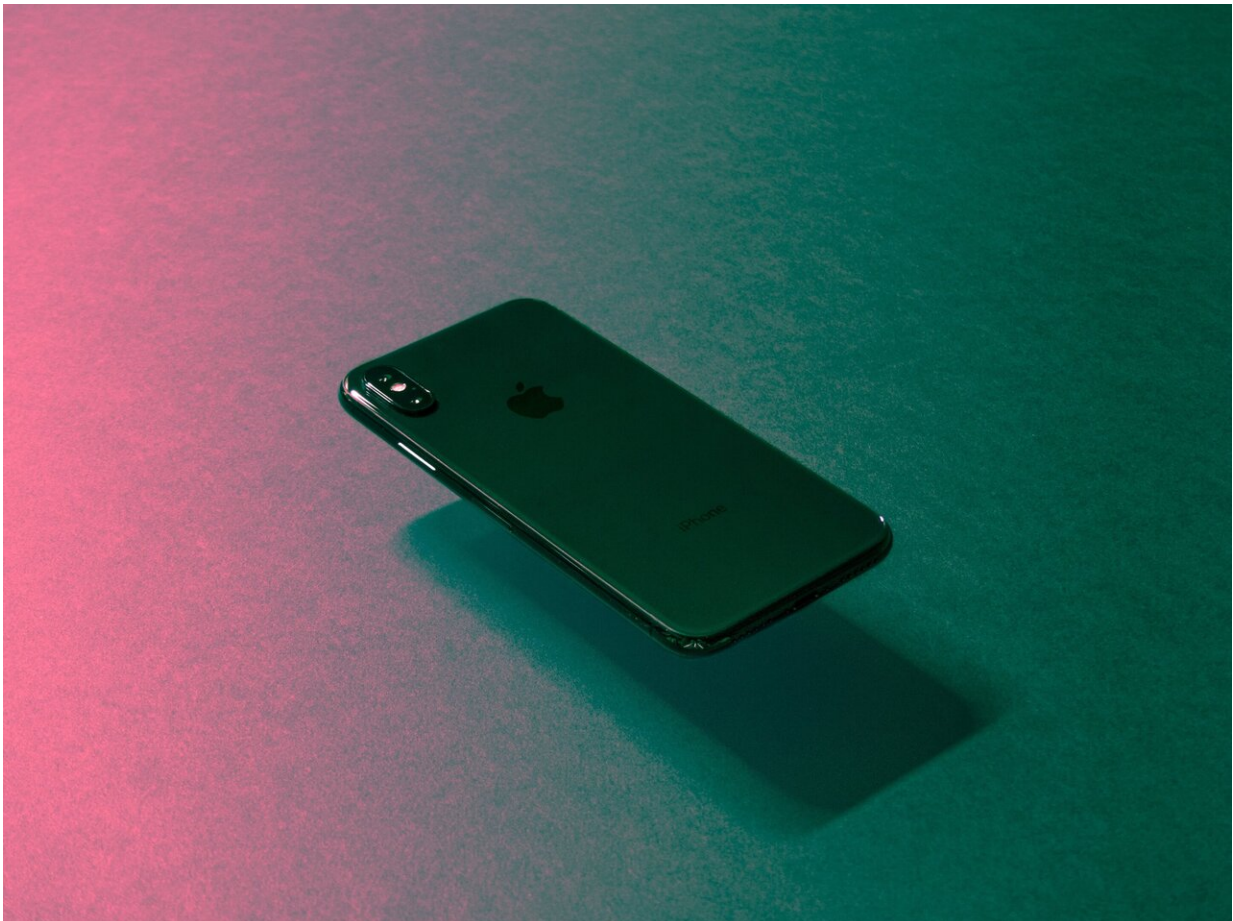


# Apple's greatest chip challenge yet: Replacing Qualcomm modems

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Apple Inc. has become a chip powerhouse in the past decade, beating

some of the semiconductor industry's leading companies at their own game. But the iPhone maker is embarking on its biggest challenge to date as it tries to replace Qualcomm Inc. cellular modems with its own design.

Qualcomm slumped 8% on Friday, its steepest decline since March, after Bloomberg reported that Apple kicked off development of its own [modem](#) this year. That reaction underestimates the task that confronts Apple in coming years, according to analysts. Some even questioned whether the Cupertino, California-based technology giant can succeed.

"The question is about if and when Apple's initiative will be successful," Chris Caso of Raymond James said. "Apple's potential for success in developing a leading-edge modem is by no means assured."

Modems are one of the most critical components in an iPhone, connecting the device to cellular networks so users can browse the web, access apps and make phone calls. Getting this to work smoothly everywhere requires layers of specialized engineering and broad industry know-how that's hard to acquire.

Wireless carriers build networks in different ways, using distinct radio frequencies and varying equipment that must conform to local rules. Modems have to integrate with this diverse technology, while also hopping back onto older wireless systems seamlessly. That complexity has increased with the ever-growing need for data and the technical tricks used to deliver it.

This requires rigorous field testing. Qualcomm runs labs that replicate the environment that any phone will experience anywhere in the world. Its engineers have worked with carriers for decades to tune their systems and make sure everything works in sync. That knowledge and experience has acted as a barrier to other companies breaking its stranglehold on this

lucrative part of the [semiconductor industry](#).

"Notwithstanding Apple's admittedly considerable semiconductor design expertise, modems are challenging beasts," Bernstein Research analysts wrote in a note to investors on Friday. "It took them 5-10 years to develop a viable PC processor even with annual iPad iterations, and modems are likely to present a greater challenge."

Qualcomm has another important advantage, according to Caso of Raymond James. The company's licensing group develops and updates wireless industry standards, which allows its chip division to be the first to implement the updates into silicon. That has kept Qualcomm ahead of other potent challengers, including Samsung Electronics Co., which has developed its own internal modem but still uses Qualcomm for some Galaxy smartphones, Caso said.

Still, Apple has taken on powerful industry players and beaten them in the past. The company spent years designing its own PC processors to replace Intel Corp. in Macs. It has used its own main processors in the iPhone and iPad since 2010 with specifications that have long outpaced competing designs. Apple has also developed its own power-management chips and wireless chips for location data, headphones and the Apple Watch.

There's already evidence that the modem challenge will be harder, though. Qualcomm's technology, particularly for 5G handsets, has been so well regarded that Apple settled a wide-ranging patent lawsuit and struck a multibillion-dollar agreement with the San Diego-based chipmaker to get its modems inside the 5G iPhone 12 range this year.

Another indication of the size of the challenge comes from a major acquisition last year. Apple typically doesn't do large deals, preferring to build its own technology. But in 2019 the company acquired Intel's

modem unit for \$1 billion. Johny Srouji, Apple's senior vice president of hardware technologies, said this week that the purchase helped the company quickly build the team of hardware and software engineers it needs to develop its own modem.

"It could take several years and potentially longer before Apple can transition from using Qualcomm for its complex iPhones," Mike Walkley, a Canacord Genuity analyst, wrote in a note to investors. "Qualcomm is several years ahead."

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