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Implementation of software-based 2X2 MIMO LTE base station system using GPU

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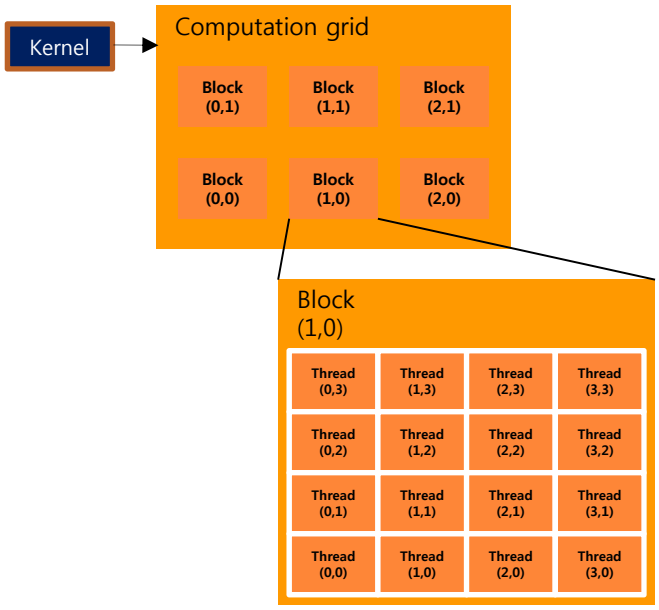
Contents

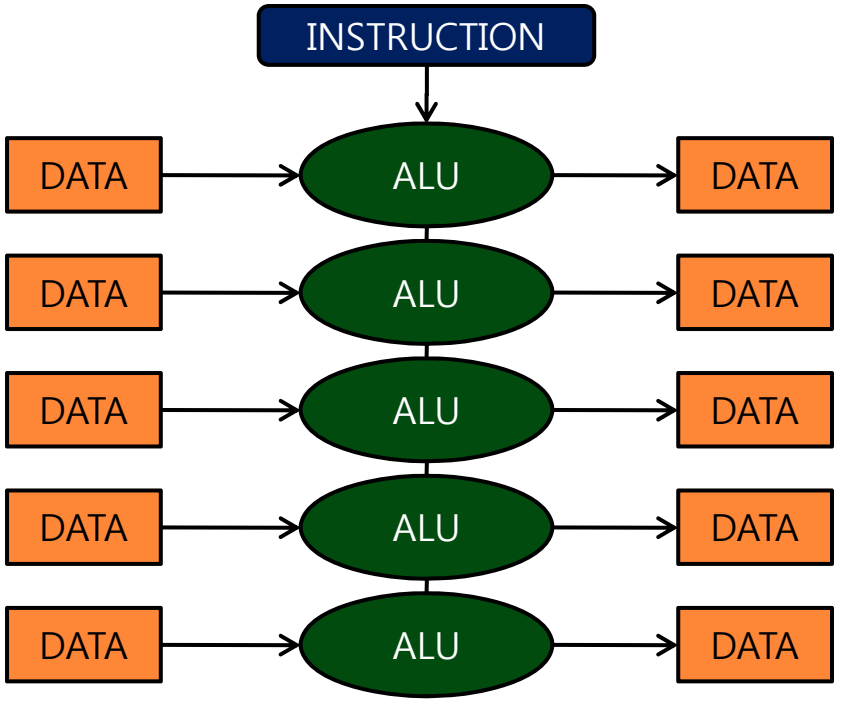
1. Introduction of GPU

Introduction of GPU – *Structure of GPU*

- Graphics Processing Unit (GPU)
- Single Instruction Multiple Data(SIMD)
- The GPU is massively parallel processor
- Kernel



