IEEE P802.11
Wireless LANs

TGa Preamble Improvement

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Preamble Improvement for Tga

- We shall consider the two issues:
  - An improvement to the channel estimation section.
  - Two methods of increasing the robustness of the rate-signaling field.
- We shall consider how to combine the proposed modifications.

Current Preamble Structure

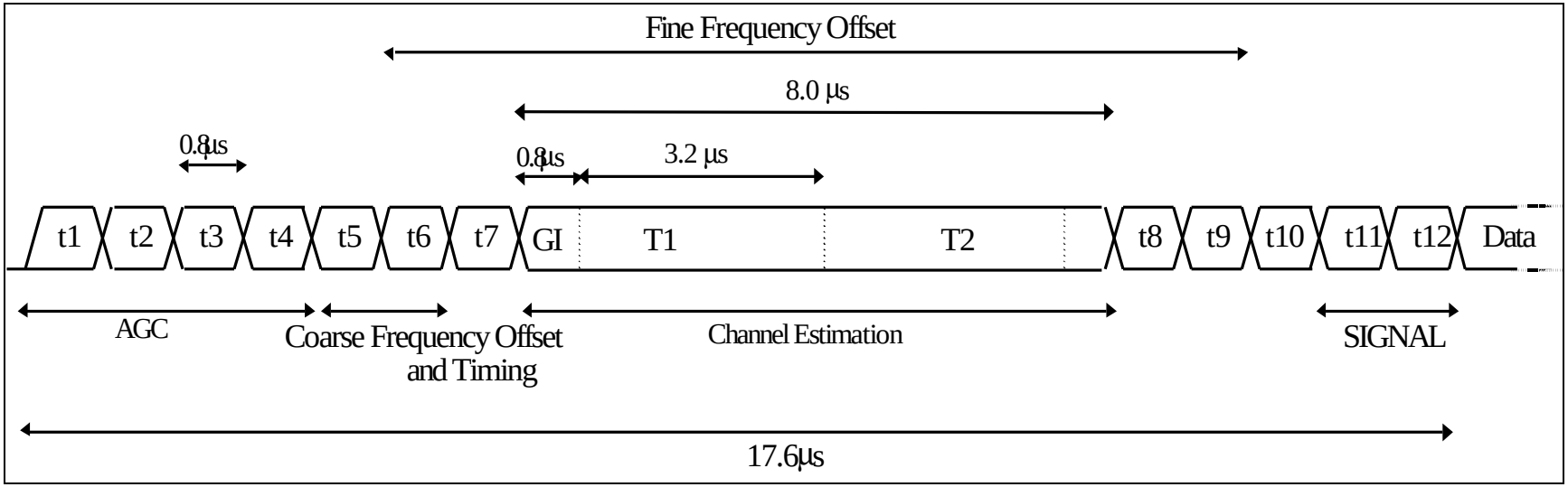


Figure 1

Functions:

- AGC tuning: t1…t3.
- Coarse frequency estimation: t5 and t6.
- Fine frequency: t6 and t9
- Channel estimation by T1 and T2.
- Rate signaling by t11 and t12.

Channel Estimation Improvement

- The functions of fine frequency estimation and channel estimation can be unified to allow a more efficient structure as shown in figure 2.

