

WAVEFORM

# DualMini

Low-Profile 2x2 MIMO Antenna

## BEFORE YOU START!

Scan this QR code to watch the setup videos, and...

- ▶ Connect to **our team of dedicated Signal Specialists** - They are eager to help!
- ▶ **Get your free Virtual Site Survey** - including a map of cell towers and where to mount your antenna.
- ▶ Access installation **guides for a wide selection of cellular routers!**
- ▶ View a **digital copy** of this manual.



[setup.wf/DualMini](http://setup.wf/DualMini)

Designed by WAVEFORM in the USA





# 00 Before You Start

Whether it be inside, outside, or on the roof, it's important that there's at least some 4G LTE or 5G signal where you're installing your DualMini. Ideally, the cell signal should be "usable."

## What Do We Mean by "Usable"?

When using your cellular router or hotspot, **you should be able to complete a data speed test** before connecting your DualMini. Connect to the Wi-Fi of your cellular device and visit [speedtest.net](https://www.speedtest.net) to run a quick data speed test.




MIMO antennas, like the DualMini, will help condition your outdoor signal and get you better data speeds. **But if the signal outside your building isn't usable to begin with, an antenna might not help.** You can certainly still give the DualMini a shot, you may not get the results you're expecting.





## Install DualMini Outdoors If Possible




For the best performance, always **install your antenna outdoors**. The walls and roof of your house may **limit performance** and impact the speeds you see from your router.





## Compatibility

Your DualMini supports almost every 4G LTE and low/mid-band 5G service in use in North America, Europe, and across the world. Here are the bands that it covers\*:

USA	 AT&T	B2/n2, B4, B5/n5, B12, B17, B29, B30, B46, B66/n66, n77
	 Verizon	B2/n2, B4, B5/n5, B13, B46, B48/n48, B66/n66, n77
	 T-Mobile	B2, B4, B5, B12, B25, B26, B41/n41, B46, B66, B71/n71, n77

UK	 EE	B1/n1, B3/n3, B7, B20, n28, n78
	 O <sub>2</sub>	B1, B3, B7, B20, n78
	 3	B1/n1, B3/n3, B7, B8, B20, n28, B32, B38, n78
	 Orange	B1, B3, B7, B20, n78

CANADA	 Bell	B2, B4, B5, B7, B12, B13, B17, B29, B46, B66/n66, B71, n78
	 ROGERS	B2, B4, B5, B7, B12, B17, B25, n41, B66/n66, n71, n78
	 TELUS	B2, B4, B5, B7, B12, B13, B17, B25, B26, B29, B46, B66/n66, B71/n71, n78

EUROPE	 O <sub>2</sub>	B1/n1, B3, B7, B8, B20, n28, n78
	 T	B1/n1, B3/n3, B7, B8, B20, B28, B32, n77, n78
	 Orange	B1/n1, B3/n3, B7, B8, B20, B28/n28, B32, B38, n78
	 orange	B1, B3, B7, B20, n78

**All supported 4G (LTE) Bands:** B1, B2, B3, B4, B5, B7, B8, B11, B12, B13, B14, B17, B18, B19, B20, B21, B22, B25, B26, B28, B29, B30, B32, B34, B37, B38, B39, B40, B41, B42, B43, B46, B47, B48, B50, B51, B53, B65, B66, B67, B69, B70, B71, B74, B75, B76, B85, B103, B106

**All supported 5G (NR) Bands:** n1, n2, n3, n5, n7, n8, n12, n13, n14, n18, n20, n25, n26, n28, n29, n30, n34, n38, n39, n40, n41, n46, n47, n48, n50, n51, n53, n65, n66, n67, n70, n71, n74, n75, n76, n77, n78, n79, n80, n81, n82, n83, n84, n85, n86, n89, n90, n91, n92, n93, n94, n95, n96, n97, n98, n99, n100, n101, n102, n105

*\*The bands your router actually uses may vary from this list. MVNOs and carrier subsidiaries, which use the same bands as those listed for the major carriers listed above are also supported.*

## How Much Improvement Should You Expect?

In short: It's hard to say. **Many people see an increase in data speeds of between 50% and 200%**, but some people may only see 10%. Despite all the science, wireless signals often work in strange and magical ways.

