

In-building cellular: the Fact File

Introduction to in-building cellular



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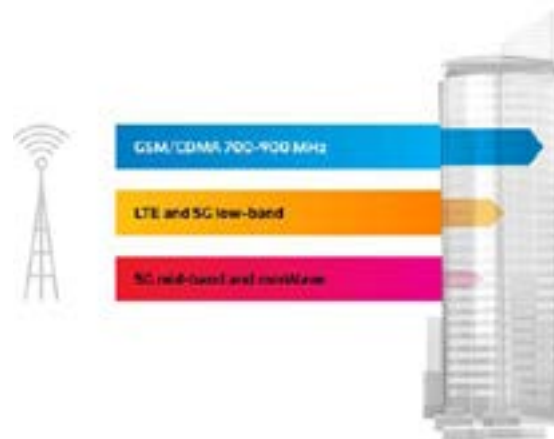
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Introduction to in-building cellular

As cellular technology has developed from the initial 1G technology in the early 1980s to the super-fast 5G networks of today, it has become ubiquitous and pervasive. Businesses rely on it, yet its usefulness has always been subject to its coverage.

In buildings of any kind, walls act as a barrier to any RF signal. This problem has been exacerbated in recent years. Not only does 5G make greater (although not exclusive) use of higher frequencies that are more easily blocked by physical barriers, modern buildings are frequently designed with climate control in mind; and, while low-emissivity glass may help reduce heating and cooling bills, it also reduces the strength of phone signals.

The answer is to extend the reach of the carrier signal via in-building cellular (aka distributed antenna systems—DAS). Unlike a wide outdoor “macro” cell site, an in-building cellular network is designed to cover indoor spaces divided into many smaller sub-spaces, i.e., floors and rooms. A single node, even at high power, would struggle to propagate an RF signal through multiple floors and walls. In such a topology, coverage is more naturally provided by multiple nodes distributed among the different spaces.



Low-E glass windows commonly reduce signal strength by a factor of 1,000, nearly equivalent to a 1/8 inch (3 mm) thick aluminum plate.

Source: Radio and Microwave Frequency Attenuation in Glass, Vitro Architectural Glass (formerly PPG), October 2016

The need for in-building cellular

What types of venue use in-building cellular?

Evaluating the need for in-building cellular is mainly a function of volume and value. One factor is the number of people in the building and the intensity of their mobile usage. Another is the value of that mobile usage to the business in question. In some cases, such as sports arenas, the value of the mobile usage is high, and the number of users is enormous. Conversely, in scenarios such financial services, law firms, and other high-end offices, highly compensated professionals are fewer in number but very high in value.

The following types of buildings are among the most commonly served by in-building cellular:

- Hotels
- Conference venues
- Sports stadiums
- Shopping malls
- College campuses
- Hospitals
- Professional offices

Evaluating the need for DAS is mainly a function of volume and value.

Do you need in-building cellular?

It may be useful to start with these questions:

- What is the existing quality of mobile coverage in your building? Is there sufficient voice clarity and data speed, from each operator?
- Do employees need their mobile devices to perform their job functions?
- Do visitors or customers need their mobile devices as part of their purchase process or customer experience?
- How large is the building? How many people occupy it?

Three key types of in-building cellular

Most enterprise uses of in-building cellular fall into one of three use cases:



Multi-operator commercial cellular

Giving employees, customers, visitors high-quality access to their mobile service provider services.



Business-critical private cellular

Specialized business applications with unique requirements that are not well served by other network types.



Emergency response wireless

Helping first responders communicate when they are inside your building.

What kinds of industries use in-building cellular?

CommScope has been involved in the implementation of different types of in-building cellular networks in a variety of countries, industries and building types; these are real-life examples of businesses that have used in-building cellular to respond to a pressing business need.

Multi-operator commercial cellular



Deutsche Bank, London, UK

Coverage across large multi-building high rise complex.



Loma Linda University Medical Centre, California, U.S.

Provide excellent mobile experience for staff, patients, visitors. Challenging installation and coverage environment.



Riyadh Metro, Saudi Arabia

Multi-operator system for major metro network including 85 stations, 11 park and rides, 40 km of tunnels.



Hospital, Milan, Italy

Large, multi-building campus with indoor and outdoor spaces.



Hotel and luxury multi-dwelling residence, Spain

Provide superior commercial cellular coverage throughout property without disrupting historic building aesthetics.

Commercial cellular and emergency response wireless



Consumer goods manufacturer, Denmark

Serve over 2,000 employees across large office campus.



