

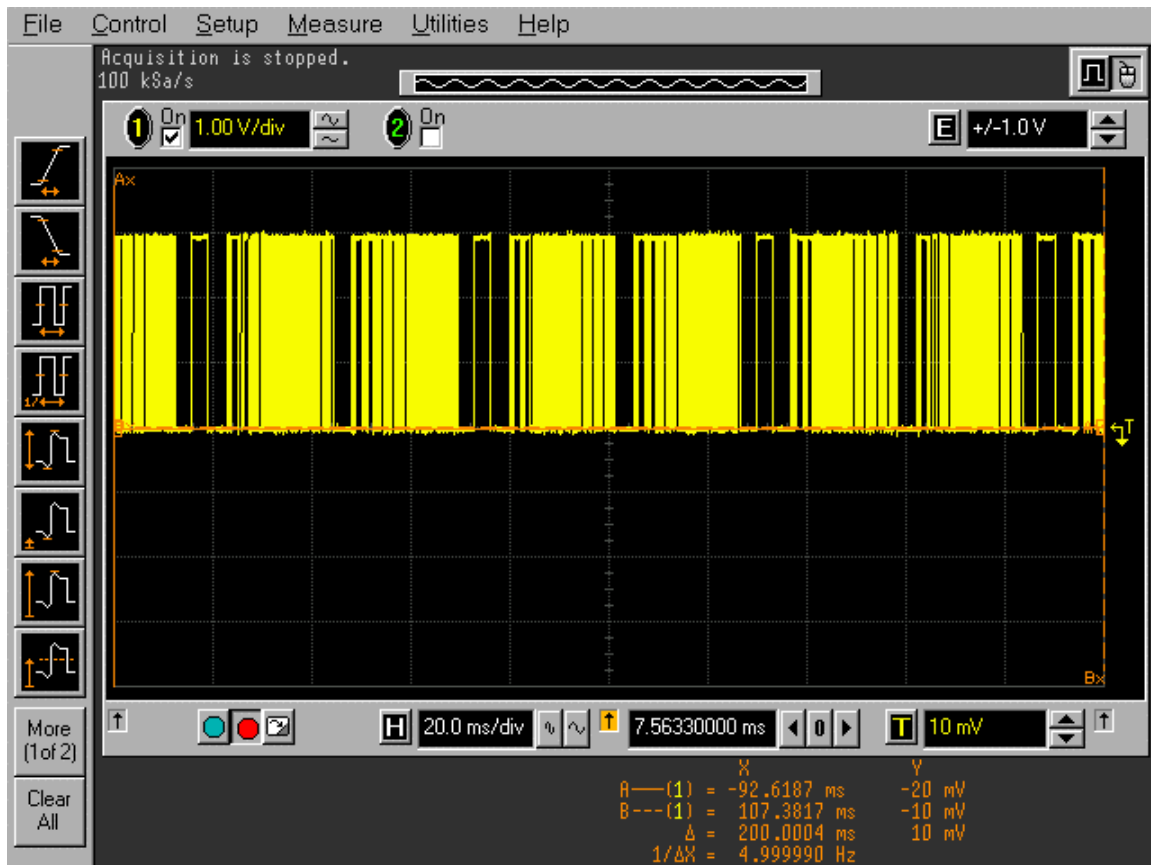
# HS-Encoder *worst-case* duty cycle plots for FCC

By: Chris Murphy  
1/5/2007

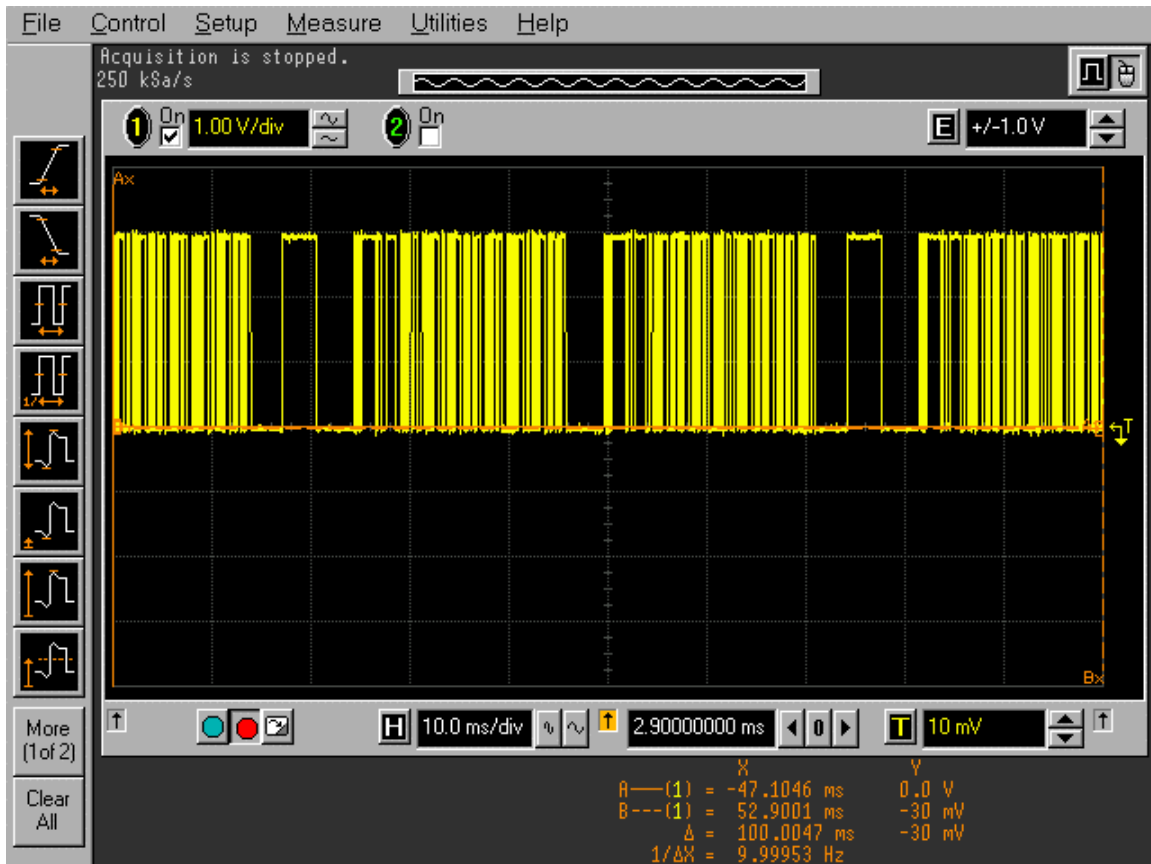
## Definitions:

1. All data is sent LSB first (D0-D7)
2. Start bit = 0
3. Stop bit = 1
4. Preamble Byte = start bit + 1100 1111 + stop bit
  - a. Error check bits 0-2 never change (110)
  - b. Inversion bit 3 is clear (0) since 50% is a non-inverting packet
  - c. UserID bits 4-7 set at 15 for worst case scenario (1111)
5. Each byte of data portion = start bit + 0101 0101 + stop bit  
\*Note: start bit appears merged with bit-0 and stop bit appears merged with bit-7
6. Start sequence = wake bits + noise filter + preamble
7. Packet = processing period + start sequence + data
8. Message = Packet-A + Packet-B
9. Pulse Train = 1 complete message

