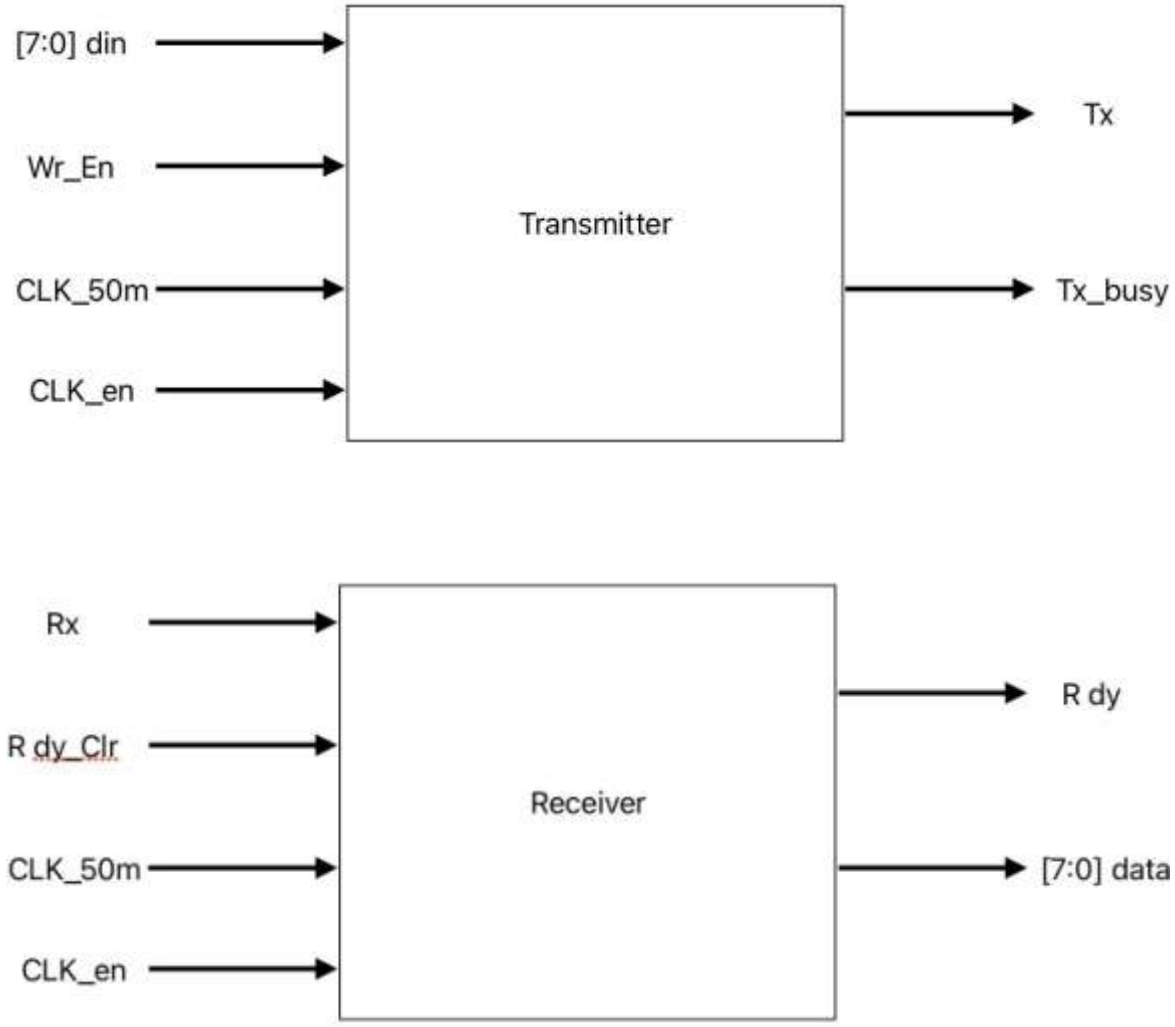
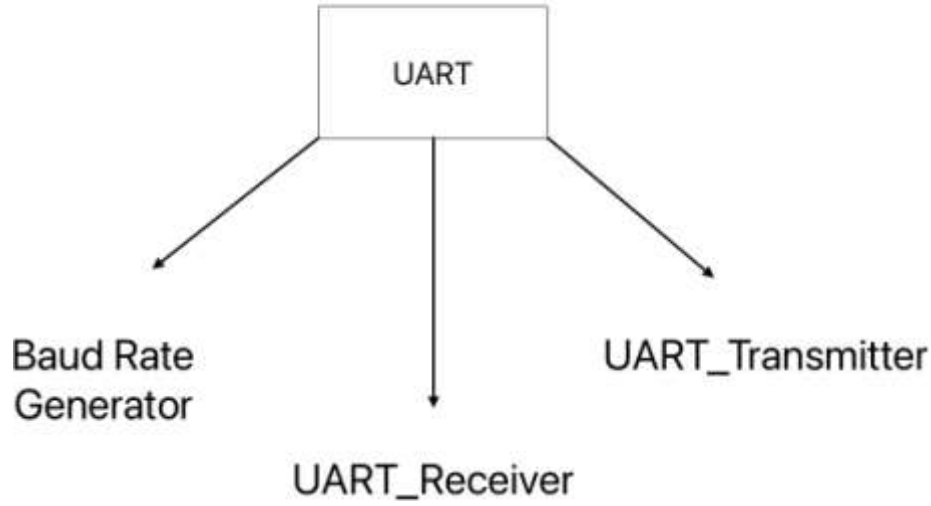
1.Introduction

UART (Universal Asynchronous Receiver/Transmitter) is a serial communication protocol widely used in electronics. It facilitates the asynchronous transmission of data between devices. UART operates on two wires, one for transmitting (TX) and one for receiving (RX). It is known for its simplicity and versatility, making it a common choice for communication between microcontrollers, sensors, and various peripherals. The absence of a shared clock signal distinguishes UART from synchronous communication protocols.



