UnRealistic Minima

From HF Signals

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From the urban Dictionary (http://www.urbandictionary.com/define.php?term=unreal):
unreal
When you see something amazing that is unbelievable, it is unreal, everything in utter amazement.
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Contents

My Minima build finally starts

Realistic DX-100 Receiver

Well I've been dragging the chain a bit. Delaying the start of my Minima build until I could get some of my other projects squared away. But finally I have started. Since Farhan has so kindly provided this MediaWiki site to post information I thought I'd use it.

Now I just know that this will probably upset someone who started their Radio career many years ago by listening to a Realistic DX-100 HF receiver. So I'll say sorry up front. Sorry.

But I've had this Realistic DX-100 kicking around for some time. It is a *very* basic HF receiver. I picked it up at a second hand store and it had a fault on one band that I could never be bothered to try and fix. Good looking radio, terrible receiver! Time passed and I came across the BitX design and I thought that this radio would make an excellent donor case for a BitX project. As it had both a large tuning knob and a fine tune control. I was just about to start building a BitX when Farhan released the design of the Minima.

I looked at the Realistic DX-100 with new 'eyes' and that dial window looked just about perfect for a LCD display. And it is!

So now with a quick change of direction this old receiver is destined to become a Minima!

Step one, tear it apart!

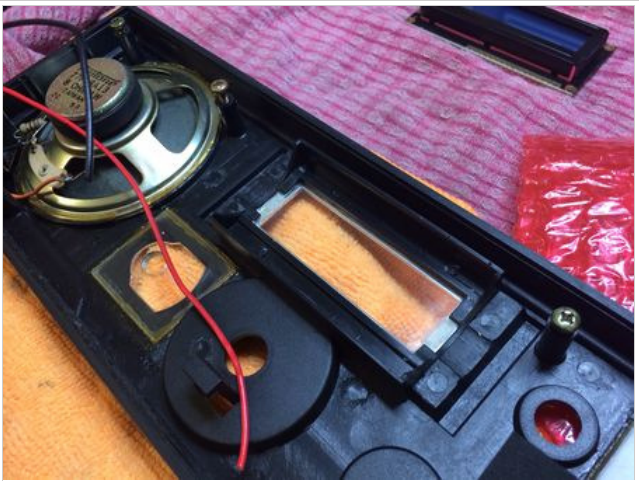
So we start by tearing the old girl apart and adding the contents therein to the junk-box collection. Never throw anything out if you can help it. This was what was inside at the start of the process.

The last photo is one of the white dial marker line removed. I didn't want to see that in front of the LCD display. Several solvents were tried to remove it. Each with cotton wool buds. What seem to be called Q-Tips in other parts of the World. Each applied carefully to the very edge of the window so that we could see the results. In the end good old "Methylated spirits" did the job of substantially removing the white line without destroying the Perspex window.

Hurrah! I've finally got a basic handle on MediaWiki editing!

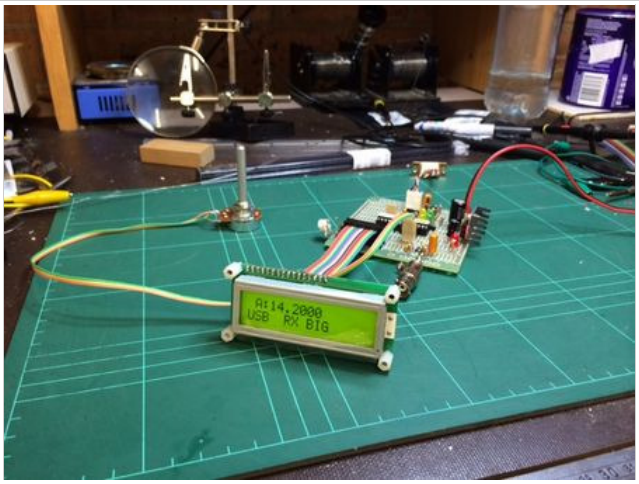
More coming soon. Next up, my Minima logic board.

Pull it apart!



Dial window marker removed.

The Arduino logic/control board



Minima logic/control board.

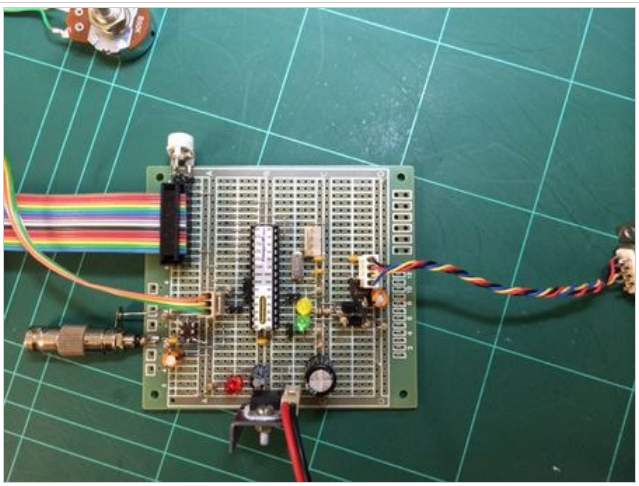
My build is going to be a "Scratch Build" with no PCB. But I decided to assemble the logic on this IC experimenters board. Which looked just about ideal for the purpose and just happened to already be in my junk box.

The Arduino ATMEGA328P IC is from an Australian company called Freetronics who make all sorts or Arduino boards and add-ons. It came with the nifty little pinout sticker on top and pre-loaded with the Arduino bootloader. So I saved myself the trouble of burning an Arduino bootloader image into a blank AVR microprocessor.

No real trouble with the build excepting for the usual debugging of 'missing links'. Wherever Farhan's circuit called for a 50uF electolytic I gleefully installed a 47uF instead. But apart from that it was built according to the book and worked first time.

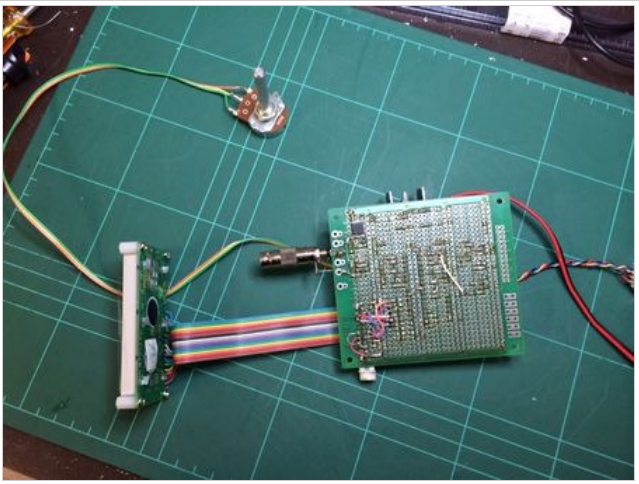
Always very satisfying to see it "light-up" and start displaying information on the LCD.

You would think that I would be happy and leave well enough alone. But this is where I decided to modify things and got myself into trouble...



Logic board with Arduino and Si570.

Here are two more close ups of the logic board. Both component and solder side. Never as neat on the solder side are these experimenters boards. But that's the side you never see ;-) And it's functional.



Solderside with LM1117 3V3 regulator.

