Tracking the Availability of Aircraft using RTL-SDR while also analyzing tuning to FM radio signals

Introduction:

Almost all cars in the modern world have radio signals installed in order to make tracking them easier. This applies to all forms of radio channels, transportation, such as vehicles, aircraft, and ships. The ADS-B (Automatic Dependent Surveillance Broadcast) Mode-S transponder is a noteworthy piece of technology utilized in contemporary aircraft. It is possible to intercept and decode these ADS-B signals using RTL-SDR technology in addition to tuning clarity into FM Radio signals. In addition, the aircrafts can also be tracked using Radar Server, which is a further in depth concept of application.

Objective:

This is a recent research on Aircraft availability in a specific region and also FM Radio Signal clarity. The goal is to be able to check for signals of air-crafts in the current location and also monitor the clarity of FM Radio signals using RTL-SDR with the assistance of ADS-B Protocol (just for aircrafts).

RTL-SDR as a receiver for ADS-B signals:

Realtek Software Defined Radio, or RTL-SDR, is capable of tracking the 1090 MHz frequency at which ADS-B broadcasts signals, which meets our objective for the Project. An array of radio frequency signals, including the 1090 MHz frequency that aircraft ADS-B broadcasts, can be received, demodulated, and decoded by the hardware platform known as RTL-SDR. My project involves trying to find the availability and also trying to understand FM Radio signals.

Tools/ Materials Involved:

- Hardware:
  - 1x RTL-SDR Blog V4 R828D RTL2832U 1PPM TCXO HF Bias Tee SMA Dongle
  - 1x Multipurpose Dipole Antenna Kit
- Software:
  - AIRSPY SDR# Studio v1.0.0.1919
  - Virtual Radar Server**(Additional)**
  - Jetvision (ADS-B, RTL1090) **(Additional)**

Methodology: (in Progress)

Set-up & Configure the Environment

- **RTL-SDR Hardware & Software:**
  The RTL-SDR dongle, such as the RTL-SDR Blog V3 or a similar model, that is capable of receiving signals in the 1090 MHz frequency range was selected for the project. The necessary softwares were carefully analyzed where Virtual Radar Server would give a map of the location of available aircrafts.

- **ADS-B Decoding Software:**
  Adjust the RTL-SDR software especially to decode ADS-B signals. Choosing the appropriate frequency (1090 MHz), adjusting gain levels for the best possible signal reception, and customizing any other parameters in accordance with the software's documentation are usually included in this process.

- **Antenna:**
  A basic dipole antenna or a specialized ADS-B antenna can be used to receive ADS-B signals. To improve signal reception, place the antenna outside or anywhere there aren't many obstacles. Our portable VHF/UHF dipole antenna kit is included with the RTL-SDR once more.
  It was set based on the Antenna Calculator, where desired frequency was 1090MHz and the Dipole length obtained was 0ft. 5 - 5/32in. or 0.131 M.