1.1 Modules declaration:

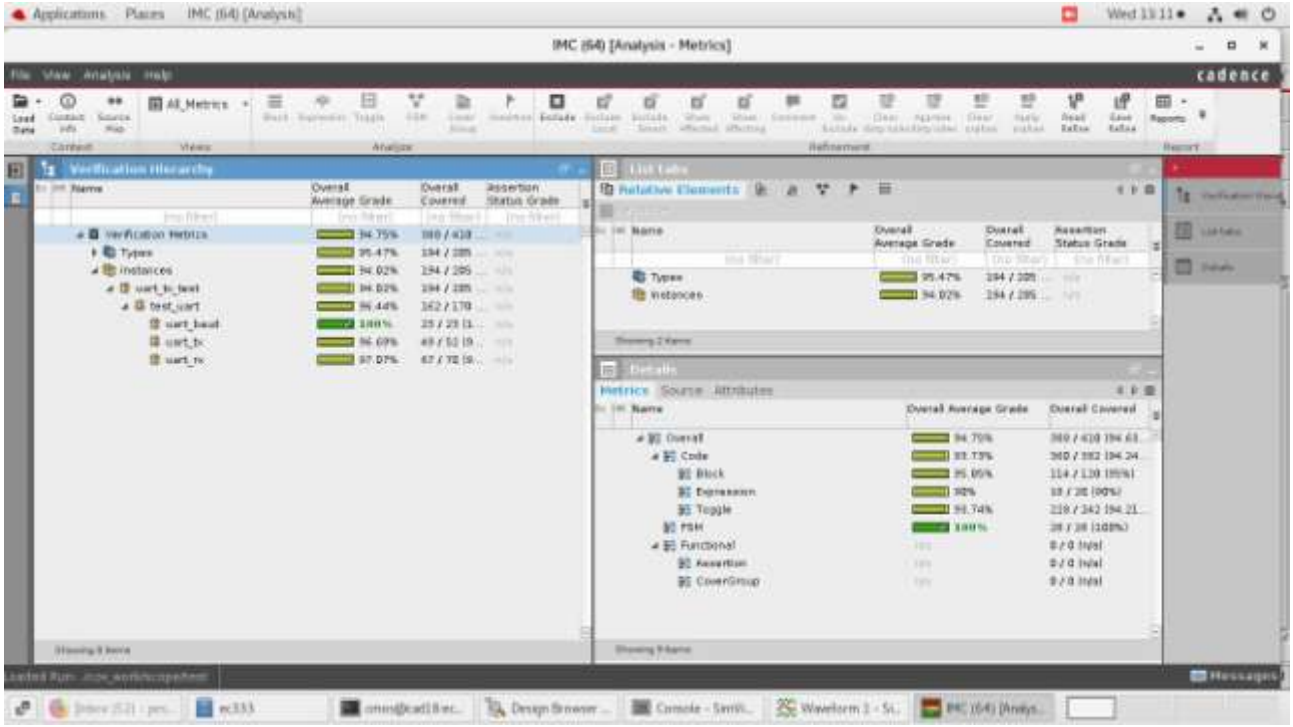


- Baud Rate Generator: A baud rate generator is a circuit that sets the rate at which data is transmitted in a communication system, determining the number of signal changes per second and ensuring synchronization between the sender and receiver.
- UART Receiver
- UART Transmitter

