

Experimental Performance Results of an Indoor Wireless Extension of IS-136 Based on $\pi/8$ D8PSK, Coded Modulation and Antenna Diversity

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**Zoran Kostic, Bruce McNair & Nelson Sollenberger
AT&T Labs - Research
Red Bank, NJ**

{kostic | bmcnair | nelson}@research.att.com

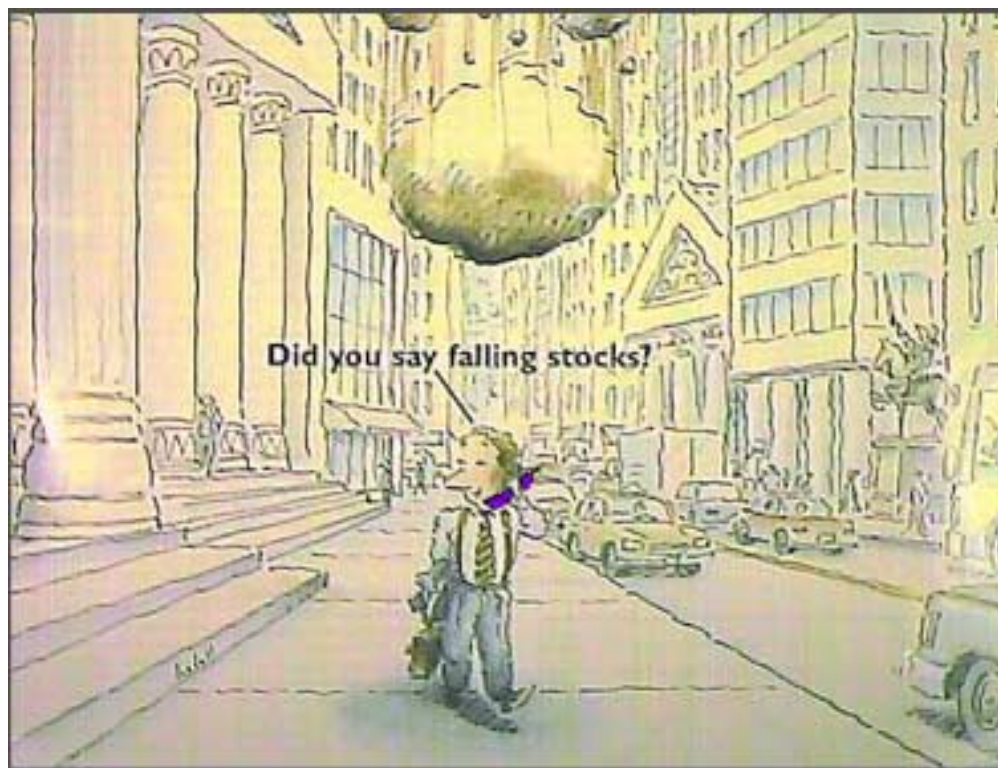
Outline of Talk

- Associated Work, Background
- System architecture
- Experimental platform
- Results
- Current work/future directions

