

MY WiFi IS SO SLOW, HOW CAN I FIX IT?

Some condos in the Vista Royale complex have a really bad WiFi environment due WiFi overcrowding of the airways and this document is going to address that. When you contract for an internet speed, that is the speed that will be delivered to your condo. If you have an Ethernet connection to the modem/router, you should get close to that contract speed on a speed test, if not call your provider. WiFi speed will never be quite as high as wired speed, because of all the encrypting and decrypting involved, but it should be close. If your WiFi is considerably slower than your wired speed, that is environmental and upping your WiFi speed or changing internet providers is not going to fix it. Overcrowding of the airways is just one of many things that can slow your wireless speed.

I'm going to use some scary technical terms here, so I'm going to try to equate these to something you may be more familiar with. WiFi is delivered on either the 2.4 GHz band and 5 GHz band. The 2.4 GHz and 5 GHz, are WiFi bands just like AM and FM are radio bands. AM radio was around long before FM, so we all remember a time when we had an AM radio, instead of an AM/FM radio. Likewise the 2.4 GHz band came along first, so there are lots of WiFi enabled devices that don't see 5GHz signals. Like AM radio, 2.4GHz travels pretty far, 150 feet indoors, 300 feet or more out in the open. Like FM radio, 5 GHz travels a much shorter distance, 50 feet indoors, 100 feet outdoors. Like FM radio that cuts out when there is an obstruction, 5GHz has more trouble passing through obstructions. Like radio signals, WiFi signals travel farther at night. Like radio bands are cut up into stations, WiFi bands are cut up into channels. So if the terms 2.4 GHz and 5 GHz scare you, just think AM and FM radio.

I live in one of those condos where 2.4GHz WiFi is a nightmare. My unit is flooded with other peoples WiFi traffic on the 2.4 GHz channel, not to mention using 2.4 GHz cordless phones that make some channels extremely slow for hours at a time and microwave oven interference that can stop wireless communications completely for minutes at a time. I know that most of the people in my building don't have internet in their unit. I know that my WiFi is only going to get worse when more people start to subscribe to the internet. So I had planned to migrate to 5GHz WiFi, in the future. The future came a bit earlier than I had planned, when Vista Royale decided to move to AT&T, and I couldn't wire into the modem/router anymore because the modem/router is now located in my bedroom, instead of the office aka the front bedroom in a B floor plan. I have switched over to the 5 GHz band where my WiFi speed varies from 28 Mbs to 29 Mbs.

Back in January, I ran some WiFi speed tests. I was one of the first to get the AT&T install and when I ran my tests back then, I was the only AT&T customer in the vicinity. I noticed that my router was not on a standard channel, so I changed to channel 11, the most crowded channel, and ran my speed tests. At that time I was getting results in the low 20Mbps range. It is the last week in March 2017, so I thought I'd take a look at my WiFi speed on the 2.4 GHz environment here at Vista Royale, before the snowbirds pack up and leave. Replicating January's test conditions as closely as I can, my speed averaged 12-13 Mbs. That's 10 Mbs slower than it was two months ago.

I assume wireless interference is causing the slowdown. Now that AT&T has come through, everybody has a wireless/modem router. That more than doubled the number of router's I see when I try to connect to the internet. Each router announces that its presence by broadcasting a Service Set Identifier (SSID) , and so the number of SSIDs being broadcast is huge. Since 60% of the SSIDs belong to non-

internet subscribers, the routers are not “talking” to equipment, so the quantity of networks shouldn't be a problem. Certainly not enough to slowdown my WiFi speed by 10Mbps, from 22Mbps to 12Mbps. So I'm going to attribute at least part of the slowdown to the way AT&T allocates WiFi channels.

