Hardware-Software Co-Simulation Environment for a Multiplier Free Blocker Detection Approach for LTE Systems

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Outline

- Introduction
  - Analog and digital front ends of the user equipment
  - Blocker environment – worst case and relaxed
  - Power on demand receiver
- Co-simulation verification environment – efficient hardware implementation
  - Co-simulation verification principle
  - Hardware testbed
- Conclusion and future work

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Introduction – Main Idea

- Problem
  - LTE UEs waste energy
- Reason
  - Analog and digital front ends are over engineered as per the worst case 3GPP LTE standards
- Possible solution
  - Relaxing the front ends when the spectral environment is not so bad
  - Therefore it saves energy
- Possible approach
  - Reconfiguring the front ends by sensing the actual spectral environment
  - Using low complex filter bank based on a dyadic structure

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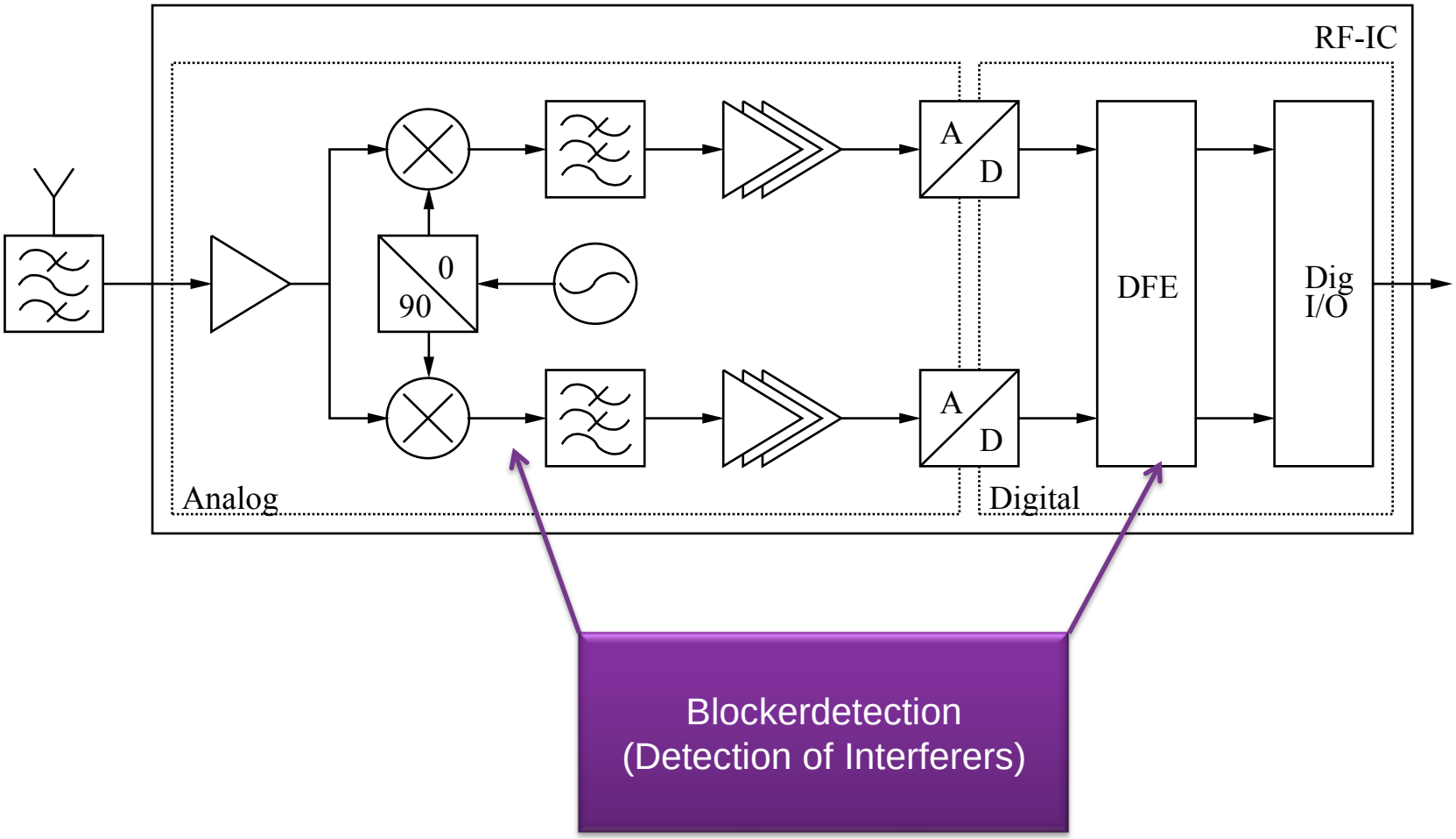
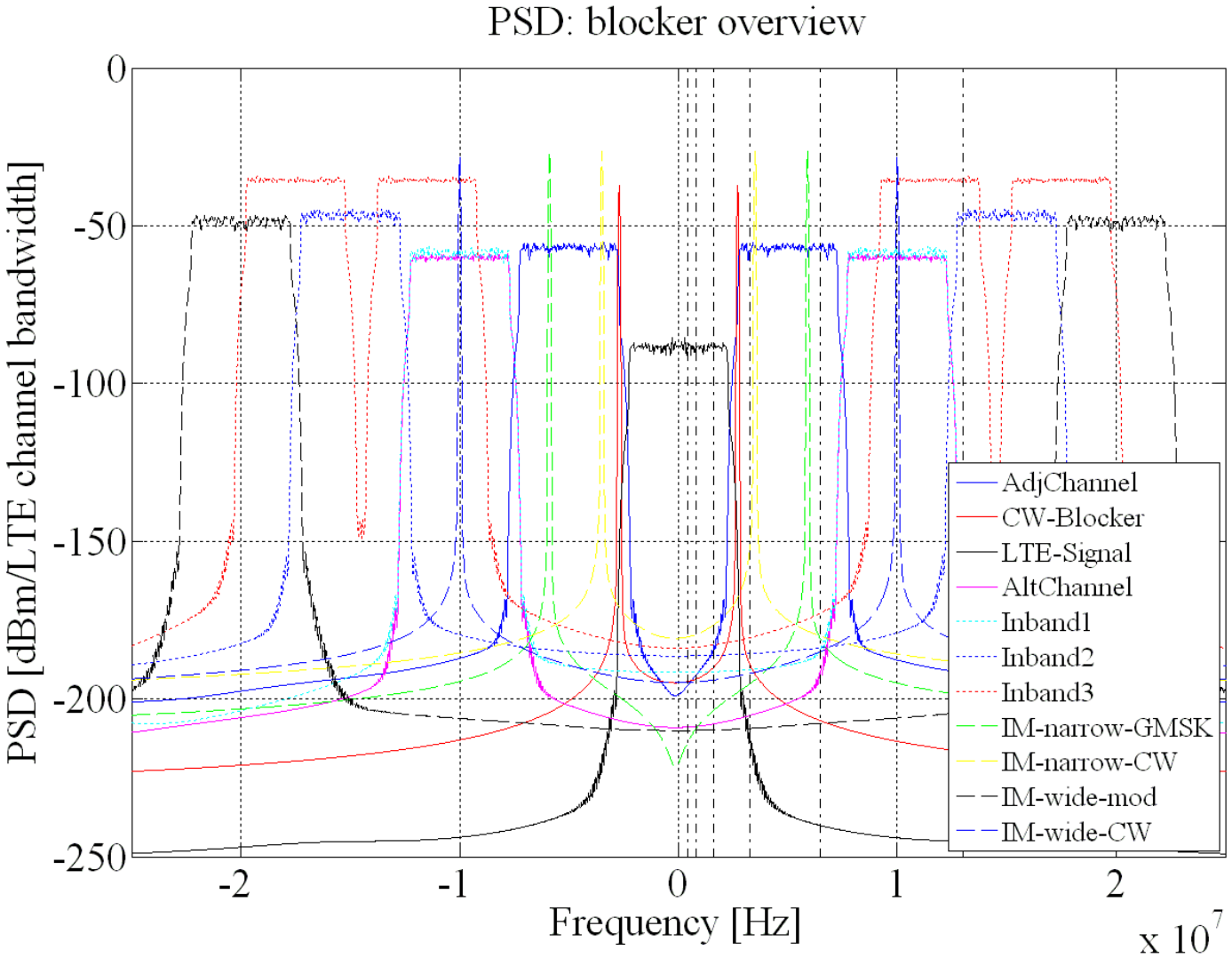
Frontends of a UE