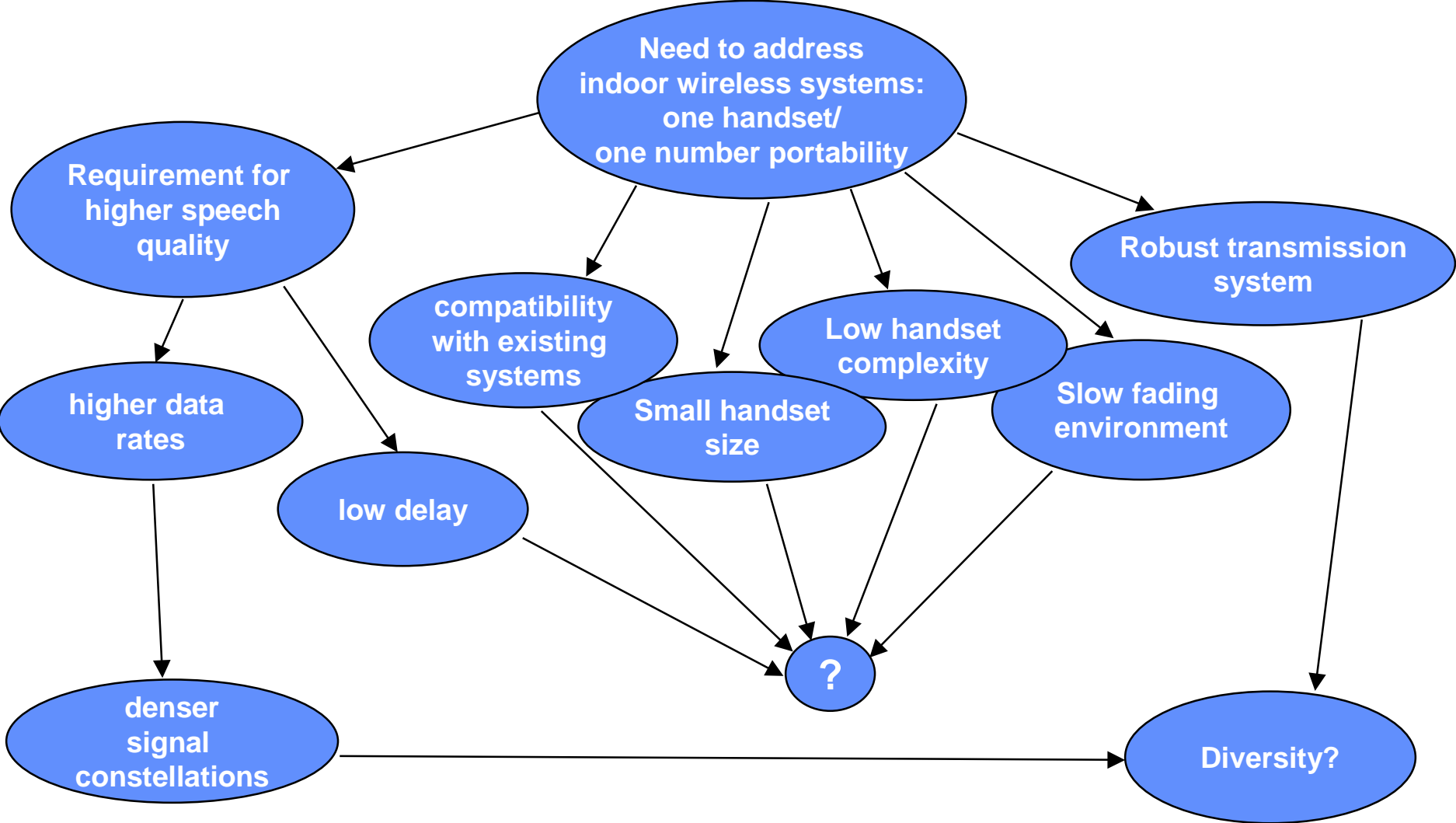
Associated Work

- Kasturia & Sollenberger, “A 16 kb/s Voice Mode for Indoor IS-136 TDMA Systems,” ICUPC96.
- Gelblum & Seshadri, “High-rate Coded Modulation Schemes for 16 kbps Speech in Wireless Systems ,” VTC97.
- McNair, “The Effectiveness of Preselection Diversity for Indoor Wireless Systems ,” ICUPC97.

