

# Analog Front-End Cost Reduction for Multi-Antenna Transmitter

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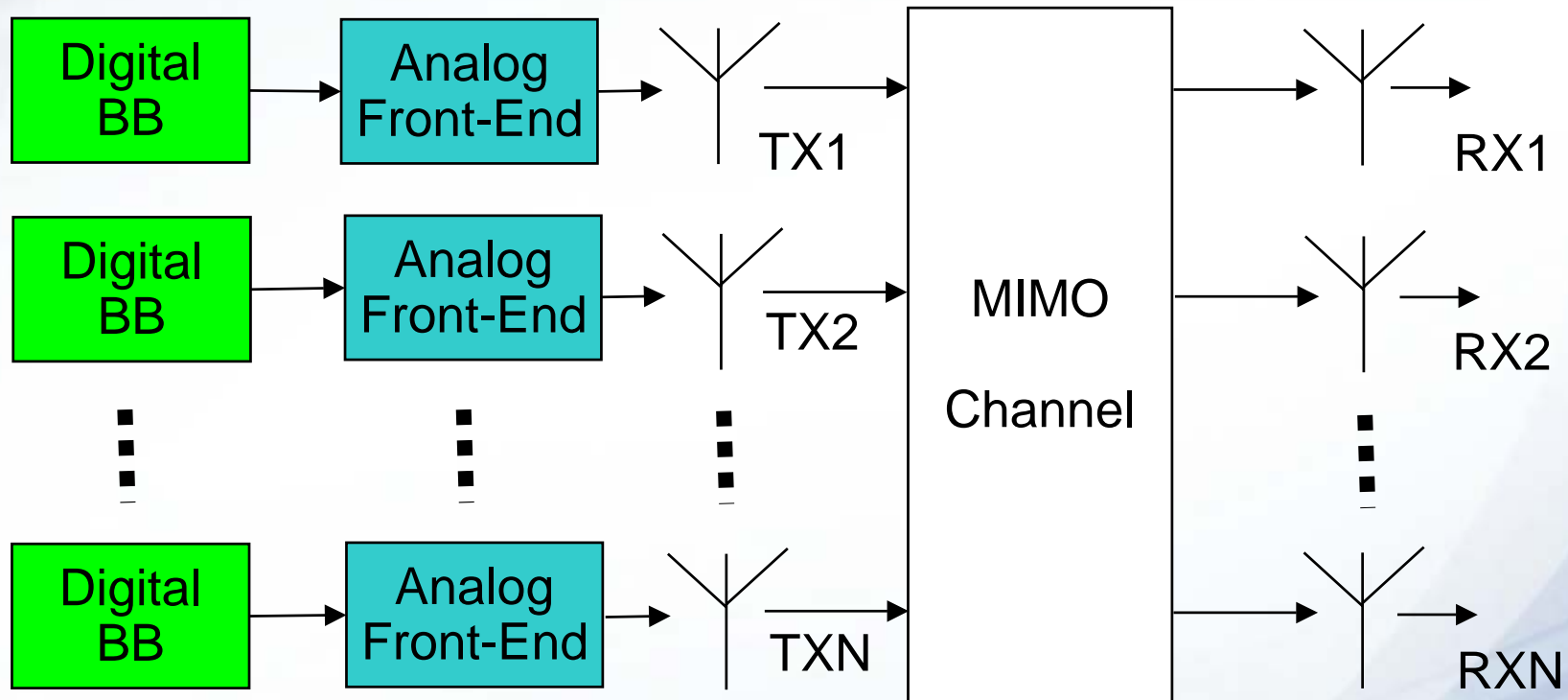
**NOKIA**