Worst case scenario
according to 3GPP standard



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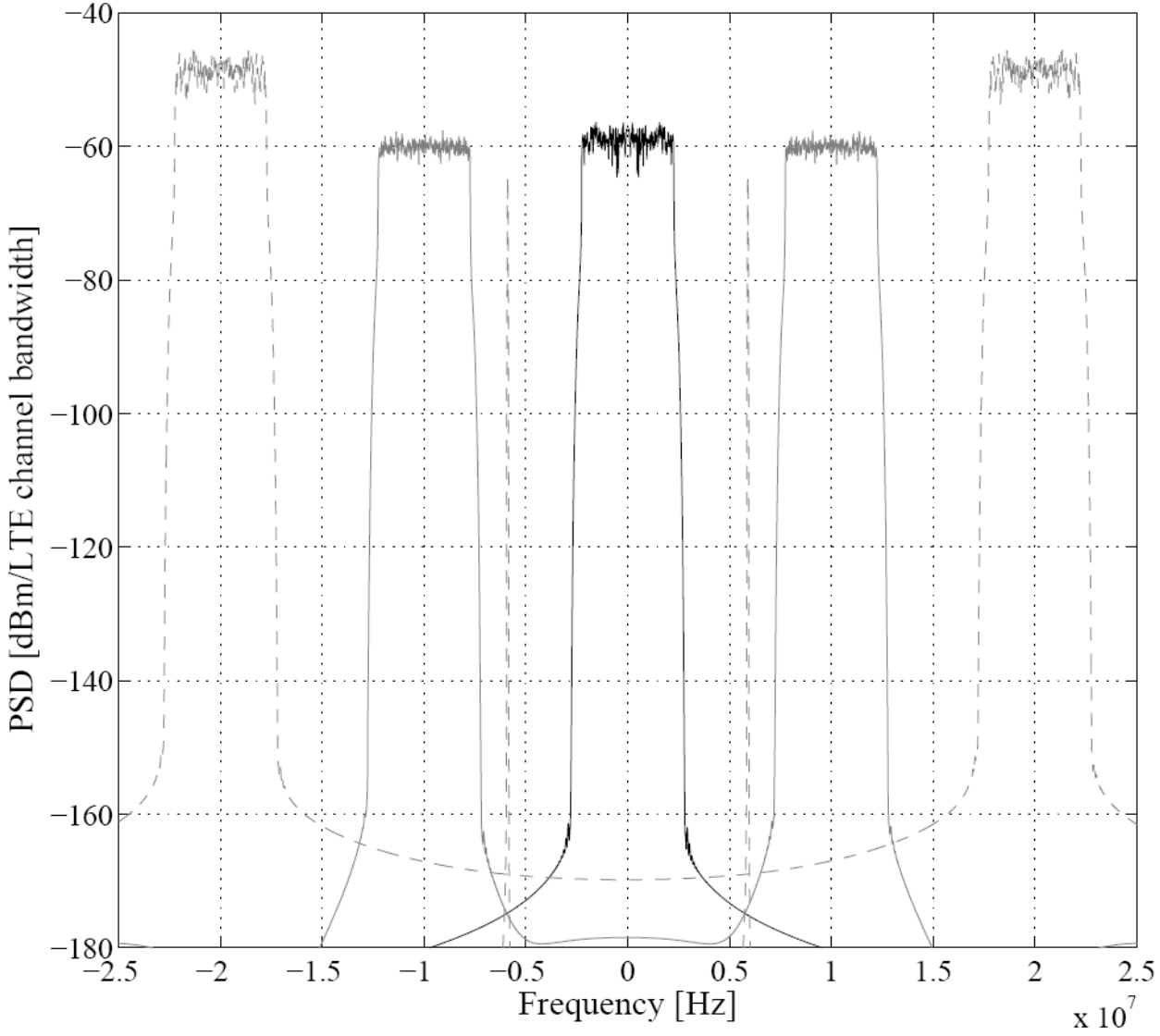
Relaxed blocker environment