2. Output

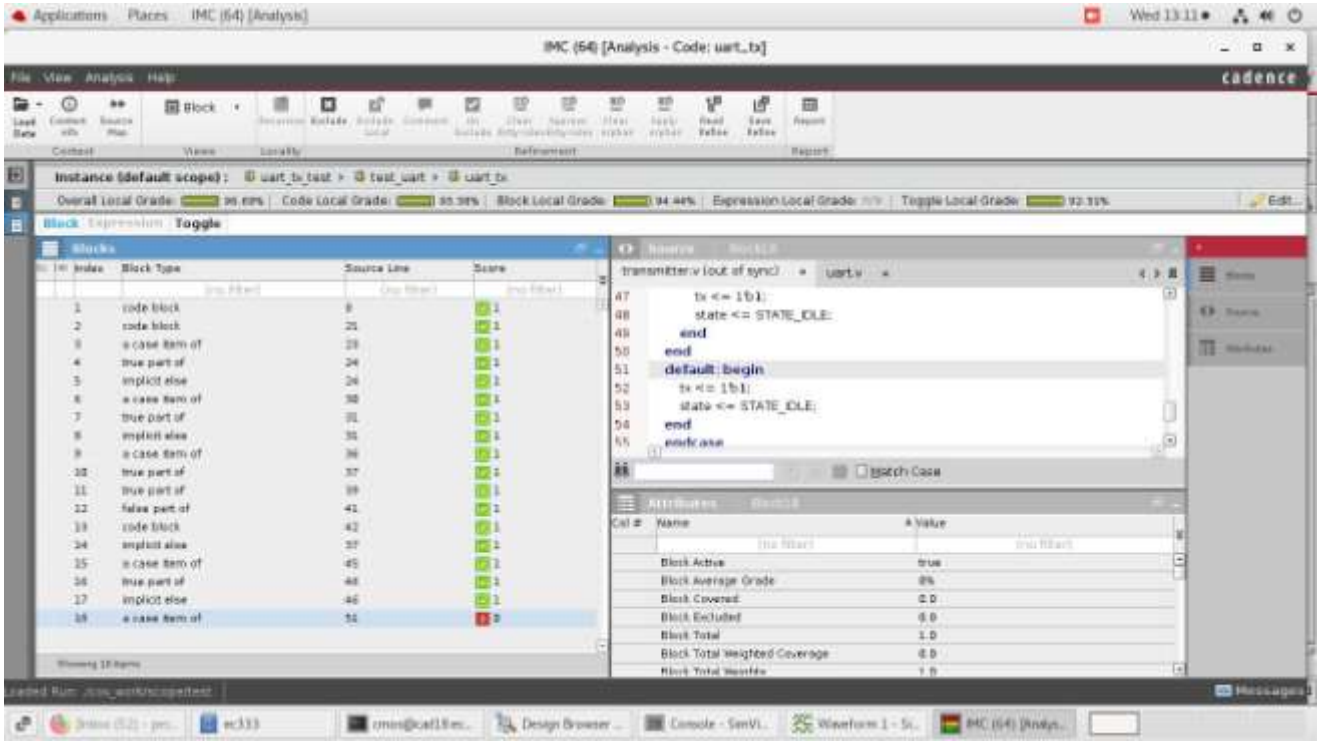
2.1 Simulation Waveform

2.2 Code Coverage

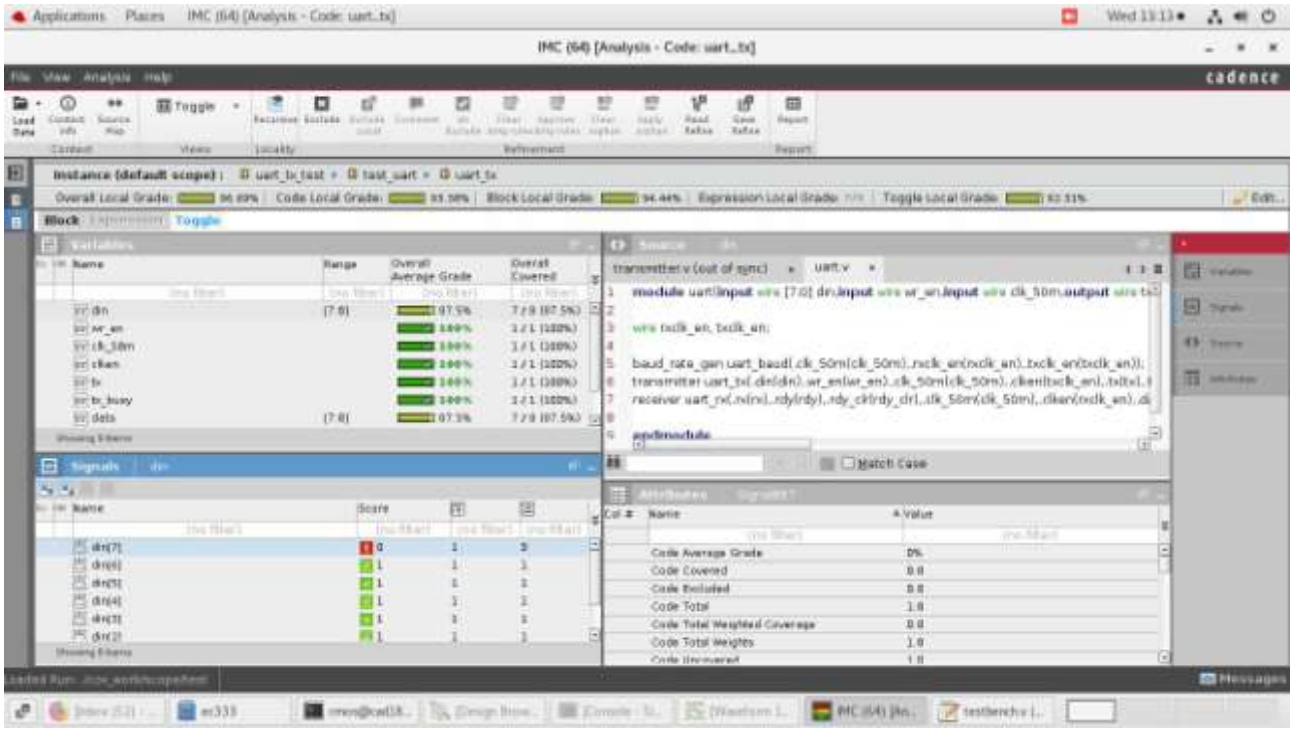


2.3 Transmitter Coverage

Block coverage

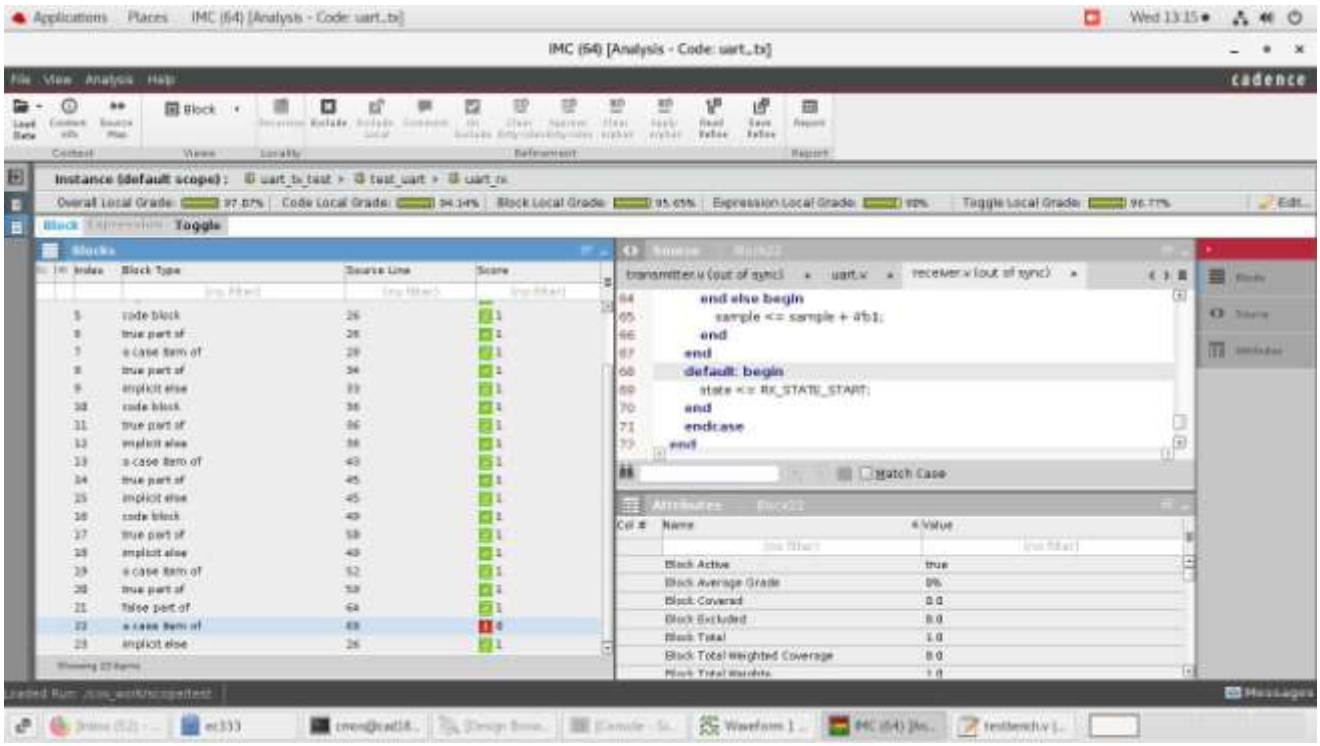


Toggle coverage

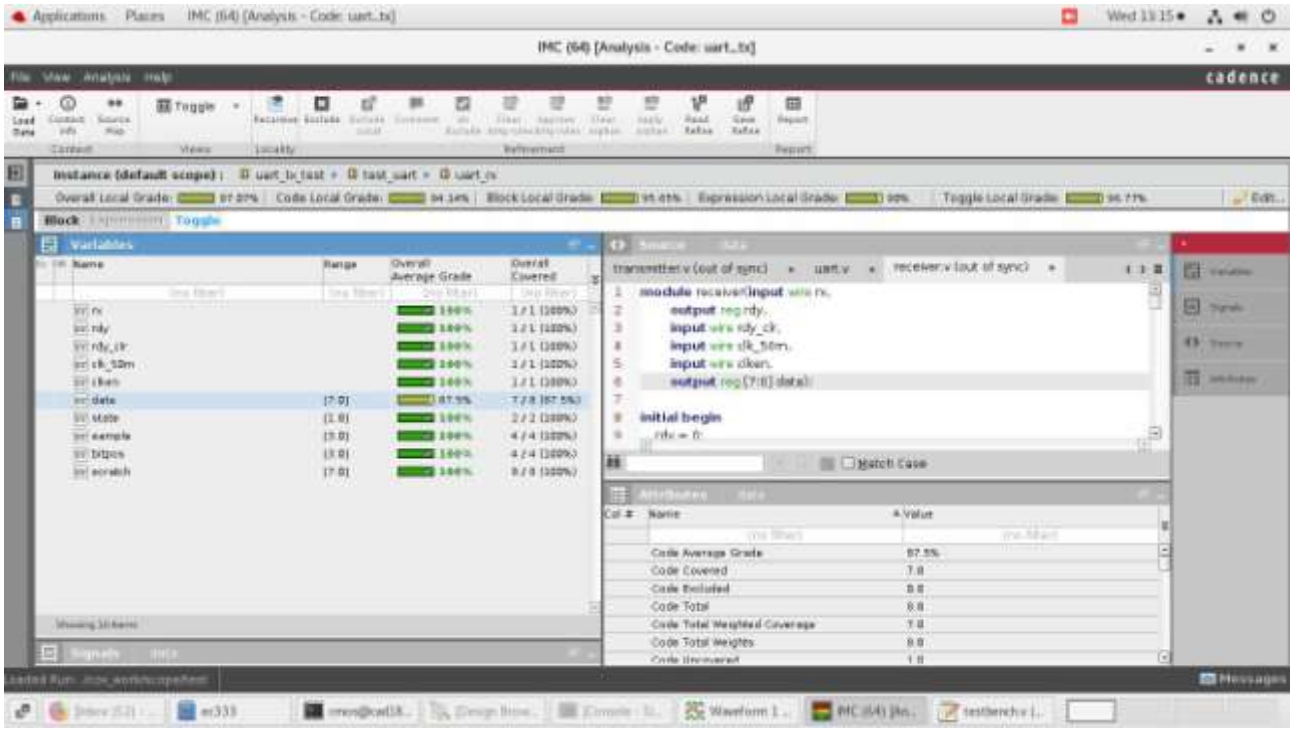


2.4 Receiver Coverage

Block coverage

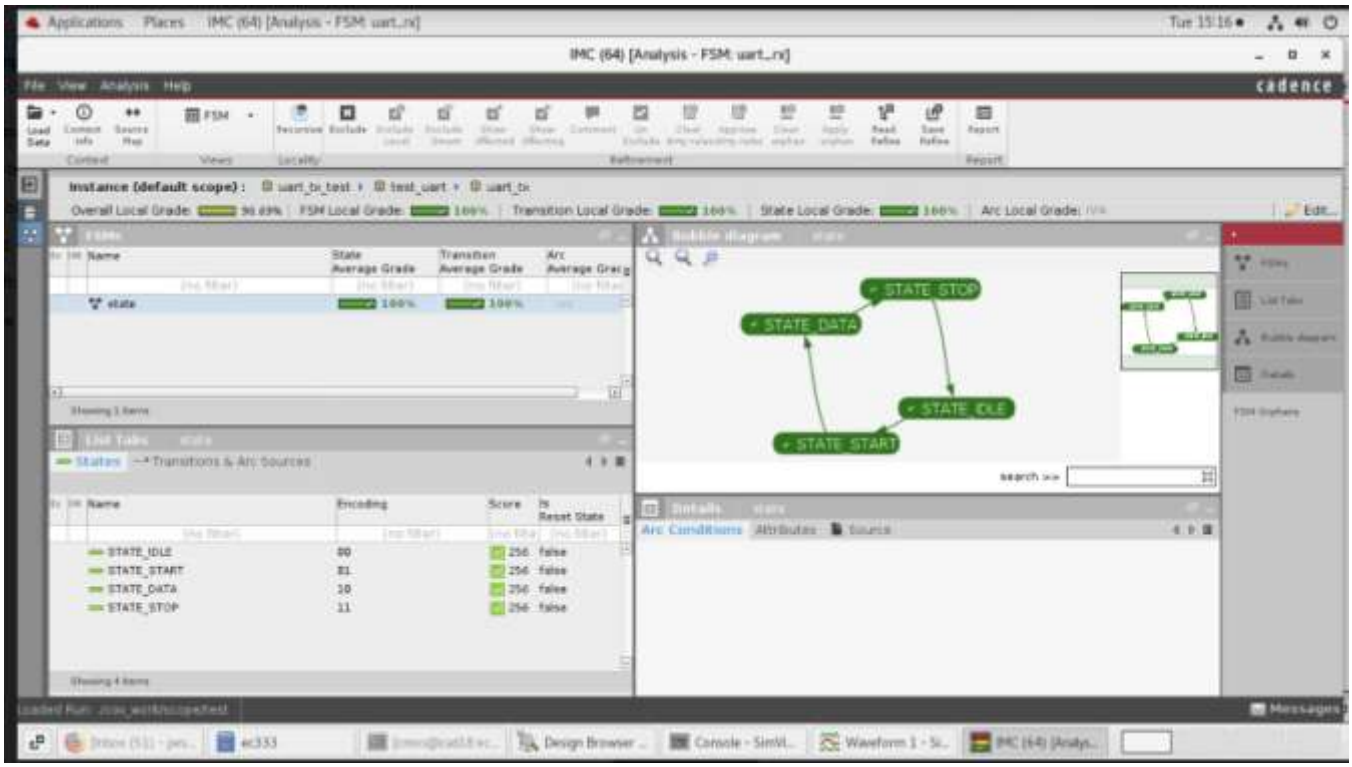


Toggle coverage

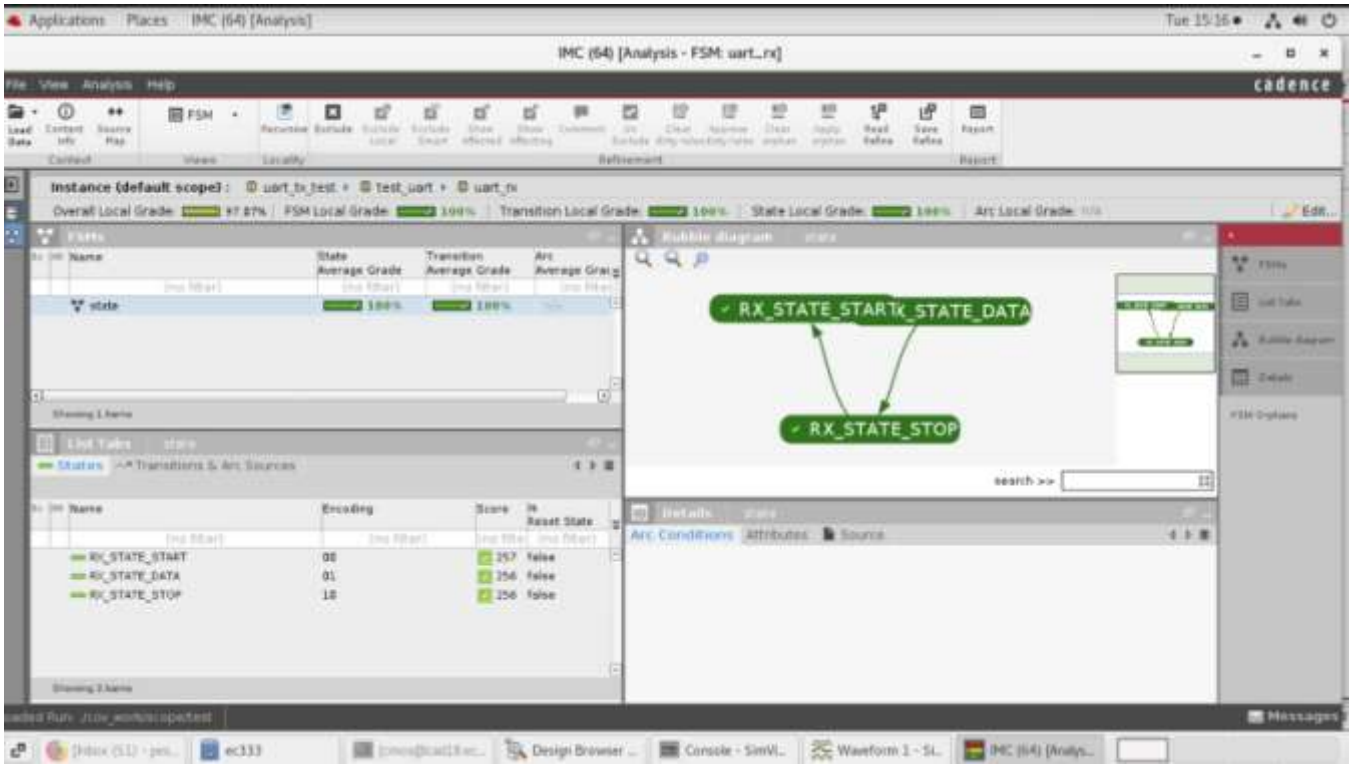


2.5 FSM coverage

Transmitter

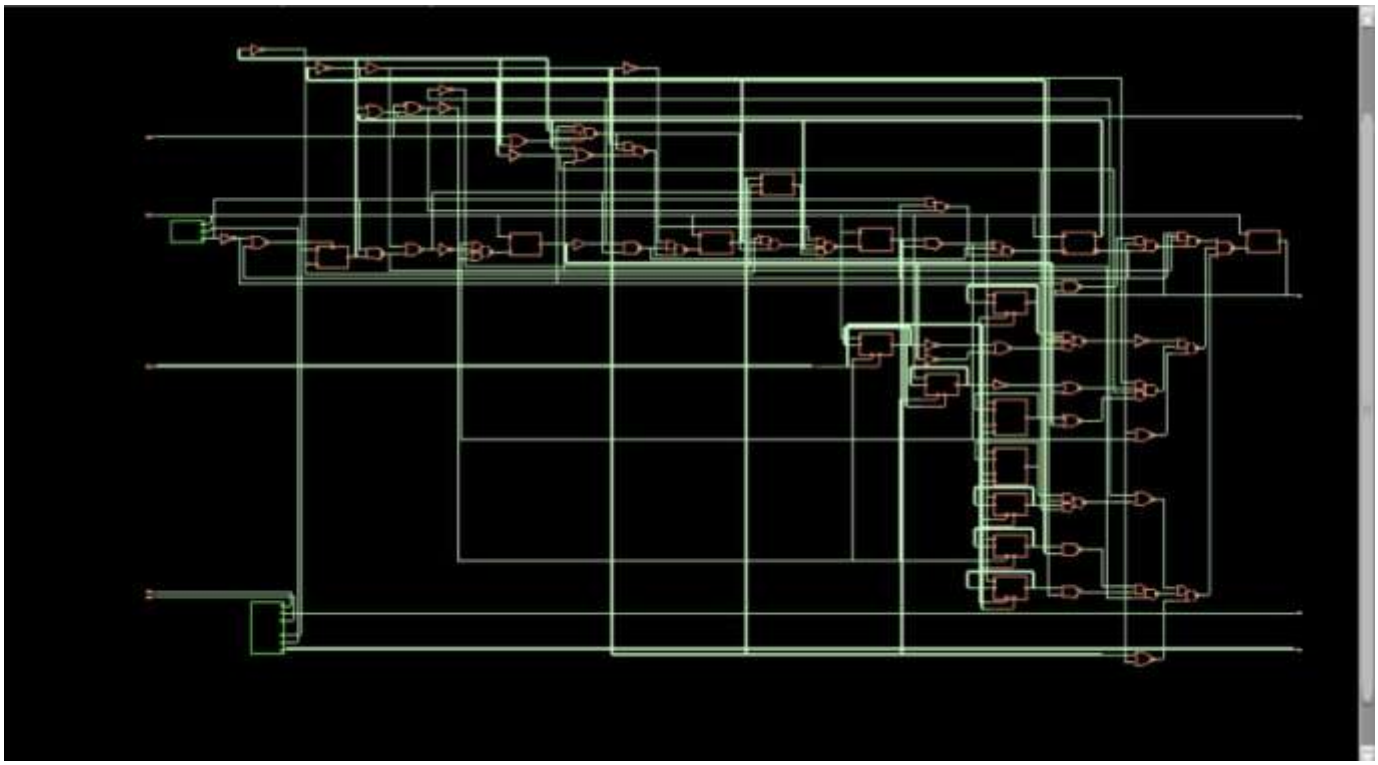


Receiver

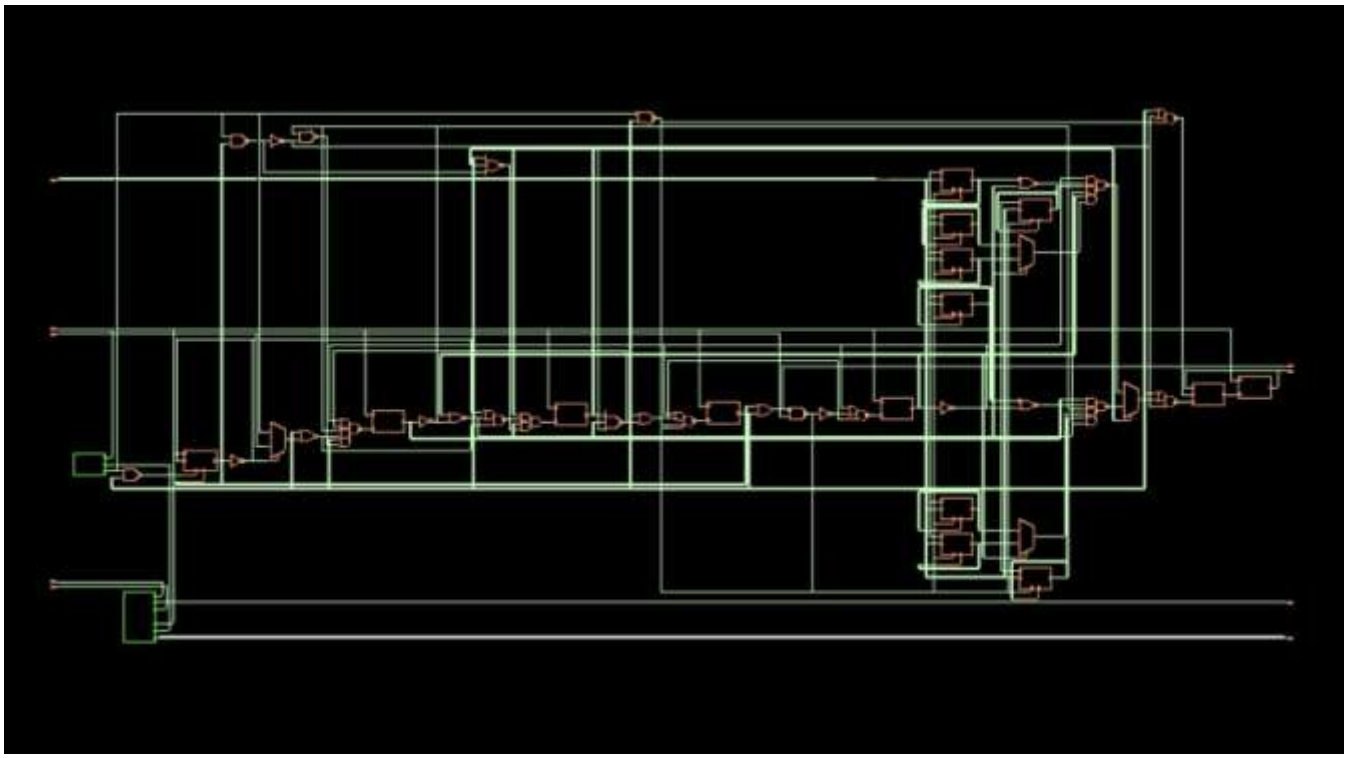


2.6 Schematic

With constraints

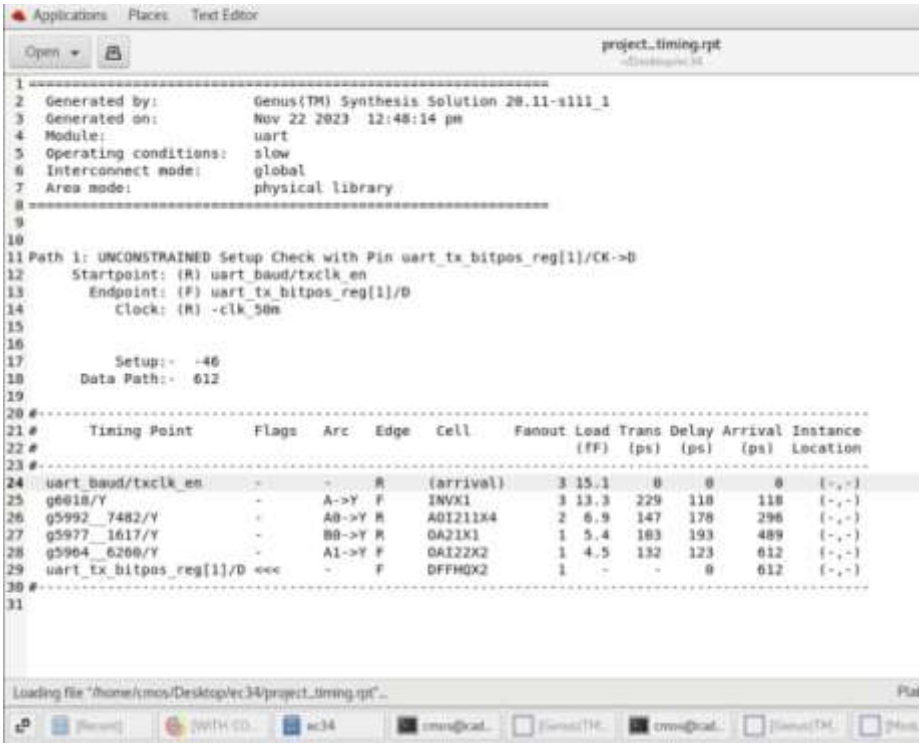


Without constraints

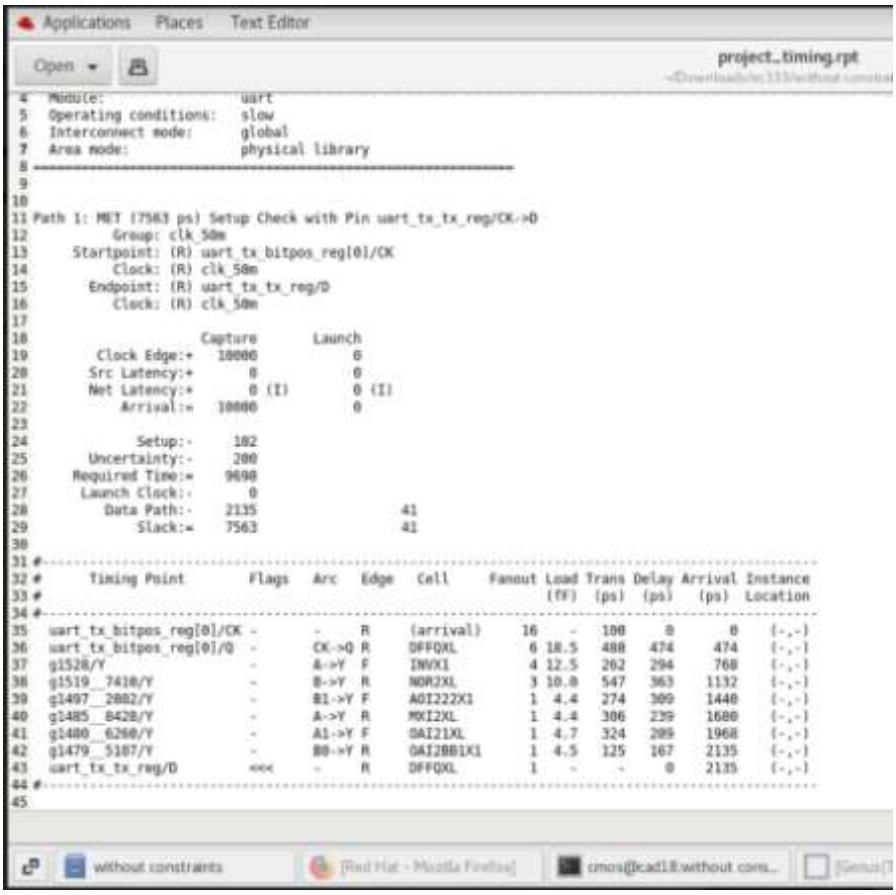


2.7 Timing Analysis