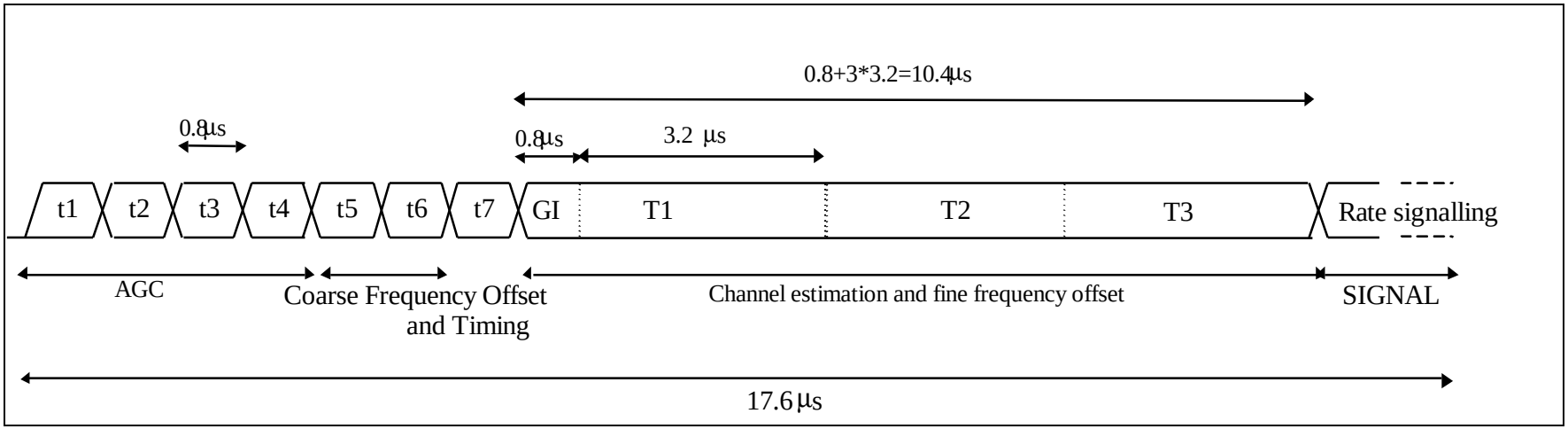


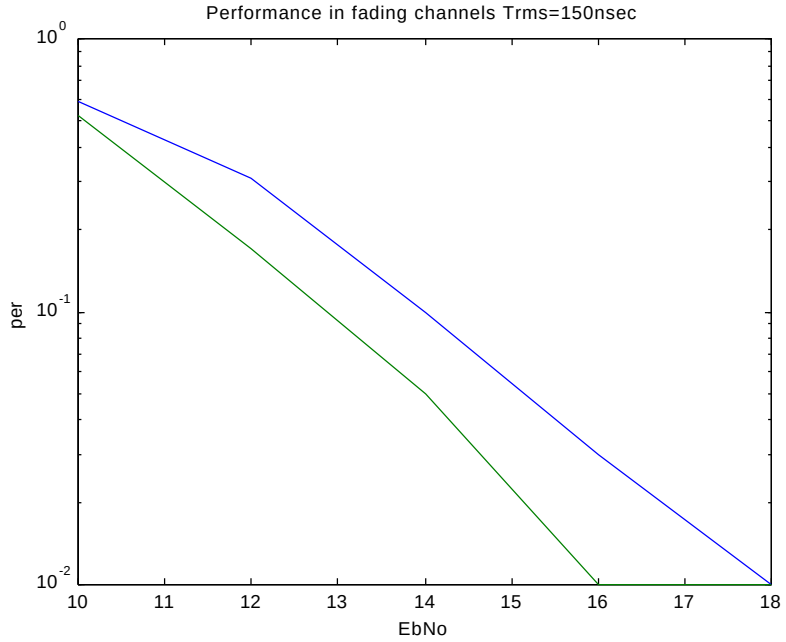
Figure 2

- The channel estimation now consists of 3 long sequences.
- Averaging over 3 results in a more accurate estimation

- Fine frequency estimation is performed by comparing the phase of the T1 sequence to that of T3 by means of a “dot product”
- Slightly better frequency estimation SNR.

Simulation results

Trms =150nSec 100Bytes



Legend :
Black: New proposal
Blue: Current proposal

A performance gain of about 1dB is apparent.

Rate Signaling Improvement

- Rate signalling is performed by QPSK modulation of the short sequences t11 and t12.
- Basic requirement: signalling scheme should as reliable as the lowest rate data (6Mb/s BPSK OFDM).
- This is the case for AWGN channels: Each rate field bit carries the energy of 3 data bits. Accounting for 5dB coding gain for data bits we have the same probability of error.
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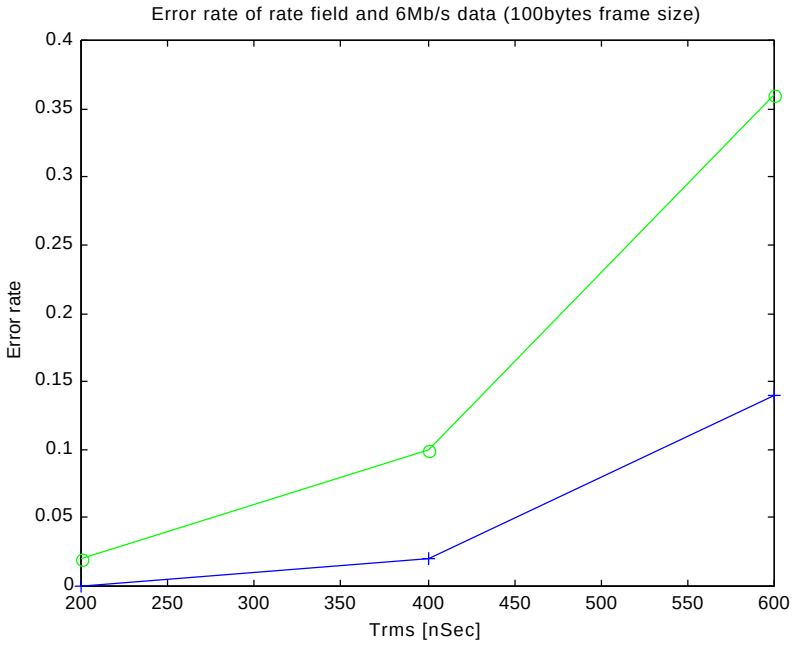
- However : **Not the case for severe multipath conditions:**



