



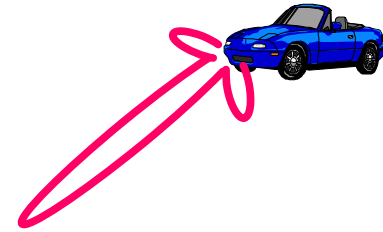
Hand-Held Smart Antennas



Benefits of the Hand-Held Smart Antenna

● Receive Smart Antenna

- Anti-jam capability
- Increased capacity
- Extended range
- Reduced fading
- Lower transmit power (increased battery life for peer-to-peer)



● Transmit Smart Antenna

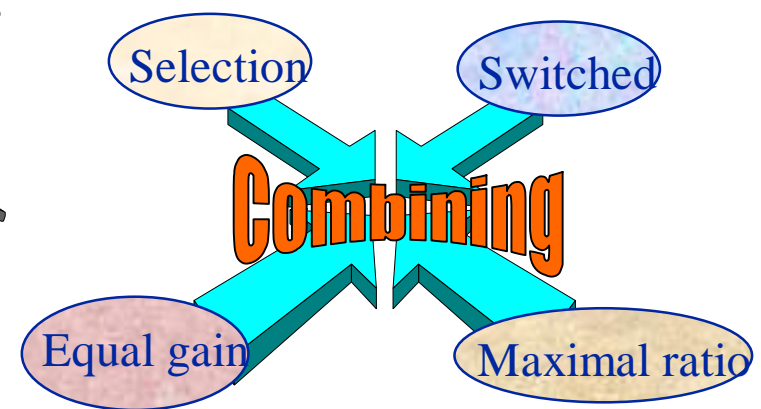
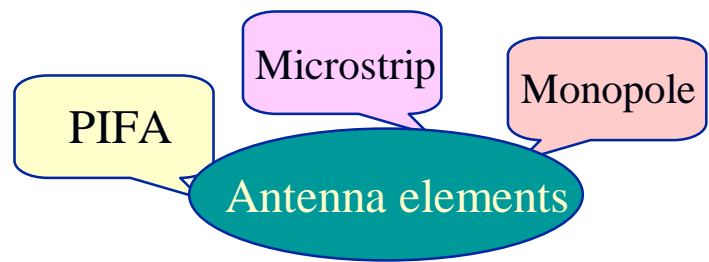
- Anti-jam capability
- Increased capacity
- Extended range
- Low probability of intercept (LPI)
- Reduced fading
- Lower transmit power (increased battery life)





General Overview

Handheld smart antenna:
Two or more antenna elements at the handset.



Literature review



Substantial gain over single element: 7-13 dB

Gain from polarization diversity Gain from spatial diversity Gain from pattern diversity

Low value of cross-correlation:
 $\rho_e < 0.6$ at separation of 0.05λ at $f = 851$ MHz.
 10^{-4} at separation of 0.6λ at $f = 2.5$ GHz



