

# Basic Jupiter & Solar Radio Telescope

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## Basic Jupiter/Solar Radio Telescope

The idea is that using a fairly simple receiver design and a half wave dipole for an aerial, radio noise can be monitored from Jupiter and from the Sun.

A typical frequency used is 20.1Mhz which is one of the rare quieter areas of the radio spectrum.

I sourced a simple kit which could be modified to operate on this frequency and decided I would keep a log on here of all the ups downs and otherwise of the project.

(Kit Availability <http://www.tentec.com/?s=information#international-dealers>)

The kit is a Ten-Tec 1056 direct conversion receiver which is a good base from which to start.



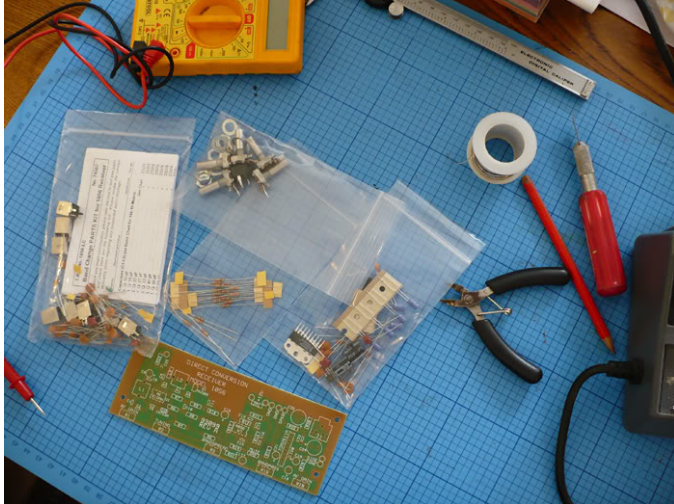
First off was an aerial and at half wave, this turned out to be two wires, 11' 8.4" in length with a coax cable at the centre point to feed the receiver.

Not as ideal as being outside but I fitted one along the inside of my bungalow roof for convenience.

# Basic Jupiter & Solar Radio Telescope

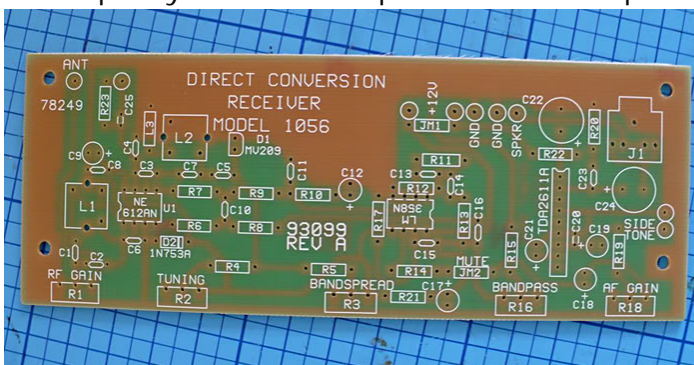
## Construction of the kit

Some pictures of the receiver during the build.

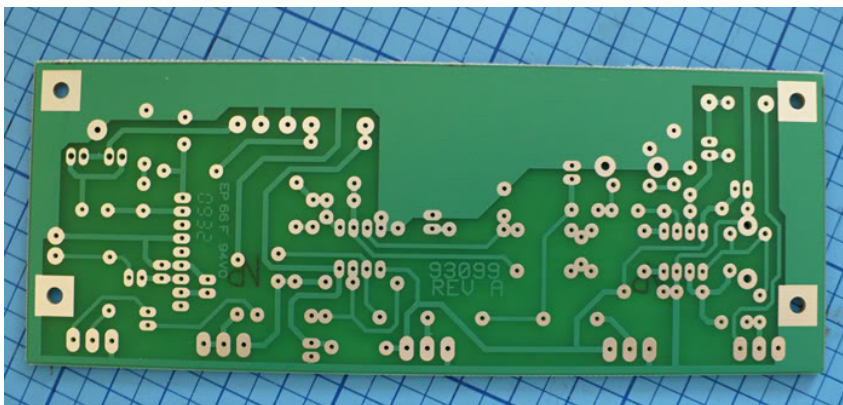


Basic Tools and the kit as received

Good quality PCB and components and fool proof instructions...