Legend :
Green: Rate field error rate
Blue: Data frame rate

- adjacent symbols due to long impulse response.
- We shall consider two solutions.

1. Adding a dedicated BPSK –OFDM symbol
2. Modifying phase assignment to QPSK symbols.

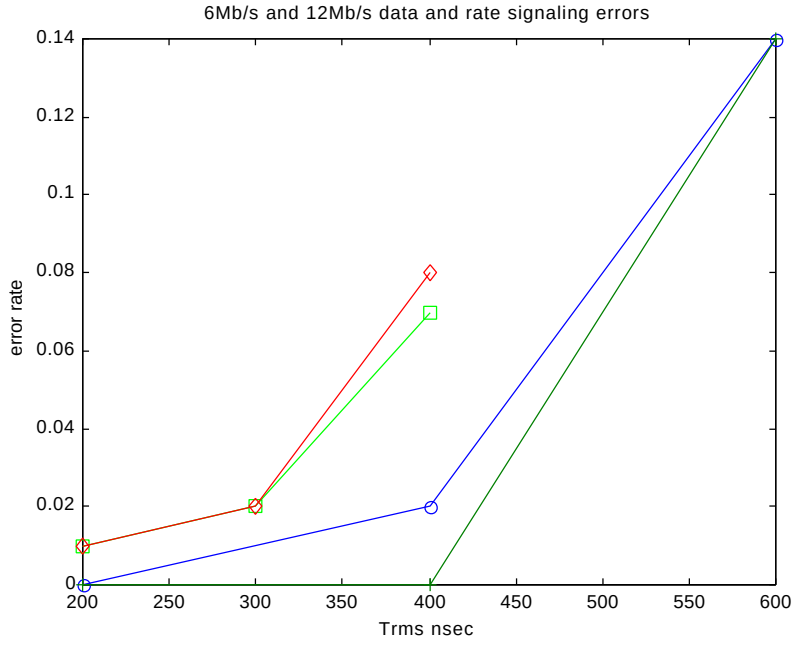
1. Adding a dedicated BPSK-OFDM symbol

- 24 bit encoded and modulated as in the 6Mb/s mode.
- Bit assignment:
  - 2 bits random scrambling
  - 4 bits rate
  - 12 bits duration field
  - 6 bits CRC
- **The duration field allows receiving units to assert a channel busy condition for the duration of the packet even if the unit is incapable to receive the PLCP header.**

- A “tail-bite” encoding mode is used in which trellis termination is achieved without incurring any overhead. This is performed by initiating the encoder registers with the *last* bits of the block. Decoding is performed by cyclically pushing the data stream into the VA. Extra bits should be entered to recover from unknown initial and final state.
- The CRC is extended hamming code (5 check bits +parity) capable of detecting up to 3 error bits.

2. Better phase assignments

- Most of the distortion is from preceding symbols.
- Basic idea: Assign the phases {0,0} the 6Mb/s case and decode by comparing the phase of t10 to that of t11 t12.
- Channel effects will be identical in t10 and t11 and t12 and will cancel out.
- For other low rate assign the phases {0, exp(pi*j*n/2)}