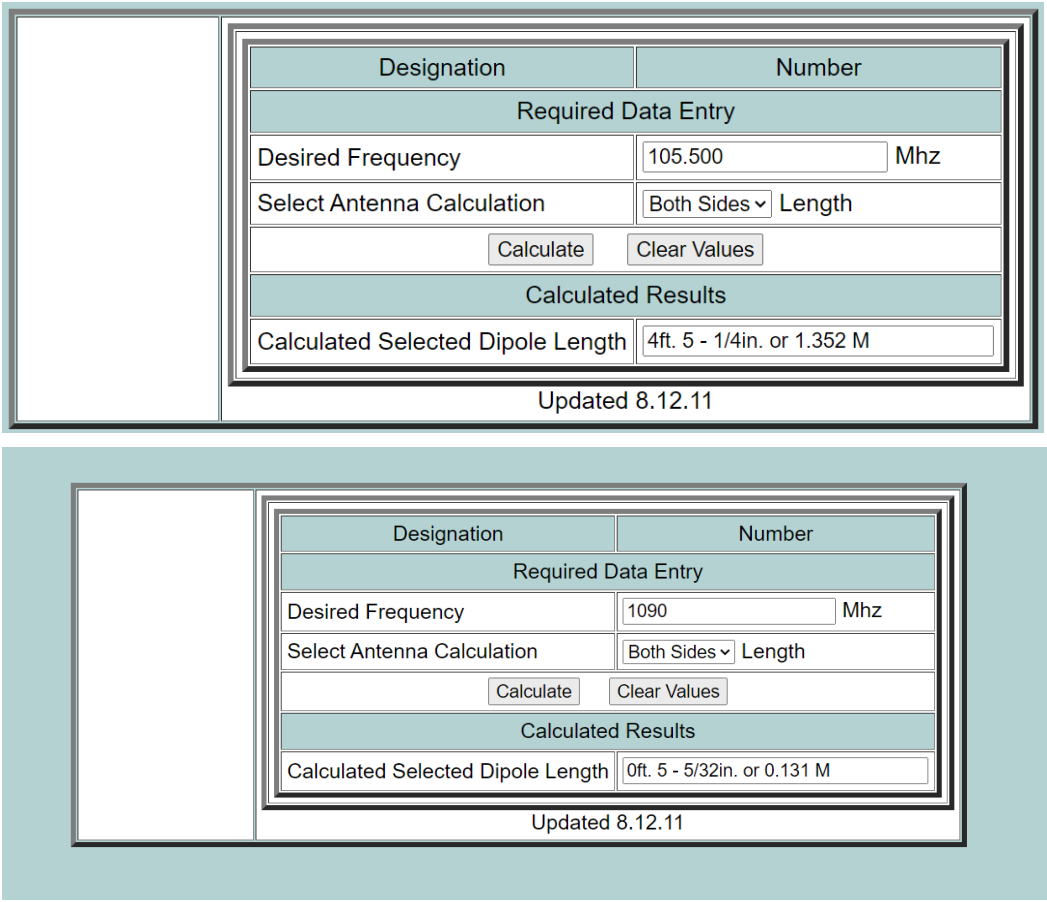


Fig:1- Antenna Calculation for both FM Radio signals and Aircraft ADS-B

Monitoring Schema:
Started the ADS-B signal monitoring procedure by launching the RTL-SDR software. When aircraft with Mode-S transponders approach, the software ought to begin picking up ADS-B signals from such aircraft. Also had to pre-set the Mapping software to be able to work in balance with the SDR#, before checking the SDR# capture test.

