Qualcomm

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Presentation for the UK Spectrum Policy Forum

On Future Demand for Unlicensed Spectrum

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Topics

Introducing Qualcomm and Wi-Fi

Application Drivers

A perspective on unlicensed spectrum needs

Global Wi-Fi leadership, innovating since 1998

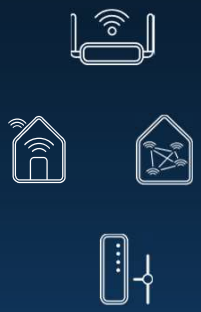
+6.5 Billion

Wi-Fi products shipped since 2015[1]

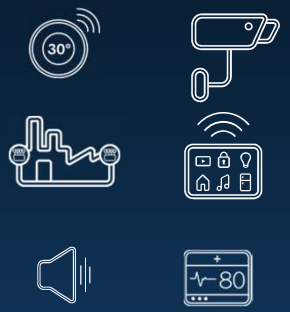
#1 in global Wi-Fi shipments[2]

Mobile

Networking



IoT



Automotive

Generational technology leadership

1. Qualcomm Technologies, Inc. internal data
2. ABI Research, Wireless Connectivity Technology Segmentation and Addressable Markets - 3Q 2022 (MD-WCMT-189)

Wi-Fi
connects the world

Carries the majority
of wireless network data traffic[1]

$3.5 trillion
global economic value[2]

19.5 billion
Wi-Fi devices in use[3]






1. Analysys Mason. Wireless network data traffic: worldwide trends and forecast 2021-2026
2. Wi-Fi Alliance
3. Wi-Fi Alliance

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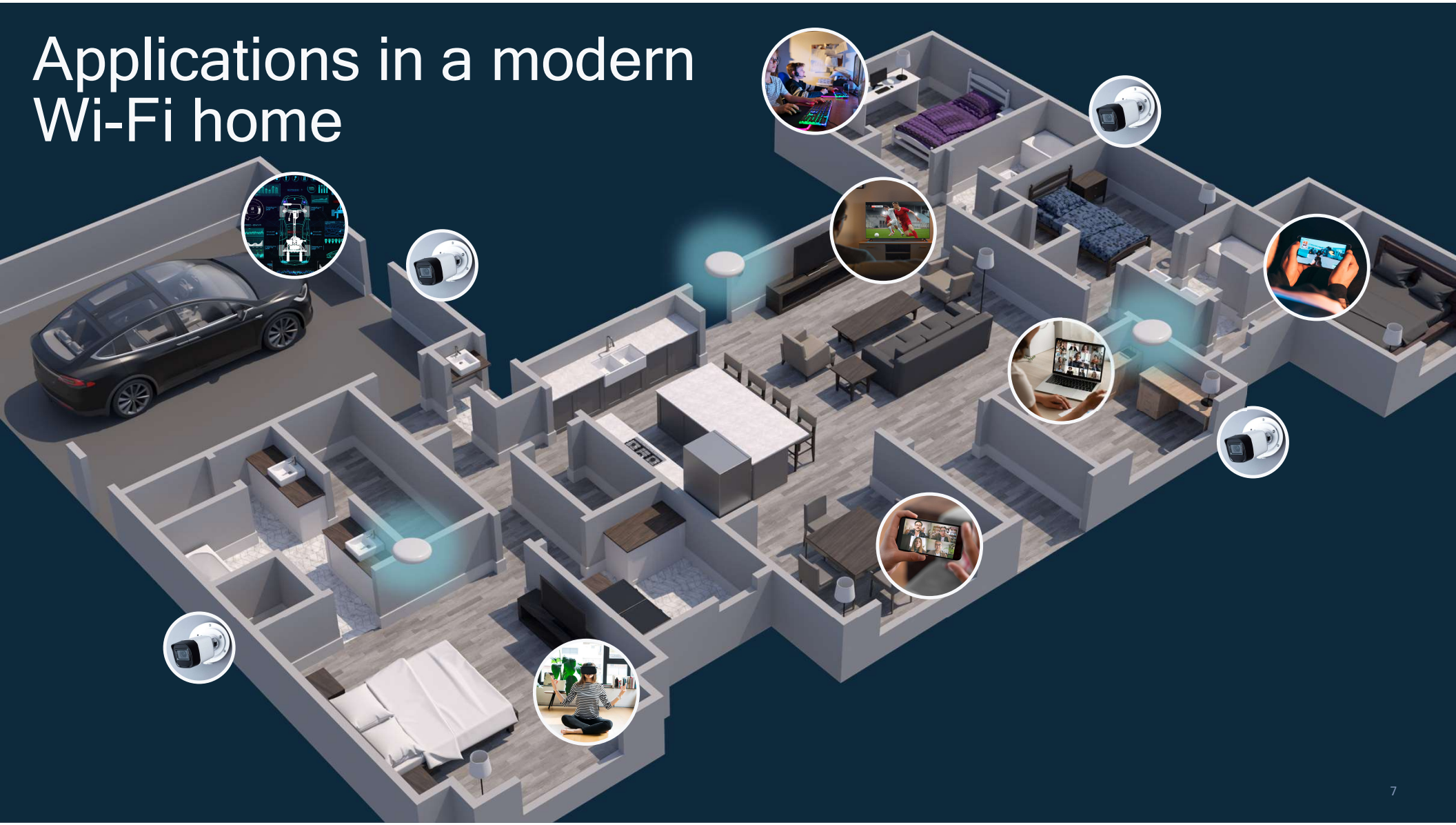
Wi-Fi evolution is driving future applications