# Overview

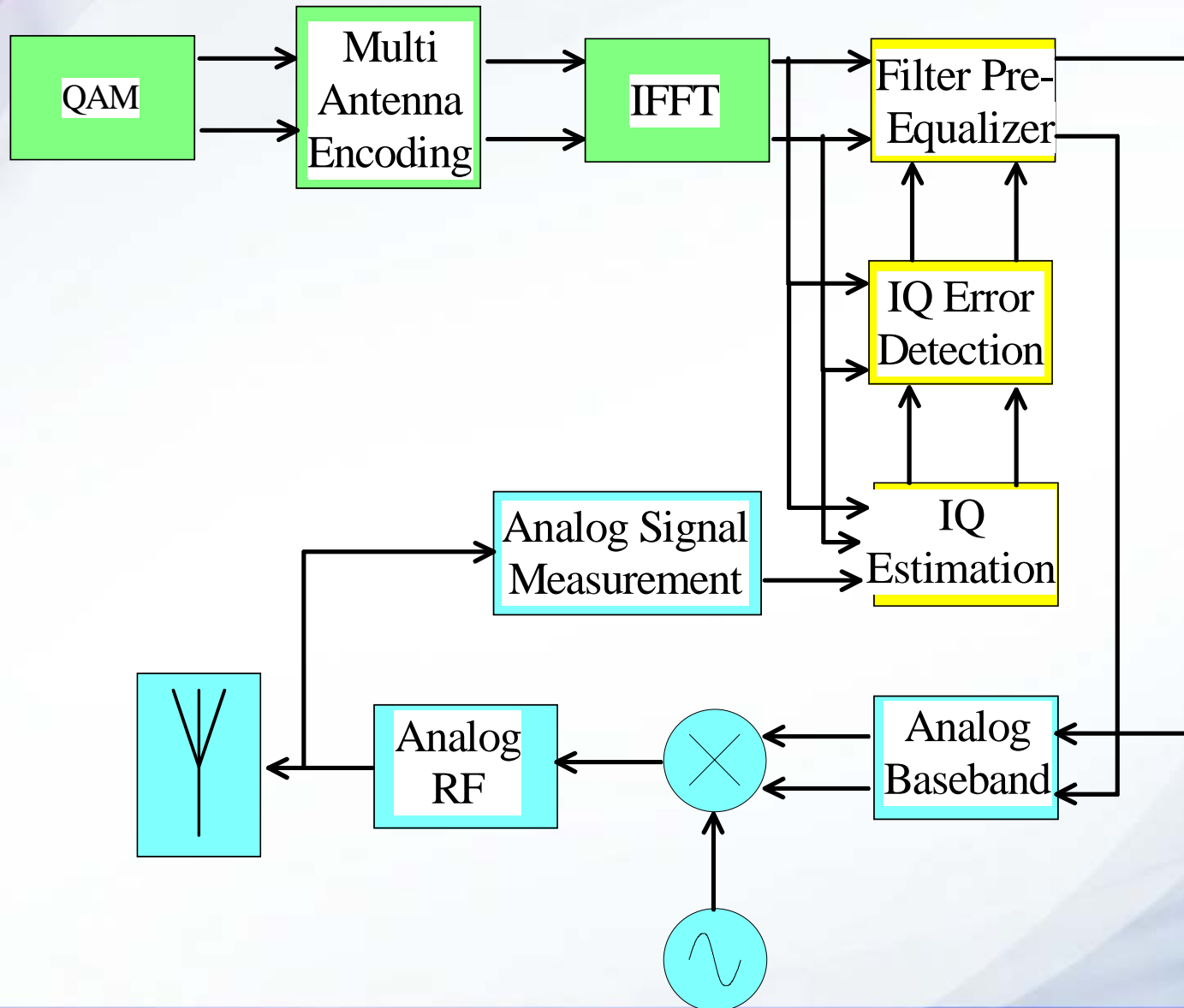
- Multi-antenna system
- Cost reduction
- Transmitter architecture – hardware and software
- Simulation results
- Conclusion

