

Implementing EDF Scheduler

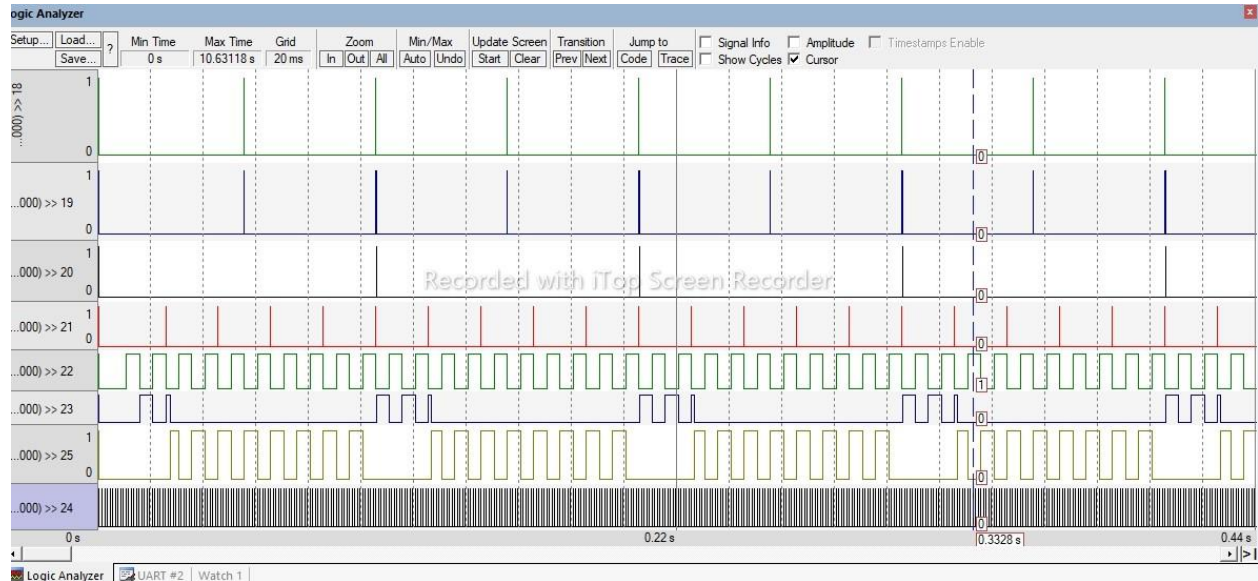
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FWD-Advanced Embedded Systems