Hyperscale social media provider, Denmark and Ireland

Provide reliable commercial cellular coverage across huge facilities. Standardization across multiple country installations.



Memorial Health System, Michigan, U.S.

Rapidly extend broadband coverage to outdoor COVID-19 triage tents, to support essential administrative and diagnostic communications.



Fortune 50 Technology Firm, U.S.

Streamline deployment and connectivity of IP Video cameras and other physical security and safety solutions.

Wi-Fi 6 or 5G?

Cellular versus Wi-Fi

Cellular and Wi-Fi have coexisted for decades and, to date, neither has replaced the other. On the contrary, both have flourished, and it is widely accepted that there will continue to be the need for multiple different wireless technologies. While Wi-Fi and cellular technologies have similarities, they largely support different use cases. More often than not, this has made them complements rather than substitutes.

CELLULAR



Cellular, operating in the licensed spectrum, implies the presence of a spectrum owner, in the form of a mobile network operator (MNO). For the subscriber, the advantage is that connection to the network is automatic, universal, and pervasive. Cellular technology also has greater range to cover large spaces, and it is inherently mobile, meaning users' sessions are maintained even as they move between serving radios. Mobility is one of the features that makes cellular suitable for voice calling, since voice call user experience is disrupted by session interruptions whereas many data experiences (e.g., email) are not. Cellular is also the technology on which emergency services organizations (fire, police, ambulances) have standardized for their communications.

[Find out more about ERA®, CommScope's in-building cellular solutions](#)

WI-FI



In contrast, Wi-Fi operates in the unlicensed spectrum, enabling a private enterprise or homeowner to create a network without reliance on a commercial service provider. As such, it is the default access to the enterprise or home network. It is in fact valued for its ability of self-deployment and absence of subscription cost. Wi-Fi technology provides unmetered high-speed connectivity and enables user data collection by entities other than an MNO. Note, however, that access to Wi-Fi is not automatic for everyone—only for regular authorized users. New or visiting users, if allowed, need to log in.

[Find out more about RUCKUS®, CommScope's wireless enterprise networking solutions](#)

Digital DAS

The digital transformation of DAS

Earlier implementations of in-building cellular may have had a reputation for being expensive and cumbersome to design, implement and operate. However, in recent years, newer generations of DAS have used digital technology to reduce the footprint, make better use of fiber infrastructure, and permit greater flexibility in the physical placement of system elements.



How digitization has simplified the deployment and use of in-building cellular.

CPRI digital donor

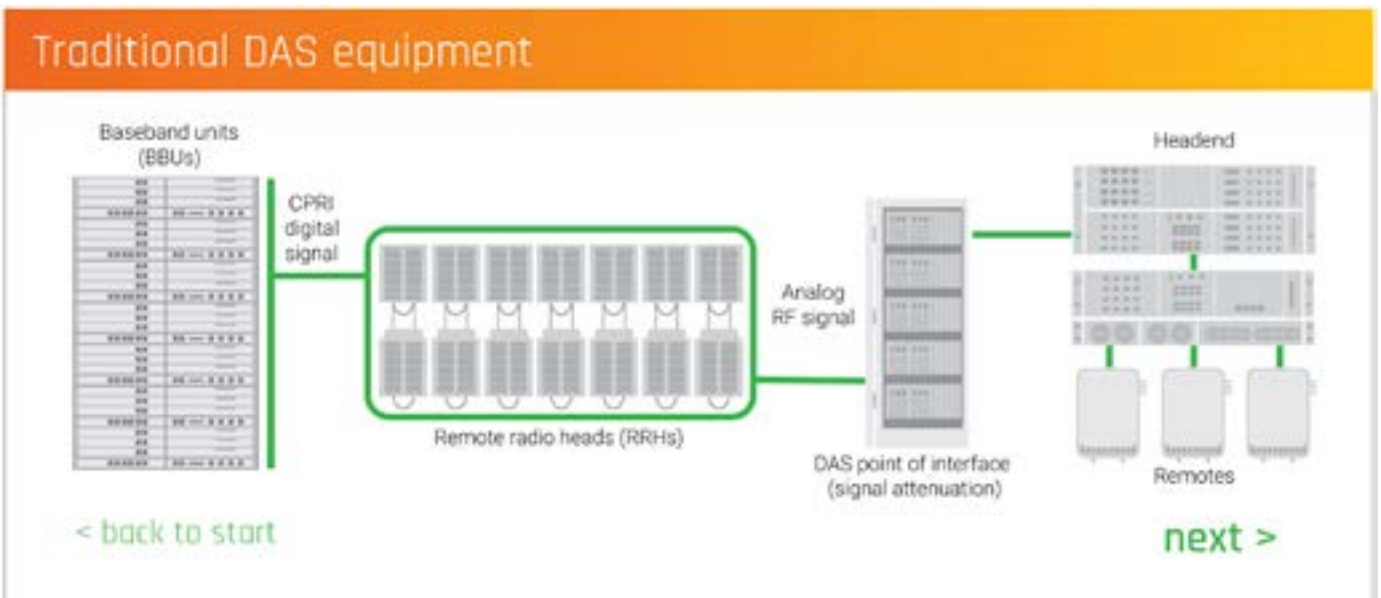
ERA® CPRI “digital donor” technology is a great example of how digital systems have made DAS implementation both simpler and more efficient than traditional analog DAS. CPRI (pronounced “sip-ree”) stands for Common Public Radio Interface—a protocol for digital transmission or radio frequency signals. See the interactive graphic below to see an overview of its benefits.