# Multi-antenna system

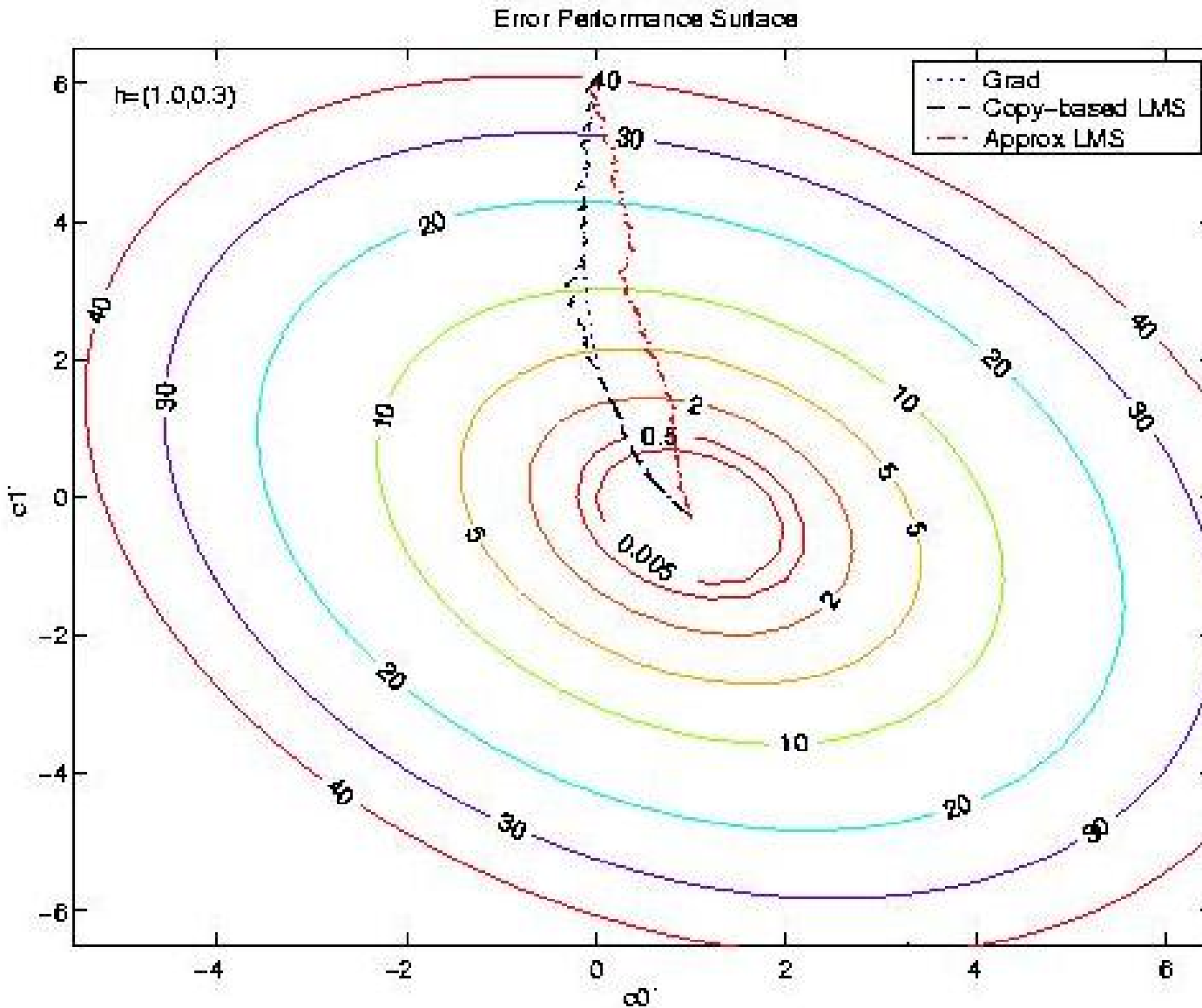
- High data rates, improved system performance
- Cost reduction through low cost analog components