Two things are for sure: **The more spots you try the more likely you are to see a big increase in data speeds. Also, you're more likely to find better performance when installing outdoors.**

If you've gone through this manual and position your DualMini as we suggest, but you're still not seeing much improvement, **please reach out to us for help.**

## What Tools Do You Need?

Your DualMini includes all of the tools necessary for assembly. If you're wall mounting your antenna, you'll need a **phillips-head screwdriver** and you may need a **drill**.

For the UltraPole, **please refer to the manual included in the package or find the manual online at [waveform.com/ultrapole-manual](http://waveform.com/ultrapole-manual).**

# 01 Install Process Overview

- 1 Read this manual**, ideally from start to finish, so that you understand the whole installation process before you begin.
- 2 Find the best antenna position (Pages 6-9)**. This step takes the most time, but getting it right has a huge impact on your system's performance. Even if you're installing indoors, we recommend a few tests outside. Note your findings in the table provided on page 9.
- 3 Verify performance and connect everything (Pages 10-11)**. Before making any holes in your roof or walls you'll fully connect your system and run speed tests. If everything looks good, you'll finalize the cable runs and hard-wire everything.
- 4 Mount your DualMini (Page 12-13)**. You'll assemble the DualMini with one of its mounting options at your choice of antenna location.
- 5 Tell us how your system is doing**. Nothing makes our day like hearing from customers. And if for any reason you're not seeing the results you were hoping for, we can help.

Simply visit [setup.wf/DualMini](http://setup.wf/DualMini) to **get connected with our team** of dedicated Signal Specialists.

# 02 Finding the Best Antenna Position

While we include indoor mounts for the DualMini, you'll almost always see much better results installing DualMini outdoors.

In this section, we'll explain the **simplest and most effective method for identifying the best location** for your DualMini outside. Finding the best antenna position is the most critical step in this whole manual. Section 9 covers advanced tips for additional optimization.

If you can't install your antenna outdoors or you're using your DualMini in a vehicle, read these steps, along with Section 3 for instructions on how to find the best indoor position.

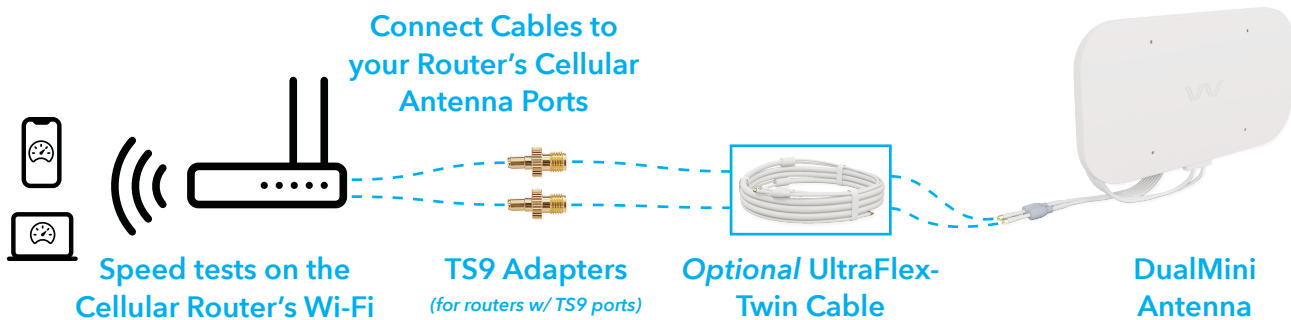
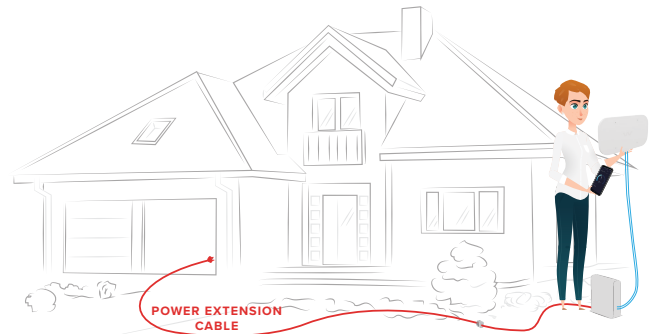
## The Goal

Your goal is to find the **best position** for the DualMini. This position should **maximize the data speeds** from your cellular router. It can take a little patience, but spending some extra time here can have a huge impact on performance - it's worth the extra effort.

