

# Battery-free 802.15.4 Receiver

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Carlos Pérez-Penichet, Claro Noda, Ambuj Varshney, Thiemo Voigt

# Backscattering Commodity Wireless Protocols



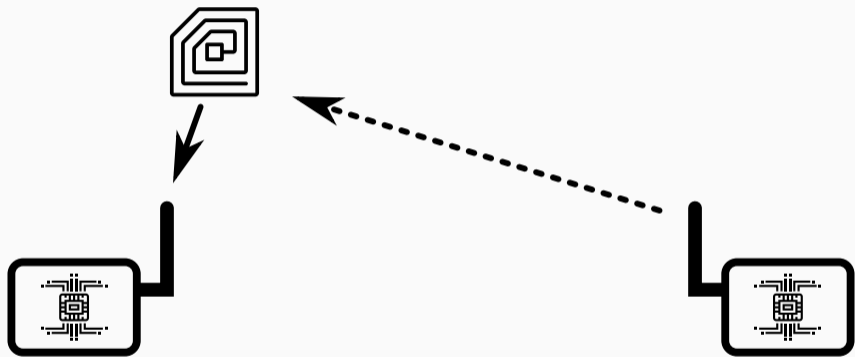
Bluetooth



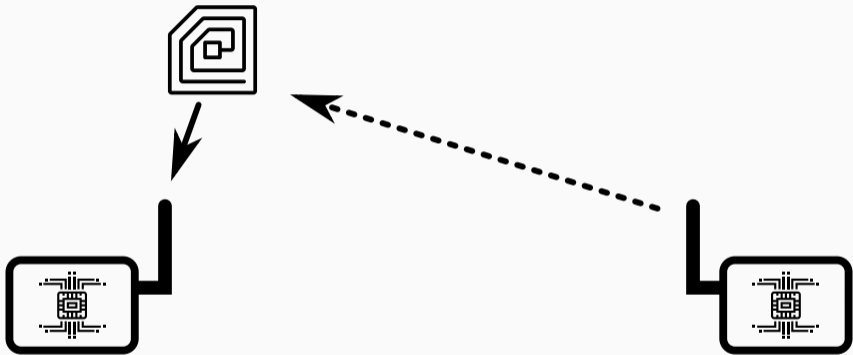
Wi-Fi

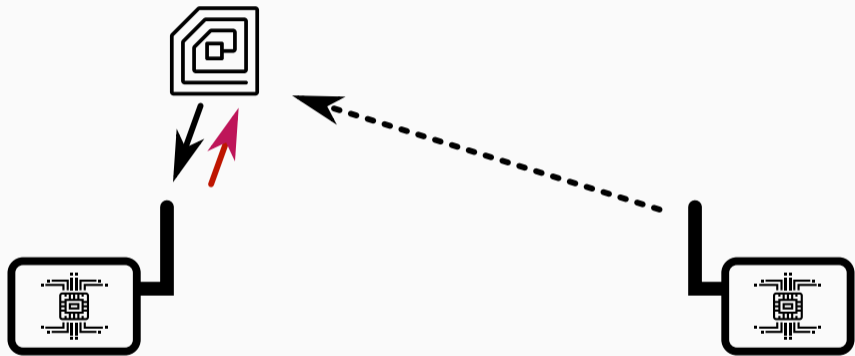


802.15.4









# Backscattering Commodity Wireless Protocols



Bluetooth



Wi-Fi



802.15.4

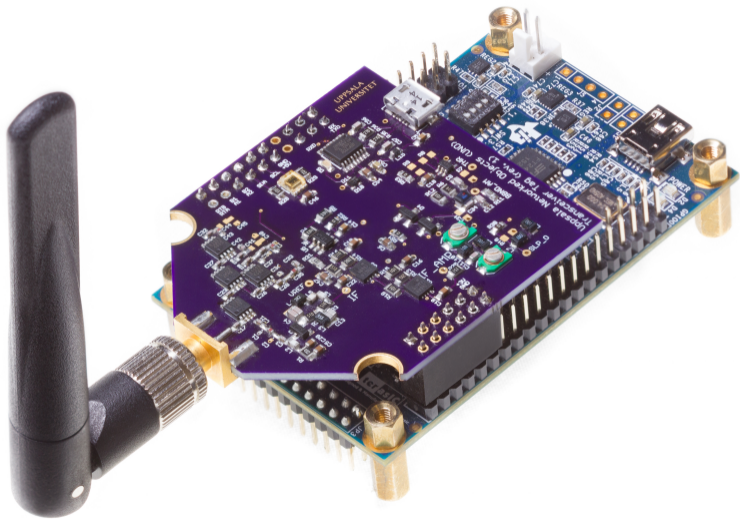


Packet Level  
Modulation

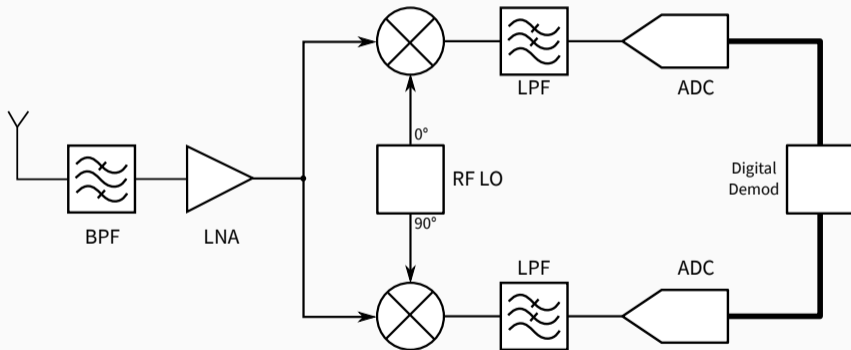


Interpreter  
Device

