

# RTL-SDR

## receiving a FM sound broadcast

### Intention:

Use RTL-SDR to receive and listen to an FM sound broadcast station.

It is a preparation to receive a live signal from a VOR station.

*How to trim the settings on RTL-SDR dongle for best reception?*

### Approach:

Use "SDRAngle" tool (on Windows 11) laptop. I have used my fix installed VHF airband antenna, installed in the attic at my home ("antenna height").

Tune to a weak FM sound broadcast channel (here, 105.1 MHz), at the upper end of the FM sound broadcast band (close to my final VOR frequency as 117.2 MHz, airband is right above the FM band).

Remark:

My VHF antenna in attic is tuned for the reception of airband signals, e.g. my nearby airport KSNA with a tower frequency 126.8 MHz. So, not really optimized for FM sound broadcast.



VHF antenna used (SWR), optimized for airband reception (not FM):  
best SWR at 125 MHz (1.18), FM reception at 105.1 MHz with SWR 8.44

Remark:

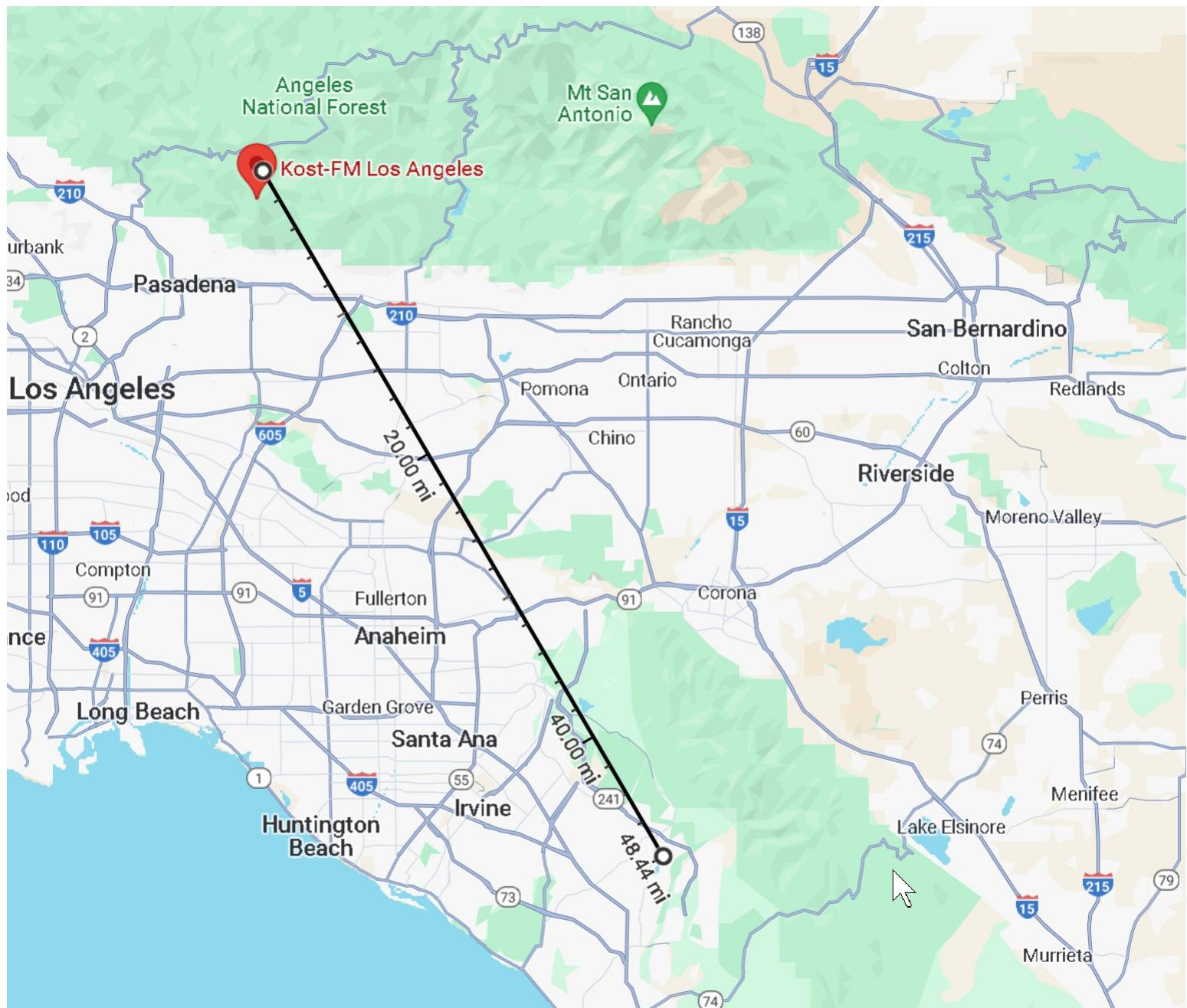
A good antenna for intended reception frequency should have a **SWR of 2 or smaller**.

