Small Cell Technology
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Public Safety Communications Research

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Small Cell Characteristics

- According to the Small Cell Forum*
  - "'Small cells' is an umbrella term for operator-controlled, low-powered radio access nodes"

* http://www.smallcellforum.org/

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Small Cell Characteristics

- RAN Equipment is "small"
  - Is it bigger than a breadbox?
- Lower Output Power
  - 5 Watts or less
- Low Power Consumption
- Limited Range
  - Less than a kilometer
- Smaller Number of Users than a Macro
  - 128 or less
- Single Sector eNodeB

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Small Cell Applications

- Solving the Indoor Coverage Problem
- Filling Holes and Shadowed Areas between Macros
- Providing Temporary Coverage
  - Special events
  - Emergencies

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Typical Installation

Antenna

Microwave Backhaul

eNodeB

Power Supply and Batteries (not shown)

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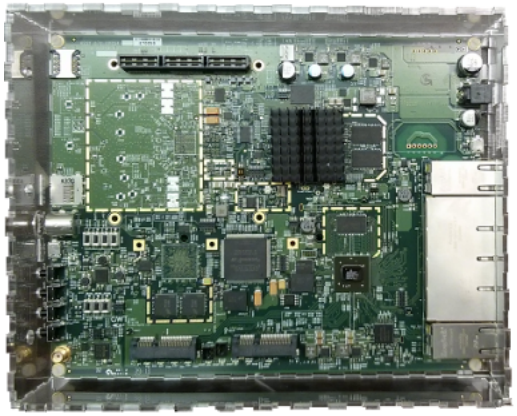
Very Small Cell



- Many more mounting options
  - Ceiling mount
  - Small vehicle
  - Drone or balloon
  - Human carried mesh network
- Coverage for immediate vicinity only
  - Interference with macro network must be mitigated

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Small Cell Deployment Issues

- Backhaul
  - Options include fiber, microwave, satellite, Ethernet, in-Band relay
  - Communication in a team can be accomplished without backhaul if a micro-EPC is used
- Timing
  - GPS may be unavailable
  - Precision Time Protocol over backhaul
  - It works pretty well without external timing
- Power and Power Backup
  - Small cell may need AC power or DC power
- Mounting and Intrusion Protection
  - Small cell may be more accessible and visible to the public

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Test Results

- Models available with output power from 20mW to 5W
- Maximum Throughput
  - Downlink: 58Mb/s to 68Mb/s
  - Uplink: 15Mb/s to 20 Mb/s
- Interference Tolerance Varies Widely
  - Band 13 UL interferer: -51dBm to -21dBm causes throughput degradation
  - P25 UL interferer: -62dBm to -21dBm causes throughput degradation

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Test Results

- Spectral Emissions
  - Similar results to Macro
  - Some will require extra filtering if colocated with Band 13
- Handover to Macro cell
  - One vendor succeeded
  - Three vendors have additional work to complete

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For Additional Information:

http://www.pscr.gov

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