

# DUAL POLARIZED ADAPTIVE ANTENNA TEST-BEDS FOR GSM

**Anders G Derneryd**

**Core Unit Antenna Technology  
Ericsson Microwave Systems AB  
Molndal, Sweden**

# Outline

- **Technology Trends**
- **Test-bed Activities**
- **Antenna Configurations**
- **Radiation Patterns**
- **Conclusions**

# Adaptive Antenna Technology Trends

- **Tailored Antenna Beams**  
=> **Reduced Interference Levels**
- **Improved Link Budget**  
=> **Fewer Sites**
- **More Users / Hertz**  
=> **Virtually Increased Bandwidth**

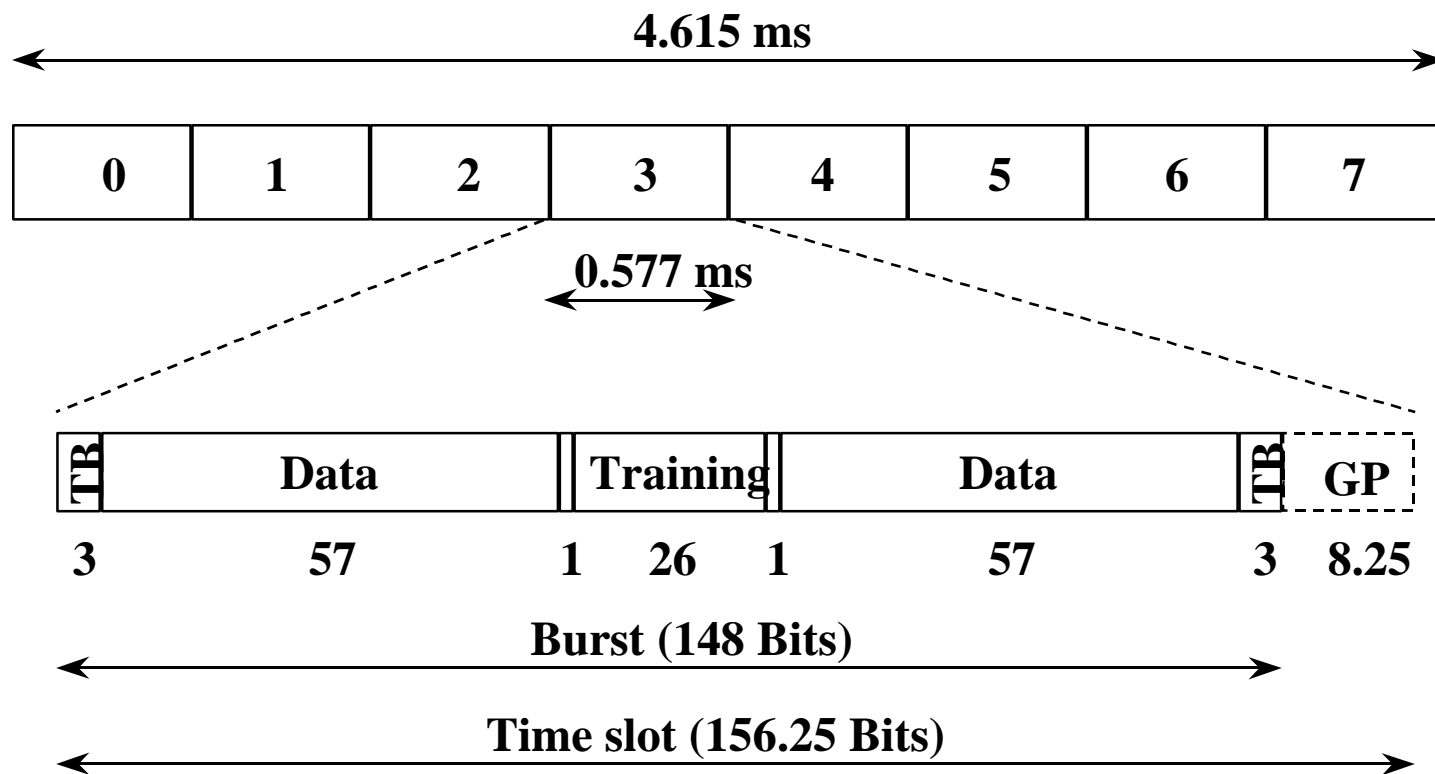
**to Reduce Operator Infrastructure Costs**

# **GSM Adaptive Antenna Test-bed Activities**

- **Ericsson - Mannesmann joint research project**
- **Evaluate radio link performance**
- **Examine capacity aspects**
- **Perform field trials with live traffic**

# GSM Radio Interface

## Basic TDMA Frame



# GSM Test-bed Field Trials

## Performance Comparison

- Dual polarized sector antenna
- Eight-branch dual polarized array antenna

## Array Antenna Functionality

- Eight-branch diversity combining in uplink
- Use uplink data to compute directional information and transmit in a narrow beam