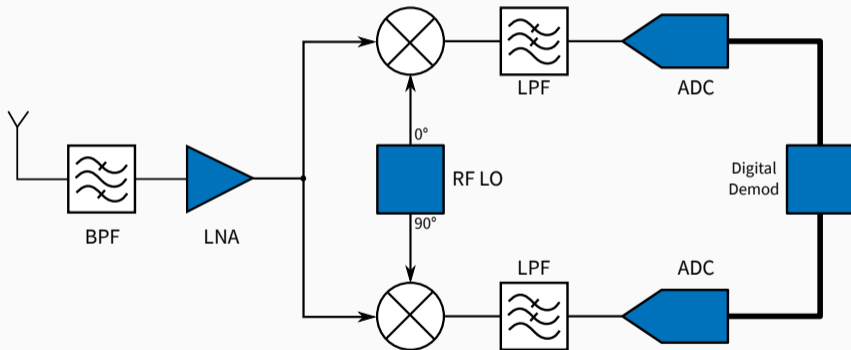


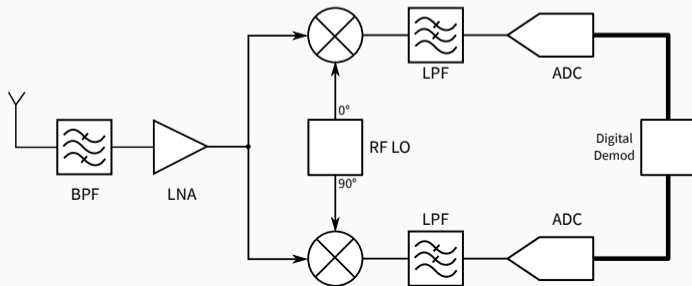


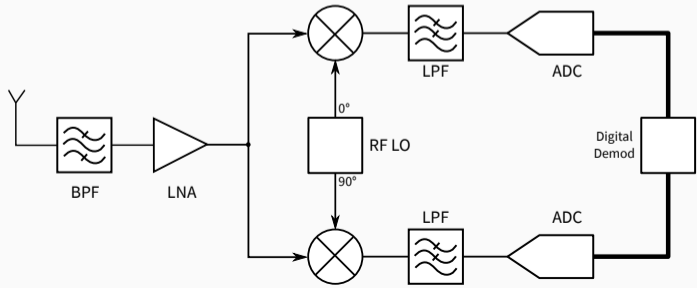
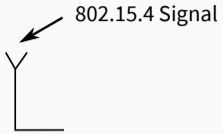
# Typical Receiver



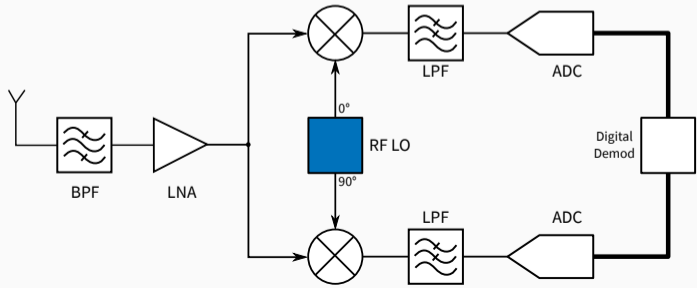

# Typical Receiver

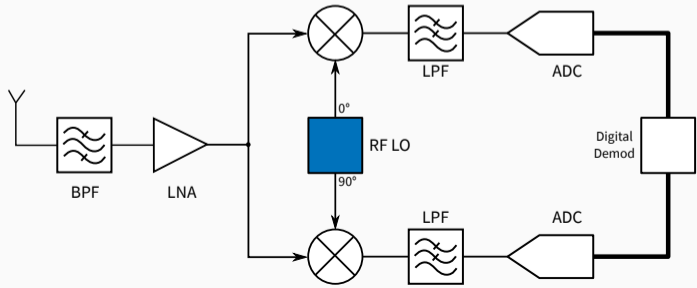
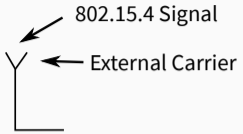


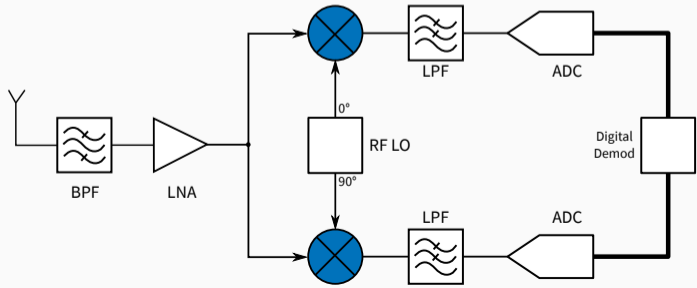
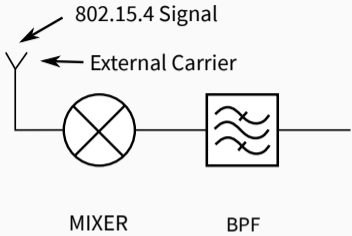




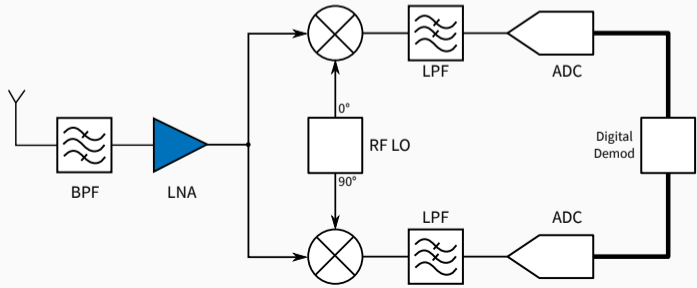
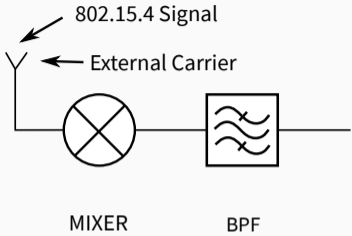
802.15.4 Signal

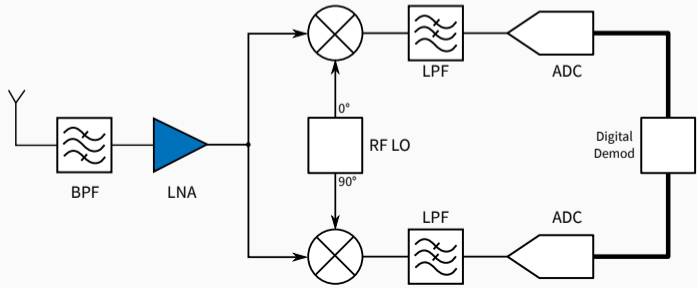
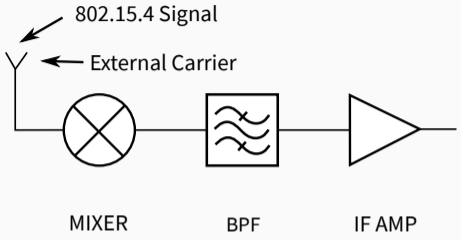




