# Small Wireless Facilities

## An Introduction to 5G Infrastructure and the Streamlined Section 106 Review of Small Wireless Facilities

FCC Environmental Compliance Workshop

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* This presentation and its contents are for informational purposes only; the Commission's rules in part 47 of the Code of Federal Regulations and the Commission's previous reports and orders adopting those rules represent the binding rules and determinations of the Commission.

# Small Wireless Facilities

## Introduction to Infrastructure Used for 5G Technology

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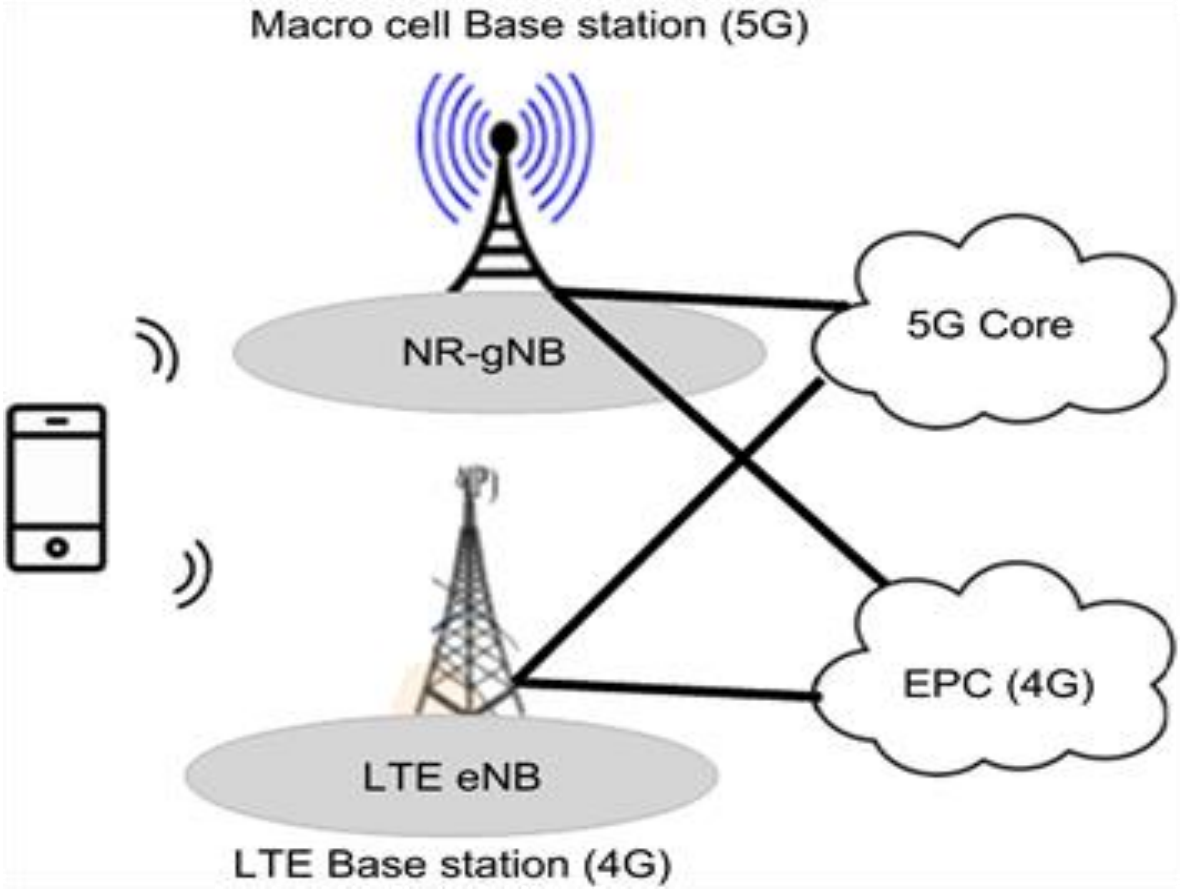
# Agenda

- Cellular Network Overview
- Types of Wireless Infrastructures
  - Macrocells
  - Small Cells and DAS
- Need for Small Wireless Facilities?
  - What is 5G?
- Examples of Deployments
- Streamlined Section 106 Review of Small Wireless Facilities

