A Look At COMWAKE For Use In SNW3

Steve Finch

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STMicroelectronics

The Transmitter

- Transmitters send COMWAKEs with precise timing
- A COMWAKE is

-	Gap	160 OOBI	(106.666 ns)
-	Burst	160 OOBI	(106.666 ns)
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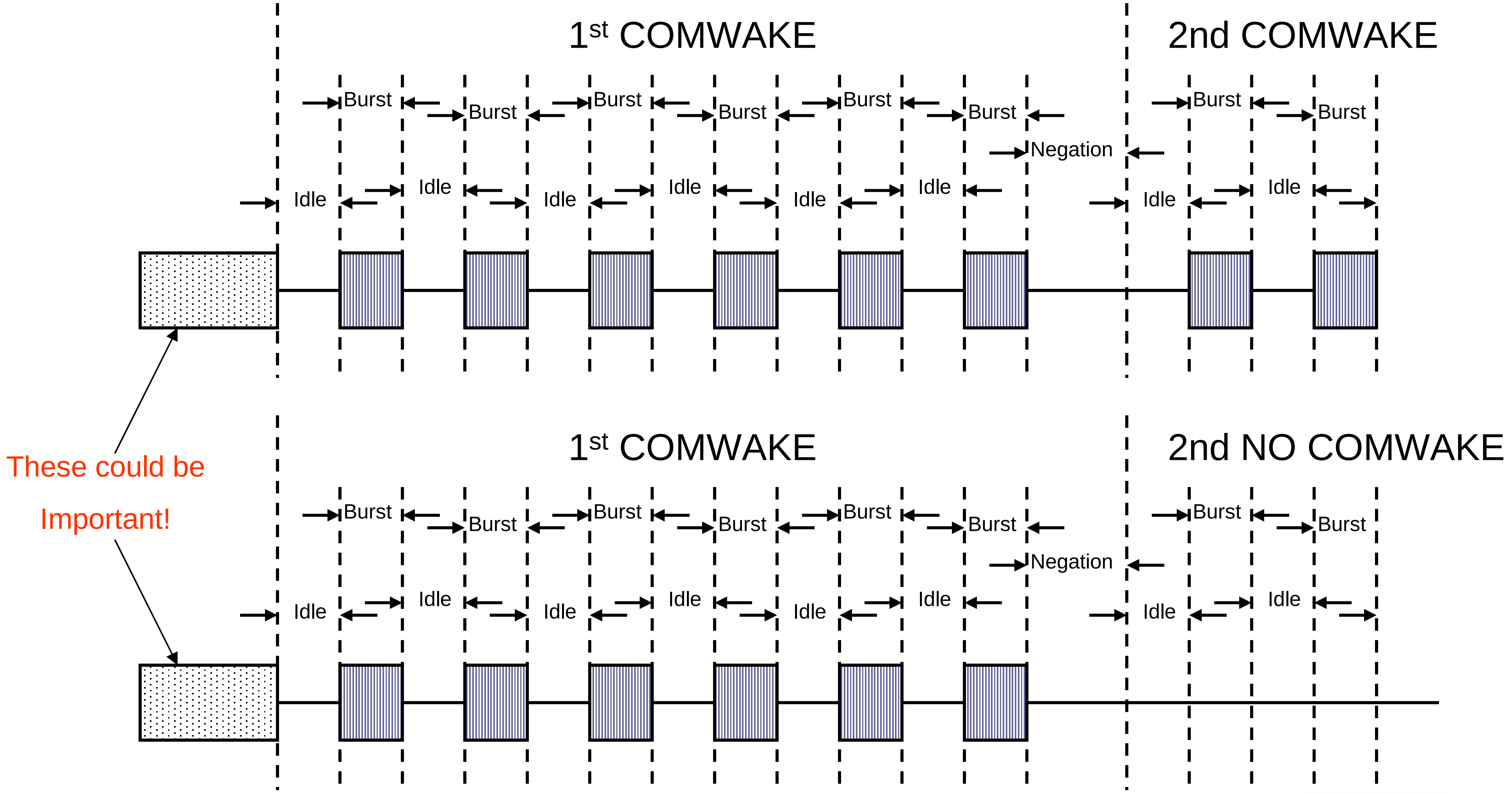
-	Gap	160 OOBI	(106.666 ns)
-	Burst	160 OOBI	(106.666 ns)
-	Negation Gap	280 OOBI	(186.666 ns)
TOTAL		2200 OOBI	(1466.666 ns)

- For each “bit window” the transmitter either sends this sequence

Transmitted COMWAKE



Receiver COMWAKE Requirement

- Detection of a COMWAKE requires detection of 4 consecutive Idle time/Burst time pairs. (Idle first, then Burst)

COMWAKE Detection

- A receiver “may detect” a Burst with as little as one transition.
  - No minimum detected Burst time specified
  - Shall at 100 ns
  - No maximum Burst time specified
    - But transmitter must send it right!
- A receiver must wait for the next Burst to start to determine if an Idle time is of the proper size.
  - There is a maximum Idle Time that must be met to declare the Idle time a valid COMWAKE Idle time.

COMWAKE Detection Uncertainty

- From the time that the beginning of a COMWAKE appears at the input of the Receiver to the time that the Receiver signals the detection of the COMWAKE is:

  Earliest: 1280 OOBI (746.66 ns)

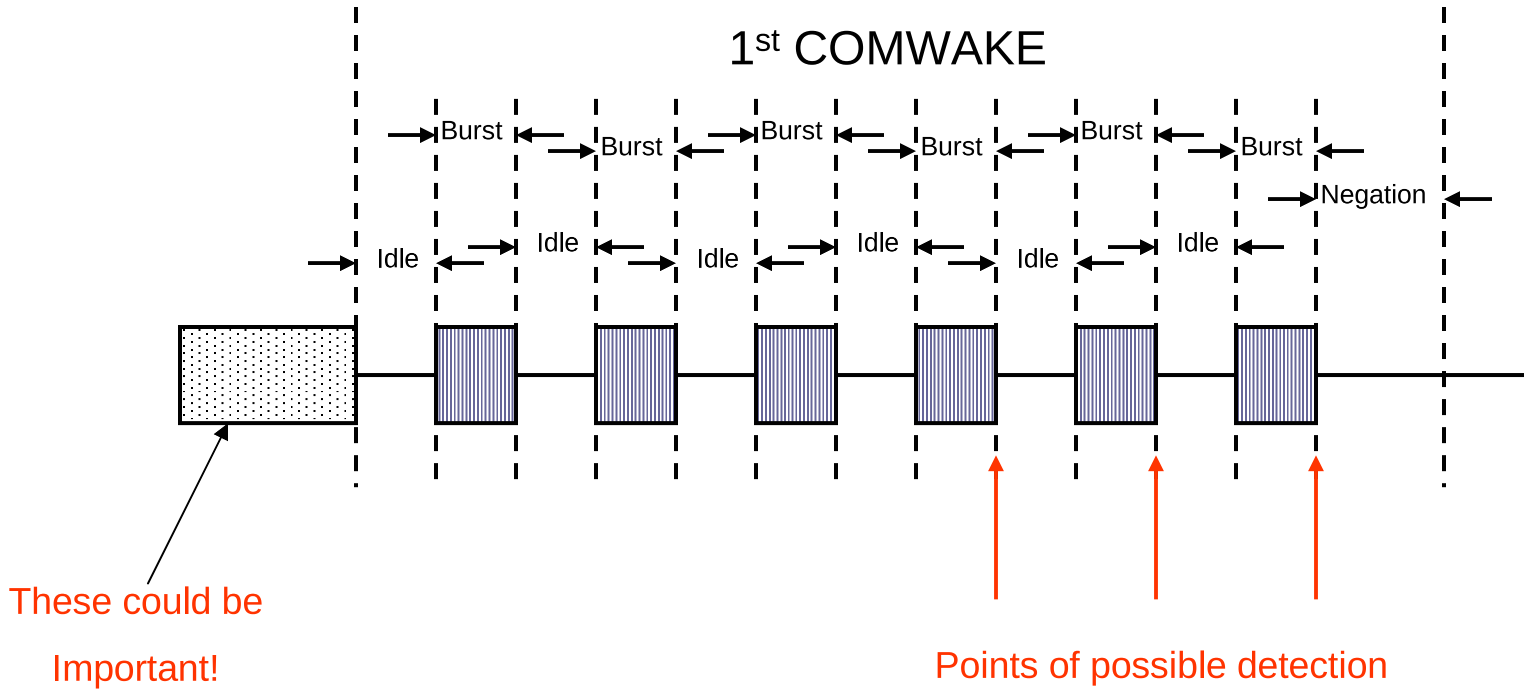
  4 Idle times plus 4 Burst times

  Latest: 1920 OOBI (1280.00 ns)

  Detect at the end of the last Burst.

- Uncertainty: 640 OOBI (426.66 ns)

Receiving COMWAKE



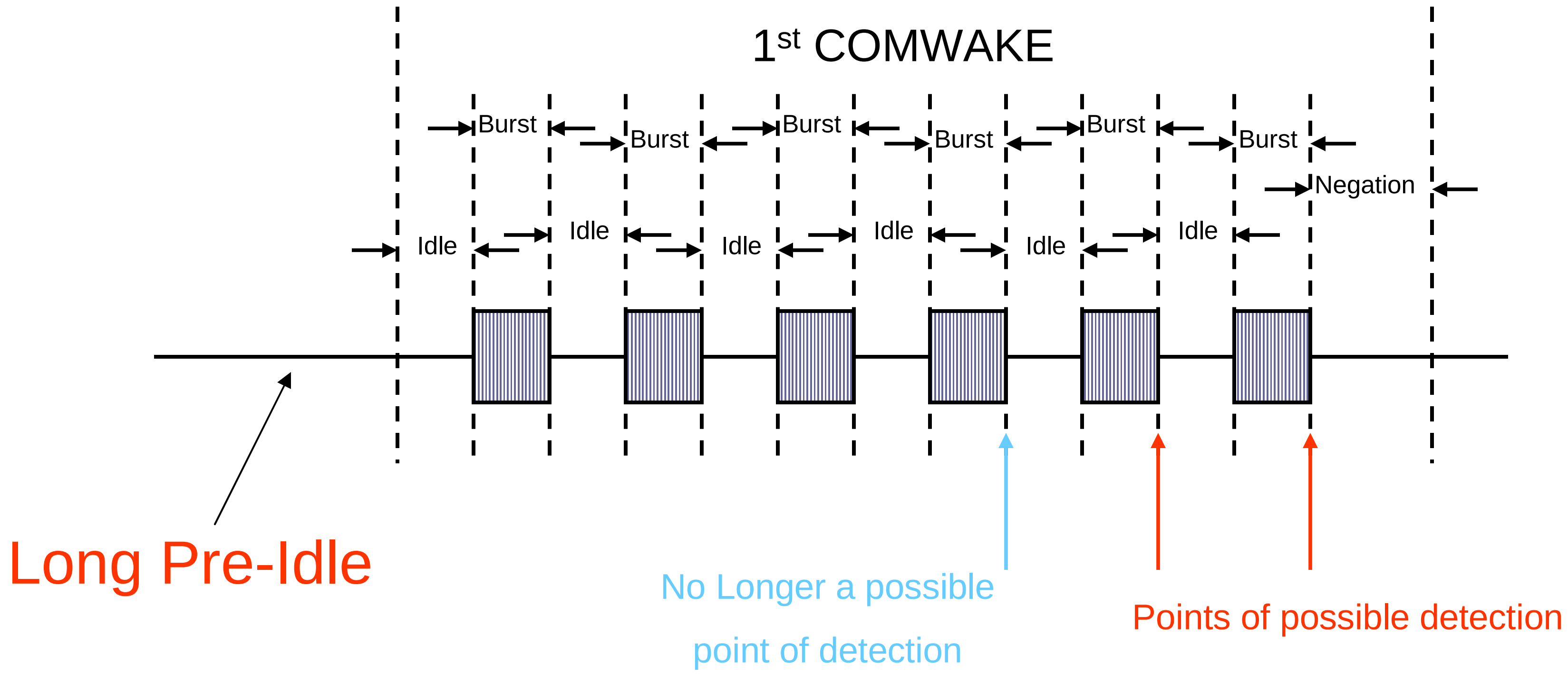
Not Quite So Uncertain

- If the COMWAKE is preceded by more 68.67 ns of idle time, then the first Idle time/Burst time pair are disqualified because the Idle time exceeds the "shall not detect" time.

Shall not detect:		175.00 ns
Transmitted time	-	106.66 ns
Maximum "pre-idle"		68.67 ns

- This WILL occur for each "bit time" other than the first.
  - The COMWAKE negation time insures it.
- We can <u>require</u> it before the first COMWAKE

Not Quite So Uncertain



COMWAKE Detection Uncertainty With Long Pre-Idle

- From the time that the beginning of a COMWAKE appears at the input of the Receiver to the time that the Receiver signals the detection of the COMWAKE is:

  Earliest: 1600 OOBI (960.00 ns)

  5 Idle times plus 5 Burst times.

  Latest: 1920 OOBI (1280.00 ns)

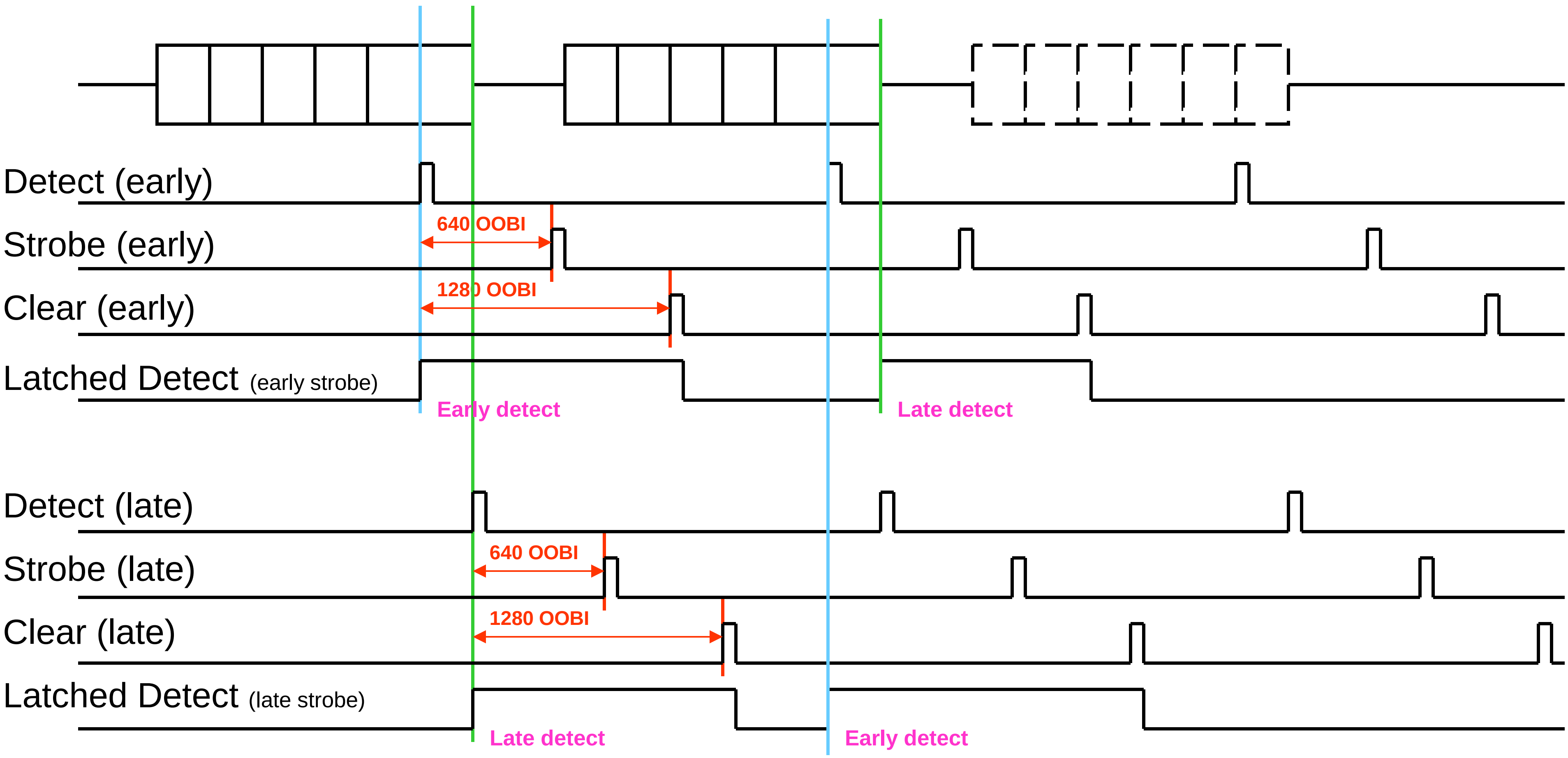
  Detect at the end of the last Burst.