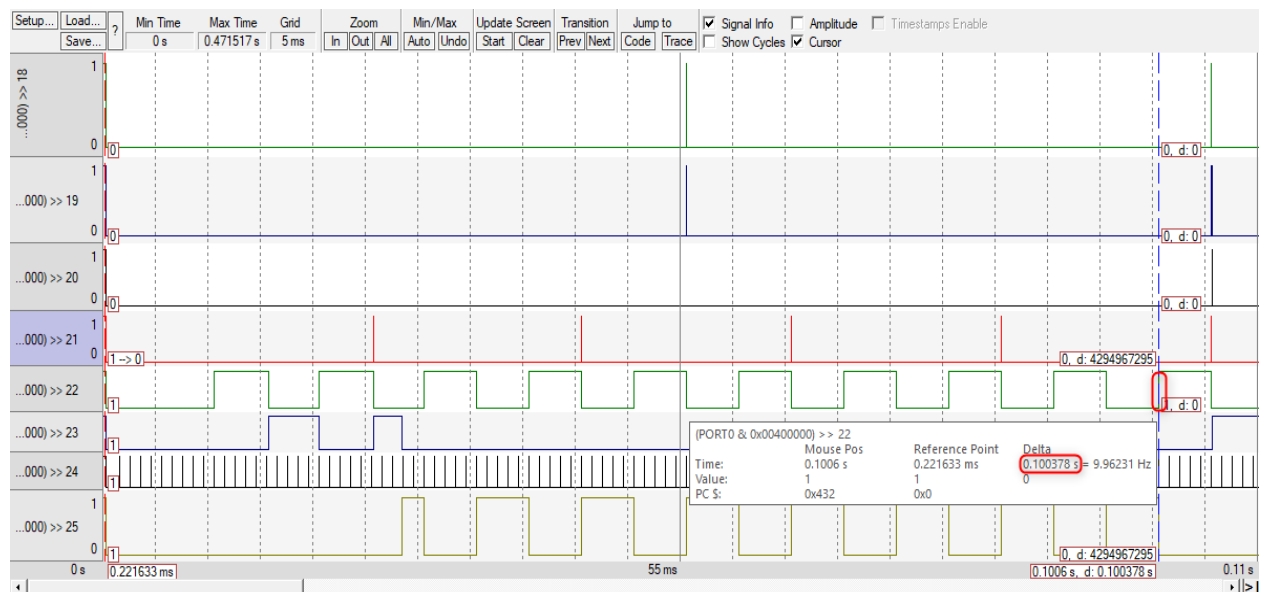
October, 2022

System Verification

- Run_Time System using Logic Analyzer



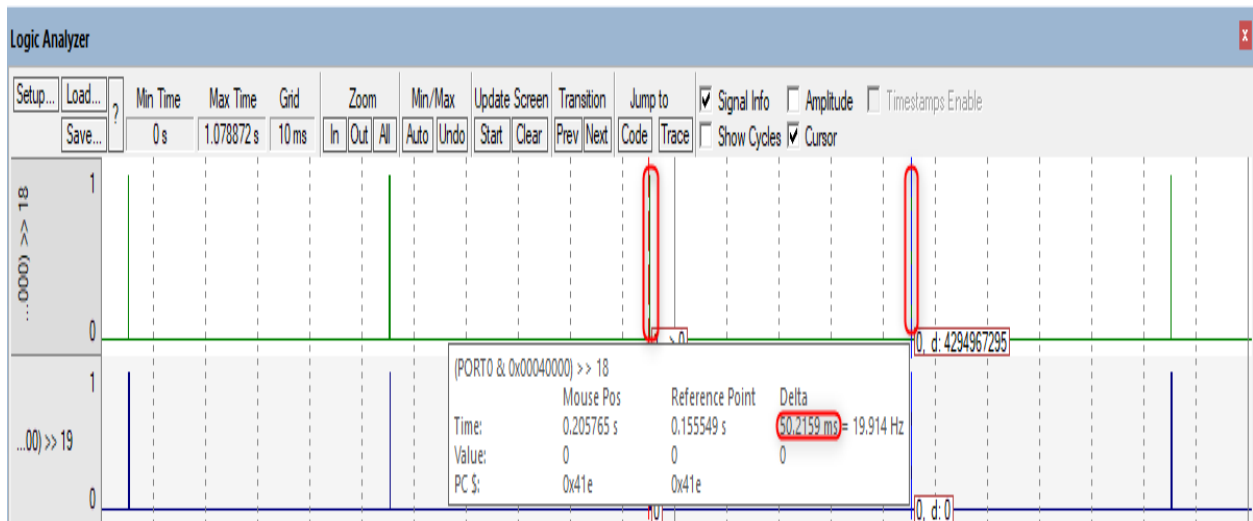
- System Hyperperiod