# **GSM Test-bed Field Trials, cont.**

## **Performance Evaluation**

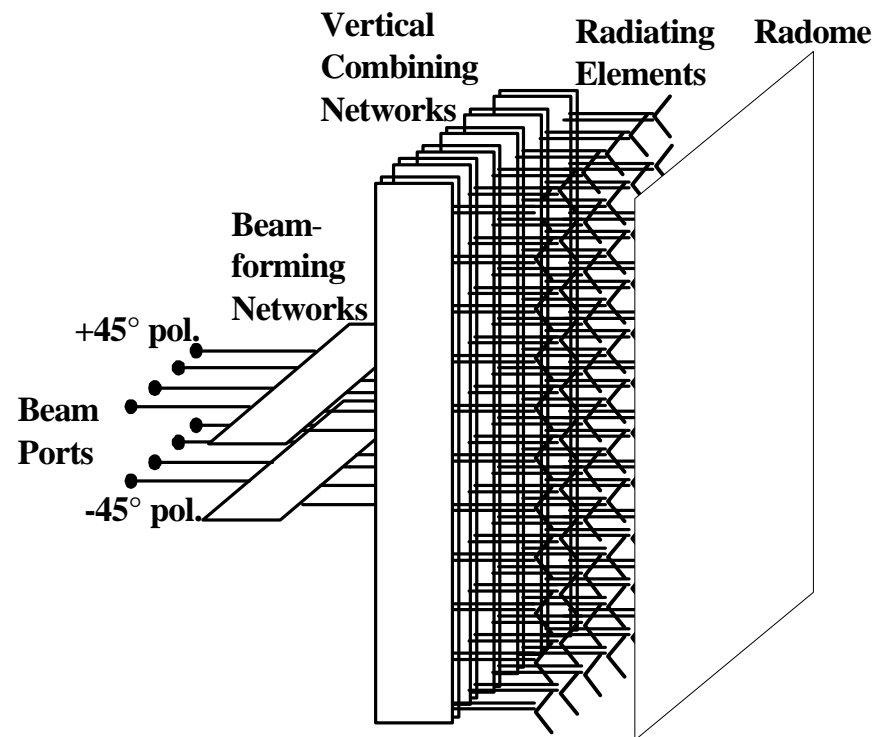
- **Integrate Adaptive Array Antenna into Mannesmann's Network**
- **Evaluate Performance with Live Traffic**

# GSM Array Antenna Characteristics

- **GSM 900 (Up: 890 - 915, Dn: 935 - 960 MHz)**
- **GSM 1800 (Up: 1710 - 1785, Dn: 1805 - 1880)**
- **Frequency bandwidth: ~ 9%**
- **Eight interleaved transmit/receive beams**
- **Dual polarized (+/- 45 deg) array antennas**
- **Low profile microstrip patch elements**

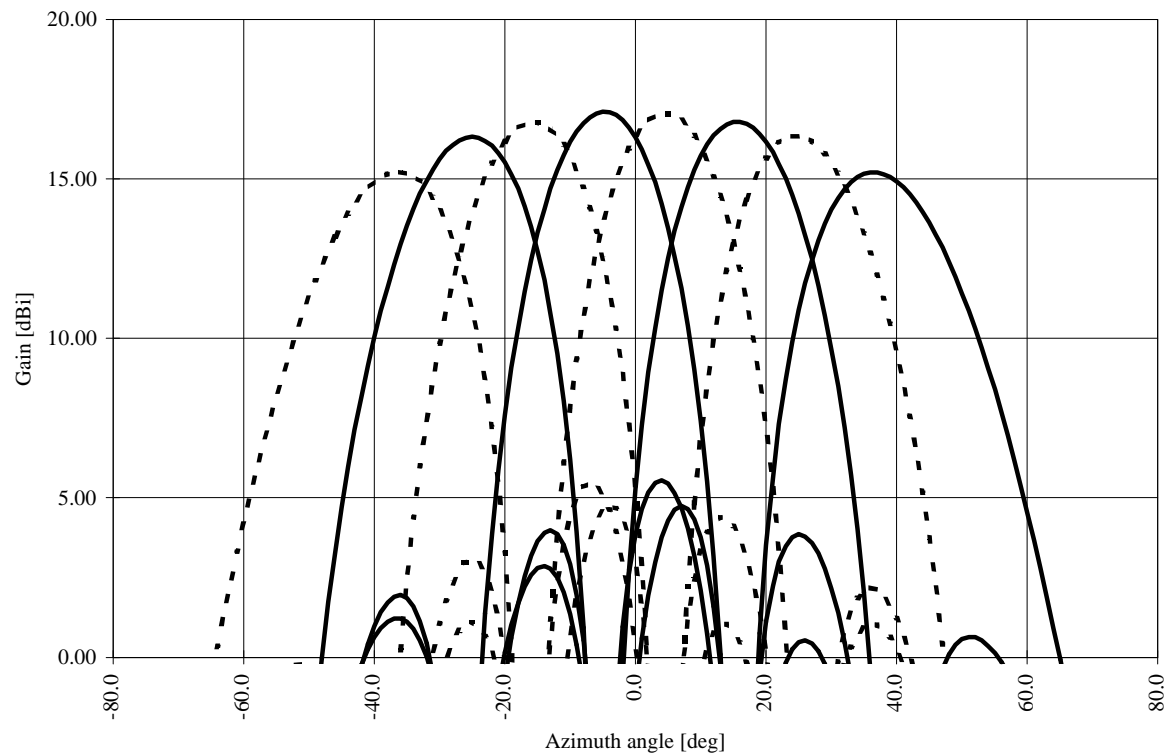


# GSM Array Antenna Configuration



# Array Antenna Radiation Patterns

(solid lines: +45 deg slant polarization, dashed lines: -45 deg slant polarization)



# Conclusions - GSM Link Performance

## Link Level Improvements - Array vs Sector

- **C/N environments:**

**4 - 5 dB**

- **C/I environments:**

**up link: > 10 dB**

**down link: 5 - 6 dB**

## Conclusions

- For a mature GSM operator, expected capacity improvements of about 100 % is of most interest; => This capacity increase corresponds to the same amount of available bandwidth if existing sites and conventional technology are used (~100 % increase).
- For a new GSM operator, coverage is of most interest; => Achievable range extension is determined by the 4 - 5 dB C/N improvements (~50 % fewer sites).