The picture below was taken in the fall, before the WiFi upgrade and before the “season” had officially started and long before the conversion from Comcast. The top of the arch is centered over the channel number. A 2.4GHz WiFi signal is wider than a channel division. My SSID is 6447, my router is set on channel 11, along with many others. These routers on channel 11 will take turns talking, they may bump into one another at times, but for the most part we got adequate throughput. There are also routers broadcasting on channels 1 and 6 and two more routers broadcasting on channel 3

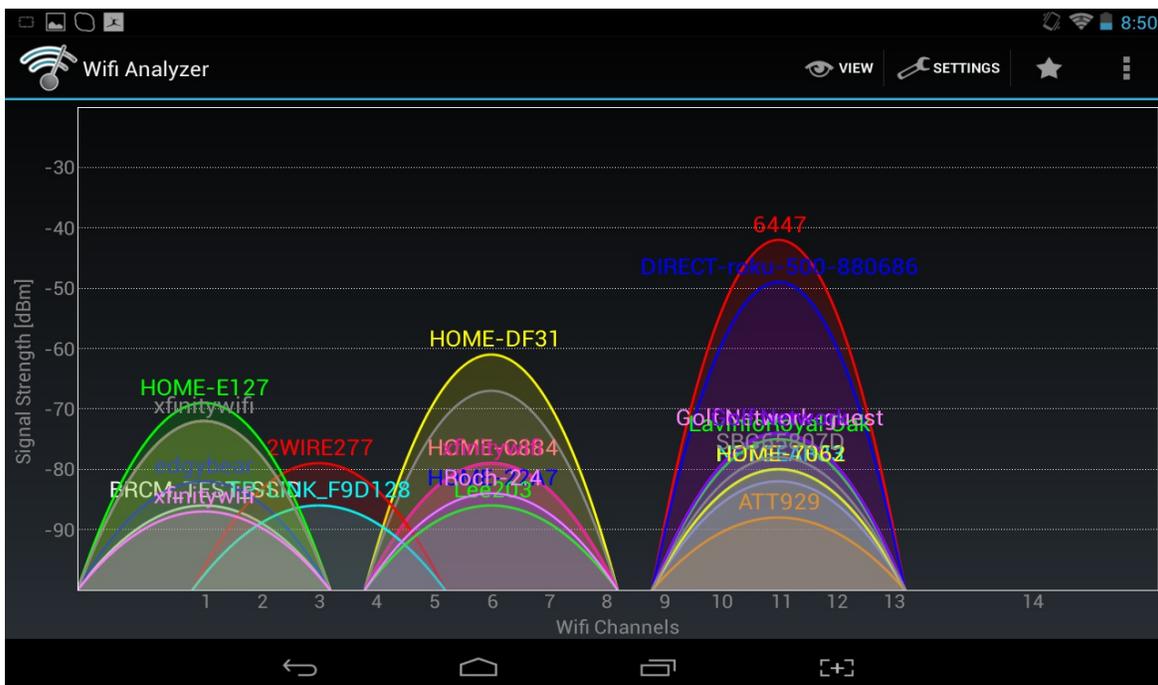


Illustration 1: WiFi Environment before AT&T Channels 1, 6 and 11

As I have understood it, the gold standard for 2.4GHz WiFi router channel selection is to pick channels 1, 6, or 11 because there is no cross-interference. WiFi's on the same channel are polite to one another, and wait their turn to speak. When there are a lot of routers on the same channel, it causes a slowdown. If you use an in-between channel you might get a faster WiFi response, because your WiFi doesn't care about interference with other channels, it just talks to its equipment, causing the standard channels to have interference and slow down a little, or a lot depending on how much communication is going on.

The routers on channel 3 will be courteous to one another, but they don't stop talking just because equipment on channel 1 and 6 is communicating. Because it is so noisy, if the equipment isn't really close to the router, it will have trouble communicating because the conversation becomes muddled by the noise, so there is a lot of repeating of the transmission.

The AT&T routers installed in our complex auto-channel through channels 1, 4, 7 and 10. Is this a new standard? I don't know, and certainly can't find any reference to this new standard on the internet. And Comcast hasn't pushed out a router update. Their routers that are still showing up in the vicinity, so they are still auto-channeling through 1, 6 and 11..