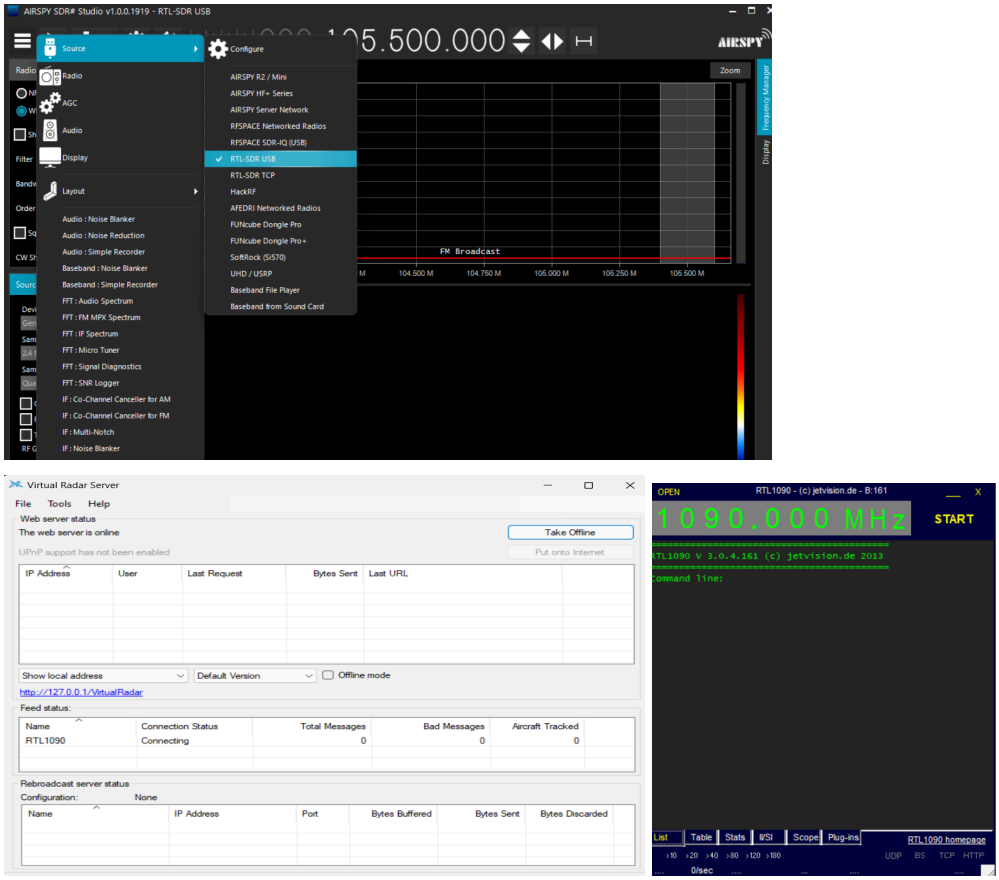


Fig:2- Monitoring the Schema through the softwares

Display Data of SDR for RTL1090: (Additional work)

As ADS-B signals are received, the RTL1090 will try tracing, in most cases the TCP doesn't connect due to server radar issues. It has been quite observed in our project as well.

Fig:3- Checking the TCP and also presence of SDR device

Visualize Current Aircraft Plane Position:(Additional work)

Use mapping software or integrated features within the RTL-SDR software to visualize the position of current location of availability of aircraft on a map. This help us create a radar-like display showing the real-time location.

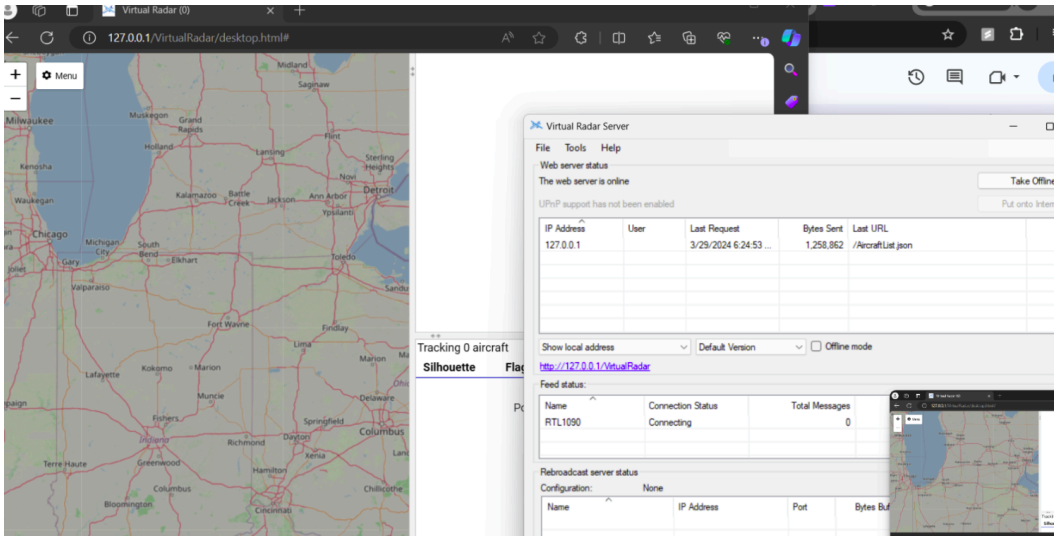
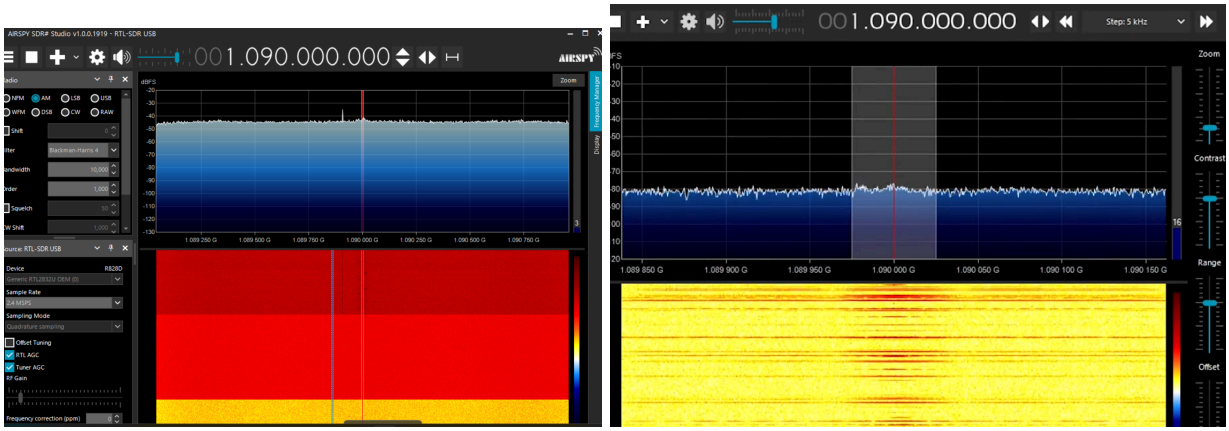