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Power on demand receiver

- Full performance mode (worst case)
  - Highly linear amplifiers
  - Filters with steep slopes
  - High dynamic range for ADCs
  - Leading to high power consumption

- Relaxed mode (typical case)
  - The performance of the receiver relaxed
  - Leading to saving in energy

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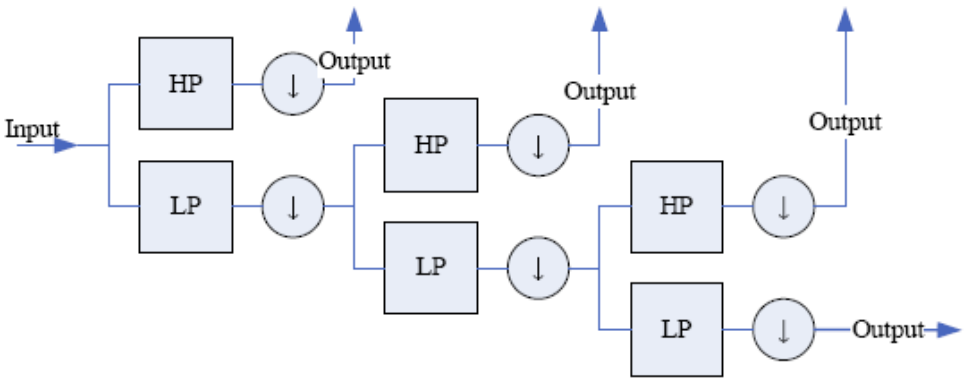
Desired: Blocker Detection Unit

- Blocker Detection Unit with (desired)
  - minimum complexity (computationally -> power consumption)
  - minimum cost (chip area)
  - maximum blocker detection accuracy

- Chosen approach
  - filter bank based spectrum sensing chain
  - Based on dyadic filter



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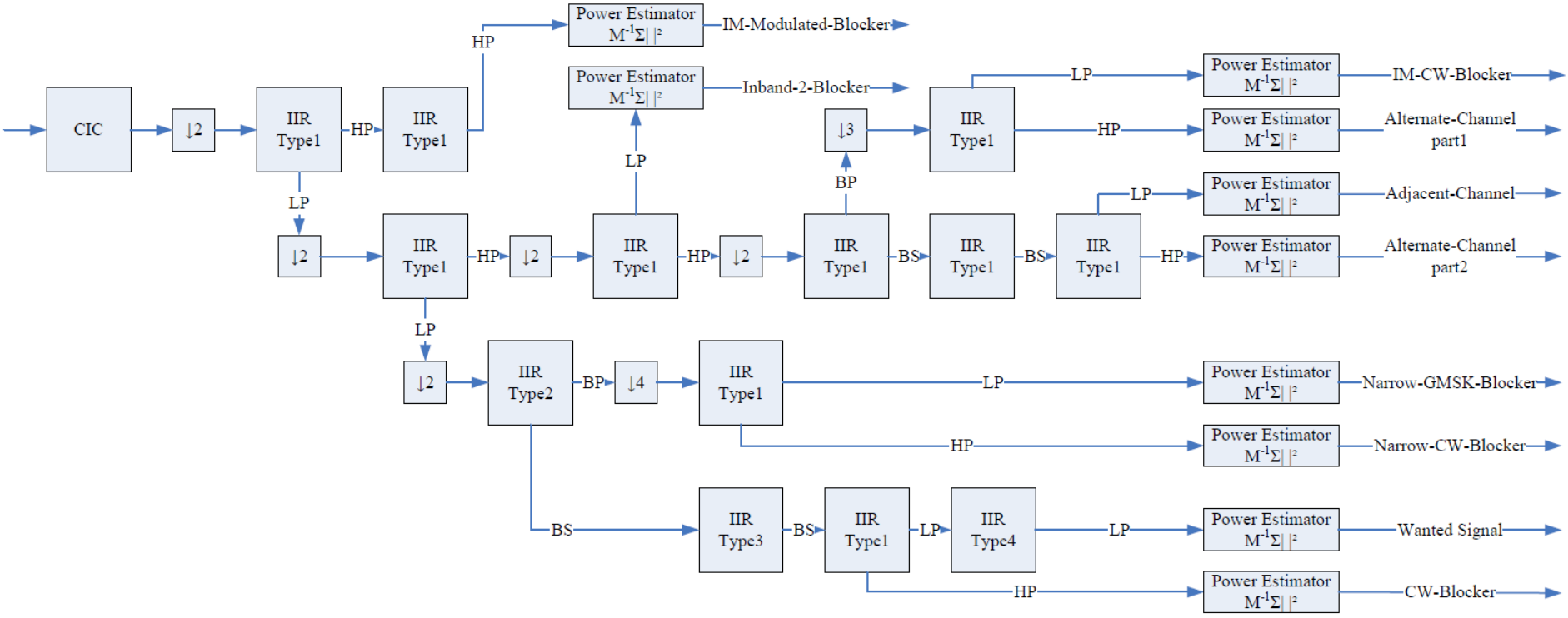
Example chain for 20MHz testcase