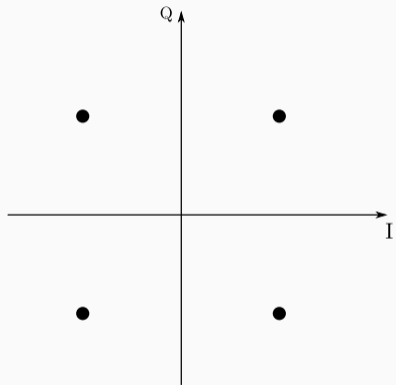




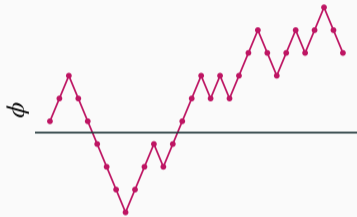
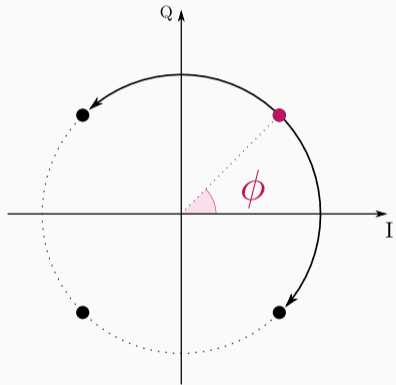




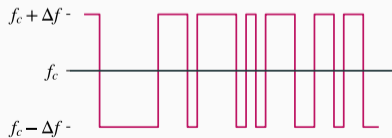
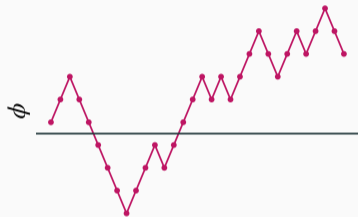
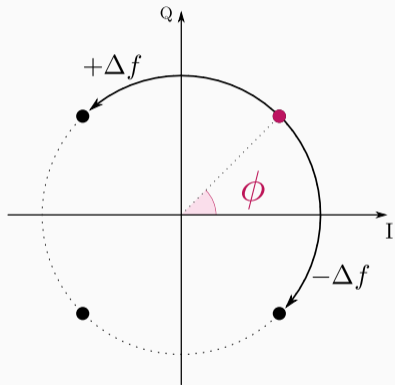
## The 802.15.4 Signal

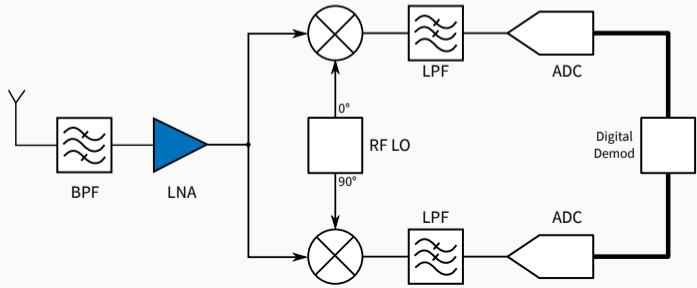
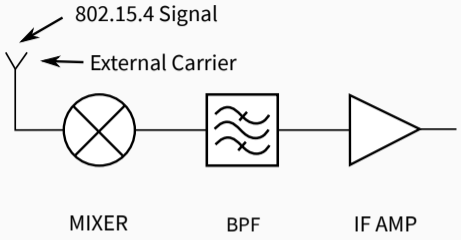


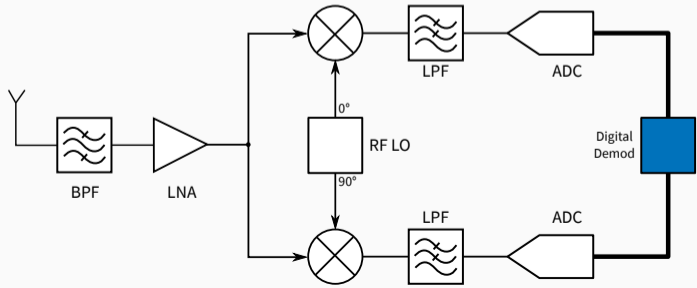
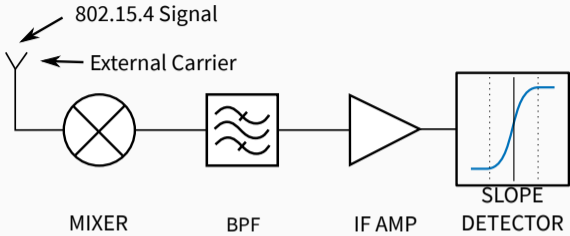
# The 802.15.4 Signal



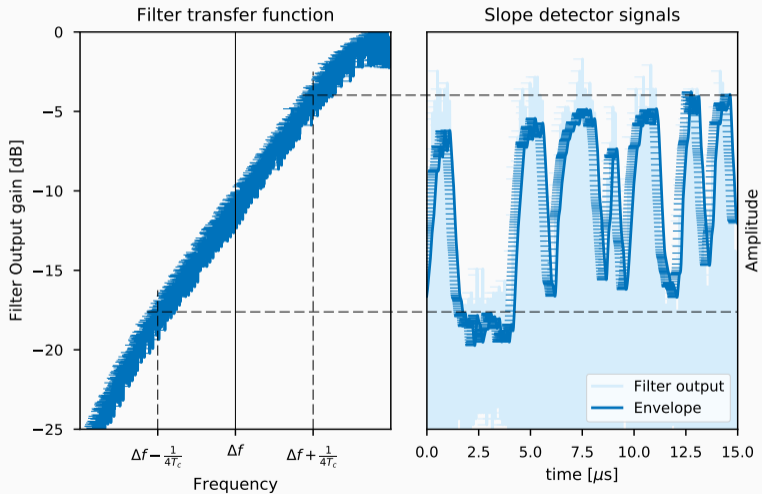
# The 802.15.4 Signal



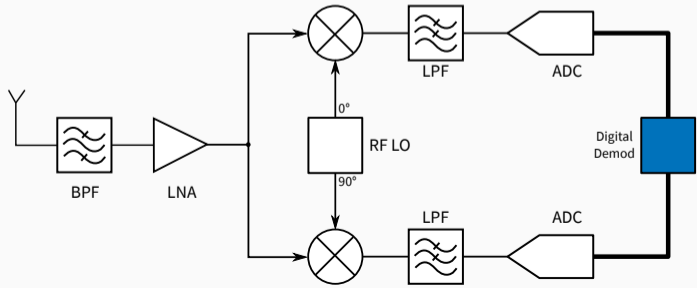
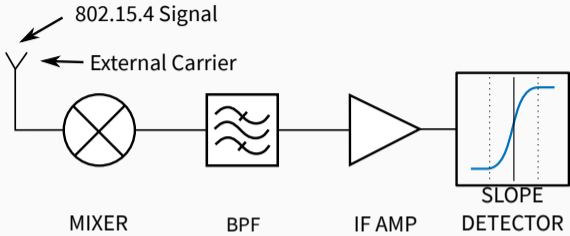