With constraints

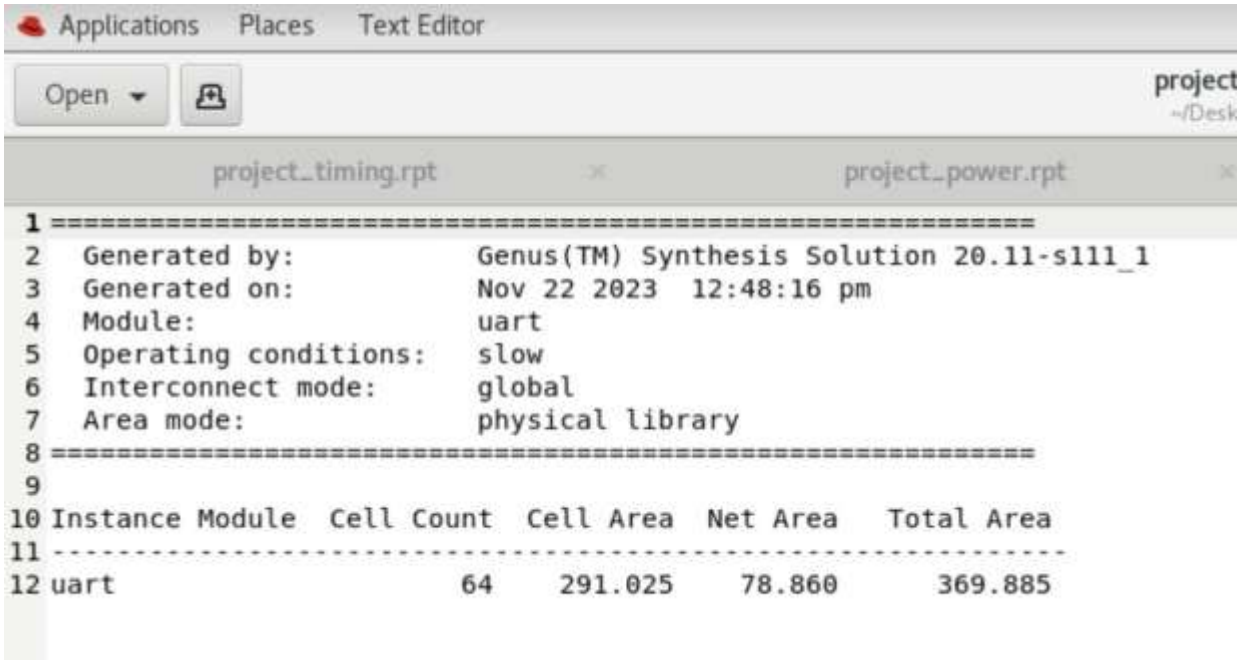


Without constraints

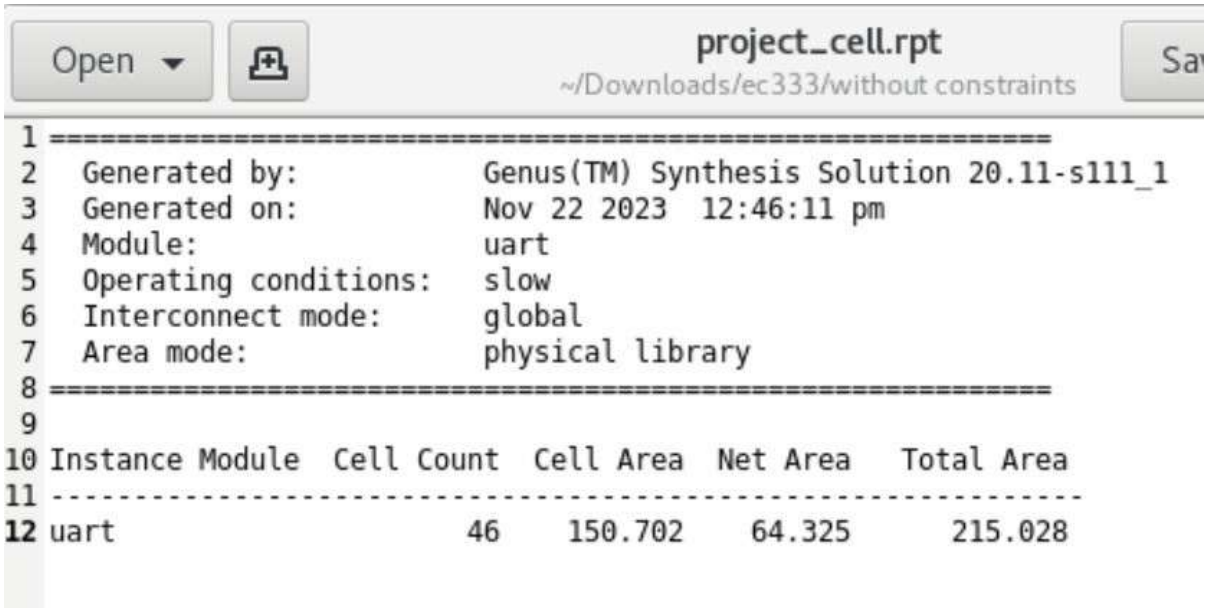


2.8 Area

With constraints



Without constraints



2.9 Power

With constraints

```
Instance: /uart
Power Unit: W
PDB Frames: /stim#0/frame#0
  ------------------------------------------------------------------------
    Category         Leakage     Internal    Switching        Total    Row%
  ------------------------------------------------------------------------
       memory     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
     register     6.14746e-09  2.87771e-05  1.16452e-05  4.04285e-05  51.21%
        latch     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