Speech Quality

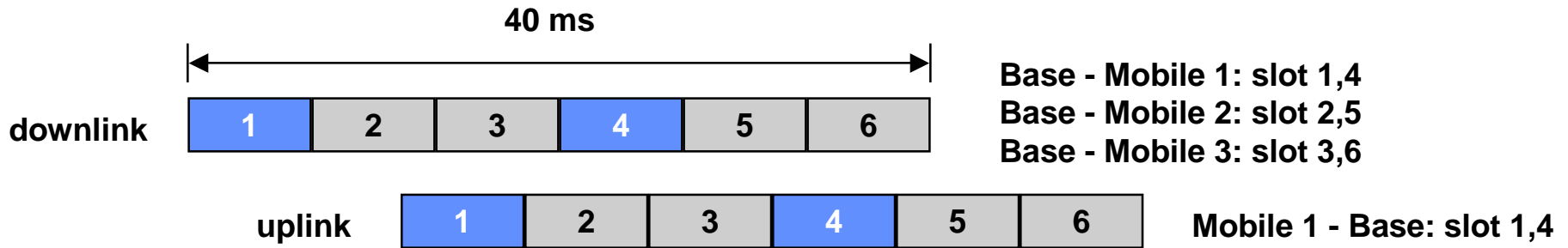


The Problem



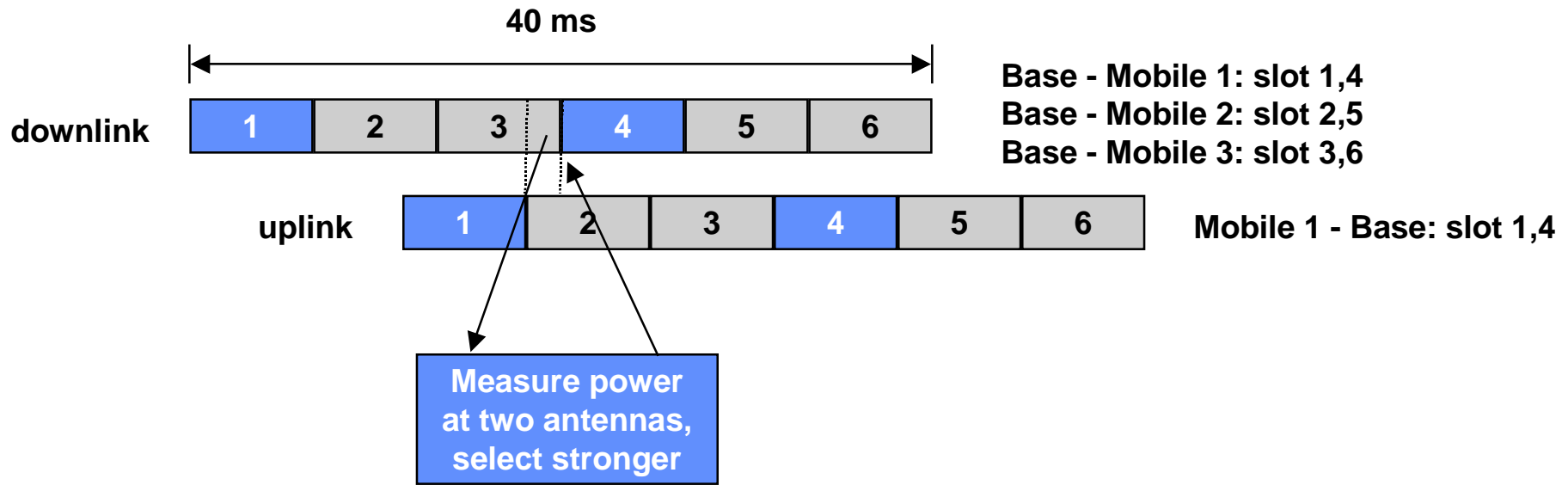
System Design

IS-136 TDMA frame structure

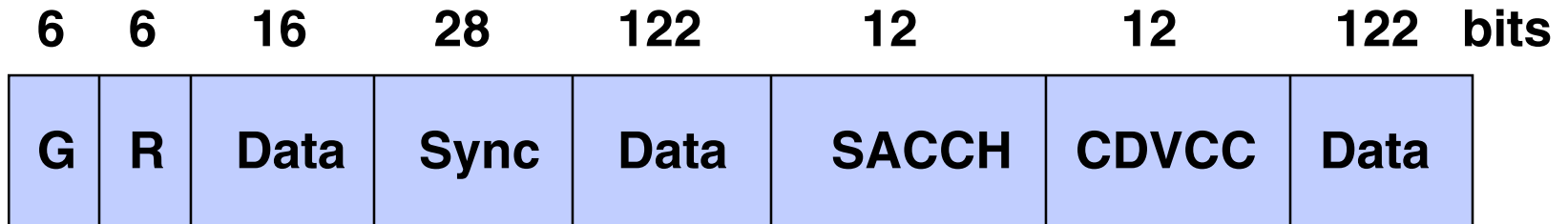


System Design - Preselection Diversity

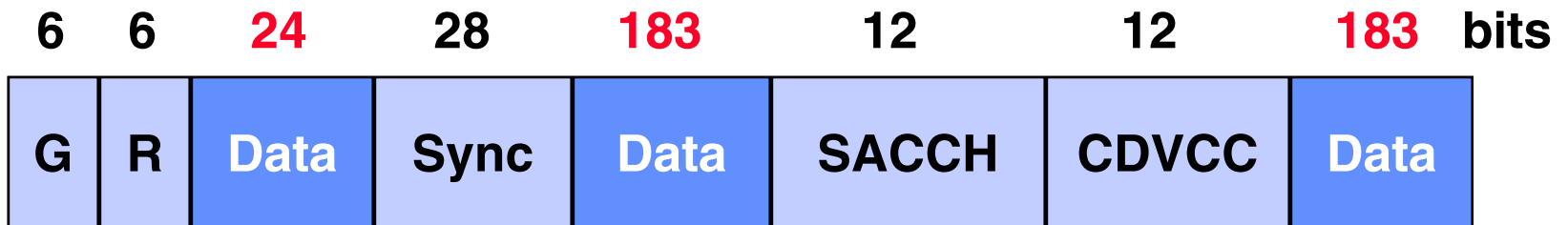
IS-136 TDMA frame structure



Enhanced IS-136 Frame Format



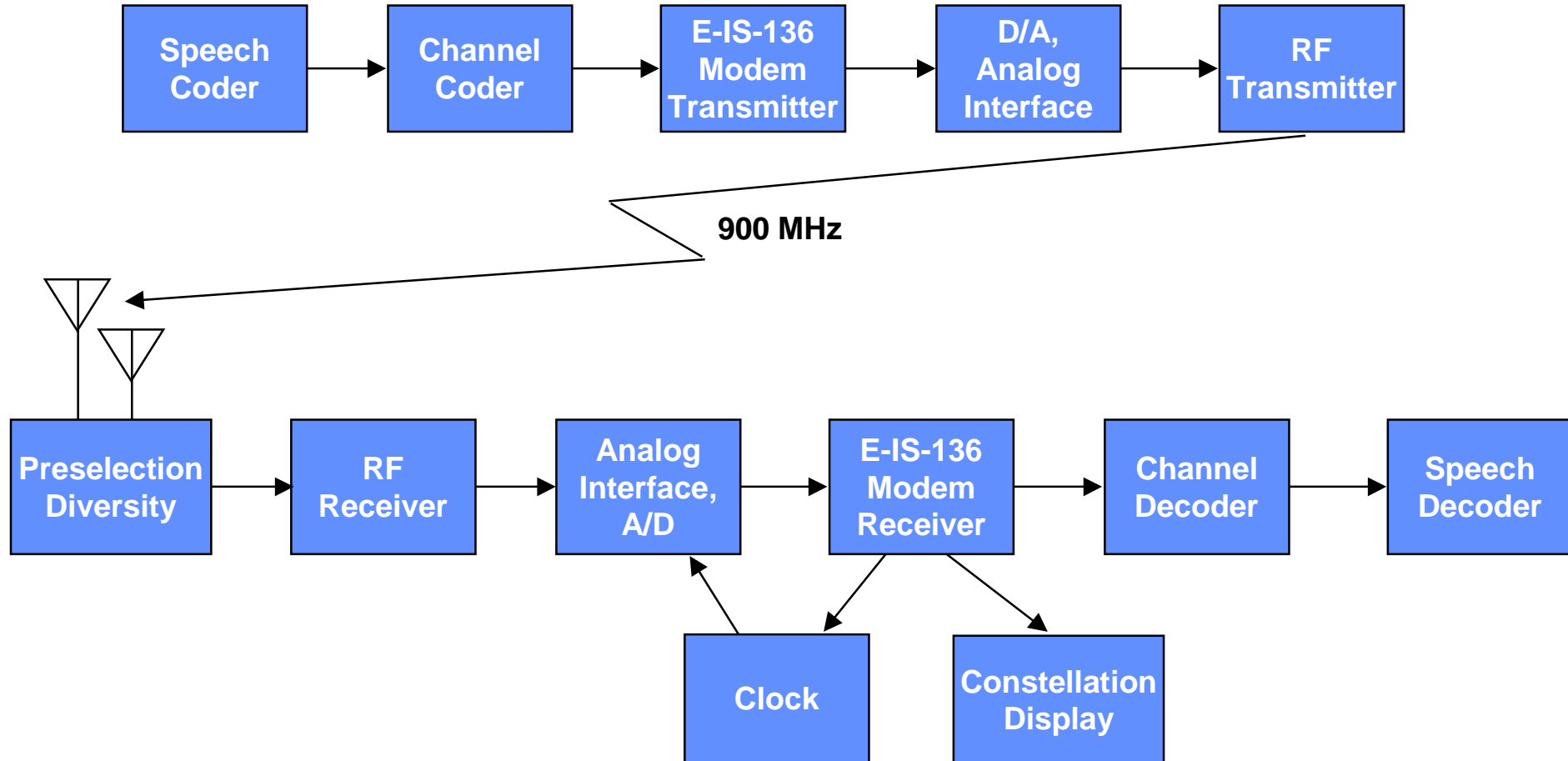
IS-54/IS-136 Format with 2 bits/symbol ($\pi/4$ -QPSK) at 24.3 kbaud