# Cellular Network Overview




Source: A. Rahman et al., licensed under CC BY

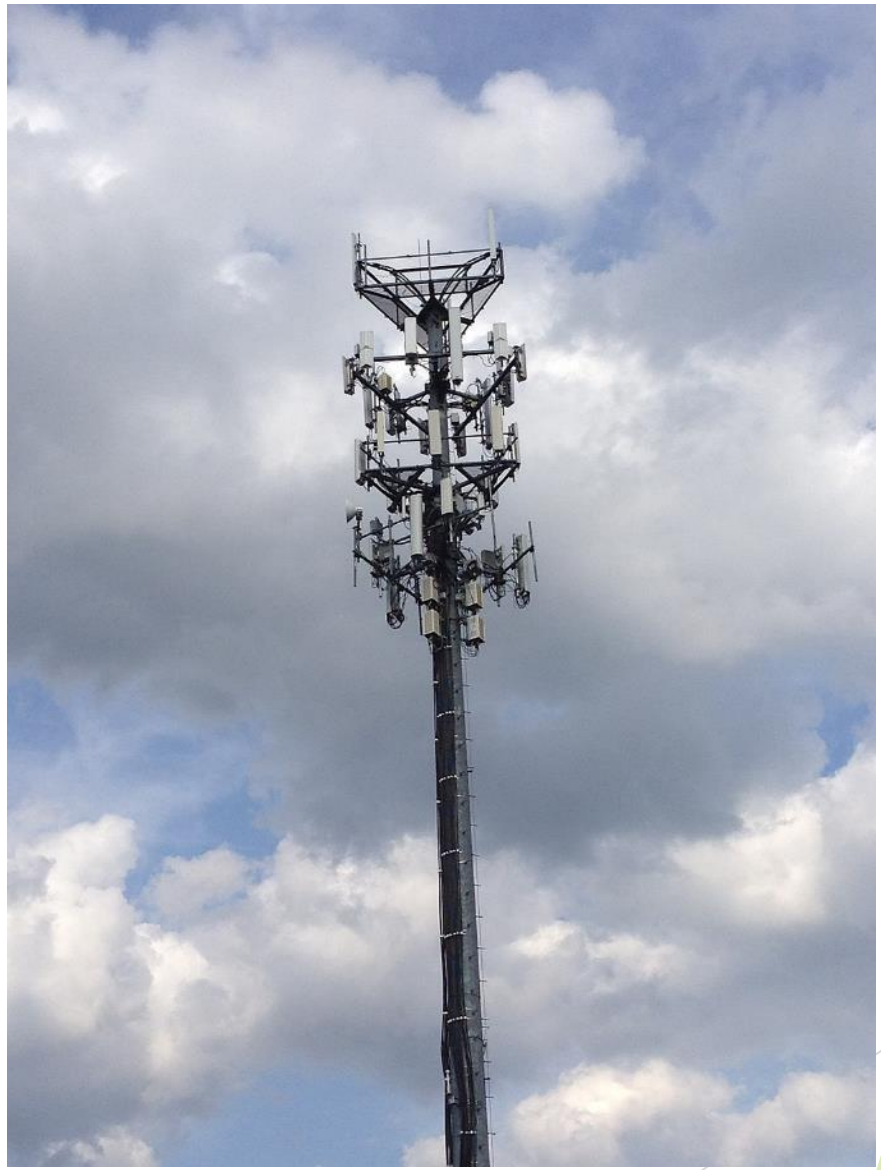
# Types of Wireless Infrastructures

- Macrocells
  - Macrocell sites are effective for covering large geographic areas (8-30 km in radius) with relatively high capacity, because the antennas are typically mounted on tall towers or the rooftops of tall buildings and transmit radiofrequency (RF) signals at high power levels.

- Small Wireless Facilities
  - On the other hand, facilities such as small cells and Distributed Antenna Systems (DAS) can be deployed to provide coverage in targeted locations (0.01 to 2 km in radius) by moving radios closer to the users, and to provide additional capacity in areas with higher demands for wireless voice and data services, which improves the quality of service and experience.
  - They use components that are a fraction of the size of traditional cell tower deployments and can often be installed on utility poles, buildings, and other existing structures.

# Types of Macrocell Antenna Structures

Monopole with antennas



Source: larry.vt.300, CC BY-SA 3.0, via Wikimedia Commons

# Types of Macrocell Antenna Structures

Lattice cellular tower

Source: Steve Kazella (talk), Author, Public domain, via Wikimedia Commons

# Types of Macrocell Antenna Structures

Building-mount camouflaged cellular antennas

Source: Jim.henderson, CC0, via Wikimedia Commons

# Types of Macrocell Antenna Structures

Stealth flagpole monopole

Source: Steve Kazella (talk) 14:17, 14 July 2009 (UTC), Public domain, via Wikimedia Commons

# Types of Macrocell Antenna Structures

Stealth tree monopole

Source: SteveKazella, Author, CC BY-SA 3.0, via Wikimedia Commons

# Small Cells

- “A small cell is a low-cost radio access point with low radio frequency (RF) power output, footprint and range. It can be deployed indoors or outdoors, and in licensed, shared or unlicensed spectrum.”
- “A small cell is a cellular base station that transmits & receives 3GPP-defined RF signals with small power and small form factor. In most cases, it services a small coverage area.”
- “The introduction of virtualized, disaggregated networks means that some small cells will consist of two or three elements, while others will still be all-in-one. Some form factors will be classed as ‘mini-macros’, which can be deployed unobtrusively on street furniture but have performance and power levels close to those of larger base stations. Others will be so tiny they can be embedded into pavements or consumer electronics.”
- Types of small cells include femtocells, picocells, and microcells—broadly increasing in size from femtocells (the smallest) to microcells (the largest).

Sources: https://www.smallcellforum.org/small-cells/; https://www.smallcellforum.org/5g-product-definition-report/

# Distributed Antenna System (DAS)

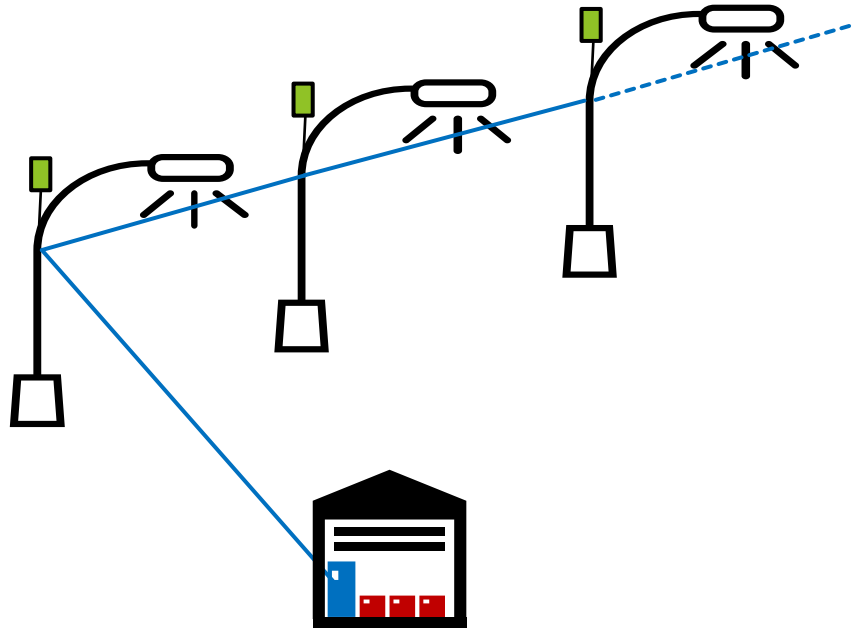
A Distributed Antenna System distributes RF signals from a central point to antennas located throughout a facility or area to provide seamless wireless coverage and capacity.