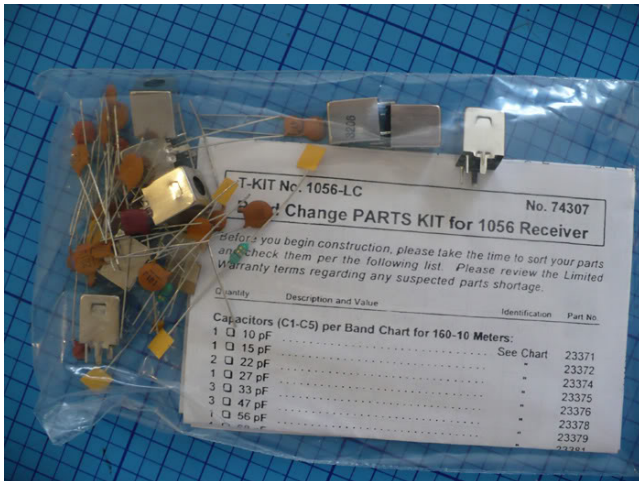


Front of the board

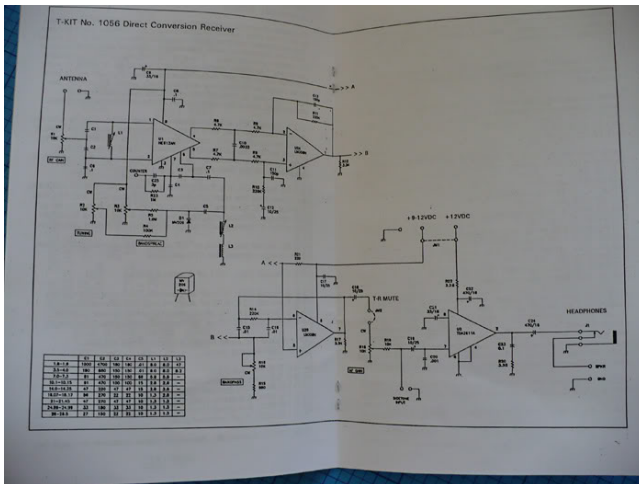


Back of the board – excellent quality with large pad sizes

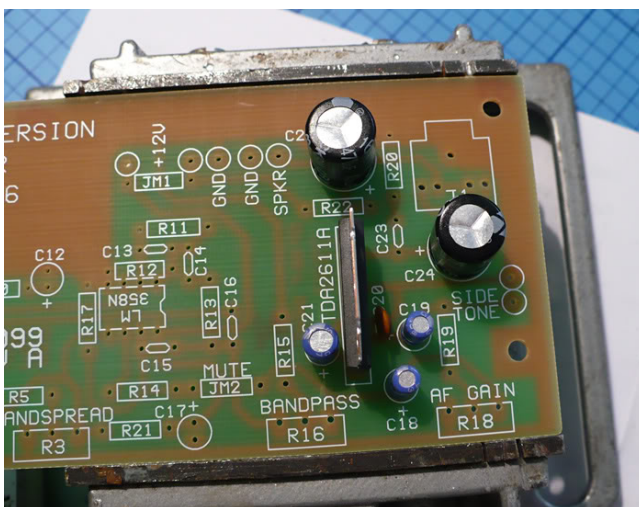
# Basic Jupiter & Solar Radio Telescope



Everything is well labelled

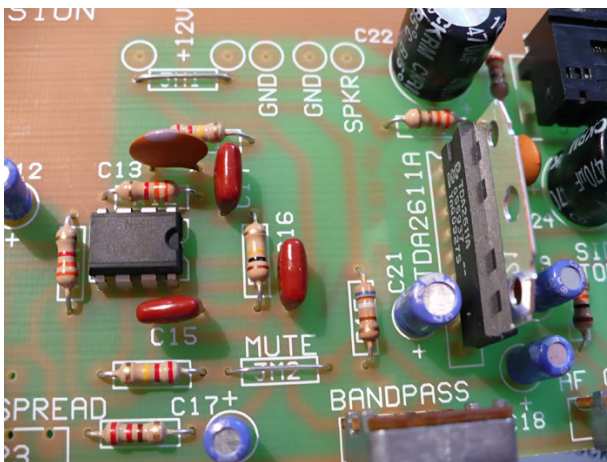
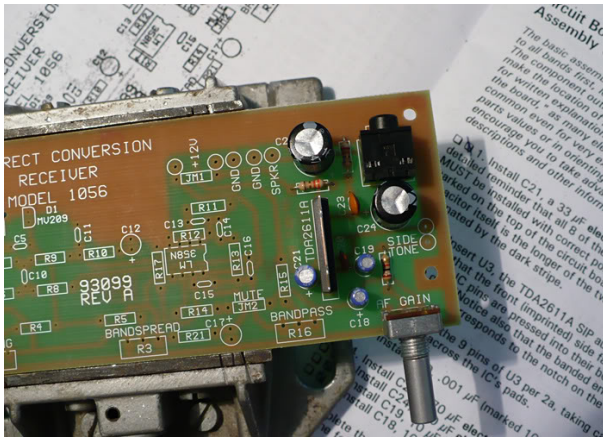