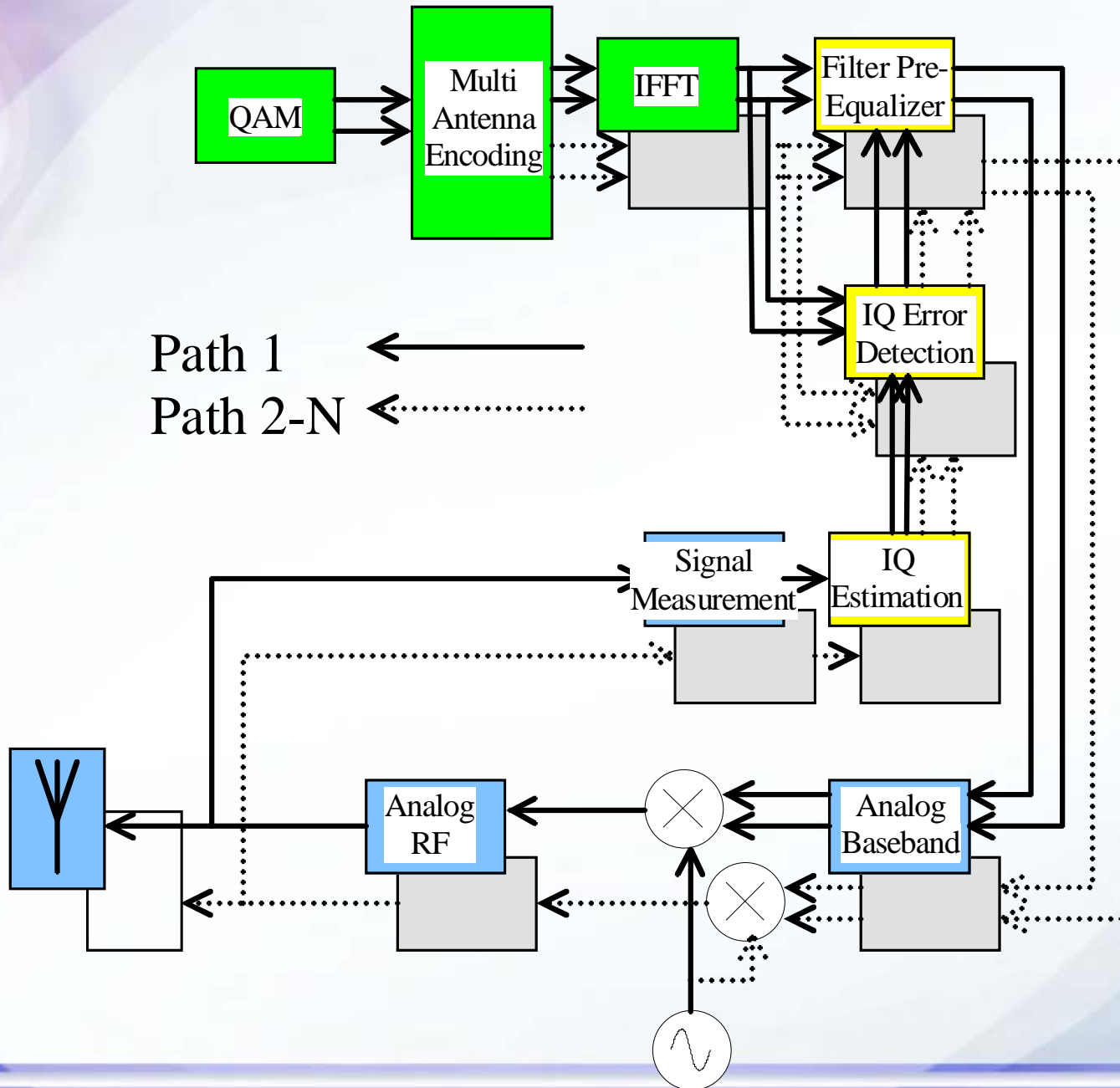
# Transmitter architecture



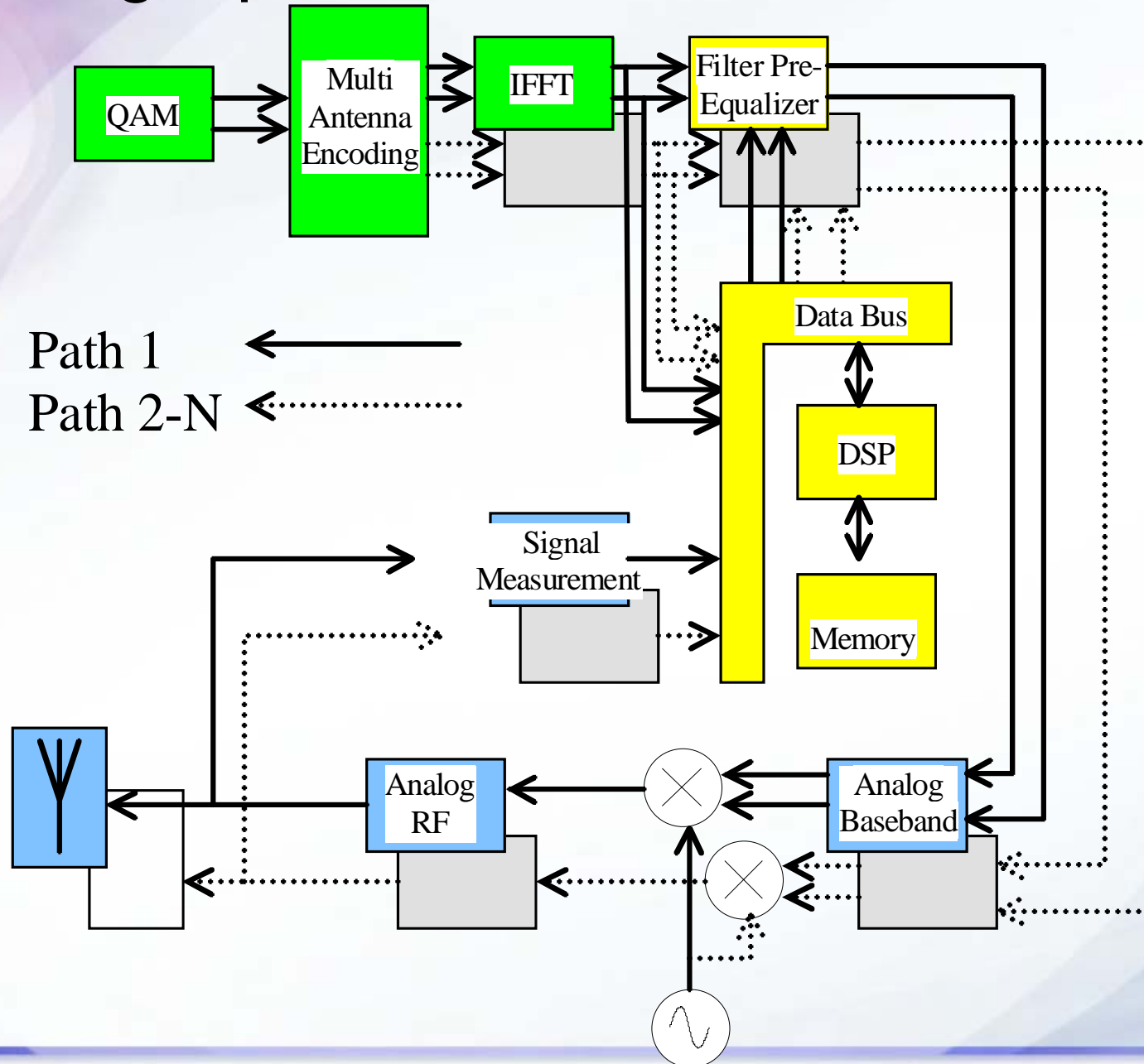