Applications in a modern Wi-Fi home



Wi-Fi home

Multi-player Gaming

- Requires unfettered connection
- Latency / jitter are unacceptable
- Two-way traffic adds congestion

Wi-Fi home

Teleconferencing

- Surging in importance
- Two-way video adds congestion
- Speed & low latency required

Wi-Fi home

Electric Vehicle

- Massive data uploads
- Coverage can be challenged
- Two-way traffic adds congestion

Wi-Fi home

Wireless XR

- XR on deck for cord-cutters
- Intensive latency requirements
- Taxing on device and network

Wi-Fi home

8K video streaming

- Content becoming richer
- Interruption to stream unacceptable
- Increases network demand/congestion

Wi-Fi home

Security

- HD video uploads to cloud/network
- HD video download to mobile/display
- Significant network congestion added

Wi-Fi home

Mesh Network

- High-density deployment
- Whole home gigabit class performance
- Tri-band support for 2.4, 5, and 6GHz bands

Topics

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Global high-speed broadband acceleration

Fiber to the home

62% Q421

75% 2030

Global % of fixed broadband subscribers[1]

1. PointTopic: https://tinyurl.com/yp7zsjwy

Qualcomm Unlicensed Spectrum Needs Analysis

- In 2016 Qualcomm published an unlicensed spectrum needs analysis was published by Qualcomm Technologies, Inc. in 2016,
- Since then, Europe decided to allocating 480 MHz of incremental spectrum (5945 to 6425 MHz) and also clarified the regulatory regime for Indoor operation.
- Qualcomm conducted additional analysis where more up to date regulatory parameters, product configurations as represented in the market and standards progress were applied.
- Approach remained to provide a top down, engineering driven analysis of required spectrum to achieve ‘Gbps or higher’ performance for unlicensed spectrum technologies in dense networking environments.
- The analysis applied:
  - 6 GHz regulatory regime (LPI power levels)
  - Product configurations for APs and clients prevalent in the higher end residential consumer markets
  - Latest generation Wi-Fi 7 technology (IEEE 802.11be)
  - European specific assumptions regarding dwelling construction

Source sample text

Assumptions for the Spectrum Needs estimates

Assumptions driving the illustrative example of license exempt frequency band requirements to sustain Fiber Access speeds