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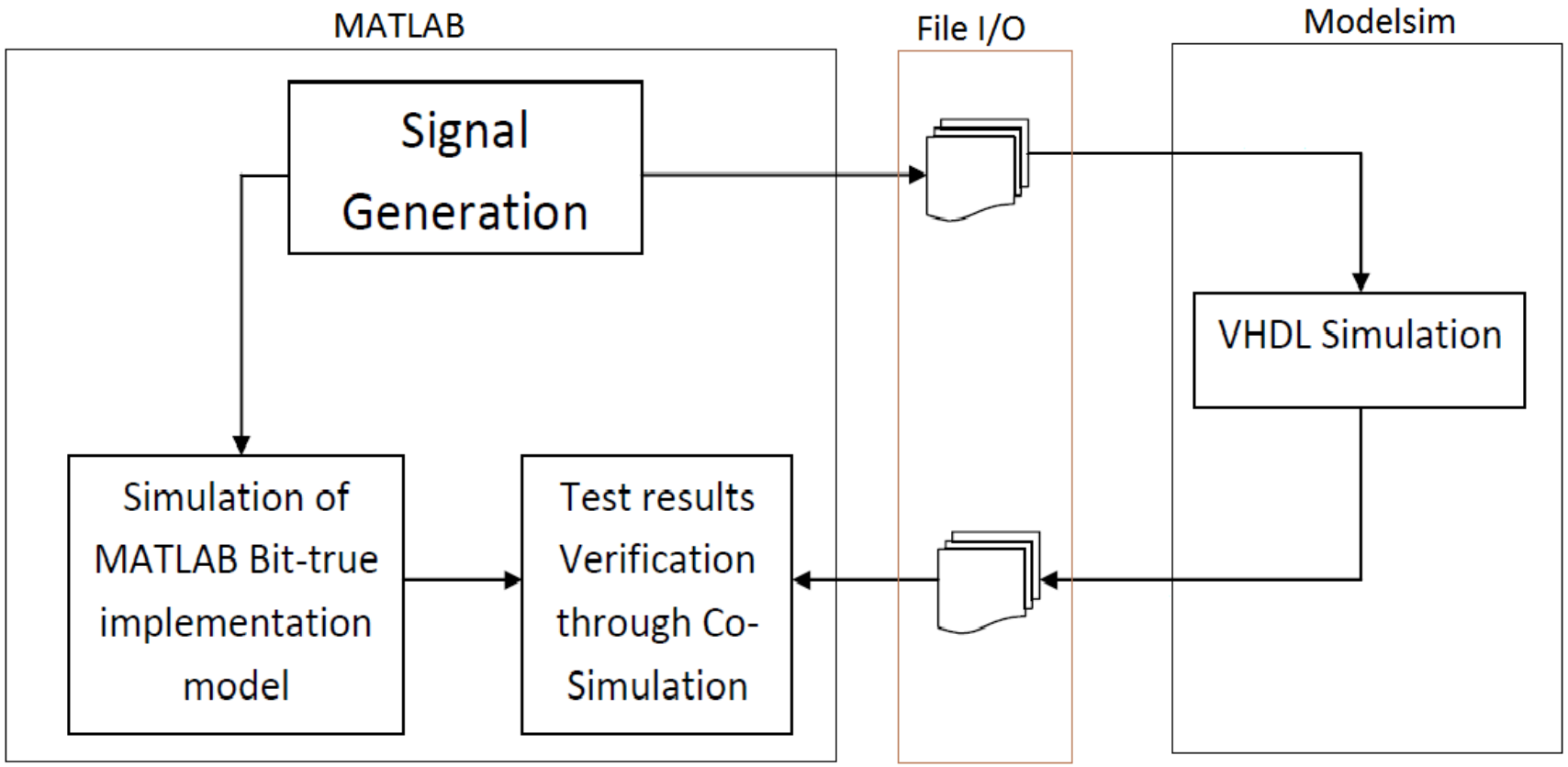
Co-Simulation Verification Principle