Typically used in large buildings, campus-type settings, stadiums, outdoor venues, city blocks, etc.

Can support a variety of frequency bands and technologies.

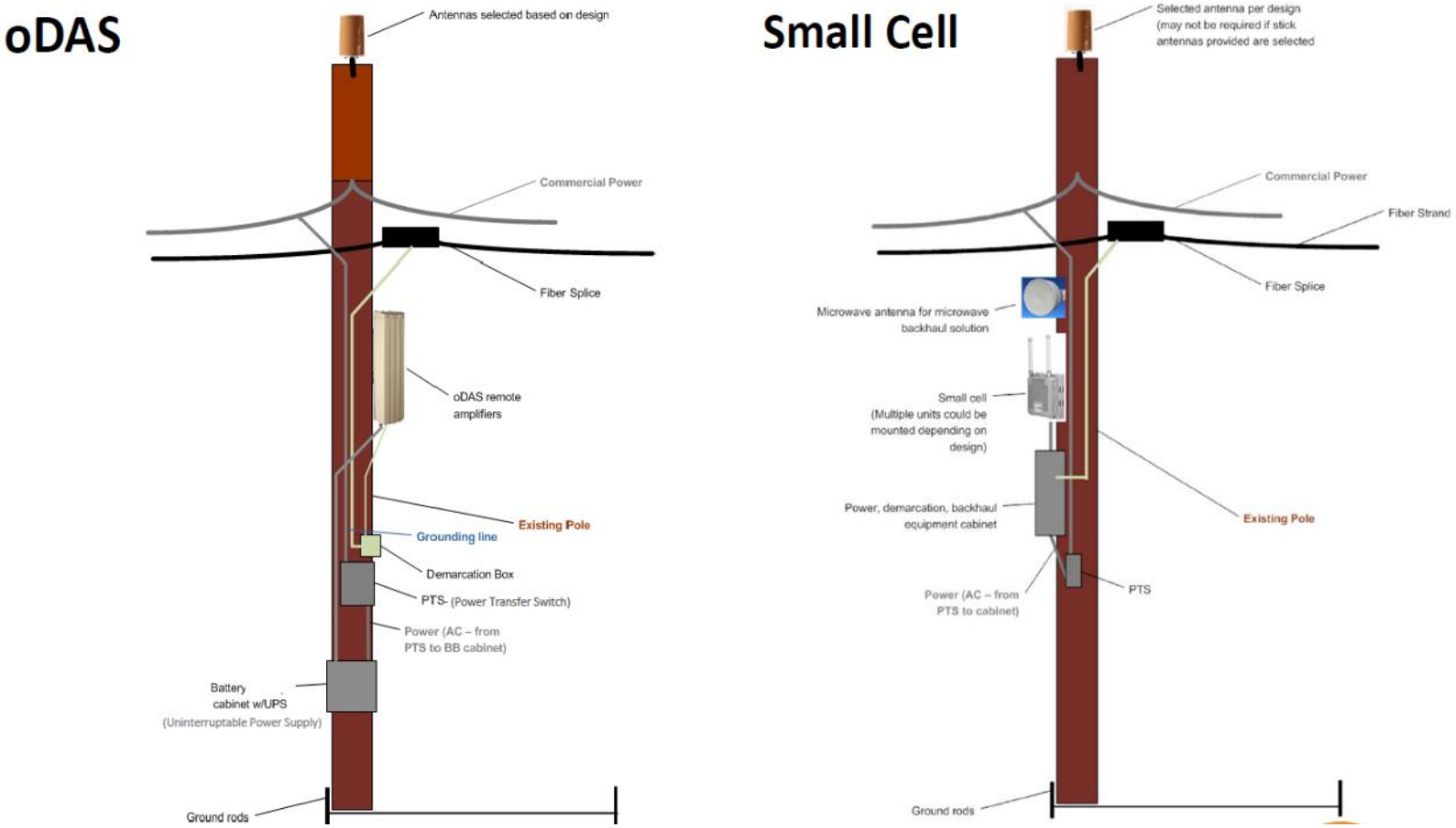
Source:
https://www.sbasite.com/English/solutions/in-building/das-and-small-cells/default.aspx

DAS Nodes connected via Fiber



Central Hub

# Pole-mounted DAS and Small Cell




Source: Letter from Colleen Thompson, AT&T, to Marlene Dortch, Secretary, Federal Communications Commission, WC Docket No. 11-59 (filed June 17, 2013)