Advanced Mode Format with 3 bits/symbol ($\pi/8$ -8PSK) for Data Fields

Retains compatibility with existing IS-136 frame structure

Enhanced IS-136 Experimental System

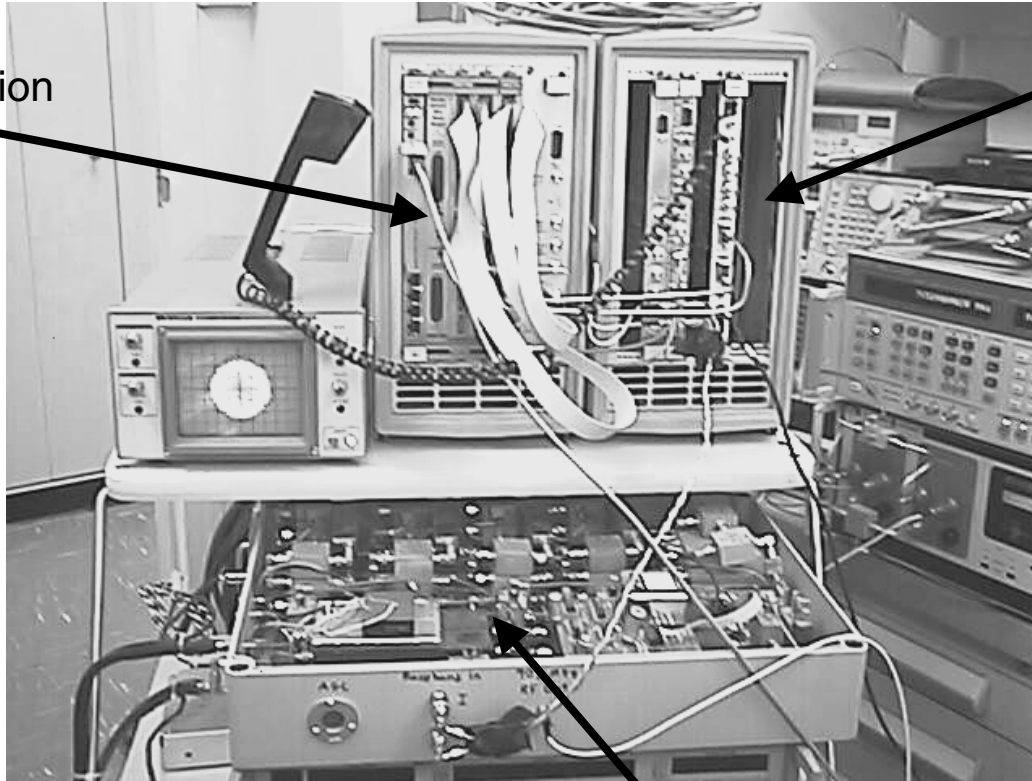


Experimental setup

Baseband

DSP processing:

- Speech coder
- TX coding/modulation
- RX demod
- RX decoding
- Speech decoder
- Clocks