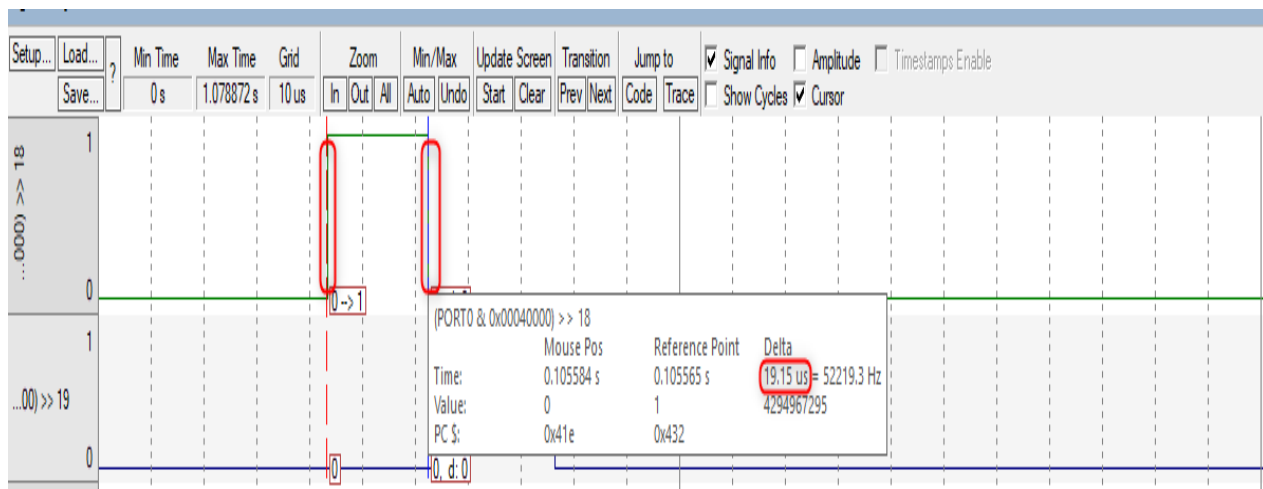
- Hyperperiod = 100 ms

- Tasks Periodicity & Execution Time

1. Button_1 Monitor



- **Periodicity = 50 ms**

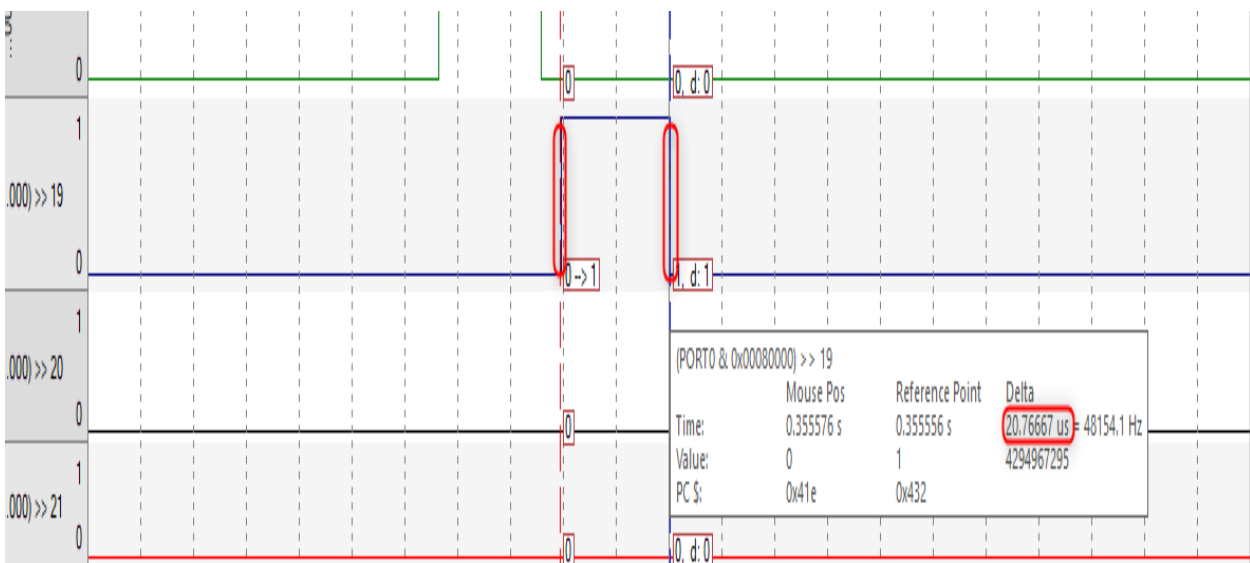