### 1. Prepare Your Test Setup

Is your cellular router battery-powered? Or, do you have a power extension cord?

If so, connect your DualMini directly to your cellular router (as shown below), and restart your router.



**Can't take your router outdoors?** No problem. Keep your router powered indoors and add the UltraFlex-Twin cable into the setup to bring the DualMini outside.

If you're leaving your router indoors, your speed tests may be limited by the router's Wi-Fi range rather than its cellular connection. Ask someone to stay near the router so they can run speed tests as you try different positions with the DualMini outside.

**Not sure which ports to connect to?** Some cellular routers have both Wi-Fi and cellular antenna ports. Make sure to attach your DualMini to your router's cellular ports, not Wi-Fi. Some devices only have internal antenna ports. **Refer to your router's manual, our device-specific guides at [waveform.com/hotspot-guides](http://waveform.com/hotspot-guides), or reach out to us for help if you're unsure.**

## 2. Get Ready to Perform Speed Tests

Since the goal is improved data speeds for your cellular router, it makes sense to **judge the best position for your antenna by measuring your data speeds.** We recommend using Speedtest by Ookla for this. Visit [waveform.com/speedtest](http://waveform.com/speedtest) to get there easily.

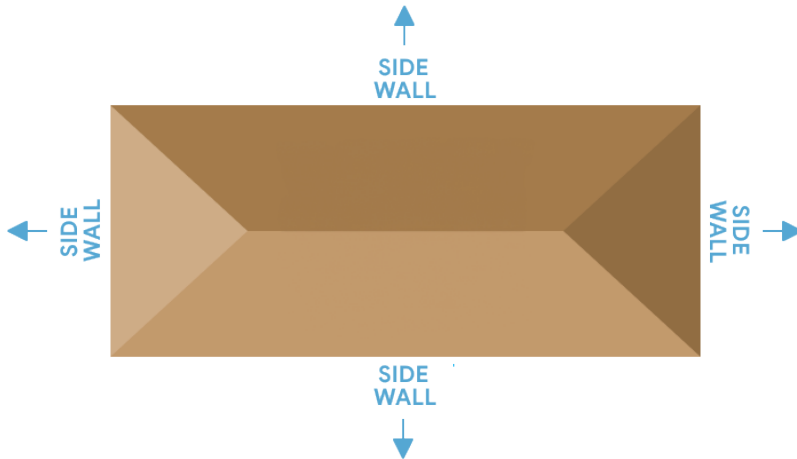
Once your test setup is ready and your testing phone or laptop is connected to your cellular router, **you'll have everything you need to start testing** at different positions outside.

Go ahead and **run a couple of speed tests to get a baseline.** You'll notice your results fluctuate a between tests - that's completely normal.

## 3. Take Outdoor Measurements

**With each new location, restart your cellular router by disconnecting and reconnecting the power. This forces the device to connect to the best bands available at that location.**

We recommend **running 2-3 speed tests at each of the following outdoor positions** with your DualMini, and writing each of your results in the table on page 9.