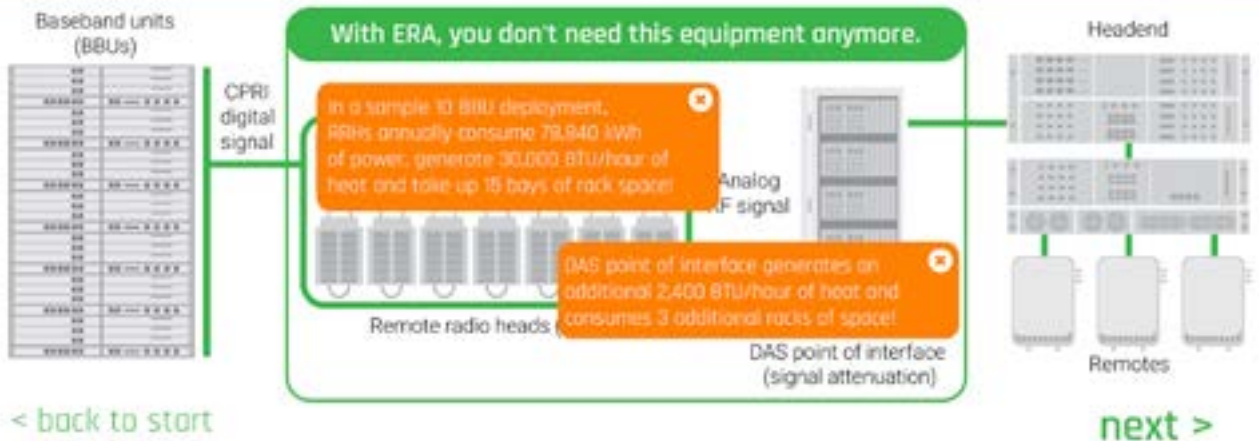
**Big in-building wireless performance.
Small footprint.**

with ERA's direct CPRI support

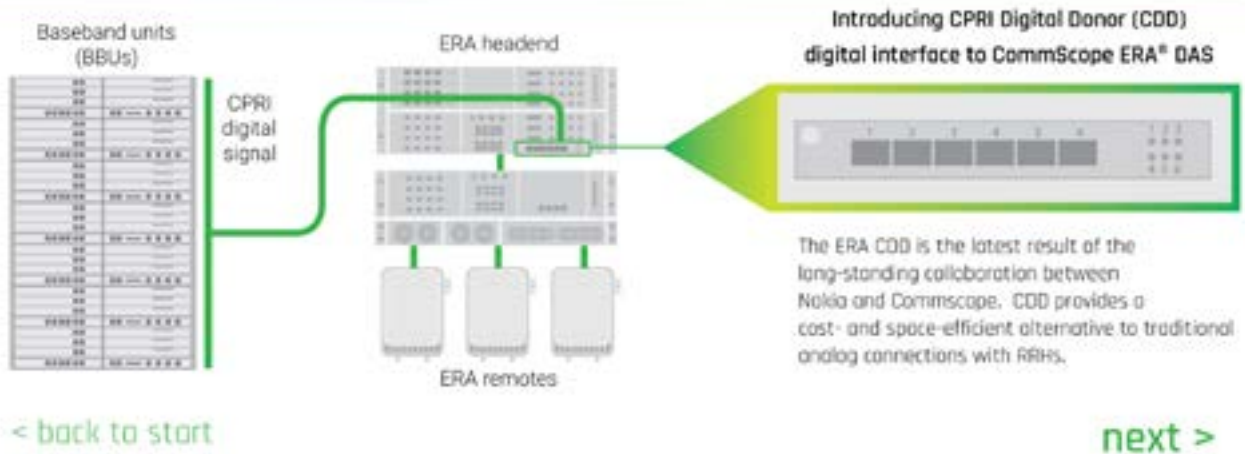
[discover how >](#)