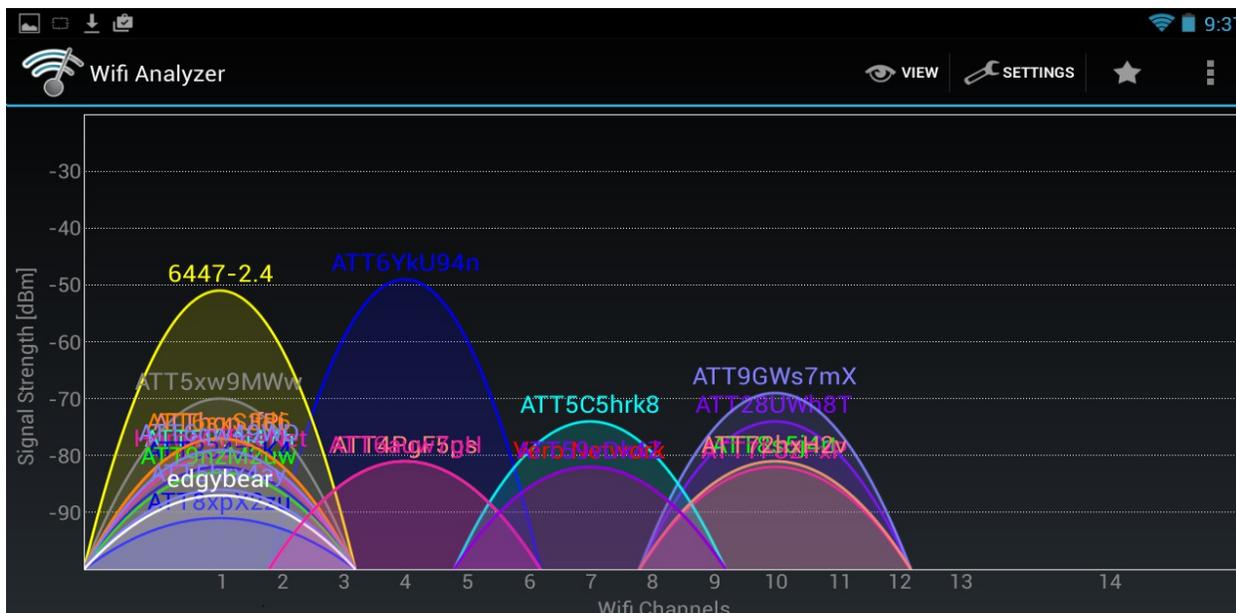


Illustration 2: After the AT&T install channels 1, 4, 7 and 10 are used

Illustration 2, is a picture of my WiFi environment in my office after the migration to AT&T. My SSID is 6447-2.4 and I'm on channel 1. Because routers are set to overlapping channels, there is a lot of noise. We've all had conversations in a noisy environment, and know how hard it is to hear correctly when there is background noise. Same thing for routers and their networks. The farther I am from the wireless router, the more trouble my equipment has hearing the router when there is lots of noise. And so instead of my equipment saying "I got it" it says "what was that again?" And then the router has to repeat the packet. The repetition is how noise contributes to making things slow.

In illustration 2, I am 25feet away from my router. I can actually still see my wireless router down the hall. I have a straight line of site between my equipment and the router, but I am losing considerable signal strength going down that short narrow hallway that separates my bedroom from my office. In my office, my neighbor's signal is a tad stronger than my own.

Each room in your condo has a different WiFi environment. How polite your router is with its neighbors depends on how well it sees its neighbors.

The next picture shows the WiFi environments in my condo.



Illustration 3: WiFi by room after the AT&T conversion

The modem/router is in my master bedroom. The location is rather protected from other signals. The living room sees more signal because it is less protected. Then there is my office where I do most of my computing. At each location there are different networks to be considered.

Unfortunately you can't tell from these pictures, how much they are actually talking, only how loud they are. If you look closely you'll see Roch2.4 in the living room. This is the Royal Oak Club House and is a very busy network. But a private router streaming video is going to be very busy too.

What channel is best? There is no way to tell from a picture, hopefully the router will decide. We see we have people picking channel 2, that in all probability is something someone hand selected, and then we have Xfinity using the gold standard 1, 6 and 11 auto channel, while AT&T is using 1, 4, 7 and 10. It is usually best to let auto-channel do its job but in a messy situation, but it is so messy no channel seemed acceptable. Luckily, I moved to the 5GHz band where I'm getting very good speed.

DUAL BAND CONSIDERATIONS

A dual band router is the first thing you are going to need to clear this up. All dual band routers are not created equal. Some dual band routers deal with one band, or the other. Other dual bands support both bands simultaneously. The AT&T router that I received, the 5268AC, is a true dual band router. It is broadcasting SSIDs and accepting clients on both 2.4GHz and 5GHz bands simultaneously. The SSIDs are configured to be the same, so your connected equipment will automatically select the best, that is the STRONGEST signal of the two. If the SSIDs are the same, you don't have to dig into settings to change your connection when you move into a zone where the 5GHz signal is too weak to use, but too strong to let go of.