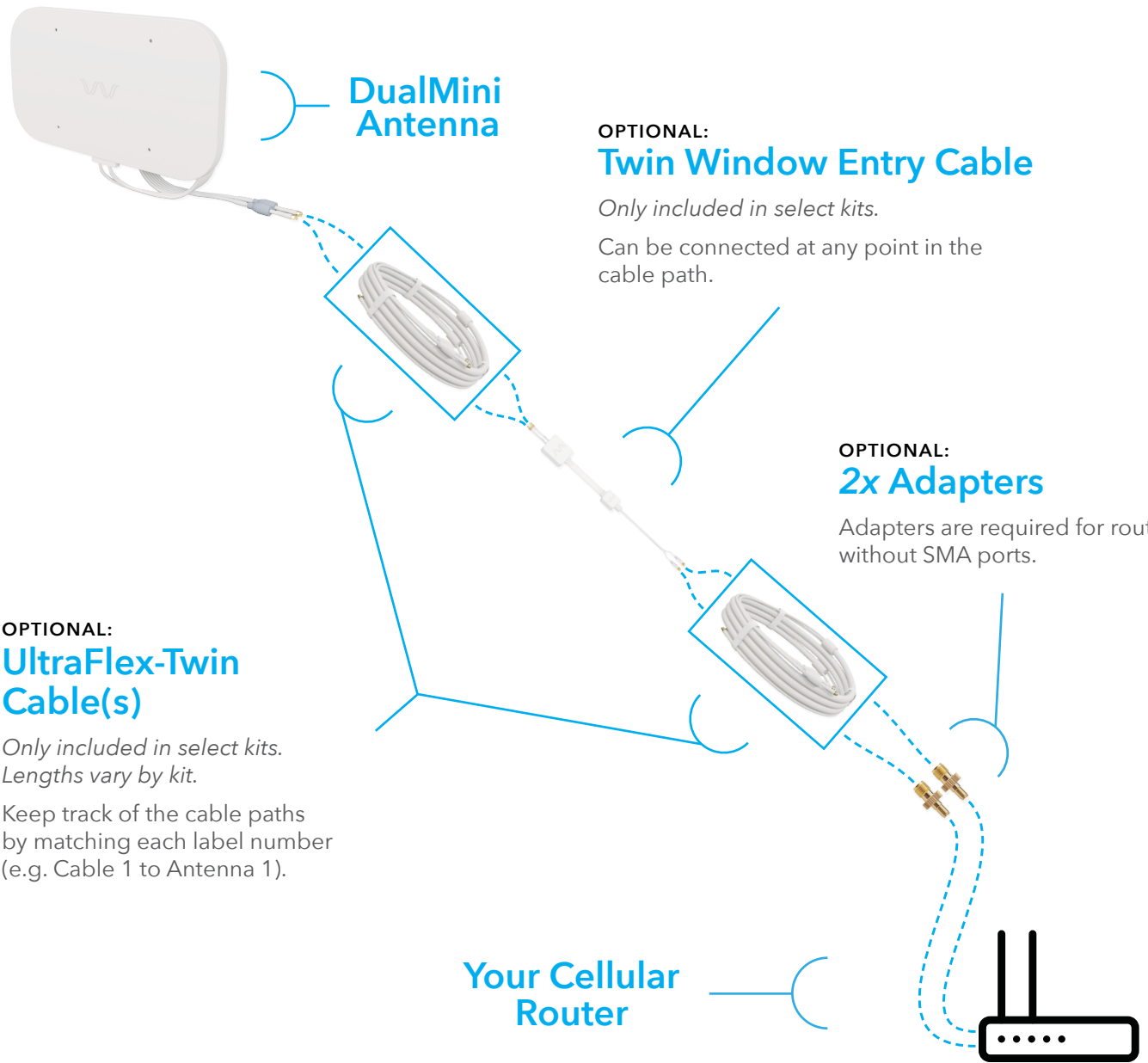
**Don't just go to the highest point of the roof!** While signal is generally stronger the higher you go, there's also often more interference. We've found it's often better to mount the DualMini on the side of the building where antennas are better shielded from interference.

If you're running into issues, we'd love to help. Simply visit [setup.wf/DualMini](http://setup.wf/DualMini) to **get connected with our team** of dedicated Signal Specialists.



