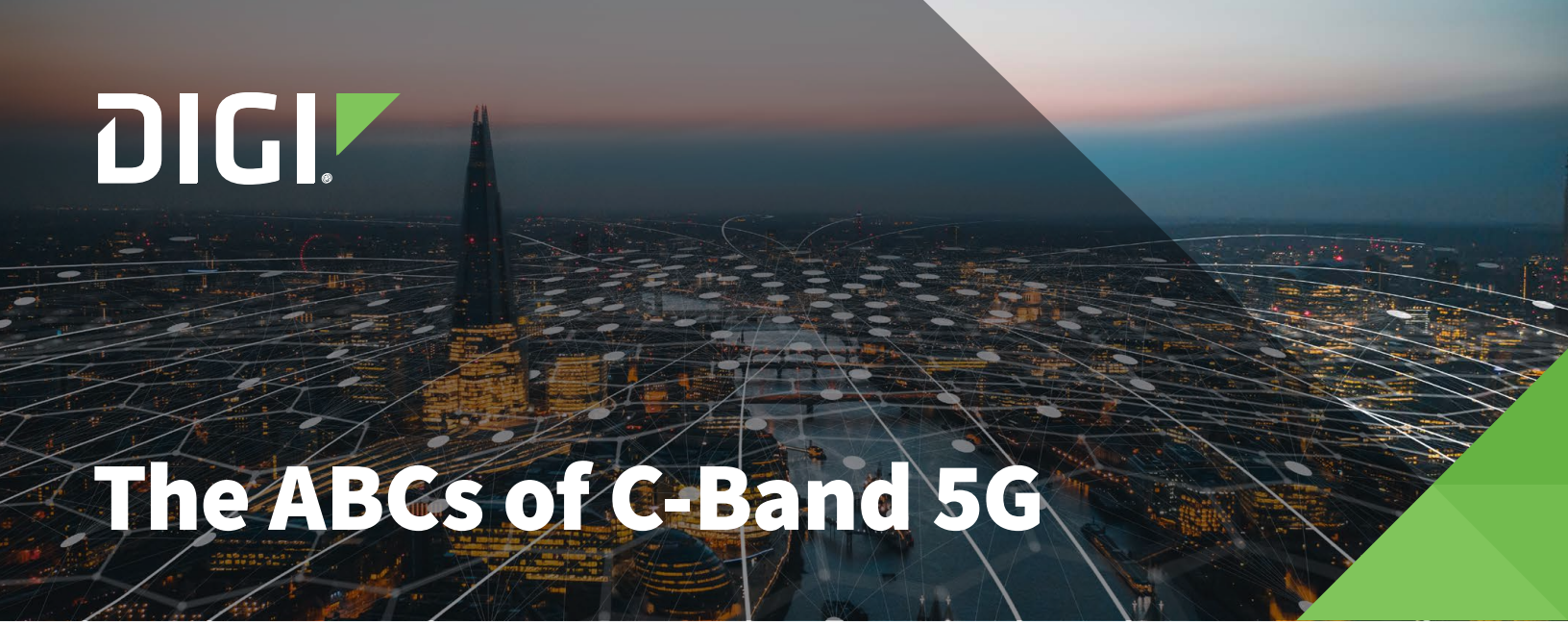
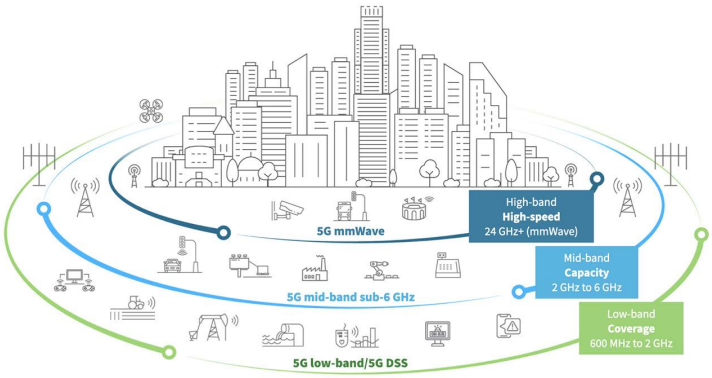


The ABCs of C-Band 5G

5G wireless connectivity promises faster speeds, lower latency, and a massive number of devices, all of which can benefit a great variety of consumer and industrial use cases. 5G however, is not a one-size-fits-all technology. Different types of 5G spectrum are excellent in some use cases, and problematic in others. In this solution brief, we'll look at a particular segment of 5G called "C-band" that strikes a happy medium in several aspects of 5G performance.