- **Execution Time = 19 us**

2. Button_2 Monitor

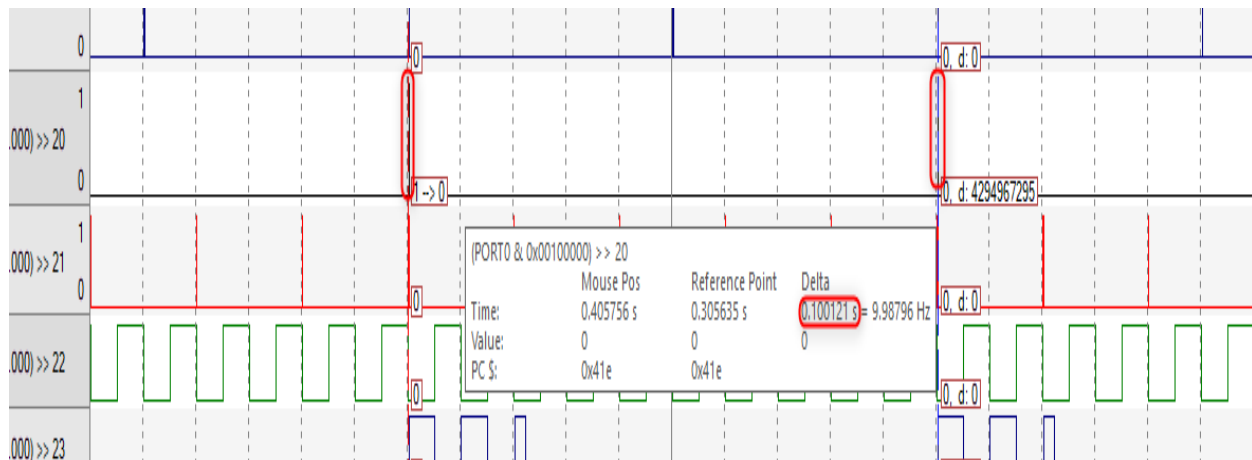


- Periodicity = 50 ms

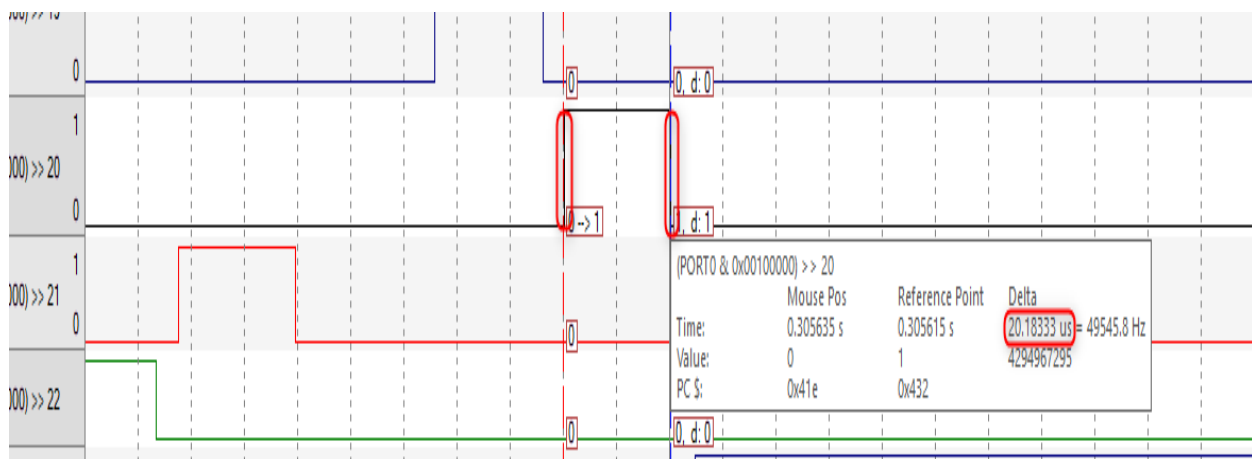