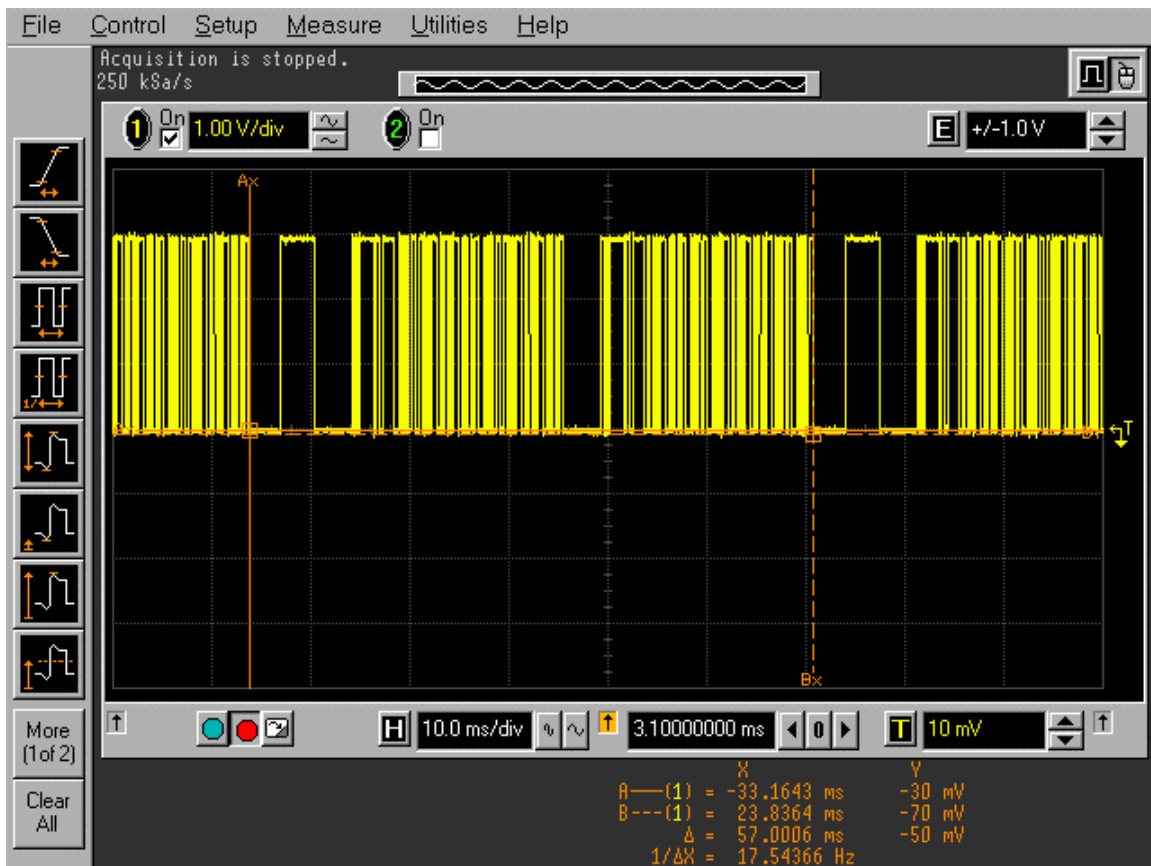
Baud rate = 4800bps



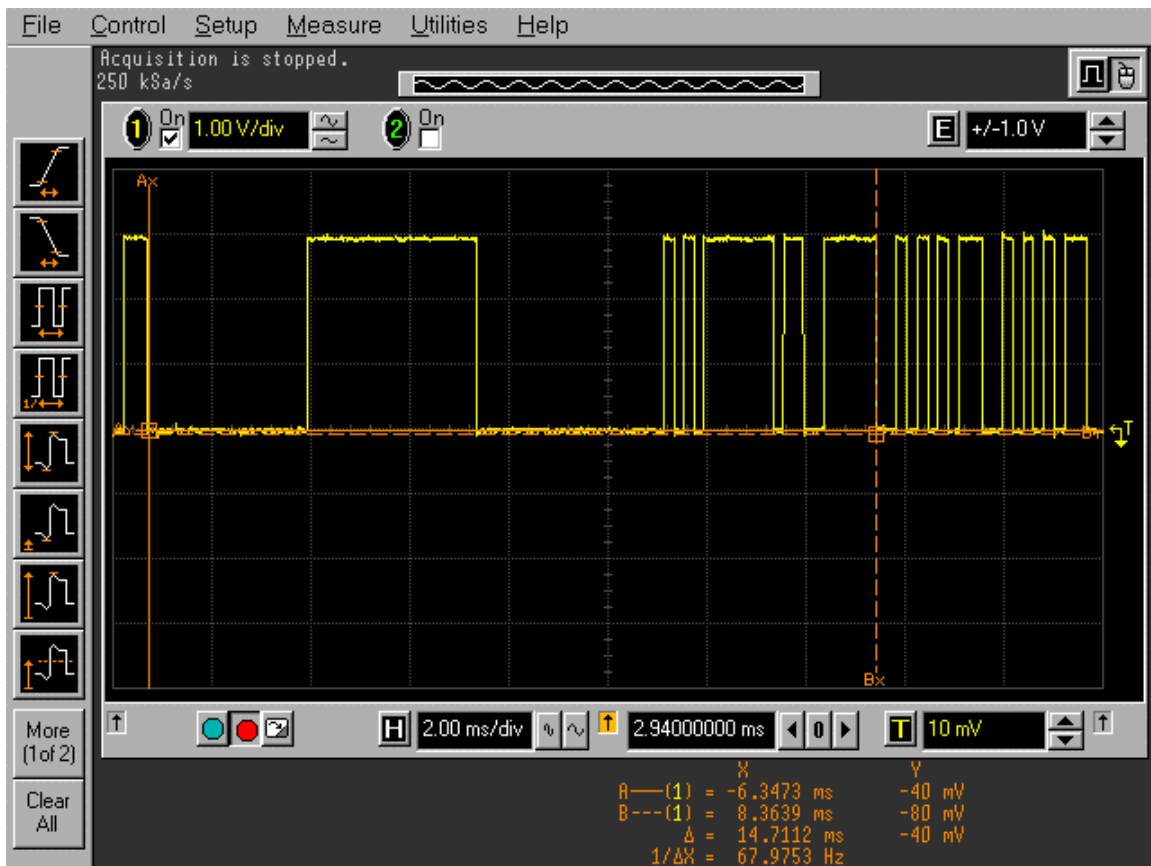
\*Complete 200ms data capture from HS encoder at 4800bps



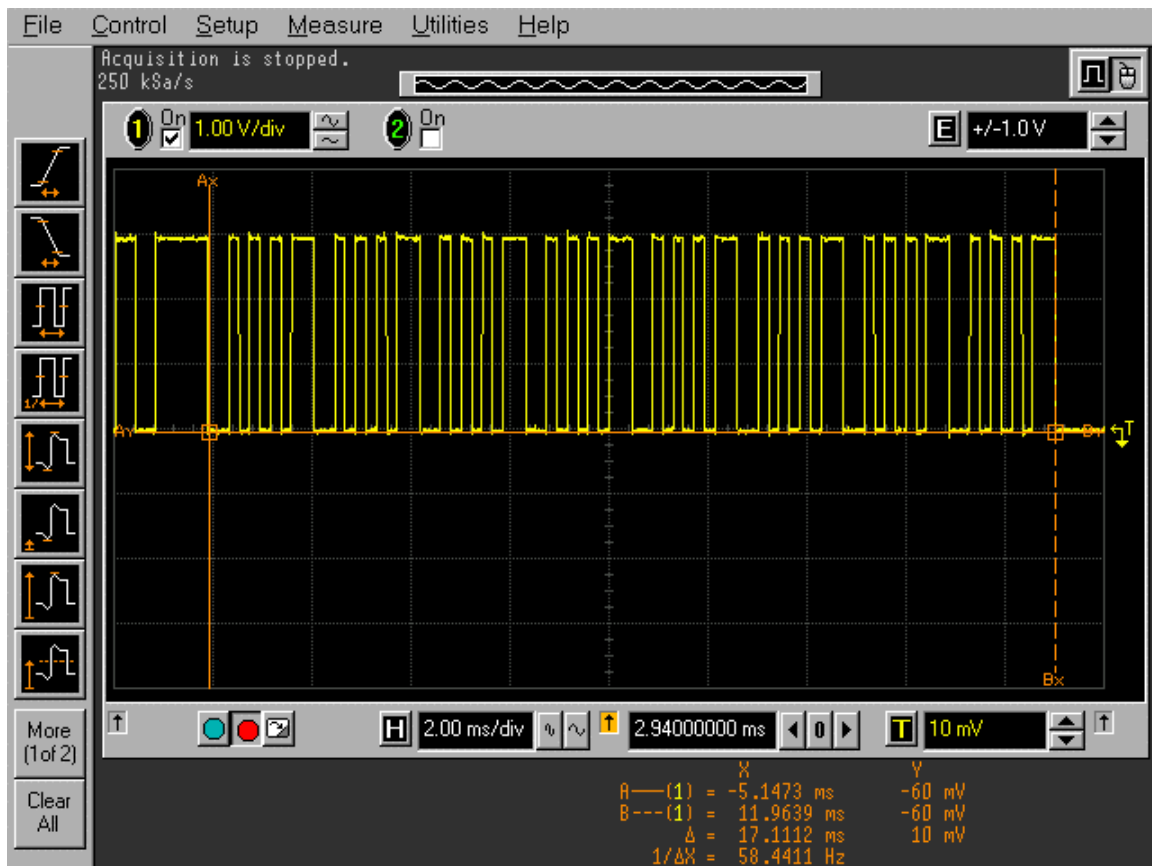
\*Complete 100ms data capture from HS encoder at 4800bps



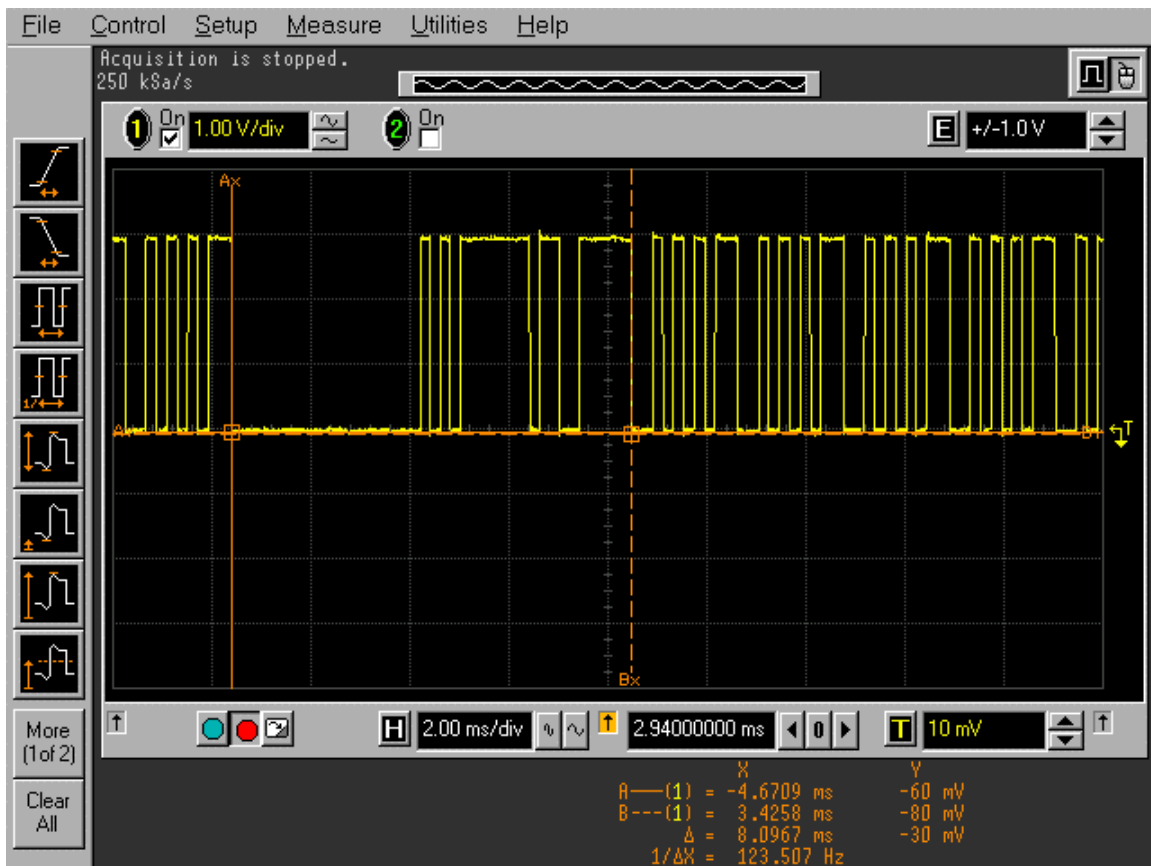
\* Total time of 1 pulse train = 57.0006ms



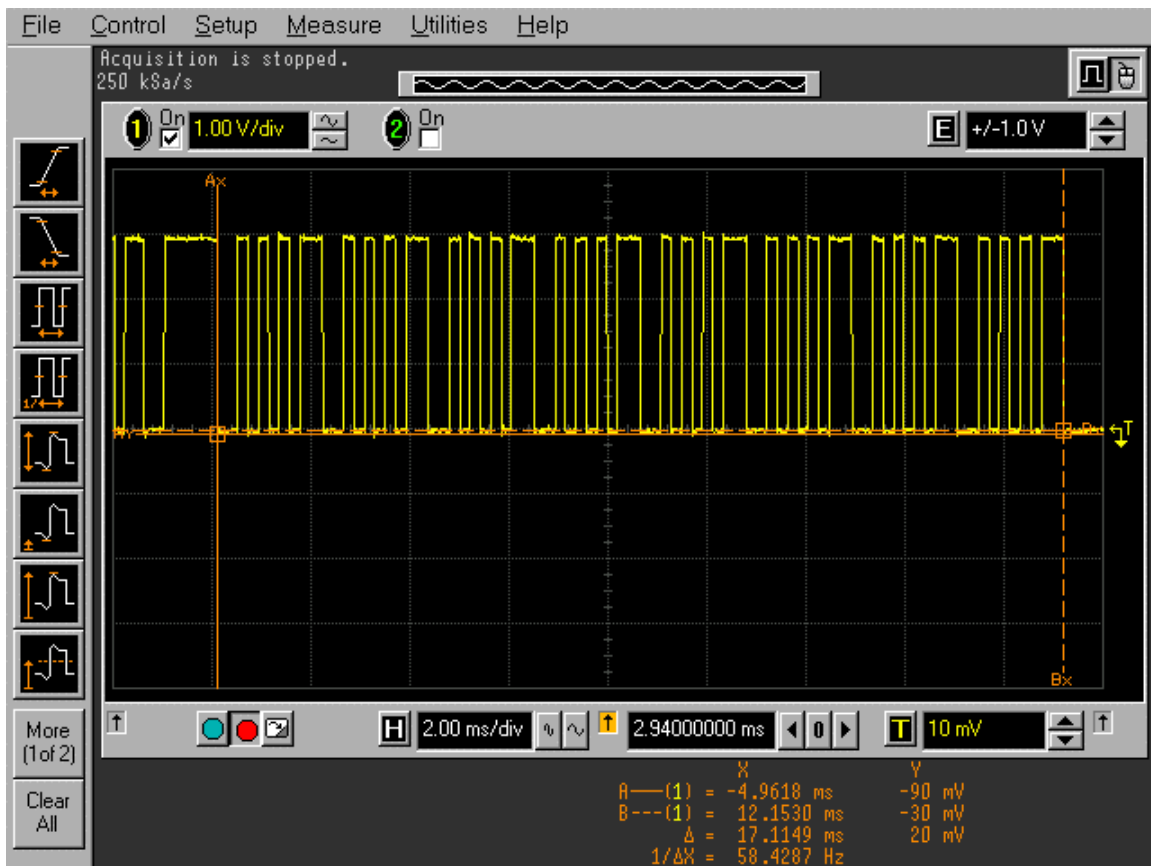
\* Zoomed in on processing period and start sequence of packet-A