- Use of IEEE 802.11be features (320 MHz channel bandwidth, MCS 12 and 13)
- Use of 5/6 GHz band
- 20/40/80/160/320 MHz channel bandwidths
- Antenna configurations: AP 4 antenna, Client 2 antenna
- LPI AP Tx power: 23 dBm EIRP for AP's (17 dBm per chain)
- Wall loss of 10 dB, floor loss: 13 dB
- 70% MAC efficiency
- Single client per AP; i.e., no contention or collision losses are taken into account
- Optimal channel planning; APs are assumed to choose a "good" channel based on the environment they see (the analysis does not take 'rogue APs' into account)
- Channel planning is optimized for each scenario / configuration analyzed; i.e., the number of channels / reuse factor is chosen to give the best performance for each scenario
- Non-Wi-Fi interference, such as LAA or 5G NR-U are not considered
- For every scenario, the amount of spectrum required for a given sustained speed is also listed for the instance where there is no interference from overlapping networks

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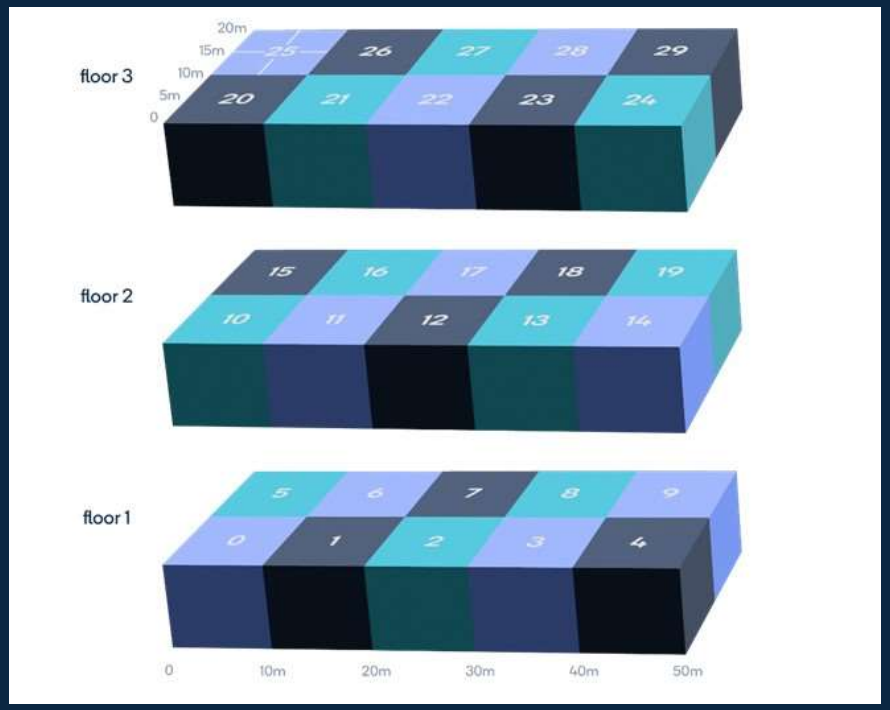
Dense Residential Deployment Scenario



- IEEE simulation scenarios for dense residential and enterprise [3].
- For the dense residential scenario:
  - 3-story apartment building
  - 10 apartments on each floor.
  - Each apartment consists of 4 rooms and its total size is 10 m × 10 m.
  - We assume a wall loss of 10 dB (both for inner and outer walls) and a 13 dB loss for floors.
  - Use of IEEE 802.11be features (320 MHz channel bandwidth, MCS 12 and 13)
  - Four ‘wiring’ architectures for apartments analyzed:
    - 4 AP’s with high speed wired backhaul (‘FTTR scenario’)
    - 4 AP’s with wireless mesh backhaul
    - 2 AP’s with high speed wired backhaul
    - 2 AP’s with wireless backhaul

