NEWSLETTER

The Fallacy of Cell Overlap in Percentage

By **Keith Parsons, CWNE #3** · 2026-06-16 · originally on LinkedIn

By Keith R. Parsons, CWNE #3. First argued in 2009. Updated for 2026.

There is never a correct time to specify Wi-Fi coverage as a percentage of cell overlap. Not for general coverage, not for backup coverage, not for roaming. Specify coverage as a measured signal strength at the client instead: a primary Access Point at a target dBm and a secondary Access Point at a target dBm. I argued this in 2009, and I argue it again now, because the argument does not rest on anyone agreeing with me. It rests on two things you can check yourself: a piece of geometry, and the plain fact that you can only specify what you can measure. You can measure a dBm threshold. You cannot measure a "percentage of overlap," and by the end of this piece you will see exactly why that phrase has no single meaning at all.

A quick note before we go further. The word "channel" in my original title was loose. This piece is not about RF channels, not about 1-6-11, not about adjacent-channel or co-channel interference, and not about channel bonding. It is about Access Point coverage-cell overlap, the thing vendors keep speccing as "15% to 30%." I renamed it so a 2026 reader doesn't arrive expecting a 6 GHz channel-planning piece.

The mistake that wont die

We have all seen the design specs calling for Access Point overlap of "15% to 30%," depending on who's talking. Seventeen years later, that mistake is still being taught. You will find it in articles all over the internet, in study guides, and in some vendor and certification materials, repeated so often that it sounds like settled doctrine. It is not. It is the exact error this piece exists to refute. Just because a number gets repeated everywhere does not make it true, and a number that gets repeated everywhere without anyone ever defining how to measure it should make you more suspicious, not less.

So treat every "15% to 30% overlap" reference here as the thing being corrected, never as backup for the correction. The people teaching it are confidently wrong. If you cannot measure it, then don't use it in your design spec.

Someone telling you "I'll know it when I see it" just isn't good enough. We have to be able to PROVE or VERIFY that our wireless networks meet a design specification. A number you cannot measure is not a specification. It is a wish.

Overlap of what, exactly?

Here is the problem with a percentage of overlap. The same picture gives you wildly different numbers depending on what you measure. Take the simplest interesting case: two equal circles whose centers sit one radius apart. Look at that geometry and answer the question, "what is the overlap?"

Don't jump to your foregone conclusion. Think about it first. For that one geometry, the answer is:

- 50% overlap of diameter
- 100% overlap of radius
- 33% overlap of circumference (the arc each circle contributes to the shared lens)
- 39% overlap of area

One picture. Four honest answers, ranging from 33% to 100%, all from the same single geometry. That right there is the whole proof, and it stands on its own. You do not have to take my word for it, and you do not need anyone else to agree, because the geometry is the geometry. "Percent overlap" is meaningless because the same overlap has no single answer. When a spec says "30% overlap," 30% of what? Diameter? Area? The arc? Nobody says, because nobody measures it. A number with four different correct values is not a specification at all, which is exactly why there is never a correct time to use it. Anyone who teaches "15% to 30% overlap" as a design target has not done this arithmetic.

The diameter and radius figures are brain-dead easy. The other two are not. The area of the lens where two equal circles intersect comes from the standard circle-circle intersection formula:

For the case where the center distance d equals the radius r, that works out to about 1.228 r^2. One full circle is πr^2, about 3.142 r^2. Divide and you get 39%, not the 23% I printed back in

2009. The arc each circle contributes subtends 120 degrees, which is 33% of its circumference, not the 29% I printed. I had the right formula in the original paper and then fumbled the arithmetic. The formula was correct; my answers were not. Consider that fixed.

And the real picture isnt a circle anyway

Now ask yourself the honest question. Are you actually running this lens-area calculation for every Access Point where it intersects with another one in your design? I think not.

Access Point radiation patterns are never really circles. They look more like amoebas or starbursts, shaped by walls, glass, metal, and every other bit of attenuation in a real building. Even if you settled on "overlap of area" as your definition and ran the math, you'd be running it on a shape the math doesn't describe. Modern design tools model those irregular, attenuation-shaped cells precisely because the circular assumption fails. The percentage was never measurable in the real world. It still isn't.

What you CAN measure, and SHOULD be using

The reason we want overlap at all is simple: each client device needs to see more than one Access Point, so it has somewhere to go when it roams or when its primary Access Point gets busy. That is the actual goal. Coverage, plus a backup. Roaming is part of that backup, and it is a signal-level requirement, not a percentage. The client must see the next Access Point at a usable measured level before it will hand off cleanly.