### 105.1 Station:

Find the details about the station here:

<https://en.wikipedia.org/wiki/KKGO>

The station signal is pretty weak on my location (Tx Tower at Mount Wilson)



Mount Wilson: 48 miles away, not a very strong signal, potentially not as “Line of Sight”  
(I live in a hilly area, a large mountain (San Bernandino mountains) blocking the reception a bit)

## 105.1 Station:

I can receive this FM sound broadcast station with any of my receivers, such as:

- AirspyHF+ : best reception
- HackRFOne : acceptable reception (with some tuning)
- RTL-SDR : worst receptions, needs careful adjustment of Rx parameters  
(e.g. gain, DC, IQ compensation, better antenna, ...)

# RTL-SDR Rx parameters:

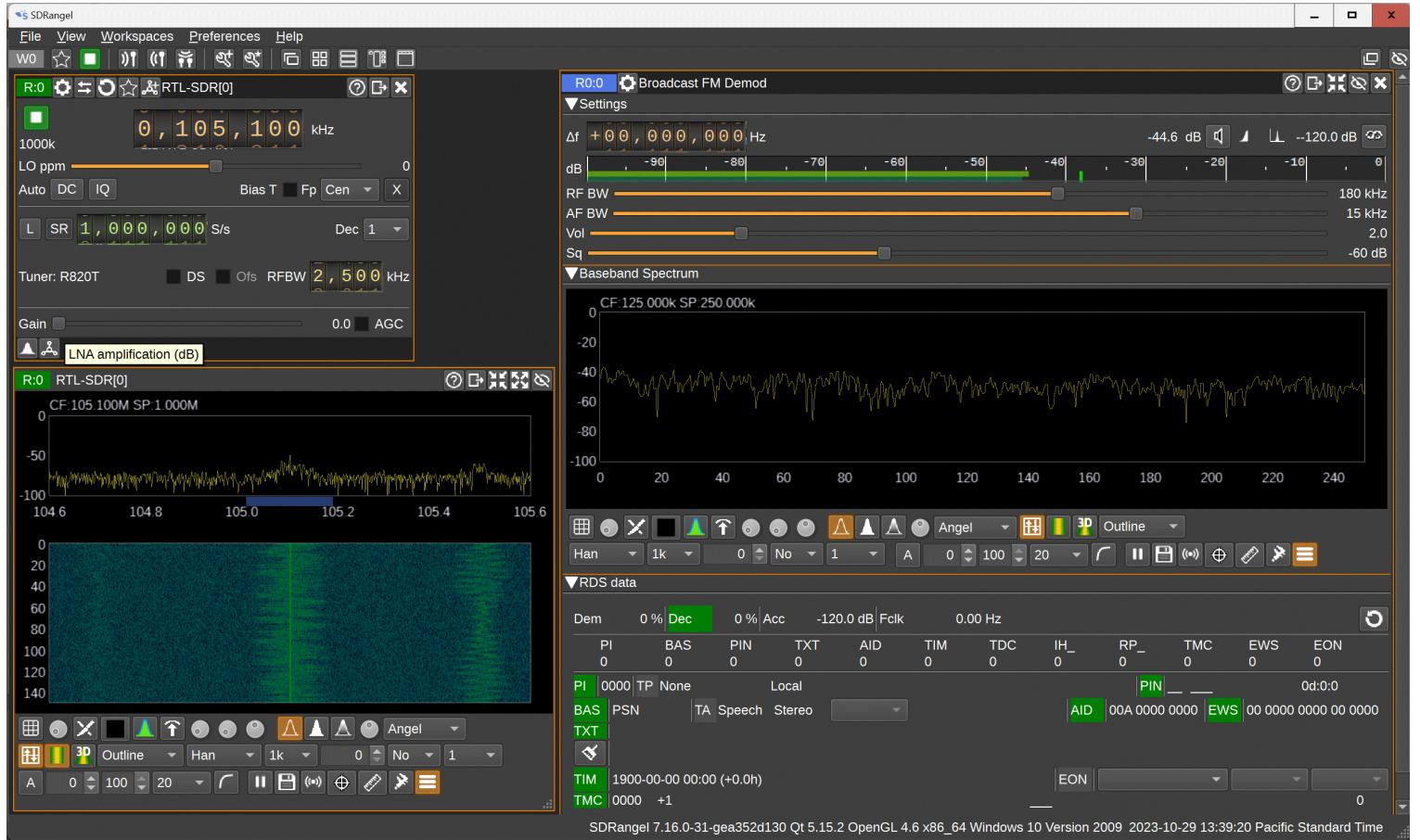
## Attention:

The RTL-SDR does not seem to have a good sensibility.

It seems to start with 0 dB gain, no DC, no IQ correction - as **default = NO RECEPTION**

With the default settings it is almost impossible to get any signal (just noise).

Therefore, the gain, optionally the DC and IQ corrections, have to be used.



With (**default!**) **0 dB gain** - and **no DC and/or IQ correction** - **no reception possible** (just a guess there could be a signal, all noise) - it can be your default setting!

## Adjust the RF gain:

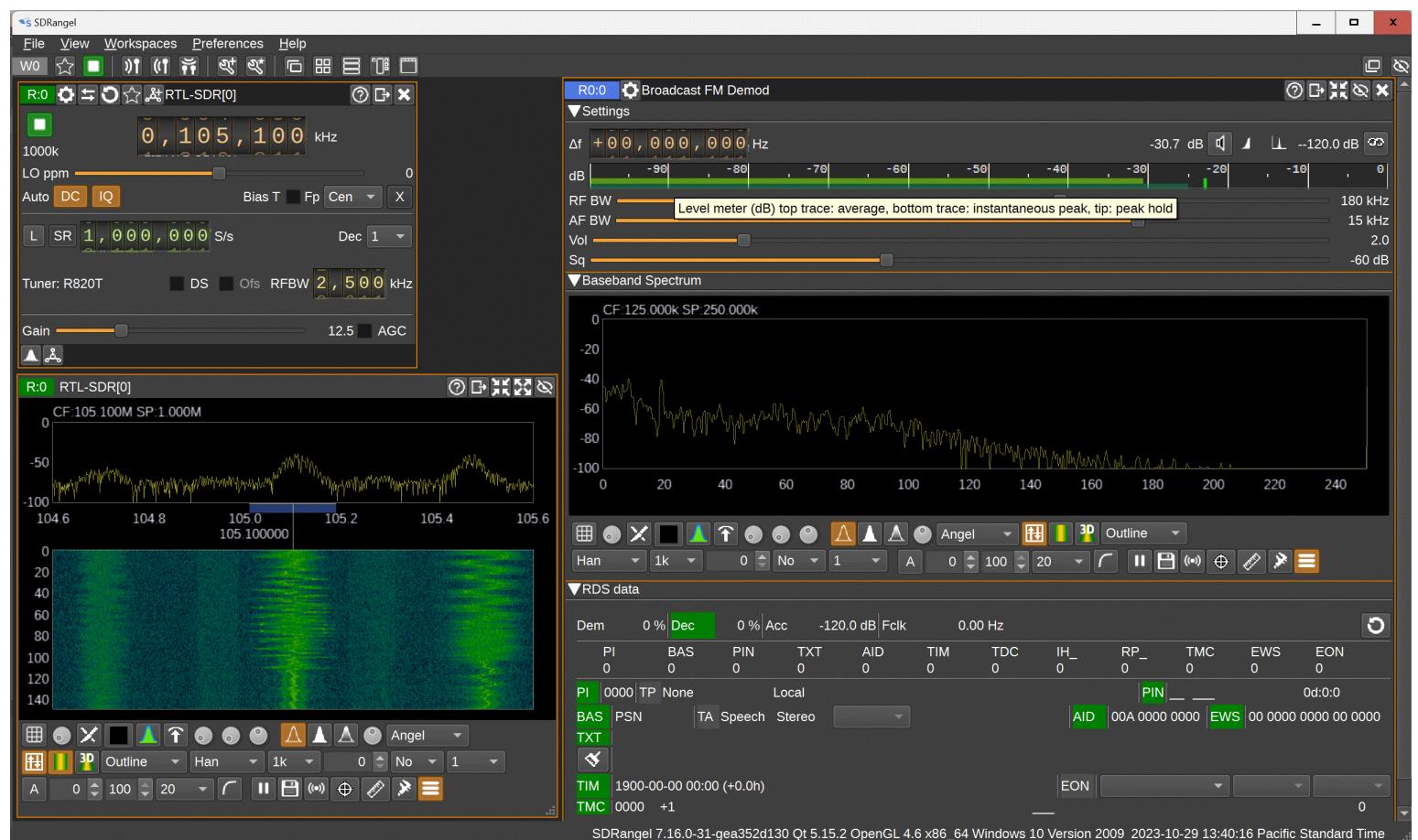
Rule of thumb: adjust parameters, esp. gain, so that you get around **-35 .. -20 dB as baseband signal strength**:

Below -40 dB - it is just noise, above -20 dB can result in distortions (clipping, due to strong signal).

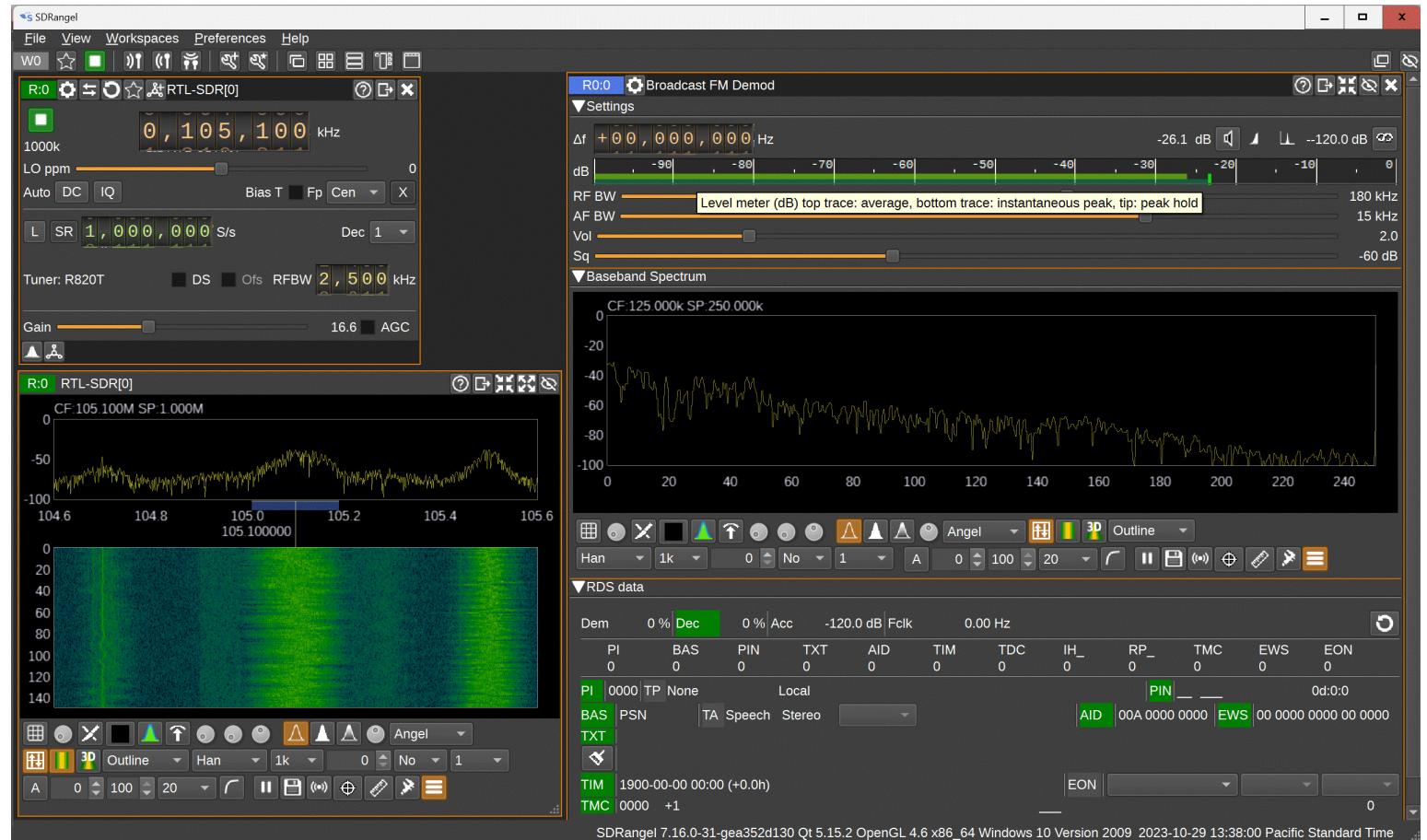
On very weak signals, try to enable also DC and IQ correction.