- Execution time = 20 us

3. Periodic Transmitter

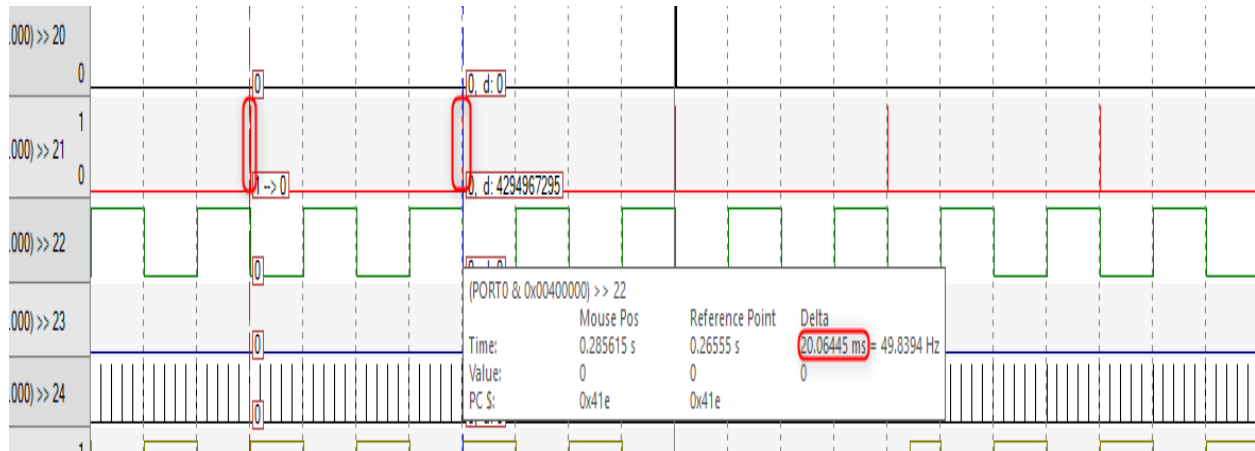


- **Periodicity = 100 ms**

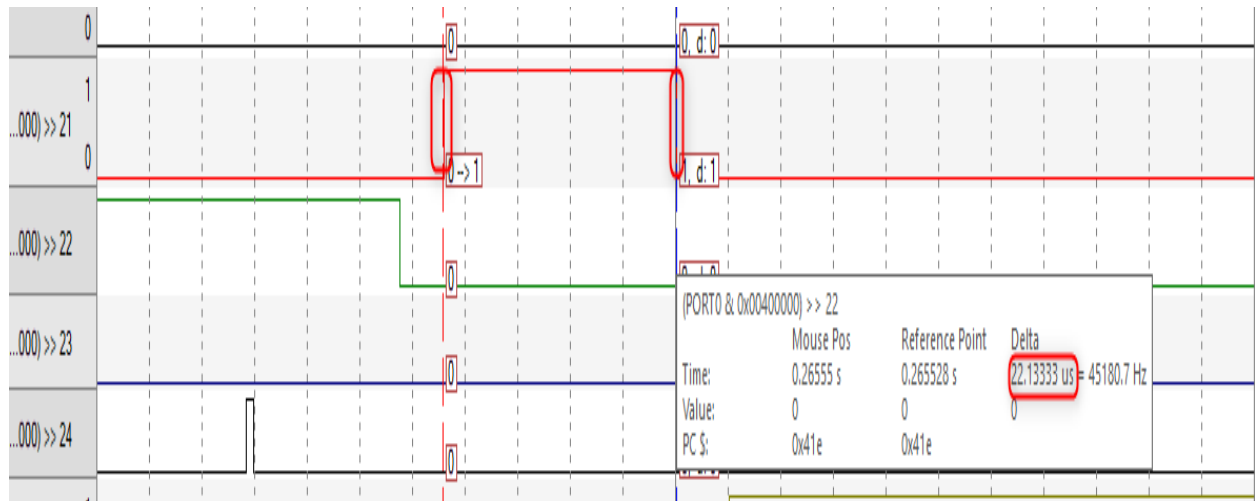


- **Execution time = 20 us**