Structure of CUDA Memory

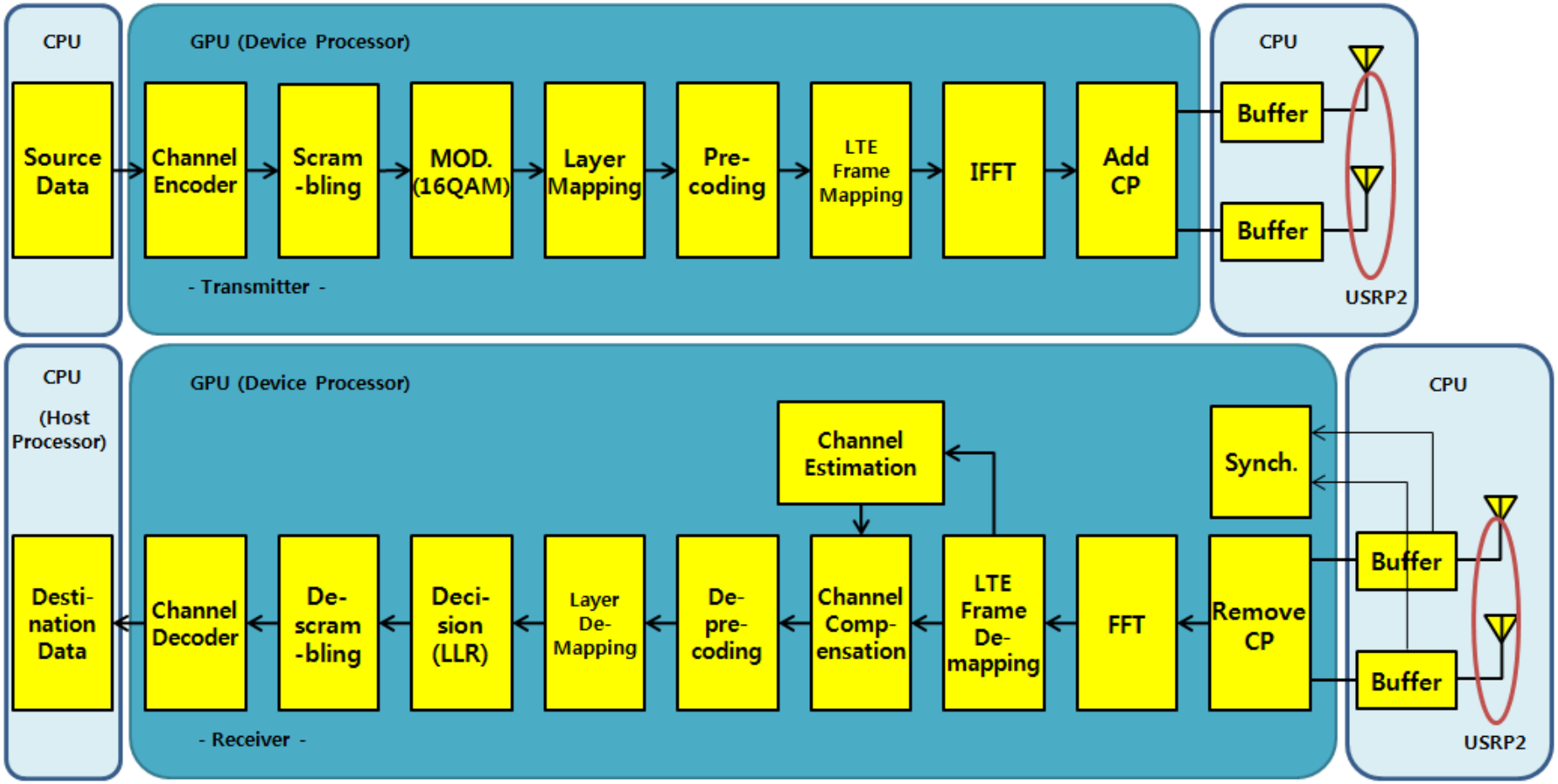


SIMD processor architecture

2. Proposed System

Proposed System – *2x2 SM MIMO LTE system*

- **Block diagram of 2x2 SM MIMO LTE Downlink system**
- **The parallelization of signal processing algorithms appropriately for the SIMD architecture -** To use GPU and CPU resources effectively