The first problem with the twin SSIDs is that if you are not in the same room as your router you will probably be using the slow 2.4GHz band, because it is stronger.

The second problem with automatically switching between bands, is that on most equipment your assigned IP address changes and this can disrupt network communication between the devices on your network.

And lastly it takes time for your equipment to find the new channel.

Since my 2.4 GHz WiFi is running at about 12 Mbs, and my 5 GHz connection run at 28Mbs, I really want to use 5GHz. With the twin SSIDs my equipment wouldn't automatically select the 5GHz band in the rooms where I actually use WiFi, so I changed my SSIDs to 6447-2.4 and 6447-5. Now I know which one is the 5GHz SSID.

Location and Signal Strength

As stated before, 5GHz has a much shorter range than 2.4GHz, and doesn't penetrate barriers as well as the other band. Even in a small condo, you might have dead zones where 5 GHz will not work well. Remember the more obstacles in the way, the weaker your signal will be. The farther away, the weaker the signal will be. If you are having trouble with your signal strength, sometimes just changing the location of your router, raising it off the floor, moving it away from other equipment or rearranging the furniture can help.

When the AT&T installer came in to install the white box on the wall, a.k.a. the Optical Network Terminator (ONT), he offered me the option to locate it behind the TV in the living room, or in the master bedroom. The ONT dictates where the wireless router is going to be located. I was shocked that I had the choice, since the TV system was going to be wireless 5GHz, and I thought the best practice of WiFi installation would be to use a central location. Quite frankly I didn't think the corner location would do, since that was almost 40 feet away from the office, and signals would have to pass through 3 walls, a metal furnace, my husband's over stuffed chair, and of course my husband. The installer didn't use that as his argument for the bedroom location. He used the argument that if I wanted to rearrange the furniture, I'd be stuck with the hard wired location for my TV. I questioned whether the wireless would even reach my office from the living room, and he assured me they don't have a problem getting the 5GHz WAP signal to TVs in mansions, so my condo would be fine. I still had a hard time believing that the living room would work well, so I opted for the master bedroom because of central location, not because of the decorating options. Sometimes at night when I can't sleep because of the green glow of the router lights, I regret my decision but I am very happy with the excellent 5GHz coverage everywhere in my condo.

BENEFITS OF 5GHz.

There are many benefits to the 5GHz band. For starters, the signal travels faster through the air. The maximum throughput on 5GHz is 3 times the maximum throughput on 2.4GHz. So even if there are several routers taking turns on the same channel, it will be faster because they are fast talkers. You won't have ancient 802.11b equipment slowing your communications either.

Next there is far less interference. Common household items, like microwaves, cordless phones, Bluetooth devices, baby monitors and wireless security cameras don't interfere with 5GHz transmission. This band doesn't suffer from interference from other wireless networks either because there are fewer signals competing for more channels.

The picture below shows that even though the neighbor's are all sending 2, 5GHz SSIDs, one for the wireless router, and one for the wireless TV boxes, the total number of 5GHz signals that penetrate my unit is much smaller than the number SSIDs on a single 2.4GHz channel.

