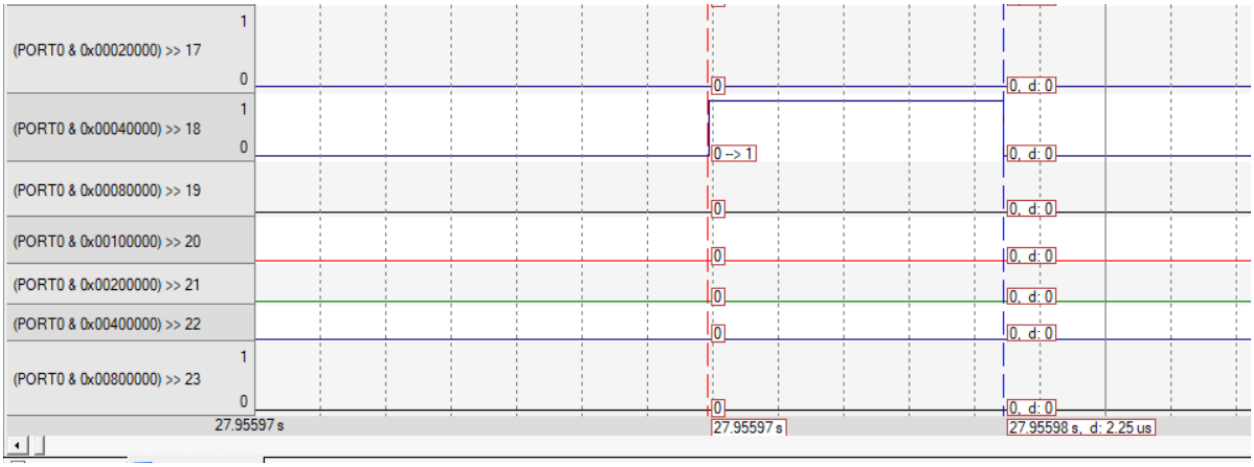
FreeRtos EDF Scheduler Verification

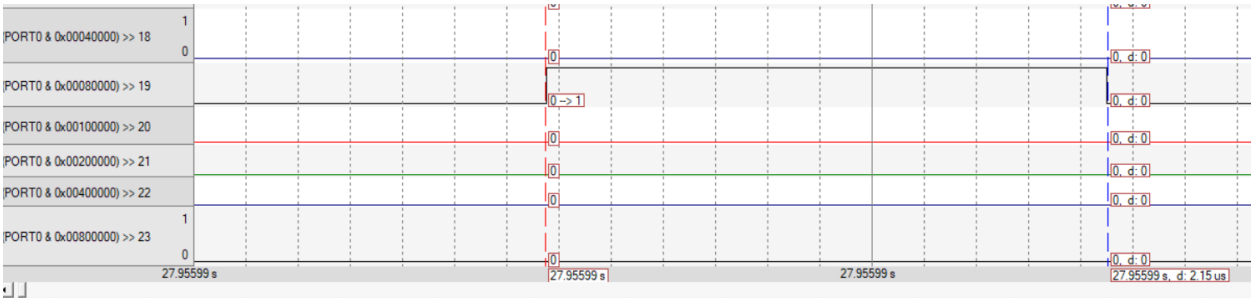
Task execution Time Calculation:

Button 1 :



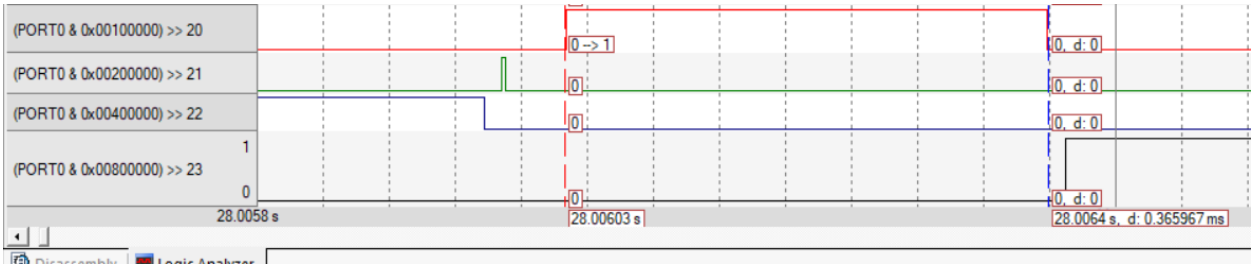
About 2.25 us

Button 2:



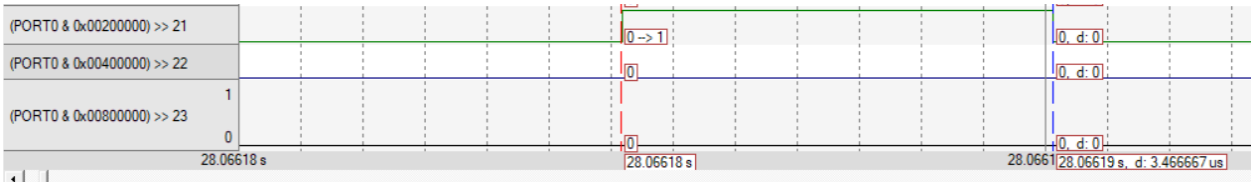
About 2.15 us

Periodic Transmitter Task:



On Pin 20 About 400 us

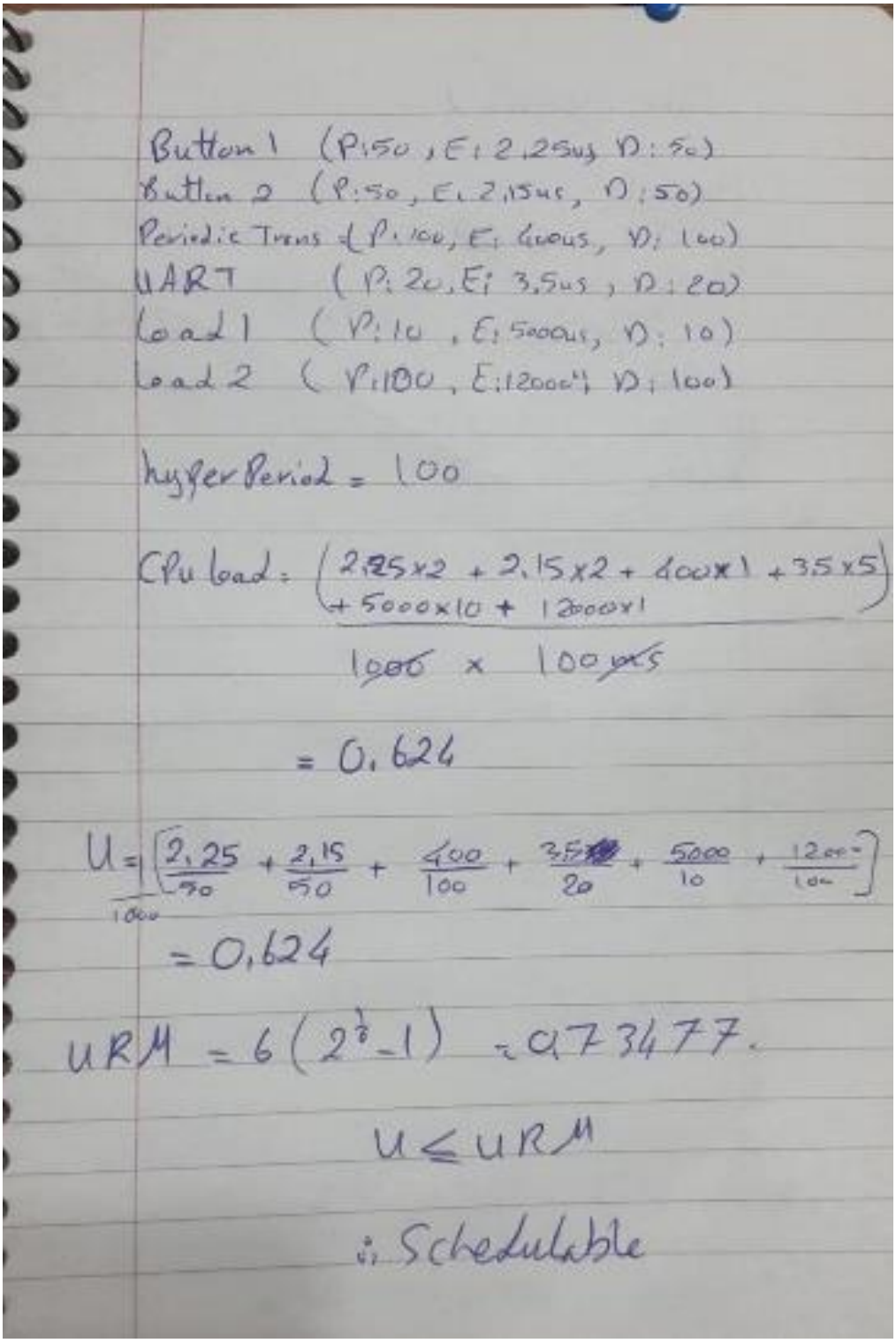
UART Task :



