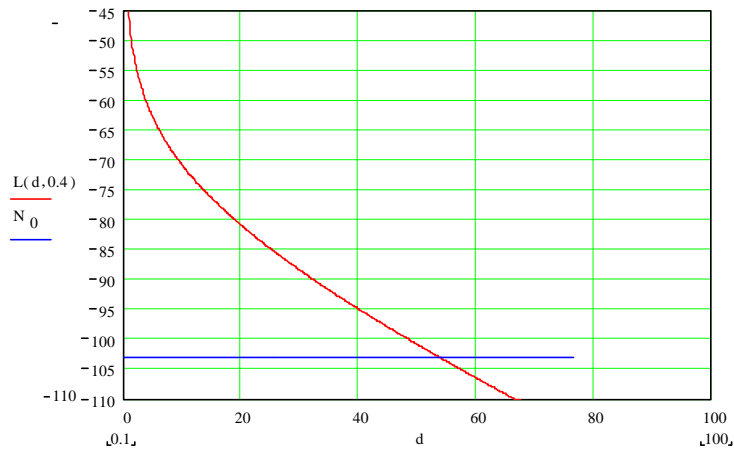
Radio parameters

- Transmit power 200mWatt (23dBm)
- 0dB-gain omni directional antennas
- Pathloss model: 5.2 model as developed for Magic WAND
- Log-normal fading of 8dB
- Receiver Noise Figure: 5dB
- Thermal Noise: (-103dBm) (2Mbit/s DSSS: -114 dBm)
- Simulated BER curves used as input
 - assume i.i.d. bit errors with probability p_i for i-th bit
 - Assess BER for i-th bit and calculate
$$\Pr\{\text{packet error}\} = 1 - \prod_i (1-p_i)$$

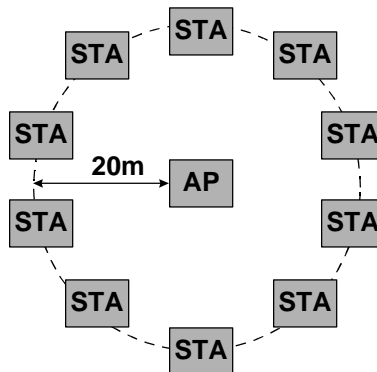
Topology

- STA - AP separation: 20 m: RSS = -58dBm,
- One Access Point, 10 Stations
- Two Access Points 60m apart, 10 Stations, 20m away
- Range approximately 50 m (see next slide)
- Simulated 10 minutes of real time

