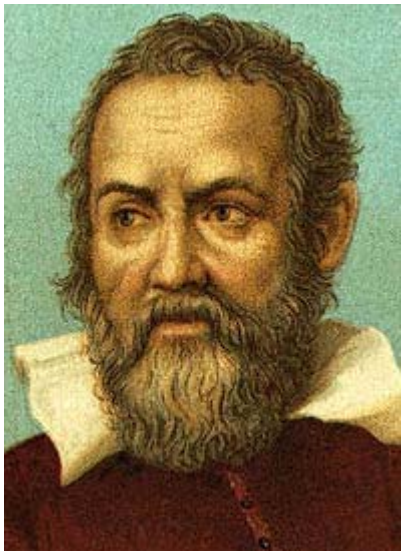
Technical Info Doc: Direct Conversion Receiver with LCD Display & A/D

This Project is dedicated to our beloved scientist Galileo:



Galileo was born in Pisa, ITALY on February 15, 1564.

Galileo made his first telescope in 1609, modeled after telescopes produced in other parts of Europe that could magnify objects three times. He created a telescope later the same year that could magnify objects twenty times.

With this telescope, he was able to look at the moon, discover the four satellites of Jupiter, observe a supernova, verify the phases of Venus, and discover sunspots.

Galileo's real originality lay in the way he approached scientific problems.

First, Galileo reduced those problems to very simple terms on the basis of everyday experience and common-sense logic.

Then he analyzed and resolved the problems according to simple mathematical descriptions.

The success with which Galileo applied this technique to the analysis of physics, especially the physics of motion, opened the way for the development of modern mathematical physics.

In this project we try to follow Galileo's simplified methods in making a complex Radio Astronomy receiver using simple design that most amateurs can work on.

Basics of 20.1MHZ Radio Astronomy Direct Conversion Receiver:

NASA's Radio Jove Project:

FD-Galileo is basically designed for NASA's Radio Jove project. I post here some basic information for your quick review.

NASA's Radio JOVE project is centered on the low cost radio telescope receiver, which can be used by science classes to collect planetary or solar radio astronomy data. Schools may opt to use other equipment to collect this data, but use of the Radio Jove receiver is highly recommended and provides good educational value to the students.

The radio telescope is intended for high school level classes, but may be appropriate for introductory college courses or advanced middle school students.