\* Zoomed in on data portion of packet A

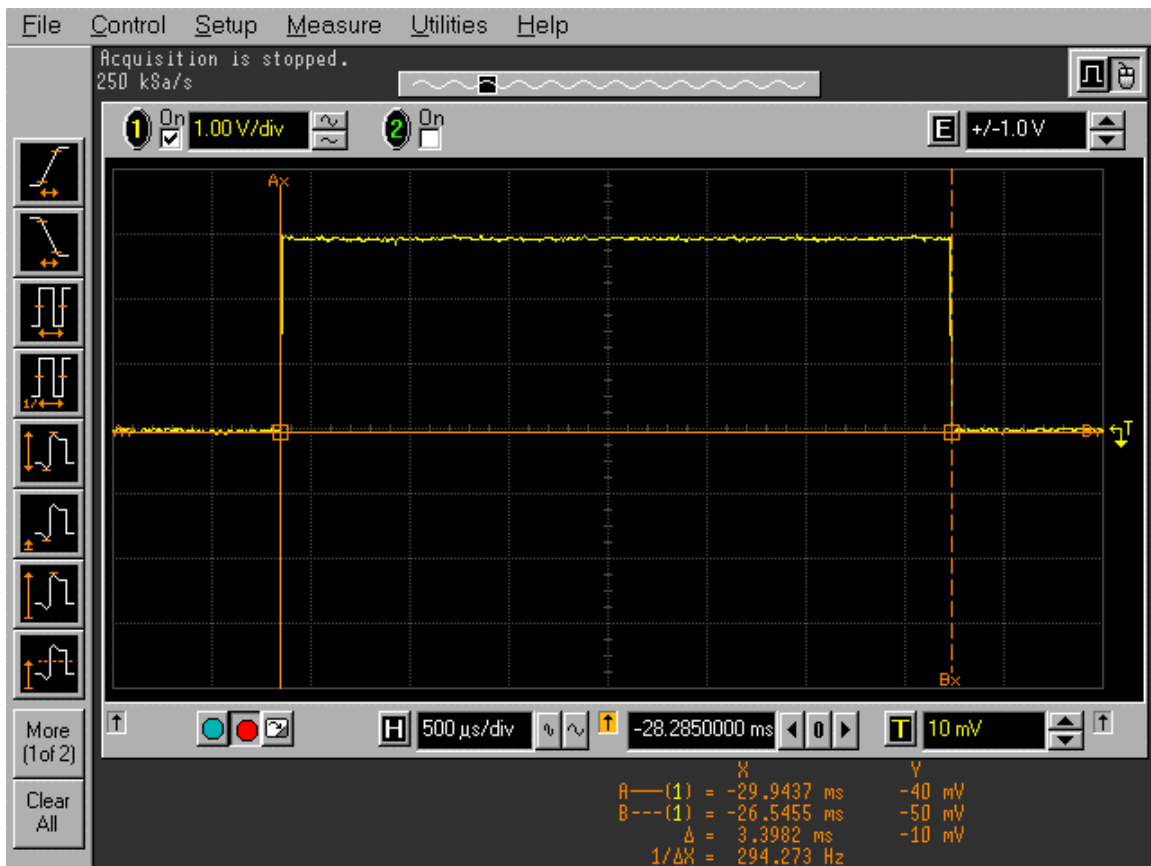


\* Zoomed in on processing period and start sequence of packet-B

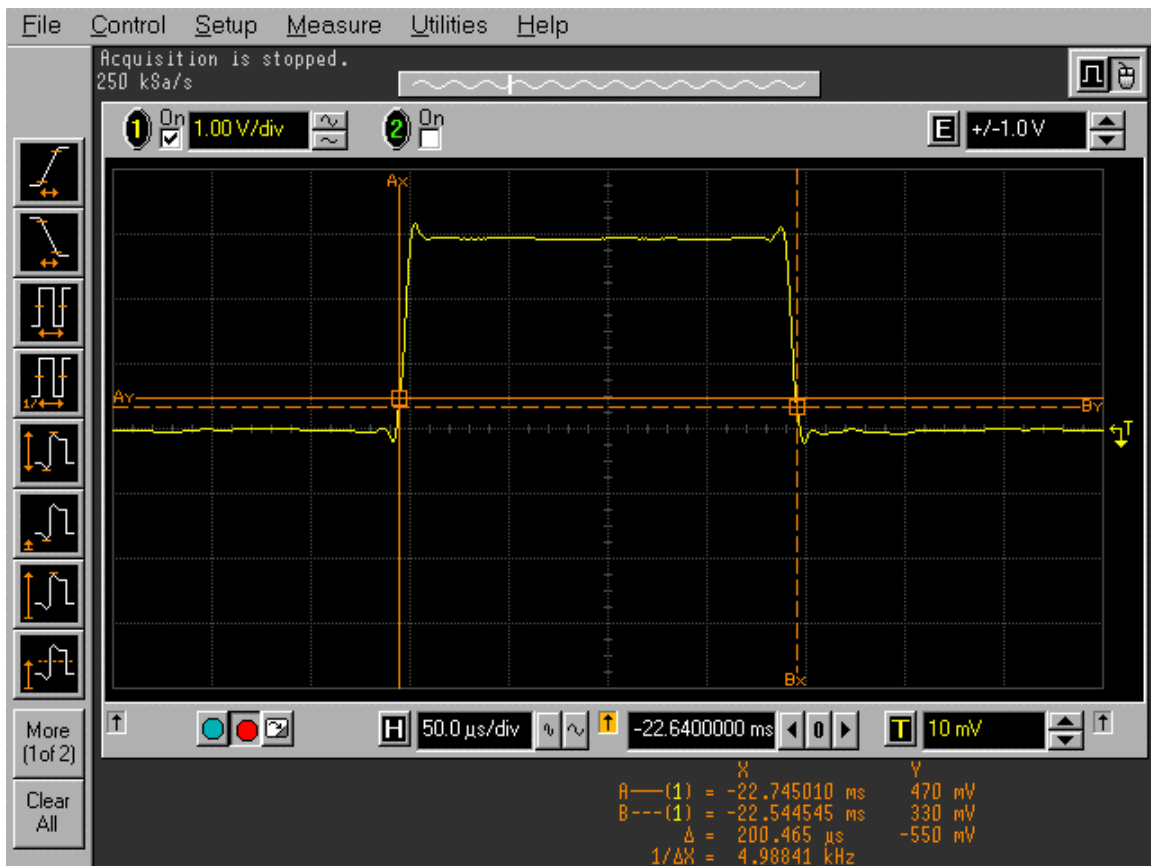


\* Zoomed in on data portion of packet-B

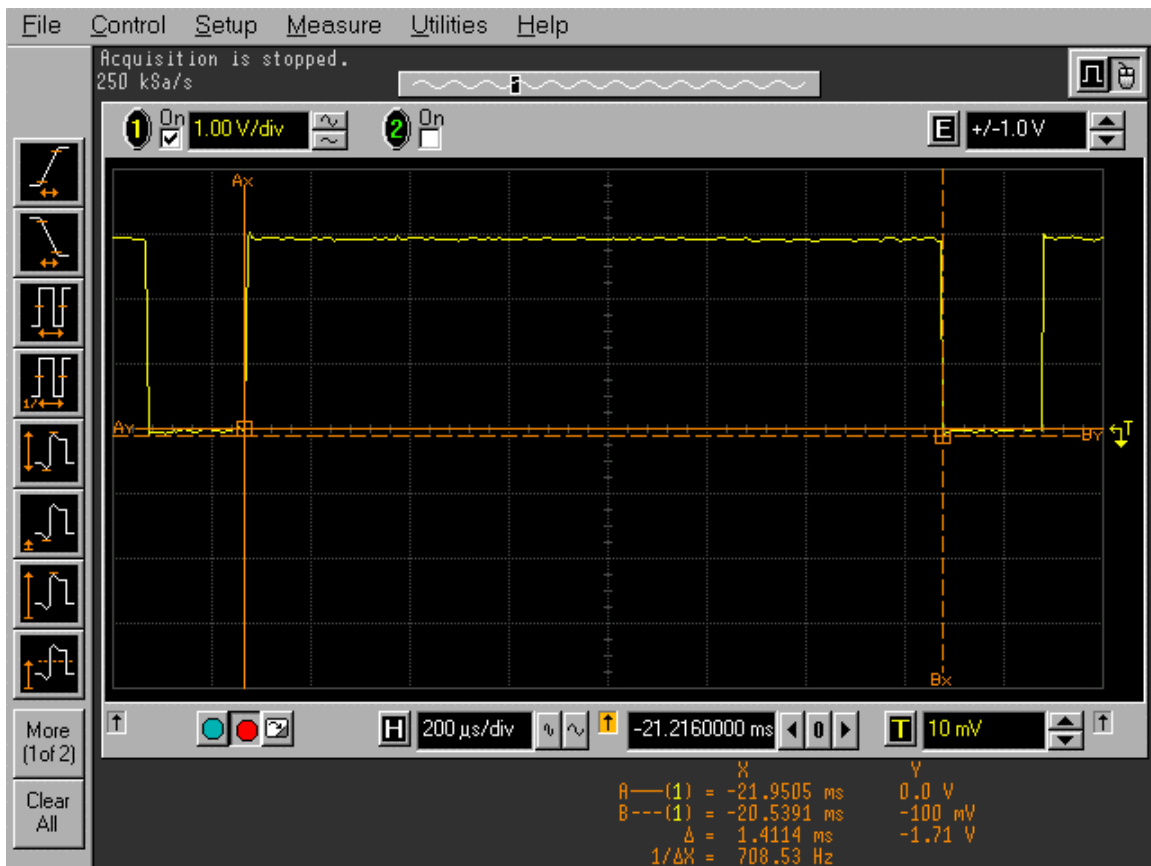




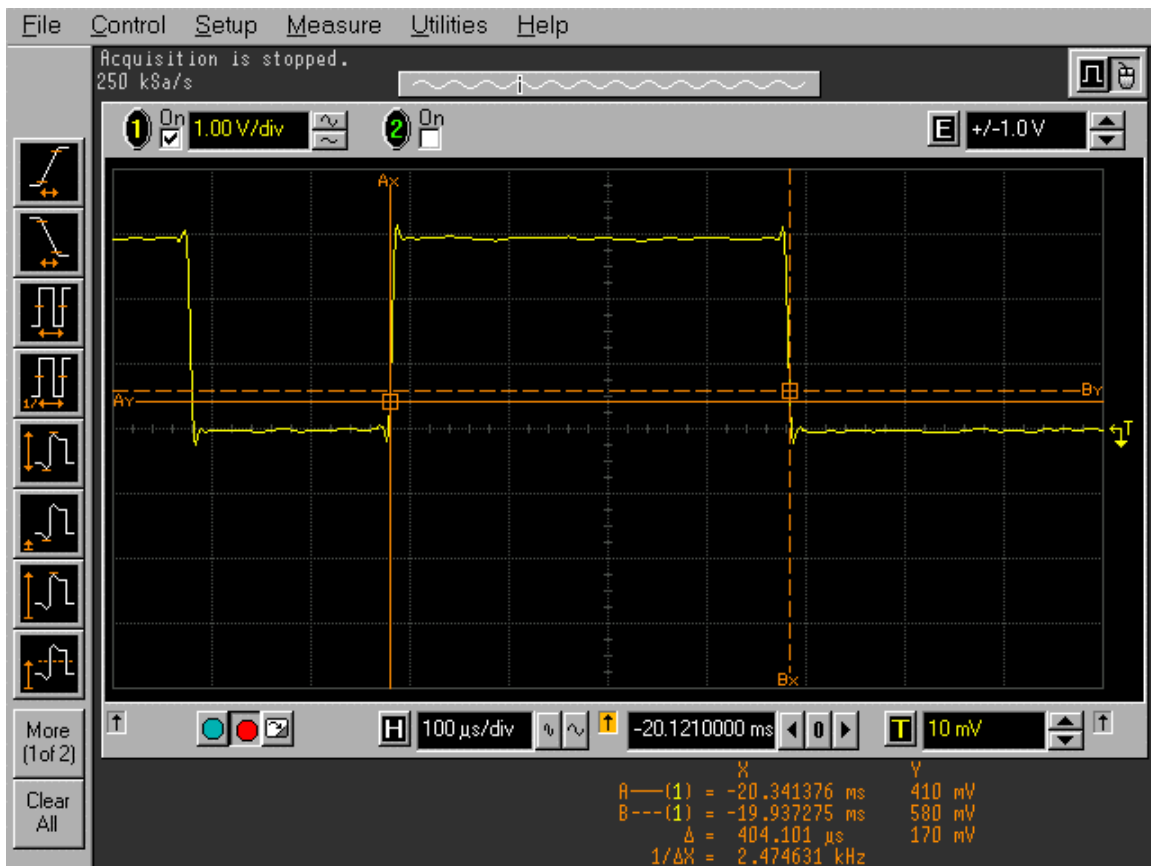
\* Pulse measurement #1 = 3.3982ms (processing pulse, only 1of these per pulse train)