# Error performance surface



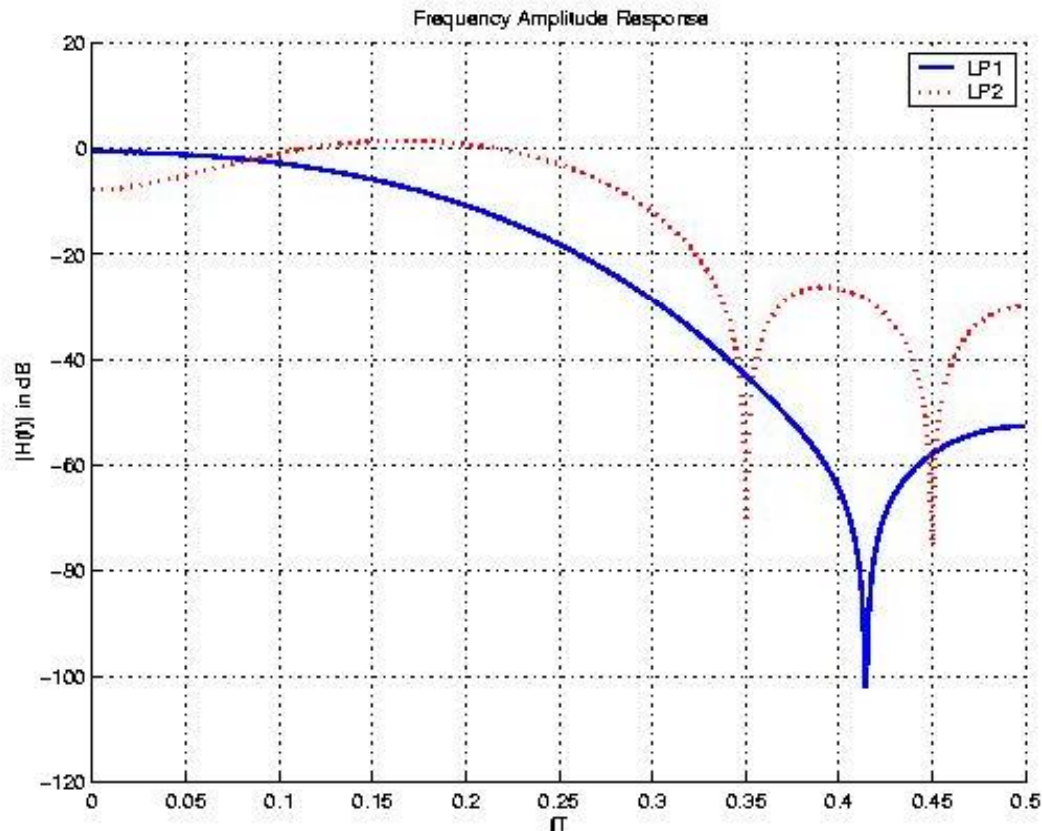
# Multi-antenna transmitter architecture