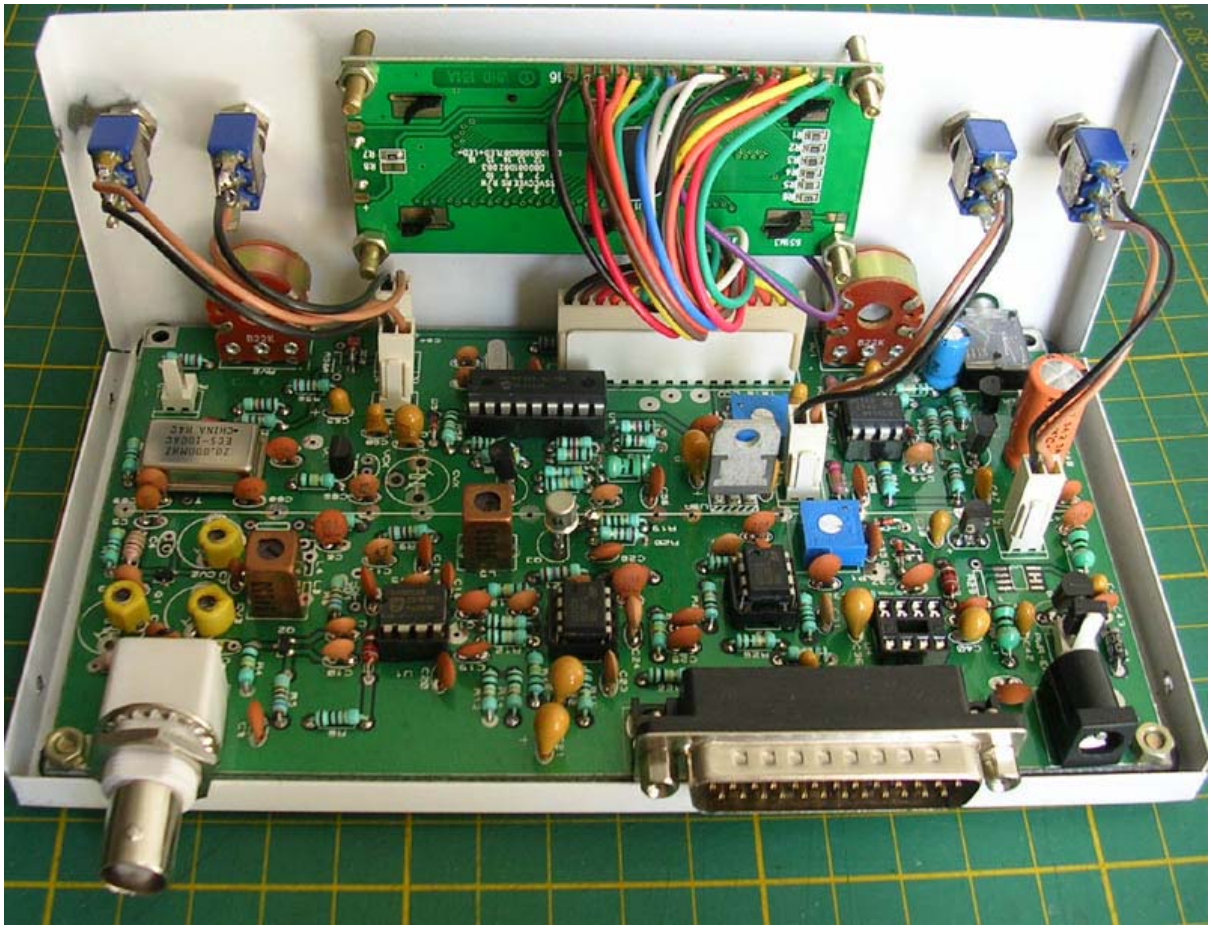
The students setup the receiver & understand receiver basics. They also construct the special antenna needed to receive the planetary or solar emissions. The antenna requires construction of a basic structure using wood or pipe, ropes, stakes, etc. which gives them basic understanding of a Dipole antenna & its construction.

Once the receiver & antenna rigged & tested, the students determine a good time to observe Jupiter based on predictions supplied on the Radio JOVE website.

Note that Jupiter radio signals can only be received at night and the conditions are often best in the hours just before dawn. Also, the antenna needs to be set up in a location that is as free from electrical interference as possible.

This may be possible near some open areas such as play grounds or schools, but it is recommended that observing be done in nighttime field trips to locations away from power lines and other sources of interference.

The Radio Telescope designed for 20.1MHZ, High Performance/Low Noise, Direct Conversion Receiver such as Fox Delta "Galileo" may be purchased online.