A Quick Primer on 5G Spectrum

5G networks operate in three distinct frequency bands, known as high-band, mid-band and low-band, each of which has its own benefits and limitations. The right to use spectrum in most of these frequencies has to be purchased at great cost by mobile network operators (MNOs) and each MNO incorporates 5G in a different way.



Different 5G frequency bands exhibit unique strengths and limitations.

- **High-band or millimeter wave (mmWave) 5G: High speed but short range.** High-band 5G frequencies range from 24 GHz to 100 GHz, making it incredibly fast with multi-gigabit-per-second speeds. But these high frequencies have trouble going through buildings or even through dense foliage, making it useful only for short distances with direct line of sight.
- **Mid-band 5G: Medium range, good speed.** The mid-band of 5G operates from 2 to 6 GHz. It provides longer range than high-band, with good speeds in the gigabit-per-second range. This segment of 5G spectrum is the most heavily used 5G band, as it is fresh spectrum that has been made available specifically for 5G.
- **Low-band 5G: Long range, slower speed.** Low-band 5G operates at frequencies below 2 GHz, which is very crowded with 4G LTE traffic, and is commercially important for industry. For example, IoT sensors can use low-band 5G to monitor conditions at wind farms and solar installations that cover large areas.

C-band in the Sweet Spot

MNOs compete in the marketplace over who has the best network, and some are promoting C-band as an ideal part of the spectrum to support new 5G use cases. C-band frequencies used in the U.S. lie in the mid-band, between 3.7 and 4.2 GHz. As one industry observer commented, "C-band is seen by a lot of analysts as the ultimate 'sweet spot' for wireless spectrum. It can provide an ideal balance of range, penetration, and transmission speeds." [1]

[1] Michael Gariffo, 5G rollout: Why C-Band matters so much, ZDNET, Feb. 7, 2022
https://www.zdnet.com/article/5g-rollout-why-c-band-matters-so-much/

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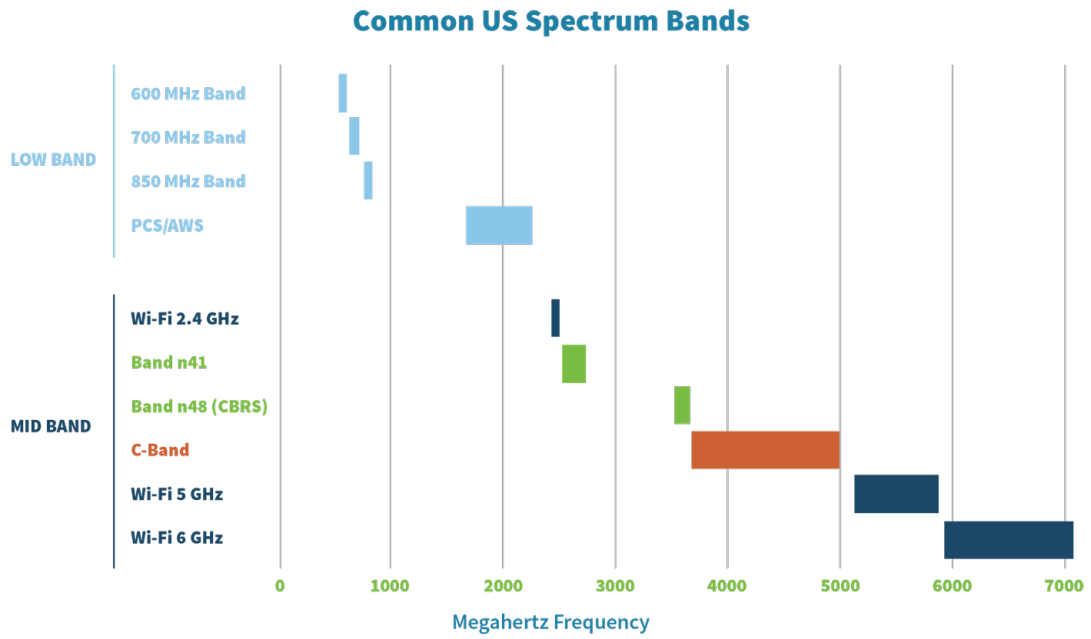

Where C-band fits in the 5G frequency spectrum.