4. UART Receiver

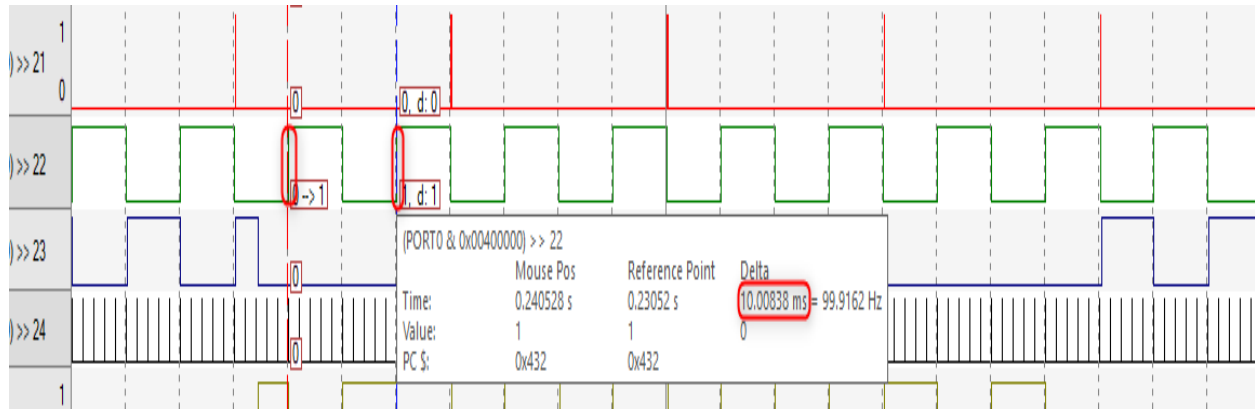


- Periodicity = 20 ms

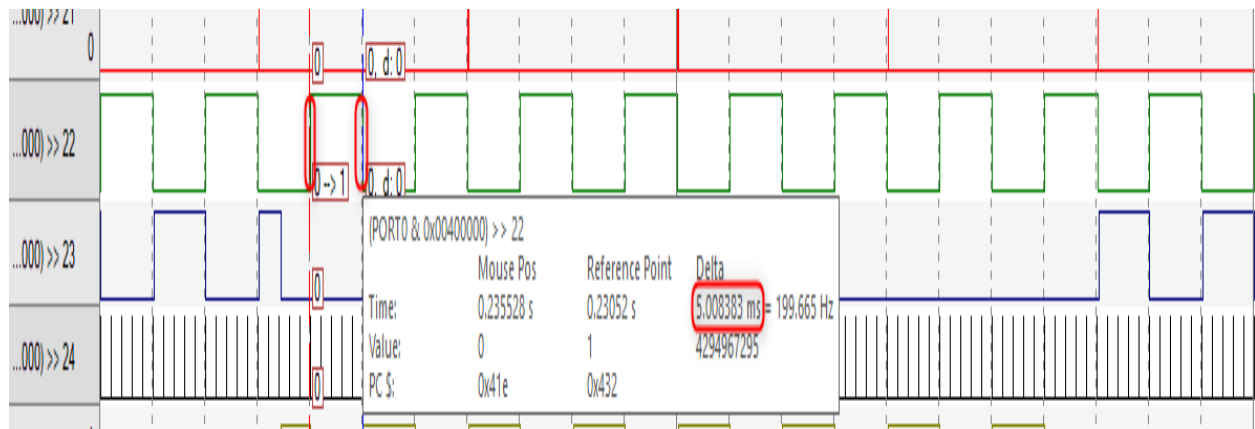


- Execution time = 22 us

5. Load_1 Simulation