On pin 21 About 3.5us

Load 1 and Load 2 one is 5000us and the other is 12000us

Verify Using Analytical Method:



Button 1 (P:50, E: 2.25us, D: 50)
Button 2 (P:50, E: 2.15us, D: 50)
Periodic Trans (P: 100, E: 400us, D: 100)
UART (P: 20, E: 3.5us, D: 20)
Load 1 (P: 10, E: 5000us, D: 10)
Load 2 (P: 100, E: 12000us, D: 100)

HyperPeriod = 100

$$\text{CPU load} = \frac{(2.25\times2 + 2.15\times2 + 400\times1 + 3.5\times5 + 5000\times10 + 12000\times1)}{1000 \times 100}$$

$$= 0.624$$

$$U = \frac{1}{100}\left[\frac{2.25}{50} + \frac{2.15}{50} + \frac{400}{100} + \frac{3.5}{20} + \frac{5000}{10} + \frac{12000}{100}\right]$$

$$= 0.624$$

$$URM = 6(2^{\frac{1}{3}} - 1) = 0.73477$$

$$U \leq URM$$

$\therefore$ Schedulable

Time Demand

assume 10 Ticks - 1 Tick

Load

$w(1) = 5000 + 0 = \frac{5000us}{1000} = 5\ ms$

$w(1) < D$

$5 < 10$

$\therefore$ Schedulable

UART

$w(2) = \frac{3.5}{1000} + (2) \times 5\ ms = 10.0035 < 20$

$\therefore$ Schedulable

Button 1

$w(5) = \frac{2.25}{1000} + \left(\frac{5}{2}\right) \times \frac{3.5}{1000} + \frac{5000}{1000} \times 5$

$= 25.01 < 50$

Schedulable

Button 2

$w(5) = \frac{2.15}{1000} + \frac{2.25}{1000} + \left(\frac{5}{3}\right)\frac{3.5}{1000} + \frac{5000 \times 5}{1000}$

$= 25.0129 < 50$ $\therefore$ Schedulable

Periodic Transmitter

$$w(10) = \frac{400}{1000} + \frac{2,25 \times 2}{1000} + \frac{2,15 \times 2}{1000} + \frac{3,5}{1000} \times 5$$

$$+ \frac{5000}{1000} \times 10 = 50,4263 < 100$$

$\therefore$ Schedulable

Load 2:-

$$w(10) = \frac{12000}{1000} + \frac{400}{1000} + \frac{2,25 \times 2}{1000} + \frac{2,15 \times 2}{1000}$$

$$+ \frac{3,5}{1000} \times 5 + \frac{5000}{1000} \times 10 = 62,43 < 100$$

$\therefore$ Schedulable

Verify Using Simso:

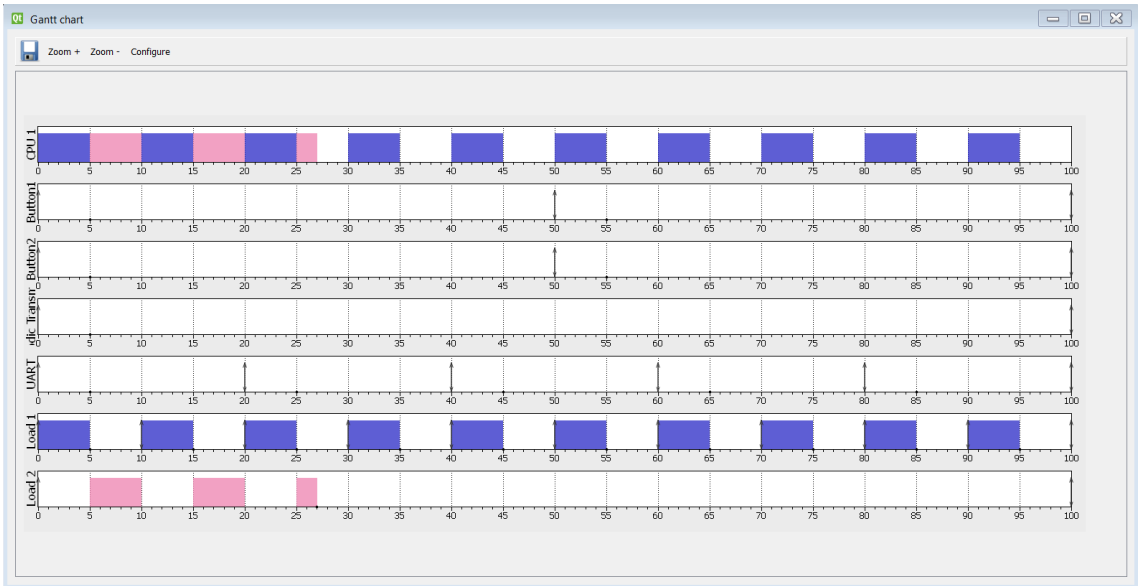
Model data

General | Scheduler | Processors | Tasks

id	Name	Task type	Abort on miss	Act. Date (ms)	Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)	Followed by
1	Button 1	Periodic	Yes	0	50	-	50	0	
2	Button 2	Periodic	Yes	0	50	-	50	0	
3	Periodic Transmitter	Periodic	Yes	0	100	-	100	0	
4	UART	Periodic	Yes	0	20	-	20	0	
5	Load 1	Periodic	Yes	0	10	-	10	5	
6	Load 2	Periodic	Yes	0	100	-	100	12	

Edit data fields...

Remove selected task(s) | Add task | Generate Task Set



Results

General | Logs | Tasks | Scheduler | Processors

Observation Window:

from 0.00 to 100.00 ms | Configure...

	Total load	Payload	System load
CPU 1	0.6200	0.6200	0.0000
Average	0.6200	0.6200	0.0000

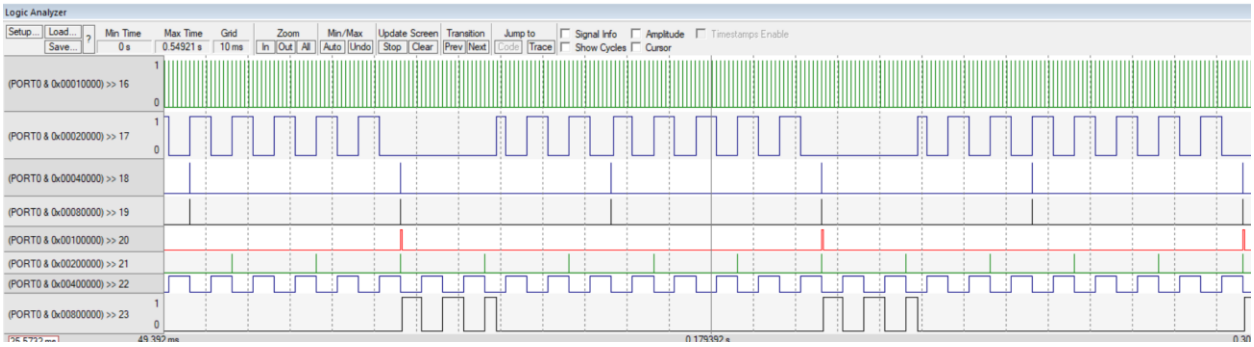
Verify Using Keil Simulator :

CPU Load Time:

```
Uart     2904            <1%
Periodi  11573           <1%
Load 2   393113          12%
Button1  1032            <1%
Monitor  1040            <1%
Load 1   1629026         50%
```

Total CPU Time = 50+12+<1+<1+<1+<1 = 63%

Second Using the Analyser:



Pin 16 → Tick Hook

Pin 17 → Idle Hook

Pin 18 → Button 1

Pin 19 → Button 2

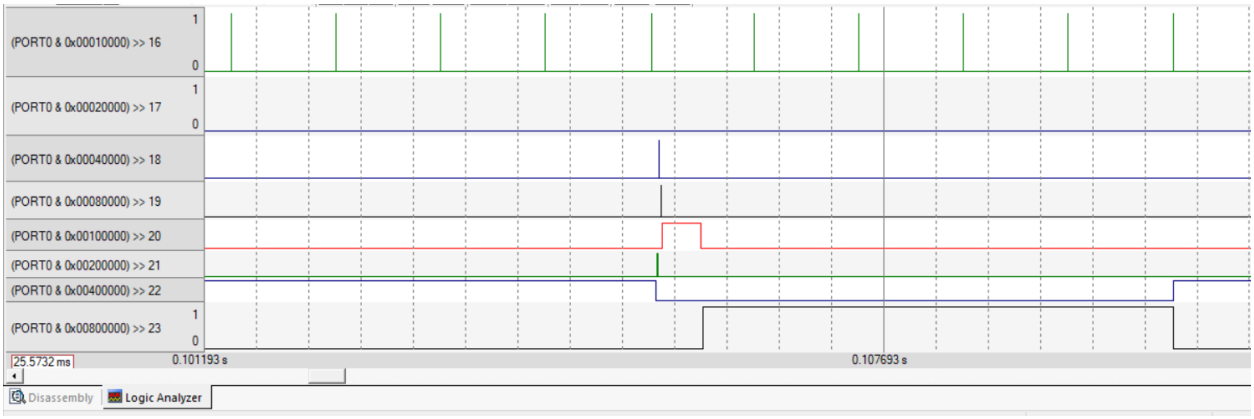
Pin 20 → Periodic Transmitter 1

Pin 21 → UART

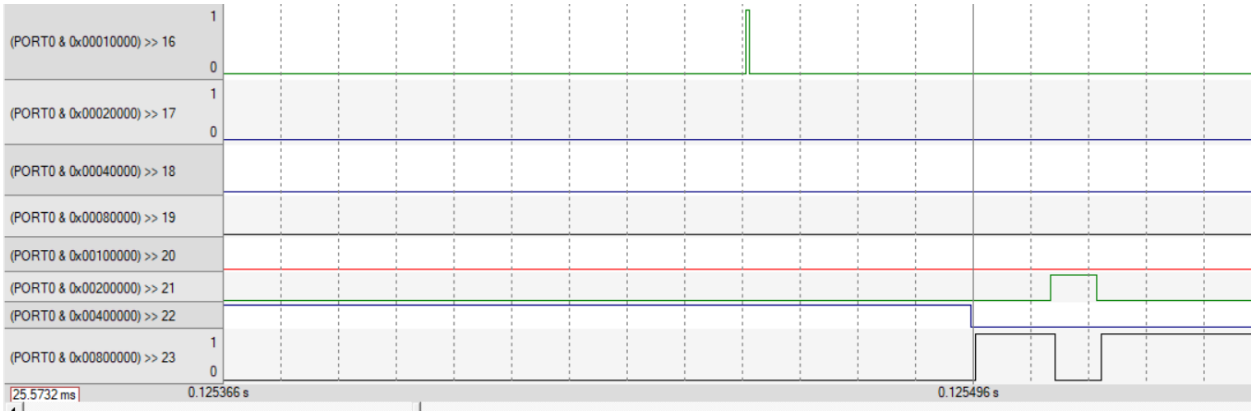
Pin 22 → Load 1

Pin 23 → Load 2

At start of system load 1 is scheduled and run before any other task its periodicity is 10 to it executes every 10 ticks, at tick 100 it has just finished executing and its deadline is after tasks starting execution now ,



This snap shot shows that load 1 just finishes execution at tick of multiple of 100 where all tasks should be scheduled, task that should be scheduled now it the UART Task as its periodicity is 20 whose old deadline was 80 so it is estimated to be 100 now then comes the 2 button tasks whose periodicity 50s then the periodic transmitter whose periodicity is 100 and also the load Task.



This sample is an example of how preemptions occur pin 22 is the UART Task and it is ready so what happens is that the load 2 task (Pin 23)is currently executing but UART Task deadline is the nearest so it preempts load 2 Task executes instead the after finishing the Load 2 Task is rescheduled as it's the only Task left in ready list apart from Ideal Task.