Is C-Band a New Band?

In the U.S., the Federal Communications Commission (FCC) made a 280 MHz segment of mid-band spectrum available for 5G, and it was auctioned as the C-band in late 2020. Winning bids topped a record $81 billion from 21 different bidders. Verizon Wireless and AT&T won the largest share of licenses, gaining 90 percent of the 5,684 licenses awarded. These mobile carriers will add the C-band spectrum to their 5G offerings to provide faster 5G for many locations.

C-band, however, is not really a new band. Satellite TV has been using C-band frequencies since the 1970s. But as satellite TV companies began concentrating their broadcasts into the upper part of the C-band to gain better video quality, that process freed up the lower part for cellular use.

5G Airport Issues Addressed by Industry and Regulators

Even the best technologies experience some hiccups in their introductions and 5G is no exception. During the early rollout of 5G in areas close to airports, there were news reports of 5G affecting the performance of radio altimeters in aircraft. The interference was attributed to C-band and 5G deployments near airports were put on hold temporarily. In spite of initial concerns, however, the issue was resolved by retrofitting aircraft with radio frequency filters.

In a **5G C-band Update**, the Federal Aviation Administration (FAA) said that, "Key stakeholders in the aviation and wireless industries have identified a series of steps that will continue to protect commercial air travel from disruption by 5G C-band interference, while also enabling Verizon and AT&T to enhance service around certain airports."[2]

Do I Need C-Band?

For 5G to offer an experience that's noticeably better than 4G, it needs new spectrum and wider channels — up to 100 MHz per channel below 6 GHz — to provide higher speed and more capacity. In comparison, 4G LTE networks today have up to only 20 MHz per channel. So, at 100 MHz per channel, 5G can carry five times the information over a single C-band channel. The primary benefits of C-band can be summarized as follows:

- Faster speeds and more capacity than 4G LTE, with up to 100 Mbps speed on mobile devices
- Connectivity over longer distances between cell towers compared to 5G high-band/mmWave
- Large amounts of new spectrum for mobile carriers

[2] Federal Aviation Administration, U.S. Department of Transportation, FAA Statements on 5G, June 17, 2022, **https://www.faa.gov/newsroom/faa-statements-5g**

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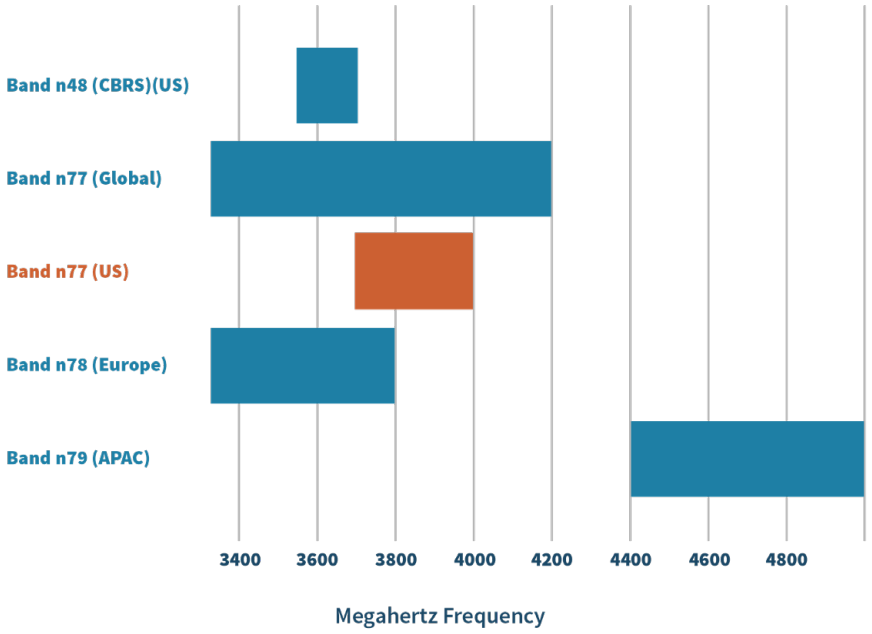
C-Band around the world



How Fast Is C-Band?