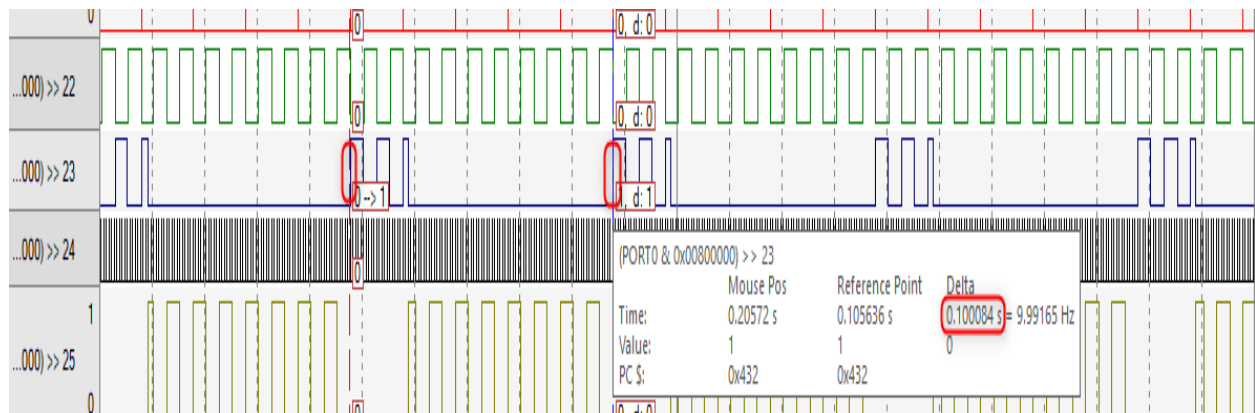


- **Periodicity = 10 ms**

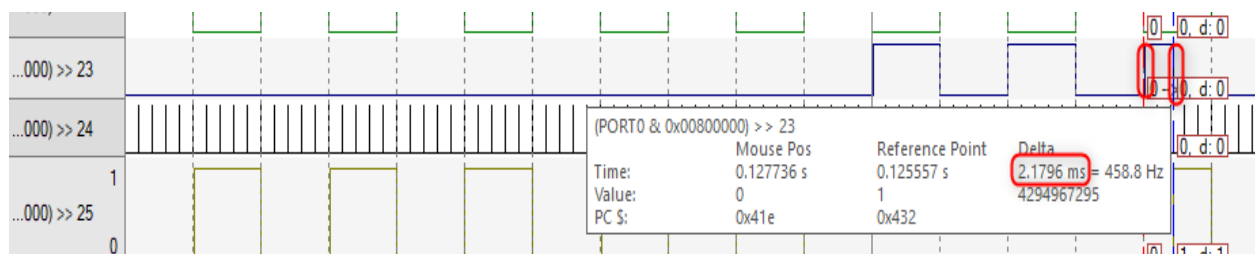
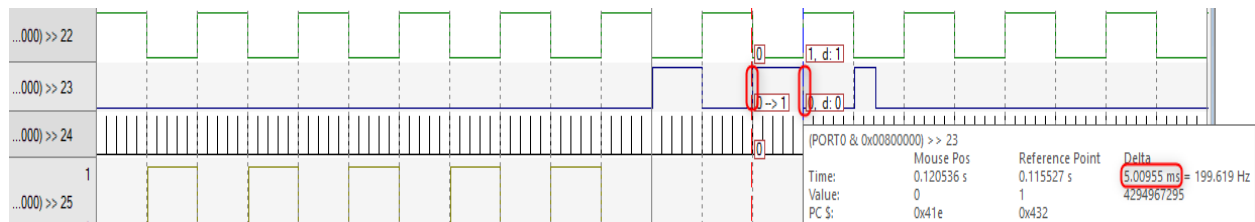
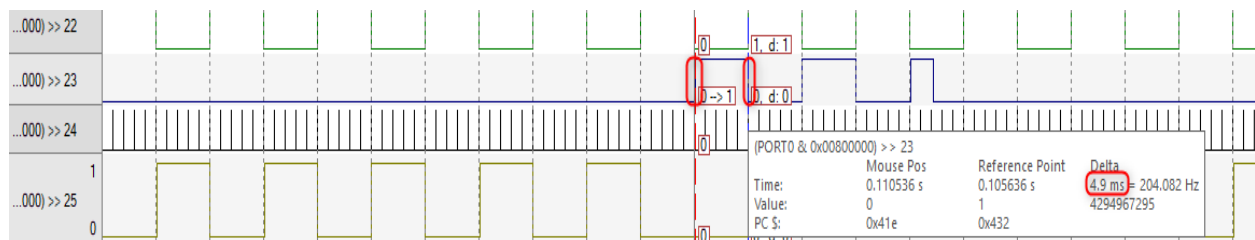