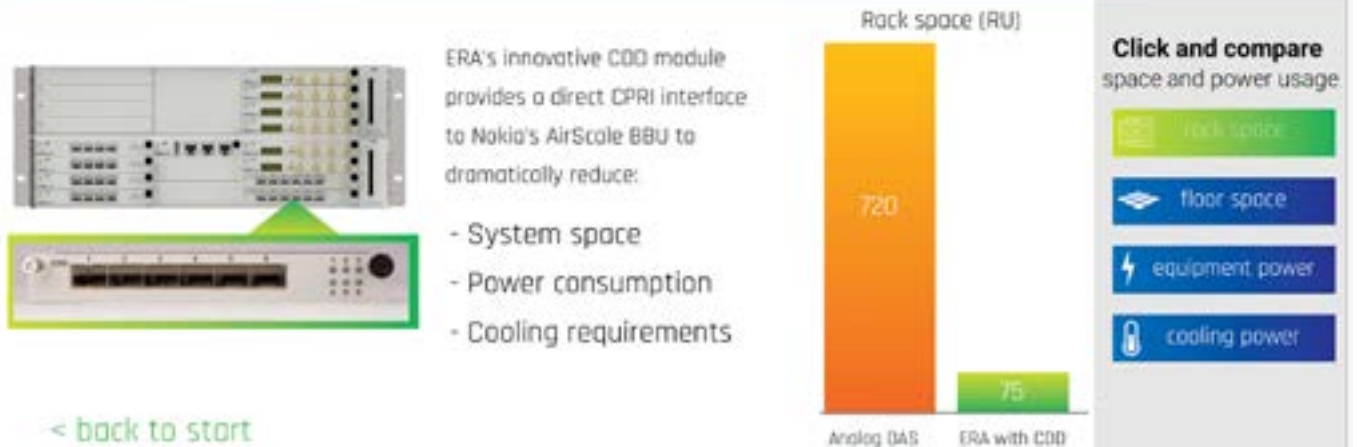
Traditional DAS equipment



ERA with CPRI digital donor (CDD) module



CDD saving by the numbers



CDD saving by the numbers



ERA's innovative CDD module provides a direct CPRI interface to Nokia's AirScale BBU to dramatically reduce:

- System space
- Power consumption
- Cooling requirements

[< back to start](#)



Click and compare space and power usage

- [rack space](#)
- [floor space](#)
- [equipment power](#)
- [cooling power](#)

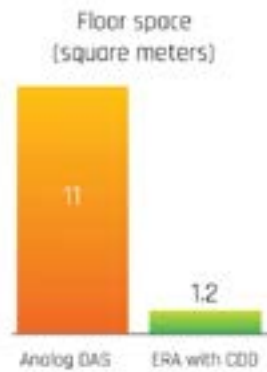
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< back to start

Cooling power consumption (MWh/yr)



Click and compare space and power usage

- rack space
- floor space
- equipment power
- cooling power

CommScope ERA: an example of in-building cellular

CommScope's all-digital ERA distributed antenna system helps make in-building wireless simple and economical, operating on standard IT infrastructure—Category 6A and fiber. These solutions help operators, neutral hosts and enterprises provide high capacity with extensive in-building coverage.

Features and benefits

ERA evolves the conventional distributed antenna system (DAS) architecture by helping organizations:

- Move all baseband functions across multiple buildings to a single, streamlined headend or even to the operator's facilities—reducing the on-site system footprint to save real estate.
- Take advantage of an all-digital CPRI baseband interface that eliminates the need for analog-to-digital conversions, further reducing head-end size and power requirements.
- Adjust capacity across the network by sector or channel through a web-based drag-and-drop interface.
- Select from among a wide range of access points that offer different power levels, copper/fiber connectivity, power over Category 6A cable, and embedded MIMO support. Outdoor and plenum ratings allow deployment in harsh environments and concealed spaces.
- Comprehensively monitor and manage deployments using CommScope's proven [AIMOS management system](#).