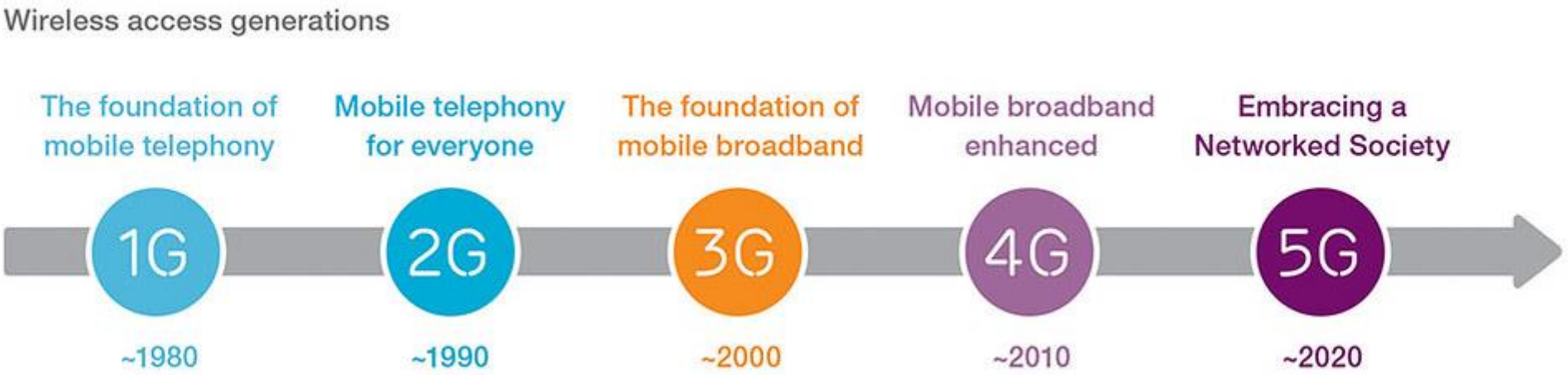
# Need for Small Wireless Facilities?

- Continuous increase in mobile traffic and required user data rates in today's 4G and 5G networks create the need for increased network capacity, which can be achieved by:
  - Making more spectrum available;
  - Using spectrum more efficiently; and
  - "Densifying" the network (i.e., adding more cell sites to increase the amount of available capacity, or adding equipment to augment existing mobile networks and provide additional capacity in areas of high usage).

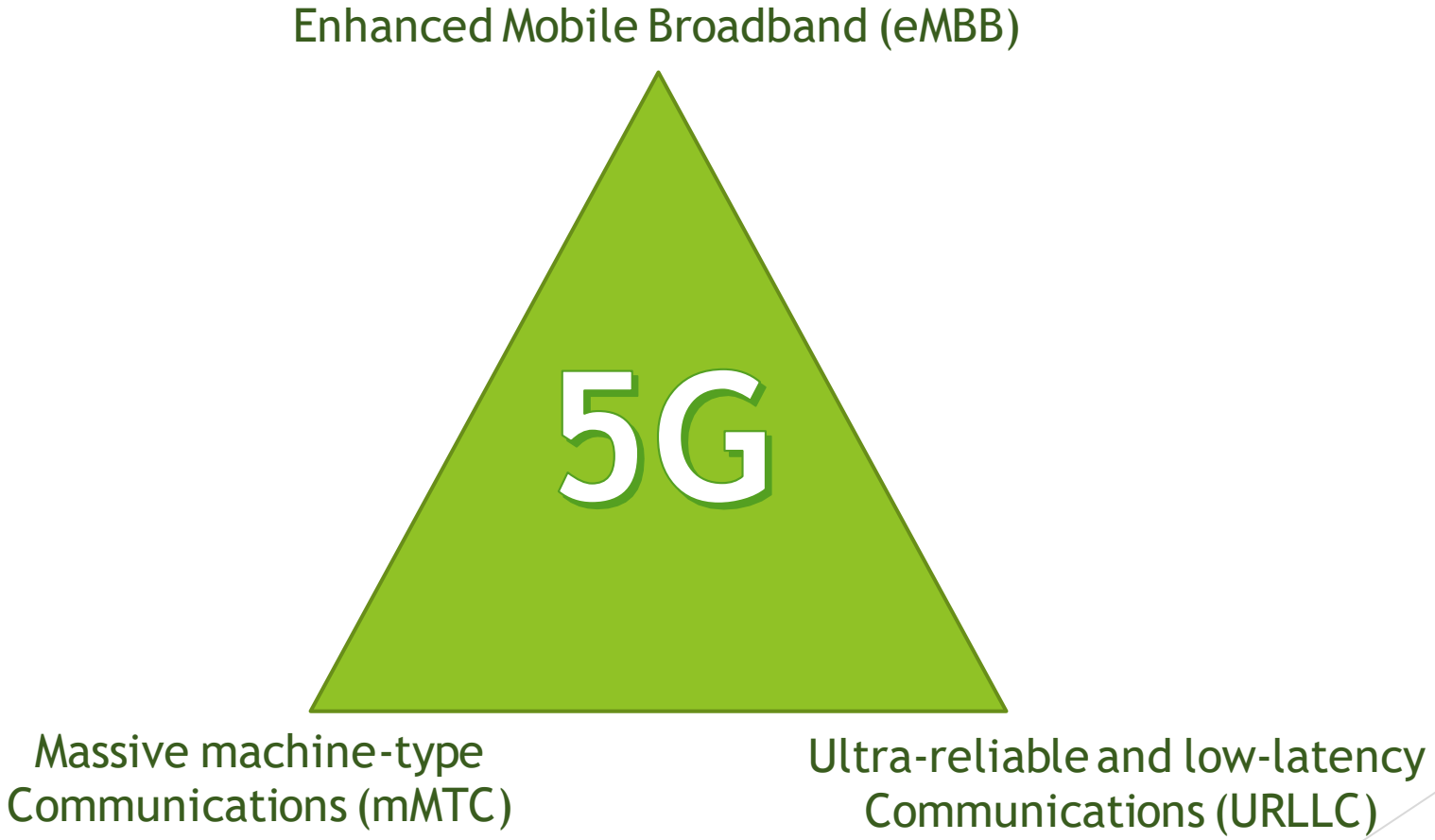
- Densification technologies include Distributed Antenna Systems (DAS) and small cells