And a clear circuit diagram and easy to follow build instructions

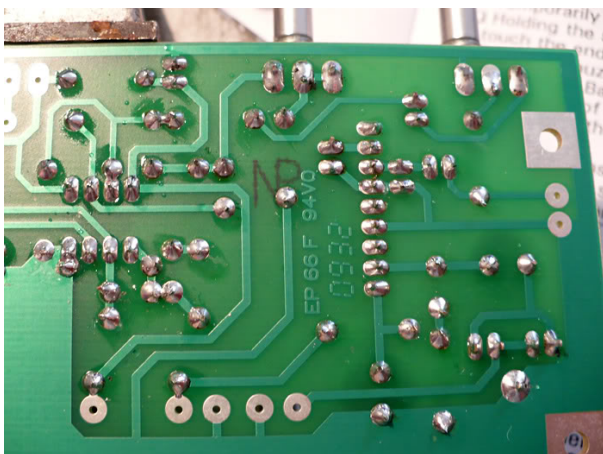


Construction progresses

# Basic Jupiter & Solar Radio Telescope



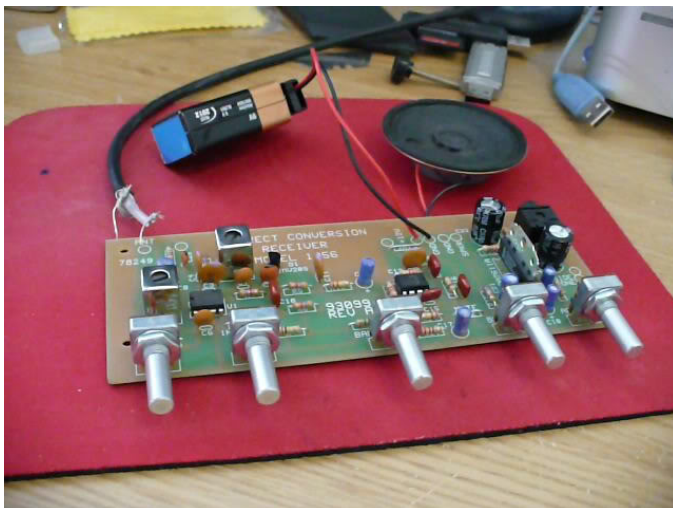
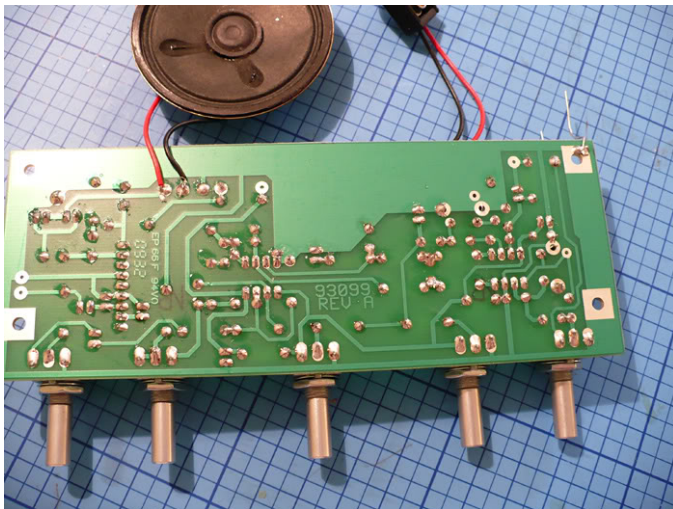
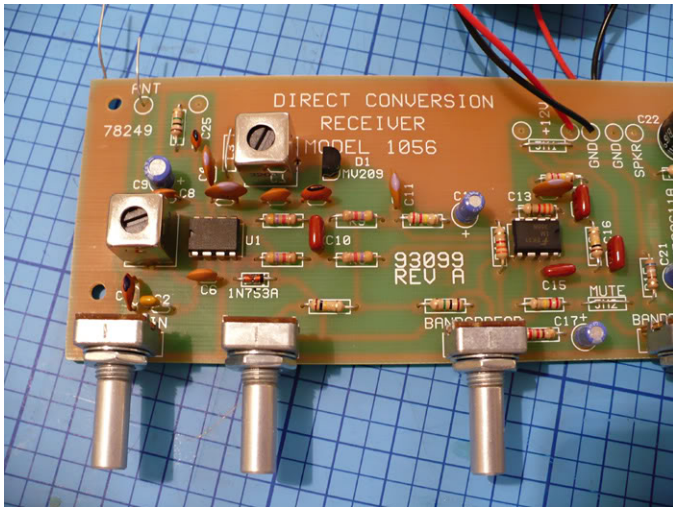
The component side is well labelled.



Make sure the soldering is done properly, clean shiny joints with no globs or solder splashes.

# Basic Jupiter & Solar Radio Telescope

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The completed receiver.

# Basic Jupiter & Solar Radio Telescope

As you can see, it's very basic but should do the job with some mods and tweaks. It worked fine during testing on the nearest ham band...

## Enhancements

These are circuits to improve the basic receiver...

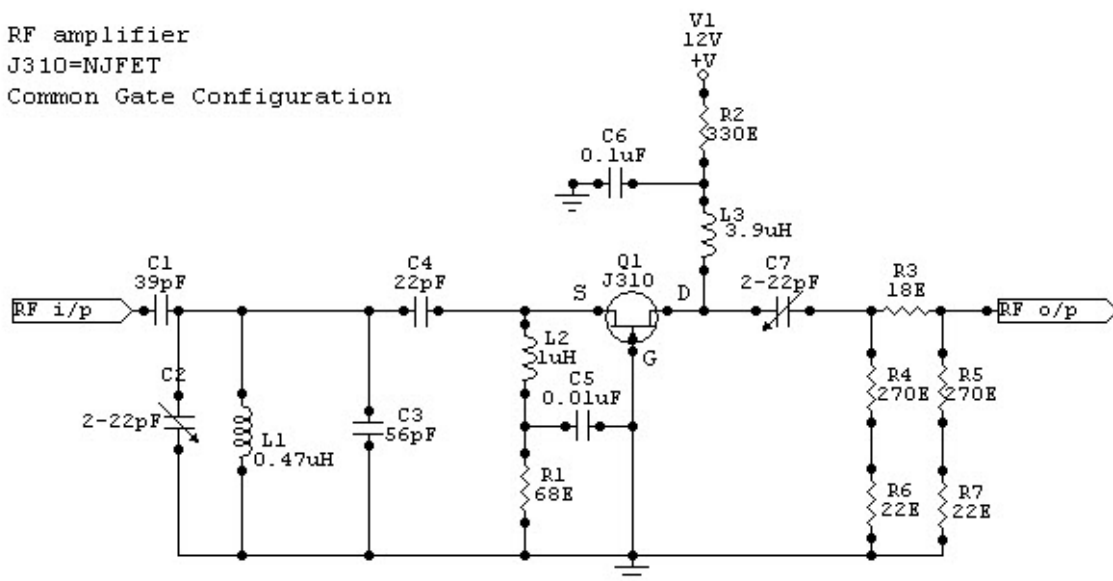
They will need printed circuit boards making and building from scratch...

## RF Amplifier

First circuit is a tuned RF amplifier.

This goes between the receiver and the aerial to boost the wanted frequencies. Might need two of these...

RF amplifier  
J310=NJFET  
Common Gate Configuration



A bit about the frequency coverage of this kit receiver...