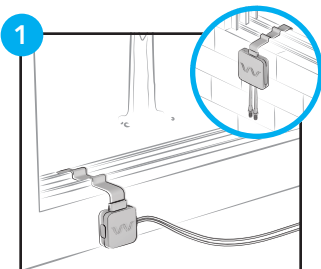




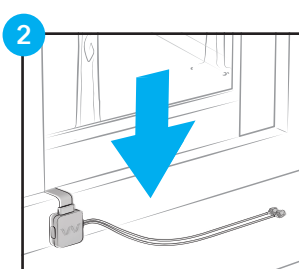


## • How to Install the Twin Window Entry Cable •

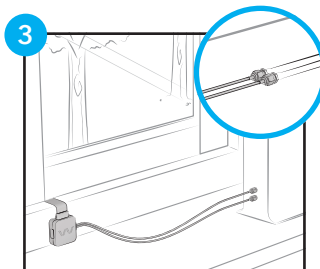
Your Twin Window Entry Cable can be connected at any point in your system as needed. Follow **the manual included or find it online at [waveform.com/window-entry-manual](http://waveform.com/window-entry-manual)**



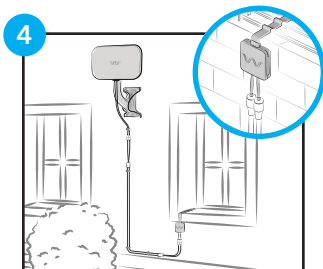
**1** Loosely position the window entry cable in your window frame, with its larger case outside.



**2** Check that your window **fully closes**. If not, please reach out to us for assistance.



**3** Connect its **indoor connectors** to your router or UltraFlex cable.



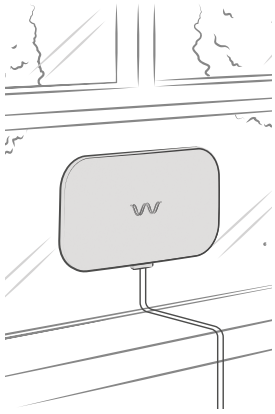
**4** Connect its **outdoor connectors** to your DualMini or UltraFlex cable.



## If you're mounting your antenna indoors...

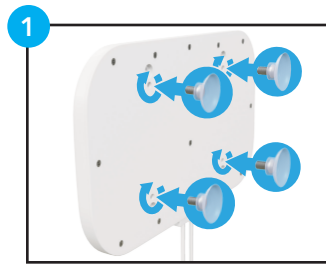
Your DualMini offers **two indoor mounting options**: window or desktop mounting. For better performance, **we strongly recommend mounting** your DualMini outdoors instead.

Regardless of the mounting option you choose, **remember to mount the antenna near the window you identified in section 4.**

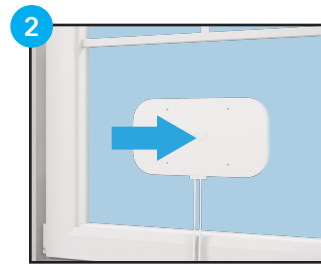


### Option 3: Window Mount

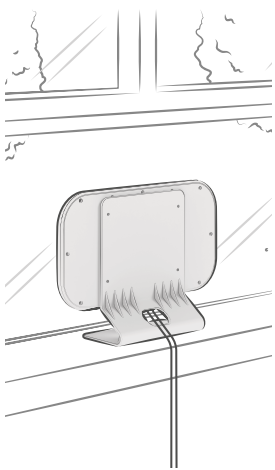
If you can't mount your DualMini outdoors, follow the steps below to mount your DualMini against a window using the included **suction cups**:



Thread each **suction cup** into the back of the DualMini.

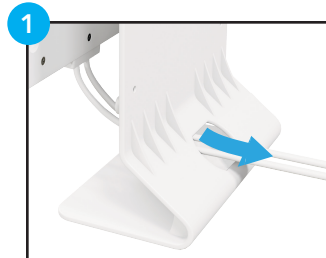


Press the **DualMini** firmly against the window.

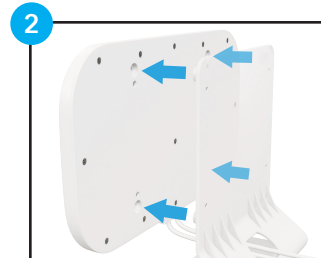


### Option 4: Desktop Mount (Limited Performance)

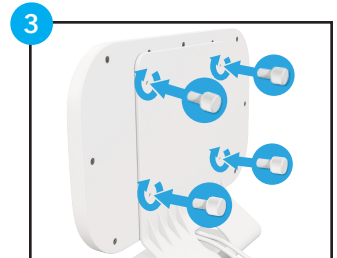
If you can't mount your DualMini directly against your window, but have an available window sill, table, desk or other flat surface nearby, follow the steps below to position your DualMini near your window:



(Optional) Feed the cables through the **desktop bracket**.