Sources: http://www.rcrwireless.com/20161109/fundamentals/network-densification-5g-tag31-tag99;
Bridging the Gap Report, at http://www.jointventure.org/initiatives/civic-technology/wireless-communications

# What is 5G?



# 5G Usage Scenarios

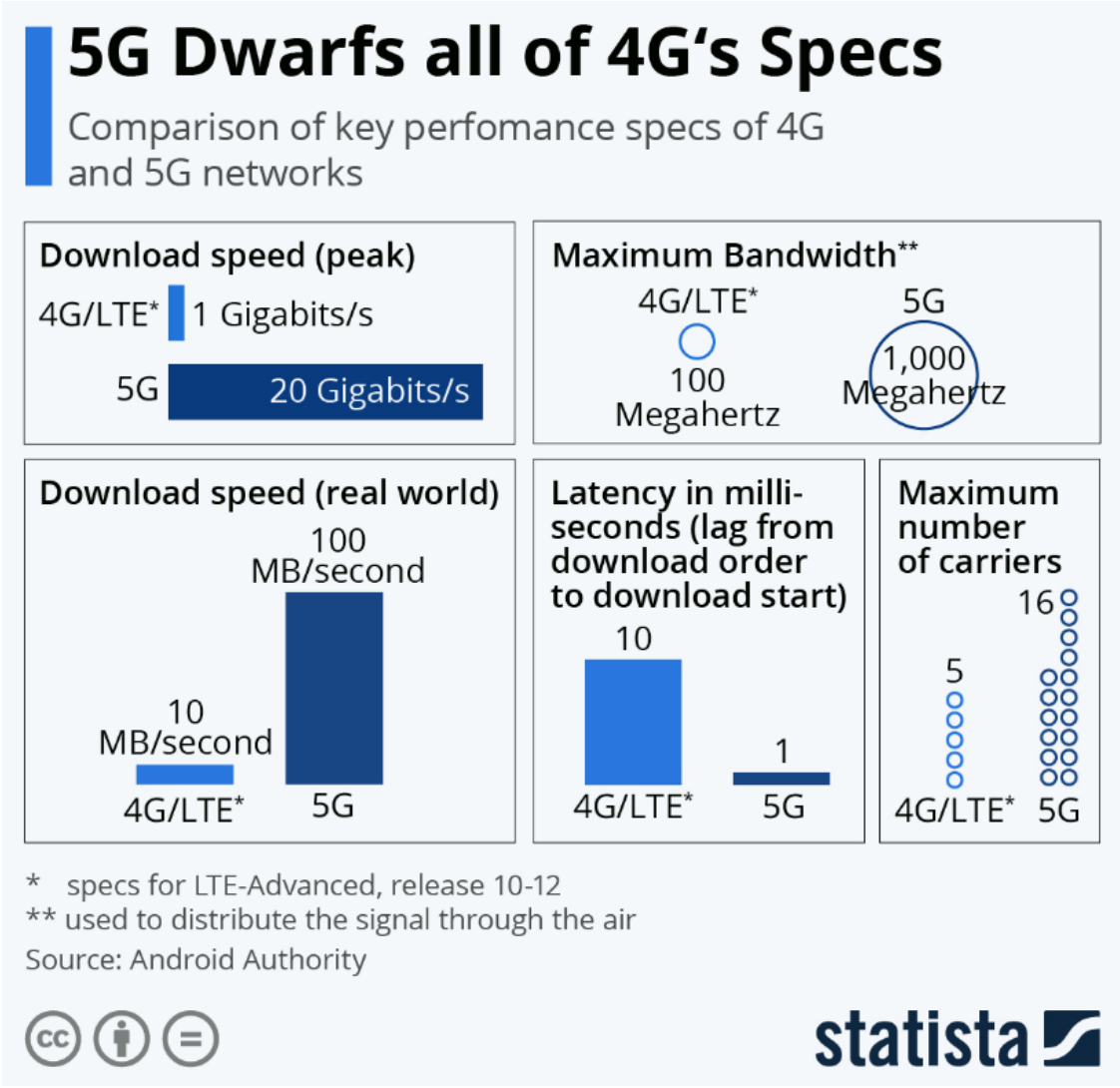


# ITU-R 5G Requirements

| Capability | Description | 5G requirement | Usage Scenario |
|---|---|---|---|
| Downlink peak data rate | Minimum requirements for peak data rates | 20 Gbps | eMBB |
| Uplink peak data rate | | 10 Gbps | eMBB |
| User experienced Downlink data rate | Target data rates in dense urban test environment, 95% of time | 100 Mbps | eMBB |
| User experienced Uplink data rate | | 50 Mbps | eMBB |
| Latency (user-plane; Radio Network) | Minimum user-plane latency assuming unloaded conditions | 4 ms | eMBB |
| | | 1 ms | URLLC |
| Bandwidth | Aggregated system bandwidth | ≥100 MHz, up to 1 GHz (higher bands) | eMBB |
| Connection density | Minimum number of devices per unit area | $10^6/km^2$ | mMTC |
| Peak downlink spectrum efficiency | Throughput per unit wireless bandwidth and per network cell | 30 bit/s/Hz | eMBB |