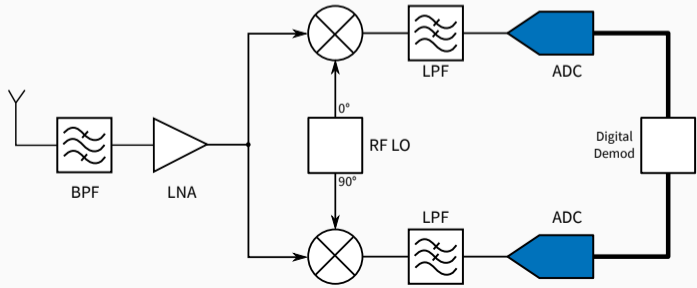
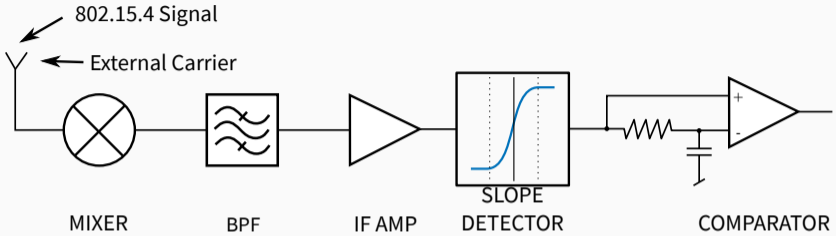


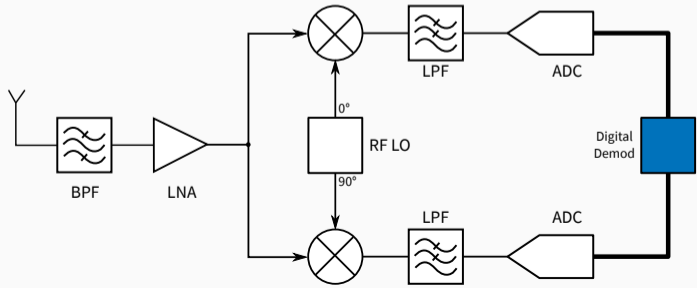
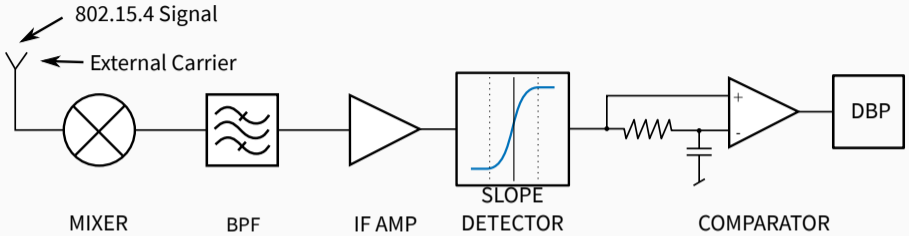
# Slope Detector