Align the **desktop bracket** with the back of the DualMini.



Secure the **desktop bracket** into the DualMini with the **thumb screws**.

## We're Here to Help!

We know that every use case is different and the steps for mounting your antenna may differ for your unique location. **Don't worry!** If you're running into issues, or have any questions, just reach out.

# 07 Protecting Your Outdoor System

If you're installing your antenna outdoors, there are a couple of final steps before your installation is complete. However, if you've installed your antenna inside your building or vehicle, skip ahead to the next section for advanced optimization tips.

In this section we'll describe how to weatherproof and properly ground your system. **These steps are crucial** to ensuring the longevity of your system by protecting it from the elements.

## Weatherproofing Your Outdoor Connections

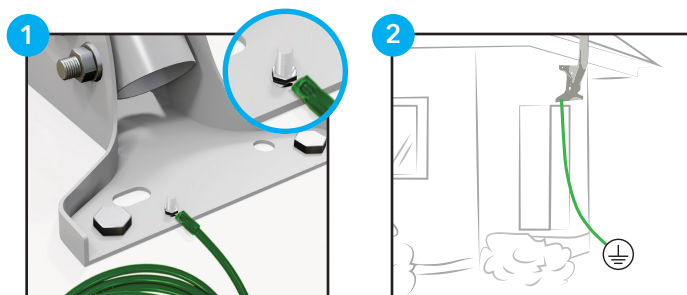
The DualMini and UltraFlex-Twin cables come with weatherproofing boots to help waterproof each outdoor cable connection. Once your connectors are tightened, **slide the weatherproofing boots over all of the outdoor cable connections**. Sliding these boots takes a bit of strength so don't be scared to put some elbow-grease into it!



## Grounding Your Mounting Pole

If you've mounted your DualMini against a pole, **it's important to ground your pole** to a suitable electrical ground. Mounting poles can be prime targets for lightning strikes and grounding them with a **10 AWG or lower gauge (thicker) grounding cable** (not included) is required by the National Electric Code (NEC).

**Follow the instructions within the manuals** included with your UltraPole to properly ground it for your system. The general steps are described below:



Attach a **ground wire** to your **pole**. e.g. Some mounting poles use a **grounding bolt & nut**.

Attach the **Ground Wire** to a suitable **Electrical Ground**.

### Grounding Tips

- If you're unsure about your grounding setup, **reach out to an electrical contractor**.
- **Expanded instructions** on grounding and **examples of suitable electrical grounds** can be found at [waveform.com/grounding](http://waveform.com/grounding)

# 08 Advanced Optimization

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By this point, you should have a really solid understanding of where to position your DualMini and get great performance. In fact, **we're convinced that for 95% of people, the instructions provided in this manual so far are more than enough.**

If, however, you'd like to go a little deeper and get technical to optimize your system even further, here are some general guidelines.

- 1 Look up your nearby towers** on [cellmapper.net](https://cellmapper.net) by performing a "Tower search" with the "eNB-ID" that your cellular router is connecting to. An eNB-ID is a unique cell tower identifier that can often be found in your cellular router's admin interface.
- 2 If your cellular router supports bandlocking**, band lock it to every band that each nearby tower transmits, and run speed tests for each tower on each band, to find your fastest band(s) and tower.
- 3 Try enabling multiple bands** and using carrier aggregation to find the fastest band combination. Carrier aggregation is supported by most cellular routers and allows them to connect to two or more bands simultaneously. However, it doesn't always result in faster data speeds so stick to a single band if that gets you the best results.

Unfortunately, **many cellular routers don't support band locking or carrier aggregation**, and some don't list eNB-IDs or any other tower identifiers, making these steps difficult. Every cellular router is so different that we could never cover them all with just one set of instructions.