ERA makes in-building wireless solutions simple to install, easy to manage and economical to operate—all while giving operators, neutral hosts and enterprises the room they need to grow as new technologies and applications come to market.

CPRI Baseband Interface

Through a collaboration with Nokia, ERA features a direct CPRI interface to Nokia's AirScale baseband unit (BBU). This integration collapses the functionality of up to six remote radio units and their associated cabling into a single 300 x 145 mm (12 x 6 inches) card, greatly reducing head-end space and power consumption.

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Safety First

Emergency responder radio coverage is often a requirement in new construction—and sometimes mandated even for existing buildings. ERA offers specialized access points that support popular public safety frequencies, including band 14 for FirstNet in the U.S. These remotes are available in different transmit power levels to help address regional differences in typical building sizes.

At the headend, CommScope offers fire and water protective enclosures meeting NEMA 4 and NFPA standards. CommScope also offers a range of [multi-band RF repeaters](#) designed for public safety applications. These can be used as a signal source to ERA or on their own with direct coaxial connection to multiple antennas.

Future-Ready

Enterprises, property owners, neutral hosts and network operators need to know that their investments today will prepare them for tomorrow's needs. In-building wireless capabilities are increasingly called upon to support emerging [smart building](#) and campus services and the internet of things (IoT). They also need to support technology evolution to 3.5 GHz bands to support 5G New Radio in Europe and Asia, and Citizens Broadband Radio Service (CBRS) in the U.S.

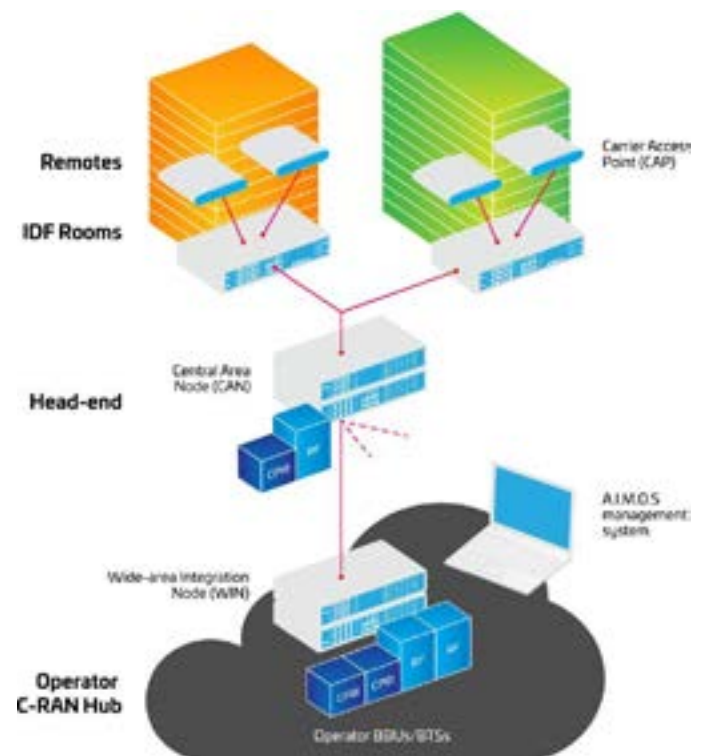
ERA's all-digital, frequency-agnostic system architecture ensures the system will be able to support new services in existing and new bands, including CBRS and sub-6 GHz 5G NR. ERA's multiplexed fiber fronthaul can also be shared with other communication services. And, as usage patterns change, capacity can be re-allocated through a web-based drag-and-drop software GUI rather than physical re-wiring.

Components of in-building cellular networks

System architectures vary, but most distributed antenna systems include the following basic elements:

1. A headend

This is where the operator base stations (signal sources) feed into the DAS. The function of the headend is to convert RF or digital base station signals into a format and power level that can be distributed to the many antennas around the building. The headend is typically located in a central building main distribution frame (MDF) but, with ERA, it can also be virtualized onto a central campus location, the operator's nearby hub, or even to multiple locations. This flexibility saves on-premises real estate while allowing operators to connect in the way that is most efficient for them.



2. Fronthaul distribution

A network of cabling and intermediate nodes that spread throughout the building or campus being served. Because ERA is entirely digital, it can make efficient use of fiber and copper connections—sometimes even being able to leverage pre-existing cabling.

3. Remotes and antennas

These are the outermost points of the DAS, where the signal is converted from digital back to analog RF for over-the-air transmission to smartphones, tablets and other connected devices.