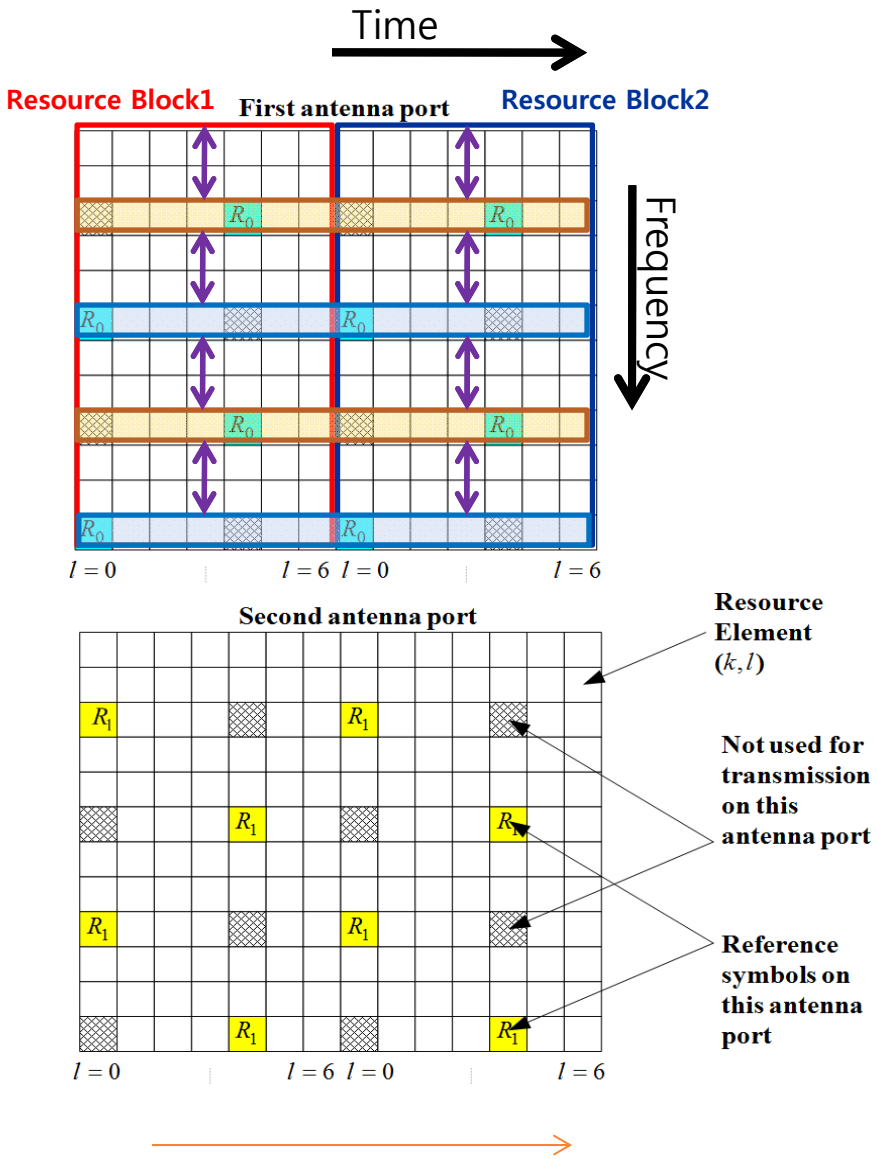
Proposed System – *Implementation of Scrambling*

- **Bit Scrambling – To avoid burst error that can happen during the procedure of data transmission**
- **Transmit bit :** $b(i)$
- **Scrambling bit :** $c(i)$

  31-bit long Pseudo-random sequence
- **10 threads for the 10 sub-frames such that 10 operations can be performed with a single instruction.**