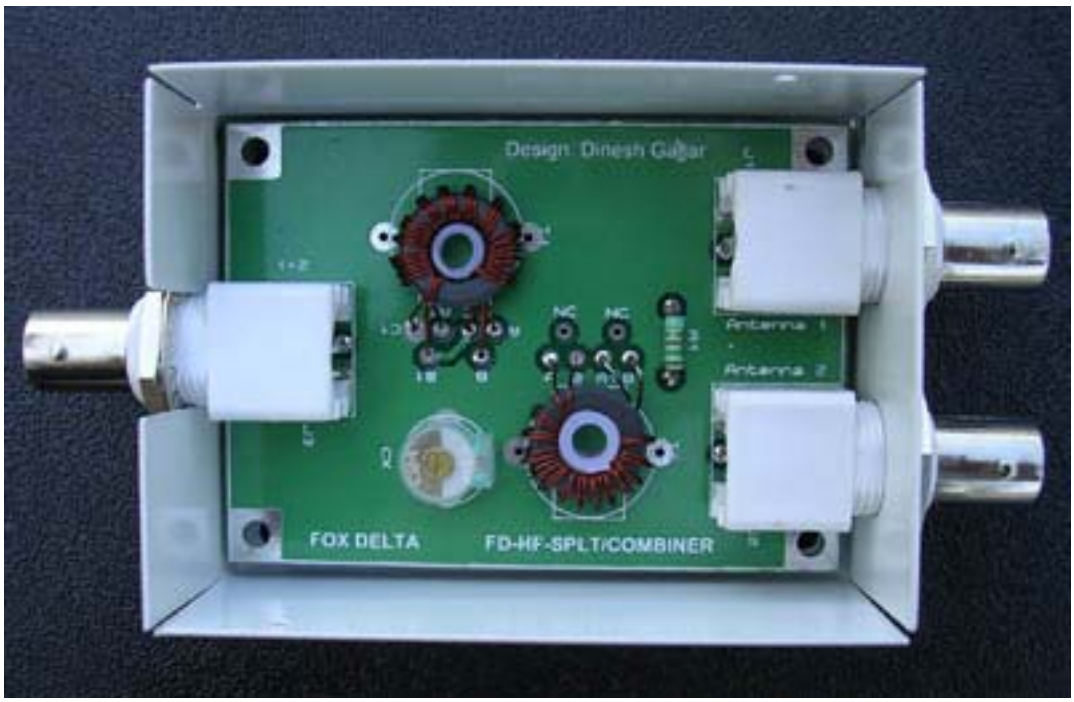


FD-Galileo Radio Astronomy Receiver is supplied fully assembled and comes with following:

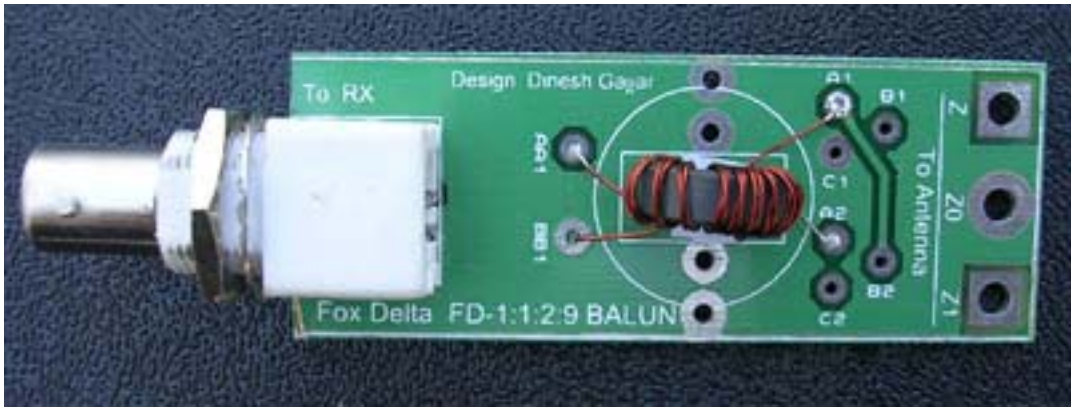
1. **Direct Conversion Receiver for 20.1MHZ**
2. **Uses SA602/612 Double balance mixer**
3. **Stable Oscillator with tuning range of over 100KHZ**
4. **Very low power consumption**
5. **Supplied in a powder coated metal case**
6. **Has built-in Frequency counter**
7. **Built-in A/D Converter for direct connection to your PC**
8. **Built-in 20MHZ osc. (Option)**
9. **Front panel audio socket for tape recorders**
10. **Front panel switches to put off A/D, Freq Counter, LCD back light etc**

In addition to above, Galileo also includes:

1. **An antenna Splitter/Combiner**



2. **Two Antenna Balun for center feed Dipoles**



Antenna kit consisting 20.1MHZ dipoles and RG59 feeder is also available.