Cleverly, they've included the necessary coils and capacitors to cover the popular shortwave amateur radio bands and you choose which band at the build stage and fit the required components..

The sheet below shows the bands in the left column and the respective components from C1 to L3 across the page.

# Basic Jupiter & Solar Radio Telescope

The nearest band to 20.1Mhz is the 15 meter band at around 21Mhz. The coils and capacitors were chosen for this band but I have substituted two 47pf capacitors (C1 and C3) with 56pf capacitors. Bit of a guess but I reckon this should pull the frequency down to nearer the 20Mhz region....

**CHART: 1056 Direct-Conversion Receiver  
160-10M Ham Band Setup**

	C1	C2	C3	C4	C5	L1	L2	L3
160	.001	.0047	180	180	.01	8.0 $\mu$ H	8.0 $\mu$ H	47 $\mu$ H
80	180	680	150	150	.01	8.0	8.0	8.2
40	91	470	150	150	68	5.8	5.8	jumper
30	91	470	100	100	15	2.8	2.8	jumper
20	47	220	47	47	15	2.8	2.8	jumper
17	56	270	22	22	10	1.3	2.8	jumper
→ 15	56 <sup>47</sup>	270	56 <sup>47</sup>	47	10	1.3	1.3	jumper
12	33	180	33	33	10	1.3	1.3	jumper
10	27	150	22	22	10	1.3	1.3	jumper

See other side of sheet for component identification information. All information on this slip is contained also in the Model 1056 Kit Instruction Manual.

I did give it a run with the components in for 40 meters, a very active band with lots of ham radio stations using morse and single sideband transmissions. It proved the kit worked and it gave me some morse code reading practice as well. Got a bit rusty over these past few years

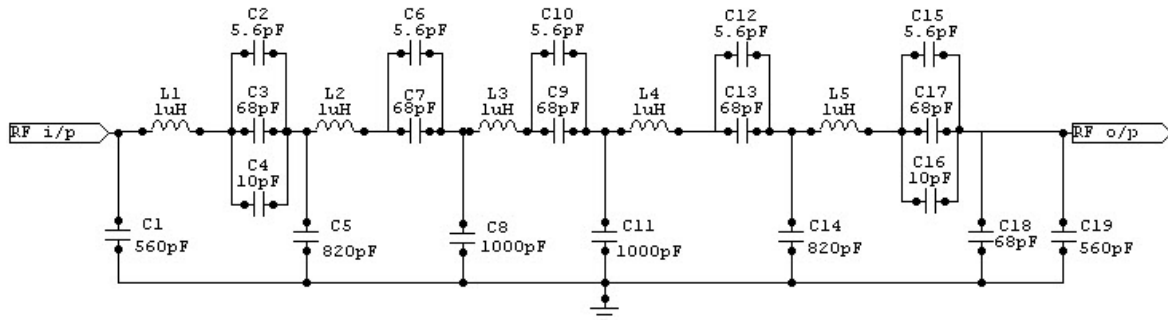


# Basic Jupiter & Solar Radio Telescope

## Bandpass filter

Next is a narrow band filter to accept the wanted frequencies and to cut back unwanted stuff. This will be quite lossy hence the possible need for a second amplifier.

Narrow bandpass filter  
Couple Resonator  
Center Frequency= 20.1 MHz  
Bandwidth = 0.7 MHz



This will fit between the first amplifier and the receiver or at the aerial, I have not decided yet.

Wound the coils for the RF amplifier and the band pass filter

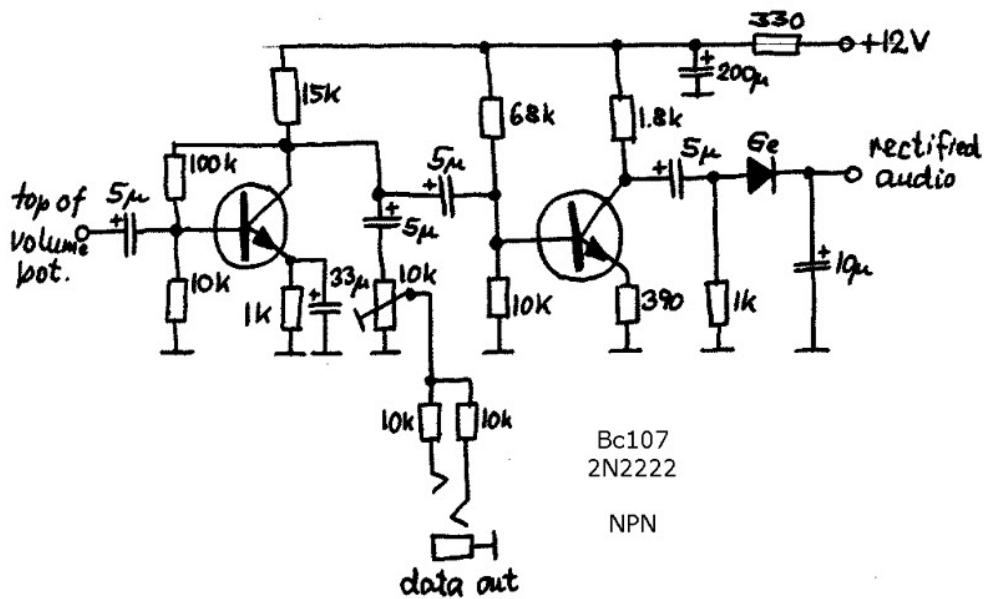
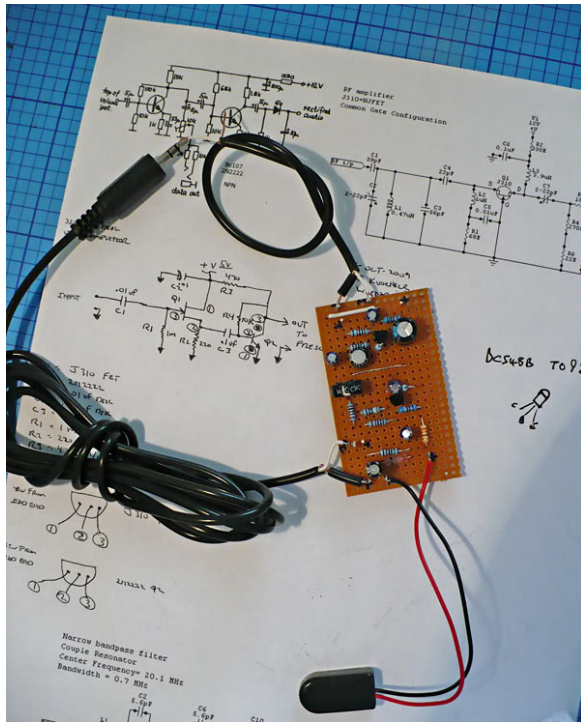
The idea is that the band-pass filter offers a narrow window to frequencies that it's tuned to, thereby rejecting a lot of unwanted interfering signals either side of the wanted frequency.