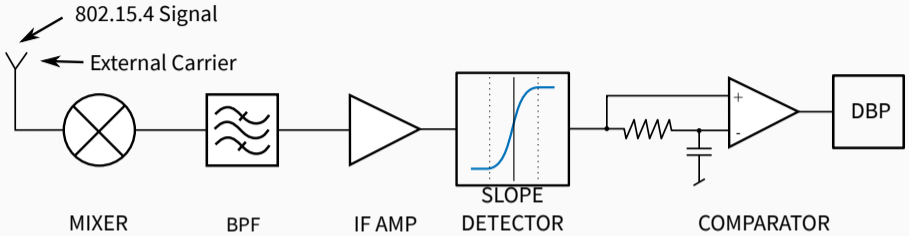


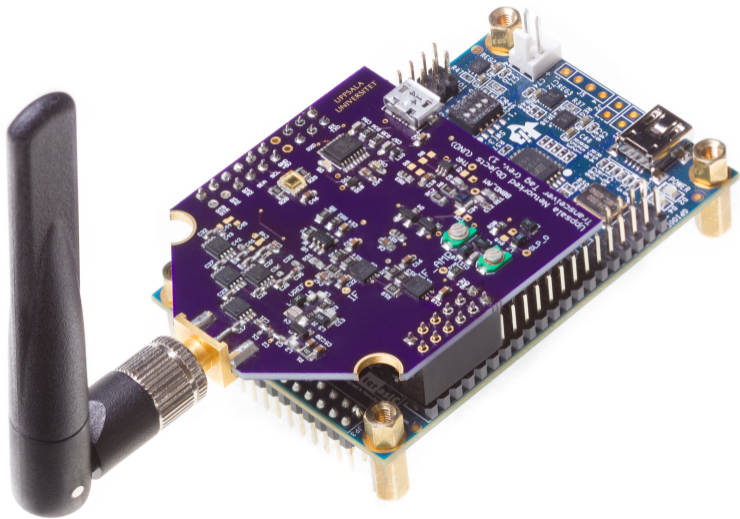














Power

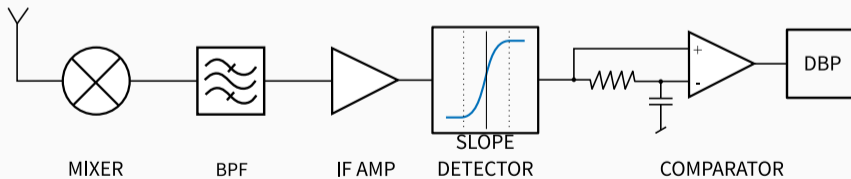


Range



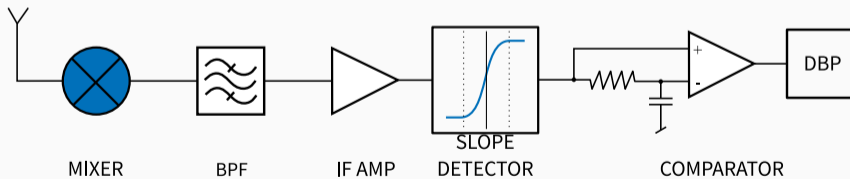
Integration

# Power Consumption



# Power Consumption

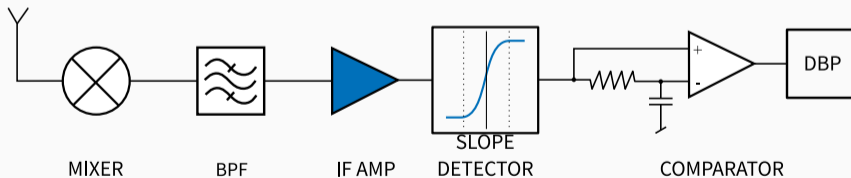
$66\mu W$





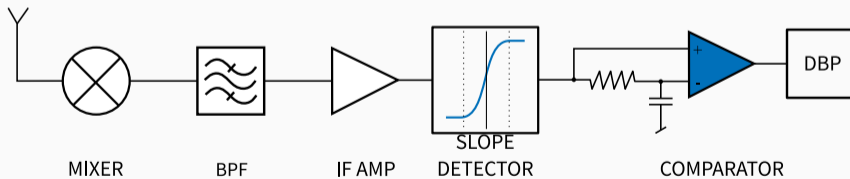
# Power Consumption

$75\mu W$



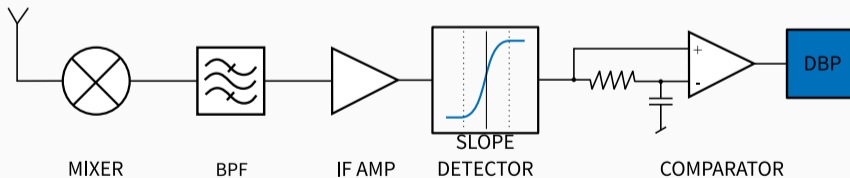
# Power Consumption

$190\mu W$



# Power Consumption

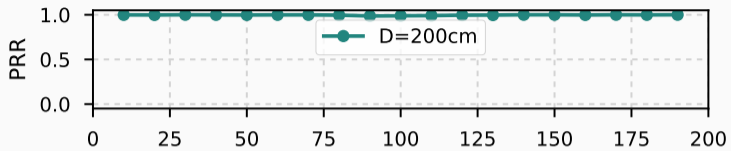
$30\mu W$



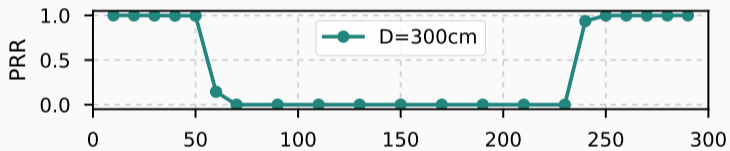
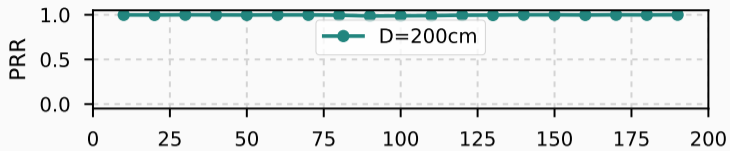
361  $\mu W$

# Range

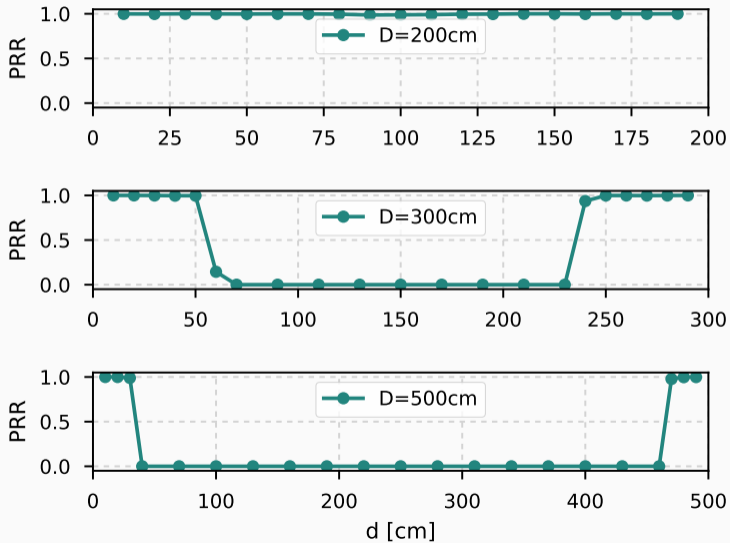
# Range



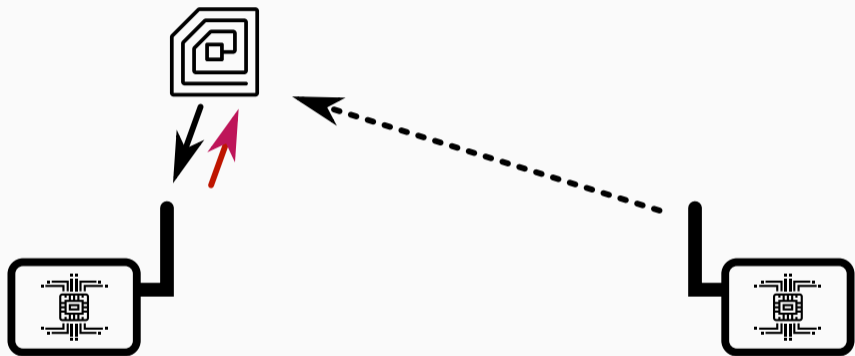
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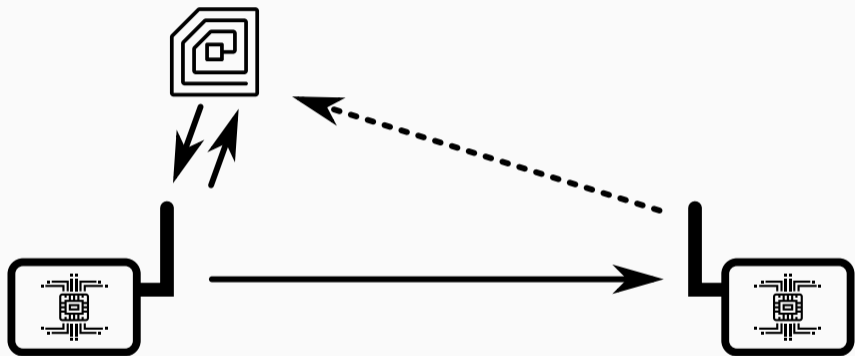