Source: https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2410-2017-PDF-E.pdf

# 4G vs 5G

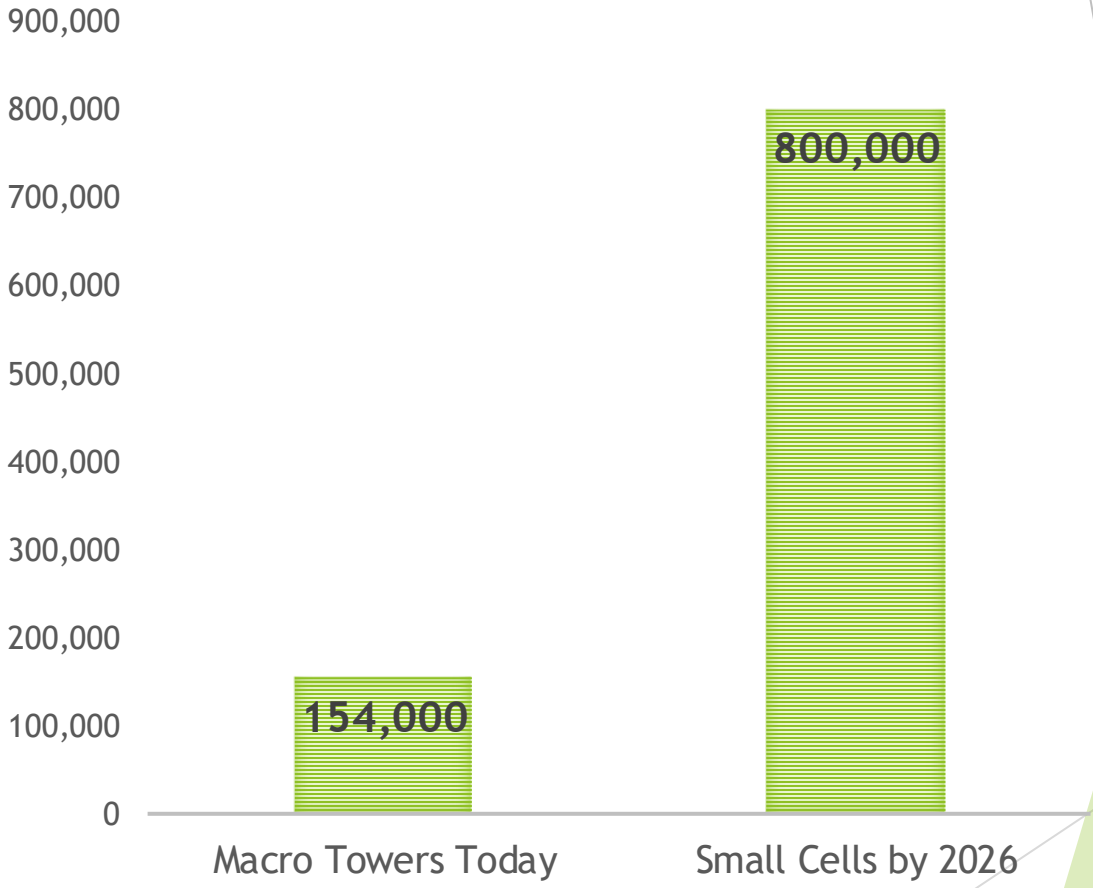



Source: https://www.statista.com/chart/17506/5g-and-4g-comparison/

# Projected Deployments of Small Wireless Facilities in the United States

- S&P Global Market Intelligence projects more than 800,000 small cells deployed by 2026.

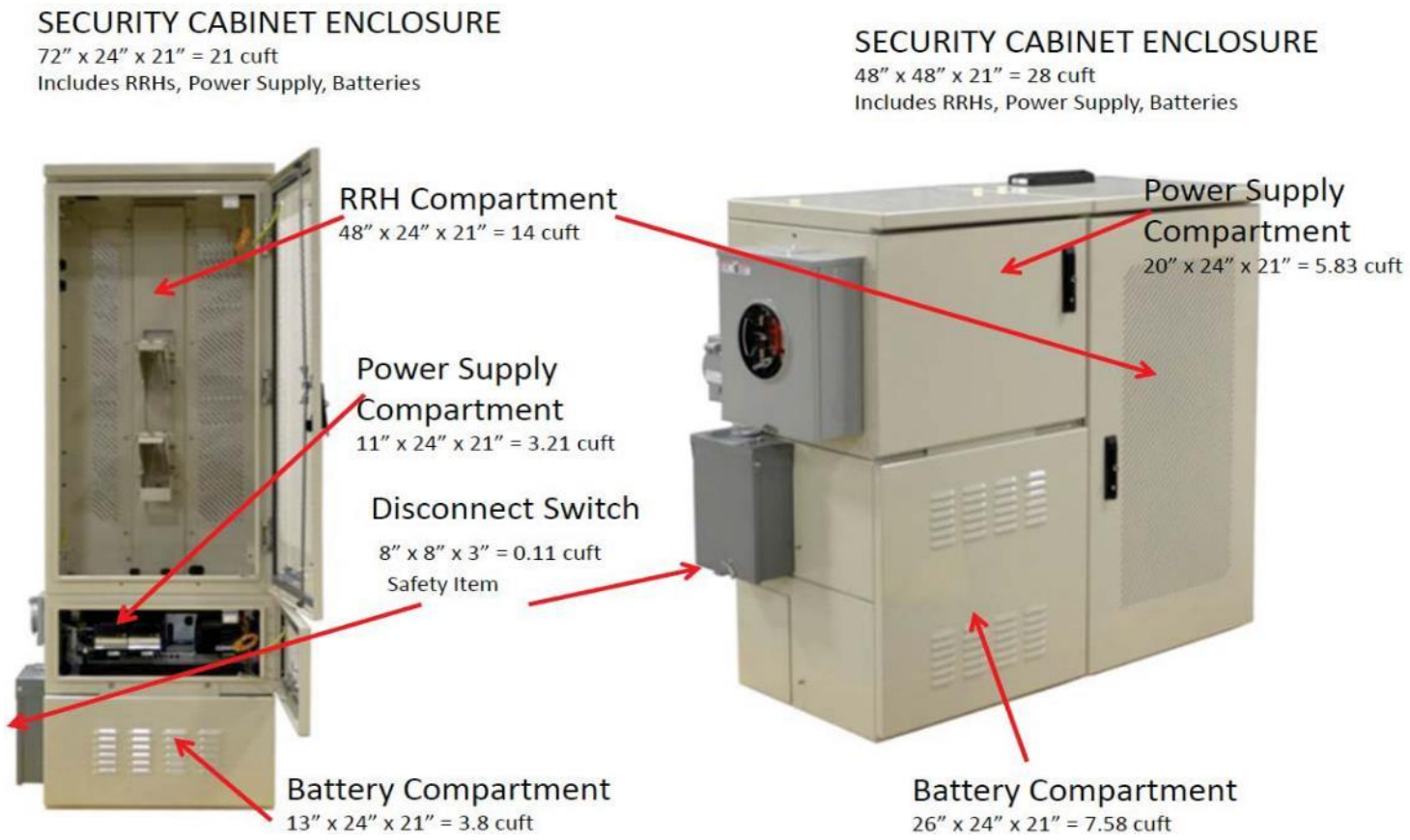
Disclaimer: Projections may not be consistent with future deployment plans of mobile service providers.