The RTL-SDR does not have a high sensibility and selectivity.

(better results with AirspyHF+, HackRFOne slightly better but also very sensitive for RF parameter settings)



Good reception: watch the -30 dB signal strength



Good reception: watch the -25 dB signal strength

Increasing the gain further results in a “stronger” signal but can result in audio distortions (“too strong” and clipping now the audio signal)

# The tuning of parameters depends on your specific situation!

## Hints to optimize reception:

1. Is your antenna tuned for the frequency you want to receive? (wavelength)
2. Could you use a directional antenna (e.g. Yagi) or at least a directed dipole?  
Watch also the polarization needed!
3. Is the SWR ratio good for the intended frequency?  
(good is: SWR 2 and lower)
4. What is the cable length between antenna and SDR Rx input?  
(try to keep it short as possible to minimize “cable loss”)
5. Do you use the right cable?  
Esp., use a 50 Ohm cable on a 50 Ohm antenna!  
(people use often a coax cable for satellite systems as 75 Ohm on a 50 Ohm antenna!)  
What is the “cable loss”?  
(use a good RF cable for this frequency range, with a small “cable loss”)
6. Impedance match:  
See also 5.: the impedance of antenna, the cable and the SDR Rx input must match,  
e.g. all as 50 Ohm.  
(when you build your own antenna, e.g. a dipole - be aware of the fact that antenna  
impedance is not 50 Ohm (way higher on a dipole antenna, including “symmetrical” vs.  
“coax” cables needed as feed).  
Measure the SWR (“*Standing Wave Ratio*”), use “baluns” and “impedance matching”  
circuits to match the impedance of all components.)
7. Do you have “Line of Sight” with the Tx station?  
Do you get reflections (“multi-path”) receptions, e.g. due to buildings or mountains on the  
reception path? (or even “behind” you as a “mirror reflection”)?
8. Antenna height:  
Is your antenna high enough above the ground?  
The higher the same antenna above the ground - the better the reception.  
Keep your body, fingers, ... and any other metal object, electronic devices away from  
the antenna.  
BTW: antenna height could also be accomplished by looking for a better location,  
e.g. on a hill top.

**Instead of increasing RF parameters (such as RF gain) -  
optimize your antenna setup and location first.**

**It increases also gain (“antenna gain”) and is the only way  
to improve signal strength without to get more noise  
(RF gain increases also noise!)**

**A good antenna and location matters most!**