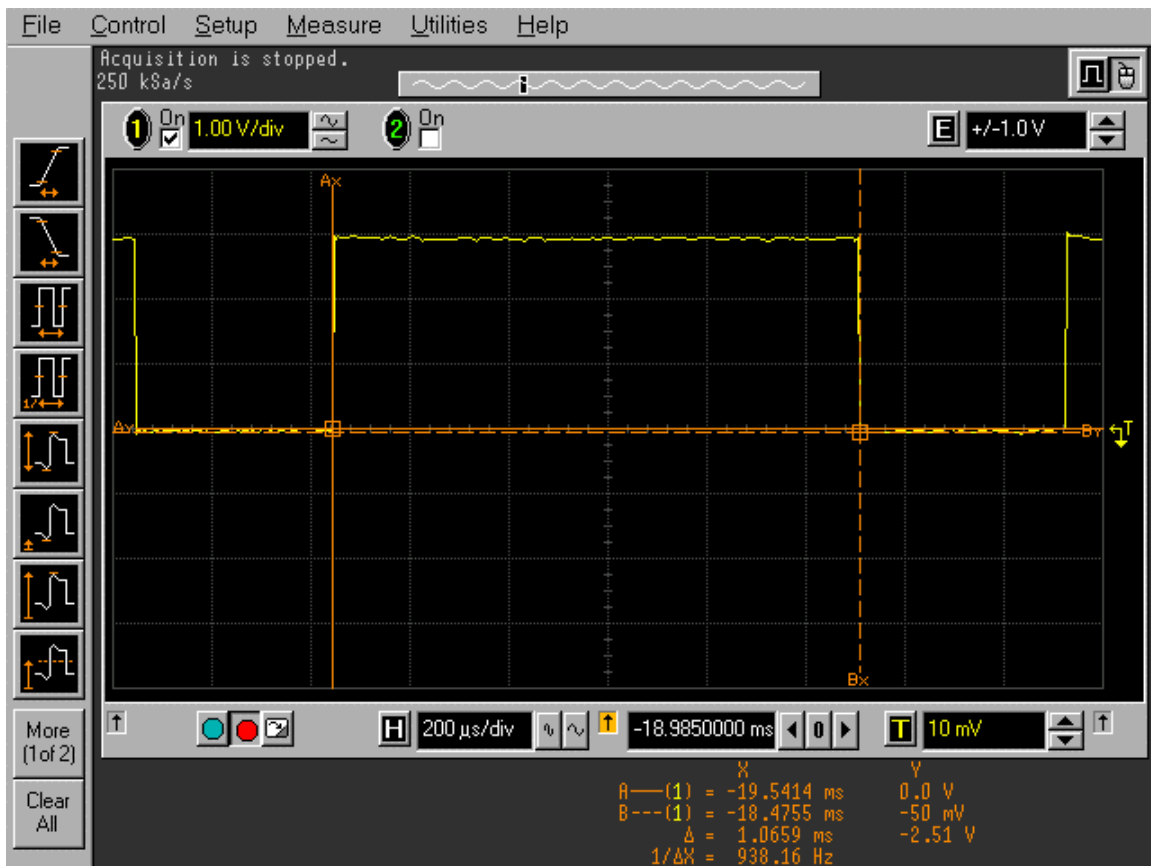
\* Pulse measurement #2 = 200.465us (wake pulses, 4 of these per pulse train)



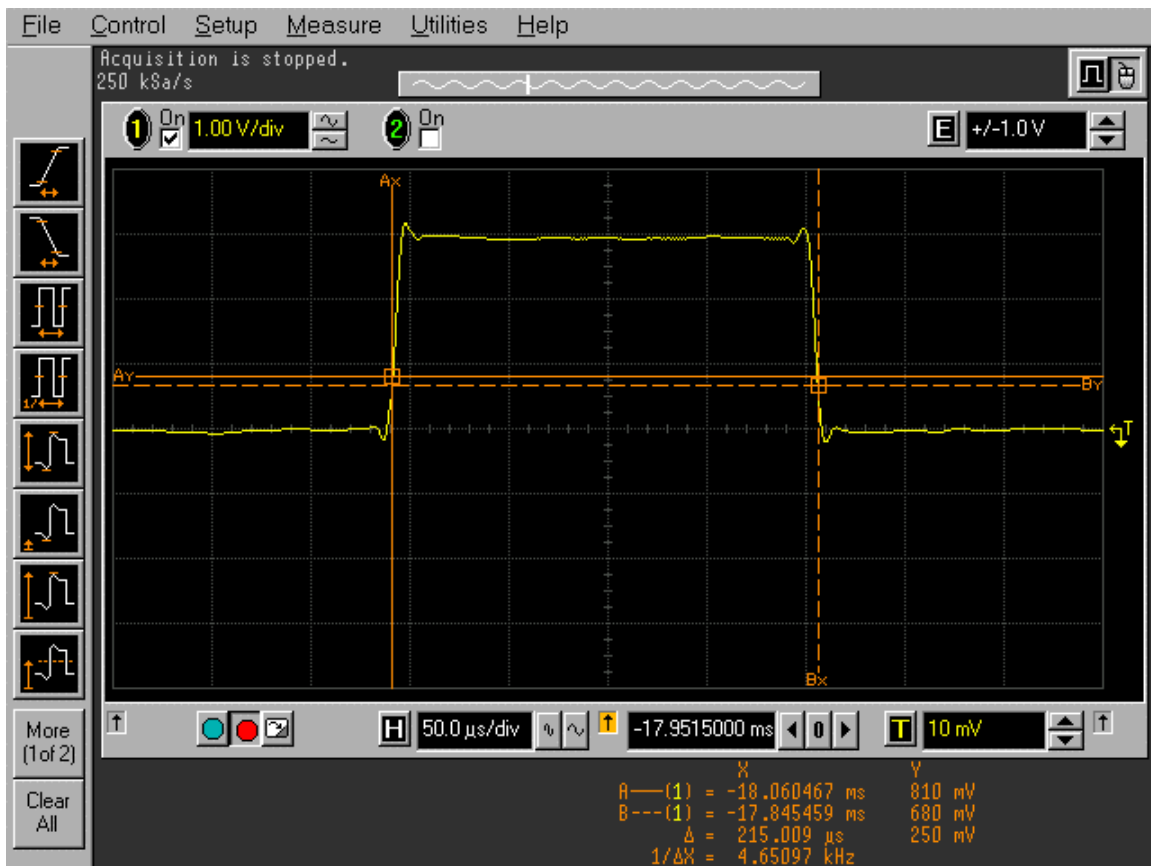
\* Pulse measurement #3 = 1.4114ms (noise filter, 2 of these per pulse train)



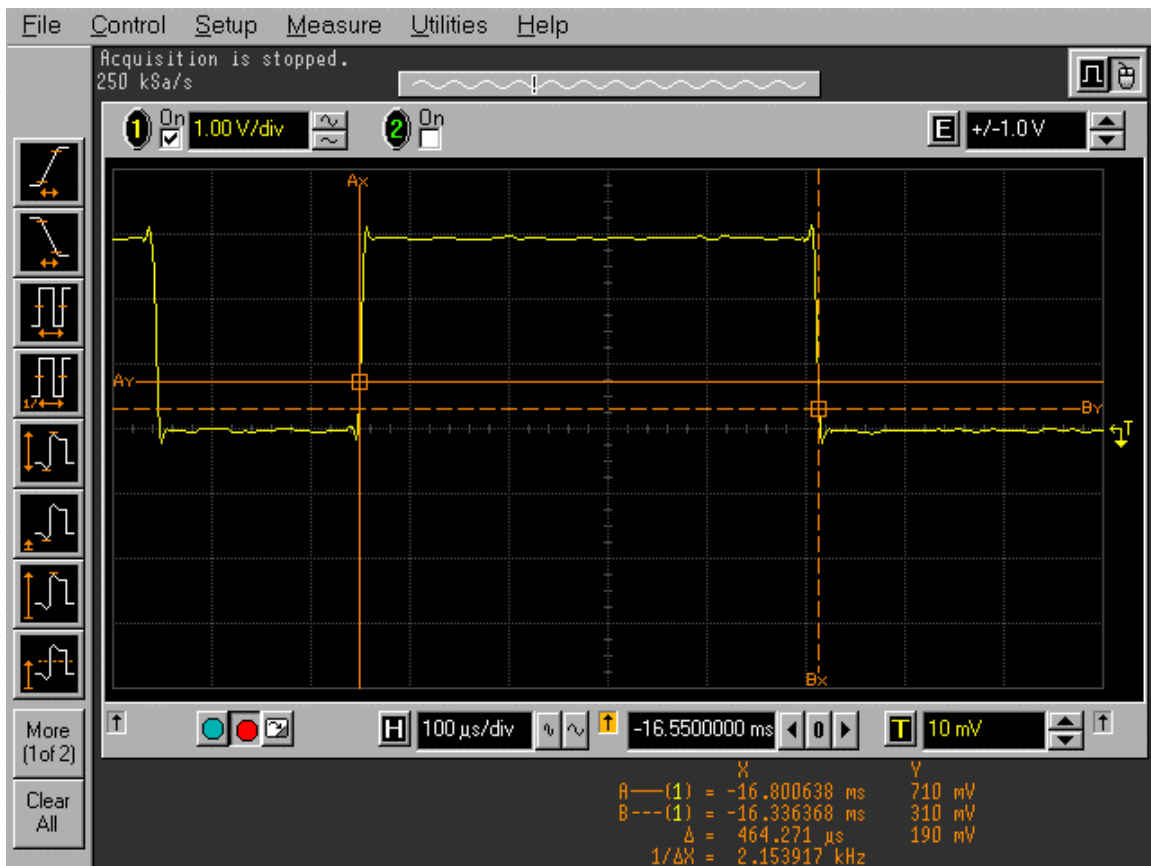
\* Pulse measurement #4 = 404.101 $\mu$ s (error check, 2 of these per pulse train)



\* Pulse measurement #5 = 1.0659ms (UserID + stop bit, 2 of these per pulse train)



\* Pulse measurement #6 = 215.009 $\mu$ s (bits 1,3,5 of each byte of data, 48 of these per pulse train)



\* Pulse measurement #7 = 464.271us (bit 7 + stop bit of each byte of data, 16 of these per pulse train)

Pulse Description	Pulse Meas. #	Pulse Length (us)	Pulses per Train	Total Time (us)
Processing time	1	3398.2	1	3398.2
Wake bits	2	200.465	4	801.86
Noise filter	3	1411.4	2	2822.8
Error check	4	404.101	2	808.202
UserID + stop bit	5	1065.9	2	2131.8
Bits 1,3,& 5 of ea. data byte	6	215.009	48	10320.432
Bit 7 + stop bit of ea. data byte	7	464.271	16	7428.336
Total On-Time @ 4800bps				27711.63