$$\tilde{b}(i) = \big(b(i) + c(i)\big) \bmod 2$$

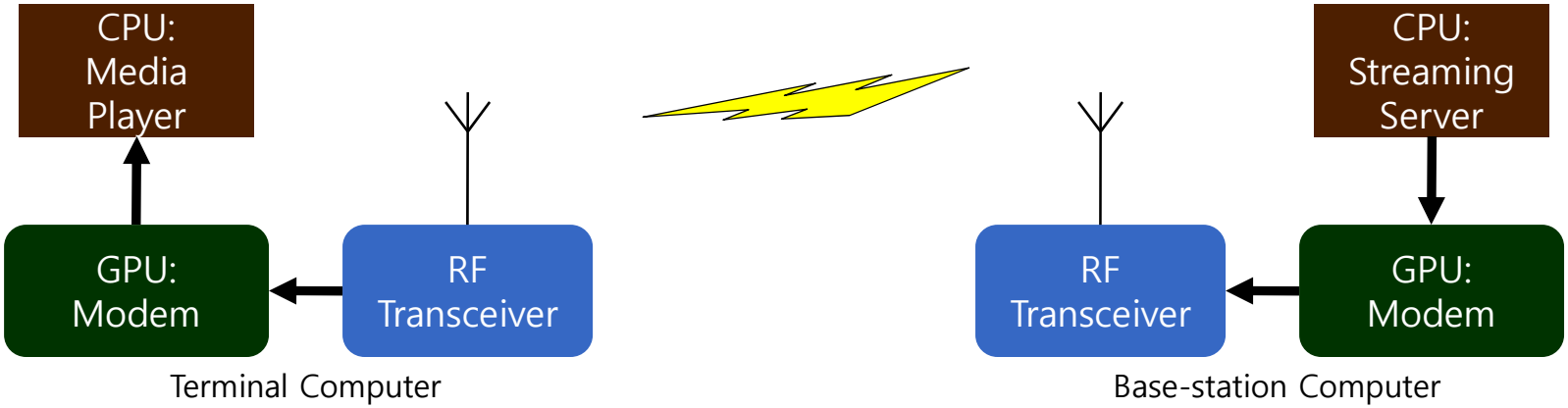
Proposed System – *Implementation of Channel Estimation*