Looks a bit crude this method of construction but it's easy to do by Dremeling away the copper in a groove around each component pad. Leaving 99% of the copper as an earth plane is good for stability at higher frequencies.





# Basic Jupiter & Solar Radio Telescope



Just done a rough test of the audio into the laptop for a quick check...

Set Skype charting software running (not set up properly yet) and charted the back ground noise from the unfiltered receiver.

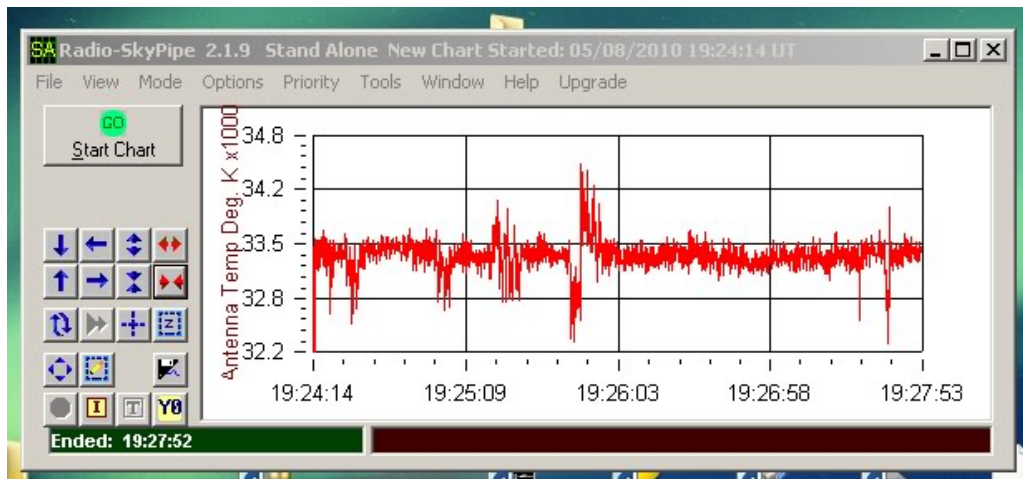
The large spikes were produced by clicking a piezo gas lighter near to it as those things kick out a hell of a pulse and make a great "poor man's" noise

# Basic Jupiter & Solar Radio Telescope

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generator

Anyhow, all seems to be working so waiting now for delivery of a few more components to finish the RF filter/amplifier



## Radio-SkyPipe Strip Chart Program

My brain is getting older and it's taking me longer to sort new software out but I've got the hang of calibrating it and setting the chart levels so quite pleased with how it works...

Idea is, that you feed the audio from the receiver into the "mic" or "line in" of your computer and the sound card does the analogue to digital conversion, the values of each sample being drawn on a live scrolling chart by SkyPipe.

Having calibrated it such that the back ground noise is the base level of the chart, then any crackles or whooshes from the sun or Jupiter will trace a plot on the graph against an accurate time marker.

On the to-do list, is to build a few items of test gear. I gave away my service gear when I had to give up the service engineer life due to major back problems...

Anyhow, on the list will be a frequency meter, a noise generator and an RF signal generator to make construction of any more of this radio stuff easier..

More later as this unfolds but up to now it's looking good

Tidied some wires up and stuff but the main job was taking a look at the audio low pass filter.

These direct conversion receivers take a signal from the aerial and mix that with a

# Basic Jupiter & Solar Radio Telescope

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tuning frequency.

The difference between these two is audio hence the simplicity of it.

All the amplification is then done at audio levels and this is where the low pass filters go.