The three LED's are Red for the +5v DC power rail. Yellow for serial data TX from the Arduino and Green for RX serial data being received into the Arduino. And this is where the trouble started. After installing the serial status LED's it stopped working. I could no longer upload a new 'Sketch'. I had borrowed the status LEDs from part of a circuit found on the internet at this location:

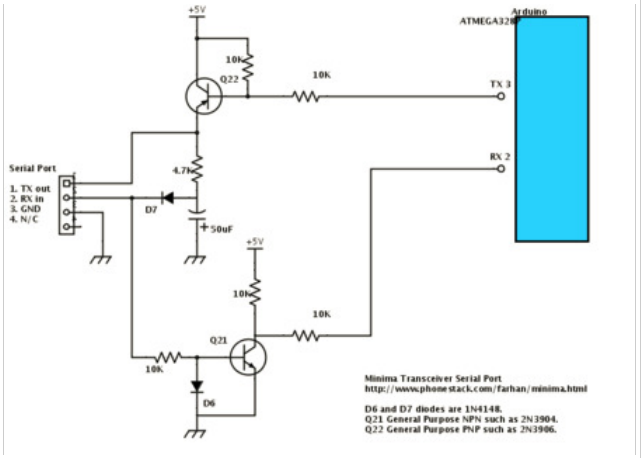
http://www.uchobby.com/index.php/2007/06/11/ttl-to-rs232-adaptor-explained/

I played around with the resulting circuit a bit and nothing simple leapt out at me. It was starting to look like I'd have to connect the digital scope and try

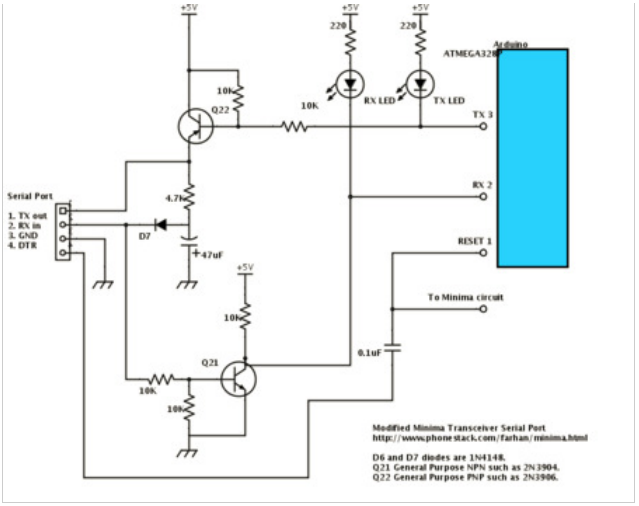
capture some serial data transfers so that I could see what was going wrong. Then I noticed that there was two fundamental differences in the TTL to Serial convertor from the Web Site above and the one on the Minima circuit diagram around transistor Q21. The Minima had a diode from the base of Q21 to ground were the internet circuit had a 10K resistor. The other difference was that the path between Q21's collector and pin 2 (RX) on the Arduino was via a 10K resistor. But the internet circuit was a direct link with no resistor. So being lazy I quickly made both of these changes and "wham" the serial port started working again. Both directions and with pretty status LED's.

Another very important modification was the addition of a 0.1uF capacitor between the Reset pin 1 of the AVR microprocessor and the serial port DTR (Data Terminal Ready) pin. Pin 4 on a DB9 connector. This enables the Arduino IDE to pulse a reset to the micro just before it starts a new sketch upload. This makes programming new firmware very easy, works every time, no manual intervention with the reset switch.

I've reproduced the original and modified circuits below.



Original Minima Serial Port.

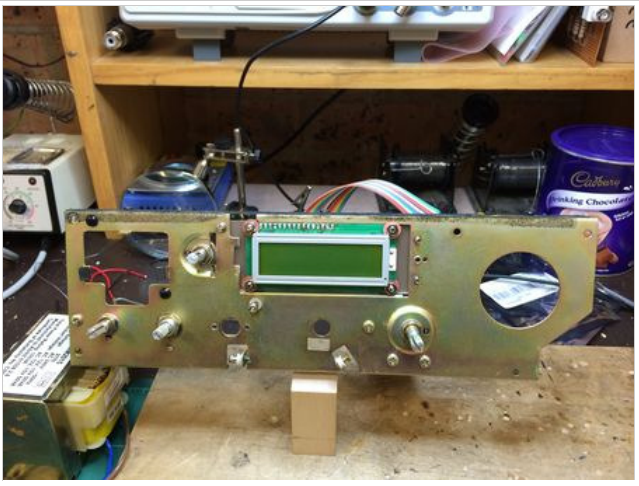


Modified Minima Serial Port.

Mounting the LCD and preparing the case

LCD mounted from inside the case.

Well we

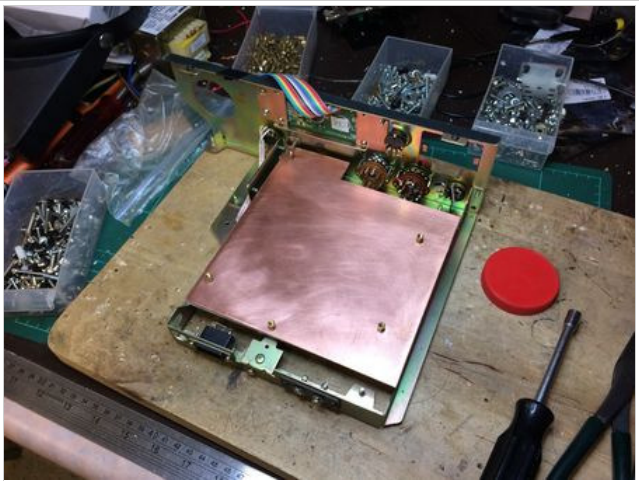


LCD mounted front view.

spent the better part of a weekend preparing the case internals and mounting the LCD. All said, it turned out well enough. I am quickly learning that adapting an existing case to a new project, can in fact be just as much work as building a nice cabinet from scratch! Modern factory equipment fits together with very fine tolerances and grafting something "Alien" into said environment tends to get tricky if you're wanting everything about the case to close back up correctly. This is a picture of the LCD mounting. This was done with small wing brackets made of PCB material. This was the second attempt, the first was with made with a set of home made aluminium brackets. Which were a failure, as the front panel could not sit flush with the case.

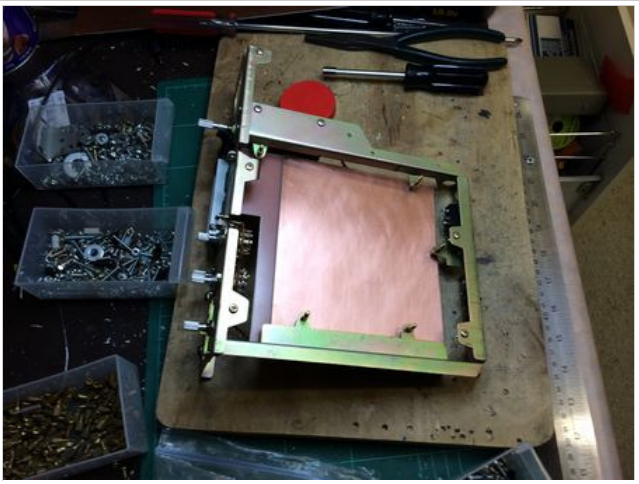
The next thing to do was add some ground plane surface area to work with. So some PCB material was cut to size. Given a spray coat of protective PCB lacquer and the result looks something like this. The rig is not a large one and I'm quite concerned about having enough raw "space" for building circuits using "Dead-Bug" or "Manhattan" style. So I wanted to be able to build circuits both top and bottom. To this end I had to use the brass PCB stand-off spacers to lift the PCB material up from where it would normally mount on the chassis. So that there would be enough room underneath for circuit components. You will note that my stand-off spacers are not fixed with bolt nuts. But instead yet more stand-off spacers are used. This is because I pulled all these brass spacers from very old PC's many years ago and for the life of me can't find another nut or bolt to match the thread pattern! Well, at least not in my junk-box that is. No harm done. It's functional and I had plenty.