- **Execution time = 5 ms**

6. Load_2 Simulation



- **Periodicity = 100 ms**



- **Execution time = 4.9 ms + 5 ms + 2.1 ms = 12 ms**

- CPU Load Calculation

- Using Analytical Method

Button_1_Task_TotalTime = $0.019 * (100/50) = 0.038$ ms

Button2_Task_TotalTime = $0.02 * (100/50) = 0.04$ ms

Periodic_Task_TotalTime = $0.02 * (100/100) = 0.02$ ms

UART_Receiver_Task_TotalTime = $0.022 * (100/20) = 0.11$ ms

Load_1_Task_TotalTime = $5 * (100/10) = 50$ ms

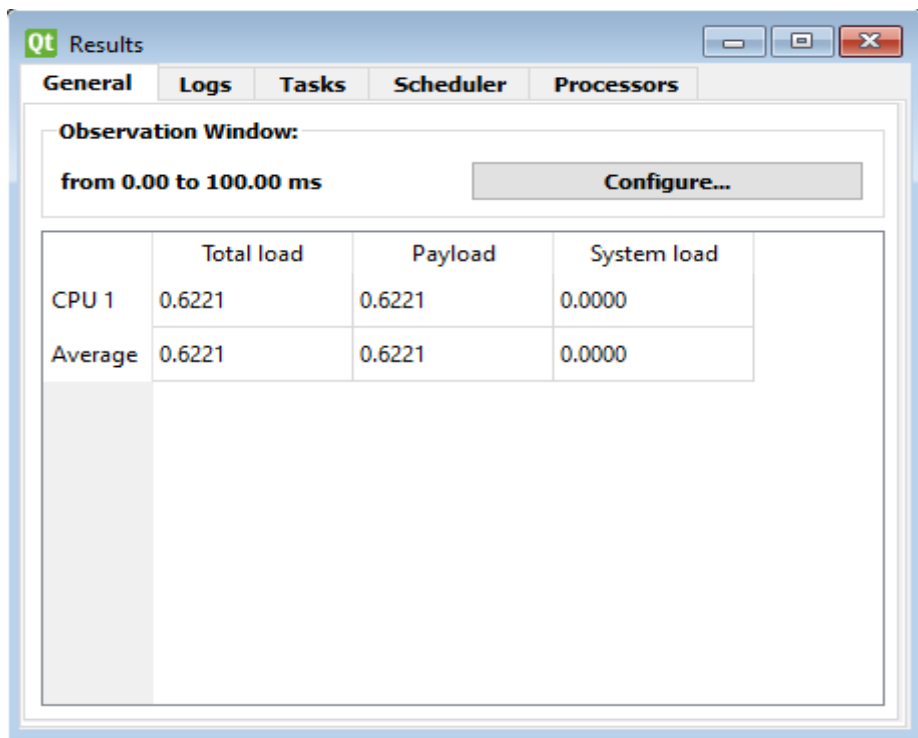
Load_2_Task_TotalTime = $12 * (100/100) = 12$ ms

CPU Load = $((0.038 + 0.04 + 0.02 + 0.11 + 50 + 12) / 100) * 100$
= 62 %

- Using Trace Macros

Watch 1		
Name	Value	Type
xButton_1TotalTime	27179	uint
xButton_2TotalTime	29188	uint
xPeriodic_TransTotalTime	14438	uint
xUart_ReceiverTotalTime	78121	uint
xLoad_1_SimTotalTime	35009953	uint
xLoad_2_SimTotalTime	8384466	uint
SystemTime	69970412	uint
CPULoad	62	uint
<Enter expression>		

- Using Simso Offline Simulator



	Total load	Payload	System load
CPU 1	0.6221	0.6221	0.0000
Average	0.6221	0.6221	0.0000

Comment : The percentage of CPU Load is equal in Analytical Method, Trace Macros and Simso Simulator.

- System Schedulability

- Using URM Analysis

$$U = (0.019/50) + (0.02/50) + (0.02/100) + (0.022/20) + (5/10) + (12/100)$$

$$= 0.62$$

$$URM = 6 * (2^{(1/6)} - 1) = 0.73$$

Comment : $U < URM$ so the system is guaranteed schedulable

- Using Time Demand Analysis

1) Load_1 Task

$$W(10) = 5 + 0 = 5 < 10$$

Load_1 Task is schedulable

2) UART_Receiver Task

$$W(20) = 2 * 5 + 0.022 = 10.022 < 20$$

UART_Receiver Task is schedulable

3) Button_1 Task

$$W(50) = (5 * 5) + (2 * 0.022) + 0.019 = 25.063 < 50$$

Button_1 Task is schedulable

4) Button_2 Task

$$W(50) = (5 * 5) + (2 * 0.022) + 0.019 + 0.02 = 25.064 < 50$$

Button_2 Task is schedulable

5) Periodic Task

$$\begin{aligned} W(100) &= (10 * 5) + (5 * 0.022) + (2 * 0.019) + (2 * 0.02) + 0.02 \\ &= 50.208 < 100 \end{aligned}$$

Periodic Task is schedulable

6) Load_2 Task

$$\begin{aligned} W(100) &= (10 * 5) + (5 * 0.022) + (2 * 0.019) + (2 * 0.02) + 0.02 + 12 \\ &= 62.208 < 100 \end{aligned}$$

Load_2 Task is schedulable

Comment : All tasks are schedulable so the system is guaranteed schedulable

- Using Simso Simulator Analysis