You can specify the actual goal directly, and you can measure it.

- **Primary coverage:** every client location sees its strongest Access Point at or above a target signal strength.
- **Secondary coverage:** every client location also sees a second Access Point at or above a (usually lower) target signal strength. This is the roaming requirement too. The next Access Point has to be there at a measured dBm, or the client has nowhere good to go.

That is it. No guessing at percentages, no eyeball answers. Walk a passive survey with the tool of your choice and ask it to show you everywhere your design provides two Access Points above your thresholds. A good survey tool can show you the signal level of the second-strongest Access Point at every point on the floor, which is the only thing "secondary coverage" ever meant. Use it as a dBm layer, with a real threshold. The moment

you let a tool, or anyone, hand that idea back to you as "the second AP at some percentage," you are back inside the error this whole piece refutes. The concept is sound. The percentage wrapper around it is not.

Pick real thresholds, by band and by use case

The original paper used a single -65 dBm number for both primary and secondary. That was a reasonable shorthand in 2009. In 2026, set the number from what the client actually has to do at that spot, and tighten it for traffic that punishes a weak edge:

- **Enterprise data, cell edge:** target around -67 dBm with at least 25 dB SNR, because that is the level where modern data rates hold up at the edge of the cell.
- **Voice over Wi-Fi:** -65 dBm primary, because real-time audio has no slack for retransmissions.
- **Primary/secondary split at 5 GHz:** -65 dBm primary and -70 dBm secondary as a working starting point, tightening the secondary to -67 dBm where the application cannot tolerate a marginal roam.
- **2.4 GHz:** design for primary coverage only, around -67 dBm. Do not design for secondary coverage in 2.4 GHz. With only 3 non-overlapping channels, designing for a second strong Access Point just manufactures co-channel contention.

Notice what every one of those numbers has in common. Each is a level you can stand in a spot and measure, and each is tied to something the radio has to accomplish there. That is the whole point. Set the number from the requirement, then go verify it. Do not borrow it from a percentage.

One more thing that changed since 2009. The SNR you need has gone up with every new PHY. The old "20 dB is plenty" assumption is now the floor, not the target. Voice wants about 25 dB. 256-QAM on Wi-Fi 5 wants about 29 dB. 1024-QAM on Wi-Fi 6 wants about 35 dB. Each of those is the SNR the modulation itself demands to decode, not a figure anyone voted on. Specify the SNR your modulation needs, then verify it.

What about fast roaming?

Fast roaming for voice and real-time apps, including 802.11r fast transition, is exactly the place people try to smuggle a percentage back in. Don't. Fast roaming is a signal-level requirement like every other coverage requirement. The client has to see the next Access

Point at a usable measured dBm before it can hand off in time. Specify that level and walk a survey to prove it. The handoff cares about the dBm the radio actually sees at the cell edge, not about a percentage drawn on a floor plan. There is no version of "percent overlap" that becomes correct because the application is voice. It is a measured dBm, same as everything else.

Does Wi-Fi 6E and Wi-Fi 7 change any of this?

No. New bands, wider channels, OFDMA, and multi-link did not change the coverage logic one bit. Coverage is still validated from the client's position, by primary and secondary signal strength, regardless of band or channel width. 6 GHz propagates a little differently than 5 GHz, so your thresholds and Access Point spacing shift, but the method is identical. You measure what the client sees.

Conclusion

There is never a correct time to specify coverage as a percentage of cell overlap. One geometry gives you 39%, 33%, 50%, and 100% all at once, so the number means nothing, for general coverage, for backup, for roaming, for any use case you can name. That single fact does not need a vote, a vendor, or a certification track to back it up. The real coverage shape is an amoeba, and you were never going to run the lens-area integral for every pair of Access Points anyway. Look at it from the client's point of view. Specify the signal strength each device needs from a primary and a secondary Access Point, in dBm, by band and by application, because dBm is the one thing in this whole discussion you can actually walk in and measure. Then walk a proper passive survey and prove you delivered it.

That was the right answer in 2009, and it is the right answer now, no matter how many articles, study guides, and vendor decks still teach the percentage. The next time someone hands you a "15% to 30% overlap" spec, ask them the only question that matters: 30% of what, and how are you going to measure it?

By Keith Parsons, CWNE #3, Wireless LAN Professionals. Free to read and share. Facts