Fig:4- Current location for searching availability of aircrafts

Fine-Tune Settings:

In an effort to enhance signal reception and tracking precision, adjustments are still being made to gain levels, antenna placement, and software settings. Try a variety of setups to maximize performance according to your unique environment and goals.



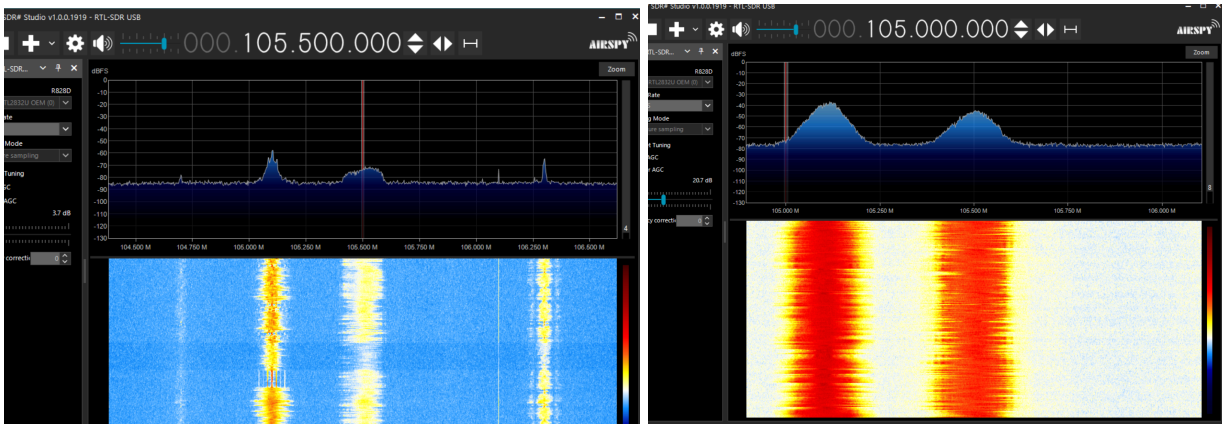


Fig:5- Fine-tuning and observing the two signals; availability of Aircrafts and trying to find clarity in FM Radio signals. (any response got is considered the results and objective of this project)

Continuous Monitoring:

Continuing to track airplane movements with the RTL-SDR equipment in operation. Data may be logged and the flight patterns can be examined more further.

Conclusion:

As a conclusion to the on-going SDR Project, the activities of Aircraft availability checking and FM Radio signals are in progress, the best would be getting slight variations in the SDR# platform observation which is through continuous monitoring. It is to be at a confirming rate that the project's progress so far has nearly met the objective. The further work is being done to attain a proper expected output (slight more variation in received signal).