For more details, see CommScope's [ERA Digital Distributed Antenna System](#)



Passives & Antennas



Management System



Structured Cabling



Head-end & Distribution Modules



Subracks & Power Supplies



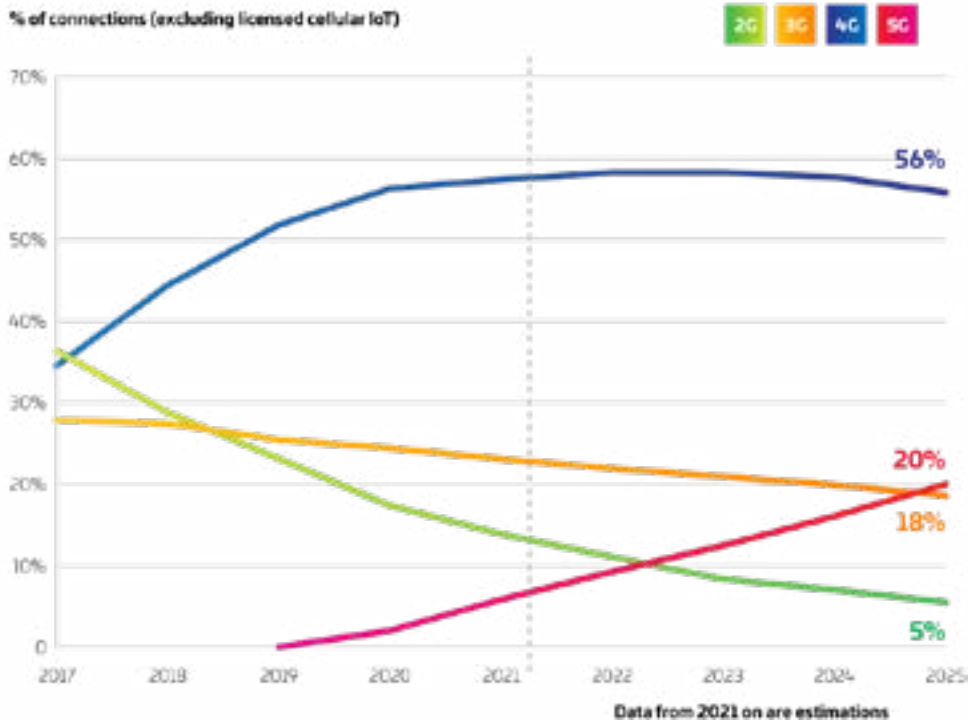
Access Points

What does the future hold?

5G is just beginning to achieve critical coverage around the world and will increase in importance over the next few years. The adoption of 5G and its undoubted potential has shone the spotlight on in-building cellular, since these technologies are developing in parallel.

The digitization of DAS systems is a timely development, since it is helping ensure that the promise of 5G is fulfilled. It is likely, therefore, that in-building cellular will be of significant strategic interest to network planners for many years to come.

4G DOMINATES GLOBALLY AS 5G BEGINS TO MAKE ITS MARK Source: GSMA Intelligence



4G now accounts for half of the total connections; 5G will start moving the needle in 2021



Watch to hear more about in-building cellular trends from our experts:

Resources and Case Studies

Case Studies



Carolina Panthers
Carolina Panthers count on CommScope to deliver a winning fan experience



Loma Linda University Health
CommScope's ION-E® in-building wireless solution helps Loma Linda raise the bar on patient care

Why choose CommScope's ERA solution?

Why CommScope?



All-digital design

All-digital means you make changes in software, not the hardware—so it's simpler to configure and maintain. Plus, our solutions deploy over existing Category 6A, fiber cabling and Ethernet switching to save time and money.



5G built in

CommScope solutions allow you to support 3G and 4G services today, then gracefully evolve to 5G when you're ready.



Market leader

Independent industry researchers consistently rank CommScope as the global market leader in distributed antenna systems. (Source: Mobile Experts Inc., Distributed Antenna Systems, 2020.)

Additional Resources



Brochure

ERA digital distributed antenna system



Brochure

In-building wireless professional services



Installation Guide

SYSTIMAX cabling design and installation guidelines for the ION-E solution



Ordering Guide

In-building wireless Passive Products and Antennas



CommScope pushes the boundaries of communications technology with game-changing ideas and ground-breaking discoveries that spark profound human achievement. We collaborate with our customers and partners to design, create and build the world's most advanced networks. It is our passion and commitment to identify the next opportunity and realize a better tomorrow. Discover more at commscope.com

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Visit our website or contact your local CommScope representative for more information.

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