I didn't have a double sided PCB board. So I simply used two sheets of single sided material back to back. Making a mental note that it is probably a very



PCB material top size.

good idea to



More again underneath.

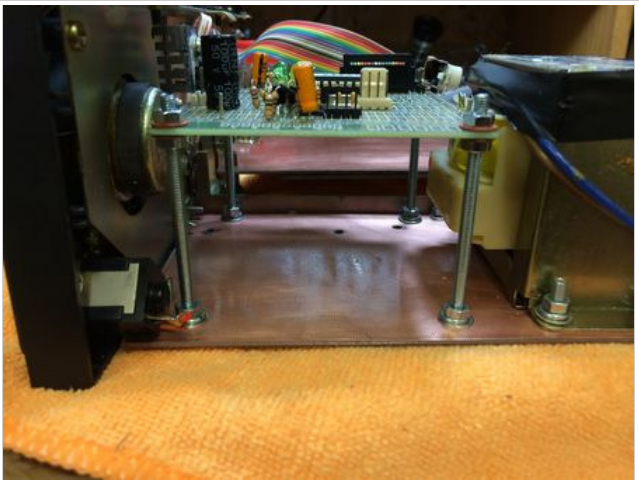
electrically join the ground-plane areas. Just so I don't get any strange unpredictable capacitance effects. Having the top and bottom boards "separate" could make experimental life easier later on if I need to remove one or the other.

The board underneath is not cut to the exact same size and shape as the top piece simply because it was the off-cut from the top board. Waste not, want not.

Those with sharp eyes will note that an additional rotary switch has snuck into the front panel in these photos. The original band switch was connected to a shaft that activated various PCB mounted stage switches. So when the original board was removed the knob and shaft went with it. Since I plan on all the front knobs and controls being functional I needed to replace it.

PCB material for the power supply.

Next I



Logic board suspended above.

wanted to add another PCB and a power transformer to the otherwise unused area of the original receiver. This radio is going to be a home QTH desk job. So I've decided to try and incorporate the power supply into the radio. To this end a multi-tap transformer went atop another slice of PCB material. Power supply to be built later.

Then I needed somewhere to mount my radio logic Ardunio board. So this was done over the top of what will be the power supply underneath. All the mucking about broke a couple of wires of the LCD display. No matter. The ribbon cable is not long enough anyway. So that's the next job.

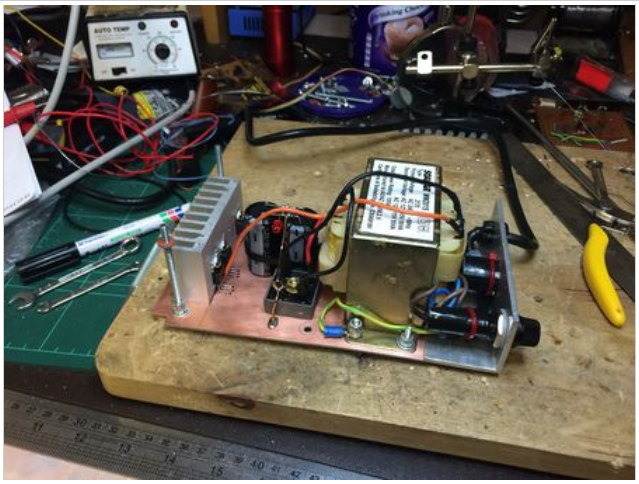
If one looks closely at the photo of the logic board and PSU area. You can see a problem waiting to bite the unsuspecting constructor - Hard! The left most corner of the PSU PCB material is sitting under a plastic protrusion from the front panel. This is in fact the integral front panel headphone socket. This is bending the PCB material down and placing preasure on the front panel where none should be. Look up from that point and you can see one of the front panel self-tapping screws holding the bezel in place. The result being the front panel was miss-aligned to the case body when assembled. Worse still, it resulted in that particular bezel mount point snapping off under the lateral force. So that front panel mount point had to be Super-glued back on. And it remains to be seen how strong it will be. Gluing plastics is tricky. A small section of the PSU PCB material was trimmed away with a nibbling tool to clear the headphone socket. Now the case can be reassembled and everything aligns properly.

So the day finished looking like this. Not too bad. At least the case fits back together nicely with proper alignment. I'm probably going to need to more ventilation holes. The case by the way, is predominantly made of plastic. In this last picture the main tuning knob is held in place for the "Photo Shoot" by a blob of Blue-Tack. The tuning pot that I had available with a splined shaft to match the original knob was just not long enough in the shaft to reach. So I've got a couple of 100K linear pots on order with a longer spline shaft which I think will be suitable.

Next up... Fixing up the LCD ribbon cable and cleaning up the shack work bench. Now that should take a day or two!!

The result of a day of modding.

Work continues on the power supply



Power supply side view.

Well

Power supply rear.

another weekend of building passes. With such little time as could be devoted to the task between "life" interruptions. You will note that so eager to return to construction was I, that the work bench didn't really get the tidy-up it urgently needed. Ah well, next time.

In the end I decided just to go ahead and complete the power supply before moving onto the radio proper. Which of course is taking much longer than expected. Here are a couple of photos of the "in progress" build of the power supply. Not yet complete but a good start. The logic board has been removed while the power supply takes shape.

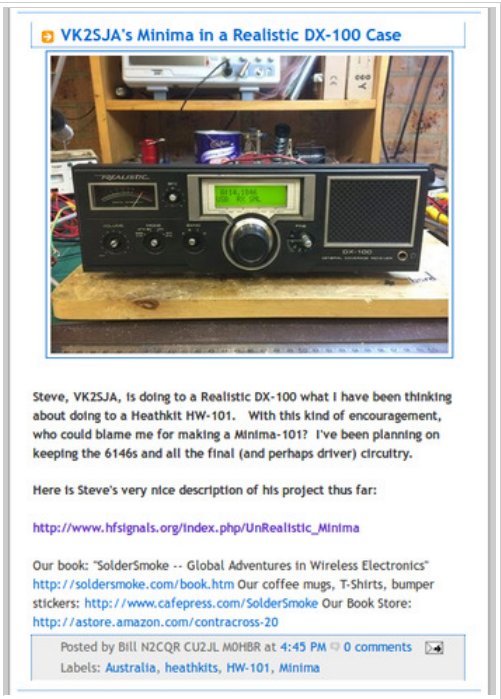
Minima Radiono LCD display.

I also went ahead and re-wired the ribbon cable to the logic board. So that it is now long enough to reach the new board position above the power supply. I've been making up ribbon cable with IDC connectors for years. And they never give me any real trouble. Until this morning that is. First attempt and no LCD display. Cable was found to have many intermittent wire faults. Any attempt to "repair" the faulty cable just seemed to make matters worse. I can normally save an IDC connector for re-use but not this time. I had to scrap the connector and start over. Second time worked a treat thank heavens. Still it wasted a good hour or two.

This last image is the front of the radio again. This time with the LCD powered up and displaying information under the control of the logic board. However the photo is very much contrived. As the logic board is simply dropped behind the front panel on a piece of insulating paper. Just to see what it would look like.

Next time. Hopefully the completion of the power supply. And maybe the start of the KISS mixer and some FET matching.