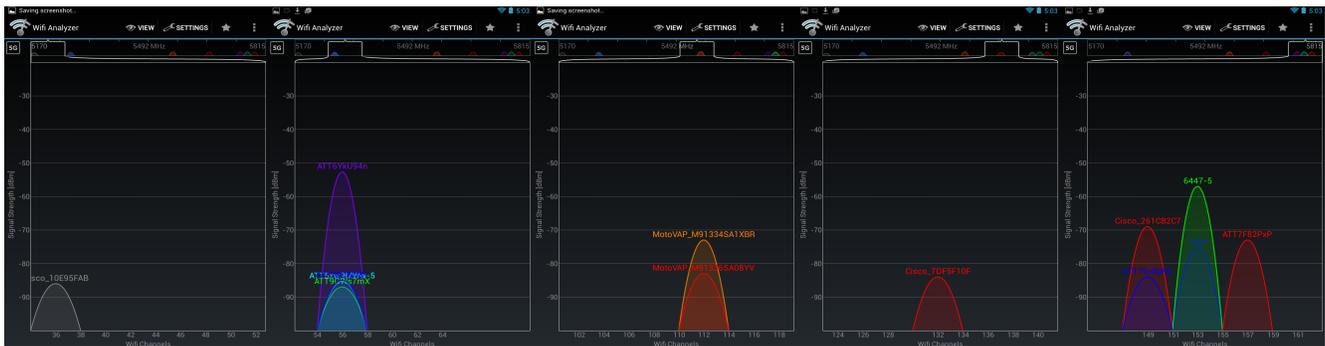


Illustration 4: These are the 5GHz signal that are broadcasting in my vicinity

The picture above is a composite of several screen shots needed to capture the 5GHz range of channels. In the U.S., 5GHz can use even numbered channels from 36-64, and 100 – 144, and the odd numbered channels 149-163.

There are some major obstacles to working with 5GHz

- The signals need to be strong enough to be exchanged between the equipment
- The equipment needs to be new enough to see 5GHz signals
- The user needs to know how to buy 5GHz equipment
- The user needs to know how to configure the router.

Here are a few more terms that generally make peoples eyes glaze over. When you buy equipment, the specifications talk about a wireless 802.11 standard. The letter after 802.11 is the part you need to pay attention to. Two wireless standards are used on the 5GHz band, 802.11n (N) and 802.11ac (AC). The N standard also applies to 2.4GHz, so if you see that designation, you need to make sure it is 5GHz as well as 2.4GHz compliant. The AC designation only applies to 5GHz equipment. The AC standard allows signals to travel farther, and faster and the N Standard.

DFS Channels

The available channels vary by country. In the United States, the N wireless standard has 15 non-overlapping channels, and the AC standard has an additional 30 non-overlapping channels. N equipment can't see those extra AC channels. In the AC standard, the FCC allows certified AC equipment to use channels that radar operates on, giving AC equipment extra channels. These channels are known as DFS channels. When operating on a DFS channel, the AC equipment analyses each information packet for errors, and if the errors indicate the possibility of radar use, the equipment must immediately relinquish the channel. The router I received from AT&T was a 2568AC. When the router auto-channeled, it was jumping to DFS channels.

The extended range and the DFS channels were a bit problematic for me. First off, most of the 5GHz equipment I have is N equipment, so when the router auto-channeled to a DFS channel, my N devices would no longer be connected. I tried to change to the 802.11n in the options on my 5GHz band, but it won't change away from the 802.11n/ac setting. So I selected a non-DFS channel and turned off auto-channel. That solved my WiFi channel hopping problem but not my TV problem.

My wireless TVs were also a huge headache. The black error screen came up several times an hour. Monitoring the wireless environment on my WiFi-analyzer, I could see that the black screen came up when my TV wireless access point (WAP) was changing to a new wireless channel. Watching the SSID's change channels, was like watching a game of musical chairs. My channel would be stable for a while, and then the sun would go down, the signals would travel farther and that would trigger the SSID musical chair game all over again. AT&T swapped out my AC type WAP for an older refurbished N type WAP for the TV's. Since then my WAP has not changed channels once in the past 6 weeks and the number of black screens dropped from 3 an hour, to 3 a week! Progress!!!!

5GHz EQUIPMENT.

The 5GHz is a relatively new and the AC version is newer still. Your newer equipment might support 5 GHz. If your equipment was manufactured before 2010, it doesn't have any 5GHz capability, and if it was manufactured before 2014 it doesn't support the AC standard.

When buying new wireless equipment, you should look for dual band wireless equipment. Dual band will work on both 2.4GHz and 5GHz band wireless networks. When you are shopping, you probably won't see 2.4/5 information on the box, you'll have to do your research ahead of time, or find a knowledgeable sales associate to get the scoop on the equipment you are going to purchase. Finding 5GHz capability is especially important if you going to buy a video streaming device to use at Vista Royale. Dual band equipment is a bit more expensive. but I believe being able to use either band is worth the extra cost.

I have a significant amount of money tied up in 2.4 GHz WiFi enabled equipment. It was not practical to go out and spend thousands of dollars to replace perfectly good equipment, just because it isn't 5GHz compatible. Settling for 12Mbps WiFi while I'm paying for 24Mbps service was not acceptable either. So I worked hard at finding a solution.

