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The Big Challenge for 5G

Does 5G have a home in mobile?

It's difficult to make a singular statement about 5G other than it's the Tower of Babel for wireless standards; a technology looking for a market. Like the wireless broadband systems of the early milieu, 5G is just the latest version of the "If you build it, they will come" school of economics. It's big on hype and forecasts, small on revenue and profits. We understand the heresy of that statement but having lived through previous incarnations of the "wireless revolution," we expect a similar outcome this time around. Technology has improved and data rates have increased, but those facts are of little consequence when the same can be said of the wired and optic solutions that bankrupted all the wireless business models that dared step out of the mobile realm.

None of that matters to the carriers and OEMs that are desperately in need of the next big growth story. The technical and market issues plaguing 5G deployment are merely hurdles to clear with higher OPEX. There's little doubt that 5G will be deployed—or at least the first installment— in the form of either fixed broadband access to homes or "massive MiMo" base stations for cell phones. Remember: the low earth orbit (LEO) satellite systems got aloft in spite of all the red flags waving off their launch. Every one of them fell back to earth in bankruptcy and most of the spectrum was returned or retaken by the FCC, but those facts are just footnotes. Once tens of billions in funding is committed, contrary data doesn't matter. But just like the LEOs and the first versions of fixed broadband wireless systems (circa 2001), 5G's prospects of material success are slim in our opinion, first and foremost because 5G's operation frequency is too high to support mobility (cell phones) or provide any kind of reliable fixed service (homes).

At 3.5GHz – 4.2GHz, the 5G bands allocated for mobile cellular are nearly twice as high as Band 41 (2.5GHz), which is the upper end of 4G and the band that caused Sprint so much trouble. At 2.5GHz, Band 41's propagation characteristics (which erode as frequency increases) are so poor Sprint had to get a special dispensation to double the transmit power to get any kind of usable coverage. And that exception was only allowed because the band was configured for TD (time division duplex, "walkie talkie" type operation), so it was only transmitting half the time. If it were an FD band (full duplex, always transmitting), it's highly unlikely Sprint would have gotten its waiver. Even if the same power allowances are made for the 5G bands, the radio signals would still only cover 30%[1] to 50%[2] of the cell site, rendering the signals virtually useless for mobile service.

"Massive MiMo" (phased arrays) antenna systems could get the signal all the way to the cell's edge, but at what price? Adding 200 antennas per sector isn't cheap and even if it were, it's expensive to generate enough processing power to keep the antennas all calibrated and phased properly for every position of the phone as it moves through the cell. Moreover, the faster the phone moves, the more processing power it requires. So by the time we get to highway speeds, we're spending more on the brains steering the antenna and the power to keep them humming along than on the antenna itself. At that point the "massive" in "massive MiMo" shifts from antennas to electricity. And to what end? What possible product or service can 5G deliver to a cell phone that could justify its cost? The standard response is "much higher data rates," but that's not a product; that's a technology. And as we've already seen with 4G, the appetite for data declines with speed: the faster subscribers move, the less data they consume. It's easy to attribute this to an aversion to speeding tickets or death, but the phenomenon is really a fundamental heuristic of human behavior. When we're moving, we're distracted; when we're distracted, we can't devote the attention required of high data rate applications like video. It's our inability to do two things at once that drives the tradeoff between mobility and data rate, so even if we had a 1GBs link at 80 mph, we'd have little use for it. We've written and discussed this in detail since 1999 but a treatise on the topic isn't necessary. The inverse relationship between data rates and speed is evidenced by cellular carriers' willingness to pay for WiFi.

Apple first included WiFi in iPhone 4, and other phone OEMs were quick to follow to remain competitive. Cellular carriers grumble about paying the extra freight for a non-cellular technology, but if they were going to survive in high-end phones they had no choice. Once iPhone became powerful enough to be the device of choice for data applications (video, gaming, photos) in portable environments (Starbucks, airports, the DMV), carriers struck a different tune. Because the vast majority of data use occurs when the user is stationary, carriers came to embrace WiFi as a means of moving users from

expensive cell to inexpensive WiFi networks at the peak of their data use. Today, WiFi is an indispensable feature in smartphones, and handset OEMs are pouring money into it at the behest of cellular service providers. It doesn't matter that WiFi is useless in the mobile environment; everyone expects the connection to drop as soon as they drive away from Starbucks.

The situation is no different with 5G. Like WiFi, 5G is a high data rate connection with limited coverage and no support for mobility. But no one will care when their phone drops the 5G connection and automatically reverts to LTE (or LTE Advanced or LTE Pro); all of those technologies provide more raw data capacity than can be used while driving a car. Users today already lose their connections to 4G and they don't care. LTE dials back the data rate based on signal strength, and because the faster we drive the weaker the signal becomes, we can be pushed back to 3G or even 2G rates in order to keep the connection. Users don't (didn't) notice much because they were distracted or only minutes from the next cell or their destination. And given there's been no uproar for faster connections while driving through 4G networks, subscribers are unlikely to know or care enough to pay for a 5G connection at 6o mph. More and faster data at hotels or airports or coffee houses makes sense, but those aren't mobile environments. So even if 5G's problems of the path loss, processing, and pricing were to magically disappear, we don't believe there's a market for it in the mobile cellular world. This isn't to say 5G won't get deployed--it certainly will. But 5G's value, utility, and growth won't be what most pundits are bantering on about today.

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Endnotes

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[1] 4.7GHz N79

[2] 3.6GHz N78