Captured by SolderSmoke!



unRealistic at SolderSmoke.

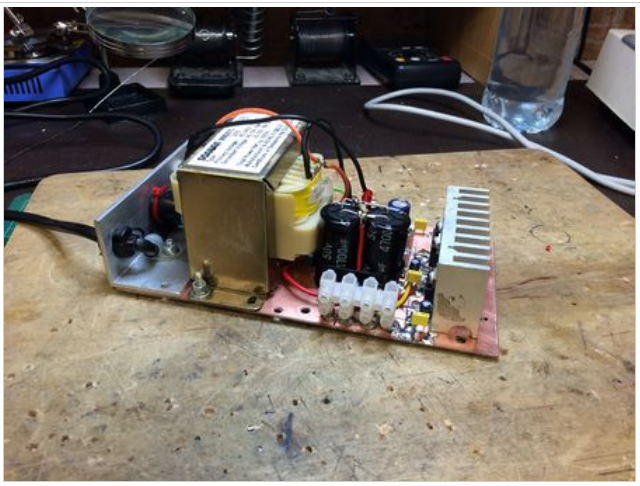
Well I'm very honoured.

Over at the SolderSmoke Daily Blog (http://soldersmoke.blogspot.com.au/) Bill Meara, N2CQR has placed this little project up on the front page. I guess that this is what the "Slashdot Effect" (http://en.wikipedia.org/wiki/Slashdot_effect) feels like in miniature? I do hope that this server is keeping up with the increased traffic demand. :-)

So Bill, I thank-you for the interest in my hardly even started project. But an even bigger Thank-You ("Three Cheers" even, as someone is want to say) for your efforts with the SolderSmoke Podcast and Blog. I enjoy listening regularly. And it always feels like pulling up a comfy shack chair, for a chat with Friends. Friends who actually understand what the 'heck' your talking about! <LOL> (or should that be HiHi?).

Last weekend flew by with not much "Solder Smoke" in the shack. The shack and bench did get a much needed tidy up but that was about it. Hopefully this weekend some more progress will be made.

Power Supply Completed


Finished PSU Left Side View.

Well this is how the


Finished PSU Right Side View.

completed power supply turned out. For those wondering at the over-engineering. Yes, this power supply while very simple is completely over the top for a little Minima. The beauty of the Minima is that it serves as a platform for experimentation.

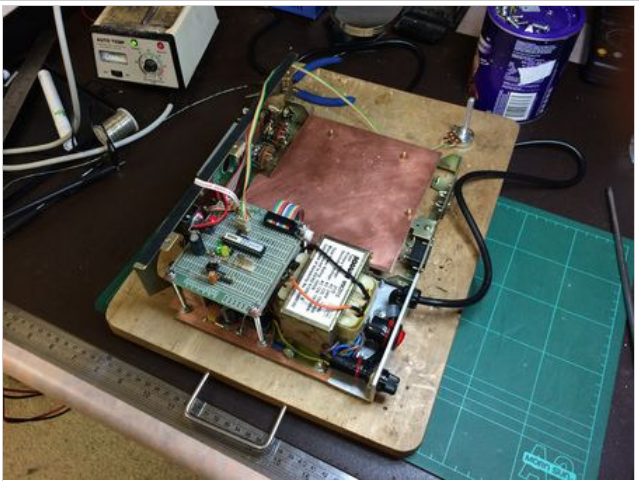
So I've build the supply with both + and -12 volt DC rails. Just in case I might want to play with split power supply audio amplifiers or similar. There is a +9v regulator that feeds from the +12 volt supply. Which in turn feeds to the +5 volt regulator on the logic board. So now the +5 regulator does not get so hot.

The supply can also provide ~40 volts DC. Which may come in handy for getting higher power from a IRF510 linear. Perhaps...

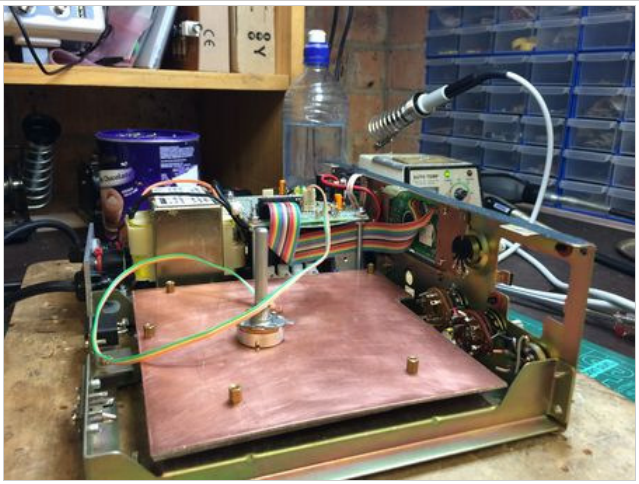
To the left is the Arduino Logic PCB mounted above the completed power supply. With the master power LED on the bleeder resistor winking out at us. "Yes I'm working and don't poke your fingers in here!".

To the right is the top view of the logic PCB mounted atop the power supply and the entire module bolted back onto the radio chassis.

PSU and Logic PCB.



PSU Mounted in Radio.



PSU Logic PCB and Ribbon to LCD.

Two

PSU in Radio Rear View.

more images of the completed PSU. The left showing the logic board ribbon cable connected to the front panel LCD. While on the right we can see the whole arrangement enclosed in the case from the rear.

Placing the radio back inside the case I ran into a problem. The case is not a clam-shell. The radio chassis needs to slide into the case from the front. When doing so it got stuck only two thirds of the way in. An inspection showed that the left most screw mount for the original rear panel was in the way of aluminium power supply plate. If you look real close at the picture you can see where I had to attack the plate with a round file to make it fit around the screw mount.

Running on Internal Power.

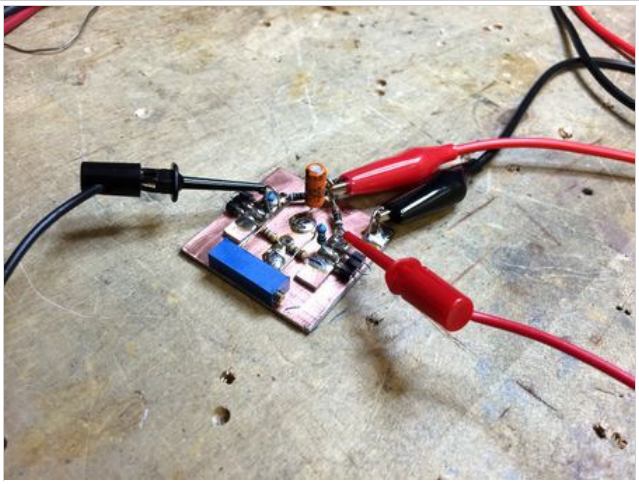
Finally another shot of the radio powered up. This time the photo is not as contrived as previous. She is running on her own internal power supply source.

It is interesting to note that this photo was taken with the "Radiono 0.4" sign-on message displayed on the LCD screen permanently. No trick photography nor hung I2C data bus. It just happens from time to time when everything is very stable and the shack has warmed up to a nice cosy constant temperature. As soon as you move the tuning knob it starts displaying the frequency. A quick glance at the source code and I'm convinced that this is normal behaviour. The current Radiono sketch does not display the frequency until there has been some sort of update.

Mostly though when people see the "Radiono 0.4" message forever it means that the I2C data bus is in a hardware fault condition which seems to hang the Arduino Wires Library.