        logic     1.11052e-08  1.86565e-05  1.97596e-05  3.84272e-05  48.68%
         bbox     0.00000e+00  0.00000e+00  8.86464e-08  8.86464e-08   0.11%
        clock     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
          pad     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
           pm     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
  ------------------------------------------------------------------------
    Subtotal     1.72527e-08  4.74336e-05  3.14935e-05  7.89444e-05 100.00%
  Percentage           0.02%       60.08%       39.89%      100.00% 100.00%
  ------------------------------------------------------------------------
```

Without constraints

```
Instance: /uart
Power Unit: W
PDB Frames: /stim#0/frame#0
  ------------------------------------------------------------------------
    Category         Leakage     Internal    Switching        Total    Row%
  ------------------------------------------------------------------------
       memory     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
     register     3.13093e-09  2.09465e-06  9.18657e-07  3.01644e-06  62.52%
        latch     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
        logic     2.23554e-09  4.93130e-07  1.22407e-06  1.71943e-06  35.64%
         bbox     0.00000e+00  0.00000e+00  8.86464e-08  8.86464e-08   1.84%
        clock     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
          pad     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
           pm     0.00000e+00  0.00000e+00  0.00000e+00  0.00000e+00   0.00%
  ------------------------------------------------------------------------
    Subtotal     5.36647e-09  2.58778e-06  2.23137e-06  4.82452e-06 100.00%
  Percentage           0.11%       53.64%       46.25%      100.00% 100.00%
  ------------------------------------------------------------------------
```

3. Applications of UART

Communication between Microcontrollers and Peripherals:

UART is frequently used for communication between microcontrollers and peripheral devices, such as sensors, actuators, and displays.

Automotive Systems:

- Car Diagnostics (OBD-II): On-board Diagnostics (OBD-II) systems in cars often use UART for communication between the vehicle's computer and diagnostic tools.
- GPS Modules: UART is commonly used in communication between GPS modules and the vehicle's navigation system.

Wireless Communication Modules:

UART is often employed in wireless communication modules, such as Bluetooth and Zigbee, to enable communication between devices.

4. Conclusion

In summary, UART's simplicity, versatility, and reliability make it a foundational element in electronic communication.

As technology advances, UART continues to play a crucial role in connecting and facilitating communication between diverse electronic devices in a multitude of applications.