# Single processor for several branches



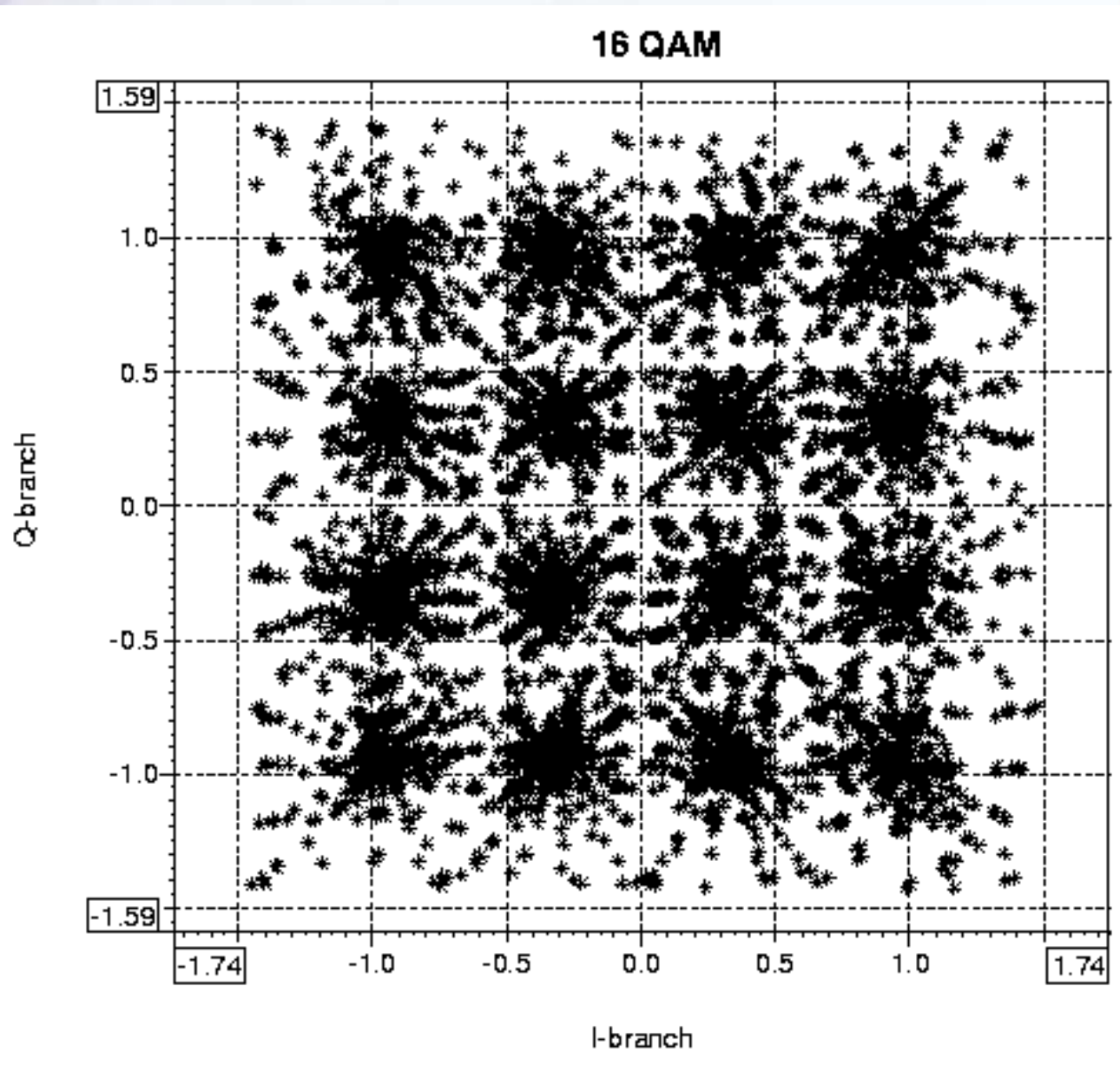
# Imperfect analog filter frequency response