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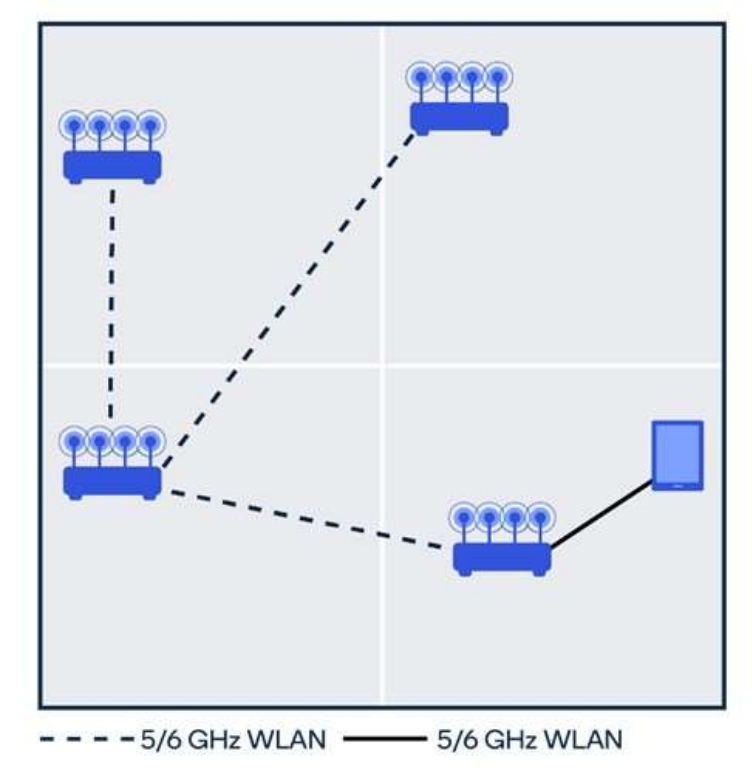
Illustrative example of a FTTR* deployment scenario
Wired Backhaul between AP's

Target Throughput	100 Mbps	500 Mbps	1 Gbps	2.5 Gbps
Required Frequency Bandwidth	80 MHz	320 MHz	640 MHz	1920 MHz
Frequency Bandwidth if no interference	20 MHz	80 MHz	80 MHz	320 MHz

* FTTR = Fiber to the Room, for this scenario, every room has a high speed wired connection, to which the Wi-Fi AP is connected

Illustrative example of a all wireless deployment scenario in a dense residential setting



Target Throughput	100 Mbps	500 Mbps	1 Gbps	2.5 Gbps
Required Frequency Bandwidth	200 MHz	800 MHz	1600 MHz	Cannot Meet
Frequency Bandwidth if no interference	40 MHz	160 MHz	160 MHz	Cannot Meet

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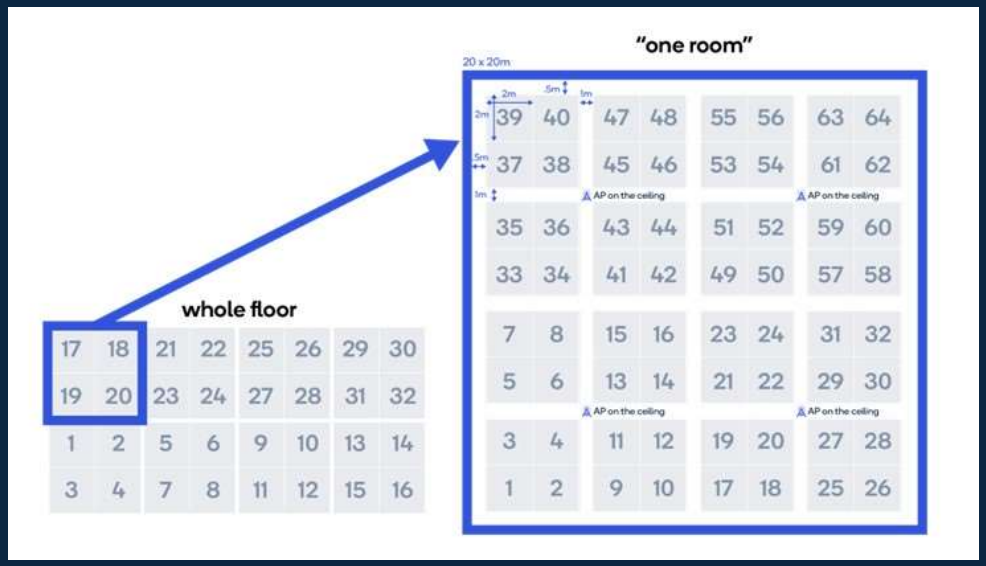
Illustrative example of an enterprise ‘open floor plan’ scenario



Target Throughput	100 Mbps	500 Mbps	1 Gbps	2.5 Gbps
Required Frequency Bandwidth	160 MHz	640 MHz	1280 MHz	Cannot Meet
Frequency Bandwidth if no interference	40 MHz	80 MHz	80 MHz	320 MHz