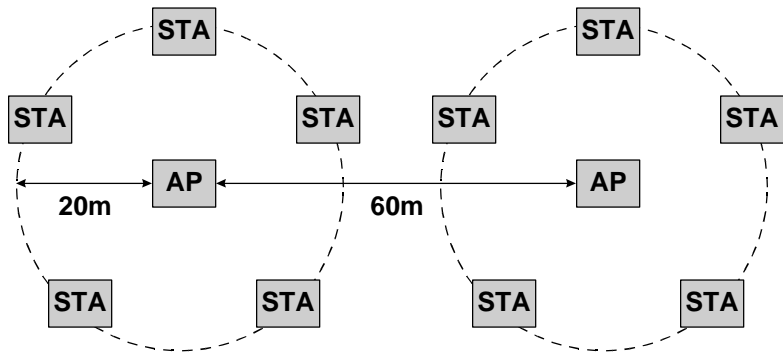
Pathloss versus distance



Constellation 1



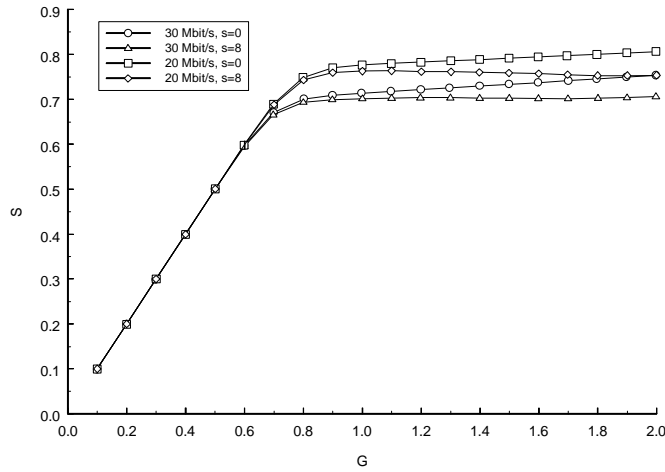
Constellation 2



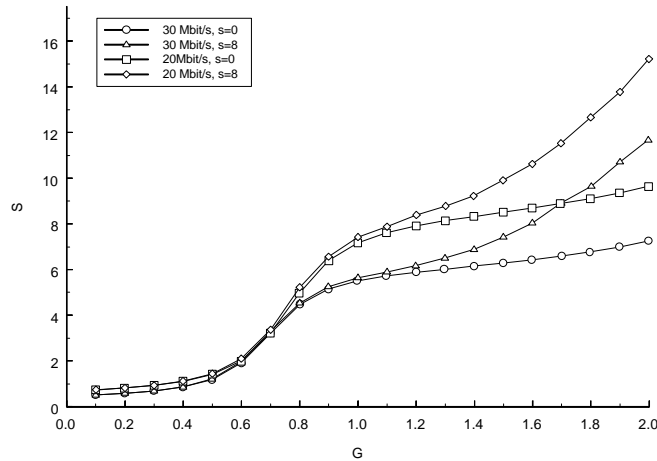
Theoretical max throughput per station packet length [bytes]

| | 100 | 500 | 1500 |
|-------------------|-----|-----|------|
| 30 Mbit/s OFDM | 16% | 50% | 75% |
| 20 Mbit/s OFDM | 22% | 59% | 81% |
| 2 Mbit/s DSSS | 34% | 72% | 89% |
| 1 Mbit/s DSSS | 46% | 81% | 93% |

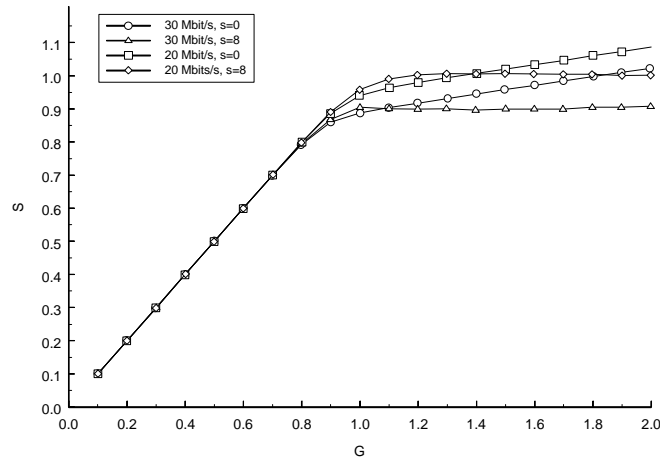
Constellation 1, Throughput



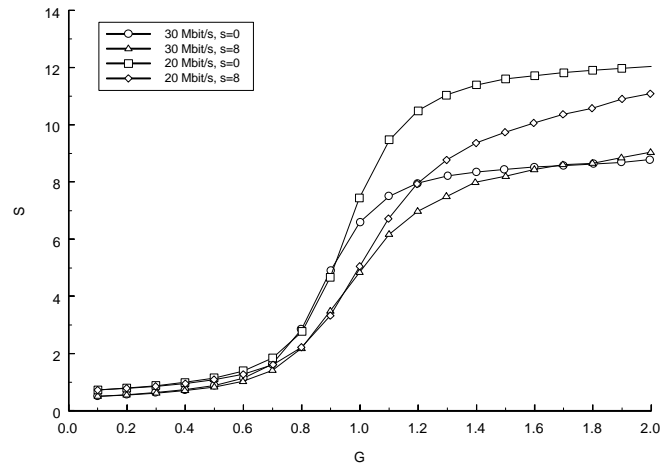
Constellation 1, Delay



Constellation 2, Throughput



Constellation 2, Delay



Conclusions

- Maximum Throughput without reuse
 - 21 Mbit/s of 30 Mbit/s (70%)
 - 15.5 Mbit/s of 20Mbit/s (77%)
 - compare: 1.72 at 2Mbit/s (86%)
- Throughput at 5% Packet loss probability
 - 0.67, for offered traffic 0.7, at 30Mbit/s
 - 0.75 for offered traffic 0.8 at 20Mbit/s
 - 0.4 for offered traffic 0.9 at 2Mbit/s DSSS
- Delay
 - less than 3.2 ms at 30Mbit/s
 - less than 5.0 ms at 20Mbits/s
 - compare 44.1 ms at 2Mbit/s
- High speed MAC maintains efficiency due to PHY preamble
 - 4% to 5% of 1500 byte packet (3% at 2Mbit/s)