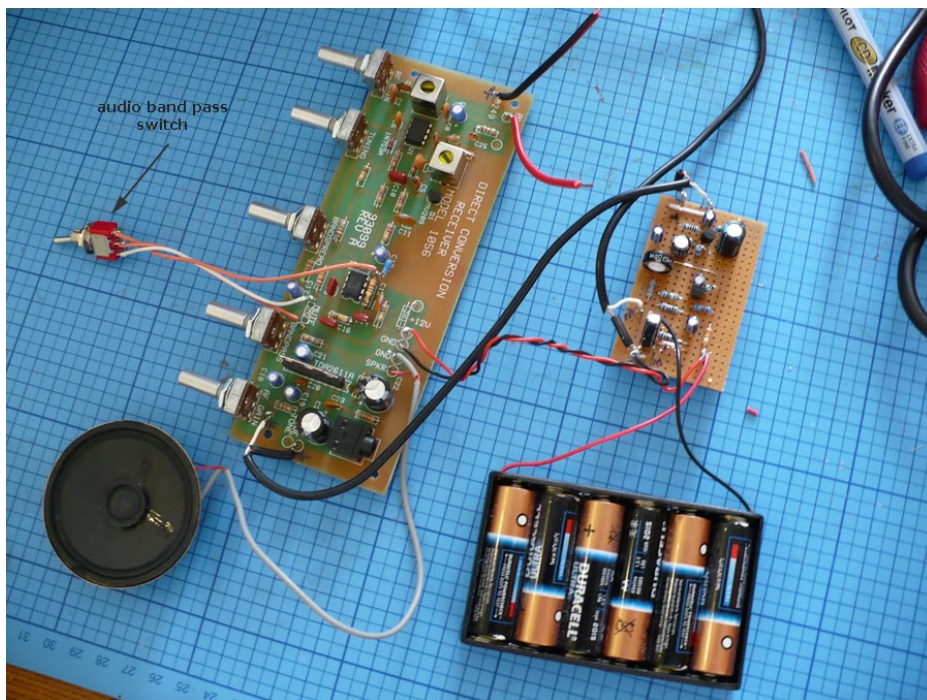
The basic receiver is designed for CW and SSB reception so the filter is quite tight to keep the noise down. It does this very well but it loses too much of the background noise for this astronomy application...

Anyhow, I fitted a switch which selects normal narrow band in one direction and wider (using a resistor and capacitor) in the other.

This really opens up the receiver to better noise reception meaning Jupiter crackles will be louder

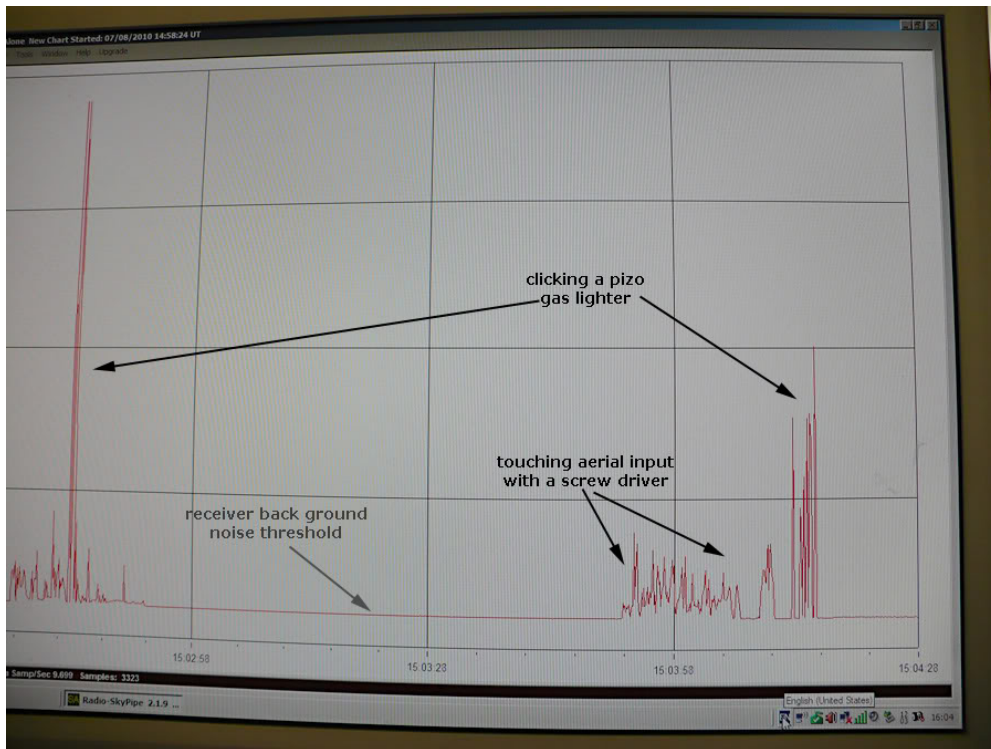
This is the setup so far doing a plotting test and my astro computer set up and calibrated.

You can see the bottom line normal noise threshold and the traces from arcs and sparks produced by my piezo lighter flicker



# Basic Jupiter & Solar Radio Telescope

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# Basic Jupiter & Solar Radio Telescope

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## Test Equipment

Last week I sent for a frequency counter kit from USA and it turned up this morning so I built it up...

Not strictly a necessary item for this Jupiter/sun receiver project but it's handy to prove it's on 20.1 MHz which the counter shows it is by sampling the receiver's variable frequency oscillator.