Fox Delta do not supply materials for supporting (poles etc) the antenna, tools that are necessary to put the antenna together, such as a soldering iron, wire clippers, and other typical tools which you will require for putting up the antenna.

In order to analyze the data and share it with others, you will require to capture the radio data. This may be done by either feeding the audio output of the receiver into a tape recorder or by directly connecting D25 connector of Galileo to a computer.

On a field trip it may be more convenient to use the tape recorder than to carry along a computer. Small tape recorders can be purchased for this purpose, but they must not have an automatic gain control (automatic volume adjustment) or the control must be capable of being switched off since such a control makes it difficult to measure the relative strength of the signals.

The Radio Jove project has created software for Window 95/98 that simulates a chart recorder for plotting the data on a 486 or better model personal computer having a sound card. The software is available from the Nasa's Jove project Website.

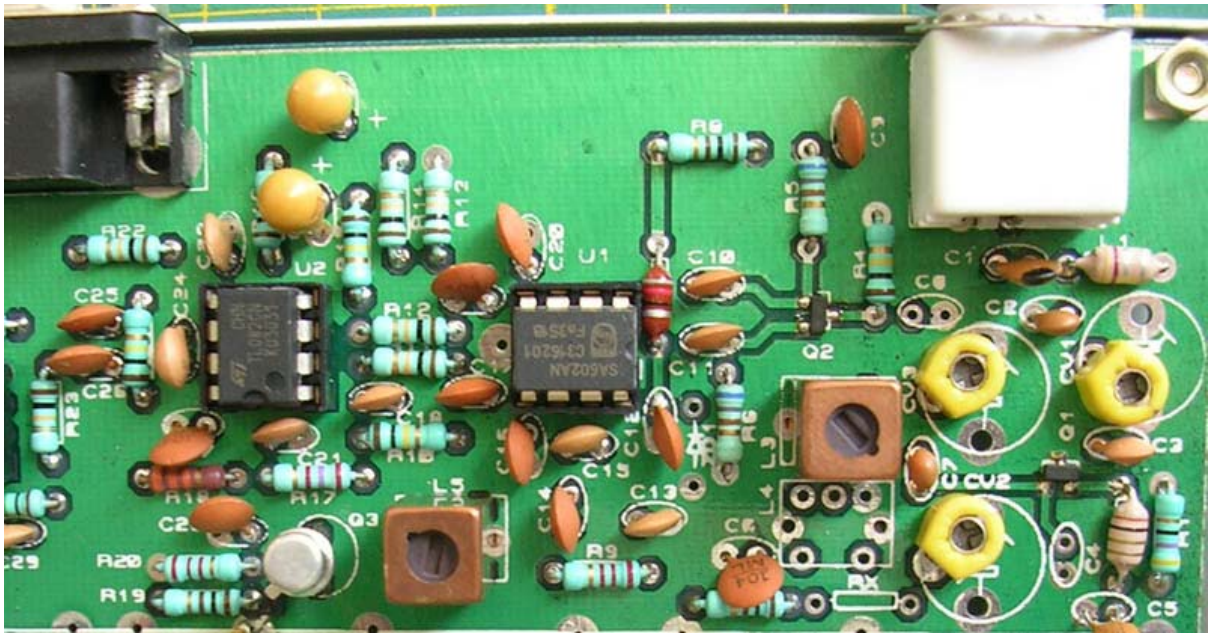
A central web site will accept files of data from observing groups around the country and make them available for schools and scientists to see and hear. The site also contains general information and activities relevant to the understanding of radio astronomy and, in particular, how to order, build, use, and understand the data from radio receiver kits. These web pages are currently under construction.