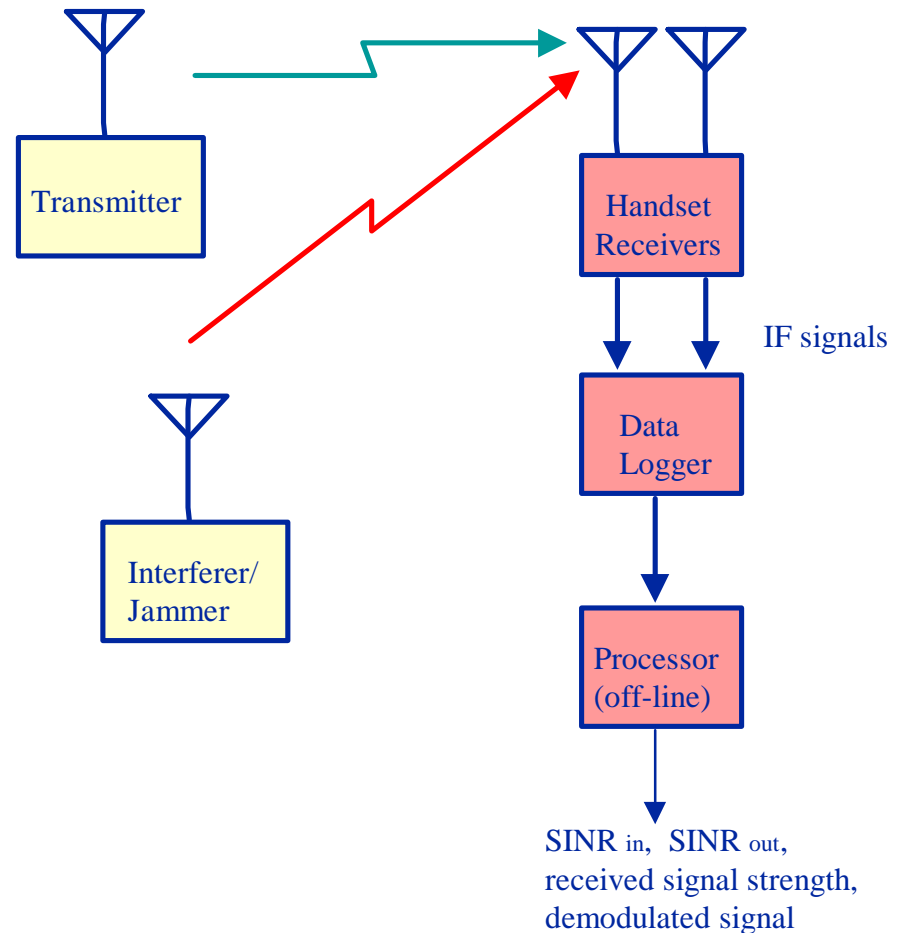
Narrowband Test-Bed System



Test-Bed System

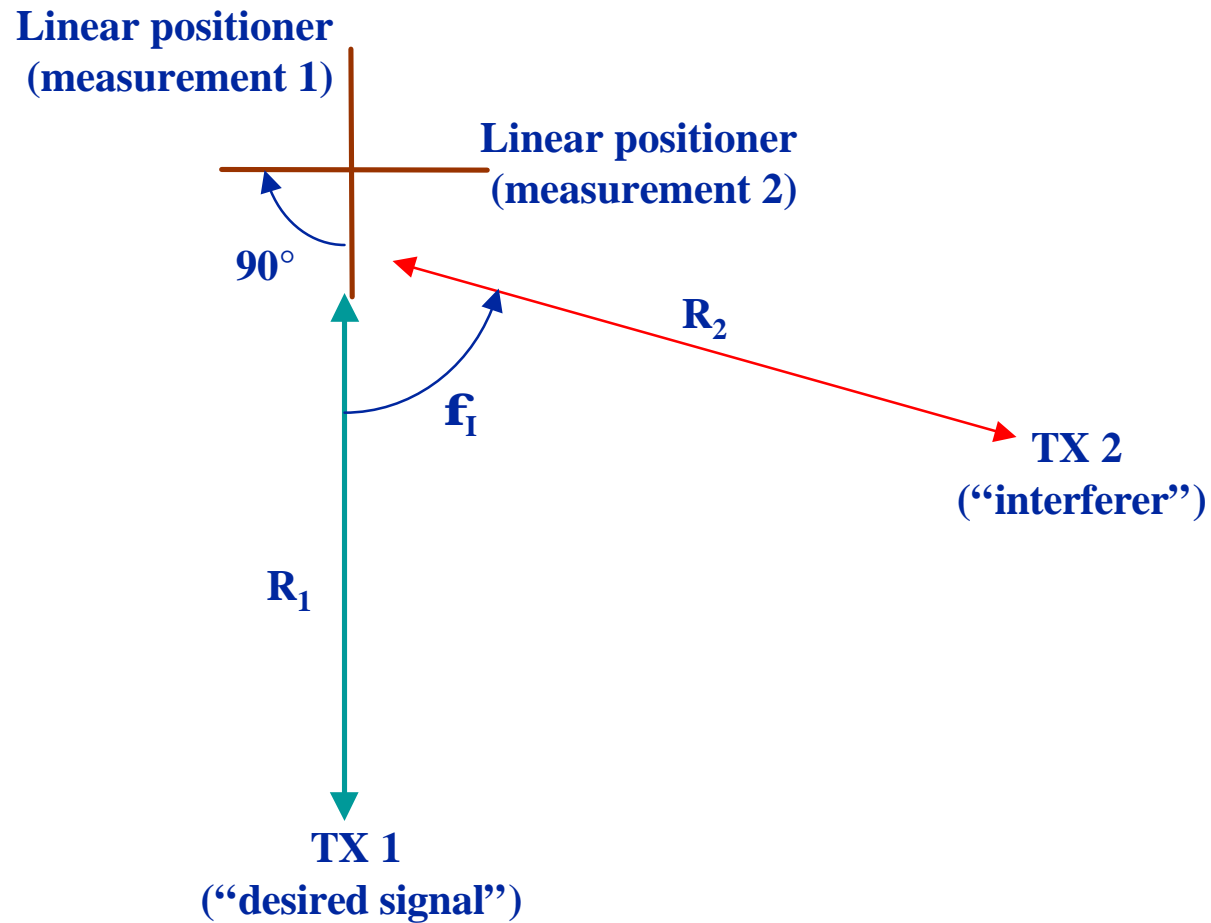
- Collect data with hand-held receiver unit
- Process data off-line using adaptive (e.g., LSCMA) and diversity combining
- Evaluate antenna configurations
- System operates at 2.05 GHz