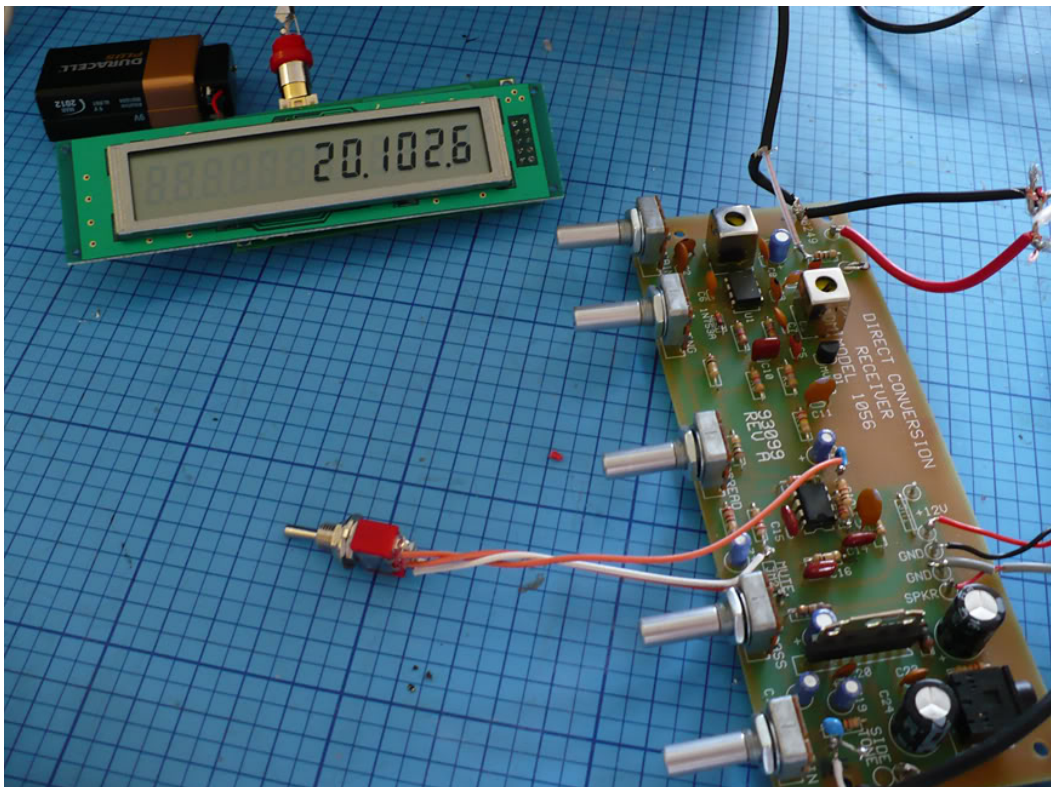
I've really enjoyed getting the soldering iron out again so I'm going to make a low power CW transceiver to get back for a play at Ham radio and this will be a very useful bit of test gear for that as well...

An absolute bargain for less than £20.00

Not too bad to put together if you take care and thanks to Doug for his great prices and great service....

N3ZI Digital Dial with universal LCD interface

Still waiting for components to finish the receiver so more later



Some more done...

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Components turned up so I was able to get cracking with the RF amp/filter

# Basic Jupiter & Solar Radio Telescope

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Been wiring the boards together now they are in the case...

Some final tweaks and the frequency counter is working great. That will go in its own case as it's a useful bit of test gear...

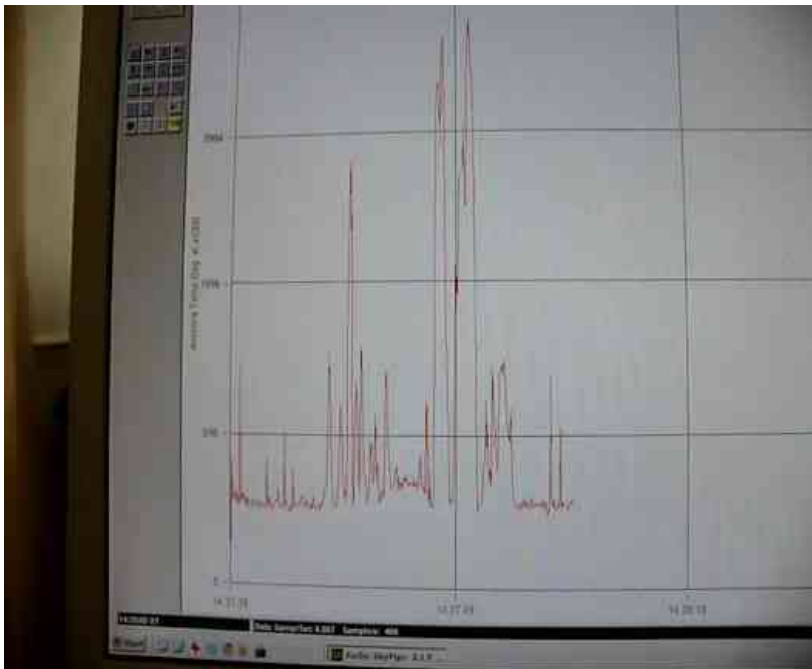
Next step will be a mains power supply.

That will have to be well regulated and fairly noise free so a bit of digging around in me spares box for some bits for that...

Took a mini video of the computer screen running the Skypipe charting software whilst moving the tuning knob in and out of a signal...

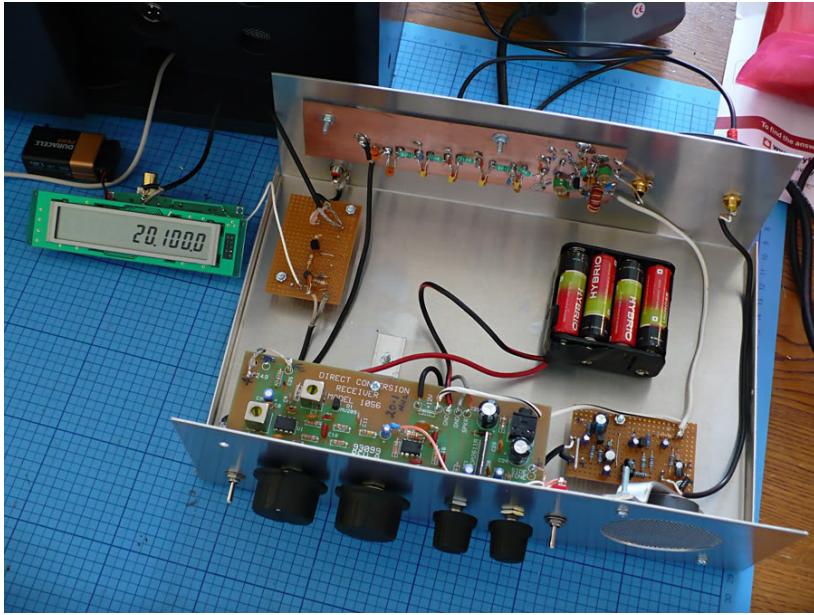
You can see the jumps in the vertical axis corresponding to the blips in audio level...

