

RTL-SDR Antenna Frequency Range

12/26/2025 23:55:44

I am trying to get my head around how my RTL-SDR handles frequencies...
Good questions — you're thinking about this in exactly the right way. RT...



I am trying to get my head around how my RTL-SDR handles frequencies.

I have the Nooelec NESDR SMARt v5 Bundle, described here: [https://www.nooelec.com/store/sdr/sdr-r ... smart.html](https://www.nooelec.com/store/sdr/sdr-r-smart.html)

The page tells me that it can handle a frequency range between 100kHz-1.75GHz.

1: I assume that this is a theoretical frequency range, and that the actual frequency range received will depend on the antenna used?

2: The RTL-SDR comes with 3 antennae, but no indication as to what frequency ranges they are good for:

a. Telescopic antenna mast (variable frequency); I assume this is the shiny silver one, but what frequency range?

b. 433MHz (ISM) antenna mast (fixed frequency); Does this mean it is good for only ONE frequency, or a range centred on this frequency

c. UHF antenna mast (fixed frequency); Google tells me that UHF is 300 megahertz (MHz) to 3 gigahertz (GHz), but since the RTL-SDR is rated at a maximum of 1.75GHz, this is the limit?

3: Do I need to worry about the antenna frequency bandwidth resolution. In other words, if my software selects a bandwidth of 3 KHz, does this also depend on my antenna?



Good questions — you're thinking about this in exactly the right way. RTL-SDR marketing pages tend to blur several *very different* concepts together: tuner range, antenna resonance, and receive bandwidth. Let's separate them cleanly.

1) “100 kHz - 1.75 GHz”: theoretical vs practical

Your assumption is **mostly correct**, with one important clarification.

- **The RTL-SDR itself** (the tuner + ADC) can *tune* anywhere from roughly **100 kHz to 1.75 GHz**.
- **Whether you can actually receive useful signals** at a given frequency depends heavily on:
 - The **antenna**
 - The **matching** between antenna and receiver
 - Noise environment, front-end filtering, etc.

So:

- You *can* dial in 100 kHz or 1.6 GHz in software
- But without a suitable antenna, sensitivity may be **poor to nonexistent**

Think of the SDR as a wide-range radio, and the antenna as a *frequency-selective microphone*. 🎤

2) The three supplied antennas

a) Telescopic antenna (the shiny silver one)

This is a **compromise wideband antenna**, not truly “variable frequency” in a precision sense.

- It’s essentially a **monopole** whose electrical length changes as you extend or collapse it.
- Best performance is when the antenna length $\approx \frac{1}{4}$ **wavelength** of the signal.

Rule of thumb:

$$\text{Length (cm)} \approx \frac{75}{\text{Frequency in MHz}}$$

Examples:

- 100 MHz \rightarrow \sim 75 cm
- 150 MHz \rightarrow \sim 50 cm
- 450 MHz \rightarrow \sim 17 cm

Practical range:

- Works *okay* from about **50 MHz up to maybe 500-600 MHz**

- Above that, it becomes inefficient
- Below that, it's physically too short

It's fine for experimenting, FM broadcast, airband, VHF/UHF amateur, etc.

b) 433 MHz ISM antenna (fixed frequency)

This one **is not single-frequency only** — it's **narrow-band but not razor-thin**.

- Designed for the **433 MHz ISM band**
- Typically usable over roughly **420-450 MHz**
- Centre-tuned around 433.92 MHz

This is ideal for:

- 433 MHz sensors
- Remote controls
- Weather stations
- Simple OOK/FSK digital signals

Outside that range it will still “work”, but with falling efficiency.

c) “UHF antenna mast” (fixed frequency)

This is where marketing language gets sloppy.

You're correct:

- **UHF = 300 MHz to 3 GHz** (by definition)
- Your RTL-SDR caps out at **~1.75 GHz**

However:

- This antenna is **not truly wideband UHF**
- It's usually a **compromise antenna** tuned for roughly **400-900 MHz**, sometimes biased toward TV bands

So:

- Yes, **1.75 GHz is the hard upper limit of the SDR**
- But this antenna will perform *reasonably* only over part of that range
- Expect rapidly declining sensitivity above ~1 GHz

3) Antenna bandwidth vs software bandwidth (important distinction)

This is the key conceptual separation:

Antenna bandwidth

- Describes **how efficiently the antenna couples RF energy** from free space
- Wideband antennas exist, but none are equally good everywhere

Software bandwidth (e.g. 3 kHz)

- Describes **how much spectrum the SDR processes**
- Set by digital filters *after* the RF is received

👉 These are independent

So:

- Selecting **3 kHz bandwidth** does **NOT** require a 3 kHz-wide antenna
- Your antenna might be happy across **tens or hundreds of MHz**
- The SDR simply zooms in digitally on a tiny slice

Analogy:

- Antenna = funnel catching rain over a wide area
- Software bandwidth = how wide you open the measuring cylinder afterward ☁️

What *does* matter?

- The antenna must be **reasonably resonant near the centre frequency**
- Poor antenna match = weaker signal + more noise
- But it won't prevent narrow-band reception per se

Practical advice (what most people do)

1. **Use the telescopic antenna** for general VHF/UHF exploration
2. **Use the 433 MHz antenna** for sensors and ISM work
3. For anything serious:
 - Buy or build **band-specific antennas**

- Even a simple quarter-wave wire often outperforms bundled antennas

And yes — the supplied antennas are **educational starters**, not reference-grade tools.

If you'd like, I can:

- Help you **cut a simple wire antenna** for a specific frequency you're interested in
- Explain **why HF (<30 MHz)** is awkward on RTL-SDRs
- Or help you choose an antenna for a **specific service** (airband, marine, amateur, etc.)

Just say the word.