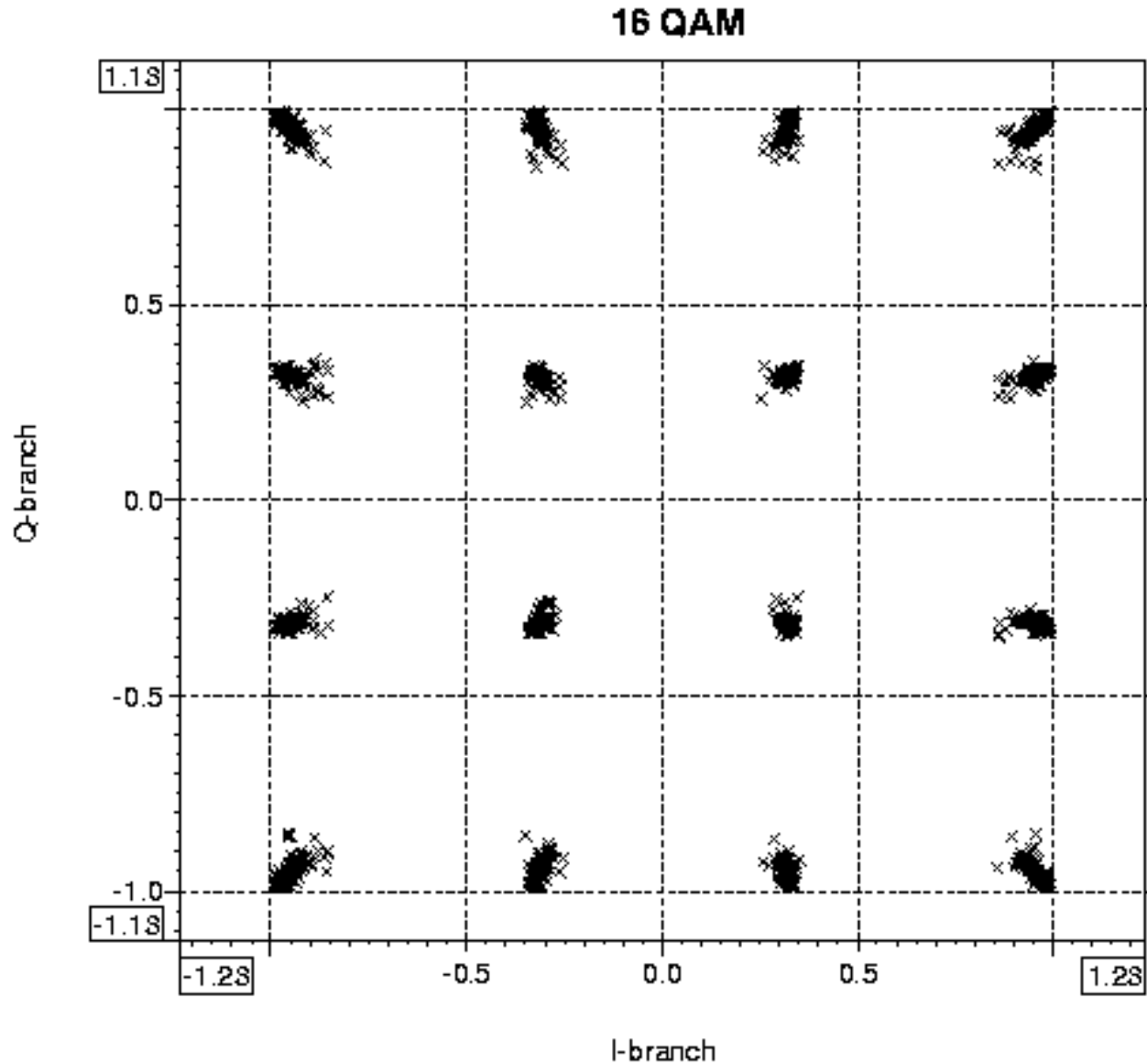
- Two different imperfect analog filters for I- and Q-branch
- Imperfections are pre-compensated in digital domain