Matching FET's

So the next thing on the building agenda was yet another piece of test gear. I want to start by building the Minima KISS mixer. The focus of so much



FET Matching Circuit/Tool.

attention recently as some builders were having trouble with it. And because the LO to RF port isolation was being reported as not being high enough. Having read as much as I can understand about the topic (very little but I'm learning). I've become convinced that success with a mixer made from two FET devices probably entails careful "matching" of the FET's. After all, we match the diodes we use in the simple BFO mixer. So why not the FET's?

From "Mixer Musings and the KISS Mixer by Chris Trask / N7ZWY:"

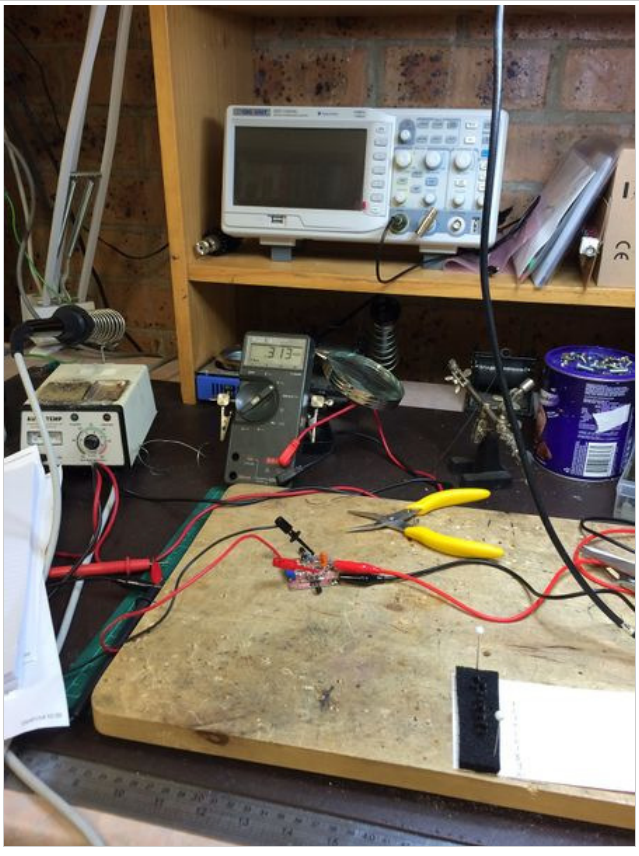
"...but that the balance of such a mixer making use of discrete transistors will be poorer than the balance of a diode mixer because of the difficulty of matching the rather complex transistor parameters over the operating range (10)." 10. HF Radio Systems & Circuits, 2nd ed. Noble Publishing Co., Atlanta, Georgie, 1998

Where the transistors mentioned above are VHF FET's. So the problem would seem well known.

Having decided that matching FET's is probably important, then how does one go about doing it? A quick scout around the Internet, once again led me back to the "QRP & SWL Homebuilder" (http://vk2sja.org/piffle/?p=185) website and a section called "FET Matching" (scroll down).

If by some miracle or bizarre twist of fate you are reading this and have have **not** already discovered "The Popcorn website" (http://vk2sja.org/piffle/?p=185), then do yourself a favour and head on over. You're in for a real treat.

The photo left shows my bridge variant. Setup with shorted links in the sockets where the FET's are normally placed. This is so you can adjust the bridge balance for exactly zero volts.



Typical FET Match - All over the place!

So the afternoon finished with using the bridge to match some FET's.

I was going to match a whole bunch of J310's. Until I discovered that I didn't have any J310's that is! I could have sworn black and blue that I had a whole heap. Apparently not.

So I went and matched a whole bunch of Audio FET's just for the fun of it and by way of practice. Yep, FET's even taken from the same cardboard parts strip are all over the place!! Best match from matching 9 samples to one control was 0.010 volts. The photo opposite shows 0.313 volts but most pairings were much higher than this.

Now it should be noted that the general consensus is that for best results in a KISS mixer we should be matching the units for highest IDSS. The bridge I've built tells me that both FET's are the 'same' but doesn't say much about IDSS. So that's the next experiment. Find one J310 FET with a high IDSS and then find him a partner.

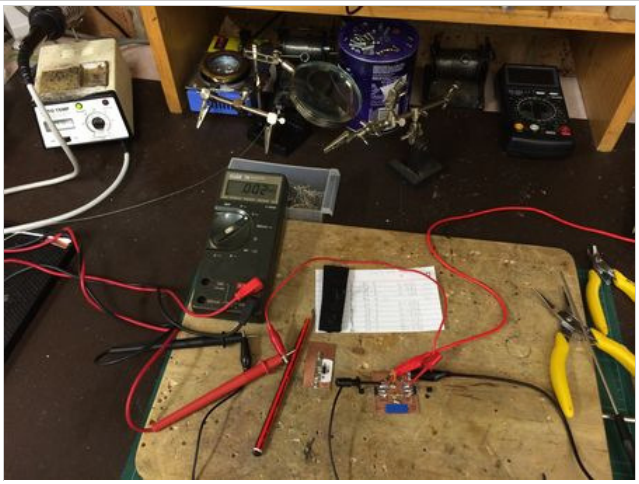
Next up.. More FET matching/selection and building a KISS.

Matching J310's and Testing a KISS Mixer

Eventually a bunch of J310's that I ordered arrived. So I proceeded to pull out 10 units at random to match.

I built another tiny little test board to measure IDSS. The circuit is so ridiculously simple that it was hardly worth the effort of building a board. It only grounds the gate to the source. You measure the current flowing into the drain. But it was handy because of the test socket. It made testing a whole group reasonably quick.

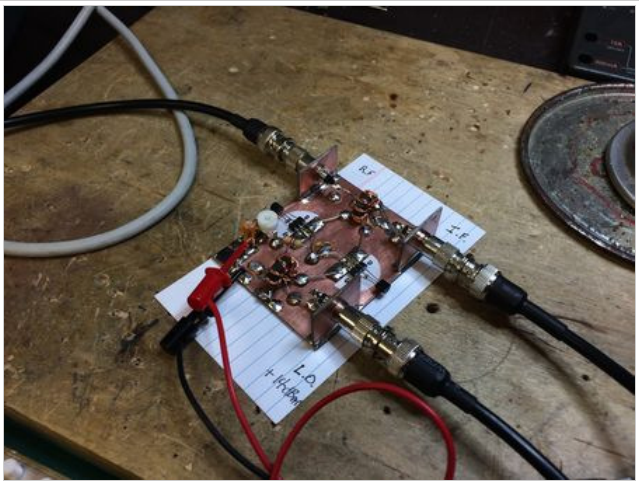
I found measuring IDSS this way on a J310 to be a moving target. The current would continue to fall off the longer I let it flow. Internal JFET heating I assume. I got sick of waiting for it to stabilise by about the 30 second mark. So in the end I plugged them in, counted to 10 seconds and then recorded the value shown on the DMM at that time. Not an exacting science but I was only interested in the relative IDSS value between FET's.



The best J310 match of the day.

