The Satnogs Project: Selecting Your Antenna (Pt 3)

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The right antenna will determine the success (or failure) of your satellite receiving station.

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In this previous article, we took a look at some of the steps we’d need to cover to set up and configure a satellite receiving station that fed data to the Satnogs network as an independent node.

However, there are two distinct issues here that we’ll need to cover. Firstly, signals from space and more particularly cubesat signals tend to be quite weak. This is partly due to the distance travelled as well as the fact that on a cubesat board, space is at a premium (pardon the pun). This means that the output power levels are typically quite low.

The second problem is that the stock antenna design that comes as standard fitment to the RTL-SDR is absolutely awful. This is due to the fact that it tries to cover all bands effectively, meaning that for the most part, it isn’t good at covering any of them.

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The stock antenna is pretty useless for space communications. Be prepared to build. Source: ebay.com

Thankfully we can offset both of these problems by selecting & building a design that will be much more suitable for our new Satnogs station.

Broadband or Fixed

Part of the reason the stock antenna is so terrible is that it’s designed to be a broadband system. However, the Satnogs network will typically aim to collect data from satellites that have downlink frequencies within the 2 meter or 70 cm amateur radio bands.

So, rather than having to have broadband antennas optimised for entire RF bands, we can optimise our antenna for just 2 m or just 70cm.

Alternatively, if space is at a premium, we can even try our luck using a dual-band system, that means we can stick with a single antenna.

While the option is available to use tracked, directional antennas like Yagi antennas on a rotator, due to the complexity of such a system we’ll be sticking with well-designed, yet basic omnidirectional systems.

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Antenna Options

Now that steered yagis are eliminated, we can get to looking at our available options.

Thanks to the SAtnogs community, we have 3 options to choose from, with each varying slightly in terms of overall build difficulty.

If you’re after an easy option to get started, you might find the simple-to-make Turnstile antenna to be your best bet.

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If you’re willing to spend some extra effort and don’t mind working with coax, the Lindenblad might be a better option. You’ll need a phasing harness to make it work correctly, but you can make these yourself if you’re patient enough.

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The top shelf option, though, would be the Quadrafilar Helix Antenna or QFH. Providing great performance at weak signal levels, the QFH is a more advanced design that will put your homebrew skills to the test.

Making antennas can be a fun part of the radio journey. While antenna theory alone can and does fill entire books, you’ll find enough info to get you started in the Satnogs Wiki.

If At First You Don’t Succeed…Use Preamps

If you haven’t played with radios before, you might be surprised at just how much of an improvement adding a preamp gives. While tracked, high-gain antennas come with their own performance benefits, even systems like that can benefit from adding a preamp to the end design.

As you’d expect, though, these add both additional cost and complexity to any system, so they may not be suitable for users on a budget or in areas where easy access to parts is not relevant.

Remember, though, there’s no rule that says you need to build your entire station in one go. So, if you’d like, you can build yourself a basic system now and then add on extra components when you’re ready to.

One Last Thing

Now we have downloaded our image, configured our station, given it a great set of ears and then put it through testing to ensure the station works properly. We’re now well on the way to being able to put our station into service as a Satnogs feeder node.

There is one more thing you need to consider before we finish, though. In fact, some radio nerds might say it’s the most important part of the system, and it’s a topic we’ve covered in recent Radio Hackers articles.

While the choice of feedline might not be as important in a ground-based station, for our Satnog’s node, we’ll want to use a quality, low-loss feedline to ensure the signals move from antenna to receiver with minimal loss along the way.

Using a marginal coax like RG58 leaves us susceptible to signal loss levels that are unacceptable for a weak signal station. Aim to use a quality-built and well-insulated coax like LMR-400 to minimise your signal loss. Or, better still, omit the feed line and put your receiver at the antenna.

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Did You Build?

Have you explored the Satnogs project or built your own receive station? Maybe you’ve found another interesting radio project to experiment with using the RTL-SDR or have been hacking on a hardware project of your own.

Leave a comment and let us know what you’ve been working on lately. If it’s RF-based, why not consider writing it up and turning it into your own Radio Hackers feature article? We’re always looking for new writers to share their adventures and experiences!

Medium has recently made some algorithm changes to improve the discoverability of articles like this one. These changes are designed to ensure that high-quality content reaches a wider audience, and your engagement plays a crucial role in making that happen.

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