Total On-Time = 27711.63us

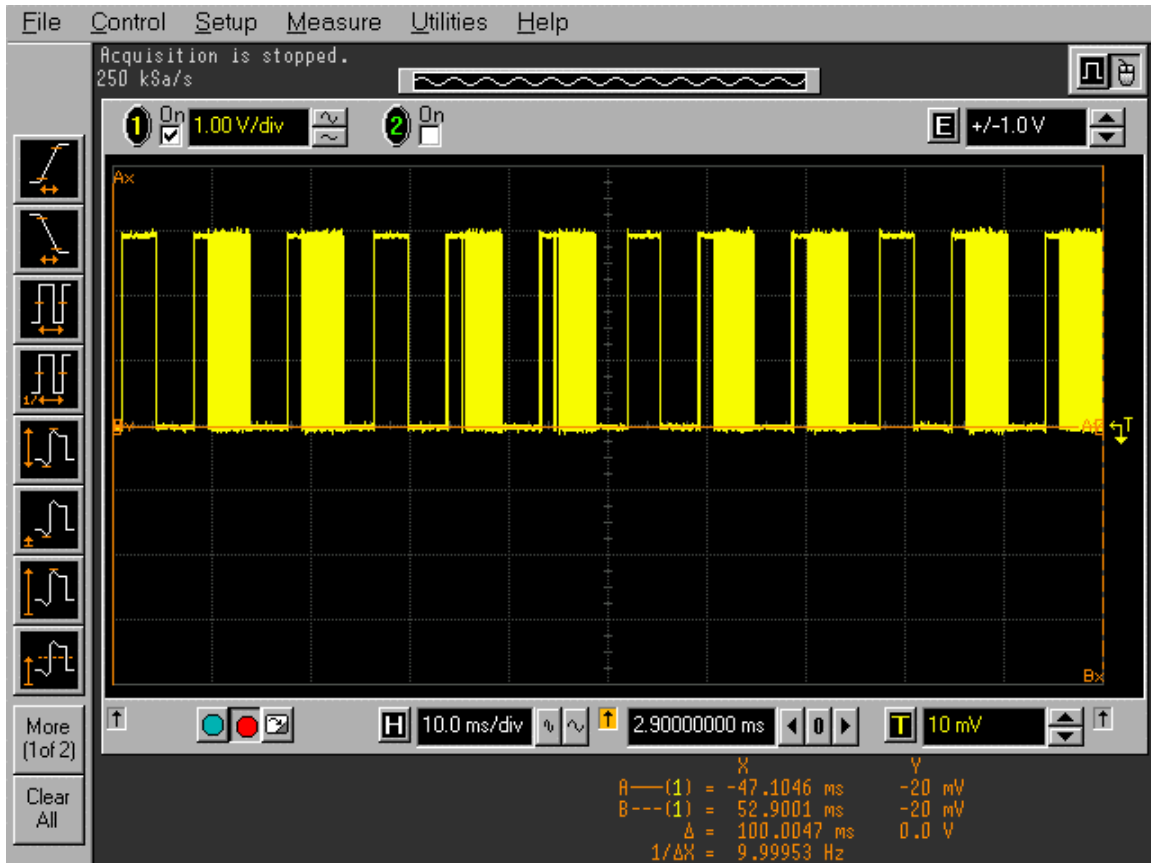
Total Time = 57000.6us

$27711.63 / 57000.6 = 0.48616$

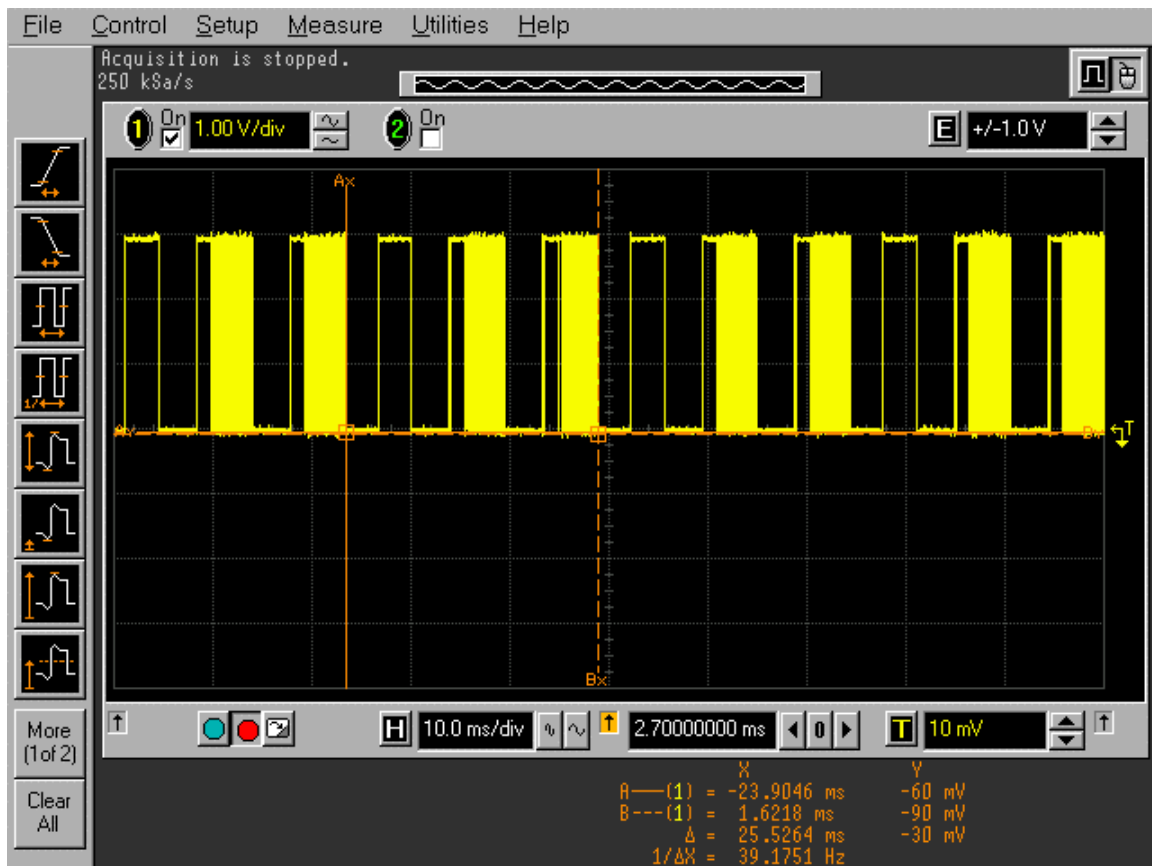
Duty Cycle @ 4800bps = 48.6%



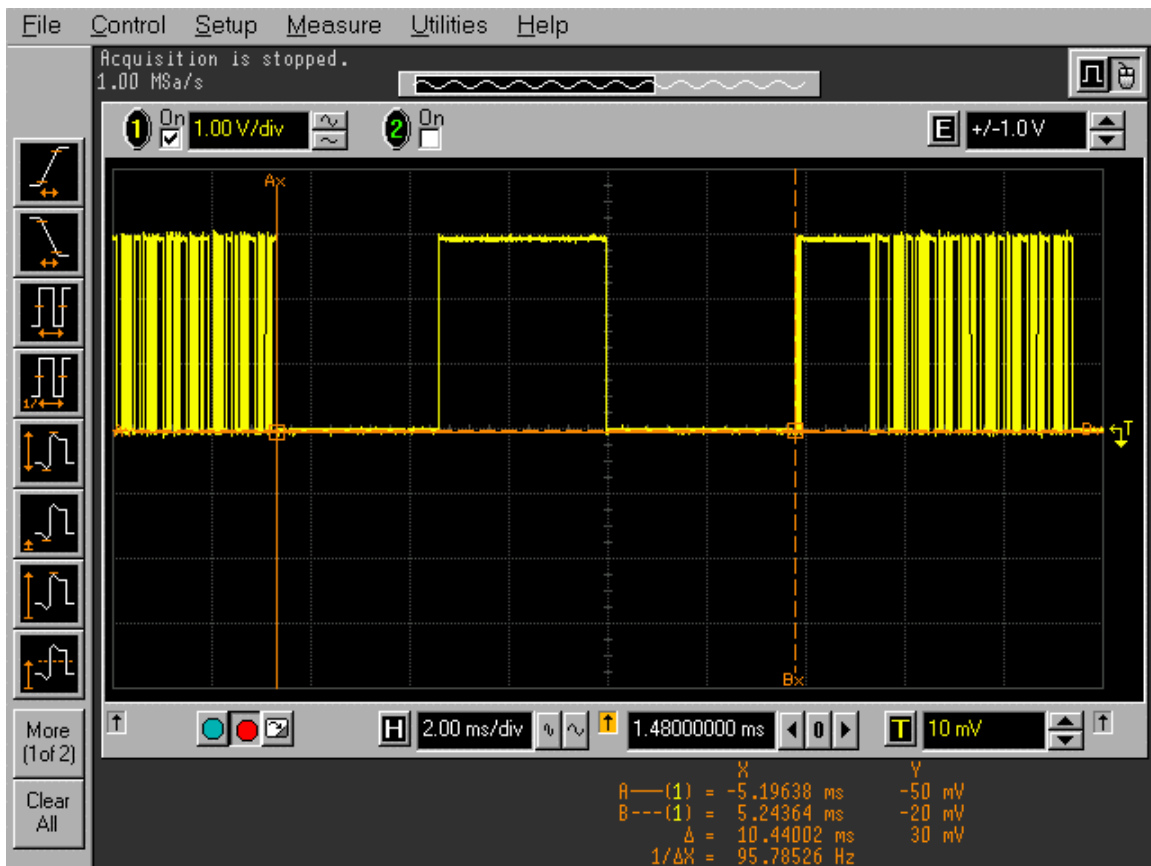
Baud rate = 28800bps



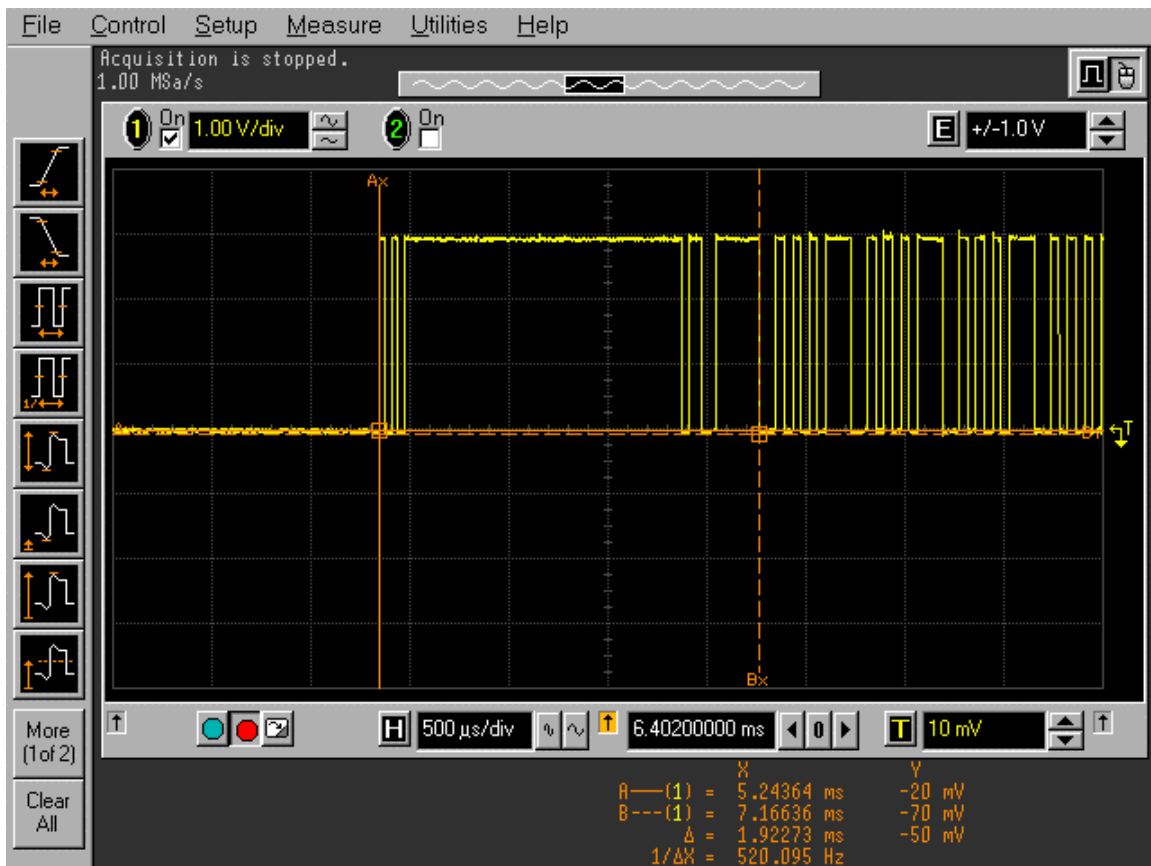
\* Complete 100ms data capture from HS encoder at 28800bps