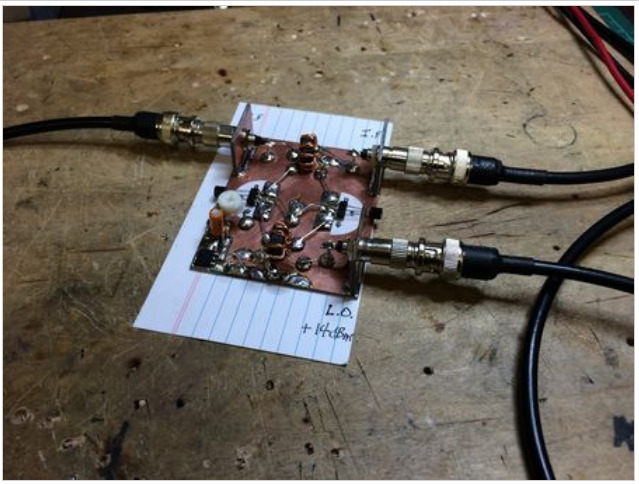
I also matched each of the J310's to the transistor I had designated unit #1. I found that two transistors with a very similar IDSS would also present very good balance in the bridge. Somewhat predictable I know. But always nice to have something you only suspect as being true proved by experimental method.

In the end I selected two FET's with not quite the highest value of IDSS because they were better matched in the bridge. This matched pair recorded only 0.002v using the bridge as the picture shows. Sorry about the quality of these images. They are a bit dark. More lighting practice required.



My version of the KISS Mixer.

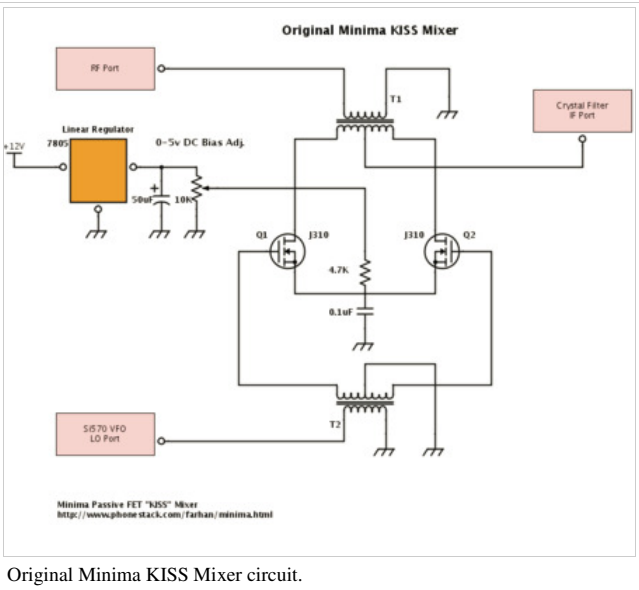
So here is my



KISS Mixer with alternate bias method.

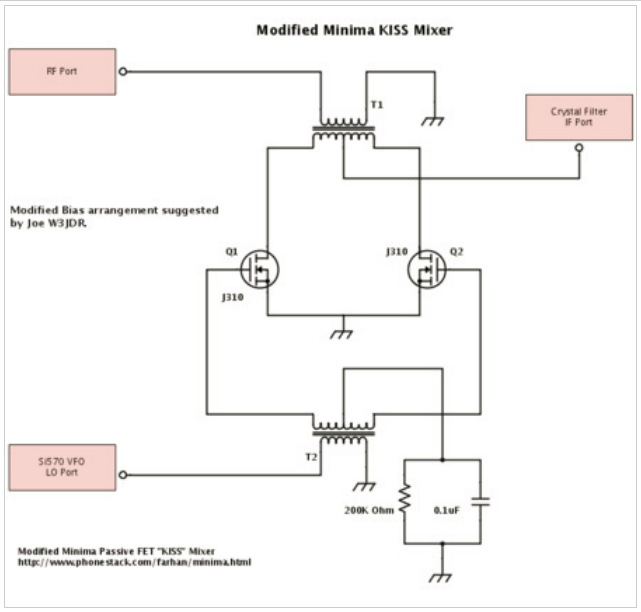
version of the KISS mixer. On the left is the Minima KISS Mixer as per Farhan's original circuit. I used FT37-50 toroids instead of FT37-43's because I didn't have any of the smaller ones on hand. I used thicker wire 0.5mm to match. Apart from that and my unusual choice of RF connector it is built as per the original.

This unit has the adjustable 0-5v DC bias which is why the power leads are connected. On my version of the KISS mixer I found that the bias adjustment seemed to have very little effect on the mixer output levels. It had some, just not a significant amount. LO leakage only varied by about 1dB and the wanted RF product by only 0.5dB over the entire bias range. One of my next experiments is to see if the adjustment range actually increases if your FET's are poorly matched.

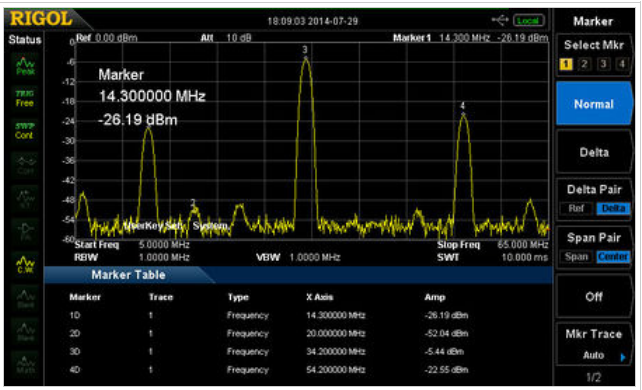


Original Minima KISS Mixer circuit.

Over on the right hand side is a modified version of the KISS mixer. Very early on in the life of the Minima Freelists mailing group Joe W3JDR suggested an alternate bias method. This method does not require the 5 volt bias regulator. It directly grounds both FET sources and connects the centre tap of the LO Gate transformer not directly to ground but instead floats that point by connection to ground via a parallel 200K Ohm resistor and a 0.1uF capacitor. You can read Joe's original post about it here (http://www.freelists.org/post/minima/Kiss-Mixer-Analysis).

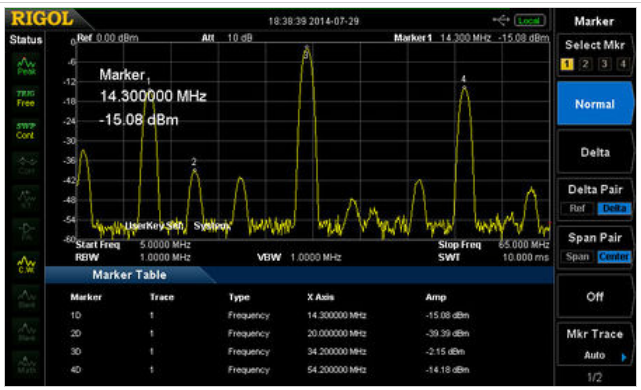


Modified KISS Mixer bias circuit.



Original KISS Mixer.

So do they



KISS Mixer alternate bias method.

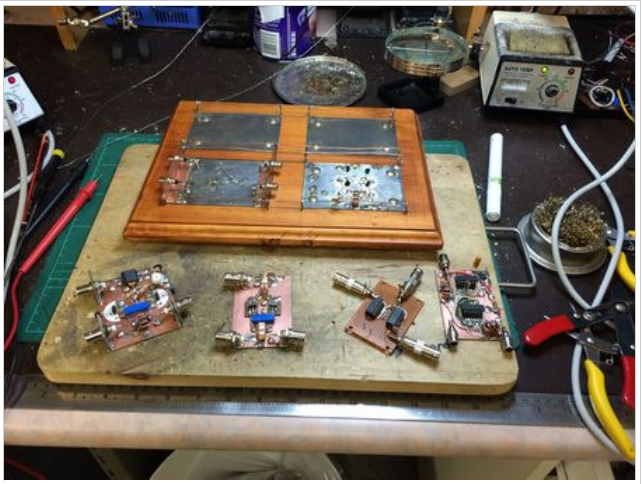
work? Yes, I'm very pleased to say. They both do.