Design of Galileo Radio Astronomy Receiver:

Although design of this DC receiver is not different from other available receivers, following points were kept in mind which developing Galileo:

1. **Low cost**
2. **Low power consumption**
3. **Portability: Works on 12V battery: Standard 2.1mm Jacks**
4. **Audio out for recorders: Standard 3.5mm**
5. **Data output for Radio Skypipe etc**
6. **Ability to switch off unwanted part of the receiver to save power.**
7. **All components installs on PCB. No loose wires.**

RF Front End:



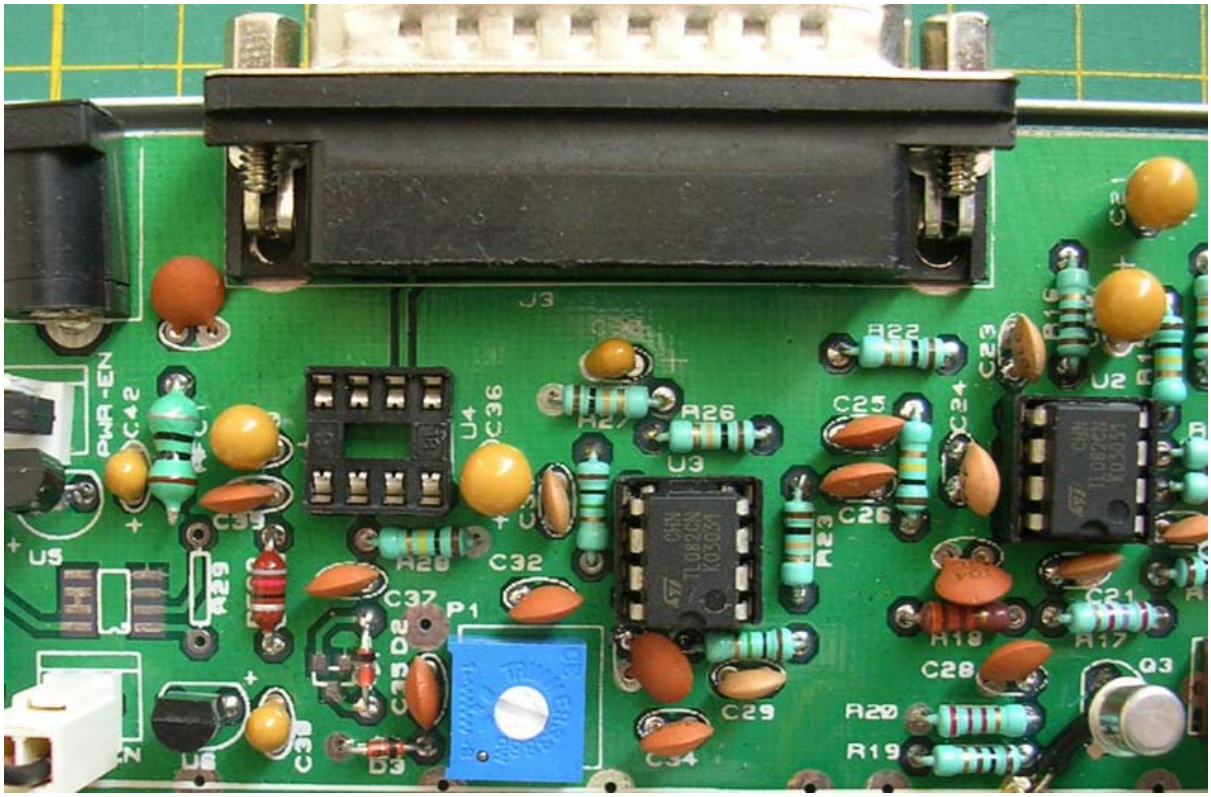
Galileo uses dual J310/309 FETs as front end. The First FET is used in Grounded Gate config and matches the Dipole antenna at source.

Output of this first FET is tuned at 20.1MHZ using resonator and trimmer capacitors.