\* Total time of 1 pulse train = 25.5264ms



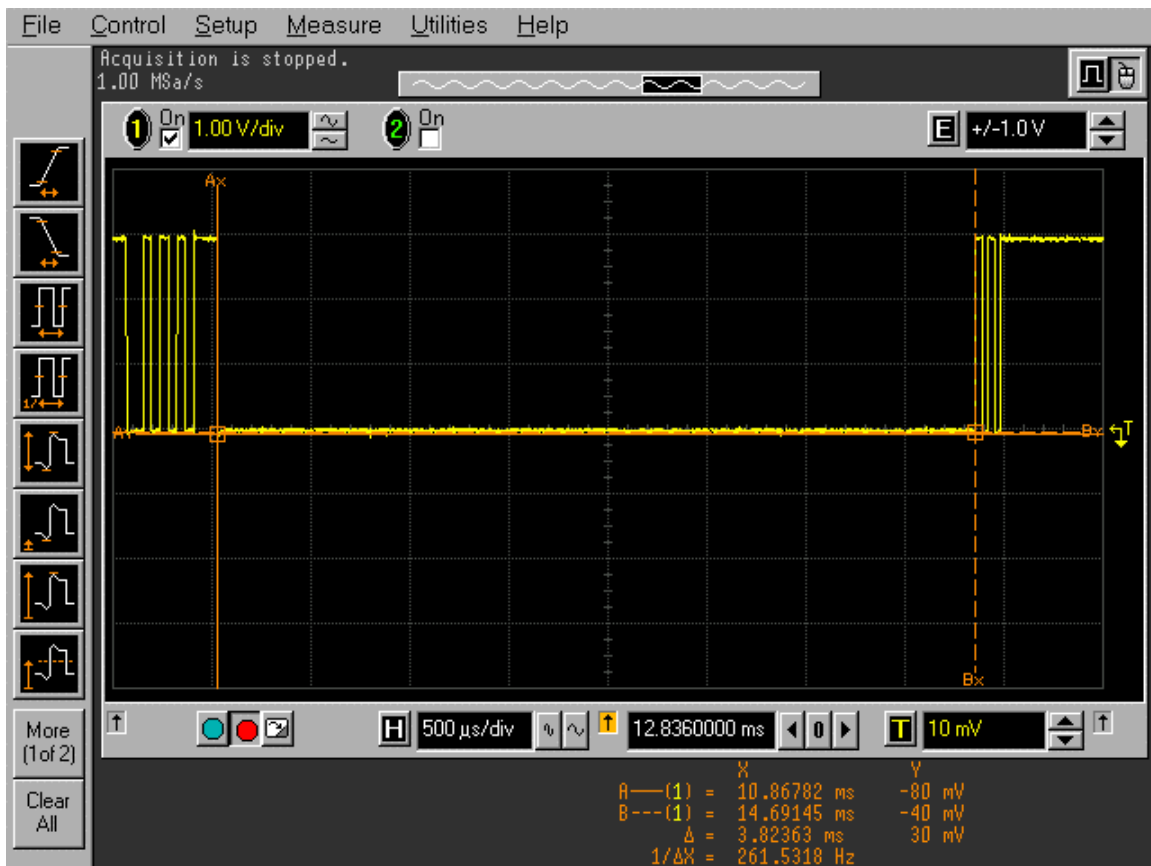
\* Zoomed in on processing period of packet-A



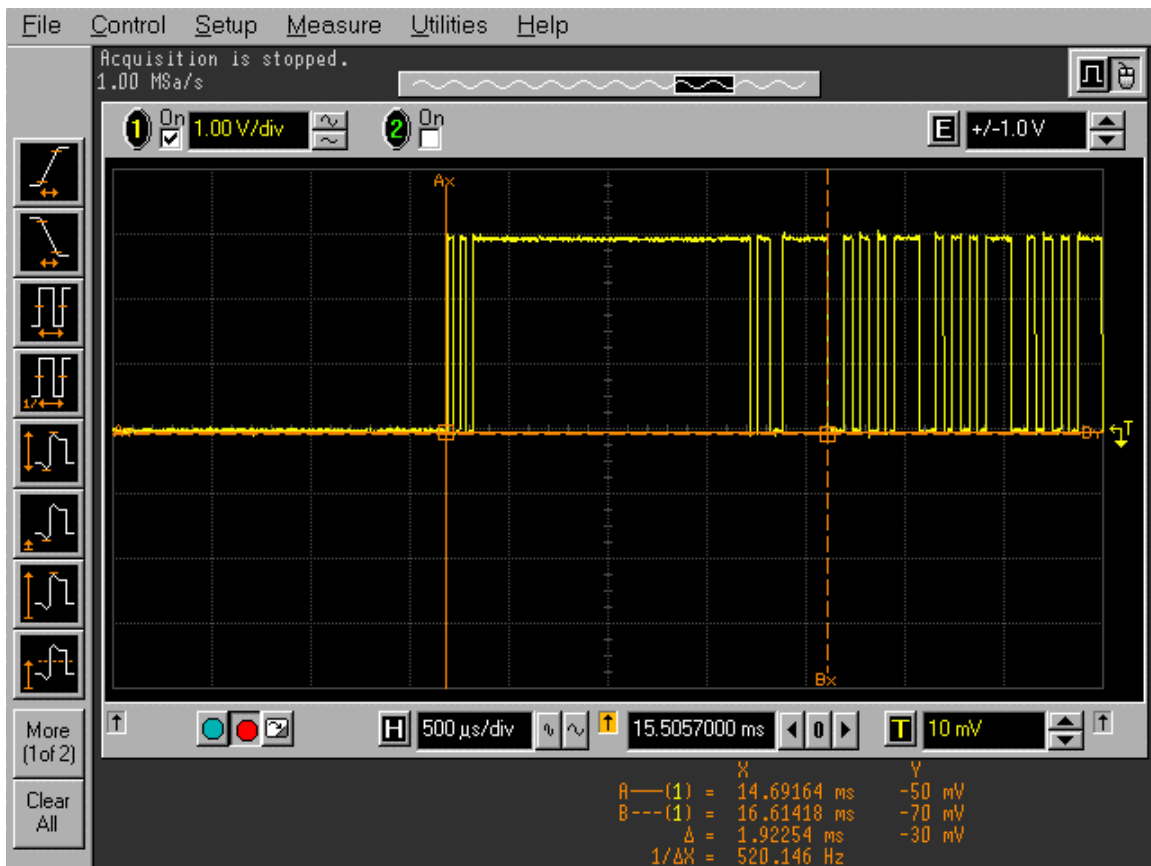
\* Zoomed in on start sequence of packet-A



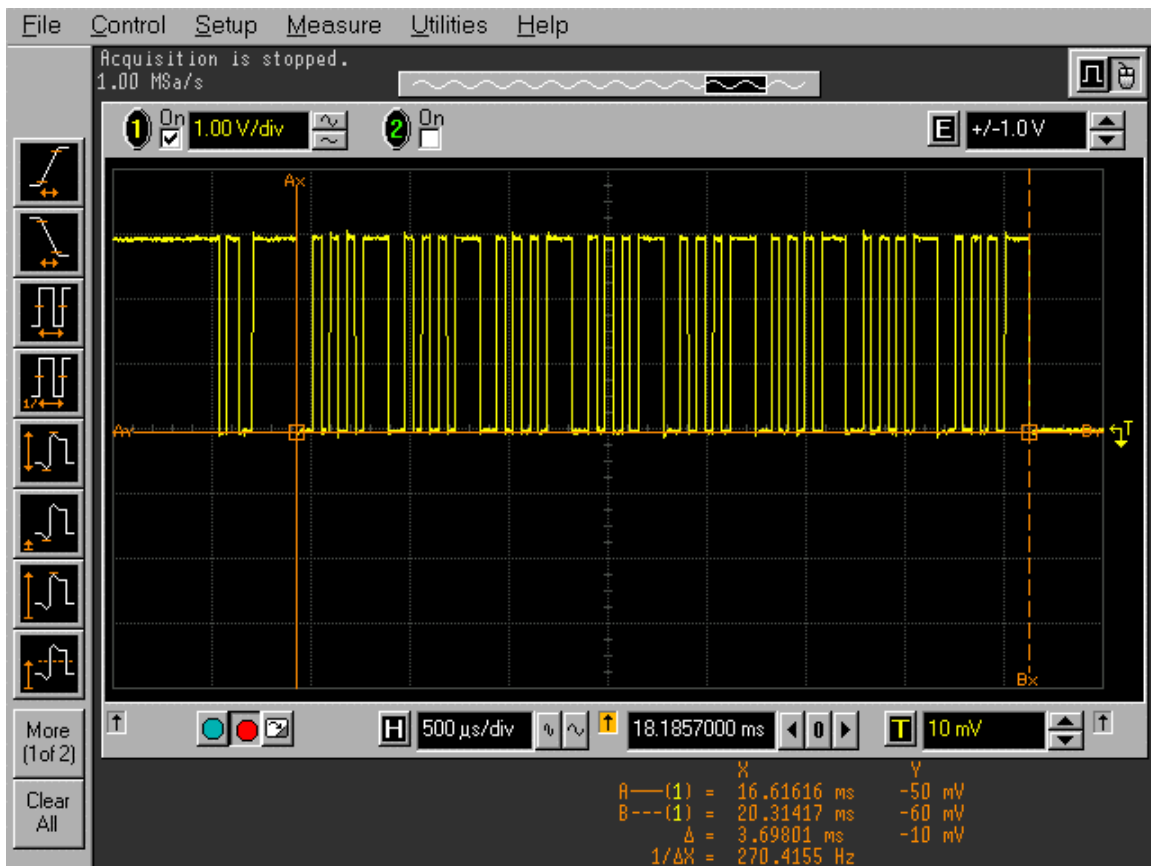
\* Zoomed in on data portion of packet A