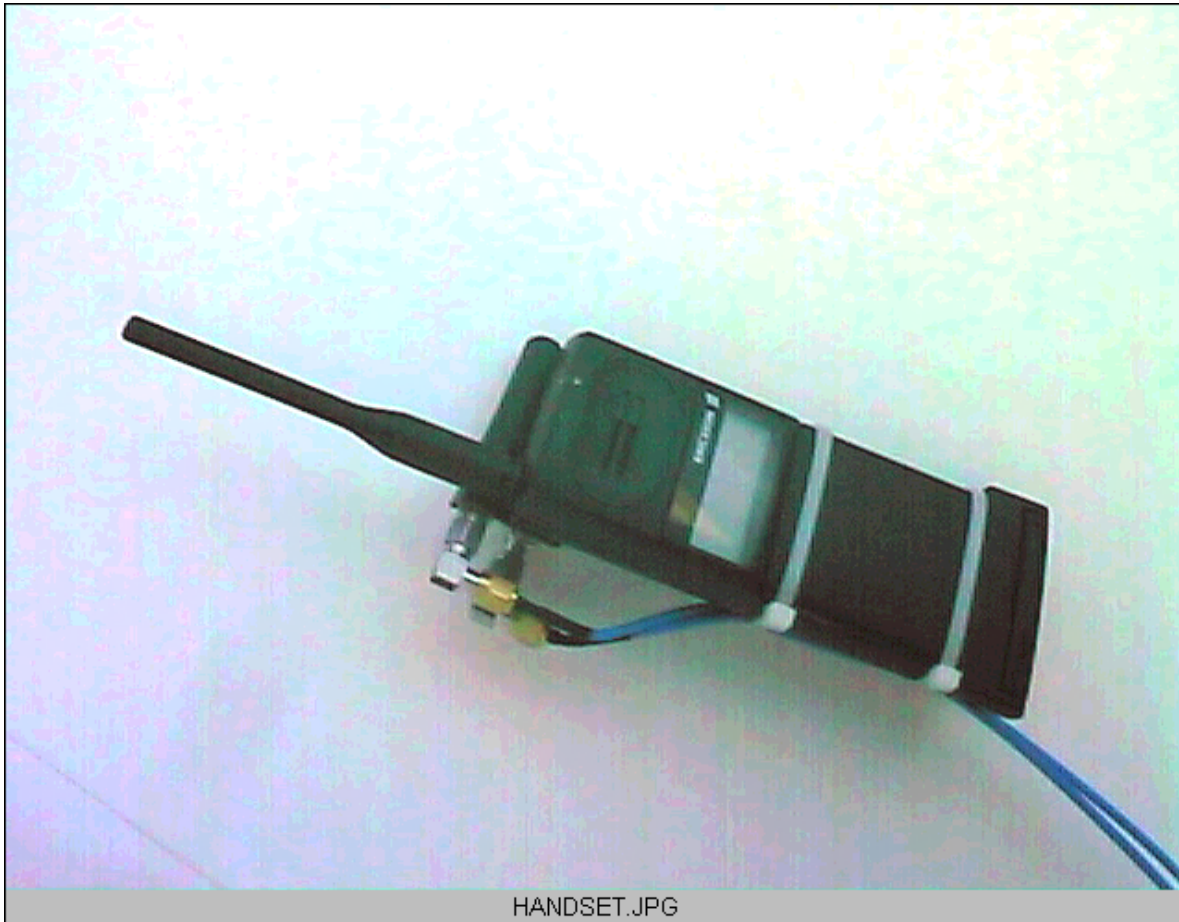


Analog:

- Audio interface,
- baseband filters
- IF

900 MHz Transceiver
Receiver - equal gain combining
or preselection diversity

Experimental handset design



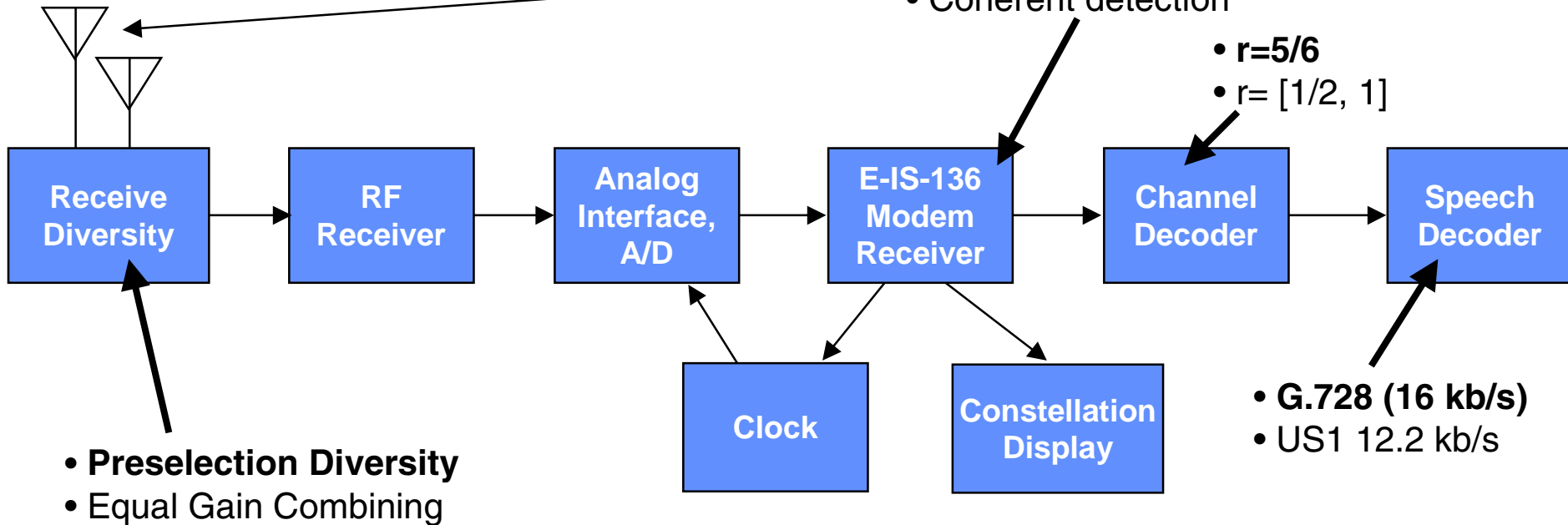
Options investigated



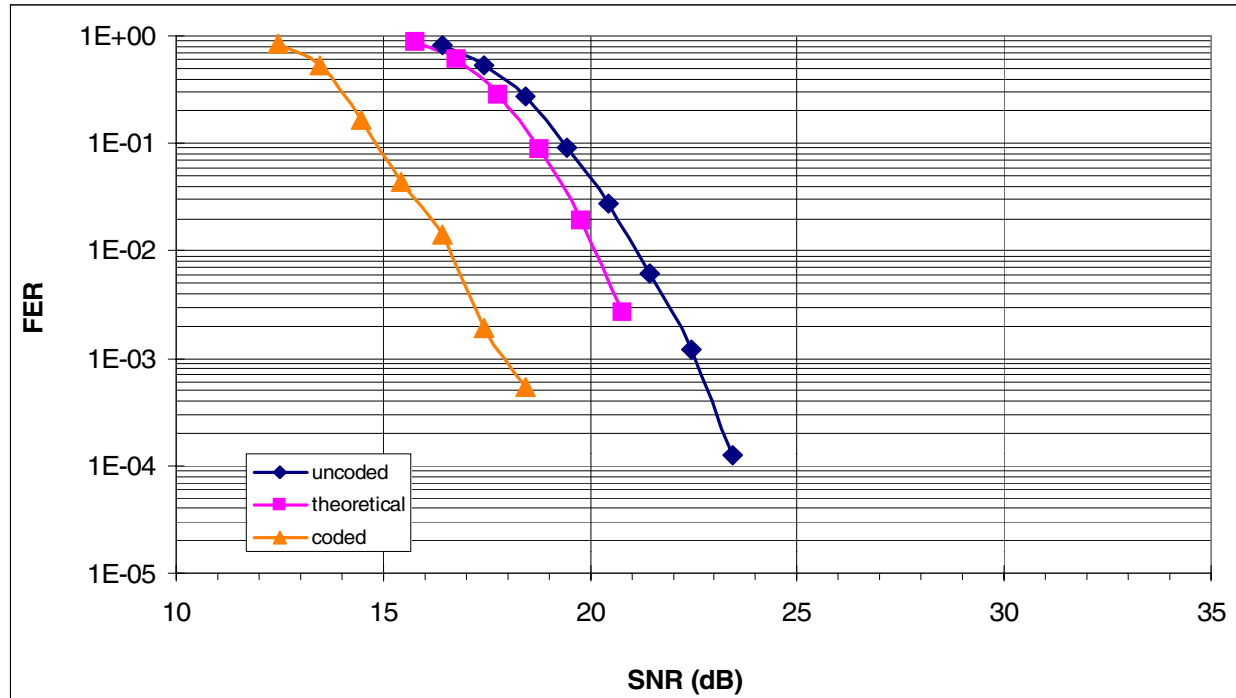
900 MHz

- Differential detection
- Coherent detection

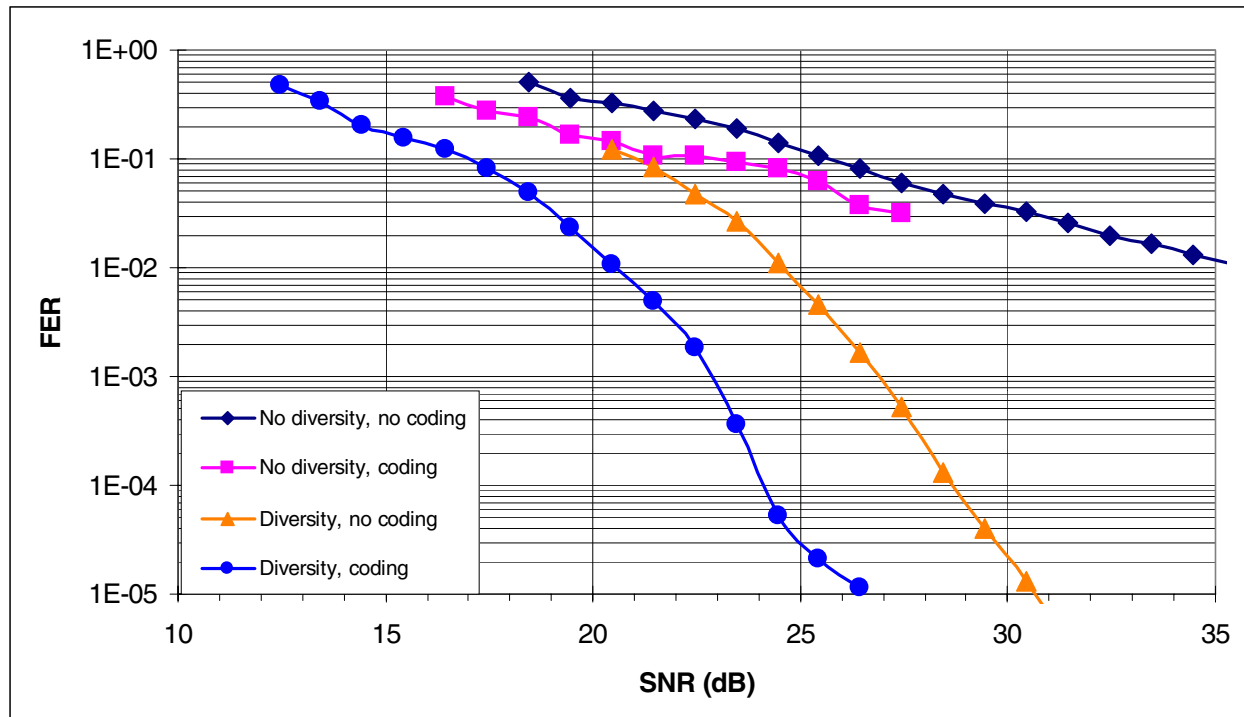
- $r=5/6$