However, **we've written up guides for some of the most common devices**, you can find them online at [waveform.com/hotspot-guides](https://waveform.com/hotspot-guides). We suggest reading our guide for your router, or referring to your user manual.

## We're Here to Help!

We know, there's a lot of information out there and this can get quite technical. If you're running into issues, aren't happy with the performance of your system, or you'd just like a hand, we'd love to help!

Simply visit [setup.wf/DualMini](https://setup.wf/DualMini) to **get connected with our team** of dedicated Signal Specialists.

## 09 Need Help with Adapters?

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- > **Have you purchased U.FL pigtail and experienced difficulties connecting them to internal antenna connectors?** U.FL connectors are small and can be difficult to install on the first try. We suggest that you **use a tweezer to hold the cable in place** and a **pencil eraser to push the U.FL connector down**.
- > **Does your cellular router need different adapters for its cellular antenna ports?** If so, please reach out to our team so we can help you obtain the parts you need.

## 10 Want Even Greater Performance?

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If you're looking for even greater performance, look no further! Consider our DualPlus Kits!

DualPlus's directional high-gain antennas may be able to provide you with **superior performance over the DualMini**.

DualPlus also comes with our **adjustable FlexMount**, for easier aiming.



## 11 Some Final Tips

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- > **Don't judge your signal by signal strength or quality alone.**  
You may find that your RSRP signal strength and SINR/RSRQ haven't improved much, but that your data speeds are meaningfully better. There's much more to an antenna than just gain, and in particular, our antennas are optimized for MIMO isolation to get you the best 5G data speeds possible.
- > **If data speeds decrease over time, consider re-optimizing your system.**  
Occasionally carriers will update their towers to broadcast different bands, light up new towers, or simply turn off existing towers altogether. If your data speeds get worse, try repositioning your DualMini to get the best results.

# 12 Tell Us How It Works

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Did your installation go well? Are you having trouble positioning your DualMini? Do you think our manual could be improved? Are your data speeds not quite what you were hoping?

**Please tell us:** Visit [setup.wf/DualMini](https://setup.wf/DualMini) to **get connected with our team** of dedicated Signal Specialists. We can't wait to hear from you!

**We're a small team** who loves hearing how our products perform and helping folks get the absolute best data speeds. **So please, reach out!**

## Three ways to get money back!

### Get \$30/£20/€25 by sending us a video of your install:

We'd love to feature your success! Send a 30+ sec video to [videos@waveform.com](mailto:videos@waveform.com) showing **your installed kit** and **speed test results from before and after** your install. *If your antenna is already installed*, briefly switch your router to its original setup to get your "before" results. Once we review your video, we'll PayPal you those funds!

### Earn 5% cash back for each friend you refer:

Love your kit? Refer a friend! They'll get 5% off their kit, and you'll earn 5% (via PayPal) when they purchase directly from [waveform.com](https://waveform.com). Visit [waveform.com/referrals](https://waveform.com/referrals) to get started.

### Get up to \$1000 for each U.S. business you refer:

Know a business in the U.S. with poor cellular signal? Send them our way! If they deploy one of our cellular coverage solutions, you can earn via PayPal:

- **\$250** for spaces between 20,000 and 100,000 sq. ft.
- **\$1,000** for spaces over 100,000 sq. ft.

To get started, simply send an email introduction with your referral to [coverage@waveform.com](mailto:coverage@waveform.com), and we'll handle the rest.







# WAVEFORM

## Need help? We're ready and waiting.

MIMO Antennas, like the DualMini, aren't always easy to install. But the end result is worth it.

One of the benefits of buying from Waveform is our **lifetime technical support** on every system we sell. We can walk you through troubleshooting and fine-tuning your installation for best results.

Simply **scan this QR code** to visit [setup.wf/DualMini](https://setup.wf/DualMini) to **connect with our team** of dedicated Signal Specialists, get your **free Virtual Site Survey**, access **installation guides**, watch our **setup videos**, and more!



We love helping solve tricky install problems.



v2.0.0



Designed by Waveform in the USA



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