\* Zoomed in on processing period of packet-B

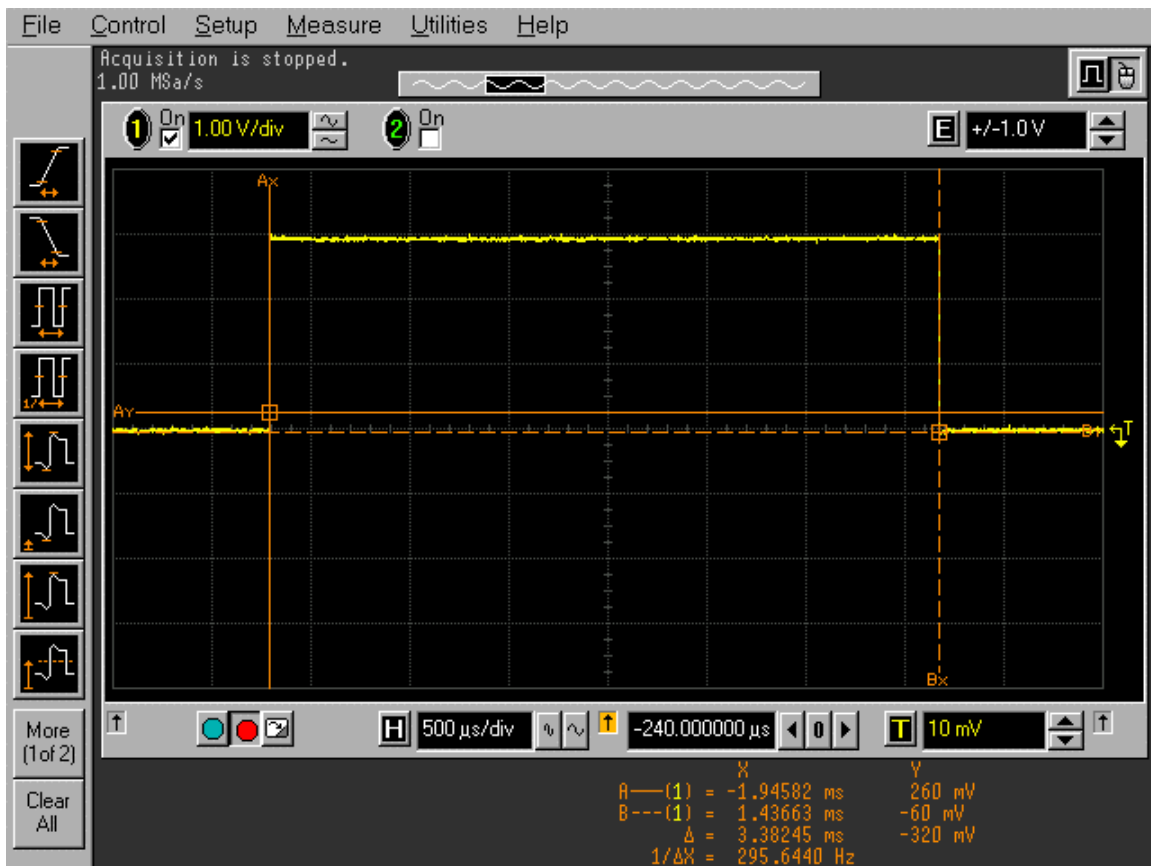


\* Zoomed in on start sequence of packet-B

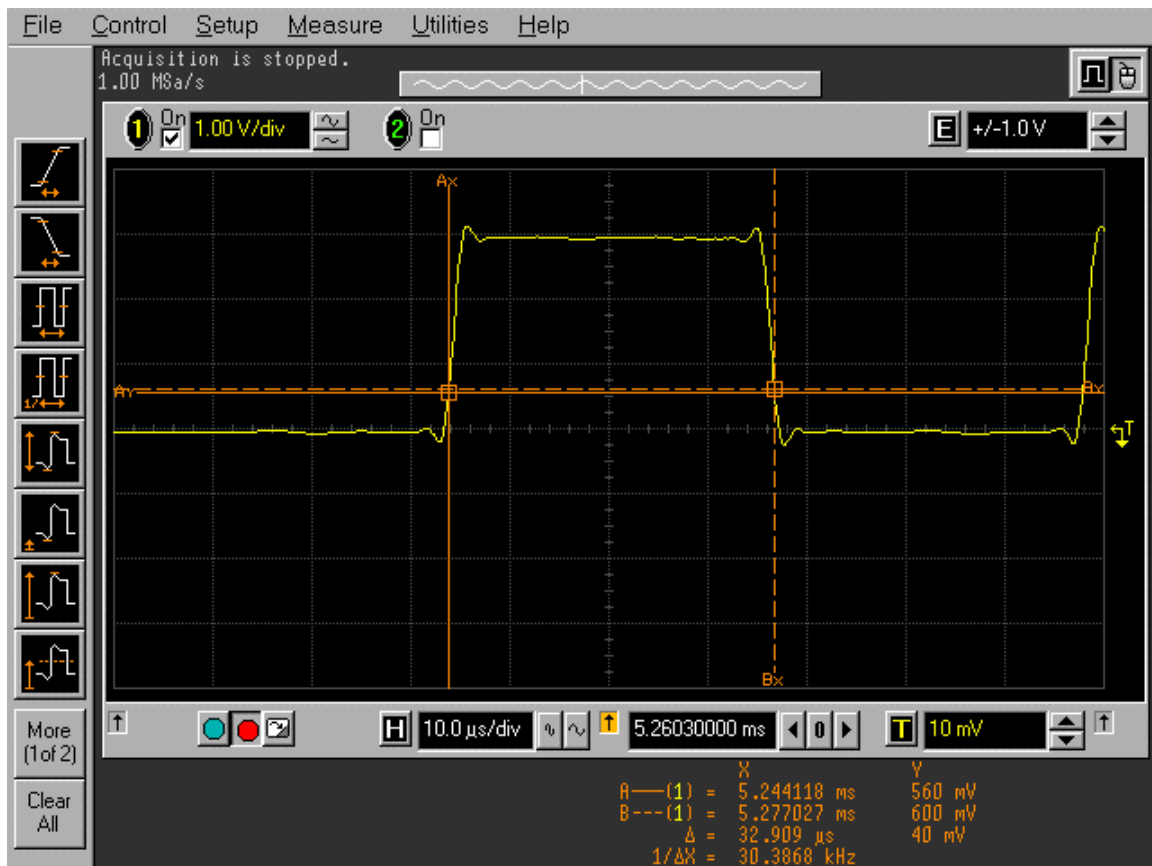


\* Zoomed in on data portion of packet B

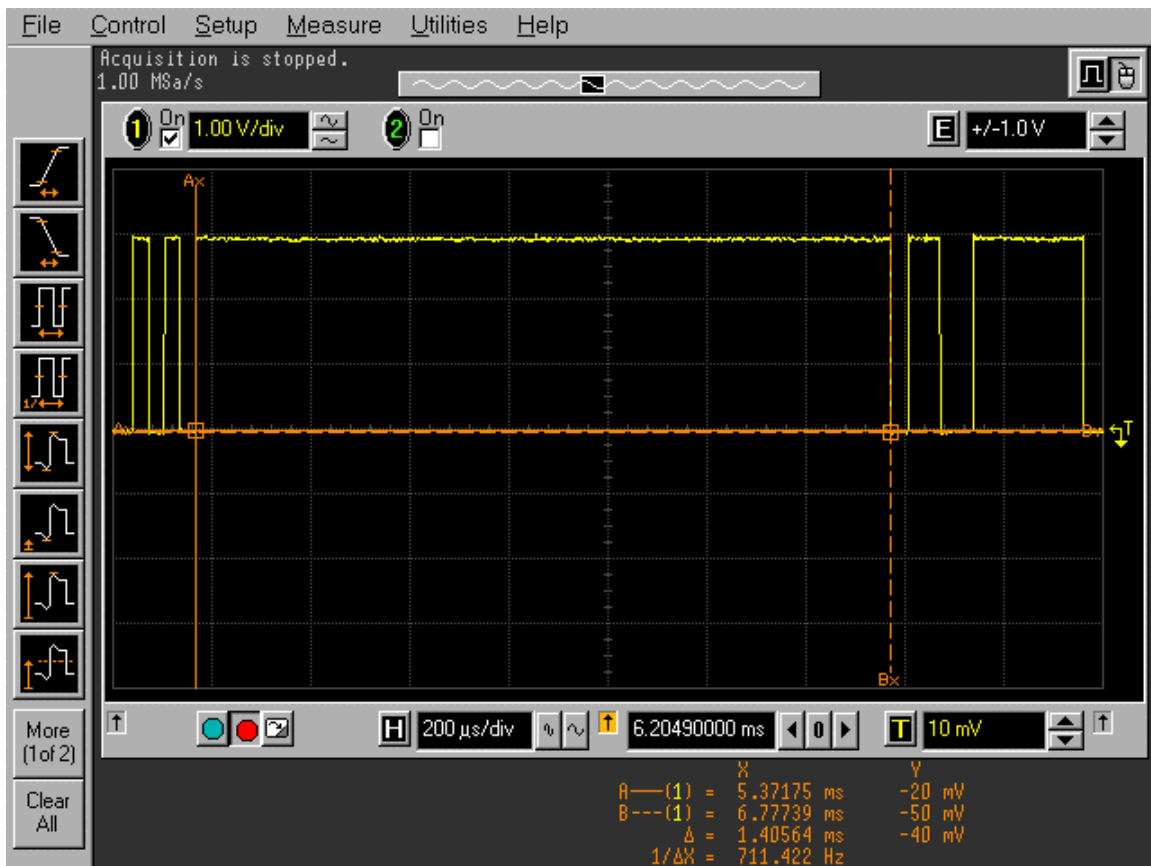




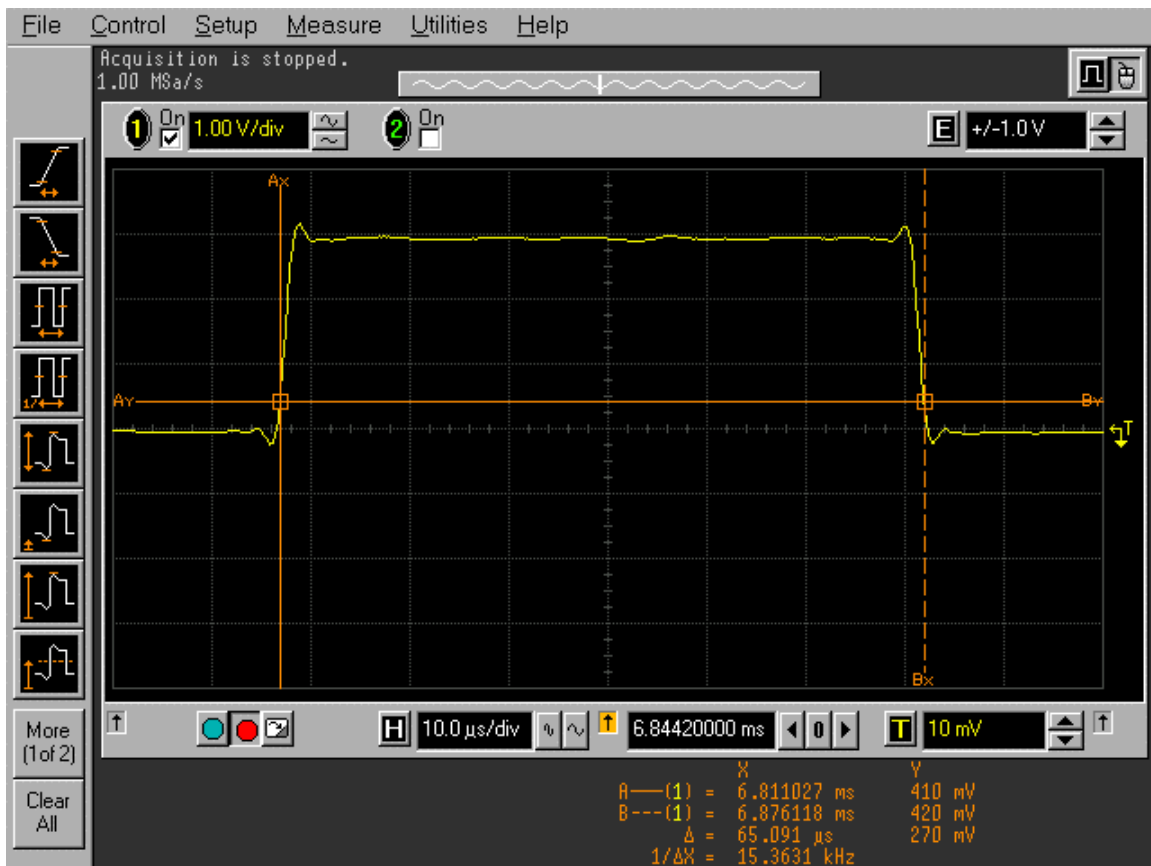
\* Pulse measurement #1 = 3.38245ms (processing pulse, only 1 of these per pulse train)