For my husband's laptop, we went with a \$24 dual band Edimax AC1200 WiFi Nano USB Adapter (model EW-7822ULC). The Nano size is very small, protruding about 3/8 of an inch from the side of his laptop. We first tried a D-Link adapter, but the user interface for connecting to WiFi was very confusing. This Edimax works with the standard Windows WiFi connection procedure.

In my office I have 2 laptops, a wireless/Ethernet printer, and an Ethernet only printer. Before the switch to AT&T, I had everything plugged into the modem/router with Ethernet cables. Now that the modem is down the hall in the master bedroom, I can't rely on Ethernet anymore. The WiFi environment is still unreliable because of random interference (microwaves and 2.4gh cordless phones) and slower than Ethernet too. So I definitely needed to find a 5GHz solution for all this equipment too.

I picked up a certified refurbished NETGEAR N600 Dual Band WiFi Range Extender (model WN2500RP) that has 4 Ethernet ports on the back. Refurbished equipment is always a gamble, but the price break on this one was significant, and it was guaranteed for 30 days, so what the heck. I plugged my network printers and my two laptops into the back of the WiFi Range Extender, and gave it a whirl. It works perfectly as long as my router is not on a DFS channel. I had done a lot of research before buying, but didn't see anything addressing DFS in the equipment specifications or reviews. Had I known what I know now, I would have looked for an AC model with Ethernet support, like a \$99 NETGEAR Nighthawk AC1900 Desktop WiFi Range Extender (EX7000-100NAS). I didn't know about DFS channels, until I tried to figure out why some of my equipment was dropping connections when the WiFi channel changed.

Range extenders by nature rebroadcast your WiFi on a different channel. I certainly didn't want to contribute to the wireless congestion here, so once I got the range extender talking to my router, the first thing I did was turn off the wireless rebroadcast. Besides being the considerate thing to do, turning off the rebroadcast improves performance. I only spent \$25 on this experiment and everything connected to the range extender is running at near Ethernet speed. I am one happy camper. I speed along at 28Mbs though the "season", totally unaware that the 2.4GHz band had slowed to a crawl.

So those are a couple of low cost ways to move to the 5GHz band and speed up your WiFi.

FORCING THE 5GHZ CONNECTIONS

As stated earlier, the AT&T is broadcasting the same SSID for both bands. Most of the time, your devices will connect on the 2.4Ghz band, because it is the strongest. If you want to force a 5Ghz connection you need to change the SSID. To change your SSID you will need some information located on the side of the router. You will need the Advanced Device Configuration address and the Device Access Code for the router.

In your browser, enter the address for the advanced device configuration. This will land you on the routers Home page. From there take the WiFi link to modify the settings and security of your router. That will land you on the Lan->Wifi page where you will be greeted by this important warning .

Warning: Modifying the settings on this page can impact the ability of devices to access your wireless network.

On this page you can change the Network Name (SSID) for either band. You can also change the WiFi password to a custom password if you wish.

After you make the changes, scroll down to the system diagram. Just above the system diagram, there is a SAVE button. Click SAVE.

You will be prompted to enter the Device Access Code that you found on the side of the router. Enter that device code. **DO NOT LET YOUR BROWSER REMEMBER THIS CODE!** If your browser remembers your access code, this could be used by hackers in a drive by attack.

If you didn't rename both SSIDs, go in and forget your old SSID on all your connected devices.

Now connect your devices to the 5GHz network.

SUMMARY

Two years ago I stumbled upon a 5GHz setting on a new router. When I researched what 5GHz was, I realized right away that this was going to be a game changer for me when dealing with the WiFi here at Vista Royale. It was hard finding the information I needed to make the switch. This was a good education for me, and I'm hoping this document helps you get a head start in understanding what 5GHz can do for your congested WiFi situation.

While the wireless situation at Vista Royale was deteriorating over the last few months, my experience has been great. While my 2.4GHz WiFi has slowed down to a meager 12Mbs, my 5GHz wireless speed continued averaging 28 Mbs.

If you have wireless speed is significantly slower than the speed you receive via Ethernet, it is some kind of environmental problem. Changing internet providers is not the answer, neither is subscribing to a higher speed. You need to change the environment.

Disclaimer: I'm not a network engineer. These are my just opinions based on my observations and experiments while living in WiFi-hell, better known as Vista Royale.

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