Technology Overview 5G/Small Cells/DAS

Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment

Consultation Conference Call

Wireless Telecommunications Bureau Office of Native Affairs and Policy Federal Communications Commission

Understanding Spectrum

(Or... "How can something that I can't see, can't feel, can't smell or can't taste be so darn important to me?")



In a symphony orchestra each of the instruments plays at a different "frequency" - - basses low & violins high - - but the human ear can listen or "tune" each one separately, even down to a single player



AM and FM radio operate across bands of frequencies and we tune the radio to pick up individual stations



AM 540 – 1700 kHz FM 88 – 108 MHz

What is Spectrum?

- Spectrum = electromagnetic energy. It is all around us.
- Radio spectrum is broken up into what we call frequency "bands" (distinct parts of spectrum based on how often their energy waves oscillate) to transmit and receive signals.
- A familiar example may be FM radio. That band, as the numbers on the dial will indicate, goes from 88 megahertz to 108 megahertz – a slice of this large range of spectrum is available for transmitting information.

- What is a megahertz?
 - Frequency is measured in hertz or cycles per second. The time it takes for the crest of each wave to pass by is the frequency.
 - Just like light, radio waves exist at all frequencies.
- Frequency = number of cycles per second:
 - Hertz = 1 cycle per second
 - Kilohertz = Thousand cycles per second
 - Megahertz = Million cycles per second
 - Gigahertz = Billion cycles per second
- Wavelength=(Speed of Light)/Frequency
- Amplitude= Signal Strength or power





FC

How and Why Does the FCC License Spectrum Use?

- Short answer: To prevent chaos over the air.
- Spectrum is mostly licensed by both frequency bands and by geographic area.
- Generally, commercial licenses are awarded via competitive auction.

What does all that mean?

- 1. Spectrum is a way to transmit and receive radio signals (like in your car). Some signals power mobile telephones and broadband.
- 2. The FCC awards exclusive licenses to entities for much of the spectrum associated with the provision of radio, basic mobile phone, and advanced wireless services.
- 3. Generally, in order to get mobile phone coverage, an entity that holds an exclusive license with the FCC for spectrum must be deploying service.

Licensed Radio Services

• Broadcasting

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- Private Wireless
 - Public Safety
 - Industrial
 - Aviation
 - Marine
 - Amateur



- Commercial Mobile
 - Cellular
 - Personal Communications
 - Advanced Wireless
 - 700 MHz
 - Broadband Radio Service
- Fixed Wireless
 - Private
 - Common Carrier





Demand For Spectrum Is Exploding



Because the demand for spectrum has grown so quickly, particularly for mobile telecommunications, the FCC is reallocating spectrum historically available for broadcast TV stations to wireless telecommunications providers.



Demand for Mobile Continues to Grow





24X Data-Hungry Devices



It is predicted that by 2019, almost all handsets in North America will be smartphones and that total smartphone traffic over mobile networks will increase 10 times between 2013 and 2019

All of these trends are resulting in more demand for network capacity and for capital to invest in the infrastructure, technology, and spectrum to support this capacity

The demand for spectrum, moreover, is expected to continue to increase.

What is 5G?

- Simply put, 5G is the next (fifth) generation of deployed wireless services.
- Provides higher speeds, greater capacity and lower latency than existing services
- New networks will rely on lower power, higher frequency devices and will provide services over a smaller geographic area per site.

What is a Small Cell?

- Low-powered wireless base stations that function like cells in a mobile data wireless network – differ from the macro cells developed for voice
- Typically cover targeted indoor or localized outdoor areas ranging in size from homes and offices to stadiums, shopping malls, hospitals, and metropolitan outdoor spaces
- Designed to augment macro coverage and provide data capacity relief in densely populated areas
- Generally placed on existing structures in the rights of way
 - Power poles
 - Street lamps/Traffic Signals
- Generally 1/2 small antennas on an existing pole with a nearby equipment box









Why Small Cells?

- Wireless service providers often use small cells to provide connectivity to their subscribers in areas that present capacity and coverage challenges to traditional wide-area macrocell networks, such as coverage gaps created by buildings, tower siting difficulties, and challenging terrain.
- Because these cells are significantly smaller in coverage area than traditional macrocells, networks that incorporate small-cell technology can reuse scarce wireless frequencies, thus greatly increasing spectral efficiency and data capacity within the network footprint.
- For example, deploying ten small cells in a coverage area that can be served by a single macrocell could result in a tenfold increase in capacity while using the same quantity of spectrum.

What are DAS?

- Distributed Antenna Systems distributes RF signals from transmitters/receivers from a central hub to a specific area with poor coverage or inadequate capacity.
- Frequently consists of:
 - Number of remote communications nodes deployed through the desired coverage area – each node containing an antenna for transmission and reception
 - High capacity signal transport medium connecting each node with a central communications hub
 - Radio transceivers located at the hub site to process or control the communications signals transmitted and received through the antennas.
- DAS networks can often accommodate multiple providers using different frequencies or wireless interfaces.

Advantages of Small Cell Technologies

- Far smaller facilities required more flexible in siting
- Can be placed on light stanchions, utility poles, building walls and rooftops, and other small structures.
- Equipment is attached to the pole itself, no platforms or shelters
- Where new poles needed, typically minimal ground disturbance (2.5' diameter) compared to larger towers
- Providers can deploy in densely populated urban areas, areas where traditional towers are not feasible, or where localized wireless traffic demands would require greater number of macrocells.
- Useful to address capacity or coverage needs in areas with stringent siting regulations.
- Easy to blend with the structures on which installed.
- Cost effective way of addressing increased demand.
- Estimated more than 37 million small cells by 2017 and 16 million DAS nodes by 2018.

EXAMPLE DEPLOYMENTS



EXAMPLE DEPLOYMENTS





EXAMPLE DEPLOYMENTS



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EXAMPLE: CARRIER STAND-ALONE APPROACH

- Polygon small cell deployment tied to one coverage objective in a linear grouping
- Low power nodes= antennas and radios on poles located in rights-of-way
- Nodes need to "talk" to each other
- Served by a central box location requiring power and possibly ground disturbance if there is no existing fiber



EXAMPLE: NON-CARRIER HYBRID APPROACH

- Non-carrier company, developing infrastructure to lease to carriers
- Transport system with backhaul to fiber covering 3-5 mile range, supported by local small cells in public rights-of-way
- 120' Transport monopole
- 45'-75' Wood poles or light pole attachments
- Working with municipalities to reduce pole height and develop stealthing, shrouding and other aesthetic improvements

Small cell installations







Small Cell Poles Construction – Minimal Ground Disturbance







Small Cell Poles Size Differential

Small cell poles require minimal ground disturbance in comparison to the larger wireless tower configurations – approximately 5% of the average macro wireless tower installation.





FEEDBACK AND QUESTIONS