So what did each version perform like?

See for yourself.

These Spectrum Analyser screen shots were taken with the LO from the actual Si570 at +14dBm and the 20Mhz IF at -10dBm into the mixer. The Rigol DSA-815 is looking at the RF port (simulated TX mode).

Mixer Melodies. KISS, KISS V2 and Double-KISS

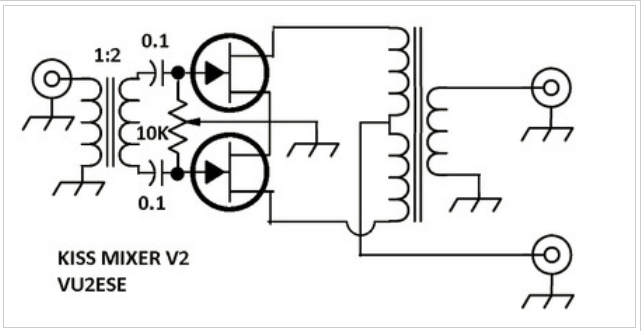


A collection of mixers.

Well its been a while between posts. I got tied up experimenting with Mixers for longer than expected. Here you can see a collection of the various mixers I've built over the last few weeks. A Passive Quad J-FET Mixer, Two versions of the J-FET KISS mixer and a couple HC4066 CMOS switching mixers. Many of these went through two or three re-builds while playing around with various configurations.

So why all the different mixers?

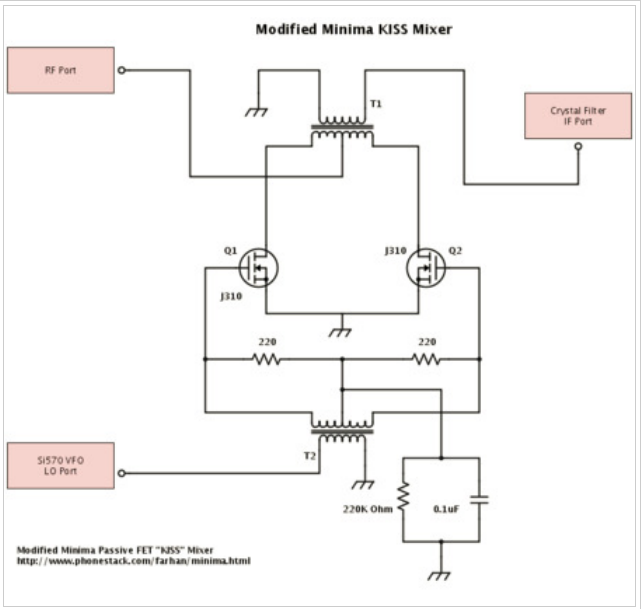
Well the story goes something like this...



KISS Version 2.

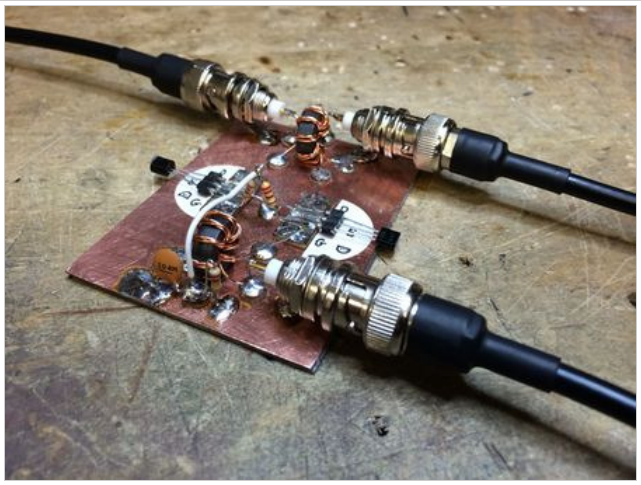
Early in the life of Minima some builders started reporting high levels of local oscillator leakage to the RF port in TX mode. You can see this at the 34Mhz point in the spectrum analyser screen shots above. The solution? Farhan then offered the KISS V2 circuit for testing. This circuit gave extremely good adjustable LO suppression but some experimenters, including myself, started seeing higher levels of insertion loss with this mixer. The original KISS mixer had about 7dB insertion loss while the newer KISS V2 was being reported at 10dB+. The first version of KISS V2 I built was up around 14dB. By the third re-build I did get it down to 10dB but couldn't manage to get it any lower than this.

To me the large local oscillator (LO) leak seems inherent in the design of KISS V1 and other variant mixers based on this pattern. If you look at the circuit schematic you can see that the LO (if nicely formed) will be of equal but opposite magnitude in each side of the input into the mixing transformer. As such these signals should cancel out very nicely at the mixing transformer centre tap. However not so much attenuation is available to the other winding of this transformer. Both the DSA-815 screen shots above are looking at the output from the port on the second mixing transformer winding, not the centre tap port. Hence the high LO level at 34Mhz.



KISS V3 Circuit.

In all this



My modified J-KISS V3.

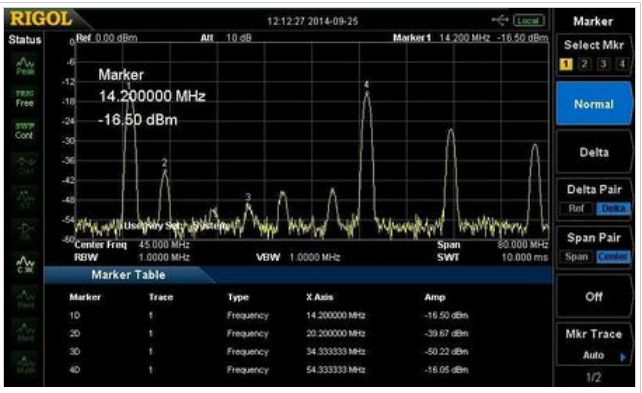
experimenting I did a lot of Googling slash reading and came across this paper:-

http://www.plextekrfi.com/images/pdfs/RF_mixer_design.pdf

On page 16 I found "Figure 28: Circuit diagram of a FET based switching mixer"

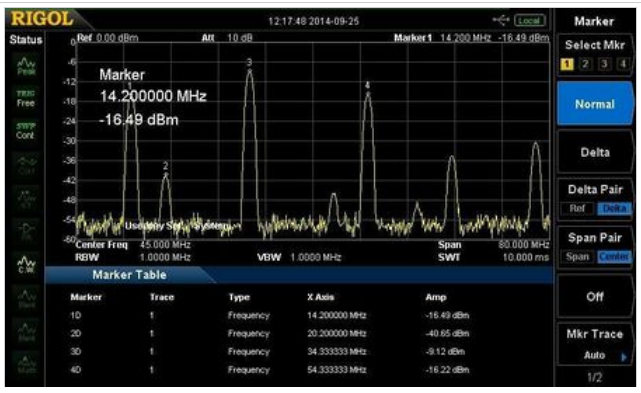
So on a whim I decided to blend this design with the alternate bias method that Joe outlined. This modified circuit can be seen left. I'm now somewhat presumptuously calling this J-KISS version 3. Because that's easier than typing "Modified version 1 Minima J-KISS mixer with Joe's floating bias modification and a couple of extra resistors that I added just to see what would happen...", all the time.

Well it turned out that it worked rather well. In fact for me it worked better and more consistently than any other version that I tried building. Joe's floating bias had pretty good conversion loss already but adding the resistors dropped the unwanted local oscillator noise almost into the noise floor.



J-KISS V3 TX Direction.