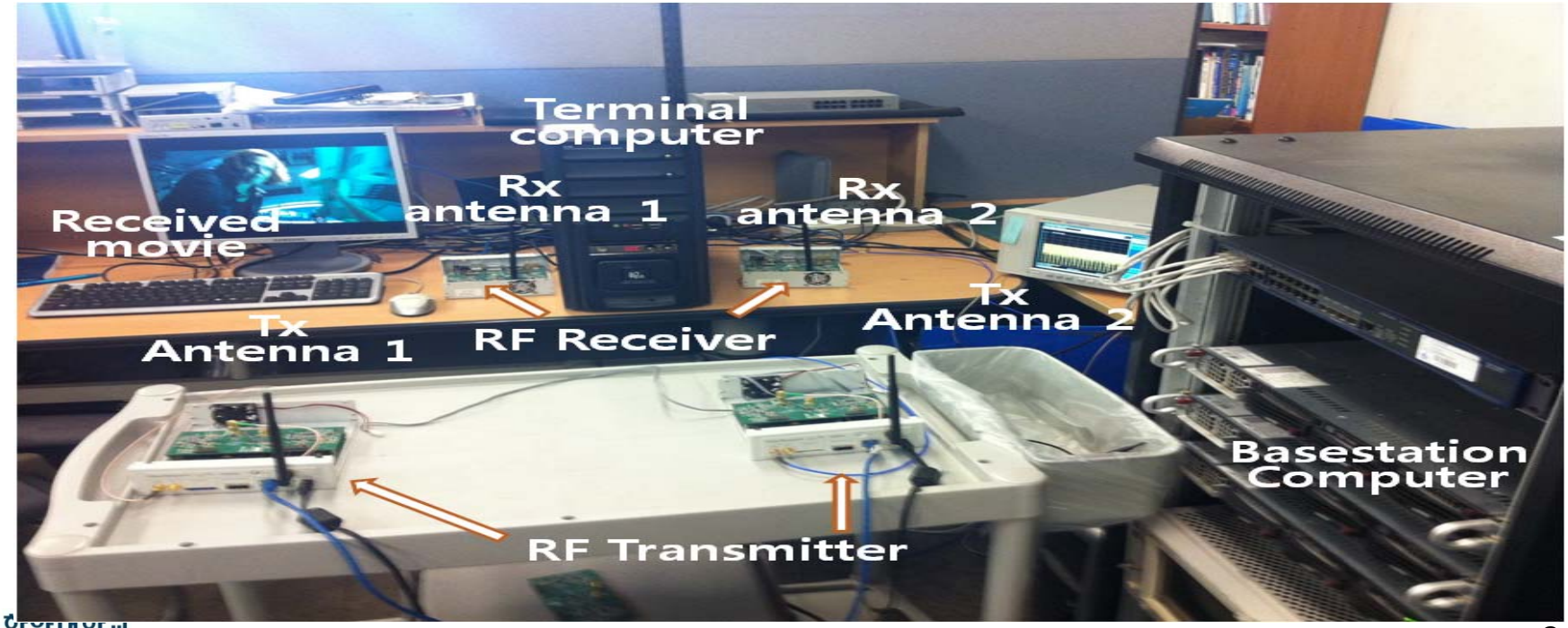


- **2D linear interpolation using 8 reference symbols existing in 2 resource blocks**
- **Linear interpolation is performed along the time axis using the reference signals (3^{rd} , 9^{th} / 6^{th} , 12^{th})**
- **The frequency axis using the channel estimation obtained by the time-axis interpolation**
- **500 parallel operations which consists of 10 CUDA Blocks along the horizontal axis and 50 CUDA Blocks along the vertical axis.**