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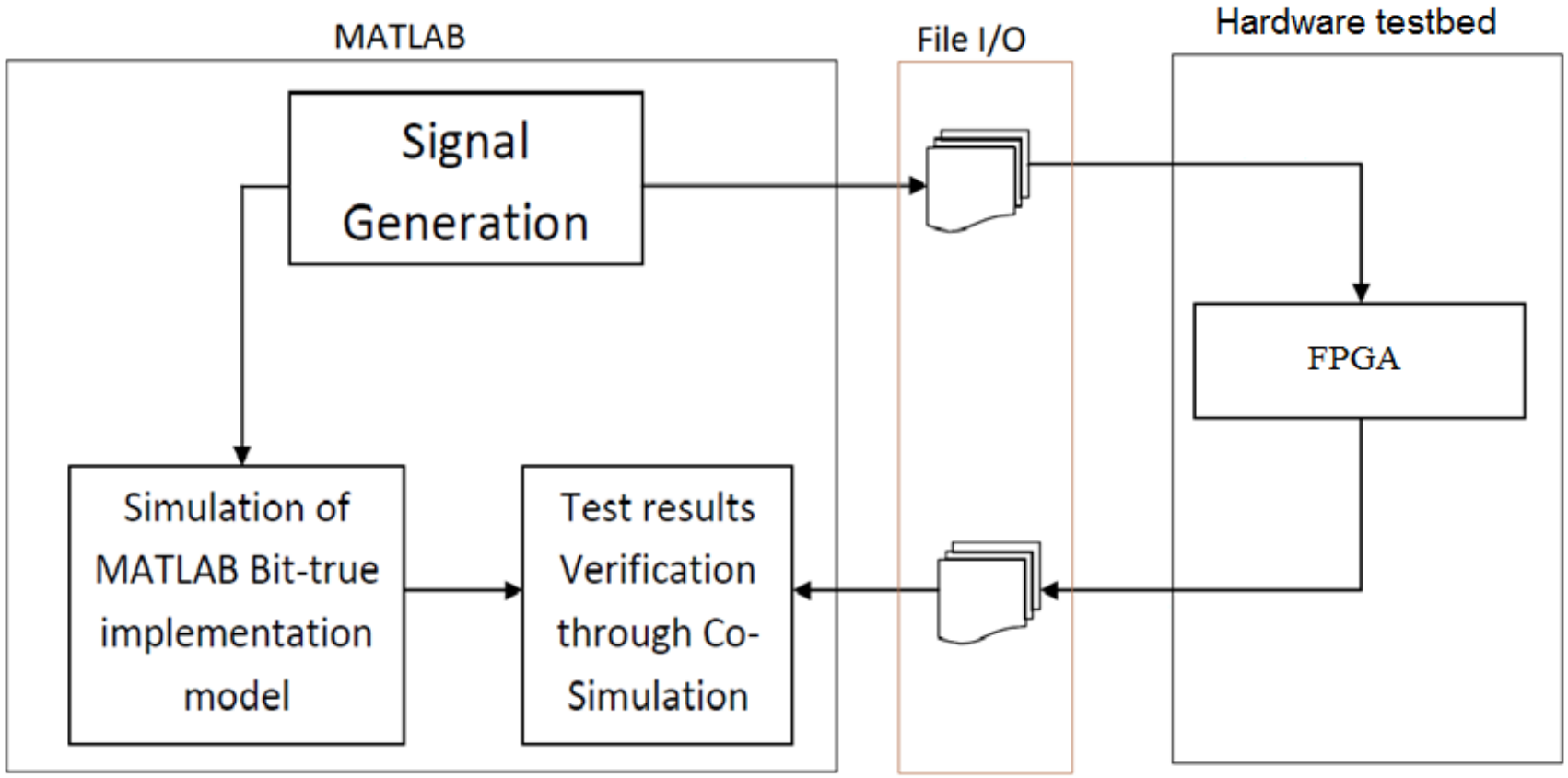
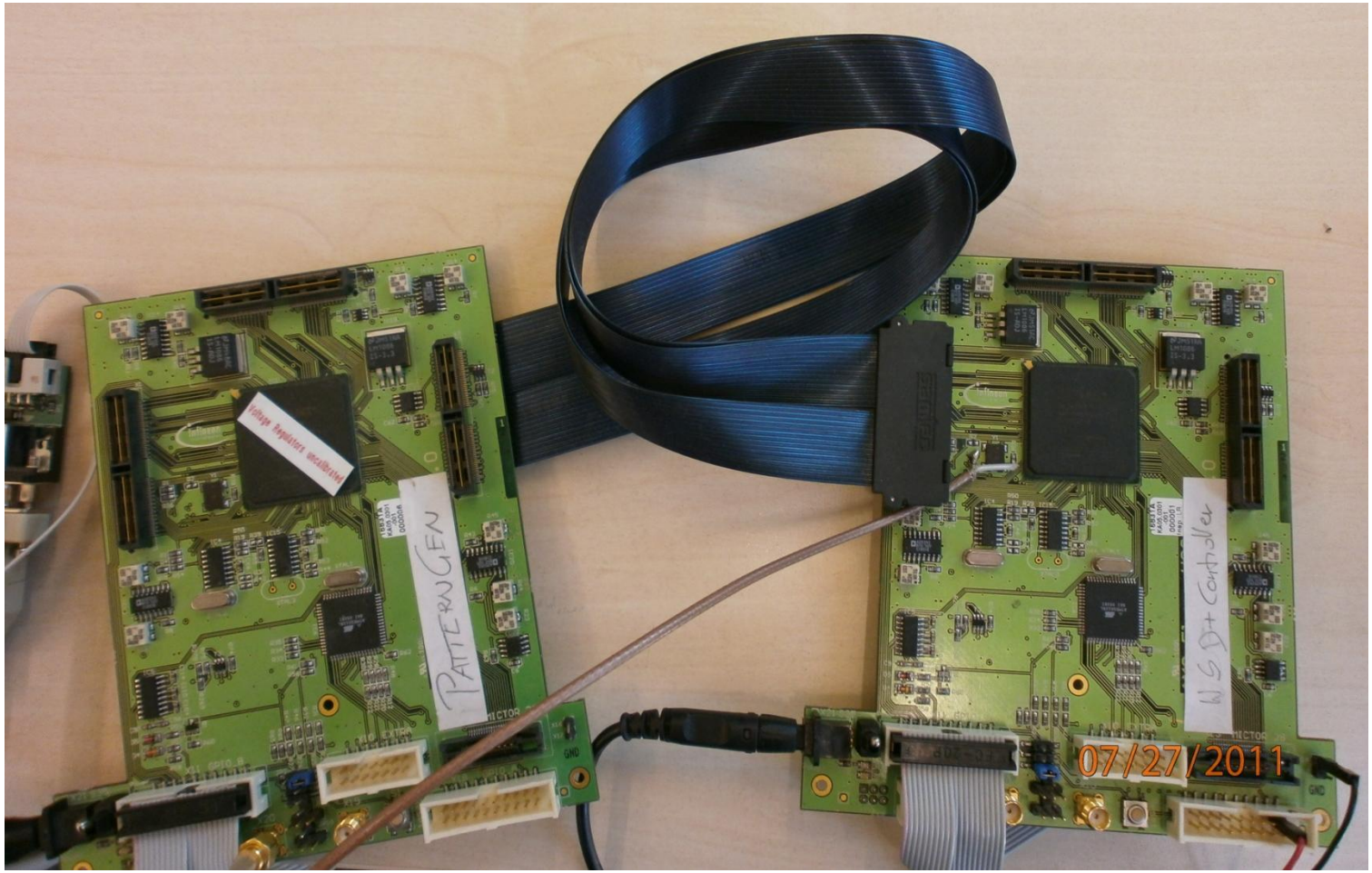
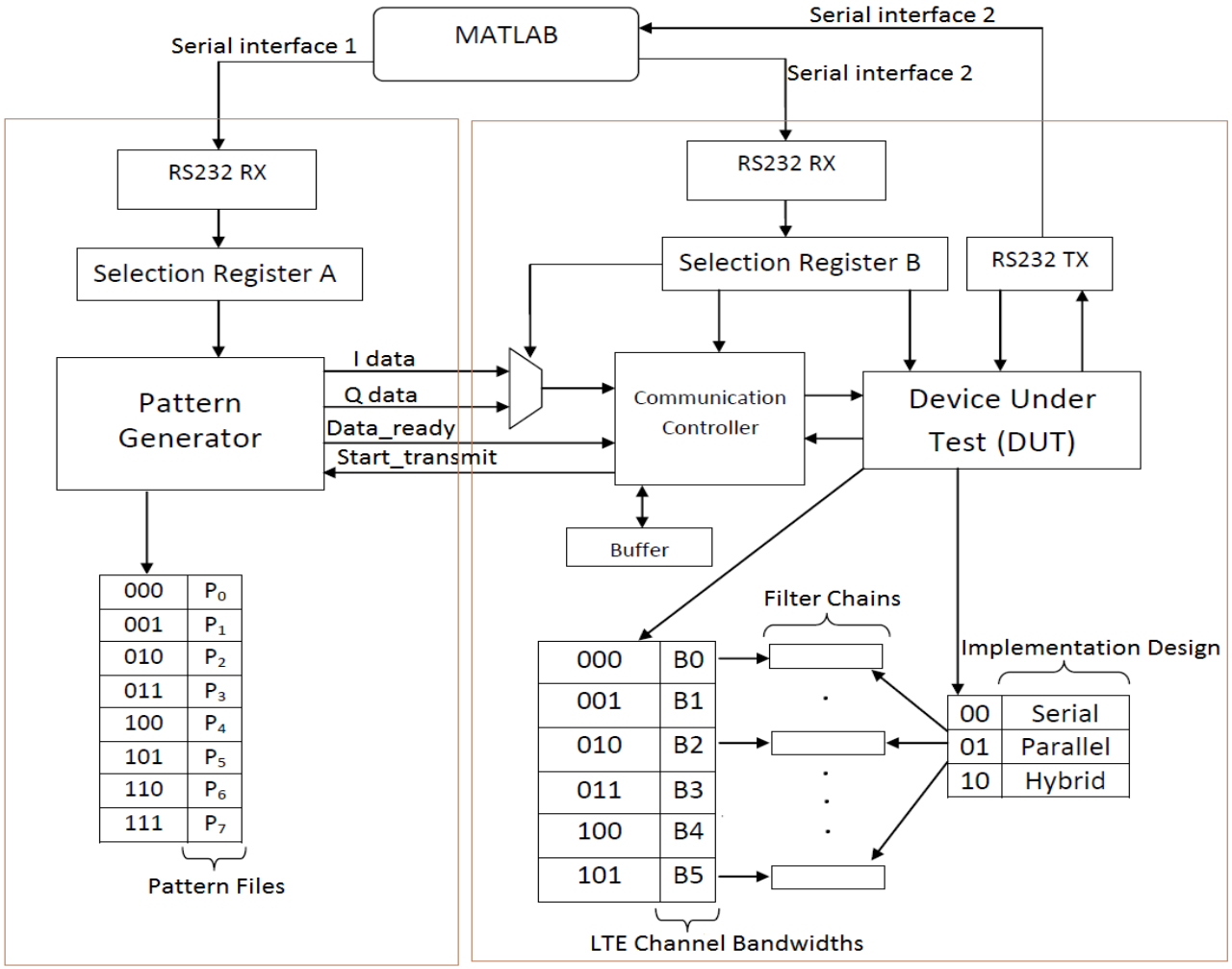
Hardware-Software Co-Simulation Verification Principle



Hardware set-up used



Hardware test bed for the verifcation



Conclusion

- Hardware-Software co-simulation environment presented
- Used for the verification of the multiplier free blocker detection approach for LTE sytems
- Efficient evaluation of the blocker detection unit is made possible
- Future work
  - Complexity estimation
  - Power consumption estimation
  - Prototype test on a test chip

Thank you!

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