

# **UWB Wave Radio**

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### Outline

- Previous architectures of Six-port Modulator/Demodulator
- New architecture of Six-port Modulator/Demodulator
- Simulated test bench
  - Monocycle pulse generator
  - Six-port Modulator/Demodulator
  - QPSK data generator
  - Power detectors
  - Detection
- System Parameters
- Results
- Conclusion

Modulator/Demodulator Architectures

Previous Six-port

• Modulator/Demodulator architectures based on Power Dividers(D), Hybrid Couplers(Q) and a Phase Shifter( )



### New Modulator/Demodulator

### **Architecture**

• New modulator/demodulator architecture based on Power Dividers(PD), Power Combiners(PC) and Phase Shifters(PS)



Poly-Grames Research Center- École Polytechnique de Montreal

#### Test Bench of UWB Wave Radio System

#### • Simulation with ADS



#### Monocycle Pulse Generator

• Following UWB standard (BW<sub>min</sub>=500MHz)

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# • Composed of: PD, PC, TL(Tx lines) and PS



#### **QPSK** Data Generator

• Generates 2 independent data streams: In-phase and Quadrature



#### **Power Detectors**

• Mathematical expression that reflects the RF power detector operation





#### • De-mapping from power levels to modulation states



### System Parameters

Parameter	Value
Generator Pulse Shape	Gaussian Monocycle
Bandwidth	1 GHz (3.0-4.0 GHz)
Carrier Frequency $(f_c)$	3.5 GHz
Data rate	20Mbps
Modulation Type	QPSK
Channel Model	AWGN



• Monocycle Pulse Generator



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• Modulator output for a single tone input for different modulation states



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• Demodulator output for a specific modulation state with a single tone input



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## • Power detection of UWB wave radio system for a specific modulation state



#### • BER for Six-port UWB demodulator



#### • Six-port modulation states table

Modulation State	Port 3	Port4	Port 5	Port 6	Δ	Ι	Q
0	Ο	Ο	Ο	S	00	0	0
1	Ο	0	S	Ο	90 <sup>0</sup>	0	1
2	Ο	S	Ο	Ο	1800	1	0
3	S	0	Ο	Ο	2700	1	1



• New Six-port UWB modulator/demodulator architecture was tested and verified using ADS simulations.

• The results show that Six-port modulator/demodulator works properly irrespective of the input UWB signal type.

• A new modulation table has been constructed for the new Six-port modulator/demodulator architecture.

• When used as a demodulator, the Six-port has proven comparable BER results to any other receiver.





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