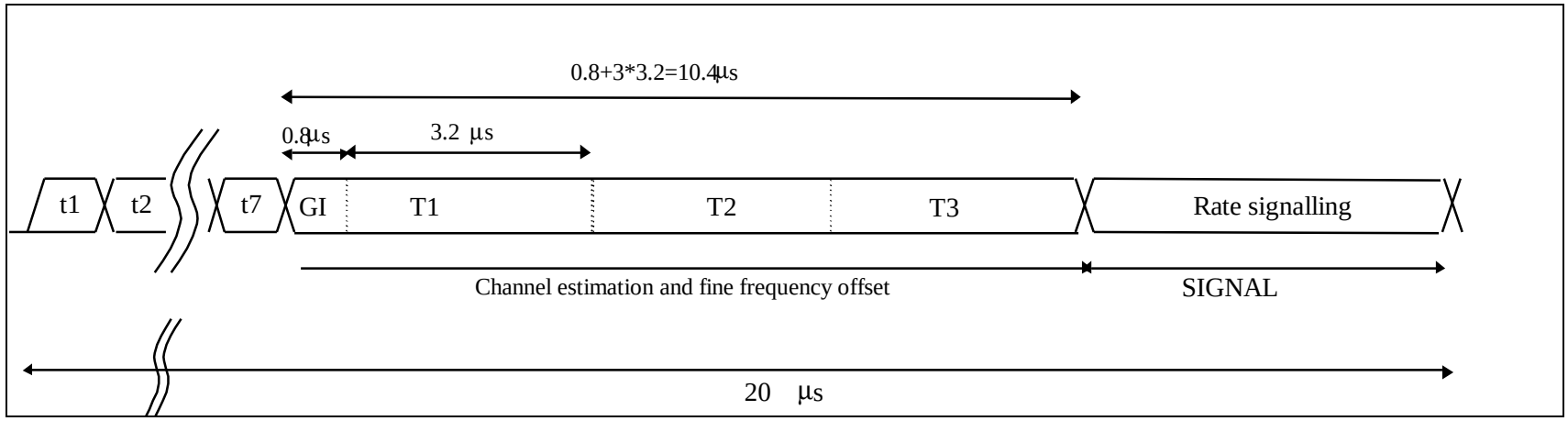


How to combine 2

Legend

6Mb/s : Black =rate error
Blue = data error

12Mb/s : Green =rate error
Red = data error



Overall length 20uSec.

Pros:

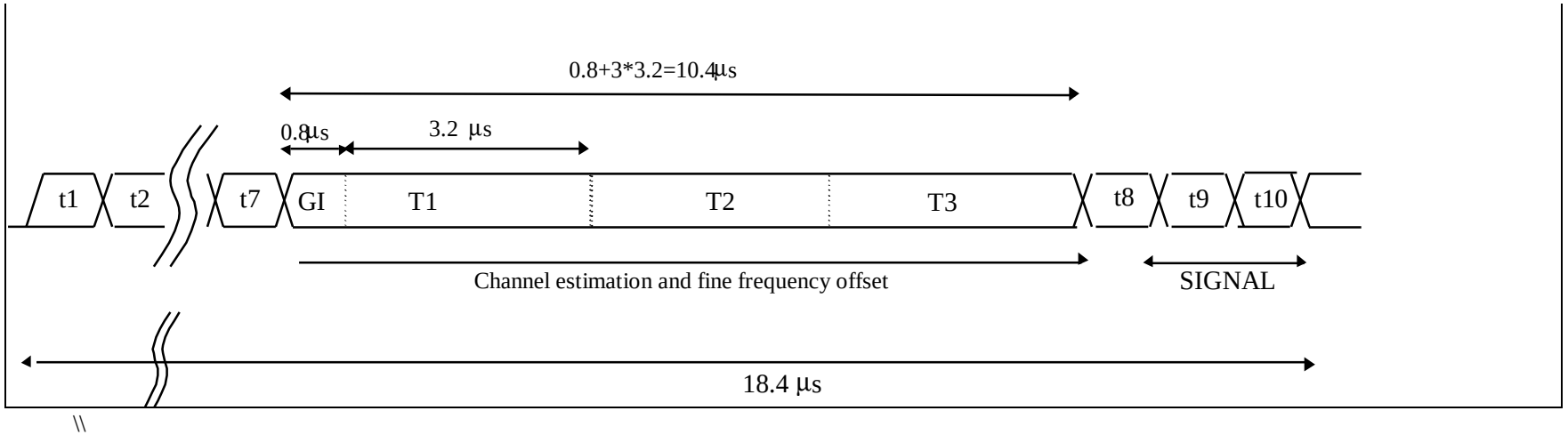
- Robustness both in channel estimation and rate-signalling.
- Duration field decodable by all stations

Cons:

High complexity and overhead

A. New channel estimation and QPSK rate signalling

Note that an extra guard interval (t8) should be added.



Overall length 18.4uSec
cons: Less robust rate signalling

B. Current channel estimation with a dedicated OFDM symbol
Overall length is 20uSec

C. Current channel estimation with QPSK symbols.
Overall length is 17.6uSec

Conclusions

- Improvement to channel estimation section
- Two method of increasing rate field robustness.
- Several ways of combining the two elements