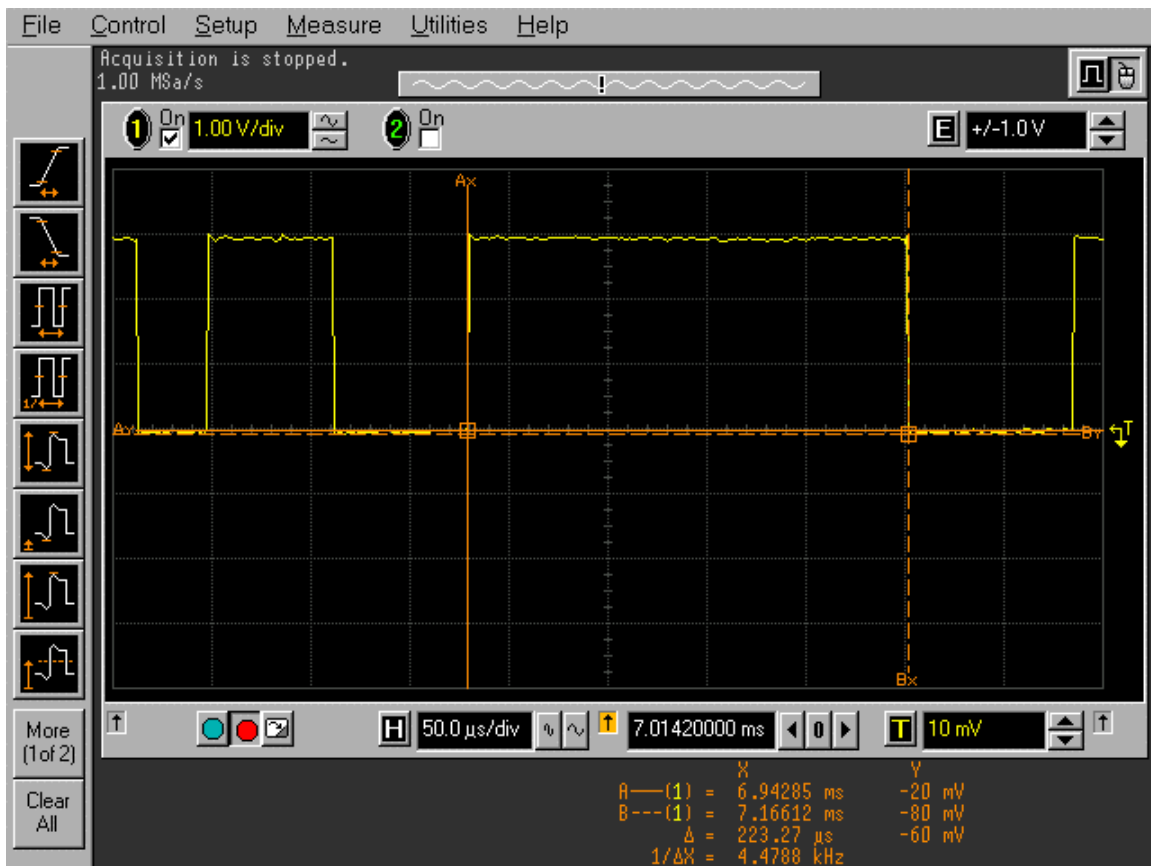
\* Pulse measurement #2 = 32.909us (wake pulses, 4 of these per pulse train)



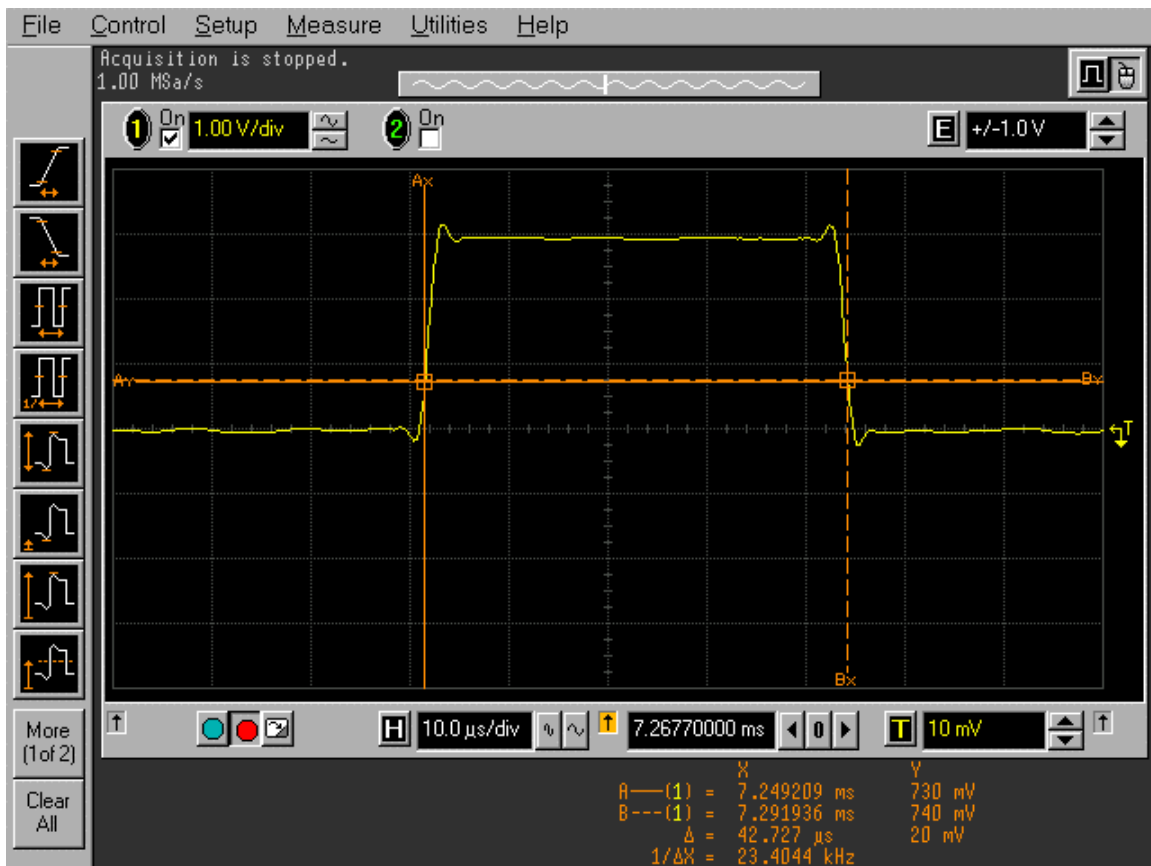
\* Pulse measurement #3 = 1.40564ms (noise filter, 2 of these per pulse train)



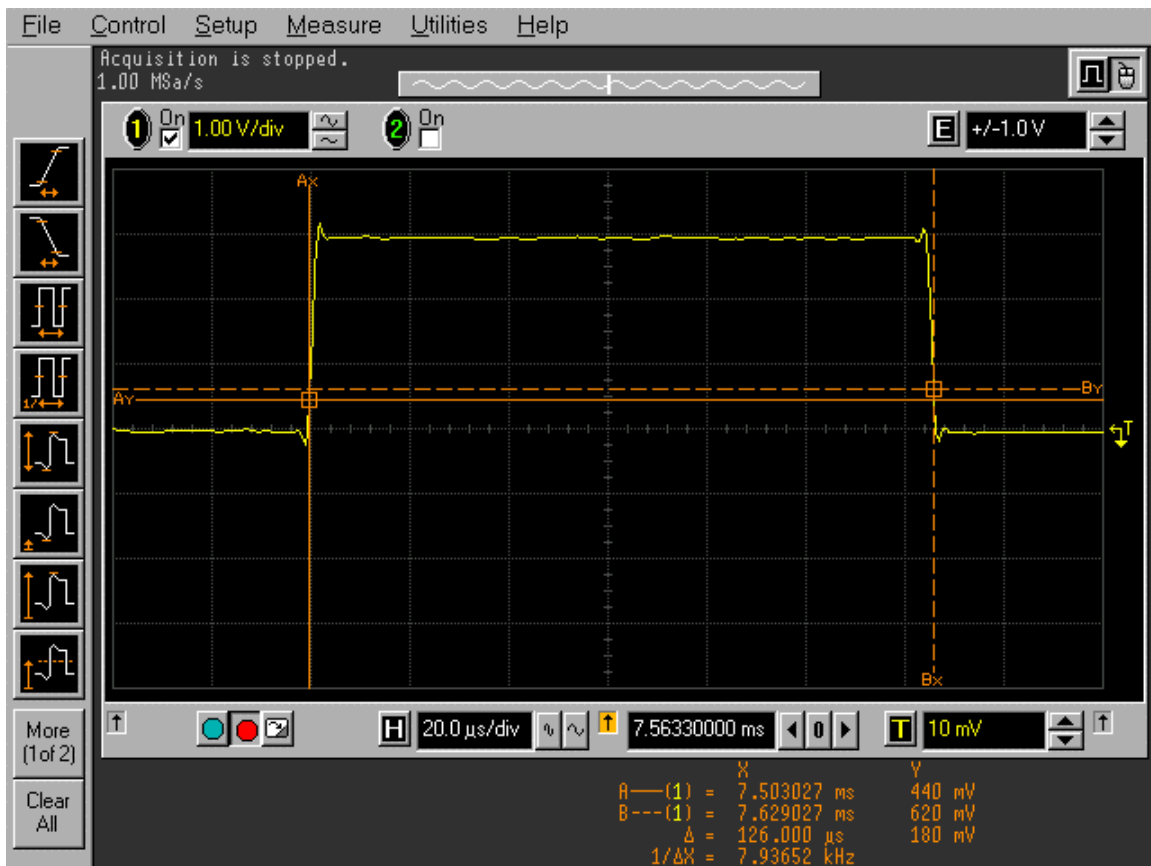
\* Pulse measurement #4 = 65.091us (error check, 2 of these per pulse train)



\* Pulse measurement #5 = 223.27us (UserID + stop bit, 2 of these per pulse train)



\* Pulse measurement #6 = 42.727 $\mu$ s (bits 1,3,5 of each byte of data, 48 of these per pulse train)



\* Pulse measurement #7 = 126.000us (bit 7 + stop bit of each byte of data, 16 of these per pulse train)

Pulse Description	Pulse Meas. #	Pulse Length (us)	Pulses per Train	Total Time (us)
Processing time	1	3382.45	1	3382.45
Wake bits	2	32.909	4	131.636
Noise filter	3	1405.64	2	2811.28
Error check	4	65.091	2	130.182
UserID + stop bit	5	223.27	2	446.54
Bits 1,3,& 5 of ea. data byte	6	42.727	48	2050.896
Bit 7 + stop bit of ea. data byte	7	126	16	2016
Total On-Time @ 28800bps				10968.984

Total On-Time = 10968.984us

Total Time = 25526.4us

$10968.984 / 25526.4 = 0.42971$

Duty Cycle @ 28800bps = 43.0%