Mapping of downlink reference signals

Proposed System – *Implemented System*

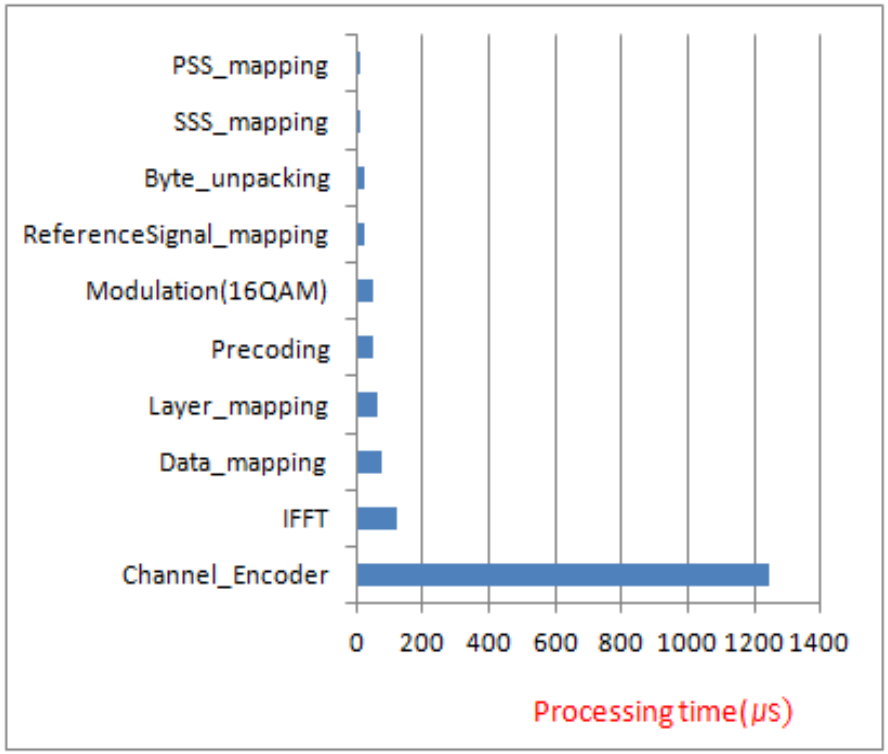




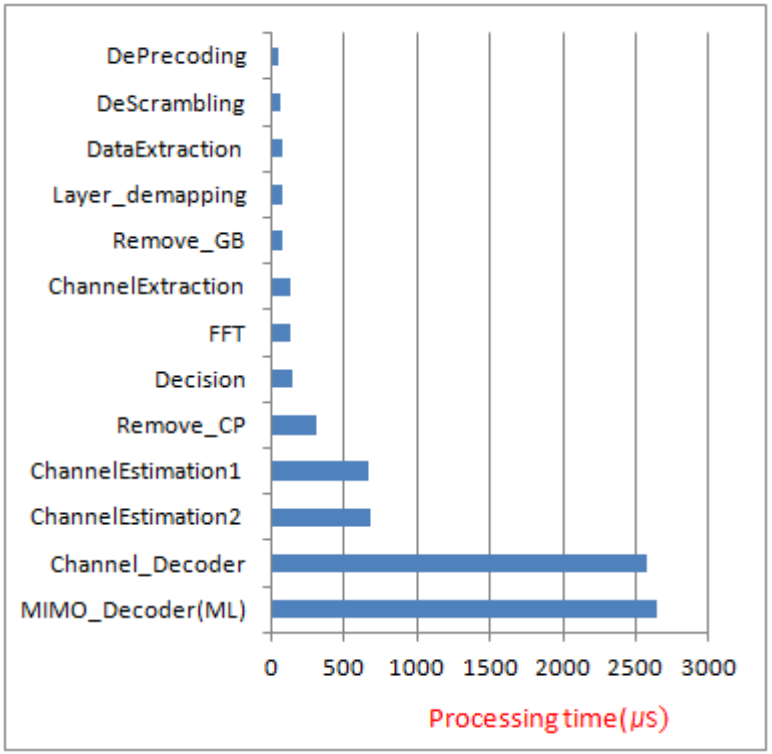
3. Performance Evaluation

Performance Analysis – *Computation Time*

- **Profiler provided by NVIDIA**



Transmitter



Receiver

Performance Analysis – *Computation Time*

- **Specifications of LTE : 1 frame = 10ms**
- **Enough for the real time processing.**

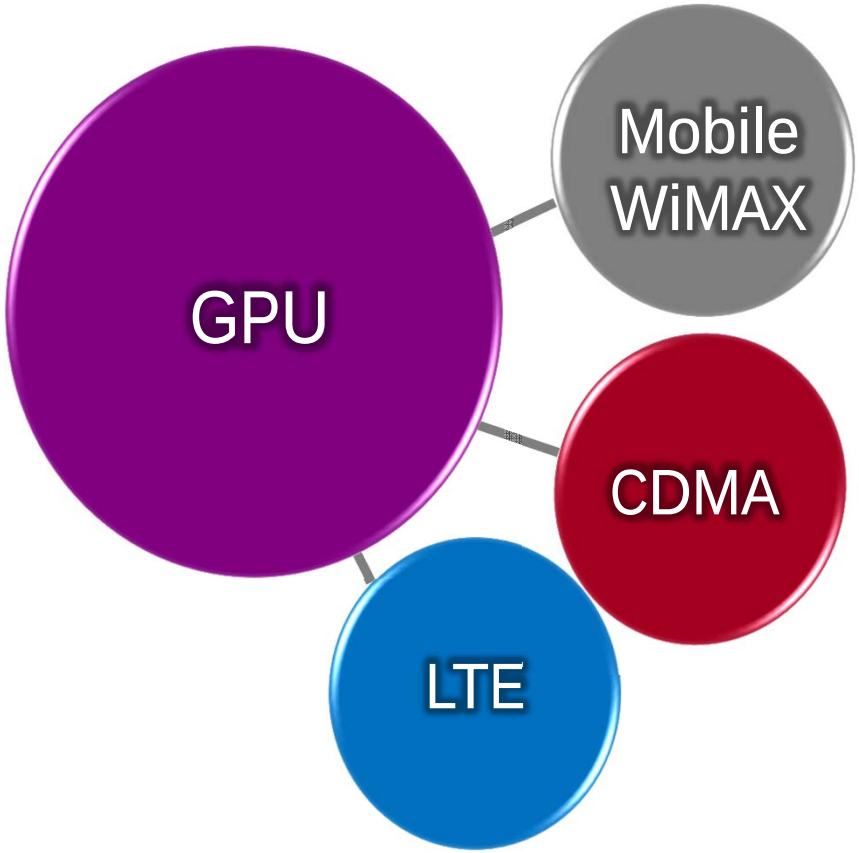
	GPU Processing time
Transmitter	4199.332 μs
Receiver	7617.342 μs

GPU Processing time for 1 frame

5. Conclusion

Conclusion

- GPU can be a solution because of its powerful computation capacity
- Also with the GPU, wireless communication systems can be implemented effectively for SDR.
- GPU can operate all waveform effectively.



Q / A

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