This is basically what the Jupiter/sun noise will cause the chart to do...



## Basic Jupiter & Solar Radio Telescope

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Anyway, the last of the bits should be here tomorrow from Maplin so the receiver should be finished very soon.

Here's a picture of the machine with its top on....  
Looks quite smart and it's not as big as this picture makes it out to be.

It's 11" wide by 8" deep by 4" high...

Spent some down time reading up on stuff for the next astro receiver which I'll start whilst the tools are out... more on that later...



## Basic Jupiter & Solar Radio Telescope

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Another little chunk put in today....

A four way switch fitted to the back of the receiver.

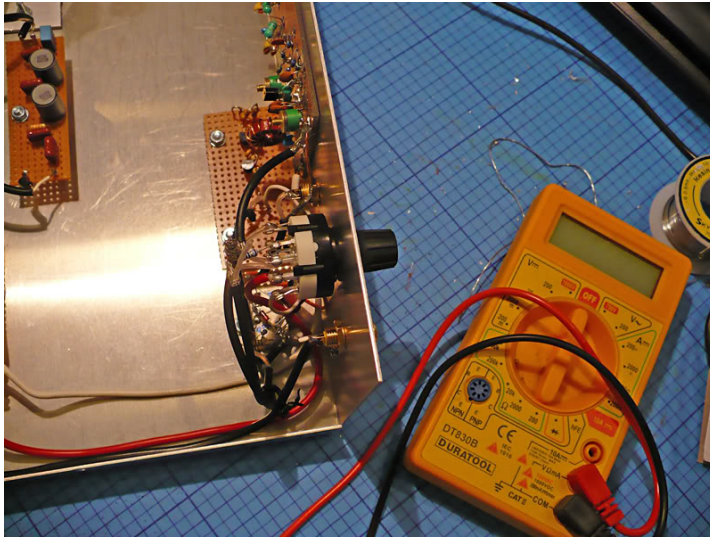
It switches the receiver aerial input to 1: the aerial socket 2: a 50 ohm dummy load 3: the noise generator and 4: the 20MHz frequency source.

Other contacts on the switch, selectively apply power to the noise generator and the 20MHz OSC where needed...

Idea is that I can have the aerial connected as normal or switched to the dummy load for receiver noise checks or switched to the noise generator for calibrating the receiver to the Skypipe charting software. The last position, the 20MHz OSC is for checking the receiver is on tune...

## Basic Jupiter & Solar Radio Telescope

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Nearing the end of the project now...

Replaced a couple of tuning capacitors with high grade ones which has improved the thermal frequency stability.

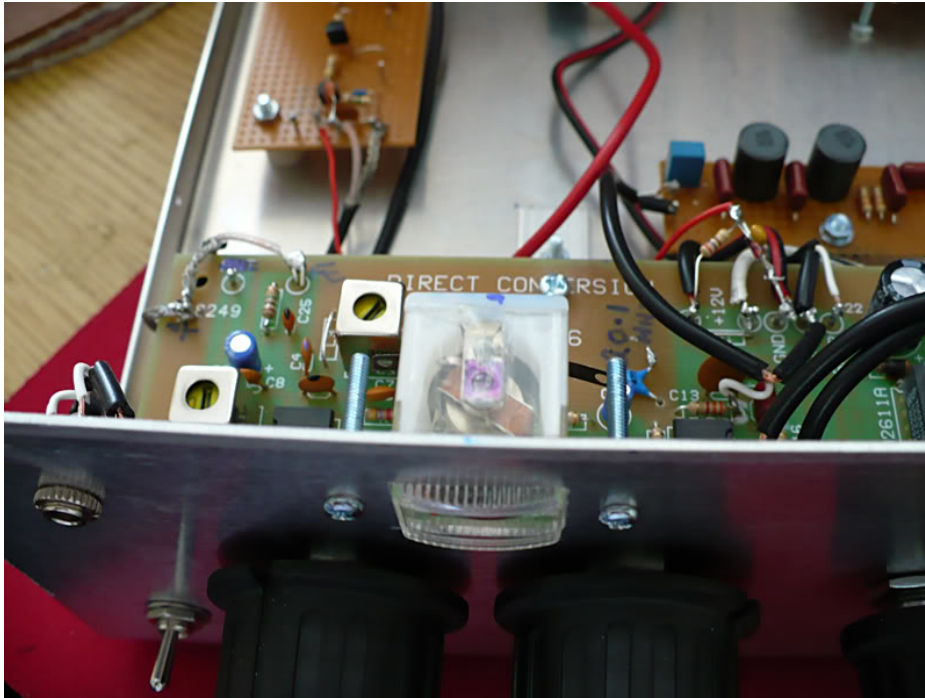
Put in a small panel meter to monitor the level of the audio signal.

This means I can keep an eye on signals coming and going by having a quick peek at the meter when I've got the sound to the speaker turned down.



## Basic Jupiter & Solar Radio Telescope

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Footnote: This is an edited version of a discussion posted on the Star Gazers Lounge web forum.

The original article is here:

<http://stargazerslounge.com/radio-astronomy/113674-basic-jupiter-solar-radio-astronomy.html>