Signal amplified by first stage is then fed to second FET, which is similar to first one but is used as a common source/Differential amplifier to interface differential inputs of SA602 Double Balanced Mixer.

To avoid oscillation or instability due to high gain, both FETs are SMT types with minimum length of leads.

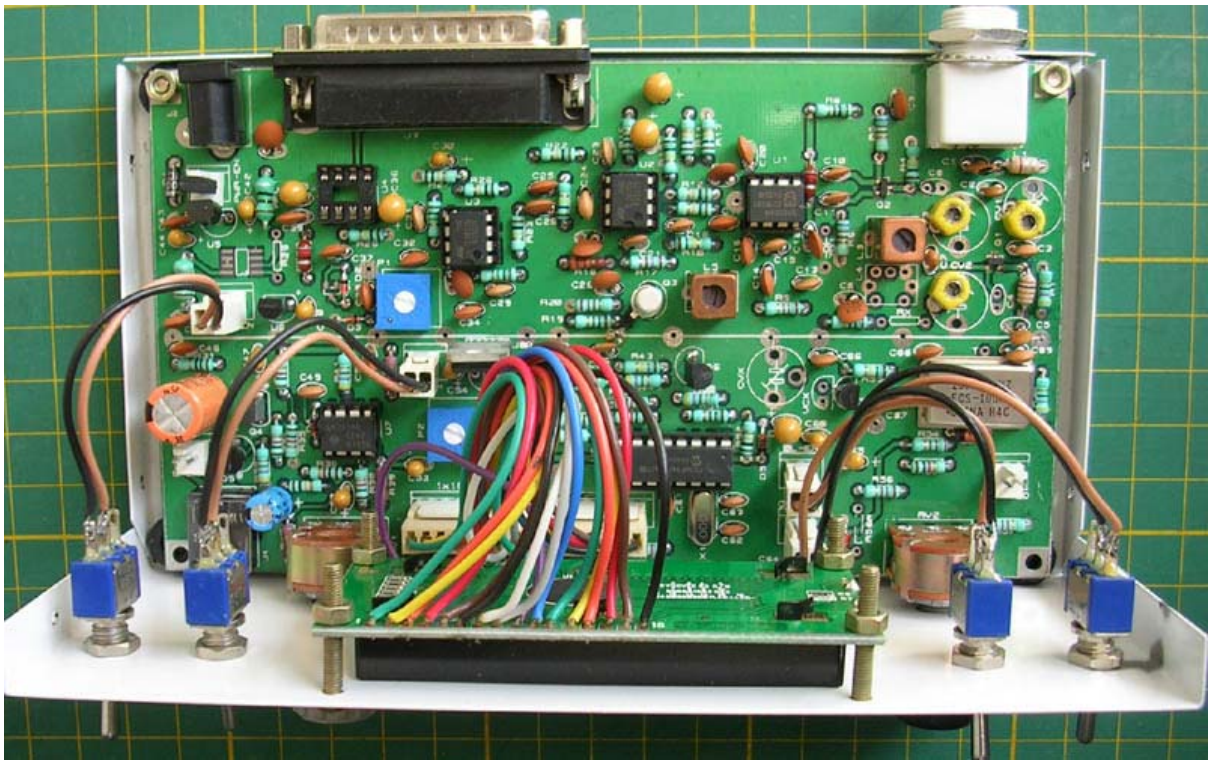
A/D Converter:



Galileo is ready for data transmission. It uses a Maxim MAX187 A to D converter chip. Data output is available at the back of the receiver thru a D25 Parallel Port connector.

Separate gain control Preset is provided to adjust audio going to MAX187.

TOP View of the completed Galileo Receiver:



Under Construction

73s
Dinesh Gajjar / 280409

For more details on this project, Updates and details on radio astronomy kits available for Radio Amateurs, please visit http://www.foxdelta.com