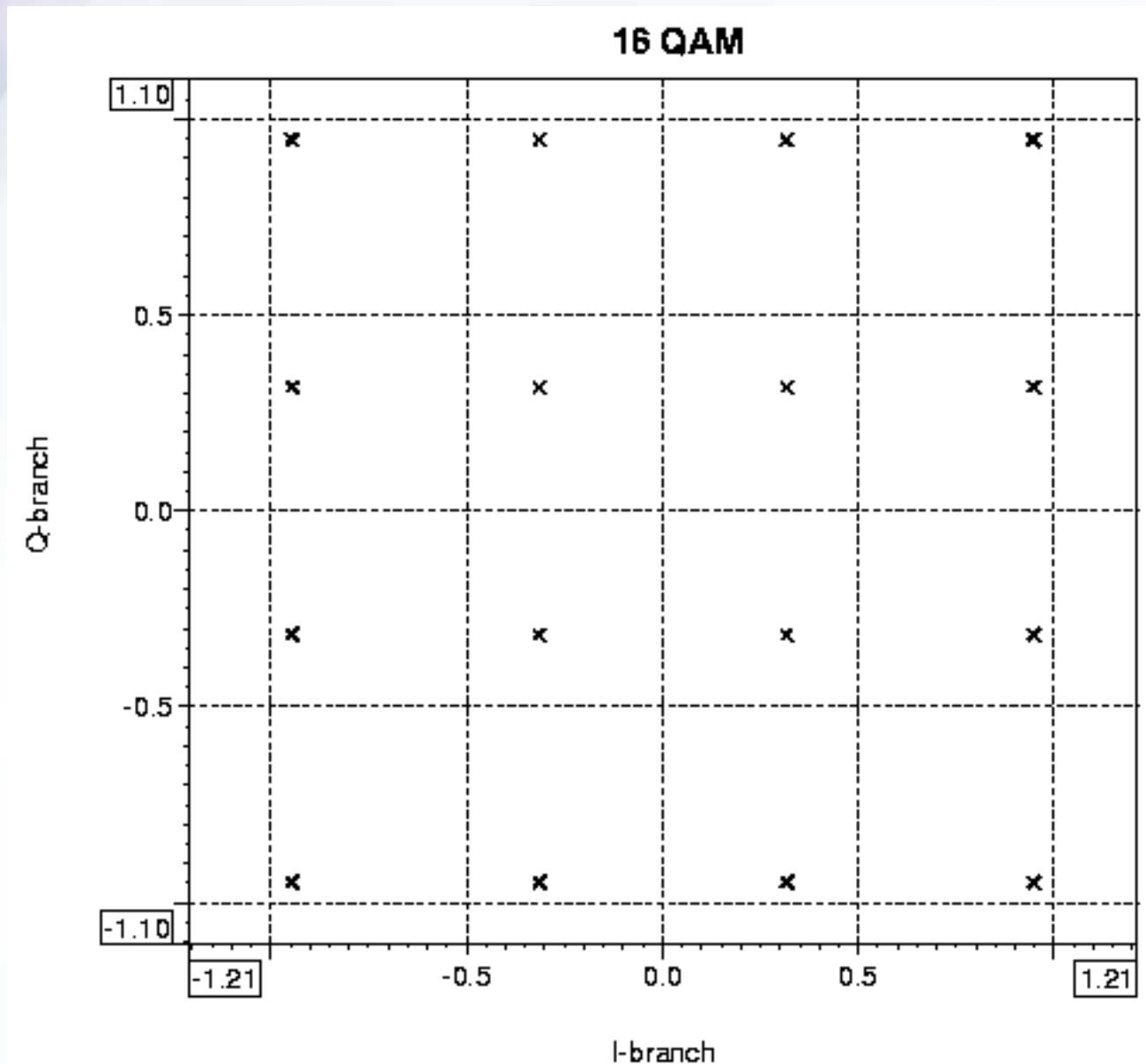
# Imperfect 16-QAM



# 16-QAM with 3-coefficient pre-equalizer



# 16-QAM with 19-coefficient pre-equalizer



# Conclusion

- Multi-antenna transmitter requires cheap analog front-ends
- Digital pre-equalization compensates imperfect analog filters
- Software-based pre-equalization approach reduces hardware costs