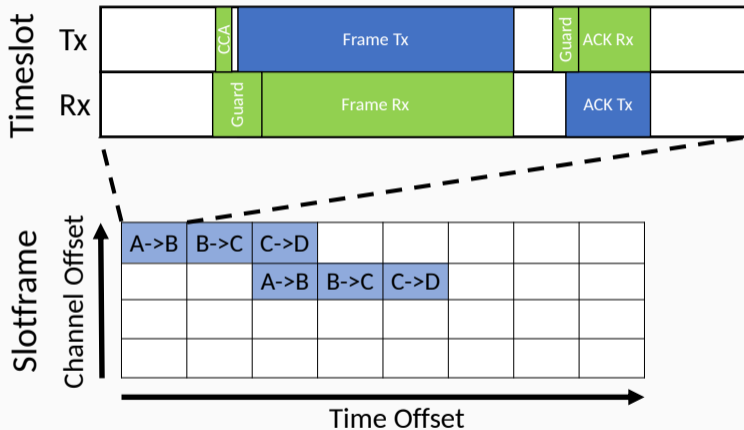
# Range



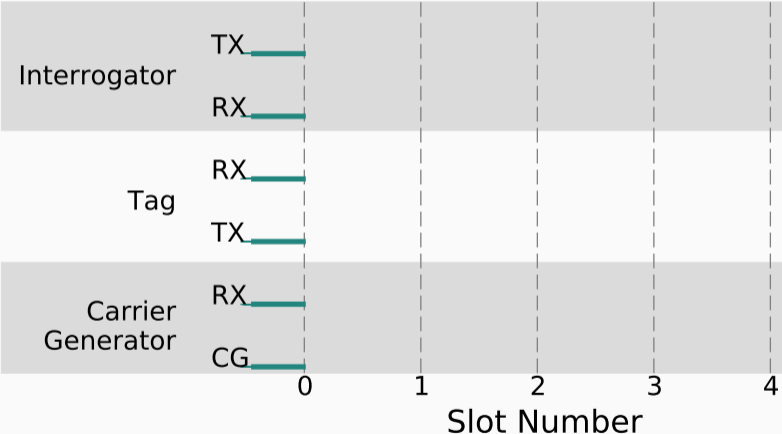




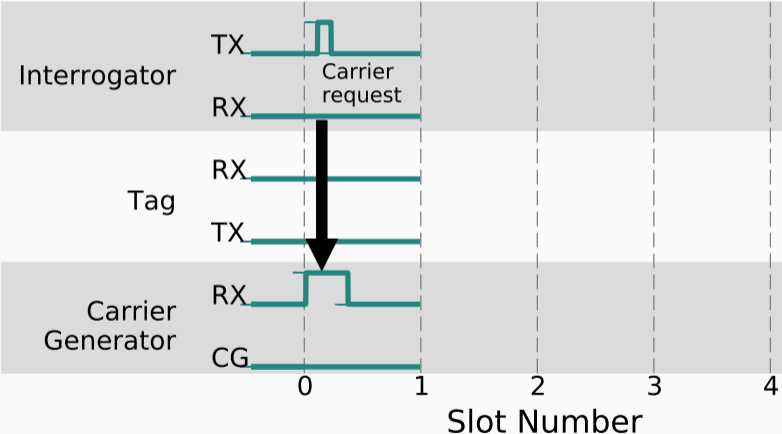




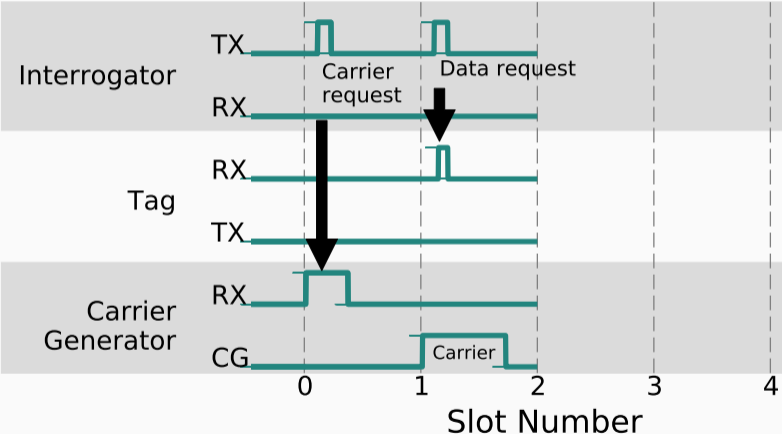
# TSCH Integration



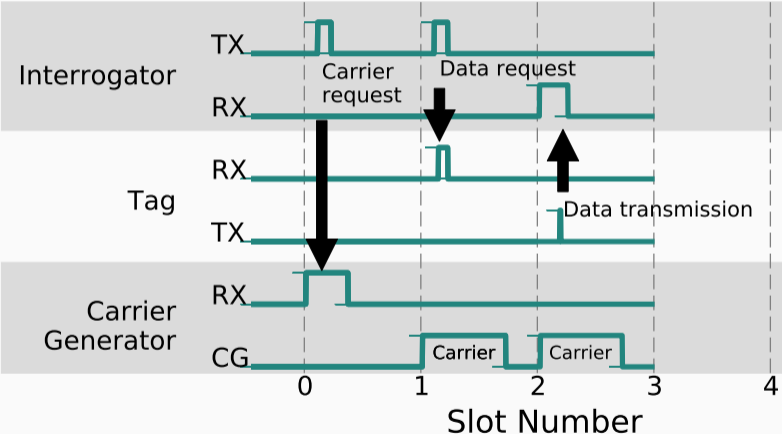
# TSCH Integration



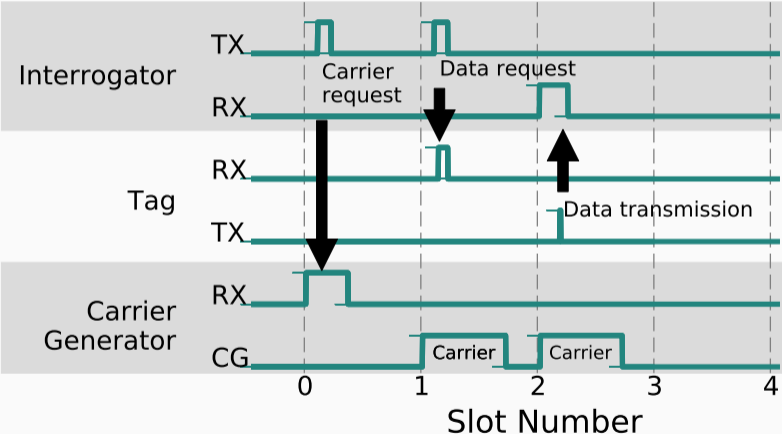
# TSCH Integration



# TSCH Integration

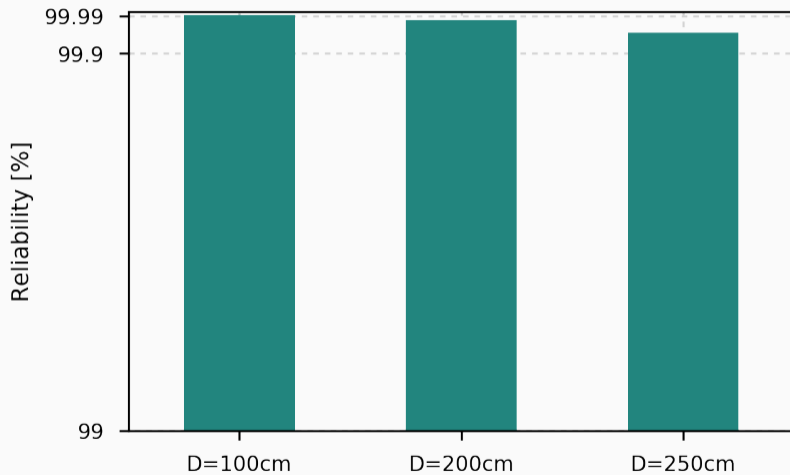


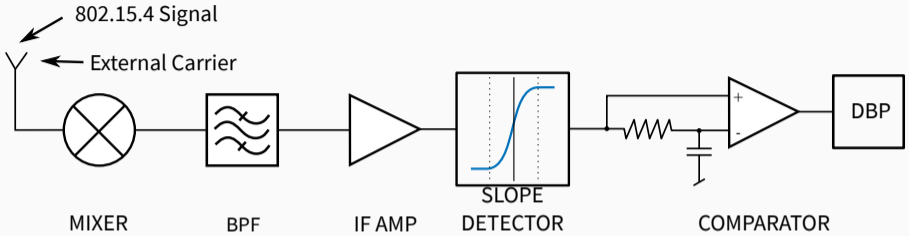