In today's 5G non-standalone (NSA) cellular networks, most of the data traffic actually flows over 4G LTE, with 5G providing a little extra bandwidth. This provides enhanced speeds without carriers having to rework much of their core network technology. A cellular device, for example, may combine several 5, 10 or 20 MHz-wide 4G channels plus a single 5G channel to gain another 5-100 MHz of bandwidth. This "stitched together" spectrum provides a total bandwidth of between 20-160 MHz and speeds between 100-400 Mbps or more.

In testing performed at Digi, we saw a significant improvement in locations that deployed C-band. With C-band's wider channel, we observed 60 to 100 MHz wide channels with 5G network speeds of 600-700 Mbps or 4 to 5 times what 4G LTE provides. In 2023 and beyond, next generation 5G devices will begin to combine multiple C-band channels for even faster speeds in the gigabit to multi-gigabit range.

What Are the 5G C-Band Use Cases?

Many new use cases for C-band 5G will be developed in the coming years. And as deployment spreads, C-band 5G will provide a boost to new applications in augmented reality, virtual reality, video, manufacturing, healthcare and smart home installations. C-band 5G will also enable consumers to interact with home appliances and streaming content on smart phones, tablets, computers and TVs — all at the same time, without delay or signal disruptions.

Here are some of the major areas where C-band 5G is already having an impact.

- **Fixed Wireless Access (FWA)** — provides wireless broadband connectivity and provides an alternative to wired connectivity, such as cable or DSL. This is especially important in rural areas where wired broadband is not available, and slower/more expensive satellite is the only other option.
- **Primary connectivity vs. failover** — 5G can be used to back up existing fiber and Ethernet connectivity in offices and schools.
- **Data-intensive applications, such as video** — One Australia-based construction company used C-band 5G to launch a holographic building visualization and real-time design displays.
- **Data offloading over cellular** — In areas with high levels of mobile network traffic, C-band 5G can help alleviate 4G LTE network capacity issues.

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These two examples demonstrate real-world applications of C-band 5G.

- GE Research announced the arrival of C-band 5G at its Niskayuna, New York campus, noting that the addition would bolster the lab's cross-industry 5G testbed and bring high-speed cellular networks to the broader Niskayuna community.
- Verizon Wireless struck a 10-year deal with the National Football League (NFL) in the U.S. to be its official 5G partner. Verizon will use **all of its spectrum, including C-band**, to deliver new 5G capabilities enhancing fan experience at stadiums, services at concession stands, and public safety applications.



C-band Around the World

C-band is probably the most popular 5G band in the world. Most European and Asian countries use a portion of C-band called band n78, which is a subset of band n77 from 3.3 to 3.8 GHz. Many countries have already started auctioning off C-band spectrum, including the U.K. and Ireland, as well as Germany, Italy, Spain, South Korea and Australia. In the US, C-band translates into 5G band n77, which mobile network operators like Verizon and AT&T have started to deploy.

Digi Devices that Support C-Band

As an increasing number of business functions become digitized, network speed and capacity deliver more and more of a competitive advantage. And because of the ability of 5G networks to serve the needs of both businesses and consumers, 5G is well on its way to becoming generally available around the world.

C-band 5G is opening opportunities for a variety of industries and public sector organizations. Digi solutions make those 5G opportunities a reality with cellular routers that support C-band today. That's why Digi made C-band a priority and supports it in all 5G products today, including **Digi EX50 5G**, **Digi TX40 5G**, **Digi IX40 5G**, **Digi TX64 5G**, and **Digi TX64 5G Rail**. Many earlier Digi routers are also able to support C-band with a simple firmware update delivered via **Digi Remote Manager**.

Digi is your 5G and IoT technology partner. We build end-to-end solutions to meet your needs and we can help you get started with C-band today. **Contact us** to learn how.

Next Steps

- **Contact us** to talk to a Digi expert.
- **Sign up for our newsletter** to learn about emerging trends and new solutions.
- **Shop for solutions** from Digi and our partners.

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