Source: https://www.ctia.org/homepage/infrastructure-channel

# Examples of Deployments

# Two Small Facility Associated Equipment Cabinets




Source: Comments of PCIA, WT Docket No. 15-180, at 3 (filed December 18, 2015)

# Rooftop Platform-mounted Small Cell Deployment

Cell Cabinet
19.92 cuft
Includes Radio Transmitter, Power Supply, and Batteries


TELCO DEMARC
0.5 cuft
Non-Verizon Owned

Disconnect Switch
0.11 cuft
Safety Item

Source: PCIA Letter to WTB, FCC, WT Docket No. 15-180, at 24 (filed December 18, 2015)

# Small Wireless Facility in Historic Central Park, NY

Source: Comments of PCIA - Attachment, WT Docket No. 15-180, at 25 (filed September 28, 2015)

# Small Cell on a Lamp Post

Small facility deployed in historic Pittsburgh, PA

Source: Comments of Crown Castle, WT Docket No. 15-180, at 14 (filed September 28, 2015)

# Small Cell on Utility Poles

Source: Comments of PCIA - Attachment, WT Docket No. 15-180, at 23 (filed September 28, 2015).

# Small Cell on a Lamp Post

Source: Tony Webster from Minneapolis, Minnesota, United States, CC BY-SA 2.0, via Wikimedia Commons

# Stealth Small Cell Pole

Equipment hidden inside the pole structure

Source: Jeffrey Beall, CC BY 4.0, via Wikimedia Commons

# Small Wireless Facilities

## Streamlined Section 106 Review of Small Wireless Facilities

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Federal Communications Commission

# Small Wireless Facilities – Environmental Review

- The Federal Communications Commission has streamlined environmental and historic preservation review processes for small wireless facilities under the National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA).
- Many small wireless facilities are deployed as collocations and the review process for collocations, including small wireless facilities, has been tailored to eliminate review of collocations that will not significantly affect the environment or adversely affect historic properties.

# NEPA – Categorical Exclusion for Collocations

- Small wireless facilities generally qualify for the categorical exclusion for collocations.
- In general, collocations are categorically excluded from detailed environmental review under NEPA and the provider is not required to file an environmental assessment.
- Two exceptions are deployments that:
  - would cause human exposure to radio frequency emissions in excess of established guidelines; and
  - may affect historic properties that are listed in or eligible for listing in the National Register.

# Section 106 Review – Small Wireless Facilities

- 2001 Nationwide Agreement for the Collocation of Wireless Antennas (Collocation Agreement) excludes from Section 106 review most collocations that are not on or near historic properties or historic districts.
- Exclusions for collocations on buildings, poles, and other non-tower structures in the original agreement were limited and did not apply to collocations that were:
  - on or near a historic building or structure; or
  - on a building or structure that was over 45 years old.
- Development of small wireless facilities created an opportunity to expand exclusions for collocations.

# Collocation Agreement Amendment

- FCC, ACHP, and NCSHPO amended the Collocation Agreement on August 8, 2016.
- The 2016 amendment provided additional limited exclusions for small wireless facilities.
  - Significantly expanded exclusions for small wireless facilities collocated on buildings and structures, regardless of age (*i.e.*, more than 45 years old) that are not historic or in or near historic districts.
  - Adopted limited exclusions for small wireless facility collocations on buildings and structures that are historic or in or near historic districts.

# Small Cells on Buildings and Structures More than 45 Years Old

- Small wireless facilities on buildings or structures that are more than 45 years old are excluded from Section 106 review unless:
  - building or structure is located inside a historic district or visible within 250 feet of a historic district;
  - the building or structure is a designated National Historic Landmark, or listed in or eligible for listing in the National Register; or
  - the collocation causes new ground disturbance.