- Uncertainty: 320 OOBI (213.33 ns)

Sampling Is Easy And Accurate

- Detect the first COMWAKE.
- Use this as the time reference
- Generate a Strobe 640 OOBI after the first detect and every 2200 OOBI after that.
- Generate a Clear 1280 OOBI after the first detect and every 2200 OOBI after that.
- Set a flop every time a COMWAKE is detected.
- Sample the flop on every Strobe
- Clear the flop on every Clear.

Sampling Is Easy And Accurate



Reference Clock Tolerance

- We will have to consider the Reference Clock tolerance (+/- 100 ppm).
- If the transmissions are limited to the 109 usec SNTT time, and we use 2 times the clock tolerance as the difference between the transmitters frequency and the receivers frequency,

  then the maximum clock delta is less than 33 OOBI.
- We have nearly 10 times that in window opening

Conclusions

- It can be done, easily.
- One simple solution can be shown. Many other implementations are possible.
- The only requirement is that the transmitter keep the bus Idle for a minimum of 68.67 ns before sending the sequence of bits.
- If we keep the requirements for RCDT field, this requirement is met.

A Look At The Effect Of SSC

- Assume SSC is at the slowest modulation rate
  - 30KHz =
  - 33.33 usec =
  - 50,000 OOBIs (33.33 us / .666 ps)
- Assume a worst case modulation technique of a square wave
  - Modulation must be balanced, so only
  - 16.66 usec at one extreme, 16.66 at the opposite extreme
  - Gives 25,000 OOBIs during the extreme period
- Assume both sides have worst case in opposite directions
- Assume one side is +2500 ppm, the other -2500 ppm
  - 5000 ppm total difference
- 25,000 OOBI * 5000/1000000 = 250 OOBI maximum drift

A Look At The Effect Of SSC

- We have a 320 OOBI margin built in using to described solution
  - Without trying to optimize the Strobe and Clear positions
- The selection of the Strobe point was arbitrary
  - It could be moved to one clock before the Clear
  - And would improve margin
- Conclusion: NO ISSUES

Another Look At The Effect Of SSC

- Assume worst case clock difference for the entire 32 bit sequence: 5000 ppm clock difference
- One COMWAKE is 2200 OOBIs
- 32 COMWAKEs is 70,400 OOBIs
- 5000 ppm on 70,400 = 352 OOBI
- We have a built in 640 OOBI optimal margin
- Results: Over a 200 OOBI actual margin

For The Non-Believers

- I ran a simulation with two clocks
  - Base frequency 1.5GHz
  - Transmitter +2500 ppm fixed
  - Receiver -2500 ppm fixed
  - And a second simulation with the clocks reversed
- Generating the Strobe and Clear signals as defined
- Using a range of initial clock phase relationships
  - All relationships in 1 fs steps
- With All 1's, All 0's and alternating 1's and 0's patterns.
  - The exception is that the start bit was 1 in all patterns
- Verifying the data.
- Simulation passed.
  - Measurement of window margin on 32nd bit confirms that margin is over 200 OOBI