- $r= [1/2, 1]$



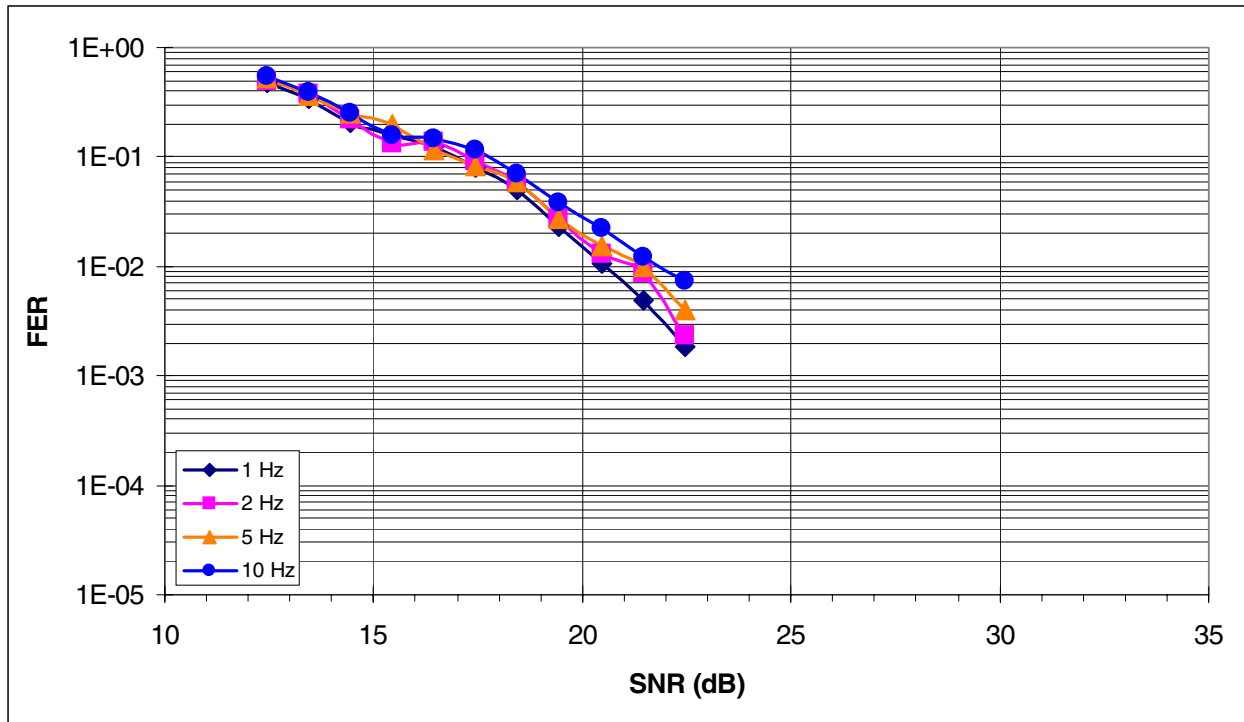
Performance in White Gaussian Noise



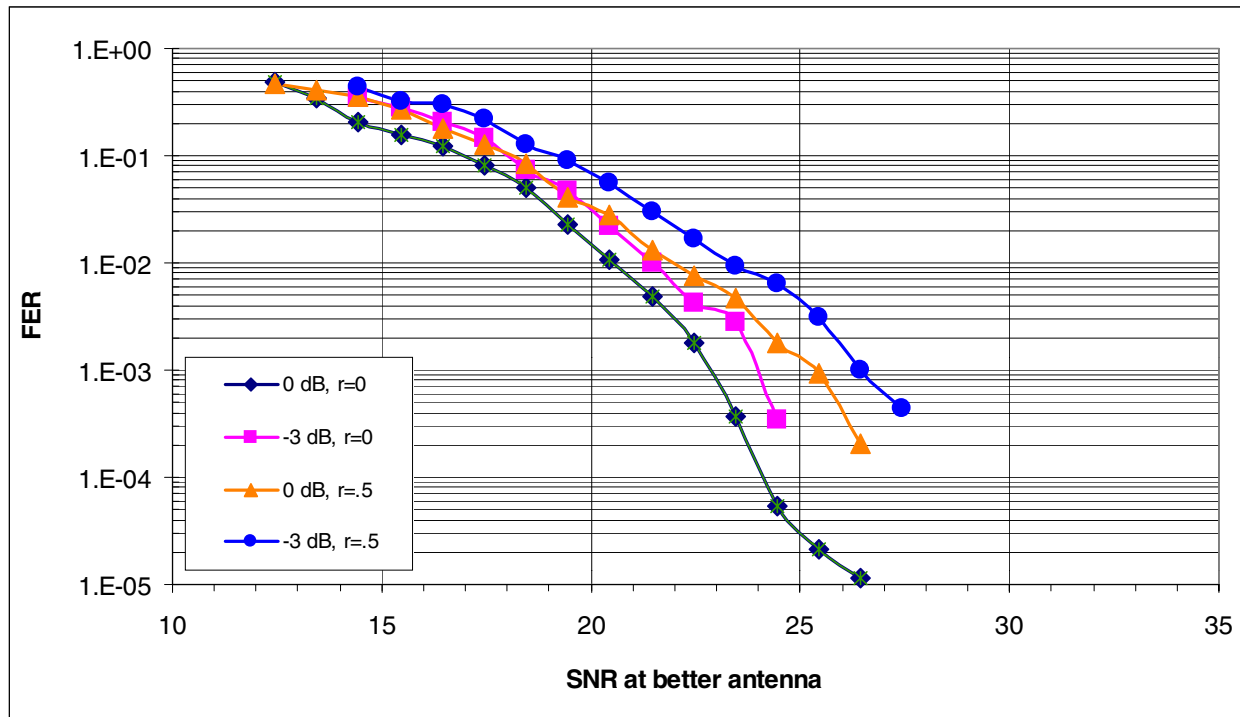
Performance in 1 Hz Flat Rayleigh Fading



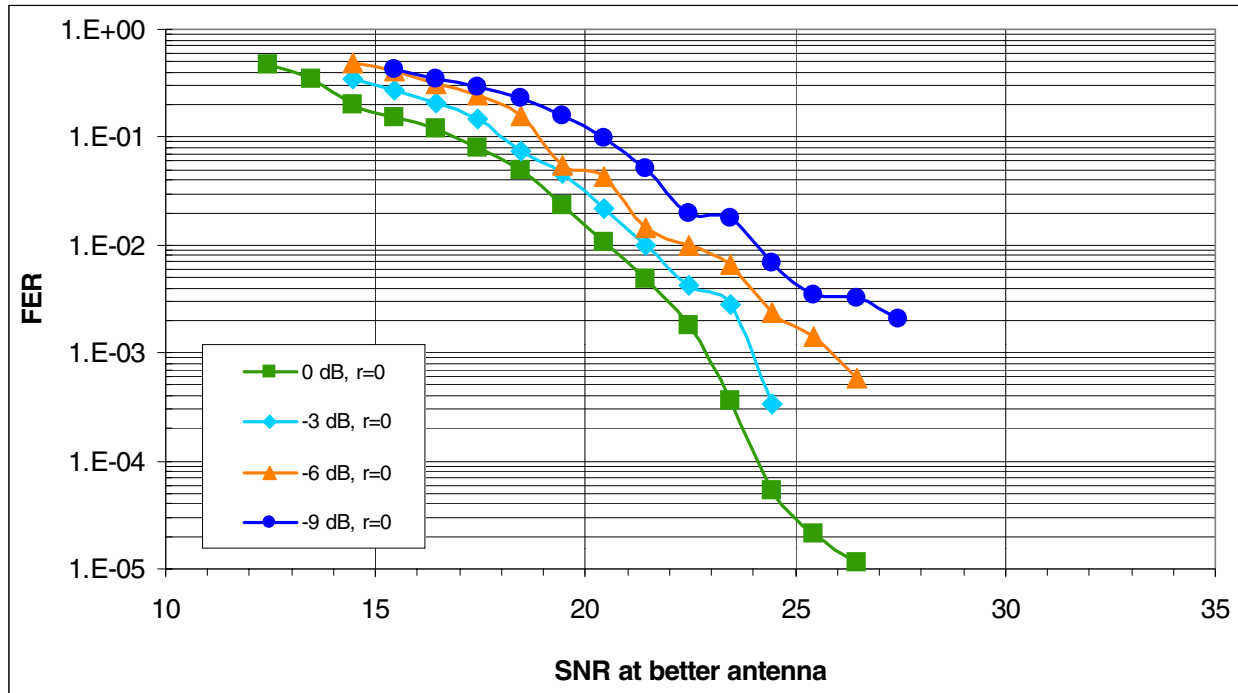
Performance at Higher Fading Rates



Performance with Correlated Fading, Unequal Antenna Gains



Performance with Unequal Antenna Gains



Current Work, Conclusions

- **Good quality (<1% FER, 16 kb/s) speech is possible at 20 dB SNR with $\pi/8$ -D8PSK, enhanced channel coding, and simple preselection diversity in an indoor, slow fading environment**
- **Ongoing investigations, focussing on coherent detection, lower bit rate speech coders offer promising results, even in rapid fading macrocell environment**