Simulation software under development for algorithm evaluation





Measurement Scenario





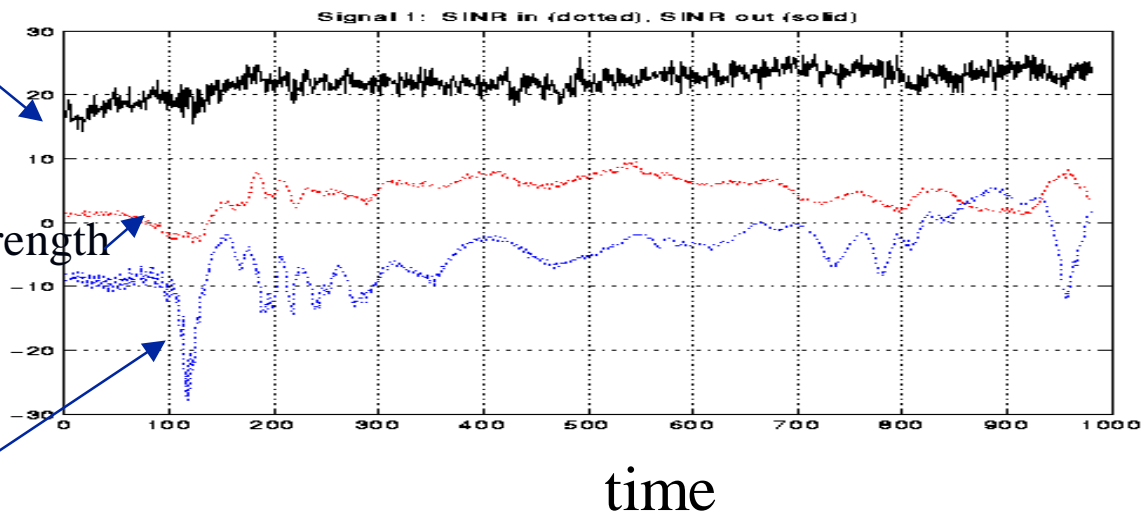
Measurement Result



Signal strength using LSCMA



Channel B signal strength



Channel A signal strength

- Indoor environment
- 2.050 GHz carrier
- stationary rx and tx
- 10 second collect

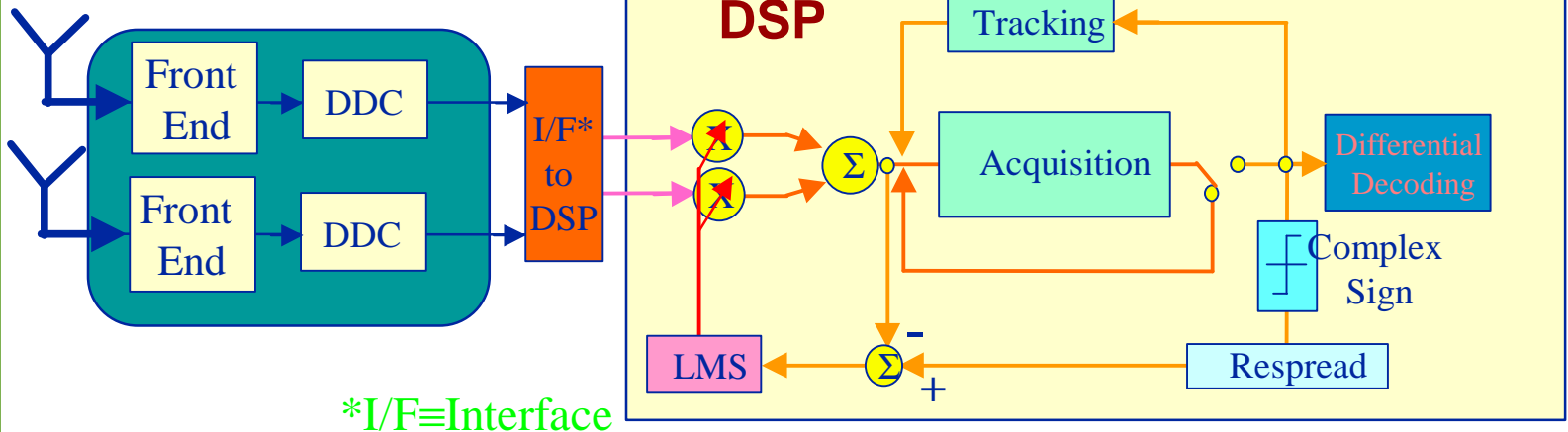




Hardware Implementation for Handset Smart Antenna Evaluation



Receiver Structure:



*I/F \equiv Interface

Spread spectrum signal

Complete hardware test-bed:

