How Cell Phones Work

(Cell Phones 101)

Senior Instructor
Technical Operations Division
Objective

• Identify the basic technology features which enable cell phone communication

• Identify resources for more advanced study of cell phone technology
Cell Phones: The Basics

- Each Cell Carrier is provided (by FCC) 832 frequencies per geographic area.
  - Of these, 42 are used by the carrier for system control
- These frequencies are distributed via “cells”, each of which is typically from 1 to 10 square miles in area.
- Distributed through a cluster of seven cells

Typical Cell

These Two Cells Share Frequencies
Cell Phones: The Basics

• Each cell is assigned 56 voice channels.
  – A ‘channel’ is comprised of two frequencies: one to transmit; one to receive
  – Called ‘Duplexing’

• When users move from cell to cell, frequencies change without noticeable interruption.
Pages 5 through 6 redacted for the following reasons: 
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Cell Phones: The Basics

• By using multiplex technology (e.g.: ‘Spread Spectrum’) the 56 assigned cell channels can provide substantially more simultaneous conversations.

• For example, TDMA technology can interlace three conversations on a single channel.

• CDMA can typically interlace 10 or more communications on a single channel.
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Cell Phones: The Evolution
Current Cell Technology

- **TDMA**
  - Voice Only. Oldest digital technology.
- **CDMA**
  - Voice as well as other data (photos, email, etc.)
- **GSM (Global Systems for Mobile Communications)**
  - The standard in 168 different countries
  - Allows for cell communications when you travel to (e.g.) Botswana
  - Identifying feature: It requires a SIM memory card
Handoffs

- When a registered phone moves closer to a stronger tower, the call is ‘handed off’.
- The call is then routed through the new tower.
- This handoff is fully automatic and is generally transparent to the user.
- Sometimes, for technical reasons, a call may be routed to a weaker tower.
Towers
Welcome to Dallas/Ft. Worth

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Dallas/Ft. Worth Towers
Can You Spot the Towers?

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Can You Spot the Towers?

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Can You Spot the Towers?

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Senior Instructor
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Appreciation to the U.S. Secret Service for some of these visuals