So here is a



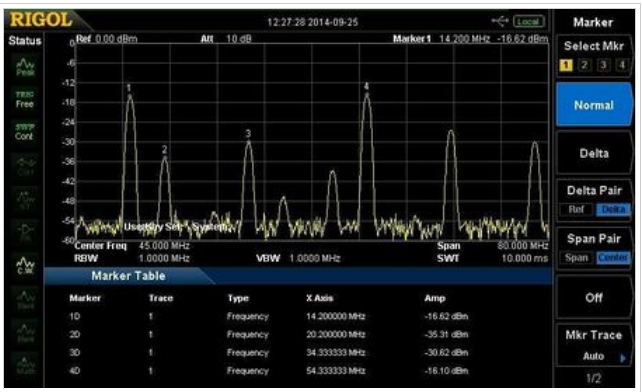
J-KISS V3 RX Direction.

couple of screen shots of KISS V3 in action. To the left is the mixer in the transmit direction. While on the right is the same mixer running in the receive direction. Note that this clearly shows the difference in the LO leak level depending in direction of signal flow (which port your looking at). Which is high here in the receive direction. This characteristic was true of all the J-KISS mixer variants I built.

A couple of important things we should note about this high LO leak level. First, in the original Minima circuit the mixer was connected the other way around. So this higher LO level would be present during transmit and flow through to the the low pass filters. Simply reversing the direction of signal flow through the mixer as done here with J-KISS V3 (and as Farhan intended for J-KISS V2) will now present this higher level to the crystal filter instead. The idea being the the crystal filter will do a better job of filtering it out than the low pass filter. Will this cause any receiver issues? I don't know yet but at least the transmitted signal should now hopefully be clean and within legal limits for harmonics.

The second important thing of note is that in those J-KISS mixer variants with some sort of manual bias adjustment. Which include both of Farhan's J-KISS V1 and V2 designs (although the bias arrangement is very different in each). The adjustment will make a significant change to the LO leak level but only on the port connected to the centre tap of the mixing transformer. On the port connected to the second winding I hardly noticed any change at all. Just a few dB at most.

Now my J-KISS V3 mixer was looking pretty good. And while performance is nothing to get too excited about. Let's face it, a cheap Mini-circuits SBL-1 double balanced diode mixer module would probably run rings around it. But at least my mixer was behaving like a proper mixer should and I can say I built it myself! Oh, and it's also operating as a switching mixer or "chopper" which is important in the Minima. This version was in some ways the easiest to build and get going because it has no bias adjustment. But herein lies the catch...



J-KISS V3 with mismatched JFETs.

For this mixer to work well the J310 FET's must be very well matched prior to building the unit. So what happens if you don't? The spectrum analyser screen shot to the left shows exactly the same mixer used above but with a pair of deliberately mismatched J310's installed. We can see that all the unwanted signal levels jump upwards. The dreaded LO leak level alarmingly so. Interestingly the conversion loss seemed to remain largely unaffected. Compare this screen shot with the one directly above it.

So building this mixer means that you must match your FET's. Personally having now been through the FET matching exercise I don't find the task too onerous. No more difficult than matching the diodes we typically use in other mixers. A procedure which we Radio Amateurs take for granted. And probably a lot easier than profiling/matching crystals for ladder filters.

It occurs to me that the FET matching process only really requires an accurate digital multimeter. While the adjustment of a mixer balancing pot ideally needs a Spectrum Analyser. Admittedly you could probably make do with a general coverage receiver listening to the LO frequency via a direct cable connect to the mixer with some in-line attenuation. The multimeter seems the somewhat simpler though. Anyway it could be that for the average home builder pre-matching the FET's used to build a mixer may be in fact be easier than adjusting a balance control setting after the mixer is built. Perhaps, maybe...


My J-KISS V3 finally installed in the radio.

So finally I tired of playing with mixers. There is much, much more that I have not tried and should have. Looking back there are experiments which need to be re-done because of flaws in my methodology or understanding at that time. Please understand that what I present here are just my experiences. While I stumble around learning new skills. This is what happened to me. With the mixers that "I" built! I'm no Electrical Engineer or RF Design Engineer. Just a hobbyist Amateur Radio enthusiast. So your mileage, as they say, may vary - significantly! But if this project was ever going to reach an operational state. Then progress had to be made at some point. At a later date since this build is a modular scratch build with no PCB to lock me into a particular design. It will be easy enough to swap out the mixer module with an improved version.

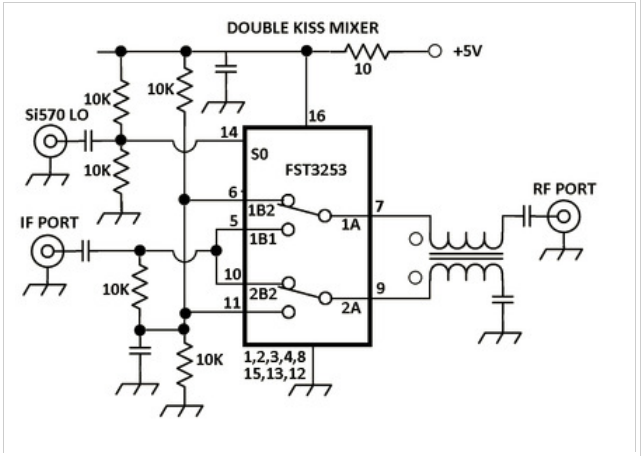
So enough was enough and I installed my modified J-KISS in the radio. As seen here from the underside. No connection to either the IF or RF ports as yet. The coaxial cable from the LO port can just be seen sneaking its way out and immediately up to the Si570/logic PCB topside.

On a final note this section would not be complete without mention of the "Double KISS". Farhan released this circuit to the Minima group for experimentation. Called the "Double-KISS", no doubt because it is doubly balanced instead of singly balanced like the original Minima JFET KISS... I think? This mixer uses a modern high speed CMOS bus switch at its heart. Which brings it much closer to the original KISS design detailed in the "Mixer Musings and the KISS Mixer" (http://www.phonestack.com/farhan/mixermusings.pdf) paper by Chris Trask/N7ZWY. Which is where all this mixing business started in the first place.

So a lot of experimental energy is now being invested in this direction. This style mixer promises exceptional performance. The only downside being the somewhat exotic part required. They are not particularly expensive, just not available from your local electronics store. So the Minima continues to evolve as time goes by. For myself I have ordered some suitable high speed CMOS bus switches for experimentation but at this stage plan on completing the radio close to the original design. I can then evaluate its performance before making any changes like a mixer substitution.

Well that's all for the moment. Next up I'll back-track a little and talk about JFET matching in more detail. Then we shall tackle the 20Mhz Crystal Ladder Filter.

73, Steve. VK2SJA



Double KISS Schematic.

The Story Continues...

Wow! You made it this far? Then you are to be congratulated for your patience, persistence and perseverance.

Well up until this point during the creation of this page, what is essentially a "Wiki Blog". I have been doing double-duty data entry. As the content you're reading here has been duplicated over at my own blog site. This doubling of effort has finally grown a tad tiresome. And I also worry about the data storage being consumed by all my images. So for these reasons for the rest of the story as the build hopefully progresses. You are warmly invited to check on the progress (or lack thereof) over at my web site "Insightful Piffle" (http://vk2sja.org/piffle).

If I have managed to show but just one useful thing here on this lengthy page. Then hopefully it was just this:- You don't need a Printed Circuit Board (PCB) to build something. So don't wait for a PCB. Start building Ugly/Manhattan style now!

Very 73 to All,

Steve VK2SJA.