# Small Cells on Buildings and Structures More than 45 Years Old

- The facility must meet specified size limitations to qualify as excluded:
  - Each individual antenna, excluding the associated equipment, may be no more than 3 cubic feet in volume and 6 cubic feet cumulatively.
  - Associated equipment may not exceed 21 cubic feet on poles and 28 cubic feet on non-pole structures.
    - If the collocation can accommodate at least three providers, associated equipment may not exceed 28 cubic feet for poles, and 35 cubic feet for non-tower structures.

# Exclusion for Small Cells – Historic Properties

- Three exclusions for small wireless facilities in or near historic districts:
  - General exclusion for small wireless facilities on (or inside) historic properties, inside or near historic districts.
  - Exclusion for small wireless facilities on utility poles/electric transmission towers that are historic properties or inside or near a historic district.
  - Streamlined process for small wireless facilities on lighting structures in historic districts.

# General Exclusion for Small Cells – Historic Properties

Small wireless facility collocations on buildings and non-tower structures that are historic properties or in or near historic districts are excluded from Section 106 review under specified conditions including:

- building may not be a National Historic Landmark;
- no pre-existing antenna on building or structure;
- antenna is disguised or stealthed to complement building or structure;
- antenna on the building or structure is no larger than 3 cubic feet;
- antenna's associated equipment may not be visible from public streets or public spaces at the ground level anywhere within 250 feet of historic district; and
- no new ground disturbance (except up to four lightning grounding rods).

# Exclusion for Small Cells – Utility Structures in Historic Districts

Collocations on utility poles or electric transmission towers located inside or near a historic district are excluded, provided that:

- structure is not a National Historic Landmark;
- antenna does not exceed 3 cubic feet in volume, with a cumulative limit of 6 cubic feet if there is more than one antenna on the structure;
- antenna's associated equipment on the structure does not cumulatively exceed 21 cubic feet in volume; and
- no new ground disturbance (beyond up to four lightning grounding rods).

# Exclusion for Small Wireless Facilities – Lighting Structures in Historic Districts

- Collocation Agreement created a streamlined process for small wireless facility collocations proposed on structures that have the primary purpose of providing public lighting.
- Small wireless facility collocations on lighting structures that are located in or near historic districts may be eligible for an exclusion provided that:
  - Structure is not a designated National Historic Landmark or listed in or eligible for listing in the National Register of Historic Places;
  - Antenna, excluding the associated equipment, is no more than 3 cubic feet in volume, with a cumulative limit of 6 cubic feet; and
  - The associated equipment and any pre-existing antennas and associated equipment on the structure, are cumulatively no more than 21 cubic feet in volume.

# Exclusion for Small Wireless Facilities – Lighting Structures in Historic Districts

- Applicant seeking an exclusion for a collocation of a small wireless facility on a lighting structure in or near a historic district is subject to the following procedural requirements:
  - Applicant determines that the structure is not a contributing or compatible element within the historic district;
  - Applicant must request in writing that the SHPO concur with its determination;
  - SHPO has 30 days to respond; and
  - If SHPO either informs applicant that the structure is not a contributing or compatible element or fails to respond to the applicant within 30-day period, the Applicant has no further Section 106 review obligations.

# Utility Pole Replacement Exclusion

- In the 2017 Pole Replacement Report and Order, the Commission excluded from Section 106 review (under certain conditions) the replacement of a utility pole where the pole was not originally constructed for the sole or primary purpose of supporting an antenna for an FCC licensed service.
- This exclusion was adopted in part to help expedite the deployment of small wireless facility collocations on utility poles.
- The replacement pole exclusion complements the exclusion adopted in the 2004 Nationwide Programmatic Agreement, which excluded from Section 106 review (under certain conditions) the replacement of a tower that was originally constructed for the sole or primary purpose of supporting an antenna for FCC licensed service.

# Utility Pole Replacement Exclusion (continued)

A utility pole replacement will be excluded from Section 106 review if both the original pole and the replacement pole meet certain conditions.

To be excluded, the original pole must meet the following conditions:

- it must be a pole that can hold utility, communications, or related transmission lines;
- the pole must not have been originally erected for the sole or primary purpose of supporting antennas that operate pursuant to a spectrum license or authorization issued by the Commission; and
- the pole itself may not be a historic property.

# Utility Pole Replacement Exclusion (continued)

To qualify for the exclusion, the replacement utility pole must meet the following conditions:

- The location of the pole can be no more than 10 feet away from the original pole;
  - Distance is calculated from the centerpoint of the replacement pole to the centerpoint of the original pole.
- the replacement pole may not create new ground disturbance (either laterally or in depth);
- the height of replacement pole may not exceed the height of the original pole by more than 5 feet or 10 percent of the height of the original pole, whichever is greater; and
- the replacement pole must be consistent with the appearance and quality of the original pole.

# Collocation of Antenna on Replacement Pole May Require Section 106 Review

- The replacement pole exclusion applies to the pole replacement alone. This exclusion does not apply to the antenna.
- Footnote 25 of the 2017 Pole Replacement Report and Order provides that the antennas are considered separately deployed and are subject to the Commission's rules implementing Section 106, including the terms of the Collocation Agreement.
- Applicants seeking to locate small wireless facilities on replacement poles excluded from review under the 2017 Pole Replacement Report and Order must consult the Collocation Agreement to determine if the antenna and associated equipment qualify for a Section 106 exclusion or require review.

# QUESTIONS?

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# LUNCH BREAK

Next Presentation Begins

@ 1:15pm EST