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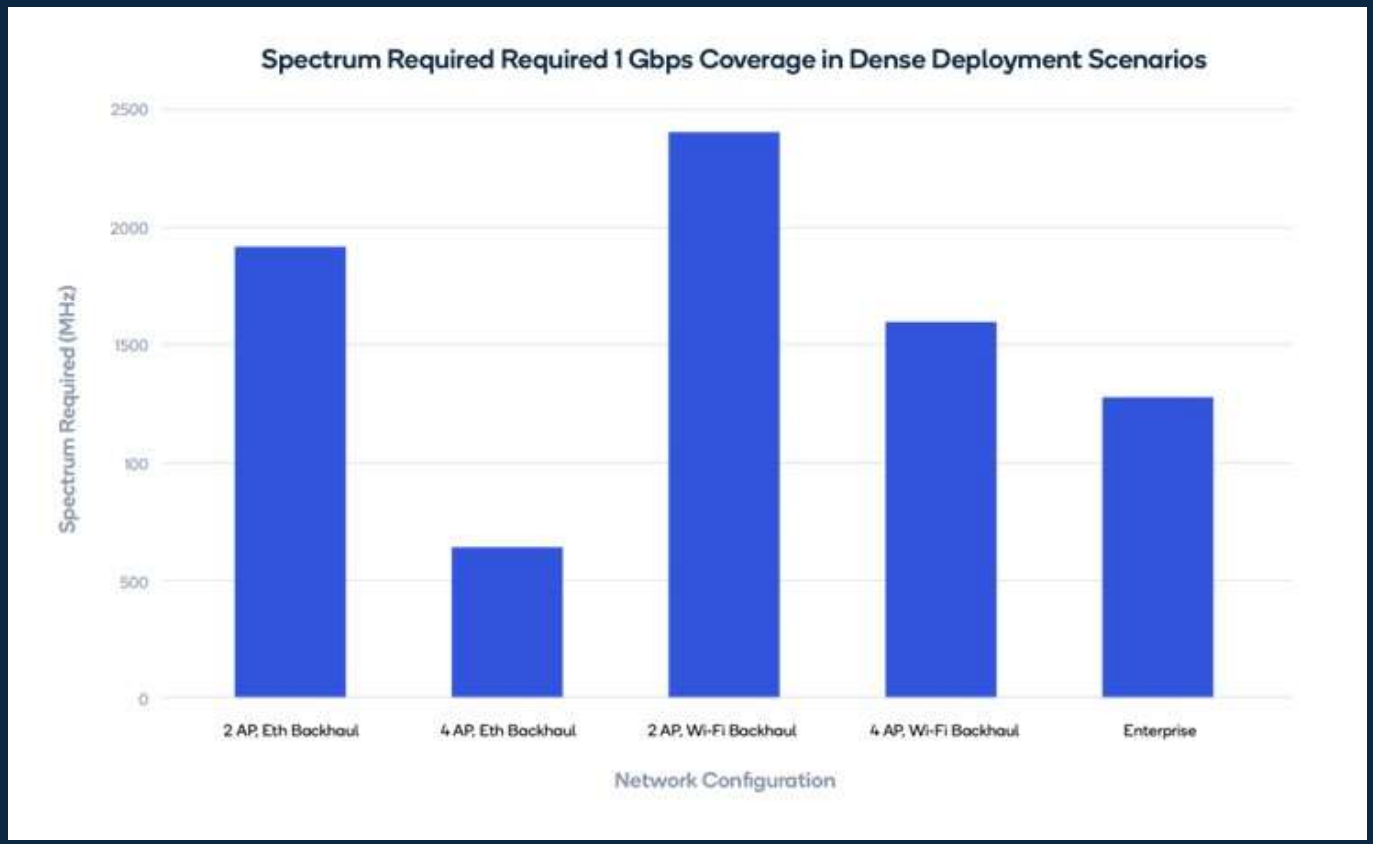
Preliminary Summary of spectrum needs estimates for 1 Gbps sustained coverage in dense environments



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