# TSCH Integration



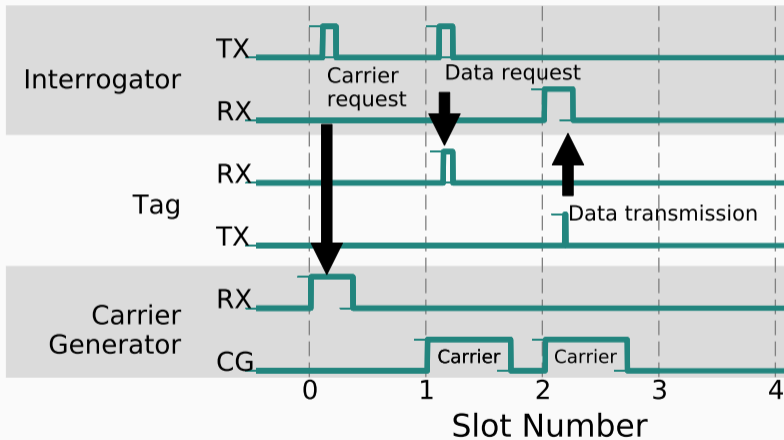


# TSCH Long-Term Reliability



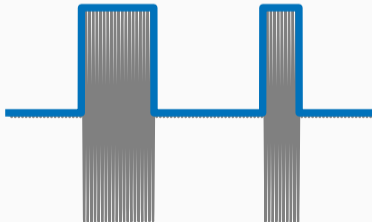


# TSCH Integration

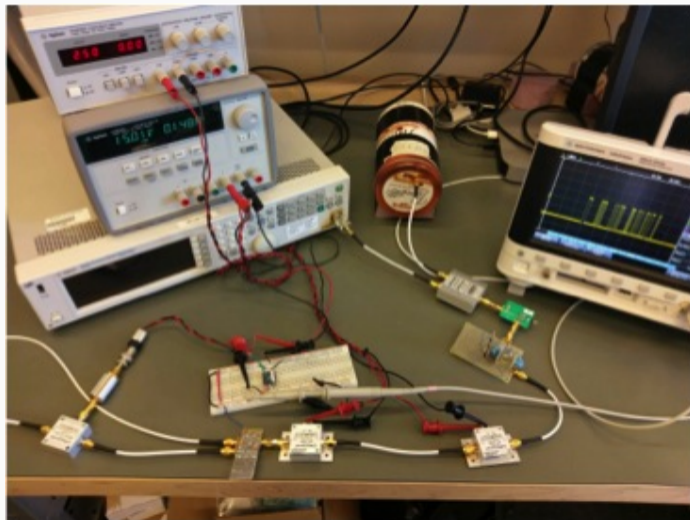


361  $\mu W$

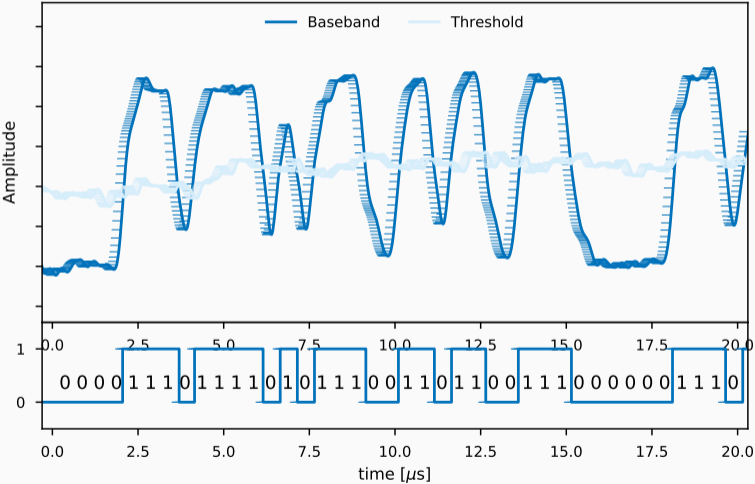
Thank you



## A Low Power 2.4 GHz Superheterodyne Receiver Architecture. . .

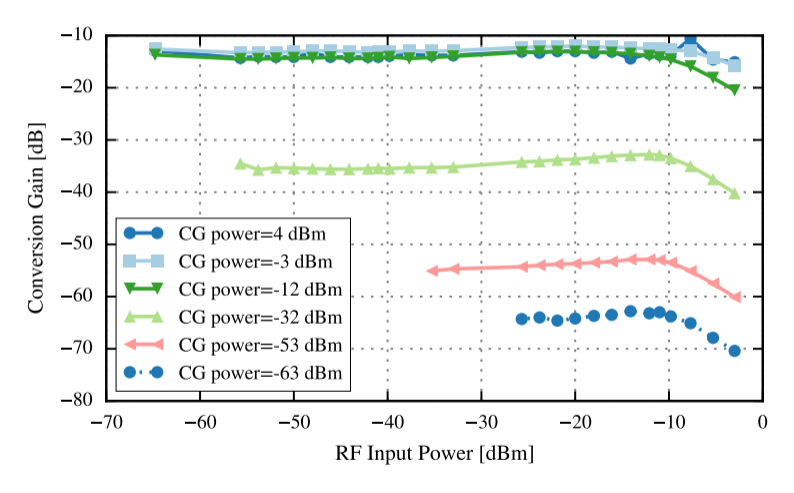


# Comparator

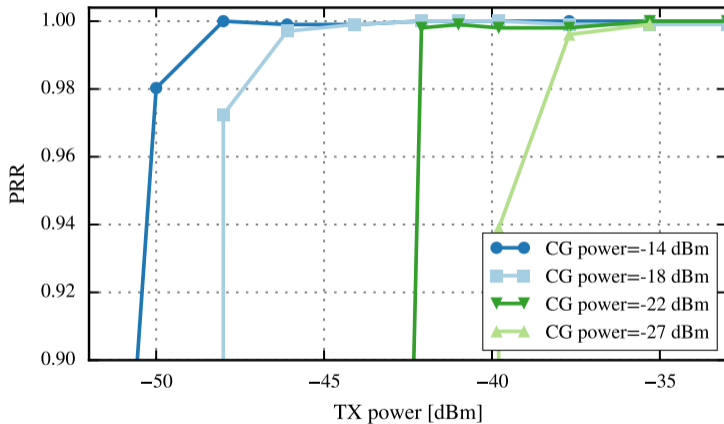




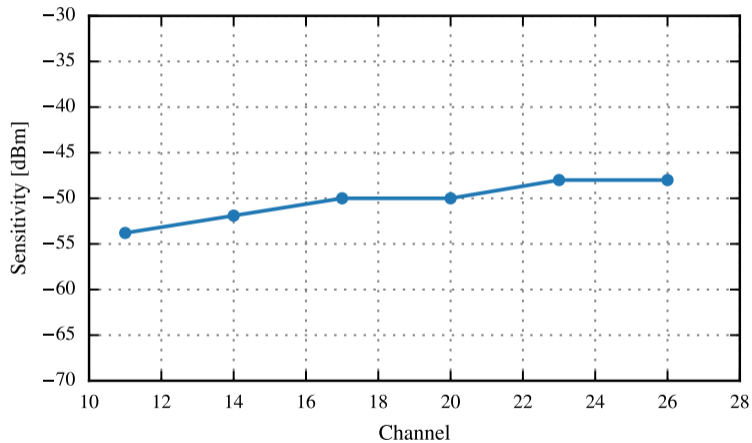
# Mixer Conversion Gain vs. Input Signal Strength



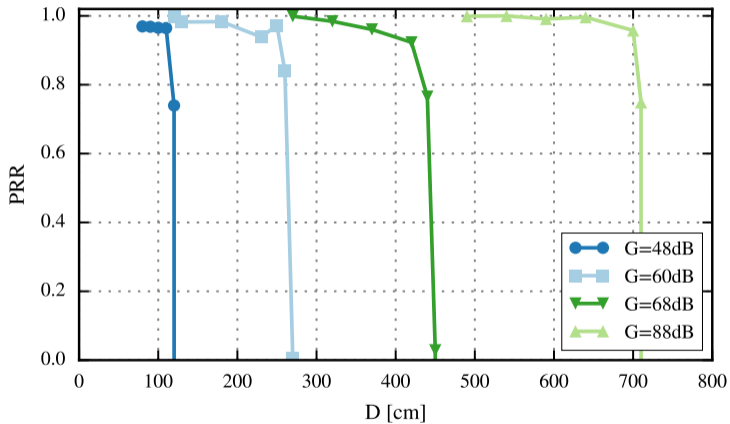
# PRR vs. Input Power



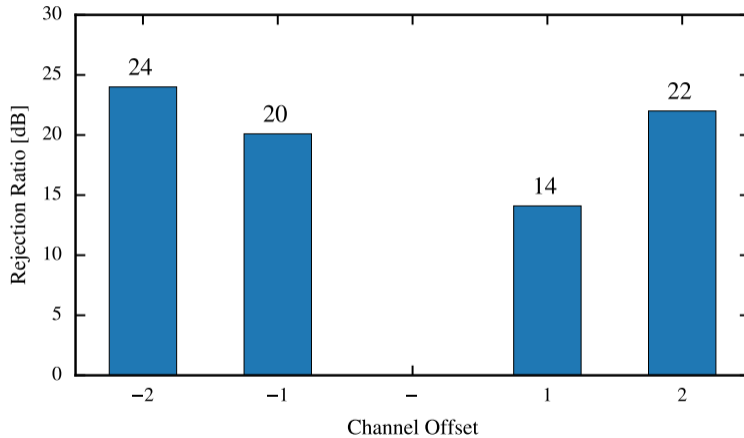
## Sensitivity over 802.15.4 Channels



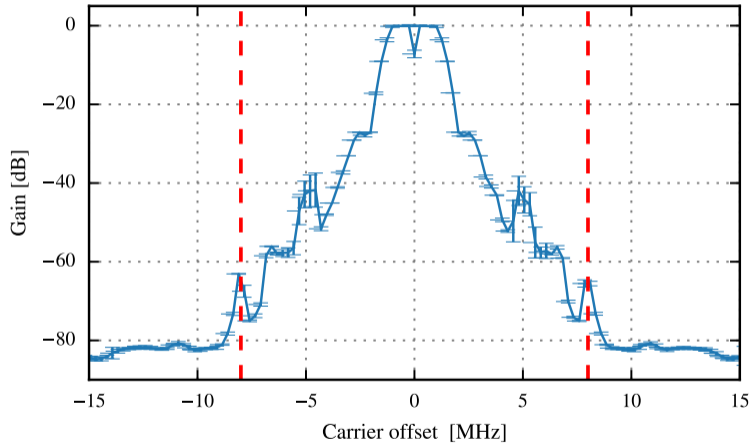
# PRR vs. IF Amplifier Gain



# Channel Rejection Ratio



# CC2538 Receiver Filter Attenuation



# Glossy Integration

